



HPV vaccination: Pilot study assessing characteristics of high and low performing primary care offices

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ARTICLE INFO

Keywords:

HPV vaccination
Adolescents
Primary care
Standing orders
Implementation
Vaccine champion

ABSTRACT

This pilot study was undertaken to identify characteristics and approaches (e.g., social, behavioral, and/or systems factors) which differentiate primary care medical offices achieving higher rates of HPV vaccination.

Eligible primary care practice sites providing care to adolescent patients were recruited within an eight county region of western New York State between June 2016 and July 2016. Practice sites were categorized as higher (n = 3) or lower performing (n = 2) based on three dose series completion rates for HPV vaccinations among females aged 13–17 years. Interviewer administered surveys were completed with office staff (n = 37) and focused on understanding approaches to adolescent vaccination. Results were summarized using basic descriptive statistics.

Higher performing offices reported more full-time clinical staff (median = 25 vs. 9.5 in lower performing clinics), larger panels of patients ages 11–17 years (median = 3541 vs. 925) and completion of NYSIS data entry within two weeks of vaccination. (less than a month vs. two). Staff in higher performing offices reviewed medical charts prior to scheduled visits (100% vs. 50) and identified their office vaccine champion as a physician and/or a nurse manager (75% vs. 22%). Also, staffs from higher performing offices were more likely to report the combination of having an office vaccine champion, previewing charts and using standing orders. These preliminary findings support future research examining implementation of organizational processes including identifying a vaccine champion, using standing orders and previewing medical charts prior to office visits as strategies to increase rates of HPV vaccination in primary care offices.

1. Introduction

Since the initial Advisory Committee on Immunization Practices (ACIP) recommendation regarding HPV vaccination was announced in 2006 for females and in 2011 for males, HPV vaccination rates have lagged far behind the Healthy People 2020 target of 80% series completion, and behind vaccination rates for Tdap and MCV4. The 2016 National Immunization Survey-Teen (NIS-Teen) identified coverage rates among adolescents 13–17 years of 88.0% for Tdap (Tetanus, diphtheria, acellular pertussis, ≥ 1 dose) and 82.2% for MCV4 (Meningococcal Conjugate Vaccine, quadrivalent, ≥ 1 dose) compared to lower rates for HPV vaccination rates (females: 65.1% for ≥ 1 dose and 49.5% for series completion, males: 56.0% and 37.5% for ≥ 1 dose

and series completion, respectively (Walker, 2017)). HPV vaccination rates in New York State (excluding New York City) are similar to rates for the US overall (females: 55.8% (46.7%–64.5%) and males: 48.0% (37.7%–56.4%) for series completion) (Walker, 2017).

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<https://doi.org/10.1016/j.pmedr.2018.03.002>

Received 29 November 2017; Received in revised form 13 February 2018; Accepted 9 March 2018

Available online 13 March 2018

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Barriers to HPV vaccination have been attributed to multiple factors involving clinicians, parents/patients, and the healthcare system. Clinician barriers include knowledge gaps, variability in the strength and quality of the recommendation to vaccinate and perceived parental hesitancy to vaccinate (Holman et al., 2014; Hudson et al., 2016; Perkins and Clark, 2012a, 2012b; Saraiya et al., 2012). Parental concerns include issues of vaccine safety/efficacy and, misperception about HPV disease burden (Rahman et al., 2015; Bastani et al., 2011).

Although clinician, parent/patient, and health system perspectives have been studied, we are unaware of studies which have comprehensively explored characteristics of medical offices with regard to HPV vaccination of adolescent patients. Offices with higher ratios of female to male adolescent patient demonstrated higher rates of HPV vaccine completion and HPV vaccination rates for adolescent patients are generally higher in pediatric compared to family medicine offices, although this has not been consistently observed in all studies (Moss et al., 2013). However, clinician demographics do not differentiate between higher and lower performing offices (Hudson et al., 2016).

The purpose of this pilot study was to identify characteristics of medical offices demonstrating higher rates of adolescent HPV vaccination to help inform the development and testing of an intervention. This paper presents findings from this pilot study, specifically results from an interviewer administered survey assessment which was conducted during the initial practice visit at medical offices with higher and lower rates of HPV vaccination.

2. Materials and methods

2.1. Study population

Sites eligible for participation ($n = 184$) included 1) primary care medical offices providing care to adolescent patients, including pediatrics, adolescent medicine, family medicine, medicine/pediatrics offices, and Federally Qualified Health Centers (FQHCs), 2) location within an eight county region of western NYS (Allegany, Cattaraugus, Chautauqua, Erie, Genesee, Niagara, Orleans, and Wyoming counties), and 3) ≥ 100 adolescent patients age 13–17 years.

NYS Immunization Information System (NYSIIS) records were used to identify eligible sites and to determine HPV vaccination rates. Vaccination rates for females aged 13–17 years old (3 doses series) were utilized to classify the performance of each office since series completion is required for lasting protection. Vaccination rates were assessed in spring 2016, prior to the dissemination of a modified recommendation for 2 dose series completion for ages 9–14. Vaccination rates in females were considered as a proxy measure for delivery of the vaccine to both sexes as HPV series completion between males and females was strongly correlated among the 184 eligible sites identified in NYSIIS (Pearson $r^2 = 0.72$, $p < 0.001$). Initially, sites were targeted for potential participation if they had a 3-dose HPV vaccination rate among adolescent females of $\geq 57\%$ (e.g. “higher performing offices”, $n = 18$ offices; ≥ 88 th percentile) or $\leq 20\%$ (“lower performing offices”, $n = 24$; ≤ 11 th percentile).

Recruitment letters were sent to sites selected for potential participation describing the goals of the study and what the site should expect if they opted to participate; offices received a follow-up phone call from the research team after one week to assess their interest. Due to a low response rate from potential office sites to the recruitment letter and follow-up phone call (initial 7% participation rate), eligibility was expanded to include offices with vaccination rates $\geq 55\%$ (≥ 86 th percentile) for high performers and $\leq 22\%$ (≤ 17 th percentile) for low

performers, generating five and eight additional offices in the higher and lower performing groups, respectively. Final enrollment included two lower performing (ranked at the 9th and 11th percentile) and three higher performing offices (at the 90th, 91st & 92nd percentile); $\sim 10\%$ final participation rate. Enrolled practices received a \$500 stipend for participation and were provided with light refreshments on the day of the office visit. This study was approved by the Institutional Review Board at Roswell Park Comprehensive Cancer Center.

2.2. Independent variables

Research staff traveled to the participating practice sites and spent 1–2 h at each location. Office managers at each practice site completed an assessment of office characteristics: medical specialty(ies), number of full and part-time staff members, total patient census, number of patients between 11 and 17 years old, number of affiliated sites, and date of last AFIX (Assessment, Feedback, Incentives, and eXchange) visit.

Verbal consent was obtained prior to conducting brief interviewer administered surveys with selected staff members ($n = 10$ and $n = 27$, at lower and higher performing offices, respectively). The survey covered key clinical, behavioral, and system factors identified as impacting the likelihood of HPV vaccination (Reiter et al., 2013; Sussman et al., 2015). Clinical staff participants were asked questions pertaining to adolescent vaccination to assess presence of a vaccine champion in the office, which individual(s) they approach with questions about vaccines, use of standing orders and recall/reminder systems for vaccinations, use of daily chart reviews and electronic medical record (EMR) prompts for vaccination completion, monitoring of vaccine completion rates, and timeliness of NYSIIS data entry. Interviewees were also asked to assess their personal level of knowledge regarding vaccines, and provided demographic information including their role in the office.

2.3. Analyses

Data were entered into IBM SPSS Statistics Version 21. Basic descriptive statistics and chi-square analyses were used to summarize findings comparing higher and lower performing sites. Mean ranks in each category for medical practice characteristics were compared by HPV vaccination level (lower & higher performing) using Wilcoxon signed ranks test. A summary score was calculated from interviewee responses to three closed-ended items with regard to systems approaches to vaccination: i) presence of office vaccine champion, ii) review of charts prior to visit, and iii) use of standing orders for vaccines; one point was awarded for each item answered affirmatively for a maximum of three points. Summary scores were then compared across HPV vaccination categories using chi-square analysis.

3. Results

3.1. Office characteristics

Five primary care offices agreed to participate including two sites from the lower performing group and three sites from the higher performing group based upon HPV vaccination rates. As shown in Table 1, these groups differed significantly with regard to office staffing and patient panels. Higher performing offices reported more full-time clinicians ($p = 0.043$) and more full-time nursing staff ($p = 0.043$), as well as larger panels of patients ages 11–17 years ($p = 0.043$). NYSIIS data entry was completed within two weeks in higher performing sites while low performing sites reported completion within one month ($p = 0.025$).

3.2. Interviewer administered survey with office staff

Interviews were completed with 37 individuals representing a

Table 1
Medical practice characteristics stratified by HPV vaccination level (lower & higher performing).

Characteristics		Lower performing (n = 2)		Higher performing (n = 3)		p-Value
		Median	Range	Median	Range	
Full time staff	MD/NP/PA	1.5	1–2	8	6–23	0.043 ^a
	RN/LPN	1.5	1–2	13	9–28	0.043 ^a
	MA	1.5	0–3	1	0–8	0.285 ^a
	Other	5.0	0–10	0	0–26	0.461 ^a
	Total	9.5	2–17	25	19–78	0.043 ^a
Part time staff	MD/NP/PA	2.5	0–5	2	1–3	0.109 ^a
	RN/LPN	3.0	1–5	0	1–10	0.564 ^a
	MA	–	–	–	–	–
	Other	3.0	1–5	–	–	–
	Total	5.5	1–10	2	1–13	0.066 ^a
Patients	Total patients	5550	1100–10,000	10,000	8604–19,400	0.043 ^a
	Patients age 11 and 17 years old	925	350–1500	3541	3442–5994	0.043 ^a
Offices	# of office sites	1	1	2	1–4	0.059 ^a
Office NYSIS entry	< 2 weeks	0	0	3	100%	0.025 +
	Within a month	2	100%	0	0	

^a Wilcoxon Signed Ranks Test; + chi-square test; MD, physician; NP, nurse practitioner; PA, physician assistant; RN, registered nurse, LPN, licensed practical nurse; MA, medical assistant.

Table 2
Participant responses to interview administered survey, stratified by office HPV vaccination level (lower & higher performing).^a

Survey items	Survey response options	Lower performing (n = 10)		Higher performing (n = 27)		p-Value +
		n	%	n	%	
Interviewee role/title	Reception/Admin	2	20.0%	4	14.8%	0.403
	MA	1	10.0%	0	0	
	LPN/RN	3	30.0%	14	51.9%	
	NP/PA	2	20.0%	3	11.1%	
	Physician	2	20.0%	6	22.2%	
Is there an office champion for vaccines?	No	2	20.0%	2	7.4%	0.273
	Yes	8	80.0%	25	92.6%	
Who is the office champion for vaccines?	Physician and/or nurse manager	2	22.2%	18	75%	0.022
	LPN/RN	6	66.7%	5	20.8%	
	Other	1	11.1%	1	4.2%	
Who is the “go to” person in your office for questions about vaccines?	Physician and/or nurse manager	5	50%	25	92.6%	0.007
	LPN/RN	3	30%	2	7.4%	
	Other	2	20%	0	–	
Does the office use standing orders for vaccines?	No/Don't know	1	10%	5	19.2%	0.506
	Yes	9	90%	21	80.8%	
Who typically administers vaccines? (select all that apply)	LPN/RN	10	100%	27	100%	–
	NP/PA	8	80%	6	22.2%	
	Physician	9	90%	7	25.9%	
Does someone monitor vaccine adherence?	No/Don't know	2	20%	1	3.7%	0.107
	Yes	8	80%	26	96.3%	
Who in your office monitors vaccine adherence?	Physician or nurse manager	1	10.0%	11	40.7%	0.16
	Office manager ± physician	4	40.0%	3	11.2%	
	MA/LPN/RN	3	30.0%	11	40.7%	
	Other	1	10.0%	1	3.7%	
	Don't know/never	1	10.0%	1	3.7%	
How often are HPV vaccination rates reviewed?	Annually	1	10%	0	–	0.221
	Every 6–12 months	1	10%	1	3.7%	
	Every 3–6 months	2	20%	12	44.4%	
	Monthly	0	0%	1	3.7%	
	Don't know/never	6	60%	13	48.1%	
Are medical charts reviewed the day before the scheduled visit?	No	5	50%	0	0%	0.001
	Yes	5	50%	27	100%	

^a level of HPV vaccination; + chi-square test; MA, medical assistant; LPN, licensed practical nurse; RN, registered nurse, PA, physician assistant; NP, nurse practitioner.

variety of office roles; including 10 persons from lower performing sites and 27 persons from higher performing sites (see Table 2). Most respondents (89% overall) reported that their office had a “vaccine champion”, an individual who is passionate about encouraging appropriate vaccinations, getting vaccination messages out, and reinforcing vaccine delivery within local setting (Centers for Disease Control and Prevention, 2017a). Interviewees from higher performing sites identified their office vaccine champion as a physician and/or nurse manager while office champions identified in lower performing offices were

typically a registered nurse (RN) and/or licensed practice nurse (LPN) (p = 0.022). Use of standing orders for vaccination was reported by a majority of interviewees (83% overall).

While RNs and LPNs in all offices administered vaccine, interviewees from lower performing sites noted that vaccines were commonly administered by nurse practitioners (NPs)/physician assistants (PAs) (p < 0.001) and by physicians (p < 0.001). Most interviewees (92% overall) indicated that someone in their office monitored vaccine adherence; typically a physician or nurse. Interviewees from the higher

Table 3
Summary scores for systems approaches to vaccination by office level of performance.^a

	Lower performing (n = 10)		Higher performing (n = 27)		p-Value	
	n	%	n	%		
Summary Score	1	4	40.0%	0	0.002	
	2	1	10.0%	8		29.6%
	3	5	50.0%	19		70.4%

+ chi-square test

* Scoring: one point for office vaccine champion; one point for pre-visit chart review; one point for use of standing orders for vaccines; higher scores indicate greater use of systems approaches.

performing sites consistently stated that medical charts are regularly reviewed the day prior to the scheduled visit (100% higher performing versus 50% lower performing, $p = 0.001$).

Office summary scores, based on reports of an office vaccine champion, review of charts prior to office visit, and use of standing orders for vaccines, were used to examine the use of systematic approaches to vaccination. As presented in Table 3, staff responses from higher performing sites reported greater usage of these approaches ($p = 0.002$).

There were no significant differences in the perceived levels of knowledge about vaccines among respondents in lower and higher performing sites. Despite the objective differences in HPV vaccine rates among participating offices, a majority of respondents in both higher and lower performing offices reported administering vaccines in accordance with the CDC, ACIP, and the American Academy of Pediatrics (AAP) childhood vaccination recommendations (data not shown).

4. Discussion

The CDC continues to promote evidence-based strategies to vaccine delivery including prompt entry into immunization information system, use of reminder and recall systems, identifying patients needing vaccination using electronic health record alerts and/or review of paper charts, and incorporating standing orders into office practice (Atkinson et al., 2011).

Eighty-three percent of office staff respondents in the present study noted use of standing orders for vaccines in their offices. This is somewhat higher than a survey of primary care medical office managers in Iowa which noted that about two-thirds of offices were using standing orders to support administration of HPV vaccines (Askelson et al., 2016). Our survey item asked only about use of standing orders which may or may not align with actual implementation of standing orders in clinical practice. Nonetheless, this does suggest that it is not simply enough to have standing orders, but rather to ensure an office environment which optimizes implementation of standing orders, including encouraging nursing staff to complete vaccination prior to the clinician seeing the patient.

We noted that higher and lower performing offices enrolled into this study differed with regard to levels of office staffing and patient panels with higher performing offices having more full-time clinicians and more full-time nurses, as well as serving larger panels of adolescent patients. Our findings suggest that larger medical practices may have a more robust infrastructure to support the implementation of policies and systems supporting vaccination, including prompt entry of vaccine administration into immunization information systems (Moss et al., 2013) and by extension, also focus on immunization delivery by non-physicians staff.

Under the New York State Immunization Registry Law all practices are required to report vaccines administered to children under age 19 within 2 weeks of vaccination. We observed that higher performing offices met this reporting regulation. Adherence with immunization

registry data entry may correlate with the presence of other factors within the office environment contributing to a culture of quality improvement and likely have a positive impact on adolescent vaccination. In addition, the AFIX program is a quality improvement strategy designed to raise immunization coverage and to improve standards of practice at the provider level; AFIX assessments are conducted at private and public sites by local health departments with assistance from regional offices as needed (<https://www.health.ny.gov/prevention/immunization/providers/afix/>). In NYS, local health departments complete AFIX visits each year with ~25% of offices administering childhood vaccines; as a result each office is visited every 4 years. All medical offices which participated in this study reported an AFIX visit in the last two years.

Importantly, notable differences in summary scores examining the use of 3 systems-based approaches (e.g., having a readily identifiable office champion for vaccines, using standing orders for vaccine administration, and previewing office charts to identify patients needing vaccines) observed between lower and higher performing offices suggest that these three systems-based factors appear to play a role in supporting higher HPV vaccination rates. Vaccine champions are individuals that are passionate about protecting health by encouraging appropriate vaccinations, getting vaccination messages out, and reinforcing them within local settings (Centers for Disease Control and Prevention, 2017b). HPV vaccine toolkits, such as those developed by the American Academy of Pediatrics, the American Cancer Society and others, recognize the importance of having an office vaccine coordinator or champion, as well as the use of vaccine standing orders and team huddles to preview charts (American Academy of Pediatrics, 2017; American Cancer Society, 2016). It is possible that these systems factors jointly serve as a surrogate for a medical office culture which endorses and promotes adolescent vaccination. Such an office environment is consistent with our observation that higher performing offices appeared to prioritize prompt entry of data into the state immunization registry (e.g., within 2 weeks).

A qualitative study conducted in the Kaiser Permanente health system explored clinician perspectives across fourteen medical centers with higher (32.6–35.7%) and lower HPV vaccine completion rates (22.8–25.8%). In contrast to the ~30% difference in HPV vaccination rates across higher and lower performing offices included in our study, HPV vaccination rates in these fourteen California medical centers differed by only about 10% in lower versus higher performing centers. Nonetheless, findings in the California study paralleled those in the present study in endorsing the importance of a team-based approach, the presence of an office champion, the use of standing orders, providing performance assessment, and reviewing charts to identify patients who are overdue for vaccination as factors influencing HPV vaccine completion rates (Hudson et al., 2016).

We acknowledge that our study has limitations. We opted to focus on systems level approaches to HPV vaccination which required aggregating clinicians within offices, likely masking heterogeneity in approaches to adolescent vaccination among clinicians in these particular offices. However, our strategy of focusing on medical offices is not unique and supports a team-based approach to the delivery of primary care services (Hudson et al., 2016). This was a pilot study with modest resources which did not support enrolling more than a limited number of offices (~10% participation rate). It is possible that non-participating offices within each category may have differed from those offices opting to participate, thus limiting generalizability. While our sampling frame was focused on the western region of New York State, HPV vaccination completion rates for this region were comparable to those for New York State and national figures. Though many offices reported having a vaccine champion, it is unclear what these champions do to make a difference with respect to the overall immunization practices within each respective office. Additionally, the focus of this pilot study was to assess HPV vaccination practices comprehensively and was not exclusive to either sex; however, we do acknowledge that actual HPV

vaccination rates are different by sex and recognize this as an important consideration and nuance in determining an office's overall performance level. Finally it is important to note that prior to 2017, the HEDIS performance measure for adolescent immunizations, which was developed before the HPV vaccine was recommended for males, assessed only the proportion of female adolescents who had received three doses of the HPV vaccine by age 13 (<http://www.ncqa.org/report-cards/health-plans/state-of-health-care-quality/2016-table-of-contents/hpv>). Despite these potential limitations, our approach of contrasting lower and higher performing offices is innovative and has yielded several potentially relevant differences with regard to how HPV vaccination is approached.

5. Conclusions

This paper contributes to the emerging literature base focused on understanding systems-based factors influencing HPV vaccination rates among adolescents. Importantly, it is based upon rates of completion for the three dose series among female adolescents as opposed to many prior studies which have focused on initiation of the HPV vaccine series.

Our findings suggest that systems-based organizational characteristics which support and facilitate vaccination, including the presence of a vaccine champion, use of standing orders, and regular review of medical charts prior to patient appointments, may serve to differentiate medical offices with higher rates of HPV vaccination. Additional factors such as periodic performance feedback and timely entry into immunization registries may also further differentiate higher performing offices. Primary care offices are encouraged to focus on the implementation of these organizational processes which support HPV vaccination as well as subscribe to recognized quality improvement strategies (e.g., AFIX, HPV vaccine toolkits). While this pilot study has generated interesting observations, additional research is needed to verify our findings, and to understand the culture of those offices that more readily adopt best practices in contrast to those that are challenged in doing so, and the most effective ways to translate these findings into impactful interventions across all levels of performance to achieve target rates of adolescent HPV vaccine completion. It is important to acknowledge that pilot studies such as described here help to inform the design of larger, more methodologically robust investigations. Based on the outcomes of our pilot study and the diverse scope of organizational structures within clinical practices, future studies are needed that: 1) take a more granular approach to understanding medical office micro-systems, and 2) design and deliver interventions that meet the needs of each medical office.

Conflict of interest

Martin C. Mahoney has served as an advisor to Merck, and has served on the Speakers Bureau for Merck, related to the topic of HPV vaccination.

Funding

This research was supported in part by the Roswell Park Comprehensive Cancer Center Alliance Foundation and in part by NCI grants 3P30CA01605 and 3P30CA016056-37S4.

Acknowledgements

We would like to acknowledge the assistance of Scott Coley from the Bureau of Immunization, New York State Department of Health, for his contributions to this project. The authors also acknowledge the assistance of Eva Zimmerman in data collection for this study.

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