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HPV Immunization in High School Student-Athletes Receiving Preparticipation Physical Evaluations at Mass Event Versus Other Venues

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Background: The preparticipation physical evaluation (PPE) is a requirement for high school sport participation in most states, but its location and role in preventive health care for adolescents is often questioned.

Hypothesis: Athletes who had their PPE performed in an office setting, in particular) by their primary care physician (PCP), will have higher human papillomavirus (HPV) immunization rates than those who had their PPE done in a group setting at a mass-participation PPE.

Study Design: Retrospective cohort study.

Level of Evidence: Level 3.

Methods: The PPE forms and immunization records for athletes at a single high school were reviewed to determine the location of PPE, the signing practitioner, and HPV immunization status.

Results: A total of 488 athletes (286 males, 202 females) were included; 51% had received at least 1 dose of the HPV vaccine while 39% had completed the series. There was no significant difference in vaccination rates between examination in an office setting versus a group setting. Athletes receiving their PPE at an urgent care facility had significantly lower rates of HPV series completion than all other settings (29% vs 43%; $P = 0.004$). PPE completion by the athlete's PCP was associated with higher rates of vaccine series completion (46% vs 34%; $P = 0.014$).

Conclusion: Athletes who completed their PPE in mass event and office-based settings had similar rates of HPV vaccine series initiation and completion. PPEs done at urgent care facilities were associated with low rates of vaccine series completion, while those done by a PCP were associated with higher rates.

Clinical Relevance: HPV immunization rates in athletes are low, and the PPE represents a potential opportunity to improve immunization rates.

Keywords: preparticipation evaluation; human papillomavirus; immunizations; vaccine

The human papillomavirus (HPV) vaccine is recommended for both boys and girls between the ages of 9 and 26 years but is usually started at 11 to 12 years of age. The vaccine is administered in a 2-dose series, ideally given 6 to 12 months apart. If given after the age of 14 years, a third dose is required for vaccine completion.¹⁰ The purpose of the HPV vaccine is mainly to prevent cervical and oropharyngeal cancers attributed

to HPV infection. While HPV vaccination is recommended by the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention, it is not currently required for school attendance in Michigan,^{5,10} and it is well-known that HPV immunization rates have trailed those of required vaccines. In 2017, only 65.5% of 13- to 17-year-old American boys and girls were current with their first HPV vaccination, and 48.6%

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had completed the series.¹¹ Some critics believe that the preparticipation physical evaluation (PPE) is of little benefit when performed outside of the medical home and have questioned its role altogether.^{4,8} The 2019-released PPE (Fifth Edition) prefers that the PPE be performed in the medical home.¹

One benefit of the office-based PPE is that traditional well-child/preventive care can be addressed.⁷ At a typical well-child examination, vaccine review and administration are standard. Immunizations are a vital aspect of preventive care and should be equally important in the care of athletes.² Many students utilize school-sponsored mass PPEs, and vaccines are not typically offered at these venues. At our particular institution, we conduct yearly mass PPEs with the schools we cover. These examinations consist of brief orthopaedic and medical screening exams, as well as a medical history questionnaire review and are typically conducted in a gymnasium or locker room. Immunizations are not administered in this setting. It is currently unknown how many students forgo visits with their primary care physician (PCP) in lieu of mass-participation PPEs and may miss vaccine opportunities. Furthermore, many students may opt to have their PPE performed at urgent care or retail medical facilities.

One prior study suggested that there are low rates of receipt of all recommended immunizations in high school athletes,³ but little has been published on HPV vaccination specifically for this population. Our objective was to determine whether there were differences in HPV immunization rates depending on location of PPE.

METHODS

Study Design

We conducted a retrospective cohort study of the HPV immunization status of high school athletes at a single high school in Michigan with whom we provide athletic training and sports medicine coverage. Our group sponsored a station-based mass PPE event at this school.

Data Collection

We retrospectively reviewed the state-required PPE forms for all athletes participating in fall and winter sports for the 2018-2019 school year.⁶ These forms were used to identify the venue of examination (office vs mass event) and the signing practitioner (PCP vs other). Additionally, we identified whether an examination form was completed at one of the many known local urgent care facilities. Immunization records were reviewed through the statewide database, and we recorded whether each athlete had received any doses of an HPV vaccine (≥ 1) and whether they had completed the series.

Outcome Measures

The primary analysis conveyed a difference in rates of receipt of ≥ 1 dose of HPV vaccine in office-based versus mass event physicals. Secondary analyses were vaccine series completion and differences in vaccine receipt based on age, sex,

Table 1. Location of examination

Venue	n (%)
Office	424 (86.9)
PCP	169 (34.6)
UC	147 (30.1)
Non-UC, non-PCP	108 (22.2)
Group	64 (13.1)

PCP, primary care physician; UC, urgent care.

examination by PCP versus another provider, and examination at an urgent care facility.

Statistical Analysis

Groups were compared using chi-square tests with a 2-sided alpha of 0.05 for an 80% power to detect a difference in vaccination rates of 15%. We estimated that 60% of athletes received at least 1 dose of HPV vaccine in office-based examinations. We estimated a sample size of 508 athletes, assuming 406 and 102 in the office-based and mass event groups, respectively.

RESULTS

A total of 488 student-athlete PPE forms and immunization records were reviewed: 64 examinations (13%) were performed in the mass event group setting and 424 (87%) were done in an office setting. Of these, 147 examinations (30%) were completed at known urgent care facilities, and 169 (35%) were performed by the listed PCP. The remaining 108 examinations were assumed to be done in an office setting of some type. In these cases, examinations were performed by a provider other than the listed PCP, or the PCP was not listed (Table 1).

Those seen in office and group settings had no statistically significant differences in age, sex, receipt of at least 1 HPV vaccine dose, or vaccine series completion. There was no statistically significant difference in those who received at least a single dose of the HPV vaccine based on age, sex, location (office vs group), or form completion by PCP versus non-PCP. Vaccine series completion was higher in those who had their forms completed by their PCP versus non-PCP (46% vs 33%; $P = 0.014$). Those seen in urgent care facilities had the lowest rates of vaccine series completion (29.3%) compared with those seen in the group or other office-based settings, both of which were statistically significant (Table 2).

DISCUSSION

In this convenience sample of high school athletes, HPV vaccine rates (both series initiation and series completion) did not differ

Table 2. HPV initiation/completion^a

Variable	Response (Total)	HPV ≥ 1 vs 0	<i>P</i>	HPV Series Complete vs Incomplete	<i>P</i>
Age, y	Mean	15.6 (1.2)	0.235	15.6 (1.2)	0.632
	Median (Q25, Q75)	15.5 (15, 17)		15 (15, 16)	
Sex	Male (n = 286)	153 (53.5)	0.270	116 (40.6)	0.381
	Female (n = 202)	97 (48.0)		74 (36.6)	
Location	Mass event (n = 64)	32 (50.0)	0.833	23 (35.9)	0.598
	Office (n = 424)	218 (51.4)		167 (39.4)	
PCP	PCP (n = 169)	95 (56.2)	0.062	77 (45.6)	0.014
	Non-PCP (n = 272)	128 (47.1)		92 (33.8)	
UC	Yes (n = 147)	65 (44.2)	0.036	43 (29.3)	0.004
	No (n = 322)	176 (54.7)		139 (43.2)	
Office location	UC (n = 147)	65 (44.2)	0.095	43 (29.3)	0.007
	Office, non-UC (n = 277)	153 (55.2)		124 (44.8)	

HPV, human papillomavirus; PCP, primary care physician; UC, urgent care.

^aAll values, except for age, are given as n (%). Boldfaced *P* values indicate statistical significance ($P < .05$).

for those who received their examination at a school-sponsored mass event compared with other locations. Overall, 51% of athletes had at least started their HPV series, while 39% had completed the series.

Examination in an urgent care setting was associated with lower rates of both HPV vaccine initiation and completion. Those who received their examination by the listed PCP were found to have the highest rates of HPV series completion (46%), which was statistically significant.

This study has multiple limitations. First, it is a sample of a single high school and subject to the demographic limitations therein. The school studied is a public high school in suburban metropolitan Detroit, Michigan, with a population of 27,076 people, of which 93% are white, and a median household income of \$69,134.⁹ Socioeconomic demographics were not addressed in our study. Another limitation of a single-school population is that this cohort would be more likely to be influenced by the vaccine practices/tendencies of a handful of practices/providers that serve the community. The aforementioned limit the generalizability of these results.

This study does not account for whether athletes were seen for a well-child/preventive visit during the school year in question, and there is likely a large degree of overlap in those groups. The number of athletes who attended the mass-participation event and still had a traditional preventive care visit is unknown. Interestingly, our results may suggest that those who attended the group physical were more likely to receive preventive care than those who sought care at an urgent

care facility. It is possible that these athletes were less likely to view the mass event examination as a substitute for their well-child examination as opposed to those seen at an urgent care. Those seen in the urgent care setting had the overall lowest vaccine rates, which may suggest that they are foregoing their well-child/preventive visits in lieu of care at retail medical clinics, which may or may not be addressing vaccine status. Additionally, the medical home is not the only venue in which vaccines can be administered, as immunizations are often given at pharmacies or the local health department.

One strength of this study is its size and confirmation of vaccination status through state immunization record review, which captures vaccine administration anywhere in the state. To our knowledge, this is the largest published data set regarding HPV immunization rates in high school athletes. Prior studies involving athletes have primarily relied on survey data and are prone to recall bias.

CONCLUSION

Within a single high school in Michigan, 51% of all athletes had received at least 1 dose of an HPV vaccine, while 39% had completed the series. A PPE performed by a PCP was associated with immunization status being up to date compared with that of an urgent care setting. This study further highlights the importance of routinely addressing the immunization status of adolescents at any office visit and demonstrates that the PPE, particularly done in the mass event setting or at an urgent care,

should not be thought of as a substitute for a traditional preventive health care visit. Ideally, the PPE would be performed by the PCP in the athlete's medical home, where immunization records can be reviewed and any deficiencies addressed.

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