RESEARCH PAPER

Improving HPV vaccine delivery at school-based health centers

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ABSTRACT

Objective: To identify characteristics associated with human papillomavirus (HPV) vaccination rates, describe barriers and facilitators to vaccine uptake and the potential role for clinician-to-clinician Assessment, Feedback, Incentives, and eXchange (AFIX) visits in school-based health centers (SBHCs).

Methods: We conducted clinician-to-clinician AFIX visits at 24 New York City (NYC) high-school and middle-school SBHCs with up-to-date adolescent vaccination rates below 40%. Using NYC's immunization information system, we assessed HPV initiation and series completion rates at the time of AFIX visit and follow-up three to five months later. We analyzed responses to a questionnaire and summarized interviews to identify barriers and facilitators to HPV immunization practices and quality improvement (QI) implementation.

Results: Baseline initiation and completion rates were 76% and 43% for high schools, and 81% and 45% for middle schools. SBHCs that allowed adolescent self-consent or did not require separate vaccine consent had higher baseline rates, but was not statistically significant. Barriers to series completion included challenges with scheduling and appointment compliance. At follow-up, high school SBHCs increased HPV vaccine initiation by 2.9 percentage points ($p < 0.01$) and series completion by 2.7 percentage points ($p < 0.05$). There was no statistically significant increase at middle school SBHCs. Most SBHCs (88%) chose reminder/recall systems as a QI strategy. Fewer than half (42%) implemented their QI strategy.

Conclusions: We identified barriers to HPV vaccine series completion at our sample of SBHCs. Clinician-to-clinician AFIX visits may help improve vaccination rates and encourage providers to address barriers, including streamlining consent processes for HPV vaccination.

Abbreviations: School-based health (SBH); quality improvement (QI)

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Introduction

Providing human papillomavirus (HPV) vaccine in the school setting has led to high HPV vaccination rates in Australia, Canada, and Great Britain^{1–3}. In regions of Spain with a school-based program, HPV vaccination rates reached over 90% for two doses.⁴ While HPV vaccine initiation rates among adolescents 13 to 17 years old in the United States have increased by approximately five percentage points per year since 2013 and are now over 65%, series completion remains below 50%.⁵ Even in the absence of a national school immunization program in the United States, there are opportunities in the school setting that can be leveraged to improve vaccination rates. These include school-located vaccination clinics, school mandates for HPV vaccination and utilizing school-based health centers (SBHCs). Parents report a willingness to have their adolescents receive HPV vaccine in schools and some school-located programs have been successful.^{6,7} Others have faced challenges with reimbursement of vaccine administration costs or securing buy-in from school administration and obtaining parental consent.^{8,9} Previous studies have shown adolescents served by SBHCs have higher vaccination rates for influenza, hepatitis B,

tetanus and HPV completion.^{10,11} SBHCs that already provide health care to students in schools are uniquely positioned to address barriers to HPV vaccination.

The Assessment, Feedback, Incentives, and eXchange (AFIX) program is an immunization quality improvement (QI) program developed by the Centers for Disease Control and Prevention (CDC).¹² The New York City (NYC) Department of Health and Mental Hygiene (Department of Health) implements AFIX for clinical practices that participate in the Vaccines for Children (VFC) program. The traditional AFIX visit consists of an in-person session during which Department of Health immunization staff meets with provider office staff to discuss the office's immunization delivery practices, review their site-specific vaccination coverage rates, and work together to choose pre-specified QI strategies. The immunization staff then follows up in three to six months via phone or email to review updated vaccination coverage rates, and discuss progress towards implementation of QI strategies.

In order to increase HPV vaccination rates and improve immunization delivery in practices with rates

below the NYC average (up-to-date rate below 40% for tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap), meningococcal conjugate, and HPV series completion), the Department of Health implemented clinician-to-clinician AFIX visits conducted by Department of Health consultant pediatricians and a registered nurse with HPV expertise. In this report we aim to 1) describe HPV vaccination rates and policies at SBHCs visited in this project, 2) identify barriers and facilitators to HPV vaccine uptake, and 3) describe the potential role for clinician-to-clinician AFIX to improve rates in this setting.

Results

Between July 2017 and August 2018, we conducted AFIX visits and follow-ups at 24 of the 31 eligible SBHCs. All eligible high school SBHCs ($n = 19$) received an AFIX visit. Only 5 of the 12 eligible middle school SBHC AFIX visits were completed. This was because custom reports had to be created for the 11 to 13 year-old middle school population, and the Department of Health could not report these data through CDC's AFIX platform.

SBHCs included in this project were operated by 10 different health care organizations, including academic medical centers, federally qualified community health centers and non-governmental organizations. In most SBHCs (75%), a nurse practitioner or physician assistant served as the medical provider (Table 1). Fewer than half of SBHCs (42%) had more than one full-time medical provider. The size of the adolescent patient population (ages 13–17 years for high schools and ages 11–13 years for middle schools) was over 200 for 54% of sites. Two high school SBHCs had fewer than 100 patients in their adolescent population.

Baseline HPV vaccination rates

At the time of the initial (baseline) AFIX visit, the average coverage rate for this project's cohort for at least 1 dose of HPV vaccine was 76% (range 43% to 99%) for high schools and 81% (range 70% to 94%) for middle schools (Table 2). Rates for HPV vaccine series completion were 43% (range 21% to 58%) and 45% (range 30% to 67%) for high schools and middle schools, respectively. There was no difference in vaccination rates based on number of providers or type of provider at the SBHC.

Table 1. Characteristics of School-Based Health Centers that Received a Clinician-to-Clinician Assessment, Feedback, Incentives, and eXchange (AFIX) Visit.

Characteristic	N (%)
High School	19 (79)
Middle School	5 (21)
Number of Full-Time Providers	
1	14 (58)
More than 1	10 (42)
Provider Type	
Physician	6 (25)
Nurse Practitioner/Physician Assistant	18 (75)
Number of Adolescent Patients in Vaccine-Eligible Population*	
< 100	2 (8)
101–200	9 (38)
> 200	13 (54)
* Patients ages 13 to 17 years for high schools and ages 11 to 13 years for middle schools	

	High School N (%)	Middle School N (%)
Consent Processes		
Require separate vaccine consent form	17 (89)	5 (100)
Consent form separates school-required from ACIP-recommended vaccines not required for school entry	10 (53)	1 (20)
Only accepts written vaccine consent	10 (53)	0 (0)
Allows adolescent self-consent for HPV vaccine	4 (21)	0 (0)
Select AFIX Questionnaire Responses		
Offer walk-in and immunization-only visits	19 (100)	5 (100)
Has a reminder/recall process in place	10 (53)	3 (60)
Has an "immunization champion"***	19 (100)	5 (100)
Uses immunization information system to determine which immunizations are due at every visit	15 (79)	4 (80)
Routinely measures adolescent immunization coverage and shares with staff	12 (63)	3 (60)
Inactivates patients from practice's immunization information system list who are no longer seen in SBHC	10 (53)	4 (80)
Recommend HPV vaccine the same day and same way as other vaccines	18 (95)	5 (100)

*** Focuses on quality improvement measures and improving coverage levels for the office

SBHC vaccination policies and procedures

In order to enroll and receive care at a SBHC, parents or guardians for students under 18 years of age must sign a general consent form. This general consent form covers the range of services provided by the SBHC, including routine immunizations. Many SBHCs also require parents to provide additional vaccine-specific consent, either in writing or verbally. All of the middle school SBHCs and most of the high school SBHCs (89%) in this project required a separate, specific consent for vaccines. High school SBHCs that did not require a separate vaccine consent had higher baseline rates of HPV vaccine initiation (95%), but this was not statistically significant ($p = 0.06$). Nearly half of the vaccine consent forms (46%) listed vaccines required by New York State public

Table 2. HPV Vaccination Coverage Rates at Time of Initial and Follow-up Clinician-to-Clinician Assessment, Feedback, Incentives, and eXchange (AFIX) Visit.

	High School Located School-Based Health Centers *				Middle School Located School-Based Health Centers *			
	Initial Mean (SD)	Follow-up Mean (SD)	Change in Coverage (percentage pts)	P	Initial Mean (SD)	Follow-up Mean (SD)	Change in Coverage (percentage pts)	P
HPV first dose	75.8 (15.4)	78.7 (13.4)	2.9	< 0.01	80.6 (9.5)	83.0 (7.7)	2.4	0.22
HPV complete series	42.6 (9.3)	45.3 (10.3)	2.7	0.0496	45.0 (14.3)	51.4 (10.9)	6.4	0.09

* Patients ages 13 to 17 years for high schools and ages 11 to 13 years for middle schools

health law for school attendance (i.e., Tdap, and meningococcal conjugate vaccine) separately from vaccines recommended by the Advisory Committee on Immunization Practices (ACIP) but not required for school (i.e., HPV, hepatitis A, influenza). In New York State, minors have the right to self-consent for services to prevent sexually transmitted infections, including HPV vaccine, but only four (21%) of the high school SBHCs allowed adolescents to self-consent for the HPV vaccine (including two SBHCs that did not require separate vaccine consent). At high school SBHCs that permitted adolescent self-consent, baseline coverage rates for HPV vaccine initiation were 86% compared to 73% for SBHCs that did not allow self-consent, but this difference did not meet statistical significance ($p = 0.15$).

Responses to select CDC standardized AFIX questions are described in [Table 1](#). High school SBHCs that inactivated patients from their NYC immunization information system (IIS), the Citywide Immunization Registry, list had lower HPV vaccine initiation rates, as compared to high schools that did not inactivate patients (69% vs 83%, $p = 0.04$). Otherwise, there were no differences in baseline HPV vaccination rates among SBHCs.

Barriers to HPV vaccine initiation and follow-up

Three providers (3/24, 13%), all at high school SBHCs, cited parental hesitation or refusal as a significant barrier to HPV vaccination. This perception of parental hesitation was not associated with a difference in HPV vaccination coverage rates.

During the clinician-to-clinician AFIX visits, SBHC providers were more likely to discuss barriers associated with follow-up doses and series completion than with initiation. Many SBHCs lacked specific, successful processes for scheduling HPV vaccination follow-up visits. During our AFIX visit discussions, it became clear that some SBHCs (21%) were not consistently scheduling follow-up appointments. Two sites were unable to schedule appointments six months or more in advance. Among SBHCs that scheduled visits for follow-up doses, many reported challenges in getting adolescents to come to the appointment. Some SBHCs lacked access to the students during the school day; for instance, the school administration would not permit or strongly discouraged SBHCs from calling students during class for vaccination or non-urgent visits. Other SBHCs (25%) reported a strong, positive relationship with the schools they serve and were able to work with school staff to notify and bring students from class who were due for follow-up vaccination. There was no difference in HPV vaccination completion rates in SBHCs who described a positive relationship with the school administration, compared to those that did not. SBHC providers also reported challenges getting adolescents to come for vaccination visits even when they had a process in place to notify them.

Change in HPV vaccination rates at time of follow-up visit

We conducted follow-up visits between three and five months after the initial visit (average 106 days). Among high school

SBHCs, coverage for HPV vaccine initiation and completion increased between the initial and follow-up visits ([Table 2](#)). HPV vaccine initiation increased by 2.9 percentage points ($p < 0.01$) and series completion increased by 2.7 percentage points ($p < 0.05$). In middle school SBHCs, initiation rates increased by 2.4 percentage points and completion by 6.4 percentage points, but these changes were not statistically significant.

Quality improvement strategy selection and implementation

All five of the middle school SBHCs chose to develop or strengthen a reminder/recall system using the Citywide Immunization Registry recall list for their AFIX QI strategy. Three also chose to develop a process to remove patients from their Citywide Immunization Registry list who had left the SBHC (in most cases because they graduated middle school). At the time of follow-up visit, two SBHCs had implemented reminder/recall systems and none had implemented a process to remove former patients. Among the high school SBHCs, most (89%) chose to develop or strengthen a reminder/recall system as their QI strategy and 63% chose to develop a process to remove patients from their Citywide Immunization Registry list who were no longer seen at the SBHC; 58% chose both. At the time of follow-up, 47% had implemented reminder/recall and 25% had implemented a process to remove former patients from their Citywide Immunization Registry list. We did not find a difference in coverage rate change associated with implementation of either of the above strategies. During follow-up discussions, among SBHCs who did not implement their chosen QI strategy, lack of staff time was the most commonly cited barrier. Providers also reported competing priorities, such as reproductive health visits, and repeated challenges with adolescent patients who do not come to the office for follow-up shots.

Discussion

We report on HPV vaccination practices in NYC SBHCs, finding that, despite high HPV vaccine initiation rates, SBHCs face barriers in series completion, and clinician-to-clinician AFIX visits may help improve these rates.

SBHCs face challenges unique to the school setting, such as obtaining consent from parents who may not be at the clinic in person.^{9,13} However, for most SBHCs in our program, parental refusal was not a major barrier to HPV vaccination, which is consistent with a previous survey of SBHC providers conducted by Daley et al.¹⁴ While in New York State adolescents can legally consent to HPV vaccination, we found only four (21%) of the high school SBHCs permitted adolescent HPV vaccine self-consent. At sites that did not permit HPV vaccine self-consent, some providers were unaware of the state law, while others were eager to implement self-consent, but were prohibited from doing so by their SBHC's policy.

While the HPV vaccine initiation rate of 76% in the high school sample was comparable to the NYC average – 76% at the time – the completion rate of 43% was much lower than the NYC average of 60%.^{15,16} The average percentage point “gap” between initiation and completion rates was

33 percentage points for high school SBHCs and 36 percentage points for middle schools. We identified barriers with follow-up appointment scheduling, processes to notify adolescents of their follow-up appointment, and procedures to allow them to leave class to attend appointments. Even SBHCs with a strong system for follow-ups reported challenges. For example, at one site, the SBHC clerk calls or faxes the school's main office staff with the next day's appointments and then individual appointment slips are sent to the security officer. When students swipe their IDs to enter school the next morning, the detector sounds for students who have an appointment, and security staff hand out the appointment slips. Nevertheless, this site had a 47% HPV vaccine completion rate despite an 88% initiation rate. Four SBHC providers specifically discussed that they have a process to reach students in the classroom, but that students often refuse to come to the SBHC office for vaccination.

Previous surveys have found that even outside the school setting adolescents play a role in the HPV vaccine decision-making process.¹⁷ Adolescents are concerned about short-term HPV vaccine side effects, such as pain at the injection site, and these concerns are negatively correlated with vaccination.^{18,19} The most common reason among high school students for accepting HPV vaccine was for the promotion of health, while lack of a doctor recommendation was the most common reason for not getting vaccinated.¹⁸ Given co-location in the school setting, there are opportunities for SBHC and school staff to work together to improve student knowledge of the HPV vaccine and address short-term side effect concerns. As one SBHC provider explained, "Now we spend a lot of time convincing students HPV vaccine is important".

While this project was not designed to have a comparison group, we did find a statistically significant increase in HPV vaccine initiation and completion rates in high school SBHCs three to five months after the AFIX visit. Previous studies on the effect of AFIX on HPV vaccination rates have demonstrated positive early effects.^{20,21} Rates at Federally Qualified Health Centers increased one month after webinar AFIX visits.²⁰ Gilkey et al. found a similar increase in HPV vaccine initiation for 11 to 12 year-olds and series completion for 13 to 18 year-olds at five months, but these increases were not sustained at one-year follow-up.²¹ Other health departments have implemented enhanced AFIX programs with clinician-to-clinician visits, including Rhode Island and Chicago.^{22,23} The Chicago program found 95% of all clinics had an increase in HPV vaccine initiation and 96% had an increase in series completion.²³ Their program included 12 SBHCs but they did not report on SBHC specific outcomes.

Other studies have shown QI interventions are effective in increasing HPV immunization rates, but these interventions involved more frequent and intensive education and feedback, and practices in these studies voluntarily chose to participate. Some offered incentives, including Maintenance of Certification (MOC) QI credit or a financial incentive to cover the cost of chart reviews.^{24,25} In contrast, our AFIX project consisted of one in-person session and a short follow-up via telephone. This limited contact may not be enough to help practices fully implement QI strategies, or serve as a sufficient incentive. Additionally, participation was not voluntary, but presented to SBHCs as

a requirement of the Vaccines for Children program, and we were not able to offer MOC or financial incentives. As a result, some SBHC staff may not have been equally invested in the QI process. Finally, most of the SBHCs had one full-time medical provider and one or two support staff (medical assistant, licensed vocational nurse, front desk). Implementation of quality improvement strategies may also be limited in SBHCs by this low staffing volume. SBHC providers also have competing priorities, including reproductive sexual health services, and acute walk-in visits.

We were unable to identify which QI components of the AFIX visit had the most impact. Most SBHCs chose to focus on a reminder/recall strategy, but less than half were able to implement it by the time of follow-up. We did note that SBHCs with the most success implemented multiple strategies to supplement their reminder/recall activities, consistent with the Community Preventive Services Task Force recommendations.²⁶ One high school SBHC that increased both HPV vaccine initiation and completion rates by four percentage points gave the school administration a list of students who needed catch-up doses, and the school staff made a phone call to the parents/guardians of these children. The provider at this site also chose to focus on graduating seniors, and went to senior morning meetings to discuss the importance of the HPV vaccine. Another site that increased completion by four percentage points, and initiation by three percentage points, started scheduling patients for a follow-up visit if they declined HPV vaccine during an urgent-care visit. They also developed a process to call the school office staff who then call students in their classrooms to come for follow-up appointments. Additionally, the SBHC medical assistant now checks the Citywide Immunization Registry when she triages patients and puts a reminder note on the charts of patients who need vaccines. The increase in HPV vaccination rates we observed at the time of follow-up visits may not have been due to the QI strategies. Instead, it may have been the face-to-face discussion between clinicians in this AFIX project that motivated some providers to prioritize HPV vaccination. As one provider described in a follow-up visit, "we are just pushing it more".

We did find lower baseline HPV vaccine initiation rates among high school SBHCs that reported inactivating former patients from their facility's CIR list compared to SBHCs that did not remove these patients from their list. This finding is counterintuitive, but may be due to these former patients having more complete immunization records. It may also be explained by our small sample size or other unidentified factors.

Limitations

This project was designed to target low performing sites and included SBHCs with below-average immunization rates. These sites are not representative of all SBHCs, and other site-specific factors may be driving underperformance. The project also did not include a control group of SBHCs, limiting our ability to attribute observed changes in HPV vaccination rates to AFIX activities. Individual provider motivation and attitudes regarding the importance of HPV vaccination may play a large role in coverage rates, both at baseline and at follow-

up, but we did not measure these factors directly. This evaluation is also limited by its small sample size, which may explain why many of our results did not reach statistical significance. Additionally, the time interval between baseline visit and follow-up visit varied between sites. However, we assessed for any difference in vaccination rate change between SBHCs with a follow-up visit 89–100 days after the initial visit, compared to SBHCs with a follow-up visit over 100 days (maximum 135 days), and found no difference. Finally, our findings may not be generalizable to SBHCs outside of NYC or similar large urban centers. Despite these limitations, the AFIX visits were able to identify clear and consistent challenges faced by SBHCs that can be addressed and this is the first report we know of that specifically examined the role of AFIX in SBHCs.

Future directions and conclusions

Despite relatively high HPV vaccine initiation rates, SBHCs in our project faced challenges with series completion due to scheduling and patient follow-up processes. Some of these challenges – e.g., motivating adolescents to return by themselves for follow-up appointments and negotiating logistics with school administration – are unique to the school setting. These findings have informed the development of a collaborative HPV immunization project between the Department of Health and the NYC Department of Education. Given that we found a trend towards higher HPV vaccination rates in SBHCs that allowed self-consent, the departments issued a joint letter to adolescent immunization providers with guidance on adolescent self-consent for HPV vaccination. Department of Health staff have also developed trainings for Department of Education school staff on HPV disease and vaccination. Plans are in development to identify ways to offer SBHCs additional support for HPV vaccination programs, including how to increase series completion. Highlighting HPV vaccination as a priority for the Department of Education may also influence SBHC providers to focus on HPV.

We identified potential opportunities to address barriers to HPV vaccination in the SBHC setting by utilizing clinician-to-clinician AFIX visits to engage providers and implement QI strategies. Areas for future investigation to identify best practices include: 1) SBHC policies to permit adolescent self-consent for HPV vaccination where permissible; 2) multi-component strategies to ensure students are scheduled for follow-up doses and notified of follow-up appointments; and 3) using clinician-to-clinician visits to motivate SBHC providers.

Methods

AFIX project description

The NYC Department of Health delivers the AFIX program using in-person office visits by Department of Health immunization staff to practices that order vaccines through the Vaccines for Children program. AFIX visits consist of a 30 to 90-minute session during which the immunization staff meets with the office staff – ideally the health care provider – to discuss the office's immunization delivery practices and review their site-specific vaccination coverage rates. They work together to

choose from a list of pre-specified QI strategies to: 1) improve the quality of immunization services (e.g., implement reminder/recall systems and deliver a strong provider recommendation for HPV vaccine); 2) decrease missed opportunities (e.g., develop standing orders and improve follow-up appointment scheduling); and 3) improve IIS functionality (e.g., report all immunizations to the IIS and inactivate patients no longer seen by the practice). The immunization staff then follows up in three to six months via phone or email to review updated vaccination coverage rates, discuss progress towards implementation of QI strategies, and identify barriers and facilitators to improving coverage rates. The SBHC visits described in this report were part of a larger NYC Department of Health project of enhanced adolescent AFIX visits targeting practices with low adolescent vaccine coverage and a large adolescent population. In the clinician-to-clinician AFIX program, a nurse or pediatrician with HPV expertise conducted the visit and follow-up with a clinician at the practice. In addition to the above, visits included a specific discussion of HPV vaccine as cancer prevention, the importance of a strong provider recommendation, and distribution of an HPV vaccine toolkit with HPV-specific resources for both providers and parents. Department of Health clinicians gave SBHC providers a list of their patients due or overdue for vaccines (including HPV, Tdap, meningococcal, hepatitis A, influenza, measles-mumps-rubella) that they could use for reminder/recall, and demonstrated how to run similar reports using the NYC Citywide Immunization Registry.

Selection

We identified eligible SBHCs using the NYC Citywide Immunization Registry. Over 94% of immunization provider sites in NYC, including SBHCs, report regularly to the Citywide Immunization Registry.²⁷ The Citywide Immunization Registry includes a web-based user interface for providers, the Online Registry, which offers access to patient immunization records. The Online Registry's functionalities, which can be used as part of QI efforts, include clinical decision support, the ability to inactivate a facility's patients who have moved or gone elsewhere, reminder/recall tools (e.g., lists of patients overdue or soon to be due or overdue for vaccines, letter mailings, standard/custom text-based messaging), and running pre-set or custom coverage reports.

To be eligible, SBHCs had to have 25 patients or more in their 13 to 17 year-old Citywide Immunization Registry population, defined as patients who received their most recently reported vaccine at the SBHC on or after the age of 9 years. Sites also had to have an up-to-date rate below 40% for vaccines included in the adolescent platform, i.e., 1 Tdap, up-to-date meningococcal conjugate vaccine (1 or 2 doses, depending on age), and HPV series completion (2 or 3 doses, based on age at initiation). For this project, we focused on HPV vaccination rates because Tdap and meningococcal vaccine rates are more likely to be driven by school requirements. In NYC for the 2018–2019 school year, Tdap is required for entry into 6th through 12th grade and meningococcal vaccine is required for entry into 7th, 8th, 9th, and 12th grades. There were 31 SBHCs (19 high schools and 12 middle schools) that met eligibility criteria.

Data collection and analysis

Using Citywide Immunization Registry data, we assessed HPV vaccine initiation (≥ 1 dose), completion (2 or 3 doses, depending on age at initiation), Tdap, and up-to-date meningococcal vaccine (1 or 2 doses, depending on age) at the time of the initial AFIX visit and again at the time of follow-up. We assessed patients ages 13 to 17 years for high school sites and patients ages 11 to 13 years for middle school sites. We used paired t-tests to assess the percentage point change in vaccination coverage between the initial and follow-up visits. Because AFIX follow-ups are scheduled at the convenience of the provider and ranged from three to five months after the initial visit, our analysis of coverage change includes different follow-up intervals. We tested for differences in coverage change based on these intervals. We used two-tailed statistical tests and a critical alpha of 0.05. Data were analyzed using SAS Enterprise Guide version 7.1 (SAS Institute, Inc., Cary, NC).

During site visits, Department of Health clinicians completed a standardized 19-item CDC AFIX questionnaire to identify the SBHCs' immunization practices and their chosen QI strategies. The questionnaire assesses strategies to improve the quality of immunization services, strategies to decrease missed opportunities and strategies to improve IIS functionality and data quality (see Appendix B for complete questionnaire). We used summary statistics to describe responses to the questionnaire and selected QI strategies, and t-tests to determine differences in baseline HPV vaccination rates based on SBHC level characteristics.

Department of Health clinicians also documented summary notes from their discussions with SBHC clinicians. Visits started with an open-ended question, "Tell me about how your vaccination process works," and included additional topics not covered in the standardized CDC AFIX questionnaire, including vaccine consent policies. After reviewing their HPV vaccination rates (compared to the NYC average) SBHC providers were asked to discuss possible reasons for their lower rates. We reviewed and coded these notes to identify and categorize perceived facilitators and barriers to HPV vaccination and vaccine consent policies. We also collected copies of the SBHC vaccine consent forms when available for comparison.

Abbreviations

SBH School-based health
QI quality improvement

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Disclosure of potential conflicts of interest

No potential conflict of interest was reported by the authors.

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Appendix A. School-Based Health Center sites by HPV vaccination rates

High School Located School-Based Health Centers

	Initial patients (n)	Initial 1 HPV	Initial HPV Complete	Follow-up 1 HPV	Follow-up HPV Completion	Change in HPV Completion (percentage pts)
A	206	43%	29%	52%	34%	5
B	98	44%	21%	48%	24%	3
C	149	59%	30%	67%	33%	3
D	210	62%	44%	65%	46%	2
E	203	63%	31%	75%	35%	4
F	81	70%	58%	74%	62%	4
G	210	76%	41%	75%	38%	–3
H	223	76%	42%	79%	45%	3
I	133	80%	48%	82%	45%	–3
J	278	80%	50%	80%	50%	0
K	295	81%	49%	80%	47%	–2
L	303	81%	45%	81%	50%	5
M	240	83%	54%	89%	52%	–2
N	329	85%	44%	88%	48%	4
O	188	86%	47%	87%	48%	1
P	214	88%	47%	87%	49%	2
Q	258	91%	48%	91%	48%	0
R	182	93%	36%	96%	38%	2
S	140	99%	46%	99%	69%	23

Middle School Located School-Based Health Centers

	Initial Adolescent patients (n)	Initial 1 HPV	Initial HPV Completion	Follow-up 1 HPV	Follow-up HPV Completion	Change in HPV Completion (percentage pts)
A	162	70%	35%	77%	46%	11
B	146	73%	30%	75%	45%	15
C	232	82%	67%	87%	70%	3
D	152	84%	45%	82%	44%	-1
E	185	94%	48%	94%	52%	4

Appendix B. AFIX Assessment (Questionnaire)***Strategies to Improve the Quality of Immunization Services**

- (1) Do you have a reminder/recall process in place for pediatric/adolescent patients? (y/n)
- (2) Do you offer walk-in or immunization only visits? (y/n)
- (3) Do you routinely measure your clinic's pediatric/adolescent immunization coverage levels and share the results with your staff? (y/n)
- (4) Do you schedule the next vaccination visit before the patients/parents leave the office? (y/n)
- (5) Do you contact patient/parents within 3–5 days when a “well child” or “immunization only” visit is a “no show” and reschedule it for as soon as possible? (y/n)
- (6) Do you have a system in place to schedule wellness visits for patients at 11–12 years of age? (y/n)
- (7) Do you recommend the HPV vaccine the same day and the same way you recommend the Tdap and meningococcal vaccines for all boys and girls aged 11–12 years?
- (8) Do you have an immunization champion at this practice that focuses on QI measures, reducing barriers, and improving coverage levels? (y/n)
- (9) Do you regularly document vaccine refusals and reasons for refusals (parent choosing to delay, parent has vaccine safety concern, medical contraindication, etc.)? (y/n)

Strategies to Decrease Missed Opportunities

- (1) Does your immunization staff educate parents about immunizations and the diseases they prevent, even when the parents refuse to immunize? (y/n)
- (2) Do you have immunization information resources to help answer questions from patients/parents? (y/n)
- (3) Is your immunization staff knowledgeable and comfortable with current ACIP recommendations, including minimum intervals, contraindications, etc.? (y/n)
- (4) Do you train front desk/scheduling staff so they know when it's appropriate to schedule immunization appointments? (y/n)
- (5) Do you have standing orders for registered nurses, physician assistants, and medical assistants to identify opportunities to administer all recommended pediatric/adolescent vaccines? (y/n)
- (6) Is your immunization staff knowledgeable and comfortable with administering all recommended vaccinations to patients at every visit? (y/n)

Strategies to Improve Completeness and Accuracy of Immunization Information in the IIS

- (1) Does your staff report all immunizations you administer at your clinic (or practice) to your state/city IIS? (y/n)
- (2) Does your staff report immunizations previously administered to your patients by other providers to the IIS (e.g., official shot record, other IIS report, copy of medical record)? (y/n)
- (3) Do you inactivate patients in the IIS who are no longer seen by your practice? (y/n)
- (4) Do you use your IIS to determine which immunizations are due for each patient at every visit? (y/n)

* Available at <https://www.oregon.gov/oha/PH/PreventionWellness/VaccinesImmunization/ImmunizationProviderResources/vfc/Documents/AFIXSiteVisitQst.pdf>. Last accessed January 10, 2019.