Achieving High Adolescent HPV Vaccination Coverage

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abstract

BACKGROUND AND OBJECTIVE: Despite national recommendations for adolescent human papillomavirus (HPV) vaccination, rates have lagged behind those of other adolescent vaccines. We implemented interventions and examined rates of vaccination coverage in a large, urban, safety net health care system to understand whether our tactics for achieving high rates of adolescent vaccination were successful.

METHODS: Denver Health is an integrated urban safety net health system serving >17 000 adolescents annually. The process for achieving high vaccination rates in our health system includes "bundling" of vaccines, offering vaccines at every visit, and standard orders. Data from vaccine registry and utilization statistics were used to determine vaccination rates in adolescents aged 13 to 17 years from 2004 to 2014, and these findings were compared with state and national rates for 2013. Regression analysis was used to identify characteristics associated with vaccination.

RESULTS: In 2013 (N = 11 463), HPV coverage of ≥1 dose was 89.8% (female subjects) and 89.3% (male subjects), compared with national rates of 57.3% and 34.6%. Rates of HPV coverage (≥3 doses) were 66.0% for female subjects and 52.5% for male subjects, versus 37.6% and 13.9% nationally. For both sexes, tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis, adsorbed, vaccine coverage was 95.9% (86.0% nationally), and meningococcal conjugate vaccine coverage was 93.5% (77.8% nationally). Female subjects, Hispanic subjects, non-English speakers, and teenagers <200% below the federal poverty level were more likely to have received 3 doses of HPV.

CONCLUSIONS: Through low-cost, system-wide standard procedures, Denver Health achieved adolescent vaccination rates well above national coverage rates. Avoiding missed opportunities for vaccination and normalizing the HPV vaccine were key procedures that contributed to high coverage rates.

Human papillomavirus (HPV) is the most common sexually transmitted infection in the United States, affecting ~76 million people.[1] HPV infection is estimated to result in ~33 000 cancer cases (cervical, vulvar, anal, oropharyngeal, and penile) per year.[2] The quadrivalent HPV vaccination was approved by the US Food and Drug Administration in 2006 and is effective against HPV strains 16 and 18, which cause the majority of HPV-associated cancers. Despite the Advisory Committee on Immunization Practice recommendation for routine adolescent HPV vaccination in 2006, as well as a Healthy People 2020 goal of 80% vaccine coverage in adolescents, HPV vaccination rates have lagged behind those of meningococcal conjugate vaccine (MCV4) and tetanus toxoid, reduced

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TABLE 1 Tactics for Successful Vaccine Delivery

Routine use of a robust immunization registry for multiple functions, including recording vaccine history and recommending needed vaccines at every visit
Medical assistants check vaccine registry for recommended vaccines at every visit
Standing order for routine immunizations
Vaccines are given early in the visit when possible, to allow time to observe for immediate side effects such as syncope
Education for providers to present Tdap, MCV, and HPV as a standard "bundle" of adolescent immunizations
Provider-level "report cards" with adolescent vaccination coverage rates
Vaccination drives at SBHCs

diphtheria toxoid, and acellular pertussis, adsorbed, vaccine (Tdap), 2 routinely administered adolescent vaccinations.[3] Barriers to HPV vaccination uptake typically fall into 2 areas: parental factors and provider factors. Patient-level and health care system factors may also contribute.

Patient characteristics associated with poor HPV vaccination rates include younger age, male sex, lack of insurance coverage, and poor knowledge about HPV disease and the vaccine.[4,5] Several studies have shown decreased uptake among patients concerned about HPV vaccine safety related to future fertility and a lack of long-term safety studies.[6] Patient socioeconomic status has not consistently been associated with uptake, as studies generally have not shown a link.[7–9] Parents may underestimate the burden of HPV disease or have concerns regarding the safety risks of receiving an HPV vaccine.[9] In addition, parents may not think that their children are sexually active, they may fear that receiving the vaccine will cause their children to initiate sexual activity, and they may not perceive a benefit to vaccinating boys for HPV or may not know the vaccine has been licensed for male subjects.[5,10] Increased HPV vaccine uptake has been observed in mothers with less than a high school education.[11,12]

Provider factors that may present a barrier to HPV vaccine uptake include lack of a strong recommendation for the vaccine, financial concerns, and missed opportunities for vaccination. Several studies have shown that a strong provider recommendation for HPV vaccination leads to a greater likelihood of HPV vaccine uptake[5,9,10,13–15] and is likely the most influential factor. Some providers have also expressed concern regarding reimbursement for HPV vaccine delivery despite the availability of free vaccine programs.[4,16]

At the systems level, missed opportunities for vaccination occur when practices do not view every visit (both acute and preventive) as an opportunity for vaccination. It has been estimated that vaccination coverage rates (of ≥1 dose of HPV in female subjects) could be as high as 91.3% if the vaccine is given at the same time as another adolescent vaccine.[17] Concerns about insurance coverage for vaccination, whether real or perceived, may also influence health care systems' decision-making regarding vaccination.[4] In addition, school systems generally do not mandate HPV vaccination for attendance; as a result, parents and patients may view this vaccine as less important or optional.[18]

Our institution is an urban safety net hospital, and as such, most of the barriers to HPV vaccination in our patient population are not refusal but more traditional reasons that low-income families do not get vaccinated. These reasons include transportation issues, access to care, and inability to take time off from work to take children to medical appointments. Insurance coverage is also less of a barrier in our population because most of these pediatric patients are covered by public insurance and have vaccine coverage via the Vaccines for Children program.

The present study describes our tactics for achieving high HPV vaccination rates in the setting of an integrated safety net health care system with a mature immunization delivery system. We also examined which factors affect the uptake of HPV in both girls and boys, both as an individual vaccine and in the context of other adolescent vaccines.

METHODS

Setting

Denver Health is a safety net–integrated health system serving more than one-half of the uninsured and Medicaid population in Denver, Colorado, and ~40% of the city's children.[19] Denver Health serves 43% of the Denver Hispanic community and 33% of the African-American community, and ~17 000 adolescents annually. Adolescent vaccines are administered at 8 federally qualified health centers, 16 school-based health centers (SBHCs), and the Denver Public Health immunization clinic.

Interventions

Adolescent vaccine delivery at Denver Health involves several steps that result in the "bundling" of the 3 adolescent vaccinations (Tdap, MCV4, and HPV) (Table 1). For all patients presenting for acute or preventative visits, there is a standard process for the medical assistants to follow that leads to vaccines being offered to the patient.

Routine Use of Vaccine Registry

The process begins with the use of the Denver Health internally developed immunization registry[20] (VaxTrax) that serves multiple functions. VaxTrax has recommend, vaccine inventory, and historic information storage functionality.

Patient demographic and insurance information is updated with every visit registration. Medical contraindications and patient or family refusals are also documented in the system to prevent the recommendation of an inappropriate dose of vaccine.

Once a patient is registered, medical assistants use the recommend functionality of VaxTrax to create a list of specific vaccines for which the patient is due. If the patient is new to the clinic or there has been a gap in care, the assistant can check the state registry to help confirm vaccine history.

Standing Order for Vaccinations

For all patients presenting for acute or preventive visits, this immunization registry list is now a standing order for the medical assistants for the vaccines to be administered to that patient. A provider signature is required only if the vaccines are to be given outside the standard of care. The medical assistant is then able to notify the family which vaccines are recommended and administer vaccines before the provider enters the examination room if the family has no concerns. This procedure allows the adolescent patient to be observed for any episodes of syncope before the visit ends. Vaccines may be given before or after the provider visit, depending on clinic flow and whether there is a need for the provider to address any parental concerns. Vaccine administration is documented in VaxTrax to create a complete immunization history for the patient. The registry uploads all vaccine data to the Colorado Immunization Information System on a nightly basis. The final step is for the medical assistant to circle the vaccines on the billing sheet in the patient's chart.

Presenting Vaccines in Standard "Bundle"

Providers have been encouraged to "bundle" the vaccines together, in that they generally do not present vaccines as optional versus required when discussing them with families, but rather as a group of vaccines that are all recommended for the adolescent's health. Provider education is incorporated into weekly educational meetings on a variety of topics for ambulatory pediatric providers. Topics covered at these meetings have included presentation of quality improvement data (eg, vaccine coverage rates according to clinic site) and addressing vaccine refusal in the clinic setting. Providers are also tracked by using their individual adolescent vaccine coverage rates, and a provider "report card" with these metrics, including HPV initiation and completion rates, is distributed monthly.

Other Interventions

Many of the SBHCs also offer periodic vaccination drives in which students' vaccination status is reviewed, students are brought to the SBHC, and vaccines are updated as indicated. In addition, adolescent patients may access care at multiple sites. A teenager might attend 1 of the community health centers for primary care and also have visits within a SBHC. Other quality measures within the organization focus on improving rates of preventive visits. When families are accustomed to coming to the clinic annually for a physical examination, adolescents are likely to have more preventive visits in their medical home. This system allows for multiple contacts with adolescents and increases opportunities for vaccination initiation and completion. In addition, even if families have previously declined vaccines, they are offered them again at all future visits.

Measures

Sociodemographic characteristics (sex, race/ethnicity, preferred language, and federal poverty level [FPL]) were obtained from administrative databases. Rates of immunizations at Denver Health were compared relative to periods of interventions over an 11-year period (2004–2014) for the study participants, defined as adolescents who were between the ages of 13 and 17 years and were seen at least once in a primary care setting at Denver Health. Immunization coverage was defined as documentation in the registry of having received ≥1 of the immunizations of interest (HPV [≥1 and ≥3 doses], Tdap, and MCV4). Immunizations are reflected on data documented in VaxTrax before the last day of each year.

Analysis

Adolescents who received ≥3 HPV doses were compared with those receiving <3 doses (or never starting the series) by using χ^2 tests and multivariate logistic regression. The covariates that were adjusted for in the multivariate logistic regression model were age, sex, race, language, and FPL.

Continuous variables were evaluated according to mean or median depending on normality and dichotomized based on their distribution. To analyze factors associated with HPV administration, χ^2 testing was used, and variables were selected for entry into a multivariable logistic regression model. We also tracked instances of parent refusal. Data were analyzed by using SAS Enterprise 4.3 (SAS Institute, Inc, Cary, NC). *P* values <.05 were considered significant.

RESULTS

Of the total study population of 11 463 subjects, their average age was 14.77 years, and they were

TABLE 2 Demographic Characteristics of Study Population ($N = 11\,463$)

Characteristic	Received <3 HPV Doses	Received ≥3 HPV Doses
Age, mean (range), y	14.77 (13.00–17.92)	15.05 (13.00–17.92)
Sex, *n* (%) [95% CI]		
Female	2019 (44.0) [45.8–48.3]	3980 (57.9) [56.7–59.2]
Male	2571 (47.1) [45.7–48.4]	2893 (53.0) [51.6–54.3]
Race/ethnicity, *n* (%) [95% CI]		
Black	808 (48.5) [46.1–50.9]	857 (51.4) [49.1–53.3]
Hispanic	3024 (36.3) [35.3–37.4]	5290 (63.6) [62.60–64.7]
White	558 (52.4) [49.4–55.4]	506 (47.6) [44.56–50.6]
Other	200 (47.6) [42.8–52.4]	220 (52.4) [47.6–57.2]
Language, *n* (%) [95% CI]		
English	3227 (43.6) [42.4–44.7]	4182 (56.44) [55.31–57.57]
Spanish	1244 (33.7) [32.2–35.2]	2448 (66.31) [64.79–67.83]
Other	119 (32.9) [28.0–37.7]	243 (67.13) [62.29–71.97]
Poverty status, *n* (%) [95% CI]		
≤200% FPL	3842 (37.8) [36.9–38.8]	6310 (62.2) [61.2–63.1]
>200% FPL	108 (46.0) [39.6–52.3]	127 (54.0) [47.7–60.4]
Unknown	640 (59.5) [56.6–62.4]	436 (40.5) [37.6–43.5]

more likely to be Hispanic, English speaking, and <200% of the FPL. Table 2 summarizes the population characteristics according to receipt of <3 doses of HPV versus receipt of ≥3 doses.

We examined adolescent vaccination rates at Denver Health from 2004, when MCV4 was first recommended, through 2014 (Fig 1). Every vaccine demonstrated a rapid uptake after introduction, including HPV. In fact, the rate of uptake of HPV for both girls and boys was faster (steeper curve) than MCV4 or Tdap.

In 2013, HPV coverage of at least 1 dose in female subjects was 89.8% and in male subjects, it was 89.3%, compared with national rates of 57.3% and 34.6%, respectively. For both sexes, Tdap coverage was 95.9% (86.0% nationally), and MCV4 coverage was 93.5% (77.8% nationally) (Fig 2). Rates improved further in 2014 for all vaccines, with Tdap coverage of 95.5%, MCV4 of 93.6%, and HPV (at least 1 dose) of 90.4% for girls and 89.7% for boys. HPV coverage of ≥3 doses in 2014 was 66.8% for girls and 59.9% for boys. In national data, Tdap coverage in 2014 was 87.6%, MCV4 was 79.3%, and HPV (≥1 dose) was 60.0% for girls and 41.7% for boys.[8] For ≥3 HPV doses, the national estimates were 39.7%

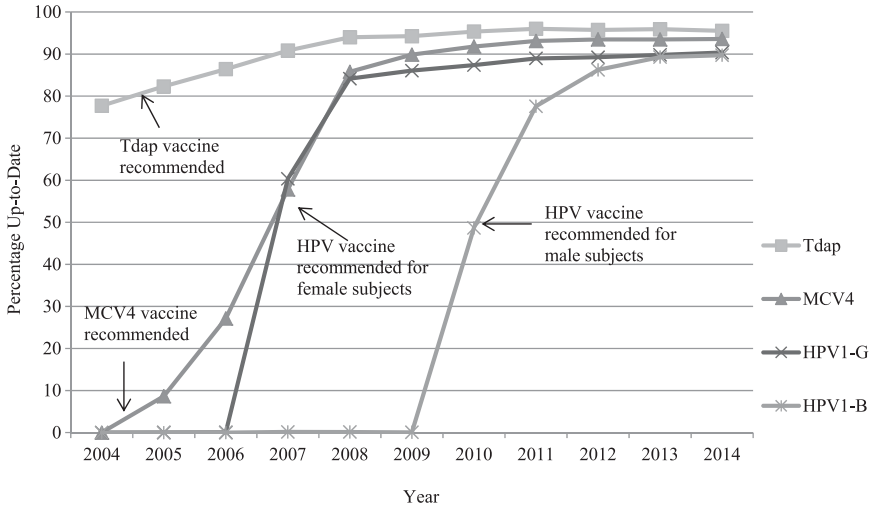

FIGURE 1
Denver Health immunization rates for adolescents (2004–2014). HPV1-G, HPV coverage of 1 dose in girls; HPV1-B, HPV coverage of 1 dose in boys.

for girls and 21.6% for boys. Thus, Denver Health vaccination coverage for adolescents has continued to be higher than national estimates.

In the multivariate model (Table 3), female subjects were much more likely to be fully vaccinated than male subjects (odds ratio [OR]: 1.74 [95% confidence interval (CI): 1.61–1.89]). In addition, Hispanic subjects (OR: 1.75 [95% CI: 1.53–2.11]), Spanish-speaking teenagers (OR: 1.25 [95% CI: 1.14–1.37]), and non–English-speaking teenagers (OR: 2.15 [95% CI: 1.67–2.77]) were more likely to have received ≥3 HPV doses. An inverse relationship with income was observed, with patients <150% of the FPL more likely to have received ≥3 HPV doses than those >200 of the FPL (OR: 1.43 [95% CI: 1.10–1.87]).

Although this adolescent vaccination program was successful, problems encountered in its implementation included parental refusals and difficulty achieving 3 doses of HPV by 13 years of age. There were 1384 HPV refusals documented in the vaccine registry, for a documented refusal rate of 2.15%.

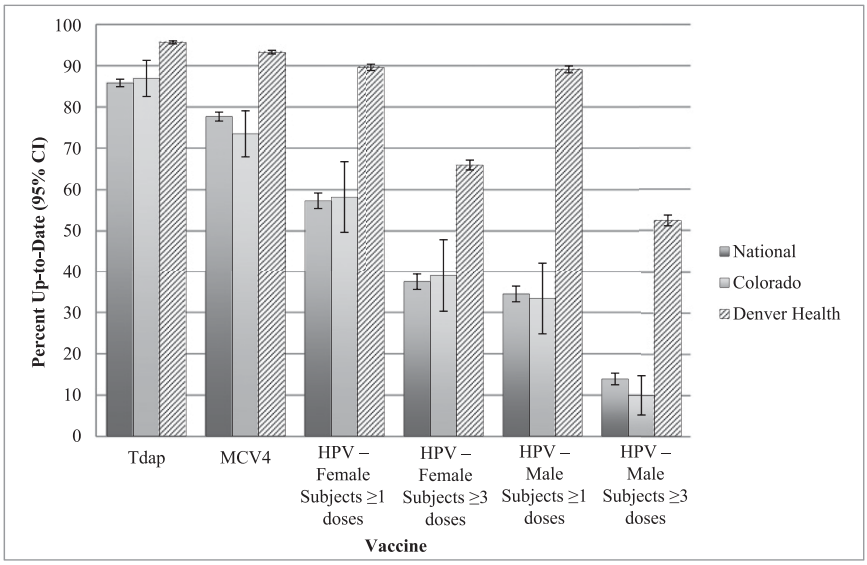

FIGURE 2
National, state, and Denver Health adolescent immunization rates (2013). HPV1, HPV type 1.

TABLE 3 Adjusted Odds for Receiving ≥3 Doses of HPV

Characteristic	OR	95% Wald CI
Age (linear)	1.17	1.13–1.20
Sex		
Male	1.00	—
Female	1.74	1.61–1.89
Race		
White	1.00	—
Black	1.13	0.97–1.33
Latino	1.77	1.54–2.03
Other	0.93	0.72–1.19
Language		
English	1.00	—
Spanish	1.26	1.15–1.38
Other	2.16	1.68–2.78
FPL		
>200%	1.00	—
≤200%	1.43	1.10–1.87
Unknown	0.67	0.50–0.90

DISCUSSION

The present study compared Denver Health's adolescent vaccination coverage rates, particularly HPV, with national and state rates. Coverage rates for all adolescent vaccines, including HPV, were significantly higher than national and state rates. We also describe the methods used to achieve such high coverage rates, including use of a vaccine registry, standing orders for vaccines, bundling of vaccines, and SBHC programs. Patients completing the HPV series were more likely to be female, Hispanic, non–English-speaking, and have family incomes <150% of the FPL.

By addressing provider- and system-level barriers, including avoiding missed opportunities and providing a strong recommendation, adolescent vaccination coverage rates at Denver Health have risen well above national rates, especially for HPV. Once a vaccine is introduced at Denver Health, coverage rates increase rapidly, indicating broad-based provider support of new vaccines, an efficient and low-cost system that uses every visit as an opportunity for vaccination, and robust vaccine registry support. The rapid rate of uptake of HPV in particular reflects the maturation of our immunization delivery system. HPV was introduced after Tdap and MCV4; therefore, the standard research previously described was more developed, and we were able to incorporate the HPV vaccine into a seasoned delivery system with standard efforts.

These results are consistent with previous research examining national and state trends in that girls, Hispanic subjects, and low-income patients are more likely to initiate the HPV series or to receive ≥3 doses.[4,5,8] To our knowledge, language has not been examined as a potential factor in HPV coverage rates. The practice of continuing to approach families who have refused HPV vaccination in the past addresses the patient groups with lower vaccine completion rates, such as English-speaking and higher income families. These families may require recurring discussion over time with a primary provider to overcome barriers to vaccination.

Limitations of the present study include the fact that we examined practices in 1 health care system, an integrated safety net system that serves a high percentage of poor families, and which may not be generalizable to all settings. However, the lessons learned may be beneficial to other practices and health systems in achieving high HPV vaccination coverage. In some pediatric practice settings, providers' financial concerns regarding reimbursement for adolescent vaccination may influence coverage rates. However, at Denver Health, the Vaccines for Children program is the primary funding source for vaccinations; thus, providers are unlikely to perceive financial barriers to adolescent vaccination.

Although not the focus of our intervention, parental barriers to vaccination are also addressed at Denver Health. In delivering a strong recommendation for all 3 adolescent vaccines, parents' concerns regarding the importance and safety of the vaccines, particularly HPV, are often allayed. Providing a strong recommendation may create an opportunity for education regarding HPV burden of illness, increased efficacy of the vaccine when given before initiation of sexual activity, and safety of the vaccine. Given that our coverage rates were lower in higher income and nonminority families, extra effort must be devoted to communication with patients and parents in these groups.

CONCLUSIONS

Through low-cost, system-wide standard procedures, Denver Health achieved adolescent vaccination rates well above national coverage rates. HPV coverage rates at Denver Health are significantly higher than national rates, especially for boys. Avoiding missed opportunities for vaccination and providing a strong recommendation for the HPV vaccine were key procedures that likely contributed to high coverage rates. Providers caring for adolescents may use these approaches to improve vaccination coverage rates in their populations.

ABBREVIATIONS

CI: confidence interval
FPL: federal poverty level
HPV: human papillomavirus
MCV4: meningococcal conjugate vaccine
OR: odds ratio
Tdap: tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis, adsorbed, vaccine
SBHC: school-based health center

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