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The relationship between men who have sex with men on PrEP and care providers is essential for HPV vaccination: A mixed-methods study in France

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ABSTRACT

Objective: Despite regular follow-up, men who have sex with men (MSM) taking PrEP (Pre-Exposure Prophylaxis) have suboptimal human papillomavirus (HPV) vaccination rates. We aimed to identify the barriers and levers to HPV vaccination among this population.
Design: A cross-sectional online survey collected quantitative data on HPV vaccination and PrEP use from 3730 French MSM; 29 qualitative interviews were also conducted between February and August 2022.
Methods: Quantitative analyses were restricted to the 354 MSM under 32 years old (i.e., individuals who were currently or had previously been eligible for HPV vaccination reimbursement) who took PrEP. The HPV vaccination rate was calculated and the associated factors were estimated by a Poisson regression model. Ten of the 29 qualitative interviews were analysed to study PrEP users' perceptions of the levers and barriers to HPV vaccination.
Results: The HPV vaccination coverage rate was 71.2 %. MSM who were recommended vaccination by a physician and those who felt comfortable talking about vaccination with their physician were more likely to be vaccinated than the others. The interviews underlined that persistent missed opportunities for HPV vaccination were linked to less close and trustful relationships with physicians, essential factors in being able to discuss sexuality, and therefore to receive appropriate vaccination recommendations.
Conclusion: The HPV vaccination coverage rate in French MSM who take PrEP is below the 80 % target. Including HPV vaccination in PrEP management recommendations, and improving the training of physicians on MSM health issues are essential measures to enhance vaccine coverage.

1. Introduction

In men who have sex with men (MSM), condyloma (i.e., genital warts) caused by the human papillomavirus (HPV) are common, and the incidence of anal cancer linked to HPV infections is high compared to men who only have sex with women [1]. The prevalence of high-risk HPV localized to the anal area was 41.2 % among MSM compared to 6.9 % among men who have sex with women exclusively [2].

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Furthermore, among MSM, those living with HIV are the most concerned by HPV infection and associated diseases [1]. A recent French study showed that MSM taking pre-exposure prophylaxis (PrEP) had a similar burden of HPV infection to MSM living with HIV [3,4].

HPV vaccination is very effective in HPV infection-naive MSM, and in preventing anal cancer and certain types of condyloma [5]. However, vaccination is only moderately effective in preventing the development of anal cancer and HPV infections among MSM who have previously been infected.

Until 2016, France recommended HPV vaccination for girls aged 11 to 14, with catch-up vaccination up to age 23. From 2016, French authorities extended these recommendations to MSM under 26. Only in 2019 did the French High Authority of Health recommend extending vaccination to all boys aged 11 to 14 years old [6,7]. In 2023, the HPV vaccination coverage was 26 % for at least one dose among 15-year-old boys, and 55 % among 15-years-old girls [8].

A study in France estimated that in 2019 (i.e., three years after the HPV vaccination recommendation for MSM) only 15 % of MSM in France were vaccinated against HPV [7]. This under-vaccination has also been documented in other countries which have implemented HPV vaccination catch-up programs for MSM (e.g., Australia, Brazil, Canada, etc.) [9]. Modelling studies have estimated that vaccination rates below 80 % are suboptimal and less cost-effective in preventing anal cancer [10].

Several factors contribute to the low HPV vaccination rate at different levels. At the individual level, MSM under 25 or over 40 with low socioeconomic status are less likely to get vaccinated. These individual factors interact with interpersonal, healthcare-related, and structural factors, such as access to LGBTQIA+- inclusive care [9].PrEP – which can be considered as a healthcare-related factor – is positively associated with HPV vaccination in MSM [11]. Since 2016, PrEP has been available in France and reimbursed for individuals exposed to the risk of HIV infection. PrEP is provided in hospitals, in CeGIDD (sexual health centres), and since 2021, by general practitioners (GP). Moreover, in the second half of 2022, physicians working outside hospitals or sexual health centres were responsible for half of PrEP initiation or renewal prescriptions, and 89 % of these prescribers were general practitioners [12]. Taking PrEP involves quarterly follow-up which includes STI screening. However, despite PrEP being a factor in HPV vaccination, a very recent study showed that the vaccination rate was low in MSM taking PrEP (hereafter, MSM-PrEP) followed-up in a sexual health centre in France [13]. Additionally, only 12.5 % of PrEP users who had been prescribed PrEP by a physician in private practice had a reimbursement for HPV vaccination [12].

It would seem that certain obstacles to HPV vaccination in the MSM population persist in the French context. In the literature, issues surrounding MSMs' relationship with health professionals are one such obstacle. These issues include the disclosure of one's sexual orientation and vaccination recommendations by physicians [14]. Accordingly, it would seem relevant to examine the role of this relationship in relation to HPV vaccination in the sub-population of MSM-PrEP, a population, which is a priori comfortable talking about sexuality with healthcare personnel, and which is followed-up regularly [15]. Such an examination would help us to better understand the missed opportunities for HPV vaccination in MSM-PrEP, despite being a subpopulation at greater risk of infection than the general population, and receiving closer health follow-up than MSM who do not take PrEP.

In France, no study has been published on the perception of the barriers and levers to HPV vaccination among MSM-PrEP [16]. In this context, we conducted a mixed-methods study, whose primary aim was to identify barriers and levers of HPV vaccination among MSM-PrEP.

The specific objectives of the quantitative component of the study were: i) to estimate the proportion of MSM-PrEP vaccinated against HPV, ii) to describe the characteristics of HPV vaccination and vaccination intention among unvaccinated MSM-PrEP, and iii) to identify the factors associated with non-vaccination. The specific objectives of the qualitative component were i) to collect MSM-PrEPs' perceptions on HPV vaccination (awareness, fears, motivations) and ii) to understand the possible barriers and levers in connection to HPV vaccination linked to their relationships with healthcare professionals (access to healthcare professionals, discussion of HPV vaccination and sexual orientation with the latter).

2. Methods

2.1. Data

Vaccigay is a French mixed-methods cross-sectional study conducted in 2022. It has been described in detail elsewhere [17]. Briefly, volunteer MSM residing in France completed an online questionnaire (quantitative component) between 15 February and 31 August 2022.

Adults aged 18 or older were eligible to participate in the online survey if they met the following criteria: self-identified as a man, a transgender man or a queer man (irrespective of sex assigned at birth) and either had sexual relations with men or had never had sexual relations with men, but did not identify as heterosexual. This study was approved by the University of Aix-Marseille Ethics Committee on the 10/23/2020 (approval number: 202010–08-008).

The questionnaire collected information on their sexual behaviour, vaccination status, and attitudes towards vaccination (i.e., hereafter understood as 'vaccination in general' and not only for HPV unless otherwise stated) and socio-demographic characteristics. At the end of this quantitative questionnaire, participants were asked to leave their contact details if they also wished to participate in the qualitative component of the study (i.e., a telephone-based semi-structured survey). A selection of participants to be contacted was made based on their age group (either $\leq$30 years old or $\geq$ 30 years old) and their HPV vaccination status, in order to have a similar number of individuals in each age group. Like the quantitative component, the qualitative component took place between February and August 2022.

The objectives of the qualitative study as well as the rights of the participants were presented at the start of the telephone interview. Interviews were conducted in French and were audio-recorded with the participants' consent. They lasted approximately 40 min. The interview guide consisted of a main question: "In general, what is your point of view on vaccination?". Specific questions focused on participants' perceptions in terms of: i) preferences, barriers and levers for certain vaccines, ii) knowledge of HPV and HPV vaccination, iii) the impact of the COVID-19 pandemic on MSM views regarding vaccination, iv) the ability of MSM to discuss their sexual orientation and vaccination with GPs, v) suggestions to improve vaccination for MSM, and vi) their needs in terms of suitable care for MSM.

2.2. Analyses

2.2.1. Data triangulation

Data triangulation aims to increase the validity of results by combining multiple data sources, including qualitative and quantitative data [18]. An initial analysis of the qualitative interviews was conducted through immersive reading of the full transcripts, using a coding grid based on predefined themes derived from the interview guide. This first step also allowed for the emergence of additional, unanticipated themes. Notably, the role of PrEP follow-up in shaping access to HPV vaccination —initially absent from the study's research framework— was identified during this stage. These findings led to a refinement of our research question, giving rise to the present analysis focused specifically on MSM using PrEP. All statistical analyses as well as the analysis of the interviews extracted were conducted jointly by three members of the research team. Results from qualitative and quantitative data were triangulated in order to jointly interpret and identify themes of divergence and convergence [19].

2.2.2. Qualitative analysis

The interviews were transcribed and analysed using NVivo software. Thematic analysis was conducted by two researchers (MM and CO) following a hybrid approach: deductive codes were based on the interview guide, and inductive coding allowed for new themes to emerge [20]. A preliminary coding framework was developed and iteratively refined as coding progressed. Codes and subcodes were then organized into a structured codebook. For this specific analysis, we extracted all interviews with participants who reported using PrEP and focused on themes related to HPV vaccination. These included perceptions of the vaccine, the role of PrEP follow-up, relationships with physicians, and barriers linked to the COVID-19 pandemic. To ensure the reliability of the analysis, a second coder reviewed the thematic structure and coding, and discrepancies were discussed and resolved collaboratively within the research team.

2.2.3. Quantitative analysis

2.2.3.1. Definition and construction of variables

2.2.3.1.1. HPV vaccination. Self-reported HPV vaccination rates were assessed using the question "Are you vaccinated against the papillomaviruses called HPV? (Yes, No, Don't know)".

2.2.3.1.2. PrEP status. Participants were identified as MSM-PrEP if they reported having used PrEP during their most recent sexual intercourse.

2.2.3.2. Statistical analyses. As HPV vaccination was already reimbursed by the French social security system for MSM under 26 years old for six years at the time of the survey, the study sample was restricted to MSM-PrEP under 32 years old.

Bivariate analyses using Chi2 tests explored the relationships between the HPV vaccination rate and the study sample's i) sociodemographic characteristics (age, gender, region of residence, country of birth, level of education, professional and financial situation, health insurance), ii) use of healthcare (attending a CeGIDD, HPV screening, screening for other STIs, regular follow-up by a physician, and sharing of one's sexual orientation with the latter), iii) relationship with one's physician (trust in the physician regarding vaccination, discussion of sexual practices) and iv) other vaccinations (specifically, Hepatitis A and B).

We then performed a modified Poisson regression model [21]: variables significantly associated with HPV vaccination at the threshold $\alpha = 0.10$ in the bivariable analyses were included in the multivariable model, as were the confounding factors identified in our literature search.

3. Results

3.1. Description of study sample

3.1.1. Study population

3.1.1.1. Quantitative data. In total, 3730 MSM fully completed Vaccigay's quantitative questionnaire. For the present analysis, the study population comprised 354 MSM-PrEP under 32 years old.

Specifically, 18–26-year-olds represented 49.4 % of our study population (Table 1). The vast majority self-identified as men (96.3 %), 87.0 % reported lifetime sexual relations exclusively with men, 42.9 % lived in the Greater Paris area, 85.3 % were born in France, 47.2 % had at least five years' third-level education, 60.2 % were employed, 33.9 % reported financial difficulties, and 94.1 % had complementary health insurance.

During the 12 months before the Vaccigay study, 58.8 % had been tested for HPV, 97.1 % for another STI, and 71.7 % reported they had attended a CeGIDD.

Table 1
Characteristics of the MSM-PrEP population under 32 years old, and HPV vaccination rate according to participant characteristics ($n = 354$).

	MSM on PrEP under 32 years old (n = 354)		HPV vaccination rate	
	N	%‡	N	% row
Overall	354	100.0	252	71.2
SOCIODEMOGRAPHIC CHARACTERISTICS				
Age, (years)				***
18–26	175	49.4	143	**81.7**
27–31	179	50.6	109	60.9
Sex assigned at birth				NS
Male	346	97.7	244	70.5
Female	8	2.3	8	100.0
Self-identified gender				NS
Man	341	96.3	240	70.4
Trans man (Female to Male)	4	1.1	4	100.0
Genderqueer /Non-binary	8	2.3	7	87.5
Other	1	0.3	1	100.0
Gender of sexual partners (lifetime)				NS
Men only	308	87.0	223	72.4
Men and women	46	13.0	29	63.0
Region of residence				NS
Ile-de-France (Greater Paris area)	152	42.9	111	73.0
Other	202	57.1	141	69.8
Country of birth				NS
France	302	85.3	220	72.9
Europe	18	5.1	10	55.6
Outside Europe	34	9.6	22	64.7
Education level				NS
< Upper secondary school diploma	18	5.1	10	55.6
Upper secondary school diploma	42	11.9	24	57.1
2,3, or 4 years - third level education	127	35.9	95	74.8
5 years or more - third level education	167	47.2	123	73.7
Employment situation				NS
Active population - employed	213	60.2	148	69.5
Active population - unemployed	24	6.8	15	62.5
Inactive population	117	33.1	89	76.1
Self-perceived financial situation				NS
Really comfortable to comfortable	234	66.1	166	70.9
Neither comfortable nor struggling to really struggling	120	33.9	86	71.7
Complementary health insurance				**
Yes	333	94.1	243	**73.0**
No / DNK	21	5.9	9	42.9
OTHER TARGET VACCINATIONS				
Vaccination Hep A				***
Yes	270	76.3	220	**81.5**
No / DNK	84	23.7	32	38.1
Vaccination Hep B				***
Yes	319	90.1	243	**76.2**
No / DNK	35	9.9	9	25.7
HEALTHCARE USE				
HPV screening in previous 12 months				NS
Yes, negative result(s)	190	53.7	144	75.8
Yes, at least one positive result	18	5.1	11	61.1
No/DNK	146	41.2	97	66.4
Screening for STIS other than HPV in previous 12 months				NS
Yes, negative result(s)	209	59.0	146	69.9
Yes, at least one positive result	135	38.1	101	74.8
No/DNK	10	2.8	5	50.0
Attended a CeGIDD (sexual Health Clinic) in previous 12 months				NS
Yes, more than once	228	64.4	167	73.3
Yes, once	26	7.3	16	61.5
No	100	28.3	69	69.0
Consultation by a physician and disclosure of sexual orientation to this professional				*
No regular consultation	12	3.4	6	50.0
Regular consultation by physician not informed about sexual orientation	30	8.5	16	53.3
Regular consultation by a physician informed about sexual orientation	312	88.1	230	**73.7**
Have you ever discussed your sexual practices with a physician who follows you?				NS
Yes, often	157	44.4	113	72.0

(*continued on next page*)

Table 1 (*continued*)

	MSM on PrEP under 32 years old (n = 354)		HPV vaccination rate	
	N	%‡	N	% row
Yes, sometimes	97	27.4	70	72.2
Yes, rarely	35	9.9	28	80.0
No, never	53	15.0	35	66.0
No regular consultation	12	3.4	6	50.0
Are you comfortable discussing vaccinations with your physician?				***
Totally comfortable	258	72.9	196	**76.0**
Quite comfortable	72	20.3	49	68.1
Not really comfortable	14	4.0	5	35.7
Not at all comfortable	4	1.1	2	50.0
You do not know	6	1.7	0	0.0
Physician recommended HPV Vaccination				***
Yes	247	69.8	216	**87.4**
No	100	28.2	35	35.0
DNK	7	1.9	1	14.2

† Chi^2 p-value for categorical variables, ANOVA for continuous variables. *** $p \leq 0.001$ ** $p \leq 0.01$ * $p \leq 0.05$ ‡Unless otherwise stated.
Abbreviation: DNK: Do not know, NS: non-significant.

3.1.1.2. Qualitative data. A total of 232 MSM who responded to the quantitative questionnaire volunteered to participate in the qualitative component of the study. From this group, 50 participants were randomly selected using stratification based on age and HPV vaccination status, and were subsequently contacted. Of these, 29 completed a telephone interview. Among them, 10 participants reported during the interview that they were using PrEP at the time of the study. Accordingly, for the present analysis, we focused on the transcripts of these 10 participants (Table 2).

3.2. PrEP, a tool that facilitates access to HPV vaccination

The self-reported HPV vaccination rate of the 354 participating MSM-PrEP was 71.2 % (Table 1). Vaccination had occurred on median one year prior to the study (Table 3).

The HPV vaccination rate differed among participants based on sociodemographic characteristics, specifically age and complementary health insurance (Table 1). The youngest MSM-PrEP (i.e., < 27 years old) were more likely to be vaccinated against HPV than the oldest MSM-PrEP (i.e., 27–31 years old) (81.7 % vs. 60.9 %, respectively; *p*-value: <0.001). Moreover, MSM-PrEP who had a complementary health insurance were more likely to be vaccinated than those without this insurance (73 % vs. 42.9 %, respectively; p-value: <0.01).

MSM-PrEP vaccinated against hepatitis A and B were also more likely to be vaccinated against HPV than those not vaccinated against these two diseases (Hepatitis A: 81.5 % vs. 38.1 %, respectively; *p*-value: <0.001; Hepatitis B: 76.2 % vs. 25.7 %, respectively; p-value: <0.001).

With regard to healthcare use, those who reported they were completely comfortable talking about vaccination (in general) with their doctor were more likely to be vaccinated against HPV (76.0 %) than those who felt somewhat comfortable (68.1 %) talking about vaccination, and those who did not feel comfortable (35.7 %, *p*-value: <0.001). The same trend was observed for MSM-PrEP regularly followed-up by a physician to whom they had shared their sexual orientation to (73.7 %) compared to those regularly seen who had not shared their sexual orientation (53.3 %), and those not regularly followed-up (50 %, *p*-value: <0.01). MSM-PrEP who had been recommended HPV vaccination by a physician were more likely to be vaccinated than those who had not received any such recommendation from a physician (87.4 % vs. 35.0 %, respectively; p-value: <0.001) (see Table 1).

The qualitative interviews highlighted that taking PrEP fostered vaccination. Participants reported that HPV vaccination and other vaccinations were offered during PrEP initiation consultations. Moreover, participants perceived that information about vaccination in general was conveyed better to them (i.e., MSM-PrEP) than to MSM who did not take PrEP, allowing them to better manage their own sexual health, and therefore to be more likely to decide to get vaccinated for recommended vaccines (e.g., as HPV, hepatitis).

"*What's true is that in PrEP follow-up, PrEP initiation, uh, they check*

Table 2
– Age and HPV vaccination status of participants at each stage of the qualitative component: contact information provided, randomly selected, interviewed, and PrEP users.

	Participants who provided contact information		Randomly selected			Participated	Participated and PrEP Users	
	N	%	N	%	N	%	N	%
Age ≥ 30 years old	**161**	**69 %**	**24**	**48 %**	**15**	**52 %**	**3**	**30 %**
HPV Vaccinated	27	17 %	**8**	33 %	6	40 %	2	67 %
Not HPV Vaccinated	134	83 %	16	67 %	9	60 %	1	33 %
Age < 30 years old	**71**	**31 %**	**26**	**52 %**	**14**	**48 %**	**7**	**70 %**
HPV Vaccinated	44	62 %	**8**	31 %	5	36 %	3	43 %
Not HPV Vaccinated	27	38 %	18	69 %	9	64 %	4	57 %
Overall	**232**		**50**		**29**		**10**	

Table 3
– i) Vaccination characteristics among MSM-PrEP under 32 years of age vaccinated against HPV ($N = 252$); ii) HPV vaccination-related information, recommendations and vaccination intention among MSM-PrEP under 32 years of age not vaccinated against HPV ($N = 102$), Vaccigay survey.

MSM-PrEP under 32 years old and vaccinated against HPV	N = 252	% col
Time between first HPV vaccination and study date (years)		
median [IQR]	249	1 [1;3]
Recommended by a physician to get vaccinated against HPV		
Yes	216	85.7
No	35	13.9
You do not know	1	0.4
MSM-PrEP under 32 years old and not vaccinated against HPV	N = 102	% col
Had heard about the HPV (papillomavirus) vaccine		
No	10	9.8
Yes, heard about it only for girls	33	31.4
Yes, heard about it for boys and girls	52	50.9
You do not know	7	6.9
Recommended by a physician to get vaccinated against HPV		
Yes	31	30.3
No	65	63.7
You do not know	6	5.8
HPV vaccination intention in the following 12 months		
Yes, as soon as possible	13	12.7
Yes, as soon as possible, even if the cost of the vaccine is not reimbursed for persons ≥27 years old	16	15.7
Yes, but I'm still hesitant	15	14.7
No, but I'd do it if the vaccine were reimbursed	18	17.6
No, but I'm thinking about it	12	11.8
No, not at all	12	11.8
You do not know	16	15.7
Not in favour of the HPV (papillomavirus) vaccine		
Yes/ DNK (i.e., not in favour)	5	5.1
No	91	94.9

everything that uh, uh [concerns] being up to date with vaccines; all this, basically, is a bit of a prerequisite for the first [PrEP] consultation. So it's…I don't know if I would have spoken straight away, well, without doing this PrEP follow-up at the hospital. I don't know if my attending physician would have approached [the subject of] vaccination on his own, like" (MSM-PrEP/HPV vaccinated/under 30 years old).

Qualitative data also highlighted that some physicians go beyond current recommendations by suggesting HPV vaccination to MSM who are over 26 years old in order to prevent HPV recurrence in those previously infected.

3.3. Persistent missed opportunities for HPV vaccination

Although PrEP follow-up in France provides a framework for fostering HPV vaccination, 28.8 % of the 354 MSM-PrEP included in the quantitative component of the present study were not vaccinated against HPV. In terms of HPV vaccine awareness, a total of 49.1 % of those not vaccinated had never heard of HPV vaccination or thought it was only for girls. Only 5.1 % of unvaccinated MSM-PrEP were against HPV vaccination (Table 3). With respect to HPV vaccination intent, 43.1 % intended to get vaccinated, 11.8 % did not intend to do so but were considering it, 17.6 % did not intend to but would get vaccinated if the cost were reimbursed, 11.8 % had no intention of being vaccinated, and 15.7 % do not know. In addition, two thirds (63.7 %) of unvaccinated MSM-PrEP reported that no physician had recommended HPV vaccination to them (see Table 3).

3.4. Factors associated with HPV vaccination: MSM-PrEPs' relationship with physicians is pivotal

In our quantitative multiple analyses, MSM-PrEP in the age group eligible for reimbursable HPV vaccination at time of the survey (i.e., 18–26 years) were more likely to be vaccinated against HPV than their older counterparts (i.e., 27–31 years) (adjusted Prevalence Rate Ratio (aPRR) = 1.23 [95 % CI: 1.09–1.40]). All things being equal, with the exception of age, only factors related to MSM-PrEPs' relationships with physicians were associated with HPV vaccination (see Table 5). Being completely comfortable talking about vaccination with a physician (aPRR = 1.27 [95 % CI: 1.08–1.45]) (compared with being somewhat or not really comfortable) and having being recommended by a physician to get vaccinated (aPRR = 2.37 [95 % CI: 1.81–3.10] were both associated with a greater likelihood of HPV vaccination.

3.5. Being comfortable with physicians and sharing one's sexual orientation: the first steps towards appropriate care

The qualitative interviews underlined that what promotes discussions on sexuality is the close relationship one has with physicians. Talking about sexuality and about one's sexual orientation can only be done in a favourable climate:

" Yes. It's really important to be able to discuss it [sexuality] with your doctor. I think of all the attending physicians I had before him; I might not have had the freedom to talk about it [with them], that's for sure." (MSM-PrEP/HPV vaccinated/over 30 years old).

Participants' discourses highlighted that when physicians were not aware of their patient's sexual orientation, questions relating to sexuality were not addressed, and consequently, care adapted to the specific needs of MSM could not be offered. Some went even further by citing heterosexuality and/or a lack of training of doctors on LGBT health issues as barriers to discussion about one's sexuality.

"As long as you don't have this relationship of trust with our doctor, you don't dare [talk about your sexuality]. Among MSM, we all know friends who dared to talk about it to their doctor and homophobic doctors; There are some, there are doctors who didn't suggest PrEP [to them]; there are doctors who didn't know [anything] at all, even [about] triple therapies. I've met them [these types of doctors] too. Anyway, there is also a problem concerning the doctor with regard to these patients." (MSM-PreP/HPV vaccinated/over 30 years old).

Generally speaking, the doctor/patient relationship is crucial in medical care, but it seems to be even more important in the context of sexual health prevention. PrEP follow-up offers routine general monitoring; accordingly, it goes beyond the scope of sexual health and may even offer more than what is generally covered in primary care. A trustful doctor-patient relationship is established in PrEP follow-up and, sometimes, MSM choose the doctor who follows them for PrEP as their attending physician.

"Yes, it's my PrEP doctor who's my attending physician now, and who has updated me on all the vaccinations I needed" (MSM-PrEPr/HPV Vaccinated/ 30+).

PrEP therefore not only protects MSM from HIV infection; it also helps them receive more appropriate global sexual health care.

A lack of information about HPV vaccination? Or the lack of vaccination recommendations from health professionals?

In the qualitative interviews, respondents explained that they were not vaccinated against HPV partly due to of a lack of knowledge and information regarding diseases in general, and more particularly regarding HPV. Some respondents had heard about the disease, but doubted what they knew; others had no idea what HPV was, or felt it did not concern them, either because they perceived they were too old to get it, or because they did not know that HPV vaccination was also recommended for boys.

"Well, yes, in any case, I was never told to come and get vaccinated against HPV, so I never asked the question either since it really wasn't an STI that I knew anything about; nothing at all; so there you go" (MSM-PrEP/HPV unvaccinated/under 30 years old).

Some respondents reported that physicians did not offer HPV vaccination even though they were regularly consulting with these physicians and met the eligibility criteria.

"No, nobody's told me about it [HPV vaccination]. […] I think I would have done it. I didn't ask them myself, but if someone had told me about it, I think I would have done it." (MSM-PrEP/HPV unvaccinated/ under 30 years old).

These extracts also highlight the importance of community information campaigns on HPV vaccination, with a lack of awareness being cited as a key factor in participants' feeling of not being concerned by the disease.

Trust in vaccination; a lever that crumbled with the COVID-19 crisis.

One theme that emerged from the qualitative interviews was the impact of the COVID-19 pandemic, which had shaken a number of previous representations about vaccination in general. MSM-PrEP who were vaccinated against HPV had a high level of trust in vaccination. For some of these persons, vaccination had become a health habit, almost a ritual (see Table 4). For these people, the fact that a physician recommended it meant that the benefits and risks had already been weighed up.

"I still have enough trust in the system of medicine validation at the European level, despite the scandals we've seen with some medicines; as regards vaccines, I find it hard to believe that they can give us cancer or something." (MSM-PrEP/HPV vaccinated/under 30 years old).

Conversely, MSM-PrEP who were not vaccinated against HPV were more vaccine hesitant and this distrust increased with the COVID-19 health crisis. They carefully chose which vaccines to get from all those offered. The greatest hesitancy was observed for COVID-19 vaccination (see Table 4).

"It [the COVID-19 crisis] actually got me having doubts. Basically, I realize that I still trust vaccination [in general] but it still got me doubting. […] I think I already had a bit of doubt, but with COVID it became more pronounced, it was almost shocking." (MSM-PrEP/HPV unvaccinated/over 30 years).

Our results show that even in a population (i.e., MSM-PrEP) that is closely followed-up medically, and convinced of the biomedical preventive approach, the COVID-19 crisis contributed to the development

Table 4
– Selection of the most illustrative verbatims of interviewed participants according to theme (N = 10);

Barriers and facilitators	Verbatim
PrEP, a tool that foster HPV vaccination	
A health check-up every three months	*"The PreP [follow-up] system, besides… it's already a great thing to have a drug that protects against HIV, that's really great, but besides that, it's [*i.e., *PrEP follow-up] also the opportunity to have a sexual health check-up every three months, have a kidney check-up, and also a liver check-up every three months, to have… there are plenty of health benefits, other than [only] sexual health and HIV, from this follow-up, and in fact, going to the doctor regularly doesn't hurt. So I think, that's [PrEP follow-up] what enables us to have vaccination consultation, to be consulted about… to be able to have someone to talk with too [about it]" (MSM-PrEP/ HPV Vaccinated/ under 30 years old)*
Suggestion by a physician informed of patient's sexual orientation to have HPV vaccination	*"Yes, but then it was my PrEP doctor – I'm on PrEP – it was my PrEP doctor who suggested it [HPV vaccination] to me, because I thought that at my age, I was no longer eligible [*i.e., *for reimbursement of vaccination cost]. And as I had, in my younger years, I had - how should I put it - I had condyloma, he suggested I should have it [HPV vaccination], telling me that it avoided cancer, that it avoided recurrence. Anyway… I only saw positive things in it, and he was the one who suggested it to me first, so we went for it…. I think it's been four years since I was vaccinated against HPV." (MSM-PrEP/ HPV vaccinated/over 30 years old)*
A close, trustful relationship with physicians	
Barrier	*"My doctor is completely heterosexual so I have difficulty discussing these things [*i.e., *sexuality]. […] You see? My general practitioner is very good; he's interested in everything, he is magnificent, but I don't talk to him about everything openly because it's difficult to talk about these practices to someone who is… let's say 'normalized', heterosexual and all that. (MSM-PrEP/ HPV unvaccinated HPV/ over 30 years old)"*
Facilitator	*"Then, well, I choose a doctor who I feel I can trust. If I feel that the doctor is cold or that he is going to let himself judge.this happened to me once. I'll be much more reluctant and make sure that it [*i.e., *participant's relationship with his physician] ends as quickly as possible." (No. 52) (MSM-PrEP/ HPV Vaccinated/ under 30 years old)*
Lack of information or not updated about HPV	
A problem only for women	***And have you heard of HPV? What can you tell me about it?*** *"Uh, is that the one also called papillomavirus? It seems to me that for men it is rather benign, but for women it is likely to lead to major health problems, uh so it seems to me that it's an STI but I don't know any more than that." (MSM-PrEP/ HPV unvaccinated / under 30 years old)*
Lack of information and recommendation	*"No, nobody told me about it. […] I think I would have done it [HPV vaccination]. I didn't ask them myself, but if someone had told me about it I think I would have done it. » (MSM-PrEP/ HPV unvaccinated HPV/ - 30 years old)*
	"Yes, there you go! With regard to HPV, it took me 10 years to understand that it was possible, before [that] I didn't know. I think someone could have offered it to me before, because, yes, initially it was for people under 16… but after five years you have to know where you stand [regarding the possibility of vaccination]! So, I learned from a questionnaire that it was possible to request vaccines from a pharmacist. And there I was surprised! I knew nothing about it, even though I am attentive to [medical] progress. I didn't even get this information in hospitals! » (MSM-PrEP/HPV unvaccinated /over 30 years)
Trust in vaccination	
Trust in the vaccine validation system	*"I believe that vaccination, once you've taken the plunge, becomes a ritual." (MSM-PrEP/ HPV Vaccinated, over 30 years old)* *"For me, the tests [vaccine validation] have been done beforehand; everything has been done beforehand; the benefits must have been weighed-up. I don't even weigh it [the benefits] anymore, in fact. If someone offers it [vaccination] to me, it's obviously because, in this case, it's good for me, so I don't ask myself any questions." (MSM-PrEP/HPV vaccinated/over 30 years)*
Distrust in vaccination since the COVID-19 pandemic	*"I am neither for nor against vaccination; I had all the childhood vaccines and all the boosters that go with them, I have also had the hepatitis A and B vaccines as part of PrEP follow-up. Uhm…I also got the one against rabies and typhoid, so there is no blockage [*i.e., *hesitancy]; the only one I was hesitant about was the one for COVID-19, which in my opinion, was rolled out too quickly" (MSM-PrEP/ HPV unvaccinated HPV/ under 30 years old)*

of vaccine hesitancy. The speed of the COVID-19 vaccine rollout also raised doubts about its effectiveness, and generated concerns about long-term health effects. For certain participants, the fact that not enough time had passed to thoroughly assess the effects of the various COVID-19 vaccines, led them to call into question the reliability of vaccines for other diseases.

4. Discussion

4.1. Summary of results

This study is the first in France to analyse HPV vaccination among MSM in the PrEP era using a mixed-methods approach. Our results highlight a high HPV vaccination rate (71 %) among the MSM-PrEP included in Vaccigay. A close relationship with a physician was associated with a greater likelihood of HPV vaccination. Specifically, being completely comfortable talking about vaccination in general with a physician and having being recommended HPV vaccination by a physician, were two factors associated with getting vaccinated against this disease.

The qualitative interviews shed light on the causes of persistent missed opportunities for HPV vaccination among the MSM-PrEP population. Discourses highlighted that while PrEP follow-up acts as a gateway to HPV vaccination within a population which mainly adheres to the biomedical prevention system, a trustful, close relationship with physicians is key to being able to approach the theme of sexuality during consultations, and therefore to have the opportunity to receive appropriate recommendations regarding vaccination, particularly in the post-COVID-19 context of increased distrust in medicine.

Table 5-
Modified Poisson models examining factors associated with the likelihood of being vaccinated for HPV versus not being vaccinated among MSM-PrEP under 32 years old ($N = 354$).

	Vaccinated against HPV
	aPRR [95 % CI]
Age	
18–26 years	**1.23 [1.09;1.40]**
27–31 years	ref
Self-identified gender	
Man	ref
Trans man/Non-binary/Other	1.13 [0.98;1.30]
Region of residence	
Ile-de-France (i.e., Greater Paris area)	ref
Other	1.01 [0.90;1.13]
Education level	
< Upper secondary school diploma	ref
Upper secondary school diploma	0.96 [0.67;1.39]
2,3, 4 years third-level education	1.15 [0.83;1.58]
≥ 5 years third-level education	1.21 [0.88;1.65]
Perceived financial situation	
Just making ends meet- Difficult to make ends meet-Debt	ref
Comfortable – Getting by	1.00 [0.88;1.14]
Do you have complementary health insurance?	
No	ref
Yes	1.42 [0.92;2.20]
Lifetime sexual partners' gender	
Exclusively men	ref
Men and women	0.93 [0.77;1.13]
Consulted in a CeGIDD in the previous 12 months	
No	ref
Yes, once	0.88 [0.68;1.14]
Yes, more than once	1.02 [0.90;1.15]
HPV screening in previous 12 months	
No or I don't know	ref
Yes, negative result(s)	0.99 [0.87;1.12]
Yes, at least one positive or unknown result	0.87 [0.62;1.21]
STI (excluding HPV) screening in previous 12 months	
No or I don't know	ref
Yes, negative result(s)	1.02 [0.61;1.70]
Yes, at least one positive or unknown result	1.01 [0.60;1.68]
Regular follow-up by a physician and disclosure of sexual orientation to this professional	
Regular follow-up by a physician not aware of MSM-PrEP's sexual orientation	ref
Regular follow-up by a physician aware of MSM-PrEP's sexual orientation	1.02 [0.75;1.40]
No regular follow-up	0.82 [0.45;1.51]
Completely comfortable talking about the subject of vaccination (in general) with physicians	
No	ref
Yes	**1.25 [1.08;1.45]**
HPV vaccination recommended by attending physician	
No / I don't know	ref
Yes	**2.37 [1.81;3.10]**

aPRR: adjusted Prevalence Rate Ratio, CI: Confidence Interval.

4.2. PrEP follow-up: a lever for HPV vaccination

The HPV vaccination rate among MSM-PrEP in our study was 71 %. This is significantly higher than the 36.6 % among MSM-PrEP in ERAS-2019, another French study on MSM which was conducted online in 2019 [7]. Furthermore, HPV vaccination in our study was recent, the median time since vaccination being one year.

This difference might be explained by the fact that ERAS-2019 was conducted in 2019, the same year HPV vaccination was expanded to all boys, and three years before Vaccigay, which was implemented in a broader context where vaccination against HPV had generally increased in France in recent years [22,23]. Moreover, ERAS recruited a larger ($N = 22,284$) and more diverse sample (especially younger, less likely to live in the greater Paris region, a lower education level, and fewer PrEP users) [24].

However, our results also suggest that PrEP initiation and follow-up fosters HPV vaccination, reflecting findings from other studies conducted in France [13], in the USA [16,25]and in Italy [26]. Although few or no MSM are vaccinated against HPV when they initiate PrEP, the general health follow-up established by PrEP programs fosters HPV vaccination uptake. Notwithstanding, our 71 % coverage rate was still below the 80 % target necessary for a global reduction in HPV infections [10].

The results of the qualitative component of the survey highlighted that the routine general health medical monitoring incorporated in PrEP programs fosters vaccination against HPV in MSM-PrEP. This follow-up includes an initial meeting with health professionals trained on the latest recommendations regarding the sexual health of MSM, followed by three-monthly meetings. These encounters foster trust between the MSM-PrEP and these professionals, thereby increasing the probability that the latter recommend HPV vaccination and that MSM-PrEP act on these recommendations.

This result is consistent with qualitative surveys in the USA conducted among MSM who highlighted that integrating HPV vaccination into routine care [27] and into HIV screening [28,29] fosters HPV vaccination uptake.

4.3. Efforts still need to be made by health professionals in the patient-physician care relationship and in the recommendation of the HPV vaccine

Although 95 % of unvaccinated MSM-PrEP in our study were in favour of HPV vaccination, and despite routine follow-up, 28.8 % were not vaccinated against HPV. This suggests the persistence of missed opportunities, reflecting findings in other studies in France [13], as well as studies in the USA [16,30,31], and Australia [11].

Our multivariate results therefore reinforce findings in the literature, which highlights the essential role of a health professional's recommendation in the context of HPV vaccination uptake [11,26,32,33].

In our study, two thirds (63.7 %) of MSM-PrEP not vaccinated for HPV reported that they had not received any recommendation from a physician to get vaccinated against the disease. This result reflects findings from another French study showing that only 40 % of MSM-PrEP under 26 years old had been prescribed HPV vaccination by health professionals in a sexual health centre [13]. For PrEP users regularly followed-up by a GP, this under-recommendation may be explained by inadequate knowledge of HPV vaccination recommendations for young MSM among GPs than among doctors working in sexual health centres, something which was highlighted in a US study [34].

In addition to the absence of a vaccination recommendation by physicians, a lack of awareness of HPV vaccination and outdated information was frequent among unvaccinated MSM-PrEP in our study. Specifically, 10 % had never heard of it, and 32 % thought it was only for girls, suggesting that changes in recommendations regarding target groups in terms of gender and age have not to have been communicated widely enough to the populations concerned.

The fact that some MSM-PrEP had been recommended by a physician to get vaccinated against HPV suggests that the latter was aware of their sexual orientation and sexual practices. Indeed, the qualitative interviews indicated that participants who had a close trustful relationship with physicians facilitated participants' disclosure of their sexual orientation and practices.

Conversely, even among PrEP users —whom we might expect to feel comfortable discussing their sexuality with healthcare providers—some still refrain from doing so, as highlighted in our qualitative interviews. One study found that although PrEP initiation is often carried out by GP, the GP who initiated PrEP was not the regular doctor for more than half of individuals [12]. Furthermore, previous research has shown that experiencing stigmatization —whether directly or indirectly through peers' experiences— and even discrimination by healthcare professionals because of one's sexual orientation can constitute an obstacle to MSM disclosing their sexual practices to their provider [35].

Ensuring that the conditions can be created where MSM can

comfortably address the question of their sexuality is all the more important given that only a minority of doctors (14 %) approach both sexual orientation and HPV vaccination systematically [36]. This latter point highlights an additional missed opportunity to address the issue of HPV vaccination for MSM under 26 years of age.

The obstacles and barriers related to the relationship with physicians which we found are consistent with other qualitative studies on the perception of HPV vaccination among PrEP users [37], young LGBT people [38], and in a scoping review on the role of healthcare professionals [14]. However, our interviews also highlight that the COVID-19 crisis reinforced hesitancy towards medicine in general, and that it led some people to start doubting the usefulness of vaccines. This form of vaccine hesitancy towards HPV vaccination – also called "complacency" – affects 31.1 % of MSM in France [17].

4.4. Study strengths and limitations

Our study has limitations. First, using a quantitative convenience sampling on a specific theme may have led to a study population more favourable to vaccination [39]. Accordingly, this sample cannot be considered representative of the whole French MSM population. That being said, the limitations associated with convenience sampling are common to most surveys of MSM, but this approach allows for a larger sample size of MSM compared to national population-based surveys that do not target MSM [39–41].

Second, HPV vaccination status in our study was self-reported, which may be subject to certain biases, such as social desirability or recall bias. However, previous research has shown a high sensitivity (83.2 %) for self-reported receipt of at least one dose of the HPV vaccine among gay, bisexual, and other MSM and trans women aged 18–26 years, suggesting that self-reported data in this population can be considered reasonably reliable and that potential bias is likely to be limited. [42].

Our study also has strengths; first, it covered the whole French territory and, was not restricted to a single sexual health centre. Second, it used a mixed-methods approach, complementing quantitative and qualitative analysis and interpretation. Third, it is likely that the barriers we observed to HPV vaccination among MSM-PrEP under 32 years old- a population which adheres to prevention tools, actively manages its health, and embraces its sexuality - are also present among young MSM who do not take PrEP.

4.5. Recommendations

Several recommendations can be made based on our results.

First, HPV vaccination should be systematically recommended by health professionals in PrEP follow-up, as is already the case for hepatitis A and B vaccination [13,25]. However, the median age of PrEP initiation in France is 33 years, and persons under 25 only represented a quarter of PrEP users in 2023 [15]. Given MSM-PrEPs' sexual practices and their relatively high risk of HPV infection, it would seem necessary to extend vaccination reimbursement in France up to 45 years of age, as is the case in the United Kingdom [43,44].

Second, improved training for doctors and other health professionals is essential to enable them to acquire skills in discussing sexual practices and sexual orientation without judgment [38].

Third, in 2023, France introduced a new national gender-neutral HPV vaccination campaign for boys and girls in 5th grade (7th grade US system) in middle school [45]. Before the 2023 school-based vaccination campaign, the HPV vaccination rate among 12-year-old boys was 26 % as of September 2023. This campaign led to a 23-percentage-point increase, reaching 49 % coverage among 12-year-old boys by June 2024. However, HPV vaccination coverage for at least one dose remains low among 15-year-old boys, at only 26 % in 2023 [46]. Additionally, attitudes towards HPV vaccination have improved in France, particularly among 18–26-year-olds. Among men in this age group, the proportion of vaccine hesitancy dropped from 23.1 % in 2021 to 10.9 % in 2023 [47]. This school campaign should make it possible to reduce the consequences of non-discussion of sexual practices by healthcare professionals. In this context, generations of MSM who have not benefited from vaccination in middle school must also be given the right to benefit from HPV vaccination. Furthermore, community actors and health mediators must also be trained on issues related to HPV in order to foster HPV vaccination within LGBTQIA+ communities [25].

5. Conclusion

Despite the availability of PrEP, a prevention tool which incorporates the regular follow-up of sexual health in MSM, the HPV vaccination rate in MSM-PrEP is lower than the target of 80 % required to protect efficiently against HPV. Although this population is favourable to HPV vaccination, the missed opportunities highlighted in our study are partly explained by a lack of a close trustful relationship with healthcare professionals, and the absence of HPV vaccination recommendations by the latter. The systematic addition of HPV vaccination to PrEP care recommendations and the extension of the age limit for reimbursement for MSM to, for example, 45 years of age, as well as better training of health professionals on LGBTQIA+ health needs are all necessary conditions to achieve HPV vaccination objectives.

CRediT authorship contribution statement

Margot Annequin: Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Marion Mora:** Writing – review & editing, Methodology, Formal analysis, Conceptualization. **Lisa Fressard:** Writing – review & editing, Methodology, Formal analysis, Conceptualization. **Chloé Cogordan:** Writing – review & editing, Project administration. **Emeline Brosset:** Writing – review & editing. **Aurélie Bocquier:** Writing – review & editing. **Annie Velter:** Writing – review & editing. **Michel Bourrelly:** Project administration. **Jean Constance:** Project administration. **David Michels:** Project administration. **Marie Costa:** Writing – review & editing. **Stéphane Morel:** Project administration. **Gabriel Girard:** Writing – review & editing. **Camilla Oliveri:** Writing – review & editing, Methodology, Formal analysis, Conceptualization. **Gwenaëlle Maradan:** Project administration. **Cyril Berenger:** Data curation. **Bruno Spire:** Writing – review & editing. **Pierre Verger:** Writing – review & editing, Supervision.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data will be made available on request.

References

[1] Looker KJ, Rönn MM, Brock PM, Brisson M, Drolet M, Mayaud P, et al. Evidence of synergistic relationships between HIV and human papillomavirus (HPV): systematic reviews and meta-analyses of longitudinal studies of HPV acquisition and clearance by HIV status, and of HIV acquisition by HPV status. J Intern AIDS Soc 2018;21:e25110.

[2] Wei F, Gaisa MM, D'Souza G, Xia N, Giuliano AR, Hawes SE, et al. Epidemiology of anal human papillomavirus infection and high-grade squamous intraepithelial lesions in 29 900 men according to HIV status, sexuality, and age: a collaborative pooled analysis of 64 studies. The Lancet HIV 2021;8:e531–43.

[3] Cotte L, Veyer D, Charreau I, Péré H, Cua E, Carette D, et al. Prevalence and incidence of human papillomavirus infection in men having sex with men enrolled in a pre-exposure prophylaxis study: a sub-study of the Agence Nationale de Recherches Sur le SIDA et les Hépatites Virales "intervention Préventive de l'Exposition aux Risques avec et pour les hommes gays" trial. Clin Infect Dis 2021; 72:41–9.

[4] Mboumba Bouassa R-S, Bélec L, Gubavu C, Péré H, Matta M, Maka A, et al. High prevalence of anal and Oral high-risk human papillomavirus in human immunodeficiency virus-uninfected French men who have sex with men and use Preexposure prophylaxis. *Open forum.* Infect Dis Ther 2019;6:ofz291.

[5] Harder T, Wichmann O, Klug SJ, van der Sande MAB, Wiese-Posselt M. Efficacy, effectiveness and safety of vaccination against human papillomavirus in males: a systematic review. BMC Med 2018;16:1–14.

[6] HCSP. Recommandations vaccinales contre les infections à papillomavirus humains chez les hommes. Paris: Haut Conseil de la Santé Publique; 2016. https://www.hcsp.fr/explore.cgi/avisrapportsdomaine?clefr=553. accessed 23 Apr2024.

[7] Ortu G, Barret A-S, Danis K, Duchesne L, Levy-Bruhl D, Velter A. Low vaccination coverage for human papillomavirus disease among young men who have sex with men, France, 2019. Euro Surveill 2021;26:2001965.

[8] Santé Publique France. Données de couverture vaccinale papillomavirus humains (HPV) par groupe d'âge. Santé Publique France 2024. https://www.santepubliquefrance.fr/determinants-de-sante/vaccination/donnees-de-couverture-vaccinale-papillomavirus-humains-hpv-par-groupe-d-age. accessed 20 Apr2025.

[9] Nadarzynski T, Frost M, Miller D, Wheldon CW, Wiernik BM, Zou H, et al. Vaccine acceptability, uptake and completion amongst men who have sex with men: a systematic review, meta-analysis and theoretical framework. Vaccine 2021;39: 3565–81.

[10] Lin A, Ong KJ, Hobbelen P, King E, Mesher D, Edmunds WJ, et al. Impact and cost-effectiveness of selective human papillomavirus vaccination of men who have sex with men. Clin Infect Dis 2017;64:580–8.

[11] McGrath L, Fairley CK, Cleere EF, Bradshaw CS, Chen MY, Chow EPF. Human papillomavirus vaccine uptake among young gay and bisexual men who have sex with men with a time-limited targeted vaccination programme through sexual health clinics in Melbourne in 2017. Sex Transm Infect 2019;95:181–6.

[12] Bamouni S, Billioti de Gage S, Desplas D, Valbousquet J, Lamant J, Joseph J-P, et al. Effect of extending PrEP initiation to primary care settings: a nationwide cohort study in France. *Lancet.* Public Health 2025;S2468-2667(25):00062–3.

[13] Bérot V, Eremin A, Fauchois A, Dechamp J, Schneider L, Chermak A, et al. Hepatitis a, hepatitis B and HPV vaccine needs and coverage in MSM initiating HIV PrEP in a sexual health clinic in Paris. Sex Transm Infect 2023;99:361–2.

[14] Chin K-Y, Ekeuku SO, Hamzah MR. The role of healthcare providers in promoting human papillomavirus vaccines among men who have sex with men: a scoping review. Vaccines 2022;10:930.

[15] Billioti de Gage S, Desplas D, Dray-Spira R. Roll-out of HIV pre-exposure prophylaxis use in France: A nationwide observational study from 2016 to 2021. Lancet Reg Health Eur 2022;(22):100486.

[16] Wheldon CW. HPV vaccination and HIV preexposure prophylaxis (PrEP): missed opportunities for anal cancer prevention among at risk populations. Hum Vaccin Immunother 2022;18:2114258.

[17] Brosset E, Fressard L, Cogordan C, Bocquier A, Velter A, Annequin M, et al. Gradient of vaccine hesitancy among French men having sex with men: an electronic cross-sectional survey in 2022. Hum Vaccin Immunother 2023;19: 2293489.

[18] Denzin NK. The research act: A theoretical introduction to sociological methods. New York: Routledge; 2017. https://doi.org/10.4324/9781315134543.

[19] Creswell JW, Plano Clark VL. Designing and conducting mixed methods research. Thousand Oaks, Calif: SAGE Publications; 2007.

[20] Paillé P, Mucchielli A. Chapitre 11 - L'analyse thématique. In: *L'analyse qualitative en sciences humaines et sociales*.Paris. Armand Colin; 2012. p. 231–314.

[21] Barros AJ, Hirakata VN. Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio. BMC Med Res Methodol 2003;3:21.

[22] Dalon F, Majed L, Belhassen M, Jacoud F, Bérard M, Lévy-Bachelot L, et al. Human papillomavirus (HPV) vaccine coverage rates (VCRs) in France: a French claims data study. Vaccine 2021;39:5129–37.

[23] Zeitoun J-D, Duclos A, de Parades V, Lefèvre JH. Human papillomavirus vaccine uptake among men in France: a national time series analysis for 2015-2018. Hum Vaccin Immunother 2020;16:3119–22.

[24] Velter A, Ousseine YM, Dupire P, Roux P, Mercier A. Trends in HIV protection methods among HIV-negative men who have sex with men: results from the rapport au Sexe survey 2017-2019-2021. France Bulletin Epidémiologique hebdomadaire 2022;24–25:430–8.

[25] Wheldon CW, Sykes KJ, Ramaswamy M, Bass SB, Collins BN. Integrating HPV vaccination within PrEP care delivery for underserved populations: a mixed methods feasibility study. J Community Health 2023;48:640–51.

[26] Raccagni AR, Ceccarelli D, Trentacapilli B, Galli L, Lolatto R, Canetti D, et al. Viral hepatitis and human papillomavirus vaccination during HIV pre-exposure prophylaxis: factors associated with missed vaccination. JAIDS J Acquired Immune Deficiency Syndromes 2023;93:351.

[27] Naidu T. Says who? Northern ventriloquism, or epistemic disobedience in global health scholarship. Lancet Glob Health 2021;9:e1332–5.

[28] van den Berg JJ, Larson HE, Zimet GD, Lally MA. Bundling human papillomavirus vaccination and rapid human immunodeficiency virus testing for young gay and bisexual men. LGBT Health 2014;1:233–7.

[29] Fontenot HB, Fantasia HC, Vetters R, Zimet GD. Increasing HPV vaccination and eliminating barriers: recommendations from young men who have sex with men. Vaccine 2016;34:6209–16.

[30] Wheldon CW, Eaton LA, Watson RJ. Predisposing, enabling, and need-related factors associated with human papillomavirus vaccination intentions and uptake among black and Hispanic sexual and gender diverse adults in the USA. J Racial Ethn Health Disparities 2023;10:237–43.

[31] Rotert P, Wheldon C, Kownack J, Sullivan-Blum Z, Cokingtin B, Khetani K, et al. Human papillomavirus prevalence and vaccination rates among users of pre-exposure prophylaxis for human immunodeficiency virus prevention. J Prim Care Community Health 2022;13. 21501319221110411.

[32] Petit B, Epaulard O. Men having sex with men and the HPV vaccine in France: a low vaccine coverage that may be due to its infrequent proposal by physicians. Vaccine 2020;38:2160–5.

[33] Mann-Barnes T, Bhimla A, Coronado M, Lin T, Duro-Aina A, Park H, et al. Factors that predict HPV vaccination behavior among young men-who-have-sex-with-men in the greater Philadelphia region. J Racial Ethn Health Disparities 2023;10: 2167–74.

[34] Merriel SWD, Flannagan C, Kesten JM, Shapiro GK, Nadarzynski T, Prue G. Knowledge and attitudes of general practitioners and sexual health care professionals regarding human papillomavirus vaccination for young men who have sex with men. Int J Environ Res Public Health 2018;15:151.

[35] Kesten JM, Flannagan C, Ruane-McAteer E, Merriel SWD, Nadarzynski T, Shapiro G, et al. Mixed-methods study in England and Northern Ireland to understand young men who have sex with men's knowledge and attitudes towards human papillomavirus vaccination. BMJ Open 2019;9:e025070.

[36] Wheldon CW, Sutton SK, Fontenot HB, Quinn GP, Giuliano AR, Vadaparampil ST. Physician communication practices as a barrier to risk-based HPV vaccine uptake among men who have sex with men. J Cancer Educ 2018;33:1126–31.

[37] Sullivan-Blum ZC, Brophy M, Didde R, Nagireddy R, Swagerty H, Weir S, et al. PrEP patient attitudes, beliefs and perceived barriers surrounding HPV vaccination: a qualitative study of semistructured interviews with PrEP patients in primary care clinics in Kansas and Missouri. BMJ Open 2022;12:e058510.

[38] Naidu J, Polonijo AN. Barriers and facilitators to HPV and meningococcal vaccination among men who have sex with men: a qualitative study. BMC Public Health 2023;23:933.

[39] Velter A, Saboni L, Bouyssou A, Bernillon P, Sommen C, Semaille C. Echantillons de convenance par Internet et par la presse — Enquête Presse Gays et Lesbiennes 2011. BMS: Bulletin of Sociological Methodology / Bulletin de Méthodologie Sociologique 2015;46–66.

[40] Prah P, Hickson F, Bonell C, McDaid LM, Johnson AM, Wayal S, et al. Men who have sex with men in Great Britain: comparing methods and estimates from probability and convenience sample surveys. Sex Transm Infect 2016;92:455–63.

[41] Paquette D, De Wit J. Sampling methods used in developed countries for Behavioural surveillance among men who have sex with men. AIDS Behav 2010; 14:1252–64.

[42] Chambers C, Deeks SL, Sutradhar R, Cox J, de Pokomandy A, Grennan T, et al. Self-reported human papillomavirus vaccination and vaccine effectiveness among men who have sex with men: a quantitative Bias analysis. Epidemiology 2023;34:225–9.

[43] Public Health England, editor. Public Health England 2018.

[44] JCVI. HPV vaccination of men who have sex with men: joint committee on vaccination and immunisation statement. Public Health England 2015. https://www.gov.uk/government/publications/jcvi-statement-on-hpv-vaccination-of-men-who-have-sex-with-men. accessed 6 May2024.

[45] Ministère du travail de la santé et des solidarités. Campagne de vaccination HPV au collège. https://sante.gouv.fr/prevention-en-sante/preserver-sa-sante/vaccination/campagne-de-vaccination-hpv-au-college/; 2023. accessed 6 May2024.

[46] Fonteneau L, Vaux S. Bilan de la campagne de vaccination contre les infections à papillomavirus humain (HPV) menée au collège dans les classes de 5e au cours de l'année scolaire 2023–2024 en France. Santé Publique France. https://www.santepubliquefrance.fr/maladies-et-traumatismes/maladies-a-prevention-vaccinale/infections-a-papillomavirus/documents/enquetes-etudes/bilan-de-la-campagne-de-vaccination-contre-les-infections-a-papillomavirus-humain-hpv-menee-au-college-dans-les-classes-de-5e-au-cours-de-l-annee; 2025.

[47] Ward JK, Peretti-Watel P, Verger P. Enquêtes SLAVACO & ICOVAC : Attitudes des français à l'égard de la vaccination contre les HPV depuis 2021 et focus sur les 18-26 ans. ORS Paca 2025. https://www.orspaca.org/sites/default/files/note-slavaco-icovac-022025.pdf. accessed 18 Apr2025.