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Self-reported barriers and facilitators to preventive human papillomavirus vaccination among adolescent girls and young women: A systematic review

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Key words: human papillomavirus, HPV, HPV vaccination, adolescence, young women, barrier, facilitator, HPV vaccine acceptability, self-report, systematic review, HPV vaccine uptake

Abstract

Objective: Widespread uptake of preventive HPV vaccination among target groups is an important public health goal. To evaluate barriers and facilitators to HPV vaccination, we conducted a systematic review of self-reported views of adolescent girls and young women.

Methods: Twenty-two studies including 8079 females aged 9-26 years in North America, published between 2008 and 2011 (representing studies conducted post vaccine availability) were included. Two reviewers performed all levels of screening and data abstraction in duplicate. We collated findings pertaining to vaccination barriers and facilitators, study characteristics, and study quality.

Results: Participants were mainly unvaccinated (70%) and sexually active. Twenty-one barriers to vaccination were identified. Cost was the most frequently reported barrier, followed by feelings that vaccination was unnecessary, and concerns regarding vaccine safety and side effects. Facilitators included perceived benefit of vaccination, health care provider recommendations, and social norms. Few studies specifically sought to isolate the views of adolescents, though not being sexually active was the most commonly reported barrier among this group.

Conclusion: Understanding factors which arbitrate in vaccination decisions among key target groups can improve the success of health promotion interventions. Additional studies of superior methodological quality are needed to produce reliable data to inform health promotion strategies.

Introduction

Human papillomavirus (HPV) causes cancer, pre-cancerous and benign disease, and is widespread in the population. Three out of every four women will become infected with HPV, most commonly shortly after first sexual contact. (Baseman and Koutsky, 2005; Moore et al., 2009; Sellors et al., 2003). A preventive HPV vaccine against four strains of HPV became available in many countries in the world in 2006. Thereafter, the National Advisory Committee on Immunization in Canada (NACI) and the Advisory Committee on Immunization Practices (ACIP) in the United States issued recommendations to advise that adolescent girls should receive the vaccine, prior to sexual debut, in order to prevent HPV-associated disease (Markowitz et al., 2007; National Advisory Committee on Immunization, 2007).

Notwithstanding these recommendations, HPV vaccine uptake has been poor in most jurisdictions in Canada and the United States even when available through publicly-funded programs. Though embedded in a complex social dynamic, the perspective of adolescent girls is an essential component of determining factors which have both prompted and precluded HPV vaccination. Academic reaction to vaccine controversy spawned a deluge of studies examining HPV vaccine acceptability among various groups. These studies have revealed a broad range of concerns including vaccine effectiveness, vaccine safety, and perceived disease risk (Brewer and Fazekas, 2007). To date, however, the vast majority of research has examined issues related to HPV vaccine acceptability from the perspective of parents, care providers, and policymakers. Literature examining vaccine acceptability from the viewpoint of intended recipients is lacking, particularly with respect to adolescents.

Identifying barriers and facilitators to HPV vaccination from the adolescent perspective is important. For public health, reducing HPV-associated disease burden in the population depends upon universal uptake among target adolescent groups (Heffernan et al., 2010; Kane, 2010; Sneller et al., 2008). For health policy, information may be obtained regarding optimal health promotion strategies which are accurately focused on gaps, ensure wise use of health care dollars, and have the greatest potential to translate into positive health outcomes. And, for

adolescents, it aims to acknowledge and address their needs more specifically which may, in turn, cultivate healthy behaviours commencing at an early and impressionable age.

Our objective was to systematically review the literature in order to draw together, summarize, and critically appraise the body of evidence that has examined self-reported barriers and facilitators to preventive HPV vaccination from the viewpoint of adolescent girls and young women in Canada and the United States.

Methods

Protocol

This systematic review was conducted as part of a MSc thesis by the first author. A systematic review protocol was compiled and reviewed by clinical and methodological experts. It is available from the first author upon request.

Eligibility criteria

Quantitative and qualitative studies examining self-reported barriers and facilitators to preventive HPV vaccination conducted among adolescent girls and young women (aged 9 to 26 years) were included. This age range was chosen because it encompasses the currently targeted population. Only studies conducted in Canada and the United States were included to obviate differences in culture, religion, population demographics, messaging in the media, and other nation-specific factors from different areas of the world. Studies written in English and conducted after June 2006 (to correspond with the date of licensure of the first available prophylactic HPV vaccine) were included. Only studies of self-reported barriers and facilitators were sought; those which identified correlations inferred from statistical associations with demographic features were excluded. Studies involving both vaccinated and unvaccinated participants were eligible.

Outcome measures

Primary outcome:

The primary outcome of the review was self-reported barriers and facilitators to preventive HPV vaccination among females 9-26 years of age. For quantitative analyses, this included barriers and facilitators found to be statistically significantly associated with vaccination intention or uptake, those identified as proportions of participants reporting a particular barrier or facilitator, or ranking of reported barriers and/or facilitators. For qualitative data, this included all barriers and facilitators reported by study participants. A barrier was defined as any factor reported by an intended vaccine recipient as being negatively associated with the likelihood of vaccination or vaccine uptake. Conversely, a facilitator was defined as a factor positively associated with vaccination likelihood or uptake.

Secondary outcome:

We also sought to explicitly determine what is known about barriers and facilitators to HPV vaccination from the perspective of adolescents, which is generally defined as the period commencing with puberty and ending when age 18 or 19 years is reached. As such, self-reported barriers and facilitators specifically reported by girls within the age range of 9-17 years formed the secondary outcome for the review. Examining this age group separately also more closely approximates one of the distinct target groups for preventive vaccination against HPV: 11-12 year old females in the United States, as recommended by ACIP; and 9-13 year old females in Canada, as recommended by NACI. Beyond these ages, catch-up vaccination is recommended by both advisory committees up to age 26 (Markowitz et al., 2007; National Advisory Committee on Immunization, 2007).

For studies which collected self-reported information and then analyzed the data for associations with vaccination intent or uptake, only correlations with attitudes or vaccination perceptions were considered. Outcomes based upon associations with demographics, behaviours, and HPV or HPV vaccine knowledge was excluded. The inclusion and exclusion criteria for the review are summarized in Appendix A.

Information sources and search

Electronic literature searches were conducted in MEDLINE, including In-Process and Other Non-Indexed Citations (1948 to April week 1 2011), EMBASE (1947 to 2011 April 13),

CINAHL, and PsycINFO (2002 to April, week 1, 2011). All search strategies were developed and executed by an experienced information specialist using relevant medical subject headings (or MeSH terms) and free-text terms identified from other reviews on HPV vaccine acceptability. The fully developed electronic search strategy for the Medline and EMBASE databases are presented in Appendix B. All other searches were customized for each database separately. The search was limited to the year 2006 onwards and to studies written in English. The electronic search was supplemented by searching the ProQuest Theses and Dissertations database, scanning the reference lists of included studies, and scanning the references of selected narrative reviews published in 2010 and 2011.

Study selection

Two reviewers performed all levels of screening in duplicate and reasons for exclusion were documented. Discrepancies were resolved by consensus or the involvement of a third reviewer. Study authors were contacted in several instances to determine eligibility for the review.

Data collection and data items

A data abstraction form was developed *a priori* and pilot-tested by two reviewers. Two reviewers then performed all data abstraction in duplicate. Authors were contacted regarding missing information, as necessary.

Data abstracted from each report included demographic characteristics pertaining to the participants in the study (e.g. age, ethnicity, relationship status, sexual history, education level), the study setting (e.g. country, university versus medical clinic), study details (study type, funding sources, sampling and data collection methods, theoretical framework), and the outcomes assessed (i.e. barriers and facilitators to vaccination). Study conclusions were also abstracted.

Methodological quality

The methodological quality of included studies was assessed using a 16-item scale developed and evaluated for appraising studies with diverse designs (Sirriyeh et al., 2012). The tool, based upon a 4-point scoring system for each item, permitted assessment of the overall quality of mixed qualitative and quantitative evidence using a unified set of criteria. Additional quality assessments were conducted to appraise the reliability and validity of the data pertaining to important outcomes reported in each of the studies. This involved evaluating the study-imposed limitations on self-reports of barriers and facilitators by respondents and correlation of outcomes with vaccination interest, acceptability, or intent versus actual uptake in each of the studies. Quality scoring and assessments were performed independently by two reviewers. Discrepancies were resolved through an iterative consensus approach and by consulting a methodologist when required.

Data synthesis

Descriptive synthesis of abstracted data was completed for all included studies with respect to study characteristics, study outcome results, and study quality. Heterogeneity among studies precluded meta-analysis.

Results

Literature search

A total of 1308 records were identified from the literature and screened (Figure). Of these, 123 potentially relevant full-text reports were obtained and reviewed, yielding 22 unique studies which met the inclusion criteria for the review: 19 of these were published articles, 1 was a report of data which otherwise met the inclusion criteria, and two were thesis dissertations. At the full-text level of screening, 97 articles were excluded because they did not examine vaccine acceptability among females aged 9-26 years ($n=34$), were not conducted in the US or Canada ($n=18$), did not provide relevant data ($n=21$), were conducted prior to the availability of the vaccine ($n=15$), and did not provide original data ($n=9$).

Study characteristics

Of the 22 unique studies, 21 were conducted in the United States, and one was conducted in Canada (Table 1). Nineteen were quantitative studies, one was a qualitative study, and two used mixed qualitative/quantitative methods. Twenty of the studies used questionnaires that were conducted in either paper format, over the telephone, or electronically and two studies used in-depth interviews conducted with each study participant individually. The earliest study began recruiting participants in October 2006 and the most recent study completed enrolment in the fall of 2009. Most of the studies (n=14) were designed to address multiple objectives in addition to addressing barriers and facilitators to vaccine uptake; such as knowledge, awareness, rates of uptake, sexual behaviour, education, and HPV prevalence. Nine of the studies were conducted in educational settings, eight were conducted in locations related to the provision of health care services, and in five studies participants were selected from among the general population.

Among the 22 studies, a total of 8079 adolescent girls and young women age 26 years or younger from diverse groups contributed their views (based upon the 21 studies that reported a sample number). In three cases, the studies also enrolled older women; however, outcome data were reported separately for participants 26 years of age or younger and thus satisfied our inclusion criteria for the review. Twelve studies involved mainly White participants and in five studies participants were primarily Black. Hispanics comprised the next most common race represented among studies. Collectively, from those studies which reported vaccination status (19), approximately 70% of the population of adolescent girls and young women were unvaccinated and 30% had received at least one dose of an HPV vaccine. Almost all participants were aware of HPV or the HPV vaccine, but this was only reported in nine of the studies. Based upon nine reports, more than half of the girls and young women were sexually active, except in one case where 71% of participants at a religiously conservative Lutheran university had never had vaginal intercourse. Some of the participants reported having a prior sexually transmitted infection, abnormal Pap smear tests, or prior HPV infection but this information was reported in few of the included studies.

Primary Outcome (adolescent girls and young women age 9-26 years)

A total of 21 barriers were reported among studies for the combined 9-26 year age range, seven were identified as statistically significant results from quantitative studies; 18 were

reported as proportions in quantitative studies; and 12 were identified from three qualitative investigations (Table 2). Cost was reported as a barrier in the highest number of studies (n=10). Feeling that the vaccine was not needed for various reasons, and concerns related to vaccine safety and potential side effects were the next most commonly reported barriers; each was reported in nine of the studies. Of the 11 different facilitators reported among studies, eight were identified as statistically significant results, seven as proportions from quantitative studies, and six from qualitative investigation. The most commonly reported facilitators were perceived benefit of the vaccine and receiving a recommendation from a health care provider, which were each reported in six of the studies. Social norms were the next most commonly reported facilitator, which was reported in five of the studies.

Secondary outcome (adolescent girls age 9-17 years)

From the three studies reporting results specifically for adolescent girls under the age of 18 years, 706 adolescent girls are represented (Table 3). A total of ten barriers and six facilitators were reported. All were reported from quantitative studies which reported proportions of girls who identified each barrier or facilitator to vaccination. Not being sexually active was the barrier reported by the highest proportion of girls (47% in the one study which identified this barrier). This was followed by a feeling of not being at risk, which was reported by 36% of girls in a different study. Two of the studies reported concerns about vaccine safety as a barrier (reported by 26% and 25% of adolescent girls in each of the studies, respectively).

Methodological quality

Twenty-one of the 22 included studies were evaluated for quality (Table 4 & Table 5), as one study only reported their results and not their methods. Among the evaluated studies, seven reported the application of a specific theoretical framework or constructs upon which to base their investigation. Eleven of the studies completely identified their objectives, and research setting. None of the studies were judged to have used a sample that was broadly representative of the target population. However, many were designed to address a specific subgroup of the target population, such as racially and ethnically diverse groups of adolescent girls and young women. The procedures used in collecting data were described in detail in 12 of the studies. However, the rationalization for the choice of data collection tools and the fit of the data collection method

with the stated research questions were judged as slight or moderate in almost all studies. The content of the data collection instruments was highly investigator driven in most instances and questioning primarily involved fixed responses and closed-ended questioning. Specific questions asked in the studies were only provided in seven of the reports. Three other reports provided some information about the questions used and two studies mentioned that the information was available from the authors upon request.

Among the studies there was not a great deal of evidence to suggest that investigators had attempted to assess the reliability and validity of the measurement tools used. Some of the studies mentioned that these assessments had been made in prior studies but details were not provided. None of the studies provided a complete justification for the choice of analytical methods in the context of the study's stated research questions. The fit between the analytical methods and study research questions was judged as moderate in most cases. There was some evidence of user involvement in the design of nine of the studies but this usually entailed the involvement of other experts in the field as opposed to the end users of the research who might be able to apply the results, such as public health personnel and policy-makers; the involvement of adolescent girls and young women themselves was uncommon. In some cases authors mentioned cognitive and field testing of data collection instruments but the population used for these assessments was not always clear.

Discussion

From the combined evidence for females from the ages of 9-26, participant self-reports revealed 22 barriers to HPV vaccination. Cost was most commonly identified and our findings indicate that when cost is a factor in vaccine access, it dominates as a barrier. This lends support to the implementation of publicly-funded vaccination programs for target groups. Still, it is important to also consider that cost concerns may be inflated by a lack of perceived value in receiving preventive HPV vaccination. In fact, feelings of not needing the vaccine predominated as the second most common barrier to vaccination. Young women frequently viewed themselves as not at risk of acquiring HPV or that the severity of HPV infection did not warrant vaccination. In particular, it seemed that young women tended to consider their present circumstances with respect to sexual activity and relationship status when contemplating vaccination. Sexually

inactive females tended to be less convinced by risk concerns compared to populations comprised of more sexually active young women, some with a history of sexually transmitted infections, who tended to accept vaccination due to a perception that they were at risk for HPV. This suggests that, young women need to perceive themselves at risk in order to view vaccination as personally valuable. Furthermore, educational initiatives should aim to improve awareness of HPV transmission and its associated health consequences, including pre-cancerous disease significance.

Our results also indicate that concerns about safety and side effects are deterrents to HPV vaccine uptake among young women. This again suggests that education is necessary for this target population, to reassure them that the vaccine is safe and that serious side effects are rare. Practical barriers were also revealed as an important obstacle to vaccination, such as the need to make health care appointments, arrange transportation, and remember to get all three vaccine doses; issues rarely exposed by earlier studies that used hypothetical ‘intention to vaccinate’ outcomes. Many of these factors appeared to be particularly relevant among ethnically diverse and low income populations. Barriers related to lack of knowledge and awareness about HPV, though less common as vaccination becomes more widespread, continue to exist and do arbitrate as important barriers when present.

Of the 11 facilitators of vaccination identified in our review, perceived benefit and health care provider recommendation were most commonly identified. Data related to the perceived benefits of vaccination came mostly from studies conducted among private school and university students. In other, more diverse populations, girls and young women tended to frame their attitudes toward vaccination mainly from personal experiences, such as an abnormal Pap test result, rather than from a perception of future or hypothetical benefits. One study in our review found that young women consider the cancer benefits of vaccination more important than anti-warts benefits (Watts et al., 2009).

Also evident from our findings is the important role health care providers play in the delivery of HPV vaccine messages. Yet while health care provider recommendations are of consistently identified importance in studies which examine this subject, their relative importance is not well understood as they have not typically been examined in the context of

other potential barriers and facilitators. It is also notable that health care provider influences can be both positive and negative. Doctor-related barriers such as missed opportunities to discuss vaccination, poor communication, and discouragement of vaccination were also identified in our review. One study revealed that health care provider messages are often not delivered in a way that is clearly and easily understood by young women (Bynum et al., 2009).

In order to gain a deeper understanding of aspects central to vaccination decisions among adolescents, the evidence compiled in our review was further distilled to yield a subset of 706, 9-17 year old girls from three studies. Among these adolescents, not believing there was a need for vaccination, either because of sexual inactivity or not believing they were at risk, formed the predominant obstacle to vaccination. Adolescent girls were most encouraged to seek vaccination if they received parental or health care provider endorsement. Furthermore, our findings reveal additional issues that may be primarily relevant to a younger population, such as fear of needles and social norms. Of note, our review did not find any qualitative studies conducted among adolescent girls aimed at eliciting their unprompted views.

A previously conducted systematic review by Brewer and Fazekas examined hypothetical HPV vaccine acceptability among adolescents, young adults, and parents. (Brewer and Fazekas, 2007). All studies were carried out prior to HPV vaccine availability. Their review identified perceived effectiveness of the vaccine and physician recommendations as key cues to action while barriers to acceptability included cost and the belief that vaccination would promote sexual activity. Despite some similarities with our findings, the validity of their findings is limited by the questionable relationship between vaccine acceptability and actual vaccine uptake, and also by the kaleidoscope of represented views with small numbers of adolescents. The concerns of adolescent girls are unique to their stage of life and warrant independent investigation. Although we limited our review to females 9-26 years of age, the tendency to merge populations of adolescents and adults in behavioural HPV research remained evident. Of the 22 included studies only three considered adolescents separately. Furthermore, we found that the number of studies that examined barriers and facilitators to HPV vaccination from the perspective of individuals other than adolescents themselves outnumbered adolescent studies by a factor of more than seven to one.

Taken altogether, our findings may have broad application to sectors such as public

health and policy-makers in terms of program development and intervention design. Whereas targeted approaches to intervention design will rely on an understanding of the salient mediating factors, such guidance is as yet scant from currently available evidence. Tailored interventions may be an optimal choice for a complex health intervention such as preventive HPV vaccination and the data brought together in our review have potential to be used to design tailored interventions that are amenable to adaptation as new research findings become available. Almost all of the studies in our review recommended age appropriate educational initiatives.

Study limitations and strengths

To our knowledge, this is the first systematic review to isolate the views of adolescent girls and young women with respect to the acceptability of preventive HPV vaccination. Acceptability data is required to provide information about how vaccination uptake may be improved among target groups. This is of particular importance, as the uptake of the HPV vaccine has been low in Canada and the United States. Previous reviews of vaccine acceptability have not addressed actual vaccine uptake nor have they isolated the views of intended vaccine recipients. Most describe vaccine acceptability at a time prior to vaccine approval, which might not reflect the opinions of adolescents and women after vaccine availability. Furthermore, previous reviews merge the views of parents, health care providers, and others, making it difficult to tease out the perspective of the target vaccine population. Our review focuses on the views of adolescent girls and young women and consequently contributes valuable information regarding the group primarily targeted for vaccination and for whom the greatest benefit is derived.

Notwithstanding the importance of the perspective of young females, we acknowledge the indispensable role that parents, health care providers, and others play in prompting vaccination and encourage the results of our systematic review to be considered in context with evidence related to the views of these influential others. Taken together, the collective data may provide guidance for the development of health promotion programs concerning HPV vaccination. Incorporating the views of adolescent girls and young women targeted for vaccination increases the likelihood that such programs will be successful.

There are several limitations in the included studies. From the evidence it is difficult to ascertain if the views of adolescents are truly reflected in the reported outcomes since the questioning in most instances was pre-established and to a large extent chosen by the investigators. There was very often no detail reported regarding questions asked or themes explored. More qualitative investigation is required to improve the breadth of our understanding of the salient issues. Only seven of the studies included in our review mentioned the application of a theoretical framework to underpin the research and even fewer justified their model selection or explained how the theory was used to inform the study design. The incomplete and suboptimal use of theory among studies limited our ability to ascribe superlative relevance to any one particular theory or construct to guide future research or program planning. In addition, most of the included studies had multiple aims and, in most cases, investigation of self-reported barriers and facilitators to vaccination decisions was not the primary outcome of interest. Often, only small subsets of the overall study population were the source of information about barriers and facilitators to vaccination among adolescent girls and young women. More studies specifically designed to address self-reported barriers and facilitators to HPV vaccination, particularly among adolescents, are necessary.

As we look to the future of preventive HPV vaccination we must consider that current initiatives to promote the vaccine among various catch-up populations will gradually dissipate, leaving us with an unchanging need to ensure vaccine uptake among adolescent girls. Our efforts will help young people transition into healthy adults who are not adversely impacted by numerous health-related consequences including those associated with HPV.

Conclusion

In our systematic review, we have aimed to place the viewpoint of the essential target group for preventive HPV vaccination at the centre of our inquiry into factors which arbitrate in their decisions. We have found that young women up to the age of 26 often feel that they do not need the HPV vaccine and that they view cost as an important barrier to vaccination. Safety and side effects are additional concerns. We found that young women are most encouraged to seek vaccination if they perceive a benefit to vaccination. And, while endorsement by influential others, such as parents and health care providers, appear to be important factors in prompting

vaccination, communication can sometimes be suboptimal or unclear. Furthermore, we found that adolescent girls do not perceive a need to get vaccinated until becoming sexually active. They commonly fear needles, want more information about vaccine safety and efficacy, and do consider parental approval important. Our results should be interpreted with caution, due to the limitations identified in the included studies.

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Conflict of Interest Statement

All authors have completed the Conflict of Interest Policy available on request from the corresponding author and declare that: (1) LR, MT, LH, & ACT did not receive any financial support for the submitted work; (2) LR, MT, & LH have no relationships with any companies that might have an interest in the submitted work in the previous 3 years, ACT was a consultant for GlaxoSmithKline Canada vaccine products, including their human papillomavirus vaccine from December 2003 until September 2011; (3) their spouses, partners, or children have no financial relationships that may be relevant to the submitted work; and (4) LR, MT, LH, & ACT have no non-financial interests that may be relevant to the submitted work.

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Figure Legend

Figure: PRISMA study flow diagram

Abbreviation: (n) number

ACCEPTED MANUSCRIPT

Table 1. Characteristics of included studies

First author, year	Study period	Study Design	Study setting	Sample Size	Characteristics of participants	Vaccination status	Age range (mean) in years	Funding
Kahn, 2008 (Kahn et al., 2008)	Oct 06 - May 07	QT	Hospital-based teen health centre, STD clinic affiliated with health department, obstetrics and gynaecology clinic in a community health centre	418 approached, 409 completed study	Low income young women, prior sexual contact, 62% Black, 29% White, 18% other, primarily unmarried, knowledge of HPV (mean score 40% on a 12 item scale), many had history of STD, abnormal Pap, and prior pregnancy	Primarily unvaccinated (5% had at least 1 dose, 0.2% had all 3 doses)	13-26 (18.7)	Charlotte R. Schmidlapp Women's Scholar Award
Lenahan, 2008 (Lenahan et al., 2008)	Jan - March 2007	QT	Hospital-based, outpatient obstetrics and gynaecology clinic	108 approached, 103 consent, 98 analyses only 13 < 26 yrs of age	Not reported for subgroup	NR	NR	NR
Gerend, 2008 (Gerend and Magloire, 2008)	Feb - March 2007	QT	Campuses of Florida State University and Florida Agricultural and Mechanical University	97 (64 were women, 60 were unvaccinated women)	Most were undergraduate students, Black (57%), White (32%), all were single (2/3 dating or in a committed relationship)	64 women in study: 4 were vaccinated, 60 were unvaccinated	18-26 (19.03)	NR
Bynum, 2009 (Bynum et al., 2009)	Jan-Apr 2007	M	Teen clinic in Columbia, South Carolina (urban)	73 completed questionnaire, 68 completed in-depth interview	Black (80%), most insured, most with high school education, most sexually active, 1/4 with past history of STI, 4% reported an HPV diagnosis	NR	14-20 (17.9)	NR
Allen, 2009 (Allen et al., 2009)	Feb - March 2007	QT	Private New England University	1897 consented, 1696 completed more than 50% of survey, final sample 1401	No prior history of cervical cancer or HPV, most White (78%), almost all had heard of HPV and the vaccine, almost half had never had a Pap test, most had never been diagnosed with an STI, almost half were currently sexually active	1226 unvaccinated (87%); 175 (13%) vaccinated	18-22 (NR)	NR

Costar, 2008 (Costar, 2008)	Spring 2007	M	University of Maryland, University of Maine, University of Massachusetts, Dartmouth, University of Virginia	251	75% White, two thirds sexually active, 94% with health insurance, low to moderate levels of knowledge about HPV (mean score 3.3/7) and the HPV vaccine (mean score 3.02/7)	Unvaccinated	18-24 (19.7)	NR
Jain, 2009 (Jain et al., 2009)	May - Aug 2007	QT	United States of America households	1102 for whole study; 168 for subgroup	Not reported for subgroup	Mostly unvaccinated (10% had initiated vaccination)	18-49 for whole study; subgroup 18-26	NR
Read, 2010 (Read et al., 2010)	Jan 07- June 08	QT	Urban, adolescent medicine clinic	175	Black 51%, Caribbean 39%, 76% in high school or less than a high school education; nearly half sexually active; most with more than 1 prior sexual partner, 27% reported ever having an STI, over half knew what HPV is	NR	13-21(NR); more than half were under 16	NR
Conroy, 2009 (Conroy et al., 2009)	June-Dec 2007	QT	Urban, hospital-based teen health centre	189	All with prior sexual contact mostly black low-income had received information about HPV and the vaccine previously in the baseline study majority insured most with history of prior STI	36% had initiated vaccination; 13% had completed vaccination;	13-26 (17.5)	NR
Grant, 2009 (Grant et al., 2009)	2007	DR	California households	NR	NR	Unvaccinated	18-26 (NR)	Many non-proprietary sources
Caskey, 2009 (Caskey et al., 2009)	Nov 2007	QT	United states of America households	2143_total____ (1011 completed questionnaire; 412 age 13-17 & 599 age 18-26)	Approximately half had less than high school education (due to age), mostly White (17%), Hispanic (13%), Black average household income most had heard of HPV and the vaccine	124 (30%) of girls age 13-17 had initiated vaccination; 57 (9%) of girls age 8-26 had initiated vaccination	13-26 (19.4)	Supported in part by an unrestricted pilot grant from the University of Chicago Program in Pharmaceutical Policy funded by the Merck Foundation

Rand, 2011 (Rand et al., 2011)	Mar 07-Apr 08	QT	5 urban and 4 suburban primary care practices in Monroe County New York	119 female adolescents age 15-17 (calculated based on info provided in report); total sample was 638 including both parents and adolescents	Mostly White; non-Hispanic; parental income >\$50 000; at least some parental college education; most had discussed HPV vaccine with a health care provider;	65% vaccinated (at least 1 dose)	15 -17 (subgroup of older adolescents)	Centers for Disease Control and Prevention
Mathur, 2010 (Mathur et al., 2010)	Aug 07-Feb 08	QT	Private all-girls high school and public co-educational high school in San Francisco	175 (100 at private school; 75 at public school)	Grade 9, 10, 11, and 12 students; Average HPV-related knowledge; 48% participated in the decision about receiving vaccination	37.8% vaccinated; 45.5% unvaccinated; 16.7% unsure if they had been vaccinated	Range NR; (16.1 for vaccinated girls; 15.7 for unvaccinated girls)	NR
Watts, 2009 (Watts et al., 2009)	Aug 07-Apr 08	QT	General medicine, gynaecology, or paediatric units at the Massachusetts General Hospital	91 vaccine eligible participants age 18-26 yrs (subgroup)	Not reported for subgroup	44% vaccinated among vaccine eligible population (18-26)	NR for subgroup	NR
Moore, 2010 (Moore et al., 2010)	Oct 07-May 08	QT	Waiting area for gynaecological care at university health services at the University of Kentucky	235 eligible; 209 analyzed	Mostly White (82%), Black (12%)	Unvaccinated	18-24 (20.7)	Supported in part by the William Gallion Family Foundation through the University of Kentucky's Markey Cancer Center
Licht, 2010 (Licht et al., 2010)	NR	QT	Two United States universities in New York State	406	All had previous knowledge of HPV; mostly White; some Asian, African American;	44% vaccinated; 56% unvaccinated	18-26 (NR)	NR
Zimet, 2010 (Zimet et al., 2010)	Apr-May 08	QT	United States of America households	185	80% White; mostly unmarried; most with good to excellent health status; most with at least some college education; all insured; almost all had heard of the HPV vaccine	Unvaccinated	19-26	Merck & Co

Hopfer, 2011 (Hopfer and Clippard, 2011)	Apr-May 08	QL	A large North-eastern University in the United States	36	90% White; almost all with insurance; 3/4 raised in suburban neighbourhoods; all had heard of the HPV vaccine; more than half sexually active; 81% accepting of vaccination	39% vaccinated; 61% unvaccinated	18-26 (20)	Grant support from the Centers for Disease Control and Prevention
Rosenthal, 2011 (Rosenthal et al., 2011)	Apr-May 08	QT	United States of America households	530	80% White; mostly unmarried; most with good to excellent health status; most with at least some college education; all insured	345 vaccinated with at least one dose (65%); 185 unvaccinated (35%)	19-26 (21.2 vaccinated group); (22.4 unvaccinated group)	NR (one author from Merck)
Dillard, 2010 (Dillard and Spear, 2011)	Fall 2008	QT	Penn State University	396	96% had heard of HPV; 98% had heard of the vaccine; 89% White;	53% vaccinated; 47% unvaccinated	18-24	NR
Janousek, 2011 (Janousek, 2011)	Fall 2009	QT	Religiously conservative Lutheran university in Nebraska	203	96.6% White; over half not dating; over half enrolled in a church work related major; 71% had never had vaginal sexual intercourse; good knowledge of HPV (80% had $\geq 7/10$ on knowledge questions) 66% not accepting of the vaccine; 85% with a high religiosity score	20.7% vaccinated; 79.3% unvaccinated	18-25 (NR)	NR
Bendik, 2011 (Bendik et al., 2011)	NR	QT	Large, South-eastern United States university	1975	90% White; 95% had heard of HPV; 2/3 never sexually active; mean HPV knowledge score was 6.85/10	37.7% vaccinated with at least one dose; 62.3% unvaccinated	18-23 (20)	Clemson University Calhoun Honours College Departmental Honours Grant and the Clemson University Department of Public Health Sciences Mary Lohr Fund

Abbreviations: QT quantitative, QL qualitative, M mixed, DR data report, STD sexually transmitted disease, STI sexually transmitted infection, HPV human papillomavirus, NR not reported.

Table 2. Self-reported barriers and facilitators to preventive HPV vaccination among adolescent girls and young women reported in studies in systematic review

First author, year	Supporting information
Facilitators (% participants who mentioned each facilitator or rank order)	
Lenehan, 2008 (Lenehan et al., 2008)	Ordered from most to least influential factor: doctor recommendation, no cost, 5 year efficacy, the need for 3 injections
Jain, 2009 (Jain et al., 2009)	Provider recommendation 90% (of the 49 females who were not aware of the vaccine)
Caskey, 2009 (Caskey et al., 2009)	Among unvaccinated participants: For total population: health provider recommendation (83%); parent recommendation (82%); cost covered (74%); if had past abnormal Pap test (79%); many close friends getting it (55%); For age 13-17 years: parent recommendation (89%); health provider recommendation 78%); past abnormal Pap test (78%); cost covered (68%); many close friends getting it (52%)
Rand, 2011 (Rand et al., 2011)	Among those vaccinated: doctor recommended it; preventing a serious and common disease (proportions NR)
Watts, 2009 (Watts et al., 2009)	Anti-cancer benefit 81%; anti-warts benefit 3%
Bendik, 2011 (Bendik et al., 2011)	Among those unvaccinated (what would motivate them most to receive the vaccine): doctor advises getting vaccinated (35.4%); a way to pay for the vaccine (19.5%); parental endorsement (16.4%); becoming sexually active (14%); start having sex with more partners (9.6%)
Barriers (% participants who mentioned each barrier or rank order)	
Lenehan, 2008 (Lenehan et al., 2008)	Cost became more of a barrier as the hypothetical cost of vaccination increased
Bynum, 2009 (Bynum et al., 2009)	Cost 34%; lack of transportation 22%; fear of vaccines 19%; social norms 19%; subjective norms 14%; feeling unable to talk to parent or caregiver 11%; fear of needles 9%; do not think it will work 4%; need for 3 doses 3%
Jain, 2009 (Jain et al., 2009)	No need because not sexually active 28%; not time to make an appointment 21%; no need because healthy or not at risk 20%; vaccine too new or might have side effects 11%; costs and insurance issues 7%; fear of needles 6%; already exposed to HPV 6%; not aware of HPV or the vaccine 2%
Read, 2010 (Read et al., 2010)	Do not know enough about the vaccine because the vaccine is too new (40%); belief that they were too young to think about or have sex (31.4%)
Conroy, 2009 (Conroy et al., 2009)	Among those who refused vaccination: concern about insurance coverage 13/15 (86.7%); Among unvaccinated: not returned to the clinic since the baseline visit 45%; returned to the clinic but not offered the vaccine 42%; concerns about safety and efficacy
Grant, 2009 (Grant et al., 2009)	Do not know enough about the vaccine (31%), worried about safety (7%), do not need the vaccine (19%), other (37%)
Caskey, 2009 (Caskey et al., 2009)	For total population: not sexually active (29%); concerns about vaccine safety (27%); cost (16%); unsure if vaccine works (14%); doctor doesn't think vaccine needed (5%); other (e.g. pregnant, married, already have HPV) (9%) For age 13-17 years: not sexually active (47%); safety concerns (26%); unsure if vaccine works (16%); other (13%); cost (10%); vaccine not available (2%); doctor doesn't think it's needed (1%)
Rand, 2011 (Rand et al., 2011)	Among those who refused vaccination: not at risk (36%); perception that vaccine had not been studied enough (21%); not wanting to receive a shot (11%); want to do more research to make an informed decision (5%)
Mathur, 2010 (Mathur et al., 2010)	Don't consider the vaccine safe (25% among those who participated in the decision; 8.5% among unvaccinated girls)
Watts, 2009 (Watts et al., 2009)	Cost (46%)
Zimet, 2010 (Zimet et	Being married or in a monogamous relationship (54.9%); vaccine too new (35.4%); not enough information about the vaccine (31.7%);

al., 2010)	concern about side effects (24.4%); unsure if cost would be covered by insurance (24.4%); can't afford cost (14.6%); pregnant or trying to conceive (11%); not sexually active (9.8%); doctor recommended against vaccination (4.9%)
Dillard, 2010 (Dillard and Spear, 2011)	Not enough research done to justify getting the vaccine (46%); not convinced vaccine is really effective (35%); not sexually active so don't need it (26%); cost (24%); not comfortable discussing the vaccine with parents (19%); don't trust pharmaceutical companies (18%); do not need vaccine because in a monogamous relationship (12%); make smart decisions about sex so not at risk (12%); not at risk because don't sleep around (9%); wouldn't be effective because already sexually active (3%)
Statistically significant facilitators	
Kahn, 2008 (Kahn et al., 2008)	With intention: normative beliefs, perceived severity of HPV-related disease With belief in one's ability: perceived severity of HPV infection
Gerend, 2008 (Gerend and Magloire, 2008)	Perceived risk of HPV infection
Allen, 2009 (Allen et al., 2009)	Subjective and social norms associated with planning to obtain vaccine after 30 days; perceived benefit of vaccination; subjective and social norms associated with planning to obtain vaccine within the next 30 days; perceived benefits; subjective and social norms associated with having already obtained the vaccine
Costar, 2008 (Costar, 2008)	Positive attitude toward receiving the vaccine; perceived behavioral control (self-efficacy); social norms
Conroy, 2009 (Conroy et al., 2009)	Normative beliefs (subjective norms)
Caskey, 2009 (Caskey et al., 2009)	Not assessed for attitudinal factors
Moore, 2010 (Moore et al., 2010)	Perception that mother would want them to get vaccinated (multivariate model)
Licht, 2010 (Licht et al., 2010)	Not significant (perceived risk)
Rosenthal, 2011 (Rosenthal et al., 2011)	Personal importance of the vaccine
Janousek, 2011 (Janousek, 2011)	Belief that getting cervical cancer would be a serious health problem
Bendik, 2011 (Bendik et al., 2011)	Facilitators found by association among those already vaccinated: perceived importance of HPV; perceived severity of HPV; perceived severity of cervical cancer
Statistically significant barriers	
Kahn, 2008 (Kahn et al., 2008)	With intention: barriers related to vaccine safety With belief in one's ability: practical barriers related to vaccination
Allen, 2009 (Allen et al., 2009)	Perceived severity (among those undecided about whether to obtain the vaccine or planning to receive the vaccine after 30 days); perceived barriers (among those who had already obtained the vaccine)
Moore, 2010 (Moore et al., 2010)	Time required to return to clinic for doses 2 and 3 (multivariate model)
Janousek, 2011 (Janousek, 2011)	Religiosity; cost; wanting to do what the church thinks is right; vaccine hurting
Qualitative data	
Bynum, 2009 (Bynum et al., 2009)	Difficulty understanding what their doctors communicated to them

Costar, 2008 (Costar, 2008)	Facilitators: benefits of prevention; benefits of reducing worry; perceiving self at risk; attitude toward vaccination; social norms; Barriers: pros do not outweigh cons ; increased anxiety (fear of needles, side effects); don't perceive self at risk; negative attitudes toward vaccination; social norms; perceived behavioural control (self-efficacy)
Hopfer, 2011 (Hopfer and Clippard, 2011)	Facilitators (acceptance): supportive family messages; explicit health care provider endorsement; peer descriptive norms reducing stigma of vaccination; disease framing (cancer) shaping vaccine benefit perceptions. Barriers (resistance): scepticism of vaccine safety, invoking alternative prevention strategies (e.g. safe and un-risky sexual behaviour); articulating stigmatizing HPV messages; overcoming self-efficacy barriers (cost, availability, time, fear of parental disclosure); delay strategies (for all women relationship status framed perception of susceptibility to HPV)

Table 3. Self-reported barriers and facilitators to preventive HPV vaccination among 9-26 year old females

	Identified as statistically significant in a quantitative study (# of studies)	Identified in a quantitative study as a proportion or other result (# of studies)	Identified in a qualitative study (# of studies)	Total number of studies in which identified
Barriers to preventive HPV vaccination identified among studies				
Cost	✓ (1)	✓ (8)	✓ (1)	10
Don't need it (e.g. perceived risk, perceived severity, in a relationship)	✓ (1)	✓ (6)	✓ (2)	9
Concerns about safety and side effects	✓ (1)	✓ (6)	✓ (2)	9
Practical barriers (e.g. requires 3 doses, booking an appointment, transportation)	✓ (2)	✓ (4)	✓ (1)	7
Fear of needles	✓ (1)	✓ (3)	✓ (1)	5
Too new		✓ (5)		5
Not sexually active		✓ (5)		5
Doctor related (doesn't think it's needed, recommended against it, didn't mention it, difficulty understanding what was communicated)		✓ (3)	✓ (1)	4
Efficacy concerns		✓ (4)		4
Social norms		✓ (1)	✓ (2)	3
Unable to talk to parents about it (e.g. uncomfortable, fear of disclosure)		✓ (2)	✓ (1)	3
Want more information (e.g. to make an informed decision)		✓ (3)		3
No benefit (e.g. already exposed to HPV, sexually active)		✓ (3)		3
Anti-vaccination views		✓ (1)	✓ (1)	2
Subjective norms	✓ (1)	✓ (1)		2
Pregnant or trying to conceive		✓ (2)		2
Self-efficacy			✓ (2)	2
Pros do not outweigh cons or general feelings of barriers	✓ (1)		✓ (1)	2
Unaware of HPV or the vaccine		✓ (1)		1
Mistrust of pharmaceutical companies		✓ (1)		1
Alternative strategies available (safe and un-risky sexual behaviour)			✓ (1)	1
Facilitators to preventive HPV vaccination identified among studies				
Perceived benefit	✓ (2)	✓ (2)	✓ (2)	6
Health care provider recommendation		✓ (5)	✓ (1)	6
Social norms	✓ (2)	✓ (1)	✓ (2)	5
Parental endorsement	✓ (1)	✓ (2)	✓ (1)	4
Perceived risk	✓ (1)	✓ (2)	✓ (1)	4
Cost-free		✓ (3)		3
Subjective norms	✓ (3)			3
Perceived severity	✓ (3)			3
Positive attitude toward the vaccine or personal importance of the vaccine	✓ (2)		✓ (1)	3
Self-efficacy	✓ (1)			1
Vaccine efficacy (for at least 5 years)		✓ (1)		1

Note: ✓ significant

Table 4. Self-reported barriers and facilitators to preventive HPV vaccination among adolescent girls <18 years of age

Based upon data from 3 studies and a total sample of 706 adolescent girls	Identified in a quantitative study as a proportion or other result (proportion of adolescent girls who reported each barrier or facilitator)
Barriers to preventive HPV vaccination identified among studies	Total 3 studies: Caskey 2009 ⁹⁷ among those who considered vaccination but declined Rand 2011 ⁹⁸ among those who refused vaccination Mathur 2010 ¹⁸ among those who participated in the decision (to not be vaccinated)
Not sexually active	✓ 47% (Caskey)
Not at risk	✓ 36% (Rand)
Concerns about vaccine safety	✓ 26% (Caskey) 25% (Mathur) (8.5% among unvaccinated girls - whether they participated in the decision or not)
Too new (not studied enough)	✓ 21% (Rand)
Concern about efficacy (not sure if vaccine works)	✓ 16% (Caskey)
Not wanting to receive a shot	✓ 11% (Rand)
Cost	✓ 10% (Caskey)
Wanting to do more research to make an informed decision	✓ 5% (Rand)
Vaccine not available	✓ 2% (Caskey)
Doctor doesn't think it's needed	✓ 1% (Caskey)
Facilitators to preventive HPV vaccination identified among studies	Total 2 studies: Caskey 2009 ⁹⁷ "Likelihood of getting vaccine if" Rand 2011 ⁹⁸ among those who had already received the vaccine
Parent recommendation	✓ 89% (Caskey)
Health provider recommendation	✓ 78% (Caskey) ✓ NR (Rand)
Past abnormal Pap test	✓ 78% (Caskey)
Cost covered	✓ 68% (Caskey)
Many close friends getting it	✓ 52% (Caskey)
Preventing a serious and common disease	✓ NR (Rand)
Note: NR = not reported	

Table 5. Quality assessment using the tool developed by Sirriyeh et al for diverse study designs⁸⁶ (combined reviewer scores)

Author, year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total score for study
Kahn, 2008	3	3	2	0	2	3	2	0	2	2	n/a	2	2	n/a	0	3	26
Lenehan, 2008	0	3	3	0	1	2	2	1	1	1	n/a	0	1	n/a	0	1	16
Gerend, 2008	0	2	3	0	1	3	2	0	0	1	n/a	2	2	n/a	0	3	19
Bynum, 2009	0	2	3	0	1	3	2	0	1	2	2	2	1	2	1	3	25
Allen, 2009	3	3	2	2	2	3	2	2	2	3	n/a	2	2	n/a	3	3	34
Costar, 2008	3	3	3	2	2	3	2	2	2	2	2	0	1	2	2	3	34
Jain, 2009	0	3	2	2	2	3	0	2	1	2	n/a	2	2	n/a	3	2	26
Read, 2010	0	2	1	0	1	1	0	1	1	2	n/a	2	0	n/a	0	2	13
Conroy, 2009	0	3	3	0	2	3	0	2	2	2	n/a	2	0	n/a	0	2	21
Caskey, 2009	0	3	3	0	2	3	2	1	0	2	n/a	2	2	n/a	0	2	22
Rand, 2011	2	2	2	2	2	2	2	2	2	2	n/a	2	2	n/a	2	1	27
Mathur, 2010	0	3	3	0	1	3	1	2	2	2	n/a	2	1	n/a	2	2	24
Watts, 2009	0	2	3	3	2	3	2	2	2	2	n/a	2	2	n/a	2	0	27
Moore, 2010	0	2	3	0	1	2	2	2	0	1	n/a	2	2	n/a	0	1	18
Licht, 2010	0	2	2	0	2	2	0	2	0	2	n/a	1	2	n/a	0	1	16
Zimet, 2010	0	2	2	2	1	2	0	2	0	2	n/a	2	1	n/a	0	2	18
Hopfer, 2011	3	3	3	0	1	3	2	2	n/a	n/a	3	3	2	2	1	2	30
Rosenthal, 2011	0	2	2	0	2	2	2	2	0	1	n/a	2	0	n/a	0	2	17
Dillard, 2010	0	3	2	0	1	2	1	2	1	1	n/a	2	1	n/a	2	2	20
Janousek, 2011	3	3	3	3	2	3	2	3	1	1	n/a	3	1	n/a	0	1	29
Bendik, 2011	1	2	2	0	2	1	1	1	0	1	n/a	2	1	n/a	0	1	15

QT = quantitative QL= qualitative M = mixed methods

Criteria (scoring items as 0=not at all, 1=very slightly, 2=moderately, 3=complete)

1 = explicit theoretical framework

2 = statement of aims/objectives in main body of report

3 = clear description of research setting

4 = evidence of sample size considered in terms of analysis

5 = representative sample of target group of a reasonable size

6 = description of procedure for data collection

7 = rationale for choice of data collection tool(s)

8 = detailed recruitment data

9 = statistical assessment of reliability and validity of measurement tool(s) (quantitative only)

10 = fit between stated research question and method of data collection (quantitative)

11 = fit between stated research question and format and content of data collection tool (e.g. interview schedule) (qualitative)

12 = fit between research question and method of analysis

13 = good justification for analytical method selected

14 = assessment of reliability of analytical process (qualitative only)

15 = evidence of user involvement in design

16 = strengths and limitations critically discussed

Figure %

Highlights

- We examine self-reported views of intended young female HPV vaccine recipients
- When cost is a factor in vaccine access it dominates as a barrier to vaccination
- Perception of risk for HPV health consequences may improve vaccine acceptance
- Importance of influential others is apparent but communication must be effective
- Qualitative, high quality studies among adolescents as a unique group are needed