Preventive Medicine Reports 4 (2016) 98–102

Contents lists available at ScienceDirect

Preventive Medicine Reports

journal homepage: http://ees.elsevier.com/pmedr

Short communication

Factors associated with early adoption of the HPV vaccine in US male adolescents include Hispanic ethnicity and receipt of other vaccines

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ARTICLE INFO

Article history:
Received 29 March 2016
Accepted 23 May 2016
Available online 25 May 2016

Keywords:
HPV vaccine
Adolescent
Young adult
Immunization
NIS-Teen

ABSTRACT

Adolescent males' HPV vaccine initiation and completion in the United States is far below the Healthy People 2020 goal of 80% 3-dose completion among boys. In 2012, less than 7% of males ages 13–17 years had completed the 3-dose series. The Diffusion of Innovations framework guided this investigation of factors related to early adoption of HPV vaccination among male adolescents. Provider-validated data from the 2012 National Immunization Survey-Teen (NIS-Teen) for male adolescents ages 13–17 years were analyzed via a multivariable Poisson regression to estimate prevalence ratios for factors associated with HPV vaccine initiation and completion. Adolescent males who are Hispanic and those who are up to date on other recommended adolescent vaccinations were most likely to complete the HPV vaccine. Public health interventions are needed to improve low HPV vaccination rates among adolescent males in the United States. Description of early adopters of the HPV vaccine provides historical context of HPV vaccination acceptance that is needed to inform the design of targeted vaccination interventions to prevent negative HPV-associated outcomes.

1. Introduction

In 2009, an estimated 13,446 human papillomavirus (HPV)-associated cancers were diagnosed among men in the United States (US) (Chaturvedi et al., 2011), including oropharyngeal (78.2%), anal (14.4%), and penile (7.4%) cancers (Jemal et al., 2013). HPV-associated cancers are increasing in incidence; for example, as of 2011 approximately 70% of cancers of the oropharynx were linked to oral HPV infection (Chaturvedi et al., 2011). The increase in oropharyngeal cancers has been attributed to oral infection of high-risk (oncogenic) HPV type 16, the prevalence of which is estimated to be 1.6% among men aged 14 to 69 years (Gillison et al., 2012). In addition, it is estimated that approximately 250,000 cases of HPV-related genital warts occur annually in the US among sexually active males (Hoy et al., 2009; Anon., 2011).

However, there is no routine screening for HPV-associated morbidities among males, leaving HPV vaccination as the best prevention strategy for these cancers and genital warts. The HPV vaccine, recommended by the Advisory Committee on Immunization Practices (ACIP) for boys ages 11–21 in 2011, (Anon., 2011) may be effective in reducing oral HPV infections and anal pre-cancer associated with HPV (Giuliano et al., 2011; Herrero et al., 2013; Palefsky et al., 2011). For example, Herrero et al. demonstrated that four years after women were randomized to receive the HPV vaccine or a control vaccine, women who received the HPV vaccine had significantly fewer infections with oral HPV (Herrero et al., 2013). Although the HPV vaccine is not currently approved for prevention of oropharyngeal cancer, it is possible that the protection against oral HPV infection that was observed in vaccinated women will also extend to vaccinated men. A vaccine that protects against oral HPV and HPV-related anal pre-cancerous lesions may in turn reduce the incidence of associated HPV oropharyngeal, anal, and other cancers.

As of 2014, the Healthy People 2020 HPV target for vaccination coverage is now 80% 3-dose-completion for males aged 13–15 years (Anon., 2014a). In 2010–2011, the first year that National Immunization Survey-Teen (NIS-Teen) data is available, barriers to HPV vaccination included lack of information and lack of provider recommendation (Reiter et al., 2013). Despite efforts to improve HPV vaccination, the most recent data from 2014 indicate that male completion of HPV vaccination is at 21.6%, (Anon., 2012a; Anon., 2014b) far below Healthy People 2020 goals. Moreover, within the first year after ACIP recommended HPV vaccination, national HPV vaccine initiation was lower

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http://dx.doi.org/10.1016/j.pmedr.2016.05.014

among boys compared to the first year initiation rates observed in girls in 2007 (Anon., 2007, 2012a).

To reach the national Healthy People 2020 goal of 80% vaccination coverage among adolescent males, research is needed to identify factors that are associated with HPV vaccination among adolescent boys. Knowledge of demographic or other factors that relate to early adoption of the HPV vaccine can provide historical context that informs the design of future interventions to increase receipt of the HPV vaccine among boys in the US. Using Rogers' Diffusion of Innovations (DOI) theory (Rogers, 1983a) for interpreting adoption of the HPV vaccine enhances our understanding of how vaccine innovations diffuse throughout social systems. This study was guided by DOI, which posits that populations can be segregated into different segments based on their willingness to adopt a particular innovation that ranges from innovators and early adopters to late majority and laggards. This paper aimed to identify factors that were associated with early adoption of HPV vaccination among adolescent boys. According to the DOI, we expected early adopters to have higher social status (e.g., higher education, being above poverty level, majority race/ethnicity, privately insured) (Rogers, 1983b).

2. Methods

The NIS-Teen is a cross-sectional national survey conducted annually using random digit dialing to sample parents of eligible adolescents regarding vaccination in the US (Anon., 2008-2014). Upon obtaining parental consent, adolescents' healthcare providers are contacted to validate vaccination records. Provider-validated data from the 2012 National Immunization Survey-Teen for male adolescents ages 13–17 years (N = 10,141) were analyzed using survey sample weighted statistics (Anon., 2012b) which adjust for non-response and reflect post stratification adjustments to reflect the control totals from national data from the National Center for Health Statistics (Anon., 2013a). Adequate provider-verified vaccination data was available for 23.6% of cellular and 55.2% of landline respondents. Provider-phase sampling weights for both landline and cell-phone samples in the US proper were used to produce dual-frame point estimates and corresponding 95% confidence intervals. Frequency counts and survey-weighted percentages were reported for the entire US boys subgroup. A survey weighted multivariable Poisson regression was fitted to assess the impact of predictor variables (mother's education, poverty status, ethnicity/race, adolescent's age, source of health insurance, facility type, and receipt of other adolescent vaccinations) and reported as an adjusted prevalence ratio with 95% CI. All predictor variables were clinically important and were included in the multivariable analysis regardless of their statistical significance. Participants with complete information for all factors in our multivariate analysis were included. A multivariable sensitivity analysis compared factors related to males completing three doses of the HPV vaccine among those who had a minimum of 24 weeks between receipt of the first dose of the HPV vaccine and the date of the interview. All tests were two-sided comparisons in STATA version 13.1. The University of Utah Institutional Review Board considers analysis of publicly available data, the NIS-Teen, exempt.

3. Results

3.1. Demographic and healthcare characteristics of male adolescents

A total of 10,141 adolescent boys with vaccination provider-reported vaccination records were included in the analysis. Of these, 2050 (20.8%) had initiated and 655 (6.8%) had completed the HPV vaccine series. In Table 1 mothers of the boys were mostly aged ≥35, had received some of or completed a college education, and were married. Adolescents were primarily living above poverty level, Non-Hispanic White, and had health insurance through a parent's employment or union.

3.2. Multivariable analysis of factors predicting HPV vaccine completion among male adolescents

In Table 2, respondents whose mothers had some college, but no college degree, were less likely to initiate the HPV vaccine series than those whose mothers had less than 12 years of education (PR = 0.78, 95% CI = 0.62–0.99). Non-Hispanic Whites and those with unclassified ethnicities listed as 'Other' were less likely to initiate the HPV vaccine series than Hispanic boys (PR = 0.66, 95% CI = 0.55–0.80; PR = 0.73, 95% CI = 0.56–0.96). For HPV vaccine completion, Non-Hispanic Whites were still less likely than Hispanics to complete (PR = 0.50, 95% CI = 0.38–0.77). Non-Hispanic Blacks were also less likely to complete HPV vaccination than Hispanics (PR = 0.55, 95% = 0.36–0.83). No statistical differences were observed for Other ethnicities. Consistent with the results observed in the descriptive analysis, adolescent boys who received their health insurance through a source other than a parent's employer or union were more likely to have both initiated (PR = 1.24, 95% CI = 1.02–1.51) and completed the HPV vaccine (PR = 1.55, 95% CI = 1.05–2.28) than boys who had received insurance through a parent's employer or union. A similar percentage of boys who received insurance through a parent's employer or union reported that their provider had recommended the HPV vaccine compared to those who did not have this type of insurance (29.2% vs. 26.8%, data not shown).

Receipt of other adolescent vaccinations was the strongest predictor of the likelihood of HPV vaccine initiation and completion. Those with at least one dose of seasonal influenza vaccination in the past three years were more likely to initiate HPV vaccination (PR = 1.77, 95% CI = 1.54–2.05) and to complete HPV vaccination (PR = 3.20, 95% CI = 2.37–4.33) than those without influenza vaccination. Adolescents with at least one dose of TDAP vaccination ages 10–13 years were more likely to complete HPV vaccination (PR = 1.61, 95% CI = 1.16–2.25) than those who had not received TDAP. Adolescents with at least one Meningitis vaccination were also more likely to initiate HPV vaccination than those without a Meningitis vaccination (PR = 4.98, 95% CI = 3.53–7.00), and were also more likely to complete HPV vaccination than those without a Meningitis vaccination (PR = 5.55, 95% CI = 2.82–10.91).

Multivariable models were used to compare factors related to males completing three doses of the HPV vaccine among those who had at least 24 weeks between the receipt of the first dose of the HPV vaccine and the date of the interview. Source of health insurance and meningitis vaccination were no longer significantly associated with 3-dose completion within the recommended time frame (data not shown).

4. Discussion

Increasing HPV vaccination coverage among adolescent males is a public health priority. Herein we identified factors associated with early adoption of HPV vaccination among adolescent boys from the 2012 NIS-Teen to inform interventional programs and policies that are effectively targeted to increase HPV vaccination among males. According to DOI, early adopters have higher social status, education, incomes, and are willing to take risks (Rogers, 1983b). However, male early adopters of the HPV vaccine do not appear to mirror the DOI early adopter profile and in fact tend to have opposite characteristics (e.g., public health insurance, lower income & education). This important difference in the profile of early adopters is unexpected, but has implications for designing interventions that appropriately target individuals who are slower to uptake the HPV vaccine.

In our analysis, HPV vaccination among boys differed by racial/ethnic group, in that Hispanic teens were more likely to be vaccinated than non-Hispanic teens. Similar to previous research, this finding reflects varying levels of support for HPV vaccination by racial/ethnic groups. Attitudes regarding vaccines generally, and the HPV vaccine specifically, may be more positive among Hispanic parents compared to non-Hispanic parents (Kornfeld et al., 2013). This finding mirrors