



HHS Public Access

Author manuscript

Cancer Epidemiol Biomarkers Prev. Author manuscript; available in PMC 2017 February 01.

Published in final edited form as:

Cancer Epidemiol Biomarkers Prev. 2016 February ; 25(2): 351–358. doi:
10.1158/1055-9965.EPI-15-0983.

Predictors of Human Papillomavirus Vaccination in a Large Clinical Population of Males Aged 11 to 26 years in Maryland, 2012 – 2013

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Abstract

Background—Despite the recommendation for routine human papillomavirus (HPV) vaccination in males, coverage estimates remain low. We sought to identify predictors of receiving each HPV vaccine dose among a large clinical population of males.

Methods—We conducted a cross-sectional analysis of electronic medical records for 14,688 males aged 11–26 years attending 26 outpatient clinics (January 2012 –April 2013) in Maryland to identify predictors of each HPV vaccine dose using multivariate logistic regression models with generalized estimating equations. All analyses were stratified in accordance with vaccine age recommendations: 11–12 years, 13–21 years, and 22–26 years. Analyses of predictors of receipt of subsequent HPV doses were also stratified by number of clinic visits (≤ 3 , >3).

Results—Approximately 15% of males initiated the HPV vaccine. Less than half of males eligible received the second and third dose, 49% and 47%, respectively. Non-Hispanic black males (vs. non-Hispanic white) aged 11–12 and 13–21 years and males with public insurance (vs. private) aged 13–21 years, had significantly greater odds of vaccine initiation, but significantly decreased odds of receiving subsequent doses, respectively. Attendance to >3 clinic visits attenuated the inverse association between public insurance and receipt of subsequent doses.

Conclusion—Overall, rates of HPV vaccine initiation and of subsequent doses were low. While non-Hispanic black and publically insured males were more likely to initiate the HPV vaccine, they were less likely to receive subsequent doses.

Impact—Tailoring different intervention strategies for increasing HPV vaccine initiation versus increasing rates of subsequent doses among males may be warranted.

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Conflicts of Interest: None

Keywords

Human papillomavirus; vaccine initiation; vaccine completion; vaccine doses; males

Introduction

Vaccination against human papillomavirus (HPV) in males is substantially lower compared to other adolescent vaccines. As of 2014, approximately 42% of males aged 13–17 years in the U.S. initiated the HPV vaccine series, as compared with approximately 79% coverage for meningococcal conjugate and 88% coverage for tetanus, diphtheria, and pertussis (1). Completion rates for the HPV vaccine are even lower, with 21.6% of males receiving all three doses in 2014 (1). The HPV vaccine was originally licensed for males in 2009 (2). In October 2011, the Advisory Committee on Immunization Practices (ACIP) recommended routine HPV vaccination for males aged 11–12 years, with catch-up vaccination for males aged 13–21 years, and permissive vaccination up to 26 years of age (3). Although HPV vaccination coverage among U.S. males has increased, more than half of the target population still remains unvaccinated.

The quadrivalent HPV vaccine (Gardasil, Merck and Co, Inc.) is administered as a 3-dose series, with the second and third doses administered at 2 and 6 months after the first dose, respectively (3). The vaccine protects against high-risk HPV types 16 and 18 and low-risk HPV types 6 and 11, and is most effective when administered prior to HPV exposure before sexual debut (4, 5). Persistent infection with HPV types 16 and 18 is causally associated with a significant proportion of anal, penile and oropharyngeal cancers in males (6, 7) and cause up to 70% of cervical cancers in females (8). Infection with low-risk HPV types 6 and 11 are responsible for nearly all cases of genital warts (9–11).

Data on determinants of HPV vaccination among males are limited, but suggest a health care provider's recommendation as one of the most important predictors of HPV vaccine initiation (12). Additionally, rates of vaccine initiation are generally higher among non-Hispanic black and Hispanic males (vs. non-Hispanic whites) and among males living below the poverty level (vs. at or above the poverty level; (1, 12, 13). Less is known about factors related to HPV vaccine completion among males; however a few studies have shown that rates are lower among non-Hispanic black and Hispanic males and among uninsured/underinsured male adolescents (1, 12, 13). Frequent contact with the healthcare system has also been cited as an important predictor of completion, particularly among low-income and minority males (12, 14). Most of the evidence on predictors of HPV vaccine initiation and completion among males was generated before the ACIP recommendation in 2011 (15–18) with a majority of studies focusing on vaccine acceptability (14, 19–22). More recent studies, such as the National Immunization Survey-Teen (NIS-Teen), include limited age ranges (13 – 17 years) and do not include males in the target age range (1, 13). To our knowledge, no recent studies have examined predictors of the second dose of the HPV vaccine, despite growing interest in reduced dosing schedules of the HPV vaccine series (23–25). To this end, the purpose of our study was to identify predictors of each dose of the

HPV vaccine series among a large, clinical population of males aged 11 to 26 years after the ACIP recommendation, January 2012 through April 2013.

Materials and Methods

Study Population

We evaluated EMR data from 15,996 males aged 11 to 26 years attending Johns Hopkins Community Physicians (JHCP) clinics from January 2012 through April 2013. JHCP is a university-affiliated practice comprised of 26 primary care outpatient sites in 11 counties in Maryland. Our study population was drawn from the Family Practice, Internal Medicine/Pediatrics (IM/Peds), Internal Medicine, and Pediatrics practice specialties at these facilities. Males who received an HPV vaccine dose outside of a JHCP clinic (coded as “historical” in the EMR, n=101) and those who initiated the HPV vaccine series prior to the start of our study (vaccine dose 1 or 2 date was missing in the EMR but date for vaccine dose 2 or 3, respectively, was not missing n=1,207, 7.6%) were excluded. We created three analytic cohorts to evaluate HPV vaccine initiation, receipt of the second dose of the HPV vaccine, and HPV vaccine completion. Therefore, the analytic cohort for HPV vaccine initiation included 14,688 males who had not received an HPV vaccine dose as of 2012. Based on estimates from U.S. census data, our study population included slightly more non-Hispanic black males and slightly less non-Hispanic white males (35.1% and 50.6%, respectively) compared with males of similar ages living in JHCP-affiliated counties in Maryland (27.0% and 59.5% on average, respectively). With respect to insurance status, the proportion of males in our study population (21.2%) was very similar to the average proportion of males with public insurance of similar ages living in JHCP-affiliated counties in Maryland (20.2%). Dates in the EMR data included only visit year (vs. month and year). As such, we could not determine whether males who initiated in 2013 (n=346) or those who received the second dose in 2013 (n=202) had enough time (i.e., 6 months) to complete the series; these males were excluded from the second dose and completion analytic cohorts, respectively. Thus, the analytic cohort for the second dose of the HPV vaccine included the 1,834 males who initiated the HPV vaccine in 2012, and the analytic cohort for the completion analysis included the 702 males who received the second dose in 2012. This study protocol was approved by the Johns Hopkins Medicine Institutional Review Board.

HPV Vaccination Outcome Definitions

Information on HPV vaccination status was available from the EMR. HPV vaccine “initiation” was defined as receipt of at least one dose of the HPV vaccine, the second dose was defined as receipt of two doses of the HPV vaccine, and HPV vaccine “completion” was defined as receipt of all three doses of the HPV vaccine series.

Demographic and Clinical Predictors of HPV Vaccination

Demographic and clinical characteristics were available from the EMR. We evaluated age at the first clinic visit during the study period (i.e., “baseline”) as a continuous variable and also categorized baseline age according to the ACIP recommendations: 11–12 years (target age range for vaccination, “Target”), 13–21 years (catch-up age range for vaccination, “Catch-Up”, and 22–26 years (permissive age for vaccination, “Permissive”). Race/ethnicity

was self-identified in the registration files of the EMR and defined as non-Hispanic white, non-Hispanic black, Hispanic, Asian, or other race/ethnicity. Insurance was categorized as private, public, or military. The number of clinic visits during the study period was categorized as ≤ 3 visits (the minimum number of visits required to complete the HPV vaccine series) vs. >3 visits. JHCP clinic location was defined as urban or suburban using U.S. census data and JHCP practice specialty was categorized as Family Practice, IM/Peds, Internal Medicine, or Pediatrics. Because males could visit more than one practice specialty type during the study period, we assigned each male the most common practice specialty observed. When we were unable to identify the most common practice specialty because a male attended an equal numbers of different specialties ($n=602$, 3.8%), we used the practice specialty at the male's first visit. Among males who were vaccinated, agreement between the assigned practice specialty and the specialty associated with the vaccine visit was 95%.

Statistical Analysis

In this cross-sectional analysis, we calculated means and proportions for demographic and clinical predictors, using descriptive statistics with t-tests and Pearson's chi-square tests to assess differences by uptake of each HPV vaccine dose. Multivariable logistic regression models using generalized estimating equations (GEE) were used to calculate adjusted odds ratios (aORs) and 95% confidence intervals of associations of demographic and clinical predictors with each HPV vaccine dose, accounting for clustering within JHCP clinics. All models were stratified by baseline age group and mutually adjusted for continuous baseline age, race/ethnicity, insurance type, number of clinic visits, JHCP clinic location, and JHCP practice specialty. Since additional clinic visits are required for receipt subsequent doses of the HPV vaccine, we conducted a sub-analysis to explore whether the number of clinic visits modifies any potential association of race/ethnicity and insurance type with receipt of the second and third dose of the HPV vaccine, respectively. In this analysis we focused on race/ethnicity and insurance because these factors are known to be differentially associated with healthcare utilization patterns (14). To increase statistical power and adequately test for interaction, we combined the target and catch-up age groups and re-categorized race/ethnicity as non-Hispanic white, non-Hispanic black and other (Hispanic, Asian/Pacific Islander, and other race/ethnicity). We stratified our models by number of clinic visits (≤ 3 and >3), and tested for statistical interaction using the Wald test. All analyses were conducted using Stata v.13.1 (StataCorp, College Station, TX). All tests were 2-sided and results were considered statistically significant if $p<0.05$.

Results

HPV Vaccine Initiation

Of the 14,688 males eligible for the first dose of the HPV vaccine, a total of 2,180 (14.8%) initiated the series. The average baseline age of males eligible for the first dose of the HPV vaccine was 18.0 ± 4.7 years, and the majority were non-Hispanic white (50.6%, Table 1). More than half of all males were privately insured and the majority attended ≤ 3 clinic visits during the study period (Table 1).

Multivariable aORs for HPV vaccine initiation by age group are shown in Table 2. In the target age group, non-Hispanic black males had 39% greater odds of initiating the HPV vaccine compared with non-Hispanic white males ($p=0.02$); and males with public insurance had 45% greater odds of HPV vaccine initiation compared with males with private insurance ($p=0.02$). Attending >3 clinic visits during the study period was associated with over a two-fold increase in odds of HPV vaccine initiation compared with ≤ 3 visits during the study period ($p<0.001$), and visiting a clinic in an urban location was associated with over a three-fold increase in odds of HPV vaccine initiation compared with clinics in a suburban location ($p<0.01$).

In the catch-up age group, similar to males in the target age group, non-Hispanic black race/ethnicity, public insurance, attending >3 clinic visits during the study period, and urban clinic location were significantly associated with increased odds of HPV vaccine initiation ($p<0.01$, respectively). Additionally in the catch-up age group, older age at baseline was significantly associated with a 14% decrease in odds of HPV vaccine initiation ($p<0.001$) and Internal Medicine practice specialty was significantly associated with a 73% decrease in odds of HPV vaccine initiation compared with Family Medicine practice specialty ($p<0.001$).

Similar to males in both the target and catch-up age groups, non-Hispanic black race/ethnicity in the permissive age group and attending >3 clinic visits during the study period were significantly associated with increased odds of HPV vaccine initiation ($p<0.001$, respectively). Like males in the catch-up age group, older age at baseline and Internal Medicine practice specialty were significantly associated with decreased odds of HPV vaccine initiation ($p=0.05$ and $p=0.02$, respectively). Additionally in the permissive age group, males with military insurance had nearly two-and-a-half times the odds of initiating the HPV vaccine compared to males with private insurance ($p=0.04$).

Second Dose of the HPV Vaccine

Of the 1,834 eligible males (those who received their first HPV vaccine dose in 2012), a total of 904 (49.1%) received the second dose of the HPV vaccine. Males eligible for the second dose of the HPV vaccine tended to be younger, and a higher proportion were non-Hispanic black and privately insured compared with males eligible for initiation (Table 1).

Multivariable aORs for the second dose of the HPV vaccine by age group are shown in Table 3. Results for the permissive age group are not shown due to limited statistical power. In the target age group, non-Hispanic black males, Hispanic males, and males who identified as other race/ethnicity had 27%, 61%, and 74% decreased odds, respectively, of receiving the second dose of the HPV vaccine compared with non-Hispanic white males ($p=0.05$, respectively). Attending >3 clinic visits during the study period was significantly associated with a four-fold increase in odds of receiving the second dose compared with ≤ 3 visits ($p<0.001$).

In the catch-up age group, similar to males in the target age group, non-Hispanic black race/ethnicity was significantly associated with decreased odds of receiving the second dose of the HPV vaccine ($p=0.02$), and attending >3 clinic visits during the study period was

associated with nearly a six-fold increase in odds of receiving the second dose of the HPV vaccine in the catch-up age group ($p < 0.001$). Additionally, males with public insurance had 27% decreased odds of receiving the second dose of the HPV vaccine compared with males with private insurance ($p = 0.02$) and IM/Peds practice specialty was significantly associated with a 48% decrease in odds of receiving the second dose of the HPV vaccine compared with Family Practice specialty ($p = 0.04$).

In the target and catch-up age groups, non-Hispanic black males with ≤ 3 visits had lower odds (aOR 0.62, 95% CI 0.4 – 0.9) of receiving the second dose of the HPV vaccine compared to their non-Hispanic white male counterparts. This association was nearly equivalent for non-Hispanic black males with > 3 visits (aOR 0.66, 95% CI 0.4 – 1.1). Similar patterns were observed for males in the combined “Other” race/ethnicity category (data not shown). Number of clinic visits did not modify the association between race/ethnicity and receipt of the second dose of the HPV vaccine (p -interaction = 0.07). In contrast, in the target and catch-up age groups, publically insured males with ≤ 3 visits had significantly lower odds of receiving the second dose of the HPV vaccine (aOR 0.67, 95% CI 0.5 – 0.9) compared to their privately insured counterparts; however, this association was attenuated for publically insured males with > 3 visits (aOR 1.05, 95% CI 0.7 – 1.6). There was no significant difference in the odds of receipt of the second dose of the HPV vaccine when comparing males with military insurance to their privately insured counterparts, irrespective of number of clinic visits (≤ 3 visits: aOR 0.85, 95% CI 0.6 – 1.2 vs. > 3 visits: aOR 0.81, 95% CI 0.3 – 1.9). Number of clinic visits modified the association between insurance type and receipt of the second dose of the HPV vaccine (p -interaction = 0.001).

HPV Vaccine Completion

Of the 702 eligible males (those who received their second HPV vaccine dose in 2012), a total of 331 (47.2%) completed the series during the study timeframe. Males eligible for the third dose of the HPV vaccine tended to be younger, and a higher proportion were non-Hispanic black and privately insured compared with males eligible for initiation (Table 1).

Multivariable aORs for HPV vaccine completion by age group are shown in Table 4. Results for the permissive age group are not shown due to limited statistical power. In the target age group, attending > 3 clinic visits during the study period was significantly associated with over a three-and-a-half-fold increase in odds of HPV vaccine completion compared with ≤ 3 visits ($p < 0.001$) and visiting a clinic in an urban location was significantly associated with a 43% decrease in odds of HPV vaccine completion compared with suburban locations ($p < 0.01$).

In the catch-up age group, similar to males in the target age group, attending > 3 clinic visits during the study period was significantly associated with over a three-and-a-half-fold increase in odds of HPV vaccine completion ($p < 0.001$). Additionally, males with public insurance had 50% decreased odds of HPV vaccine completion compared with males with private insurance ($p = 0.05$).

In the target and catch-up age groups, non-Hispanic black males with ≤ 3 visits had lower odds (aOR 0.53, 95% CI 0.2 – 1.3) of completing the HPV vaccine compared to their non-

Hispanic white male counterparts. This association was nearly equivalent for non-Hispanic black males with >3 visits (aOR 0.69, 95% CI 0.3 – 1.5). Similar patterns were observed for males in the combined “Other” race/ethnicity category (data not shown). Number of clinic visits did not modify the association between race/ethnicity and HPV vaccine completion (p-interaction = 0.14). In contrast, in the target and catch-up age groups, publically insured males with ≤3 visits had significantly lower odds of completing the HPV vaccine (aOR 0.46, 95% CI 0.3 – 0.6) compared to their privately insured counterparts; however, this association was attenuated for publically insured males with >3 visits (aOR 0.72, 95% CI 0.3 – 1.7). There was no significant difference in the odds of completing the HPV vaccine when comparing males with military insurance to their privately insured counterparts, irrespective of number of clinic visits (≤3 visits: aOR 0.76, 95% CI 0.3 – 1.7 vs. >3 visits: aOR 0.89, 95% CI 0.5 – 1.5). Number of clinic visits modified the association between insurance type and completing the HPV vaccine (p-interaction = 0.0001).

Discussion

In this large clinical population of over 14,500 males aged 11 to 26 years, the overall proportion of HPV vaccine initiation was low, with approximately 15% of males receiving at least one dose of the vaccine between January 2012 and April 2013. We observed differences in rates of initiation by age group; approximately 25% of males in the target age group initiated the HPV vaccine, while 18.5% and 2% of males in the catch-up and permissive age groups initiated the HPV vaccine, respectively. Our rates of initiation were lower than those reported from the NIS-Teen, which estimated that 35% of males aged 13–17 years initiated the HPV vaccine in the U.S. in 2013 (21% in 2012; (13)). In our study, among all males who initiated the HPV vaccine in 2012, 49% received the second dose, and among those who received the second dose in 2012, 47% completed the HPV vaccine series. Our rates of completion were comparable with those reported for the general U.S. male population in the NIS-Teen study, which estimated that 48% of males who initiated the HPV vaccine (45.1% in 2012; (13)) completed the series in 2013.

Among all age groups, we found that non-Hispanic black males were more likely to initiate the HPV vaccine compared with non-Hispanic white males. Irrespective of race/ethnicity, males in the target and catch-up age groups who were publically insured were also more likely to initiate the HPV vaccine. These findings are in line with previous studies among both males and females suggesting higher HPV vaccine initiation rates among non-Hispanic black and publically insured populations (1, 12, 13). Although cost has been previously cited as a barrier to HPV vaccination (26–29), efforts over the past several years have focused on improving HPV vaccine reimbursement (30). For low-income children, the Vaccine For Children (VFC) program provides access to the HPV vaccine for Medicaid and underinsured children less than 18 years of age (31). In the private sector, the Affordable Care Act requires most private insurance plans to cover the HPV vaccine at no cost to patients up to 18 years of age (32). We also observed that males in the permissive age group with military insurance were more likely to initiate the HPV vaccine compared with males with private insurance. HPV vaccination is a covered benefit for males aged 11 to 26 years under military insurance plans (33). Given that cost should not be a barrier going forward,

interventions targeting parents and/or providers to increase HPV vaccine initiation may be warranted.

In contrast to our findings for HPV vaccine initiation, we found that non-Hispanic black males (vs. non-Hispanic white) in both the target and catch-up age groups and males with public insurance (vs. private insurance) in the catch-up age group were less likely to receive subsequent doses of the HPV vaccine. These findings are comparable with previous studies reporting lower completion rates among non-Hispanic black and publically insured/underinsured populations (12). It is unclear why the same males who are more likely to initiate the vaccine series are less likely to receive subsequent doses. Our data indicated that for non-Hispanic black males, returning for additional clinic visits did not explain this disparity; however for publically insured males, those who attended >3 clinic visits during the study period were equally likely to complete the HPV vaccine series compared to males with private insurance. These findings suggest provider alerts and/or patient reminder systems may facilitate HPV series completion for all males, and could be particularly effective among minority and publically insured male patients.

We also found important clinical predictors associated with HPV vaccination in our study. Among all age groups, attending >3 clinic visits was associated with increased odds of HPV vaccine initiation and with receipt of subsequent doses. These findings are similar to other studies reporting that males require more primary care visits to complete HPV vaccine series (14, 34). We also found that males in the catch-up and permissive age groups who primarily attended Internal Medicine clinics (vs. Family Practice) were less likely to initiate the HPV vaccine, however once they initiated, they were equally likely to receive subsequent doses. Together these findings have important implications for clinical intervention strategies. For example, broad interventions encouraging routine healthcare visits may promote HPV vaccine initiation and completion among all age-eligible males, whereas more targeted interventions focused on increasing vaccine initiation among patients of Internal Medicine physicians may be needed for increasing coverage in males who require catch-up HPV vaccination.

To our knowledge, this is one of the first and largest studies of demographic and clinical predictors of HPV vaccination among age-eligible males after the ACIP began routinely recommending the vaccine in 2011 (12). Our study is unique in that we assessed independent predictors of each dose of the HPV vaccine, and contributes to the literature by identifying predictors of the second dose of the vaccine. Additional strengths include our diverse study population in terms of patient age, race/ethnicity, insurance, and practice specialties. However, some important limitations are worth noting. First, our study population was selected from clinics affiliated with a single academic-institution in Maryland, representing a small proportion of all males in the 11 to 26 year old age range in the underlying counties. Although males attending JHCP clinics appear to be similar to males in the same age range within their respective counties with respect to race/ethnicity and insurance type, our results may not be generalizable to non-academic practice settings or other geographic regions. Second, because we assigned each male a practice specialty type based on his most common visit or first visit (if most common was not available), it is possible that we misclassified practice specialty type; however we would expect such

misclassification to be non-differential by vaccine status. Third, we did not have exact visit date, and therefore were limited in our ability to determine dosing intervals and assess timing of each vaccine dose. Finally, we used data obtained from the medical record, which is subject to the limitations of databases that were not designed for research purposes (e.g., a limited number of predictor variables, lack of data on potential confounders such as parent perceptions, provider recommendation to vaccinate, etc.). With this type of EMR, it is difficult to know how many males received services exclusively at JHCP. The rate of vaccination was low in our study population and consistent with the literature regarding HPV vaccination in males during this time period, which suggests that the number of males who may have been misclassified as unvaccinated is relatively low.

In conclusion, our study indicates that a substantial proportion of age-eligible males attending primary care clinics did not receive the HPV vaccine during visits with their healthcare provider. Consistent with the literature, we found important disparities in HPV vaccine completion by race/ethnicity and insurance status. Moreover, we provide new evidence demonstrating that these disparities are as equally important for receipt of the second dose of the HPV vaccine. These findings point toward a need for understanding barriers to receiving subsequent doses of the HPV vaccine and focused interventions among minority and publically insured males to ensure HPV vaccine series completion. Further, our data suggest that interventions may need to be targeted by provider specialty, and warrant future research on provider-level factors associated with HPV vaccination.

Acknowledgements

We wish to thank the Optimizing Cancer Screening Working Group, also known as the Johns Hopkins Program to Individualize Cancer Screening (*inCAS*) for their support of this study. We acknowledge the support from T32 CA009314 (P.I., E.A. Platz), and P30 CA006973 (P.I., W.G. Nelson). We would also like to thank the Research Staff at Johns Hopkins Community Physicians for their expert assistance with this project.

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Table 1

Demographic and Clinical Characteristics of Males Aged 11–26 Years Attending JHCP Clinics from 2012 – 2013 by HPV Vaccine Dose Eligibility

	Vaccine Dose Eligibility		
	HPV Vaccine Initiation	HPV Vaccine 2 nd Dose	HPV Vaccine Completion
Total N	14,688	1,834	702
Total Vaccinated n (%)	2,180 (14.8)	904 (49.1)	331 (47.2)
Mean Baseline Age (SD)	18.0 (4.7)	14.9 (3.2)	14.7 (3.2)
Age Group n (%)			
Target	2,471 (16.8)	493 (26.9)	197 (28.1)
Catch-Up	8,011 (54.5)	1,270 (69.2)	472 (67.2)
Permissive	4,206 (28.6)	71 (3.9)	33 (4.7)
Race/Ethnicity n (%)			
White	7,432 (50.6)	585 (31.9)	291 (41.4)
Black	5,163 (35.1)	1,062 (57.9)	328 (46.7)
Hispanic	684 (4.7)	66 (3.6)	32 (4.6)
Asian/Pacific Is.	454 (3.1)	29 (1.6)	13 (1.9)
Other	955 (6.5)	92 (5.0)	38 (5.4)
Insurance Type n (%)			
Private	8,688 (59.1)	709 (38.7)	310 (44.2)
Public	3,114 (21.2)	797 (43.5)	226 (32.2)
Military	2,494 (17.0)	318 (17.3)	162 (23.1)
Missing	392 (2.7)	10 (0.5)	4 (0.5)
Number of Clinic Visits n (%)			
1–3 Visits	12,325 (83.9)	1,296 (70.7)	346 (49.3)
>3 Visits	2,363 (16.1)	538 (29.3)	356 (50.7)
JHCP Clinic Location n (%)			
Suburban	10,955 (74.6)	939 (51.2)	436 (61.1)
Urban	3,730 (25.4)	895 (48.8)	266 (37.9)
JHCP Practice Specialty n (%)			
Family Practice	5,643 (38.4)	494 (26.9)	230 (32.8)
IM/Peds	1,021 (7.0)	115 (6.3)	41 (5.8)
Internal Med	3,553 (24.2)	72 (3.9)	29 (4.1)
Pediatrics	4,471 (30.4)	1,153 (62.9)	402 (57.3)

Abbreviations: Asian/Pacific Is., Asian/Pacific Islander; IM/Peds, Internal Medicine/Pediatrics; Internal Med, Internal Medicine

Table 2
Associations of Demographic and Clinical Characteristics with HPV Vaccine Initiation by Age Group Among 14,688 Males Attending JHCP Clinics from 2012–2013

	Target (11–12 years)				Catch-Up (13–21 years)				Permissive (22–26 years)			
	HPV Vaccine Initiation		aOR (95% CI)		HPV Vaccine Initiation		aOR (95% CI)		HPV Vaccine Initiation		aOR (95% CI)	
	Yes (n=617)	No (n=1,854)	Yes (n=1,483)	No (n=6,528)	Yes (n=80)	No (n=4,126)	Yes (n=80)	No (n=4,126)	Yes (n=80)	No (n=4,126)	Yes (n=80)	No (n=4,126)
Mean Baseline Age (SD)	11.43 (0.5)	11.42 (0.5)	1.07 (0.82 – 1.40)	1.07 (0.82 – 1.40)	15.80 (2.2)	17.15 (2.6)	0.86 (0.84 – 0.89)	0.86 (0.84 – 0.89)	23.53 (1.3)	24.03 (1.4)	0.84 (0.72 – 0.97)	0.84 (0.72 – 0.97)
Race/Ethnicity n												
White	187	943	1.0 (Reference)	1.0 (Reference)	469	3,400	1.0 (Reference)	1.0 (Reference)	39	2,394	1.0 (Reference)	1.0 (Reference)
Black	368	660	1.39 (1.06 – 1.84)	1.39 (1.06 – 1.84)	866	2,165	1.39 (1.12 – 1.74)	1.39 (1.12 – 1.74)	32	1,072	1.93 (1.20 – 3.09)	1.93 (1.20 – 3.09)
Hispanic	20	65	1.36 (0.79 – 2.35)	1.36 (0.79 – 2.35)	54	312	1.04 (0.76 – 1.42)	1.04 (0.76 – 1.42)	5	228	1.58 (0.42 – 5.89)	1.58 (0.42 – 5.89)
Asian	11	57	1.15 (0.69 – 1.90)	1.15 (0.69 – 1.90)	21	198	0.85 (0.46 – 1.57)	0.85 (0.46 – 1.57)	2	165	0.76 (0.18 – 3.26)	0.76 (0.18 – 3.26)
Other	31	129	1.16 (0.77 – 1.75)	1.16 (0.77 – 1.75)	73	453	1.01 (0.76 – 1.33)	1.01 (0.76 – 1.33)	2	267	0.50 (0.12 – 2.11)	0.50 (0.12 – 2.11)
Insurance Type n												
Private	193	896	1.0 (Reference)	1.0 (Reference)	588	3,692	1.0 (Reference)	1.0 (Reference)	59	3,260	1.0 (Reference)	1.0 (Reference)
Public	312	457	1.45 (1.07 – 1.96)	1.45 (1.07 – 1.96)	625	1,237	1.21 (1.05 – 1.39)	1.21 (1.05 – 1.39)	9	474	0.61 (0.28 – 1.37)	0.61 (0.28 – 1.37)
Military	112	493	1.25 (1.03 – 1.51)	1.25 (1.03 – 1.51)	261	1,466	1.06 (0.91 – 1.25)	1.06 (0.91 – 1.25)	10	152	2.46 (1.06 – 5.71)	2.46 (1.06 – 5.71)
Number of Clinic Visits n												
1–3 Visits	429	1,528	1.0 (Reference)	1.0 (Reference)	1,103	5,562	1.0 (Reference)	1.0 (Reference)	51	3,652	1.0 (Reference)	1.0 (Reference)
>3 Visits	188	326	2.39 (1.84 – 3.11)	2.39 (1.84 – 3.11)	380	966	2.19 (1.76 – 2.73)	2.19 (1.76 – 2.73)	29	474	4.08 (2.20 – 7.56)	4.08 (2.20 – 7.56)
JHCP Clinic Location n												
Suburban	299	1,474	1.0 (Reference)	1.0 (Reference)	765	5,298	1.0 (Reference)	1.0 (Reference)	63	3,056	1.0 (Reference)	1.0 (Reference)

	Target (11–12 years)				Catch-up (13–21 years)				Permissive (22–26 years)			
	HPV Vaccine Initiation		aOR (95% CI)		HPV Vaccine Initiation		aOR (95% CI)		HPV Vaccine Initiation		aOR (95% CI)	
	Yes (n=617)	No (n=1,854)	Yes (n=1,483)	No (n=6,528)	Yes (n=80)	No (n=4,126)	Yes (n=80)	No (n=4,126)	Yes (n=80)	No (n=4,126)	Yes (n=80)	No (n=4,126)
Urban	318	380	718	1,229	17	1,068	17	1,068	17	1,068	17	1,068
			3.27 (1.53 – 6.99)	1.0 (Reference)			3.84 (2.23 – 6.61)	1.0 (Reference)			0.98 (0.35 – 2.76)	1.0 (Reference)
JHCP Specialty n												
Family Practice	120	613	423	2,873	43	1,571	43	1,571	43	1,571	43	1,571
			1.0 (Reference)	1.0 (Reference)			1.0 (Reference)	1.0 (Reference)			1.0 (Reference)	1.0 (Reference)
IM/Peds	39	125	86	515	7	249	7	249	7	249	7	249
			1.17 (0.73 – 1.88)	1.17 (0.73 – 1.88)			1.00 (0.74 – 1.34)	1.00 (0.74 – 1.34)			0.97 (0.35 – 2.66)	0.97 (0.35 – 2.66)
Internal Med	5	4	55	1,187	29	2,273	29	2,273	29	2,273	29	2,273
			1.43 (0.78 – 2.63)	1.43 (0.78 – 2.63)			0.27 (0.15 – 0.47)	0.27 (0.15 – 0.47)			0.47 (0.22 – 0.98)	0.47 (0.22 – 0.98)
Pediatrics	455	1,112	919	1,953	1	33	1	33	1	33	1	33
			0.81 (0.51 – 1.28)	0.81 (0.51 – 1.28)			1.28 (0.95 – 1.73)	1.28 (0.95 – 1.73)			1.77 (0.23 – 13.37)	1.77 (0.23 – 13.37)

All models mutually adjusted for all variables listed in the table.

Abbreviations: aOR – Adjusted Odds Ratio; CI, Confidence Interval; Asian/Pacific Is., Asian/Pacific Islander; IM/Peds, Internal Medicine/Pediatrics; Internal Med, Internal Medicine

Table 3
Associations of Demographic and Clinical Characteristics with 2nd Dose of HPV Vaccine by Age Group Among 1,834 Males Attending JHCP Clinics from 2012–2013

	Target (11–12 years)		Catch-Up (13–21 years)		aOR (95% CI)
	2 nd Dose HPV Vaccine	No (n=232)	2 nd Dose HPV Vaccine	No (n=667)	
Mean Baseline Age (SD)	Yes (n=261) 11.43 (0.5)	No (n=232) 11.46 (0.5)	Yes (n=603) 15.55 (2.1)	No (n=667) 15.97 (2.2)	0.95 (0.88 – 1.02)
Race/Ethnicity n					
White	104	43	257	147	1.0 (Reference)
Black	132	160	283	458	0.65 (0.46 – 1.00)
Hispanic	8	10	21	23	0.72 (0.17 – 0.89)
Asian	6	4	10	7	1.11 (0.17 – 1.46)
Other	11	15	32	32	0.71 (0.09 – 0.81)
Insurance Type n					
Private	100	61	266	230	1.0 (Reference)
Public	104	142	195	347	0.73 (0.43 – 1.39)
Military	57	29	138	86	0.78 (0.60 – 1.79)
Number of Clinic Visits n					
1–3 Visits	136	194	326	596	1.0 (Reference)
>3 Visits	125	38	277	71	5.82 (3.22 – 4.99)
JHCP Clinic Location n					
Suburban	149	89	374	273	1.0 (Reference)

	Target (11–12 years)		Catch-Up (13–21 years)		
	2 nd Dose HPV Vaccine		2 nd Dose HPV Vaccine		
	Yes (n=261)	No (n=232)	Yes (n=603)	No (n=667)	aOR (95% CI)
Urban	112	143	229	394	0.77 (0.46 – 1.31)
JHCP Specialty n					
Family Practice	64	37	205	149	1.0 (Reference)
IM/Peds	19	13	32	44	0.52 (0.28 – 0.97)
Internal Med	0	3	17	28	0.65 (1.00 – 1.40)
Pediatrics	178	179	349	446	1.07 (0.74 – 1.54)

All models mutually adjusted for all variables listed in the table. Results for the permissive age group are not shown due to limited statistical power

Abbreviations: aOR – Adjusted Odds Ratio; CI, Confidence Interval; Asian/Pacific Islander; Asian/Pacific Is., Asian/Pacific Islander; IM/Peds, Internal Medicine/Pediatrics; Internal Med, Internal Medicine

Table 4
Associations of Demographic and Clinical Characteristics with HPV Vaccine Completion by Age Group Among 702 Males Attending JHCP Clinics from 2012–2013

	Target (11–12 years)		Catch-Up (13–21 years)	
	HPV Vaccine Completion	aOR (95% CI)	HPV Vaccine Completion	aOR (95% CI)
Mean Baseline Age (SD)	Yes (n=86) 11.45 (0.5)	No (n=111) 11.41 (0.5)	Yes (n=228) 15.47 (2.1)	No (n=244) 15.55 (2.0)
Race/Ethnicity n				
White	40	38	116	83
			(Reference)	1.0 (Reference)
Black	36	60	87	130
			0.63 (0.31 – 1.29)	0.54 (0.25 – 1.19)
Hispanic	4	4	10	11
			1.01 (0.38 – 2.73)	0.57 (0.17 – 1.88)
Asian	3	2	2	6
			1.95 (0.17 – 23.02)	0.24 (0.06 – 0.99)
Other	3	7	13	14
			0.36 (0.11 – 1.21)	0.62 (0.31 – 1.26)
Insurance Type n				
Private	35	42	112	95
			(Reference)	1.0 (Reference)
Public	29	45	55	94
			1.10 (0.74 – 1.63)	0.50 (0.25 – 1.01)
Military	22	23	58	55
			1.14 (0.69 – 1.86)	0.67 (0.43 – 1.04)
Number of Clinic Visits n				
1–3 Visits	29	72	78	157
			(Reference)	1.0 (Reference)
>3 Visits	57	39	150	87
			3.69 (2.00 – 6.82)	3.56 (2.34 – 5.40)
JHCP Clinic Location n				
Suburban	54	62	151	144
			(Reference)	1.0 (Reference)

	Target (11–12 years)				Catch-Up (13–21 years)			
	HPV Vaccine Completion		HPV Vaccine Completion		HPV Vaccine Completion		HPV Vaccine Completion	
	Yes (n=86)	No (n=111)	aOR (95% CI)	Yes (n=228)	No (n=244)	aOR (95% CI)	Yes (n=228)	No (n=244)
Urban	32	49	0.57 (0.38 – 0.85)	77	100	1.42 (0.64 – 3.12)	77	100
JHCP Specialty n								
Family Practice	18	32	1.0 (Reference)	82	83	1.0 (Reference)	82	83
IM/Peds	7	7	1.51 (0.49 – 4.69)	11	13	0.82 (0.37 – 1.80)	11	13
Internal Med	0	0	--	7	7	1.10 (0.32 – 3.83)	7	7
Pediatrics	61	72	2.15 (0.93 – 5.00)	128	141	1.34 (0.81 – 2.20)	128	141

All models mutually adjusted for all variables listed in the table. Results for the permissive age group are not shown due to limited statistical power

Abbreviations: aOR – Adjusted Odds Ratio; CI, Confidence Interval; Asian/Pacific Islander, IM/Peds, Internal Medicine/Pediatrics; Internal Med, Internal Medicine