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Research Article

Cancer Epidemiology, Biomarkers & Prevention

Messages to Motivate Human Papillomavirus Vaccination: National Studies of Parents and Physicians

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Abstract

Background: Physician communication about human papillomavirus (HPV) vaccine is a key determinant of uptake. To support physician communication, we sought to identify messages that would motivate HPV vaccination.

Methods: From 2014 to 2015, we surveyed national samples of parents of adolescents ages 11 to 17 ($n = 1,504$) and primary care physicians ($n = 776$). Parents read motivational messages, selected from nine longer messages developed by the Centers for Disease Control and Prevention and six brief messages developed by the study team. Parents indicated whether each message would persuade them to get HPV vaccine for their adolescents. Physicians read the brief messages and indicated whether they would use them to persuade parents to get HPV vaccine for 11- to 12-year-old children.

Results: The highest proportion of parents (65%) and physicians (69%) found this brief message to be persuasive: "I strongly believe in the importance of this cancer-preventing vaccine for [child's name]." Parents disinclined to vaccinate were most receptive to messages with information about HPV infection being common, cancers caused by HPV, and HPV vaccine effectiveness. Parents' endorsement did not vary by race/ethnicity, education, child age, or child sex (all $P > 0.05$).

Conclusions: Our national surveys of parents and physicians identified messages that could motivate HPV vaccination, even among parents disinclined to vaccinate their children. The lack of difference across demographic subgroups in parental endorsement may suggest that these messages can be used across these subgroups.

Impact: Our findings support physicians' use of these messages with parents to help motivate uptake of this important cancer-preventing vaccine. *Cancer Epidemiol Biomarkers Prev; 25(10); 1383–91. ©2016 AACR.*

Introduction

Low uptake of human papillomavirus (HPV) vaccine is a serious public health problem that is thwarting progress in cancer prevention (1). Each year, an estimated 21,300 cancers in the United States are attributable to HPV types 16 and 18 (2). These types are preventable through vaccination, yet only 40% of females and 22% of males ages 13 to 17 have received all three doses in the vaccine series (3). This low HPV vaccination coverage is despite national guidelines for routine administration (4, 5) and relatively high levels of coverage for other adolescent vaccines (6). Missed clinical opportunities for concomitant vaccination, defined as clinical visits at which a child received another vaccine but not HPV vaccine, are an important reason HPV vaccine initiation is not higher (7).

Healthcare provider recommendations are uniquely persuasive in motivating HPV vaccination. However, many physicians offer weak (8) or late recommendations (9), if they offer a recommendation at all. Physicians' HPV vaccine recommendations can be inconsistent, with many physicians selectively recommending the vaccine to patients they perceive are at higher risk for infection rather than all patients (9). This practice is especially worrisome as receiving a physician recommendation is a robust predictor of HPV vaccine uptake (10–15). Given the central role physicians' recommendations play in vaccine uptake, low-quality or absent physician communication about HPV vaccine undermines the vaccine's tremendous potential to prevent anogenital cancers.

Recognizing the need for improved physician communication about HPV vaccination, the Centers for Disease Control and Prevention (CDC) developed and widely disseminated resources for healthcare providers through the national "You Are the Key" campaign (16). To help strengthen physicians' communication, CDC offers nine messages physicians could use to recommend HPV vaccine to parents (6, 17). These messages were designed to address common parental barriers to HPV vaccination (e.g., vaccine safety, efficacy, necessity) and resulted from several rounds of testing with parents and physicians. Beginning with a larger pool of messages, CDC surveyed mothers to assess their perceptions of messages that would help them make the decision to get their children vaccinated. CDC then interviewed pediatricians to assess their understanding and usability of the messages, and conducted focus groups with parents to refine the messages

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Note: Supplementary data for this article are available at Cancer Epidemiology, Biomarkers & Prevention Online (http://cebp.aacrjournals.org/).

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(J. Roark, MPH, written communication, June 2016). However, parents' perceptions of these messages remain unknown in the absence of published evaluation data. Moreover, at an average length of 52 words, these messages are fairly long, which may make them challenging to remember and thus deter physicians' use. Our study sought to identify messages physicians would use to recommend HPV vaccine and that would motivate parental acceptance. The study team also developed shorter messages and examined whether they were as effective as the longer CDC-developed messages.

Materials and Methods

Participants and procedures

We conducted two national, online surveys of parents and physicians in the U.S. who were members of standing panels maintained by a survey research company (18, 19). Parents were part of a panel of about 55,000 adults identified through a probability-based sampling of addresses from the U.S. Postal Service's Delivery Sequence File. This sample frame covers about 97% of U.S. households. The survey research company recruited its physician panelists through lists compiled by the American Medical Association (20). The University of North Carolina Institutional Review Board approved both study protocols. We described the participants, procedures, and survey instruments previously (9, 21, 22) and summarize them here briefly.

Parent survey

Parents completed our online survey between November 2014 and January 2015 (22). Eligible respondents were parents of an 11- to 17-year-old child who lived in the household at least half of the time. For parents who had more than one child in this age range, the survey asked parents to respond with regard to the child who had the most recent birthday. This selection method is quick, easy, and relatively noninvasive for participants (23), compared with a potentially more burdensome enumeration approach in which we obtain an identifier and request responses for every eligible child. Parents provided a name or nickname for the referent child, which was used in item stems throughout the survey. To support inclusion of lower-income respondents, the survey company provided a computer and free Internet access to panel members without these resources for the duration of their participation in the survey panel (19). Parents who already had a computer and Internet access received points for completing the survey, which could be redeemed for cash, products, or sweepstakes entries.

The survey company emailed invitations to 2,845 randomly selected parents. Of those, 1,760 accessed the survey site, provided informed consent, and completed an eligibility screener. A total of 1,518 parents met eligibility criteria and completed the survey. After excluding 14 parents who had incomplete data, the final analytic sample included 1,504 parents. We estimated that 13.75% of our total sample was not eligible for the survey, resulting in 2,454 eligible parents. Using American Association for Public Opinion Research (AAPOR) definition 5 (24), the overall response rate was 61% (1,504/2,454).

Physician survey

Physicians completed our online survey between April and June 2014 (9, 21). Eligible respondents were pediatricians and family physicians providing preventive care, including vaccinations, to patients ages 11 to 12. We were particularly interested in patients in this age group because they represent the target ages for routine HPV vaccination (2). The survey company emailed invitations to all 2,368 panel members with pediatric or family medicine specialties, and 1,022 (43%) clicked on the link provided to access the survey site. Of these, 776 (76%) met eligibility criteria and completed the survey. The survey company was unable to provide the information required to calculate a response rate using AAPOR definitions (24). Although data on the percentage of ineligible respondents were unavailable, overall, 33% of physicians in the panel completed the survey. Physicians received $25 to $45 for participating, with higher incentives used to encourage participation later in the fielding process.

Motivational messages

The brief and longer motivational messages and their sources appear in Supplementary Table S1. In consultation with pediatricians, family physicians, and other experts on HPV vaccination, the study team developed six brief messages (defined as 25 words or fewer; messages B1–B6) designed to motivate HPV vaccination. Nine longer messages (defined as 26 words or longer; messages L1–L9) came from materials that the CDC developed to aid physician communication with parents and adolescents about HPV vaccination (6, 17). Although relatively little is known about the relationship between health-related print literacy and health-related oral literacy, the cognitive processes necessary to understand information presented orally and in writing are closely connected (25). Thus, we calculated message readability using five standard approaches (Flesch–Kincaid Grade Level, Gunning-Fog Score, Coleman–Liau Index, Simple Measure of Gobbledygook (SMOG) Index, Automated Readability Index) and calculated an average readability grade level for each message; grade 8 or lower is a minimum standard for readability for patient communication materials, and grade 6 or lower is desirable (26). On average, the brief messages were 17 words long, and the reading grade level was 6.3 (Supplementary Table S1). The longer messages averaged 52 words and a reading grade level of 9.8.

Measures

Study surveys are available online at www.unc.edu/∼ntbrewer/hpv.htm.

Parent survey. The parent survey included the six brief motivational messages, plus nine longer messages (17), for a total of fifteen messages. Parents were randomly assigned to panels (Panel A, Panel B, Panel C), each of which included two brief messages and three longer messages in a random order. The survey asked parents, "Which of these statements made by a doctor would persuade you to get the HPV vaccine for [child's name]?" Before viewing the messages, parents indicated the number of HPV vaccine doses their children had received (coded as 0 or $\geq$1 doses). For children who had not initiated HPV vaccination, the survey assessed parents' HPV vaccination intention by asking, "How likely are you to get [child's name] the HPV vaccine in the next year? Would you say you ... [*definitely won't, probably won't, probably will, definitely will*]." The survey also evaluated attitudes toward adolescent vaccines, including importance of HPV vaccine: "I feel that the HPV vaccine for [child's name] is ... [*not important, slightly important, moderately important, very important, extremely important*]." On demographic and household characteristics, the survey assessed respondents' sex, age, race/

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ethnicity, education, marital status, household income, and state of residence. It also assessed the index child's sex and age.

Physician survey. The physician survey included the six brief motivational messages presented to parents and asked, "Which of these statements would you use to persuade parents to get HPV vaccine for their 11–12 year olds?" Physicians could choose as many messages that applied or select *none of these*. On demographic and professional characteristics, our survey assessed respondents' medical specialty, sex, and number of years in practice since residency. Respondents also indicated their typical adolescent patient volume per week and the percentage of vaccine doses they administer that are provided by the federal Vaccines for Children (VFC) program. On clinical practice characteristics, respondents reported their practice type and the total number of physicians in the clinic. Respondents also reported the state in which their clinic is located, which we categorized these locations into one of four U.S. census regions.

Data analysis

We calculated frequencies and percentages of respondents who indicated that a given message would persuade them (parents) or that they would use a given message to persuade parents (physicians) to get HPV vaccine for their child. For parent data, we used bivariate logistic regression models to determine if message endorsement differed by child's HPV vaccination status. Among parents whose child was not previously vaccinated, we conducted bivariate logistic regression models to assess whether message endorsement differed by HPV vaccine intention. For all parents, we used bivariate logistic regression to identify correlates of endorsement of each motivational message. Candidate correlates were child's HPV vaccination status, parent's intention to vaccinate their child, parent's race/ethnicity, parent's education level, child's age, child's sex, and parents' perception of HPV vaccine importance. The parent Panels A, B, and C were similar on 10 of 11 demographic variables, indicating that randomization successfully created largely equivalent groups; as the panels differed on income ($P = 0.05$), analyses controlled for income. Given that message endorsement differed by child's vaccination status, analyses also controlled for this variable. For physician data, we used χ^2 tests to identify correlates of endorsement of each motivational message. Candidate correlates were medical specialty and years in practice. We conducted analyses using SAS Version 9.4. Statistical tests were two-tailed with a critical alpha of 0.05.

Results

Sample characteristics

Parents. About half of parents were female (56%; Table 1). About 9% of parents were non-Hispanic black and 14% were Hispanic. Nearly two-thirds (62%) had at least some college education. Almost half (47%) reported an annual household income of $75,000 or more, and the majority (84%) lived in a metropolitan area. About one-quarter (28%) responded with regard to an 11- or 12-year-old child. About half (51%) of parents reported their index child was male and just over half (54%) reported their child had not received any doses of HPV vaccine.

Physicians. Just over half of respondents were pediatricians (53%), roughly two-thirds (68%) were male, and over half (55%) had been practicing for 20 or more years. The largest proportion saw 10 to 24 adolescent patients weekly (45%). Most respondents worked in private practices (85%), and about half (51%) reported that their practice had four or fewer physicians.

Parents' endorsement of messages

Parents' endorsement of message persuasiveness averaged 41% (range, 9%–65%) for brief messages and 60% (range, 42%–70%) for longer messages (Table 2). At least half of parents supported eight of the nine longer messages and three of six brief messages. About 18% of parents endorsed all messages they read, whereas 22% did not endorse any.

Among the brief messages, the highest proportion of parents endorsed a message that explicitly expressed a strong recommendation for HPV vaccine (B5 important cancer prevention vaccine; 65%; Fig. 1). Many parents also supported messages that speak directly to their role in preventing their child from getting anal/cervical cancer through HPV vaccination (B3 prevent cancer; 59%) and messages that emphasize their control over whether their child becomes infected with HPV (B4 control getting HPV; 58%). For the longer, CDC-developed messages, the highest proportion of parents supported a message with information about HPV vaccine effectiveness shown in clinical trials and studies in the U.S. and other countries (L8 effective vaccine; 70%; Table 2). About two-thirds of parents also endorsed messages about the prevalence of HPV infection and the cancers and precancerous conditions HPV vaccine protects against (L7 HPV causes cancers; 67%), messages about vaccine safety and an emphasis on minor, short-term side effects (L2 safe vaccine; 65%), and a longer version of the brief message in which a physician clearly gives a strong recommendation for HPV vaccine (L6 important cancer prevention vaccine; 65%).

HPV vaccination status. Endorsement of each of the 15 messages was higher among parents whose children had received HPV vaccine (all $P < 0.05$; Table 2). Parents whose children had not received any doses of HPV vaccine favored five longer messages (L2 safe vaccine, L5 HPV is common, L6 important cancer prevention vaccine, L7 HPV causes cancers, and L8 effective vaccine; 53%–56%) and three short messages (B3 prevent cancer, B4 control getting HPV, and B5 important cancer prevention vaccine; 48%–49%). Few parents of unvaccinated children endorsed brief messages B6 (5%), which uses a car seatbelt analogy, and B1 (16%), in which a physician draws on the experience of vaccinating his or her own child. About two-thirds (67%) of parents of unvaccinated children supported at least one message, as did 91% of parents whose child received $\geq$1 dose of HPV vaccine.

In an exploratory analysis, we examined sociodemographic correlates of not endorsing any messages among parents of an unvaccinated child. In bivariate logistic regression analyses, we identified parent race and marital status as significant predictors of not endorsing any messages. In a multivariable model containing these two predictor variables, parents who reported black, non-Hispanic race had lower odds of not endorsing any messages compared with white, non-Hispanic parents [odds ratio (OR), 0.47; 95% confidence interval (CI), 0.24–0.92]. Parents who reported they were not married had lower odds of not endorsing any messages compared with parents who were married (OR, 0.58; 95% CI, 0.37–0.89).

HPV vaccination intentions. For 14 of the 15 messages, parents with higher prior intentions to vaccinate were more likely to say

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the messages would be persuasive (all $P < 0.001$; Supplementary Table S2; Fig. 2). Of parents who *probably would not* get their child vaccinated, more than 60% endorsed three longer messages (L5 HPV is common, L7 HPV causes cancers, L8 effective vaccine; 61%–64%). About half endorsed three brief messages (B3 prevent cancer, B4 control getting HPV, and B5 important cancer prevention vaccine; 48%–51%). Of parents who *definitely would not* get their child vaccinated, about one-quarter indicated three brief messages would persuade them to vaccinate their child (B3 prevent cancer, B4 control getting HPV, and B5 important cancer prevention vaccine; 23%–25%). Two longer messages would be effective with about one-quarter of these parents (L5 HPV is common and L8 effective vaccine; 23%–24%). About one-third (33%) of parents who *definitely would not* get their child vaccinated and 75% of parents who *probably would not* get their child vaccinated endorsed at least one message (Fig. 3).

Table 1. Sample characteristics

	***n* (%)**
Parent sample, $N = 1{,}504$	*N* (%)
Panel	
Panel A	515 (34)
Panel B	483 (32)
Panel C	506 (34)
Parent characteristics	
Sex	
Male	668 (44)
Female	836 (56)
Age (y)	
21–29	34 (2)
30–44	809 (54)
45–59	617 (41)
≥60	44 (3)
Race	
White, non-Hispanic	1,058 (70)
Black, non-Hispanic	135 (9)
Other, non-Hispanic[a]	99 (7)
Hispanic	212 (14)
Education	
High school degree or less	576 (38)
Some college, no degree	390 (26)
Bachelor's degree or higher	538 (36)
Marital status	
Married	1,207 (80)
Not married	297 (20)
Household characteristics	
Income	
<$35K	329 (22)
$35K–<$75K	470 (31)
≥$75K	705 (47)
MSA status	
Nonmetropolitan	236 (16)
Metropolitan	1,268 (84)
Region	
Northeast	261 (17)
Midwest	393 (26)
South	499 (33)
West	351 (23)
Child characteristics	
Sex	
Male	765 (51)
Female	739 (49)
Age (y)	
11–12	422 (28)
13–14	443 (29)
15–17	639 (42)
HPV vaccination status	
0 doses	809 (54)
≥1 doses	695 (46)

(Continued on the following column)

Table 1. Sample characteristics (Cont'd)

	***n* (%)**
Physician sample, $n = 776$	
Personal 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 week	
≤9	129 (17)
10–24	351 (45)
≥25	296 (38)
Vaccine doses through VFC	
≤9%	290 (37)
10%–49%	274 (35)
≥50%	152 (20)
Not sure	60 (8)
Clinic or practice characteristics	
Type	
Private practice (solo, group, HMO)	660 (85)
Other[b]	116 (15)
Total physicians	
1–4	398 (51)
5–9	217 (28)
≥10	161 (21)
Region	
Northeast	184 (24)
Midwest	165 (21)
South	275 (35)
West	152 (20)

NOTE: Percentages may not total 100% due to rounding.
Abbreviations: HMO, health maintenance organization; MSA, metropolitan statistical area; VFC, Vaccines for Children program.
[a]Includes 39 participants who reported two or more races, non-Hispanic.
[b]Includes hospital- and university-based clinics, Federally Qualified Health Centers, and community, rural, migrant, Indian, military, public health, and school health clinics.

Demographics. Endorsement was not associated with parent race/ethnicity, parent education, child age, or child sex (all $P > 0.05$; Supplementary Table S3).

Physicians' endorsement of messages

Physicians' endorsement of the brief messages averaged 39%; about 4% of physicians endorsed all messages, whereas 7% did not endorse any messages. Of the six brief messages presented to physicians, the highest proportion of physicians endorsed B5 (important cancer prevention vaccine, 69%), closely followed by B3 (prevent cancer, 64%; Fig. 1). The lowest proportion of physicians (9%) reported they would use message B6 (seatbelt analogy) to persuade parents to agree to HPV vaccine.

Compared with pediatricians, a higher proportion of family physicians endorsed message B3 (prevent cancer, 59% vs. 69%, $P = 0.002$), but a lower proportion of family physicians endorsed messages B1 (physician vaccinates own child, 35% vs. 25%, $P = 0.003$) and B5 (important cancer prevention vaccine, 74% vs. 63%, $P < 0.001$). Relative to clinicians who have been in practice for ≤19 years, a higher proportion of those practicing longer endorsed

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Table 2. Parents' perceptions of whether messages to promote HPV vaccination are persuasive, by child's HPV vaccination status ($n = 1{,}504$)

Message	Total *n* (%)	Child's HPV vaccination status		*P*
		0 doses *n* (%)	≥1 dose *n* (%)	
Panel A	$n = 515$	$n = 279$	$n = 236$	
B1. My child has gotten HPV vaccine. [Child's name] should, too. *(brief)*	125 (24)	46 (16)	79 (33)	<0.001[a]
B2. I see you got hepatitis B vaccine for [child's name]. That's also a cancer vaccine for an infectious disease. *(brief)*	171 (33)	80 (29)	91 (39)	0.018[b]
L1. HPV vaccine is very important because it prevents cancer. I want [child's name] to be protected from cancer. That's why I'm recommending that [he/she] receives the first dose of HPV vaccine today. *(longer)*	293 (57)	126 (45)	167 (71)	<0.001[a]
L2. HPV vaccine has been carefully studied by medical and scientific experts. HPV vaccine has been shown to be very effective and very safe. Like other shots, most side effects are mild, primarily pain or redness in the arm. This should go away quickly, and HPV vaccine has not been associated with any long-term side effects. Since 2006, about 57 million doses of HPV vaccine have been distributed in the United States, and in the years of HPV vaccine safety studies and monitoring, no serious safety concerns have been identified. *(longer)*	333 (65)	151 (54)	182 (77)	<0.001[a]
L3. We're vaccinating today so [child's name] will have the best protection possible long before the start of any kind of sexual activity. We vaccinate people well before they are exposed to an infection, as is the case with measles and the other recommended childhood vaccines. Similarly, we want to vaccinate children well before they get exposed to HPV. *(longer)*	303 (59)	134 (48)	169 (72)	<0.001[a]
Panel B	$n = 483$	$n = 265$	$n = 218$	
B3. [Child's name] can get [anal/cervical cancer] as an adult, but you can stop that right now. The HPV vaccine prevents most [anal/cervical cancers]. *(brief)*	285 (59)	131 (49)	154 (71)	<0.001[a]
B4. There will be many things in [child's name]'s life that you can't control. But you can control whether [he/she] gets some dangerous kinds of HPV. *(brief)*	281 (58)	128 (48)	153 (70)	<0.001[a]
L4. Research has shown that getting the HPV vaccine does not make kids more likely to be sexually active or start having sex at a younger age. *(longer)*	203 (42)	81 (31)	122 (56)	<0.001[a]
L5. HPV is so common that almost everyone will be infected at some point. It is estimated that 79 million Americans are currently infected, with 14 million new HPV infections each year. Most people infected will never know. So even if [child's name] waits until marriage to have sex, or only has one partner in the future, [he/she] could still be exposed if [his/her] partner has been exposed. *(longer)*	297 (61)	144 (54)	153 (70)	<0.001[a]
L6. I strongly believe in the importance of this cancer-preventing vaccine, and I have given HPV vaccine to my child. Experts (like the American Academy of Pediatrics, cancer doctors, and the CDC) also agree that this vaccine is very important for [child's name]. *(longer)*	316 (65)	140 (53)	176 (81)	<0.001[a]
Panel C	$n = 506$	$n = 265$	$n = 241$	
B5. I strongly believe in the importance of this cancer-preventing vaccine for [child's name]. *(brief)*	329 (65)	130 (49)	199 (83)	<0.001[a]
B6. Would you wait until [child's name] is in a car accident before you tell [him/her] to wear a seatbelt? *(brief)*	46 (9)	14 (5)	32 (13)	0.001[a]
L7. HPV can cause cancers of the cervix, vagina, and vulva in women, cancer of the penis in men, and cancers of the anus and the mouth or throat in both women and men. There are about 26,000 of these cancers each year—and most could be prevented with HPV vaccine. There are also many more precancerous conditions requiring treatment that can have lasting effects. *(longer)*	338 (67)	149 (56)	189 (78)	<0.001[a]
L8. In clinical trials of boys and girls, the vaccine was shown to be extremely effective. In addition, studies in the United States and other countries that have introduced HPV vaccine have shown a significant reduction in infections caused by the HPV types targeted by the vaccine. *(longer)*	352 (70)	149 (56)	203 (84)	<0.001[a]
L9. I want to make sure that [child's name] receives all 3 shots of HPV vaccine to give [him/her] the best possible protection from cancer caused by HPV. Please make sure to make appointments on the way out, and put those appointments on your calendar before you leave the office today! *(longer)*	285 (56)	104 (39)	181 (75)	<0.001[a]

NOTE. The message length is indicated in parentheses. Brief messages consisted of 25 or fewer words, whereas longer messages had more than 25 words. Frequencies and percentages reflect agreement that the message would be persuasive. *P* values were derived from bivariate logistic regression models that determined if endorsement of each message differed by child's HPV vaccination status.

[a]$P < 0.01$.

[b]$P < 0.05$.

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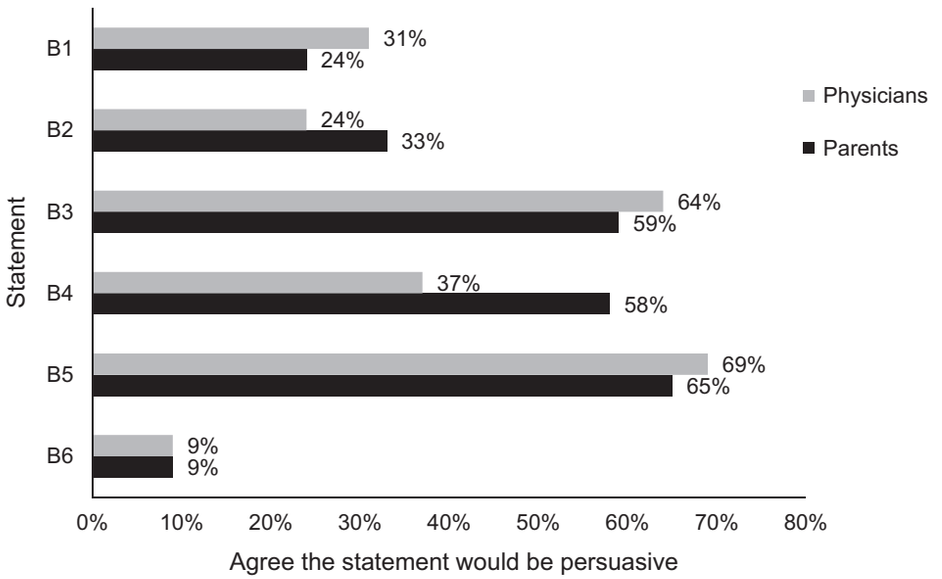

Figure 1.
Physicians' ($n = 776$) and parents' ($n = 1{,}504$) belief that brief messages would encourage HPV vaccine uptake. Panel A parents ($n = 515$) evaluated messages B1 and B2, Panel B parents ($n = 483$) evaluated messages B3 and B4, and Panel C parents ($n = 506$) evaluated messages B5 and B6.

messages B1 (physician vaccinates own child, 24% vs. 36%, $P < 0.001$) and B4 (control getting HPV, 32% vs. 41%, $P = 0.019$). No other associations were statistically significant (all $P > 0.05$).

Discussion

Through our national survey of parents, we identified three brief (B3–B5) and eight longer (L1–L3, L5–L9) messages that at least half of parents reported would persuade them to agree to HPV vaccination for their children. Physicians also endorsed two of these brief messages touching on the strong belief "in the importance of this cancer-preventing vaccine" (B5) and that the child could get cancer as an adult "but you can stop that right now" (B3). Given the importance of provider recommendation in HPV vaccine uptake (7, 27), perhaps it is not surprising that a high proportion of parents endorsed a straightforward and strong recommendation for HPV vaccine. Equally high proportions of parents endorsed the brief and longer versions of this message, suggesting that such a recommendation need not be lengthy so long as the physician clearly states that he or she strongly recommends HPV vaccine.

Many parents also endorsed messages that included information about vaccine safety and effectiveness (L2, L8), the importance of vaccinating prior to sexual activity (L3), HPV

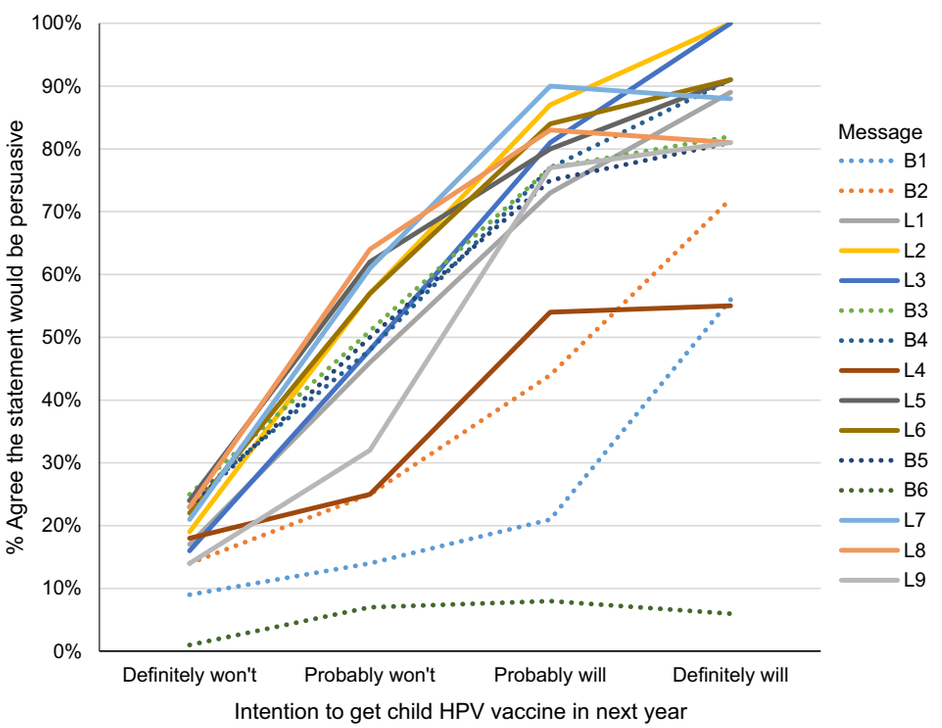

Figure 2.
Parents' perception of messages by HPV vaccine intention, among those whose child was not previously vaccinated ($n = 809$). Lines are dotted for brief messages and solid for longer messages.

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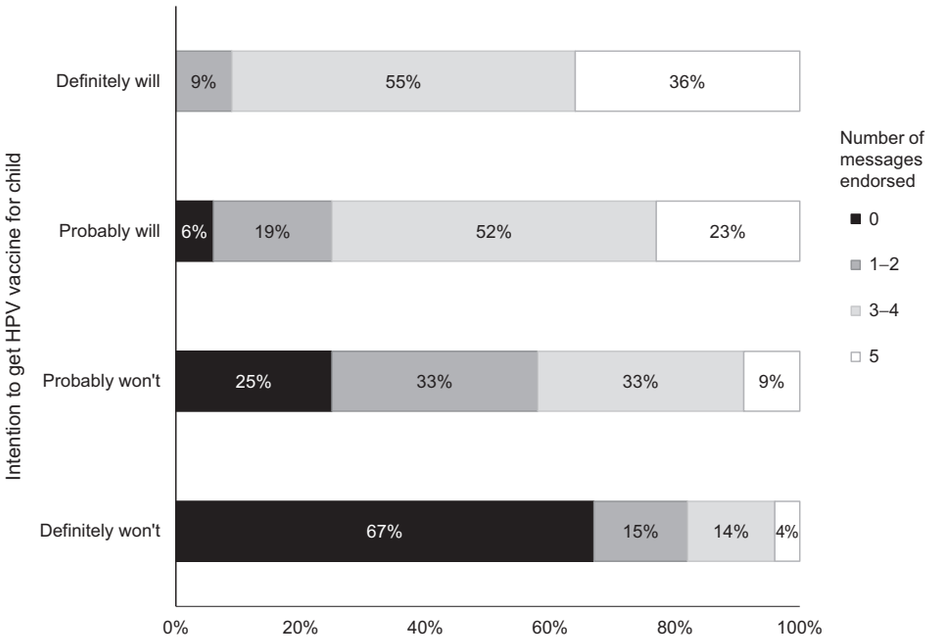

Figure 3.
Number of messages endorsed by parents, by intention to get HPV vaccine for their child ($n = 809$).

infection being common (L5), and cancer prevention (L1, L6, L7, L9). These messages address the primary parental barriers to HPV vaccination, including concerns about vaccine safety, lack of knowledge, and belief that HPV vaccine is not needed or not necessary (7). Moreover, the messages align with communication best practices that suggest effective messages highlight HPV vaccine's role in cancer prevention, explain risks and prevalence of HPV infection, and provide evidence about HPV vaccine safety (28).

These messages may be especially useful as part of a larger HPV vaccine recommendation strategy. The survey used in the current study informed an intervention in which we developed and led a training that taught clinicians an HPV vaccine recommendation strategy. As part of the strategy, we trained clinicians on an approach for eliciting and easing parents' primary concern about HPV vaccine, and to end with a strong recommendation. In the context of this strategy, we foresee physicians using the messages from the current study during these steps. These messages may be particularly helpful once physicians have identified a focal point for discussion by eliciting parents' primary concern about HPV vaccine. To support their communication with parents, physicians can use the motivational message that best addresses the parent's specific concern. Also, physicians can use a message to end the discussion with a strong recommendation for HPV vaccine (e.g., B5 important cancer prevention vaccine). Given that we did not identify a difference in parental endorsement of messages across demographic subgroups, physicians may be able to effectively use these messages across demographic subgroups.

Of particular interest, some parents without prior intentions to vaccinate their child identified messages that would be persuasive. Two messages that were the most highly endorsed by these parents placed the onus of protection on the parent (B3) and emphasized the control they possess over their child's health (B4). This finding is aligned with the tenets of various theories of fear appeals, which posit that fear messages inspire action if the receiver believes he or she has some control over the situation (29). Parents without prior intentions to vaccinate their child may be particularly receptive to messages that arouse fear while fostering a sense of efficacy. Our findings offer promise for appealing to parents with a range of prior intentions to vaccinate.

Concordance between parents' and physicians' perceptions of the brief messages was fairly high. One exception was message B4 (control getting HPV), where many parents (58%) reported the message was persuasive, yet only 37% of physicians would use this message to persuade parents. It is especially concerning that so few physicians would use this message given that it was one of the top messages that would persuade parents without prior intentions to vaccinate their child. It is unclear whether physicians were not amenable to using this message because they personally do not believe in its content, or because they do not think the message would motivate parents.

We also identified some differences in message endorsement by physician specialty and length of time in practice. Pediatricians typically are stronger proponents of vaccination compared with other physician specialties, including family physicians (30, 31). Thus, it may be unsurprising that pediatricians preferred messages B1 (physician vaccinates own child) and B5 (important cancer prevention vaccine), both of which reflected personal endorsement and experience, whereas family physicians preferred message B3 (prevent cancer), which does not use language that reflects their personal beliefs. Given that so many parents reported message B5 (important cancer prevention vaccine) would persuade them to pursue HPV vaccination, it would be worthwhile to encourage family physicians to use this message or further explore their hesitancy to use it. Using this message could be easily incorporated into routine clinical practice and included in training materials targeted to helping family physicians make effective HPV vaccine recommendations.

To facilitate comprehension, experts recommend that health information be written at a sixth-grade or lower reading level (32, 33). We found that the brief messages were generally around this

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recommended grade level, whereas the longer messages were around four grades above the recommended level. CDC has since disseminated a new set of messages for physicians to use to address parents' questions about HPV vaccine that are somewhat shorter than the previous CDC messages but still lengthy (38 vs. 52 words; ref. 34). Grade level of the new messages remained high and unchanged at around tenth grade. Given that the messages are designed for physicians to deliver to parents orally, it is worthwhile for future research to explore parents' comprehension of the messages when spoken by a physician. Also of note, the highest proportion of parents endorsed the brief statement (B5 important cancer prevention vaccine) with the highest reading grade level (10), and over half of parents endorsed most of the longer statements, with grade levels ranging from 7 to 12. Future research also is needed to understand the trade-offs between message reading grade level, persuasiveness, message length, and ability for providers and patients to remember the messages.

Study strengths include data from large, national samples of parents, and primary care physicians, including physicians who practice in specialties that deliver the majority of HPV vaccine doses in the U.S. (10). To our knowledge, our study is among the first to evaluate the messages developed and disseminated by the CDC. Study weaknesses include that we achieved a modest cooperation rate for the physician survey, which is a common challenge for physician surveys (35). The study relied on parents' and physicians' self-report in response to hypothetical scenarios; thus, we were unable to account for clinical context or other factors that may affect physicians' use of and parents' receptivity to the messages. For instance, physicians' nonverbal cues may influence parents' perceptions of message persuasiveness. Also, it is possible that physicians will modify the messages rather than say them verbatim; these modifications may enhance or undermine the messages' persuasiveness. Moreover, we did not clarify with parents whether they were motivated by the message in its entirety or if there was a specific component of the message that was particularly stimulating. These limitations highlight that this research should be augmented with future studies that further test these messages. Future research also should extend this work by examining whether these messages lead to HPV vaccine uptake. Furthermore, future work should distinguish between messages designed to address parent concerns and messages intended to direct parents to vaccinate.

Conclusion

Our national study of parents and physicians identified messages perceived as persuasive for motivating HPV vaccination, even among parents disinclined to vaccinate their children. The lack of difference across demographic subgroups in parental endorsement of messages may suggest that these messages can be used across demographic subgroups, and warrants further investigation. Our findings provide physicians with evidence that using these messages may help them to communicate effectively with parents about this important cancer-preventing vaccine.

Disclosure of Potential Conflicts of Interest

N.T. Brewer reports receiving commercial research grants from Merck and Pfizer 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: T.L. Malo, M.B. Gilkey, M.E. Hall, P.D. Shah, N.T. Brewer
Development of methodology: M.E. Hall, N.T. Brewer
Acquisition of data (provided animals, acquired and managed patients, provided facilities, etc.): M.E. Hall, P.D. Shah, N.T. Brewer
Analysis and interpretation of data (e.g., statistical analysis, biostatistics, computational analysis): T.L. Malo
Writing, review, and/or revision of the manuscript: T.L. Malo, M.B. Gilkey, M.E. Hall, P.D. Shah, N.T. Brewer
Administrative, technical, or material support (i.e., reporting or organizing data, constructing databases): T.L. Malo, M.E. Hall, N.T. Brewer
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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. 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.
3. Reagan-Steiner S, Yankey D, Jeyarajah J, Elam-Evans LD, Singleton JA, Curtis CR, et al. National, regional, state, and selected local area vaccination coverage among adolescents aged 13–17 years - United States, 2014. MMWR Morb Mortal Wkly Rep 2015;64: 784–92.
4. Markowitz LE, Dunne EF, Saraiya M, Lawson HW, Chesson H, Unger ER. Quadrivalent human papillomavirus vaccine: Recommendations of the advisory committee on immunization practices (ACIP). MMWR Recomm Rep 2007;56:1–24.
5. Centers for Disease Control and Prevention. Recommendations on the use of quadrivalent human papillomavirus vaccine in males–advisory committee on immunization practices (ACIP), 2011. MMWR Morb Mortal Wkly Rep 2011;60:1705–8.
6. Centers for Disease Control and Prevention. Human papillomavirus vaccination coverage among adolescent girls, 2007–2012, and postlicensure vaccine safety monitoring, 2006–2013 - United States. MMWR Morb Mortal Wkly Rep 2013;62:591–5.
7. 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.
8. 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.
9. Gilkey MB, Malo TL, Shah PD, Hall ME, Brewer NT. Quality of physician communication about human papillomavirus vaccine: Findings from a national survey. Cancer Epidemiol Biomarkers Prev 2015;24:1673–9.

10. Dorell CG, Yankey D, Santibanez TA, Markowitz LE. Human papillomavirus vaccination series initiation and completion, 2008–2009. Pediatrics 2011;128:830–9.
11. Dorell C, Yankey D, Kennedy A, Stokley S. Factors that influence parental vaccination decisions for adolescents, 13 to 17 years old: National immunization survey-teen, 2010. Clin Pediatr (Phila) 2013; 52:162–70.
12. Gilkey MB, Moss JL, McRee AL, Brewer NT. Do correlates of HPV vaccine initiation differ between adolescent boys and girls? Vaccine 2012;30: 5928–34.
13. Perkins RB, Apte G, Marquez C, Porter C, Belizaire M, Clark JA, et al. Factors affecting human papillomavirus vaccine use among White, Black and Latino parents of sons. Pediatr Infect Dis J 2013; 32:e38–44.
14. Ylitalo KR, Lee H, Mehta NK. Health care provider recommendation, human papillomavirus vaccination, and race/ethnicity in the US National Immunization Survey. Am J Public Health 2013;103:164–9.
15. Reiter PL, Gilkey MB, Brewer NT. HPV vaccination among adolescent males: Results from the National Immunization Survey-Teen. Vaccine 2013;31:2816–21.
16. Centers for Disease Control and Prevention. HPV vaccine resources for healthcare professionals. [cited 2015 September 29]. Available from: http://www.cdc.gov/vaccines/who/teens/for-hcp/hpv-resources.html.
17. Centers for Disease Control and Prevention. Tips and time-savers for talking with parents about HPV vaccine. [cited 2015 July 23]. Available from: http://www.cdc.gov/vaccines/who/teens/for-hcp-tipsheet-hpv.html.
18. GfK. Physicians Consulting Network. [cited 2015 July 23]. Available from: http://www.knowledgenetworks.com/resources/pcn.html.
19. GfK. KnowledgePanel Design Summary; 2013. [cited 2016 February 15]. Available from: http://www.knowledgenetworks.com/knpanel/docs/knowledgepanel(R)-design-summary-description.pdf.
20. GfK. Physicians Consulting Network (PCN): An online solution for complex health care research; 2010. [cited 2016 June 10]. Available from: http://www.knowledgenetworks.com/accuracy/spring2010/pcn-spring10.html.
21. Gilkey MB, Moss JL, Coyne-Beasley T, Hall ME, Shah PD, Brewer NT. Physician communication about adolescent vaccination: How is human papillomavirus vaccine different? Prev Med 2015;77: 181–5.
22. Gilkey MB, Calo WA, Moss JL, Shah PD, Marciniak MW, Brewer NT. Provider communication and HPV vaccination: The impact of recommendation quality. Vaccine 2016;34:1187–92.
23. Lind K, Link M, Oldendick R. A comparison of the accuracy of the last birthday versus the next birthday methods for random selection of household respondents. ASA Proc Sect Sur Res Methods 2000:887–9.
24. The American Association for Public Opinion Research. Standard definitions: Final dispositions of case codes and outcome rates for surveys, 5th ed. Lenexa, KA: AAPOR; 2008.
25. Baker DW. The meaning and the measure of health literacy. J Gen Intern Med 2006;21:878–83.
26. Neuhauser L, Paul K. Chapter 14: Readability, comprehension, and usability. In: Fischhoff B, Brewer NT, Downs JS, editors. Communicating risks and benefits: An evidence-based user's guide. Washington, DC: Government Printing Office; 2011. p. 129–148.
27. Holman DM, Benard V, Roland KB, Watson M, Liddon N, Stokley S. Barriers to human papillomavirus vaccination among US adolescents: A systematic review of the literature. JAMA Pediatr 2014;168: 76–82.
28. World Health Organization. HPV vaccine communication: Special considerations for a unique vaccine; 2013. [cited 2015 November 23]. Available from: http://apps.who.int/iris/bitstream/10665/94549/1/WHO_IVB_13.12_eng.pdf#sthash.NsHcQjuv.dpuf.
29. Tannenbaum MB, Hepler J, Zimmerman RS, Saul L, Jacobs S, Wilson K, et al. Appealing to fear: A meta-analysis of fear appeal effectiveness and theories. Psychol Bull 2015;141:1178–1204.
30. Vadaparampil ST, Kahn JA, Salmon D, Lee JH, Quinn GP, Roetzheim R, et al. Missed clinical opportunities: provider recommendations for HPV vaccination for 11–12 year old girls are limited. Vaccine 2011;29: 8634–41.
31. 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.
32. Cotugna N, Vickery CE, Carpenter-Haefele KM. Evaluation of literacy level of patient education pages in health-related journals. J Community Health 2005;30:213–9.
33. National Institutes of Health. How to write easy to read health materials; 2015. [cited 2016 February 15]. Available from: https://www.nlm.nih.gov/medlineplus/etr.html.
34. Centers for Disease Control and Prevention. Addressing parents' top questions about HPV VACCINE; 2016. [cited 2016 February 26]. Available from: http://www.cdc.gov/vaccines/who/teens/for-hcp-tipsheet-hpv.pdf.
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.

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