Cancer Prevention Education for Providers, Staff, Parents, and Teens Improves Adolescent Human Papillomavirus Immunization Rates

Manika Suryadevara, MD[1], Cynthia A. Bonville, MS[1], Donald A. Cibula, PhD[2], and Joseph B. Domachowske, MD[1]

Objective To develop a program to educate providers, office staff, patients, and parents on life-long cancer prevention strategies, including the use of human papillomavirus (HPV) vaccine to improve adolescent HPV vaccination rates.

Study design A 2-phase program was implemented at 6 pediatric practices across upstate New York. Phase 1 included provider and staff education regarding practice-specific vaccination challenges and discussion of the contents of a study-specific cancer-prevention booklet, which included HPV vaccine information. Throughout phase 2, the booklets were distributed to all adolescents and their parents during office visits over a 12-month period. Practice-specific, countywide, and statewide HPV vaccination rates were assessed before phase 1, and 6 and 12 months after the launch of phase 2.

Results One year after implementing phase 2 in 6 practices, adolescent HPV vaccine series initiation increased by at least 10% in 3 practices, and at least 5% in 5 practices. Similarly, adolescent vaccine series completion rates increased by more than 10% in 3 practices. The percent change in vaccine series completion rates across all study sites postintervention ranged from 12% to 20% for 11- to 12-year-olds, and from 7% to 23% for 13- to 18-year-olds.

Conclusions Cancer prevention education targeting providers, office staff, patients, and parents was modestly effective for improving adolescent HPV vaccination rates. *(J Pediatr 2019;205:145-52).*

Human papillomavirus (HPV) vaccination rates remain suboptimal despite the universal recommendation that all adolescents be immunized. In the US, it is estimated that 79 million people are currently infected with HPV and that each year, approximately 40 000 new HPV-associated cancers are diagnosed.[1] The 9-valent HPV vaccine is highly effective at preventing infections caused by the most common oncogenic HPV types, yet adolescent HPV vaccine series completion rates remain low. Despite the availability and universal recommendation for the use of HPV vaccine starting at age 11 or 12 years, 2016 data for series completion among 13- to 17-year-olds is only 43.4% nationally.[1,2]

Adolescent HPV vaccine uptake is influenced by patient, parent, and provider factors. Among both parents and providers, HPV nonvaccination is associated with the belief that immunized adolescents are more likely to have unprotected sex and with the conviction that HPV vaccination needs to include a discussion about sexual activity.[3-5] On the other hand, 2 patient factors that are consistently associated with HPV vaccine acceptance include receiving a strong vaccine recommendation from one's provider and a general understanding that HPV vaccine has the potential to prevent some forms of cancer.[6-10] Despite the well-established, positive impact of a provider's stated recommendation on improving vaccine uptake, many providers continue to give weak, unclear, or inaccurate vaccine recommendations.[11-13] Others report or convey incomplete or inaccurate knowledge regarding HPV-associated cancers, particularly related to malignancies other than cervical cancer.[14] Published reports suggest that educational programs for providers that focus on delivering strong vaccine recommendations together with consumer messages that focus on cancer prevention benefits of vaccine improve adolescent HPV vaccine completion rates.[13-15] Here, we describe an educational program for providers, their office staff, adolescents, and their parents designed to raise awareness that HPV vaccine is an important cancer-prevention tool. We hypothesized that raising such awareness would be associated with an increase in HPV vaccination rates.

Methods

In 2015, we secured funding from the American Academy of Pediatrics (AAP) Adolescent Vaccinations and Wellness Grant Program, to develop and implement a cancer prevention educational program designed to target all stakeholders in the immunization delivery system at the practice level. This program included on-site education for providers and staff as well as the development and distribution

AAP	American Academy of Pediatrics
HPV	Human papillomavirus

From the [1]Department of Pediatrics; and [2]Department of Public Health and Preventive Medicine, SUNY Upstate Medical University, Syracuse, NY

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of a cancer prevention booklet for the adolescents and their families in the practice. The color monograph presents basic life-long cancer prevention advice related to exercise, tobacco use, sun exposure, and HPV- and hepatitis B-associated diseases and vaccines. The booklet was designed by the study team by combining resources available from both the US Centers for Disease Control and Prevention and the American Cancer Society with the goal of bundling HPV vaccine information with other generally well-accepted anticipatory guidance for cancer prevention.[16-20]

To test the effects of our novel cancer prevention education platform, we recruited 6 large pediatric offices in upstate New York to participate in a pilot effort. Each practice designated a project champion, all of whom were AAP National and District 2, Chapter I member pediatricians. The project champions acted as site contacts with the study team, facilitated practice follow-through with the program, and attended an end-of-study meeting to discuss the study results.

Phase 1

Phase 1 of the program was designed to engage and educate the providers, their nurses, and office staff about practice-specific immunization concerns, challenges, and successes. This component included an on-site education session with each participating practice led by the 2 senior study investigators starting in the fall of 2015. All office staff members were asked to attend. First, an anonymous survey was administered to the providers to assess their baseline knowledge and beliefs about HPV vaccine and cancer prevention, and to ascertain the frequency with which verbal and written counseling regarding cancer prevention guidance is administered to the adolescent patients in their practice (**Table I**; available at www.jpeds.com). The educational component of the session (**Table II**; available at www.jpeds.com) included topics of vaccine hesitancy, information about HPV disease and HPV vaccine, and the role of HPV vaccine in cancer prevention. Although HPV vaccine was the primary focus of the sessions, general advice regarding common vaccine hesitancy issues was provided. Other common reasons for suboptimal adolescent vaccine coverage rates unrelated to vaccine hesitancy also were discussed, such as missed opportunities and failure to bundle recommended vaccines together. The discussion included reminders of the importance of a consistent positive vaccine messaging throughout the practice and that the same strength of vaccine recommendation should be conveyed for all category A Advisory Committee on Immunization Practices recommended adolescent immunizations (tetanus diphtheria acellular pertussis, quadrivalent conjugate meningococcal vaccine, HPV, and influenza). Practice members also shared their prior successes with quality improvement efforts to boost vaccine coverage rates. We answered individual provider vaccine questions, reviewed the content of the study-specific cancer prevention educational booklet, and explained the objective and details for phase 2 to each group.

Phase 2

Phase 2 education, which started immediately following phase 1, was provided to adolescents and their parents by the providers and staff at each study site. The education included distributing the cancer prevention awareness booklets to all adolescents and their parents who came to an office visit over a 12-month period. It was left to the discretion of each practice to determine the logistics for when to provide the booklets to the patients during the visit (check-in, when patient is assigned a room, or when provider enters the room), and when to use the booklet to actively point out a specific educational detail.

Measures

Practice-specific HPV vaccination rates were determined immediately prior to phase 1 education and again 6 and 12 months after beginning phase 2. Phase 2 initiation was defined by the date the practice began to distribute the booklets to their patients. In an effort to control for external factors, which may affect adolescent HPV vaccination rates, including media-specific public service announcements and statewide mailings of HPV vaccine information, the practice-specific HPV vaccination rates were compared with statewide and countywide HPV vaccination rates at the same time points. Statewide and countywide immunization rates were retrieved from the New York State Immunization Information System, the state's immunization registry that is mandated for all vaccines administered prior to 19 years of age.

Statistical Analyses

Vaccination rates and change in rates from baseline (prior to phase 1) were calculated for each practice and county of practice at 6 and 12 months following the initiation of the intervention. Descriptive statistics and 95% CI estimates were calculated for mean rates for individual intervention sites and for counties. Vaccination rates and change in rates for the practices were compared with county rates at 6 and 12 months using paired Wilcoxon signed-rank tests. Analysis was stratified by sex and age group within sex. All statistical analyses were conducted using SPSS v 24 (SPSS Inc, Chicago, Illinois).

Results

Six large general pediatric practices, A through F, each serving between 1900 and 6000 adolescents, participated in the program (**Table III**; available at www.jpeds.com). All 6 practices accept patients who are covered by public or private health insurance. Four of the practices describe themselves as serving a suburban population. Two practices describe themselves as serving rural, suburban, and urban communities.

All 46 providers and nurses working in the 6 practices completed the anonymous survey just before phase 1 education was started, but not all participants answered every question included on the survey. At least 96% of the providers and nurses who responded strongly agreed with the following statements: HPV infection is associated with cancer, HPV vaccine is effective in preventing cancer (n = 45), and HPV vaccine is an important cancer prevention method for their adolescent patients (n = 44). Eight-five percent (n = 39) of participants strongly agreed that cancer prevention guidance was within

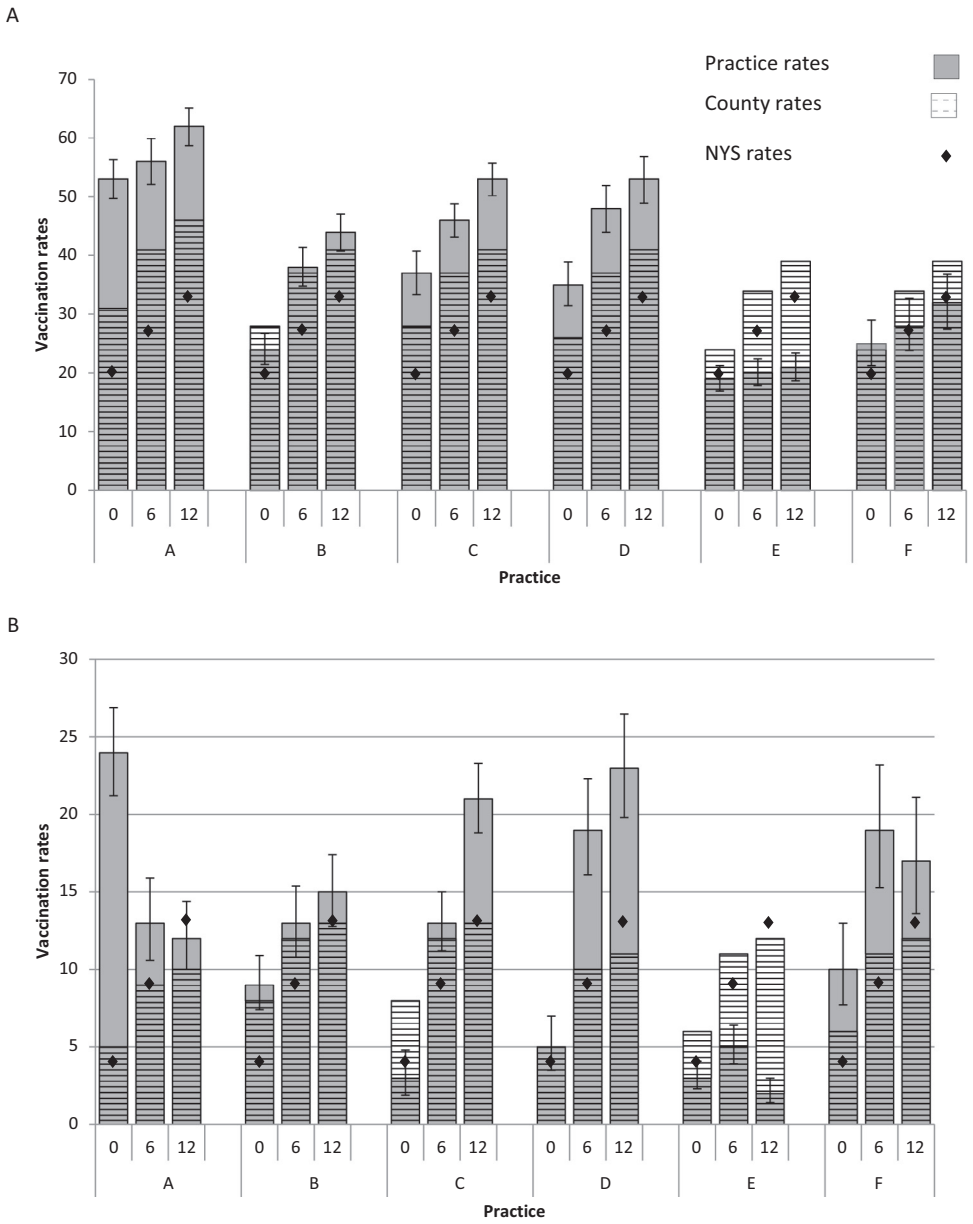

Figure 3. Overlapping graph depicting HPV vaccination rates by practice (*colored columns*), county of practice (*horizontal bars*), and New York state (*NYS*, *diamonds*) before, 6 months, and 12 months after implementation of phases 1 and 2 of the cancer prevention education program. Represented rates include **A,** vaccine initiation and **B,** completion among 11- to 12-year-olds, and **C,** vaccine initiation and **D,** completion among 13- to 18-year-olds. (*Continues*)

the scope of their practice and that their adolescent patients are at risk for acquiring HPV infection and the subsequent development of cancer (**Figure 1**; available at www.jpeds.com).

The self-reported delivery of cancer prevention guidance prior to the start of phase 1 varied by risk factor, with just over one-half of participants providing verbal counseling to all adolescent patients regarding smoking and HPV vaccine, and less than one-half regarding sun exposure, tanning bed exposure, physical activity, and hepatitis B vaccine (**Figure 2**, A; available at www.jpeds.com). Written counseling to all adolescent patients regarding the following cancer preventing lifestyle choices varied by factor, but none were 50% or higher (**Figure 2**, B; available at www.jpeds.com).

Practice-specific baseline HPV vaccination rates for 11- to 12-year-old patients ranged from 19% to 53% for series initiation (**Figure 3**, A) and from 3% to 24% for series completion (**Figure 3**, B). Of the 6 practices, baseline vaccination rates in 5 (83%) and 4 (67%) practices were at or above statewide rates for series initiation (**Figure 3**, A) and completion (**Figure 3**, B), respectively. Four (67%) practices had vaccine initiation (**Figure 3**, A) and completion (**Figure 3**, B) rates at or above the practice's county rates.

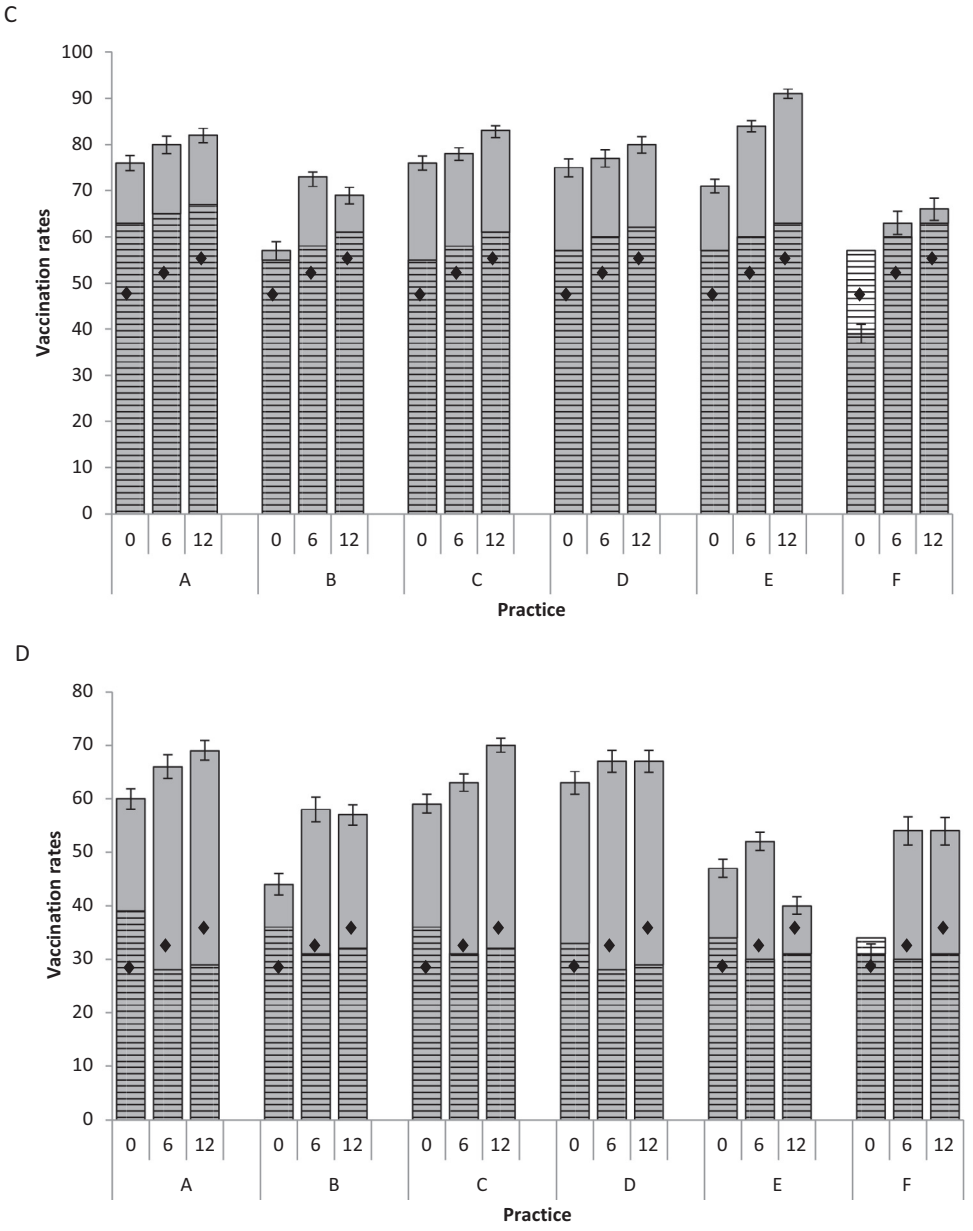

Figure 3. Continued.

For 13- to 18-year-old patients, practice-specific baseline HPV vaccination rates ranged from 39% to 76% for series initiation (**Figure 3**, C) and from 31% to 63% for series completion (**Figure 3**, D). Of the 6 practices, baseline vaccination rates in 5 (83%) and 6 (100%) practices were at or above statewide rates for series initiation (**Figure 3**, C) and completion (**Figure 3**, D), respectively. Five (83%) practices were at or above county-specific rates for series initiation (**Figure 3**, C) and completion (**Figure 3**, D).

Percent changes in vaccine series initiation and completion rates for each practice over the 12-month study period are shown in **Table IV**. Three (50%) practices improved vaccine initiation rates by at least 10% and 5 (83%) improved by greater than 5% in both age groups (**Table IV**). Similarly, 2 (33%) and 3 (50%) practices had at least a 10% change in vaccine completion rates in 11- to 12-year-olds and 13- to 18-year-olds, respectively, and 4 (67%) of the practices had at least a 5% change in vaccine completion rates in both age groups (**Table IV**).

When stratified by patients' sex, there were infrequent instances of statistically significant differences in vaccine initiation and completion rates among male and female participants in the 11- to 12-year-old age range and in vaccine initiation rates among male and female participants in the 13- to 18-year-old cohort within each practice. However, in the 13- to 18-year-old cohort, HPV vaccine completion rates were significantly higher among female participants compared with male participants in both the baseline and the postintervention comparisons for all but 1 practice (**Table V**).

Table IV. HPV vaccine series initiation and completion rates for total adolescent patient population by practice before and after intervention

	Before intervention		12 mo after starting intervention		
11- to 12-y-olds	Vaccine initiation rates n (%)	Total patients n	Vaccine initiation rates n (%)	Total patients n	% increase in series initiation over study duration (95% CI)
Practice A	478 (53)	896	552 (62)	891	9 (4.4-13.5)
Practice B	253 (24)	1073	436 (44)	983	20 (15.9-24)
Practice C	243 (37)	659	696 (53)	1307	16 (11.4-20.5)
Practice D	229 (35)	650	329 (53)	619	18 (12.6-23.3)
Practice E	230 (19)	1230	253 (21)	1196	2 (–1.2-5.2)
Practice F	129 (25)	513	129 (32)	405	7 (1.1-12.9)
13- to 18-y-olds					
Practice A	1946 (76)	2575	1996 (82)	2436	6 (3.7-8.2)
Practice B	1385 (57)	2439	1841 (69)	2669	12 (9.4-14.6)
Practice C	2317 (76)	3062	3846 (83)	4614	7 (5.8-9.6)
Practice D	1465 (75)	1954	1577 (80)	1972	5 (2.4-7.6)
Practice E	2414 (71)	3378	3163 (91)	3490	20 (18.2-21.8)
Practice F	912 (39)	2327	985 (66)	1487	27 (23.8-30.1)
11- to 12-y-olds	Vaccine completion rates n (%)	Total patients n	Vaccine completion rates n (%)	Total patients n	% increase in series initiation over study duration (95% CI)
Practice A	211 (24)	896	107 (12)	891	–12 (–15.5-8.5)
Practice B	92 (9)	1073	144 (15)	983	6 (3.2-8.8)
Practice C	22 (3)	659	279 (21)	1307	18 (15.3-20.5)
Practice D	31 (5)	650	141 (25)	619	20 (16.2-23.8)
Practice E	31 (3)	1230	23 (2)	1196	–1 (–2.3-0.3)
Practice F	51 (10)	513	67 (17)	405	7 (2.6-11.6)
13- to 18-y-olds					
Practice A	1538 (60)	2575	1672 (69)	2436	9 (6.4-11.7)
Practice B	1082 (44)	2439	1508 (57)	2669	13 (10.3-15.7)
Practice C	1820 (59)	3062	3221 (70)	4614	11 (8.8-13.2)
Practice D	1230 (63)	1954	1320 (67)	1972	4 (1-7)
Practice E	1594 (47)	3378	1410 (40)	3490	–7 (–9.3-–4.7)
Practice F	730 (31)	2327	807 (54)	1487	23 (19.8-26.1)

Figure 3 shows that several of the practices that were below or at baseline countywide vaccination rates were well above countywide rates 12 months after the initiation of phase 2 education. Taken all together, countywide vaccine completion rates for 13- to 18-year-olds decreased during the 12-month study period in each county represented, and study site-specific vaccination rates increased in 5 (83%) of the 6 recruited practices. Accounting for the reduction in countywide rates, the corrected improvement for vaccine completion among 13- to 18-year-olds at the 5 practices ranged from 8 to 20 percentage points.

Following the 12-month study period, the study team held a debriefing session with the project champion from each practice. Project champions from practices with positive changes in immunization rates consistently commented that they believed the provider education component provided during phase 1 played a vital role for how vaccine recommendations were conveyed in the practice. Champions also provided positive feedback regarding the cancer prevention booklets because none of the practices had previously offered written cancer prevention guidance to their families. Providers also reported positive parent feedback regarding the manner in which the booklets combined and reinforced cancer prevention messages, some familiar, and others new.

Discussion

We show that the introduction of a cancer prevention education platform geared toward providers, office staff, adolescents,

Table V. Differences in HPV vaccination rates by patient's sex—practice, before and after the cancer prevention awareness program

Vaccine completion among 13- to 18-y-olds

	Preintervention		Postintervention	
Practices	Female % (95% CI)	Male % (95% CI)	Female % (95% CI)	Male % (95% CI)
A	66 (63.8-69.0)*	54 (50.9-56.2)	72 (70.0-74.9)*	65 (62.2-67.6)
B	49 (45.9-51.6)*	40 (37.7-43.1)	60 (57.0-62.3)*	54 (50.9-56.1)
C	65 (62.8-67.7)*	54 (51.6-56.5)	50 (47.7-51.6)*	94 (92.9-94.9)
D	68 (65-70.8)*	58 (54.8-61.0)	70 (67.0-72.8)*	64 (61.0-66.9)
E	51 (48.7-53.6)*	43 (41.1-45.8)	43 (41.0-45.8)*	38 (35.4-40.0)
F	36 (33.0-39.1)*	27 (24.4-29.4)	59 (55.4-62.5)	57 (53.4-60.6)

*Statistical difference between female and male vaccination rates.

and their parents as a 2-phase effort improved HPV vaccine series initiation and completion rates by as much as 20%. Straightforward, low-cost provider education combined with the distribution of cancer prevention awareness booklets to patients and families addresses 2 factors well known to improve vaccine uptake: a strong provider recommendation and the understanding that HPV vaccine plays a role in cancer prevention. Our intervention was the use of a general cancer prevention education booklet that bundles all 5 cancer prevention topics in 1 resource. Presenting HPV vaccine as a high impact strategy to prevent cancer alongside of the very well-known strategies of smoking cessation and use of sunscreen allow the adolescent and the parent to better understand its importance.

In our anonymous survey, we found that 85% of participating pediatric providers and nurses strongly agreed that cancer prevention was in their scope of practice. Yet, the US Preventive Services Task force clearly recommends comprehensive counseling of adolescents directed at preventing threats to the health of their patients.[21] Similarly, despite available AAP policy statements for counseling adolescent patients regarding tobacco use, physical activity, healthy nutrition, HPV infection, and ultraviolet radiation through sun exposure or indoor tanning, all known risk factors for the development of cancer in adulthood, we found that only one-half of providers self-reported routinely providing verbal counseling regarding these lifestyle choices and even fewer provider written materials.[22-27] Our finding is consistent with other studies documenting that US adolescents are underserved in their health counseling needs.[21,28,29] For example, 1 study showed that diet and exercise guidance was provided at only 26% and 22% of well visits, respectively.[28] We have shown that education-driven changes in the way providers and their staffs convey vaccine information that also incorporates written material with simple, consistent messages, has the potential to raise HPV vaccination rates with minimal cost and effort.

Our study was performed more than 5 years after the Advisory Committee on Immunization Practices expanded its HPV vaccination recommendation to include male adolescents, yet age-specific HPV vaccine completion rates for boys and girls remained highly discordant across all 6 of our participating practices, a finding consistent with published regional and national epidemiologic data.[30-33] There are several possible reasons for this observation. Routine vaccination for female adolescents was recommended almost 2 years earlier than for male adolescents. There may be a general lack of understanding on the part of providers and parents regarding the potential for HPV-associated anal, penile, and oropharyngeal cancers, and many providers still do not provide a strong, consistent recommendation for their male patients.[34-37] Interventions are needed to improve provider, parent, and adolescent male awareness regarding the risks that male patients who are infected with oncogenic HPV-types are at risk for developing malignancy, and that the most common types associated with cancer are vaccine preventable.

We recognize that our study has several limitations. Only 6 pediatric practices were included. The majority of the practices care for a large suburban population in upstate New York, which may limit the ability to generalize the data. Similarly, the recruited practices had baseline immunization rates at or above the state and county rates, thus, the data may not be generalizable to those practices with immunization rates lower than the state and county. It is possible that provider education and use of cancer prevention education booklets in practices with low baseline rates could show greater changes in HPV vaccine uptake. Another important limitation is that there was no standardization to the approach and delivery of the verbal and written information to the adolescents and their parents, with regards to the timing, duration, method of delivery, and amount of information provided by practice providers and staff. Instead, it was left to the staff to determine the logistics that suited their work flow best. Variations in the decided approach may explain, in part, why 3 of the outpatient practices demonstrated some decline in vaccine completion over time. Further study is necessary to determine the impact, if any, on when and how the flow of education is provided during an individual's outpatient visit. The study team, also, had little control over the utilization methods of the provider messaging and booklet distribution, which may be relevant to the practice-specific differences in the measured outcomes. Also, it is unclear whether the results observed in this study are long-lasting or if periodic intervention and provider feedback will be required to ensure sustainability of results. Lastly, the surveys we performed assessed self-reported delivery of verbal counseling and written material regarding cancer prevention guidance. It has been well-described that self-reporting by providers over estimate their behavior, however, this would result in overestimation of provider's delivery of cancer prevention guidance. This emphasizes the need for tools to facilitate delivery of information to adolescent patients and their families.

Other factors to consider regarding adolescent vaccine acceptance that may merit future study include the potential impacts of social media and peer pressure. Depending on the source and content of social media postings or the focus of direct or indirect peer pressure, substantial shifts in either vaccine acceptance or refusal could ensure. Such effects might impact vaccination rates among small groups of friends, but it is also feasible that larger scale influences could develop across those attending a particular school or to a larger number of teens living in the same community.

A strong vaccine recommendation from a provider who is confident and knowledgeable about the HPV vaccine in addition to messages regarding HPV vaccine as cancer prevention motivates HPV vaccinations.[38-40] Our multicomponent intervention was associated with small to moderate increases in HPV vaccination rates among the recruited practices. It is likely that additional systematic changes will be needed to optimize vaccine uptake in this population. Future larger studies are needed to measure the effect of a cancer prevention platform on adolescent HPV vaccine completion rates. ■

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Reprint requests: Manika Suryadevara, MD, Department of Pediatrics, SUNY Upstate Medical University, 750 East Adams St, Syracuse, NY 13210. E-mail: suryadem@upstate.edu

References

1. 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.
2. Walker TY, Elam-Evans LD, Singleton JA, Yankey D, Markowitz LE, Fedua B, et al. National, regional, state, and selected local area vaccination coverage among adolescents aged 13-17 years—United States, 2016. MMWR Morb Mortal Wkly Rep 2017;66:874-82.
3. 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.
4. Bonville CA, Domachowske JB, Cibula DA, Suryadevara M. Immunization attitudes and practices among family medicine providers. Hum Vaccin Immunother 2017;13:2646-53.
5. Bynum SA, Staras SAS, Malo TL, Giuliano AR, Shenkman E, Vadaparampil ST. Factors associated with Medicaid providers' recommendation for the HPV vaccine to low-income adolescent girls. J Adolesc Health 2014;54:190-6.
6. Griffioen AM, Glynn S, Mullins TK, Zimet GD, Rosenthal SL, Fortenverry JD, et al. Perspectives on decision making about human papillomavirus vaccination among 11- to 12- year old girls and their mothers. Clin Pediatr (Phila) 2012;51:560-8.
7. Jeudin P, Liveright E, del Carmen MG, Perkins RB. Race, ethnicity, and income factors impacting human papillomavirus vaccination rates. Clin Ther 2014;36:24-37.
8. Brawner BM, Baker JL, Voytek CD, Leader A, Cashman RR, Silverman R, et al. The development of a culturally relevant theoretically driven HPV prevention intervention for urban adolescent females and their parents/guardians. Health Promot Pract 2013;14:624-36.
9. Kennedy S, Osgood R, Rosenbloom L, Feinglass J, Simon M. Knowledge of human papillomavirus among publicly and privately insured women. J Midwifery Women's Health 2011;56:481-7.
10. Gowda C, Schaffer SE, Dombrkowski KJ, Dempsey AF. Understanding attitudes toward adolescent vaccination and the decision-making dynamic among adolescents, parents, and providers. BMC Public Health 2012;12:509.
11. Gargano LM, Herbert NL, Painter JE, Sales JM, Morfaw C, Rask K, et al. Impact of a physician recommendation and parental immunization attitudes on receipt or intention to receive adolescent vaccines. Hum Vaccin Immunother 2013;9:2627-33.
12. Daley MF, Crane LA, Markowitz LE, Black SR, Beaty BL, Barrow J, et al. Human papillomavirus vaccination practices: a survey of US physicians 18 months after licensure. Pediatrics 2010;126:425-33.
13. Shay LA, Street RL, Baldwin AS, Marks EG, Lee SC, Higashi RT, et al. Characterizing safety-net providers' HPV vaccine recommendations to undecided parents: a pilot study. Patient Educ Couns 2016;99:1452-60.
14. Berkowitz Z, Malone M, Rodriguez J, Saraiya M. Providers' beliefs about the effectiveness of HPV vaccine in preventing cancer and their recommended age groups for vaccination: findings from a provider survey, 2012. Prev Med 2015;81:405-11.
15. Widman CA, Rodriguez EM, Saad-Harfouche F, Twarozek AM, Erwin DO, Mahoney MC. Clinician and parent perspectives on educational needs for increasing adolescent HPV vaccination. J Cancer Educ 2016;doi:10.1007/s13187-016-1105-3.
16. Centers for Disease Control and Prevention. Human papillomavirus. www.cdc.gov/vaccines/parents/diseases/teen/hpv-indepth-color.pdf. Accessed September 25, 2018.
17. Immunization Action Coalition. Every week hundreds of people get hepatitis B. www.immunize.org/catg.d/p4112.pdf. Accessed September 25, 2018.
18. US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion. Preventing tobacco use among youth and young adults: a report of the surgeon general. Atlanta (GA): 2012.
19. National Council on Skin Cancer Prevention. Sun protection messages. www.skincancerprevention.org/sites/default/files/publications/sun-safety-background/dfdsunprotectionmessages.pdf. Accessed September 25, 2018.
20. American Cancer Society. Physical Activity Cancer Fact Sheet. www.cancer.org/content/dam/cancer-org/cancer-control/en/booklets-flyers/physcial-activity-and-cancer-fact-sheet.pdf. Accessed September 25, 2018.
21. Hedberg VA, Klein JD, Andresen E. Health counseling in adolescent preventive visits: effectiveness, current practices, and quality measurement. J Adolesc Health 1998;23:344-53.
22. Sauer AG, Siegel RL, Jemal A, Fedewa SA. Updated review of prevalence of major risk factors and use of screening tests of cancer in the United States. Cancer Epidemiol Biomarkers Prev 2017;26:1192-208.
23. Goodarz D, Vander Hoon S, Lopez AD, Murray CJ, Ezzzati M, Comparative Risk Assessment Collaborating Group. Causes of cancer in the world: comparative risk assessment of nine behavioral and environmental risk factors. Lancet 2005;366:1784-93.
24. Council on Environmental Health, Section on Dermatology, Balk SJ. Ultraviolet radiation: a hazard to children and adolescents. Pediatrics 2011;127:588-97.
25. Balk SJ, Gottschlich EA, Holman DM, Watson M. Counseling on sun protection and indoor tanning. Pediatrics 2017;140:doi:10.1542/peds.2017-1680.
26. American Academy of Pediatrics. Clinical practice policy to protect children from tobacco, nicotine, and tobacco-smoke. Pediatrics 2015;136:1008-17.
27. US Preventive Services Task Force. Screening for obesity in children and adolescents. US Preventive Services Task Force Recommendation Statement. JAMA 2017;317:2417-26.
28. Ma J, Wang Y, Stafford RS. US adolescents receive suboptimal preventive counseling during ambulatory care. J Adolesc Health 2005;36:441.
29. Akers AY, Davis EM, Jackson Foster LJ, Morrison P, Sucato G, Miller E, et al. Parental report of receipt of adolescent preventive health counseling services from pediatric providers. Patient Educ Couns 2014;94:269-75.
30. Reagan-Steiner S, Yankey D, Jeyarajah J, Elam-Evans LD, Curtis CR, MacNeil J, 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.
31. Reagan-Steiner S, Yankey D, Jeyarajah J, Elam-Evans LD, Curtis CR, MacNeil J, et al. National, regional, state, and selected local area vaccination coverage among adolescents aged 13-17 years—United States, 2015. MMWR Morb Mortal Wkly Rep 2016;65:850-8.
32. CDC. National and state vaccination coverage among adolescents aged 13-17 years—United States, 2012. MMWR Morb Mortal Wkly Rep 2013;62:685-93.
33. Underwood NL, Weiss P, Gargano LM, Seib K, Rask KJ, Morfaw C, et al. Human papillomavirus vaccination among adolescents in Georgia. Hum Vaccin Immunother 2015;11:1703-8.
34. McRee AL, Gilkey MB, Dempsey AF. HPV vaccine hesitancy: findings from a statewide survey of healthcare providers. J Pediatr Health Care 2014;28:541-9.
35. 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.
36. Pytynia KB, Dahlstrom KR, Sturgis EM. Epidemiology of HPV-associated oropharyngeal cancer. Oral Oncol 2014;50:380-6.
37. Jemal A, Simard EP, Dorell C, Noone AM, Markowtiz LE, Kohler B, et al. Annual report to the nation on the status of cancer, 1975-2009, featuring the burden and trends in human papillomavirus (HPV)-associated cancers and HPV vaccination coverage levels. J Natl Cancer Inst 2013;105:175-201.

38. Alexander AB, Stupiansky NW, Ott MA, Herbenick D, Reece M, Zimet GD. What parents and their adolescent sons suggest for male HPV vaccine messaging. Health Psychol 2014;33:448-56.
39. Malo TL, Gilkey MB, Hall ME, Shah PD, Brewer NT. Messages to motivate human papillomavirus vaccination: national studies of parents and physicians. Cancer Epidemiol Biomarkers Prev 2016;25:1383-91.
40. Fontenot HV, Domush V, Zimet GD. Parental attitudes and beliefs regarding the nine-valent human papillomavirus vaccine. J Adolesc Health 2015;57:595-600.

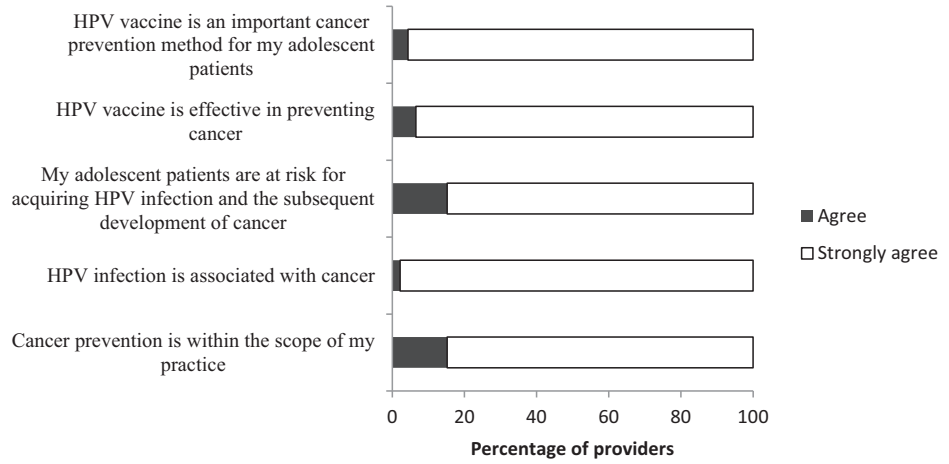

Figure 1. Pediatric provider attitudes toward HPV vaccine and cancer prevention practices.

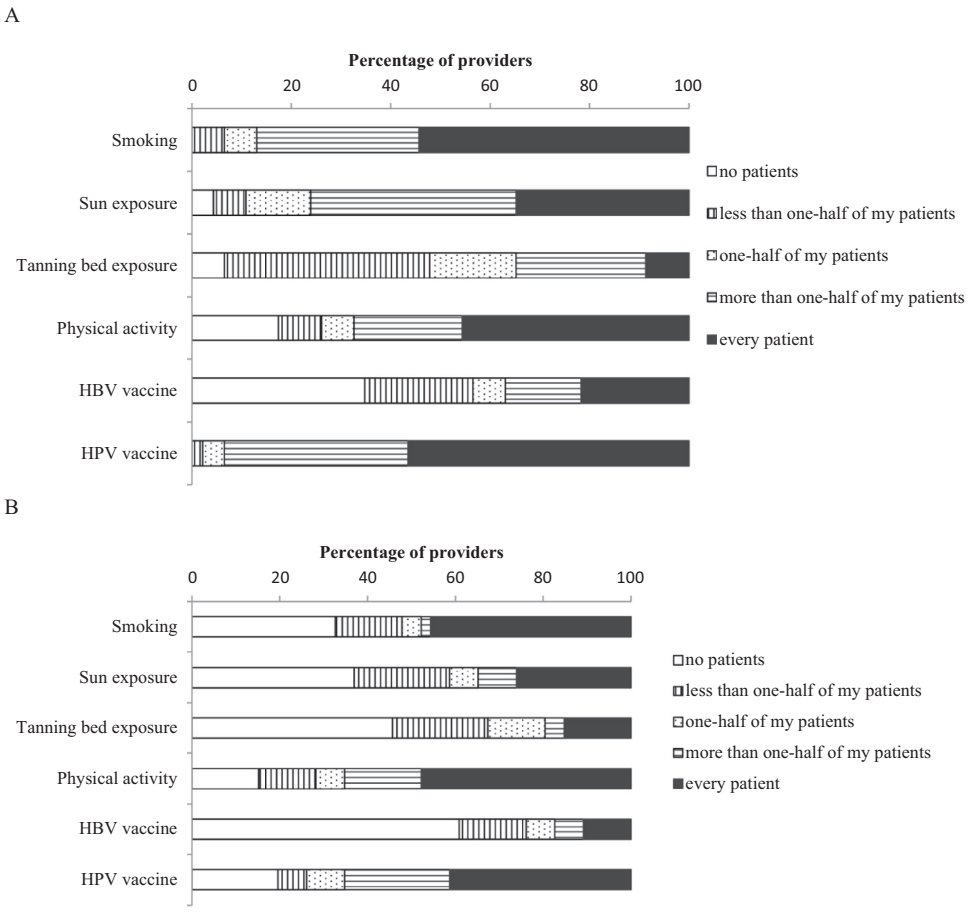

Figure 2. Percentage of pediatric providers who deliver **A,** verbal and **B,** written counseling regarding cancer risk reduction to their adolescent patients.

Table I. Survey of providers from recruited practices regarding their cancer prevention guidance attitudes and practices

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I consider cancer prevention education to adolescents and their families to be within the scope of pediatric practice					
I consider HPV infection to be directly associated with cancer					
I believe that our adolescent patients are at risk for HPV infection and subsequent development of cancer					
I believe that HPV vaccine is effective in preventing cancer					
I believe that HPV vaccine is an important cancer prevention measure for our adolescent patients.					
	Every patient	More than one-half of patients	One-half of patients	Less than one-half of patients	No patients
I counsel adolescent patients at their well child visits regarding:					
Risk of smoking and lung cancer					
Risk of sun exposure and skin cancer					
Risk of tanning bed exposure and skin cancer					
Physical activity and healthy nutrition in cancer prevention					
Hepatitis B vaccine and preventing liver cancer					
HPV vaccine and prevention of genitourinary and oropharyngeal cancers					
I provide my adolescent patients with written material regarding:					
Smoking initiation prevention					
Ways to reduce sun exposure					
Reduction of tanning bed exposure					
Age appropriate physical activity and nutrition guidelines					
Hepatitis B vaccine as a preventive measure for liver cancer					
HPV vaccine as prevention of genitourinary and oropharyngeal cancers					

Table II. Phase 1: format of practice provider and staff education program

Didactic component	HPV vaccine safety and importance
	Strategies for improving vaccination rates
	Message of cancer prevention
	Delivery of a strong vaccine recommendation
	Reduction of missed opportunities
	Bundle with adolescent vaccine recommendations
Interactive component	Role playing to address parental concerns
	Prior quality improvement experiences to increase vaccination rates
Cancer prevention booklet	Review of booklet contents
	Incorporation of booklet into work-flow
Question and answers	Provider- and staff-specific questions discussed

Table III. Participating practice demographics

Pediatric practices	Practice county	Community served	Insurance accepted	Number of 11- to 12-y-old patients	Number of 13- to 18- y-old patients
A	Monroe	Suburban	Public, private	891	2436
B	Onondaga	Rural, suburban, urban	Public, private	1297	2669
C	Onondaga	Rural, suburban, urban	Public, private	1307	4614
D	Albany	Suburban	Public, private	619	1972
E	Erie	Suburban	Public, private	1196	3490
F	Erie	Suburban	Public, private	405	1487