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Acceptability of human papillomavirus vaccination and sexual experience prior to disclosure to health care providers among men who have sex with men in Vancouver, Canada: Implications for targeted vaccination programs

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ABSTRACT

Background: Men who have sex with men (MSM) may benefit from human papillomavirus (HPV) vaccine due to increased risk for HPV infection and related disease. We assessed HPV vaccine acceptability and sexual experience prior to disclosure to Health Care Providers (HCP) to understand implications of targeted vaccination strategies for MSM.
Methods: From July 2008 to February 2009, 1169 MSM aged ≥19 years were recruited at community venues in Vancouver. We assessed key variables from a self-administered questionnaire and independent predictors of HPV vaccine acceptability using multivariate logistic regression.
Results: Of 1041 respondents, 697 (67.0%) were willing to receive HPV vaccine and 71.3% had heard of HPV. Significant multivariate predictors of higher vaccine acceptability were (adjusted odds ratio [95% CI]): previous diagnosis of genital warts (1.7 [1.1, 2.6]), disclosure of sexual behavior to HCP (1.6 [1.1, 2.3]), annual income at least $20,000 (1.5 [1.1, 2.1]), previous hepatitis A or B vaccination (1.4 [1.0, 2.0]), and no recent recreational drug use (1.4 [1.0, 2.0]). Most MSM (78.7%) had disclosed sexual behavior to HCP and median time from first sexual contact with males to disclosure was 6.0 years (IQR 2–14 years); for men ≤26 years these were 72.0% and 3.0 years (IQR 1–8 years) respectively.
Conclusions: Willingness to receive HPV vaccine was substantial among MSM in Vancouver; however, acceptability varied by demographics, risk, and health history. HPV vaccine programs delivered by HCP would offer limited benefit given the duration of time from sexual debut to disclosure to HCP.

1. Background

Gay, bisexual and other men who have sex with men (MSM) are at increased risk for human papillomavirus (HPV) infection and related disease [1]. Anal cancer is causally associated with infection by high-risk HPV types [2]. Incidence of anal cancer in MSM has been estimated to be up to 35 per 100,000 among HIV-negative men and 137 per 100,000 among HIV-positive men, compared to 2 per 100,000 among males overall [3–5]. The quadrivalent HPV vaccine (Gardasil™, Merck and Co., Inc.) has been approved in Canada for use in males aged nine to 26 to prevent genital warts caused by infection with HPV types 6 and 11, but is also indicated to prevent infection with oncogenic HPV types 16 and 18. Vaccine efficacy against HPV 6/11/16/18-related external genital lesions in males (60.2–90.4%), and any anal intraepithelial neoplasia in MSM (50.3–77.5%) is high. [6,7] A substantial reduction in the burden of HPV-related disease could be expected with the use of quadrivalent HPV vaccine in males, especially MSM, and vaccination programs targeted to young MSM have demonstrated cost-effectiveness. [8].

Important factors when considering the potential impact of a targeted vaccination program are willingness of MSM to receive HPV vaccine, and sexual experience prior to disclosure of sexual orientation to a health care provider (HCP). Such disclosure would be

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essential in a program targeted to MSM, as it would alert the HCP to offer vaccination. These factors have not been well-studied among MSM: we are aware of only one study that examined reported sexual behavior prior to disclosure to a HCP to access HPV vaccine among MSM seeking care at a sexual health center, which the authors acknowledged may be biased by health-seeking behavior. [9] To address this gap we examined HPV vaccine acceptability, whether disclosure to HCP had occurred, and compared age of sexual debut to age at disclosure among participants in a community venue-based survey of MSM in Vancouver, British Columbia.

2. Methods

2.1. Study design

Our study was based on men in the ManCount Survey, the Vancouver site of the M-Track surveillance system led by the Public Health Agency of Canada which monitors HIV, sexually transmitted and blood-borne infections (STBBI) and associated risk behaviors among MSM [10]. From August 1, 2008 to February 28, 2009, participants aged 19 years or older who identified as MSM were recruited using time-space sampling at community venues frequented by MSM including bars, community events, associations, bathhouses and businesses. Consenting participants were given a $10 honorarium for participation, provided a dried blood spot (DBS) for HIV, HCV and syphilis testing, and completed a self-administered questionnaire on sexual behaviors, HIV/STBBI testing and health care. The survey was developed in partnership with researchers and community-based associations in Vancouver, and was piloted among 40 participants at four representative venues prior to implementation.

2.2. HPV vaccine acceptability

A single survey question assessed willingness to receive HPV vaccine if it was available for men, using a five point Likert scale. The question was preceded by a short statement indicating that HPV causes genital warts and anal cancer. Participants considered to accept HPV vaccination were those who indicated they were willing or very willing to receive HPV vaccine. Key survey variables examined for association with HPV vaccine acceptance included demographic variables, self-reported sexual behaviors indicative of increased sexual risk and potentially associated with HPV infection, and possible explanatory factors of HPV vaccine acceptability.

All analyses were carried out in SAS version 9.2 (SAS Institute Inc., Cary, NC, USA). Variables were recoded for bivariate and multivariate analyses as shown in Table 2. In bivariate analyses, we calculated crude odds ratios (OR) and 95% confidence intervals (95% CI) of vaccine acceptance for each study variable and assessed statistical significance using Wald tests. Variables associated with vaccine acceptance at $p < 0.10$ were entered simultaneously into a multivariate logistic regression model; those independently associated with vaccine acceptance at $p < 0.05$ following backward selection were retained in the final model from which adjusted odds ratios (AOR) were obtained.

2.3. Sexual experience prior to disclosure to HCP

We examined the proportion of participants who reported ever having communicated with a HCP about male sexual partners. In order to understand the potential duration of exposure to HPV prior to receipt of HPV vaccine if delivered by a HCP through a targeted program for MSM, we assessed time from age at sexual debut with male partners (oral or anal sex) to age at disclosure to a HCP. Time to disclosure was estimated using Kaplan–Meier analysis, where participants who had not disclosed to a HCP were censored on the

Table 1
Demographic and behavioral characteristics of ManCount participants ($n = 1169$).

Characteristic	n	(%)[a]
Age (years)		
≤26	319	(27.5)
27–34	286	(24.7)
35–44	289	(24.9)
≥45	265	(22.9)
Sexual orientation		
Gay	927	(80.4)
Bisexual	127	(11.0)
Other	99	(8.6)
Ethnicity		
Caucasian	846	(76.9)
Asian/South Asian	113	(10.3)
Aboriginal	74	(6.7)
Hispanic	42	(3.8)
African/Arab	25	(2.3)
Education		
High school or less	239	(20.6)
Greater than high school	920	(79.4)
Annual income ($)		
<20,000	304	(26.7)
20,000–59,000	569	(50.0)
≥60,000	264	(23.2)
HIV status (DBS)		
Positive	206	(18.1)
Negative	932	(81.9)
Had unprotected anal sex with casual partner[b]		
Yes	323	(41.7)
No	451	(58.3)
Had sex partner concurrent to regular partner		
Yes	425	(52.2)
No	389	(47.8)
Number of lifetime sexual partners[b]		
0	77	(7.4)
1	92	(8.9)
2–5	275	(26.6)
6–19	274	(26.5)
20–49	156	(15.1)
≥50	160	(15.5)
Number of anal sex partners in past six months		
0	2	(0.26)
1	262	(35.0)
2–5	301	(40.2)
≥6	184	(24.6)
Used recreational drugs before or during sex[b,c]		
Yes	292	(26.2)
No	821	(73.8)
Received money/goods in exchange for sex[b]		
Yes	156	(14.2)
No	943	(85.8)
Diagnosed with an STI in past 12 months[d,e]		
Yes	123	(11.2)
No	980	(88.9)
Ever diagnosed with genital warts[e]		
Yes	195	(17.9)
No	897	(82.1)
Ever heard of HPV		
Yes	755	(70.7)
No	313	(29.3)
Vaccinated for hepatitis A or B[e]		
Yes	855	(76.7)
No	260	(23.3)
Identified as MSM to HCP		
Yes	882	(78.7)
No	239	(21.3)

[a] Proportion of respondents for each characteristic. Missing data not shown.
[b] Based on self-reported behavior within past six months
[c] Includes at least one of the following: ecstasy, ketamine, crystal meth, GHB, psychedelics or amphetamines.
[d] Includes at least one of the following: gonorrhea, chlamydia, syphilis, genital warts or genital herpes.
[e] Based on self-reports.

date of survey completion. We dichotomized participants at ≤26 or >26 years of age to analyze vaccine acceptance among men who would be eligible or ineligible to receive Gardasil™ as per current Health Canada approval, respectively. Additionally, we examined the number of lifetime sex partners reported among men aged ≤26 years who had not disclosed to a HCP.

2.4. Ethical approval

Ethics approval was obtained from research ethics boards at Health Canada, the University of British Columbia, Providence Health Care, and Vancouver Coastal Health.

3. Results

The ManCount survey was completed by 1169 MSM aged 19–83 years (median 33 years, interquartile range [IQR] 26–44 years). Characteristics of the study population are shown in Table 1. MSM predominantly identified as gay (80.4%), almost one-third (26.7%) reported low income (<$20,000 annually), and 18.1% were HIV-positive. A substantial proportion of participants (70.7%) had heard of HPV and most (78.7%) reported having communicated with a HCP about male sexual partners.

Overall, 1041 participants (89.0%) provided a response regarding HPV vaccine acceptability: 697 (67.0%; 95% CI: 64.1–69.8%) indicated they were willing or very willing to be vaccinated, 214 (20.6%) reported a neutral response and 130 (12.5%) were unwilling or very unwilling. Vaccine acceptability was lowest among MSM aged ≤26 years but there was no statistically significant trend with age; the proportion indicating acceptance by age group was as follows: ≤26 years (63.7%), 27–34 (64.3%), 35–44 (69.4%), ≥45 years (71.0%), $p = 0.21$.

Table 2 presents crude and adjusted odds ratios of HPV vaccine acceptance by select variables. In bivariate analysis, there was no statistical difference in vaccine acceptability among participants aged ≤26 years compared to older MSM. Vaccine acceptability was significantly lower in MSM who did not identify as gay and among Aboriginal or Hispanic groups. Willingness to vaccinate was significantly higher among MSM who reported a previous diagnosis of genital warts, had heard of HPV, were previously vaccinated for Hepatitis A or B, had disclosed sexual orientation to a HCP, reported an annual income of at least $20,000, as well as among those who did not report recreational drug use or receipt of money/goods in exchange for sex. In multivariate regression, factors independently associated with vaccine acceptability were annual income of at least $20,000 (AOR 1.5, 95% CI: 1.1–2.1), no recent recreational drug use before or during sex in the past 6 months (AOR 1.4, 95% CI: 1.0–2.0), previous diagnosis with genital warts (AOR 1.7, 95% CI: 1.1–2.6), hepatitis A or B vaccination (AOR 1.44, 95% CI: 1.02–2.04) and disclosure of sexual orientation to a HCP (AOR 1.6, 95% CI: 1.1–2.3). There was no effect modification by age, and adjustment for age group did not meaningfully change these patterns of association.

The proportion of participants who had communicated with a HCP about having male sex partners was lowest among those aged ≤26 years (72.0%) compared to older age groups (77.3–83.4%) (Table 3). Among participants who had disclosed to a HCP, the median age at disclosure was 21.0 years (IQR 18.0–25.0 years), and younger participants disclosed at an earlier age. The median age at first sexual contact with males was 17.0 years (IQR 14.0–20.0 years). Overall, disclosure to a HCP occurred a median of 6.0 years (IQR 2–14 years) following sexual debut, and the median time from sexual debut to disclosure increased significantly with age, from 3.0 years among those aged ≤26 years to 10.0 years among participants 45 years or older (log-rank $p < 0.0001$). There were 70 men ≤26 years of age who would have been eligible to receive HPV vaccine who had not disclosed sexual orientation to a HCP; the distribution by reported number of lifetime sex partners was as follows: 0 (8, 11.4%); 1 (15, 21.4%); 2–5 (21, 30.0%); 6–19 (21, 30.0%); 20–39 (5, 7.1%).

4. Discussion

A substantial proportion (67.0%) of MSM surveyed in Vancouver was willing to accept HPV vaccination. In multivariate analyses, men who reported higher income, no recent recreational drug use before or during sex, a previous diagnosis of genital warts, receipt of Hepatitis A or B vaccines, or communication with a HCP about male sex partners were significantly more likely to accept HPV vaccination. Vaccine acceptability was not significantly different among men for whom HPV vaccine is approved (≤26 years of age) compared to others.

Vaccine acceptance has been shown to be greater among MSM with more lifetime sex partners, higher perceived risk of HPV infection, concurrent partners, history of STI testing, awareness of HPV, and perceived vaccine efficacy against cancer as opposed to genital warts alone [11–15]. Our estimate of HPV vaccine acceptability is similar to those found in other surveys carried out among MSM (47–74%) [9,16]. In a population-based sample of MSM in the United States, 74% were willing to receive HPV vaccine and acceptability was greater among those who had five or more lifetime sex partners [16]. In our study, vaccine acceptability was not associated with increased number of sex partners or other sexual risk variables such as concurrency, previous STI diagnosis or unprotected anal sex. Although not significant in multivariate analysis, we found higher acceptability among MSM who reported having heard of HPV. Additionally, important predictors of vaccine acceptability among MSM in other studies were out of pocket costs, higher perceived severity of HPV-related disease, and recommendation by a HCP [9,16]. In Australia, 47% of MSM surveyed at sexual health clinics were willing to pay for HPV vaccination and 93% would disclose sexual orientation to a HCP to receive HPV vaccine at no cost [9]. We found MSM who disclosed to a HCP more likely to accept HPV vaccination, and those with low income less likely. Recommendation by a HCP may increase opportunities for vaccination; however, as suggested by Simatherai et al. [9] MSM may more readily disclose to a HCP to access the vaccine.

Given that vaccine efficacy is greatest and the likelihood of prior HPV infection through sexual contact lowest at a younger age [17,18] targeted efforts would be required to optimize vaccine coverage in young MSM. We found vaccine acceptability as well as the proportion who disclosed sexual orientation to a HCP lowest among participants ≤26 years of age in our study. While 72.0% of men in this age group had communicated with a HCP about male sexual partners, they reported disclosing after a median three years following sexual debut. A high proportion (88.6%) of men ≤26 years of age who had never disclosed to a HCP reported at least one lifetime sexual partner. Of all men surveyed in this age group, 7.7% reported a previous diagnosis of genital warts (data not shown).

The elapsed time from first sexual contact with male partners to disclosure would greatly limit the effectiveness of a targeted HPV vaccine program delivered by HCP. While age at sexual debut remained fairly consistent across age groups, younger men who disclosed did so at an earlier age, and, therefore, had the lowest time from sexual debut to disclosure. Clearly, the risk for HPV acquisition during the period in which MSM would have opportunities to be vaccinated is considerable. Although availability of HPV vaccine for MSM may facilitate disclosure to a HCP, this may nevertheless occur after substantial risk for HPV exposure. In Australia, MSM reported having a median of 15 sexual partners before they would

Table 2
Bivariate and multivariate analysis of HPV vaccine acceptance among ManCount participants ($n = 1041$).

Characteristic	Willing to vaccinate *n* (%)	Unadjusted odds ratio OR (95% CI)	*p* value	Adjusted odds ratio AOR (95% CI)	*p* value
Age (years)					
≤26	179/281 (63.7)	0.82 (0.62–1.09)	0.174	–	
>26	514/754 (68.2)	1.00		–	
Sexual orientation					
Bisexual	64/114 (56.1)	0.57 (0.38–0.84)	0.003	–	
Other	50/87 (57.5)	0.60 (0.38–0.94)		–	
Gay	576/831 (69.3)	1.00		–	
Ethnic origin					
Asian/South Asian	74/102 (72.5)	1.19 (0.75–1.89)	0.047	–	
Aboriginal	36/65 (55.4)	0.56 (0.34–0.94)		–	
Hispanic	22/41 (53.7)	0.52 (0.28–0.98)		–	
African/Arab	14/20 (70.0)	1.05 (0.40–2.77)		–	
Caucasian	523/759 (68.9)	1.00		–	
Education					
Greater than high school	561/826 (67.9)	1.24 (0.90–1.70)	0.192	–	
High school or less	132/209 (63.2)	1.00		–	
Annual income					
<20,000	161/277 (58.1)	1.00		1.00	
≥20,000	523/746 (70.1)	1.69 (1.27–2.22)	<0.001	1.49 (1.07–2.08)	0.018
HIV status (DBS)					
Positive	122/184 (66.3)	0.97 (0.69–1.36)	0.842	–	
Negative	564/841 (67.1)	1.00		–	
Had unprotected anal sex with casual partner[a]					
Yes	198/285 (69.5)	0.93 (0.67–1.30)	0.670	–	
No	291/410 (71.0)	1.00		–	
Had sex partner concurrent to regular partner					
Yes	273/383 (71.3)	1.17 (0.85–1.60)	0.332	–	
No	240/353 (68.0)	1.00		–	
Number of anal sex partners in past six months					
1	156/240 (65.0)	1.00	0.119	–	
2–5	201/274 (73.4)	1.48 (1.02–2.16)		–	
≥6	114/162 (70.4)	1.28 (0.83–1.96)		–	
Used recreational drugs before or during sex[a]					
Yes	156/256 (60.9)	1.00		1.00	
No	541/785 (68.9)	1.38 (1.03–1.85)	0.030	1.41 (1.01–1.96)	0.043
Received money/goods in exchange for sex[a]					
Yes	76/140 (54.3)	1.00		–	
No	589/856 (68.8)	1.85 (1.30–2.63)	<0.001	–	
Diagnosed with a STI in past 12 months[b]					
Yes	74/111 (66.7)	0.98 (0.65–1.49)	0.931	–	
No	603/899 (67.1)	1.00		–	
Ever diagnosed with genital warts[b]					
Yes	137/181 (75.7)	1.66 (1.15–2.40)	0.007	1.73 (1.14–2.64)	0.010
No	560/860 (65.1)	1.00		1.00	
Ever heard of HPV					
Yes	512/741 (69.1)	1.41 (1.06–1.86)	0.018	–	
No	183/298 (61.4)	1.00		–	
Vaccinated for hepatitis A or B					
Yes	543/775 (70.1)	1.72 (1.28–2.32)	<0.001	1.44 (1.02–2.04)	0.039
No	140/243 (57.6)	1.00		1.00	
Identified as MSM to HCP					
Yes	565/806 (70.1)	1.86 (1.36–2.54)	<0.001	1.57 (1.07–2.30)	0.021
No	116/208 (55.8)	1.00		1.00	

[a] Based on self-reported behavior within past six months.
[b] Based on self-reports.

Table 3
Age and timing of disclosure among participants who reported ever having communicated with a HCP about male sexual partners, by age.

Age	Total	Ever disclosed *n* (%)	Age at sexual debut Median (IQR)	Age at disclosure Median (IQR)	Time to disclosure[a] Median (IQR)
≤26	303	218 (72.0)	16.0 (14.0–19.0)	19.0 (17.0–21.0)	3.0 (1.0–8.0)
27–34	277	214 (77.3)	18.0 (15.0–20.0)	21.0 (18.0–24.0)	4.0 (1.0–12.0)
35–44	277	231 (83.4)	16.0 (13.0–21.0)	22.0 (19.0–28.0)	8.0 (3.0–15.0)
≥45	257	213 (82.9)	16.0 (12.0–20.0)	25.0 (20.0–30.0)	10.0 (4.0–23.0)
Total	1121	882 (78.7)	17.0 (14.0–20.0)	21.0 (18.0–25.0)	6.0 (2.0–14.0)

[a] Kaplan–Meier estimates of time (years) from first sexual contact with males to disclosing sexual orientation to a HCP; log-rank $p < 0.0001$.

have spoken with a HCP about sexual contact with males to access HPV vaccine [9]. In our study, 37% of men ≤26 years of age who had never disclosed to a HCP reported six or more lifetime sexual partners.

Our findings should be interpreted within the context of several limitations. Due to recruitment of participants at public venues and the requirement for men to self-identify as a man who has sex with men to take part in the survey, our sample may not be generalizable to all MSM in Vancouver. While likely less biased than recruitment in health settings, men who frequent gay community venues may be more likely to communicate with a HCP about male sex partners due to greater comfort regarding sexual orientation. In a separate analysis where we adjusted for frequency of venue attendance in our sample, the prevalence of disclosure to a HCP decreased significantly [19]. While the current generation of younger MSM may be more comfortable disclosing sexual orientation earlier to HCP compared to older generations in the past, it is also possible that those who have not disclosed may have been less likely to attend venues where study recruitment took place. We were unable to assess other factors associated with disclosure to HCP, such as access to health care where opportunities to disclose may have existed. Our survey was not specifically designed to measure intent to vaccinate according to an established theoretical model to predict behavior change; therefore, willingness to receive HPV vaccine may not reflect true HPV vaccine uptake in the future. Finally, we did not assess vaccine acceptability within the context of cost, which may be a considerable factor affecting willingness to vaccinate.

In this study, we demonstrated that acceptability of HPV vaccination in a Canadian sample of MSM is high and associated with income, recreational drug use, previous diagnosis of genital warts, vaccination for hepatitis A or B, and risk communication with a HCP. Targeted vaccination programs would likely have an impact on reducing the burden of HPV infection and associated outcomes among MSM, although variables such as direct costs to patients, awareness of HPV and related disease, knowledge about HPV vaccine, access to health care, and uptake among higher risk subgroups of MSM would need to be addressed. Due to variation in communication with HCP about same sex sexual behavior as well as the typical delay between age of sexual onset and disclosure to a HCP, the benefit of HPV vaccine programs delivered by HCP would be limited given the likelihood of exposure to HPV infection prior to opportunities to vaccinate. In the United States (U.S.), the addition of HPV vaccination of 12 year old males to current female vaccination programs is potentially cost-effective at current low U.S. female vaccination levels, considering all outcomes including anal, penile, and oropharyngeal cancers [20]. This, alongside other evidence, has led to recent U.S. recommendations for the administration of quadrivalent HPV vaccine to boys in this age group (based primarily on consideration of heterosexual HPV transmission) [21]. While our data lends support to the recommendation for a population-based HPV vaccination approach targeting all males before the onset of sexual activity, further modeling and cost-effectiveness studies to determine the impact of this strategy among MSM would be of benefit.

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Conflicts of interest:

None of the authors of this study have conflicts of interest.

Appendix A.

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References

[1] Palefsky JM. HPV infection in men. Dis Markers 2007;23:261–72.
[2] International Agency for Research on Cancer (IARC). IARC monographs on the evaluation of carcinogenic risks to humans: human papillomaviruses. IARC Press: Lyon, France; 2007.
[3] Piketty C, Selinger-Leneman H, Grabar S, Duvivier C, Bonmarchand M, Abramowitz L, et al. Marked increase in the incidence of invasive anal cancer among HIV-infected patients despite treatment with combination antiretroviral therapy. AIDS 2008;22:1203–11.
[4] Frisch M, Biggar RJ, Goedert JJ. Human papillomavirus-associated cancers in patients with human immunodeficiency virus infection and acquired immunodeficiency syndrome. J Natl Cancer Inst 2000;92:1500–10.
[5] Johnson LG, Madeleine MM, Newcomer LM, Schwartz SM, Daling JR. Anal cancer incidence and survival: the surveillance, epidemiology, and end results experience, 1973–2000. Cancer 2004;101:281–8.
[6] Giuliano AR, Palefsky JM, Goldstone S, Moreira Jr ED, Penny ME, Aranda C, et al. Efficacy of quadrivalent HPV vaccine against HPV infection and disease in males. N Engl J Med 2011;364:401–11.
[7] Palefsky JM, Giuliano AR, Goldstone S, Moreira Jr ED, Aranda C, Jessen H, et al. HPV vaccine against anal HPV infection and anal intraepithelial neoplasia. N Engl J Med 2011;365:1576–85.
[8] Kim JJ. Targeted human papillomavirus vaccination of men who have sex with men in the USA: a cost-effectiveness modelling analysis. Lancet Infect Dis 2010;10:845–52.
[9] Simatherai D, Bradshaw CS, Fairley CK, Bush M, Heley S, Chen MY. What men who have sex with men think about the human papillomavirus vaccine. Sex Transm Infect 2009;85:148–9.
[10] Public Health Agency of Canada. HIV/AIDS: M-Track Survey. Available at: http://www.phac-aspc.gc.ca/aids-sida/about/mtrack-eng.php.
[11] Boehner CW, Howe SR, Bernstein DI, Rosenthal SL. Viral sexually transmitted disease vaccine acceptability among college students. Sex Transm Dis 2003;30:774–8.
[12] Jones M, Cook R. Intent to receive and HPV vaccine among university men and women and implications for vaccine administration. J Am Coll Health 2008;57:23–32.
[13] Lenselink CH, Schmeink CE, Melchers WJ, Massuger LF, Hendriks JC, van Hamont D, et al. Young adults and acceptance of the human papillomavirus vaccine. Public Health 2008;122:1295–301.
[14] Gerend MA, Barley J. Human papillomavirus vaccine acceptability among young adult men. Sex Transm Dis 2009;36:58–62.

[15] Ferris DG, Waller JL, Miller J, Patel P, Price GA, Jackson L, et al. Variables associated with human papillomavirus (HPV) acceptance by men. J Am Board Fam Med 2009;22:34–42.
[16] Reiter PL, Brewer NT, McRee AL, Gilbert P, Smith JS. Acceptability of HPV vaccine among a national sample of gay and bisexual men. Sex Transm Dis 2010;37:197–203.
[17] Block SL, Nolan T, Sattler C, Barr E, Giacoletti KE, Marchant CD, et al. Comparison of the immunogenicity and reactogenicity of a prophylactic quadrivalent human papillomavirus (types 6,11,16, and 18) L1 virus-like particle vaccine in male and female adolescents and young adult women. Pediatrics 2006;118:2135–45.
[18] Lu B, Viscidi RP, Lee JH, Wu Y, Villa LL, Lazcano-Ponce E, et al. Human papillomavirus (HPV) 6, 11, 16, and 18 seroprevalence is associated with sexual practice and age: results from the multinational HPV infection in men study (HIM study). Cancer Epidemiol Biomarkers Prev 2011;20:990–1002.
[19] Gilbert M, Gustafson P, Xia M, Michelow W, Robert W, Trussler T, et al. Impact of statistical adjustment for frequency of venue attendance in the Vancouver site of the M-Track HIV surveillance system. Presented at: 21st Annual Canadian Conference on HIV/AIDS Research. 2012.
[20] Chesson HW, Ekwueme DU, Saraiya M, Dunne EF, Markowitz LE. The cost-effectiveness of male HPV vaccination in the United States. Vaccine 2011;29:8443–50.
[21] Media Advisory ACIP recommends all 11–12 year-old males get vaccinated against HPV (Recommendations subject to approval by CDC). Available at: http://www.cdc.gov/media/releases/2011/a1025_ACIP_HPV_Vote.html; [accessed 18.11.11].