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Human papillomavirus and vaccine-related perceptions among men who have sex with men: a systematic review

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ABSTRACT

Background Targeted human papillomavirus (HPV) vaccine could prevent HPV-related cancers and genital warts among men who have sex with men (MSM). In order to develop effective vaccination programmes for MSM, it is crucial to understand their knowledge, beliefs about HPV and attitudes towards HPV vaccine.

Methods A systematic search of 10 databases examined articles investigating HPV knowledge and HPV-related perceptions among MSM. Each paper was assessed to identify potential research directions in the context of targeted HPV vaccination for MSM.

Results We identified 16 studies that included 5185 MSM and conducted mainly in North America. Generally, participants were over 26 years old, had poor-to-moderate knowledge about HPV and were not concerned about HPV-related diseases. Over a half of MSM were willing to accept HPV vaccine, if offered. However, there was large variability in HPV vaccine acceptability, partially due to inconsistencies in methods of ascertainment but also different levels of HPV vaccine awareness.

Conclusions Despite several misconceptions and poor knowledge of HPV infection, MSM might be receptive to HPV vaccination. However, further research is needed to identify which factors contribute to potential vaccine uptake in hypothetical MSM-targeted HPV vaccination. Future studies need to target those MSM with little sexual experience, who would benefit most from HPV vaccination.

INTRODUCTION

Men who have sex with men (MSM) are at risk of sexually transmitted human papillomavirus (HPV) infection, associated with genital warts, anogenital and oropharyngeal cancers.[1–3] Due to sexual practices such as receptive anal intercourse, MSM are at greater risk of anal cancer as a consequence of HPV infection than heterosexual men.[4] The incidence of anal cancer among MSM has risen in the last few decades, and HIV-positive men are at the highest risk (~78 per 100 000 men), even with antiretroviral therapy.[5 6] While effective screening programmes are being developed to reduce anal cancer morbidity, vaccination of MSM against HPV is a valuable preventive measure.

HPV vaccination reduces the risk of genital warts, and consequently, a fall in HPV-related cancers is expected.[7] Australian data show that female HPV vaccination has resulted in a dramatic decline in genital warts among both vaccinated women and unvaccinated heterosexual men of a similar age, demonstrating that high female vaccination coverage indirectly protects a proportion of heterosexual men through 'herd immunity'.[8] However, such reduced infection rates have not been observed in MSM, suggesting that vaccinating women will not protect MSM against anal cancer. To reduce the incidence of cervical cancer more effectively, policymakers in the USA, Canada and Australia have recently changed eligibility criteria to include males in HPV immunisation. As such, successful male vaccination in these countries will also reduce HPV-related diseases among MSM.[9] If affordable, high coverage of gender-neutral HPV vaccination will provide the best preventive opportunities for MSM. However, this strategy is unlikely to be implemented in countries with high coverage levels of female vaccination because of the low anticipated benefit and lack of cost-effective evidence.[10] This will further increase the health inequalities documented in MSM.[11]

MSM-targeted HPV vaccination

It is uncertain whether targeting MSM with HPV vaccination could significantly reduce the incidence of HPV-related diseases, although there is early indication that MSM-targeted vaccination in addition to routine female immunisation is likely to be cost-effective for MSM below the age of 26 and potentially therapeutic for seropositive MSM.[12–15] In order to speculate about the feasibility of such a risk-based strategy, it is crucial to examine HPV vaccine acceptability among MSM, as low vaccine uptake will fail to reduce HPV-related diseases. When preventing cervical cancers, HPV vaccination is most effective before sexual debut, as subsequent sexual experience increases the likelihood of HPV infection. This could be problematic as disclosure of sexual orientation in MSM tends to be after sexual debut. Furthermore, factors such as lack of readiness to discuss same-sex practices with healthcare providers (HCP), difficulty in self-identifying as gay or bisexual, low awareness of HPV-related diseases and negative attitudes towards HPV vaccination might compromise the effectiveness of targeted vaccination.[16] It is important to understand which factors contribute to HPV vaccine acceptability among MSM to develop effective preventive programmes. Therefore, we assessed the scientific literature to identify current levels of HPV knowledge, specific beliefs about HPV infection and attitudes towards HPV vaccination among MSM.

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METHODS

In accordance with PRISMA 2009 guidelines,[17] 10 electronic databases (figure 1) were systematically searched in December 2012 for studies investigating HPV knowledge, beliefs about HPV infection and attitudes towards HPV vaccine among MSM. Database search alerts were set up to identify newly published and relevant articles since the original database search. There were no geographical, time or publication-type restrictions, but only papers published in English were eligible. The references of reviewed articles were also hand-searched. Three international HPV experts and relevant search engines (eg, Google Scholar) were used to identify unpublished papers, reports and conference abstracts. Only articles reporting original quantitative primary data were included. These studies focused on MSM in relation to their sexual practices as well as self-identified homosexual/gay and bisexual men. Studies aimed at males and measuring sexual orientation but reporting low numbers of MSM participants (ie, less than 30 or 5% of the sample) were excluded. Data of heterosexual men were excluded. These criteria were established to ensure that the data included in the review were sufficient to draw valuable conclusions in the context of selective vaccination for MSM. No comparisons with heterosexual populations were made.

The lead author (TN) scanned titles and abstracts from each database and fully reviewed articles that met the inclusion criteria. Shortlisted studies were then assessed by two reviewers (TN, CJJ) working independently to extract key data. For studies that reported males in general, specific data about MSM were requested from authors to supplement the published findings.

The STROBE checklist for observational studies[18] and guidance for assessing risk of bias[19] were used to examine scientific quality. Two authors (TN, CJJ) assessed each study for its methodological strengths and weaknesses, generalisability of findings, use of theoretical frameworks and reliability of measures to establish scientific quality of reporting. Additionally, we comparatively examined the usefulness of data from each study in the context of hypothetical MSM-targeted HPV vaccination, taking into account the number and age of MSM participants and generalisability of the sample to the wider population of MSM below the age of 26 years. This criterion was in line with current HPV vaccine licence regulations. Based on these evaluations, each article was characterised as having *lower*, *medium* or *higher* comparative quality (table 1).

RESULTS

Study characteristics

Five studies involving MSM participants were excluded,[20–24] and 16 studies (table 1) met the inclusion criteria.[25–40] All studies were conducted prior to official HPV vaccine recommendation for men in the following countries between 2005 and March 2013: the USA (8), Australia (2), Canada (1), Italy (1), Sweden (1), Puerto Rico (1), Malaysia (1) and Hong Kong (1). Nine studies targeted MSM and seven recruited males regardless of sexual orientation. A total of 5185 men, self-identified as gay/bisexual, took part in cross-sectional surveys. Most studies did not report separate data for homosexual and bisexual men, so the review reflects a general MSM population. The majority of participants were white, either in education or already holding a higher degree, and living in urban areas. Participants were aged between 16 and 71 years, three studies targeted MSM below the age of 26.[33 36 39] Participants were mainly recruited via convenience sampling within large urban areas: gay community events and meeting points (7), sexual health clinics (4), universities (3) and population-based panels (2). Five studies applied psychological models within their design using constructs from either the Health Belief Model or Theory of Planned Behaviour.

The quality assessment classified two articles as having higher quality, five as medium and nine as lower. We selected two studies as having higher comparative quality because their methodological approach and findings could be generalised to a larger MSM population, likely to be eligible for HPV vaccination. The STROBE checklist (table 2) revealed that descriptions of the measurements' sources/reliability, potential sources of bias in design, anticipated sample size and possible generalisability were frequently omitted from the text.

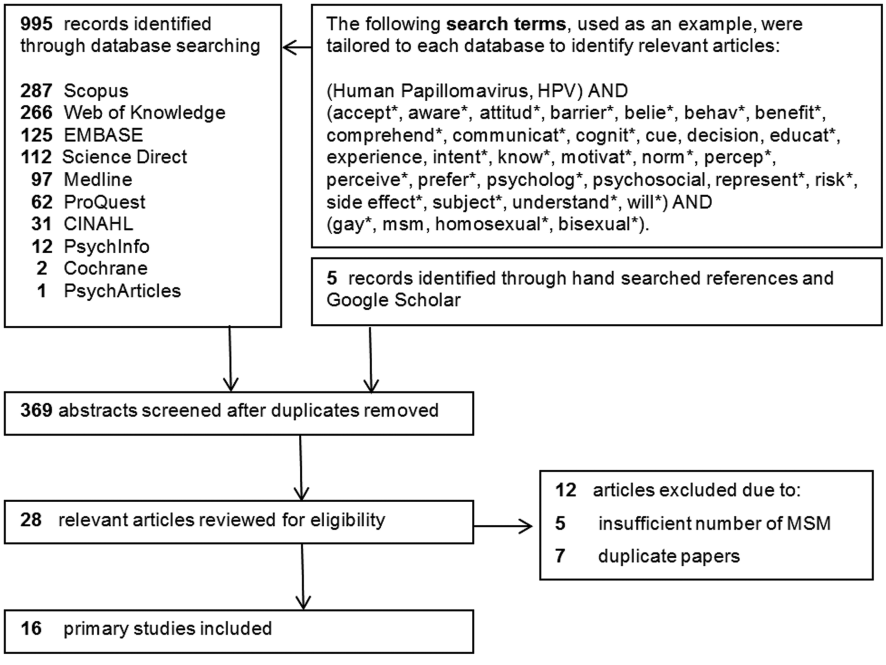


Figure 1 Review of articles for inclusion in systematic review.

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Table 1 The characteristics of 16 studies included in the review, including key variables, HPV vaccine acceptability and the overall quality

Author (year of publication)	Country	Number of MSM	Study design	Selected characteristics	Key variables	HPV vaccine acceptability	Comparative quality
Tider *et al* (2005)[25]	USA	1065	Questionnaire at two gay community events in New York	Mean age=36 (SD=10) 65% white/European	HPV knowledge Sexual history	NR	Lower
Pitts *et al* (2007)[26]	Australia	384	Questionnaire at gay community event in Melbourne	Mean age=37 (range: 16–67) 58% had high education qualification 67% in full-time employment	HPV knowledge HPV information source HPV risk factors beliefs Healthcare access	NR	Medium
Simatherai *et al* (2009)[27]	Australia	200	Questionnaire for gay/bisexual men at sexual health clinic in Melbourne	Median age=27 (range 19–71)	Willing to pay $A450 for HPV vaccine* HPV awareness Sexual history Sexual orientation disclosure	47%	Lower
Reiter *et al* (2009)[28]	USA	312†	Internet-based questionnaire for males via pre-existing panel of US households	Age range 18–59 (4.5% 18–26) 81% non-Hispanic white 56% had high education qualification 94% living in urban area	HPV vaccine acceptability* HPV knowledge Concern Perceived susceptibility Perceived severity Perceived vaccine effectiveness Perceived barriers Anticipated regret Cue to action Sexual history	74%	Medium
Sundstrom *et al* (2010)‡[29]	Sweden	75†	Multimodal nationwide survey of 14 000 adults recruited from the Swedish Population Register	Mean age=24 (SD=3, range 18–31) 86% born in Sweden 75% had high education qualification 55% living in rural area	Willingness to get vaccinated* Willingness to get vaccinated at any cost* Willingness to pay some cost of the vaccination* HPV awareness Perceived risk Belief about vaccine Sexual history Willingness to pay for vaccine HPV vaccine information request Reasons to abstain from HPV vaccine Beliefs about compensating risk	79% 7% 31%	Lower
Hernandez *et al* (2010)‡[30]	USA	88†	Questionnaire for males at university campus and general public in Hawaii	23% were under 26 years old	HPV vaccine acceptability*	75%	Lower
Thomas and Goldstone (2011)[31]	USA	191	Telephone and face-to-face survey at practice for HPV treatment offering 'off-label' HPV vaccine for gay/bisexual men	Mean age=37 (range 22–56) 80% white 86% previously diagnosed with HPV 50% diagnosed with non-HPV STI	Paid for HPV vaccine when offered (uptake)* HPV knowledge HPV vaccine information source Perceived barriers Perceived benefits Cue to action Risk compensation	65%	Lower
Blackwell and Eden (2011)[32]	USA	89	Questionnaire at various gay pride and gay community events	Mean age=32 (SD=13) 75% white 31% married/living with partner 67% had high education qualification	HPV knowledge HPV information source	NR	Medium
Wheldon *et al* (2011)[33]	USA	179	Internet-based questionnaire for gay/bisexual men through snowball sampling method via student organisations at 23 colleges and universities in southeast US	Mean age=21.6 (SD=3) 68% white 78% were in education 39% knows someone who received HPV vaccine 10% had no sexual experience	Likely to get vaccinated* HPV vaccine intentions* HPV knowledge Perceived susceptibility Perceived severity Perceived benefits	36% Mean=4.5 (SD=1.3, range 1–7)	High

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Table 1 Continued

Author (year of publication)	Country	Number of MSM	Study design	Selected characteristics	Key variables	HPV vaccine acceptability	Comparative quality
					Perceived barriers Self-efficacy Attitudes towards HPV vaccine Subjective norms Perceived behavioural control		
Pelullo *et al* (2012)[34]	Italy	630†	Face-to-face interview at gay community venues in Naples	Mean age=26 (SD=7, range: 16–62) 90% married 89% employed 14% had high education qualification	HPV vaccine acceptability* HPV knowledge	NR	Medium
Colón-López *et al* (2012)‡[35]	Puerto Rico	58†	Questionnaire for males and females at sexual health clinic in San Juan	Mean age=38 (SD=13) 68% HIV positive	HPV vaccine willingness* HPV awareness HPV vaccine awareness Perceived susceptibility	21%	Lower
Al-Naggar (2012)‡[36]	Malaysia	46†	Questionnaire for males on university campus in Shah Alam	Mean age=21 (SD=2) 100% had not heard of HPV vaccine	Likelihood of getting HPV vaccine* HPV vaccine awareness Sexual history	0%	Lower
Rank *et al* (2012)[37]	Canada	1169	Questionnaire at various gay community events in Vancouver	Median age=33 77% white 79% had high education qualification 18% HIV positive 56% have more than 5 sexual partners 26% use recreational drugs 18% diagnosed with genital warts	HPV vaccine acceptability* HPV knowledge Sexual orientation disclosure	67%	Higher
Sanchez *et al* (2012)[38]	USA	116	Questionnaire at sexual health clinic in New York City	Median age=25±7.8 (range 17–62) 46% non-Hispanic white 10% diagnosed with genital warts	HPV vaccine acceptability* HPV knowledge Perceived risk	86%	Lower
Gutierrez *et al* (2013)[39]	USA	41†	Questionnaire of a community-based convenience sample in Philadelphia	Median age=18 (range 13–21) 77% African-American	HPV vaccine intentions* HPV knowledge Attitudes Subjective norms Perceived behavioural control	Mean=2.6 (SD=1.2, range 1–5)	Lower
Lau *et al* (2013)[40]	Hong Kong	542	Face-to-face questionnaire at various gay venues in Hong Kong	25% were 18–25 years old 75% were 26–60 years old	Intention to uptake HPV vaccine* Intention to pay for the vaccine* Intention to uptake free HPV vaccine* HPV knowledge Perceived susceptibility Perceived severity Perceived benefits Perceived barriers Perceived self-efficacy Cues to action Sexual history	20% 29% 79%	Medium

*Reference variable for HPV vaccine acceptability/intention.
†Selected number of MSM subjects taken from a larger study sample.
‡Additional data retrieved from the authors.
HPV, human papillomavirus; MSM, men who have sex with men; NR, not reported; STI, sexually transmitted infection.

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Table 2 The result of the STROBE checklist assessment for reporting in observational studies

Author (year of publication)	Title and abstract	Intro		Methods									Results					Discussion				
		Background/ rationale	Objectives	Study design	Setting	Participants	Variables	Data sources/ measurement	Bias	Study size	Quantitative variables	Statistical methods	Participants	Descriptive data	Outcome data	Main results	Other analysis	Key results	Limitations	Interpretation	Generalisability	Funding
Tider *et al* (2005)[25]	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Pitts *et al* (2007)[26]	1	1	1	1	1	0	1	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0
Simatherai *et al* (2009)[27]	1	0	0	0	0	0	1	0	0	1	1	0	0	1	0	1	0	1	0	0	0	0
Reiter *et al* (2009)[28]	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Sundstrom *et al* (2010)[29]	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1
Hernandez *et al* (2010)[30]	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1
Thomas and Goldstone (2011)[31]	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1
Blackwell and Eden (2011)[32]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1
Wheldon *et al* (2011)[33]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1
Pelullo *et al* (2012)[34]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Colón-López *et al* (2012)[35]	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	1	0	0	0	1
Al-Naggar (2012)[36]	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	0	1	1	1	0	0
Rank *et al* (2012)[37]	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	0	1	1	1	0	1
Sanchez *et al* (2012)[38]	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0
Gutierrez *et al* (2013)[39]	1	1	1	1	0	1	1	1	0	0	1	1	1	1	1	1	0	1	1	1	1	1
Lau *et al* (2013)[40]	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0
Total	16	14	12	13	12	12	14	6	3	9	10	13	14	14	14	16	7	15	11	11	5	10

Knowledge about HPV

The majority of MSM sampled had a poor understanding of HPV and its causal role in cancer. On average, 63% (range 20–93%, 11 studies) had heard of HPV but fewer (39%; range 0–86%, five studies) were aware of HPV vaccine. Most MSM were more aware of 'a warts virus' rather than HPV per se. One study demonstrated that 63% of HPV-infected MSM reported having genital warts, but not HPV.[25] In a Swedish study, 20% reported hearing about HPV and 93% about condyloma.[29] Eight studies[26 28 31–33 38–40] used scales to assess HPV knowledge, showing that 36–75% of MSM associated HPV with sexual activity. While half knew HPV caused genital warts, fewer associated HPV with anal (32–53%), oral (25–47%) and penile (28–31%) cancers.[28 33 34] Between 22% and 55% recognised smoking, receptive anal intercourse, multiple sexual partners and unprotected sexual intercourse as the main risk factors for anal cancer.[26 28 34] Half of MSM knew HPV affects both sexes, and that infection may be asymptomatic.[28] The most cited sources of HPV information were primary care doctors and nurses, other healthcare professionals (HCP), magazines, television adverts, family members and friends.[28 31]

Perceptions of HPV

The majority of participants did not perceive themselves at risk of HPV or related diseases. There were greater perceptions of vulnerability to genital warts than anal cancer. Half of MSM in the Hong Kong sample had misconceptions about HPV, such as it being of low infectivity or controlled by antibiotics.[40] Most MSM in the US population-based study reported low levels of concern about developing HPV-related disease.[28] While 60% of New York sexual health clinic attendees considered themselves susceptible to HPV, 30% perceived a risk of anal cancer.[38] In contrast, three studies indicated that the majority of MSM thought HPV-related diseases such as anal cancer were severe and had a potentially damaging impact on health.[28 33 40]

Attitudes towards HPV vaccine

Most MSM showed positive attitudes towards HPV vaccine. Two studies reported that MSM believed HPV vaccination would be good, safe, smart, easy, important and harmless.[33 39] In general, MSM considered the HPV vaccine effective in preventing HPV-related diseases, with one study indicating lower perceived effectiveness in preventing genital warts than cancers.[40] One study showed that young MSM believed they would be generally encouraged by their family and friends to be vaccinated.[39] Five studies showed that MSM were concerned about high vaccine costs and possible side effects.[28–30 33 40] Factors such as fear of needles or difficulties accessing the clinic were perceived as potential barriers to receive the vaccine.[30] MSM expressed concerns about HPV vaccine safety, availability, lack of approval from healthcare authorities and number of doses needed to be effective.[28–30 40] In two studies, 78% of MSM had disclosed same-sex practices to their HCP and 93% would be willing to disclose their sexual orientation in order to be vaccinated.[27 37] MSM would also largely regret refusing HPV vaccination if diagnosed with HPV-related cancer later in life.[28]

HPV vaccine acceptability

Over half of MSM would accept HPV vaccination (mean=56%, median=65%, range 0–86%, 12 studies). There were no clear trends in HPV vaccine acceptability across various sampling venues, time of data collection and geographical location. To determine vaccine acceptability, four studies used *willingness to receive* the vaccine,[28–30 37] three *willingness to pay* for the vaccine,[27 29 40] one *likelihood of getting the HPV vaccine*,[36] three *intentions to be vaccinated*[33 39 40] and one estimated actual vaccine uptake status when it was offered 'off-label'.[31] The results were highly heterogeneous, and there were large differences between measures. For example, surveys that measured hypothetical *intentions* to receive the vaccine as an approximation of vaccine acceptability reported lower rates than those asking about *willingness* to receive HPV vaccine.

Awareness about HPV vaccine was related to vaccine acceptability. The studies conducted in the USA reported generally higher rates of HPV awareness and also greater willingness to be vaccinated.[28 30–31 33 38] For example, 85% of MSM from a New York sexual health clinic had heard of HPV and 86% reported willingness to receive the vaccine.[38] In contrast, none of the Malaysian MSM participants had previously heard of HPV vaccine and none considered themselves likely to receive it.[36]

Studies asking about willingness to pay reported lower acceptability than studies not addressing cost. Proposed greater personal vaccination cost was also associated with lower vaccine acceptability. While 41% of MSM in the Swedish sample would accept the vaccine if free of charge, only 7% would accept it at any cost.[29] Similarly, participants from Hong Kong showed higher rates of intention to be vaccinated when the HPV vaccine was free compared with $1000–2000 per shot (79% vs 29%).[40]

Three studies reported no significant associations between the age of participants and vaccine acceptability, demonstrating that there was no difference in willingness to be vaccinated between younger and older MSM.[28 33 37] One study also showed that there were no differences in HPV knowledge associated with age.[26]

Table 3 summarises statistically significant correlates of HPV vaccine acceptability among MSM across five studies.[28 31 33 37 40] The most frequently cited correlates of MSM HPV vaccine acceptability were HPV knowledge, perceived severity of HPV-related diseases, perceived risk of HPV-related diseases, perceived benefits of HPV vaccine and doctor's recommendation.

DISCUSSION

This review demonstrates that MSM showed insufficient knowledge of HPV-related cancers and the availability of HPV vaccine as a method of prevention. Most MSM failed to recognise HPV risk; however, anogenital cancers were generally perceived as severe. Despite little knowledge, more than half of MSM were willing to accept HPV vaccination. The observed differences in acceptability could be explained by variations in HPV awareness, specific barriers such as perceived vaccine cost, uncertainty about personal eligibility, side effects and perceptions of vaccine effectiveness. These findings are useful in the context of targeted vaccination, as little knowledge about HPV, low perceived susceptibility to HPV infection, negative attitudes towards the vaccine and lack of readiness to discuss same-sex practices with HCPs are likely to compromise the effectiveness of this preventive method. Previous studies have shown that individuals unaware of their risk and those with negative attitudes are less likely to adopt self-protective behaviours.[41 42]

Nevertheless, for individuals unaware of HPV, attitudes such as the willingness to accept vaccination are likely to be constructed instantly rather than revealed if faced with vaccination offer. These attitudes are usually weak, unstable and most likely dependent on the environment under which the decision is made.[43] It is possible that unaware MSM would construct stronger HPV vaccination preferences when facing doctor's recommendation in a clinical setting rather than answering a vaccine-related questionnaire. Therefore, future studies need to

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Table 3 Summary of statistically significant correlates of HPV vaccine acceptability among MSM presented in five studies

Acceptability correlates	Reference
Positive correlates	
Demographic variables	
Educational attainment—having a degree	33
>$20 000 income	37
Behavioural correlates	
Number of lifetime sexual partners	28
Ever diagnosed with genital warts	37
Vaccinated for hepatitis A or B	37
Identified as MSM to HCP	37
Exposed to HIV-related services in the last year (peer education)	40
Watching media reports promoting HPV vaccine	40
Knowledge about HPV and HPV vaccine	31, 40
Heard of HPV	37
Psychosocial correlates	
Concern about getting HPV-related disease	28
Perceived severity of HPV-related disease	28, 33, 40
Perceived likelihood of getting HPV-related disease	28, 33
Anticipated regret	28
Perceived effectiveness of HPV vaccine	28
Perceived benefits of HPV vaccination	33, 40
Attitudes towards HPV vaccine	33
Belief that doctor would recommend HPV vaccine	28, 40
Belief that peers would recommend HPV vaccine	40
Negative correlates	
Behavioural correlates	
Not using recreational drugs before or during sex	37
Age of first oral sex with a man	31
Unprotected anal intercourse in the last 6 months	40
Psychosocial correlates	
Perceived barriers to HPV vaccination (cost, safety)	33
Belief that HPV vaccine is a sign of promiscuity	40
Not self-identified as gay	37

HCP, healthcare providers; HPV, human papillomavirus; MSM, men who have sex with men.

assess HPV vaccine acceptability in the specific context of MSM-targeted vaccination incorporating information about the potential compromised effectiveness (due to the risk of HPV infection), settings, price, delivery methods and so on. We recommend that future acceptability measures portray scenarios, under which the hypothetical decision is going to be made, in order to increase individual understanding of the vaccination context, assess vaccine desirability and to identify the consistency of these preferences.

HPV awareness might be related to vaccine acceptability, and therefore, it is crucial to examine whether educating MSM about HPV would predict higher vaccine acceptability. Additional health promotion could also encourage younger MSM to disclose sexual orientation to enable discussion of HPV vaccine availability. Knowledge about hepatitis B vaccine and openness about sexual orientation to HCPs predicts hepatitis B vaccination.[44] UK data demonstrate a 90% uptake of hepatitis B vaccine among MSM at sexual health clinics, suggesting MSM are willing to adopt protective behaviours against sexually transmitted infections (STIs).[45] Australian data indicate that high coverage of MSM-targeted hepatitis B vaccination has contributed to increased levels of hepatitis B immunity in MSM.[46] Although this suggests that MSM-targeted vaccination is acceptable and achievable, uncertainty exists as to what degree HPV and hepatitis B vaccination strategies can be compared across various healthcare systems and countries. Consideration should be also given to the specific additional resources needed for this strategy to succeed such as information campaigns encouraging vaccination when evaluating its practicability.

The feasibility of targeted vaccination in various settings (eg, primary care, pharmacies, specialised sexual health services, alternative settings[47]) needs to be explored to identify strategies to enable a large number of MSM to accept HPV vaccination. Willingness to accept HPV vaccine at an early stage of sexual activity is likely to play an important role in establishing effectiveness of this risk-based strategy. Correspondingly, future studies need to examine HCP's attitudes towards offering HPV vaccination to their MSM patients and identify potential training requirements, as doctor's recommendation is a significant factor likely to influence the efficacy of this strategy.

Methodological issues

There is wide variation in individual study designs, methodological approaches and characteristics of MSM resulting in limited comparability of findings. There is no standardised measurement of vaccine acceptability, and researchers report *willingness, intentions* or *likelihood* when referring to the hypothetical openness and readiness to receive HPV vaccination. These constructs are likely to represent different psychological properties and could introduce bias when estimating vaccine desirability or uptake rates.[48] For example, participants unaware of HPV might be unable to construct *intentions* to be vaccinated, indicating restrictions of this measurement when assessing hypothetical behaviours. As such, there is a need to develop a sensitive and standardised measurement of vaccine acceptability that could be incorporated in modelling of vaccination behaviour.

The earlier studies present lower quality and the applicability of findings when estimating the feasibility of MSM-targeted HPV vaccination. While nine studies recruited MSM, seven were aimed at males in general, restricting generalisability of findings. Inability to relate the content of the questionnaire to individual circumstances might influence the validity of results. Two studies attempted to recruit MSM via population-representative sampling, whereas most studies were conducted in predominantly urban places likely to be visited by MSM (eg, gay pride, sexual health clinic). These sampling methods are likely to attract MSM with substantial sexual experience. Only three studies focused on perceptions and preferences of MSM below the age of 26 who would most benefit from vaccination against HPV. Future studies need to focus on younger MSM, as this group is most relevant for HPV vaccination. Studies used various measurements of HPV knowledge, and it was challenging to distinguish whether participants were primed with any information about HPV. Any form of priming could influence vaccine acceptability. Only five studies incorporated theoretical frameworks when examining correlates of HPV vaccine acceptability. It is important to understand how MSM perceive their own risk and whether HPV information would result in positive attitudes towards HPV vaccination. Finally, seven studies assessed sexual history and additional behavioural data enhance the understanding of whether sexual experience is associated with vaccine acceptability.

CONCLUSION

Despite poor knowledge about HPV, most MSM are receptive to HPV vaccination. Future intervention studies need to

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examine whether awareness campaigns with corresponding doctor's recommendation result in higher HPV vaccine acceptability. In order to design the most optimal MSM-targeted HPV vaccination programmes, it is essential to understand which demographic, behavioural and psychosocial factors correlate with vaccine acceptability among MSM. We recommend that future studies focus on MSM with little sexual experience, apply measures of acceptability that incorporate specific vaccination scenario, use theoretical frameworks and define predictors of HPV vaccine acceptability and uptake. It is crucial to understand factors that would enable sexual orientation disclosure of young MSM and whether offering a vaccination combination for both HPV and hepatitis B could potentially attract a larger number of MSM willing to be vaccinated. As such, in the absence of gender-neutral HPV vaccination, MSM-targeted strategies would require the implementation of sensitive techniques at an individual level to encourage a large number of MSM to discuss their HPV risk and the availability of HPV vaccine.

Key messages

- Men who have sex with men (MSM) have poor understanding of the causal role of human papillomavirus (HPV) in the development of anogenital and oral cancers.
- The majority of MSM did not consider themselves at risk of HPV.
- Men who were aware of the virus expressed greater willingness to receive the vaccine.
- The diverse HPV vaccine acceptability measures used in these studies might not indicate actual uptake rates. Future research must use validated tools, able to predict vaccination uptake.
- More research is needed to understand which factors predict HPV vaccine acceptability among MSM with little sexual experience.

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