



# Falling Short of Clinical Recommendations: Low Uptake of the Human Papillomavirus Vaccine Among Gay, Bisexual, and Other Men Who Have Sex with Men in Ontario, Canada—Results from the Ontario Gay Men’s Health Survey

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## Abstract

**Introduction** Despite the high prevalence of human papillomavirus (HPV) infection and incidence of associated anal cancer among men who have sex with men (MSM) and the recommendation that all MSM in Canada receive the HPV vaccine, uptake of the vaccine remains low. The objective of this study was to identify correlates of HPV vaccination among MSM to expose gaps and better inform vaccination strategies and policies.

**Methods** Data were collected from an anonymous, online, self-administered survey of MSM in Ontario, Canada’s most populous province. Participants were recruited by network and snowball sampling from June 2018 to March 2019.

**Results** Of 1788 survey respondents, only 27.3% reported having received the HPV vaccine. Those who were vaccinated tended to be  $\leq 30$  years of age, live in an urban center, have more sexual partners, and more frequently access sexual health services. Having a primary care provider was not associated with HPV vaccination.

**Conclusion** These data mandate increased efforts to deliver the HPV vaccine to MSM.

**Policy Implications** Our data suggest at least four areas for policy reform to help increase HPV vaccine uptake among MSM. First, public funding of the HPV vaccine should be aligned with clinical recommendations and the vaccine should be available free of charge to MSM irrespective of age. Second, sexual health clinics, as clinics of choice for sexual minorities, should be supported and the HPV vaccine should be bundled with other sexual health services. Third, innovative strategies should be developed and funded to better deliver the HPV vaccine to older MSM and those living in rural areas. Finally, policymakers must remember the MSM population is diverse, and data acquired from MSM living in large metropolitan centers should not be the sole source of information used to inform health policies for this population. More awareness of and data from men living outside urban settings is needed.

**Keywords** Human papillomavirus · Vaccination · Men who have sex with men · Ontario

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## Introduction

To date, over 200 different types of human papillomaviruses (HPV) have been identified, with approximately 40–50 of these infecting the oral and anogenital tissues (Gargano et al., 2017). Estimates suggest that approximately 75–80% of sexually active adults will acquire at least one HPV infection by age 50 (PHAC, 2019), with about 90% remaining asymptomatic throughout infection and roughly the same percentage clearing the infection naturally within 24 months (Gargano et al., 2017). Anal HPV is particularly common among men who have sex with men (MSM). Among human immunodeficiency virus

(HIV)-negative MSM, the point prevalence of a single HPV type within the anal canal is 39–61% with multiple types detected in 23% (Palefsky et al., 1998; Wei et al., 2021; Zou et al., 2014). For MSM living with HIV, this increases to 83–93% with one type and 60–73% with multiple concurrent HPV types (Del Amo et al., 2013; Palefsky et al., 1998; Wei et al., 2021).

HPV types that infect the oral and anogenital tissues may be classified as either low risk (e.g., HPV-6 and HPV-11) causing benign condyloma or high risk (e.g., HPV-16) and associated with malignancy. Persistent infections with oncogenic types are known to cause squamous cell carcinomas of the cervix, vagina, vulva, anus, penis, and oropharynx (Egawa et al., 2015; PHAC, 2019; Taylor et al., 2016). While routine cervical Pap screening tests have successfully reduced the incidence of HPV-associated cervical cancer in Ontario to 7.6 per 100,000 (Ontario Health (Cancer Care Ontario), 2022), HPV-associated malignancy remains high among men who have sex with men (MSM). Although relatively rare in the general population, the incidence of anal cancer is estimated to be 35 per 100,000 in HIV-negative MSM (Chiao et al., 2006) and 61–85 per 100,000 among MSM living with HIV (Clifford et al., 2021; Nicolau et al., 2022; Wei et al., 2021).

Vaccines targeting the most common HPV types including those associated with squamous cell carcinomas were approved for use in women in Canada in 2006 (NACI, 2015) and extended for use in males in 2011. A nonavalent vaccine protecting against two types that cause most genital warts (HPV-6 and 11) and seven types associated with 90% of squamous cell carcinomas (HPV-16, 18, 31, 33, 45, 52, and 58) was approved by Health Canada in 2015 (Merck Canada, 2016). This vaccine has resulted in significant reductions in genital warts among vaccine recipients (Ali et al., 2013), as well as reductions in cervical intraepithelial neoplasia among vaccinated women (Joura et al., 2015) and in anal intraepithelial neoplasia among vaccinated MSM (Palefsky et al., 2011). The nonavalent vaccine is now indicated for the prevention of genital warts, as well as cervical, vulvar, vaginal, and anal cancers and their precursors, and HPV-related oropharyngeal cancers (PHAC, 2019).

The Canadian National Advisory Committee on Immunization (NACI, 2018) recommends the nonavalent vaccine for all males and females 9–26 years of age, while for MSM there is no upper age limit. All provinces now include this vaccine in school-age vaccination programs for both girls and boys (Goyette et al., 2021). Persons not vaccinated in the school system can obtain the nonavalent vaccine by prescription according to NACI guidelines. While most third-party insurance plans cover the vaccine and the Ministry of Health and Long-Term Care in Ontario has a special free-access program for MSM < 27 years of age (Ontario, 2016), the cost of this vaccine, upwards of \$550 CAD, can be prohibitive for others.

Despite, among MSM, the high prevalence of HPV infection, the increased incidence of HPV-associated anal cancer, and the recommendation in Canada that all MSM receive the nonavalent HPV vaccine regardless of age, uptake of the vaccine in this population remains low. Indeed, studies in both Canada and the United States indicate only 30–38% of MSM have received the HPV vaccine (Grewal, et al., 2021; Meites, et al., 2022). In order to inform strategies and public health policies aimed to increase vaccine uptake, we set out to better understand the rates and correlates of HPV vaccination among MSM in Ontario, Canada. To do this, we extracted data from the Ontario Gay Men’s Health Survey.

## Methods

### Survey

The Ontario Gay Men’s Health Survey was developed in consultation with researchers, local community members, and healthcare providers and was based on a previously published survey of gay, bisexual, and other MSM in Eastern Ontario (Charest et al., 2023). The survey, completed online and anonymously, contained 81 questions and collected information on participant demographics, location(s) where they obtained healthcare, physical health, mental health, sexual health, and either HIV prevention for participants who were HIV-negative or HIV care for those living with HIV. We also inquired about the construct of outness, which we measured by asking participants if people in their families, social networks, workplaces, and where they received primary healthcare were aware that they had sex with other men. Within the survey, we embedded the Patient Health Questionnaire-4 (PHQ-4) (Kroenke et al., 2009), a validated screening tool comprising the PHQ-2 and General Anxiety Disorder 2-item (GAD-2), which screen for symptoms of depression and anxiety, respectively. The survey was available in English and French from June 2018 to March 2019. The survey was preceded by an information section describing the purpose of the study, risks, benefits, and assurance of anonymity. Consent was implied when participants proceeded to complete the survey. This study was approved by the Ottawa Health Sciences Network Research Ethics Board (Protocol 20140657-01H) and funded by the Ontario HIV Treatment Network (AHRC G1064).

### Sampling

The target area of recruitment was Ontario, Canada, a province of approximately 1 million square kilometers and 14.6 million inhabitants. The province contains two large metropolitan areas, Ottawa (population 1 million) and Toronto (population 3 million) as well as many smaller urban centers.

To be eligible to participate, persons had to be  $\geq 18$  years of age, live in Ontario, identify as male, and report having or having had sex with men. There were no exclusion criteria. Participants were recruited by both network and snowball sampling to yield a convenience sample of MSM from all regions of Ontario. The survey was advertised through social media, community groups and organizations, professional networks, and on a gay dating website where only members living in Ontario received the advertisement banner. In all communications related to the survey, the survey uniform resource locator (URL) was provided. Participants were not remunerated, and respondent authenticity was not verified. Only respondents who answered the question on vaccination were included in this analysis.

## Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) Version 24.0 (IBM, Armonk, NY, United States). For variables missing  $< 5\%$  of data points, data were imputed using the multiple imputation method in SPSS. Pairwise deletion was performed for variables missing  $\geq 5\%$  of data points. Descriptive statistics were performed on the data set including frequencies, proportions, means, and standard deviations. Chi-square tests were carried out to determine statistically significant differences between groupings. Categories were collapsed when conducting chi-squares to ensure that the minimum expected cell count of at least 5 was reached. A  $p$  value less than or equal to 0.05 was considered significant a priori. To examine the relationship between the dependent variable, HPV vaccination, and independent variables including age, place of residence, who respondents live with, who they are out to, employment status, and income, a binary logistic regression analysis was performed. Analysis and reporting of data followed the STROBE (Strengthening and Reporting of Observational studies in Epidemiology) guidelines (Vandenbroucke et al., 2007).

## Results

### Participant Demographics

A total of 1960 respondents completed the survey. The number of respondents and proportions of the total sample residing in each region of Ontario are shown in Table 1. The mean age of the sample was 38.1 years (SD = 15.2, range 21–83) and 83.5% identified as being of British/European ethnicity. Just over half (58.1%) lived in an urban setting, whereas 20.6% lived in suburban areas and 21.3% lived in small towns and rural/remote regions. While 22.8% of respondents had completed community college, 30.1% had

**Table 1** Number of respondents and proportions of the sample from each region of Ontario

Region of Ontario	<i>n</i>	% total
East	131	6.7%
Ottawa	314	16.0%
Central north	105	5.4%
Central	264	13.5%
Toronto	331	16.9%
Niagara	226	11.5%
West	279	14.2%
South	102	5.2%
North	208	10.6%

an undergraduate university degree and 25.4% had either a professional or graduate degree. Just over a third (35.5%) reported an annual income less than \$40,000 compared to 25.1% who reported an income of \$80,000 a year or higher.

The majority of respondents had sex with only men (83.3%), while 11.1% reported sex with mostly men and 5.6% reported sex with equally men and women or mostly women. Respondents were most likely to be out with their friends (76.7%) compared to their family (61.0%) and least likely to be out at work (53.3%) and within their social circles (54.0%). A full 85.3% of respondents indicated they had a family doctor or nurse practitioner for primary care and of those 84.5% reported seeing their primary care provider at least once a year or more. Despite this relatively high degree of contact with the healthcare system, 29.1% of respondents had not disclosed their sexual orientation or same-sex sexual activity to their primary care provider.

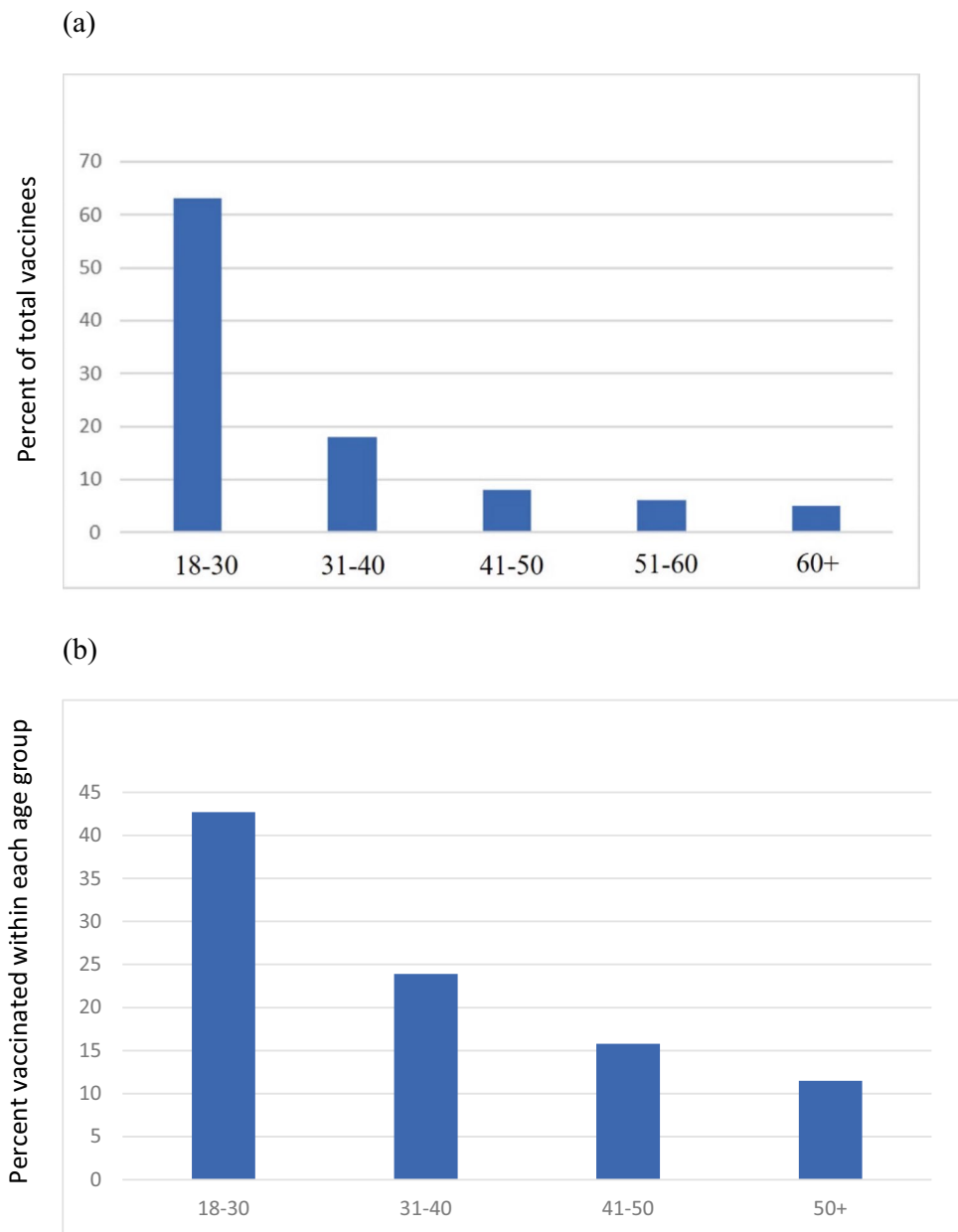
### Rates and Correlates of HPV Vaccination

#### (a) Age and Age-Related Factors

Of the 1960 survey respondents, 1788 (91%) answered the question regarding vaccinations. Of these, 488 (27.3%) indicated they had received the HPV vaccine. Unsurprisingly, vaccination was associated with younger age. Among vaccinees, 63.3% were 18–30 years of age and 18.2% were 31–40 years of age with less than 10% in each of the decennial age groups above (Fig. 1a). By age group, 42.7% of respondents 18–30 years of age reported having received the HPV vaccine while 23.9% aged 31–40, 15.8% aged 41–50, and 11.5% of respondents over the age of 50 had been vaccinated (Fig. 1b).

By single variable analysis using Chi-square, rates of vaccination based on living situation, income, and employment status were all a reflection of age. Respondents who lived with their parents (42.0%) or with a friend or roommate (34.5%) were more likely

**Fig. 1** **a** HPV vaccine recipients by age group ( $n=488$ ). **b** Proportion of survey respondents in each age group reporting they have received the HPV vaccine



to have received the HPV vaccine compared to those who lived alone (27.1%;  $p < 0.001$ ), with a same-sex partner or spouse (21.6%;  $p < 0.001$ ) or with an opposite-sex partner or spouse (3.2%;  $p < 0.001$ ). Similarly, respondents with an annual income less than \$20,000 were more likely to be younger and vaccinated (36.2%) compared to those in all higher income groups ( $p \leq 0.03$ ). Again, reflecting the influence of age, respondents 18–30 years of age were more likely to be vaccinated whether they worked part-time (48.4%) or full-time (40.7%;  $p = 0.07$ ) compared to respondents over 30 years of age who worked part-time (22.7%;  $p < 0.001$ ) or full time (18.2%;  $p < 0.001$ ) and more likely to be vaccinated compared to respondents

of any age who were unemployed (28.4%;  $p < 0.001$ ) (Table 2). Using binary logistic regression, age, place of residence, employment status, income, and who respondents live with were all found to influence HPV vaccine uptake.

#### (b) Place of Residence

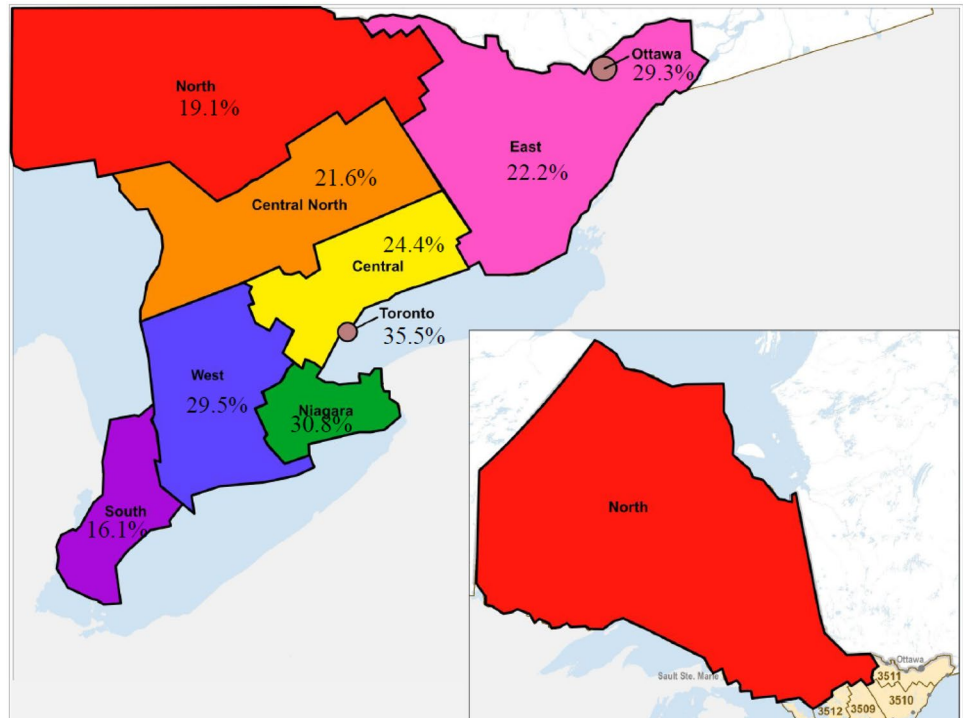
With respect to geography, rates of vaccination varied. Rates were highest in Toronto, where 35.5% of survey respondents reported having received the HPV vaccine, followed by the Niagara region (30.8%), the western part of the province (29.5%), and Ottawa (29.3%). Vaccination rates were lowest in the north

**Table 2** Percentage of survey respondents having received the HPV vaccine by living situation, employment status, and income

	% HPV vaccinated
<b>Living situation</b>	
With parents	42.0%
With friend/roommate	34.5%
Alone	27.1%
Same-sex partner/spouse	21.6%
Opposite-sex partner/spouse	3.2%
<b>Employment</b>	
Part-time, age 18–30	48.4%
Full-time, age 18–30	40.7%
Part-time, age > 30	22.7%
Full-time, age > 30	18.2%
Unemployed	28.4%
<b>Annual income</b>	
\$0–\$19,999	36.2%
\$20,000–\$39,999	27.0%
\$40,000–\$59,999	20.6%
\$60,000–\$79,999	27.7%
\$80,000–\$99,999	25.6%
> \$100,000	26.3%

(19.1%) and south (16.1%) (Fig. 2). Vaccination rates were highest for respondents who lived in urban settings (30.4%) followed by suburban areas (25.7%), small towns (22.5%), and rural/remote regions (16.0%).

**Fig. 2** HPV vaccine uptake among MSM in each region of Ontario. Figure modified from: Statistics Canada. (2017). Health Regions: Boundaries and Correspondence with Census Geography Map 8 Ontario, Local Health Integration networks (LHIN), 2017 [Infographic]. <https://www150.statcan.gc.ca/n1/pub/82-402-x/2017001/maps-cartes/rm-cr08-eng.htm>

**Table 3** Percentage of survey respondents having received the HPV vaccine relative to whether they were vaccinated (yes) or unvaccinated (no) to hepatitis A, hepatitis B, or seasonal influenza

Vaccinated	Yes	No	<i>p</i> value
Hepatitis A	34.6%	11.5%	<0.001
Hepatitis B	34.1%	7.3%	<0.001
Seasonal influenza	29.5%	24.8%	0.026

### (c) General Health and Primary Care

There was no significant difference in the rates of HPV vaccination among respondents who had a primary care provider versus those who did not (27.5% versus 26.3%;  $p=0.688$ ). For those who had a provider, there were also no significant differences with respect to how often they saw their provider. Among those who saw their provider 4 or more times a year, 29.5% reported having received the HPV vaccine. This was not different compared to those who saw their providers 2–3 times per year (27.9%;  $p=0.254$ ), once a year (25.7%;  $p=0.239$ ), or once every 2–3 years (22.4%;  $p=0.052$ ). Notably, there was also no difference in vaccination rates comparing respondents who had disclosed their sexual orientation or same-sex sexual activity to their provider (28.2%) and those who had not disclosed (26.0%;  $p=0.369$ ).

Interestingly, respondents who rated their health as average, good, or excellent were more likely to have received the HPV vaccine (28.6%) compared

**Table 4** Percentage of survey respondents having received the HPV vaccine relative to number of casual and regular sexual partners per month

Number of regular sex partners per month	% HPV vaccinated	Number of casual sex partners per month	% HPV vaccinated
None	26.8%	None	24.2%
1	25.7%	1	27.6%
2–5	29.6%	2–5	32.4%
6–10	36.6%	6–10	35.1%
> 10	34.3%	> 10	40.2%

to respondents who rated their health as fair or poor (18.1%;  $p = 0.001$ ) though it is possible this was age-related. There was no difference in HPV vaccination comparing respondents who were HIV-positive or negative (33.8% versus 27.7%;  $p = 0.114$ ). Unsurprisingly, respondents who had been vaccinated against hepatitis A, hepatitis B, or seasonal influenza were each more likely to have also received the HPV vaccine compared to those who had not received other vaccines (Table 3). In terms of mental health, there were no differences in rates of HPV vaccination with respect to depression, anxiety, or body image. Finally, in terms of extended health insurance, respondents who had an employee health plan (24.7%) were covered by an Ontario public plan (Ontario Drug Benefits/Trillium, 20.6%) and were on a private plan (18.5%), or a partner/spouse's plan (15.0%), all had relatively low rates of vaccine uptake suggesting access to vaccine payment coverage did not increase vaccination rates.

#### (d) Sexual Health

After age, the best predictors of HPV vaccination were sexual activity and engagement in sexual health. Vaccination rates increased steadily among respondents reporting more casual sex partners from 24.2% among respondents with no casual partners to 40.2% among those with more than 10 casual sex partners per month. A similar pattern was observed for increasing number of regular sex partners (Table 4). Notably, HPV vaccine uptake also increased among respondents undergoing regular HIV and sexually transmitted infections (STI) testing. While 35.5% and 36.0% of respondents who had tested within the last year for HIV and STIs, respectively, had received the HPV vaccine, only 10.9% and 10.7% who had tested more than 2 years ago were

**Table 5** Percentage of survey respondents having received the HPV vaccine relative to frequency of HIV and STI testing

Testing frequency	HIV	STIs
Within 1 year	35.5%	36.0%
Within 2 years	19.7%	20.3%
More than 2 years	10.9%	10.7%

vaccinated (Table 5). In the same vein, respondents reporting a prior diagnosis of gonorrhea, Chlamydia, or syphilis were all more likely to have received the HPV vaccine compared to those with no prior diagnosis (Table 6). Much of this may reflect a direct link with sexual health clinics. When asked where they sought health information, respondents who obtained information from sexual health clinics were more likely to have received the HPV vaccine (38.5%) compared to those who did not get information from these clinics (21.3%;  $p < 0.001$ ). Respondents who obtained health information from friends, the internet, and social media were also more likely to be vaccinated compared to those who did not seek information from these sources. Notably, respondents who obtained health information from their primary care provider were not more likely to have received the HPV vaccine when compared to those who did not seek information from their primary care provider (Table 7).

## Discussion

Using data from the Ontario Gay Men's Health Survey, we found low HPV vaccine uptake among MSM in Ontario with only about a quarter of respondents (27.3%) reporting that they had received the vaccine. Indeed, less than half (42.7%) of respondents between the ages of 18 and 30 years were vaccinated with successively less in each decennial age group above. These data are in line with other studies. Examining HPV vaccination among MSM in Canada's three largest cities (Montreal, Toronto, and Vancouver), Grewal et al. reported 26–35% of men  $\leq 26$  years of age, and only

**Table 6** Percentage of survey respondents having received the HPV vaccine relative to whether they had a prior (yes) or no prior (no) diagnosis of an STI

	Yes	No	<i>p</i> value
Gonorrhea	34.5%	25.3%	<0.001
Chlamydia	39.3%	24.8%	<0.001
Syphilis	33.7%	26.4%	0.038
Herpes	32.7%	26.8%	0.121
Genital warts	30.3%	27.0%	0.436

**Table 7** Percentage of survey respondents having received the HPV vaccine relative to whether they have sought health information from a specific source (yes) or not (no)

	Yes	No	% Difference	<i>p</i> value
STI clinic	38.5%	21.3%	17.2%	<0.001
Friends	33.3%	24.4%	8.9%	<0.001
Internet	29.9%	21.7%	8.2%	<0.001
Social media	31.4%	25.3%	6.1%	0.007
Family	31.8%	26.4%	5.4%	0.058
Media (TV, radio, and magazines)	28.8%	26.6%	2.2%	0.330
Family physician/nurse practitioner	27.7%	25.7%	2.0%	0.471

7–26% of men  $\geq 27$  years of age had received at least one dose of the vaccine (Grewal et al., 2021). Similarly, HPV vaccine uptake among MSM in the United States has been reported at 33–38% (Meites et al., 2022), while vaccination rates among MSM in France have been reported to be quite low at 1.2–8% (Bérot et al., 2023; Petit & Epaulard, 2020). On a positive note, uptake of the HPV vaccine appears to be increasing over time. In the present study, 29.3% of MSM in Ottawa (mean age 38.1) reported being vaccinated compared to 16.2% in a similar study we conducted among MSM in Ottawa (mean age 37.0) five years earlier (Moore et al., 2015). This increase cannot be attributed to vaccination within the school system. It was not until September 2016 that Ontario expanded its school-aged HPV vaccine program to include boys in grade 7. Since our survey was conducted from June 2018 to March 2019, the initial cohort of school-aged male vaccinees would not have been captured in our sampling, restricted to men 18 years of age and older.

Notably, having a primary healthcare provider did not increase the likelihood of HPV vaccination among our survey respondents nor did more frequent contact with providers. That said, a proactive offer of HPV vaccination to MSM is dependent on patient disclosure of sexual orientation. In this vein, 29.1% of our survey respondents reported they had not disclosed their sexual orientation or same-sex sexual activity to their primary care provider. Hesitancy to disclose sexual orientation within the healthcare system is a consistent finding in the literature (Brooks et al., 2018; Coleman et al., 2017) and manifests as a barrier to optimal care. Recognizing this, we still found no difference in HPV vaccination rates comparing survey respondents who had disclosed their sexual orientation to their provider and those who had not. Despite this, we still emphasize the first step in delivering appropriate care to MSM patients is the creation of clinical environments that are open and accepting to encourage and facilitate disclosure of sexual orientation. Research shows this includes having items such as pride flags, inclusive literature, and posters depicting same-sex couples visible in clinic spaces (Joint Commission, 2011). Providers also need to inquire about sexual orientation when talking to patients. While several studies have shown physicians feel unprepared and rarely ask about sexual orientation

(Kitts, 2010; Knight et al., 2014; Stott, 2013), providers with experience in MSM health find most patients appreciate the ask provided it is done with respect and genuine acceptance (Makadon, 2011). Finally, healthcare providers need to be more aware of clinical care recommendations as they pertain to MSM. Whereas the HPV vaccine is recommended for males between the ages of 9 and 26 years, in Canada, NACI has recommended no upper age limit for MSM.

Consistent with previous reports (Grewal et al., 2021; Meites et al., 2014), we found survey respondents were significantly more likely to have received the HPV vaccine when they had more sexual partners, had more recently undergone HIV and STI testing, had been diagnosed with an STI, had received other vaccines, and accessed health information from sexual health clinics. This connection between receiving the HPV vaccine and sexual health is not surprising but does emphasize the important role sexual health clinics play in delivery of optimal healthcare. Several studies from Australia and the United Kingdom have demonstrated patient preference for sexual health clinics over primary care for STI testing and treatment (Biggs & Walsh, 2015; Hambly & Luzzi, 2006; Llewellyn et al., 2013; Llewellyn et al., 2012; Miners et al., 2012). These studies have consistently shown patients experience greater comfort in these clinics, have more confidence in maintaining confidentiality, and have a greater appreciation of healthcare staff with respect to their attitudes around sexuality and expertise in sexual health. As has been suggested previously (Grewal et al., 2021), bundling HPV vaccination with other sexual health services for MSM is a strategy that may well increase vaccine uptake in this population. Indeed, this was shown to be effective in Scotland where 63.7% of eligible MSM ( $\leq 45$  years of age, male, and had sex with men) attending a sexual health or HIV clinic received at least one dose of the vaccine (Pollock et al., 2019).

An important finding in our study is that HPV vaccine uptake varied with area of residence. Examining MSM living only in Canada's three largest cities, Grewal et al. (Grewal et al., 2021) reported 33% of MSM  $\leq 26$  years of age and 26% of MSM  $\geq 27$  years of age living in Toronto received the HPV vaccine. Similarly, 35.5% of our survey respondents in Toronto reported being vaccinated. We

found, however, vaccine uptake was lower in Ontario's second-largest city, Ottawa, at 29.3% and was much lower in the northern (19.1%) and southern (16.1%) regions of the province. In fact, compared to MSM living in urban settings where 30.4% reported being vaccinated, we found uptake of the HPV vaccine among MSM was lower in suburban areas (25.7%), small towns (22.5%), and rural/remote regions (16.0%). Again, we note MSM living outside major metropolitan centers are largely ignored in both research design and clinical care.

Our study of course has limitations. First, our survey was based on self-report and so is subject to recall bias. Patients may not always remember which vaccines they have received. With that in mind, we did not ask survey participants if they had received the quadrivalent or nonavalent vaccine nor did we ask how many doses of the vaccine they received. Our study may also be subject to selection bias. An invitation to MSM to complete a survey on their health and healthcare needs may select for more health-conscious individuals and thus perhaps those more likely to seek vaccinations. This then could have led to an overestimate of HPV vaccine uptake. While survey respondents were fairly evenly distributed over age and income, the sample was overwhelmingly white and identified as either of British or European ethnicity. We were thus underpowered and cannot comment on vaccine uptake and correlates of vaccination for racialized groups and visible minorities. Finally, our study was conducted in Ontario where the HPV vaccine is available for free to certain demographics. Our findings thus may not be fully transferable to MSM living in other jurisdictions.

## Conclusions and Policy Implications

While the Canadian National Advisory Committee on Immunization (NACI) recommends the HPV vaccine for all MSM regardless of age, only a quarter of MSM in Ontario report having received the vaccine. If we are serious about delivering patient-centered care, given the high prevalence of HPV infection and incidence of HPV-associated anal cancer among MSM, uptake of the HPV vaccine within this population should be a priority. Our data suggest at least four areas for policy reform to help achieve that goal.

First, we recommend public funding of the HPV vaccine be aligned with clinical recommendations. While NACI recommends vaccination for all MSM regardless of age, men over the age of 26 must pay for the vaccine creating a barrier for many (Grace et al., 2018; Moores et al., 2015). In view of the clinical recommendation, we urge the HPV vaccine be made available free of charge to MSM irrespective of age. Currently, the province of Nova Scotia provides the vaccine free of charge to MSM  $\leq 45$  years of age (Goyette et al., 2021).

Second, while governments post-pandemic question the need for publicly funded sexual health clinics, our data reinforce their value as these clinics are often the clinics of choice for sexual minorities where individuals feel safe disclosing sexual orientation and confident in healthcare recommendations. Our data and those of others have shown sexual health clinics are effective and efficient in delivering preventative sexual health services to individuals at risk. As discussed previously, we believe bundling the HPV vaccine with other sexual health services for MSM, such as HIV pre-exposure prophylaxis (PrEP) and STI testing, is not only logical but is an efficient way to increase vaccine uptake and deliver comprehensive care.

Third, innovative strategies should be developed and funded to better deliver the HPV vaccine to older MSM and those living in rural areas. We have previously shown MSM living in small towns and rural settings in Eastern Ontario tend to be older, bisexual, and more likely to conceal their sexual orientation especially from their healthcare providers (Charest et al., 2023). In the current survey, 67.1% of respondents lived outside the two largest urban centers (Toronto and Ottawa) and 23.1% identified as living in small towns and rural regions. These numbers reflect a significant proportion of the target population. Online resources and information accessible from dating apps and social media directed to MSM may increase awareness of the vaccine among these men and direct them to clinics where the vaccine may be accessed safely and discretely.

Finally, policymakers and researchers must remember the MSM population is diverse in age, ethnicity, place of residence, and access to relevant healthcare. Data acquired from MSM living in large metropolitan centers should not be the sole source of information used to inform health policies for this population. We have previously shown MSM living in urban centers tend to be younger with greater access to sexual health services and are not representative of the larger MSM population as a whole (Charest et al., 2023). In line with this, we have shown here men living outside urban settings are far less likely to receive the HPV vaccine. More data on men living in smaller towns and rural/remote settings are needed, and policies and strategies must be developed to ensure these men are not ignored or left behind in the delivery of relevant healthcare. Optimal and inclusive healthcare for MSM should not be an urban phenomenon.

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**Author Contribution** PM and PO developed the study concept and research design. PM oversaw the acquisition of data. SR conducted the statistical analyses. PM and PO drafted the manuscript. All authors contributed to the interpretation of the data. All authors critically reviewed the manuscript and approved the final version.



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**Availability of Data and Material** The data are contained within this article. The datasets used and analyzed in this study are available on reasonable request from the corresponding author.

**Code Availability** Not applicable.

## Declarations

**Ethics Approval** This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by The Ottawa Health Sciences Network Research Ethics Board (Protocol 20140657-01H).

**Consent to Participate** Informed consent was obtained from all individual participants included in the study.

**Consent for Publication** Not applicable.

**Competing Interests** The authors declare no competing interests.

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