Parents' human papillomavirus vaccine decision-making:

Theory, measurement and models

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Dedication

To מגי, Mrs. T, Debbie and so many more who lost their lives prematurely to cancer….

Hoping that one-day this thesis will be a work of fiction as cancer will be a disease of our past!

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Abstract

The human papillomavirus (HPV) infects approximately 550,000 Canadians annually. Cancers of the cervix, mouth, genitals, anus, head and neck are caused by various strains of the HPV. The HPV also causes genital warts. The disease and economic burden of HPV infections is high. Three HPV vaccines are available: Cervarix®, Gardasil®, and Gardasil ® 9. Consistent with global practices in developed countries, these vaccines are currently publicly funded for girls and provided in school-based programs in all provinces and territories in Canada. As of September 2016, six provinces provide publicly funded school-based programs for boys. Despite well-documented vaccine efficacy and effectiveness with minimal adverse effects, uptake of the HPV vaccines remains suboptimal in most countries, including Canada. Although HPV immunization rates have increased over the last decade, they remain significantly below the rates of other vaccine-preventable diseases. One of the main challenges for boys' uptake has been to help parents understand that the HPV vaccine is now available, recommended and effective for boys in reducing health risks for themselves and transmission to their partners.

With low HPV uptake rates in Canada, success of increased vaccination rates is contingent on parents' awareness, understanding and ultimately their decision-making process. Of the HPV vaccination research that has targeted parents of boys, most studies examined demographic and descriptive factors associated with vaccination intentions. While this research is informative, it treats decision-making as binary, when there are likely multiple stages of vaccination decision-making. Conceptualizing vaccine decision-making as distinct stages would allow us to examine those individuals who are vaccine hesitant, as well as parents who are not yet aware or engaged in HPV vaccine decision-making. Moreover, much of the existing research on the correlates and factors associated with vaccination intentions are unreliable, which is likely

due to differences in the conceptualization of the factors and inconsistent and unstable measures. This in turn provides limited insight about leverage points of how to move individuals along the HPV vaccine decision-making trajectory and ultimately increase HPV vaccine uptake.

This dissertation addresses some of these research gaps by using theory-based research, as well as the development of two psychometrically validated scales, an extended HPV and HPV vaccine knowledge scale and the HPV Attitudes and Beliefs Scale (HABS) to identify the factors that are associated with HPV vaccination decision-making among a nationally representative sample of Canadian parents of 9-16-year-old boys using a longitudinal design. The unique contributions of the four manuscripts in this thesis are that by conceptualizing HPV vaccine decision-making as a series of distinct stages, by using theory, psychometrically-tested and validated measures, as well as multinomial logistic regression models, we can have a greater understanding about what influences parents' HPV vaccine decision-making for their sons. This more nuanced understanding will help to better target our efforts to increase HPV vaccine uptake for boys. Future research directions and recommendations for better informed and targeted interventions are made.

Résumé

Le virus du papillome humain (VPH) infecte environ 550, 000 Canadiens chaque année. Les cancers de col du l'utérus, de la bouche, des organes génitaux, l'anus, de tête et cou sont causées par diverses types du VPH. Le VPH provoque également des condylomes génitales. La maladie et le fardeau économique de VPH est élevé. Trois vaccins sont disponibles, Cervarix®, Gardasil®, Gardasil® 9. En accord avec les pratiques internationales dans les pays développés, ces vaccins sont actuellement financés publiquement pour les filles et fournis à l'école dans des programmes d'immunisation dans toutes les provinces et territoires au Canada. En septembre 2016, six provinces fournissent maintenant à l'école des programmes d'immunisation gratuite pour les garçons. Malgré l'efficacité des vaccins bien documenté et l'efficacité avec un minimum d'effets secondaires, le taux d'immunisation contre le VPH reste faible dans la plupart des pays, incluant le Canada. Bien que les taux de vaccination contre le VPH ont augmenté au cours de la dernière décennie, ils restent nettement en dessous du taux d'autres maladies évitables par la vaccination. L'un des principaux défis pour les garçons a été d'aider les parents et les adultes à comprendre que le vaccin contre le VPH est maintenant disponible, efficace et recommandé pour les garçons pour la reduction du risque de l'infection pour eux-mêmes et la transmission aux partners.

Avec un faible taux de la vaccination du VPH au Canada, le succès de l'augmentation des taux de vaccination est dépendant sur la sensibilisation et la compréhension des parents et, finalement, leurs processus de décision. Parmi la recherche sur la vaccination contre le VPH dans la population des parents des garçons, la plupart des études examine les facteurs démographiques et descriptives associées aux intentions de vaccination. Bien que cette recherche est informatif, il permet de traiter la prise de décisions en tant que binaire, quand il y a probablement plusieurs

étapes de la prise de décisions de vaccination. La conceptualisation de la prise de décision comme des étapes nous permettrait d'examiner ceux qui sont hésitants de vaccins, ainsi que les parents qui ne sont pas au courant ou engagés dans leur processus de prise de décisions. Aussi, la majeure des recherches sur les corrélats et les facteurs associés à la vaccination intentions sont variables, ce qui est probablement dû aux différences dans la différente conceptualisation des facteurs et les mesures instables. Cela donne un aperçu limité sur les points de levage que on doit adresser pour bouger les personnes sur la trajectoire de prendre leurs décisions, et en fin, de se faire vacciner.

Cette thèse aborde certaines de ces lacunes de recherche en utilisant la recherche fondée sur la théorie ainsi que la développement de deux échelles validées sur ces propriétaires psychométrique : une échelle du connaissance sur le VPH et une échelle des attitudes et croyances du VPH (HABS) pour identifier les facteurs associés à la prise de décisions pour la vaccination contre le VPH chez les parents garçons de 9-16 ans au Canada. Le caractère unique des quatres articles de cette thèse sont: de démontrer que le vaccin contre le VPH constitue la prise de décisions de plusieurs étapes, et qu'en utilisant la théorie et des mesures validées, ainsi que des modèles multinomiaux, nous pouvons avoir une plus bon compréhension de les facteurs qui influencent la prise de décisions pour les parents des fils. Cette compréhension plus nuancée aidera à mieux cibler les efforts d’augmenter le taux de vaccination contre le VPH pour les garçons. Des directions de la recherche et des recommandations pour améliorer l'information et des interventions ciblées sont effectuées.

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When reflecting on my PhD, the African adage "It takes a village to raise a child" resonates as it has taken a "village" to bring this thesis, "my child, my baby" to fruition. I would like to express my sincere thanks to those individuals—mentors, colleagues, friends and family who have supported me along this journey.

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Contributions of Authors

Four manuscripts (three which are published, one which is currently under review) are presented in this doctoral thesis. As the first author on the four manuscripts, I developed the specific research questions and hypotheses. I took the lead on creating, testing and piloting all questionnaire items that were used in our survey tool. I coordinated and managed the relationship with our data-marketing firm who used our survey to collect the data. I cleaned the data and ran statistical analyses. I wrote the first drafts of all manuscripts incorporating suggestions from co-authors on subsequent drafts. I selected the academic journals and led the submission process of all manuscripts to final publication.

Zeev Rosberger, my supervisor and the senior author on the four manuscripts, supervised me and offered expertise and assistance throughout all phases of the study development until culmination in final manuscripts. He offered suggestions on survey development and design, areas of focus, statistical advice, interpretation of findings as well as reading and editing numerous drafts of each manuscript. He also provided critical feedback and suggestions on all aspects of this dissertation.

Specific to manuscript 1 which was published in *BMC Public Health*, I conceived and designed the study; performed the statistical analysis, interpreted the data and drafted the manuscript. Ovidiu Tatar performed the statistical analysis, interpreted the data and assisted in drafting the manuscript. Gilla Shapiro assisted in data interpretation and provided cfeedback on manuscript revisions. Eve Dubé, Gina Ogilvie, Juliet Guichon and Vladimir Gilca participated in study design and conceptualization, and provided critical feedback on manuscript revisions. Zeev Rosberger conceived and designed the study; assisted in data interpretation, provided critical feedback on manuscript revisions.

Specific to manuscript 2, which was published in *Preventive Medicine*, I conceptualized

the idea to extend and validate an existing knowledge scale. I planned, conducted and interpreted the statistical analyses. I wrote and revised the manuscript. Remo Ostini, statistics consultant was familiar with the items from our scale as we were extending on a previous scale written by him, Jo Waller and Gregory Zimet, all co-authors on the paper. Remo Ostini conducted some of the more advanced statistical analyses and provided feedback on my interpretation and summary of the results. Ovidiu Tatar also conducted the statistical analysis and helped in drafting parts of the manuscript. Gilla Shapiro, Jo Waller, Gregory Zimet provided feedback and suggestions on editing of the manuscript.

Specific to manuscript 3, which was published in *Sexually Transmitted Diseases*, I conceptualized the idea to create an attitudes and belief scale specific to HPV. Keven Joyal-Desmarais and Ovidiu Tatar and I conducted the data analyses. I conducted the literature review and wrote the manuscript. Ovidiu Tatar also contributed to the writing the manuscript. Gilla Shapiro provided feedback and suggestions on editing of the manuscript.

Specific to manuscript 4, I planned, analyzed and interpreted the statistical analyses to be included in the manuscript. I interpreted the results, wrote and revised the manuscript. Ovidiu Tatar conducted the analyses, was involved in the interpretation of results and drafting parts of the manuscript. Vladimir Gilca provided feedback on the statistical analysis and content of the manuscript. Gina Ogilvie, Juliet Guichon, Gilla Shapiro and Anila Naz, provided important feedback on manuscript revisions.

Statement of Original Contribution

This research constitutes an original contribution in the exploration of factors influencing HPV vaccination decision-making in parents of boys. To date, in the HPV vaccination literature, many studies have explored people's HPV vaccination intentions and or HPV vaccination. Only two studies have examined the factors that influence the earlier stages of vaccination decision-making, though this was not among parents. Many authors in the social and behavioral sciences following their systematic reviews conclude that there is no universal definition of HPV vaccine acceptance nor universal tools for the measurement of factors (e.g., attitudes, knowledge), making it difficult to draw conclusions about results due to the heterogeneity. Furthermore, the theoretical constructs that comprise the majority of health theories are broadly defined and the model does not stipulate how the constructs interact. In turn, this contributes to different operational definitions of the constructs, which makes it difficult to compare results across studies. Lastly, the vast majority of studies in this area typically report basic descriptive results, most often using frequencies to understand what influences parents' HPV vaccine decision-making. This restricts our understanding of the relationships and the inferences that can be made. Taken together, these limitations have led to inconsistent and variable findings from study to study. There is presently insufficient evidence to confidently know what are the important factors involved in parents' HPV vaccine decision-making that should be targeted; and are these influences the same for different groups of people.

This dissertation adds to the literature by examine a large, representative sample of Canadian parents HPV vaccine decision-making process. We draw on multiple health theories including the Precaution Adoption Process Model as our conceptual framework. Furthermore, we offer two extensively psychometrically-tested published scales, one that measures HPV and

HPV vaccine knowledge, and the second that measures HPV attitudes and beliefs that we hope researchers in the field will use in a variety of populations. Finally, we examined the psychosocial determinants of HPV vaccine decision-making using multinomial modeling. We offer implications and future research directions for the field.

General Introduction

Changes in health behaviour are our greatest hope for reducing the incidence, morbidity and mortality of preventable diseases worldwide. Diseases like diabetes, cancer, heart and lung disease are responsible for millions of death worldwide (Mathers, Boerma, & Fat, 2008; Yach, Hawkes, Gould, & Hofman, 2004). Evidence has accumulated to substantiate that engagement in health risk behaviours such as tobacco consumption, alcohol and drug use, unhealthy diet, sedentary lifestyles, unsafe sexual behaviours, are significant contributors to disease incidence and mortality. There are evidence-based clinical and community practice guidelines to target and improve a wide variety of health behaviours including but not limited to: healthy eating, physical activity, vaccination uptake, improved workplace health conditions, disease self-management, disease screening, and decrease exposure to known health risks like sun exposure, first and secondhand smoke among children and adults worldwide.

Over the past two decades, there has been a dramatic increase in interest in health promotion and prevention of disease through changes in health behaviour and lifestyle. Much of the interest is attributable to shift from focus on acute infectious diseases to chronic diseases which are now the leading cause of death, our aging population, as well as the ever-increasing health care costs (Glanz, Rimer, & Viswanath, 2008).

Despite advances in prevention, we continue to put ourselves at varying levels of risk by engaging in potentially detrimental health behaviours and failing to implement health promotion behaviours. There is a clear gap between what we know to be "optimum health practices and that which is actually practiced" (Griffiths, 1972, p. 7).

About two in five Canadians will be diagnosed with cancer in their lifetime, with one in four dying from cancer (Canadian Cancer Statistics Advisory Committee on Cancer Statistics,

2016). While tobacco has long been recognized as the primary modifiable risk factor contributing to cancer mortality, increased attention is now focused on other modifiable risk factors, including but not limited to: diet and physical activity, pollutants and viral infections, ultraviolet light exposure, reproductive hormones, food additives, ionizing radiation. With only 5-10% of cancers being 'genetically determined', the focus has shifted to prevention as nearly *half* (30-50%; this number varies dependent on approach and cancer type) of all cancers may be prevented (Blot & Tarone, 2015; Colditz, Wolin, & Gehlert, 2012; Danaei et al., 2005; Doll & Peto, 1981; Parkin, 2001; Parkin & Bray, 2006). In fact, while most research in the field of psychosocial oncology has been carried out from diagnosis to end of life, recently there has been a strong recommendation that research into prevention practices prior to diagnosis should be given greater consideration (Rosberger, Perez, Bloom, Shapiro, & Fielding, 2015).

Understanding HPV and its relation to cancer

It may be surprising to many to learn that parasitic, bacterial and viral infections contribute to an estimated 10-25% of all cancer cases (Blot & Tarone, 2015; De Martel et al., 2012; Doll & Peto, 1981; Shields, 2005). One virus that has plagued humans for thousands of years is the human papillomavirus, most commonly known as 'HPV'(Castellsagué, 2008). Worldwide, HPV is the most common sexually transmitted infection (STI) and affects 3 out of 4 sexually active individuals at some point in their lives (Chaturvedi, 2010; Trottier & Franco, 2006). HPV is transmitted through skin-to-skin or skin-to-mucosa contact (Castellsagué, 2008). Although there are over 100 different strains or types of HPV, HPV types express themselves differently (Castellsagué, 2008). HPV can cause warts or papillomas in many parts of the body, including the genital areas of males and females such as the skin of the penis, vulva and anus, and the lining of the cervix, penis, vagina and anus (Castellsagué, 2008). HPV can also be found

in the lining of the mouth and throat especially at the base of the tongue and tonsils (Parkin & Bray, 2006). As HPV is a common infection, it is important to understand that most HPV infections are transient i.e., the infection clears within 1-2 years and cause no visible signs or symptoms (Dunne & Markowitz, 2006; Molano et al., 2003). It is only when some HPV types develop into HPV-associated diseases i.e., genital warts and cancer, that the consequences are clinically relevant and can impact quality of life and mortality (Parkin & Bray, 2006).

HPV types 6 and 11, often referred to as 'low-risk types', and predominantly cause genital warts in both males and females. The following HPV types are often referred to as 'high-risk types' or 'oncogenic genotypes' and have been classified by the International Agency for Research on Cancer (IARC) as human carcinogens: HPV 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59 (Bouvard et al., 2009; International Agency for Research on Cancer 2007; International Agency for Research on Cancer, 2012). HPV 68 was classified as a probable carcinogen and 12 other types were identified as possible carcinogens (Bouvard et al., 2009; International Agency for Research on Cancer 2007; International Agency for Research on Cancer, 2012).

HPV is a necessary cause of cervical cancer, with HPV 16 being responsible for more than half of all cervical cancers worldwide (Forman et al., 2012; Joura et al., 2014; Schiffman, Castle, Jeronimo, Rodriguez, & Wacholder, 2007). HPV (primarily types 16 and18) are also associated with ~70% of vaginal and ~40% vulvar cancers (Alemany et al., 2014; de Sanjosé et al., 2013). HPV (primarily types 16 and 18) are also associated with about 80-90% of anal cancers (Alemany et al., 2015). While the incidence of anal cancer is slightly higher in females than males, the highest incidence of anal cancer is reported in men who have sex with men and HIV positive men (Alemany et al., 2015; Palefsky, 2009). Moreover, while a rare cancer, ~ 40-50% of penile cancers are caused by HPV (primarily types 16, 18 and 6) (Alemany et al., 2016;

Backes, Kurman, Pimenta, & Smith, 2009). Lastly, approximately 5% of oral cavity and larynx cancers as well as~18-35% oropharyngeal cancers are associated with HPV (primarily types 16 and 18) (Castellsagué et al., 2016; Kreimer, Clifford, Boyle, & Franceschi, 2005).

Epidemiology of HPV and HPV-associated cancers

It is estimated that 5.2% of all cancers are HPV-related: 2.2% has been reported in developed countries and 7.7% has been reported in developing countries (Forman et al., 2012; Parkin & Bray, 2006; World Health Organization Report, 2015). According to Centers for Disease Control and Prevention (CDC, 2015c) "every year, over 27,000 women and men are affected by a cancer caused by HPV- that's a new case every 20 minutes". In economically developed countries, the burden of HPV associated diseases in males is now comparable to that in women (Stanley, 2014).

Cervical cancer is the fourth most common cancer among women worldwide (Bruni et al., 2016). In 2012, an estimated 527,624 women were diagnosed with cervical cancer and more than 85% of the 265,653 deaths occurred in developing countries (Bruni et al., 2016; Forman et al., 2012). In a recent special report by the Canadian Cancer Society on HPV-associated cancers, in 2012, over 1,100 Canadians died from an HPV-associated cancer and 3,760 Canadians were diagnosed with an HPV-associated cancer, of which 64% were female and 36% were male (Canadian Cancer Statistics Advisory Committee on Cancer Statistics, 2016). Canadian statistics also indicate that the most commonly diagnosed HPV-related cancers were oropharyngeal cancer (1,335 cases) and cervical cancer (1,300 cases), followed by anal cancer (475 cases).

The incidence rate of HPV-associated oropharyngeal cancer has increased significantly in both males and females since the mid-1990s, though the rate of growth is 4.5 times higher in males as compared to females. In males, there was a 3.1% increase per year, from 4.1 per

100,000 in 1997 to 6.4 per 100,000 in 2012. If recent trends continue, the rate of oropharyngeal cancer in males is expected to surpass the rate of cervical cancer in females by the year 2020 (Chaturvedi, Engels, Anderson, & Gillison, 2008). It is also expected that by 2016, 4,375 Canadians will be diagnosed with an HPV-associated cancer, and this will include almost 1,700 new cases among males (Canadian Cancer Statistics Advisory Committee on Cancer Statistics, 2016).

Cancer Prevention: Screening and the HPV Vaccine

As approximately one-third of all cancers are preventable, prevention offers the most logical and cost-effective strategy for cancer control (Colditz et al., 2012; Rennert, 2007; World Health Organization, 2007). Cervical cancer screening i.e., the detection of pre-cancerous cells before they become cancer by the Pap test has been available across Canada for over 60 years. Current guidelines recommend cervical cancer screening to women 25-69 years at 3-year intervals (Canadian Task Force on Preventive Health Care, 2013). As a result of Pap testing, the incidence and mortality of cervical cancer has dramatically decreased from 1992 to 2006, although the rate has been relatively stable since (Canadian Cancer Statistics Advisory Committee on Cancer Statistics, 2016). On the other hand, the incidence of vulvar, anal and oropharyngeal cancers are increasing, with no method of early detection or screening available. Since two-thirds of HPV-associated cancers occur in areas beside the cervix, and males are also affected by HPV-associated cancer, cervical cancer screening alone is not sufficient to reduce the incidence and mortality from HPV-associated cancers.

The HPV vaccine, Gardasil® was first licensed in Gabon in March 2006; Mexico, Australia, the United States, Canada and many European countries followed between June and September (Merck, 2015). Presently, Gardasil® is approved in 129 countries and over 205

million doses of the vaccine had been distributed worldwide (Wigle, Fontenot, & Zimet, 2016). As of February 2015, there were an estimated 80 national HPV vaccination programs and 37 pilot programs, with many of these implemented in low- and middle-income countries (Cervical Cancer Action, 2016).

Currently, in Canada, there are three HPV vaccines available: The bivalent vaccine (2-valent or HPV2) Cervarix®, which protects against infection from HPV types 16 and 18; the quadrivalent (4-valent or HPV4) vaccine, Gardasil® which protects against infection from HPV types 16, and 18, as well as types 6, 11; and the nonavalent (9-valent or HPV9) vaccine, Gardasil® 9 which protects against infection from HPV types 16, 18, 6, 11 as well as 31, 33, 45, 52 and 58. All three vaccines protect against types 16 and 18, which are responsible for 70% of all cervical cancers and are also associated with other cancer sites e.g., penis, vagina, anus, oral cavity and oropharynx (Dawar, Dobson, & Deeks, 2007; Garland et al., 2016; Public Health Agency of Canada, 2015a; Public Health Agency of Canada, 2016a). Gardasil® and Gardasil® 9 also protect against types 6 and 11, which are responsible for 85% of genital warts (Giuliano et al., 2011; Mariani, Vici, Suligoi, Checcucci-Lisi, & Drury, 2015). Gardasil® 9 offers protection against 5 additional HPV types, making the vaccine account for about 90% of cervical cancers, so that "virtual elimination of this disease [cervical cancer] in vaccinated women is likely" (Cuzick, 2015, p. 1048).

It should be noted that the HPV vaccine does not eliminate the need for cervical cancer screening. Vaccinated females are still susceptible to HPV types not covered by the various vaccines. Also, women who were sexually active prior to receiving the HPV vaccine may have been previously infected with a high-risk HPV type. As a result, current screening guidelines are the same for unvaccinated and vaccinated females at this time, and will likely continue to evolve

in the era of HPV vaccination (El-Zein, Richardson, & Franco, 2016).

HPV testing

While Pap tests are used to find cell abnormalities, HPV testing can be used to detect the presence of high-risk HPV types even before there are visible changes to cells in the cervix. HPV testing as a single screening method is generally not recommended to women prior to the age 30 as most HPV infections are transient and will clear on their own within 1–2 years (Canadian Task Force on Preventive Health Care, 2013; US Preventive Services Task Force, 2012).

There is growing evidence that perhaps HPV testing should replace Pap tests as the primary screening method in Canada largely because HPV tests are more sensitive (though less specific), which will be important to consider as the prevalence of certain common HPV types decrease due to HPV vaccination uptake (Tota et al., 2015). HPV testing is available in Canada and will sometimes be used as a follow-up to a positive Pap test. Also, anal Pap tests are sometimes used to detect early signs of anal cancer, particularly among high-risk populations, such as men who have sex with men (MSM). Moreover, some dental professionals will perform physical examinations of the mouth to detect early signs of oral cancer. Currently, there are no organized screening programs for non–cervical HPV-associated cancers in Canada. More research is needed to demonstrate the effectiveness, benefits and potential harms of such screening practices.

HPV vaccine efficacy

All three HPV vaccines are highly efficient in preventing infections against the types of HPV they protect against (Dawar et al., 2007; Joura et al., 2015; Public Health Agency of Canada, 2007; Public Health Agency of Canada, 2012; Public Health Agency of Canada, 2015a;

Saslow et al., 2007). These vaccines are most effective when administered prior to the onset of sexual activity, when the likelihood of infection is very low. An extensive explanation of vaccine efficacy data is beyond the scope of this summary due to the complexity of this data: see Garland et al. (2016) for the most up-to-date review of the global effect of 4-valent HPV vaccination on HPV infection and disease as well as Schiller et al. (2012) for a review of HPV vaccinations clinical trials. Other extensively cited (>500 citations) HPV vaccine efficacy clinical trials can be found here: (Harper et al., 2004; Harper et al., 2006; Malagón et al., 2012; Paavonen et al., 2007; Schiller et al., 2012; Villa et al., 2005).

It is also important to understand that beyond the many clinical trials, which provide robust evidence for high efficacy against multiple endpoints (Schiller et al., 2012), the 'real world' impact of HPV vaccination have also been extensively substantiated (Brotherton et al., 2011; Drolet et al., 2015; Mariani et al., 2015). In a recent systematic review of both the direct and indirect impact of 4-valent HPV vaccine specifically on genital warts, the authors write "The results are coherent with the genital warts incidence reduction reported in clinical trials and are an early indicator of what can be expected for the long-term clinical impact on vaccine-type HPV-related cancers" (Mariani et al., 2015, p. 11). The authors write that of the many examples studies listed, Australia can be used as an exemplary standard: "In Australia, no genital warts were diagnosed in women aged 21 years and younger who reported being vaccinated. A 92.6% reduction in genital warts incidence was reported for all women in this age group, where the vaccine uptake rate was 70% for 3 doses"(Mariani et al., 2015, p. 11).

Significant 'real world' impact (post marketing studies) has also been reported in Australia, Canada, Denmark, Sweden, US and others which show strong evidence demonstrating significant declines (~20- 90%) in both high and low-grade cervical cytological abnormalities

(pre-cancerous lesions that may become cancer if left untreated) among vaccinated compared to unvaccinated females (Garland et al., 2016). For example, in Australia and Denmark, high-grade precancerous lesions reductions as high as 57% and 80% were reported in the youngest cohorts vaccinated shortly after program implementation (Garland et al., 2016). It can be said that the 'real world' impact on preventing cervical as well as oral, anal, penile, vaginal cancers has yet to be fully realized (Canadian Cancer Statistics Advisory Committee on Cancer Statistics, 2016).

HPV vaccine safety

Similar to the HPV vaccine efficacy data, an extensive explanation of HPV vaccine safety data is beyond the scope of this summary; see Macartney et al. (2013) for a review of safety data, as well as ("IPVS Policy statement on safety of HPV vaccines," 2016; Vichnin et al., 2015). The safety profile of the three HPV vaccines has been reviewed extensively, and the research supports they are generally safe, well-tolerated and have side effects similar to those experienced with other vaccines (Macartney et al., 2013; Public Health Agency of Canada, 2012; Public Health Agency of Canada, 2015a; Vichnin et al., 2015). The most common side effects of the vaccines are soreness (pain), swelling, itching and redness at the injection site, as well as syncope (fainting) (Vichnin et al., 2015). The safety profiles of the three HPV vaccines are continuously being followed in Canada, the US and around the world. Similar to the CDC's Vaccine Adverse Event Reporting System (Centers for Disease Control and Prevention, 2015b), Canada uses the Canadian Adverse Events Following Immunization Surveillance System (CAEFISS), a national monitoring system for reporting adverse events and suspected adverse events following immunization (Immunize Canada, 2016). The CAEFISS objectives are "to continuously monitor the safety of marketed vaccines in Canada; to identify increases in the frequency or severity of previously identified vaccine-related reactions; to identify previously

unknown adverse events following immunization (AEFI) that could possibly be related to vaccine (unexpected AEFI); to identify areas that require further investigation and/or research; and to provide timely information on AEFI reporting profiles for vaccines marketed in Canada that can help inform immunization related decisions"(Public Health Agency of Canada, 2015b).

HPV Vaccination Dosing

All three HPV vaccines were initially licensed and recommended for use in a 3-dose series, at a 0, 2 and 6-month schedule (Markowitz, Meites, & Unger, 2016). Of note, three-dose regimens were costly and difficult to complete (approximately $150 per dose). The rationale for the 3-dose schedule used in the efficacy trials for the HPV vaccines was that two priming vaccine doses would be needed followed by a boosting dose at 6 months (Mishra, Pimple, & Shastri, 2015). Two-dose schedules that eliminate the second priming dose but retain the boosting dose were evaluated in immunogenicity trials (Markowitz et al., 2016; Mishra et al., 2015). A systematic review of alternative vaccination schedules that assessed the seroconversion and seropositivity comparing girls receiving 2-doses with women receiving 3-doses at different time points up to 24 months after vaccination found them to be non-inferior or inconclusive at all time-points (World Health Organization, 2014). These findings, and many others, led to the approval of a 2-dose schedule for the bivalent and quadrivalent HPV vaccines by most regulatory authorities, including Canada's National Advisory Committee on Immunization (NACI), the CDC, the European Medicines Agency, as well as the World Health Organization's recommendation for a 2-dose vaccination schedule for those under 15 years of age(Markowitz et al., 2016; Public Health Agency of Canada, 2016a; World Health Organization Report, 2015). In Canada, the two doses schedule for the quadrivalent vaccine applies for children 9-14 and 9-17 in Quebec (Public Health Agency of Canada, 2016a; Tunic, Deeks, & on behalf of the National

Advisory Committee on Immunization (NACI), 2016). Those older than 15 years old are recommended to receive three doses (Public Health Agency of Canada, 2015a; Tunic et al., 2016). NACI also concluded that there is insufficient evidence at this time to recommend a 2-dose immunization schedule with the HPV9 vaccine as compared to 3 doses (Tunic et al., 2016)

Markowitz and colleagues (2016) eloquently summarized the last decade of HPV vaccination efficacy, dosing, safety and impact:

> "During the first decade of the HPV vaccination program, knowledge has increased about these highly effective HPV vaccines. Population-level effects of vaccination programs on infection and disease outcomes have exceeded expectations in many countries, and extensive safety evaluations have not identified concerns. In the second decade, reduced dose schedules might help achieve higher HPV vaccination coverage, advance HPV vaccine program introductions in more countries, and further reduce the burden of HPV-associated cancers and disease worldwide."(Markowitz et al., 2016, p. E2)

HPV vaccination: The Canadian context

In July 2006, Gardasil® was approved and recommend by NACI for use in females aged 9 to 26 years. In February 2010, Gardasil® was authorized to expand its indications to include males 9 to 26 years old. Also in February 2010, Gardasil® was authorized for use in females 10 through 25 years of age. The NACI concluded that any of the currently authorized HPV vaccines in Canada can be used according to the recommended HPV immunization schedules (Tunic et al., 2016). The first provincial publicly funded HPV vaccination programs were implemented in 2007 for females following a 300-million-dollar allocation by the Canadian government (Steben, 2008).

HPV immunization programs were introduced for females across Canada between 2007

and 2010. By the end of 2010, all provinces and territories had free school-based HPV vaccination programs for girls. Each province implemented slightly different variations of the program: different age at vaccination i.e., different school grades were targeted (grade 4 to 6), different dosing schedules (e.g., Quebec offered 2 doses as of 2015) and catch up programs were also offered to older females in grades 8-11, and in some provinces up to 21-years-old. The commonality across Canada was that all HPV vaccination programs were free, school-based and for females only.

The shift to male HPV vaccination

In 2010, there was major shift to "defeminize" the characterization of the HPV vaccine (Daley et al., 2016). HPV was initially labeled a women's health issue due to the overwhelming burden of cervical cancer worldwide. The HPV vaccine was approved and recommended for females only and subsequently, the major focus of information has been directed towards young women and parents of girls. Aside from the growing evidence supporting the HPV-associated disease burden among males and the role males play in HPV transmission, other compelling arguments were put forward (and continue so) to favor HPV vaccination of males (Giuliano, 2007; Giuliano & Salmon, 2008; Hull & Caplan, 2009; Michels & zur Hausen, 2009; Palefsky, 2010; Prue, 2016; Prue, Lawler, Baker, & Warnakulasuriya, 2016a; Rosberger, Perez, King, & Franco, 2013; Shapiro, Perez, & Rosberger, 2016b; Stanley, 2012; Stanley, 2014; Stupiansky, Alexander, & Zimet, 2012a; Szarewski, 2008; Zimet & Rosenthal, 2010):

1. Despite HPV vaccine (and in some countries HPV vaccine programs) for females being easily accessible and available, HPV vaccine uptake rates (for females) varied considerably across the world. A similar pattern of variability was described in Canada e.g., in 2012, HPV vaccine uptake rates as low as 50% in Alberta and as high as 86% in

Quebec were reported (Eggertson, 2012). Some argued that female-only HPV vaccination programs would confer protection to males, a concept known as 'herd immunity' i.e., the protection of a population against an infectious disease due to a high proportion of the population being vaccinated against it(Shapiro et al., 2016b). Since control of HPV infection among females requires vaccination coverage rates of approximately 70%, which in many areas was not being achieved, it was argued that including males in the vaccination schedule might be cost-effective in order to obtain the highest coverage for the population (Brisson, van de Velde, Franco, Drolet, & Boily, 2011; Public Health Agency of Canada, 2014).

2. Historically, universal vaccination policies generally have been more effective and less confusing to the public. Lessons learned from gender-targeted vaccines in the case of rubella, for example, demonstrate that in order to effectively control disease, immunization policy should encompass both genders to avoid a resurgence of disease in the unvaccinated group (Tookey & Peckham, 1999).
3. Vaccinating females would not offer protection to MSM, who are at increased risk of HPV-associated diseases (Brabin, Roberts, Farzaneh, & Kitchener, 2006; Glick, Feng, Popov, Koutsky, & Golden, 2013; Kreuter & Wieland, 2009; Machalek et al., 2012; Nyitray et al., 2011; Zou et al., 2014)
4. Some cultural, religious and ethnic groups may perceive it as more acceptable to vaccinate boys over girls (Bhandari, Shrestha, & Ghimire, 2007; Hill & Upchurch, 1995; Merten et al., 2015).

Most of the initial resistance to HPV vaccination in males can be attributable to three key factors (Chesson, Ekwueme, Saraiya, Dunne, & Markowitz, 2011). First, it was a casualty of the

research and licensing processes of the HPV vaccine. Since most of the clinical trials data available were initially for females only, the question became: "Is adding male vaccination *worthwhile*?" rather than, "Is vaccinating all young people worthwhile?" The second though related issue was the debate surrounding cost-effectiveness. Many modeling studies reported that including males was less cost-effective when achieving high female HPV vaccine uptake rates (Brisson, Van de Velde, & Boily, 2009; Seto, Marra, Raymakers, & Marra, 2012). This result shifted the burden back to females, implying that the focus should be on improving HPV vaccine uptake rates among females as opposed to vaccinating both genders. Third, there is always the issue of limited resources. This was particularly a concern for developing countries, but was an issue globally due to rising health care costs.

Between 2008 and 2014, many argued (Giuliano & Salmon, 2008; Gorin, Glenn, & Perkins, 2011; Hull & Caplan, 2009; Michels & zur Hausen, 2009; Palefsky, 2010; Peate, 2014; Perez, 2013; Perez, 2014; Rosberger et al., 2013; Stanley, 2012; Stanley, 2014; Stupiansky et al., 2012a; Zimet & Rosenthal, 2010) that a vaccine that offered to females only was inequitable. Scientists, clinicians, activists and lobbyists advocated that vaccinating males against HPV would ensure greatest protection for the population.

There were (and still are) numerous challenges in attempting to shift the focus of HPV-related cancers from 'female only' to gender-neutral, i.e. diseases that impact males and females alike. In February 2013, Australia blazed the trail as they had done previously with female HPV vaccination, by offering school-based HPV immunization to males (Garland, 2014). Canada joins only a couple of countries (e.g., Austria, Australia, Israel, Barbados, Lichtenstein, Switzerland; the US offers HPV vaccination for uninsured and underinsured children through their vaccines for children program, but not through school) offering free HPV immunization

programs for males (Prue, Shapiro, Maybin, Santin, & Lawler, 2016b; Shapiro et al., 2016b).

In September 2013, Prince Edward Island (PEI) became the first province to expand its publicly funded HPV vaccination program to include males in Grade 6 (Public Health Agency of Canada, 2016b). Alberta and Nova Scotia followed in September 2014 and 2015, as well as Manitoba, Quebec and Ontario (September 2016), which now all also offer gender-neutral HPV vaccination programs in different grades (4 to 7) (Colbert, 2015; Gouvernement du Québec, 2016; Manitoba Government, 2016; Ministry of Health and Long-Term Care Ontario, 2016). British Columbia (BC) offers free HPV vaccination to certain populations at high risk of HPV, including MSM and street youth, but does not yet offer comprehensive school-based HPV vaccination for males, which is similar to the province of Saskatchewan, which offers HPV vaccination exclusively to HIV+ males 9-17 years old. Quebec is the only province that offers a comprehensive, gender-neutral, school-based program along with a program for MSM. The provinces of Saskatchewan, British Columbia, New Brunswick, Newfoundland (Labrador) as well as the three territories Yukon, Nunavut and Northwest territories all do not offer universal coverage for boys. A detailed summary of the date of implementation of programs for females and males is shown in Table 1.

Table 1. HPV immunization programs by province/territories[1,2]

Province/ Territory	**Routine Schedule (0, 2 and 6 months)**	**Date of Implementation of Girls Program**	**Catch-up Programs for Girls (Date of Implementation)**	**Date of Implementation of Boys Program**	**Catch-up Programs for Boys (Date of Implementation)**
British Columbia	Grade 6	September 2008	Grade 9 (2008-2011)	Announced for September 2017 for Grade 6	No program presently
Alberta	Grade 5	September 2008	Grade 9 (2009-2012)	September 2014 for Grade 6	Grade 9 (2014-2018)
Saskatchewan[3]	Grade 6	September 2008	Grade 7 (2008-2009)	Announced for September 2017 for Grade 6	No program presently
Manitoba[4]	Grade 6	September 2008		September 2016	No program presently
Ontario[5]	Grade 8	September 2007	Grade 8 (2016-2017	September 2016 for Grade 6	Free of charge, until they finish Grade 12 at clinics

[1] As of April 3, 2017
[2] https://www.canada.ca/en/public-health/services/provincial-territorial-immunization-information/provincial-territorial-routine-vaccination-programs-infants-children.html
[3] http://globalnews.ca/news/3331430/grade-6-boys-to-start-receiving-hpv-vaccinations-in-sask/
[4] http://www.gov.mb.ca/health/publichealth/cdc/docs/hpv_phn_qa.pdf
[5] http://www.health.gov.on.ca/en/ms/hpv/

Quebec	Grade 4 (doses 1 and 2), in 3rd year of secondary school (dose 3)	September 2008	9 to13 years of age (High Risk of HPV Infections) 14-17 years of age 9 to 17 years of age in First Nations communities 3rd year of secondary school (2008-2013)	September 2016 for Grade 4	No program presently[6]
New Brunswick	Grade 7	September 2008	Grade 8 (2008-2009)	Announced for September 2017 for Grade 7	
Nova Scotia	Grade 7	September 2007	Grade 10 (2009-2010 only) Grade 8 (2010-2011 only)	September 2015 for Grade 7 boys	
Prince Edward Island	Grade 6	September 2007	Grade 9 (2009-2010 only)	September 2013 for Grade 5	No program presently
Newfoundland & Labrador	Grade 6	September 2007	Grade 9 (2008-2010)	September 2016	No program presently
Northwest Territories	Grade 4	September 2009	Grades 11 and 12 (2009-2010) Grades 10 and 11 (2010-2011) Grades 9 and 10 (2011-2012) Grade 9 (2012-2014)	No program presently	No program presently
Yukon	Grade 6	September 2009	Grades 7 and 8	No program presently	No program presently

[6] Available for free to men aged 26 or under who have or plan to have sex with men

HPV Vaccination Uptake in Canada

It is difficult to quantify HPV vaccine uptake and give a single percentage for "Canada" for a number of reasons including different methods of monitoring vaccination coverage among the 10 provinces and 2 territories, changes in dosing, definition of uptake (1, 2 or 3 doses and for which HPV vaccine). Quebec and BC's HPV vaccination coverage is monitored by regional public health authorities, whereas in Manitoba monitoring is centralized through the population-based Manitoba Immunization Monitoring System (Drolet et al., 2016). In a recent paper by Drolet and colleagues (2016), HPV vaccination coverage of pre-adolescent girls from the start of the programs (2008/2009 -2012/2013) was generally high in four provinces (Quebec 78%; Ontario 80%; Manitoba 64%, and BC 69% in 2012/2013), though some socio-demographic inequalities were found. For example, HPV vaccination uptake was lower in areas with higher percentages of immigrants and also among native English speakers, particularly in Quebec. These results suggest that Quebec is comprised of certain areas that have greater proportions of vulnerable populations have, which on average, have lower HPV vaccination coverage (Drolet et al., 2016). Importantly, there are areas within Canada that are not reaching the Canadian Immunization Committee (CIC) recommended publicly funded HPV programs goal of 80–90%, particularly as some provinces rates are declining (e.g., in Quebec, rates significantly decreased from 81% to 78% in the last 5 years) (Canadian Immunization Committee, 2007; Drolet et al., 2016). While overall HPV vaccinates rates for females have been relatively acceptable in most Canadian provinces, rates as low as 60% have been reported in certain rural areas and among certain immigrant groups (Drolet et al., 2016).

Moreover, several Canadian studies report that a significant proportion of Canadians hold negative views about vaccination (Buchan & Kwong, 2016; Dubé et al., 2016a; Dubé et al.,

2016b; Public Health Agency of Canada, 2016c). According to the most recent Childhood National Immunization Coverage Survey (CNICS) results, 70% of the parents reported that they were concerned about potential side effects from vaccines and 37% reported that a vaccine can cause the same disease it was meant to prevent (Public Health Agency of Canada, 2016c). A sizeable proportion of Canadians (estimated at ~20%-40%) are vaccine hesitant, that is they delay or refuse vaccination despite the availability of vaccine services (Dubé et al., 2016a; Dubé, Gagnon, Zhou, & Deceuninck, 2016c; MacDonald, 2016).

No one would argue that Canada is anywhere near the rates of over 95% reported in Finland and several other countries(MacDonald, 2016). As such, Canada must do better in terms of vaccination acceptance for both childhood, adolescent and adult vaccination (MacDonald, 2016). To the best of our knowledge, the only known published estimate of HPV vaccination coverage in males in Canada was reported in PEI for the 2014/2015 at 79% (McClure, MacSwain, Morrison, & Sanford, 2015)

At the time of study conceptualization, HPV vaccine uptake rates for males in Canada were not known. Also, Canada did not have any school-based HPV vaccination programs for males, highlighting the need to study HPV vaccine acceptability, specifically knowledge, attitudes, behaviours and decision-making processes of parents of boys. Furthermore, males or parents of young boys would need to pay for the vaccine (~350$ CAD, though price can differ depending on number of doses and insurance coverage) and receive it from their health care provider.

How do 'social scientists' study HPV vaccine decision-making?

Improving HPV vaccine uptake requires an understanding of vaccine decision-making. Many different, and often competing *factors* also known as *predictors*, *influences*, *correlates* or

determinants (used interchangeably throughout the dissertation) play a role in an individual's decision to vaccinate (or not) against HPV.

HPV vaccine decision-making was first studied in the earlier 2000's when public availability of an HPV vaccine was evolving. Researchers began asking questions about a 'hypothetical HPV vaccine' as there was a strong likelihood that it would soon become widely available (Brabin et al., 2006; Kahn, Rosenthal, Hamann, & Bernstein, 2003; Kahn et al., 2005; Mays & Zimet, 2004; Olshen, Woods, Austin, Luskin, & Bauchner, 2005; Riedesel et al., 2005; Waller, McCaffery, Forrest, & Wardle, 2004; Zimet et al., 2005; Zimet et al., 2000). Populations of interest studied included adolescents, physicians and nurses as well as parents of children and pre-adolescents as it was expected that they would be the ones entrusted with the decision to vaccinate their children against HPV. These studies are often classified as the pre-approval or pre-recommendation era as the HPV vaccine was not yet readily available.

Over the last decade, following the widespread approval of the HPV vaccines across the world, there has been a proliferation of studies attempting to identify factors associated with vaccination intentions and vaccination uptake often termed *HPV vaccine acceptability*. As a testament to the exponential growth of literature in this area, there are seventeen systematic reviews examining at the acceptability and uptake of HPV vaccination with emphasis typically on knowledge, attitudes, beliefs and behaviours in different populations (Brewer & Fazekas, 2007; Chan, Chan, Ng, & Wong, 2012; Cunningham, Davison, & Aronson, 2014; Ferrer, Trotter, Hickman, & Audrey, 2014; Garcini, Galvan, & Barnack-Tavlaris, 2012; Hendry, Lewis, Clements, Damery, & Wilkinson, 2013; Holman et al., 2014; Kasting, Shapiro, Rosberger, Kahn, & Zimet, 2016; Kessels et al., 2012; Klug, Hukelmann, & Blettner, 2008; Madhivanan et al., 2016; Nadarzynski, Smith, Richardson, Jones, & Llewellyn, 2014; Newman, Logie, Doukas, &

Asakura, 2013; Patel, Jeve, Sherman, & Moss, 2016; Prue et al., 2016b; Trim, Nagji, Elit, & Roy, 2012; Young, 2010). This includes the first systematic review in this area in 2007, with subsequent reviews following in diverse pulsations including females alone, male alone, both genders, parents as well as continent specific reviews in Asia and Africa. While the search strategy, eligibility criteria, and data synthesis methods differs across the reviews, by and large there are overlapping factors examined, most often knowledge, attitudes and beliefs, socio-demographics that influence HPV vaccination decision-making.

Challenges in understanding HPV vaccine decision-making

"Human behaviour flows from three main sources: desire, emotion and knowledge"

—Plato

Not unique to HPV vaccination, health decision-making is complex and difficult to study. There are a few issues that are specific to HPV vaccination, while others apply generally to studying health behaviours and are described in the context of the HPV vaccine psychosocial literature.

"What" is the behaviour we are studying?

One of the challenges with HPV vaccine acceptability research has been related to the "what" behaviour are we studying. The outcome variable can be classified in many different ways making comparisons across studies difficult. Many studies use the term HPV vaccine uptake or acceptability, but there is heterogeneity if the outcome is actual uptake of the HPV vaccine, vaccination intentions (i.e., planning or deciding to or not to vaccinate), and vaccination willingness. This is further complicated by how many doses e.g., partial or completion, which also depends on whether the vaccine was recommended for 2 or 3 doses at the time of data

collection. It is not uncommon for the word HPV acceptability to be synonymous with intentions, plans or willingness to vaccinate. Many of the earlier studies (~2008-2010) studied vaccination intentions or parents' willingness rather than actual vaccine uptake. And because of inconsistent or non-existent vaccine registries in most countries, we are forced to rely on self-report of vaccination status, which has inherent limitations.

"What" are the factors we are studying and how are we defining/measuring them?

"There is nothing so useful as a good theory"

——Lewin, 1995

A study by Sturm et al. (2005) was one of the first to present a theoretical framework specific to parents' HPV vaccination for how the different components (factors or constructs) relate and ultimately influence HPV vaccine decision-making. Sturm's model takes into account both personal or parental underlying beliefs, external factors including socio-demographics while also considering the broader landscape e.g., policy level mandates at the provincial regional and federal levels as well as the influence of health care provider (HCP). Most of these influences are "borrowed" from health behaviour theory.

In Sturm's conceptual model, she relied heavily on the Health Belief Model (HBM), one of the most widely used theories to explain and understand the correlates of health behaviours. The HBM posits that health behaviour is determined by ones's personal beliefs or perceptions about the disease and/or the associated behaviours available to decrease its occurrence (Hochbaum, 1958). The core components of the HBM are *perceived susceptibility*, *perceived severity*, *perceived barrier*s and *benefits* (to adapting the behaviour in question), *cues to action* and *self-efficacy* (Champion & Skinner, 2008; Janz & Becker, 1984; Skinner, Tiro, & Champion,

2015). The overarching premise of the HBM is that these factors in essence "combine" to influence health behaviour. The predictive validity or the utility of the HBM is described elsewhere (Champion & Skinner, 2008; Skinner et al., 2015), but a few general conclusions can be made. First, there is a substantial body of research supporting the prospective and retrospective utility and validity of the HBM. However, the magnitude of constructs has varied greatly, and at times differing constructs impact or effect has been deemed small. Moreover, numerous limitations and challenges have been described including differences between cross-sectional and retrospective designs and issues of measurement. All of these challenges and issues can be applied to the study of HPV vaccination decision-making (Skinner et al., 2015).

Another popular and widely used theory is the Theory of Reasoned Action (TRA), which was conceptualized by Fishbein and Ajzen (Ajzen & Fishbein, 1975; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 2010). The TRA asserts that *behavioural intentions* i.e., a person's readiness to perform a given behaviour is the most immediate antecedent of behaviour, which is determined by *attitudes* toward the behaviours, i.e., overall feeling that the behaviour is favorable or unfavorable as well as *social norms*, i.e., an individual's estimate of the social pressure to perform or not perform a behaviour (Ajzen & Driver, 1991; Ajzen & Fishbein, 1980). The Theory of Planned Behaviour (TPB) is an extension of the TRA, adding *perceived behavioural control*, i.e., the extent that an individual believes they are able to perform the behaviour to more accurately predict behavioural intention (Fishbein & Ajzen, 2010; Montano & Kasprzyk, 2015). The TPB posits that behavioural, normative, and control beliefs about a given behaviour shape attitude toward the behaviour, subjective norm, and perceived behavioural control, respectively, which influence behavioural intention, and subsequently, behaviour (Montano & Kasprzyk, 2015).

Both the HBM and TPB/TRA have been used to examine HPV vaccine acceptability. In facts, researchers have even compared the utility of the HBM and TPB in predicting college women's HPV vaccine uptake or intention in two independent studies; both studies concluded that the TPB outperformed the HBM based on amount of variance explained (Bennett, Buchanan & Adams, 2012; Gerend & Shepherd, 2012). The findings should be interpreted with caution due to differences in measurement and small number of studies.

Although both the HBM and TPB/TRA have been applied to study HPV vaccine-decision-making, it should be noted that as with every theory, both theories have some inherent limitations, which may reduce their predictive ability and utility to ultimately design interventions to increase HPV vaccine uptake. For example, the HBM does not take into account that an individual may perform a behaviour for non-health-related reasons, such as social acceptability (Janz & Becker, 1984). Also, both the original HBM and TPB/TRA do not take into account economic, political and environmental factors e.g., socio-demographics (which may be beyond an individual's control) that impact health behaviour.

While the HBM and TRA/TPB can be viewed as two of the most widely used health behaviour theories, and are likely the two theories that have been applied most when studying HPV vaccine decision-making, there are now a wide variety of additional theories or frameworks (both from the health, social/behavioural sciences) that can be used to study health behaviour change. Other commonly used theories include the Transtheoretical model of change (TTM), social cognitive theory, the culture-centric narrative theory, the Reasoned Action Approach (RAA) and the Precaution Adoption Process Model (PAPM) (Glanz et al., 2008; Glanz, Rimer, & Viswanath, 2015). While the constructs and variables may differ and/or often overlap between

the differing theories, the underlying principle is that there are certain key concepts that influence health behaviour change.

Health behaviours theories are generally concerned with underlying beliefs and attitudes. However, we cannot ignore that there are other additional factors or constructs (e.g., at the organizational and policy level) beyond attitudinal factors, which influence health behaviour (Betsch, Bohm, & Chapman, 2015; Ferrer et al., 2014; Sturm et al., 2005). These factors include socio-demographics, knowledge, previous health practices, media exposure, larger societal norms (e.g., policy recommendations). While some have argued that these factors play a proximal role first on the underlying beliefs and attitudes, and thus a distal role on the actual behaviour, this notion has yet to be substantiated (Glanz et al., 2008; Glanz et al., 2015). As such, these factors are potentially equally important in HPV vaccine decision-making.

The Precaution Adoption Process Model (PAPM)

A sound theory is critical to support our research, to ensure clear conceptualization of health behaviour change constructs, generalization of results, and ultimately the development of effective interventions. The PAPM is the underpinning theoretical framework that we have chosen to frame our outcome (Weinstein, 1988; Weinstein & Sandman, 1992). Unlike most health behaviour and motivational theories (e.g. HBM, TPB), which are typically used to predict only intentions (Fisher, 2012) or the likelihood of behaviour, the PAPM allows for the possibility of a series of explanatory equations for both individual stages, and more importantly, for stage transitions. In this way, the PAPM views HPV decision-making as a set of unique, distinct stages.

The PAPM has been applied to many types of health behaviours, including osteoporosis prevention (Blalock, 2005; Blalock, 2007; Glanz & Rimer, 2005; Sharp & Thombs, 2003),

cancer screening (Clemow et al., 2000; Costanza et al., 2005), hepatitis B vaccination (Hammer, 1997), home radon testing (Weinstein, Lyon, Sandman, & Cuite, 1998; Weinstein & Sandman, 1992; Weinstein, Sandman, & Roberts, 1991), smoking cessation (Borrelli et al., 2002) and numerous other health behaviours (Glanz et al., 2008). The PAPM consists of seven distinct stages of decision-making: 1) unaware (of the health threat/precaution); 2) unengaged; 3) undecided; 4) decided not to act; 5) decided to act (intending); 6) acting; and 7) maintenance. We chose the PAPM as the theoretical framework for the present work for a number of reasons:

1. A major advantage of the PAPM is that Stage 1, unaware, is particularly important and often neglected in other theories. At the time of study conceptualization, eighty percent of U.S. parents of unvaccinated sons reported being unaware that the vaccine can be given to males (Reiter, McRee, Gottlieb, & Brewer, 2010). The unaware stage allows us to capture parents who are unaware, and who are often conflated with parents are already engaged in the decision-making process.
2. Some Canadian parents while aware of the new HPV vaccine recommendations, may not yet have begun to consider this decision (Stage 2-unengaged). Research affirms that the stage of awareness without personal engagement is quite common. The distinction between those who are unengaged versus those who are undecided (Stage 3-undecided) may be an important one, as individuals who are undecided may be different than those who are still quite unengaged from adopting the behaviour.
3. The distinction between Stage 5 (decided to act) and Stage 6 (acted) is clearly captured in the PAPM. This distinction is not part of most health behaviour change models. As mentioned, the HPV literature thus far has often examined individuals with intentions to vaccinate. Intentions are often conceptualized as the precursors to action (Glanz & Rimer,

2005). However, intentions to engage in health behaviours may not directly translate into action (Gollwitzer & Sheeran, 2006; Webb & Sheeran, 2006). A growing body of research, including the TPB (Ajzen & Fishbein, 1975; Ajzen & Fishbein, 1980), supports the differences between these two intentions and uptake. Much work has explored the concept of 'implementation intentions', i.e., that having certain implementations or a concrete plans can help facilitate the acting (Gollwitzer, 1999; Gollwitzer & Sheeran, 2006). With the lack of a publicly funded school programs, and the barrier of cost involved in adopting this behaviour, examining if parents do in fact transition from Stage 5 to Stage 6 is critical.

4. Some parents will fall in Stage 4 (decided to not act). Research shows that they can be quite well informed, but their beliefs and attitudes have led them to decide not to act (Dubé et al., 2016a; Gilbert, Gilmour, Dubé, Wilson, & Laroche, 2016; Roberts et al., 2015). Previous work in our research lab showed that Quebec parents of eligible daughters in the context of a universal school program showed that 12% of parents chose to not vaccinate their daughters (Krawczyk et al., 2015a; Krawczyk et al., 2015b). This group may be reflective of general anti-vaccine types, but are an equally important sub-population to study.
5. The PAPM maps most readily onto single, concrete and specified health behaviours that are dichotomous, or single point decisions (yes/no), making it fitting for HPV vaccination.
6. There is evidence from the HPV vaccination literature that supports the use of a stage model (Allen et al., 2009; Allen et al., 2010b). The PAPM suggests that practical concerns (e.g. cost, time) and access mediates the transition from 'deciding to act' to 'acting'. Similarly, Liau et al. (2012) found that the effectiveness of health beliefs in explaining HPV vaccination behaviour is moderated by vaccine cost (Liau, Stupiansky, Rosenthal, & Zimet, 2012) At low cost, a greater proportion of the variance in vaccination behaviour is explained

by health belief variables. At high cost, health beliefs account for little or no variance. Additionally, Gerend et al. (2013) found that perceived barriers vary as function of women's vaccination intentions and that tailoring information to the barriers reported improves intentions. Thus, in the present context where no universal, free HPV vaccination program exists, cost is likely to be an important barrier in moving parents from deciding to vaccinate to actual uptake, and positive intentions may not accurately reflect achievable uptake (or acting).

While the PAPM was selected to help define a more nuanced outcome than intentions, uptake or acceptability alone, there were several other theories of health behaviour change that guided the understanding and conceptualization of the predictor variables and the study. This included constructs from the HBM, TRA and social cognitive theory, as constructs from multiple theoretical frameworks have been salient predictors of HPV vaccine decision-making, and constructs in each theory are not mutually exclusive and are often broadly defined (Glanz et al., 2008). Taken together, these health behaviour theories provide a useful conceptual framework for identifying key attitudinal, behavioural, cognitive, social, cultural and logistical determinants (referred to as psychosocial) that shape HPV vaccine decision-making.

The operationalization of constructs

A systematic review of measures used in HPV vaccine acceptability highlighted the need for standardized theoretical and operational definitions of constructs (Allen et al., 2010a). With few exceptions, such as Carolina HPV Immunization Attitudes Scales (CHIAS), Waller et al's HPV and HPV vaccine knowledge scale and Gilkey's Vaccination Confidence scale (Gilkey et al., 2014b; Gowda et al., 2012; McRee, Brewer, Reiter, Gottlieb, & Smith, 2010; Waller, Ostini, Marlow, McCaffery, & Zimet, 2013), few scales in this area have been extensively

psychometrically evaluated. The recommendations from the review of measurements called for 1) utilizing theory to guide construct definitions, 2) Employing cognitive testing, 3) review of measures by panels of experts and pilot-testing of items, 4) Measuring intention and actual behaviour and 5) Development of constructs take into account language and literacy levels (Allen et al., 2010a). Consequently, many studies findings can be questioned due to their measurement tools.

At the time of study design, one of the challenges with the research in HPV vaccine acceptability was the lack of theoretical health behaviour models or frameworks to guide the research as well as the absence of operationalized and validated scales to define the factors known to influence decision-making (Allen et al., 2010a; Brewer & Fazekas, 2007; Fernández, Allen, Mistry, & Kahn, 2010). Even when theory is applied, the theoretical constructs that comprise the majority of health theories are broadly defined. Also, most theories do not stipulate how they define the constructs (e.g., what attitudes exactly are we referring to) and how constructs interact, there are no common which makes it quite difficult to compare results across studies (Glanz et al., 2008; Skinner et al., 2015). Most psychosocial HPV vaccine studies typically classify parents into two e.g., intending to vaccinate or vaccinated. This treats decision-making as binary rather than a continuum or a trajectory of stages. The conclusions regarding the factors known to influence could then be questioned, as perhaps those individuals who are classified in the intentions group often do not constitute of individuals who truly intend to vaccinate their child. Lastly, the vast majority of studies in this area typically report basic descriptive results, most often using frequencies to understand what influences parents' HPV vaccine decision-making. This restricts our understanding of the relationships and the inferences that can be made. Taken together, these limitations have led to inconsistent and variable findings

from study to study, and there is presently insufficient evidence to confidently know what are the important factors involved in parents' HPV vaccine decision-making. Addressing these research gaps would allow us to better understand which specific factors should be targeted in order to increase HPV vaccine uptake.

The content of the dissertation

In response to the approval and recommendation of HPV vaccination for males, the complexity of the variety of psychosocial factors that influence this process, the present thesis addresses the challenge to understanding the psychosocial predictors that influence parents' HPV vaccine decision-making for their sons. Using health behaviour theories, the four articles in this doctoral dissertation build upon previous empirical evidence about our understanding of constructs that influence HPV vaccination decision-making, and extends the literature by establishing better measurement tools to assess these psychosocial constructs as well as contemporary analytic methods to describe the relationships between psychosocial predictors on HPV vaccination decision-making.

Manuscript 1 presents a comprehensive description of the research objectives and study methodology, including an overview of the study design, an explanation about the development and creation the study's questionnaire instrument, the use of theory, and a detailed description of the sample characteristics. Preliminary descriptive results are also presented.

Manuscript 2 presents the rationale and the psychometric development and validation of an existing HPV and HPV vaccine knowledge scale in order to better measure and assess the psychosocial predictors of General HPV and HPV vaccine knowledge.

Manuscript 3 presents the rationale and the psychometric development and testing of a novel HPV Attitudes and Beliefs scale (HABS) in order to better measure, defines and assess the psychosocial predictors of vaccination attitudes and beliefs.

Manuscript 4 examines the relationship between HPV knowledge, HPV attitudes and beliefs, as we all as a broad number of factors and PAPM stages. The article focuses on the establishing and interpretation of the association between a broad number of psychosocial predictors of parents' HPV vaccination decision-making stages. The associations were measured at two points in time as defined by the theoretical framework of the PAPM, using multinomial logistic regression models.

Manuscript 1

Psychosocial determinants of parental human papillomavirus (HPV) vaccine decision-making for sons: Methodological challenges and initial results of a pan-Canadian longitudinal study

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Abstract

Background. HPV vaccination decision-making is a complex process that is influenced by multiple psychosocial determinants. Given the change in policy recommendation to include males in routine HPV vaccination, our goals were to assess the HPV vaccination uptake in Canada, to understand *where* Canadian parents were situated in the HPV vaccine decision-making process for their son, *how* they changed over time and *which* psychosocial determinants were relevant for this process.

Methods. We used an online survey methodology and collected data from a nationally representative sample of Canadian parents of boys aged 9-16 at baseline (T1, February 2014) and at 9 months' follow-up (T2). Our analyses were guided by the Precaution Adoption Process Model (PAPM), a theoretical health behaviour model that classifies parents in one of six stages: unaware, unengaged, undecided, decided not to vaccinate, decided to vaccinate and those who had already vaccinated their sons. Rigorous methods were used to filter out careless responders: response variance, bogus items, psychometric antonyms and psychometric synonyms.

Results. At T1 and T2 we received 3,784 and 1,608 respectively completed questionnaires; after data cleaning 3,117 (T1) and 1,427 (T2) were retained. Less than 3% of boys were vaccinated at both time points. At both T1 and T2, most parents (over 70%) belonged to the earlier vaccination adoption stages: 57% were unaware (T1) and 15.3% (T2); 20.9% were unengaged (T1) and 32.4% (T2); and 9.1% were undecided (T1) and 25.2% (T2). At follow-up, 37.7% of participants did not move from their initial PAPM decision-making stage. Most parents (55%) preferred to receive information from their healthcare provider (HCP) but only 6% (T1) and 12% (T2) had actually spoken with a HCP about the HPV vaccine for their son.

Conclusions. HPV vaccination uptake in Canadian boys was very low in the absence of a publicly funded HPV vaccination programs for boys. Optimal HPV information preferences were identified and can be used in interventions to increase HPV knowledge and increase HPV vaccine uptake. Intentions to vaccinate or planning to speak to one's HCP did not translate into action for most parents over the 9-month follow up; this finding is critical to consider to inform implementation strategies. Methodological challenges are described and suggestions for future research are offered.

Keywords: Human papillomavirus, Cancer Prevention, Vaccination, Determinants of health, Health decision-making, Health behaviour, Precaution Adoption Process Model, Parents, Boys, Knowledge, Attitudes, Beliefs

Introduction

The prevention of human papillomavirus (HPV)-associated diseases is an increasingly prominent public health issue. HPV is the most common sexually transmitted infection (STI) and accounts for 4.8% of the worldwide cancer burden (Chaturvedi, 2010; Public Health Agency of Canada, 2012). HPV has been traditionally viewed as an infection that impacts females (Forman et al., 2012; Vardas et al., 2011), even though it poses a significant disease burden for males. Current data suggests that 100% of cervical, 88% of anal, 70% of vaginal, 50% of penile, 43% of vulvar and 13-56% of oropharyngeal cancers are attributable to HPV (Forman et al., 2012). Like females, males are at risk also for contracting HPV-associated genital warts (GW), which can negatively impact quality of life (Forman et al., 2012).

The quadrivalent vaccine, Gardasil® (Merck) protects against four strains of HPV: two oncogenic strains (HPV 16, 18) , and two that cause GW (HPV 6 and 11) (Stillo, Carrillo, & Lopalco, 2015). Epidemiological studies from Australia, Canada, UK and the US demonstrate population level reductions in the rates of HPV, GW, and cervical cancer lesions after introduction of HPV vaccine programs for girls (Ali et al., 2013; Brotherton et al., 2011; Fairley et al., 2009; Howell-Jones et al., 2013; Markowitz et al., 2013; Ogilvie et al., 2015). With strong empirical evidence for both vaccine safety and efficacy (Stillo et al., 2015), the HPV vaccine is an important innovation in cancer prevention (Garland et al., 2016; Ogilvie et al., 2015).

In 2007, in Canada, the HPV vaccine (Gardasil®) was recommended for females and subsequently rolled out for females only in school-based immunization programs (Dawar et al., 2007). As the research evidence grew, demonstrating the burden of HPV-associated diseases in males, many argued for vaccination of males (Shapiro et al., 2016b). Inclusion of males in HPV immunization programs grew further because: 1) HPV vaccine uptake rates among females are

failing to reach sufficient levels (of at least 70%) to confer herd immunity to heterosexual males, 2) female-only programs do not offer protection to men having sex with men (MSM); and 3) a gender specific vaccine raises issues of equity (Brisson et al., 2011; Burchett, Mounier-Jack, Griffiths, & Mills, 2012; Graham et al., 2015; Olsen & Jorgensen, 2015; Pearson et al., 2014; Shapiro, Guichon, Perez, & Rosberger, 2015; Shapiro et al., 2016b; Stanley, 2014; Zimet & Rosenthal, 2010).

Presently, all Canadian provinces and territories offer free, school-based HPV vaccination programs for females. Canada's National Advisory Committee on Immunization (NACI, 2012 and 2015) recommends HPV vaccine for females and males aged 9-26 (Public Health Agency of Canada, 2012); this recommendation is consistent with that of other nations (e.g., US (Centers for Disease Control and Prevention, 2011), Australia (Australian Government Department of Health, 2015) and some of the European Union, e.g. Germany (Saxony), Italy (Emilia-Romagna, Sicily) (European Centre For Disease Prevention and Control, 2012; Prue, 2016). In February 2013, Australia was the first country to extend national vaccination programs for boys. In Canada, the HPV vaccination program for males has unfolded as follows. In September 2013, Prince Edward Island (PEI) began including boys in grade 6 in their school-based HPV vaccination programs. Alberta and Nova Scotia subsequently followed in September 2014 for grade 5 boys and in autumn 2015 for grade 7 boys respectively. In September 2015, British Columbia (BC) began offering the HPV vaccine without cost for "at risk" males e.g., MSM and 'street-involved' youth (BC Gov News, 2015). Similarly, as of January 2016, Quebec offers the HPV vaccine without cost to MSM aged 9-26. Beginning in September 2016, Ontario, Quebec and Manitoba will include boys in their school-based programs (grades 7, 4 and 6, respectively) (Ministry of Health and Long-Term Care Ontario, 2016; Shapiro et al., 2016b). In

contrast with the female programs, only Alberta and Ontario offer catch-up programs for older boys. When this research study was developed (2012), no HPV vaccinations programs for males existed in Canada or elsewhere in the world.

The examination of the attitudinal, behavioural, cognitive, social, cultural and logistical determinants (hereafter referred to as psychosocial) that influence the HPV-vaccine decision-making is a growing area of research (Allen et al., 2010a; Bartlett & Peterson, 2011; Brewer & Fazekas, 2007; Gamble, Klosky, Parra, & Randolph, 2010; Kessels et al., 2012; Klug et al., 2008; Liddon, Hood, Wynn, & Markowitz, 2010; Zimet, Liddon, Rosenthal, Lazcano-Ponce, & Allen, 2006). Because HPV was traditionally considered an infection that affects females only, the vast majority of behavioural research has been conducted among samples of females or parents of daughters (Brewer & Fazekas, 2007; Trim et al., 2012). To the best of our knowledge, there are very few studies examining HPV vaccine decision-making that were conducted exclusively among parents of boys (Liddon et al., 2010; Trim et al., 2012). In the Canadian context, only two studies outside the present one examine the psychosocial decision-making process among Canadian parents of sons; both studies were conducted before the HPV vaccine was recommended for males and therefore the outcome variable reflects *intentions* to vaccinate rather than *actual* vaccination uptake (Gainforth, Cao, & Latimer-Cheung, 2012; Ogilvie et al., 2008).

Further, experts in HPV vaccine behavioural research recommend using theoretical health behaviour frameworks to better understand the psychosocial determinants that influence an individual's vaccine decision-making process (Allen et al., 2010b; Garcini et al., 2012; Zimet et al., 2006). Many studies that examine the correlates of HPV vaccine decision-making utilize the Health Belief Model (HBM) (Brewer & Fazekas, 2007; Cunningham et al., 2014). The linear

HBM attempts to understand better HPV vaccine decision-making by focusing on attitudes and beliefs about the costs and benefits of HPV vaccination that are relevant *only* to people who have been engaged (or are presumed to be engaged) sufficiently by the HPV vaccination to have formed such beliefs (Champion & Skinner, 2008). As such, most existing studies examine the psychosocial determinants that predict vaccination intentions and/or uptake are for a group of individuals who are assumed to be already aware and engaged in HPV vaccination (Brewer & Fazekas, 2007; Cunningham et al., 2014; Trim et al., 2012). Since this group does not include everyone—and with respect to HPV vaccination likely captures *few* parents because HPV vaccination for males is relatively new and many parents may not yet have formed their beliefs—there are likely other stages in adopting HPV vaccination. The Precaution Adoption Process Model (PAPM) is a categorical stage theory, which aims to identify *all* the stages involved when people commence health-protective behaviours. The PAPM is therefore appropriate to apply to parental decision-making about HPV vaccination to determine the psychosocial determinates that lead parents to move from one stage to the next, and ultimately to vaccinate their child (Weinstein, Sandman, & Blalock, 2008).

The PAPM consists of *six* distinct stages of health decision-making: 1) *unaware* of the health behaviour); 2) *unengaged* in the decision; 3) *undecided*; 4) *decided not to* act; 5) decided to act (intending); and 6) acting (vaccinated). As opposed to linear models, the PAPM staged model acknowledges the fact that transition between stages can be explained by different psychosocial determinants, i.e. there are differences between determinants which influence the transition from stage 1 to 2 compared to the determinants which influence the transition from stage 5 to 6.

Using a longitudinal design and online survey methodology guided by the PAPM, we surveyed a national sample of Canadian parents of boys to understand *where* Canadian parents currently stand in the HPV vaccine decision-making process for their son and w*hich* psychosocial determinants influence their HPV vaccination decision-making process. Importantly, the present study was conducted just before several Canadian provinces began to include males in their school-based public vaccination program. This created a unique opportunity to provide baseline data about HPV vaccine uptake in the absence of publicly funded programs, and to evaluate the impact of recent recommendations of male HPV vaccination.

The study objectives were:

1. To provide an estimate of HPV vaccine uptake among males in Canada;
2. To classify *where* Canadian parents' stand in the HPV vaccine decision-making process for their son(s) using the PAPM, at baseline (Time 1, T1) and at follow-up 9 months later (Time 2, T2);
3. To describe *how* Canadian parents' changed in their HPV vaccine decision-making process from T1 to follow-up (T2); and
4. To describe and analyze *which* psychosocial determinants influence parents' HPV vaccine decision-making process i.e., PAPM stage

This research article will present a comprehensive description of the study methodology, sample characteristics as well as the results for objectives 1-3. Descriptive result for objective four, specifically for the following psychosocial determinants: HPV and HPV vaccine Knowledge, HPV vaccination information sources, health behaviours (i.e., primary decision-maker, routine check-ups with a healthcare provider (HCP), and childhood immunization practices) and implementation intentions will be presented. A more comprehensive statistical

analysis of the psychosocial determinants of PAPM stages over time i.e., objective 4, is under way.

Methods

Recruitment

The population of interest was Canadian parents and/or guardians (hereafter referred to as parents) of 9-16 year-old boys. We selected this population because it covers the current NACI HPV vaccine recommendation for males aged 9-26, and because after the age of 16, virtually all Canadian minors may make a vaccination choice without parental consent (Court of Appeal of Alberta, 1986; Judgements of the Supreme Court of Canada, 2009). Data collection was facilitated by Leger, a polling and market research firm that maintains a national panel of 400,000 Canadians across the 10 provinces. The first wave of data collection occurred between February 7 and 25, 2014. E-mail invitations to complete a ~20-minute online questionnaire were sent to 29,867 panelists who met the study's inclusion criteria (i.e., those who had a 9-16-year-old son living in their household) according to data Leger maintains on their panelists. These invitations were followed by 16,004 reminder emails (between 1-3 emails per participant). The second wave of data collection occurred between October 27 and November 19, 2014. E-mail invitations were sent to 3,135 participants who were eligible from T1 to participate at T2. These invitations were followed by 8,341 reminder emails were (between 1-5 emails). At the time of data collection, HPV vaccination for males in Canada was just commencing; PEI had initiated a school-based HPV vaccination program for boys five months before (~Sept 2013) our T1 data collection, while Alberta followed one month ahead of (~Sept 2014) our T2 data collection. See Figure 1 for a detailed schematic of study participants following study recruitment and data cleaning.

Procedure

Prior to beginning the questionnaire, participants were asked first if they prefer to answer the questionnaire in English or French and were provided the questionnaire in the language of preference. Participants were also asked to agree to answer the questions truthfully and thoughtfully or were excluded from completing the study. Participants were also asked at the beginning of the questionnaire to provide a name, nickname, initials or abbreviations for their son who is between the ages of 9 and 16 and who has had the nearest birthday. Using intelligent programming, the provided sons' initials, name or nickname (e.g., *Dan*) was then replaced for *my son* in most items, making the questionnaire individualized for each participant. In this way, participants were asked about their beliefs and attitudes relative to one specific son. Participants were informed that their son's name will not be used in any other way by the researchers. Participants were required to complete every item, obviating the problem of missing data. For 16 sensitive questions, "I prefer not to answer" was a response option provided. In order to further ensure recollection of answering the questionnaire at T1, participants were asked at T2 "Do you remember completing the survey related to the HPV vaccine about *my son*?" Participants who indicated no recollection were not invited to participate at T2. Respondents were compensated 3$ per completed questionnaire at both T1 and T2.

Measures

Questionnaire Development

A 2010 systematic review of measures used in HPV vaccine acceptability research called for standardized theoretical and operational definitions of constructs (Allen et al., 2010a). This recommendation included: 1) utilizing theory to guide construct definitions (Krawczyk et al., 2012; Ogilvie et al., 2010); 2) employing cognitive testing (Richman et al., 2012); 3) reviewing

measures by panels of experts (Constantine & Jerman, 2007; Krawczyk et al., 2012; Ogilvie et al., 2010; Ogilvie et al., 2008); 4) measuring intentions and actual behaviour through clear definitions (e.g., asking about compliance to recommended number of doses) (Krieger, Kam, Katz, & Roberto, 2011); and, 5) development of constructs to take into account language and literacy levels (Ogilvie et al., 2010; Richman et al., 2012; Wong et al., 2011). Our questionnaire development adhered to all five recommendations, including a 'think aloud' pilot testing of the questionnaire with 20 parents of 9-16-year-old boys (see Appendix A for ethics approval). The questionnaire was developed, reviewed and approved by a bilingual panel of seven experienced HPV researchers.

The English questionnaire was translated into French by a specialized translation firm and reviewed for accuracy by an independent bilingual group of professionals (n = 5) working in the healthcare field. The questionnaires were virtually identical at T1 and T2 except for minor differences (e.g., demographic items were removed at T2; items related to conspiracy beliefs were added at T2). The complete questionnaire contained 165 items at T1 and 191 items at T2, and is available by contacting the corresponding author. A summary of the questionnaire constructs, sample items and response options are provided in Appendix C.

Socio-demographics (12 items)

The first 12 items were standard socio-demographic variables (e.g., province, education, religion) selected from Statistics Canada 2011 Census questionnaire. We compared our sample to data the authors requested from Statistics Canada's National Household Survey (2011) of participants who met our inclusion criteria i.e., parents of 9-16-year-old sons (n = 2,336,115) residing in the 10 Canadian provinces in order to assure the generalizability of our results to the entire Canadian population. First, chi-square tests were performed to examine if there were any

significant differences in socio-demographics between our T1 and T2 samples. Next, chi-square tests were performed to examine if there were any significant differences in socio-demographics between T1 and Statistics Canada's sample (see Table 1). Because statistical significant differences ($p < 0.05$) in proportions do not indicate the size of the difference, we further calculated Cohen's *h* (Cohen, 1988) (see Table 1). Consistent with Cohen's recommendations, we interpreted $h \leq 0.2$ as small, $h = 0.5$ as medium and $h \geq 0.8$ as a large difference (Cohen, 1988).

PAPM Stage (1 item)

The primary outcome variable in our study was parents' self-reported HPV vaccine decision-making stage, i.e., PAPM stage. Parents were asked: "Before today, which of the following best describes your thoughts about the HPV vaccine concerning my son?" Six response options were provided which allowed us to classify parents according to six distinct categorical stages of HPV vaccine decision-making (see Appendix C). Of note, after assessing socio-demographics and HPV and HPV vaccine knowledge and just prior to assessing the outcome variable i.e., PAPM stage, participants were provided with a brief informative statement about HPV and the HPV vaccine in order to ensure that they had some basic awareness as to what HPV and the HPV vaccine was.

Psychosocial Determinants

HPV and HPV Vaccine Knowledge Items (36 items)

There is mixed evidence for the relationship between HPV-general and HPV-vaccine knowledge and parents' HPV vaccination intentions/uptake for their child (Allen et al., 2010b; Brewer et al., 2011; Gerend, Weibley, & Bland, 2009). In order to assess what parents know about HPV and the HPV vaccine, we utilized Waller and colleagues existing psychometrically-

tested, validated 16-item HPV and 7-item HPV vaccine scales (Waller et al., 2013). We added 9 general HPV knowledge items and 4 HPV-vaccination specific items that were missing from the scale (e.g., items assessing about whether parents know about the link between HPV and other HPV-associated cancers beyond cervical cancer), (see Appendix C). Items answered correctly were assigned 1 point while incorrect and "don't know" were assigned 0 points to generate a total HPV-general and HPV vaccine knowledge scores.

Attitudes and beliefs (61 Items)

HPV-specific vaccination attitudes and general vaccine beliefs has been associated with parental vaccination intentions and uptake (Chow et al., 2010; Trim et al., 2012). The authors generated a list of 200 potential attitudinal items found after reviewing the psychosocial HPV vaccine literature and selected items based on constructs derived from different theoretical models of health behaviour, including the HBM and the Theory of Reasoned Action) (Montano & Kasprzyk, 2015). For each attitude and belief item, a 7-point Likert response format with 1 = Strongly Disagree, 4 = Neutral and 7 = Strongly Agree was used (see Appendix C).

Information Sources (6 items), Health Behaviours (6 items), Implementation Intentions (3 items) and other items

Participants were asked about the sources where they actually heard about the HPV vaccine and the sources they would prefer receiving information about the HPV vaccine. They were also asked if, and what type of recommendation (for, against, neutral, or neither) they received from a HCP for their son concerning the HPV vaccine. Self-reported health behaviours were also assessed e.g., whether their son has attended a routine medical check-up in the past year, acceptance of all the recommended childhood vaccines. Parents were asked who the primary health decision-maker was for their son (e.g., mother, father or joint).

Lastly, parents were also asked about behaviours they intended to complete at T1 (e.g., contact an HCP, search the internet), and at T2, using the computer-adaptive testing, we re-assessed if the specified behaviours they indicated at T1 were indeed carried out by T2. Other additional items include: if the participant have any daughters and/or any vaccinated daughters (2 items); parent's health behaviours (3 items) communication about sex/HPV vaccination (7 items); degree of parental/son involvement in HPV vaccine decision-making (3 items), willingness to vaccinate at different price points (4 items); vaccine conspiracy beliefs (9 items)(Shapiro, Holding, Perez, Amsel, & Rosberger, 2016a); right wing authoritarianism (7 items); beliefs about other parents who do not vaccinate their child (2 items) and the Conspiracy Mentality Questionnaire (5 items) (Bruder, Haffke, Neave, Nouripanah, & Imhoff, 2013) are found in the Appendix C.

Data cleaning

Addressing careless/unmotivated responders

Once data collection was completed, we sought to ensure the highest level of data quality and integrity of our conclusions. We used four data cleaning methods to identify participants who might not have used appropriate care while completing the questionnaire i.e., careless or unmotivated responders (Meade & Craig, 2012). The four methods employed were: variance, bogus items, psychometric antonyms and psychometric synonyms (Meade & Craig, 2012). For the variance criterion, we examined 64 items (some reverse coded) dispersed across 7 separate web pages in our online questionnaire. There were 13, 9, 7, 11, 8, 10 and 6 items across the 7 different web pages. We flagged participants who had 0 variance across the items on more than 4 of the 7 pages.

For the validity criterion, we used three bogus items from Weinberger and colleagues (Weinberger, 1987): "I have never met anyone younger than I am"; "Everyone makes mistakes at least once in a while", and "I am answering these questions truthfully" with response options ranging from 1 = "strongly disagree" to 7 = "strongly agree", where 4 = "neutral". We reverse coded the first item and created a total validity score for the three items. We removed participants who scored 12 or below, then, re-introduced any participant who answered "neutral" to all three items. The rationale for this cut-off was that we sought to identify participants who scored below "neutral" (somewhat disagree, disagree and strongly disagree) given that the correct answer to these items was to "agree" with them (note that the opposite is true for the one reverse coded item.) We chose to re-introduce any participant who answered "neutral" to all three items as these items are available for subjective interpretation and those who were systematically answering "neutral" to *all* items would be removed by the variance method. Another method used was psychometric synonyms and antonyms (Johnson, 2005; Meade & Craig, 2012), which are consistency indices that help to eliminate bias by examining differences in items that are highly similar or opposing in content. We examined any questionnaire item that had a 7-point Likert response option. Post hoc, we standardized all relevant items into *z* scores and correlated all items. We identified the 30 most positively and 30 most negatively correlated items. We recoded these items to create pairs of synonyms and then calculated the correlation between synonyms and antonyms for each participant, which established a synonym index and an antonym index for each participant. We then flagged all values less than -2 standard deviations (*SD*) on the synonyms index and greater than +2 *SD* on the antonyms index as these correlations could be seen as extreme outliers.

These four methods identified that 15% of our sample at T1 (n = 575) and 5% of our sample (n = 202) at T2 belonged to a latent class that can be considered careless or unmotivated in their responses, a percentage nearly identical to findings by other research groups (Kurtz & Parrish, 2001; Meade & Craig, 2012). Data collected from these participants were removed from our final sample (see Figure 1).

Self-report of son's vaccination status

Following T1 data collection, we inspected the data from our primary outcome variable, PAPM stage. The authors observed that some participants' responses were implausible, nonsensical or inaccurate. We speculated that perhaps parents may have confused the HPV vaccine with other childhood vaccinations, and therefore some participants likely did not match the profile of a participant who had truly vaccinated his or her son against HPV. For example, some participants indicated that their son had been vaccinated in school, even though they lived in provinces where indeed no school-based programs for boys yet existed. This challenge of self-report (i.e., subjective) vaccination as opposed to objective (e.g., vaccination booklet with official stamps or electronic vaccination registries) has been reported in the literature (Miles, Ryman, Dietz, Zell, & Luman, 2013; Stupiansky, Zimet, Cummings, Fortenberry, & Shew, 2012b).

During data cleaning at T1, the authors therefore established a first method of examining a set of 10 criteria to increase the likelihood that parents who had indicated that they had vaccinated their son were not false positives. Furthermore, in order to improve upon the accuracy of parents' self-reported vaccination status, at T2, we prompted those who selected PAPM stage 6 (i.e., vaccination) with a brief informative statement about the Canadian HPV vaccine policy (e.g., we informed participants that except for PEI, parents have to pay/purchase the HPV

vaccine) and then asked the PAPM stage item a second time to ensure that their PAPM stage was as accurate as possible.

At T2, two additional issues arose. The first issue was impossible PAPM stage transitions. From both a theoretical and practical perspective, it is impossible for someone to report being in stages 2-6 at T1, and then to report being in stage 1 at T2. For such a report to be true, the participant would need to have become *unaware*, after having previously been *aware* that the HPV vaccine could be administered to males. The second issue was the impossibility of someone moving from reporting that their son had been *vaccinated* (Stage 6) at T1, to then reporting any other stage at T2 (i.e. implying that their son is no longer vaccinated). In total, using the aforementioned three methods, 92 participants were removed from the final sample due to likely inaccurate or implausible vaccination stage (see Figure 1). Statistical analysis was conducted using SPSS v23 and R v3.2.2.

Results

The mean time to complete the questionnaire was 21 minutes at T1 and 24 minutes at T2.

Participants and socio-demographics

The final cohort consisted of 3,117 participants at T1 and 1,427 at T2, representing a 45% attrition rate (see Figure 1 for recruitment overview). The response rate, calculated based on completion by participants who initiated the questionnaire (n = 5765 at T1 and n = 2000 at T2), was 65.6% at T1 and 80.4% at T2. The sample's socio-demographic characteristics are presented in Table 1.

When comparing the T1 and T2 samples, the samples were found to be similar as there were no significant differences on all socio-demographic variables except for two provinces and language (see Table 1). We had significantly more respondents from Quebec and fewer

respondents from Saskatchewan at T2 compared to T1 but the difference was small ($h \leq 0.2$). We also had fewer English respondents and more French respondents at T2 compared to T1, and the difference was small as well ($h \leq 0.2$).

A comparison of the T1 and Statistics Canada samples revealed that there were statistically significant differences for the proportions of responses between the two samples for all provinces (except Alberta, Manitoba and Saskatchewan), language (except bilinguals), gender, education, marital status, employment status, income (except those earning between $40 000 and $59 999 and those earning between $60 000 and $79 999), nationality, ethnicity and religion (see Table 1). An examination of the effect size indicates that the effect size was small for 14 differences and medium for 18 differences (see Table 1). In no case, was the effect size large (see Table 1).

PAPM Stages

The number and percentage of parents across the six PAPM stages is presented in Table 2. The HPV vaccination uptake of Canadian males 9-16 years old was very low, with only 34 and 39 parents reporting that their sons were vaccinated at T1 and T2, which represents an HPV vaccine uptake rate of 1.1% at T1 and 2.7% at T2. Of the few parents who indicated that they had vaccinated their son, 47% received one dose at T1 and 56% at T2 ($p > 0.05$). Two or three doses were reportedly received by 53% of sons at T1 and 44% at T2 ($\chi^2 = 0.32$, CI: -0.34; 0.16, $p > 0.05$).

While there was a free school-based program in place for boys in Grade 6 in PEI, our results still show that 19 parents from PEI were unaware, unengaged or undecided. At T2, there was a program in place for boys in Grade 5 in Alberta, and our results indicate that 85 parents were unaware, unengaged or undecided from these two provinces. Moreover, at T1, only 1

parent from the 34 (2.9%) who reported their son was vaccinated were from provinces offering free HPV vaccination for boys (PEI) and at T2, 11 from the 39 (28.2%) were parents of vaccinated sons who were from provinces that were vaccinating boys against HPV as part of the provincial immunization schedule (PEI and Alberta).

HPV and HPV Vaccine Knowledge

We validated and extended Waller et al.'s existing knowledge scales and create a 25-item HPV general knowledge scale and the 11-item HPV vaccine knowledge scale, which were found to be psychometrically robust (Perez et al., 2016b).

The mean scores for HPV knowledge were 11.67 (from 25 possible points) at T1 and 14.02 at T2 (t = 12.11, CI: 1.97; 2.73, $p < 0.01$). The mean scores for HPV vaccination knowledge were 5.22 (from 11 possible points) at T1 and 6.3 at T2 (t = 12.27, CI: 0.9; 1.24, $p < 0.01$).

A detailed elaboration of these results (e.g., what parents know/don't know) and the relationship between knowledge and PAPM stage are presented elsewhere (Perez et al., 2016b)

Attitudes and Beliefs

We developed and validated a comprehensive, psychometrically-sound HPV vaccination attitudes and belief scale (HABS), which contains 46 items and 9 factors: benefits, threat, influence, harms, risk, affordability, communication, accessibility and general attitudes (see Appendix C. The psychometric properties of the scale are described in another paper (Perez, Shapiro, Tatar, Joyal-Desmarais, & Rosberger, 2016a).

Information Sources

Most parents (94% at T1 and 88% at T2) never spoke with a doctor /HCP about the HPV vaccine for their son (χ^2 = 40.4, CI: 0.04; 0.08, $p < 0.01$, h = 0.2).

Of the few parents (6% at T1 and 11.4% at T2) who did speak to their doctors/HCP, 59% of them were recommended to get the HPV vaccine for their son at T1 and 69% at T2 ($\chi^2 = 3.33$, CI: -0.21; 0.006, $p = 0.07$). At T1, 55.8% of those parents who vaccinated their son had spoken with a HCP about the HPV vaccine. More than half the sample (54%) at both T1 and T2 prefer to receive their information from an HCP, which was by far the most preferred source of information, followed by public health brochures, pamphlets, flyers or posters which was reported by 18% of parents at T1 and T2. Parents reported that the sources from which they actually received information about the HPV vaccine (e.g., TV or radio) did not correspond with their most preferred information source (e.g., from their HCP, see Figure 2).

Health Behaviours

At both time points, parents indicated that their son's healthcare decisions are typically a joint decision made by both parents (60.4% at T1 and 62% at T2, $\chi^2 = 0.5$, $p > 0.05$), followed by mothers alone (40.2% at T1 and 39% at T2, $\chi^2 = 1.05$, $p > 0.05$) and fathers alone (5% at T1 and 4.6% at T2, $\chi^2 = 0.28$, $p > 0.05$).

More than half of parents (61% at T1 and 59% at T2) mentioned that their son underwent a routine checkup with a healthcare provider in the previous year ($\chi^2 = 2.07$, CI: -0.008; 0.054, $p > 0.05$). Most parents (93% at both T1 and T2) stated that their sons have received all childhood vaccines. Interestingly, at T1 and T2 respectively, 25.5% and 21.2% of parents who decided not to vaccinate their son against HPV stated their son did not receive all recommended childhood vaccines; the proportions were significantly higher than parents belonging to any of the other 5 PAPM stages at both time-points ($p < 0.05$).

Implementation Intentions

In most cases, parents did not implement their planned/intended actions to facilitate HPV vaccination between T1 and T2. Parents increased the search for information about HPV vaccine in written sources (i.e., brochures, books, magazines) at T2 (21%) compared to T1 (15%) (see Figure 3). Some parents did not name a planned intention, but when they stated nothing, they indeed remained in status quo.

Stage Transitions from T1 to T2 (*n* = 1427)

We had 539 (37.7%) participants who remained in the same stages of vaccination adoption (i.e., PAPM stage) from T1 to T2; this includes 3 participants who indicated at T1 that their sons were vaccinated. A higher number, 705 (49.4%) progressed from T1 to T2 towards advanced PAPM stages that are closer to action i.e., vaccination; 53 participants (3.7%) regressed (to earlier stages than they initially were in, away from action). Only 36 parents (2.5%) advanced to having their sons vaccinated at T2. Of the 1238 participants who initially identified as being unaware, unengaged or undecided at T1 and who completed the T2 questionnaire, 27 progressed to vaccinated at T2. Of the 80 participants who had decided to act at T1 and who completed the T2 questionnaire, only 9 participants (11%) progressed to being vaccinated at T2. Not a single participant in stage 4 in T1 (i.e. decided not to act, *n* = 106) moved towards decided to act or vaccination at T2. 130 participants (9.1%) moved from unaware, unengaged, undecided or decided to act at T1 to decided not to act at T2 (see Figure 4).

Discussion

To our knowledge, this is the first HPV vaccination specific survey in a pan-Canadian representative sample of parents of boys after the first HPV vaccine (Gardasil®) was licensed in Canada for males in September 2010 (Shapiro et al., 2016b). Other vaccination surveys such as the Childhood National Immunization Coverage Survey (CNICS) conducted by Statistics Canada

have not been gender and HPV specific (Gilbert et al., 2016), such that the data collected are less representative of the Canadian population of parents of boys and do include items about HPV vaccination for males. At the time of data collection, only one of the ten provinces at T1 (PEI), and two of the provinces at T2 (PEI and Alberta) had implemented school-based HPV vaccination program for males, and no territories offered school-based HPV vaccination for boys. As such, only a small number of parents from PEI and Alberta and (i.e., only those with sons in grade 6 and 5 respectively) were eligible for free school-based HPV vaccination programs. In the absence of programs, the HPV vaccine uptake, was exceptionally low at both T1 (1.1%, *n* = 34 from 3117) and T2 (2.7%, *n* = 39 from 1427).

Similarly, the lack of programs for boys, and in turn the cost of vaccinations as well the lack of information (e.g., not even knowing boys can get the HPV vaccine; lack of understanding about the benefits/risks; no recommendation from a HCP) likely explains why at both time-points most parents (87% at T1 and 73% at T2) were in the first three stages of adoption (unaware, unengaged or undecided). Furthermore, post-hoc, we examined the few sons (*n* = 34 and T1 and *n* = 39 at T2) who were vaccinated, and the majority was not *even* from provinces that offered free-school based HPV vaccination programs. Having two provinces that had introduced male HPV vaccination programs did not appear to skew our 'snapshot' of parental HPV vaccine decision. We were also able to establish a reliable estimate of HPV vaccine uptake in Canada. Currently (as of September 2016), there are six Canadian provinces with HPV vaccination programs for males. The six Canadian provinces join only a handful of other countries/regions e.g., Australia, Austria, Israel, Barbados, Lichtenstein, New Zealand that have implemented or are set to implement publicly funded HPV vaccination programs for boys (European Centre For Disease Prevention and Control, 2012; Kessels et al., 2012; Zimet et al.,

2006). Our work offers valuable baseline information to all stakeholders involved in implementing and evaluating HPV vaccination programs.

At T2, almost half the sample moved forward along the PAPM vaccine decision-making trajectory, with most moving towards unengaged or undecided. Over a third of the sample remained in the same stage as at baseline. These results are not surprising, considering our study was an observation design and not an intervention study. Moreover, the movement towards the later stages of adoption was minimal, i.e., very few parents moved towards deciding to act and acting/vaccination. In the absence of programs or targeted interventions that match parents' informational needs, most parents remained fixed in their current and/or earlier stages of adoption. The forward movement along the PAPM vaccine decision-making trajectory could likely be explained by parents acquiring information through written sources (e.g., media) or simply by virtue of completing the questionnaire at T1. Furthermore, voluntary initiation of parents e.g. to acquire information via the internet or to speak to their HCP was not found at T2. Of those parents who had decided to vaccinate their son at T1 i.e., had intentions and who completed the T2 questionnaire, very few parents followed through in vaccinating their sons even when they were in the later stages of decision-making. This finding supports a growing body of research showing that there are important gaps between intending to act and carrying out intentions (Gollwitzer, 1999). Therefore, some individuals likely require help developing specific implementation plans to reduce the barriers.

Of interest, the most immobile group were those who had decided not to vaccinate, with no parent in this stage (of 106) moving toward intentions or vaccination at T2. Our results complement previous research suggesting that a proportion of these parents may likely be hesitant towards *all* vaccines and not uniquely against the HPV vaccine, and perhaps more akin

to what are known as "anti-vaxxers" (Larson, Jarrett, Eckersberger, Smith, & Paterson, 2014; Perez et al., 2015).

For the entire sample, HPV knowledge and HPV vaccine knowledge remained poor at both time-points. The relationship between parent's knowledge and vaccine acceptance/intentions is mixed and equivocal (Bianco, Pileggi, Iozzo, Nobile, & Pavia, 2014; Gilkey, Moss, McRee, & Brewer, 2012; Griebeler, Feferman, Gupta, & Patel, 2012; Reiter et al., 2013; Taylor et al., 2014). Low knowledge in the present group of parents could be explained by the relatively new recommendation of the HPV vaccine for boys and indicate the need to inform parents about the link between HPV and penile, anal and oral cancers as well as GW. Importantly, there were discrepancies between preferred and actual HPV information channels. Although parents are requesting and requiring more information on HPV vaccination, their needs are not being met. Providing relevant, accurate information about the recommendation and benefits of the HPV vaccine for boys, ideally delivered by a doctor or HCP, could improve HPV vaccine uptake.

Our results also indicated that the vast majority of Canadian parents have not received a recommendation from their HCP about the HPV vaccine for their sons despite their HCP being the primary source they prefer and want to receive information from. Moreover, while the sample size is small (n = 36), 80% of parents who advanced towards actual vaccination from T1 to T2 received a recommendation from their HCP. An HCP recommendation has almost consistently been shown to be associated with increased parental HPV vaccine acceptability (Bianco et al., 2014; Mortensen, Adam, & Idtaleb, 2015; Perkins et al., 2013; Reiter et al., 2013; Taylor et al., 2014) and the absence of an HCP recommendation has been associated with negative attitudes and refusal of HPV vaccination (Gilkey et al., 2012; Mortensen et al., 2015;

Reiter et al., 2013; Taylor et al., 2014). Facilitating knowledge translation through HCPs should be a major goal for future interventions to increase HPV knowledge and in turn, improve HPV vaccination uptake (Shapiro et al., 2016b). Other potential avenues where parents could acquire HPV information is from public health brochures, pamphlets and posters provided by government health organizations and endorsed by different medical organizations (e.g. Canadian Medical Association) which may be seen as an HCP endorsement. Since other vaccines (e.g. Tdap, Hepatitis B and meningococcal) are given to Canadian children at a similar age/grade as the HPV vaccine, an opportunity exists to pair the vaccines together in administration and educate parents about HPV vaccination.

The present study's strengths are related to the study's longitudinal design, data collection tool (questionnaire), data collection method (online survey to acquire a pan-Canadian sample) and data cleaning techniques. The online survey approach allowed us to: 1) use computer-adaptive testing, 2) avoid missing data, and 3) collect data in a time efficient way. Furthermore, by developing a strong data-cleaning algorithm, we increased the reliability of our final data. Moreover, the authors engaged in extensive psychometric testing (Perez et al., 2016a; Perez et al., 2016b) to ensure the validity of the psychosocial constructs which has been recommended in this area of research (Allen et al., 2010a) . Additionally, our study utilized a longitudinal design, which will allow us to analyze how the psychosocial determinants influence HPV vaccine decision making over time. To the best of our knowledge, there is only one existing longitudinal study of parents of boys which was conducted outside of Canada (Reiter, McRee, Kadis, & Brewer, 2011). Moreover, our results confirmed that intentions do not translate into vaccination over time (only 7/80 of the decided to when on to vaccinate their sons), which is often unknown in most intention studies. Lastly, the use of the PAPM allowed us to capture HPV

vaccine decision-making in a more nuanced way, and not presume that all parents are aware or engaged in this particular health behaviour. Therefore, our results demonstrate that in studying HPV decision-making, the PAPM is likely the most fitting theoretical model in contrast to the HBM or IBM, which ignore the earlier stages of vaccine decision-making.

Our study is limited in several ways. Compared to data collected from Statistics Canada household survey sample of parents with 9-16-year-old, there were differences in the structure of our sample. The effect size was mostly small to medium with no effect size exceeding 0.6. In our opinion, the small to medium differences allow us to generalize our results to the Canadian context. Our suggestion for future studies would be to impose quotas based on the repartition of respondents consistently with national representative available data in order to further reduce sample differences. Additionally, our sample consisted of more mothers (65%) than fathers (35%). Importantly, our response rate of males is higher than in other studies reporting HPV vaccine related attitudes where the average proportion of mothers was 82.3% (Trim et al., 2012). Therefore, in our opinion the proportion of males and females in our sample closely reflects the gender specific HPV vaccination decision-making process in Canada. Participants were also lost to follow-up, but importantly our T2 sample was comparable and nearly identical to the original T1 sample on all socio-demographic variables albeit province and language, where the effect was small. Moreover, we were unable to sample the three Northern territories constituting of mostly Indigenous peoples (e.g., North American Indian, Inuit), as these residents were not represented in Leger's panel. Future research should evaluate the psychosocial determinants of HPV vaccine decision-making in this population. Additionally, the present findings did not analyze the confounding role of having daughters who are eligible for HPV vaccination in the household. Future analyses are underway which will examine whether having a vaccinated daughter is a

predictor of PAPM stage. A final limitation was the recall bias of some participants' self-reported vaccination status. The issue of inaccurate *self-report* of vaccination as opposed to *actual* (e.g. vaccination booklet, physician's record) has been reported in the vaccine literature (Stupiansky et al., 2012b). In the absence of an HPV immunization school-based program, most males receive the HPV vaccine privately and the option to register this information with national databases is voluntary. As the HPV vaccination rate was extremely low (1-3%) in our study, and the HPV vaccine was not included in provincial immunization programs, we have reason to believe that the lack of objective proof of vaccination had only a small influence on our results. Future studies should consider that parents' self-reported vaccinated status may be unreliable and should try to use objective records to precisely measure HPV vaccine uptake.

Conclusions

Our results illustrate the exceptionally low uptake of the HPV vaccine in Canadian boys in the absence of a funded immunization program. Parents are critical to a successful HPV vaccination program in children. Directing our attention to males as much as females is important because males play a role in transmission and are vulnerable to HPV-associated diseases. This data can help direct efforts towards helping Canadians become aware that males are recommended to get the HPV vaccine and be engaged in the decision to vaccinate their sons.

Moreover, intentions to vaccinate one's son or planning to speak to one's HCP did not translate into action for most parents over the 9-month follow-up. These results have implications for implementation of strategies (e.g., HCPs offering the HPV vaccine to the parent of a son directly and immediately during a routine visit, fostering resources within schools to increase HPV vaccine uptake). Lastly, the use of staged-based health behaviour model, i.e., the PAPM, allowed for more precision as to where parents stood along the HPV vaccine decision-

making trajectory. Forthcoming analyses to better understand the psychosocial determinants that influence each specific stage will allow us to target the unique gaps and barriers of each PAPM stage.

Endnotes

The PAPM original model consists of seven stages of health decision-making. The seventh stage is a maintenance stage and does not apply to HPV vaccination. For simplicity, only the six stages are described.

[2]Leger has the largest representative panel in Canada and the largest Franco-Canadian panel. Since members are recruited randomly over the phone, the Leger Panel is highly representative and offers exceptional quality respondents. Leger sampling process is based on data from Statistics Canada (e.g., province, age, gender, language and region).

[3]As the questionnaire was computer adapted, few items were asked of only some groups. For example, only those participants who indicated they vaccinated their son, were further asked about how many doses he received.

[4]The informative statement read as follows: Please read carefully the following information about HPV. The Human Papillomavirus (HPV) is the most common sexually transmitted infection. HPV can cause genital warts. HPV can also cause cancers of the cervix, penis, anus, vagina, vulva and oral cancers. There are HPV vaccines available that are sometimes referred to as the cervical cancer vaccine, Gardasil®, or Cervarix®. The HPV vaccine is given in 2 or 3 doses and costs approximately $150-$200 per dose. Health Canada has approved and recommended an HPV vaccine for both males aged 9-26 years and females aged 9-45 years

Table 1

Socio-Demographics for T1, T2 and Statistics Canada National household survey samples. Test of proportions and effect size between T1 to T2 and T1 to Statistics Canada sample

	Time 1 *n* = 3117 **n**	**%**	**Time 2** *n* = 1427 **n**	**%**	**StatCan** *n* = 2336115 **n**	**%**	**T1:T2 Chi square value *p* value**	**Effect size Cohen's *h***	**T1: StatCan Chi square value *p* value**	**Effect size Cohen's *h***
Province										
Alberta	319	10.2	144	10.1	265110	11.3	$\chi^2 < 0.01$ $p = 0.92$	h < 0.01	$\chi^2 = 3.73$ $p = 0.05$	h = -0.04
British Columbia	332	10.7	130	9.1	297400	12.7	$\chi^2 = 2.38$ $p = 0.12$	h = 0.05	$\chi^2 = 11.93$ $p < 0.01$	h = -0.07
Manitoba	120	3.8	53	3.7	89070	3.8	$\chi^2 = 0.02$ $p = 0.90$	h < 0.01	$\chi^2 < 0.01$ $p = 0.95$	h < 0.01
New Brunswick	90	2.9	36	2.5	49715	2.1	$\chi^2 = 0.36$ $p = 0.55$	h = 0.02	$\chi^2 = 8.25$ $p < 0.01$	h = 0.05
Newfoundland and Labrador	64	2.1	20	1.4	34210	1.5	$\chi^2 = 1.95$ $p = 0.16$	h = 0.05	$\chi^2 = 7.07$ $p < 0.01$	h = 0.05
Nova Scotia	138	4.4	50	3.5	61005	2.6	$\chi^2 = 1.88$ $p = 0.17$	h = 0.05	$\chi^2 = 39.62$ $p < 0.001$	h = 0.10

	Time 1 *n* = 3117		**Time 2** *n* = 1427		**StatCan** *n* = 2336115		**T1:T2 Chi square value *p* value**	**Effect size Cohen's *h***	**T1: StatCan Chi square value *p* value**	**Effect size Cohen's *h***
	n	**%**	**n**	**%**	**n**	**%**				
Ontario	926	29.7	400	28.0	938750	40.2	$\chi^2 = 1.25$ $p = 0.26$	h = 0.04	$\chi^2 = 141.71$ $p < 0.001$	h = -0.22
Prince Edward Island	26	0.8	7	0.5	10375	0.4	$\chi^2 = 1.16$ $p = 0.28$	h = 0.04	$\chi^2 = 9.83$ $p < 0.01$	h = 0.05
Quebec	1020	32.7	566	39.7	506640	21.7	$\chi^2 = 20.44$ $p < 0.001$	h = -0.14	$\chi^2 = 222.49$ $p < 0.001$	h = 0.25
Saskatchewan	82	2.6	21	1.5	74840	3.2	$\chi^2 = 5.42$ $p = 0.02$	h = 0.08	$\chi^2 = 3.11$ $p = 0.08$	h = -0.03
Language										
Bilingual	55	1.8	32	1.5	34560	2.2	$\chi^2 = 0.95$ $p = 0.33$	h = -0.03	$\chi^2 = 1.55$ $p = 0.21$	h = 0.02
English	1839	59	756	53	1238705	53.0	$\chi^2 = 14.24$ $p < 0.001$	h = 0.12	$\chi^2 = 44.38$ $p < 0.001$	h = 0.12
French	1030	33	560	39.2	432220	18.5	$\chi^2 = 16.26$ $p < 0.001$	h = -0.13	$\chi^2 = 435.30$ $p < 0.001$	h = 0.34
Other	191	6.1	78	5.5	630630	27.0	$\chi^2 = 0.66$ $p = 0.42$	h = 0.03	$\chi^2 = 687.17$ $p < 0.001$	h = -0.59
Gender										
Male	998	32.0	460	32.2	1075200	46.0	$\chi^2 = 0.01$ $p = 0.91$	h = -0.01	$\chi^2 = 245.30$ $p < 0.001$	h = -0.29

	Time 1 *n* = 3117 **n**	**%**	**Time 2** *n* = 1427 **n**	**%**	**StatCan** *n* = 2336115 **n**	**%**	**T1:T2 Chi square value *p* value**	**Effect size Cohen's *h***	**T1: StatCan Chi square value *p* value**	**Effect size Cohen's *h***
Female	2119	68.0	967	67.8	1260910	54.0	$\chi^2 = 0.01$ $p = 0.91$	h < 0.01	$\chi^2 = 245.31$ $p < 0.001$	h = 0.29
Education										
Elementary or High School	680	21.8	301	21.1	773935	33.1	$\chi^2 = 0.26$ $p = 0.61$	h = 0.02	$\chi^2 = 179.37$ $p < 0.001$	h = -0.25
College	1180	37.9	518	36.3	945980	40.5	$\chi^2 = 0.95$ $p = 0.33$	h = 0.03	$\chi^2 = 8.87$ $p < 0.01$	h = -0.05
University	1250	40.1	607	42.5	616200	26.4	$\chi^2 = 2.30$ $p = 0.13$	h = -0.05	$\chi^2 = 301.14$ $p < 0.001$	h = 0.29
Marital Status										
Single	228	7.3	107	7.5	109045	4.7	$\chi^2 = 0.03$ $p = 0.87$	h < -0.01	$\chi^2 = 48.38$ $p < 0.001$	h = 0.11
Married or Common Law	2545	81.6	1173	82.2	2030060	86.9	$\chi^2 = 0.16$ $p = 0.68$	h = -0.01	$\chi^2 = 74.87$ $p < 0.001$	h = -0.14
Separated/Divorced	339	10.9	145	10.2	197005	8.4	$\chi^2 = 0.45$ $p = 0.50$	h = 0.02	$\chi^2 = 23.73$ $p < 0.001$	h = 0.08
Employment Status										
Working full-time	2064	66.2	943	66.1	1245090	53.3	$\chi^2 < 0.01$ $p = 0.96$	h < 0.01	$\chi^2 = 208.25$ $p < 0.001$	h = 0.26

	Time 1 *n* = 3117		**Time 2** *n* = 1427		**StatCan** *n* = 2336115		**T1:T2 Chi square value *p* value**	**Effect size Cohen's *h***	**T1: StatCan Chi square value *p* value**	**Effect size Cohen's *h***
	n	**%**	**n**	**%**	**n**	**%**				
Working part-time	470	15.1	215	15.1	753585	32.3	$\chi^2 = 0$ $p = 1$	h < 0.01	$\chi^2 = 419.79$ $p < 0.001$	h = -0.41
Not working/Retired/Other	570	18.3	264	18.5	337445	14.4	$\chi^2 = 0.02$ $p = 0.90$	h < -0.01	$\chi^2 = 36.86$ $p < 0.001$	h = 0.10
Household Income (CAD before taxes)										
39 999 or less	395	12.7	173	12.1	344940	14.8	$\chi^2 = 0.22$ $p = 0.64$	h = 0.02	$\chi^2 = 10.67$ $p < 0.001$	h = -0.06
between $40 000 and $59 999	428	13.7	187	13.1	332650	14.2	$\chi^2 = 0.28$ $p = 0.60$	h = 0.02	$\chi^2 = 0.62$ $p = 0.43$	h = -0.01
between $60 000 and $79 999	468	15.0	221	15.5	338000	14.5	$\chi^2 = 0.14$ $p = 0.71$	h = -0.01	$\chi^2 = 0.71$ $p = 0.40$	h = 0.02
between $80 000 and $99 999	511	16.4	237	16.6	323935	13.9	$\chi^2 = 0.02$ $p = 0.89$	h < -0.01	$\chi^2 = 16.44$ $p < 0.001$	h = 0.07
$100 000 or more	1009	32.4	459	32.2	996590	42.7	$\chi^2 = 0.01$ $p = 0.92$	h < 0.01	$\chi^2 = 134.32$ $p < 0.001$	h = -0.21
Nationality										
Born in Canada	2717	87.2	1263	88.5	1617475	69.2	$\chi^2 = 1.50$ $p = 0.22$	h = -0.04	$\chi^2 = 469.17$ $p < 0.001$	h = 0.44
Not born in Canada	397	12.7	164	11.5	718635	30.8	$\chi^2 = 1.29$	h = 0.04	$\chi^2 = 474.22$	h = -0.45

	Time 1 *n* = 3117 **n**	**%**	**Time 2** *n* = 1427 **n**	**%**	**StatCan** *n* = 2336115 **n**	**%**	**T1:T2 Chi square value *p* value**	**Effect size Cohen's *h***	**T1: StatCan Chi square value *p* value**	**Effect size Cohen's *h***
							$p = 0.26$		$p < 0.001$	
Ethnicity										
White (e.g., Caucasian, European)	2741	87.9	1280	89.7	1686435	72.2	$\chi^2 = 2.81$ $p = 0.09$	h = -0.06	$\chi^2 = 383.89$ $p < 0.001$	h = 0.40
East Asian (e.g., Chinese, Filipino, Japanese, Korean, Vietnamese)	119	3.8	49	3.4	203295	8.7	$\chi^2 = 0.30$ $p = 0.58$	h = 0.02	$\chi^2 = 92.93$ $p < 0.001$	h = -0.21
Other Ethnicities	231	7.4	84	5.9	446385	19.1	$\chi^2 = 3.29$ $p = 0.07$	h = 0.06	$\chi^2 = 274.96$ $p < 0.001$	h = -0.35
Religion										
Christian	1898	60.9	881	61.7	1578295	67.6	$\chi^2 = 0.26$ $p = 0.61$	h = -0.02	$\chi^2 = 62.85$ $p < 0.001$	h = -0.14
No Faith	984	31.6	444	31.1	485885	20.8	$\chi^2 = 0.07$ $p = 0.79$	h < 0.001	$\chi^2 = 218.42$ $p < 0.001$	h = 0.25
Other Faiths	170	5.5	74	5.2	271935	11.6	$\chi^2 = 0.09$ $p = 0.76$	h = 0.01	$\chi^2 = 115.30$ $p < 0.001$	h = -0.22

Note. StatCan = Statistics Canada. T1:T2 is the comparison between Time 1 sample and Time 2 sample. T1: StatCan is comparison between the Time 1 sample and Statistics Canada's National Household Survey (2011) sample

Table 2

PAPM Stages at Time 1 and Time 2

PAPM Stage	**Time 1**		**Time 2**	
	n	**%**	***n***	**%**
I was ***unaware*** that the HPV vaccine could be given to males (Stage 1)	1778	57.0	218	15.3
I was aware that the HPV vaccine can be given to males, but I have not thought about getting the HPV vaccine for *my son* (***unengaged***, Stage 2)	652	20.9	462	32.4
I have thought about getting the HPV vaccine for *my son*, but I am ***undecided*** about getting the HPV vaccine for him (Stage 3)	284	9.1	360	25.2
I have decided I do NOT want *my son* to get the HPV vaccine *(Stage 4*, ***decided not to***)	212	6.8	208	14.6
I have decided I DO want *my son* to get the HPV vaccine (Stage5, ***decided to***)	157	5.0	140	9.8
My son has already received the HPV vaccine (Stage 6, **vaccinated**)	34	1.1	39	2.7

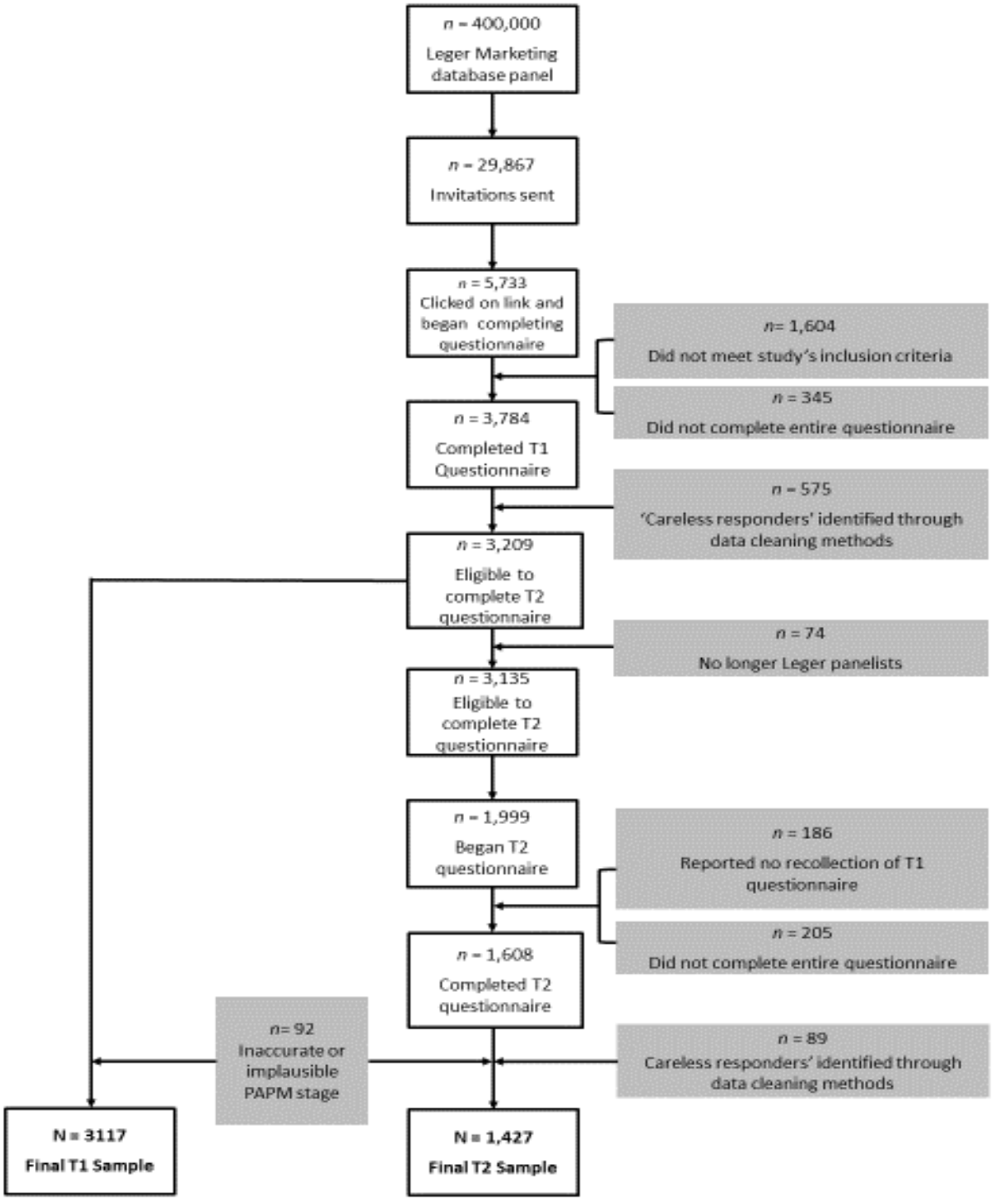

Figure 1. Flow diagram of study participants

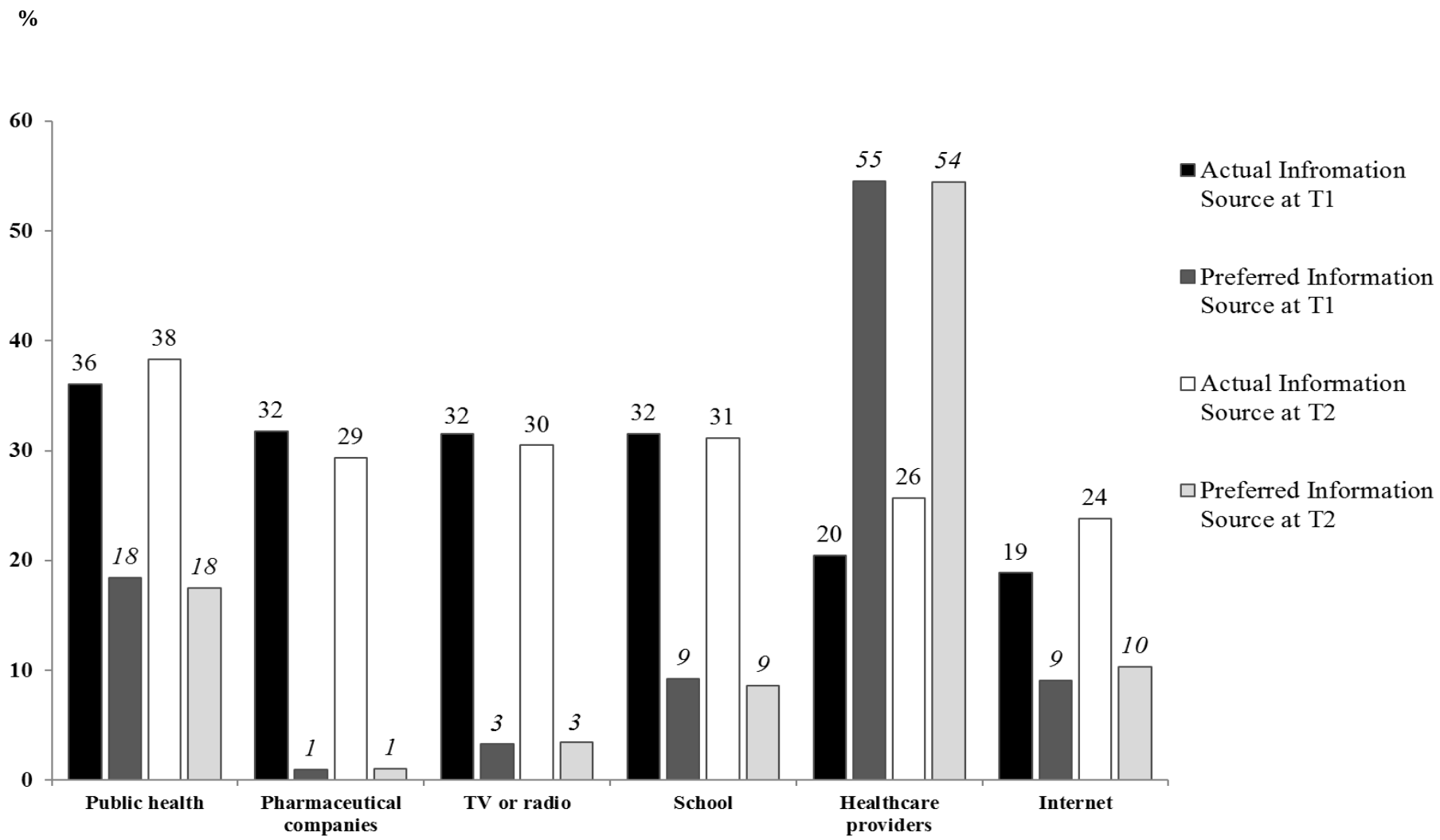

Figure 2. Percentage of participant's actual source of receiving HPV vaccine information compared to their preferred information sources at both Time 1 and Time 2

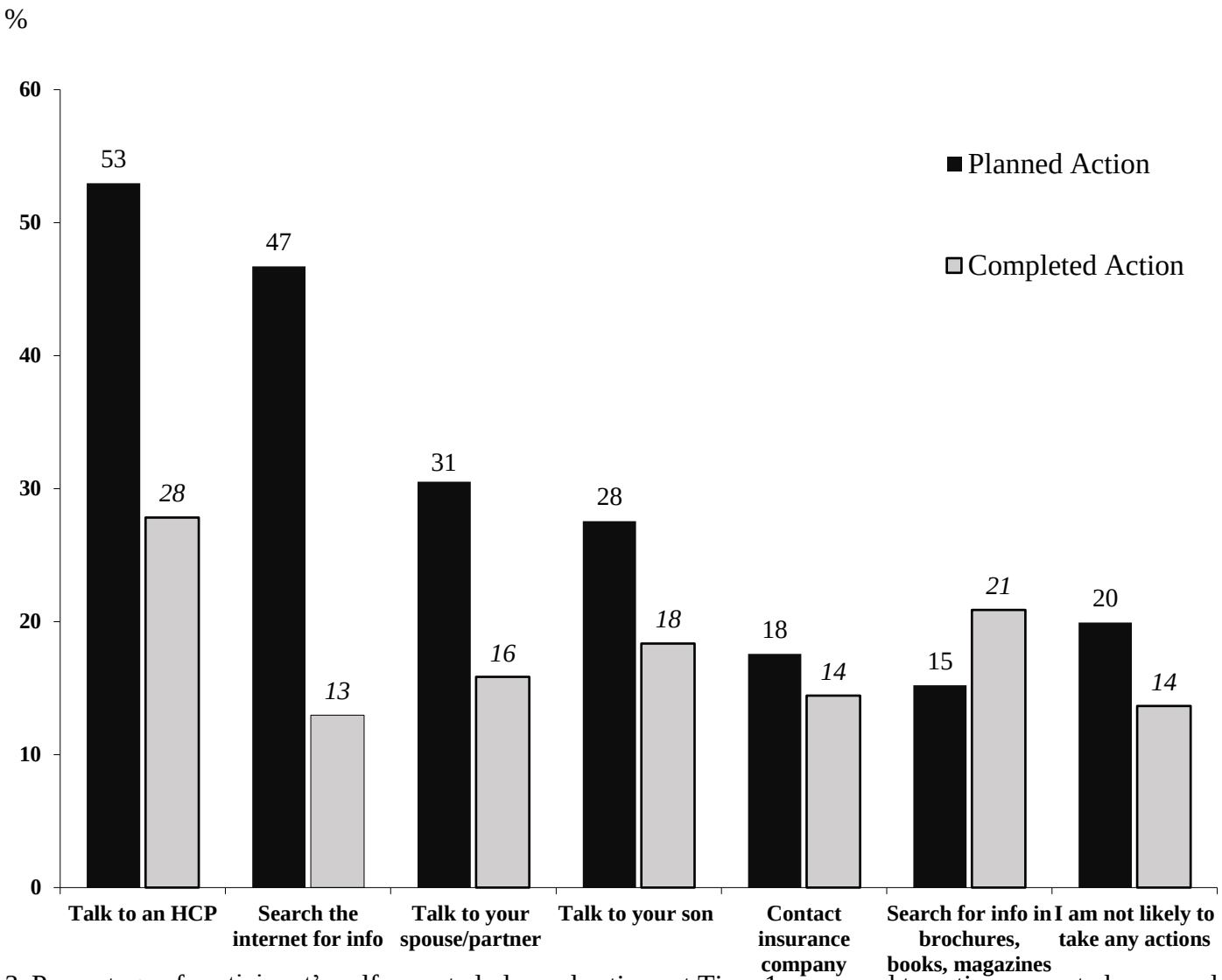

Figure 3. Percentage of participant's self-reported planned actions at Time 1 compared to actions reported as completed at Time 2 (implementation intentions)

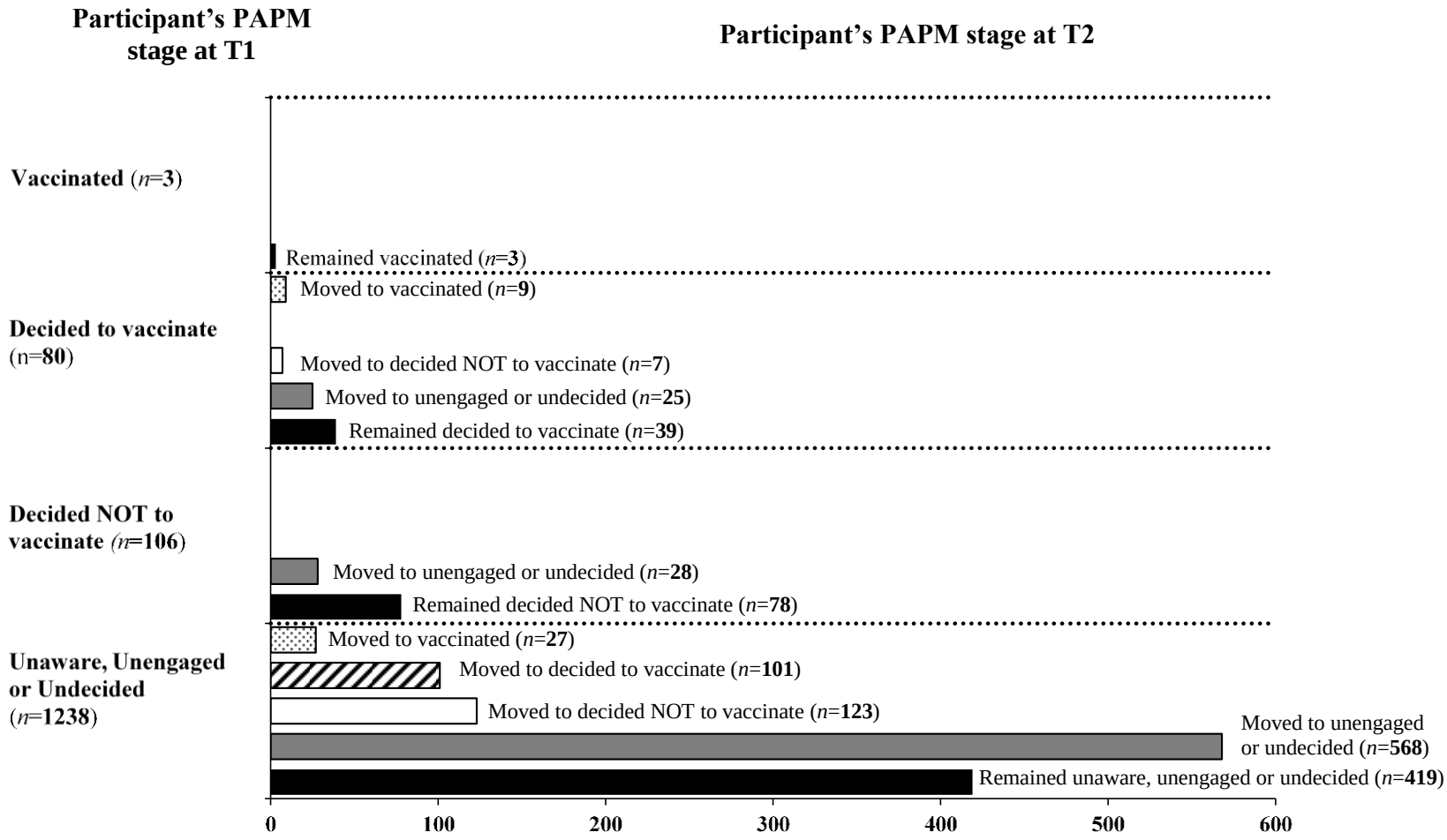

Figure 4. Number of participant's initial PAPM stage reported at T1 is shown on the y-axis. Number of participant's who remained in the same PAPM stage or their movement to a different PAPM stage at T2 shown on the x-axis (*n* =1427)

Bridge to Manuscript 2

Manuscript 1 presented a detailed outline of the study's aims and objectives, as well as the methodology, the study design and the creation and development of the measurement tool used in our study. As evidence by our initials results, many parents were unaware that the HPV vaccine can be given to males, and few had received information about the HPV vaccine.

One of the factors most often studied in the HPV vaccine acceptability literature is knowledge. While knowledge is not formally part of the HBM or TPB, it is a pre-requisite for vaccine decision-making. The majority of psychosocial studies often report or describe the level of HPV or HPV vaccine knowledge in their samples (Garcini et al., 2012; Prue et al., 2016b; Trim et al., 2012). Generally, low or modest knowledge or awareness about HPV and the HPV continues to be found among parents (Griebeler et al., 2012; Reiter et al., 2010; Schuler & Coyne-Beasley, 2015; Trim et al., 2012). Specifically among parents of boys, many studies find (especially those studies in the first few years post-vaccination approval for males) that parents did not know the vaccine was available for males, and that they often express lack of knowledge and a need for more information about the HPV vaccine before making a decision about vaccinating their son (Bianco et al., 2014; Cates, Ortiz, Shafer, Romocki, & Coyne-Beasley, 2012; Donahue, Stupiansky, Alexander, & Zimet, 2014; Gilkey et al., 2012; Mortensen, 2010; Mortensen et al., 2015; Perkins et al., 2013; Reiter et al., 2013).

Yet, very few studies report on the findings about the association between parents' knowledge and HPV vaccine acceptability outcome (Perkins et al., 2013; Reiter et al., 2010; Reiter et al., 2013), and from the few that do, there is mixed and inconsistent evidence with respect to the association between knowledge and parents' HPV vaccination intentions or uptake for their child (Allen et al., 2010b; Brewer et al., 2011; Christian, Christian, & Hopenhayn, 2009;

Dempsey, Zimet, Davis, & Koutsky, 2006; Gerend et al., 2009; Perkins et al., 2013). Many studies find that primary reason parents reported for not vaccinating their child was insufficient vaccine information, including not knowing that the HPV vaccine is recommended for males (Brabin et al., 2008; Donahue et al., 2014; Hendry et al., 2013; Lindley et al., 2016; Trim et al., 2012). In contrast, some parents sign and give consent to their children's school without extensive knowledge or active engagement in the decision-making process (Robbins, Bernard, McCaffery, Brotherton, & Skinner, 2010). Similarly, HPV knowledge was found to not influence parents' intentions to vaccinate their sons (Perkins et al., 2013).

One possible explanation for the mixed findings concerning the relation between HPV knowledge and vaccination intentions/uptake may be an issue with the conceptualization and measurement of the construct. Studies have varied greatly in how they measure HPV and HPV vaccine knowledge (Prue et al., 2016b): some conceptualize it simple as 'awareness'', e.g., Have you ever heard of HPV? Are you aware that of the HPV vaccine? Are you aware that the HPV vaccine is available for males? Other studies "test" specific knowledge from single to few items (e.g., knowledge that both sexes are at risk of infection) to open-ended questions (e.g., identifying modes of HPV prevention, identify from a list possible health outcomes of HPV) to true-false format or Likert scales (Bianco et al., 2014; Griebeler et al., 2012; Perkins et al., 2013; Reiter et al., 2013; Schuler & Coyne-Beasley, 2015). Some researchers develop composite or totals scores or classify parents into low or high levels of knowledge based on the number of correct answers obtained (Reiter et al., 2010; Schuler & Coyne-Beasley, 2015). At times researchers, will consider "knowledge" as participants endorsing or citing the reason that they have a lack of information. This leads to confusion as knowledge is no longer objective (e.g., correctly identifying facts), but rather the perception of *feeling or believing* of not having

sufficient information, also known as perceived knowledge (Krawczyk, Stephenson, Perez, Lau, & Rosberger, 2013). It is thus important to understand that there are differences between perceived knowledge (feeling you know nothing, something, or a lot) or *actually* understanding facts about HPV and the HPV vaccine. Furthermore, our own study found that the way in which researchers assess HPV knowledge e.g. measuring HPV knowledge separately from HPV vaccine knowledge is important (Krawczyk et al., 2013), which is not done in many studies.

At the time of data collection, Waller and colleagues (2013) had recently published an extensively psychometrically refined general HPV and HPV vaccination knowledge specific scale. While the scale was found to be structurally cohesive, unidimensional and reliable, the scale did not include knowledge items that were relevant to males (e.g., the scale did not assess about HPV-associated cancers other than cervical cancer). As our questionnaire contained all the items from Waller's Knowledge scale, Manuscript 2 is a replication analysis of Waller's HPV and HPV vaccine knowledge scale in our Canadian sample of both English and French speakers, as well as further testing of whether our additional items could be added to the comprehensiveness and cohesiveness of the existing HPV knowledge scales. The article also uniquely provides descriptive results of how HPV and HPV vaccine knowledge changes over time.

Manuscript 2

Extending and validating a human papillomavirus (HPV) knowledge measure in a national sample of Canadian parents of boys

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Abstract

As the human papillomavirus (HPV) vaccine is now recommended for males, a reliable, comprehensive HPV knowledge measurement tool which addresses issues relevant to males is needed. We aimed to replicate, validate and test the comprehensiveness of an existing general HPV and an HPV vaccination knowledge scale in English and French. We also measured parental HPV knowledge and changes over time. An online questionnaire was administered in February (Time 1; T1) and November 2014 (Time 2; T2) to a nationally representative sample of Canadian parents of boys. Dimensionality, internal consistency and model fit were evaluated at both time points and separately in English and French sub-samples. Differences in knowledge scores were measured. Analyses were performed on 3117 participants at T1 and 1427 at T2. The 25-item HPV general knowledge and an 11-item HPV vaccination scale were unidimensional, showed high internal consistency ($\alpha > 0.87$, $\alpha > 0.73$) and had good model fit. Both general HPV and vaccine-specific knowledge significantly increased over time in both languages, but remained low at T2, with only about half of the items being answered correctly. Correct responses at T2 are best explained by correct responses at T1, with some small changes from 'Don't know' at T1 to correct at T2. The extended general and vaccine-specific knowledge scales are valid, reliable and comprehensive, and could be used among parents of boys, in both English and French. Educational interventions could target specific knowledge gaps and focus on providing information rather than correcting misconceptions.

Keywords: Human papillomavirus (HPV); Papillomavirus vaccines; Papillomavirus Infections/prevention & control; Knowledge; Health Knowledge, Attitudes, Practice; Measure; Parents; Males; Acceptability

Introduction

Strong empirical evidence supports the causal role of the human papillomavirus (HPV) in the development of cervical, vaginal, penile, anal and oropharyngeal cancers and genital warts (Forman et al., 2012; Vardas et al., 2011). In Canada, all provinces and territories vaccinate females against HPV as part of provincial school-based immunization programs i.e., grades 4 through 8 (~10-14 years old), dependent on location (Shapiro et al., 2016b). Most organizations now also recommend HPV immunization for males (Centers for Disease Control and Prevention, 2015a; Public Health Agency of Canada, 2015a; World Health Organization Report, 2015). In Canada, the HPV vaccine has been included for boys in school-based provincial immunization programs, with other provinces due to follow in the autumn 2016 (e.g. Alberta (autumn 2014), Prince Edward Island (PEI) (autumn 2013), and Nova Scotia (autumn 2015) for grade 5, 6 and 7 (~11-13 years old), respectively. Quebec and Manitoba are set to begin programs (autumn 2016) for boys in grades 4 and 6 respectively (Public Health Agency of Canada, 2016b; Shapiro et al., 2016b). Across many parts of Canada, HPV vaccination uptake for girls is not reaching the ~70% needed to provide herd protection (Brisson et al., 2011; Public Health Agency of Canada, 2014). Data from the first male HPV immunization program in PEI indicates that although HPV vaccination uptake was high (79% for males and 85% for females), grade six girls had a 1.5 higher likelihood of being vaccinated compared to boys of the same age (McClure et al., 2015). In this early period where male HPV vaccination programs are being initiated, there is a need to understand what influences parental decision-making concerning HPV vaccination for their sons.

Psychosocial research examining the factors that influence HPV vaccination acceptance suggests a direct relationship exists between parents' HPV and HPV vaccine knowledge and intentions to vaccinate against HPV (Allen et al., 2010b; Giambi et al., 2014; Pelucchi et al.,

2010). A comprehensive measurement of parents' HPV knowledge is important to target HPV vaccine specific knowledge gaps, when designing and implementing educational interventions, aimed at increasing HPV vaccine uptake. A reliable HPV general knowledge and HPV vaccination specific knowledge scale was developed and validated by Waller et al. (2013). While the scales were extensively psychometrically tested and found to be structurally cohesive and reliable, they do not capture knowledge items relevant to males (e.g., did not assess knowledge about HPV-associated diseases *beyond* cervical cancer) and were only validated among English speakers. Waller et al. concluded with the recommendation to validate the measure in other settings and languages and to examine the addition of new items particularly when the HPV vaccine becomes readily available for males.

The present study's objectives were: 1) to replicate the validation of the general HPV and HPV vaccine knowledge scales proposed by Waller and colleagues among a national sample of both English and French-speaking Canadian parents of boys; 2) to examine whether our additional items add to the comprehensiveness and cohesiveness of the existing general HPV knowledge and HPV vaccine scales and; 3) to measure and describe general HPV and HPV vaccine knowledge patterns of change over time.

Methods

Study Participants and Design

Parents who had a son aged 9-16 years old living in their household were recruited through a research firm, Leger Marketing, which maintains a representative panel of 400,000 Canadian households. We targeted a sample of 4,000 parents, weighted according to the population distribution of the ten Canadian provinces. In February 2014, panel participants who

met the inclusion criteria were sent an invitation email with a link to the online study. Participants elected whether they preferred to answer the questionnaire in English or French.

Data were collected using an online questionnaire that took approximately 20 minutes to complete and contained a variety of quantitative and qualitative items including: socio-demographics, knowledge, HPV vaccination attitudes, and health behaviours. The focus of this study is on the HPV and HPV vaccine knowledge items. Participants who completed the questionnaire at Time 1 (T1) and deemed eligible respondents were invited to re-complete the questionnaire at 9-months follow up (November 2014, Time 2, (T2)). The study was approved by the Research Ethics Board at the Jewish General Hospital, Montreal, Canada (see Appendix B). A detailed methodology of the study protocol and sample characteristics is provided elsewhere (Perez et al., 2016c).

Knowledge Items

The authors expanded upon the HPV-general knowledge (herein referred to as GK) and the HPV-vaccine knowledge (herein referred to as VK) scales published by Waller et al (2013), who, using a Principal Axis Factor Analysis (PFA), found that both a 16-item HPV knowledge subscale, GK ($\alpha = 0.849$) and the 7-item HPV vaccination knowledge subscale, VK ($\alpha = 0.561$) were reliable and unidimensional . Results of the Confirmatory Factor Analysis (CFA) suggested a better fit for the 16-item GK scale than for the 7-item VK scale.

The present study included the identical Waller et al.'s 16-item GK scale with two minor semantic changes (shown in italics): "HPV can be *transmitted* through genital skin-to-skin contact" and "Using condoms reduces the *chances* of HPV transmission[1]." Our study also included the identical Waller et al.'s 7-item VK scale with one semantic change: "Girls who have had the HPV vaccine do not need a Pap test (cervical cancer screening) when they are older[2]". It

was also necessary to slightly revise one of the VK items about dosing as since Waller et al.'s (2013) publication, the WHO recommendation (World Health Organization Report, 2015) had shifted from a three to a two-dose policy for children under 15 years of age ("The HPV vaccine requires only one dose[3]"). Response options were identical to Waller's scale and used forced choice response categories of True/False/Don't know.

Based on our previous HPV research (Krawczyk et al., 2015a; Krawczyk et al., 2013; Krawczyk et al., 2012), consultation with an expert panel and a comprehensive literature search, we identified additional knowledge items that were not included in Waller's scale. These items reflected the most up-to-date emerging scientific evidence and were frequently being measured in the HPV psychosocial/epidemiological literature (Daley et al., 2009; Daley et al., 2010; Fisher; Gerend & Barley, 2009; Giede et al., 2010; Gutierrez et al., 2013; Katz, Krieger, & Roberto, 2011). The addition of the 9 GK (see Appendices D1 & D2; items 17- 25 for the new added items) and 4 VK items (see Appendices E1 & E2 ; items 8- 11 for the new added items) aimed to measure: 1) the association of HPV with oral, penile, and anal cancers (items 17, 20, 24), 2) transmission (items 19, 22, 25), 3) HPV-associated signs and symptoms (items 18, 21, 23), 4) prevention (items 8), 5) treatment (item 9), 6) the recommendation for males and females in the Canadian context (items 10,11).

Questionnaire development took into account language and literacy levels. The entire questionnaire was pilot tested for readability and validity with 20 parents of 9-16-year-old boys. The reading level of the survey was measured using the Flesch-Kincaid scale available through Microsoft Word (Microsoft Corp., Redmond, WA) and found to be appropriate for a grade 8 reading level. The English survey was translated into French by a specialized translation firm with expertise in health literacy and reviewed for accuracy by an independent bilingual group of

professionals (n = 5) working in the healthcare field. Questionnaire development and translation was reviewed by a bilingual panel of seven highly experienced HPV researchers.

GK and VK scores were calculated by assigning 1 point to each correct answer and zero points for incorrect or 'Don't know' answers (Range = 0-25 for GK and range = 0-11 for VK). A GK and VK total score were calculated at baseline (Time 1, T1) and at 9-months follow up (Time 2, T2) for the English and French sub-samples.

Analysis

Analyses were performed on the T1 and T2 samples separately, which were also divided into two sub-samples, English and French respondents. Analyses included internal consistency analysis (Cronbach's alpha), exploratory factor analysis (EFA) to investigate dimensionality and a CFA to investigate validity (model fit). Results for the 16-item GK scale and the 7-item VK scale in French and English were compared with the results obtained by Waller et al. (2013). The effects of adding nine new GK items and four new VK items on internal consistency and dimensionality were then investigated by comparing the scale properties with and without the additional items. Additionally, descriptive statistics and Welch two sample t-tests, $p < 0.05$ were used to explore knowledge scores over time and across languages.

For the EFA, a PFA was used with varimax rotation. Similar to Waller's analysis, four criteria (Slocum-Gori & Zumbo, 2010) were used to explore dimensionality; three criteria are presented in Table 2. Results for the fourth criterion, examining items that did not load higher than 0.33 on a forced one-factor solution, are presented in text. For the CFA, results are based on four indices (Hu & Bentler, 1999) (see Table 3 and Table 4). Differences in proportions were tested using Chi-square, $p < 0.05$. Statistical analysis was conducted using SPSS v21, Stata 13 and R Studio v0.99.896.

Results

At T1 *n* = 3117 respondents and at T2, *n* = 1427 respondents were included in the analysis. At T1, 2117 participants from T1 completed the questionnaire in English and 1000 in French. At T2, 873 participants completed the questionnaire in English and 554 completed it in French.

Internal Consistency Analysis

The internal consistency results for the GK16 compared favorably with the results obtained by Waller et al. The internal consistency of the GK25 was higher than GK16 across all subsamples (Table 1). Item level analysis indicated that the item "HPV usually doesn't need any treatment" sometimes had a slightly negative effect (in the third decimal place) on scales' internal consistency.

Internal consistency values for the VK7 and VK11 subscales were higher than those found by Waller et al. (Table 1). Item specific analysis suggested a slight misfit for the item "One of the HPV vaccines offers protection against genital warts" but the effect was very small**.**

Dimensionality Analysis (EFA)

For the GK16, on all subsamples and at both time points, we obtained only one factor with Eigenvalue (EV) > 1; the extracted loading of factor one was more than three times larger than factor two (F1 > 3 x F2); and the one factor percentage of common variance (1FVar) was higher than the reference value (27.78) from Wallers' scale (2013), with one exception. Item level analysis found that the item "HPV usually doesn't need any treatment" failed to load > 0.33 on a 1-factor solution for all subsamples and at both time points.

For the GK25, the criteria F1 > 3 x F2 and 1FVar were met (Table 2) for all subsamples and at both time points. At T1 and T2, the percentage of common variance accounted for in the

French language sample was lower than that of the English sample (Table 2). A consistent finding, with the exception of the T1 combined sample, was that the addition of the nine new items (GK25) resulted in three factors with EV greater than 1 (Table 2). Similar to the GK16, the item "HPV usually doesn't need any treatment" failed to load > 0.33 on a 1-factor solution. The item "HPV can cause herpes" also failed to load greater than .33 on a 1-factor solution for the French language at the second time point.

EFA results for VK7 and VK11 across both language subsamples and at both time points found only one factor with an EV > 1 (Table 2). In almost all cases, F1 was > 3 x F2 (Table 2). For both the VK7 and the VK11 and across all subsamples, the percentage of variance accounted for by a 1-factor solution was higher (22.17-31.39) than the percentage of variance obtained by Waller et al. (21.65). Item level analysis indicated that for both the VK7 and the VK11, most items loaded > 0.33 on the one factor solution for all subsamples at both time points. The item "One of the HPV vaccines offers protection against genital warts" frequently failed to load >0.33 and the items "The HPV vaccines offer protection against most cervical cancers" and "The HPV vaccine only requires one dose" occasionally failed to load > 0.33.

Model fit (CFA)

CFA analysis for the GK16 and the GK25 found that the Standardized Root Mean Square Residual (SRMR) and the Coefficient of Determination (CD) values met the suggested model fit criteria (Hu & Bentler, 1999). The Comparative Fit Index (CFI) values were close to the cutoff criteria while the *p* value for Chi square and Root Mean Square Error Approximation (RMSEA) criteria for model fit were not met (Table 3). For the VK7 and the VK11, previous observations related to cut-off criteria for the GK scales apply (Table 4).

GK across Time and Language

Consistently, for every single item for both the English and French subsamples, there was an increase in the proportion of correct responses from T1 (n = 3117) to T2 (n = 1427). This increase was significant for 24 from 25 items for the English sample and 21 from 25 items for the French sample. For example, two items with the largest significant increase (12-25%) over time in both English and French were "Men cannot get HPV" and "HPV can cause cancer of the penis". Importantly, the overall mean GK25 score significantly increased for both languages across time ($Mean_{EN}$ at T1= 11.76; $Mean_{EN}$ at T2 = 14.23, t = 9.78, CI [1.97; 2.95] and $Mean_{FR}$ at T1 = 11.47; $Mean_{FR}$ at T2 = 13.69, t = 7.35, CI [1.63; 2.82]).

There were differences in the proportion of correct answers at the item level between English and French samples at both time points i.e., 18 from 25 items significantly differed between French and English samples at T1 and 15 from 25 significantly differed between French and English samples at T2. Importantly, there was no significant difference between the overall mean GK25 score for the two languages at either time point: $Mean_{EN}$ = 11.76 and $Mean_{FR}$ = 11.47 at T1; and $Mean_{EN}$ = 14.23 and $Mean_{FR}$ = 13.69 at T2.

VK across Time and Language

An identical pattern as GK25 was found for VK11. There was an increase in the proportion of correct responses for every single item for both the English and French subsamples from T1 (n = 3117) to T2 (n = 1427). This increase was significant for 11 of 11 items for the English sample and 9 of 11 items for the French sample. For example, two items with the largest significant increase (11-27%) over time were "The HPV vaccine is approved and recommended by Health Canada for males aged 9-26 years" and "Someone who has had the HPV vaccine cannot develop cervical cancer". Importantly, the mean VK11 score significantly increased for

both languages across time: $Mean_{EN}$ at T1 = 5.21; $Mean_{EN}$ at T2 = 6.38, t = 10.4, CI [0.94;1.39] and $Mean_{FR}$ at T1 = 5.26 and $Mean_{FR}$ at T2 = 6.17, t = 6.52, CI [0.63;1.18].

There were differences in the proportion of correct answers at the item level between English and French samples at both time points i.e., 7 of 11 items significantly differed between French and English at T1 and 4 of 11 significantly differed between FR and EN at T2. Importantly, there was no significant difference between the overall mean VK11 score for the two languages at either time point: $Mean_{EN}$ = 5.21 and $Mean_{FR}$ = 5.26 at T1; and $Mean_{EN}$ = 6.38 and $Mean_{FR}$ = 6.17 at T2.

Knowledge Patterns of Change

An examination of knowledge changes over time was conducted among those participants who answered the questionnaire at both T1 and T2 (n = 1427). At T1, for the GK25, participants answered 49.1% of items correctly, 13.2% of items incorrectly and 37.7% of answers as "Don't know". At T2, at the item level, < 50% of the sample achieved the correct answers for 10 out of 25 GK items (Figure 1). The mean knowledge score for the GK25 scale at T1 was 12.28/25 and 14.02/25 at T2, (t = 7.56, 95% CI [1.29; 2.19], p < 0.001).

At T1 for the VK11, participants answered 49.9% of items correctly, 9.6% of items incorrectly and 40.5% of answers as "Don't know". At T2, at the item level, < 50% of the sample got the correct answer for 5 out of the 11 VK items (Figure 2). The mean knowledge score for the VK11 scale at T1 was 5.49 of 11 and 6.3 of 11 at T2, (t = 7.86, 95% CI [0.6; 1.0], p < 0.001). The most and least known GK items at T2 are provided in Figure 1 and the most and least known VK items at T2 are provided in Figure 2.

Item-level analysis of both the GK and VK scales revealed that for best known items, correct responses at T2 can be best explained by correct responses at T1 (Figure 1 and Figure 2).

For both GK and VK items, few correct responses at T2 can be explained by changing from incorrect at T1 (Figure 1 and Figure 2). The number of correct responses at T2 originating from "Don't know" answers at T1 was relatively constant across items (Figure 1). For GK, the largest increase was observed for parents who did not know at T1 that: a) men can get HPV, b) HPV can cause cancer of penis and c) HPV can be transmitted through anal sex (Figure 1). For VK, the largest increase was observed for parents who did not know at T1 that the vaccine is recommended for males aged 9-26 (Figure 2).

Discussion

As a replication analysis, our results support the conclusion that Waller's HPV general (GK) and HPV vaccine (VK) knowledge subscales operate as structurally coherent and reliable measures that can continue to be used in English and now in French. Investigation of the addition of the 9 new items and the 4 items to the GK and VK subscales respectively, found improved internal consistency compared to Waller et al.'s (2013), scale. The exception to this was "HPV usually doesn't need any treatment", which when removed improved reliability (although not substantially) and was by far the item which the fewest participants were able to answer correctly.

Similar to Waller et al., our hypothesis of unidimensionality holds for both the GK25 and the VK11 scales. Of note, for the GK25 scale, obtaining three factors with Eigenvalues greater than one is not of concern because the first factor was typically a very dominant factor such that subsequent rotated factors often involved cross-loaded items and rarely led to meaningful factors in item content terms. Item loading results for the GK25 were similar to the Waller et al.'s results. The item "HPV can cause herpes" and the item "HPV usually doesn't need any treatment" loaded poorly in both our and Waller's study.

Interestingly, knowledge of these items was very poor in our Canadian sample which is in line with other populations (Blake et al., 2015; Bynum, Brandt, Friedman, Annang, & Tanner, 2011; Daley et al., 2010; Gerend & Shepherd, 2011; Giambi et al., 2014; Holcomb, Bailey, Crawford, & Ruffin, 2004; Kang & Kim, 2011; Marlow, Zimet, McCaffery, Ostini, & Waller, 2013; Mollers et al., 2014; Yacobi, Tennant, Ferrante, Pal, & Roetzheim, 1999). Future consideration should be given to excluding these items from the GK scales as perhaps they are not necessary to understanding HPV and may be confusing (e.g., *HPV itself* does not require any treatment but *HPV-associated diseases* do require treatment) and likely unnecessary (e.g., is it relevant to know that HPV does not cause herpes). Post hoc, we explored the effect of removing these two items from the GK25 scale, and model fit remained largely unchanged and the change in internal consistency was inconsequential. The decision then to include or exclude these items would thus be left to the individual researcher, though it is our suggestion to exclude these 2 items, as it make more substantive sense, leaving a 23-item solution, the GK23.

For the VK11 scale, two items failed to appropriately load: "One of the HPV vaccines offers protection against genital warts" and "The HPV vaccine only requires one dose", which was similarly found by Waller et al. (2013). These items require further attention as they are conceptually valuable for measuring HPV vaccine knowledge as the protection against genital warts may be an additional benefit to some individuals to prompt vaccination and dosage is important as we know that many parents do not complete the full vaccination series. As most countries are now only using vaccines that prevent both cancers and warts (i.e., 4vHPV and 9vHPV), and as most countries transition to the WHO recommended 2-dose schedule, it may have confused parents to inter-change HPV vaccine with ('one of the') HPV vaccine*s (plural).* We hypothesize that a slight change in wording/semantics for all VK could potentially improve

model fit, e.g., “The HPV vaccine offers protection against genital warts” and “The HPV vaccine requires at least 2 doses”.

The mean GK and VK in our sample was poor at both time points i.e. on average, parents answered around only half the items for both scales correctly, which is consistent with Waller’s (2013) and most study results (Davlin, Berenson, & Rahman, 2015; Holcomb et al., 2004; Joseph et al., 2015; Klug et al., 2008). Item-level analysis showed a similar ranking of knowledge items compared to Marlow et al.’s study (n = 2409 participants living in the UK, US, and Australia, M_{age} = 41-48, with 12-14% of them having daughters aged 9-17 (2013). This may suggest a pattern among the general population where most individuals, regardless of parental status, know about the association between HPV and cervical cancer and that increasing the number of partners increases the risk of HPV. In both our and Marlow et al.’s sample, most individuals did not know that “Most sexually active people will get HPV at some point in their lives”. These results suggest that there may be similar knowledge gaps that are widespread among different subsamples (e.g., parents, young adults), and that parents are not acquiring any additional knowledge beyond the general population. Educational interventions, dispersed in many widespread channels could target these specific knowledge gaps.

Both GK and VK total scores increased statistically significant over time but the effect size was small (Cohen’s $d < 0.3$ for the 1427 sample). At T1, we provided a brief informative statement about HPV after the knowledge section, but we estimate that the impact on knowledge at follow-up was very small, considering the nine months’ time interval between baseline and follow-up. A closer examination at the item level reveals that correct responses remained consistent for at least nine months. Moreover, at T2, only a tiny proportion (between 0.8 and 12%) of correct responses can be attributed to a change from incorrect at T1 to correct at T2 and

a small proportion (10%-51%) can be attributed to a change from 'Don't know' at T1 to correct at T2. Therefore, we suggest providing both general HPV and HPV vaccine information/facts, with emphasis on the items that parents do not know, rather than correcting misconceptions. As an example, specifying the age and gender recommendation in one's country is advisable. This is further substantiated by our results which showed an overall pattern across both GK and VK items where few individuals answered items *incorrectly* as compared to an often higher proportion of participants who answered 'Don't know', indicating *a lack of HPV knowledge* rather than *wrong/mis*information.

Our study is not without limitations. Firstly, our response rate, calculated based on completion by participants who began the questionnaire *(n* = 5733 at T1 and *n* = 1999 at T2), was modest (66% at T1 and 80.4% at T2) but superior to other studies (Blake et al., 2015; Gowda et al., 2012). Secondly, a high attrition (49.9%) can be expected in online surveys, but we believe that the effect on our results was minimal due to very few significant changes between the baseline and follow-up sample (Perez et al., 2016c), and a fairly large sample at T2. Third, although Leger aimed to maintain a nationally representative panel of Canadians, there may be differences between panel members and the general Canadian population (Perez et al., 2016c). Fourth, we made a few semantic changes to Waller et al.'s scale, which though minimal, result in an imperfect replication. Lastly, the internal consistency was lower amongst French speakers compared to English, and the reason for this requires further exploration.

It remains challenging to compare HPV and HPV vaccine knowledge across studies as researchers vary extensively in the number of items used (e.g., some use as few as three items (Allen et al., 2010b; Pelucchi et al., 2010), different response options (e.g., multiple choice, true-false, yes/no/not sure, Likert scale, open-ended) and differing content (Davlin et al., 2015; Giede

et al., 2010; Klug et al., 2008). We strongly encourage researchers to utilize the extended GK23 scales to measure HPV knowledge and the VK11 to measure HPV vaccine knowledge, which could allow for comparisons on the overall knowledge level as well as the item level. Additionally, beyond English and French, future researchers could translate these scales to other languages and evaluate the validity among different languages and populations.

Conclusions

Our extended HPV general knowledge and HPV vaccine knowledge scales are reliable and unidimensional in both English and French, and capture issues related to both genders. Interestingly, the added items tended to be least known, which suggests parents may know specific facts about HPV better (e.g. the link with cervical cancer; that HPV is an STD) than others (e.g., the link with oral/anal cancers). We suggest educational interventions to inform about the updated points about HPV and the HPV vaccine that are least known and to focus on providing information rather than correcting misconceptions. In our opinion, our comprehensive HPV knowledge scales can significantly contribute to the understanding of how knowledge can influence vaccine decision-making, and in turn improve, HPV vaccination uptake.

Endnotes

[1]Waller's items: HPV can be *passed* on during sexual intercourse; using condoms reduces the *risk* of getting HPV

[2]Waller's items: Girls who have had the HPV vaccine do not need a [Pap test/Smear test/Pap smear test] when they are older

[3]Waller's item: HPV vaccines require three doses

Table 1

Internal Consistency (Cronbach's alpha) of HPV General Knowledge (GK) and HPV Vaccine Knowledge (VK) across subsamples at Time 1 (T1) and Time 2 (T2)

		HPV general knowledge (GK)		HPV Vaccine Knowledge (VK)	
		GK16	GK25	VK7	VK11
T1	French (*n* = 1000)	0.869	0.902	0.699	0.778
	English (*n* = 2117)	0.898	0.922	0.733	0.819
	Combined (*n* = 3117)	0.889	0.916	0.722	0.807
T2	French (*n* = 554)	0.828	0.874	0.651	0.737
	English (*n* = 873)	0.855	0.894	0.619	0.742
	Combined (*n* = 1427)	0.844	0.887	0.629	0.739

Note. Waller et al. GK (16 items) $\alpha = 0.849$; Waller et al. VK (7 items) $\alpha = 0.561$

Table 2

Results of the Exploratory Factor Analysis for the 16 and 25-item HPV general knowledge (GK) and the 7and 11-item HPV vaccine knowledge (VK) scales at Time 1 (T1) and Time 2 (T2)

		GK16			**GK25**			**VK7**			**VK11**		
		EV > 1	F1 >3xF2	1FVar	EV>1	F1>3xF2	1FVar	EV>1	F1>3xF2	1FVar	EV>1	F1>3xF2	1FVar
T1	French (*n* = 1000)	One	Yes	31.35	Three	Yes	27.9	One	Yes	26.61	One	Yes	26.32
	English (*n* = 2117)	One	Yes	37.18	Three	Yes	33.09	One	Yes	31.39	One	Yes	31.12
	Combined (*n* = 3117)	One	Yes	35.26	Two	Yes	31.32	One	Yes	30.38	One	Yes	29.48
T2	French (*n* = 554)	One	Yes	26.03	Three	Yes	23.26	One	No*	25.26	One	Yes	22.85
	English (*n* = 873)	One	Yes	29.72	Three	Yes	27.04	One	No*	-	One	Yes	22.28
	Combined (*n* = 1427)	One	Yes	28.13	Three	Yes	25.38	One	No*	-	One	Yes	22.17

Note. EV = Eigenvalue; EV>1 = number of factors with EV>1; F1>3xF2 = extracted loadings of factor1 three times bigger than factor 2; 1FVar = 1 factor % common variance.

* = very close to yes.

Waller's results for the 16-item GK scale were: EV>1 = one; F1>3xF2 = Yes; 1FVar =27.78. Waller's results for the 7-item VK scale were: EV>1 = 1; F1>3xF2 = No; 1FVar = 21.65.

Table 3

Results of the Confirmatory Factor Analysis for the 16 and 25-item HPV General Knowledge (GK) scales

		GK16					**GK25**				
		χ^2	CFI	RMSEA	SRMR	CD	χ^2	CFI	RMSEA	SRMR	CD
T1	French (*n* =1000)	889.15 *p* < 0.001	0.843	0.087	0.055	0.900	2571.48 *p* < 0.001	0.725	0.091	0.071	0.916
	English (*n* =2117)	1311.88 *p* < 0.001	0.905	0.074	0.042	0.918	4807.88 *p* < 0.001	0.784	0.088	0.066	0.933
	Combined (*n* = 3117)	2054.54 *p* < 0.001	0.889	0.078	0.045	0.912	7185.70 *p* < 0.001	0.764	0.090	0.068	0.927
T2	French (*n* =554)	484.63 *p* < 0.001	0.853	0.081	0.055	0.895	1435.47 *p* < 0 0.001	0.729	0.087	0.073	0.911
	English (*n* =873)	588.96 *p* < 0.001	0.904	0.073	0.045	0.916	2308.79 *p* < 0.001	0.766	0.092	0.070	0.931
	Combined (*n* = 1427)	948.23 *p* < 0.001	0.889	0.075	0.047	0.908	3518.88 *p* < 0.001	0.749	0.091	0.071	0.923

Note. χ^2 = Chi square; CFI = comparative fit index; RMSEA = root mean square error approximation;

SRMR = standardized root mean square residual; CD = coefficient of determination.

Cut-off criteria: a) *p* for $\chi^2 > 0.05$, b) CFI > 0.9, c) RMSEA< 0.06, d) SRMR < 0.08 and e) CD as close as possible to 1. Waller et. al results: Chi square 1981.6, *p* < 0.0001; CFI = 0.816; RMSEA = 0.087; SRMR = 0.063; NFI = 0.809

Table 4

Results of the Confirmatory Factor Analysis for the 7 and 11-item HPV Vaccination Knowledge (VK) scales across subsamples at Time 1 (T1) AND Time 2 (T2)

		VK7					**VK11**				
		X^2	CFI	RMSEA	SRMR	CD	X^2	CFI	RMSEA	SRMR	CD
T1	French (*n* = 1000)	128.21 *p* < 0.001	0.908	0.090	0.052	0.804	294.02 *p* < 0.001	0.883	0.075	0.050	0.832
	English (*n* = 2117)	226.19 *p* < 0.001	0.930	0.085	0.049	0.822	576.73 *p* < 0.001	0.909	0.076	0.048	0.863
	Combined (*n* = 3117)	335.48 *p* < 0.001	0.925	0.086	0.049	0.815	834.75 *p* < 0.001	0.901	0.076	0.048	0.853
T2	French (*n* = 554)	68.86 *p* < 0.001	0.899	0.084	0.052	0.767	174.02 *p* < 0.001	0.870	0.073	0.053	0.805
	English (*n* = 873)	104.61 *p* < 0.001	0.917	0.086	0.053	0.799	275.40 *p* < 0.001	0.896	0.078	0.051	0.850
	Combined (*n* = 1427)	154.44 *p* < 0.001	0.914	0.084	0.051	0.786	409.95 *p* < 0.001	0.886	0.076	0.050	0.833

Note. χ^2 = Chi square; CFI = comparative fit index; RMSEA = root mean square error approximation; SRMR = standardized root mean square residual; CD = coefficient of determination.

Cut-off criteria: a) *p* for $\chi^2 > 0.05$, b) CFI > 0.9, c) RMSEA < 0.06, d) SRMR < 0.08 and e) CD as close as possible to 1. Waller et. al results: Chi square 428.9, *p* < 0.0001; CFI = 0.793; RMSEA = 0.111; SRMR = 0.083; NFI = 0.789

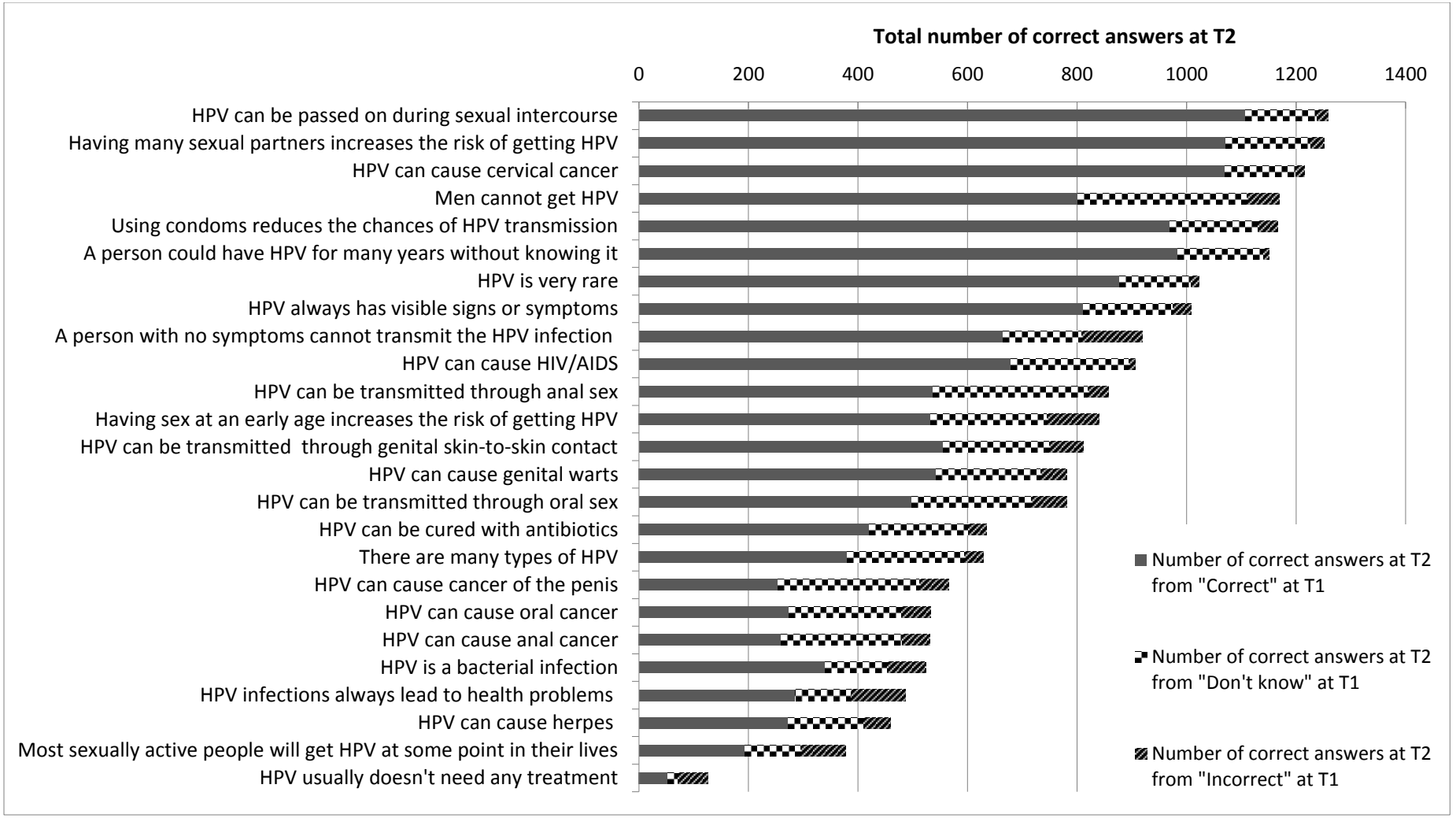

Figure 1. Number of correct answers to each item at Time 2, by their answer at Time 1 for HPV General Knowledge (GK) items

Note. Data is presented for n = 1427 at T1 and n = 1427 at T2. For each item, the entire bar represents the number of correct answers at T2. Shading represents the way in which these participants remained correct or changed to correct from their initial response at T1. For example, for the item "*HPV can be passed on during sexual intercourse*", 1108 correct answers at T1 remained correct at T2; 130 'Don't Know' answers at T1 and 20 incorrect answers at T1 changed to correct at T2.

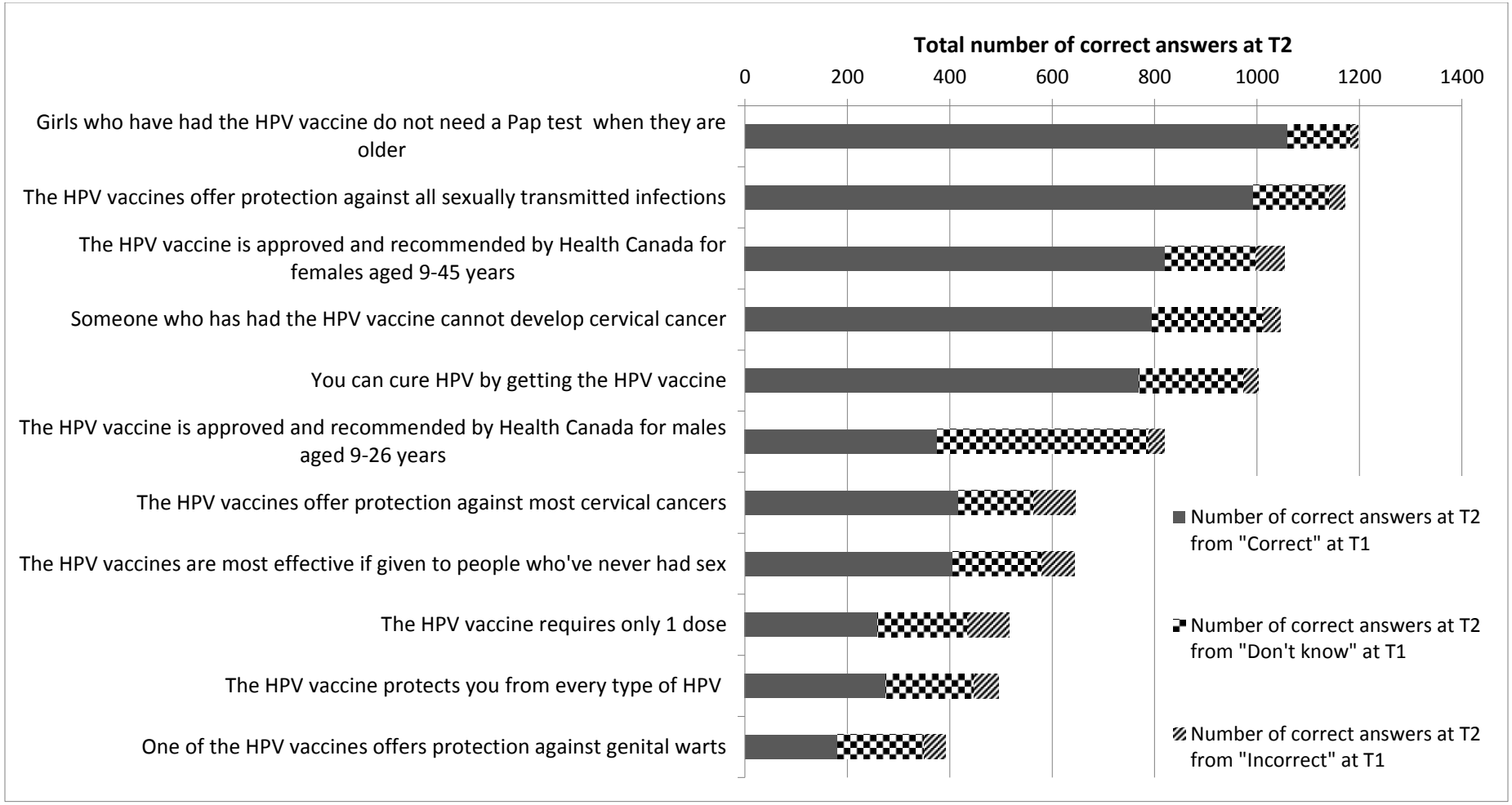

Figure 2. Number of correct answers to each item at Time 2, by their initial answer at Time 1 for HPV Vaccination Knowledge (VK) items

Note. Data is presented for n = 1427 at T1 and n = 1427 at T2. For each item, the entire bar represents the correct number of answers at T2. Shading represents the way in which these participants remained correct or changed to correct from their initial response at T1. For example, for the item "Girls who have had the HPV vaccine do not need a Pap test when they are older", 1060 correct answers at T1 remained correct at T2; 123 'Don't Know' answers at T1 and 14 incorrect answers at T1 changed to correct at T2

Bridge to Manuscript 3

Similar to knowledge, attitudes and beliefs are commonly studied in the HPV vaccine acceptability literature. There are a variety of attitudes and beliefs that may influence a parent's decision to have their child vaccinated. A non-exhaustive list of attitude and belief items include: concern of the severity of HPV, genital warts and/or cancer; beliefs about susceptibility to HPV and/or cancer, genital warts; attitudes toward vaccines in general; beliefs about the costs versus the benefits of vaccination e.g. concern about the safety of the vaccine, perceived benefits and efficacy of the vaccine, perceived risk and worry, beliefs about adverse behavioural consequences – e.g. concerns for increased/riskier sexual activity if child is vaccinated. Understanding how parents weigh the advantages and disadvantages of the HPV vaccine and how what their underlying attitudes and beliefs related to HPV vaccination specifically and vaccination in general are of paramount importance to increase HPV vaccine uptake. The construct of 'attitudes and beliefs' reflect the theoretical and conceptual concepts from theories like the HBM, TPB/TRA and other health behaviour theories and are in no way mutually exclusive. The challenge, similar to knowledge, is the inconsistency and variability in measurement across studies.

At the time of the questionnaire development, there existed only two published psychometrically-evaluated HPV attitudes and beliefs scales- the Carolina HPV immunization attitudes and beliefs scale (CHIAS), and the Parental Human Papillomavirus Vaccine Survey (PHPVS) (McRee et al., 2010; Thomas et al., 2013). Both scales were developed shortly after the HPV vaccine's approval (2007-2009), and did not include certain beliefs about HPV and the HPV vaccine, such as attitudes about the association between HPV and cancers other than cervical cancer. Importantly, both the CHIAS and the PHPVS were developed and tested

exclusively among parents of daughters, and thus the items are gender-specific. Last, both of these scales were developed solely in English-speaking samples, and it remains unknown whether the scales are reliable in non-Anglophone cultural contexts.

There are a multitude of HPV vaccine related attitude and belief items used in the literature and thus inconsistency of used items makes comparisons between study's findings very difficult. "Attitudes" is also a very broad construct, and it is important to try to more precisely define which specific and relevant attitudes encompass this factor with respect to HPV vaccination. An accurate, comprehensive, reliable and validated measurement tool assessing parent's vaccination attitudes and beliefs for their sons was needed. Manuscript 3 builds upon the existing scales and presents the development of reliable and valid attitude and beliefs scale specific to HPV and HPV vaccination that could be used in English and French and among parents of boys. The objective was to create an attitudes and beliefs scale theory that was guided by several health behaviour theories as well as the empirical literature.

Manuscript 3

Development and Validation of the Human Papillomavirus Attitudes and Beliefs Scale (HABS) in a National Canadian sample

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Abstract

Background. Parents' HPV vaccination decision-making is strongly influenced by their attitudes and beliefs towards vaccination. To date, psychometrically evaluated HPV vaccination attitudes scales have been narrow in their range of measured beliefs and often limited to attitudes surrounding female HPV vaccination. The study aimed to develop a comprehensive, validated and reliable HPV vaccination attitudes and beliefs scale among parents of boys.

Methods. Data were collected from Canadian parents of 9-16-year-old boys using an online questionnaire completed in two waves with a 7-month interval. Based on existing vaccination attitudes scales, a set of 61 attitude and belief items were developed. Exploratory and confirmatory factor analyses were conducted. Internal consistency was evaluated with Cronbach's α and stability over time with intraclass correlations.

Results. The HPV Attitudes and Beliefs Scale (HABS) was informed by 3117 responses at Time one and 1427 at Time two. The HABS contains 46 items organized in 9 factors: Benefits (10 items), Threat (3 items), Influence (8 items), Harms (6 items), Risk (3 items), Affordability (3 items), Communication (5 items), Accessibility (4 items), and General Vaccination Attitudes (4 items). Model fit at time two were: $\chi^2/df = 3.13$, standardized root mean square residual = 0.056, root mean square error approximation (confidence interval) = 0.039 (0.037- 0.04), comparative fit index = 0.962 and Tucker-Lewis index = 0.957. Cronbach's alphas were greater than 0.8 and intraclass correlations of factors were greater than 0.6.

Conclusions. The HABS is the first psychometrically-tested scale of HPV attitude and beliefs among parents of boys available for use in English and French. Further testing among parents of girls and young adults and assessing predictive validity are warranted.

Key words: Human papillomavirus; HPV vaccination; Attitudes; Beliefs; Scales; Prevention; Sexually transmitted diseases; Parents

Introduction

Data from randomized controlled trials and population-based studies strongly support both the safety and efficacy of the human papillomavirus (HPV) vaccine in preventing and reducing rates of genital warts and precancerous lesions (Bruni et al., 2016). HPV vaccination is available through the private sector in over 100 countries and has been introduced into public immunization programs (mostly for females) in over 30 countries. In North America and Europe, HPV vaccine uptake varies widely, and is frequently well below 80% (Bruni et al., 2016; Centers for Disease Control and Prevention, 2015a; Gowda et al., 2012; Public Health Agency of Canada, 2014), failing to reach sufficient levels to confer herd immunity. Worldwide, most immunization guidelines recommend HPV vaccination for both males and females from 9 years of age (Bruni et al., 2016; Centers for Disease Control and Prevention, 2015a). Consequently, parents are the most common decision-makers, and HPV vaccination decisions largely depend on their attitudes and beliefs regarding the HPV vaccine and towards vaccination in general (Allen et al., 2010b; Trim et al., 2012).

Recent systematic reviews summarize how HPV vaccination attitudes and beliefs influence HPV vaccination decisions amongst adolescents, young adults, and parents (Allen et al., 2010a; Holman et al., 2014; Kessels et al., 2012; Newman et al., 2013; Trim et al., 2012). The attitudes and key beliefs commonly known to predict HPV vaccine uptake are: benefits of HPV vaccination, HPV vaccine efficacy, perceived severity of and susceptibility to HPV and HPV-associated diseases, HPV vaccine safety, beliefs that HPV vaccination might influence sexual behaviour, beliefs about cost, physicians' recommendation, influence of significant others and peers, religious and cultural attitudes, and age-related concerns (Trim et al., 2012). These items are often framed by the theoretical concepts from widely used health behaviour theories,

such as the Health Belief Model (HBM) and the Theory of Planned Behaviour (TPB) (Allen et al., 2010a; Gilkey et al., 2014b; Gowda et al., 2012; McRee et al., 2010).

A systematic review by Allen and colleagues (Allen et al., 2010a) examined measures used in studies of HPV vaccination acceptability, and found that constructs varied widely in their definitions, that few authors reported on the reliability or validity of their measures, that they lacked details on item retention in factor analytic studies, and that many studies failed to report scales' internal consistency and that assessment of any form of validity was rare. Moreover, of the 79 studies reviewed, only one study assessed test-re-test reliability (Allen et al., 2010a).

There are only two existing scales that measure HPV vaccination attitudes and beliefs, which extensively tested and thoroughly reported on the measures' psychometric properties: the Carolina HPV Immunization Attitudes and Beliefs Scale (CHIAS) (McRee et al., 2010), and the Parental Human Papillomavirus Vaccine Survey (PHPVS) (Thomas et al., 2013). Although these measures are reliable, both scales focus on a narrow set of vaccination attitudes and beliefs, measuring only three to four factors. Thus, researchers who want to assess a wide variety of HPV vaccine attitudes and beliefs need to include additional items to complement these scales, which can lead to inconsistency of measurement and difficulty comparing results across studies (Allen et al., 2010a). Moreover, both the CHIAS and the PHPVS were developed and tested exclusively among parents of girls, and consequently some items are gender-specific. In addition to these gaps, both scales were developed shortly after the HPV vaccine's approval (2007-2009), and did not include certain beliefs about HPV and the HPV vaccine, such as attitudes about the association between HPV and cancers *beyond* cervical cancer. Lastly, both the CHIAS and the PHPVS were developed solely in English-speaking samples, and it remains unknown whether the scales are reliable and can be used in other languages.

Our own research in HPV vaccine acceptability (Krawczyk et al., 2015a; Zimet, Rosberger, Fisher, Perez, & Stupiansky, 2013) and review of the literature suggest that due to the breadth and growing complexity of vaccination attitudes, HPV attitudes and beliefs scales are vaster and that some key attitudes and beliefs are absent from existing scales (e.g., beliefs about the threat/risk of HPV-associated diseases; comfort in communicating about sexual health with one's child). To the best of our knowledge, there exist no standardized instruments to assess attitudes and beliefs about HPV vaccination that were tested among parents of sons. The present study's objectives were to develop a comprehensive, validated, reliable HPV vaccination attitudes and beliefs scale (HABS) that could be used in English and French and was validated among parents of boys. As recommended by Allen et al.'s systematic review (Allen et al., 2010a), our second objective was to validate the scale over two time points in a large nationally representative population that is diverse in terms of parents' gender, race/ethnicity, language and literacy levels. The development and validation of the HABS would address the need for a psychometrically sound tool to be used widely, allow for easier comparisons across studies, and better understand the predictors of HPV vaccination, with the ultimate goal of improving HPV vaccine uptake.

Material and Methods

Study design and participants

This survey was part of a larger project entitled "Parents, Sons and the HPV Vaccine: What Factors Influence Decision-Making over Time?" (Canadian Institutes of Health Research grant #288295), which was designed to investigate the cognitive, social and behavioural (i.e., psychosocial) factors that influence HPV vaccine decision-making among Canadian parents of sons over time.

The development of the HABS was a first step in analyzing data from the larger web-based survey. The sampling, recruitment and data collection methods used are presented in detail elsewhere (Perez et al., 2016c) and are outlined here briefly. The first wave of data collection was in February 2014 (time 1, T1); the second in October to November 2014 (time 2, T2). Eligible participants were Canadian parents or guardians of 9 to16-year-old boys. Additional eligibility criteria included functional knowledge of English or French, internet access, and residence in one of the 10 Canadian provinces. Léger, a polling and market research firm that maintains a national panel of 400,000 Canadians, of which 29,867 met our eligibility criteria, facilitated data collection. Panelists who met the eligibility criteria were contacted by Léger via email and invited to participate in the study. The Institutional Review Board (IRB) at the Jewish General Hospital in Montreal, Canada, approved the study.

Scale development

An iterative five-step process was used to develop the HABS. First, our research team reviewed previous studies examining HPV vaccination decision-making with special attention to findings pertaining to vaccination attitudes and beliefs, as well as existing vaccination attitudes and beliefs scales (Allen et al., 2010b; Gowda et al., 2012; McRee et al., 2010; Thomas et al., 2013). We also contacted various authors in the field to obtain copies of their measurement instruments used. In addition, we reviewed theories such as the HBM, TPB and the Integrated Behavioural Model, to develop items that reflect the constructs of these models. A list of approximately 200 items assessing various attitudes and beliefs regarding HPV, the HPV vaccine, and vaccines in general was compiled. We organized items by conceptual constructs. Items relevant only to women were modified to be gender neutral, and if this was not possible, the female-specific items were removed. Because many items were assessing conceptually

similar concepts and the face validity was quite similar, we selected items based on the strength and details of the validity and reliability statistics reported in the original studies with focus on studies that used the exploratory factor analysis (EFA) and confirmatory factor analysis (CFA); reporting of factor loadings; and strong emphasis on selecting items from existing psychometrically tested HPV vaccine-specific attitudes and belief scales (Gowda et al., 2012; McRee et al., 2010; Thomas et al., 2013). A draft questionnaire was created.

Second, a bilingual panel of seven highly experienced HPV researchers from Canada and the United States reviewed the questionnaire and provided extensive feedback on items that should be retained, eliminated, or revised. We were overinclusive in item selection to assure the full breadth of constructs of interest and after consensus discussion, 61 attitudes and belief items were retained for the questionnaire.

Third, the revised questionnaire was pretested with a convenience sample of parents (n = 10) of boys. Parents participated in an individual cognitive interview with one of the authors (S.P. or K.J.D). Two commonly used cognitive interviewing techniques were employed: (1) *verbal probing*: parents were asked to answer questions about their interpretation of a survey item, to paraphrase the construct; and (2) *think aloud*: parents were asked to verbalize any ideas that come to mind, shedding light on inferences and beliefs that helped them answer the survey item. Fourth, the authors extensively discussed feedback from these cognitive interviews with the expert panel, and appropriate modifications were made with group consensus. The reading level of the survey was measured using the Flesch-Kincaid scale available through Microsoft Word (Microsoft Corp., Redmond, WA) and found to be appropriate for a grade 8 reading level. Fifth, the final survey was translated into French by a specialized translation firm. The questionnaire was then reviewed for accuracy with an independent bilingual group (n = 5) working in the

healthcare field to ensure translation accuracy. For each attitude and belief item, a 7-point Likert response format with *1, strongly disagree; 4, neutral;* and *7, strongly agree* was used.

Data Analysis

To explore the dimensionality of the HABS, an EFA was conducted based on responses to the 61 items at T1. Factor analysis was performed using maximum likelihood extraction with an oblique (oblimin) rotation because we expected that the factors would be correlated. The selection of the optimal number of factors to retain was informed by the parallel analysis approach, which was consistent with the syntax developed by O'Connor (O'Connor, 2000). To determine how many factors to retain, parallel analysis was conducted on data collected at T1. In the EFA, factors with loadings below 0.4 were excluded. In the next step, a CFA was performed using the T1 sample. To improve model fit, we used the within-factor correlation of error terms, as suggested by high values of modification indices in the co-variances table (Hooper, Coughlan, & Mullen, 2008). The following indices were selected to report the model fit: (a) Wheaton et al.'s relative/normed chi-square (χ^2/df), (b) the standardized root mean square residual (SRMR), (c) the root mean square error approximation (RMSEA), (d) the comparative fit index (CFI) and (e) the non- normed-fit index (NNFI) also known as Tucker-Lewis index (TLI) (Hooper et al., 2008). The following cut-off criteria were used: (a) χ^2/df between 2 and 5, (b) SRMR less than 0.08, (c) RMSEA of 0.06 or less, (d) CFI of 0.95 or greater, and (e) NNFI-TLI of 0.95 or greater (Hooper et al., 2008). The model fit was tested separately for both data collected in the first and second wave.

The following model characteristics were assessed using the following indices and cut-off criteria: (a) reliability using a composite reliability cut-off > 0.7, (b) convergent validity of indicator items within scales using the average variance extracted (AVE) cut-off > 0.5, and (c)

discriminant validity using the maximum shared variance < AVE, and the average shared variance (ASV) < AVE.

To confirm the internal consistency of the scales, Cronbach's α was calculated for items loading on each factor subscale for both data collected at T1 and T2. A test-re-test reliability analysis of factors was performed to assess the stability of scales over time based on intra-class correlations between T1 and T2.

To address possible differences between English and French respondents, the model fit was tested separately on French and English scales for both T1 and T2. Statistical analyses were performed using IBM SPSS V.20 and IBM SPSS Amos V.23.

Results

The total number of participants analyzed at T1 was 3117 of which 1427 were analyzed at T2. Sample demographics are presented in Table 1. There were no statistically significant differences between T1 and T2 for gender, education, employment status, household income, religion and ethnicity. At T1, there were more English speakers (59%) compared to T2 (53%). At T2, there were more French speakers (39.2%) compared to T1 (33%). All *p* values were less than 0.05, and the effect size was small (Cohen's $h < 0.2$).

Parallel analysis at T1 suggested a maximum of an 8 to10 factor solution. The authors examined and evaluated the three possible solutions, and found that the 9-factor solution was the most theoretically interpretable. Based on the EFA loadings at T1, 11 of 61 items were excluded with loadings less than 0.4. In the CFA performed at T1, four items out of 61 were removed because of AVE < 0.5. In total, 46 items for the final 9-factor model solution remained. The 9 factors were reviewed and conceptually labelled as follows: "Benefits of HPV vaccination (Benefits)" -10 items, "Threat of HPV-infection and HPV-associated diseases (Threat)"-3 items,

"Social influence (Influence)"-8 items, "Harms"-6 items, "Risk"-3 items, "Affordability"-3 items, "Communication"-5 items, "Accessibility"-4 items, "General vaccination attitudes (General Attitudes)"-4 items (see Appendix F for the full HPV attitude and beliefs scale (HABS), 46 items).

The variable loadings on factors and the items are provided in Table 2. The data collected both at T1 and T2 fit the model well. Because there were no significant differences found in model fit between English and French scales, we provide the results for the whole sample. At T1, we obtained following fit indices: $\chi^2/df = 4.728$, SRMR = 0.052, RMSEA (confidence interval) = 0.035 (0.034-0.036), CFI = 0.968 and TLI = 0.964. At T2, the fit indices were: $\chi^2/df = 3.13$, SRMR = 0.056, RMSEA (confidence interval) = 0.039 (0.037- 0.04), CFI = 0.962 and TLI = 0.957. The reliability, convergent, and discriminant validity of the model at T1 and T2 met all criteria with 3 exceptions for which obtained values were slightly below proposed cutoff values: (1) At T1, the AVE value of 0.392 for "Accessibility", (2) at T2, the AVE for "Accessibility" was 0.474, and (3) at T2 the AVE value for "Influence" was 0.475 with a maximum shared variance of 0.507.

The factor correlations with intra-class correlations and Cronbach's α for each scale at T1 and T2 are provided in Table 3.

Discussion

To the best of our knowledge, this is the first psychometrically evaluated scale assessing HPV vaccination attitudes and beliefs among parents of boys. The HABS consists of 46 items grouped into 9 factors and assesses a greater number of parental attitudes and beliefs compared to existing HPV specific (Gowda et al., 2012; McRee et al., 2010; Thomas et al., 2013) and non-HPV specific attitude and beliefs vaccination scales (Gilkey et al., 2014b; Opel et al., 2011;

Roberts et al., 2015). The development and validation of the HABS was informed by items guided by theoretical frameworks, included a large, national, population-based sample and was evaluated thoroughly in English and French. The HABS demonstrated excellent validity and reliability of the nine-factor model along with good internal consistency and stability over time (Allen et al., 2010a). Moreover, the psychometric properties were consistent across both the English and French scales.

It is most appropriate to compare the HABS to the CHIAS (McRee et al., 2010) and the PHPVS (Thomas et al., 2013), because those are the only two rigorously psychometrically evaluated HPV vaccination attitudes scales available in the literature. When compared to the CHIAS, the HABS is more comprehensive in breadth (i.e., 9 vs 4 factors; 46 vs 16 items) and is adapted to include belief items relevant to both genders (e.g., risks associated with genital warts and *all* HPV-associated cancers). Moreover, the HABS captures four new factors (15 new items): "Threat", Risk", "Communication" and "General vaccine attitudes". Additionally, during item development stage, the authors extensively reviewed all CHIAS items. On the item level, 11 items were adapted from the 16-items CHIAS (McRee et al., 2010) and are nearly identical in the HABS. Importantly, some of these items were conceptualized under different factor names/constructs in the HABS. For example, the HABS item "I feel that other parents in my community are getting their sons the HPV vaccine" is conceptualized under the "Influence" factor, and the item "I feel that the HPV vaccine is too new" is conceptualized under the "Harms" factor, where in contrast, both of those items in the CHIAS belong to the "Uncertainty" factor. Other differences pertain to delineating items under more specific factors e.g., "Accessibility" and "Affordability" in the HABS, in contrast to the CHIAS, where all items were classified as the "Barriers" factor. In our opinion, these differences in conceptualizations,

including using combined factor names can be best explained by the reduced number of items-factors ratio proposed by McRee (16/4) and Gowda (14/3) compared to the HABS (46/9) and are explicated by the HABS expanded factor structure.

An example of factors with a greater item-factor ration is the HABS "Benefits" (10 items) which was conceptualized in the CHIAS as "Effectiveness" (2 items), which McRee and colleagues explained was likely an unstable factor due to few items i.e., less than 3 items. The HABS benefits factor went beyond the vaccine's effectiveness for cervical cancer alone and measured perceived efficacy in preventing HPV-related cancers more broadly, allowing the HABS to assess benefits that are gender neutral and not unique to females. This conceptualization builds upon the now accepted knowledge that the HPV vaccine is effective in preventing cancers *beyond* cervical cancer, which was not as well-supported in 2009 when the CHIAS scale was developed. This change will help in 'de-feminizing' the HPV vaccine, which was initially branded solely for females in the prevention of cervical cancer (Shapiro et al., 2016b). Additionally, our benefit factor contains two items which measures altruistic beliefs, that is the benefit of receiving the HPV vaccine to protect a son's current or future partner (see items 9 and 10, Appendix F), which is a category of benefits that is absent from most, if not all, existing vaccination attitudes scales (Dempsey, Fuhrel-Forbis, & Konrath, 2014; Gowda et al., 2012; McRee et al., 2010; Thomas et al., 2013).

In contrast to the CHIAS, we did not retain items in the HABS related to age such as: "I feel that my child is too young to receive the HPV vaccine" and one item related to short term side effects "I feel that the HPV vaccine might cause short time side effects like pain or discomfort" because both items loaded below 0.4 in the EFA. Additionally, in contrast to McRee et al. (McRee et al., 2010), we did not include the item "I feel that the HPV vaccine would

encourage my son to have sex at an earlier age" due to below cut-off factor loadings. The idea that the HPV vaccine causes earlier or increased sexual promiscuity (i.e., risk compensation) has been systematically refuted (Kasting et al., 2016), and does not appear to be a predictive concern for parents (Krawczyk et al., 2015a; Ogilvie et al., 2010), and perhaps even surveying about this could inadvertently fuel this misconception.

Our results also suggest differences between the HABS and the PHPVS (Thomas et al., 2013). For example, from the 8 items, which loaded on the "Benefits" factor in PHPVS, only one ("A vaccine against HPV could prevent future problems for my child") corresponded with the HABS "Benefits" items. Certain PHPVS items that were categorized as "Benefits" are arguably more appropriately conceptualized and captured in the HABS under distinct factors, such as "Influence" (PHPVS-"Most people I know think vaccinating children with the HPV vaccine before they are teenagers is a good idea"), "Harms" (PHPVS-"Giving my child a new vaccine is like performing an experiment on him" and "I am more likely to trust vaccinations that have been around awhile") or "General vaccination attitudes" (PHPVS-"Children should only get vaccinated for serious diseases") rather than a non-specific, overly inclusive benefits factor. Also, we believe that certain PHPVS items ("Genital warts are caused by HPV" and "Using condoms can prevent HPV") which were conceptualized as "Vulnerability" would be better understood as HPV knowledge rather than HPV attitudes and beliefs.

One limitation of the PHPVS is that attitudes and beliefs, HPV knowledge, intentions, acceptability and experiential items were all treated as conceptually identical constructs during psychometric testing, which likely limits the scales specificity and construct validity. Though the PHPVS resulted in a 4-factor unidimensional model framed on the theoretical constructs of the

HBM, the scale did not distinguish items that measure *perceived/ subjective* beliefs with *objective* HPV knowledge, intentions, acceptability and other experiential items.

In contrast to the HABS, the PHPVS was validated on a smaller sample (n = 200), and model fit (CFA), reliability, convergent and discriminant validity were not reported (Thomas et al., 2013). Conversely, the CHIAS (McRee et al., 2010), was developed with a sample of 783 respondents, has undergone rigorous psychometric testing and largely retained its structure of factors when it was tested in a different population by Gowda et al (Gowda et al., 2012). Therefore, we concluded that the HABS represents an improved scale when compared with the PHPVS and that the HABS brings added value to the CHIAS by encompassing three times the number of items measured, which will allow researchers to assess additional attitudes and beliefs that are known to influence HPV vaccination decision-making (Holman et al., 2014; Kessels et al., 2012; Newman et al., 2013; Trim et al., 2012). Moreover, the items were designed to be utilized among parents of sons (e.g., vaccinating *my son* against HPV would protect his current/future partner against cancer). These items could be tested and used among parents of girls, by replacing *my son* with *my daughter*.

General vaccination attitude and belief scales are available in the literature, such as the Vaccination Confidence Scale (Gilkey et al., 2014b) (8 items and 3 factors), and the modified Parents Attitudes about Childhood Vaccines Survey (Roberts et al., 2015) (16 items and 2 factors). Although these scales are useful, both lack specificity to the beliefs related uniquely to HPV vaccination (e.g., the barrier of the newness of the HPV vaccine and the beliefs related to a sexually transmitted infection). Moreover, the Vaccination Confidence Scale (Gilkey et al., 2014b) proposes 2 factors ("Harms" and "Trust") which contain only 2 items, making internal consistency results unreliable. The HABS does successfully include a *general vaccination*

attitudes factor, which overlaps with six items from the Vaccination Confidence Scale and 5 items for Parents Attitudes about Childhood Vaccines Survey.

Our study is not without limitations. Important differences in health beliefs between parents who belong to Leger's panel and subsequently agreed to participle compared with parents who do not belong to the panel or who did not partake in the study might have been missed. This limitation was addressed by attempting to recruit any Canadian parent with a son 9 to16 years without specifying the subject matter in the invitation email (i.e., we did not specify that we were surveying about health, HPV or vaccination). Therefore, we reduced the bias of attracting individuals with greater interest in health or vaccination beliefs. Moreover, although we attempted to include a satisfactory set of items to comprehensively assess HPV attitudes and beliefs, the HABS does not capture *all* attitudinal items.

Future directions include that the HABS be validated among other populations, such as parents of females, young adults, and in other geographical areas to confirm the robustness of the HABS in categorizing HPV vaccination attitudes and beliefs in different populations. Second, we suggest considering broadening the "Influence" factor by testing the utility of adding items related to the opinion of experts, scientists, health authorities because we obtained borderline convergent and discriminant validity for this factor. By adding these items, the influence of peers could potentially be separated into two distinct factors from the influence of health authorities. Lastly, our research group will test and report on the predictive validity of the HABS using the Precaution Adoption Process Model (Weinstein et al., 2008), to understand how the HABS relates to the six stages of decision-making: (1) unaware, (2) unengaged, (3) undecided, (4) decided not to act, (5) decided to act, and (6) acting among parents of sons (manuscript 4).

There is an established association between HPV vaccination acceptance and parental attitudes and beliefs (Dempsey, Butchart, Singer, Clark, & Davis, 2011; Krawczyk et al., 2015a; Krawczyk et al., 2015b; Trim et al., 2012). It has been shown that parents with medium positive attitudes as compared with low positive attitudes were six times more likely to report that their teenager had received all the recommended vaccinations, including the HPV vaccine (Rickert, Rehm, Aalsma, & Zimet, 2015). Additionally, parents who had the strongest attitudes were more likely to report a greater number of vaccines discussed with their health care provider (Rickert et al., 2015), which is a well-established predictor of HPV vaccine uptake (Zimet et al., 2013). Moreover, positive parental attitudes (e.g., the HPV vaccine is safe) toward HPV and general vaccination were found to predict actual HPV vaccine uptake among three large samples of parents of girls (Allen et al., 2010b; Krawczyk et al., 2015a; Ogilvie et al., 2010). Negative HPV vaccine attitudes have been found to be a predictor of HPV vaccine refusal. A similar finding of HPV vaccine attitudes being a significant predictor of HPV vaccine uptake has been found in men who have sex with men (Gerend, Madkins, Phillips, & Mustanski, 2016) as well as adolescent females (Brewer et al., 2011) and males (Reiter et al., 2013). Taken together, it is important to understand what parents *feel* and *believe* about HPV, the HPV vaccine and vaccines in general, because this impacts their decision to vaccinate or not vaccinate their child against HPV. Furthermore, by better understanding parental beliefs, we can target the ways in which health care providers can adequately address their opinions and attend to their concerns.

Conclusions

In conclusion, the HABS represents a valuable addition to existing HPV attitudes and beliefs vaccination scales and an indispensable measurement tool. We encourage researchers to use the HABS, available in both English and French, when assessing HPV attitudes and beliefs

(see Appendix F). This will also allow for cross comparisons between HPV behavioural studies, as to date, the tools to measure HPV attitudes and beliefs vary greatly from study to study. Parental immunization attitudes and beliefs surrounding HPV and the HPV vaccine (e.g., benefits, risks, harms, communication), and vaccines in general, are an important ingredient and a key influence to improving HPV immunization rates among adolescents (Allen et al., 2010b; Krawczyk et al., 2015a; Ogilvie et al., 2010). It is our ultimate goal that researchers use the psychometrically evaluated HABS to better assess attitudes and beliefs, which can increase HPV immunization rates, and in turn reduce HPV-associated morbidity and mortality.

Table 1

Characteristics of study participants

		T1 (*n* = 3117)		T2 (*n* = 1427)	
		n	**%**	***n***	**%**
Gender	Female	2119	68	967	67.8
	Male	998	32	460	32.2
Language	English	1839	59	756	53
	French	1030	33	560	39.2
	Other	246	7.9	110	7.7
	Preferred not to answer	2	0.1	1	0.1
Education	Elementary or high school	680	21.8	301	21.1
	Pre-university or vocational program	1180	37.9	518	36.3
	University	1250	40.1	607	42.5
	Preferred not to answer	7	0.2	1	0.1
Household income (CAD before taxes)	<60.000	823	26.4	360	25.2
	60.000-99.999	979	31.4	458	32.1
	>=100.000	1009	32.4	459	32.2
	Preferred not to answer	306	9.8	150	10.5
Race/ethnicity	White	2741	87.9	1280	89.7
	Asian	166	5.3	60	4.2
	Other	184	5.9	73	5.1
	Preferred not to answer	26	0.8	14	1
Age		***M* (SD)**		***M* (SD)**	
		44.43 (6.65)		44.77 (6.66)	

Note. Language refers to first language learned at home in childhood. *M* = Mean, *SD* = Standard Deviation.

Table 2

Confirmatory Factor Analysis (CFA) Standardized Factor Loadings for the 9 Factor Scales at T1 and T2

Items: "I feel that…"ǂ	Benefits		Threat		Influence		Harms		Risk		Affordability		Communication		Accessibility		General Vaccination Attitudes	
	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2
…the HPV vaccine has many benefits	0.86	0.88																
…the HPV vaccine will protect my son's sexual health	0.83	0.84																
…the HPV vaccine works well	0.76	0.79																
…the HPV vaccine is effective in preventing HPV	0.79	0.80																
…the HPV vaccine is effective in preventing genital warts	0.71	0.72																
…vaccinating *my son*ǂ against HPV may be a good thing to do for his health	0.92	0.93																
…vaccinating *my son* against HPV would give me peace of mind about his sexual health	0.82	0.83																
…the HPV vaccine is effective in preventing HPV-related cancers	0.78	0.79																
…vaccinating *my son* against HPV would protect his current/future partner from getting infected with HPV	0.80	0.80																
…getting *my son* the HPV vaccine would protect his current/future partner against cancer	0.75	0.73																
…it would be serious if *my son* contracted HPV later in life			0.88	0.89														
…it would be serious if *my son* contracted genital warts later in life			0.86	0.85														
…it would be serious if *my son* contracted an HPV-related cancer later in life			0.80	0.76														
…other parents in my community are getting their sons the HPV vaccine					0.69	0.62												
…my friends are getting their sons vaccinated with the HPV vaccine					0.70	0.67												
…other boys around my sons 's age are getting vaccinated for HPV					0.67	0.62												
…it is expected of me that I should vaccinate *my son* against HPV					0.64	0.48												
…most of my friends think vaccinating my son against HPV is a good idea					0.81	0.78												
…doctors/health care providers believe vaccinating boys against HPV is a good idea					0.54	0.52												
…my son's other parent believes we should get the HPV vaccine for *my son*					0.81	0.80												
…my family thinks it is a good idea to vaccinate *my son* against HPV					0.95	0.91												
…the HPV vaccine is unsafe							0.86	0.88										
…giving *my son* the HPV vaccine would be like performing an experiment on him							0.84	0.85										
…the HPV vaccine may lead to long-term health problems							0.79	0.80										
…the HPV vaccine is being pushed to make money for pharmaceutical companies							0.62	0.58										
…the HPV vaccine is too new							0.74	0.78										
…there has not been enough research done on the HPV vaccine							0.72	0.78										
…without the HPV vaccine, *my son* would be at risk of getting HPV later in life									0.88	0.92								
…without the HPV vaccine, *my son* would be at risk of getting genital warts later in life									0.85	0.85								

…without the HPV vaccine, *my son* would be at risk of getting an HPV-related cancer later in life	0.85	0.84										
…the HPV vaccine is too expensive			0.78	0.83								
…my/our insurance does not cover enough of the cost of the HPV vaccine for my son			0.71	0.75								
…the HPV vaccine costs more than I can afford			0.85	0.83								
…it is hard to talk to *my son* about his sexual health					0.78	0.79						
…I am uncomfortable discussing *my son* sexual health with a doctor/health care provider					0.68	0.67						
…sex is not a subject I talk about with *my son*					0.77	0.77						
…I am uncomfortable talking to *my son* about the HPV vaccine					0.90	0.88						
…I do not know how to approach the topic of the HPV vaccine with *my son*					0.87	0.88						
…it is hard to find a clinic that would be easy to access for getting the HPV vaccine for *my son* *							0.61	0.67				
…it is hard to find a provider or clinic where I would not have to wait a long time to get an appointment for *my son* to get vaccinated*							0.58	0.66				
…dealing with getting the HPV vaccine for *my son* would be simple							0.65	0.70				
…the process of actually getting the HPV vaccine for *my son* would be easy							0.66	0.72				
…vaccines are a good way to protect public health									0.81	0.79		
…vaccinating children is a good idea									0.81	0.88		
I do not like the idea of vaccines*									0.86	0.84		
…doctors give out too many vaccines*									0.96	0.97		

Note. CFA Standardized Factor loadings are for T1 (3117) and T2 (1427). All scales are 7-point- Likert scales with 1 = "Strongly disagree" to 7 = "Strongly agree".

*indicates items that are reverse-coded.

† All items began with I feel

‡ Participants were asked at the beginning of the questionnaire to provide a name, nickname, initials or abbreviations for their son who is between the ages of 9 and 16 and who has had the nearest birthday. Using intelligence programming, Parents' sons' initials, name, nickname (e.g., JT, Dan) was then replaced and "my son" in all items listed above where my son is italicized, making the questionnaire individualized for each participant.

Table 3

Factor Inter-correlations at T1/T2 and Intra-class Correlations between Factors at T1 and T2 (along the diagonal, bold)

	Benefits	Threat	Influence	Harms	Risk	Affordability	Communication	Accessibility	General Vaccination Attitudes
Benefits	**0.848**								
Threat	0.63/0.54	**0.627**							
Influence	0.68/0.71	0.37/0.36	**0.766**						
Harms	-0.68/-0.75	-0.32/-0.27	-0.48/-0.56	**0.866**					
Risk	0.65/0.68	0.39/0.30	0.55/0.57	-0.44/-0.57	**0.761**				
Affordability	0.07/0.13	0.05/0.09	0.01/0.00	0.14/0.05	0.06/0.13	**0.655**			
Communication	0.03/0.06	-0.09/-0.09	0.00/0.02	0.12/0.03	0.03/0.05	0.20/0.16	**0.827**		
Accessibility	0.10/0.06	0.16/0.14	0.17/0.17	-0.26/-0.15	0.11/0.05	-0.41/-0.37	-0.49/-0.46	**0.697**	
General Vaccination Attitudes	0.53/0.59	0.32/0.26	0.32/0.40	-0.67/-0.72	0.40/0.49	-0.10/-0.03	-0.10/-0.02	0.23/0.14	**0.905**

Note. Cronbach's α for each factor at T1/T2 were: Benefits: 0.952/0.954, Threat: 0.882/0.869, Influence: 0.906/0.884, Harms: 0.900/0.912, Risk: 0.891/0.905, Affordability: 0.821/0.844, Communication: 0.902/0.903, Accessibility: 0.814/0.845, General Vaccination Attitudes: 0.897/0.898

Bridge to Manuscript 4

There is no doubt that HPV vaccine decision-making is complex and difficult to study. To date, there are have been approximately a dozen quantitative studies examining the factors associated with HPV vaccine decision-making among parents of boys in the post-licensure era of HPV vaccine for males (Berenson & Rahman, 2012; Bianco et al., 2014; Donahue et al., 2014; Gainforth et al., 2012; Gilkey et al., 2012; Lindley et al., 2016; Mortensen, 2010; Mortensen et al., 2015; Perkins et al., 2013; Reiter et al., 2013; Schuler & Coyne-Beasley, 2015; Taylor et al., 2014; Tisi et al., 2013). Similar to the parents of girls literature, with few exceptions (Gainforth et al., 2012; Mortensen, 2010; Mortensen et al., 2015; Tisi et al., 2013), the majority of these studies were conducted in the U.S, were cross-sectional in design and presented descriptive findings only. No published studies to date have employed a large population-based sample of parents of boys and examined the psychosocial determinants that predict parents' HPV decision-making over time using extensively psychometrically validated scales.

The vast majority of studies in this area typically report basic descriptive results, most often using frequencies to understand what influences parents' HPV vaccine decision-making. (Berenson & Rahman, 2012; Bianco et al., 2014; Donahue et al., 2014; Gilkey et al., 2012; Griebeler et al., 2012; Mortensen, 2010; Tisi et al., 2013). This limits our understanding of the relationships and the inferences that can be made. There is presently insufficient evidence to confidently know what are the important factors involved in parents' HPV vaccine decision-making that should be targeted; and are these influences the same for different groups of people. Moreover, many studies typically classify parents into two or three groups e.g., intending to vaccinate, not intending to vaccinate or vaccinated. This falsely presumes that parents are aware and engaged in adopting HPV vaccination, when in fact most studies report that many parents

are unaware what HPV and the HPV vaccine is. The conclusions regarding the factors associated with intentions are blurred, as those individuals who are classified in the intentions group often do not constitute of individuals who truly intend to vaccinate their child.

My fourth manuscript addresses these important gaps in the literature by studying a broad number of factors related to HPV-vaccine decision-making by using a stage theory which classifies parents into six stages of adoption while utilizing psychometrically validated scales and multinomial logistic regression modeling.

Manuscript 4

Beyond Intentions: Untangling the psychosocial predictors of HPV vaccination decision-making stages among parents of boys

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Abstract

Background. HPV vaccination uptake in boys is suboptimal in many jurisdictions, particularly in the absence of publicly funded HPV vaccination programs. Parents represent key decision-makers of HPV vaccination and their HPV vaccine decision-making stage is influenced by multiple psychosocial determinants. Our objective was to assess the relationship between a broad range of psychosocial factors and parents of boys' HPV vaccine decision-making stage.

Methods. Data was collected through an online survey from a national representative sample of Canadian parents of boys in February (Time 1, T1) and November 2014 (Time 2, T2). We assessed a broad range of psychosocial factors including: socio-demographics, health behaviours and validated scales for assessing HPV knowledge, attitudes and beliefs. Parents selected their HPV vaccination adoption stage based on the Precaution Adoption Process Model (PAPM). Multinomial logistic regression was used to test the association between predictors and PAPM stage at T1 and T2.

Results. Discussion with a healthcare provider about the HPV vaccine and increased HPV knowledge was associated with higher odds of being in more advanced PAPM stages. Increased perception of risks related to non-vaccinating against HPV, increased perception that others endorse HPV vaccination and positive attitudes related to vaccines in general were associated with higher odds of being in the *decided to* vaccinate stage. Believing that HPV vaccination is harmful increased, and perceiving the benefits of HPV vaccination decreased the odds of *deciding not* to vaccinate against HPV.

Conclusions. We have highlighted that the psychosocial predictors of HPV vaccination parent-reported decision-making stage that were significant at two time-points. Targeted interventions

should be designed and instituted to help parents make better informed decisions i.e., move closer to actual vaccination adoption.

Keywords: Human papillomavirus vaccination, Determinants of health, Health behavior change, Precaution Adoption Process Model

Introduction

The International Agency for Research on Cancer (IARC) recognized several types of human papillomavirus (HPV) as human carcinogens (International Agency for Research on Cancer 2007; International Agency for Research on Cancer, 2012). This finding prompted the development, approval and recommendation of the HPV vaccination, which has become an indispensable part of worldwide cancer prevention (World Health Organization Report, 2015). The HPV vaccines Gardasil® and Gardasil® 9 have been deemed safe and effective to protect against HPV types which are the major cause of ano-genital and head and neck cancers as well as genital warts (Koutsky et al., 2002; Vichnin et al., 2015). While HPV vaccination of females has been implemented in most countries for over 10 years; males have become an increasingly important part of this cancer prevention strategy (Stanley, 2012; Stanley, 2014). Although HPV vaccination is recommended for males, uptake rates remain low worldwide (Brotherton, Zuber, & Bloem, 2016).

Because the vaccination is targeting pre-adolescent boys and girls, parental acceptance of vaccination against HPV is a critical consideration. Over the last decade, there has been a growth of literature in this area attempting to identify and understand what factors are associated with vaccination intentions and uptake, often referred to as 'HPV vaccine acceptability'. Seventeen published systematic reviews were found examining the relationships between numerous factors (e.g., socio-demographic disparities) and HPV vaccine acceptability with emphasis typically on knowledge, attitudes and behaviours in different populations e.g., parents, adolescents, adults or a combination of these (Brewer & Fazekas, 2007; Chan et al., 2012; Cunningham et al., 2014; Ferrer et al., 2014; Garcini et al., 2012; Hendry et al., 2013; Holman et al., 2014; Kasting et al., 2016; Kessels et al., 2012; Klug et al., 2008; Madhivanan et al., 2016; Nadarzynski et al., 2014;

Newman et al., 2013; Patel et al., 2016; Prue et al., 2016b; Trim et al., 2012; Young, 2010). Two systematic reviews focused exclusively on parents' HPV vaccine acceptability (Garcini et al., 2012; Trim et al., 2012). From these two reviews, virtually all the studies reviewed were conducted among mothers, and the child of interest were girls except for two studies among parents of boys (Garcini et al., 2012; Trim et al., 2012). The two reviews concluded that most studies were conducted in the US, among convenience samples and explored vaccination intentions solely (Garcini et al., 2012; Trim et al., 2012).

In recent years, there have been a growing number of studies examining HPV vaccine acceptability of parents of boys to achieve high HPV vaccine uptake among boys. Most studies conducted among parents of boys do not use theoretical frameworks and/or do not use validated scales to examine factors related to HPV vaccination decision-making (Berenson & Rahman, 2012; Bianco et al., 2014; Donahue et al., 2014; Gilkey et al., 2012; Griebeler et al., 2012; Hansen, Credle, Shapiro, & Niccolai, 2015; Mortensen, 2010; Mortensen et al., 2015; Perkins et al., 2013; Taylor et al., 2014; Tisi et al., 2013). The overwhelming majority of these studies focus on the factors that are associated with intentions or uptake. The presumption is that parents are already aware, engaged and have made a decision about HPV vaccination, when in fact many parents are unaware even that the HPV vaccine is available for their son (Donahue et al., 2014; Gilkey et al., 2012; Mortensen et al., 2015; Reiter et al., 2013; Tisi et al., 2013). Previous studies have shown that there are more stages of vaccine-decision making than intentions and uptake, such as earlier stages like unaware and undecided (Allen et al., 2009; Allen et al., 2010b). Examining HPV vaccine decision-making using multiple stages of adoption is necessary in order to better understand the nuance of vaccine decision-making. Also, there is insufficient evidence to confirm what are the important predictive factors which are related to HPV vaccine

acceptability. In the absence of publicly funded HPV vaccine programs for boys, our study's objective was to establish the association between a number of psychosocial determinants (as previously established in studies with parents of girls) with multiple stages of HPV vaccine decision-making among a national sample of Canadian parents of boys.

Methods

The current study's protocol including sampling, recruitment, socio-demographic sample characteristics, generalizability, measurement as well as preliminary findings are described in detail elsewhere (Perez et al., 2016c). An online self-reported survey was employed assessing socio-demographics, HPV and HPV vaccine knowledge, attitudes and beliefs, and health behaviors (full questionnaire available elsewhere (Perez et al., 2016c). Parents were required to answer all items, and therefore there was no missing data. In February 2014 (Time 1, T1), data was collected from a nationally representative sample of Canadian parents of boys aged 9-16 and participants were followed up in November 2014 (Time 2, T2).

Measures

Outcome

Our dependent, nominal variable was parents' Precaution Adoption Process Model (PAPM) stage. Using the PAPM as our framework, parents chose one of following six stages: 1. Unaware that the HPV vaccine can be given to males, termed *unaware;* 2. Aware that the HPV vaccine can be given to males, but have not thought about getting the HPV vaccine for my son, termed *unengaged*; 3. Thought about giving the HPV vaccine to my son, but are undecided about giving it to him, termed *undecided;* 4. Decided against giving their son the HPV vaccine, termed *decided not to vaccinate;* 5. Decided in favor of giving their son the HPV vaccine, termed

decided to vaccinate, and; 6. Vaccinated their son termed *vaccinated*. At T2, parents' HPV-decision-making stage (referred to as PAPM stage) was re-assessed similarly.

Predictors

The psychosocial predictors of HPV-decision-making (i.e., the study's independent variables) were selected based on the empirical literature and guided by multiple health behaviour theories. The psychosocial predictors consisted of four broad categories:

1) Socio-demographic characteristics of parents and their sons (12 variables) included the following nominal categorical variables: parents' gender, language, marital status, religion, ethnicity, Canada born, education level, household income, employment status, size of town/city of residence. Parents' age and son's age were continuous variables (see Appendix G & H for exact items and response options).
2) Health behaviours (4 variables) included the following nominal categorical variables with yes/no/I don't know response options: Son having attended a routine medical check-up with a doctor in the last year, son having received all the recommended childhood vaccines; having a daughter who was vaccinated against HPV; having had a discussion with the doctor/health care professional (HCP) about HPV vaccination for their son.
3) Knowledge (2 variables) was measured with previously validated scales (Perez et al., 2016b) using a true/false/I don't know response options for which a total score was calculated based on correct answers: general HPV knowledge (23 items, range 0-23) and HPV vaccine knowledge (11 items, range 0-11). Higher scores indicate higher levels of knowledge.
4) Attitudes and beliefs (9 variables) were measured with the previously validated HPV attitudes and beliefs Scale (HABS) (Perez et al., 2016a) on a 7-point Likert scale where 1 = strongly disagree and 7 = strongly agree. All constructs were specific to beliefs about HPV

vaccination (for their son), with the exception of 'general vaccination attitudes'. A total mean score was calculated for each of the following constructs, where higher scores indicates higher agreement with the items. Perceived benefits (10 items) e.g., 'Getting my son the HPV vaccine would protect his current/future partner against cancer'. Perceived threat (3 items) e.g., 'It would be serious if my son contracted an HPV-related cancer later in life'. Perceived influence (8 items) e.g., 'Other parents in my community are getting their sons the HPV vaccine'. Perceived harms (6 items) e.g., 'The HPV vaccine is unsafe'. Perceived risk (3 items) e.g., 'Without the HPV vaccine, my son would be at risk of getting an HPV-related cancer later in life'. Affordability (3 items) e.g., 'The HPV vaccine is too expensive'. Communication (5 items) e.g., 'I am uncomfortable talking to my son about the HPV vaccine'. Accessibility (4 items) e.g., "The process of actually getting the HPV vaccine for my son would be easy'. General vaccination attitudes (4 items) e.g., 'Vaccines are a good way to protect public health'.

Data Cleaning and Analysis

To identify and eliminate extreme outliers, standardized z scores for attitudes and beliefs were calculated. Values higher than $z = 2.58$ or lower than $z = -2.58$ (99% confidence level (CI)) on two or more scales were considered outliers and removed (Tabachnick & Fidell, 2013).

We used multinomial logistic regression to analyze the nominal outcome (PAPM stage). The log odds of the PAPM stages were modeled as a linear combination of the predictor variables. The largest stage ($n = 1778$) (PAPM stage *unaware*) was selected as the reference category. Odds ratios and 95% CI were calculated for each PAPM stage for the change in each predictor. For nominal predictors, we report the change versus the reference category (e.g.

married vs. single, divorced vs. single) and for continuous variables (e.g. HPV knowledge, HPV attitudes and beliefs), we report the change represented by a one-unit score increase.

Bivariate analyses were first conducted for all predictors to explore their individual relationship with PAPM stage. To assess multicollinearity, the Variation Inflation Factor (VIF) was calculated for all predictors using a cutoff of VIF < 5 (Stevens, 2002). Multivariate analyses were then conducted in three steps. First, we fitted a model with all 27 predictors (initial model) on T1 data and conducted model fit diagnostics based on following criteria: a) Cox-Snell R^2, b) Cragg-Uhler R^2, c) McFadden R^2 and d) Akaike Information Criterion (AIC)(Stevens, 2002). Second, in order to obtain the most parsimonious model, non-significant predictors were removed step-wise and model fit was assessed after each step. Third, we used the lowest AIC value while only retaining significant predictors to build our final model.

To confirm the validity of our final model over the initial model, we used the log-likelihood test. The final model was also evaluated for independence of irrelevant alternatives (IIA) which posits that a person's choice (i.e. PAPM stage) is unaffected by other available choices (i.e. fewer PAPM stages). For this purpose, the Hausman and McFadden test (Hausman & McFadden, 1984) was conducted by comparing the final model containing all PAPM stages with a restricted model containing fewer PAPM stages. The final model was then fitted on T2 data. Statistical analyses were performed using SPSS version 23 and R version 3.3.1.

Results

The sample initially consisted of 3117 and 1427 participants at T1 and T2, respectively (Perez et al., 2016c). Seventy-two outliers were removed at T1 and 52 at T2. Participants who identified as belonging to PAPM stage 6 (vaccinated) were excluded from all analyses at both time points due to small cell size, 34 parents (at T1) and 39 (at T2). The final sample consisted of

3011 and 1336 participants at T1and T2. At T1/T2, participants by PAPM stages were: 1751/213 – *unaware*; 646/454 – *unengaged*; 281/357 *undecided,* 178/176 *decided not to vaccinate;* and 155/136 *decided to vaccinate*.

A VIF < 5 was obtained for all predictors, indicating no concern regarding multicollinearity. The fit statistics of the initial model (Cox-Snell R^2 = 0.42; Cragg-Uhler R^2 = 0.47; McFadden R^2 = 0.23; AIC = 5740) was similar to the final model (see Table 2). The likelihood ratio test showed no statistical significant difference, (df = 40, $\chi 2$ = 42.39, p = .37) between the initial model (27 predictors) and the final model (18 predictors). Thus, the final model was retained and fitted on both T1 and T2 data. The test for IIA yielded statistically similar estimated coefficients of the full (final model with 5 PAPM stages) and restricted models (final model with PAPM stages 1 to 4, χ^2 = -285.4, df = 66, p = 1 and final model with PAPM stages 1 to 3, χ^2 = -318.3, df = 44, p = 1), suggesting that the multinomial regression model was appropriate for analyzing our outcome.

Bivariate Multinomial Regression

At T1, in the bivariate analysis, all 27 predictors were significantly associated with being in at least one PAPM stage, with the exception of the items 'Canadian born' and 'son's having attended at least one routine medical checkup in the past year' (see Table 1).

Multivariate Multinomial Regression

Results of multivariate analysis along with model fit diagnostics at both time-points are presented in Tables 2 and 3 respectively.

The following predictors were found to be significant at both T1 and T2: language, daughter receiving the HPV vaccine, doctor discussion about the HPV vaccine for their son,

general HPV and HPV vaccine knowledge, benefits, influence, harms, risk, affordability, and general vaccination attitudes.

Parents' who reported that the language they first learned was English (as compared to French) was associated with higher odds of being *undecided* (OR = 2.45 and 2.41) and *decided to vaccinate* (OR = 2.05 and 3.89) at T1 and T2 respectively.

In terms of health behaviors, having had a daughter who received the HPV vaccine (as compared to not having a vaccinated daughter) was associated with lower odds of having *decided not to vaccinate* (OR = 0.51 and 0.46) at T1 and T2 respectively. Having had discussion with a doctor about the HPV vaccine for their son (as compared to no discussion) was associated with higher odds of being *undecided* (OR = 12.36 and 3.54), *decided not to vaccinate* (OR = 15.07 and 4.46) and *decided to vaccinate* (OR = 30.59 and 7.69) at T1 and T2 respectively.

Higher general HPV knowledge (i.e. for one-unit increase in score) was associated with higher odds of being *unengaged* (OR = 1.10 and 1.07), *undecided* (OR = 1.14 and 1.11), *decided not to vaccinate* (OR = 1.05 and 1.16), and *decided to vaccinate* (OR = 1.12 and 1.15) at T1 and T2 respectively. Higher HPV vaccination knowledge (i.e. for one-unit increase in score) was associated with higher odds of being *unengaged* (OR = 1.14 and 1.12), *undecided* (OR = 1.13 and 1.18) at T1 and T2 respectively.

Higher perception of the vaccine's benefits (i.e. for one-unit increase in score) was associated with lower odds being *decided not to vaccinate* (OR = 0.49 and 0.50) at both T1 and T2. Higher perception of influence of others for vaccination (i.e. for one-unit increase in score) was associated with higher odds of being *decided to vaccinate* (OR = 2.09 and 2.62) at both T1 and T2 respectively. Higher perception of the harms (i.e. for one-unit increase in score) was also associated with higher odds of having *decided not to vaccinate* (OR = 1.77 and 1.94) at both T1

and T2. Higher perception of the risks in the absence of the HPV vaccination (i.e. for one-unit increase in score) was associated with higher odds of having *decided to vaccinate* (OR = 1.30 and 1.37) and was associated with lower odds of having *decided not to vaccinate* (OR = 0.68 and 0.60) at both T1 and T2. Higher affordability (i.e. for one-unit increase in score) was associated with lower odds of being *decided not to vaccinate* (OR = 0.73 and 0.75) at T1 and T2. Higher general (pro) vaccination attitudes (i.e. for one-unit increase in score) was associated with lower odds of being *decided not to vaccinate* at T1 (OR = 0.78) and higher odds of being *decided to vaccinate* (OR = 1.95) at T2.

Discussion

The success of HPV vaccination programs and high levels of uptake are dependent on parents' involvement and their willingness to vaccinate their sons. This study examined a comprehensive number of psychosocial determinants of HPV vaccine decision-making among a nationally representative sample of Canadian parents. While most parental HPV vaccine decision-making studies define their outcome as HPV vaccine intentions and/or acceptance (Garcini et al., 2012; Trim et al., 2012), our study is unique in that we considered vaccine decision-making as a series of distinct stages using the PAPM framework. This classification highlighted the utility of the PAPM given that we learned that the vast majority of parents were either *unaware unengaged* or *undecided;* the classification also enabled the elucidation of the psychosocial determinants at a more nuanced level. We have highlighted that the psychosocial predictors of HPV vaccination decision-making that were significant at both time-points should be targeted in order to shift parents towards more advanced HPV vaccination decision stages i.e., closer to actual vaccination adoption.

In our study, general HPV knowledge was a significant predictor for nearly all stages, at both time-points, and HPV vaccination knowledge was confidently a significant predictor for the earlier PAPM stages. Perkins et al (2013) found that knowledge did not predict differences between parents of sons who intend to accept and those who intended to decline. Post hoc, we performed a binary logistic regression having as outcome decided not/decided yes (PAPM stages 4 and 5) and included all predictors from our final model and found similar results as Perkins and colleagues. Therefore, HPV and HPV vaccination knowledge does not appear to be a significant determinant of HPV vaccination in parents who have already reached a decision (i.e. have decided pro or against HPV vaccination). In contrast, addressing knowledge among parents in the earlier stages (e.g., unaware, unengaged and undecided) would likely facilitate parents' progression to more advanced HPV vaccination stages.

The study reveals that there is an important need to increase HPV and HPV knowledge among parents of boys; most of our sample (58% at T1) was unaware that the HPV vaccine is available for males (49% who were still unaware or unengaged at T2), which underlines the current landscape that HPV vaccination for males is still relatively new, and in the absence of programs, parents are not aware of this potential preventive health measure for their son (Bianco et al., 2014; Cates et al., 2012; Donahue et al., 2014; Gilkey et al., 2012; Mortensen et al., 2015). Our finding that some parents (15%) reported being unaware that the HPV vaccine could be given to males at T2 is similar to Reiter and colleagues, who hypothesized (which we agree) that even though parents in both studies completed baseline surveys with informative statements about the vaccine being recommended for their son, it is possible that some parents forget this information between baseline and follow-up.

Second, the level of knowledge in our sample was poor for both general HPV (T_1mean = 11.27/23, *SD* = 6.34; T_2mean = 13.60/23, *SD* = 5.55) and HPV vaccination knowledge (T_1mean = 5.19/11, *SD* = 2.96; T_2mean = 6.24/11, *SD* = 2.63). This finding is consistent with the majority of research that parents have low levels of knowledge (Trim et al., 2012). As in our previous research, we recommend providing information to address key knowledge gaps e.g., that HPV causes oral, anal and penile cancer (and not *just* cervical cancer) and that the HPV vaccine is available and recommended for males (Perez et al., 2016b).

Our results further substantiate that attitudes and beliefs are also important in parents' HPV vaccine decision-making for their sons (Bianco et al., 2014; Gainforth et al., 2012). At both time points, a greater number of attitudes and belief constructs (e.g. benefits, harms) were consistently significant in predicting parents being in an advanced HPV vaccination decisional stage (i.e. *decided not* or *decided to vaccinate*) as compared to being in an early HPV vaccination decisional stages (i.e. *unengaged* and *undecided*). This finding likely indicates that once parents have reached a decisional stage (i.e. *decided to* or *decided not to vaccinate*), their attitudes and beliefs are better defined compared to parents who are *unengaged* or *undecided*. Also, we found that attitudes and beliefs can predict parents being in one of the two HPV vaccine "established" decisional stages. For example, perceiving the HPV vaccine as harmful (e.g., vaccine safety issues) significantly increased the odds to *decide not* to vaccinate and decreases the odds to *decide to* vaccinate (compared to *unaware* parents).

Moreover, we believe that the *decided not* to vaccinate group has clearly defined attitudes and beliefs related to the HPV vaccine decision-making because most of the predictors which were significant for this group at baseline were replicated at follow-up. Parents who had *decided not* to vaccinate typically showed a reverse (opposite direction) odds ratio of their attitudes as

compared to the four other stages. For example, the more benefits they perceive of the HPV vaccine, the lower the odds are that they *decided not to vaccinate*. Importantly, parents who had one or more daughters vaccinated against HPV had lower odds of deciding against the vaccine for their son. It is possible that for parents, the decisional process involves primarily the type of vaccine and its benefits for the health of their child, eliminating at least partially the gender barrier. These findings emphasize the advantage of the PAPM as we did not assume that all parents had positive intentions and we were able to study the predictors of vaccine hesitancy which is viewed as a conceptually different group by other researchers (Betsch et al., 2015).

Having a discussion with a doctor/HCP about the HPV vaccine was a strong predictor of both the earlier and advanced HPV vaccination decision-making stages at both time points. We found similar evidence in the literature (Bianco et al., 2014; Mortensen, 2010; Mortensen et al., 2015; Perkins et al., 2013; Reiter et al., 2013; Taylor et al., 2014), as many parents perceive doctors/HCP as knowledgeable and trustworthy, and represent their preferred source of HPV vaccination information (Mortensen et al., 2015; Perez et al., 2016c; Perkins et al., 2013). Moreover, our attitude construct 'influence 'was a significant predictor for the *decided to vaccinate* group at both time points. The construct 'influence' included items such as parents' "beliefs that HCPs, their son's other parent and family members believe that vaccinating their son against HPV is a good idea", as well as, "their friends and others parents in my community are vaccinating their son", which are both descriptive and injunctive norms. This finding was similar to another Canadian study of 137 Canadian parents of grade 5-7 sons where subjective norms were a significant predictor of intentions to vaccinate their sons (Gainforth et al., 2012). This result is also consistent with studies which showed that having the vaccine endorsed by governments health authorities or by a publicly funded national or local immunization program

was associated with vaccination intentions (Bianco et al., 2014; Mortensen, 2010). As the ultimate goal is to encourage parents to vaccinate their sons, the influence of the doctor and the normalization that others around them endorse and/or are also vaccinating their son appears to be among the most important influences on parents' HPV vaccine decision-making.

Socio-demographics such as marital status, religion, income and parents and son's age lost predictive significance at follow-up. This finding is reflective of other studies that have found certain socio-demographics like gender, age, marital status, ethnicity and political views do not predict intentions or uptake (Perkins et al., 2013; Taylor et al., 2014; Tiro et al., 2012a). Interestingly, parent's language first learned during childhood remained a strong predictor over time. Thus, primarily English speaking parents (compared to French) showed higher odds of being *undecided* and *decided to vaccinate* their sons at both time points. This finding is similar to that of McClure *et al.* (McClure et al., 2015) who found that the odds of students in the English Language School Board receiving all recommended doses of the HPV vaccine was more than twice as great as the odds of students in the French Language School Boards. Driven by the fact that Canada is a multicultural country and that Quebec is mostly French speaking as opposed to the rest of Canada, which is predominantly English speaking, we conducted a sensitivity analysis at T1 and controlled for the province of residence. Primarily English speaking parents still had significantly higher odds of being *unengaged* (OR = 1.73; p = .02) compared to *unaware.* A possible explanation of this finding for language is that better knowledge translation of the importance of HPV vaccination is available through English information channels. Therefore, in bilingual areas, primary language of parents may play of role in HPV vaccine decision-making, suggesting that interventions should include, where appropriate, knowledge dissemination in more than one language. School consent forms and follow-up reminder calls by public health

nurses should continue to be provided in both languages, in order to ensure that language differences do not impact program success.

Study strengths include the use of validated, psychometrically-tested scales encompassing a broad number of items to measure both knowledge and attitudes, which represents an improved approach as we were able to capture novel benefits (e.g., future transmission or protection to potential partners), as well as beliefs beyond proximal outcomes compared to most studies that used few items to measure these constructs (Allen et al., 2010b; Gainforth et al., 2012). Moreover, by collecting data from a large Canadian sample of parents of boys, our findings are generalizable to most Canadian parents and were found to be similar on nearly all socio-demographic characteristics of a sample of over 2 million Canadians from the Statistics Canada household survey (Perez et al., 2016c). Additionally, while many studies often describe various psychosocial predictors (e.g., levels of knowledge, perceived beliefs), fewer ultimately report on how this is directly related to HPV vaccine decision-making. Our study is one of the first to confirm these associations at a second time point, which helps supports their validity.

Our study is limited as we were unable to study actual HPV vaccine uptake due to the small sample size of parents who vaccinated their sons, the HPV vaccination programs for boys were in their earlier beginning in Canada. In the absence of an intervention design, we can suggest only important psychosocial determinants for the different HPV vaccine decision-making stages. It remains for future research to elucidate whether addressing significant predictors through interventions can indeed facilitate the progression along the adoption stages and eventually towards vaccination uptake. We believe that the group of parents *decided not to vaccinate* display unique characteristics and future research is warranted when considering

strategies for vaccine uptake among these parents. Moreover, we are looking forward for other studies to use the same validated scales to assess theoretical psychosocial predictors to allow for better comparisons across different populations and reduced heterogeneity of findings. Finally, not all predictors that were significantly associated with PAPM stages at Time 1 were found to be significant at Time 2. This was particularly the case for the socio-demographic variables (e.g., marital status, religion, Canada born, parents' and sons' age) as well as the HABS variable 'threat'. This may suggest that the socio-demographic predictors are not consistent and could vary as significant predictors from sample to sample. Importantly, doctor discussion, knowledge and virtually all the HABS held their significance at Time1 and Time 2.

In conclusion, HPV vaccine decision-making is complex and multidimensional. Our results indicate that the PAPM is a valuable theoretical framework to apply to HPV vaccine decision-making. The most influential predictors of HPV vaccine decision-making should be targeted with interventions which encourages doctor discussion, improves HPV knowledge and aims to influence HPV vaccine attitudes and beliefs by helping parents better understand the benefits, risk and harms. Our study provides a fine-tuned insight into the psychosocial predictors across multiple stages of HVP vaccine decision-making, and have important implications for understanding key messages that could be implemented in future HPV educational interventions, helping to tailor vaccine educational interventions to specific audiences.

Table 1

Bivariate multinomial logistic regression analysis between PAPM decision-making stages and the psychosocial predictors at Time 1

Psychosocial predictor	**Unaware** *n* = 1751 (Reference)	**Unengaged** OR [95% CI] *n* = 646	**Undecided** OR [95% CI] *n* = 281	**Decided not to vaccinate** OR [95% CI] *n* = 178	**Decided to vaccinate** OR [95% CI] *n* = 155
Gender					
Male		(reference)	(reference)	(reference)	(reference)
Female		1.01 [0.83, 1.21]	**1.41** [1.06, 1.87]	**1.74*** [1.20, 2.50]	1.45 [0.99, 2.10]
Language					
French		(reference)	(reference)	(reference)	(reference)
English		**1.73*** [**1.41, 2.11]	**2.30*** [**1.71, 3.11]	1.09 [0.79, 1.51]	**2.24*** [1.52, 3.32]
Other		1.04 [0.68, 1.57]	0.97 [0.50, 1.89]	1.03 [0.54, 1.96]	1.27 [0.57, 2.80]
Marital status					
Single		(reference)	(reference)	(reference)	(reference)
Married		**1.52** [1.04, 2.22]	1.18 [0.73, 1.90]	1.54 [0.79, 2.99]	1.86 [0.85, 4.06]
Divorced		**1.79** [1.15, 2.81]	0.81 [0.42, 1.54]	1.53 [0.69, 3.40]	**2.54** [1.06, 6.11]
Religion					
Yes		(reference)	(reference)	(reference)	(reference)
No		1.04 [0.86, 1.26]	1.05 [0.80, 1.37]	1.34 [0.98, 1.85]	**1.41** [1.01, 1.97]
Ethnicity					
White		(reference)	(reference)	(reference)	(reference)
East Asian		1.29 [0.84, 1.97]	0.87 [0.44, 1.72]	0.53 [0.19, 1.46]	0.62 [0.22, 1.72]
Other		0.95 [0.68, 1.33]	0.82 [0.50, 1.35]	**0.46** [0.21, 0.99]	0.69 [0.35, 1.39]
Canada born					
Yes		(reference)	(reference)	(reference)	(reference)
No		1.23 [0.96, 1.59]	0.75 [0.50, 1.14]	0.86 [0.53, 1.40]	0.84 [0.50, 1.42]
Highest level of education					
High school		(reference)	(reference)	(reference)	(reference)
University		**1.56**** [1.24, 1.96]	**1.66*** [1.19, 2.31]	1.36 [0.93, 2.00]	**1.73** [1.12, 2.70]
Household income					
< 100,000 CAD$		(reference)	(reference)	(reference)	(reference)

Psychosocial predictor	**Unaware** *n* = 1751 (Reference)	**Unengaged** OR [95% CI] *n* = 646	**Undecided** OR [95% CI] *n* = 281	**Decided not to vaccinate** OR [95% CI] *n* = 178	**Decided to vaccinate** OR [95% CI] *n* = 155
> 100,000 CAD$		**1.52*** ** [1.25, 1.85]	**1.43** [1.09, 1.87]	0.93 [0.66, 1.32]	**1.53** [1.08, 2.18]
Preferred not to disclose		**1.37 [**1.01, 1.86]	1.20 [0.77, 1.85]	1.04 [0.62, 1.76]	1.19 [0.67, 2.12]
Employment status Employed		(reference)	(reference)	(reference)	(reference)
Not Employed		**0.75** [0.59, 0.96]	0.85 [0.61, 1.19]	1.09 [0.74, 1.59]	0.80 [0.51, 1.24]
City of residence <100,000 people		(reference)	(reference)	(reference)	(reference)
>100,000 people		**1.24** [1.03, 1.48]	1.24 [0.96, 1.60]	0.74 [0.54, 1.01]	1.30 [0.93, 1.80]
Parent's age (One-year increase)		**1.02*** [1.01, 1.03]	1.01 [0.99, 1.03]	0.99 [0.97, 1.01]	**1.03** [1.01, 1.05]
Son's age (One-year increase)		**1.05** [1.01, 1.09]	**1.08*** [1.01, 1.14]	1.02 [0.95, 1.09]	0.97 [0.91, 1.05]
Son attended routine medical checkup Yes		(reference)	(reference)	(reference)	(reference)
No		0.83 [0.69, 1.01]	0.81 [0.62, 1.05]	0.90 [0.66, 1.24]	0.78 [0.55, 1.10]
Son received all routine childhood vaccines Yes		(reference)	(reference)	(reference)	(reference)
No		0.86 [0.58, 1.26]	0.53 [0.28, 1.03]	**4.07***** [2.72, 6.09]	0.58 [0.25, 1.35]
Daughter received HPV vaccine No daughter vaccinated		(Reference)	(reference)	(reference)	(reference)
One or more daughters vaccinated		1.15 [0.93, 1.42]	1.26 [0.94, 1.68]	**0.34***** [0.20, 0.58]	**1.95**** [1.38, 2.76]
Doctor discussion about HPV vaccine No		(reference)	(reference)	(reference)	(reference)

Psychosocial predictor	**Unaware** *n* = 1751 (Reference)	**Unengaged** OR [95% CI] *n* = 646	**Undecided** OR [95% CI] *n* = 281	**Decided not to vaccinate** OR [95% CI] *n* = 178	**Decided to vaccinate** OR [95% CI] *n* = 155
Yes		**4.37*** ** [2.47, 7.72]	**14.81*** ** [8.53, 25.71]	**16.87*** ** [9.32, 30.55]	**40.04*** ** [22.96, 69.82]
General HPV knowledge One-unit increase		**1.14*** ** [1.12, 1.16]	**1.18*** ** [1.15, 1.21]	**1.16*** ** [1.12, 1.19]	**1.27*** ** [1.22, 1.32]
Vaccination HPV knowledge One-unit increase		**1.28*** ** [1.24, 1.33]	**1.35*** ** [1.29, 1.43]	**1.42*** ** [1.33, 1.52]	**1.67*** ** [1.53, 1.81]
Benefits (One-unit increase)		1.03 [0.95, 1.13]	**1.49*** ** [1.30, 1.70]	**0.28*** ** [0.24, 0.33]	**2.84*** ** [2.30, 3.49]
Threat (One-unit increase)		0.95 [0.87, 1.05]	1.12 [0.97, 1.29]	**0.58*** ** [0.50, 0.66]	**1.46** ** [1.19, 1.80]
Influence (One-unit increase)		0.96 [0.88, 1.05]	**1.31*** ** [1.16, 1.48]	**0.55*** ** [0.47, 0.63]	**2.30*** ** [1.96, 2.69]
Harms (One-unit increase)		**0.89*** [0.82, 0.97]	**0.77*** ** [0.69, 0.86]	**3.48*** ** [2.95, 4.11]	**0.34*** ** [0.29, 0.40]
Risk (One-unit increase)		1.03 [0.95, 1.12]	**1.37*** ** [1.22, 1.53]	**0.44*** ** [0.38, 0.50]	**2.47*** ** [2.11, 2.89)
Affordability (One-unit increase)		**0.89** ** [0.83, 0.95]	0.92 [0.84, 1.00]	**0.68*** ** [0.61, 0.75]	**0.88** [0.78, 0.99]
Communication One-unit increase		**0.92*** [0.86, 0.98]	**0.84** ** [0.76, 0.92]	**0.62*** ** [0.54, 0.70]	**0.66*** ** [0.58, 0.75]
Accessibility One-unit increase		**1.17** ** [1.08, 1.28]	**1.38*** ** [1.22, 1.55]	**1.69*** ** [1.46, 1.95]	**2.11*** ** [1.80, 2.48]
General vaccination attitudes One-unit increase		**1.13** ** [1.06, 1.22]	**1.26*** ** [1.14, 1.39]	**0.53*** ** [0.47, 0.60]	**2.17*** ** [1.84, 2.56]

Note. OR = odds ratio; Bold indicates significant odds ratio (OR) at $p < .05$. *$p < .01$, *$p < .001$, ***$p < .0001$; 95% CI = 95% Confidence Interval; Reference = reference category. The bivariate analyses ran on *n* = 3011.

Table 2

Multivariate multinomial logistic regression analysis between PAPM decision-making stages and the psychosocial predictors at Time 1

Psychosocial predictor	**Unaware** *n* = 1751 (Reference)	**Unengaged** OR [95% CI] *n* = 646	**Undecided** OR [95% CI] *n* = 281	**Decided not to vaccinate** OR [95% CI] *n* = 178	**Decided to vaccinate** OR [95% CI] *n* = 155
Language French		(reference)	(reference)	(reference)	(reference)
English		**1.72*** ** [1.37, 2.16]	**2.45*** ** [1.76, 3.42]	0.82 [0.53, 1.27]	**2.05*** [1.26, 3.33]
Other		0.79 [0.47, 1.32]	1.16 [0.52, 2.59]	0.87 [0.32, 2.33]	1.33 [0.45, 3.90]
Marital status Single		(reference)	(reference)	(reference)	(reference)
Married		1.20 [0.79, 1.82]	1.08 [0.63, 1.86]	1.41 [0.57, 3.47]	1.82 [0.72, 4.56]
Divorced		1.59 [0.98, 2.58]	0.81 [0.40, 1.61]	1.26 [0.44, 3.64]	**3.04** [1.08, 8.53]
Religion Yes		(reference)	(reference)	(reference)	(reference)
No		1.11 [0.90, 1.37]	1.23 [0.91, 1.65]	1.09 [0.71, 1.66]	**2.06**** [1.35, 3.14]
Canada Born Yes		(reference)	(reference)	(reference)	(reference)
No		**1.60*** [1.16, 2.22]	0.93 [0.56, 1.54]	1.07 [0.54, 2.12]	1.32 [0.63, 2.74]
Household income < 100,000 CAD$		(reference)	(reference)	(reference)	(reference)
> 100,000 CAD$		**1.27** [1.01, 1.61]	1.13 [0.82, 1.57]	1.01 [0.63, 1.63]	1.23 [0.77, 1.97]
Prefer not to disclose		**1.46 [**1.05, 2.04]	1.39 [0.86, 2.24]	1.31 [0.67, 2.56]	1.76 [0.86, 3.61]
Parent's age (One-year increase)		1.02 [1.00, 1.03]	1.01 [0.99, 1.03]	1.01 [0.98, 1.05]	**1.05*** [1.02, 1.09]
Son's age (One-year increase)		1.04 [1.00, 1.09]	1.06 [0.99, 1.13]	1.08 [0.99, 1.19]	**0.88** [0.80, 0.97]
Daughter received HPV vaccine No daughter vaccinated		(reference)	(reference)	(reference)	(reference)

Psychosocial predictor	**Unaware** *n* = 1751 (Reference)	**Unengaged** OR [95% CI] *n* = 646	**Undecided** OR [95% CI] *n* = 281	**Decided not to vaccinate** OR [95% CI] *n* = 178	**Decided to vaccinate** OR [95% CI] *n* = 155
One or more daughters vaccinated		0.90 [0.71, 1.14]	0.91 [0.66, 1.26)	**0.51** [0.27, 0.95]	0.93 [0.60, 1.45]
Doctor discussion about HPV vaccine No		(reference)	(reference)	(reference)	(reference)
Yes		**4.15***** [2.26, 7.61]	**12.36***** [6.75, 22.62]	**15.07***** [6.94, 32.72]	**30.59***** [15.49, 60.41]
General HPV knowledge (One-unit increase)		**1.10***** [1.07, 1.13]	**1.14***** [1.10, 1.18]	**1.05** [1.01, 1.11]	**1.12***** [1.06, 1.19]
Vaccination HPV knowledge (One-unit increase)		**1.14***** [1.08, 1.20]	**1.13*** [1.04, 1.21]	**1.32***** [1.19, 1.48]	**1.32***** [1.17, 1.49]
Benefits (One-unit increase)		0.95 [0.82, 1.10]	1.21 [0.96, 1.51]	**0.49***** [0.38, 0.63]	1.11 [0.76, 1.61]
Threat (One-unit increase)		0.88 [0.78, 1.00]	0.85 [0.71, 1.03]	0.90 [0.74, 1.09]	**0.67** [0.49, 0.92]
Influence (One-unit increase)		1.07 [0.96, 1.20]	**1.28*** [1.09, 1.49]	**1.33** [1.05, 1.67]	**2.09***** [1.65, 2.65]
Harms (One-unit increase)		**0.88** [0.78, 0.99]	0.90 [0.77, 1.06]	**1.77***** [1.40, 2.24]	**0.52*** [**0.41, 0.67]
Risk (One-unit increase)		0.92 [0.83, 1.02]	0.99 [0.87, 1.14]	**0.68**** [0.56, 0.84]	**1.30*** [1.07, 1.58]
Affordability (One-unit increase)		0.94 [0.87, 1.01]	0.95 [0.86, 1.05]	**0.73***** [0.64, 0.85]	1.11 [0.96, 1.29]
General vaccination attitudes (One-unit increase)		0.95 [0.86, 1.05]	0.93 [0.81, 1.07]	**0.78*** [0.67, 0.92]	0.97 [0.77, 1.23]

Note. OR = odds ratio; Bold indicates significant odds ratio (OR) at $p < .05$. *$p < .01$, *$p < .001$, ***$p < .0001$; 95% CI = 95% confidence interval; Reference = reference category. The model ran on $n = 3011$. Model fit statistics: Cox-Snell $R^2 = 0.42$; Cragg-Uhler $R^2 = 0.46$; McFadden $R^2 = 0.23$; Akaike information criterion (AIC) = 5703.

Table 3

Multivariate multinomial logistic regression analysis between PAPM decision-making stages and the psychosocial predictors at Time 2

Psychosocial predictor	**Unaware** *n* = 213 (Reference)	**Unengaged** OR [95% CI] *n* = 454	**Undecided** OR [95% CI] *n* = 357	**Decided not to vaccinate** OR [95% CI] *n* = 176	**Decided to vaccinate** OR [95% CI] *n* = 136
Language French		(reference)	(reference)	(reference)	(reference)
English		1.32 [0.91, 1.93]	**2.41*** ** [1.60, 3.64]	0.99 [0.57, 1.71]	**3.89*** ** [2.06, 7.34]
Other		0.84 [0.35, 2.05]	0.73 [0.27, 1.97]	0.59 [0.14, 2.55]	**5.19** [1.34, 20.16]
Marital status Single		(reference)	(reference)	(reference)	(reference)
Married		1.27 [0.66, 2.47]	0.95 [0.46, 1.95]	0.96 [0.36, 2.54]	0.85 [0.31, 2.33]
Divorced		1.24 [0.53, 2.91]	1.45 [0.59, 3.56]	0.84 [0.25, 2.84]	0.91 [0.25, 3.34]
Religion Yes		(reference)	(reference)	(reference)	(reference)
No		0.97 [0.66, 1.42]	1.16 [0.80, 1.74]	0.76 [0.43, 1.34]	1.38 [0.78, 2.43]
Canada Born Yes		(reference)	(reference)	(reference)	(reference)
No		1.32 [0.66, 2.65]	1.87 [0.90, 3.86]	1.26 [0.47, 3.32]	0.87 [0.30, 2.51]
Household income < 100,000 CAD$		(reference)	(reference)	(reference)	(reference)
> 100,000 CAD$		0.83 [0.55, 1.25]	1.10 [0.71, 1.73]	1.22 [0.66, 2.28]	0.91 [0.49, 1.71]
Preferred not to disclose		0.61 [0.35, 1.07]	1.03 [0.57, 1.86]	0.56 [0.24, 1.34]	0.98 [0.40, 2.41]
Parent's age (One-year increase)		0.99 [0.96, 1.02]	0.99 [0.96, 1.02]	0.97 [0.92, 1.01]	0.98 [0.94, 1.03]
Son's age (One-year increase)		1.01 [0.94, 1.10]	1.03 [0.94, 1.12]	1.09 [0.97, 1.22]	0.90 [0.79, 1.01]
Daughter received HPV vaccine No daughter vaccinated		(reference)	(reference)	(reference)	(reference)

Psychosocial predictor	**Unaware** *n* = 213 (Reference)	**Unengaged** OR [95% CI] *n* = 454	**Undecided** OR [95% CI] *n* = 357	**Decided not to vaccinate** OR [95% CI] *n* = 176	**Decided to vaccinate** OR [95% CI] *n* = 136
One or more daughters vaccinated		1.23 [0.82, 1.87]	0.97 [0.62, 1.51]	**0.46** [0.21, 0.99]	1.28 [0.70, 2.33]
Doctor discussion about HPV vaccine No		(reference)	(reference)	(reference)	(reference)
Yes		1.40 [0.51, 3.87]	**3.54** [1.34, 9.36]	**4.46*** [1.45, 13.75]	**7.69**** [2.70, 21.87]
General HPV knowledge One-unit increase		**1.07*** [1.02, 1.12]	**1.11***** [1.06, 1.17]	**1.16***** [1.09, 1.25]	**1.15**** [1.07, 1.24]
Vaccination HPV knowledge One-unit increase		**1.12** [1.02, 1.23]	**1.18*** [1.07, 1.31]	1.11 [0.97, 1.26]	1.13 [0.97, 1.32]
Benefits (One-unit increase)		0.87 [0.66, 1.16]	1.00 [0.73, 1.36]	**0.50**** [0.34, 0.73]	0.92 [0.56, 1.50]
Threat (One-unit increase)		0.93 [0.75, 1.15]	0.87 [0.68, 1.10]	0.92 [0.69, 1.22]	0.78 [0.53, 1.14]
Influence (One-unit increase)		0.83 [0.66, 1.05]	1.28 [0.99, 1.65]	0.82 [0.59, 1.13]	**2.62***** [1.83, 3.76]
Harms (One-unit increase)		0.98 [0.77, 1.24]	1.06 [0.82, 1.36]	**1.94***** [1.40, 2.68]	0.74 [0.53, 1.05]
Risk (One-unit increase)		0.88 [0.72, 1.06]	1.00 [0.82, 1.23]	**0.60**** [0.46, 0.79]	**1.37** [1.02, 1.83]
Affordability (One-unit increase)		0.93 [0.79, 1.09]	0.97 [0.82, 1.14]	**0.75** [0.59, 0.94]	0.96 [0.78, 1.18]
General opinions One-unit increase		1.08 [0.89, 1.29]	1.19 [0.97, 1.46]	0.81 [0.64, 1.04]	**1.95**** [1.36, 2.79]

Note. OR = odds ratio; Bold indicates significant odds ratio (OR) at $p < .05$. *$p < .01$, *$p < .001$, ***$p < .0001$; 95% CI = 95% Confidence Interval; Reference = reference category. The model ran on $n = 1336$. Model fit statistics: Cox-Snell $R^2 = 0.52$; Cragg-Uhler $R^2 = 0.55$; McFadden $R^2 = 0.25$; Akaike information criterion (AIC) = 3223.

General Discussion

The overarching objective of this dissertation was to better understand the psychosocial determinants of parents' HPV vaccine decision-making for their sons. The methodological challenges and measurement issues that arose while designing and conceptualizing the study ultimately led to the development of two new measures: an HPV knowledge scale and an HPV attitudes and belief scale (Perez et al., 2016a; Perez et al., 2016b). By using valid and reliable tools to measure these psychosocial determinants, we were able to study parents' HPV vaccine decision-making in a more in depth, and reliable way. The use of multinomial logistic regression modelling and theory were instrumental in guiding this research to better understand this complex and multidimensional health behavior. I review the implications of our study findings and make recommendations and suggestions for future research.

Utility of extensively tested questionnaire with validated measures

Manuscript 1 provides an overview of the study methodology and design, the development of the study instrument—the questionnaire and preliminary results. Designing the questionnaire was one of the study's fundamental strengths. We thoroughly reviewed the existing literature as well as existing questionnaires with emphasis on items/surveys that were used in parents and or for males/sons, as well as particular focus on studies that reported on their psychometric properties e.g., reliability coefficients (Allen et al., 2010a; Allen et al., 2009; Allen et al., 2010b; Askelson et al., 2010; Brabin et al., 2006; Crosby, DiClemente, Salazar, Nash, & Younge, 2011; Daley et al., 2009; Fisher; Gerend et al., 2013; Geshnizjani, Jozkowski, & Middlestadt, 2013; Gilkey et al., 2012; Gowda et al., 2012; Grabiel et al., 2013; Guerry et al., 2011; Gutierrez et al., 2013; Juraskova, Bari, O'Brien, & McCaffery, 2011; Kahn et al., 2008; Katz, Kam, Krieger, & Roberto, 2012; Katz et al., 2011; Marlow et al., 2013; McRee et al.,

2010; Ogilvie et al., 2010; Petrovic, Burney, & Fletcher, 2011; Reiter, Brewer, Gottlieb, McRee, & Smith, 2009; Reiter et al., 2010; Rosenthal et al., 2011; Thomas et al., 2013; Tiro et al., 2012b; Waller et al., 2013; Zimet, Weiss, Rosenthal, Good, & Vichnin, 2010). When developing the questionnaire, we also agreed that we wanted to measure theoretical constructs by using more than one items. We also aimed to be as comprehensive as possible in capturing many of the common items or variables being asked in the literature, while also considering participant burden.

We believe that our questionnaire (see Appendix G & H) adheres to virtually all the recommendations made by Allen and colleagues in their systematic review of measures as well as Fernandez et al's suggestions (Allen et al., 2010a; Fernández et al., 2010). We were explicit in describing the theoretical model(s) that guided the selection of our hypothesized determinants. Our questionnaire was comprehensive and captures a broad range of factors that are reflective of many health behavior theories. These includes personal factors from the well-known health belief theories like the HBM and TRA, as well as potential environmental, interpersonal, organizational, and community influences, such as knowledge, physician recommendation, social and subjective norms, the media, and cost (Fernández et al., 2010). Finally, as recommended, a panel of experts reviewed our questionnaire, and it was pilot tested by a convenience sample of parents in order to optimize content validity and assure comprehension. Each item was extensively reviewed and revised accordingly, and we included both quantitative and qualitative (open-ended response options) items.

At the time of development of the study, there were few valid measurement tools to conceptualize most constructs, such as attitudes and beliefs. The advantage of strong measurement is that it enables us to detect significant effects and reduces the likelihood of type II

errors. We are hopeful that researchers will utilize the extended knowledge scale and the HABS going forward in order to allow for better comparisons across study findings.

Utility of best practices in analyzing our data

Once the T1 data was collected, we wanted to apply best practices in dealing with our data (DeSimone, Harms, & DeSimone, 2015; Osborne, 2008). One of the first challenges was the issue of careless, unmotivated or extreme responders, which is not specific to HPV vaccination but generally to survey research (Curran, 2016; Meade & Craig, 2012). As explained in Manuscript 1, we determined the data screening techniques that were most appropriate for the identification of insufficient-effort respondents in our study and applied these techniques at both T1 and T2 to remove such respondents. We also wanted to identify participants who were consistently providing responses far from the mean for a specific set of items i.e., extreme scores which can increase error variance and reduce the power of statistical tests (Osborne, 2008; Osborne, 2010). By removing this data, we can be more confident that our scores are not biased and that our sample does not contain influence estimates that may not be generated by the population of interest. Removing outliers should also serve to mitigate skewness in the data (Field, 2009).

The issue of self-report vaccination status

During the process of identifying data-entry errors or implausible values for each variable from our T1 data, we identified inconsistencies with our dependent variable (PAPM stage). We observed parents who indicated at T1 that they had vaccinated their son, but some of their other responses to subsequent items were incongruent and suggested that they had in fact not vaccinated their child (e.g., some participants indicated their son received the vaccine at school when there was no school-based program, or answered they had never heard about the HPV

vaccine for their son). We believe that parents may have confused the HPV vaccine with other childhood vaccines or simply been unaware. This is the notion of semantic synonyms, that is responding inconsistently or implausibility across similar items (DeSimone et al., 2015). Since PAPM stage was our outcome variable, it was important to establish the validity as best as we could. In order to improve our methodology, at T2, we provided additional information in our brief informative statement about the accessibility HPV vaccines in Canada to parents who stated that they had vaccinated their son. This highlights that in the absence of objective vaccination records or registries, researchers should use additional items e.g. ask about vaccination in several ways in order to assure valid and reliable vaccination uptake rates.

The utility of theory

This study provides substantial evidence that the PAPM stage criteria was useful in defining groups when applied to parents' HPV vaccination decision-making. The PAPM posits that health behavior may be conceptualized as distinct, qualitative stages determined by differential factors including the processing of risk perception at each stage (Weinstein et al., 1998). For example, there is a qualitative difference between a parent who knows nothing about HPV vaccination and a parent who has thought about the issue, concluded that there is no risk and decided not to vaccinate her child. The first parent will likely be opened minded about the vaccination, and the second parent will tend to produce a biased response and selectively attend to messages that support his or her own position (Janis & Mann, 1977).

Our results demonstrate that nearly two thirds of our sample was unaware that the HPV vaccine can be given to boys and 30% were unengaged and undecided. Had we asked participants if they had vaccinated their son with a yes-no response format, and then followed up with the no participants with vaccination intentions, we would falsely presume that these

individuals are planning to vaccinate their son when in fact they are not even aware or engaged in this particular health behavior. Allen and colleagues (2009) used a similar methodology where they categorized women according to six stages of adoption using the transtheoretical model of change (DiClemente et al., 1991; Prochaska, Redding, & Evers, 2008). These stages were slightly different from our classification, and move from unaware to planning to get the vaccine, eliminating the people who may simply not be engaged or have not formed their health beliefs about HPV vaccination.

We know that many parents have not heard of HPV and/or of the HPV vaccine (Hendry et al., 2013; Trim et al., 2012). While it has been theorized that being uninformed about a health precaution does not preclude the forming of attitudes and beliefs about the health precaution (Windschitl, Martin, & Flugstad, 2002), how we can appropriately measure what influences the decision-making process (in our case, HPV vaccination)? This also calls into question the validity of many studies findings as categorizing people as not having intentions to vaccinate is conceptually different than being unaware about the health behavior.

Another novel aspect of the study is focusing on the predictors of those who decided not to vaccinate, which some researchers refer to as *vaccine hesitancy* (Dubé et al., 2013; MacDonald, 2015; Roberts et al., 2015). Some researchers have even suggested four distinct psychological profiles of this group: 1) those who are *complacent* and do not care about immunization; 2) those who do not vaccinate because it is *inconvenient* (c) those who have a lack of *confidence* in vaccines and the health system, and (d) those who engage in some reasoning process by weighing the pros and cons (*utility calculation*) (Betsch et al., 2015). The researchers believe that there are different sets of determinants that influence their decisions, and different interventions should target these differences (Betsch et al., 2015).

The PAPM allowed us to differentiate parents' HPV decision-making processes since it has categories which other health behaviour models do not embrace. However, it is important to acknowledge that our data did not validate this model. Compared to other health behaviour theories, notably the HBM, the PAPM is in its early infancy. In a seminal paper by Brewer and Gilkey, the authors write about the difficulty and the complexity to test health behavior theories. The authors encourage the idea of competitive hypothesis testing, which forces researchers "not to treat a theory not as an unbreakable whole, but rather as sets of specific arguments about how the world works". Some remaining questions about the PAPM include: Are the differences between unengaged and undecided truly distinct? Do parents need to "pass" through all stages, even if for an instant? Our analyses did indeed "cross-pollinate [multiple] health behavior theories".

Overarching findings from the four manuscripts

In this study, knowledge, attitudes and beliefs, HCP discussion were the key factors associated with the different PAPM stages of adoption for HPV vaccination decision-making in a representative sample of Canadian parents of boys.

Irrespective of stage, parent's HPV and HPV vaccine knowledge was a significant predictor and was low i.e., parents only answered approximately 50% of knowledge items correctly. Parents generally knew that HPV can be transmitted during sexual intercourse, that having many partners increases the risk of getting HPV and that HPV van cause cervical cancer. The least well known (either incorrect or did not know) items were that HPV usually doesn't need any treatment, that most sexually active people will get HPV at some point in their lives and that HPV does not cause herpes. Importantly, many parents also did not know that HPV can cause oral and anal cancers.

For HPV vaccination knowledge, most parents knew that girls who have had the HPV vaccine still need a Pap test when they are older, that the HPV vaccines does not offer protection against all STIs, and that the HPV vaccine is approved and recommended by Health Canada for females aged 9-45 years old, and that someone who has had the HPV vaccine can still develop cervical cancer. Most parents did not know that one of the HPV vaccines offers protection against genital warts, that the HPV vaccines does not protect you from every type of HPV and that more than one dose is required. While there was a significant increase of both HPV and HPV knowledge at the item level over time, the overall HPV and HPV knowledge mean scores did not significantly increase from T1 to T2. Incorrect answers at T1 very rarely changed to correct answers at T2. This suggests that the information provided in the questionnaire, including our informative statement is not the replacement for a well-designed educational intervention.

As many parents are lacking the basic information about HPV and HPV vaccination, it is important to educate them and provide them with the necessary knowledge to make an informed decision. Our results highlighted that parents know about the association between HPV and cervical cancer but not with other HPV-associated cancers as well as genital warts. We suggest that information be provided to specifically target these knowledge gaps i.e., highlight that HPV causes oral, penile and anal cancers, inform them about the multiple doses through their preferred channels (HCPs, public health brochures, pamphlets, posters).

On the other hand, several researchers have argued that knowledge is a more distal determinant of an individual's attitudes and beliefs. This raises the question if knowledge is truly necessary for uptake? For example, in many health behavior interventions such as HIV prevention and smoking cessation, knowledge is also not a strong predictor. It will be important

to continue to study what specific knowledge is necessary, if any, or is it the perception/feeling of having enough information that impacts parents' HPV vaccine decision-making processes.

Also, we recommend providing clear and accurate information rather than correcting misinformation or myths. Seethaler explained that "false balance—the presentation of claims on both sides of an issue when the preponderance of scientific evidence is on one side—increases uncertainty and decreases intention to take recommended action"(Clarke, Weberling McKeever, Holton, & Dixon, 2015; Dixon & Clarke, 2013; Seethaler, 2016). For example, when scientific myths are presented alongside the scientific facts that debunk them, the myths are often misremembered as true (Peter & Koch, 2016). The idea is then to repeat the key factual information that is not known and not to try to discredit the myths.

Overall, the patterns we found for the HABS confirm the utility of the PAPM model with respect to attitudinal variables related to HPV vaccine decision-making. The HABS distinguishes adjacent stages from one another in several ways that are consistent with differences predicted by the theory. The attitude and beliefs factors were particularly important for the decisional stages i.e., those who had decided not to and those who had decided to vaccinate as compared to the earlier stages. This may suggest that those who have formed decision will require interventions that target their understanding of the risks, perceptions of benefits and harms, norms and their opinions of vaccination more broadly.

One of the strongest findings from this study is that having a discussion with a healthcare provider was important at all stages of adoption, suggesting that it is an important factor in moving parents to think about getting their son vaccinated and to actually decide to vaccinate him. Those who had a doctor discussion had almost 8 times more odds of being decided to vaccinate compared to unaware parents (at T2). Paradoxically, those who had a doctor discussion

had also almost five times more odds of being decided not to vaccinate compared to unaware parents. This suggests that perhaps one "needs" to have a discussion with an HCP to form a decision, regardless if it is in favor or against HPV vaccination. Another explanation is that we don't know exactly what this discussion constitutes of i.e., whether a strong, clear, weak or mixed message was provided. Either way, our study confirms existing studies indicating how important HCP recommendations are for HPV vaccination, and how critical this information channel is (Brewer et al., 2011; Clark, Cowan, Filipp, Fisher, & Stokley, 2015; Dorell, Yankey, Santibanez, & Markowitz, 2011; Gilkey & McRee, 2016; Holman et al., 2014; Reiter et al., 2013; Rosenthal et al., 2011; Trim et al., 2012; Zimet, 2014).

Importantly, further research needs to unpack if providing knowledge, specifically to the decided not to group is effective. Our results indicate that vaccine decision-making is complicated and that vaccine refusal is not solely due to inadequate knowledge (i.e., "the knowledge deficit") but also to underlying attitudes and beliefs. Some counselling strategies suggest discovering whether one's patient is vaccine hesitant, or more extreme on this continuum and a "true" vaccine refuser (Dubé et al., 2016a; Healy & Pickering, 2011; Leask et al., 2012). Suggestions for providers dealing with individuals who are vaccine hesitant include building rapport, answering questions, having an honest dialogue, using decision aids, and providing information about both the risks and benefits. For vaccine refusers, it is advised to keep the discussion brief, inform about the risks of non-vaccination, avoid engaging in back and forth arguments and offer attendance at a special clinic (available in some countries) (Dubé et al., 2016a; Healy & Pickering, 2011; Leask et al., 2012; Wood, 2003).

Interventions to increase HPV vaccine acceptability

To date, there have been four systematic reviews evaluating educational interventions aimed to increased HPV vaccine acceptance (Fu, Bonhomme, Cooper, Joseph, & Zimet, 2014; Niccolai & Hansen, 2015; Smulian, Mitchell, & Stokley, 2016; Walling et al., 2016). Fu et al.'s (2014) review commented how many studies did not use vaccination uptake as their outcome; that most interventions consisted of written informational handouts targeting educated populations; and that there was no strong evidence to recommend any specific education intervention for wide spread implementation. They recommended stronger research methodology for future interventions and to use HPV vaccine uptake as the outcome. Niccolai and colleagues (2015) systematic review conclusions (while US-specific) contrasted with Fu and colleagues, and reported that most practice and community based interventions significantly increased HPV vaccination rates. Many of the interventions focused on reminder and recall systems, which though effective, are likely only relevant to those already engaged in the decision-making process and to ensure uptake of multiple doses of the vaccines.

Interestingly, seven of the interventions were physician focused and 4/7 saw an increase in HPV vaccination rates (Niccolai & Hansen, 2015). Many of the recent studies are now focusing directly on physicians/HCPs and/or nurse (Brewer et al., 2016; Gilkey et al., 2014a; Perkins et al., 2015). There is information about HPV and the HPV vaccine (particularly as this science is constantly evolving) that many HCPs do not know (Rutten et al., 2017); evidence supported by some parents in our study reporting that their physician recommended delaying or recommended against vaccination. It has been suggested that clinician education also does not improve vaccination uptake directly and that perhaps clinician knowledge and HPV delivery is more complex (Rutten et al., 2017). This reflects a similar pattern to our study findings. Perhaps knowledge is necessary but not sufficient, and that there is likely not a causal relationship

between parents' uptake and knowledge, but this is related to their underlying attitudes and beliefs. Some of the hesitations or barriers of HCPs echo those of parents: concerns about safety, communication difficulties, and lack of understanding about the risks (Gilkey & McRee, 2016; Rutten et al., 2017). It has been shown that HCPs may overestimate the level of parental concern or hesitation about vaccines (Healy, Montesinos, & Middleman, 2014). Perhaps informing HCPSs to better understand their own barriers towards HPV vaccination would better equip them to influence their patients' barriers.

More than half of parents (61% at T1 and 59% at T2) reported that their sons underwent a routine checkup with a HCP in the past year, yet the overwhelming majority of parents reported (94% at T1 and 88% at T2) that they did not speak to their doctor/HCP about the HPV vaccine for their son, consistent with other studies (Darden et al., 2013). Substantial missed opportunities are occurring for recommending and administering HPV vaccine, particularly when it is now well established and our results confirm how significant an HCP recommendation is for all stages of vaccination decision-making, including those who decided to and the few who moved to vaccination uptake. Future research is needed to better understand why Canadian HCPs are not discussing and/or recommending HPV vaccine for males. This will be particularly important to examine as more provinces began to have school-based vaccination programs, as it raises the question: Are HCP discussions/recommendations important in regions where school-based vaccination programs exist. Our results do support that HCPs were by and large parents preferred information source. It will be worthwhile to understand if it matters *which* HCP parents would like to have a discussion e.g., the family doctor, a nurse

. The role of the public health nurse in the school system may become more important in the context of HPV vaccination, and this professional would require tools and resources to educate and endorse HPV vaccination among parents, elementary and high school students.

Continuing to help HCPs have these discussions and assist them in making impactful, strong recommendations (Opel et al., 2015; Shay et al., 2016) will be key to improving HPV vaccine uptake among males, particularly in provinces where there are no programs or among males aged 18-26. Another recommended method is the CASE approach—corroborate, about me, science, and explain/advise (Jacobson, Van Etta, & Bahta, 2013). The CASE approach is grounded in clinician recognition and acknowledgement of patient barriers and concerns as a foundation for corroboration of those concerns (corroborate), establishment of the clinician's expertise and professional standing (about me), summarization of relevant scientific evidence (science), followed by the clinician's statement of a strong recommendation as a conclusion of addressing that parental concern (explain/advise).

The most recent systematic review of interventions to increase HPV vaccination coverage, though US specific, concluded that while many interventions were effective, more research is needed to examine how interventions can be implemented on a wide scale (Smulian et al., 2016). A recent pilot study aimed to examine how HCP's make HPV vaccine recommendations and what constitutes a strong recommendation (Shay et al., 2016). The authors found that most HCP's were using a participatory introduction and making weak recommendations (i.e., using passive voice, gave parents leeway in their decision and did not assume the parent would get the vaccine today) in contrast with a strong recommendation (i.e., a clear and direct town that "owned" the recommendation). Most providers did not use a presumptive style (i.e., presuming the parents would vaccinate), and this was shown to impact

HPV vaccine uptake (Shay et al., 2016). The use of a participatory style (in contrast) to a presumptive style highlighted that HCPs are recommending the HPV vaccine differently than other adolescent vaccination, which is consistent with other research findings (Hughes, Jones, Feemster, & Fiks, 2011; McRee, Gilkey, & Dempsey, 2014; Perkins et al., 2014). The "uniqueness" of the HPV vaccine likely evolved from the gender-specific roll out, the fact that the HPV vaccine protects against an STI that causes other diseases rather a vaccine that protects directly against one specific vaccine (e.g., the flu). The scientific, medical and research community should start treating the HPV vaccine similar to other vaccines, and find ways to help "consumers" view, conceptualize and consider HPV vaccination as a routine immunization.

Finally, on occasions where parents have private insurance coverage or would be financially able to 'pay out of pocket', HCPs can provide a strong presumptive recommendation, as well as bundle the HPV vaccine with other vaccinations (Shay et al., 2016). This would be particularly appropriate in provinces without school-based programs, for older boys or for hesitant parents who are considering opting out from vaccinating their son at school.

Study strengths & Limitations

The study's overarching strengths is the use of rigorous and sound survey methodology that was guided by theory. One of the study strengths in contrast with other PAPM studies, is that we did not group together individuals with different levels of awareness and engagement or intentions with uptake, i.e., we did not combine stages, which can lead to misclassification. Misclassification often blurs distinctions across groups and biases the measure of association towards the null when the misclassification is non-differential.

Our sample was drawn from all 10 provinces, and included both English and French language speakers. Also, we had nearly a third (32%) of fathers at both time points, in contrast

with other studies where mothers are the primary participants studied (Trim et al., 2012). Most parents were white and of fairly high socioeconomic status, though the online panel was very similar to corresponding Canadian population on nearly all socio-demographic characteristics. Our sample also contained a higher proportion of Quebec residents and a lower proportion of Ontario residents compared to the actual distribution of Canada. Given the small or moderate effect size in comparison to the Statistics Canada sample of over 2 million Canadians, we believe that our sample can be generalizable to the Canadian population of parents with 9-16-year-old sons. Another limitation to note is that panel members also regularly complete surveys, some of which may be health-related, and this could potentially have affected their responses. We also had a 45% attrition rate, though our T1 and T2 were similar on virtually all socio-demographic variables and our T2 sample contained over 1400 participants.

Unfortunately, in our study, there were not enough people who were vaccinated (Stage 6) for meaningful analysis at either time points. Importantly, at the time of data collection, two provinces had already begun to offer free-school based vaccination programs for males. It is virtually impossible for the author to assess the impact of these programs e.g., certain information pamphlets that were sent home or media attention. Of note, the programs were geared to a specific cohorts parents of boys in two of the smaller Canadian provinces (PEI – Grade 6 boys only and Nova Scotia – Grade 5 boys only). We do not believe the impact of these programs skewed our results as our samples range of boys was 9-16 years old, and we did not see a higher proportion of vaccinators in these two provinces. As programs roll out, future studies should assess what information parents gather from these programs.

With respect to the development of our measures, we attempted to utilize multiple stringent criteria to evaluate the psychometrics of our studies. It is important to note that no

threshold is absolute, and in fact, we did apply a higher threshold for the HABS as compared to our knowledge scale. Continued progression within the field psychometrics will help us to improve future scales. Additionally, it is also important to not that both our knowledge scale and our HABS may present a significant burden on participants as well as a cost to researchers administrating the questionnaire. It will be important to consider the benefits and cots of shorter and longer scales in terms of what knowledge items and beliefs are critical to measure to fully understand what people know and how people feel about HPV and the HPV vaccine. Future analyses could examine if a shorter knowledge or attitudes scale is more feasible, reliable and valid. Lastly, in our third manuscript, while we compared our HABS to existing measures such as the CHIAS, and the PHPVS, this was focused on the scales' face validity. Future studies could statistically compare whether the HABS factor structure has improved model fit as compared to existing measures.

Also, this study was not intended to be an intervention design. In the absence of a well-thought out intervention, we can only suggest important psychosocial determinants for the different HPV vaccine decision-making stages. The authors had also hoped to examine movement from intentions to actual uptake over time, as this has been an important recommendation in the field as it is known that intentions do not always translate into action (Gollwitzer, 1999; Gollwitzer & Sheeran, 2006). However, at T2, only 9 parents moved from deciding to vaccinate to actual vaccination uptake. These results, along with that most participants did not complete their planned action from T1 to T2 confirm that intentions often do not translate to action. In the absence of an intervention, only 36 parents from the entire sample advanced to vaccinated at T2. Nonetheless, this is an important group (if not the most) to understand and future studies should examine the psychosocial predictors for vaccination. Last,

while this study explored the relationship of a broad range of psychosocial predictors in both the univariate and multivariate model, our study not explore the relationships among the different psychosocial predictors. For example, are there are any mediator or moderator effects? Future studies should consider examining the different relationships between the different psychosocial predictors. Moreover, due to power and the infinite number of predictors possible, we selected our variables based on the empirical literature. There are certain variables that may worthy of considering, e.g., not only having a vaccinated daughter but rather the presence of a female child in the home, that may be worthwhile examining.

Future Research and study implications

The use of a stage-based behavior change theory was an innovative aspect of this study. Although our objective was not to test the PAPM as a theory, to our knowledge it is the first study that uses the PAPM in its entirety and applies it to parents' HPV vaccination decision-making. Parents who are unaware, unengaged, and undecided may be categorically different than those who have taken a decision to and those who have taken a decision not vaccinate. Parents in the earlier stages are likely more amenable to simple informational-based interventions to raise awareness than those who have taken a decision (Baldwin, Bruce, & Tiro, 2013). For example, for parents who are undecided, the use of self-persuasion i.e., generating one's own arguments to change one's attitude and/or behaviour, might be particularly appropriate and effective (Tiro et al., 2016). In contrast, those who have already taken a decision (decided to or decided not) may require different types of intervention to influence risk perceptions, correct myths, and strengthen their positive attitude toward vaccination. As such, perhaps a self-persuasion type of intervention might not be applicable to the decided not to group as it could increase their anti-vaccination beliefs and potentially persuade them further against vaccination (Tiro et al., 2016).

Although the PAPM is perhaps more complex than a theory based on a single prediction equation, the stages proposed appear to be very helpful in understanding how parents come to vaccinate their son and could be useful in designing tailored interventions. We believe that this is one of the key advantages of the PAPM or stage based theories; it allows decision-making to be more nuanced and highlights that not everyone is planning on adopting the behavior.

One of the notable implications is how do we bridge the knowledge translation gap between research and science with policy-makers and decision-makers in order to increase collaboration. Some ideas include working with different federal and national organizations on their websites (e.g., http://sante.gouv.qc.ca/en/programmes-et-mesures-daide/programme-de-vaccination-contre-les-infections-par-les-virus-du-papillome-humain-vph/ and consent forms sent home to parents when their child receives the HPV vaccination to address specific knowledge gaps, as well as HPV vaccination benefits and barriers. In a recent study, none of the pro-vaccine messages created by public health authorities increased vaccination intentions among parents who were vaccinated their child with the MMR vaccine (Nyhan, Reifler, Richey, & Freed, 2014). These results suggest the need to empirically test vaccination messages before making them public and for the collaboration between researchers (e.g., behavioural and heath communication scientists, health psychologists, public health researchers) with public health officials to ensure that forms and information has the intended effect. This also includes the consideration of message framing and biased processing (Viswanath, Finnegan, & Gollust, 2015). Tools to help modify some of the HCPs who have misinformation or negatively skewed attitudes about HPV and the HPV vaccine are critical. Following up on this, providing HCPs resources such as handouts, communication strategies and tips to help them address frequent encountered parental concerns or barriers could help increase HPV vaccine uptake. It is critical

that we develop a more solid, easily accessible, user-friendly platforms for HCPs, parents, patients and researchers to share what works in HPV vaccination, including the development and implementation of electronic immunization registries across the country.

There is still much work to be done to both increase awareness and overcome resistance with respect to HPV vaccination, and vaccines in general. The media (including social media) plays a big role in what information is disseminated and in turn what different 'societies' think about vaccination. Communication, including patient-provider communication, parental communication, and mass and social media communication are all integral to our understanding and conceptualization of the challenges (Viswanath et al., 2015).

Final conclusions

> "Vaccination has greatly reduced the burden of infectious diseases. Only clean water, also considered to be a basic human right, performs better. . . . The benefits of vaccination extend beyond prevention of specific diseases in individuals. They enable a rich, multifaceted harvest for societies and nations. . . . A comprehensive vaccination programme is a cornerstone of good public health and will reduce inequities and poverty."
>
> — (Andre et al., 2008, pp. 140-144)

In Canada, the HPV vaccine is now covered by the government publicly funded programs for all girls in all provinces and territories and for boys in 5 out of the 10 provinces. In a recent systematic review and meta-analysis of HPV vaccination uptake in Canada which included 12 studies, vaccination uptake varied widely from 12% to 88% (Obidiya, Bird, Mahmood, Nwankwo, & Moraros, 2016). The pooled random effects model indicated an HPV vaccination rate of 55.92% [95% CI: 44.88, 66.53] in Canada. The authors reported that individuals who

were young (<18 years old), female, and those in school based programs that were publicly funded were more likely to receive the HPV vaccine (Obidiya et al., 2016).

As of now, that there are still 4 Canadian provinces and 3 territories without school-based programs for boys. While we expect to see a sizeable increase in the upcoming years in HPV vaccine uptake among males due to the expansion of the publicly funded programs and the availability of the HPV vaccine to certain high-risk groups, the reality is that HPV vaccination rates for boys (and girls) are not yet where they should be. Continued advocacy for expansion of the school-based programs for boys across Canada, including catch-up programs is necessary to protect *all* people from HPV-associated diseases. As recent as July 2016, there was a push by the Canadian Cancer Society to the BC Minister of Health to encourage to expand the publicly-funded HPV vaccination program to include both genders (Canadian Cancer Society, 2016).

From a theoretical perspective, this dissertation contributed to the understanding of the complex and multidimensional decision-making process regarding a particular cancer preventive behavior: HPV vaccination. In particular, it provided insight on how certain psychosocial determinants are related to HPV vaccination stages of adoption, e.g., attitudes, knowledge, and physician recommendation are related to four other stages of decision-making. Because the determinants of HPV vaccine acceptance are complex and multidimensional, there is no "magic bullet" that can address all individuals and enhance vaccine acceptance.

Seethaler writes: "Vaccination decision-making involves reasoning under conditions of uncertainty, and heuristics are commonly triggered under such conditions… The costs and benefits of a health decision are short term and long term and depend on a person's age, physical condition, and exposure risk factors. Also, while individual and community health are the most obvious themes of tradeoffs in vaccine decision making, economics and ethics come into play."

(Seethaler, 2016, p. 267). These quotes highlight how complicated and multifaceted health decision-making are on the individual, interpersonal, societal and environmental levels. Discussions of vaccination have shifted from the collective good to the individual benefit. The issue with HPV vaccination is that parents are the ones making the decision even though the benefit is not entirely for them. This raises a whole slew of questions on when children should get involved and have a say in their health/vaccination decision-making.

There is a vaccine that is available, recommended and effective to prevent cancer morbidity and mortality. Canada could very well be a world leader with high HPV vaccination rates. Continuing to monitor and evaluate the benefits of the HPV vaccine on the reduction of infection and disease in both males and female will hopefully shed light on its importance and its value and inform policy and programs worldwide. There are and will continue to be different opportunities and challenges to ensure high levels of HPV vaccination uptake depending on the outcome and setting. Understanding how to help individuals and groups make informed HPV vaccination decisions to protect their own and their children's is complicated and challenging but a worthwhile endeavor.

References

Ajzen, I., & Driver, B. L. (1991). Prediction of leisure participation from behavioral, normative, and control beliefs: An application of the theory of planned behavior *Leisure Sciences, 13* (3), 185-204.

Ajzen, I., & Fishbein, M. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. Don Mills, Ontario: Addison-Wesley.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour*. Englewood Cliffs, N.J.: Prentice-Hall.

Alemany, L., Cubilla, A., Halec, G., Kasamatsu, E., Quirós, B., Masferrer, E., . . . Lonsdale, R. (2016). Role of Human Papillomavirus in Penile Carcinomas Worldwide. *European Urology, 69*(5), 953-961.

Alemany, L., Saunier, M., Alvarado-Cabrero, I., Quirós, B., Salmeron, J., Shin, H. R., . . . Felix, A. (2015). Human papillomavirus DNA prevalence and type distribution in anal carcinomas worldwide. *International Journal of Cancer, 136*(1), 98-107.

Alemany, L., Saunier, M., Tinoco, L., Quirós, B., Alvarado-Cabrero, I., Alejo, M., . . . Salmerón, J. (2014). Large contribution of human papillomavirus in vaginal neoplastic lesions: a worldwide study in 597 samples. *European Journal of Cancer, 50*(16), 2846-2854.

Ali, H., Donovan, B., Wand, H., Read, T. R., Regan, D. G., Grulich, A. E., . . . Guy, R. J. (2013). Genital warts in young Australians five years into national human papillomavirus vaccination programme: national surveillance data. *British Medical Journal, 346*, f2032. doi:10.1136/bmj.f2032

Allen, J. D., Coronado, G. D., Williams, R. S., Glenn, B., Escoffery, C., Fernandez, M., . . . Mullen, P. D. (2010a). A systematic review of measures used in studies of human papillomavirus (HPV) vaccine acceptability. *Vaccine, 28*(24), 4027-4037. doi:10.1016/j.vaccine.2010.03.063

Allen, J. D., Mohllajee, A. P., Shelton, R. C., Othus, M. K. D., Fontenot, H. B., & Hanna, R. (2009). Stage of adoption of the human papillomavirus vaccine among college women. *Preventive Medicine, 48*(5), 420-425.

Allen, J. D., Othus, M. K., Shelton, R. C., Li, Y., Norman, N., Tom, L., & del Carmen, M. G. (2010b). Parental decision making about the HPV vaccine. *Cancer Epidemiology, Biomarkers & Prevention, 19*(9), 2187-2198. doi:10.1158/1055-9965.EPI-10-0217

Andre, F., Booy, R., Bock, H., Clemens, J., Datta, S., John, T., . . . Ruff, T. (2008). Vaccination greatly reduces disease, disability, death and inequity worldwide. *Bulletin of the World Health Organization, 86*(2), 140-146.

Askelson, N. M., Campo, S., Lowe, J. B., Smith, S., Dennis, L. K., & Andsager, J. (2010). Using the theory of planned behavior to predict mothers' intentions to vaccinate their daughters against HPV. *The Journal of School Nursing, 26*(3), 194-202. doi:10.1177/1059840510366022

Australian Government Department of Health. (2015). Immunise Australia Program-Human Papillomavirus (HPV). Retrieved from http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/content/immunise-hpv

Backes, D. M., Kurman, R. J., Pimenta, J. M., & Smith, J. S. (2009). Systematic Review of Human Papillomavirus Prevalence in Invasive Penile Cancer. *Cancer Causes & Control, 20*(4), 449-457.

Baldwin, A. S., Bruce, C. M., & Tiro, J. A. (2013). Understanding how mothers of adolescent girls obtain information about the human papillomavirus vaccine: associations between mothers' health beliefs, information seeking, and vaccination intentions in an ethnically diverse sample. *J Health Psychol, 18*(7), 926-938. doi:10.1177/1359105312445078

Bartlett, J. A., & Peterson, J. A. (2011). The uptake of Human Papillomavirus (HPV) vaccine among adolescent females in the United States: a review of the literature. *The Journal of School Nursing, 27*(6), 434-446. doi:10.1177/1059840511415861

BC Gov News. (2015, July 7, 2015). HPV immunization program expanded to vulnerable boys. *Health.* Retrieved from https://news.gov.bc.ca/stories/hpv-immunization-program-expanded-to-vulnerable-boys

Berenson, A. B., & Rahman, M. (2012). Gender differences among low income women in their intent to vaccinate their sons and daughters against human papillomavirus infection. *Journal of Pediatric and Adolescent Gynecology, 25*(3), 218-220. doi:10.1016/j.jpag.2012.01.003

Betsch, C., Bohm, R., & Chapman, G. B. (2015). Using Behavioral Insights to Increase Vaccination Policy Effectiveness. *Policy Insights from the Behavioral and Brain Sciences, 2*(1), 61-73. doi:10.1177/2372732215600716

Bhandari, P., Shrestha, S. S., & Ghimire, D. J. (2007). Sociocultural and geographical disparities in child immunization in Nepal. *Asia Pacific Population Journal, 22*(1), 43.

Bianco, A., Pileggi, C., Iozzo, F., Nobile, C. G., & Pavia, M. (2014). Vaccination against human papilloma virus infection in male adolescents: knowledge, attitudes, and acceptability among parents in Italy. *Human Vaccines & Immunotherapeutics, 10*(9), 2536-2542. doi:10.4161/21645515.2014.969614

Blake, K. D., Ottenbacher, A. J., Finney Rutten, L. J., Grady, M. A., Kobrin, S. C., Jacobson, R. M., & Hesse, B. W. (2015). Predictors of human papillomavirus awareness and knowledge in 2013: gaps and opportunities for targeted communication strategies. *American Journal of Preventive Medicine, 48*(4), 402-410. doi:10.1016/j.amepre.2014.10.024

Blalock, S. J. (2005). Towards a better understanding of calcium intake: behavioral change perspectives. *Journal of Reproductive Medicine 50*(11 Suppl), 901-906.

Blalock, S. J. (2007). Predictors of calcium intake patterns: A longitudnal analysis. *Health Psychology, 26*(3), 251-258.

Blot, W. J., & Tarone, R. E. (2015). Doll and Peto's quantitative estimates of cancer risks: holding generally true for 35 years. *Journal of the National Cancer Institute, 107*(4), djv044.

Borrelli, B., McQuaid, E. L., Becker, B., Hammond, K., Papandonatos, G., Fritz, G., & Abrams, D. (2002). Motivating parents of kids with asthma to quit smoking: The PAQS project. *Health Education Research, 17*(5), 659-669.

Bouvard, V., Baan, R., Straif, K., Grosse, Y., Secretan, B., Ghissassi, F. E., . . . On behalf of the WHO International Agency for Research on Cancer Monograph Working Group. (2009). A review of human carcinogens--Part B: biological agents. *The Lancet Oncology, 10*(4), 321-322. doi:10.1016/S1470-2045(09)70096-8

Brabin, L., Roberts, S. A., Farzaneh, F., & Kitchener, H. C. (2006). Future acceptance of adolescent human papillomavirus vaccination: a survey of parental attitudes. *Vaccine, 24*(16), 3087-3094. doi:10.1016/j.vaccine.2006.01.048

Brabin, L., Roberts, S. A., Stretch, R., Baxter, D., Chambers, G., Kitchener, H., & McCann, R. (2008). Uptake of first two doses of human papillomavirus vaccine by adolescent schoolgirls in Manchester: prospective cohort study. *British Medical Journal, 336*(7652), 1056-1058.

Brewer, N. T., & Fazekas, K. I. (2007). Predictors of HPV vaccine acceptability: a theory-informed, systematic review. *Preventive Medicine, 45*(2-3), 107-114. doi:10.1016/j.ypmed.2007.05.013

Brewer, N. T., Gottlieb, S. L., Reiter, P. L., McRee, A. L., Liddon, N., Markowitz, L., & Smith, J. S. (2011). Longitudinal predictors of human papillomavirus vaccine initiation among adolescent girls in a high-risk geographic area. *Sexually Transmitted Diseases, 38*(3), 197-204. doi:10.1097/OLQ.0b013e3181f12dbf

Brewer, N. T., Hall, M. E., Malo, T. L., Gilkey, M. B., Quinn, B., & Lathren, C. (2016). Announcements Versus Conversations to Improve HPV Vaccination Coverage: A Randomized Trial. *Pediatrics*, e20161764.

Brisson, M., Van de Velde, N., & Boily, M. C. (2009). Economic evaluation of human papillomavirus vaccination in developed countries. *Public Health Genomics, 12*(5-6), 343-351.

Brisson, M., van de Velde, N., Franco, E. L., Drolet, M., & Boily, M. C. (2011). Incremental impact of adding boys to current human papillomavirus vaccination programs: role of

herd immunity. *Journal of Infectious Diseases*, *204*(3), 372-376. doi:10.1093/infdis/jir285

Brotherton, J. M., Fridman, M., May, C. L., Chappell, G., Saville, A. M., & Gertig, D. M. (2011). Early effect of the HPV vaccination programme on cervical abnormalities in Victoria, Australia: an ecological study. *The Lancet*, *377*(9783), 2085-2092. doi:10.1016/S0140-6736(11)60551-5

Brotherton, J. M. L., Zuber, P. L. F., & Bloem, P. J. N. (2016). Primary Prevention of HPV through Vaccination: Update on the Current Global Status. *Current Obstetrics and Gynecology Reports, 5*(3), 210-224. doi:10.1007/s13669-016-0165-z

Bruder, M., Haffke, P., Neave, N., Nouripanah, N., & Imhoff, R. (2013). Measuring individual differences in generic beliefs in conspiracy theories across cultures: conspiracy mentality questionnaire. *Frontiers in Psychology, 4*, 225. doi:10.3389/fpsyg.2013.00225

Bruni, L., Barrionuevo-Rosas, L., Albero, G., Serrano, B., Mena, M., Gomez, D., . . . de Sanjosé, S. (2016). *Human Papillomavirus and Related Diseases in the World. Summary Report 2016*. Retrieved from ICO Information Centre on HPV and Cancer (HPV Information Centre), Barcelona, Spain: http://www.hpvcentre.net/statistics/reports/XWX.pdf

Buchan, S. A., & Kwong, J. C. (2016). Trends in influenza vaccine coverage and vaccine hesitancy in Canada, 2006/07 to 2013/14: results from cross-sectional survey data. *CMAJ Open, 4*(3), E455-E462.

Burchett, H. E., Mounier-Jack, S., Griffiths, U. K., & Mills, A. J. (2012). National decision-making on adopting new vaccines: a systematic review. *Health Policy and Planning, 27 Suppl 2*, ii62-76. doi:10.1093/heapol/czr049

Bynum, S. A., Brandt, H. M., Friedman, D. B., Annang, L., & Tanner, A. (2011). Knowledge, beliefs, and behaviors: examining human papillomavirus-related gender differences among African American college students. *Journal of American College Health, 59*(4), 296-302. doi:10.1080/07448481.2010.503725

Canadian Cancer Society. (2016). *Expanding the publicly-funded Human Papillomavirus (HPV) vaccination program to include all genders*. Retrieved from Vancouver, BC.:

Canadian Cancer Statistics Advisory Committee on Cancer Statistics. (2016). *Canadian Cancer Statistics 2016. Special topic: HPV-associated cancers* (ISSN: 08345-2976). Retrieved from http://www.cancer.ca/~/media/cancer.ca/CW/cancer%20information/cancer%20101/Canadian%20cancer%20statistics/Canadian-Cancer-Statistics-2016-EN.pdf?la=en

Canadian Immunization Committee. (2007). *Recommendations on a Human Papillomavirus Immunization Program* (ISBN 978-0-662-48433-2). Retrieved from Canada: http://www.phac-aspc.gc.ca/publicat/2008/papillomavirus-papillome/papillomavirus-papillome-index-eng.php

Canadian Task Force on Preventive Health Care. (2013). Recommendations on screening for cervical cancer. *Canadian Medical Association Journal, 185*(1), 35-45. doi:10.1503/cmaj.121505

Castellsagué, X. (2008). Natural history and epidemiology of HPV infection and cervical cancer. *Gynecologic Oncology, 110*(3), S4-S7.

Castellsagué, X., Alemany, L., Quer, M., Halec, G., Quirós, B., Tous, S., . . . Szafarowski, T. (2016). HPV Involvement in Head and Neck Cancers: Comprehensive Assessment of Biomarkers in 3680 Patients. *Journal of the National Cancer Institute, 108*(6), djv403.

Cates, J. R., Ortiz, R., Shafer, A., Romocki, L. S., & Coyne-Beasley, T. (2012). Designing messages to motivate parents to get their preteenage sons vaccinated against human papillomavirus. *Perspectives on Sexual and Reproductive Health, 44*(1), 39-47. doi:10.1363/4403912

Centers for Disease Control and Prevention. (2011). *Recommendations on the Use of Quadrivalent Human Papillomavirus Vaccine in Males - Advisory Committe on Immunization Practices (ACIP)*. Retrieved from https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6050a3.htm

Centers for Disease Control and Prevention. (2015a). HPV Vaccines: Vaccinating Your Preteen or Teen. Retrieved from http://www.cdc.gov/hpv/parents/vaccine.html

Centers for Disease Control and Prevention. (2015b, August 28, 2015). Vaccine Safety Monitoring. Retrieved from http://www.cdc.gov/vaccinesafety/ensuringsafety/monitoring/index.html

Centers for Disease Control and Prevention. (2015c, December 28, 2015). What is HPV? . Retrieved from http://www.cdc.gov/hpv/parents/whatishpv.html

Cervical Cancer Action. (2016, November 2016). Global Maps: Global Progress in HPV Vaccination. Retrieved from http://www.cervicalcanceraction.org/comments/comments3.php.

Champion, V. L., & Skinner, C. S. (2008). The health belief model. In K. Glanz, B. K. Rimer, & K. E. Viswanath (Eds.), *Health behavior and health education: Theory, research and practice* (4 ed., pp. 45-62). San Francisco, CA: John Wiley & Sons, Incorporated.

Chan, Z. C., Chan, T. S., Ng, K. K., & Wong, M. L. (2012). A systematic review of literature about women's knowledge and attitudes toward human papillomavirus (HPV) vaccination. *Public Health Nursing, 29*(6), 481-489.

Chaturvedi, A. K. (2010). Beyond cervical cancer: burden of other HPV-related cancers among men and women. *Journal of Adolescent Health, 46*(4 Suppl), S20-26. doi:10.1016/j.jadohealth.2010.01.016

Chaturvedi, A. K., Engels, E. A., Anderson, W. F., & Gillison, M. L. (2008). Incidence trends for human papillomavirus-related and -unrelated oral squamous cell carcinomas in the United States. *Journal of Clinical Oncology, 26*(4), 612-619. doi:10.1200/JCO.2007.14.1713

Chesson, H. W., Ekwueme, D. U., Saraiya, M., Dunne, E. F., & Markowitz, L. E. (2011). The cost-effectiveness of male HPV vaccination in the United States. *Vaccine, 29*(46), 8443-8450.

Chow, S. N., Soon, R., Park, J. S., Pancharoen, C., Qiao, Y. L., Basu, P., & Ngan, H. Y. (2010). Knowledge, attitudes, and communication around human papillomavirus (HPV) vaccination amongst urban Asian mothers and physicians. *Vaccine, 28*(22), 3809-3817. doi:10.1016/j.vaccine.2010.03.027

Christian, W. J., Christian, A., & Hopenhayn, C. (2009). Acceptance of the HPV vaccine for adolescent girls: analysis of state-added questions from the BRFSS. *Journal of Adolescent Health, 44*(5), 437-445.

Clark, S. J., Cowan, A. E., Filipp, S. L., Fisher, A. M., & Stokley, S. (2015). Parent perception of provider interactions influences HPV vaccination status of adolescent females. *Clinical pediatrics*, 0009922815610629.

Clarke, C. E., Weberling McKeever, B., Holton, A., & Dixon, G. N. (2015). The Influence of Weight-of-Evidence Messages on (Vaccine) Attitudes: A Sequential Mediation Model. *Journal of Health Communication, 20*(11), 1302-1309. doi:10.1080/10810730.2015.1023959

Clemow, L., Costanza, M. E., Haddad, W. P., Luckmann, R., White, M. J., Klaus, D., & Stoddard, A. M. (2000). Underutilizers of mammography screening today: characteristics of women planning, undecided about, and not planning a mammogram. *Annals of Behavioral Medicine, 22*(1), 80-88.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2 ed.). New York, NY: Lawrence Erlbaum Associates.

Colbert, Y. (2015, April 13). HPV vaccine for Nova Scotia boys called 'groundbreaking. *CBC News*. Retrieved from http://www.cbc.ca/news/canada/nova-scotia/hpv-vaccine-for-nova-scotia-boys-called-groundbreaking-1.3031169

Colditz, G. A., Wolin, K. Y., & Gehlert, S. (2012). Applying what we know to accelerate cancer prevention. *Science Translational Medicine, 4*(127), 127rv124-127rv124.

Constantine, N. A., & Jerman, P. (2007). Acceptance of human papillomavirus vaccination among Californian parents of daughters: a representative statewide analysis. *Journal of Adolescent Health, 40*(2), 108-115. doi:10.1016/j.jadohealth.2006.10.007

Costanza, M. E., Luckmann, R., Stoddard, A. M., Avrunin, J. S., White, M. J., Stark, J. R., . . . Rosal, M. C. (2005). Applying a stage model of behavior change to colon cancer screening. *Preventive Medicine, 41*(3), 707-719.

Court of Appeal of Alberta. (1986, December 31, 1986). J.S.C. v. Wren, 1986 ABCA 249. Retrieved from http://www.canlii.org/en/ab/abca/doc/1986/1986abca249/1986abca249.html

Crosby, R. A., DiClemente, R. J., Salazar, L. F., Nash, R., & Younge, S. (2011). Gardasil for guys: correlates of intent to be vaccinated. *Journal of Men's Health, 8*(2), 119-125.

Cunningham, M. S., Davison, C., & Aronson, K. J. (2014). HPV vaccine acceptability in Africa: a systematic review. *Preventive Medicine, 69*, 274-279. doi:10.1016/j.ypmed.2014.08.035

Curran, P. G. (2016). Methods for the detection of carelessly invalid responses in survey data. *Journal of Experimental Social Psychology, 66*, 4.

Cuzick, J. (2015). Gardasil 9 joins the fight against cervix cancer. *Expert Review of Vaccines, 14*(8), 1047-1049. doi:10.1586/14760584.2015.1051470

Daley, E. M., Buhi, E. R., Baldwin, J., Lee, J. H., Vadaparampil, S., Abrahamsen, M., . . . Giuliano, A. (2009). Men's responses to HPV test results: development of a theory-based survey. *American Journal of Health Behavior, 33*(6), 728-744.

Daley, E. M., Vamos, C. A., Buhi, E. R., Kolar, S. K., McDermott, R. J., Hernandez, N., & Fuhrmann, H. J. (2010). Influences on human papillomavirus vaccination status among female college students. *Journal of Women's Health 19*(10), 1885-1891. doi:10.1089/jwh.2009.1861

Daley, E. M., Vamos, C. A., Zimet, G. D., Rosberger, Z., Thompson, E. L., & Merrell, L. (2016). The feminization of HPV: reversing gender biases in US human papillomavirus vaccine policy. *American journal of public health, 106*(6), 983.

Danaei, G., Vander Hoorn, S., Lopez, A. D., Murray, C. J., Ezzati, M., & group, C. R. A. c. (2005). Causes of cancer in the world: comparative risk assessment of nine behavioural and environmental risk factors. *The Lancet, 366*(9499), 1784-1793.

Darden, P. M., Thompson, D. M., Roberts, J. R., Hale, J. J., Pope, C., Naifeh, M., & Jacobson, R. M. (2013). Reasons for not vaccinating adolescents: National Immunization Survey of Teens, 2008–2010. *Pediatrics, 131*(4), 645-651.

Davlin, S. L., Berenson, A. B., & Rahman, M. (2015). Correlates of HPV knowledge among low-income minority mothers with a child 9-17 years of age. *Journal of Pediatric and Adolescent Gynecology, 28*(1), 19-23. doi:10.1016/j.jpag.2014.01.109

Dawar, M., Dobson, S., & Deeks, S. (2007). Literature review on HPV 6, 11, 16 and 18: Disease and Vaccine Characteristics, 1-33. Retrieved from http://www.phac-aspc.gc.ca/naci-ccni/pdf/lr-sl_2_e.pdf

De Martel, C., Ferlay, J., Franceschi, S., Vignat, J., Bray, F., Forman, D., & Plummer, M. (2012). Global burden of cancers attributable to infections in 2008: a review and synthetic analysis. *The Lancet Oncology, 13*(6), 607-615.

de Sanjosé, S., Alemany, L., Ordi, J., Tous, S., Alejo, M., Bigby, S. M., . . . Bravo, I. G. (2013). Worldwide human papillomavirus genotype attribution in over 2000 cases of intraepithelial and invasive lesions of the vulva. *European Journal of Cancer, 49*(16), 3450-3461.

Dempsey, A. F., Butchart, A., Singer, D., Clark, S., & Davis, M. (2011). Factors associated with parental intentions for male human papillomavirus vaccination: results of a national survey. *Sexually Transmitted Diseases, 38*(8), 769-776. doi:10.1097/OLQ.0b013e318211c248

Dempsey, A. F., Fuhrel-Forbis, A., & Konrath, S. (2014). Use of the Carolina HPV Immunization Attitudes and Beliefs Scale (CHIAS) in young adult women. *PLoS One, 9*(6), e100193. doi:10.1371/journal.pone.0100193

Dempsey, A. F., Zimet, G. D., Davis, R. L., & Koutsky, L. (2006). Factors that are associated with parental acceptance of human papillomavirus vaccines: a randomized intervention study of written information about HPV. *Pediatrics, 117*(5), 1486-1493.

DeSimone, J. A., Harms, P. D., & DeSimone, A. J. (2015). Best practice recommendations for data screening. *Journal of Organizational Behavior, 36*(2), 171-181.

DiClemente, C. C., Prochaska, J. O., Fairhurst, S. K., Velicer, W. F., Velasquez, M. M., & Rossi, J. S. (1991). The process of smoking cessation: an analysis of precontemplation, contemplation, and preparation stages of change. *Journal of Consulting and Clinical Psychology, 59*(2), 295.

Dixon, G. N., & Clarke, C. E. (2013). Heightening uncertainty around certain science media coverage, false balance, and the autism-vaccine controversy. *Science Communication, 35*(3), 358-382.

Doll, R., & Peto, R. (1981). The causes of cancer: quantitative estimates of avoidable risks of cancer in the United States today. *Journal of the National Cancer Institute, 66*(6), 1192-1308.

Donahue, K. L., Stupiansky, N. W., Alexander, A. B., & Zimet, G. D. (2014). Acceptability of the human papillomavirus vaccine and reasons for non-vaccination among parents of adolescent sons. *Vaccine, 32*(31), 3883-3885. doi:10.1016/j.vaccine.2014.05.035

Dorell, C. G., Yankey, D., Santibanez, T. A., & Markowitz, L. E. (2011). Human Papillomavirus Vaccination Series Initiation and Completion, 2008–2009. *Pediatrics, 128*(5), 830-839. doi:10.1542/peds.2011-0950

Drolet, M., Benard, E., Boily, M. C., Ali, H., Baandrup, L., Bauer, H., . . . Brisson, M. (2015). Population-level impact and herd effects following human papillomavirus vaccination programmes: a systematic review and meta-analysis. *Lancet Infectious Diseases, 15*(5), 565-580. doi:10.1016/s1473-3099(14)71073-4

Drolet, M., Deeks, S. L., Kliewer, E., Musto, G., Lambert, P., & Brisson, M. (2016). Can high overall human papillomavirus vaccination coverage hide sociodemographic inequalities? An ecological analysis in Canada. *Vaccine, 34*(16), 1874-1880. doi:10.1016/j.vaccine.2016.02.069

Dubé, E., Bettinger, J. A., Fisher, W. A., Naus, M., Mahmud, S. M., & Hilderman, T. (2016a). Vaccine acceptance, hesitancy and refusal in Canada: Challenges and potential approaches. *Canada Communicable Disease Report, 42*(12), 246-251.

Dubé, E., Gagnon, D., Ouakki, M., Bettinger, J. A., Guay, M., Halperin, S., . . . MacDonald, S. (2016b). Understanding Vaccine Hesitancy in Canada: Results of a Consultation Study by the Canadian Immunization Research Network. *PloS one, 11*(6), e0156118.

Dubé, E., Gagnon, D., Zhou, Z., & Deceuninck, G. (2016c). Parental Vaccine Hesitancy in Quebec (Canada). *PLoS currents, 8*.

Dubé, E., Laberge, C., Guay, M., Bramadat, P., Roy, R., & Bettinger, J. A. (2013). Vaccine hesitancy: an overview. *Human Vaccines & Immunotherapeutics, 9*(8), 1763-1773.

Dunne, E. F., & Markowitz, L. E. (2006). Genital human papillomavirus infection. *Clinical Infectious Diseases, 43*(5), 624-629.

Eggertson, L. (2012). Provinces weighing HPV vaccination of boys. *Canadian Medical Association Journal, 184*(5), E250-E251.

El-Zein, M., Richardson, L., & Franco, E. L. (2016). Cervical cancer screening of HPV vaccinated populations: Cytology, molecular testing, both or none. *Journal of Clinical Virology, 76, Supplement 1*, S62-S68. doi:10.1016/j.jcv.2015.11.020

European Centre For Disease Prevention and Control. (2012). *ECDC GUIDANCE Introduction of HPV vaccines in European Union countries – an update*. (ISBN: 978-92-9193-377-8). Stockholm: ECDC Retrieved from http://ecdc.europa.eu/en/publications/Publications/20120905_GUI_HPV_vaccine_update.pdf.

Fairley, C. K., Hocking, J. S., Gurrin, L. C., Chen, M. Y., Donovan, B., & Bradshaw, C. S. (2009). Rapid decline in presentations of genital warts after the implementation of a national quadrivalent human papillomavirus vaccination programme for young women. *Sexually Transmitted Infections, 85*(7), 499-502. doi:10.1136/sti.2009.037788

Fernández, M. E., Allen, J. D., Mistry, R., & Kahn, J. A. (2010). Integrating clinical, community, and policy perspectives on HPV vaccination. *Annual Review of Public Health, 31*, 235.

Ferrer, H. B., Trotter, C., Hickman, M., & Audrey, S. (2014). Barriers and facilitators to HPV vaccination of young women in high-income countries: a qualitative systematic review and evidence synthesis. *BMC Public Health, 14*(1), 700-722. doi:10.1186/1471-2458-14-700

Field, A. P. (2009). *Discovering statistics using SPSS*. Thousand Oaks, California: SAGE Publications.

Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior : the reasoned action approach*.

Fisher, B. HPV Vaccination: Knowledge, Attitudes, and Practice of Undergraduates. *Department of Psychology, The University of Western Ontario, Canada*.

Fisher, W. A. (2012). Understanding human papillomavirus vaccine uptake *Vaccine, 30*, F149-F156.

Forman, D., de Martel, C., Lacey, C. J., Soerjomataram, I., Lortet-Tieulent, J., Bruni, L., . . . Franceschi, S. (2012). Global burden of human papillomavirus and related diseases. *Vaccine, 30*(Suppl 5), F12-23. doi:10.1016/j.vaccine.2012.07.055

Fu, L. Y., Bonhomme, L.-A., Cooper, S. C., Joseph, J. G., & Zimet, G. D. (2014). Educational interventions to increase HPV vaccination acceptance: A systematic review. *Vaccine, 32*(17), 1901-1920. doi:10.1016/j.vaccine.2014.01.091

Gainforth, H. L., Cao, W., & Latimer-Cheung, A. E. (2012). Determinants of human papillomavirus (HPV) vaccination intent among three Canadian target groups. *Journal of Cancer Education, 27*(4), 717-724. doi:10.1007/s13187-012-0389-1

Gamble, H. L., Klosky, J. L., Parra, G. R., & Randolph, M. E. (2010). Factors influencing familial decision-making regarding human papillomavirus vaccination. *Journal of Pediatric Psychology, 35*(7), 704-715. doi:10.1093/jpepsy/jsp108

Garcini, L. M., Galvan, T., & Barnack-Tavlaris, J. L. (2012). The study of human papillomavirus (HPV) vaccine uptake from a parental perspective: a systematic review of observational studies in the United States. *Vaccine, 30*(31), 4588-4595. doi:10.1016/j.vaccine.2012.04.096

Garland, S. M. (2014). The Australian Experience With the Human Papillomavirus Vaccine. *Clinical Therapeutics, 36*(1), 17-23. doi:10.1016/j.clinthera.2013.12.005

Garland, S. M., Kjaer, S. K., Munoz, N., Block, S. L., Brown, D. R., DiNubile, M. J., . . . Velicer, C. (2016). Impact and Effectiveness Of the Quadrivalent Human Papillomavirus Vaccine: A Systematic Review of Ten Years of Real-World Experience. *Clinical Infectious Diseases, 63*(4), 519-527. doi:10.1093/cid/ciw354

Gerend, M. A., & Barley, J. (2009). Human papillomavirus vaccine acceptability among young adult men. *Sexually Transmitted Diseases, 36*(1), 58-62. doi:10.1097/OLQ.0b013e31818606fc

Gerend, M. A., Madkins, K., Phillips, G. n., & Mustanski, B. (2016). Predictors of Human Papillomavirus Vaccination Among Young Men Who Have Sex With Men. *Sexually transmitted diseases, 43*(3), 185-191.

Gerend, M. A., & Shepherd, J. E. (2011). Correlates of HPV knowledge in the era of HPV vaccination: a study of unvaccinated young adult women. *Women Health, 51*(1), 25-40. doi:10.1080/03630242.2011.540744

Gerend, M. A., Shepherd, M. A., & Shepherd, J. E. (2013). The multidimensional nature of perceived barriers: Global versus practical barriers to HPV vaccination. *Health Psychology, 32*(4), 361-369.

Gerend, M. A., Weibley, E., & Bland, H. (2009). Parental response to human papillomavirus vaccine availability: uptake and intentions. *Journal of Adolescent Health, 45*(5), 528-531. doi:10.1016/j.jadohealth.2009.02.006

Geshnizjani, A., Jozkowski, K. N., & Middlestadt, S. E. (2013). Factors influencing the intention of getting the HPV vaccine among college women: An application of the reasoned action approach. *California Journal of Health Promotion, 11*(2), 1-11.

Giambi, C., D'Ancona, F., Del Manso, M., De Mei, B., Giovannelli, I., Cattaneo, C., . . . Local Representatives for, V. (2014). Exploring reasons for non-vaccination against human papillomavirus in Italy. *BMC Infectious Diseases, 14*, 545. doi:10.1186/s12879-014-0545-9

Giede, C., McFadden, L. L., Komonoski, P., Agrawal, A., Stauffer, A., & Pierson, R. (2010). The acceptability of HPV vaccination among women attending the University of Saskatchewan Student Health Services. *Journal of Obstetrics and Gynaecology Canada (JOGC), 32*(7), 679-686.

Gilbert, N. L., Gilmour, H., Dubé, E., Wilson, S. E., & Laroche, J. (2016). Estimates and determinants of HPV non-vaccination and vaccine refusal in girls 12 to 14 y of age in Canada: Results from the Childhood National Immunization Coverage Survey. *Human Vaccines & Immunotherapeutics, 12*(6), 1484-1490.

Gilkey, M. B., Dayton, A. M., Moss, J. L., Sparks, A. C., Grimshaw, A. H., Bowling, J. M., & Brewer, N. T. (2014a). Increasing provision of adolescent vaccines in primary care: a randomized controlled trial. *Pediatrics, 134*(2), e346-353. doi:10.1542/peds.2013-4257

Gilkey, M. B., Magnus, B. E., Reiter, P. L., McRee, A. L., Dempsey, A. F., & Brewer, N. T. (2014b). The Vaccination Confidence Scale: a brief measure of parents' vaccination beliefs. *Vaccine, 32*(47), 6259-6265. doi:10.1016/j.vaccine.2014.09.007

Gilkey, M. B., & McRee, A.-L. (2016). Provider communication about HPV vaccination: a systematic review. *Human vaccines & immunotherapeutics*, 1-15.

Gilkey, M. B., Moss, J. L., McRee, A. L., & Brewer, N. T. (2012). Do correlates of HPV vaccine initiation differ between adolescent boys and girls? *Vaccine, 30*(41), 5928-5934. doi:10.1016/j.vaccine.2012.07.045

Giuliano, A. R. (2007). Human papillomavirus vaccination in males. *Gynecologic Oncology, 107*(2), S24-S26.

Giuliano, A. R., Palefsky , J. M., Goldstone , S., Moreira , E. D. J., Penny , M. E., Aranda , C., . . . Guris , D. (2011). Efficacy of Quadrivalent HPV Vaccine against HPV Infection and Disease in Males. *New England Journal of Medicine, 364*(5), 401-411. doi:doi:10.1056/NEJMoa0909537

Giuliano, A. R., & Salmon, D. (2008). The case for a gender-neutral (universal) human papillomavirus vaccination policy in the United States: Point. *Cancer Epidemiology Biomarkers & Prevention, 17*(4), 805-808.

Glanz, K., & Rimer, B. K. (2005). *Theory at a glance: A guide for health promotion practice* (NIH Publication No. 05-3896). Retrieved from National Cancer Institute, Maryland, United States: http://www.sbccimplementationkits.org/demandrmnch/wp-content/uploads/2014/02/Theory-at-a-Glance-A-Guide-For-Health-Promotion-Practice.pdf

Glanz, K., Rimer, B. K., & Viswanath, K. (2008). *Health behavior and health education : Theory, Research, and Practice* (4 ed.). San Francisco, CA: John Wiley & Sons, Incorporated

Glanz, K., Rimer, B. K., & Viswanath, K. (2015). *Health behavior: Theory, Research, and Practice* (5 ed.). San Francisco, CA: John Wiley & Sons, Incorporated.

Glick, S. N., Feng, Q., Popov, V., Koutsky, L. A., & Golden, M. R. (2013). High rates of incident and prevalent anal human papillomavirus infection among young men who have sex with men. *Journal of Infectious Diseases, 209*(3), 369-376.

Gollwitzer, P. M. (1999). Implementation intentions: strong effects of simple plans. *American Psychologist, 54*(7), 493-503.

Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes *Advances in Experimental Social Psychology, 38*(69-119).

Gorin, S. N. S., Glenn, B. A., & Perkins, R. B. (2011). The human papillomavirus (HPV) vaccine and cervical cancer: uptake and next steps. *Advances in Therapy, 28*(8), 615-639.

Gouvernement du Québec. (2016, September 22, 2016). Human Papillomavirus (HPV) Vaccine. Retrieved from http://sante.gouv.qc.ca/en/conseils-et-prevention/vaccin-contre-les-infections-par-les-virus-du-papillome-humain-vph/

Gowda, C., Carlos, R. C., Butchart, A. T., Singer, D. C., Davis, M. M., Clark, S. J., & Dempsey, A. F. (2012). CHIAS: a standardized measure of parental HPV immunization attitudes and beliefs and its associations with vaccine uptake. *Sexually Transmitted Diseases, 39*(6), 475-481. doi:10.1097/OLQ.0b013e318248a6d5

Grabiel, M., Reutzel, T. J., Wang, S., Rubin, R., Leung, V., Ordonez, A., . . . Jordan, E. (2013). HPV and HPV vaccines: The knowledge levels, opinions, and behavior of parents. *Journal of Community Health, 38*(6), 1015-1021.

Graham, D. M., Isaranuwatchai, W., Habbous, S., de Oliveira, C., Liu, G., Siu, L. L., & Hoch, J. S. (2015). A cost-effectiveness analysis of human papillomavirus vaccination of boys for

the prevention of oropharyngeal cancer. *Cancer, 121*(11), 1785-1792. doi:10.1002/cncr.29111

Griebeler, M., Feferman, H., Gupta, V., & Patel, D. (2012). Parental beliefs and knowledge about male human papillomavirus vaccination in the US: a survey of a pediatric clinic population. *International Journal of Adolescent Medicine and Health, 24*(4), 315-320. doi:10.1515/ijamh.2012.045

Griffiths, W. (1972). Health education definitions, problems, and philosophies. *Health Education & Behavior, 1*(31), 7-11.

Guerry, S. L., De Rosa, C. J., Markowitz, L. E., Walker, S., Liddon, N., Kerndt, P. R., & Gottlieb, S. L. (2011). Human papillomavirus vaccine initiation among adolescent girls in high-risk communities. *Vaccine, 29*(12), 2235-2241.

Gutierrez, B., Jr., Leung, A., Jones, K. T., Smith, P., Silverman, R., Frank, I., & Leader, A. E. (2013). Acceptability of the human papillomavirus vaccine among urban adolescent males. *American Journal of Men's Health, 7*(1), 27-36. doi:10.1177/1557988312456697

Hammer, G. P. (1997). *Hepatitis B vaccine acceptance among nursing home workers*. Unpublished dissertation. Department of Health Policy and Management. Johns Hopkins University.

Hansen, C. E., Credle, M., Shapiro, E. D., & Niccolai, L. M. (2015). "It All Depends": A Qualitative Study of Parents' Views of Human Papillomavirus Vaccine for their Adolescents at Ages 11–12 years. *Journal of Cancer Education, 31*(1), 147-152. doi:10.1007/s13187-014-0788-6

Harper, D. M., Franco, E. L., Wheeler, C., Ferris, D. G., Jenkins, D., Schuind, A., . . . De Carvalho, N. S. (2004). Efficacy of a bivalent L1 virus-like particle vaccine in prevention

of infection with human papillomavirus types 16 and 18 in young women: a randomised controlled trial. *The Lancet, 364*(9447), 1757-1765.

Harper, D. M., Franco, E. L., Wheeler, C. M., Moscicki, A. B., Romanowski, B., Roteli-Martins, C. M., . . . Dubin, G. (2006). Sustained efficacy up to 4· 5 years of a bivalent L1 virus-like particle vaccine against human papillomavirus types 16 and 18: follow-up from a randomised control trial. *The Lancet, 367*(9518), 1247-1255.

Hausman, J., & McFadden, D. (1984). Specification Tests for the Multinomial Logit Model. *Econometrica, 52*(5), 1219-1240.

Healy, C. M., Montesinos, D. P., & Middleman, A. B. (2014). Parent and provider perspectives on immunization: are providers overestimating parental concerns? *Vaccine, 32*(5), 579-584. doi:10.1016/j.vaccine.2013.11.076

Healy, C. M., & Pickering, L. K. (2011). How to communicate with vaccine-hesitant parents. *Pediatrics, 127*(Supplement 1), S127-S133.

Hendry, M., Lewis, R., Clements, A., Damery, S., & Wilkinson, C. (2013). "HPV? Never heard of it!": A systematic review of girls' and parents' information needs, views and preferences about human papillomavirus vaccination. *Vaccine, 31*(45), 5152-5167. doi:10.1016/j.vaccine.2013.08.091

Hill, K., & Upchurch, D. M. (1995). Gender Differences in Child Health: Evidence from the Demographic and Health Surveys. *Population and Development Review, 21*(1), 127-151. doi:10.2307/2137416

Hochbaum, G. M. (1958). *Public participation in medical screening programs: A socio-psychological study*. Retrieved from Washington, D.C: U.S. Department of Health, Education, and Welfare, Public Health Service, US Government Printing Office:

http://www.sbccimplementationkits.org/demandrmnch/wp-content/uploads/2014/02/Theory-at-a-Glance-A-Guide-For-Health-Promotion-Practice.pdf

Holcomb, B., Bailey, J. M., Crawford, K., & Ruffin, M. T. (2004). Adults' Knowledge and Behaviors Related to Human Papillomavirus Infection. *The Journal of the American Board of Family Practice, 17*(1), 26-31. doi:10.3122/jabfm.17.1.26

Holman, D. M., Benard, V., Roland, K. B., Watson, M., Liddon, N., & Stokley, S. (2014). Barriers to human papillomavirus vaccination among US adolescents: a systematic review of the literature. *JAMA Pediatrics, 168*(1), 76-82.

Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural Equation Modelling: Guidelines for Determining Model Fit. *Electronic Journal of Business Research Methods, 6*(1), 53-60. doi:http://arrow.dit.ie/cgi/viewcontent.cgi?article=1001&context=buschmanart

Howell-Jones, R., Soldan, K., Wetten, S., Mesher, D., Williams, T., Gill, O. N., & Hughes, G. (2013). Declining genital Warts in young women in england associated with HPV 16/18 vaccination: an ecological study. *Journal of Infectious Diseases, 208*(9), 1397-1403. doi:10.1093/infdis/jit361

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1-55. doi:10.1080/10705519909540118

Hughes, C. C., Jones, A. L., Feemster, K. A., & Fiks, A. G. (2011). HPV vaccine decision making in pediatric primary care: A semi-structured interview study. *BMC Pediatrics, 11*(74). doi:10.1186/1471-2431-11-74

Hull, S. C., & Caplan, A. L. (2009). The case for vaccinating boys against human papillomavirus. *Public Health Genomics, 12*(5-6), 362-367.

Immunize Canada. (2016). Safety. Retrieved from http://www.immunize.ca/en/vaccine-safety.aspx

International Agency for Research on Cancer (2007). *Human Papillomaviruses* (ISBN: 978-92-832-1290-4). Retrieved from World Health Organization International Agency for Research on Cancer (IARC), Lyon, France: http://monographs.iarc.fr/ENG/Monographs/vol90/index.php

International Agency for Research on Cancer. (2012). *Human Papillomaviruses*. Retrieved from World Health Organizataion International Agency for Research on Cancer (IARC),: http://monographs.iarc.fr/ENG/Monographs/vol100B/mono100B-11.pdf

IPVS Policy statement on safety of HPV vaccines. (2016). *Papillomavirus Research, 2*, 9-10. doi:10.1016/j.pvr.2015.11.001

Jacobson, R. M., Van Etta, L., & Bahta, L. (2013). The CASE approach: guidance for talking to vaccine-hesitant parents. *Minnesota Medicine, 96*(4), 49-50.

Janis, I. L., & Mann, L. (1977). *Decision making: A psychological analysis of conflict, choice, and commitment*: Free Press.

Janz, N. K., & Becker, M. H. (1984). The health belief model: A decade later. *Health Education & Behavior, 11*(1), 1-47.

Johnson, J. A. (2005). Ascertaining the validity of individual protocols from Web-based personality inventories. *Journal of Research in Personality, 39*(1), 103-129. doi:10.1016/j.jrp.2004.09.009

Joseph, N. P., Shea, K., Porter, C. L., Walsh, J. P., Belizaire, M., Estervine, G., & Perkins, R. (2015). Factors Associated with Human Papillomavirus Vaccine Acceptance Among Haitian and African-American parents of Adolescent Sons. *Journal of the National Medical Association, 107*(2), 80-88. doi:10.1016/s0027-9684(15)30028-6

Joura, E. A., Ault, K. A., Bosch, F. X., Brown, D., Cuzick, J., Ferris, D., . . . Velicer, C. (2014). Attribution of 12 high-risk human papillomavirus genotypes to infection and cervical disease. *Cancer Epidemiology, Biomarkers and Prevention, 23*(10), 1997-2008. doi:10.1158/1055-9965.epi-14-0410

Joura, E. A., Giuliano, A. R., Iversen, O. E., Bouchard, C., Mao, C., Mehlsen, J., . . . Broad Spectrum, H. P. V. V. S. (2015). A 9-valent HPV vaccine against infection and intraepithelial neoplasia in women. *The New England Journal of Medicine, 372*(8), 711-723. doi:10.1056/NEJMoa1405044

Judgements of the Supreme Court of Canada. (2009, June 26, 2009). A.C. v. Manitoba (Director of Child and Family Services), 2009 SCC 30, [2009] 2 S.C.R. 181. Retrieved from https://scc-csc.lexum.com/scc-csc/scc-csc/en/item/7795/index.do

Juraskova, I., Bari, R. A., O'Brien, M. T., & McCaffery, K. J. (2011). HPV vaccine promotion: does referring to both cervical cancer and genital warts affect intended and actual vaccination behavior? *Women's Health Issues, 21*(1), 71-79.

Kahn, J. A., Rosenthal, S. L., Hamann, T., & Bernstein, D. I. (2003). Attitudes about human papillomavirus vaccine in young women. *International Journal of STD & AIDS, 14*(5), 300-306.

Kahn, J. A., Rosenthal, S. L., Jin, Y., Huang, B., Namakydoust, A., & Zimet, G. D. (2008). Rates of human papillomavirus vaccination, attitudes about vaccination, and human

papillomavirus prevalence in young women. *Obstetrics & Gynecology, 111*(5), 1103-1110.

Kahn, J. A., Zimet, G. D., Bernstein, D. I., Riedesel, J. M., Lan, D., Huang, B., & Rosenthal, S. L. (2005). Pediatricians' intention to administer human papillomavirus vaccine: the role of practice characteristics, knowledge, and attitudes. *Journal of Adolescent Health, 37*(6), 502-510. doi:10.1016/j.jadohealth.2005.07.014

Kang, H. Y., & Kim, J. S. (2011). Knowledge, attitudes of human papillomavirus vaccine, and intention to obtain vaccine among Korean female undergraduate students. *Women Health, 51*(8), 759-776. doi:10.1080/03630242.2011.627091

Kasting, M. L., Shapiro, G. K., Rosberger, Z., Kahn, J. A., & Zimet, G. D. (2016). Tempest in a teapot: A systematic review of HPV vaccination and risk compensation research. *Human Vaccines & Immunotherapeutics, 12*(6), 1435-1450. doi:10.1080/21645515.2016.1141158

Katz, M. L., Kam, J. A., Krieger, J. L., & Roberto, A. J. (2012). Predicting human papillomavirus vaccine intentions of college-aged males: An examination of parents' and son's perceptions. *Journal of American College Health, 60*(6), 449-459.

Katz, M. L., Krieger, J. L., & Roberto, A. J. (2011). Human papillomavirus (HPV): college male's knowledge, perceived risk, sources of information, vaccine barriers and communication. *Journal of Men's Health, 8*(3), 175-184. doi:10.1016/j.jomh.2011.04.002

Kessels, S. J., Marshall, H. S., Watson, M., Braunack-Mayer, A. J., Reuzel, R., & Tooher, R. L. (2012). Factors associated with HPV vaccine uptake in teenage girls: a systematic review. *Vaccine, 30*(24), 3546-3556. doi:10.1016/j.vaccine.2012.03.063

Klug, S. J., Hukelmann, M., & Blettner, M. (2008). Knowledge about infection with human papillomavirus: a systematic review. *Preventive Medicine, 46*(2), 87-98. doi:10.1016/j.ypmed.2007.09.003

Koutsky, L. A., Ault, K. A., Wheeler , C. M., Brown, D. R., Barr, E., Alvarez, F. B., . . . Jansen, K. U. (2002). A Controlled Trial of a Human Papillomavirus Type 16 Vaccine. *New England Journal of Medicine, 347*(21), 1645-1651. doi:doi:10.1056/NEJMoa020586

Krawczyk, A., Knauper, B., Gilca, V., Dubé, E., Perez, S., Joyal-Desmarais, K., & Rosberger, Z. (2015a). Parents' decision-making about the human papillomavirus vaccine for their daughters: I. Quantitative results. *Human Vaccines & Immunotherapeutics, 11*(2), 322-329. doi:10.1080/21645515.2014.1004030

Krawczyk, A., Perez, S., King, L., Vivion, M., Dubé, E., & Rosberger, Z. (2015b). Parents' decision-making about the human papillomavirus vaccine for their daughters: II. Qualitative results. *Human Vaccines & Immunotherapeutics, 11*(2), 330-336. doi:10.4161/21645515.2014.980708

Krawczyk, A., Stephenson, E., Perez, S., Lau, E., & Rosberger, Z. (2013). Deconstructing Human Papillomavirus (HPV) Knowledge: Objective and Perceived Knowledge in Males' Intentions to Receive the HPV Vaccine. *American Journal of Health Education, 44*(1), 26-31. doi:10.1080/19325037.2012.749714

Krawczyk, A. L., Perez, S., Lau, E., Holcroft, C. A., Amsel, R., Knauper, B., & Rosberger, Z. (2012). Human papillomavirus vaccination intentions and uptake in college women. *Health Psychology, 31*(5), 685-693. doi:10.1037/a0027012

Kreimer, A. R., Clifford, G. M., Boyle, P., & Franceschi, S. (2005). Human Papillomavirus Types in Head and Neck Squamous Cell Carcinomas Worldwide: A Systematic Review.

Cancer Epidemiology Biomarkers & Prevention, 14(2), 467-475. doi:10.1158/1055-9965.epi-04-0551

Kreuter, A., & Wieland, U. (2009). Human papillomavirus-associated diseases in HIV-infected men who have sex with men. *Current Opinion in Infectious Diseases, 22*(2), 109-114.

Krieger, J. L., Kam, J. A., Katz, M. L., & Roberto, A. J. (2011). Does Mother Know Best? An Actor-Partner Model of College-Age Women's Human Papillomavirus Vaccination Behavior. *Human Communication Research, 37*(1), 107-124. doi:10.1111/j.1468-2958.2010.01395.x

Kurtz, J. E., & Parrish, C. L. (2001). Semantic response consistency and protocol validity in structured personality assessment: the case of the NEO-PI-R. *Journal of Personality Assessment, 76*(2), 315-332. doi:10.1207/S15327752JPA7602_12

Larson, H. J., Jarrett, C., Eckersberger, E., Smith, D. M., & Paterson, P. (2014). Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007-2012. *Vaccine, 32*(19), 2150-2159. doi:10.1016/j.vaccine.2014.01.081

Leask, J., Kinnersley, P., Jackson, C., Cheater, F., Bedford, H., & Rowles, G. (2012). Communicating with parents about vaccination: a framework for health professionals. *BMC pediatrics, 12*(1), 1.

Liau, A., Stupiansky, N. W., Rosenthal, S. L., & Zimet, G. D. (2012). Health beliefs and vaccine costs regarding human papillomavirus (HPV) vaccination among a US national sample of adult women. Preventive medicine, 54(3), 277-279. *Preventive Medicine, 54*(3), 277-279.

Liddon, N., Hood, J., Wynn, B. A., & Markowitz, L. E. (2010). Acceptability of human papillomavirus vaccine for males: a review of the literature. *Journal of Adolescent Health, 46*(2), 113-123. doi:10.1016/j.jadohealth.2009.11.199

Lindley, M. C., Jeyarajah, J., Yankey, D., Curtis, C. R., Markowitz, L. E., & Stokley, S. (2016). Comparing human papillomavirus vaccine knowledge and intentions among parents of boys and girls. *Human Vaccines & Immunotherapeutics, 12*(6), 1519-1527. doi:10.1080/21645515.2016.1157673

Macartney, K. K., Chiu, C., Georgousakis, M., & Brotherton, J. M. L. (2013). Safety of human papillomavirus vaccines: a review. *Drug Safety, 36*(6), 393-412.

MacDonald, N. E. (2015). Vaccine hesitancy: Definition, scope and determinants. *Vaccine, 33*(34), 4161-4164.

MacDonald, N. E. (2016). The long and winding road to improving immunization rates: Sharing best practices in Canada. *Canadian Communicable Disease Report, 42*(12), 243-245.

Machalek, D. A., Poynten, M., Jin, F., Fairley, C. K., Farnsworth, A., Garland, S. M., . . . Tabrizi, S. N. (2012). Anal human papillomavirus infection and associated neoplastic lesions in men who have sex with men: a systematic review and meta-analysis. *The Lancet Oncology, 13*(5), 487-500.

Madhivanan, P., Pierre-Victor, D., Mukherjee, S., Bhoite, P., Powell, B., Jean-Baptiste, N., . . . Krupp, K. (2016). Human Papillomavirus Vaccination and Sexual Disinhibition in Females: A Systematic Review. *American Journal of Preventive Medicine, 51*(3), 373-383. doi:10.1016/j.amepre.2016.03.015

Malagón, T., Drolet, M., Boily, M. C., Franco, E. L., Jit, M., Brisson, J., & Brisson, M. (2012). Cross-protective efficacy of two human papillomavirus vaccines: a systematic review and meta-analysis. *The Lancet Infectious Diseases, 12*(10), 781-789.

Manitoba Government. (2016, August). Manitoba's HPV Immunization Program. Retrieved from http://www.gov.mb.ca/health/publichealth/cdc/docs/hpv_phn_qa.pdf

Mariani, L., Vici, P., Suligoi, B., Checcucci-Lisi, G., & Drury, R. (2015). Early Direct and Indirect Impact of Quadrivalent HPV (4HPV) Vaccine on Genital Warts: a Systematic Review. *Advances in Therapy, 32*(1), 10-30. doi:10.1007/s12325-015-0178-4

Markowitz, L. E., Hariri, S., Lin, C., Dunne, E. F., Steinau, M., McQuillan, G., & Unger, E. R. (2013). Reduction in human papillomavirus (HPV) prevalence among young women following HPV vaccine introduction in the United States, National Health and Nutrition Examination Surveys, 2003-2010. *Journal of Infectious Diseases, 208*(3), 385-393. doi:10.1093/infdis/jit192

Markowitz, L. E., Meites, E., & Unger, E. R. (2016). Two vs three doses of human papillomavirus vaccine: New policy for the second decade of the vaccination program *Journal of the Aerican Medical Association* (pp. E1-E3).

Marlow, L. A., Zimet, G. D., McCaffery, K. J., Ostini, R., & Waller, J. (2013). Knowledge of human papillomavirus (HPV) and HPV vaccination: an international comparison. *Vaccine, 31*(5), 763-769. doi:10.1016/j.vaccine.2012.11.083

Mathers, C., Boerma, T., & Fat, D. M. (2008). *The global burden of disease: 2004 update* (ISBN: 978 924 1563710). Retrieved from World Health Organization, Geneva, Switzerland:

http://www.who.int/healthinfo/global_burden_disease/GBD_report_2004update_full.pdf?ua=1

Mays, R. M., & Zimet, G. D. (2004). Recommending STI vaccination to parents of adolescents: the attitudes of nurse practitioners. *Sexually Transmitted Diseases, 31*(7), 428-432.

McClure, C. A., MacSwain, M. A., Morrison, H., & Sanford, C. J. (2015). Human papillomavirus vaccine uptake in boys and girls in a school-based vaccine delivery program in Prince Edward Island, Canada. *Vaccine, 33*(15), 1786-1790. doi:10.1016/j.vaccine.2015.02.047

McRee, A. L., Brewer, N. T., Reiter, P. L., Gottlieb, S. L., & Smith, J. S. (2010). The Carolina HPV immunization attitudes and beliefs scale (CHIAS): scale development and associations with intentions to vaccinate. *Sexually Transmitted Diseases, 37*(4), 234-239. doi:10.1097/OLQ.0b013e3181c37e15

McRee, A. L., Gilkey, M. B., & Dempsey, A. F. (2014). HPV vaccine hesitancy: findings from a statewide survey of health care providers. *Journal of Pediatric Health Care, 28*(6), 541-549.

Meade, A. W., & Craig, S. B. (2012). Identifying careless responses in survey data. *Psychological Methods, 17*(3), 437-455. doi:10.1037/a0028085

Merck. (2015). Gardasil (HPV Recombinant, Quadrivalent) Total Number of Countries Approved: 129 Registrations. Kenilworth, NJ, USA.

Merten, S., A., M. H., Biaggi, C., Secula, F., Bosch-Capblanch, X., Namgyal, P., & Hombach, J. (2015). Gender Determinants of Vaccination Status in Children: Evidence from a Meta-Ethnographic Systematic Review. *PLoS One, 10*(8), e0135222. doi:10.1371/journal.pone.0135222

Michels, K. B., & zur Hausen, H. (2009). HPV vaccine for all. *The Lancet, 374*(9686), 268-270.

Miles, M., Ryman, T. K., Dietz, V., Zell, E., & Luman, E. T. (2013). Validity of vaccination cards and parental recall to estimate vaccination coverage: a systematic review of the literature. *Vaccine, 31*(12), 1560-1568. doi:10.1016/j.vaccine.2012.10.089

Ministry of Health and Long-Term Care Ontario. (2016, April 21, 2016). Expanding Ontario's Immunization Program to Help Protect Against Cancer. Retrieved from https://news.ontario.ca/mohltc/en/2016/04/ontario-expanding-hpv-vaccine-program-to-include-boys.html

Mishra, G. A., Pimple, S. A., & Shastri, S. S. (2015). HPV vaccine: One, two, or three doses for cervical cancer prevention? *Indian Journal of Medical and Paediatric Oncology : Official Journal of Indian Society of Medical & Paediatric Oncology, 36*(4), 201-206. doi:10.4103/0971-5851.171534

Molano, M., van den Brule, A., Plummer, M., Weiderpass, E., Posso, H., Arslan, A., . . . Group, H. S. (2003). Determinants of clearance of human papillomavirus infections in Colombian women with normal cytology: a population-based, 5-year follow-up study. *American Journal of Epidemiology, 158*(5), 486-494.

Mollers, M., Lubbers, K., Spoelstra, S. K., Weijmar-Schultz, W. C., Daemen, T., Westra, T. A., . . . Tami, A. (2014). Equity in human papilloma virus vaccination uptake?: sexual behaviour, knowledge and demographics in a cross-sectional study in (un)vaccinated girls in the Netherlands. *BMC Public Health, 14*(1), 288. doi:10.1186/1471-2458-14-288

Montano, D. E., & Kasprzyk, D. (2015). Theory of reasoned action, theory of planned behavior, and the integrated behavioral model. In K. Glanz, B. K. Rimer, & K. E. Viswanath

(Eds.), *Health behavior: Theory, research, and practice* (5 ed., pp. 67-92). San Francisco, CA: John Wiley & Sons, Incorporated.

Mortensen, G. L. (2010). Parental attitudes towards vaccinating sons with human papillomavirus vaccine. *Danish Medical Bulletin, 57*(12), 1-6.

Mortensen, G. L., Adam, M., & Idtaleb, L. (2015). Parental attitudes towards male human papillomavirus vaccination: a pan-European cross-sectional survey. *BMC Public Health, 15*, 624. doi:10.1186/s12889-015-1863-6

Nadarzynski, T., Smith, H., Richardson, D., Jones, C. J., & Llewellyn, C. D. (2014). Human papillomavirus and vaccine-related perceptions among men who have sex with men: a systematic review. *Sexually Transmitted Infections, 90*(7), 515-523.

Newman, P. A., Logie, C. H., Doukas, N., & Asakura, K. (2013). HPV vaccine acceptability among men: a systematic review and meta-analysis. *Sexually Transmitted Infections, 89*(7), 568-574.

Niccolai, L. M., & Hansen, C. E. (2015). Practice- and Community-Based Interventions to Increase Human Papillomavirus Vaccine Coverage: A Systematic Review. *JAMA Pediatr, 169*(7), 686-692. doi:10.1001/jamapediatrics.2015.0310

Nyhan, B., Reifler, J., Richey, S., & Freed, G. L. (2014). Effective messages in vaccine promotion: a randomized trial. *Pediatrics, 133*(4), e835-842. doi:10.1542/peds.2013-2365

Nyitray, A. G., da Silva, R. J. C., Baggio, M. L., Lu, B., Smith, D., Abrahamsen, M., . . . Giuliano, A. R. (2011). Age-specific prevalence of and risk factors for anal human papillomavirus (HPV) among men who have sex with women and men who have sex with men: the HPV in men (HIM) study. *Journal of Infectious Diseases, 203*(1), 49-57.

O'Connor, B. P. (2000). SPSS and SAS programs for determining the number of components using parallel analysis and Velicer's MAP test. *Behavior Research Methods, Instruments, & Computers, 32*(3), 396-402. doi:10.3758/bf03200807

Obidiya, O., Bird, Y., Mahmood, R., Nwankwo, C., & Moraros, J. (2016). *HPV vaccination uptake in Canada: A systematic review and meta-analysis*. Paper presented at the Canadian Immunization Conference, Ottawa, Canada.

Ogilvie, G. S., Anderson, M., Marra, F., McNeil, S., Pielak, K., Dawar, M., . . . Naus, M. (2010). A population-based evaluation of a publicly funded, school-based HPV vaccine program in British Columbia, Canada: parental factors associated with HPV vaccine receipt. *PLoS Medicine, 7*(5), e1000270. doi:10.1371/journal.pmed.1000270

Ogilvie, G. S., Naus, M., Money, D. M., Dobson, S. R., Miller, D., Krajden, M., . . . Coldman, A. J. (2015). Reduction in cervical intraepithelial neoplasia in young women in British Columbia after introduction of the HPV vaccine: An ecological analysis. *International Journal of Cancer, 137*(8), 1931-1937. doi:10.1002/ijc.29508

Ogilvie, G. S., Remple, V. P., Marra, F., McNeil, S. A., Naus, M., Pielak, K., . . . Money, D. M. (2008). Intention of parents to have male children vaccinated with the human papillomavirus vaccine. *Sexually Transmitted Infections, 84*(4), 318-323. doi:10.1136/sti.2007.029389

Olsen, J., & Jorgensen, T. R. (2015). Revisiting the cost-effectiveness of universal HPV-vaccination in Denmark accounting for all potentially vaccine preventable HPV-related diseases in males and females. *Cost Effectiveness and Resource Allocation, 13*(1), 1-10. doi:10.1186/s12962-015-0029-9

Olshen, E., Woods, E. R., Austin, S. B., Luskin, M., & Bauchner, H. (2005). Parental acceptance of the human papillomavirus vaccine. *Journal of Adolescent Health, 37*(3), 248-251.

Opel, D. J., Mangione-Smith, R., Robinson, J. D., Heritage, J., DeVere, V., Salas, H. S., . . . Taylor, J. A. (2015). The influence of provider communication behaviors on parental vaccine acceptance and visit experience. *American Journal of Public Health, 105*(10), 1998-2004.

Opel, D. J., Taylor, J. A., Mangione-Smith, R., Solomon, C., Zhao, C., Catz, S., & Martin, D. (2011). Validity and reliability of a survey to identify vaccine-hesitant parents. *Vaccine, 29*(38), 6598-6605. doi:10.1016/j.vaccine.2011.06.115

Osborne, J. W. (2008). *Best practices in quantitative methods*. Thousand Oaks, Calif.: Sage Publications.

Osborne, J. W. (2010). Data cleaning basics: best practices in dealing with extreme scores. *Newborn and Infant Nursing Reviews, 10*(1), 37-43.

Paavonen, J., Jenkins, D., Bosch, F. X., Naud, P., Salmerón, J., Wheeler, C. M., . . . Castellsague, X. (2007). Efficacy of a prophylactic adjuvanted bivalent L1 virus-like-particle vaccine against infection with human papillomavirus types 16 and 18 in young women: an interim analysis of a phase III double-blind, randomised controlled trial. *The Lancet, 369*(9580), 2161-2170.

Palefsky, J. (2009). Human papillomavirus-related disease in people with HIV. *Current Opinion in HIV and AIDS, 4*(1), 52-56. doi:10.1097/COH.0b013e32831a7246

Palefsky, J. M. (2010). Human papillomavirus-related disease in men: not just a women's issue. *Journal of Adolescent Health, 46*(4), S12-S19.

Parkin, D. M. (2001). Global cancer statistics in the year 2000. *The lancet oncology*, *2*(9), 533-543.

Parkin, D. M., & Bray, F. (2006). The burden of HPV-related cancers. *Vaccine*, *24*, S11-S25.

Patel, H., Jeve, Y. B., Sherman, S. M., & Moss, E. L. (2016). Knowledge of human papillomavirus and the human papillomavirus vaccine in European adolescents: a systematic review. *Sexually Transmitted Infections*, *92*(6), 474-479. doi:10.1136/sextrans-2015-052341

Pearson, A. L., Kvizhinadze, G., Wilson, N., Smith, M., Canfell, K., & Blakely, T. (2014). Is expanding HPV vaccination programs to include school-aged boys likely to be value-for-money: a cost-utility analysis in a country with an existing school-girl program. *BMC Infectious Diseases*, *14*, 351. doi:10.1186/1471-2334-14-351

Peate, I. (2014). The need for a gender-neutral approach to HPV immunisation. *British Journal of School Nursing*, *9*(1), 15-16.

Pelucchi, C., Esposito, S., Galeone, C., Semino, M., Sabatini, C., Picciolli, I., . . . Principi, N. (2010). Knowledge of human papillomavirus infection and its prevention among adolescents and parents in the greater Milan area, Northern Italy. *BMC Public Health*, *10*(1), 378. doi:10.1186/1471-2458-10-378

Perez, S. (2013, April 25, 2013). Don't be myth-informed about vaccines. *Montreal Gazette*. Retrieved from http://www.montrealgazette.com/opinion/editorials/Opinion+myth+informed+about+vaccines/8294722/story.html

Perez, S. (2014). The Rabbis, the clergy and HPV. Retrieved from http://www.abitoffthetop.com/blog-articles/hpv-vaccine-religious-dilemma/

Perez, S., Shapiro, G. K., Brown, C. A., Dubé, E., Ogilvie, G., & Rosberger, Z. (2015). 'I didn't even know boys could get the vaccine': Parents' reasons for human papillomavirus (HPV) vaccination decision making for their sons. *Psycho-Oncology, 24*(10), 1316-1323. doi:10.1002/pon.3894

Perez, S., Shapiro, G. K., Tatar, O., Joyal-Desmarais, K., & Rosberger, Z. (2016a). Development and Validation of the Human Papillomavirus Attitudes and Beliefs Scale in a National Canadian Sample. *Sexually Transmitted Diseases, 43*(10), 626-632. doi:10.1097/olq.0000000000000506

Perez, S., Tatar, O., Ostini, R., Shapiro, G. K., Waller, J., Zimet, G., & Rosberger, Z. (2016b). Extending and validating a human papillomavirus (HPV) knowledge measure in a national sample of Canadian parents of boys. *Preventive Medicine, 91*, 43-49. doi:10.1016/j.ypmed.2016.07.017

Perez, S., Tatar, O., Shapiro, G. K., Dubé, E., Ogilvie, G., Guichon, J., . . . Rosberger, Z. (2016c). Psychosocial determinants of parental human papillomavirus (HPV) vaccine decision-making for sons: Methodological challenges and initial results of a pan-Canadian longitudinal study. *BMC Public Health, 16*(1), 1223. doi:10.1186/s12889-016-3828-9

Perkins, R. B., Apte, G., Marquez, C., Porter, C., Belizaire, M., Clark, J. A., & Pierre-Joseph, N. (2013). Factors affecting human papillomavirus vaccine use among White, Black and Latino parents of sons. *The Pediatric Infectious Disease Journal, 32*(1), e38-e44. doi:10.1097/INF.0b013e31826f53e3

Perkins, R. B., Clark, J. A., Apte, G., Vercruysse, J. L., Sumner, J. J., Wall-Haas, C. L., . . . Pierre-Joseph, N. (2014). Missed opportunities for HPV vaccination in adolescent girls: a qualitative study. *Pediatrics*, peds. 2014-0442.

Perkins, R. B., Zisblatt, L., Legler, A., Trucks, E., Hanchate, A., & Gorin, S. S. (2015). Effectiveness of a provider-focused intervention to improve HPV vaccination rates in boys and girls. *Vaccine*, *33*(9), 1223-1229.

Peter, C., & Koch, T. (2016). When Debunking Scientific Myths Fails (and When It Does Not) The Backfire Effect in the Context of Journalistic Coverage and Immediate Judgments as Prevention Strategy. *Science Communication*, *38*(1), 3-25.

Petrovic, K., Burney, S., & Fletcher, J. (2011). The relationship of knowledge, health value and health self-efficacy with men's intentions to receive the human papillomavirus (HPV) vaccine. *Journal of Health Psychology, 16*(8), 1198-1207.

Prochaska, J. O., Redding, C. A., & Evers, K. E. (2008). The transtheoretical model and stages of change. In K. Glanz, B. K. Rimer, & K. E. Viswanath (Eds.), *Health behavior and health education. Theory, research and practice* (4 ed., pp. 97-122). San Francisco, CA.

Prue, G. (2016). Human papillomavirus: a strong case for vaccinating boys. *Trends in Urology & Men's Health 7*(1), 7-11. doi:onlinelibrary.wiley.com/doi/10.1002/tre.499/pdf

Prue, G., Lawler, M., Baker, P., & Warnakulasuriya, S. (2016a). Human papillomavirus (HPV): making the case for Immunisation for All. *Oral Diseases*. doi:10.1111/odi.12562

Prue, G., Shapiro, G., Maybin, R., Santin, O., & Lawler, M. (2016b). Knowledge and acceptance of human papillomavirus (HPV) and HPV vaccination in adolescent boys worldwide: A systematic review. *Journal of Cancer Policy, 10*, 1-15. doi:10.1016/j.jcpo.2016.09.009

Public Health Agency of Canada. (2007). *An Advisory Committe Statement (ACS). National Advisory Committee on Immunization. Statement on human papillomavirus vaccine* (ACS-2, ISSN 1481-8531). Retrieved from http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/07vol33/acs-02/index-eng.php

Public Health Agency of Canada. (2012). *An Advisory Committee Statement (ACS). National Advisory Committee on Immunization (NACI): Update On Human Papillomavirus (HPV) Vaccines* (ASC-1, ISSN 1481-8531). Retrieved from http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/12vol38/acs-dcc-1/index-eng.php

Public Health Agency of Canada. (2014). *Recommendations for Human Papillomavirus Immunization Programs: Canadian Immunization Committee* (ISBN 978-1-100-23534-9). Retrieved from http://publications.gc.ca/collections/collection_2014/aspc-phac/HP40-107-2014-eng.pdf

Public Health Agency of Canada. (2015a). *An Advisory Committee Statement (ACS) National Advisory Committee on Immunization (NACI). Update on the recommended Human Papillomavirus vaccine immunization schedule* (ISBN: 978-1-100-25456-2). Retrieved from http://publications.gc.ca/collections/collection_2015/aspc-phac/HP40-128-2014-eng.pdf

Public Health Agency of Canada. (2015b). Canadian Adverse Events Following Immunization Surveillance System (CAEFISS). *Immunization & Vaccines.* Retrieved from http://www.phac-aspc.gc.ca/im/vs-sv/index-eng.php

Public Health Agency of Canada. (2016a). *An Advisory Committee Statement (ACS), National Advisory Committee on Immunization (NACI). Updated recommendations on Human Papillomavirus vaccines: 9-valent HPV vaccine and clarification of minimum intervals*

between doses in the HPV immunization schedule (ISBN: 978-0-660-05478-0). Retrieved from Public Health Agency of Canada, Ontario, Canada:

Public Health Agency of Canada. (2016b). Canada's Provincial and Territorial Routine (and Catch-up) Vaccination Programs for Infants and Children. Retrieved from http://healthycanadians.gc.ca/healthy-living-vie-saine/immunization-immunisation/schedule-calendrier/alt/infants-children-vaccination-enfants-nourrissons-eng.pdf

Public Health Agency of Canada. (2016c). *Vaccine coverage in Canadian children: Results from the 2013 Childhood National Immunization coverage survey (CNICS)*. Retrieved from Ottawa, Ontario: http://publications.gc.ca/collections/collection_2016/aspc-phac/HP40-156-2016-eng.pdf

Reiter, P. L., Brewer, N. T., Gottlieb, S. L., McRee, A. L., & Smith, J. S. (2009). Parents' health beliefs and HPV vaccination of their adolescent daughters. *Social Science & Medicine, 69*(3), 475-480.

Reiter, P. L., McRee, A. L., Gottlieb, S. L., & Brewer, N. T. (2010). HPV vaccine for adolescent males: acceptability to parents post-vaccine licensure *Vaccine, 28*(38), 6292-6297.

Reiter, P. L., McRee, A. L., Kadis, J. A., & Brewer, N. T. (2011). HPV vaccine and adolescent males. *Vaccine, 29*(34), 5595-5602. doi:10.1016/j.vaccine.2011.06.020

Reiter, P. L., McRee, A. L., Pepper, J. K., Gilkey, M. B., Galbraith, K. V., & Brewer, N. T. (2013). Longitudinal predictors of human papillomavirus vaccination among a national sample of adolescent males. *American Journal of Public Health, 103*(8), 1419-1427. doi:10.2105/ajph.2012.301189

Rennert, G. (2007). Cancer prevention: from public health interventions to individual tailoring. *European Journal of Cancer Prevention, 16*(3), 165-166.

Richman, A. R., Coronado, G. D., Arnold, L. D., Fernandez, M. E., Glenn, B. A., Allen, J. D., . . . Brewer, N. T. (2012). Cognitive testing of human papillomavirus vaccine survey items for parents of adolescent girls. *Journal of Lower Genital Tract Disease, 16*(1), 16-23. doi:10.1097/LGT.0b013e3182293a49

Rickert, V. I., Rehm, S. J., Aalsma, M. C., & Zimet, G. D. (2015). The role of parental attitudes and provider discussions in uptake of adolescent vaccines. *Vaccine, 33*(5), 642-647. doi:10.1016/j.vaccine.2014.12.016

Riedesel, J. M., Rosenthal, S. L., Zimet, G. D., Bernstein, D. I., Huang, B., Lan, D., & Kahn, J. A. (2005). Attitudes about Human Papillomavirus Vaccine among Family Physicians. *Journal of Pediatric and Adolescent Gynecology, 18*(6), 391-398. doi:10.1016/j.jpag.2005.09.004

Robbins, S. C., Bernard, D., McCaffery, K., Brotherton, J. M., & Skinner, S. R. (2010). "I just signed": Factors influencing decision-making for school-based HPV vaccination of adolescent girls. *Health Psychology, 29*(6), 618-625. doi:10.1037/a0021449

Roberts, J. R., Thompson, D., Rogacki, B., Hale, J. J., Jacobson, R. M., Opel, D. J., & Darden, P. M. (2015). Vaccine hesitancy among parents of adolescents and its association with vaccine uptake. *Vaccine, 33*(14), 1748-1755. doi:10.1016/j.vaccine.2015.01.068

Rosberger, Z., Perez, S., Bloom, J., Shapiro, G. K., & Fielding, R. (2015). The missing piece: cancer prevention within psycho-oncology - a commentary. *Psycho-Oncology, 24*(10), 1330-1337. doi:10.1002/pon.3916

Rosberger, Z., Perez, S., King, L., & Franco, E. L. (2013). Public perception: A significant challenge in the battle against HPV. *Oncology Exchange, 12*(2), 16-20.

Rosenthal, S., Weiss, T. W., Zimet, G. D., Ma, L., Good, M., & Vichnin, M. (2011). Predictors of HPV vaccine uptake among women aged 19–26: importance of a physician's recommendation. *Vaccine, 29*(5), 890-895.

Rutten, L. J., St Sauver, J. L., Beebe, T. J., Wilson, P. M., Jacobson, D. J., Fan, C., . . . Jacobson, R. M. (2017). Clinician knowledge, clinician barriers, and perceived parental barriers regarding human papillomavirus vaccination: Association with initiation and completion rates. *Vaccine, 35*(1), 164-169. doi:10.1016/j.vaccine.2016.11.012

Saslow, D., Castle, P. E., Cox, J. T., Davey, D. D., Einstein, M. H., Ferris, D. G., . . . Moscicki, A. B. (2007). American Cancer Society Guideline for human papillomavirus (HPV) vaccine use to prevent cervical cancer and its precursors. *CA: A Cancer Journal for Clinicians, 57*(1), 7-28.

Schiffman, M., Castle, P. E., Jeronimo, J., Rodriguez, A. C., & Wacholder, S. (2007). Human papillomavirus and cervical cancer. *The Lancet, 370*(9590), 890-907. doi:10.1016/s0140-6736(07)61416-0

Schiller, J. T., Castellsagué, X., & Garland, S. M. (2012). A review of clinical trials of human papillomavirus prophylactic vaccines. *Vaccine, 30*, F123-F138.

Schuler, C. L., & Coyne-Beasley, T. (2015). Has their son been vaccinated? Beliefs about other parents matter for human papillomavirus vaccine. *American journal of men's health*, 1557988314567324.

Seethaler, S. L. (2016). Shades of Grey in Vaccination Decision Making: Tradeoffs, Heuristics, and Implications. *Science Communication, 38*(2), 261-271. doi:10.1177/1075547016637083

Seto, K., Marra, F., Raymakers, A., & Marra, C. A. (2012). The cost effectiveness of human papillomavirus vaccines. *Drugs, 72*(5), 715-743.

Shapiro, G. K., Guichon, J., Perez, S., & Rosberger, Z. (2015, September 25, 2015). British Columbia's flawed HPV vaccination policy. Retrieved from http://policyoptions.irpp.org/issues/september-2015/british-columbias-flawed-hpv-vaccination-policy/

Shapiro, G. K., Holding, A., Perez, S., Amsel, R., & Rosberger, Z. (2016a). Validation of the Conspiracy Beliefs Scale. *Papillomavirus Research, 2*, 167-172. doi:In press

Shapiro, G. K., Perez, S., & Rosberger, Z. (2016b). Including males in Canadian human papillomavirus vaccination programs: a policy analysis. *Canadian Medical Association Journal, 188*(12), 881-886. doi:10.1503/cmaj.150451

Sharp, K., & Thombs, D. L. (2003). A cluster analytic study of osteoprotective behavior in undergraduates. *American Journal of Health Behavior, 27*(4), 364-372.

Shay, L. A., Street, R. L., Baldwin, A. S., Marks, E. G., Lee, S. C., Higashi, R. T., . . . Tiro, J. A. (2016). Characterizing safety-net providers' HPV vaccine recommendations to undecided parents: A pilot study. *Patient Education and Counseling, 99*(9), 1452-1460. doi:10.1016/j.pec.2016.06.027

Shields, P. G. (2005). *Cancer risk assessment*. Boca Raton: Taylor & Francis.

Skinner, C. S., Tiro, J., & Champion, V. L. (2015). The health belief model. In K. Glanz, B. K. Rimer, & K. E. Viswanath (Eds.), *Health behavior: Theory, Research, and Practice* (5 ed., pp. 75-94). San Francisco, CA: John Wiley & Sons, Incorporated.

Slocum-Gori, S. L., & Zumbo, B. D. (2010). Assessing the Unidimensionality of Psychological Scales: Using Multiple Criteria from Factor Analysis. *Social Indicators Research, 102*(3), 443-461. doi:10.1007/s11205-010-9682-8

Smulian, E. A., Mitchell, K. R., & Stokley, S. (2016). Interventions to increase HPV vaccination coverage: A systematic review. *Human Vaccines & Immunotherapeutics, 12*(6), 1566-1588. doi:10.1080/21645515.2015.1125055

Stanley, M. (2012). Perspective: Vaccinate boys too. *Nature, 488*(7413), S10-S10.

Stanley, M. (2014). HPV vaccination in boys and men. *Human Vaccines & Immunotherapeutics, 10*(7), 2109-2111. doi:10.4161/hv.29137

Steben, M. (2008). Do you approve of spending $300 million on HPV vaccination? YES. *Canadian Family Physician, 54*(2), 174-176.

Stevens, J. (2002). Applied multivariate statistics for the social sciences. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=63477

Stillo, M., Carrillo, S. P., & Lopalco, P. L. (2015). Safety of human papillomavirus vaccines: a review. *Expert Opinion on Drug Safety, 14*(5), 697-712. doi:10.1517/14740338.2015.1013532

Stupiansky, N. W., Alexander, A. B., & Zimet, G. D. (2012a). Human papillomavirus vaccine and men: what are the obstacles and challenges? *Current Opinion in Infectious Diseases, 25*(1), 86-91.

Stupiansky, N. W., Zimet, G. D., Cummings, T., Fortenberry, J. D., & Shew, M. (2012b). Accuracy of self-reported human papillomavirus vaccine receipt among adolescent girls and their mothers. *Journal of Adolescent Health, 50*(1), 103-105. doi:10.1016/j.jadohealth.2011.04.010

Sturm, L. A., Mays, R. M., & Zimet, G. D. (2005). Parental beliefs and decision making about child and adolescent immunization: from polio to sexually transmitted infections. *Journal of Developmental & Behavioral Pediatrics, 26*(6), 441-452.

Szarewski, A. (2008). HPV vaccines: peering through the fog. *Journal of Family Planning and Reproductive Health Care, 34*(4), 207-209.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics*. Boston: Pearson Education.

Taylor, J. L., Zimet, G. D., Donahue, K. L., Alexander, A. B., Shew, M. L., & Stupiansky, N. W. (2014). Vaccinating sons against HPV: results from a U.S. national survey of parents. *PLoS One, 9*(12), e115154.

Thomas, T. L., Strickland, O. L., DiClemente, R., Higgins, M., Williams, B., & Hickey, K. (2013). Parental Human Papillomavirus Vaccine Survey (PHPVS): Nurse-Led Instrument Development and Psychometric Testing for Use in Research and Primary Care Screening. *Journal of Nursing Measurement, 21*(1), 96-109. doi:10.1891/1061-3749.21.1.96

Tiro, J. A., Lee, S. C., Marks, E. G., Persaud, D., Skinner, C. S., Street, R. L., . . . Baldwin, A. S. (2016). Developing a Tablet-Based Self-Persuasion Intervention Promoting Adolescent HPV Vaccination: Protocol for a Three-Stage Mixed-Methods Study. *JMIR Research Protocols, 5*(1), e19. doi:10.2196/resprot.5092

Tiro, J. A., Pruitt, S. L., Bruce, C. M., Persaud, D., Lau, M., Vernon, S. W., . . . Skinner, C. S. (2012a). Multilevel correlates for human papillomavirus vaccination of adolescent girls attending safety net clinics. *Vaccine, 30*(13), 2368-2375. doi:10.1016/j.vaccine.2011.11.031

Tiro, J. A., Tsui, J., Bauer, H. M., Yamada, E., Kobrin, S., & Breen, N. (2012b). Human papillomavirus vaccine use among adolescent girls and young adult women: an analysis of the 2007 California Health Interview Survey. *Journal of Women's Health, 21*(6), 656-665. doi:10.1089/jwh.2011.3284.

Tisi, G., Salinaro, F., Apostoli, P., Bassani, R., Bellicini, A., Groppi, L., . . . Pecorelli, S. (2013). HPV vaccination acceptability in young boys. *Annali dell'Istituto Superiore di Sanità, 49*(3), 286-291.

Tookey, P. A., & Peckham, C. S. (1999). Surveillance of congenital rubella in Great Britain, 1971-96. *British Medical Journal, 318*(7186), 769-770.

Tota, J. E., Bentley, J., Blake, J., Coutlée, F., Duggan, M. A., Ferenczy, A., . . . Ratnam, S. (2015). *Introduction of molecular HPV testing as the primary technology in cervical cancer screening: Acting on evidence to change the current paradigm*. Retrieved from

Trim, K., Nagji, N., Elit, L., & Roy, K. (2012). Parental Knowledge, Attitudes, and Behaviours towards Human Papillomavirus Vaccination for Their Children: A Systematic Review from 2001 to 2011. *Obstetrics and Gynecology International, 2012*, 1-12. doi:10.1155/2012/921236

Trottier, H., & Franco, E. L. (2006). The epidemiology of genital human papillomavirus infection. *Vaccine, 24*, S4-S15.

Tunic, M. C., Deeks, S. L., & on behalf of the National Advisory Committee on Immunization (NACI). (2016). Summary of the National Advisory Committee on Immunization's Updated Recommendations on Human Papillomavirus (HPV) vaccines: Nine- valent HPV vaccine and clarification of minimum intervals between doses in the HPV immunization schedule. *Canada Communicable Disease Report 42*(7), 146-148.

US Preventive Services Task Force. (2012). *Final Recommendation Statement: Cervical Cancer: Screening*. Retrieved from https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/cervical-cancer-screening

Vardas, E., Giuliano, A. R., Goldstone, S., Palefsky, J. M., Moreira, E. D., Jr., Penny, M. E., . . . Guris, D. (2011). External genital human papillomavirus prevalence and associated factors among heterosexual men on 5 continents. *Journal of Infectious Diseases, 203*(1), 58-65. doi:10.1093/infdis/jiq015

Vichnin, M., Bonanni, P., Klein, N. P., Garland, S. M., Block, S. L., Kjaer, S. K., . . . Kuter, B. J. (2015). An overview of quadrivalent human papillomavirus vaccine safety: 2006 to 2015. *The Pediatric Infectious Disease Journal, 34*(9), 983-991.

Villa, L. L., Costa, R. L., Petta, C. A., Andrade, R. P., Ault, K. A., Giuliano, A. R., . . . Lehtinen, M. (2005). Prophylactic quadrivalent human papillomavirus (types 6, 11, 16, and 18) L1 virus-like particle vaccine in young women: a randomised double-blind placebo-controlled multicentre phase II efficacy trial. *The Lancet Oncology, 6*(5), 271-278.

Viswanath, K., Finnegan, J. R., & Gollust, S. (2015). Communication and health behaviour in a changing media environment. In K. Glanz, B. K. Rimer, & K. E. Viswanath (Eds.),

Health behavior: Theory, Research, and Practice (5 ed., pp. 327-348). San Francisco, CA: John Wiley & Sons, Incorporated.

Waller, J., McCaffery, K. J., Forrest, S., & Wardle, J. (2004). Human papillomavirus and cervical cancer: Issues for biobehavioral and psychosocial research. *Annals of Behavioral Medicine, 27*(1), 68-79. doi:10.1207/s15324796abm2701_9

Waller, J., Ostini, R., Marlow, L. A., McCaffery, K., & Zimet, G. (2013). Validation of a measure of knowledge about human papillomavirus (HPV) using item response theory and classical test theory. *Preventive Medicine, 56*(1), 35-40. doi:10.1016/j.ypmed.2012.10.028

Walling, E. B., Benzoni, N., Dornfeld, J., Bhandari, R., Sisk, B. A., Garbutt, J., & Colditz, G. (2016). Interventions to improve HPV vaccine uptake: a systematic review. *Pediatrics, 138*(1), e20153863.

Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological Bulletin, 132*(2), 249-268.

Weinberger, D. A. (1987). *Construct validation of the weinberger adjustment inventory*. Unpublished work. Stanford University.

Weinstein, N. D. (1988). The precaution adoption process. *Health Psychology, 7*(4), 355-386.

Weinstein, N. D., Lyon, J. E., Sandman, P. M., & Cuite, C. L. (1998). Experimental evidence for stages of health behavior change: the precaution adoption process model applied to home radon testing *Health Psychology, 17*(5), 445-453.

Weinstein, N. D., & Sandman, P. M. (1992). A model of the precaution adoption process: Evidence from home radon testing *Health Psychology, 11*(3), 170-180.

Weinstein, N. D., Sandman, P. M., & Blalock, S. J. (2008). The precaution adoption process model. In K. Glanz, B. K. Rimer, & K. E. Viswanath (Eds.), *Health behavior and health education. Theory, research and practice* (4 ed., pp. 123-148). San Francisco, CA: Jossey-Bass.

Weinstein, N. D., Sandman, P. M., & Roberts, N. E. (1991). Perceived susceptibility and self-protective behavior: a field experiment to encourage home radon testing *Health Psychology, 10*(1), 25-33.

Wigle, J., Fontenot, H. B., & Zimet, G. D. (2016). Global delivery of human papillomavirus vaccines. *Pediatric Clinics of North America, 63*(1), 81-95.

Windschitl, P. D., Martin, R., & Flugstad, A. R. (2002). Context and the interpretation of likelihood information: the role of intergroup comparisons on perceived vulnerability. *Journal of Personality and Social Psychology, 82*(5), 742.

Wong, C. A., Berkowitz, Z., Dorell, C. G., Anhang Price, R., Lee, J., & Saraiya, M. (2011). Human papillomavirus vaccine uptake among 9- to 17-year-old girls: National Health Interview Survey, 2008. *Cancer, 117*(24), 5612-5620. doi:10.1002/cncr.26246

Wood, N. (2003). Immunisation adverse events clinics. *New South Wales public health bulletin, 14*(2), 25-27.

World Health Organization. (2007). *Cancer control: knowledge into action: WHO guide for effective programmes* (Vol. 2): World Health Organization.

World Health Organization. (2014). *Evidence based recommendations on Human Papilloma Virus (HPV) Vaccines Schedules. Background paper for SAGE discussions*. Retrieved from

http://www.who.int/immunization/sage/meetings/2014/april/1_HPV_Evidence_based_recommendationsWHO_with_Appendices2_3.pdf

World Health Organization Report. (2015). Human papillomavirus vaccines: WHO position paper, October 2014-Recommendations. *Vaccine, 33*(36), 4383-4384. doi:10.1016/j.vaccine.2014.12.002

Yach, D., Hawkes, C., Gould, C. L., & Hofman, K. J. (2004). The global burden of chronic diseases: overcoming impediments to prevention and control. *The Journal of the American Medical Association 291*(21), 2616-2622.

Yacobi, E., Tennant, C., Ferrante, J., Pal, N., & Roetzheim, R. (1999). University students' knowledge and awareness of HPV. *Preventive Medicine, 28*(6), 535-541. doi:10.1006/pmed.1999.0486

Young, A. (2010). HPV vaccine acceptance among women in the Asian Pacific: a systematic review of the literature. *Asian Pacific Journal of Cancer Prevention, 11*(3), 641-649.

Zimet, G. D. (2014). Health care professionals and adolescent vaccination: A call for intervention research. *Human Vaccines & Immunotherapeutics, 10*(9), 2629-2630. doi:10.4161/hv.28525

Zimet, G. D., Liddon, N., Rosenthal, S. L., Lazcano-Ponce, E., & Allen, B. (2006). Chapter 24: Psychosocial aspects of vaccine acceptability. *Vaccine, 24* (Suppl 3), S3/201-S203/209. doi:10.1016/j.vaccine.2006.06.017

Zimet, G. D., Mays, R. M., Sturm, L. A., Ravert, A. A., Perkins, S. M., & Juliar, B. E. (2005). Parental attitudes about sexually transmitted infection vaccination for their adolescent children. *Archives of Pediatrics & Adolescent Medicine, 159*(2), 132-137.

Zimet, G. D., Mays, R. M., Winston, Y., Kee, R., Dickes, J., & Su, L. (2000). Acceptability of human papillomavirus immunization. *Journal of Women's Health & Gender-Based Medicine, 9*(1), 47-50.

Zimet, G. D., Rosberger, Z., Fisher, W. A., Perez, S., & Stupiansky, N. W. (2013). Beliefs, behaviors and HPV vaccine: correcting the myths and the misinformation. *Preventive Medicine, 57*(5), 414-418. doi:10.1016/j.ypmed.2013.05.013

Zimet, G. D., & Rosenthal, S. L. (2010). HPV vaccine and males: issues and challenges. *Gynecologic Oncology, 117*(2 Suppl), S26-31. doi:10.1016/j.ygyno.2010.01.028

Zimet, G. D., Weiss, T. W., Rosenthal, S. L., Good, M. B., & Vichnin, M. D. (2010). Reasons for non-vaccination against HPV and future vaccination intentions among 19-26 year-old women. *BMC women's health, 10*(1), 1.

Zou, H., Tabrizi, S. N., Grulich, A. E., Garland, S. M., Hocking, J. S., Bradshaw, C. S., . . . Chen, M. Y. (2014). Early acquisition of anogenital human papillomavirus among teenage men who have sex with men. *Journal of Infectious Diseases, 209*(5), 642-651.

Appendix C: Summary of questionnaire constructs, sample items and response choices

Variable Construct	# of Items	Sample Items	Response Choices
Socio-Demographics (e.g., Province, Sex, Parent's Age, Language, Education, Marital Status, Employment Status, Urbanity, Canadian born, Years in Canada, Ethnicity, Religion, Income, Son's age)	12	What is the language you first learned at home in your childhood and that you still understand? With which religious or spiritual belief system do you most strongly identify?	Categories derived from those commonly used by Statistics Canada. Prefer not to answer was an option for some items.
Religiosity	1	Please rate how much you agree with the following statement: My religious or spiritual belief system guides my daily decisions.	Strongly Disagree – Strongly Agree (7-point Likert scale)
HPV & HPV Vaccine Awareness	2	Have you ever heard of HPV (Human Papillomavirus)? Have you ever heard of the HPV vaccine (Human Papillomavirus vaccine)? You may also have heard of this vaccine under the names Gardasil® or Cervarix®.	Yes-No
HPV & HPV Vaccine Perceived Knowledge	2	How much would you say you know about HPV (Human Papillomavirus)? How much would you say you know about the HPV vaccine (Human Papillomavirus vaccine, also referred to as Gardasil® or Cervarix®)?	Nothing at all – A lot (4-point Likert scale)
Precaution Adoption Process Model	1	Before today, which of the following best described your thoughts about the HPV vaccine concerning *my son*[1]?	**Stage 1:** I was unaware that the HPV vaccine could be given to males **Stage 2:** I was aware that the HPV vaccine can be given to males, but I have not thought about getting the HPV vaccine for *my son* **Stage 3:** I have thought about getting the HPV vaccine for *my son*, but I am undecided about getting the HPV vaccine for him

			Stage 4: I have decided I do NOT want my son to get the HPV vaccine **Stage 5:** I have decided I DO want *my son* to get the HPV vaccine **Stage 6:** *My son* has already received the HPV vaccine
HPV Knowledge[2]	25	HPV is very rare (F) HPV can cause genital warts (T)	True; False; Don't know
HPV Vaccine Knowledge[2]	11	The HPV vaccines offer protection against all sexually transmitted infections (F) The HPV vaccines are most effective if given to people who've never had sex (T)	True; False; Don't know
Attitudes and Beliefs[3]	61	**Benefits (10):** I feel that the HPV vaccine is effective in preventing genital warts **Threat (3):** I feel that it would be serious if m*y son* contracted HPV-related cancer later in life. **Influence (8):** I feel that other parents in my community are getting their sons the HPV vaccine. **Harms (6):** I feel that the HPV vaccine may lead to long-term health problems **Risk (3):** I feel that without the HPV vaccine, *my son* would be at risk of getting HPV-related cancer later in life **Affordability (3):** I feel that the HPV vaccine is too expensive **Communication (5):** I feel that it is hard to talk to *my son* about his sexual health **Accessibility (4):** I feel that dealing with getting the HPV vaccine for *my son* would be simple **General Vaccinations Attitudes (4):** I do not like the idea of vaccines.	Strongly Disagree – Strongly Agree (7-point Likert scale)
Information Sources	6	Where have you heard about the HPV vaccine in general (other than this survey)? From which sources, would you prefer to receive information about the HPV vaccine? Which is your most preferred source?	E.g. Public health brochures, doctor, nurse, or other health care provider, school, internet, etc.

Doctor Discussion	1	Have you ever talked with a doctor/health care provider about the HPV vaccine for *my son?*	No; Yes, and he/she recommended that *my son* get the HPV vaccine; Yes, and he/she has no opinion about the HPV vaccine for *my son*; Yes and he/she recommended against *my son* getting the HPV vaccine; Yes, but he/she recommended to wait until he's older before giving *my son* the HPV vaccine; Other, please specify.
Son's Health Behaviours	6	Who normally makes *my son* healthcare decisions?: Has *my son* gone for a routine medical check-up with a doctor/health care provider in the last year? Has *my son* received all the recommended childhood vaccines?	E.g. Mother/female guardian; Joint decision between parents/guardians Yes; No; I don't know
Parent Heath Behaviours	3	Have you ever been told that you have a sexually transmitted infection or disease (e.g., HPV, chlamydia, genital herpes, syphilis, etc.)? Have you ever been diagnosed with cancer?	Yes; No; I prefer not to answer
Vaccinated Daughters	4	How many daughters do you have? How many of your daughters have received the HPV vaccine	Specify numbers
Communication about Sex and HPV vaccine	7	How much have you talked with *my son* about sex? Has *my son* ever mentioned to you that he would like to get the HPV vaccine? When you talked to friends, peers or co-workers about the HPV vaccine, this was about:	Not at all – A lot (4-point Likert scale) Yes; No E.g. Sex and other topics of a sexual nature; Risks and side effects of the HPV vaccine
Parent/Son Involvement	3	How involved do you feel you should be in the decision to get *my son* the HPV vaccine? How involved do you feel your son's other parent should be in the decision to get *my son* the HPV vaccine?	Not at all involved – Extremely Involved (5-point Likert scale)
Willingness to vaccinate at different price points	4	Please indicate how willing you would be to get all the HPV vaccine doses for *my son* if vaccinating *my son* against HPV would cost $300? (from your own money, without any insurance or government coverage)	Extremely unwilling – Extremely willing (5-point Likert scale)

Implementation Intentions	3	You indicated that you decided you DO want *my son* to get the HPV vaccine. Which of the following best describes your thoughts?[4] I have taken the following actions since deciding that *my son* will get the HPV vaccine:[4] Now that you have completed this survey, which of the following are you likely to do?[5]	E.g. I plan on getting *my son* his first HPV vaccine dose within the next 6-12 months; I do not know when I plan on getting *my son* the HPV vaccine E.g. I contacted a health care provider to ask questions; I set aside money to pay for the HPV vaccine E.g. I am not likely to take any actions; Search for information about HPV and/or the HPV vaccine on the internet; Contact your insurance company to see if they cover any of the costs of the HPV vaccine; Talk to your doctors/health care provider about HPV and/or the HPV vaccine;
Open Ended Qualitative Items	4	What would influence your decision to have *my son* vaccinated or not against HPV? What do you remember hearing in the media about the HPV vaccine? What questions do you need answered to make a decision regarding the HPV vaccine for your son?	Free-text responses
Vaccine Conspiracy Beliefs[6, 7]	9	Immunizing children is harmful and this fact is covered up	Strongly Disagree – Strongly Agree (7-point Likert scale)
Right Wing Authoritarianism	7	Everyone should have their own lifestyle, religious beliefs, and sexual preferences, even if it makes them different from everyone else	Strongly Disagree – Strongly Agree (7-point Likert scale)
Beliefs about other parents vaccination choices	2	Parents who don't vaccinate their children with the HPV vaccine are putting *my child* at risk Parents who don't vaccinate their children with the HPV vaccine are putting *their child* at risk	Strongly Disagree – Strongly Agree (7-point Likert scale)
Conspiracy Mentality Questionnaire	5	I think that many very important things happen in the world, which the public is never informed about	Certainly Not (0%)– Certain (100% (11-point Likert scale)

Participants were asked at the beginning of the questionnaire to provide a name, nickname, initials or abbreviations for their son who is between the ages of 9 and 16 and who has had the nearest birthday. Using intelligence programming, Parents' sons initials, name, nickname (e.g., JT, Dan) was then replaced for "*my son*" in all items, making the questionnaire individualized for each participant.

[2] Waller, J., Ostini, R., Marlow, L. A., McCaffery, K., Zimet, G. (2013). Validation of a measure of knowledge about human papillomavirus (HPV) using item response theory and classical test theory. *Preventive Medicine,* 56(1):35-40.

[2] Perez, S., Tatar, O., Ostini, R., Shapiro, G. K., Waller, J., Zimet, G., & Rosberger, Z. (2016b). Extending and validating a human papillomavirus (HPV) knowledge measure in a national sample of Canadian parents of boys. *Preventive Medicine, 91*, 43-49.

[3] Perez, S., Shapiro, G. K., Tatar, O., Joyal-Desmarais, K., & Rosberger, Z. (2016a). Development and Validation of the Human Papillomavirus Attitudes and Beliefs Scale in a National Canadian Sample. *Sexually Transmitted Diseases, 43*(10), 626-632.

[4]Asked to participants in Stage 5 only

[5]Only the actual behaviours participants selected at T1 were shown at T2 to assess if the actions they planned were indeed carry out: You indicated in February that you were planning the following actions. Which one(s) have you done since then?

[6]These items were only asked to participants at T2 at the end of the entire questionnaire.

[7] Shapiro GK, Holding, A., Perez, S., Amsel, R., Rosberger, Z. (2016a). Validation of the Conspiracy Beliefs Scale. *Papillomavirus Research*, 2, 167-172

[8] Bruder, M., Haffke, P., Neave, N., Nouripanah, N., Imhoff, R. (2013). Measuring individual differences in generic beliefs in conspiracy theories across cultures: conspiracy mentality questionnaire. *Frontiers in Psychology*, 4:225

Appendix D1: English HPV General Knowledge (GK) Items[1]

	Please answer the following questions to the best of your ability:
1.	HPV is very rare (F)
2.	HPV always has visible signs or symptoms (F)
3.	HPV can cause cervical cancer (T)
4.	HPV can be transmitted through genital skin-to-skin contact (T)
5.	There are many types of HPV (T)
6.	HPV can cause HIV/AIDS (F)
7.	HPV can be passed on during sexual intercourse (T)
8.	HPV can cause genital warts (T)
9.	Men cannot get HPV (F)
10.	Using condoms reduces the chances of HPV transmission (T)
11.	HPV can be cured with antibiotics (F)
12.	Having many sexual partners increases the risk of getting HPV (T)
13.	HPV usually doesn't need any treatment (T)
14.	Most sexually active people will get HPV at some point in their lives (T)
15.	A person could have HPV for many years without knowing it (T)
16.	Having sex at an early age increases the risk of getting HPV (T)
17.	HPV can cause anal cancer (T)
18.	HPV is a bacterial infection (F)
19.	HPV can be transmitted through oral sex (T)
20.	HPV can cause cancer of the penis (T)
21.	HPV can cause herpes (F)
22.	HPV can be transmitted through anal sex (T)
23.	HPV infections always lead to health problems (F)
24.	HPV can cause oral cancer (T)
25.	A person with no symptoms cannot transmit the HPV infection (F)

Appendix D2: French HPV General Knowledge Items[6]

	Veuillez répondre aux questions suivantes du mieux que vous le pouvez:
1.	Le VPH est très rare (F)
2.	Le VPH présente toujours des signes ou symptômes visibles (F)
3.	Le VPH peut causer le cancer du col de l'utérus (V)
4.	Le VPH peut se transmettre par contact génital peau à peau (V)
5.	Il existe plusieurs types de VPH (V)
6.	Le VPH peut causer le VIH ou le sida (F)
7.	Le VPH peut être transmis au cours de relations sexuelles (V)
8.	Le VPH peut causer des verrues génitales (V)
9.	Les hommes ne peuvent pas contracter le VPH (F)
10.	L'utilisation d'un condom réduit les chances de transmission du VPH (V)
11.	Le VPH peut être guéri avec des antibiotiques (F)
12.	Avoir de nombreux partenaires sexuels augmente les risques de contracter le VPH (V)
13.	Le VPH ne nécessite habituellement pas de traitement (V)
14.	La plupart des personnes sexuellement actives contracteront le VPH à un moment ou à un autre de leur vie (V)
15.	Une personne pourrait être atteinte du VPH pendant de nombreuses années sans le savoir (V)
16.	Avoir des relations sexuelles à un jeune âge augmente les chances d'attraper le VPH (V)
17.	Le VPH peut causer le cancer de l'anus (V)
18.	Le VPH est une infection bactérienne (F)
19.	Le VPH peut être transmis par sexe oral (V)
20.	Le VPH peut causer le cancer du pénis (V)
21.	Le VPH peut causer l'herpès (F)
22.	Le VPH peut être transmis par sexe anal (V)
23.	Les infections au VPH entraînent toujours des problèmes de santé (F)
24.	Le VPH peut causer le cancer de la bouche (V)
25.	Une personne ne présentant pas de symptômes ne peut pas transmettre le VPH (F)

Appendix E1: English HPV Vaccination Knowledge (VK) Item[2]

	Please answer the following questions to the best of your ability:
1.	The HPV vaccine[3] requires only 1 dose (F)
2.	The HPV vaccine[4] offer protection against all sexually transmitted infections (F)
3.	The HPV vaccines[4] are most effective if given to people who've never had sex (T)
4.	Someone who has had the HPV vaccine cannot develop cervical cancer (F)
5.	The HPV vaccines[4] offer protection against most cervical cancers (T)
6.	One of the HPV vaccines[4] offers protection against genital warts (T)
7.	Girls who have had the HPV vaccine do not need a Pap test when they are older (F)
8.	The HPV vaccine protects you from every type of HPV (F)
9.	You can cure HPV by getting the HPV vaccine (F)
10.	The HPV vaccine is approved and recommended by Health Canada for females aged 9-45 years (T)
11.	The HPV vaccine is approved and recommended by Health Canada for males aged 9-26 years (T)

Appendix E2: French HPV Vaccination Knowledge (VK) Items[7]

	Veuillez répondre aux questions suivantes du mieux que vous le pouvez:
1.	Le vaccin[8] contre le VPH ne nécessite qu'une seule dose (F)
2.	Les vaccins[9] contre le VPH protègent contre toutes les infections transmises sexuellement (F)
3.	Les vaccins[4] contre le VPH sont les plus efficaces lorsqu'ils sont administrés à des personnes n'ayant jamais eu de rapports sexuels (V)
4.	Une personne ayant été vaccinée contre le VPH ne peut pas développer le cancer du col de l'utérus (F)
5.	Les vaccins[4] contre le VPH protègent contre la plupart des cancers du col de l'utérus (V)
6.	L'un des vaccins[4] contre le VPH protège contre les verrues génitales (V)
7.	Les filles ayant été vaccinées contre le VPH n'ont pas besoin de passer de test Pap lorsqu'elles sont plus âgées (F)
8.	Le vaccin contre le VPH vous protège contre tous les types de VPH (F)
9.	Vous pouvez guérir le VPH en recevant le vaccin contre le VPH (F)
10.	Le vaccin contre le VPH est approuvé et recommandé par Santé Canada pour les filles/femmes de 9 à 45 ans (V)
11.	Le vaccin contre le VPH est approuvé et recommandé par Santé Canada pour les garçons/hommes de 9 à 26 ans (V)

[1] Items 1-16 are from Waller et al.'s (2013) scale. Items 17- 25 were added in this study. Items 13 and 21 could ideally be removed, leaving a 23-item solution (GK23). We leave this to the discretion of the researchers. Response options are: *True, False, Don't know*.

[2] Items 1-7 are from Waller et al.'s scale. Items 8-11 were added in this study. Items 10 and 11 can be adapted to each specific country or regions policy/recommendation. Response options are: *True, False, Don't know*.

[3] We recommend modifying this item to: *The HPV vaccine requires at least 2 doses* (T).

[4] We recommend using *HPV vaccine* (singular) throughout the VK items instead of *HPV vaccine**s*** (plural) as this can be confusing to the reader. For item 6, we recommend the item be asked as follows: *The HPV vaccine offers protection against genital warts.*

[6] Items 1-16 are from Waller et al.'s scale. Items 17- 25 were added in this study. Items 13 and 21 could ideally be dropped, leaving a 23-item solution (GK23). We leave this to the discretion of the researchers. Response options are: *Vrai, Faux, Je ne sais pa*s

[7]Items 1-7 are from Waller et al.'s scale. Items 8-11 were added in this study. Items 10 and 11 can be adapted to each specific country or regions policy/recommendation. Response options are: *Vrai, Faux, Je ne sais pas*.

[8] We recommend modifying this item to: *Le vaccin contre le VPH nécessite au moins deux doses* (T).

[9]We recommend using Le vaccin contre le VPH (singular) throughout the VK items instead of les vaccins contre le VPH (plural) as this can be confusing to the reader. For item 6, we recommend the item be asked as follows: *Le vaccin contre le VPH protège contre les verrues génitales.*

Appendix F: The HPV Attitude and Beliefs Scale (HABS)

The following sections will present a series of statements about HPV and the HPV vaccine. We wish to know your opinion. Please note that we are not testing your knowledge. If you do not know an answer, that's alright, simply select the answer that most reflects your opinion

	ITEMS	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	I feel that the HPV vaccine has many benefits	1	2	3	4	5	6	7
2	I feel that the HPV vaccine will protect *[son's name]* sexual health	1	2	3	4	5	6	7
3	I feel that the HPV vaccine works well	1	2	3	4	5	6	7
4	I feel that the HPV vaccine is effective in preventing HPV	1	2	3	4	5	6	7
5	I feel that the HPV vaccine is effective in preventing genital warts	1	2	3	4	5	6	7
6	I feel that vaccinating *[son's name]* against HPV may be a good thing to do for his health *I feel that vaccinating [son's name] against HPV was a good thing to do for his health**	1	2	3	4	5	6	7
7	I feel that vaccinating *[son's name]* against HPV would give me peace of mind about his sexual health *I feel that having vaccinated [son's name] against HPV gives me peace of mind about his sexual health**	1	2	3	4	5	6	7

8	I feel that the HPV vaccine is effective in preventing HPV-related cancers	1	2	3	4	5	6	7
9	I feel that vaccinating *[son's name]* against HPV would protect his current/future partner from getting infected with HPV *I feel that having vaccinated [son's name] against HPV protects his current/future partner from getting infected**	1	2	3	4	5	6	7
10	I feel that getting *[son's name]* the HPV vaccine would protect his current/future partner against cancer *I feel that having gotten [son's name] the HPV vaccine protects his current/future partner against cancer**	1	2	3	4	5	6	7
11	I feel that it would be serious if *[son's name]* contracted HPV later in life	1	2	3	4	5	6	7
12	I feel that it would be serious if *[son's name]* contracted genital warts later in life	1	2	3	4	5	6	7
13	I feel that it would be serious if *[son's name]* contracted an HPV-related cancer later in life	1	2	3	4	5	6	7
14	I feel that other parents in my	1	2	3	4	5	6	7

	community are getting their sons the HPV vaccine							
15	I feel that my friends are getting their sons vaccinated with the HPV vaccine	1	2	3	4	5	6	7
16	I feel that other boys around my son's age are getting vaccinated for HPV	1	2	3	4	5	6	7
17	I feel that it is expected of me that I should vaccinate *[son's name]* against HPV *I feel that it was expected of me that I should vaccinate [son's name] against HPV**	1	2	3	4	5	6	7
18	I feel that most of my friends think vaccinating *[son's name]* against HPV is a good idea *I feel that most of my friends think vaccinating [son's name] against HPV was a good idea**	1	2	3	4	5	6	7
19	I feel that doctors/health care providers believe vaccinating boys against HPV is a good idea	1	2	3	4	5	6	7
20	I feel that my son's other parent believes we should get the HPV vaccine for *[son's name]* *I feel that my son's other parent believes in having*	1	2	3	4	5	6	7

	gotten the HPV vaccine for my [son's name] *							
21	I feel that my family thinks it is a good idea to vaccinate *[son's name]* against HPV. *I feel that my family thinks it was a good idea to vaccinate [son's name] against HPV**	1	2	3	4	5	6	7
22	I feel that the HPV vaccine is unsafe	1	2	3	4	5	6	7
23	I feel that giving *[son's name]* the HPV vaccine would be like performing an experiment on him *I feel that giving [son's name] the HPV vaccine was like performing an experiment on him**	1	2	3	4	5	6	7
24	I feel that the HPV vaccine may lead to long-term health problems	1	2	3	4	5	6	7
25	I feel that the HPV vaccine is being pushed to make money for pharmaceutical companies	1	2	3	4	5	6	7
26	I feel that the HPV vaccine is too new	1	2	3	4	5	6	7
27	I feel that there has not been enough research done on the HPV vaccine							
28	I feel that without the HPV vaccine, *[son's name]* would be at risk of getting HPV later	1	2	3	4	5	6	7

	in life							
29	I feel that without the HPV vaccine, *[son's name]* would be at risk of getting genital warts later in life	1	2	3	4	5	6	7
30	I feel that without the HPV vaccine, *[son's name]* would be at risk of getting an HPV-related cancer later in life	1	2	3	4	5	6	7
31	I feel that the HPV vaccine is too expensive *I feel that the HPV vaccine was too expensive**	1	2	3	4	5	6	7
32	I feel that my/our insurance does not cover enough of the cost of the HPV vaccine for *[son's name]* *I feel that my/our insurance did not cover enough of the cost of the HPV vaccine for [son's name] **	1	2	3	4	5	6	7
33	I feel that the HPV vaccine costs more than I can afford *I feel that the HPV vaccine cost more than I could afford**	1	2	3	4	5	6	7
34	I feel that it is hard to talk to *[son's name]* about his sexual health	1	2	3	4	5	6	7
35	I feel that I am uncomfortable discussing *[son's name]* sexual health with a doctor/health care provider	1	2	3	4	5	6	7

36	I feel that sex is not a subject I talk about with *[son's name]*	1	2	3	4	5	6	7
37	I feel that I am uncomfortable talking to *[son's name]* about the HPV vaccine	1	2	3	4	5	6	7
38	I feel that I do not know how to approach the topic of the HPV vaccine with *[son's name]*	1	2	3	4	5	6	7
39	I feel that it is hard to find a clinic that would be easy to access for getting the HPV vaccine for *[son's name]* [+] *I feel that it was hard to find a clinic that was easy to access for getting the HPV vaccine for [son's name]* * [+]	1	2	3	4	5	6	7
40	I feel that it is hard to find a provider or clinic where I would not have to wait a long time to get an appointment for *[son's name]* to get vaccinated[+] *I feel that it was hard to find a provider or clinic where I didn't have to wait a long time to get an appointment for [son's name] to get vaccinated**[+]	1	2	3	4	5	6	7
41	I feel that dealing with getting the HPV vaccine for *[son's name]* would be simple	1	2	3	4	5	6	7

	*I feel that dealing with getting the HPV vaccine for [son's name] was simple**							
42	I feel that the process of actually getting the HPV vaccine for *[son's name]* would be easy *I feel that the process of actually getting the HPV vaccine for [son's name] was easy**	1	2	3	4	5	6	7
43	I feel that vaccines are a good way to protect public health	1	2	3	4	5	6	7
44	I feel that vaccinating children is a good idea	1	2	3	4	5	6	7
45	I do not like the idea of vaccines[+]	1	2	3	4	5	6	7
46	I feel that doctors give out too many vaccines[+]	1	2	3	4	5	6	7

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Note: [1]Participants were asked at the beginning of the questionnaire to provide a name, nickname, initials or abbreviations for their son who is between the ages of 9 and 16 and who has had the nearest birthday. Parents' sons' initials, name, nickname (e.g., JT, Dan) was then replaced and "my son" in all items listed above, making the questionnaire individualized for each participant.

*Items for respondents were phrased differently (by an intelligent program) for parents who indicated they had vaccinated their son.

[+] Items were reverse-coded

[2]Items 1-10 correspond to "Benefits" with a maximum scale score of 70. Items 11-13 correspond to "Threat" with a maximum scale score of 21. Items 14-21 correspond to "Influence" with a maximum scale score of 56. Items 22-27 correspond to "Harms" with a maximum score of 42. Items 28-30 correspond to "Risk" with a maximum subscale score of 21. Items 31-33 correspond to "Affordability" with a maximum score of 21. Items 34-38 correspond to "Communication"

with a maximum score of 35. Items 39-42 correspond to “Accessibility” with a maximum score of 28. Items 43-46 correspond to “General Vaccination Attitudes” with a maximum score of 28. Scale is available in French by contacting the corresponding author.

Appendix G: Questionnaire at Time 1

LANG:

Would you prefer to complete the survey in English or French? Préféreriez-vous répondre à ce questionnaire en anglais ou en français ?

English..... EN
Français..... FR

HELLO:

The following survey is conducted in collaboration with the following partners, If you have any questions about this study, you may reach the study coordinator, at the Jewish General Hospital, a McGill University Teaching Hospital, at (514) 340-8222 ext. 3978 or via email at pso.jgh@gmail.com. If you wish to verify this study or have any concerns about your treatment or rights as a research subject, you may contact the Jewish General Hospital's Local Commissioner of Complaints & Quality of Services, Rosemary Steinberg at (514) 340-8222 ext. 5833

Continue 1

Q1. PROV:

In which province or territory do you live?

Newfoundland and Labrador..... NL
Prince Edward Island ..... PE
Nova Scotia ..... NS
New Brunswick ..... NB
Quebec ..... QC
Ontario..... ON
Manitoba ..... MB
Saskatchewan ..... SK
Alberta ..... AB
British Columbia ..... BC
Nunavut ..... NU
Northwest Territories ..... NT
Yukon ..... YK

Q2. SEXE:

Please indicate your gender:

Male..... 1
Female 2

Q3. AGE:

How old are you?

Under 18 years of age 0
Between 18 and 24 1
Between 25 and 34 2
Between 35 and 44 3
Between 45 and 54 4
Between 55 and 64 5
Between 65 and 74 6
75 years of age or older 7
I prefer not to answer 9

Q4. AGEX:

In what year were you born? _____

Q5. LANGU:

What is the language you first learned at home in your childhood and that you still understand?

French 1
English 2
Other 3
English and French 7
French and other 4
English and other 5
Other and other 6
I prefer not to answer 9

Q6. SCOLA:

What is the highest level of education that you have completed (diploma obtained)?

Elementary 1
High school: general or vocational training 2
College: general pre-university programs or technical programs 3
University 4
I prefer not to answer 9

Q7. ENFA:

Are there any children under 18 years old living in your household?

Yes 1
No 2
I prefer not to answer 9

Q8:

Do you personally have a son (sons)?

Yes 1
No ..... 2 → Terminate
I prefer not to answer ..... 9 → Terminate

Q9:

How old is(are) your son(s)?
Please check all that apply if you have more than one son.
8 years old or younger 1
Between 9 and 16 years old 2
17 years old or older 3
I prefer not to answer ..... 9 → Terminate

Q10:

What is your current marital status?
Single 01
Married 02
Common law relationship (have lived with your partner for
over a year, but are not legally married) 03
Separated, but still legally married 04
Divorced 05
Widowed 06
Other 96
I prefer not to answer 99

Q11. EMPLO:

What is your current employment status?
Working full-time 1
Working part-time (less than 30 hours per week) 2
Not working 3
Retired 4
Other 6
I prefer not to answer 9

Q12:

Where do you currently live?
Please answer to the best of your ability
Area with a population of less than 1,000 people
(e.g., countryside or farming area) 1
Area with a population of between 1,000 and 29,999 people
(e.g., small town or city) 2
Area with a population of between 30,000 and 99,999 people
(e.g., medium town or city) 3
Area with a population of over 100,000 people
(e.g., large town or city) 4

Q13:

Which statement best applies to you?
I was born in Canada 1
I was not born in Canada 2
I prefer not to answer 9

If Q13 = 2

Q13X:

You indicated that you were NOT born in Canada.
How many years have you lived in Canada? _____
I don't know 98
I prefer not to answer 99

Q14:

Which of the following best describes you?
Aboriginal (e.g., Inuit, Metis, First Nations, etc.) 01
Arab / West Asian (e.g., Armenian, Egyptian, Iranian, Lebanese, Moroccan, etc.) 02
Black (e.g., African, Haitian, Jamaican, etc.) 03
East Asian (e.g., Chinese, Filipino, Japanese, Korean, Vietnamese, etc.) 04
Latin / Central American (e.g., Mexican, Colombian, Brazilian, Cuban, etc.) 05
South Asian (e.g., Indian, Sri Lankan, etc.) 06
White (Caucasian, European, etc.) 07
Other 96
I prefer not to answer 99

Q15:

With which religious or spiritual belief system do you most strongly identify?
Aboriginal spirituality 01
Agnostic 02
Atheist 03
Buddhist 04
Catholic 05
Christian Orthodox 06
United Church 07
Anglican 08
Protestant, other than United Church or Anglican 09
Christian, other than Catholic, Christian Orthodox, or Protestant 10
Hindu 11
Jewish 13
Muslim 14
Sikh 12
I am spiritual, but do not identify with any particular religion. 95
Other 96
No Religion 97
I prefer not to answer 99

Q16:

Please rate how much you agree with the following statement: **My religious or spiritual belief system guides my daily decisions**.							
	Strongly disagree	*Disagree*	*Somewhat disagree*	*Neutral*	*Somewhat agree*	*Agree*	*Strongly agree*
	1	2	3	4	5	6	7

Q17. REVEN:

Among the following categories, which one best reflects the total income, before taxes, of all the members of your household in 2013?

$19,999 or less 1
between $20,000 and $39,999 2
between $40,000 and $59,999 3
between $60,000 and $79,999 4
between $80,000 and $99,999 5
$100,000 or more 6
I prefer not to answer 9

Q20:

Have you ever heard of HPV (Human Papillomavirus)?

Yes 1
No 2

Q21:

How much would you say you know about HPV (Human Papillomavirus)?				
	Nothing at all	*A little*	*A moderate amount*	*A lot*
	1	2	3	4

Q22:

Have you ever heard of the HPV vaccine (Human Papillomavirus vaccine)? You may also have heard of this vaccine under the names Gardasil® or Cervarix®.

Yes 1
No 2

Q23:

How much would you say you know about the HPV vaccine (Human Papillomavirus vaccine, also referred to as Gardasil® or Cervarix®)?				
	Nothing at all	*A little*	*A moderate amount*	*A lot*
	1	2	3	4

SEC2:

Please answer the following questions about your son between the ages of 9 and 16. If you have more than one son in this age range, please think about the one who had the most recent birthday.

Continue 1

Q18:

Please indicate your son's name (or any name, nickname, initials or abbreviations that would help you remember to which son you are referring e.g.: Alex, PJ, David). This name will be used throughout this survey to refer to your son. It will NOT be used in any other way by the researchers.

Son's name or nickname: _____

[participant provided name nickname. For the sake of this example, we will use Dan as the nickname in the next example. Throughout the survey <Q18> would be replaced with the name or nickname provided by the parent]

Q19:

What is Dan 's current age? (What is <Q18's? current age)

9 years old 09
10 years old 10
11 years old 11
12 years old 12
13 years old 13
14 years old 14
15 years old 15
16 years old 16

Q24:

Before today, which of the following best described your thoughts about the HPV vaccine concerning <Q18>? (Select only one)

I was **unaware** that the HPV vaccine could be given to males 1
I was **aware** that the HPV vaccine can be given to males,
but I have not thought about getting the HPV vaccine for <Q18> 2
I have thought about getting the HPV vaccine for <Q18>, but
I am **undecided** about getting the HPV vaccine for him..... 3
I have decided I do **NOT** want <Q18> to get the HPV vaccine..... 4
I have decided I ***DO*** want Dan to get the HPV vaccine 5
Dan has already received the HPV vaccine..... 6

Q25:

How many doses has <Q18 received?

Only if Q24=6

1 dose 1
2 doses..... 2
3 doses..... 3

If Q24 = 6

Q26:

When did <Q18> receive his first dose?

Between 0-6 months ago..... 1
Between 7-12 months ago..... 2
Between 1-2 years ago 3
Between 2-3 years ago 4
More than 3 years ago..... 5

If Q24 = 4, 5, or 6

Q27:

Who made the decision whether to give <Q18> the HPV vaccine or not?
Mother/female guardian 1
Father/male guardian 2
Joint decision between parents/guardians 3
Dan..... 4
Other..... 6

Q28:

Please answer the following questions to the best of your ability:			
	True	***False***	***Don't know***
a) HPV is very rare			
b) HPV always has visible signs or symptoms			
c) HPV can cause cervical cancer			
d) HPV can be transmitted through genital skin-to-skin contact			
e) There are many types of HPV			
f) HPV can cause HIV/AIDS			
g) HPV can be passed on during sexual intercourse			
h) HPV can cause genital warts			
i) Men cannot get HPV			
j) Using condoms reduces the chances of HPV transmission			
k) HPV can be cured with antibiotics			
l) Having many sexual partners increases the risk of getting HPV			
m) HPV usually doesn't need any treatment			
n) Most sexually active people will get HPV at some point in their lives			
o) A person could have HPV for many years without knowing it			
p) Having sex at an early age increases the risk of getting HPV			
q) HPV can cause anal cancer			
r) HPV is a bacterial infection			
s) HPV can be transmitted through oral sex			
t) HPV can cause cancer of the penis			
u) HPV can cause herpes			
v) HPV can be transmitted through anal sex			
w) HPV infections always lead to health problems			
x) HPV can cause oral cancer			
y) A person with no symptoms cannot transmit the HPV infection			

Q29:

Please answer the following questions to the best of your ability:			
	True	***False***	***Don't know***
a) The HPV vaccine requires only 1 dose			
b) The HPV vaccines offer protection against all sexually transmitted infections			
c) The HPV vaccines are most effective if given to people who've never had sex			
d) Someone who has had the HPV vaccine cannot develop cervical cancer			
e) The HPV vaccines offer protection against most cervical cancers			
f) One of the HPV vaccines offers protection against genital warts			
g) Girls who have had the HPV vaccine do not need a Pap test (cervical cancer			

screening) when they are older			
h) The HPV vaccine protects you from every type of HPV			
i) You can cure HPV by getting the HPV vaccine			
*j) The HPV vaccine is approved and recommended by Health Canada for **females** aged 9-45 years*			
*k) The HPV vaccine is approved and recommended by Health Canada for **males** aged 9-26 years*			

Q30:

About how much do you think 1 dose of the HPV vaccine costs without any insurance or government coverage?

Less than $50 1
$50 - $150 2
$151 - $250 3
$251 - $350 4
More than $350 5
I don't know 8

Please read carefully the following information about HPV.

The Human Papillomavirus (HPV) is the most common sexually transmitted infection.
HPV can cause genital warts. HPV can also cause cancers of the cervix, penis, anus, vagina, vulva and oral cancers.
There are HPV vaccines available that are sometimes referred to as the cervical cancer vaccine, Gardasil®, or Cervarix®.
The HPV vaccine is given in 2 or 3 doses and costs approximately $150-$200 per dose.
Health Canada has approved and recommended an HPV vaccine for **both** males aged 9-26 years and females aged 9-45 years.

continue .....

SEC4:

The following sections will present a series of statements about HPV and the HPV vaccine. We wish to know your opinion. Please note that we are not testing your knowledge. If you do not know an answer, that's alright, simply select the answer that most reflects your opinion.

continue 1

Q31:

For each statement, please indicate how much you disagree or agree by selecting the appropriate number:							
	Strongly Disagre 1	***Disagree 2***	***Somewhat Disagre 3***	***Neutral 4***	***Somewhat Agree 5***	***Agree 6***	***Strongly Agree 7***
a) I feel that the HPV vaccine has many benefits.							
b) I feel that the HPV vaccine will protect my son's sexual health.							
c) I feel that the HPV vaccine works well.							
d) I feel that the HPV vaccine is							

effective in preventing HPV.							
e) I feel that the HPV vaccine is effective in preventing genital warts.							
f) I feel that vaccinating <Q18> against HPV may be a good thing to do for his health.							
*g**) If Q24 = stage 6, this would read:** I feel that vaccinating <Q18> against HPV was a good thing to do for his health.*							
h) I feel that vaccinating <Q18> against HPV would give me peace of mind about his sexual health.							
*i) **If Q24 = stage 6, this would read:** I feel that having vaccinated <Q18> against HPV gives me peace of mind about his sexual health.*							
j) I feel that the HPV vaccine is effective in preventing HPV-related cancers.							
k) I feel that vaccinating <Q18> against HPV would protect his current/future partner from getting infected with HPV.							
*l) **If Q24 = stage 6, this would read:** I feel that having vaccinated <Q18> against HPV protects his current/future partner from getting infected.*							
m) I feel that getting <Q18> the HPV vaccine would protect his current/future partner against cancer.							
*n) **If Q24 = stage 6, this would read:** I feel that having gotten <Q18> the HPV vaccine protects his current/future partner against cancer.*							
o) I feel that it would be serious if <Q18> contracted HPV later in life.							
p) I feel that it would be serious if <Q18> contracted genital warts later in life.							
q) I feel that it would be serious if <Q18> contracted an HPV-related cancer later in life.							

Q32:

For each statement, please indicate how much you disagree or agree by selecting the appropriate number:							
	Strongly Disagre 1	***Disagree 2***	***Somewhat Disagre 3***	***Neutral 4***	***Somewhat Agree 5***	***Agree 6***	***Strongly Agree 7***
a) I feel that other parents in my community are getting their sons the HPV vaccine.							
b) I feel that my friends are getting their sons vaccinated with the HPV vaccine.							
c) I feel that other boys around <Q18>'s age are getting vaccinated for HPV.							
d) I feel that it is expected of me that I should vaccinate <Q18> against HPV.							
e) ***If Q24 = stage 6, this would read:*** *I feel that it was expected of me that I should vaccinate <Q18> against HPV.*							
f) I feel that most of my friends think vaccinating <Q18> against HPV is a good idea.							
g) ***If Q24 = stage 6, this would read:*** *I feel that most of my friends think vaccinating <Q18> against HPV was a good idea.*							
h) I feel that doctors/health care providers believe vaccinating boys against HPV is a good idea.							
i) I feel that my son's other parent believes we should get the HPV vaccine for <Q18>.							
j) ***If Q24 = stage 6, this would read:*** *I feel that my son's other parent believes in having gotten the HPV vaccine for <Q18>.*							
k) I feel that my family thinks it is a good idea to vaccinate <Q18> against HPV.							
l) ***If Q24 = stage 6, this would read:*** *I feel that my family thinks it was a good idea to vaccinate <Q18> against HPV.*							
m) I feel that the government believes parents should vaccinate their sons against HPV.							

Q33:

For each statement, please indicate how much you disagree or agree by selecting the appropriate number:							
	Strongly Disagre 1	***Disagree 2***	***Somewhat Disagre 3***	***Neutral 4***	***Somewhat Agree 5***	***Agree 6***	***Strongly Agree 7***
a) The opinion of doctors/health care providers about getting the HPV vaccine for my son matters to me.							
i) I have never met anyone younger than I am.							
b) My son's other parent's opinion about getting the HPV vaccine for <Q18> is important to me.							
c) The opinion of friends about whether I should get the HPV vaccine for <Q18> matters to me.							
*d) **If Q24 = stage 6, this would read:** The opinion of friends about getting the HPV vaccine for <Q18> matters to me.*							
e) The opinion of my family about getting <Q18> the HPV vaccine matters to me.							
*f) **If Q24 = stage 6, this would read:** The opinion of my family about getting <Q18> the HPV vaccine matters to me.*							
j) Everyone makes mistakes at least once in a while							
g) I trust the government's opinion concerning the HPV vaccine for <Q18>.							

Q34:

For each statement, please indicate how much you disagree or agree by selecting the appropriate number:							
	Strongly Disagre 1	***Disagree 2***	***Somewhat Disagre 3***	***Neutral 4***	***Somewhat Agree 5***	***Agree 6***	***Strongly Agree 7***
a) I feel that the HPV vaccine is unsafe.							
b) I feel that the HPV vaccine might cause short term side effects like pain or discomfort.							
c) I feel that the HPV vaccine is being pushed to make money for pharmaceutical companies.							
d) I feel that giving <Q18> the HPV vaccine would be like							

performing an experiment on him.							
*e) **If Q24 = stage 6, this would read:** I feel that giving <Q18> the HPV vaccine was like performing an experiment on him.*							
f) I feel that the HPV vaccine would encourage <Q18> to have sex at an earlier age.							
*g) **If Q24 = stage 6, this would read:** I feel that vaccinating <Q18> for HPV would send a message that he would not have to use safe sex practices.*							
h) I feel that vaccinating <Q18> for HPV sent a message that he would not have to use safe sex practices.							
i) I feel that the HPV vaccine may lead to long-term health problems.							
j) I feel that the HPV vaccine may affect <Q18>'s fertility.							
k) I feel that without the HPV vaccine, <Q18> would be at risk of getting HPV later in life.							
l) I feel that without the HPV vaccine, <Q18> would be at risk of getting genital warts later in life.							
m) I feel that without the HPV vaccine, <Q18> would be at risk of getting an HPV-related cancer later in life.							

Q3501:

For each statement, please indicate how much you disagree or agree by selecting the appropriate number:							
	Strongly Disagre 1	***Disagree 2***	***Somewhat Disagre 3***	***Neutral 4***	***Somewhat Agree 5***	***Agree 6***	***Strongly Agree 7***
01) I feel that getting the HPV vaccine for <Q18> would take too much effort.							
*02) **If Q24 = stage 6, this would read:** I feel that getting the HPV vaccine for <Q18> took too much effort.*							
03) I feel that it is hard to find a clinic that would be easy to access for getting the HPV							

vaccine for <Q18>.							
04) ***If Q24 = stage 6, this would read:*** *I feel that it was hard to find a clinic that was easy to access for getting the HPV vaccine for <Q18>.*							
05) I feel that it is hard to find a provider or clinic where I would not have to wait a long time to get an appointment for <Q18> to get vaccinated.							
06) ***If Q24 = stage 6, this would read:*** *I feel that it was hard to find a provider or clinic where I didn't have to wait a long time to get an appointment for <Q18> to get vaccinated.*							
07) I feel that the HPV vaccine is too expensive.							
08) ***If Q24 = stage 6, this would read:*** *I feel that the HPV vaccine was too expensive.*							
09) I feel that my/our insurance does not cover enough of the cost of the HPV vaccine for <Q18>.							
10) ***If Q24 = stage 6, this would read:*** *I feel that my/our insurance did not cover enough of the cost of the HPV vaccine for <Q18>.*							
11) I feel that the HPV vaccine costs more than I can afford.							
12) ***If Q24 = stage 6, this would read:*** *I feel that the HPV vaccine cost more than I could afford.*							
13) I feel that the HPV vaccine is too new.							
14) I feel that I do not have enough information about the HPV vaccine.							

Q3515:

For each statement, please indicate how much you disagree or agree by selecting the appropriate number:							
	Strongly Disagre 1	***Disagree 2***	***Somewhat Disagre 3***	***Neutral 4***	***Somewhat Agree 5***	***Agree 6***	***Strongly Agree 7***
15) I feel that there has not been enough research done on the HPV vaccine.							
16) I feel that it is hard to talk to							

<Q18> about his sexual health.							
17) I feel that I am uncomfortable discussing <Q18>'s sexual health with a doctor/health care provider.							
18) I feel that sex is not a subject I talk about with <Q18>.							
19) I feel that I am uncomfortable talking to <Q18> about the HPV vaccine.							
20) I feel that I do not know how to approach the topic of the HPV vaccine with <Q18>.							
21) I feel that I am confident in my ability to get the HPV vaccine for <Q18>.							
*22) **If Q24 = stage 6, this would read:** I feel that I was confident in my ability to get the HPV vaccine for <Q18>.*							
23) I feel that dealing with getting the HPV vaccine for <Q18> would be simple.							
*24) **If Q24 = stage 6, this would read:** I feel that dealing with getting the HPV vaccine for <Q18> was simple.*							
25) I feel that the process of actually getting the HPV vaccine for <Q18> would be easy.							
*26) **If Q24 = stage 6, this would read:** I feel that the process of actually getting the HPV vaccine for <Q18> was easy.*							
27) I feel that the HPV vaccine requires too many doses.							

Q36: For each statement, please indicate how much you disagree or agree by selecting the appropriate number:

	Strongly Disagre 1	***Disagree 2***	***Somewhat Disagre 3***	***Neutral 4***	***Somewhat Agree 5***	***Agree 6***	***Strongly Agree 7***
a) I feel that vaccines are a good way to protect public health.							
b) I feel that vaccinating children is a good idea.							
c) I do not like the idea of vaccines.							
d) I feel that doctors give out too							

many vaccines.							
e) I am answering these questions truthfully.							
f) I have never met anyone younger than I am.							
g) Everyone makes mistakes at least once in a while.							
h) I feel that my child is too young to receive the HPV vaccine.							
i) ***If Q2 4= stage 6, this would read:*** *I feel that my child was too young to receive the HPV vaccine.*							
j) ***Ask only if Q24 = stage 6, this would read:*** *I regret getting the HPV vaccine for <Q18>.*							
k) I am answering these questions truthfully.							

Q37:

Where have you heard that the HPV vaccine could be given to **males** (other than this survey)?

Check all that apply.

I have not heard that the HPV vaccine could be given to males 01
Public health brochures, pamphlets, flyers or posters 02
Commercials or advertisements from pharmaceutical companies 03
Doctor, nurse, or other health care provider 04
Family member(s) 05
Friend, peer or co-worker 06
Information from my child or children's school 07
Newspapers or magazines 08
TV or the radio 09
The Internet (e.g., health related websites, news, Facebook/Twitter) 10
<Q18> 90
Other source 96

Q38:

Where have you heard about the HPV vaccine **in general** (other than this survey)?
(Check all that apply.)

I have not heard about the HPV vaccine 01
Public health brochures, pamphlets, flyers or posters 02
Commercials or advertisements from pharmaceutical companies 03
Doctor, nurse, or other health care provider 04
Family member(s) 05
Friend, peer or co-worker 06
Information from my child or children's school 07
Newspapers or magazines 08
TV or the radio 09
The Internet (e.g., health related websites, news, Facebook/Twitter) 10
<Q18> 90
Other source 96

Q39:

What you heard about the HPV vaccine in the media (e.g., internet, newspaper, TV, etc.) has been:

I have not heard about the HPV vaccine in the media 1
Mostly in favour the HPV vaccine 2
Somewhat in favour the HPV vaccine 3
Neither in favour nor against the HPV vaccine (neutral) 4
Somewhat against the HPV vaccine 5
Mostly against the HPV vaccine 6

Q40A:

From which sources would you prefer to receive information about the HPV vaccine? Which is your **most** preferred source?

Public health brochures, pamphlets, flyers or posters 01
Commercials or advertisements from pharmaceutical companies 02
Doctor, nurse, or other health care provider 03
Family member(s) 04
Friend, peer or co-worker 05
Information from my child or children's school 06
Newspapers or magazines 07
TV or the radio 08
The Internet (e.g., health related websites, news, Facebook/Twitter) 09
Other source 96

Q40B:

From which sources, would you prefer to receive information about the HPV vaccine? Which is your **second** most preferred source?

(response from Q40A no longer available).....

Public health brochures, pamphlets, flyers or posters 01
Commercials or advertisements from pharmaceutical companies 02
Doctor, nurse, or other health care provider 03
Family member(s) 04
Friend, peer or co-worker 05
Information from my child or children's school 06
Newspapers or magazines 07
TV or the radio 08
The Internet (e.g., health related websites, news, Facebook/Twitter) 09
Other source 96

Q40C:

From which sources would you prefer to receive information about the HPV vaccine? Which is your **third** most preferred source?

(response from Q40B no longer available).....

Public health brochures, pamphlets, flyers or posters 01
Commercials or advertisements from pharmaceutical companies 02
Doctor, nurse, or other health care provider 03
Family member(s) 04
Friend, peer or co-worker 05
Information from my child or children's school 06
Newspapers or magazines 07
TV or the radio 08
The Internet (e.g., health related websites, news, Facebook/Twitter) 09
Other source 96

Q41:

Have you ever talked with a doctor/health care provider about the HPV vaccine for <Q18>?

No 01
Yes, and he/she recommended that <Q18> get the HPV vaccine 02
Yes, and he/she had no opinion about the HPV vaccine for <Q18> 03
Yes, and he/she recommended against <Q18> getting the HPV vaccine04
Yes, but he/she recommended to wait until he's older before giving
[son's name] the HPV vaccine 05
Other, please specify: ..... 96 Open ended response

Q42:

Who normally makes <Q18>'s healthcare decisions?

(Check all that apply.)

Mother/female guardian 01
Father/male guardian 02
Joint decision between parents/guardians 03
<Q18> 90
Other 96

Q43:

Has <Q18> gone for a routine medical check-up with a doctor/health care provider in the last year?
Yes 1
No 2
I don't know 8

Q44:

Has <Q18> received all the recommended childhood vaccines?
Yes 1
No 2
I don't know 8

Q45:

Which of the following is <Q18>'s primary source of health insurance coverage?
Provincial/public insurance (e.g., Medicare, OHIP, etc.) 01
<Q18> is covered by my private or corporate health insurance plan .. 02
<Q18> is covered by his other parent's private or corporate health insurance plan … 03
<Q18> does not have any health insurance coverage 04
Other, please specify: 96
I don't know 98

Q46:

To your knowledge, is there a program at <Q18>'s school for boys to receive the HPV vaccine for free (where you would not have to pay for the vaccine)?
Yes 1
No 2
I don't know 8

Q47:

Including <Q18>, how many sons do you have? _____

If Q47 = 1 or more

Q48:

Including <Q18>, how many of your sons have received the HPV vaccine? ____

Q49:

How many daughters do you have? _____

If Q49 = 1 or more

Q50:

How many of your daughters have received the HPV vaccine? _____

Q51:

Have you ever been told that you have a sexually transmitted infection or disease (e.g., HPV, chlamydia, genital herpes, syphilis, etc.)?

Yes 1
No 2
I don't know 8
I prefer not to answer 9

Q52:

Have you ever been diagnosed with cancer?

Yes 1
No 2
I prefer not to answer 9

Q53:

Has a member of your family ever been diagnosed with any of the following cancers: Cervical, penile, anal, vaginal, vulvar, oral (head and neck)?

Yes 1
No 2
I don't know 8

Q54:

Do you think other children/teenagers around <Q18> have been sexually active (including oral sex and/or genital contact)?

Yes 1
No 2
I don't know 8

Q55:

Do you think <Q18> has been sexually active (including oral sex and/or genital contact)?

Yes 1
No 2
I don't know 8
I prefer not to answer 9

Q56:

How much have you talked with <Q18> about sex?

Not at all 1
A little bit 2
A moderate amount 3
A lot 4

Q57:

How much have you talked with <Q18> about the HPV vaccine?

Not at all 1
A little bit 2
A moderate amount 3
A lot 4

If Q57 = 2, 3, 4

Q58:

When talking to <Q18> about the HPV vaccine, this was about.
(Check all that apply.)

<Q18> getting the HPV vaccine 01
Boys getting the HPV vaccine 02
Girls getting the HPV vaccine..... 03
Sex and other topics of a sexual nature 04
Benefits of the HPV vaccine..... 05
Risks and side effects of the HPV vaccine..... 06
Sexually transmitted infections and/or diseases (STIs/STDs) 07
Other, please specify: ..... 96 Open ended response

If participant selected Q38 = Friend, peer or co-worker

Q59:

When you talked to friends, peers or co-workers about the HPV vaccine, this was about.
(Check all that apply.)

<Q18> getting the HPV vaccine 01
Boys getting the HPV vaccine 02
Girls getting the HPV vaccine..... 03
Sex and other topics of a sexual nature 04
Benefits of the HPV vaccine..... 05
Risks and side effects of the HPV vaccine..... 06
Sexually transmitted infections and/or diseases (STIs/STDs) 07
Other..... 96

Q60:

Has <Q18> ever mentioned to you that he would like to get the HPV vaccine?

Yes 1
No 2

Q61:

1How involved do you feel <Q18> should be in the decision to get him the HPV vaccine?
2 if (Q24=4,5,6)→ How involved was <Q18> in the decision to get him the HPV vaccine?

Not at all involved..... 1
A little involved..... 2
Moderately involved..... 3
Very involved 4
Extremely involved 5

Q62:

1How involved do you feel you should be in the decision to get <Q18> the HPV vaccine? 2
2 If ((Q24=4,5,6)→ How involved were you in the decision to get <Q18> the HPV vaccine?
Not at all involved 1
A little involved 2
Moderately involved 3
Very involved 4
Extremely involved 5

Q63:

1How involved do you feel your son's other parent should be in the decision to get <Q18> the HPV vaccine?
2 If ((Q24=4,5,6)→ How involved was your partner/spouse in the decision to get <Q18> the HPV vaccine?

Not at all involved 1
A little involved 2
Moderately involved 3
Very involved 4
Extremely involved 5
Not applicable, I am the only parent involved in decisions for my son .. 7

Q64:

Please indicate how willing you would be to get all the HPV vaccine doses for <Q18> if…					
	Extremely Unwilling	***Somewhat Unwilling***	***Neutral***	***Somewhat Willing***	***Extremely Willing***
*a) … vaccinating <Q18> against HPV would be **free**?*	1	2	3	4	5
*b) … vaccinating <Q18> against HPV would cost **$100** (from your own money, without any insurance or government coverage)*	1	2	3	4	5
*c) … vaccinating <Q18> against HPV would cost **$200** (from your own money, without any insurance or government coverage)*	1	2	3	4	5
*d) … vaccinating <Q18> against HPV would cost **$300** (from your own money, without any insurance or government coverage)*	1	2	3	4	5

If Q24 = 5

Q65:

You indicated that you decided you DO want <Q18> to get the HPV vaccine. Which of the following best describes your thoughts?

I plan on getting <Q18> his first HPV vaccine dose within the next 3 months. 1
I plan on getting <Q18> his first HPV vaccine dose within the next 3-6 months. 2
I plan on getting <Q18> his first HPV vaccine dose within the next 6-12 months. 3
I plan on getting <Q18> his first HPV vaccine dose in more than 12 months. 4
I do not know when I plan on getting <Q18> the HPV vaccine. 8

If Q24 = 5

66:

I have taken the following actions since deciding that <Q18> will get the HPV vaccine:
(Check all that apply.)

I contacted a health care provider to ask questions 01
I have scheduled an appointment with a doctor/health care provider for <Q18> to receive the HPV vaccine 02
I phoned my insurance company to see if they cover any of the costs of the HPV vaccine..... 03
I set aside money to pay for the HPV vaccine 04
I planned how <Q18> will get to his HPV vaccine appointment..... 05
I have not made any plans to initiate <Q18>'s HPV vaccination 06
I have taken other steps/made other plans. Please specify: ..... 96 Open ended response

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If Q24 = 6 and If Q25 = 1

Q67:

You indicated that <Q18> has received only 1 dose of the HPV vaccine. Are you planning to get him the remaining dose(s)?

Yes 1
No 2
I don't know..... 8

If Q67 = 1

Q68:

You indicated that you are planning to get <Q18> his second dose of the HPV vaccine. Which of the following best describes your thoughts?

I plan on getting <Q18> his second HPV vaccine dose within the next 3 months. 1
I plan on getting <Q18> his second HPV vaccine dose within the next 3-6 months. 2
I plan on getting <Q18> his second HPV vaccine dose within the next 6-12 months. 3
I plan on getting <Q18> his second HPV vaccine dose n more than 12 months. 4
I do not know when I plan on getting <Q18> his second dose. 8

Q69: What factors would influence your decision to have <Q18> vaccinated or not against HPV?

.....
.....
.....
.....

If Q24=4,5,6) What factors influenced your decision to have <Q18> vaccinated or not against HPV?

.....
.....
.....
.....

Q70:

What do you remember hearing in the media about the HPV vaccine?

.....
.....

Q71:

What questions do you need answered to make a decision regarding the HPV vaccine for your son?

.....
.....

Q72:

Now that you have completed this survey, which of the following are you likely to do?
(Check all that apply.)

I am not likely to take any actions 97
Search for information about HPV and/or the HPV vaccine on the internet..... 02
Search for information about HPV and/or the HPV vaccine in written sources (e.g., brochures, books, magazines, etc.) 03
Talk to your friends about HPV and/or the HPV vaccine..... 04
Talk to your family about HPV and/or the HPV vaccine 05
Talk to your spouse/partner about HPV and/or the HPV vaccine 06
Talk to your doctor/health care provider about HPV and/or the HPV vaccine 07
Talk to your son about HPV and/or the HPV vaccine 08
Set aside money to pay for the HPV vaccine 09
Contact your insurance company to see if they cover any of the costs of the HPV vaccine..... 10
Other, please specify: ..... 96 Open ended response

Appendix H: Questionnaire at Time 2

LANG:

Would you prefer to complete the survey in English or French? Préféreriez-vous répondre à ce questionnaire en anglais ou en français ?

English..... EN
Français..... FR

INT01:

I agree to answer the following survey questions truthfully and thoughtfully

Yes 01
No ..... NE
Continue 1

You completed a survey related to the HPV vaccine about your son <Q18> in February.
This is a follow-up survey to see how things have changed since then.
[Linked to Time 1 Survey data]
Note: <Q18> is the name/nickname/initials you entered to refer to your son who has the closest birthday to February. This son was between the ages of 9 and 16. The name <Q18> will be used throughout this survey to refer to your son. It will NOT be used in any other way by the researchers.

Do you remember completing the survey related to the HPV vaccine about your son <Q18>?
Yes
No → TERMINATE

HELLO:

The following survey is conducted in collaboration with the following partners. If you have any questions about this study, you may reach the study coordinator, at the Jewish General Hospital, a McGill University Teaching Hospital, at (514) 340-8222 ext. 3978 or via email at pso.jgh@gmail.com. If you wish to verify this study or have any concerns about your treatment or rights as a research subject, you may contact the Jewish General Hospital's Local Commissioner of Complaints & Quality of Services, Rosemary Steinberg at (514) 340-8222 ext. 5833
Continue 1

N20:

Have you ever heard of HPV (Human Papillomavirus)?

Yes 1
No 2

N21:

How much would you say you know about HPV (Human Papillomavirus)?

Nothing at all 1
A little 2
A moderate amount 3
A lot 4

N22:

Have you ever heard of the HPV vaccine (Human Papillomavirus vaccine)? You may also have heard of this vaccine under the names Gardasil® or Cervarix®.

Yes 1
No 2

N23:

How much would you say you know about the HPV vaccine (Human Papillomavirus vaccine, also referred to as Gardasil® or Cervarix®)?

Nothing at all 1
A little 2
A moderate amount 3
A lot 4

N19:

What is <Q18>'s current age?

9 years old 09
10 years old 10
11 years old 11
12 years old 12
13 years old 13
14 years old 14
15 years old 15
16 years old 16
17 years old 17

N24N:

At this moment, which of the following best describes your thoughts about the HPV vaccine concerning <Q18>? (Select only one)

I am **unaware** that the HPV vaccine could be given to males 1
I am **aware** that the HPV vaccine can be given to males,
but I have not thought about getting the HPV vaccine for <Q18> 2
I have thought about getting the HPV vaccine for <Q18>,
but I am **undecided** about getting the HPV vaccine for him 3
I have decided I do **NOT** want <Q18> to get the HPV vaccine..... 4
I have decided I **DO** want <Q18> to get the HPV vaccine..... 5
<Q18> has already received the HPV vaccine 6

If Q24N = 6

N25:

How many doses has <Q18> received?

1 dose 1
2 doses..... 2
3 doses..... 3

If Q24N = 6

N25A:

Where did <Q18> receive the HPV vaccine?
At school 1
At the doctor / clinic / community health center 2
At the pharmacy 3

If Q24N = 6

N26:

When did <Q18> receive his first dose?
Between 0-6 months ago..... 1
Between 7-12 months ago..... 2
Between 1-2 years ago 3
Between 2-3 years ago 4
More than 3 years ago..... 5

If Q24N = 4, 5, 6

N27:

Who made the decision whether to give <Q18> the HPV vaccine or not?
(Check all that apply.)
Mother/female guardian 1
Father/male guardian 2
Joint decision between parents/guardians 3
<Q18> 4
Other..... 6

N28:

Please answer the following questions to the best of your ability:			
	True 1	**False 2**	**Don't know 8**
a) HPV is very rare			
b) HPV always has visible signs or symptoms			
c) HPV can cause cervical cancer			
d) HPV can be transmitted through genital skin-to-skin contact			
e) There are many types of HPV			
f) HPV can cause HIV/AIDS			
g) HPV can be passed on during sexual intercourse			
h) HPV can cause genital warts			
i) Men cannot get HPV			
j) Using condoms reduces the chances of HPV transmission			
k) HPV can be cured with antibiotics			
l) Having many sexual partners increases the risk of getting HPV			
m) HPV usually doesn't need any treatment			
n) Most sexually active people will get HPV at some point in their lives			
o) A person could have HPV for many years without knowing it			
p) Having sex at an early age increases the risk of getting HPV			
q) HPV can cause anal cancer			

r) HPV is a bacterial infection			
s) HPV can be transmitted through oral sex			
t) HPV can cause cancer of the penis			
u) HPV can cause herpes			
v) HPV can be transmitted through anal sex			
w) HPV infections always lead to health problems			
x) HPV can cause oral cancer			
y) A person with no symptoms cannot transmit the HPV infection			

N29:

Please answer the following questions to the best of your ability:			
	True 1	**False 2**	**Don't know 8**
a) The HPV vaccine requires only 1 dose			
b) The HPV vaccines offer protection against all sexually transmitted infections			
c) The HPV vaccines are most effective if given to people who've never had sex			
d) Someone who has had the HPV vaccine cannot develop cervical cancer			
e) The HPV vaccines offer protection against most cervical cancers			
f) One of the HPV vaccines offers protection against genital warts			
g) Girls who have had the HPV vaccine do not need a Pap test (cervical cancer screening) when they are older			
h) The HPV vaccine protects you from every type of HPV			
i) You can cure HPV by getting the HPV vaccine			
*j) The HPV vaccine is approved and recommended by Health Canada for **females** aged 9-45 years*			
*k) The HPV vaccine is approved and recommended by Health Canada for **males** aged 9-26 years*			

N30:

About how much do you think 1 dose of the HPV vaccine costs without any insurance or government coverage?

Less than $50 1
$50 - $150 2
$151 - $250 3
$251 - $350 4
More than $350 5
I don't know 8

N30X:

Please read carefully the following information about HPV.
The Human Papillomavirus (HPV) is the most common sexually transmitted infection.

HPV can cause genital warts. HPV can also cause cancers of the cervix, penis, anus, vagina, vulva and oral cancers. There are HPV vaccines available that are sometimes referred to as the cervical cancer vaccine, Gardasil®, or Cervarix®. The HPV vaccine is approved for boys aged 9-26 years.

Across Canada, there are currently programs in schools where GIRLS receive the HPV vaccine for free. At the present time, there are NO free school programs for BOYS. With exception, the province of Prince Edward Island has been giving the HPV vaccine in school to boys in grade 5 only, since September 2013. The province of Alberta will begin giving the HPV vaccine to boys in grade 6 only as of the 2014-2015 school year. Those parents, other than parents of grade 5 boys in PEI and parents of grade 6 boys in Alberta, who wish to vaccinate their son would need to **pay for the HPV vaccine**.
continue..... 1

If Q24N = 6

N30XX:

You had indicated that your son was vaccinated with the HPV vaccine. Given that there are no school programs (with the exception of PEI (grade 5 boys only) and Alberta (grade 6 boys only), are you sure that your son <Q18> was vaccinated with the HPV vaccine?
Yes 1
No 2

If Q30XX = 2

N24X:

Please correct your answer to this question. At this moment, which of the following best describes your thoughts about the HPV vaccine concerning <Q18>?
(Select only one)
I am **unaware** that the HPV vaccine could be given to males 1
I am **aware** that the HPV vaccine can be given to males, but I have not thought about getting the HPV vaccine for <Q18> 2
I have thought about getting the HPV vaccine for <Q18>, but I am **undecided** about getting the HPV vaccine for him 3
I have decided I do **NOT** want <Q18> to get the HPV vaccine..... 4
I have decided I **DO** want <Q18> to get the HPV vaccine 5

N24X replaces PAPM stage for N24N for those who were re-asked PAPM stage
.....

SEC4:

The following sections will present a series of statements about HPV and the HPV vaccine. We wish to know your opinion. Please note that we are not testing your knowledge. If you do not know an answer, that's alright, simply select the answer that most reflects your opinion.
continue..... 1

N31:

For each statement, please indicate how much you disagree or agree by selecting the appropriate number:							
	Strongly Disagre 1	***Disagree 2***	***Somewhat Disagre 3***	***Neutral 4***	***Somewhat Agree 5***	***Agree 6***	***Strongly Agree 7***
a) I feel that the HPV vaccine has many benefits.							
b) I feel that the HPV vaccine will protect my son's sexual health.							
c) I feel that the HPV vaccine works well.							
d) I feel that the HPV vaccine is effective in preventing HPV.							
e) I feel that the HPV vaccine is effective in preventing genital warts.							
f**)** I feel that vaccinating <Q18> against HPV may be a good thing to do for his health.							
g) **If N24= 6**, I feel that vaccinating <Q18> against HPV was a good thing to do for his health.							
h) I feel that vaccinating <Q18> against HPV would give me peace of mind about his sexual health.							
i) **If N24= 6,** I feel that having vaccinated <Q18> against HPV gives me peace of mind about his sexual health.							
j) I feel that the HPV vaccine is effective in preventing HPV-related cancers.							
k) I feel that vaccinating <Q18> against HPV would protect his current/future partner from getting infected with HPV.							
*l) **If N24= 6**, I feel that having vaccinated <Q18> against HPV protects his current/future partner from getting infected.*							

m**)** I feel that getting <Q18> the HPV vaccine would protect his current/future partner against cancer.							
n) **If N24= 6,** I feel that having gotten <Q18> the HPV vaccine protects his current/future partner against cancer.							
o) I feel that it would be serious if <Q18> contracted HPV later in life.							
p) I feel that it would be serious if <Q18> contracted genital warts later in life.							
q) I feel that it would be serious if <Q18> contracted an HPV-related cancer later in life.							

N32A:

For each statement, please indicate how much you disagree or agree by selecting the appropriate number:							
	Strongly Disagre 1	***Disagree 2***	***Somewhat Disagre 3***	***Neutral 4***	***Somewhat Agree 5***	***Agree 6***	***Strongly Agree 7***
a) I feel that other parents in my community are getting their sons the HPV vaccine.							
b) I feel that my friends are getting their sons vaccinated with the HPV vaccine.							
c) I feel that other boys around <Q18>'s age are getting vaccinated for HPV.							
d) I feel that it is expected of me that I should vaccinate <Q18> against HPV.							
e) ***If N24 = 6, this would read:*** *I feel that it was expected of me that I should vaccinate <Q18> against HPV.*							
f) ***I*** *feel that most of my friends think vaccinating <Q18> against HPV is a good idea.*							
g) ***If N24 = 6, this would read:*** *I feel that most of my friends think vaccinating <Q18> against HPV was a good idea.*							

h) I feel that doctors/health care providers believe vaccinating boys against HPV is a good idea.							
i) I feel that my son's other parent believes we should get the HPV vaccine for <Q18>							
*j) **If N24 = 6, this would read:** I feel that my son's other parent believes in having gotten the HPV vaccine for <Q18>.*							
*k**)** I feel that my family thinks it is a good idea to vaccinate <Q18> against HP.*							
*l) **If N24 = 6, this would read:** I feel that my family thinks it was a good idea to vaccinate <Q18> against HPV*							
m) I feel that the government believes parents should vaccinate their sons against HPV.							
n) I feel that experts are in favour of vaccinating boys against HPV.							
o) I feel that scientists believe it is a good idea to vaccinate boys against HPV.							

N33:

For each statement, please indicate how much you disagree or agree by selecting the appropriate number:							
	Strongly Disagre 1	***Disagree 2***	***Somewhat Disagre 3***	***Neutral 4***	***Somewhat Agree 5***	***Agree 6***	***Strongly Agree 7***
a) The opinion of doctors/health care providers about getting the HPV vaccine for my son matters to me.							
b) My son's other parent's opinion about getting the HPV vaccine for <Q18> is important to me.							
c) The opinion of friends about whether I should get the HPV vaccine for <Q18> matters to me.							
*d) **If N24 = 6, this would read:** The opinion of friends about getting the HPV vaccine for <Q18> matters to me*							

e) The opinion of my family about whether I should get the HPV vaccine for <Q18> matters to me.							
*f) **If N24 = 6, this would read**: The opinion of my family about getting <Q18> the HPV vaccine matters to me.*							
g) I trust the government's opinion concerning the HPV vaccine for <Q18>.							
i) I have never met anyone younger than I am.							
j) Everyone makes mistakes at least once in a while							
k) I trust scientific evidence concerning the HPV vaccine.							

N34:

For each statement, please indicate how much you disagree or agree by selecting the appropriate number:							
	Strongly Disagre 1	***Disagree 2***	***Somewhat Disagre 3***	***Neutral 4***	***Somewhat Agree 5***	***Agree 6***	***Strongly Agree 7***
a) I feel that the HPV vaccine is unsafe							
b) I feel that the HPV vaccine might cause short term side effects like pain or discomfort.							
c) I feel that the HPV vaccine is being pushed to make money for pharmaceutical companies.							
d)I feel that giving <Q18> the HPV vaccine would be like performing an experiment on him.							
*e) **If N24 = 6, this would read:** I feel that giving <Q18> the HPV vaccine was like performing an experiment on him.*							
f) I feel that the HPV vaccine would encourage <Q18> to have sex at an earlier age.							
g) I feel that vaccinating <Q18> for HPV would send a message that he would not have to use safe sex							

practices.							
h) ***If N24 = 6, this would read:*** *I feel that vaccinating <Q18> for HPV sent a message that he would not have to use safe sex practices.*							
i) I feel that the HPV vaccine may lead to long-term health problems.							
j) I feel that the HPV vaccine may affect <Q18>'s fertility.							
k) I feel that without the HPV vaccine, <Q18> would be at risk of getting HPV later in life.							
l) I feel that without the HPV vaccine, <Q18> would be at risk of getting genital warts later in life.							
m) I feel that without the HPV vaccine, <Q18> would be at risk of getting an HPV-related cancer later in life.							
n) I feel the HPV vaccine is unpleasant for my son to receive.							
o) I feel that vaccinating <Q18> for HPV would help him understand the risks of sexually transmitted infections.							
p) I feel that vaccinating <Q18> for HPV would help him understand why it is important to have safe sex.							

N350:

For each statement, please indicate how much you disagree or agree by selecting the appropriate number:							
	Strongly Disagre 1	***Disagree 2***	***Somewhat Disagre 3***	***Neutral 4***	***Somewhat Agree 5***	***Agree 6***	***Strongly Agree 7***
a) I feel that getting the HPV vaccine for <Q18> would take too much effort.							
b) ***If N24 = 6, this would read:*** *I feel that getting the HPV vaccine for <Q18> took too much effort.*							
c) I feel that it is hard to find a clinic that would be easy to access for getting the HPV vaccine for <Q18>.							
d) ***If N24 = 6, this would read:*** *I feel that it was hard to find a clinic that was easy to access for getting the HPV vaccine for <Q18>.*							
e) I feel that it is hard to find a provider or clinic where I would not have to wait a long time to get an appointment for <Q18> to get vaccinated.							
f) ***If N24 = 6, this would read:*** *I feel that it was hard to find a provider or clinic where I didn't have to wait a long time to get an appointment for <Q18> to get vaccinated.*							
g) I feel that the HPV vaccine is too expensive							
h) ***If N24 = 6, this would read:*** *I feel that the HPV vaccine was too expensive.*							
i) I feel that my/our insurance does not cover enough of the cost of the HPV vaccine for <Q18>.							
j) ***If N24 = 6, this would***							

read: *I feel that my/our insurance did not cover enough of the cost of the HPV vaccine for <Q18>.*							
k) I feel that the HPV vaccine costs more than I can afford.							
l) ***If N24 = 6, this would read****: I feel that the HPV vaccine cost more than I could afford.*							
m) I feel that the HPV vaccine is too new.							
n) I feel that I do not have enough information about the HPV vaccine.							
n) I feel that I do not have enough knowledge about the HPV vaccine.							

N3515:

For each statement, please indicate how much you disagree or agree by selecting the appropriate number:							
	Strongly Disagre 1	***Disagree 2***	***Somewhat Disagre 3***	***Neutral 4***	***Somewhat Agree 5***	***Agree 6***	***Strongly Agree 7***
a) I feel that there has not been enough research done on the HPV vaccine.							
b) I feel that it is hard to talk to <Q18> about his sexual health.							
c) I feel that I am uncomfortable discussing <Q18>'s sexual health with a doctor/health care provider.							
d) I feel that sex is not a subject I talk about with <Q18>.							
e) I feel that I am uncomfortable talking to <Q18> about the HPV vaccine.							
f) I feel that I do not know how to approach the topic of the HPV							

vaccine with <Q18>.							
g) I feel that I am confident in my ability to get the HPV vaccine for <Q18>.							
*h) **If N24 = 6, this would read:** I feel that I was confident in my ability to get the HPV vaccine for <Q18>.*							
i) I feel that dealing with getting the HPV vaccine for <Q18> would be simple.							
*j) **If N24 = 6, this would read:** I feel that dealing with getting the HPV vaccine for <Q18> was simple.*							
k) I feel that the process of actually getting the HPV vaccine for <Q18> would be easy.							
*l) **If N24= 6, this would read:** I feel that the process of actually getting the HPV vaccine for <Q18> was easy.*							
m) I feel that the HPV vaccine requires too many doses.							
*n) **If N24 = 6, this would read:** I feel that the HPV vaccine required too many doses.*							
o) I do not understand a word of English.							
p) I am using a computer currently.							

N36A:

For each statement, please indicate how much you disagree or agree by selecting the appropriate number:							
	Strongly Disagre 1	***Disagree 2***	***Somewhat Disagre 3***	***Neutral 4***	***Somewhat Agree 5***	***Agree 6***	***Strongly Agree 7***
a) I feel that vaccines are a good way to protect public health.							
b) I feel that vaccinating							

children is a good idea.							
c) I do not like the idea of vaccines.							
d) I feel that doctors give out too many vaccines.							
e) I have never met anyone younger than I am.							
f) Everyone makes mistakes at least once in a while.							
g) I feel that my child is too young to receive the HPV vaccine.							
h) ***If N24 = 6, this would read:*** *I feel that my child was too young to receive the HPV vaccine.*							
i) I have been to every country in the world.							
j) ***If N24 = 6, this would read:*** *I regret getting the HPV vaccine for <Q18>.*							
k) I am answering these questions truthfully.							

N37:

Where have you heard that the HPV vaccine could be given to **<u>males</u>** (other than this survey and the survey you completed in February)?

(Check all that apply.)

I have not heard that the HPV vaccine could be given to males 01
Public health brochures, pamphlets, flyers or posters 02
Commercials or advertisements from pharmaceutical companies 03
Doctor, nurse, or other health care provider 04
Family member(s) 05
Friend, peer or co-worker 06
Information from my child or children's school 07
Newspapers or magazines 08
TV or the radio 09
The Internet (e.g., health related websites, news, Facebook/Twitter) 10
<Q18> 90
Other source 96

N38:

Where have you heard about the HPV vaccine **in general** (other than this survey and the survey you completed in February)?

(Check all that apply.)

I have not heard about the HPV vaccine 01
Public health brochures, pamphlets, flyers or posters 02
Commercials or advertisements from pharmaceutical companies 03
Doctor, nurse, or other health care provider 04
Family member(s) 05
Friend, peer or co-worker 06
Information from my child or children's school 07
Newspapers or magazines 08
TV or the radio 09
The Internet (e.g., health related websites, news, Facebook/Twitter) 10
<Q18> 90
Other source 96

N39:

What you heard about the HPV vaccine in the media (e.g., internet, newspaper, TV, etc.) has been:

I have not heard about the HPV vaccine in the media 1
Mostly in favour of the HPV vaccine 2
Somewhat in favour of the HPV vaccine 3
Neither in favour nor against the HPV vaccine (neutral) 4
Somewhat against the HPV vaccine 5
Mostly against the HPV vaccine 6

N40A:

From which sources would you **prefer** to receive information about the HPV vaccine? Which is your **most** preferred source?

Public health brochures, pamphlets, flyers or posters 01
Commercials or advertisements from pharmaceutical companies 02
Doctor, nurse, or other health care provider 03
Family member(s) 04
Friend, peer or co-worker 05
Information from my child or children's school 06
Newspapers or magazines 07
TV or the radio 08
The Internet (e.g., health related websites, news, Facebook/Twitter) 09
Other source 96

N40B:

From which sources would you prefer to receive information about the HPV vaccine? Which is your **second most** preferred source?

eliminate -> 9 .....
according to Q40A .....
Public health brochures, pamphlets, flyers or posters 01
Commercials or advertisements from pharmaceutical companies 02
Doctor, nurse, or other health care provider 03
Family member(s) 04
Friend, peer or co-worker 05
Information from my child or children's school 06
Newspapers or magazines 07
TV or the radio 08
The Internet (e.g., health related websites, news, Facebook/Twitter) 09
Other source 96

N40C:

From which sources would you prefer to receive information about the HPV vaccine? Which is your **third most** preferred source?

eliminate -> 9 .....
according to Q40A Q40B .....
Public health brochures, pamphlets, flyers or posters 01
Commercials or advertisements from pharmaceutical companies 02
Doctor, nurse, or other health care provider 03
Family member(s) 04
Friend, peer or co-worker 05
Information from my child or children's school 06
Newspapers or magazines 07
TV or the radio 08
The Internet (e.g., health related websites, news, Facebook/Twitter) 09
Other source 96

N41:

Since February (the time you completed the first survey), have you talked with a doctor/health care provider about the HPV vaccine for <Q18>?

No 01
Yes, and he/she recommended that <Q18> get the HPV vaccine 02
Yes, and he/she had no opinion about the HPV vaccine for <Q18> 03
Yes, and he/she recommended against <Q18> getting the HPV vaccine..... 04
Yes, but he/she recommended to wait until he's older before giving <Q18> the HPV vaccine....05
Other, please specify: ..... 96 Open ended response provided

N41X:

If Q41 = 02, 03, 04, 05

Please rate the strength of the recommendation you received.

Very weak 01
Weak 02
Neither weak or strong 03
Strong 04
Very strong 05

N42:

Who normally makes <Q18>'s healthcare decisions?
(**Check all that apply.)**

Mother/female guardian 01
Father/male guardian 02
Joint decision between parents/guardians 03
<Q18> 90
Other 96

N43:

Has <Q18> gone for a routine medical check-up with a doctor/health care provider in the last year?

Yes 1
No 2
I don't know 8

N44:

Has <Q18> received all the recommended childhood vaccines?

Yes 1
No 2
I don't know 8

N45:

How do you pay for <Q18>'s prescription drugs?

Provincial/public insurance (e.g., Medicare, OHIP, etc.) 01
<Q18> is covered by my private or corporate health insurance plan .. 02
<Q18> is covered by his other parent's private or corporate health insurance plan……03
<Q18> does not have any health insurance coverage 04
Other, please specify: 96
I don't know 98

N47:

Including <Q18>, how many sons between the ages of 9 and 26 do you have? _____

N48:

If N47 = 1 or more
Including <Q18>, how many of your sons between the ages of 9 and 26 have received the HPV vaccine? _____

IF N48 >N47→ Participant was prompted. **You cannot enter more than the number of sons you have. Please verify your response and try again.**
If N24 =6 and N48=0 → Participant was prompted. **You previously indicated that <Q18> was vaccinated. Please verify your response and try again.**

N49:

How many daughters between the ages of 9 and 26 do you have? _____

N50:

If N49>=1
How many of your daughters between the ages of 9 and 26 have received the HPV vaccine? _____

IF N49 >N50→ Participant was prompted. **You cannot enter more than the number of daughters you have. Please verify your response and try again.**

N51:

Have you ever been told that you have a sexually transmitted infection or disease (e.g., HPV, chlamydia, genital herpes, syphilis, etc.)?
Yes 1
No 2
I don't know 8
I prefer not to answer 9

N53:

Has a member of your family ever been diagnosed with cancer?
Yes 1
No 2
I don't know 8

N54:

Do you think other children/teenagers around <Q18> have been sexually active (including oral sex and/or genital contact)?
Yes 1
No 2
I don't know 8

N55:

Do you think <Q18> has been sexually active (including oral sex and/or genital contact)?

Yes 1
No 2
I don't know 8
I prefer not to answer 9

N56:

How much have you talked with <Q18> about sex?

Not at all 1
A little bit 2
A moderate amount 3
A lot 4

N57:

How much have you talked with <Q18> about the HPV vaccine?

Not at all 1
A little bit 2
A moderate amount 3
A lot 4

N58:

If Q57 = 2, 3, 4

When talking to <Q18> about the HPV vaccine, this was about.
(Check all that apply.)

<Q18> getting the HPV vaccine 01
Girls getting the HPV vaccine 02
Sex and other topics of a sexual nature 03
Benefits of the HPV vaccine 04
Risks and side effects of the HPV vaccine 05
Sexually transmitted infections and/or diseases (STIs/STDs) 06
Boys getting the HPV vaccine 07
Other, please specify: ..... 96 O

N59:

If Q38 = 06

When you talked to friends, peers or co-workers about the HPV vaccine, this was about.
(**Check all that apply.)**

Boys getting the HPV vaccine 01
Girls getting the HPV vaccine 02
Sex and other topics of a sexual nature 03
Benefits of the HPV vaccine 04
Risks and side effects of the HPV vaccine 05
Sexually transmitted infections and/or diseases (STIs/STDs) 06
<Q18> getting the HPV vaccine 07
Other 96

N60:

Has <Q18> ever mentioned to you that he would like to get the HPV vaccine?
Yes 1
No 2

N61:

1How involved do you feel **<Q18>** should be in the decision to get him the HPV vaccine?
2 **If N24= 4,5,6 this would read** How involved was **<Q18>** in the decision to get him the HPV vaccine?

Not at all involved 1
A little involved 2
Moderately involved 3
Very involved 4
Extremely involved 5

N62:

1. How involved do you feel **you** should be in the decision to get <Q18> the HPV vaccine?
2. **If N24= 4,5,6 this would read** How involved were **you** in the decision to get <Q18> the HPV vaccine?

Not at all involved 1
A little involved 2
Moderately involved 3
Very involved 4
Extremely involved 5

N63:

1. How involved do you feel **your son's other parent** should be in the decision to get <Q18> the HPV vaccine?
2. **If N24= 4,5,6 this would read** How involved was your partner/spouse in the decision to get <Q18> the HPV vaccine?

Not at all involved 1
A little involved 2
Moderately involved 3
Very involved 4
Extremely involved 5
Not applicable, I am the only parent involved in decisions for my son .. 7

N64:

Please indicate how willing you would be to get all the HPV vaccine doses for <Q18> if…					
	Extremely Unwilling	**Somewhat Unwilling**	**Neutral**	**Somewhat Willing**	**Extremely Unwilling**
*a) … vaccinating <Q18> against HPV would be **free**?*	**1**	**2**	**3**	**4**	**5**
***b)** … vaccinating <Q18> against HPV would cost **100$**? from your own money, without any insurance or government coverage)*					
***c)** … vaccinating <Q18> against HPV would cost **200$**? from your own money, without any insurance or government coverage)*					
***d)** … vaccinating <Q18> against HPV would cost **300$**? from your own money, without any insurance or government coverage)*					

N65:

You indicated that you decided you **DO** want <Q18> to get the HPV vaccine. Which of the following best describes your thoughts?
If N24 = 5

I plan on getting <Q18> his first HPV vaccine dose within the next 3 months……. 1
.....
I plan on getting <Q18> his first HPV vaccine dose within the next 3-6 months…. 2
.....
I plan on getting <Q18> his first HPV vaccine dose within the next 6-12 months. 3
.....
I plan on getting <Q18> his first HPV vaccine dose in more than 12 months……. 4
.....
I do not know when I plan on getting <Q18> the HPV vaccine. 8

N66:

I have taken the following actions since deciding that <Q18> will get the HPV vaccine:
(Check all that apply.)
IF N24 = 5

I contacted a health care provider to ask questions 01
I have scheduled an appointment with a doctor/health care provider for <Q18> to receive the HPV vaccine ….02
I phoned my insurance company to see if they cover any of the costs of the HPV vaccine…… 03
.....
I set aside money to pay for the HPV vaccine 04
I planned how <Q18> will get to his HPV vaccine appointment..... 05
I have not made any plans to initiate <Q18>'s HPV vaccination 06
I have taken other steps/made other plans. Please specify:..... 96

N67:

You indicated that <Q18> has received only 1 dose of the HPV vaccine. Are you planning to get him the remaining dose(s)?
IF N24 = 6 AND N25 = 1

Yes 1
No 2
I don't know..... 8

N68:

You indicated that you are planning to get <Q18> his second dose of the HPV vaccine.
Which of the following best describes your thoughts?
IF N67 = 1

I plan on getting <Q18> his second HPV vaccine dose within the next 3 months..... 1
I plan on getting <Q18> his second HPV vaccine dose within the next 3-6 months..... 2
I plan on getting <Q18> his second HPV vaccine dose within the next 6-12 months. 3
I plan on getting <Q18> his second HPV vaccine dose in more than 12 months..... 4
I do not know when I plan on getting <Q18> his second dose. 8

N69:

1. What factors would influence your decision to have <Q18> vaccinated or not against HPV?

.....
.....
.....

IF (N24 = 4, 5, 6), 2, 1

2. What factors influenced your decision to have <Q18> vaccinated or not against HPV?2

.....
.....
.....

N70X:

In February you indicated that "<Q24>". Now, you indicated that <N24>. What occurred since February that changed your opinion concerning the HPV vaccine for <Q18>?

.....
.....

This information was carried forward from T1 to match what they had specified in Q24. Asked to all participants if they changed stages from T1 and T2. This item was not asked if Q24=N24.

N72N:

You indicated in February that you were planning the following actions. Which one(s) have you done since then? **(Check all that apply.)**

[This information was carried forward from T1 to match what they had specified in Q72. If N72 = 97 OR N72 =0, then item was not asked]

.....

I am not likely to take any actions 97
Search for information about HPV and/or the HPV vaccine on the internet….02
Search for information about HPV and/or the HPV vaccine in written sources (e.g., brochures, books, magazines, etc.)..... 03
Talk to your friends about HPV and/or the HPV vaccine 04
Talk to your family about HPV and/or the HPV vaccine 05
Talk to your spouse/partner about HPV and/or the HPV vaccine 06
Talk to your doctor/health care provider about HPV and/or the HPV vaccine…… 07
Talk to your son about HPV and/or the HPV vaccine 08
Set aside money to pay for the HPV vaccine 09
Contact your insurance company to see if they cover any of the costs of the HPV vaccine…….10
<Q72:Open ended response>..... 96
None 99

N73:

For each statement, please indicate how much you disagree or agree by selecting the appropriate number:							
	Strongly Disagre 1	***Disagree 2***	***Somewhat Disagre 3***	***Neutral 4***	***Somewhat Agree 5***	***Agree 6***	***Strongly Agree 7***
a) Many diseases, said to have been eradicated by vaccines, are still around today.							
b) Vaccine safety data is often fabricated.							
c) Immunizing children is harmful and this fact is covered up.							
d) Pharmaceutical companies cover up the dangers of vaccines.							
e) People are deceived about vaccine efficacy.							
f) Vaccines are not harmful.							
g) Vaccine efficacy data is often fabricated.							
h) People are deceived about vaccine safety.							
i) The government is trying to cover up the link between vaccines and autism.							

N74:

For each statement, please indicate how much you disagree or agree by selecting the appropriate number:							
	Strongly disagree 1	**Disagree 2**	**Somewhat Disagree 3**	**Neutral 4**	**Somewhat Agree 5**	**Agree 6**	**Strongly Agree 7**
a) It is always better to trust the judgment of the proper authorities in government and religion than to listen to the noisy rabble-rousers in our society who are trying to create doubts in people's minds.							
b) It's better to have trashy magazines and radical pamphlets in our communities than to let the government have the power to censor them.							
c) What our country needs most is discipline, with everyone following our leader in unity.							
d) Gays and lesbians are just as healthy and moral as anybody else.							
e) Everyone should have their own lifestyle, religious beliefs, and sexual preferences, even if it makes them different from everyone else.							
f) People should pay less attention to the Bible and other old traditional forms of religious guidance, and instead develop their own personal standards of what is moral and immoral.							
g) There is nothing wrong with premarital sexual intercourse.							

N75A:

For each statement, please indicate how much you disagree or agree by selecting the appropriate number:							
	Strongly disagree 1	**Disagree 2**	**Somewhat Disagree 3**	**Neutral 4**	**Somewhat Agree 5**	**Agree 6**	**Strongly Agree 7**
Parents who don't vaccinate their children with the HPV vaccine are putting my child at risk							
Parents who don't vaccinate their children with the HPV vaccine are putting their child at risk							

N76A:

How likely do you think that each of these statements is true? I think that…

… many very important things happen in the world, which the public is never informed about

Certainly not (0%) 00
Extremely unlikely (10%) 10
Very unlikely (20%) 20
Unlikely (30%) 30
Somewhat unlikely (40%) 40
Undecided (50%) 50
Somewhat likely (60%) 60
Likely (70%) 70
Very likely (80%) 80
Extremely likely (90%) 90
Certain (100%) 100

N76B:

How likely do you think that each of these statements is true? I think that…

… politicians usually do not tell us the true motives for their decisions

Certainly not (0%) 00
Extremely unlikely (10%) 10
Very unlikely (20%) 20
Unlikely (30%) 30
Somewhat unlikely (40%) 40
Undecided (50%) 50
Somewhat likely (60%) 60
Likely (70%) 70
Very likely (80%) 80
Extremely likely (90%) 90
Certain (100%) 100

N76C:

How likely do you think that each of these statements is true? I think that…

… government agencies closely monitor all citizens

Certainly not (0%) 00
Extremely unlikely (10%) 10
Very unlikely (20%) 20
Unlikely (30%) 30
Somewhat unlikely (40%) 40
Undecided (50%) 50
Somewhat likely (60%) 60
Likely (70%) 70
Very likely (80%) 80
Extremely likely (90%) 90
Certain (100%) 100

N76D:

How likely do you think that each of these statements is true? I think that…

… events which superficially seem to lack a connection are often the result of secret activities

Certainly not (0%) 00
Extremely unlikely (10%) 10
Very unlikely (20%) 20
Unlikely (30%) 30
Somewhat unlikely (40%) 40
Undecided (50%) 50
Somewhat likely (60%) 60
Likely (70%) 70
Very likely (80%) 80
Extremely likely (90%) 90
Certain (100%) 100

N76E:

How likely do you think that each of these statements is true? I think that…

… that there are secret organizations that greatly influence political decisions

Certainly not (0%) 00
Extremely unlikely (10%) 10
Very unlikely (20%) 20
Unlikely (30%) 30
Somewhat unlikely (40%) 40
Undecided (50%) 50
Somewhat likely (60%) 60
Likely (70%) 70
Very likely (80%) 80
Extremely likely (90%) 90
Certain (100%) 100

INT99:

Thank you for completing our survey. Your contribution to our research is greatly appreciated. The goal of this study is to understand the process through which parents decide to accept or refuse HPV vaccination for their sons. Included below are various credible resources regarding HPV vaccination in Canada that you may want to visit.

Great Explanation by Dr. Mike Evans: http://youtu.be/wQSTUIw8_1U
The Society of Obstetricians and Gynaecologists of Canada (SOGC): http://www.hpvinfo.ca/
The Public Health Agency of Canada: http://www.phac-aspc.gc.ca/std-mts/hpv-vph/hpv-vph-qaqr-eng.php

Province specific Websites
British Columbia: http://www.immunizebc.ca/diseases-vaccinations/hpv
http://www.immunizebc.ca/diseases-vaccinations/hpv/who-can-get-vaccine-free
Alberta: http://www.health.alberta.ca/health-info/imm-HPV.html
Saskatchewan: http://www.health.gov.sk.ca/hpv
Manitoba: http://www.gov.mb.ca/health/publichealth/diseases/hpv.html
http://www.gov.mb.ca/health/publichealth/cdc/vaccineeligibility.html
Ontario: http://www.health.gov.on.ca/en/ms/hpv/
Quebec: http://www.msss.gouv.qc.ca/sujets/santepub/vaccination/index.php?aid=193
http://www.msss.gouv.qc.ca/sujets/santepub/vaccination/index.php?aid=106
New Brunswick: http://www2.gnb.ca/content/dam/gnb/Departments/h-s/pdf/en/HealthyPeople/hpv/HaveYourDaughterImmunizedAgainstHPV.pdf
Prince Edward Island: http://www.gov.pe.ca/health/immunizationschedule
Newfoundland: http://www.health.gov.nl.ca/health/publichealth/cdc/im_section3.pdf

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