HUMAN VACCINES & IMMUNOTHERAPEUTICS
2020, VOL. 16, NO. 11, 2736–2743
https://doi.org/10.1080/21645515.2020.1747923

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RESEARCH PAPER

Effect of a multi-component intervention on providers' HPV vaccine communication

Rebecca B. Perkins [a], Bolanle Banigbe[b], Anny T. Fenton[c], Amanda K. O'Grady[b], Emily M. Jansen[d], Judith L. Bernstein[e], Natalie P. Joseph[f], Terresa J. Eun[g], Dea L. Biancarelli[h], and Mari-Lynn Drainoni[b,h,i]

[a]Department of Obstetrics and Gynecology, Boston University School of Medicine/Boston Medical Center, Boston, MA, USA; [b]Boston University School of Public Health, Boston, MA, USA; [c]Maine Medical Center Research Institute, Center for Outcomes, Research, & Evaluation (CORE), Portland, ME, USA; [d]Boston University School of Medicine, Continuing Medical Education Office, Boston, MA, USA; [e]Department of Community Health Sciences, Boston University School of Public Health, Boston, MA, USA; [f]Department of Pediatrics and Adolescent Medicine, Boston University School of Medicine/Boston Medical Center, Boston, MA, USA; [g]Department of Sociology, Stanford University, Stanford, CA, USA; [h]Section of Infectious Diseases, Department of Medicine, Boston University School of Medicine, Boston, MA, USA; [i]Evans Center for 10 Implementation and Improvement Sciences, Boston University School of Medicine, Boston, MA, USA

ABSTRACT

Objective: To evaluate the effect of a multi-component intervention including communication training on provider beliefs and recommendation practices around the human papillomavirus (HPV) vaccine using both self-reports and audio-recordings of clinical interactions.

Methods: We conducted a mixed method study at five family medicine and pediatric practices. Providers self-reported beliefs and practices about HPV vaccination via surveys and qualitative interviews conducted pre- and post-intervention. We also assessed provider recommendation style using audio-recordings of clinical interactions pre- and post-intervention. Content analysis was used to identify themes in qualitative interviews. Matched pre- and post-intervention surveys were analyzed for changes in provider beliefs and attitudes. Pre- and post-intervention audio recordings of clinical interactions were analyzed for observed differences in recommendation styles. Bivariate analyses of quantitative data used Chi-square and Fisher's exact tests; t-tests were used for continuous variables.

Results: Providers reported in interviews that the intervention led to communication changes by increasing their knowledge, reframing the HPV vaccine as a routine vaccination, and providing tools for engaging with parents. Surveys indicated that the proportion of providers reporting that the HPV vaccine is one of the most important adolescent vaccines increased from 71% pre-intervention to 100% post-intervention (p = .03). Audio-recording analysis demonstrated that use of an indicated (presumptive) recommendation style increased from 62.5% pre-intervention to 79.6% post-intervention (p = .047).

Conclusions: Educating providers about HPV vaccination and giving them tools to facilitate communication with parents can reframe HPV as a routine adolescent vaccination and motivate providers to routinely use effective recommendation styles in practice.

ARTICLE HISTORY
Received 7 February 2020
Revised 6 March 2020
Accepted 22 March 2020

KEYWORDS
HPV vaccination; provider communication; multi-level interventions; vaccine recommendation style; audio recordings; qualitative interviews; surveys

Introduction

Each year, nearly 44,000 new cancers attributable to HPV infection are diagnosed in the US, approximately 79% of which could have been prevented by HPV vaccination.[1] At the same time, HPV vaccination coverage rates have been rising slowly, but still fall short of the Healthy People 2020 target of 80%.[2] In 2018, only 68.1% of adolescents aged 13–17 years received at least one dose of HPV vaccine and 51.1% had completed the series.[2] Raising HPV vaccination rates is a public health priority.[3,4]

Receiving a provider recommendation is one of the most important and consistent predictors of HPV vaccination.[5-9] While provider recommendations improve uptake of all adolescent vaccines, the effect is highest for HPV vaccines.[5,10] The effect of provider recommendation is consistent across boys and girls as well as different racial and ethnic groups.[11–13] Adolescents whose parents receive a provider recommendation are five to nine times more likely to receive at least one HPV vaccine dose than those whose parents report no recommendation.[11] Provider recommendation is more predictive of vaccine initiation and completion than parental vaccine knowledge.[14]

Despite widespread recognition that provider recommendation increases HPV vaccine uptake, 22.5% of parents reported receiving no provider recommendation for HPV vaccine in 2018.[2] Even among those receiving HPV vaccine recommendations, recommendation quality may vary. Recommendation styles described as "indicated," "presumptive" or "announcement" involve a clear recommendation for vaccine receipt at the current visit, while recommendation styles described as "elective", "participatory" or "conversation" styles present vaccination as optional at the current visit.[9,15,16] Use of an indicated or presumptive communication style is associated with significantly higher odds of vaccine uptake than an elective or conversation style.[9,15,17,18] Interventions that teach providers to use an indicated style when recommending HPV vaccination have demonstrated success in

CONTACT Rebecca B. Perkins rbperkin@bu.edu Department of Obstetrics and Gynecology, Boston University School of Medicine/Boston Medical Center, MSc, 85 E. Concord St., 6th Floor, Boston, MA 02118, USA

Present affiliation of Mari-Lynn Drainoni is Center for Healthcare Organization and Implementation Research, ENRM VA Hospital, Bedford, MA.

changing provider behavior; however most outcomes were measured using provider surveys, which can be subjective, or using changes in vaccination rates, which may be due to other factors.[16,19] The goal of this paper is to describe the effects of a multi-component intervention involving both communication training and systems improvement on change in provider HPV vaccine communication using both self-report (interviews and surveys) and analysis of audio recorded clinical interactions.

Methods

Study setting and participants

Our study focuses on primary care providers who participated in Development of Systems and Education for HPV Vaccination (DOSE-HPV), a multi-component intervention aimed at improving HPV vaccination rates, that was implemented sequentially at five family medicine and pediatric practices in Northeastern United States between 2016 and 2018. Interventions lasted six to nine months and consisted of seven sessions that included standardized provider-focused HPV education, individualized data feedback, and tailored systems changes.[20,21,34] Three of the seven intervention sessions were devoted to provider education on vaccine communication techniques; one session on HPV vaccine knowledge and the indicated presentation style, and two on motivational interviewing training, including both didactic and practical portions. Physicians and nurse practitioners who participated in the intervention and provided direct primary care including HPV vaccine recommendations to patients were eligible to provide data for this study.

Data sources

Three data sources were used to examine the effect of the intervention on provider communication about HPV vaccination: (1) in-depth qualitative interviews with participating providers following intervention completion; (2) pre- and post-intervention surveys completed by participating providers during the first and last intervention sessions; and (3) audio recordings of conversations about vaccinations between patients and providers during routine medical visits of vaccine-eligible children in the pre- and post-intervention periods.

Provider interviews

Study personnel conducted in person (n = 24) or telephone (n = 2) semi-structured interviews with primary care providers who participated in at least three of the seven intervention sessions. Interviews took place four to six weeks after the final session at each participating clinical site. Interviews lasted approximately 30 minutes, and explored how provider communication about HPV vaccination changed because of the intervention. Interviews were audio-recorded and professionally transcribed. Interview questions relevant to this analysis included: *Did the intervention change your thinking about the HPV vaccine? If so, how? Did you learn anything new from the intervention? Did you make any changes on how you talk about HPV vaccination because of the program?*

Twenty-three interview participants provided primary care and were therefore eligible to provide data for this study. Coding of the interviews continued until we reached thematic saturation, defined as the point at which additional interviews no longer provided new analytic concepts. The provider interview team (DB, MD, RP) analyzed transcripts throughout the interview process, consistent with grounded theory methodology,[22] and agreed by consensus when to discontinue interviews. Data were analyzed for themes using both inductive and deductive approaches as described previously.[23] Three team members (DB, MD, RP) read the transcripts and developed a codebook iteratively, until a final version was agreed upon. The final codebook was then applied to all the interview transcripts. Each transcript was coded by DB and either RP or MD, and discrepancies resolved through discussions with the entire team. Final codes were entered into NVIVO qualitative software (QSR International Pty Ltd., version 11, 2017).

Provider surveys

We administered a survey assessing beliefs and practices around HPV vaccination to participating providers during the first and final sessions of the intervention at each site. Responses from 21 participants who completed both pre- and post-intervention surveys are included in this analysis. We summarized participant characteristics, and compared differences in HPV vaccine perceptions, attitudes, and self-reported communication practices pre- and post-intervention using Chi-squared and Fisher's exact tests.

Audio-recordings

We recorded 165 clinical interactions between providers and patients. After excluding interactions in which HPV vaccine conversations were not initiated by providers, 129 clinical interactions were eligible for analysis of providers' recommendation styles when presenting the vaccine to parents/guardians of eligible adolescents (64 pre-intervention and 65 post-intervention). A detailed analysis of the audio-recorded data has been described previously.[9] To summarize, all providers at clinical sites participating in the intervention agreed to audio recording. Parents of adolescents who were eligible to begin the HPV vaccine series were approached to participate in audio recordings of their clinical interactions with their providers. Written informed consent was obtained from parents and assent from adolescent patients. Parents completed a brief survey prior to the medical visit which included demographic information and asked them to rate their likelihood of accepting HPV vaccination for their child at that visit using a Likert scale from 1 (very unlikely) to 5 (very likely). Audio recording devices were placed in exam rooms by the research assistant, and retrieved at the end of the visit. Parents, patients, and providers were aware that recording was occurring. Audio recordings were transcribed and coded using content analysis. Provider recommendation style was classified as "indicated" if providers presented the HPV vaccine as a recommended component of the current visit and "elective" if HPV vaccination was presented as optional during the visit. We examined the differences between pre- and post-intervention periods and vaccine recommendation style

using chi square tests of independence for categorical variables and t-tests for continuous variables.

The institutional review board of Boston University Medical Center provided ethical approval for all study protocols.

Results

Section 1: provider qualitative interviews

Most of the 23 interview participants were female (83%); 35% also had administrative or leadership roles within the clinical setting. Most providers (65%) worked in pediatric departments; the remainder (35%) worked in family medicine departments. Overall, pediatric providers reported that a plurality of their patients were eligible for HPV vaccination (21-61%), while family medicine providers typically had few eligible patients (<20%). Three main themes were identified in the qualitative analysis of the post-intervention provider interviews: 1) changes in provider communication post-intervention 2) concrete tools for communicating with parents and patients and 3) effective strategies for communication (Table 1).

Theme 1: changes in provider communication post-intervention

Providers identified three main changes as a result of the intervention: 1) a shift from elective to indicated HPV vaccine presentations; 2) increased knowledge leading to greater confidence in presenting and discussing the HPV vaccine; and 3) increased persistence when faced with reluctant parents or patients. Some providers noted that they switched from using an elective to using an indicated vaccine recommendation style after participating in the intervention: "*I started saying, 'Your child is also due for this vaccine,' rather than something along the lines of, 'At this age, we also start offering this vaccine.' Just to kind of reframe it, I think. It was certainly reframed in my own mind." (Provider 24)* Providers noticed not only an increase in their confidence talking about the vaccine to parents and adolescents as a result of increased knowledge of the HPV vaccination, but also an increase in their motivation to achieve high vaccination rates: "*I felt much more comfortable promoting a vaccine that I felt there was reasonable data saying this actually is not any different from other vaccines' adverse event profiles. It's the same risk. And then looking to strong data that supports the benefit of it. I definitely cannot sell stuff I don't believe in." (Provider 21)* Providers also felt more motivated to continue conversations about HPV vaccination with parents who expressed initial reluctance, and felt that the intervention provided necessary skills to address parental concerns: "*If they decline? Yeah, that motivational interviewing piece of the intervention was really helpful with that. I think I'm prone to feel scared by the awkwardness of that situation – that moment, to just be like, okay, never mind. [LAUGH] And the intervention I think helped me to feel like okay, this doesn't have to be the last conversation, at least." (Provider 22)*

Theme 2: concrete tools for communicating with parents

Providers identified four conversational tools that were useful when communicating with patients: 1) facts about HPV-related cancers and cancer prevention; 2) improved understanding of HPV transmission; 3) information on the increased effectiveness of vaccination at younger ages; and 4) impact of repeating the recommendation every year. Providers discussed the impact of presenting HPV vaccination as a medical intervention to prevent cancer. Appealing to parents' desire to keep their children safe from cancer and assigning responsibility to protect their children in this way encouraged parents to view the benefits of vaccination through a different lens: "*Just that one little thing: it's the one vaccine we have to prevent cancer. You know? I mean – it's a very powerful message. It's the one thing you can do to prevent cancer in your child. You know, I wish we had more. But this is the only one I can offer you. It's hard to say no to that."(Provider 10).* Providers discussed that receiving information about the link between HPV and oropharyngeal cancers improved their ability to convincingly discuss the benefits of HPV vaccination, especially for male patients. Providers also found it helpful to offer explanations of HPV transmission without the need for penetrative sexual intercourse.

Several providers stated that they were initially reluctant to recommend HPV vaccination to younger patients, but felt more comfortable doing so after the intervention. They indicated that learning about improved antibody responses and the need for fewer doses to complete the vaccine series was motivating for both providers and parents. Provider 24 illustrated how she adapted her communication with parents to include antibody response data: "*The reason we're offering it at this time is because it helps to prevent HPV related cancers, including cervical cancers, and all these things, and the reason we do it now, is because you get the best immune response, and it offers the best protection."* The intervention also addressed provider hesitancy about readdressing HPV vaccination with parents who had previously declined by encouraging providers to keep the conversation open and to continue offering the vaccination each year. Provider 25 said, "*I'll try to assess why they're declining and if there's something I can address about that. And then if I can't assuage their fears or, convince them at that visit I'll say, 'Will it be okay with you if I bring this up the next time we meet and just check in with you again about it?'"*

Theme 3: other effective strategies for communication

The intervention allowed providers to understand which strategies for communicating with parents were effective and which strategies had less of an impact. Providers described three effective strategies: 1) personal stories; 2) cultivating relationships with patients; and 3) using simple language to discuss the vaccine. Some providers found that personal stories about HPV vaccination were effective when discussing the vaccine, especially when speaking to patients with whom they have a long-term, trusting relationship: "*They just want more information or 'do you really agree, you've been here a long time, would you do this to your child?' And I often say, 'I have a fourteen year old, she's gotten the vaccine' and I find that really helps." (Provider 3)* Another way to personalize the issue of HPV was to relate vaccination to the avoidance of cervical procedures and cancers: "*And so the trick that they gave us, is ask parents if they have ever seen anyone with cancer, and intrauterine cancer and is this what they would like to see their child go through, or would they like to prevent this disease in*

Table 1. Qualitative themes identified in provider interviews.

Theme	Illustrative Quotes
Changes in Provider Communication	
Shift from elective to indicated HPV vaccine presentations	*I'm just like, okay, we do these three shots now. And then if there's sort of objections, we talk about those, and I maybe go over why it would, you know, if you can stand it, it's good to get all three of them now. (Provider 16)*
Increased knowledge leading to greater confidence in presenting and discussing the HPV vaccine	*I think I felt a little better equipped to say to people, well, yeah, it really works, and we should just do it. (Provider 21)* *I think it increased my awareness of the severity – not the severity of the cancers but the prevalence of them, and I also think it increased my understanding of why the early vaccination is important, and made me push harder for people who have younger children in the nine to thirteen range to do it. (Provider 15)*
Increased persistence when faced with reluctant parents or patients	*I just revisit it and then just mention that, 'The last time you had some reservations, and you've had some time to talk about it with your family and read some literature, and I just kind of wanted to see where you're at and if you're interested in getting it today,' and just take it from there. (Provider 20)* *I think also helped me to sort of like re-prioritize it in terms of when we were offering it, and how comfortable I was sort of encouraging parents who initially were maybe a little bit more ambivalent. (Provider 24)*
Concrete Tools for Communicating with Parents and Patients	
Facts about HPV-related cancers and cancer prevention	*So hearing her [provider educator] talk about someone in her thirties who died of cervical cancer that had a big impact on me, personally. I was able to say that to parents and I had a few instances where people were sort of reluctant and then I was able to sort of tell that anecdote that this actually really is related to prevention of cancer. And it changed people's minds. (Provider 1)* *The information about the oropharyngeal cancers, that helped me understand ways that I can use to promote it with my male patients.* (Provider 25)
Improved understanding of HPV transmission	*I wasn't ever saying, 'Oh this is all STD,' but one of the things that [provider expert] talked about is that you can get it from non-sexual contact. I say, 'Well yes, it's an STD but you can also get it other ways.' (Provider 12)*
Information on the increased effectiveness of vaccination at younger ages	*So I tell them we are starting earlier because the goal is that by eleven, the child would be fully immunized and that we guarantee that they would be protected and also it will be only two shots instead of three. (Provider 2)*
Impact of repeating the recommendation every year	*Mom, you remember last year I gave you information with this about the reasons of HPV, HPV vaccine is safe, I know that you have read many, many things but we have now the luxury to protect against cancer. (Provider 2)*
Other Effective Strategies for Communication	
Personal stories, cultivating relationships with patients, using simple language to discuss the vaccine	*I say, 'So your daughter is due for the HPV vaccine today.' And I say that it is for a nine year old ….I say 'Mom, do you get your pap smear every year?' and they say yes or no. I say, 'Has your test ever come back with anything positive in there? And they say yes. 'That virus, mom, that you had to go to this and this, is the one that we are preventing with these. That disease is what we are preventing with this vaccine.' (Provider 2)*

someone they love?" (Provider 14) Many providers discussed the importance of cultivating long-term trusting relationships with the patients and parents to improve the totality of healthcare, including vaccinations. "*People who feel comfortable with you, they've seen you advocate for them in other situations, and they know that you've got their back, and that you have their best interest in mind." (Provider 4)* Finally, providers spoke of the importance of clear, simple communication, rather than overwhelming patients with a litany of complex medical facts: "*Sometimes I feel like that can be frightening, like sometimes too much information is too much, you know?" (Provider 3)*

Section 2: provider surveys on self-reported attitudes and behavior

Among the 21 providers who completed both pre- and post-intervention surveys, 90% were female, 80% self-identified as Non-Hispanic White, 5% as Hispanic/Latino, and 15% as Asian. Seventy-five percent of providers were physicians, 25% were nurse practitioners, and they worked in either pediatrics (60%) or family medicine (40%) (Table 2). Providers responded pre-and post-intervention to the same set of questions concerning their own attitudes and behaviors related to HPV vaccination and their perceptions of parents' attitudes toward HPV vaccination (Table 2). Following the intervention, levels of agreement with the statement: "HPV vaccine is one of the most important vaccines" rose from 71.4% to 100% (p = .02). Providers also felt more comfortable offering the HPV vaccine to adolescents under the age of 13 after the intervention compared to before the intervention (71.4% pre-intervention vs. 100% post-intervention; p = .02). Prior to the intervention, 28.6% of providers cited time pressure as a barrier to vaccination compared with 19.0% following the intervention (p = .72). Interestingly, providers reported changes in parent attitudes in the post intervention period, although parents did not receive the intervention. Prior to the intervention, only 1 provider (4.8%) believed that parents found the HPV vaccination to be extremely/very important, but 42.8% (n = 9) expressed this belief after the intervention (p = .01). Parental reluctance to have children immunized against a sexually transmitted infection was identified as a barrier to offering HPV vaccination by 57.1% of providers (n = 12) in the pre-intervention period and 38.1% (n = 8) of providers in the post-intervention period (p = .35).

Section 3: audio recordings of clinical interactions

The demographic characteristics of parent-child dyads were similar in the 64 pre- and 65 post-intervention audio recordings (Table 3). Parents were racially diverse (34.4–37.9% Hispanic, 15.2–23.4% Non-Hispanic White, and 32.8–36.4% Non-

Table 2. Demographic characteristics and survey responses of providers surveyed (pre- and post-intervention).

Demographic information		
Provider Race	Non-Hispanic White	16 (80%)
	Hispanic/Latino	1 (5%)
	Asian	3 (15%)
Provider Sex	Female	19 (90.5%)
	Male	2 (9.5%)
Professional Training	Physician	15 (75%)
	Nurse Practitioner	5 (25%)
Clinical Specialty	Family Medicine	8 (40%)
	Pediatrics	12 (60%)

Survey responses	Pre-Intervention n (%)	Post-Intervention n (%)	P-value (chi square or Fisher exact)
I believe that HPV vaccine is one of the most Important vaccines that I give to patients.			
Agree/Strongly Agree	15 (71.4%)	21 (100%)	0.02
Disagree/Strongly Disagree	6 (28.6%)	0	
I feel more comfortable offering HPV vaccine to adolescents age 13 and over compared to those younger than 13.			
Agree/Strongly Agree	6 (28.6%)	0	0.02
Disagree/Strongly Disagree	15 (71.4%)	21 (100%)	
Time pressure is a barrier to providing HPV vaccination.			
Likely	6 (28.6%)	4 (19.0%)	0.72
Unlikely	15 (71.4%)	17 (80.9%)	
Parents believe the HPV vaccine is:			
Extremely/Very Important	1 (4.8%)	9 (42.8%)	0.01
Somewhat/Not important	20 (95.2%)	12 (57.1%)	
Parental Reluctance to have children immunized against an STI is a barrier to HPV vaccination.			
Likely	12 (57.1%)	8 (38.1%)	0.35
Unlikely	9 (42.8%)	13 (61.9%)	

**1 missing value each for race, profession, and clinical specialty.*

Table 3. Parent-patient demographic characteristics, parent-reported likelihood of vaccine acceptance, and provider vaccine recommendation style for audio-recorded clinical interactions (pre- and post-intervention).

		Pre-Intervention Survey (N = 64) n (%)	Post-Intervention Survey (N = 65) n (%)	P-value (chi square or t-test)
Parent Race	Non-Hispanic White	15 (23.4%)	10 (15.2%)	
	Hispanic/Latino	22 (34.4%)	25 (37.9%)	
	Non-Hispanic Black	21 (32.8%)	24 (36.4%)	
	Other	6 (9.4%)	7 (10.6%)	0.70
Parent Sex	Female	48 (75%)	52 (80%)	
	Male	16 (25%)	13 (20%)	0.50
Parent Age	Mean (Standard Deviation)	41.86 (7.85)	40.14 (7.19)	0.21
Parent Highest Educational Attainment*	Less than High School	14 (22.2%)	11 (16.9%)	
	High School or GED	14 (22.2%)	23 (35.4%)	
	Some College	11 (17.5%)	13 (20.0%)	
	Associates, Bachelors, or Graduate degree	24 (38.1%)	18 (27.7%)	0.31
Annual Household Income*	<$25,000	24 (44.4%)	28 (43.1%)	
	$25,001-$50,000	18 (18.5%)	22 (33.9%)	
	$51,001-$100,000	14 (25.9%)	9 (13.9%)	
	>$100,000	6 (11.1%)	6 (9.2%)	0.18
Parental pre-visit likelihood of vaccination score**	Mean (standard deviation)	3.23 (1.05)	3.49 (1.21)	0.20
Child Race	Non-Hispanic White	13 (20.3%)	10 (15.4%)	
	Hispanic/Latino	23 (35.9%)	26 (40.0%)	
	Non-Hispanic Black	21 (32.8%)	18 (27.7%)	
	Other	7 (10.9%)	11 (16.9%)	0.64
Child Sex	Female	31 (48.4%)	35 (53.8%)	
	Male	33 (51.6%)	30 (46.2%)	0.54
Child age	Mean (Standard Deviation)	12.02 (1.81)	10.77 (1.50)	<0.001
Vaccine recommendation style	Indicated	40 (62.5%)	51 (79.6%)	**0.047**
	Elective	24 (37.5%)	14 (20.4%)	

*1 missing value for educational attainment and 2 missing values for household income in the pre-intervention period
**Parents expressed their likelihood of accepting HPV vaccine for child on a Likert scale from 1 (very unlikely) to 5 (very likely)

Hispanic Black) and predominantly female (75-80%), with an average age of approximately 40 years. Parental education ranged from less than high school to completion of a graduate degree, and annual household incomes ranged from <$25,000 to >$100,000. Children were largely racially concordant with their parent, and were equally divided between boys and girls. Children were younger in the post- compared to the pre-intervention period (10.77 and 12.02 respectively, $p < .001$), which likely reflected the decision by participating practices to begin routinely recommending HPV vaccination prior to age 11. Parents' self-reported likelihood of accepting vaccination was similar in the pre- and post-intervention periods (mean scores of 3.23 and 3.49 respectively, $p = .20$). Analysis of provider communication found that providers' use of an indicated recommendation style increased from 62.5% of clinical encounters in the pre-intervention period to 79.6% in the post-intervention period ($p = .047$).

Discussion

Our results suggest that the DOSE-HPV multilevel intervention directly influenced providers' HPV vaccine communication. When interviewed, providers expressed feeling more confident discussing HPV vaccination with parents and engaging with parental concerns after the intervention. They stated that the intervention gave them new tools for communicating with parents: focusing on cancer prevention; explaining the reason for early vaccination as related to antibody responses and fewer doses needed rather than related to sexual activity; and additional confidence to continue conversations with hesitant parents at subsequent visits. Participating providers identified and used effective communication strategies such as personal stories, leveraging long-term relationships with parents, and using simple language to describe the vaccine. Analysis of audio recordings noted a nearly 20% increase in the use of "indicated" vaccine recommendations, supporting providers' self-reported data describing changes in their communication behavior.

Prior research suggests that providers frequently overestimate parental hesitancy about the HPV vaccine,[24] which is negatively associated with willingness to recommend the vaccine and with lower initiation rates.[25,26] Parent and provider survey data from this study indicate that providers' perceptions of parents may be influenced by communication training. Providers reported that parents were more enthusiastic about vaccination following the intervention, yet the parents' self-reported likelihood of accepting vaccination at the clinic visit did not increase from the pre- to the post-intervention period. Thus, the shift in providers' perception of parents may reflect their increased confidence and improved communication skills, rather than changes in underlying parental attitudes.

Provider behavior change, while critical for uptake of new evidence-based practices, is difficult to achieve.[27,28] Provider behavior is influenced by personal factors such as knowledge, self-efficacy and outcome expectation, patient related factors, healthcare context, and cultural expectations and beliefs.[29,30] Interventions aimed at promoting provider behavior change include education, environmental restructuring, incentives, audit and feedback, reminders, and marketing.[27,31] For HPV communication, factors influencing health care provider behavior include provider HPV and vaccine knowledge, vaccine safety concerns, perceived parental hesitancy, and time constraints.[28,30]

While many resources aimed at improving provider communication have been developed by national organizations and researchers, data on their effectiveness are limited.[28] Evidence on what works and why is mixed depending on context and intervention type, although multi-faceted interventions appear to be more effective than single intervention strategies.[27,31] Interventions tailored to specific barriers also tend to be more effective than diffuse ones such as marketing.[32] Communication trainings that emphasize the use of an indicated recommendation style seem most effective for improving HPV vaccination initiation and completion.[16,19,30] Training in motivational interviewing allows concerns to emerge and be mutually addressed.[33] Our study describes the effect of a multilevel intervention on provider communication using two sources of self-reported data: interviews and surveys, and one objective source of data: audio recordings of clinical interactions. The ability to combine data from three sources allowed exploration of the different ways in which this multi-level intervention impacted provider communication.

Our study had several limitations. This study took place in an urban setting in the Northeastern US, in healthcare settings that serve primarily low-income and minority patients, which may limit generalizability. The interview results have limitations common to qualitative interviews, specifically small sample size (n = 23) and a homogenous population of mostly female primary care providers. The survey data are also limited by the small number of providers (n = 21) who completed both pre- and post-intervention surveys. The audio recordings had the limitation of the inability to compare the recommendation styles of the same providers pre- and post-intervention due to relatively small numbers of patients per provider. In addition, providers and patients were aware of the recording devices so recorded conversations may represent a "best-case scenario" of communication around vaccines. The recording protocol was the same in the pre-intervention and post-intervention periods, therefore awareness of the recording devices would not explain observed differences between the pre- and post-intervention periods. These factors may reduce the generalizability of our findings. Future research may explore the impacts of multi-level interventions on provider communication in larger settings.

Conclusions

Provider behavior is difficult to change, but we found evidence that multi-level interventions may provide effective tools to modify providers' approaches to vaccine communication. Multi-level interventions have demonstrated effectiveness in improving HPV vaccination rates, and these data outline a potential mechanism by which these interventions may directly impact communication with patients.

Abbreviation

HPV	Human Papillomavirus

Disclosure of potential conflicts of interest

No potential conflicts of interest were disclosed.

Dr. Joseph has received grant funding from Merck & Co. The other authors have no financial relationships relevant to this article to disclose.

Funding

This work was supported by an American Cancer Society Research Scholar Grant [grant number 128607-RSG-15-150-01-CPHPS]. No commercial support was obtained.

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An interprofessional, multi-component HPV vaccination intervention resulted in both self-perceived and objectively observed changes in provider communication with patients.

Data sharing statement

De-identified individual participant data will not be made available.

Clinical trial registration

This study is registered in Clinical Trials.gov, ID number NCT02812732.

ORCID

Rebecca B. Perkins http://orcid.org/0000-0002-7054-3014

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