



Using an integrated conceptual framework to investigate parents' HPV vaccine decision for their daughters and sons

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ABSTRACT

Despite being an effective cancer prevention strategy, human papillomavirus (HPV) vaccination in Canada remain suboptimal. This study is the first to concurrently evaluate HPV vaccine knowledge, attitudes, and the decision-making stage of Canadian parents for their school-aged daughters and sons. Data were collected through an online survey from a nationally representative sample of Canadian parents of 9–16 year old children from August to September 2016. Measures included socio-demographics, validated scales to assess HPV vaccine knowledge and attitudes (using the Health Belief Model), and parents' HPV vaccination adoption stage using the Precaution Adoption Process Model (PAPM; six stages: unaware, unengaged, undecided, decided not, decided to, or vaccinated). 3779 parents' survey responses were analyzed (1826 parents of sons and 1953 parents of daughters). There was a significant association between child's gender and PAPM stage of decision-making, with parents of boys more likely to report being in earlier PAPM stages. In multinomial logistic regression analyses parents of daughters (compared to sons), parents of older children, and parents with a health care provider recommendation had decreased odds of being in any earlier PAPM stage as compared to the last PAPM stage (i.e. vaccinated). Parents who were in the 'decided not to vaccinate' stage had significantly greater odds of reporting perceived vaccine harms, lack of confidence, risks, and vaccine conspiracy beliefs. Future research could use these findings to investigate theoretically informed interventions to specifically target subsets of the population with particular attention towards addressing knowledge gaps, perceived barriers, and concerns of parents.

1. Introduction

Human papillomavirus (HPV) can cause a number of anogenital and oropharyngeal cancers in men and women (Brotherton et al., 2016; Canadian Cancer Society, 2016). To prevent morbidity and mortality, three vaccines have been licensed and recommended for use (Shapiro et al., 2017a; Blake and Middleman, 2017). Currently, over 80 countries have implemented national HPV vaccination programs (Brotherton et al., 2016; Brotherton and Bloem, 2015; Cervical Cancer Action. Global Progress in HPV Vaccination, 2017). In Canada, provinces and territories have implemented publicly funded school-based HPV vaccine programs. All Canadian jurisdictions implemented programs for girls, from 2007 to 2010 (Shapiro et al., 2016a, 2017b). As of 2018, all

jurisdictions also offer programs for boys in schools (Public Health Agency of Canada, 2017); however, the roll out of these programs (since 2013) has been staggered and HPV vaccination rates in Canada remain suboptimal (Shapiro et al., 2017a, 2017b, 2015).

Because HPV vaccination targets children (Shapiro et al., 2017a), parental acceptance is critical to ensuring uptake. Previous research has indicated common themes associated with uptake, such as the importance of parents believing in the benefits of vaccination and perceiving few barriers (Holman et al., 2014; Radisic et al., 2017). Unsurprisingly, parents are less likely to vaccinate their child if they are not aware of, or do not know enough about, HPV vaccination. Parents are also less likely to vaccinate their child if they believe that HPV vaccination can cause harm, or that vaccination is not accessible or

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affordable (Gerend and Shepherd, 2012). Furthermore, positive attitudes towards vaccines in general are related to HPV vaccine acceptance (Shapiro et al., 2016b, 2018). Notably, a strong health care provider (HCP) recommendation significantly improves parental vaccine acceptance (Blake and Middleman, 2017; Holman et al., 2014; Perez et al., 2017). Other social influences, including by a partner, family, friends, or online social network, can also influence parents' decision (Gerend and Shepherd, 2012; Perez et al., 2017, 2016a; Shapiro et al., 2017c).

It is likely that these factors have varying impact on parents depending on where they are in the decision-making process, which is obscured in much previous research investigating vaccination as a binary outcome (vaccinated or not). Literature on vaccine hesitancy highlights many reasons a parent may delay or refuse vaccination for their child (Dube et al., 2013). A theoretical stage-based model, the Precaution Adoption Process Model (PAPM), allows for a nuanced examination of which modifying factors and individual health beliefs are important for each stage of decision-making (Fig. 1) (Shapiro et al., 2017d; Weinstein, 1988; Prue and Santin, 2015). The PAPM identifies six stages involved in making a health decision and clarifies what factors lead individuals to move from one health behaviour decision-making stage to the next (Weinstein and Sandman, 1992). A stage-based understanding of HPV vaccine decision-making is important for identifying the psychosocial correlates for each stage and how to best intervene for parents at different stages. Nevertheless, few studies have examined the stages of HPV vaccine decision-making in college students and parents of only boys (Perez et al., 2017; Barnard et al., 2017; Perez et al., 2016b; Tatar et al., 2017), and no study has compared the stages of decision-making of parents of girls to parents of boys. Previous studies have found that college students and parents of boys were in the earliest stages of HPV vaccine decision-making (Perez et al., 2017; Barnard et al., 2017; Perez et al., 2016b; Tatar et al., 2017). Given HPV vaccine programs and policies have differentially targeted boys and girls, it is important to examine differences in decision-making stage between parents of girls and boys.

This study will identify and compare parents' stage of decision-making by gender for their school-aged daughters and sons, examine differences in parents' HPV vaccine knowledge and attitudes by PAPM stage, and investigate the psychosocial correlates of parents' PAPM stages.

2. Methods

2.1. Survey design and participants

Details of the methodology are presented in the protocol paper (Shapiro et al., 2017d). This study used a cross-sectional design to collect self-reported online survey data from a national sample of Canadian parents. Data presented here were part of a larger two-wave protocol and were collected from August 17 to September 11, 2016 (i.e. Time one). All Canadian jurisdictions at this time had publicly funded, school-based HPV vaccination programs for girls but only three provinces (i.e. Alberta, Prince Edward Island, and Nova Scotia) had programs for boys.

This study targeted parents and/or guardians (hereafter referred to as parents) of 9–16 year-old boys and girls. Parents with more than one child were asked to answer the questionnaire in reference to the child who had the most recent birthday to ensure randomization. The online survey was offered in English and French (i.e. Canada's two official languages). Participants were recruited using Leger-The Research Intelligence Group, which maintains a nationally representative panel of 400,000 Canadians (Leger, 2018). This study received Research Ethics Board approval from the Research Review Office, Integrated Health and Social Services University Network for West-Central Montreal (CODIM-FLP-16-219) (Shapiro et al., 2017d).

2.2. Measures

The dependent variable was parents' PAPM stage, which categorizes parents' stage of decision-making regarding HPV vaccination into six stages (Fig. 1) (Weinstein, 1988).

Potential psychosocial predictors of HPV vaccine decision-making included socio-demographics, HCP recommendation, as well as validated scales to assess HPV and HPV vaccine knowledge, HPV vaccine attitudes, and general vaccine attitudes. HCP recommendation was assessed by asking parents, 'did a health care provider (e.g. a doctor, pediatrician, or nurse) recommend that [child's name] receive the HPV vaccine within the last 12 months?'. Parents were only administered this question if they had answered affirmatively that they had seen a HCP and discussed their child receiving the HPV vaccine with a HCP.

Two validated scales were used to measure parents' knowledge of HPV and the HPV vaccine (Waller et al., 2013; Perez et al., 2016c). Specifically, the 23-item HPV General Knowledge Scale ($\alpha = 0.94$) and the 11-item HPV Vaccine Knowledge (VK) Scale ($\alpha = 0.88$) were used (Appendix A). To each item, respondents answered 'true', 'false', or 'don't know', for which a total score was calculated based on correct answers (higher scores indicate greater knowledge on both scales).

HPV vaccine attitudes were assessed using constructs from the Health Belief Model (HBM) including perceived benefits of, and barriers to, HPV vaccination; perceived severity of, and susceptibility to, HPV infection and disease; external influences prompting HPV vaccine uptake (i.e. cues to action), and the ability to exert change (i.e. self-efficacy). Sub-scales from the psychometrically validated HPV vaccination Attitudes and Beliefs Scale (HABS) were used to evaluate constructs from the HBM using a 7-point Likert-type rating scale ranging from 1 (strongly disagree) to 7 (strongly agree) (Perez et al., 2016c). Sub-scales were evaluated for internal consistency using Cronbach's α . HBM constructs, predominantly assessed using HABS subscales, included perceived susceptibility of child to HPV and its consequences (3 items, $\alpha = 0.92$), perceived severity of HPV and its consequence (3 items, $\alpha = 0.84$), perceived benefits of HPV vaccine (10 items, $\alpha = 0.94$), perceived barriers to HPV vaccine (6 items to measure harms, $\alpha = 0.93$; 4 items to measure accessibility, $\alpha = 0.79$; and 3 items to measure affordability, $\alpha = 0.87$), cues to action (8 items, $\alpha = 0.91$), and self-efficacy (4 items $\alpha = 0.89$) (Appendix A).¹

General vaccine attitudes were assessed using two psychometrically validated scales: the Vaccine Conspiracy Beliefs Scale (VCBS) and the Vaccine Hesitancy Scale (VHS) (Shapiro et al., 2016b, 2018). The VCBS has seven items assessed on a 7-point Likert-type rating scale ($\alpha = 0.95$). The VHS was developed by the World Health Organization Sage Working Group on Vaccine Hesitancy (Larson et al., 2015), and psychometrically validated by our research group (Shapiro et al., 2018). The VHS was found to have two underlying factors (i.e. 'lack of confidence', $\alpha = 0.92$; and 'risks', $\alpha = 0.64$) and items are assessed on a 5-point Likert-type rating scale (Appendix A).

2.3. Analysis

This study reports parents' HPV vaccine decision-making in percentages based on the six PAPM stages. For assessing significant differences in PAPM stage based on child's gender, a chi-square test was used.

To examine differences between reported vaccine knowledge and attitudes by PAPM stage, one-way ANOVA and Tukey Honest Significant Difference (HSD) post-hoc tests were conducted.

Multinomial logistic regression analyses were used to calculate the odds ratios of being in one of the first five PAPM stages compared to PAPM stage 6 (i.e. vaccinated, reference category). PAPM stage was the

¹ All scales are subscales the HABS except self-efficacy, which is a construct of the HBM but was not included as a subscale in the HABS.

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