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Trends and predictors of HPV vaccination among U.S. College women and men

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ABSTRACT

Background. HPV vaccination was recommended by the Advisory Committee on Immunization Practices for young adult females in 2006 and males in 2011 to prevent HPV-related cancers and genital warts. As this prevention mechanism continues to disseminate, it is necessary to monitor the uptake of this vaccine. College students represent an important population for HPV vaccination efforts and surveillance due to increased risk for HPV infection and representing a priority population for catch-up HPV vaccination. The purpose of this study was to assess the trends in HPV vaccination among U.S. college females and males from 2009 to 2013, and to examine whether predictors for HPV vaccination differ between males and females.

Methods. The National College Health Assessment-II (Fall 2009–2013) was used to assess trends in HPV vaccination using hierarchical logistic regression across genders and demographics. Data from 2013 were used to assess demographic variables associated with HPV vaccination for males and females, respectively. The analysis was conducted in 2015.

Results. Females had nearly double the rates of HPV vaccination compared to males over time. All demographic sub-groups had significant increases in vaccine rates over time, with select male sub-groups having more accelerated increases (e.g., gay). Young age (18–21 vs. 22–26 years) was a significant predictor for HPV vaccination among males and females, while race/ethnicity was a predictor of vaccination among females only.

Conclusions. These findings identified specific demographic sub-groups that need continued support for HPV vaccination. Campus health centers may be rational settings to facilitate clinical opportunities for HPV vaccination among unvaccinated college students.

Introduction

Human papillomavirus (HPV) is the most common sexually transmitted infection in the U.S. (Satterwhite et al., 2013). Moreover, it is a cause of genital warts and HPV-related cancers, including cervical, vaginal, vulvar, penile, anal, and oropharyngeal (Munoz et al., 2003; H., 2002; Lacey et al., 2006). In 2006, a quadrivalent HPV vaccine was approved and recommended by the Advisory Committee on Immunization Practices (ACIP) for females 9 to 26 years of age (Markowitz et al., 2007). In 2009, the vaccine was permitted for use among males and then recommended for routine vaccination for ages 9 to 21 and 22 to 26 years for high-risk populations (e.g., men who have sex with men and persons who are immune compromised) in 2011 (Centers for Disease Control and Prevention, 2011; Centers for Disease Control and Prevention, 2010). Recently, a 9-valent HPV vaccine has become available and is congruent with previous ACIP guidelines for both genders (Petrosky et al., 2015). As this prevention mechanism continues to disseminate to age-eligible sub-groups, it is necessary to monitor the uptake of this vaccine over time. According to Healthy People 2020, national priorities aim to achieve 80% completion of the three dose HPV vaccine among 13 to 15 year old males and females (Healthy People 2020, 2015). While national objectives are not developed for young adult HPV vaccine catch-up groups, theoretically, rates would need to be similar to the 13 to 15 year old population. Yet, rates of HPV vaccination among young adult males and females in the United States are suboptimal, 6% (2011–12) and 34% (2012), respectively (Pierre-Victor et al., 2014; Schmidt and Parsons, 2014).

College students represent an important population for HPV vaccination and necessitate continued vaccination surveillance due to increased risk for HPV infection. As of 2013, approximately 48% of young adults ages 18 to 24 were enrolled/completed college (Annie E Casey Foundation, 2015). College students are of prime importance since they comprise the age groups for females at highest risk for HPV; according to national data, 20–24 year old females had the highest prevalence of genital HPV (59.8%) and HPV vaccine types 6, 11, 16, and 18 (19.9%) (Markowitz et al., 2013). The prevalence of genital warts is also highest among young adult males (25 to 29 year olds) and females

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(20 to 24 year olds) (Insinga et al., 2003). Thus, this significant proportion of easily accessible and high-risk young adults presents an opportunity for catch-up vaccination for persons who did not receive the HPV vaccine as adolescents. To date, only one study has examined predictors of HPV vaccination among a *national* sample of college women; in 2009 the rate of uptake was 45% (Lindley et al., 2013). While college students may have higher uptake of the HPV vaccine compared to the general population, this is a unique group with access to health resources that would facilitate vaccination. Moreover,the extent of dissemination of the HPV vaccine among specific demographic sub-groups in college is unknown. For instance, certain sub-groups may have lower vaccine uptake that is masked by overall HPV vaccine rates, and thus require tailored intervention efforts.

The purpose of this study was to assess the trends in HPV vaccination among United States college females and males from 2009 to 2013. Moreover, this study aimed to evaluate if predictors for HPV vaccination differ between males and females utilizing 2013 data. Findings from this analysis can indicate groups among college students that have improved HPV vaccine rates and those that require more invested public health efforts to promote HPV vaccination.

Methods

Study sample

This secondary data analysis, conducted in 2015, utilized datasets from the American College of Health Association (ACHA). The National College Health Assessment (NCHA) II is a national survey that collects data at universities regarding health status, health behaviors, and perceptions (American College Health Association, 2014). Universities must opt-in to the survey and pay fees in order to participate. Each institution determined its targeted sample size and recruited from a randomized subset of the student population. The aggregate data were available from ACHA via a data request (American College Health Association, 2009–2013). This study was considered exempt from the Institutional Review Board.

For the purpose of this secondary data analysis, the NCHA II data were analyzed from Fall semesters of 2009 to 2013 survey collection periods. During this time period, 248 institutions and 153,276 students participated. The mean response rates for the surveys ranged between 20% and 36% (American College Health Association, 2014).

All data from the Fall 2009 to 2013 NCHA II survey were aggregated (N = 153,276). This dataset was then restricted to participants between the ages of 18–26 years since this is when the HPV vaccine is available for catch-up (N = 130,553). Because the primary outcome for this analysis was HPV vaccination status, participants were removed list-wise from the dataset if he/she were unsure of receiving the HPV vaccine (N = 110,481). Missing values for predictor variables were also removed list-wise due to the low frequency (N = 107,910): gender (0.7%; N = 883), sexual orientation (1.0%; N = 1336), relationship status (0.9%; N = 1122), and marital status (0.9%, N = 1216); note that a case may have had multiple missing values. Finally, due to the low frequency of participants identifying as transgender in this sample, (n = 194), this group was dropped from the final sample. This resulted in a final sample size of 107,716 for analysis.

Measures

The outcome for this analysis was HPV vaccination. Participants were asked if they ever received vaccinations/shots for human papillomavirus/HPV/cervical cancer vaccine (yes, no), which measured the initiation of at least one dose of the three dose vaccine. Additional variables included: gender (male, female); sexual orientation (heterosexual, gay/lesbian, bisexual, unsure); age (18 to 21 years, 22 to 26 years); relationship status (not in a relationship, in a relationship but not living together, in a relationship and living together); marital status (single, married/partnered, other); and race/ethnicity (Non-Hispanic White, Non-Hispanic Black, Hispanic/Latino, Asian/Pacific Islander, Biracial/Multiracial, Other). The variable race/ethnicity permitted participants to self-identify with any of these categories. For the purposes of this analysis, participants who identified with more than one category were categorized as Biracial/Multiracial. Additionally, the measurement of race/ethnicity changed in 2011; therefore, comparisons of this variable were restricted to two separate time periods (i.e., 2009 to 2010, and 2011 to 2013). These variables were selected from those available in the NCHA-II survey as these represent basic demographic characteristics that remain relatively stable over time.

Statistical analyses

This study used SAS 9.4 for statistical analysis. Descriptive statistics for demographic characteristics and HPV vaccination were calculated by gender. Chi square tests assessed differences in these characteristics by gender. A p-value less than 0.05 was considered statistically significant.

To assess trends in HPV vaccination by year and demographic characteristics, logistic regression models were used to estimate the impact of time on HPV vaccination and demographic sub-groups. However, due to the sampling structure of this survey, hierarchical modeling with a binary distribution was used to account for the variability in these estimates by each individual college/university sampled (i.e., student participants are nested within colleges/universities that participated). The unconditional model for HPV vaccination (2009–2013) indicated that the proportion of variability explained by the college/university variable was approximately 9% (intraclass correlation coefficient = 0.087). These regression analyses used 2009 as the reference category to estimate the impact of year of survey on HPV vaccination for each sub-group. The only exception was for race/ethnicity where separate models were conducted for 2009–2010 and 2011–2013. This is the result of changes in measuring race/ethnicity across these survey periods, which does not permit comparison over the entire five-year period.

Finally, to compare the impact of these demographic characteristics on HPV vaccination between males and females, Fall 2013 data were used to estimate odds of HPV vaccination for each gender. The unconditional model for HPV vaccination (2013 only) indicated that there was approximately 5% of the variability attributable to college/university (intraclass correlation coefficient = 0.047). Crude odds ratios were computed to assess the independent effect of each explanatory variable on HPV vaccination. The adjusted regression model included all of these demographic predictor variables to estimate the odds of HPV vaccination, stratified by gender. Odds ratios and 95% confidence intervals are presented for these regression models, with the reference categories denoted.

Results

Sample

Among the Fall 2009 to 2013 NCHA II sample, the majority of respondents were female (71.1%). A significantly higher proportion of females received at least one dose of the HPV vaccine compared to males (59.0% females, 29.8% males; p-value < 0.01). Most participants were between the ages of 18 and 21 years (78.5% females, 73.6% males; p-value < 0.01), identified as heterosexual (92.8% females, 91.4% males; p-value < 0.01) and Non-Hispanic White (67.4% females, 65.2% males; p-value < 0.01), and reported not being in a relationship (51.2% females, 60.3% males; p-value < 0.01) and single, not married (93.2% females, 93.2% males; p-value < 0.89).

HPV vaccine trends

Rates of HPV vaccination for females were more than double the rates for males between Fall 2009 and 2011. While female rates continued to surpass male vaccination rates in years 2012 and 2013, the difference between the two groups had narrowed (Fig. 1). However, both groups experienced increases in HPV vaccination rates from 2009 to 2013. The increasing change was more rapid among males compared to females. Among females, the odds of HPV vaccination in 2013 was 2.43 (95%CI 2.01–2.94) compared to 2009 (Table 1). In contrast, for males, the odds of HPV vaccination in 2013 was 2.97 (95%CI 2.48–3.55) (Table 2).

Increases in HPV vaccination rates over the five-year time period were evident for all demographic sub-groups. For females, the greatest absolute difference in vaccination rates was for women in the 22 to 26 year old age category (26.5% to 62.2%; Δ 35.7%). When examining HPV vaccine rates by sexual orientation sub-groups for females, all