



A sequential logit model of caretakers' decision to vaccinate children for the human papillomavirus virus in the general population



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ABSTRACT

Objectives. This study explores the predisposing, enabling, and need-based factors associated with parents' or guardians' decision to have their child initiate, continue, and complete the human papillomavirus (HPV) vaccine.

Methods. Parents and guardians of children between the ages of 9 and 17 years who completed the 2010 Behavioral Risk Factor Surveillance System survey collected by the Center for Disease Control (CDC, 2010) were analyzed. Utilizing Andersen's health care beliefs model, we explored the sequential nature of the decision to vaccinate (i.e., the decision to receive the first, second, and third dose), thereby allowing the independent variables to vary across each transition.

Results. Among all children, 3.7% received exactly 1 shot, 16.3% received at least one shot, and 8.9% received all three shots. Among those who received at least one shot, 22.4% received exactly one shot, 23.7% received exactly 2 shots, and 54.9% completed all 3 shots. A differential impact was observed across transitions. Predisposing factors, such as being Hispanic (OR = 1.9) and child age (OR = 1.4), significantly predicted the decision to receive the first dose but enabling factors, such as having a regular physician (OR = 4.5) and income (OR = .74) were more important for predicting completion.

Conclusions. The decision to initiate and complete HPV vaccination depends on a specific mix of enabling, predisposing, and need-based factors. Our analysis underscores the importance of modeling the vaccination decision in a manner that is consistent with how primary caregivers navigate real-life health care decisions for their children.

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The human papillomavirus (“HPV”) is one of the most common sexually transmitted infections in the world (Casper and Carpenter, 2008; Dunne et al., 2014). An estimated 79 million Americans are currently infected with HPV (Dunne et al., 2014), and approximately half of all sexually active men and women will become infected with HPV in their lifetime (CDC, 2014). More than 40 different HPV infection-causing strains exist in either the genital or the oral cavities of both males and females (CDC, 2011). Persistent infection with high-risk HPV strains is related to the development of precancerous lesions and to the eventual growth of more invasive cancers of the cervix, anus, vulva, vagina, and penis (Dunne et al., 2014). HPV-16 has been associated with oropharyngeal cancer of the head and neck, which can be spread through oral sexual activity. HPV-16 and HPV-18 alone cause approximately 70% of cervical cancer (Muñoz et al., 2002), while HPV-6 and HPV-11 cause almost 90% of genital warts cases (Greer et al., 1995).

Due to the high number of HPV-related health problems caused by specific HPV strains, including genital warts and cervical cancer, prophylactic vaccines that prevent infection have become widely available

over the past decade. Gardasil and Cervarix were introduced to the market in 2007 as a vaccination against the specific strains of HPV known to cause cervical cancer (Casper and Carpenter, 2008). To be effective, three doses must be administered over 6 months: Gardasil at 0, 2, and 6 months and Cervarix at 0, 1, and 6 months (Schiller et al., 2012).

A World Health Organization survey in 2002 found that 5.2% of all new cancer cases were attributed to HPV infection (Colón-López et al., 2010). In 2006, there were 10,000 new diagnoses, 3700 resulted in death (Casper and Carpenter, 2008). The CDC estimates that approximately 26,000 new HPV-related cancers occur each year even though primary prevention through vaccination exists (CDC, 2012). Despite the insidious nature of the human papillomavirus, the vaccines effectiveness in disease prevention and the widespread availability of screening strategies (Chao et al., 2009) individuals too frequently fail to complete the 3-dose regimen. The CDC reported that in 2015, 53% of females and 8.7% of males between the ages of 13 and 15 years received more than one dose but only 34.8% and 1.3% received all three doses (Curtis et al., 2011). Other studies report completion rates ranging from 13% to 58% among those who initiate the first dose (Chao et al., 2009; Conroy et al., 2009; Neubrand et al., 2009; Demarco, 2011; Dorell et al., 2012). Only a small body of research explores the correlates of both initiation and completion of the three-dose regimen among young boys and girls. In a 2012 study published in

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the journal *Vaccine*, Kessels and her associates (Kessels et al., 2012) undertook a systematic review of research related to HPV vaccine uptake among adolescent girls between 9 and 18. They found that only 5 of 25 studies reported data on HPV completion. By exploring the characteristics associated with the decision to initiate, continue, and complete the HPV vaccine, this study extends current research by considering *both* initiation and completion and then by identifying factors with the greatest magnitude of effect on the transition of children from vaccination initiation *through* completion.

Methods

Study design and participants

Data were analyzed from the 2010 Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is an ongoing data collection program designed to measure behavioral risk factors for the adult population (18 years of age or older) living in households. Data are collected from a random sample of adults (one per household) through a telephone survey. In 2010, states had the opportunity to select modules that may provide additional information about a specific public health topic/priority. One such module addressing childhood HPV vaccination was developed by the Centers for Disease Control (CDC) for the states to include in their BRFSS survey. Six states included this module: Connecticut, Kentucky, Pennsylvania, Texas, West Virginia, and Wyoming. Respondents who reported living in a household with at least one child were asked about HPV uptake and completion. If there was more than one child living in the household, respondents were asked about a randomly selected child. The study population included parents and primary caretakers who were administered the HPV vaccination module in six states and who resided in a household with a son or daughter between the ages of 9 and 17 years (CDC, 2011).

Dependent variable

The dependent variable combined two survey questions, “A vaccine to prevent the human papillomavirus or HPV infection is available and is called the cervical cancer vaccine, HPV shot, or GARDASIL®. Has this child EVER had the HPV vaccination?” and “How many HPV shots did she receive?” The dependent variable was recoded in accordance with the sequential decision (Fig. 1).

Independent variables

Andersen’s Behavioral Model of Health Services Use (BMHSU) (Babitsch et al., 2012; Andersen, 1995) was used to categorize those factors that may contribute to the vaccination decision: (1) enabling factors, (2) predisposing factors, and (3) need-based. Enabling factors emphasize access to the structural or material resources that facilitate health service utilization and included income (1 = under \$25,000 per year to 8 = \$75,000 or more), health insurance coverage such as HMOs or Medicare (1 = yes, 0 = no), access to at least one regular health care provider (1 = yes, 0 = no), affordability of care (1 = yes, 0 = no), routine checkup in past year (1 = yes, 0 = no), and place of residence (1 = lives in a central city, 0 = does not live in a central city). Predisposing factors influence health service utilization by shaping expectations, prior experiences, and perceptions. These included age and gender of both the primary caretaker (23–78) and the child (9–17), number of children residing in the household (1 to 5 or more), caregiver’s highest level of educational attainment (1 = less than high school to 6 = post-baccalaureate), and race/ethnicity (non-Hispanic white, non-Hispanic black, and Hispanic). Finally, need is reflected in health status or presence of illness and measured by presence of poor psychological and physical functioning and having regular physical examinations. The child’s primary caretaker’s general health status (1 = fair/poor, 0 = good/very good), number of days in either poor physical or mental health (1 = 2 or more weeks in past 30 days, 0 = less than 2 weeks in past 30 days), and having receipt of a checkup in the past year (1 = yes, 0 = no) were identified as need-based.

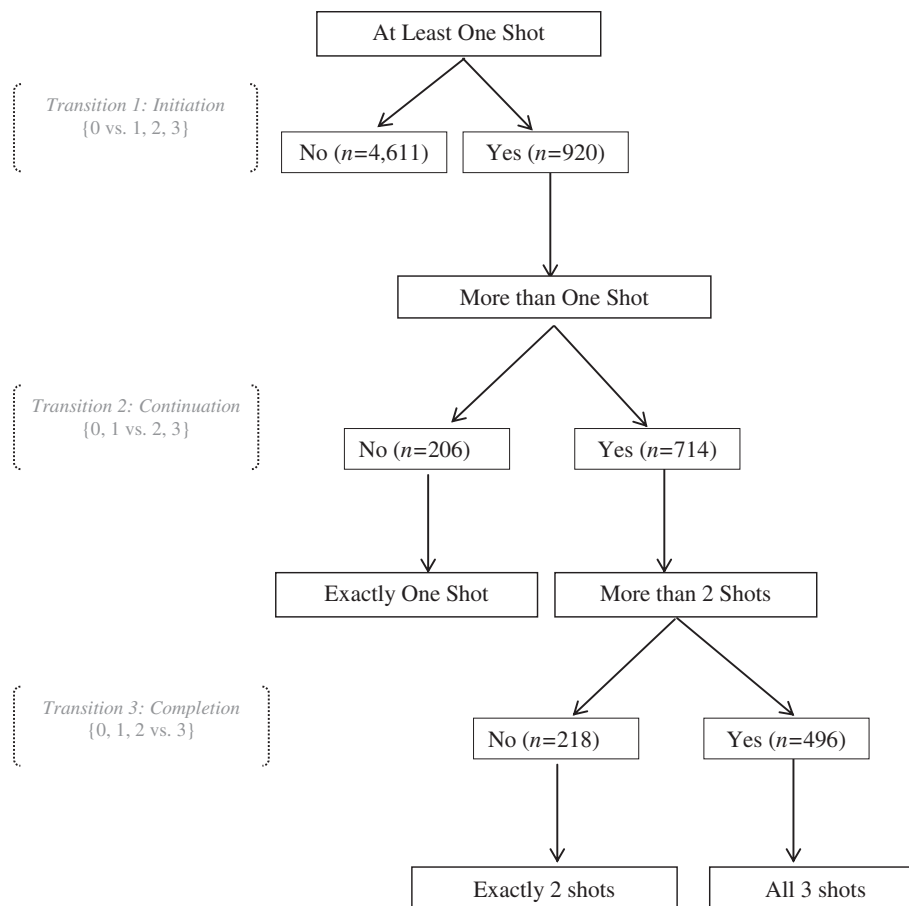


Fig. 1. Number of children between the ages 9–17 who received 0, 1, 2, and 3 HPV shots at each transition. Note: The total number of respondents is 5531, which is the sum of the number of children receiving “No Shot” (4,611) plus the number of children receiving “A Least One Shot” (920).

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