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RESEARCH ARTICLE



## Gradient of vaccine hesitancy among French men having sex with men: An electronic cross-sectional survey in 2022

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### ABSTRACT

In developed countries, vaccinations against hepatitis B (HBV), hepatitis A (HAV), and human papillomavirus (HPV) are often recommended to men who have sex with men (MSM) because of the risky sexual practices in which some engage. Vaccine coverage against these diseases is not optimal in France, probably due in part to vaccine hesitancy (VH). The overall aim of this survey among MSM was to estimate the prevalence of different grades of VH for these vaccines as well as of general VH (toward any vaccine). The specific objectives were to study the sociodemographic correlates of MSM specific and general VH and its association with vaccine uptake. A cross-sectional electronic survey (February–August 2022) collected information from 3,730 French MSM about their perceptions of HBV, HAV, and HPV and their related vaccines, to construct “specific VH” variables. Information about their past vaccination behaviors for any vaccine was used to construct a “general VH” variable, based on the World Health Organization definition. Almost 90% of MSM showed moderate or high specific VH for HBV, HAV, and/or HPV, and 54% general VH. A higher education level and comfortable financial situation were associated with lower grades of specific and general VH. Younger age was associated with less frequent specific VH and more frequent general VH. Specific VH, versus general, was more strongly associated with frequent self-reported non-vaccination against these three disease. Addressing their concerns about vaccines, improving their knowledge of vaccine-preventable sexually transmitted infections, and motivating them to get vaccinated are public health priorities.

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### Introduction

Studies show that a significant fraction of men who have sex with men (MSM) engage in risky sexual practices, such as condomless anal sex, anonymous sex, sex parties, chemsex, and high numbers of sexual partners.<sup>1</sup> Those practices put them at high risk of contracting vaccine-preventable sexually transmitted infections (STIs), notably hepatitis B (HBV) and A (HAV) viruses and human papillomaviruses (HPV).<sup>1</sup> Many Western countries recommend that MSM be vaccinated against these three diseases.<sup>2</sup> In France, their vaccination against HPV has only been recommended since 2017, up to the age of 26 years.<sup>3</sup> Yet coverage rates for these diseases often remain far below the public health targets set by different countries.<sup>2</sup> There are no specific vaccine coverage objectives for MSM in France. The Public Health Act of 2004 set a target, for all vaccine-preventable diseases (except seasonal influenza), of achieving or maintaining (depending on the disease) a vaccination coverage of at least 95% at the appropriate ages.<sup>4</sup> However, the National Cancer Plan more recently set a less ambitious objective of 80% for HPV vaccination<sup>5</sup> for both girls and boys (this vaccination has been recommended for the latter since 2021).<sup>6</sup> These vaccination coverage targets are

similar to those in other Western countries. In Canada, for example, the vaccination coverage target for HPV among 17-year-olds is 90% for 2025<sup>7</sup> while, in the U.S.A, it is 80% for 2030.<sup>8</sup> In 2019, in France, the estimated vaccination coverage among MSM non-users of pre-exposure prophylaxis (PrEP) for HIV prevention attending a sexual health clinic was 73% for HBV, 57% for HAV, and only 20% for HPV (among those under 27).<sup>9</sup> Another study found vaccination coverage for HPV was 15% among MSM under 28 in 2019.<sup>10</sup>

Reasons that may explain these insufficient vaccination coverage rates include lack of awareness of vaccine recommendations directed at MSM,<sup>11</sup> lack of medical follow-up and/or ignorance by the doctor of the patient’s sexual orientation, difficulties in accessing vaccination, in particular, for the HPV vaccine, because of its cost,<sup>2</sup> and/or vaccine hesitancy (VH). The World Health Organization (WHO) Strategic Advisory Group of Experts on Immunization (the SAGE group) defined VH as the delay in acceptance or refusal of vaccination or even acceptance with doubts about its safety and/or benefits, despite availability of vaccination services,<sup>12</sup> and the WHO has identified it as one of the top 10 threats to global public health.<sup>13</sup>

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This definition was used to measure the prevalence of general VH in various populations.<sup>14,15</sup> The SAGE group also laid the groundwork for a theoretical model of VH's core determinants, called the "3C"; it proposed the following three main determinants: (lack of) confidence in the safety of vaccines or in health authorities; complacency, that is, perception that the risk of disease is low and vaccination therefore unnecessary; and (lack of) convenience in accessing vaccines.<sup>12</sup> The latter dimension is nonetheless the subject of debate, as physical or financial barriers to access to vaccination services are very different from attitudinal barriers to acceptance of vaccination itself.<sup>16</sup> The 3C model more or less overlaps with previous theoretical models of prevention behavior adoption, such as the Health Belief Models (HBM) family: these models underscore the importance, in the adoption of these behaviors, of perceptions regarding the risk of contracting a disease, its severity, and the benefits and risks of the corresponding behavior.<sup>17</sup> In line with the 3C and HBM models, VH determinants found among the general population for various vaccines were notably the lack of confidence in vaccine safety and/or efficacy, and the perception that the risk of vaccine-preventable diseases is low.<sup>18,19</sup> VH follows a gradient of intensity depending on individual characteristics (including psychosocial factors such as beliefs), vaccine, country, and period.<sup>12,20</sup>

Previous studies of HBV, HAV, and HPV vaccines among MSM have focused not on VH prevalence but rather on vaccine acceptability (i.e. willingness to be vaccinated), vaccination uptake, and associated factors, without taking perceptions of these diseases and vaccines into account.<sup>2</sup> To our knowledge, the prevalence of VH among MSM has been measured with methods more or less similar to ours only for the COVID-19 and mpox vaccines.<sup>21–23</sup> The prevalence of VH specific to HBV, HAV, and HPV vaccines, its grade, and its variation among MSM according to sociodemographic characteristics are not well known. Improving knowledge of these aspects is essential to design and target strategies to improve vaccination coverage against these diseases among this population.

Using the theoretical frameworks described above, the overall aim of this study was to define and quantify the different grades of general VH and of VH specific to HBV, HAV, and HPV vaccines (hereafter referred to as the vaccines of interest). Its specific objectives were to study: (1) the prevalence of general and specific VH according to their grades and their main dimensions (complacency and lack of confidence), (2) the sociodemographic correlates of general and specific VH gradients, and (3) the association of these VH gradients with self-reported uptake of the three vaccines of interest. The associations between VH and characteristics more specific of the MSM population, such as sexual practices and sexual health prevention, are intentionally not studied in this article; a second article will be devoted to this topic.

## Material and methods

### Ethical approval

This study was approved by the University of Aix-Marseille Ethics Committee on the 10/23/2020 (approval number: 2020-

10-08-008). The survey was performed in accordance with the principles stated in the Declaration of Helsinki. At the start of the survey, all participants gave their informed consent to participate in the research.

### Study design

We conducted a cross-sectional online survey of a convenience sample of MSM who were French residents and used online dating sites and/or social networks, by applying the methodology (described below) of previous surveys among MSM in France and elsewhere.<sup>24–26</sup>

### Participants

Adults aged 18 years or older were eligible if they were of male sex, self-identifying as a man genderqueer, or other than a woman, or they were of female sex, self-identifying as a man or trans man; and who have had sex with men (exclusively or not) or have never had sex but do not self-identify as heterosexual.

### Procedure

A website ([www.vaccigay.fr](http://www.vaccigay.fr)) was set up to present the project and host the online anonymous survey. The survey was available online from February 15 to August 31, 2022, and could be accessed through a QR code or a URL. A first wave of media-oriented promotion began in February-March with the launch of a Facebook page and a dedicated Twitter account, both run by a community manager already involved in MSM networks. Posts encouraging participation were sent to both open and closed MSM social groups. This activity on social networks was accompanied by the publication of communications (news flashes and/or full-page) on MSM media dedicated to STI information, general news, and local cultural and social events (the Seronet website and the AgendaQ and Strobomag magazines).

A wave of field-based promotion began in March 2022. Three national associations involved in health promotion and prevention among MSM (AIDES, the National Prevention and Health Intervention Team [ENIPSE], and the Association for Research, Communication and Action for Access to Treatment [ARCAT]), contributed to the project by placing posters in their various premises spread over continental France (LGBT festival venues or health centers) and distributing flyers to visitors. From April onwards, the third, and most important, wave of promotion focused on the insertion of banner ads on Grindr, a geolocated MSM dating app. The banners redirected directly to the survey website. This advertising took place during nine separate periods beginning on various days of the week and lasting from 1 to 5 days from April through August.

### Data collection

We developed a questionnaire based on a literature review, on questionnaires from surveys conducted in France among MSM, the general population, and more specific groups such

as young women or parents of teenage girls on the specific topic of VH,<sup>14,15,24,25,27</sup> and on a qualitative study of 12 MSM. The latter study found that MSM were most often in favor of vaccination in general, but reported a lack of knowledge about the risks associated with their sexual practices and vaccine-preventable diseases, particularly HPV, even among MSM receiving regular medical care. The questionnaire was then critically reviewed by three experts from AIDES and tested by 20 MSM recruited by AIDES for evaluation of face validity, filter sequence, and completion time. The average completion time for the final version was 20 minutes.

The questionnaire collected information on participants' sociodemographic characteristics: age, gender, education level, employment status, perceived financial situation, and complementary health insurance; and on their vaccination status for the vaccines of interest.

### Questions related to specific or general vaccine hesitancy

To measure specific VH, MSM were asked about their perceptions of each of HBV, HAV, and HPV vaccines (effectiveness – “How effective do you perceive the vaccine to be in preventing the disease?”, worries about severe side effects – “How worried are you about the vaccine's potential severe side effects?”) and of the diseases they prevent (fear of being infected with it – “How worried are you about being infected with it?”, severity – “How severe do you think this disease is?”). There were 4 items for each vaccine, with scale answers from 0 (“Not at all”) to 10 (“Totally”), with a “don't know” option. These items echo the two key components of the 3C model of VH<sup>12</sup> – complacency and (lack of) vaccine confidence. They are also rooted in the HBM,<sup>17</sup> as they enable a comparison of these vaccines' perceived benefits and risks. This comparison will hereafter be labeled the “benefit-risk balance” (BRB).

To measure general VH, we used three questions adapted from the WHO SAGE group's definition of VH previously used in studies of VH prevalence in the general population<sup>14,15</sup>: (1) “Have you ever refused a vaccine recommended by your physician, because you considered this vaccination dangerous or useless?” (2) “Have you ever delayed a vaccine recommended by your physician because you hesitated over it?” and (3) “Have you ever had a vaccine despite

doubts about its effectiveness or its safety?” (“yes”/“no”/“don't know”). These items were designed to ensure that reasons for delay/refusal other than hesitancy (e.g., access barriers) were excluded, that is, could not be interpreted as VH.<sup>15,28</sup>

### Statistical methods

#### Measures

**VH specific to HAV, HBV, or HPV vaccines.** As a “don't know” option was not initially included in the response scale for the disease and vaccine perception items studied here, these answers were recoded according to their correlations from multiple correspondence analyses with the other responses on the 0–10 scales. They were recoded at 5 for fear of infection, 0 for perceived disease severity, 1 for perceived vaccine efficacy, and 4 for the vaccine's perceived risks.

A variable measuring the VH specific to each vaccine was constructed with its related perception items by applying the algorithm and threshold scores presented in Table 1.

The resulting variables (for each vaccine) were then used to construct a “specific VH gradient” variable for HBV, HAV, and/or HPV vaccines by synthesizing VH related to the three vaccines targeting MSM specifically; this variable indicated whether participants had (1) “high VH” (complacency and lack of confidence for at least one vaccine); (2) “moderate VH” (complacency or lack of confidence – but not both – for at least one vaccine); or (3) “no VH” (no VH for any of the three vaccines).

**General VH.** We used the three items derived from the WHO definition of VH (having ever refused, delayed or accepted a vaccine despite doubts) to construct a “General VH gradient” variable according to a previously published methodology.<sup>28,29</sup> This variable had four exclusive categories (in descending order of VH intensity): had ever refused a vaccine (“refusers”), had delayed but not refused a vaccine (“delayers”), had been vaccinated despite doubts, but never refused or delayed (“unsure acceptors”), or had never refused, delayed or accepted a vaccine with doubts (“no VH”).

**Table 1.** Algorithms and threshold scores used to construct the VH variables.

	Perceived disease severity	Perceived fear of infection	Perceived vaccine effectiveness	Perceived vaccine risk
No VH (Disease perceived as serious OR worrisome) AND (vaccine perceived as effective AND safe)	Score >5/10	Score >5/10	Score >5/10	Score <5/10
Moderate VH Complacency (Disease perceived as not serious AND not worrisome) AND vaccine perceived as safe – regardless of its effectiveness <sup>a</sup>	Score ≤5/10	Score ≤5/10	–	Score <5/10
Lack of confidence in vaccine (Disease perceived as serious OR worrisome) AND (vaccine perceived as ineffective OR unsafe)	Score >5/10	Score >5/10	Score ≤5/10	Score ≥5/10
High VH (Disease perceived as not serious AND not worrisome), AND vaccine perceived as unsafe – regardless of its effectiveness <sup>b</sup>	Score ≤5/10	Score ≤5/10	–	Score ≥5/10

<sup>a</sup>We assumed that participants who consider the vaccine as safe, but the disease as neither serious nor worrisome will choose not to be vaccinated, regardless of the vaccine's effectiveness.

<sup>b</sup>We assumed that participants who consider the vaccine dangerous will choose not to be vaccinated, regardless of the vaccine's effectiveness.  
VH = vaccine hesitancy.

### Statistical analyses

Bivariate analyses using Chi<sup>2</sup> tests explored the relations between the prevalence rates of specific and general VH and between these measures and the sample's sociodemographic characteristics. Because these characteristics may be interrelated, we used multiple logistic multinomial regressions to further study the latter associations.

Then, to determine the extent to which self-reported uptake rates of the vaccines of interest were associated with specific or general VH, we computed multiple modified Poisson regressions with robust error variances. When the outcome is not rare (prevalence >10%), modified Poisson regressions enable robust relative risks to be estimated while odds ratios from logistic regressions overestimate them.<sup>30</sup> All regressions tested each factor separately and were adjusted for sociodemographic characteristics (age (quartiles), region of residence, level of education, employment status, perceived financial situation and complementary health insurance).

All analyses were based on two-sided *P*-values, with *P* ≤ .05 indicating statistical significance. They were conducted with SAS 9.4 software (SAS Institute, Cary, NC).

## Results

### Participants' characteristics

Overall, 5,460 MSM started the questionnaire; 3,730 (68%) completed it in full and were included in the study (Table 2); 98% considered themselves men, half were younger than 39 years, and 32% lived in the Paris region. They were highly educated: 41% reported 2 to 4 years of postsecondary schooling, and 37% had at least a master's degree. Most (78%) were employed, with 17% not in the labor force (retired, student, or other). Thirty percent reported financial difficulties, and 6% did not have complementary health insurance, which reimburses health care costs not covered by the National Health Insurance Fund. Reported vaccine uptake differed by disease: 76% of participants reported they were vaccinated against HBV, 50% against HAV, and 22% against HPV (46% among MSM younger than 32 years: these participants were aged younger than 27 in 2017, the year the HPV vaccine was first recommended for them).

### Prevalence of specific and general VH and sociodemographic correlates

Among participants, 13% (95% confidence interval [CI]: 12;14%) showed a high grade of specific VH related to at least one of the three vaccines of interest and 74% (95%CI: 73;76%) evidenced moderate specific VH. The VH grades specific to each vaccine are detailed in Table 3. The prevalence of complacency varied by vaccine, from 25% (HBV) to 39% (HPV) while the prevalence of lack of confidence ranged from 23% (HAV) to 35% (HPV).

General VH prevalence, based on the WHO definition of VH, was estimated at 54% (95% CI: 53;56%), reported by decreasing grades of severity: 13% refusers, 9% delayers, and 32% unsure acceptors.

**Table 2.** Sociodemographic characteristics of study participants (2022 French National MSM survey, *N* = 3 730).

	Finally included	
	N	%
Age (quartiles)		
18–29	953	25.6
30–38	873	23.4
39–49	992	26.6
50–84	912	24.5
What is your current gender?		
Male	3652	97.9
Trans male (FtM/FT)	14	0.4
Genderqueer/nonbinary	55	1.5
Other	9	0.2
French area of residence (2 missing values)		
Ile-de-France	1185	31.8
Northwest	515	13.8
Northeast	599	16.1
Southwest	606	16.3
Southeast and Corsica	788	21.1
Overseas	35	0.9
Educational level		
Did not pass "baccalaureate" <sup>a</sup> exam at end of high school or lower	403	10.8
Passed "baccalaureate" at end of high school	454	12.2
2 to 4 years of higher education	1512	40.5
Master's degree or higher	1361	36.5
Employment status		
Employed	2907	77.9
Unemployed	178	4.8
Not in the labor force <sup>b</sup>	645	17.3
Currently, you are financially ...		
Comfortable or ok	2612	70.0
Barely managing or in difficulty or in debt	1118	30.0
Complementary health insurance <sup>c</sup>		
No or don't know	235	6.3
Yes	3495	93.7
<b>Self-reported vaccine uptake<sup>d</sup></b>		
Against hepatitis B virus (HBV)	2845	76.3
Against hepatitis A virus (HAV)	1849	49.6
Against human papillomaviruses (HPV)	832	22.3 <sup>e</sup>

<sup>a</sup>Exam at the end of high school.

<sup>b</sup>Mostly students and retired people.

<sup>c</sup>Complementary health insurance: not-for-profit companies that reimburse their members' healthcare costs not covered by the compulsory insurance fund.

<sup>d</sup>For each vaccine, participants who did not know their vaccination status were recoded with the unvaccinated participants HBV: 7.3% (*n* = 268), HAV: 17.6% (*n* = 585), HPV: 8.4% (*n* = 313).

<sup>e</sup>Among participants aged under 32 (this age corresponds to MSM who were already eligible for vaccination in 2017, when it was first recommended to them), vaccination coverage against human papillomaviruses was 46.4% (*n* = 527/1135).

Multiple logistic multinomial regressions showed that the prevalence of moderate and high specific VH for at least one of the three vaccines of interest increased with MSM age and decreased with their education level (Table 4, simple crosstabs in Appendix A, Table A1), and perception of acceptable/comfortable financial situation.

In contrast to specific VH, the prevalence of general VH (unsure acceptors and delayers) decreased with age. As with specific VH, it also decreased with education level and the perception of an acceptable/comfortable financial situation. For the unsure acceptors only, it was also lower among those who had complementary health insurance or were out of the labor force (i.e., mostly students and retirees, Table 4).



**Table 3.** Specific VH grades for the HBV, HAV, and HPV vaccines separately (2022 French National MSM survey,  $N = 3\,730$ ).

	N	%	95% CI
<b>HBV specific VH</b>			
High VH	199	5.3	[4.6;6.0]
Moderate VH			
Complacency	923	24.8	[23.4;26.2]
Lack of confidence in vaccine	1060	28.4	[27.0;29.8]
No VH	1548	41.5	[39.9;43.1]
<b>HAV specific VH</b>			
High VH	250	6.7	[5.9;7.5]
Moderate VH			
Complacency	1467	39.3	[37.7;40.9]
Lack of confidence in vaccine	869	23.3	[21.9;24.7]
No VH	1144	30.7	[29.2;32.2]
<b>HPV specific VH</b>			
High VH	181	4.9	[4.2;5.6]
Moderate VH			
Complacency	1159	31.1	[29.6;32.6]
Lack of confidence in vaccine	1315	35.3	[33.8;36.8]
No VH	1075	28.8	[27.3;30.3]

VH = vaccine hesitancy; HBV = hepatitis B virus; HAV = hepatitis A virus; HPV = human papillomaviruses; 95% CI = 95% confidence interval.

Specific VH and general VH were strongly associated with each other (Table 5): MSM with a high grade of specific VH were overrepresented among delayers and refusers; those with moderate specific VH were overrepresented among the unsure acceptors, while MSM with no specific VH were overrepresented among those who had no general VH. Nonetheless 74% of MSM with no general VH had moderate specific VH for at least one of the three vaccines of interest and 8% high specific VH.

### Associations between VH and self-reported uptake of vaccines of interest

VH of any grade was significantly associated with lower self-reported uptake of HBV, HAV, and HPV vaccines, with some variations (Table 6). For each vaccine, a high

grade of VH specifically related to the vaccine of interest was the factor associated with the lowest probability of uptake. For example, for MSM with high HBV-specific VH, the relative risk (RR) of HBV vaccine uptake was 0.71 (95% CI: 0.63; 0.80): these participants were 29% less likely to be vaccinated against HBV than those with no VH. High grades of HAV- and HPV-specific VH were respectively 48% and 55% less likely to be vaccinated against the corresponding disease than those with no VH. A high grade of VH specific for at least one of these three vaccines was the variable with the second lowest RR for uptake of HBV and HAV, and the third lowest for HPV. The highest grade of general VH, having ever refused a vaccine, and moderate VH specific to each of the three vaccines were each associated – at similar orders of magnitude – with lower vaccine uptake for all three vaccines.

## Discussion

### Summary of results

This is the first French study providing data on VH and its grades among MSM regarding the three vaccines recommended for them – those against HBV, HAV, and HPV STIs. Among the participants, 87% showed some VH for at least one of these three vaccines: high VH among 13%, and moderate VH among 74%. Moreover, 54% evidenced general VH. A comfortable financial situation and high education level were each associated with lower grades of both specific and general VH. Younger age was associated with less frequent specific VH but more frequent general VH. The highest grade of general VH (refusers) was negatively associated with self-reported uptake of the three vaccines of interest. However, high and moderate grades of specific VH were, in most cases, even more strongly negatively associated with this uptake.

**Table 4.** Sociodemographic correlates of the prevalence of grades of specific and general vaccine hesitancy (multiple multinomial logistic regressions, 2022 French National MSM survey,  $N = 3,730^a$ ).

	Specific VH grade (ref. No VH)		General VH grade (ref. No VH)		
	Moderate	High	Unsure acceptors	Delayers	Refusers
	aOR [95%CI]				
Age (quartiles) (ref. 18–29)					
30–38	<b>1.67 [1.27;2.21]</b>	<b>1.71 [1.15;2.53]</b>	<b>0.72 [0.53;0.97]</b>	0.93 [0.66;1.32]	1.11 [0.88;1.40]
39–49	<b>2.15 [1.61;2.88]</b>	<b>2.97 [2.02;4.38]</b>	<b>0.62 [0.46;0.83]</b>	0.85 [0.60;1.20]	1.11 [0.88;1.39]
50–84	<b>2.29 [1.72;3.06]</b>	<b>3.10 [2.11;4.55]</b>	<b>0.46 [0.34;0.63]</b>	<b>0.44 [0.30;0.64]</b>	0.85 [0.68;1.06]
Employment status (ref. Employed)					
Unemployed	1.24 [0.72;2.11]	1.33 [0.70;2.55]	1.15 [0.73;1.82]	1.25 [0.71;2.20]	1.26 [0.86;1.83]
Not in labor force <sup>b</sup>	0.88 [0.67;1.15]	0.72 [0.49;1.06]	<b>0.48 [0.35;0.66]</b>	0.86 [0.60;1.23]	0.86 [0.68;1.07]
Educational level (ref. Did not pass “baccalaureate <sup>c</sup> or lower)					
Passed “Bac” at end of high school	0.63 [0.38;1.06]	0.68 [0.38;1.23]	1.15 [0.77;1.71]	0.72 [0.44;1.19]	0.98 [0.71;1.35]
2 to 4 years of higher education	<b>0.52 [0.34;0.81]</b>	<b>0.40 [0.24;0.67]</b>	<b>0.69 [0.49;0.97]</b>	<b>0.66 [0.44;0.97]</b>	<b>0.71 [0.55;0.93]</b>
Master’s degree or higher	<b>0.41 [0.26;0.64]</b>	<b>0.27 [0.16;0.46]</b>	<b>0.49 [0.34;0.70]</b>	<b>0.53 [0.35;0.81]</b>	<b>0.58 [0.44;0.77]</b>
Feels financially ok/comfortable (ref. No)					
Yes	<b>0.79 [0.62;0.999]</b>	<b>0.65 [0.48;0.88]</b>	<b>0.55 [0.44;0.70]</b>	<b>0.72 [0.55;0.95]</b>	<b>0.73 [0.62;0.87]</b>
Complementary health insurance					
Yes	0.73 [0.47;1.15]	0.68 [0.39;1.19]	<b>0.52 [0.36;0.75]</b>	1.10 [0.66;1.85]	1.19 [0.85;1.67]

<sup>a</sup>All analyses were adjusted for French geographic area of residence; 2 missing values for this variable.

<sup>b</sup>Mostly students and retired people.

<sup>c</sup>Exam at end of high school.

VH = vaccine hesitancy; aOR [95% CI] = adjusted odds-ratio [95% confidence interval].

**Table 5.** Association between grades of specific vaccine hesitancy<sup>a</sup> and general vaccine hesitancy<sup>b</sup> (2022 French National MSM survey, N = 3 730).

	All N = 3730		Specific VH grade		
			No VH (13%)	Moderate (74%)	High (13%)
		%	row %		
General VH grade					***
No VH	1697	45.5	<b>18.4</b>	73.6	8.0
Unsure acceptor	1204	32.3	10.1	<b>77.3</b>	12.5
Delayer	329	8.8	11.6	71.7	<b>16.7</b>
Refuser	500	13.4	4.0	70.2	<b>25.8</b>

<sup>a</sup>Specific vaccine hesitancy: variable combining the three vaccine hesitancy variables for each of HBV, HAV, and HPV vaccines.

<sup>b</sup>General vaccine hesitancy: variable constructed to operationalize the definition of the WHO SAGE group.<sup>12</sup>

VH = vaccine hesitancy.

\*\*\*P ≤ .001.

**Table 6.** Associations between self-reported HBV, HVA, and HPV vaccination uptake and vaccine hesitancy variables (multiple modified Poisson regressions<sup>a</sup>, 2022 French National MSM survey, N = 3,730).

Self-reported vaccination against ... (ref. No)	HBV	HAV	HPV
	RR [95% CI]		
Specific VH grade for at least one of the three vaccines of interest (ref. no VH)			
Moderate	<b>0.88 [0.85;0.92]</b>	<b>0.71 [0.66;0.76]</b>	<b>0.63 [0.56;0.71]</b>
High	<b>0.80 [0.75;0.86]</b>	<b>0.57 [0.50;0.65]</b>	<b>0.55 [0.45;0.69]</b>
HBV-specific VH grade (ref. no VH)			
Moderate	<b>0.83 [0.80;0.86]</b>		
High	<b>0.71 [0.63;0.80]</b>		
HAV-specific VH grade (ref. no VH)			
Moderate		<b>0.61 [0.57;0.65]</b>	
High		<b>0.52 [0.44;0.62]</b>	
HPV-specific VH grade (ref. no VH)			
Moderate			<b>0.51 [0.46;0.57]</b>
High			<b>0.45 [0.31;0.64]</b>
General VH (ref. No VH)			
Unsure acceptor	0.97 [0.94;1.01]	<b>0.91 [0.85;0.98]</b>	<b>0.87 [0.77;0.98]</b>
Delayer	0.95 [0.89;1.02]	<b>0.84 [0.75;0.95]</b>	<b>0.83 [0.68;1.00]</b>
Refuser	<b>0.83 [0.78;0.89]</b>	<b>0.75 [0.66;0.84]</b>	<b>0.64 [0.52;0.78]</b>

<sup>a</sup>All models were run separately and adjusted for sociodemographic characteristics (age, geographic area of residence, employment status, education level, perceived financial situation, and complementary health insurance). 2 missing values for area of residence.

HBV = hepatitis B virus; HAV = hepatitis A virus; HPV = human papillomaviruses; RR [95% CI] = relative risk [95% confidence interval]; VH = vaccine hesitancy.

### Prevalence of specific and general VH

The prevalence of high specific VH (for at least one of the three vaccines of interest in our study) was low (13%) especially when considering the three vaccines of interest separately (maximum: 7% for HAV vaccine). We did not find previous studies measuring VH prevalence for these vaccines among MSM, except in China, for vaccines against mpox in 2022<sup>23</sup> and against COVID-19 in 2021.<sup>21</sup> In these studies, VH measures were based on MSM's perceptions of vaccine safety and effectiveness, and of disease severity. Among the participants in the mpox study, about 14% had high VH.<sup>23</sup> Participants in the COVID-19 study were all HIV-infected MSM, recruited via an official WeChat online chat group: 91% were not vaccinated against COVID-19, and among them, the prevalence of high VH was 47%.<sup>21</sup> However, these results cannot be directly compared to ours because the way the VH measures were built differed from our methodology. Moreover, specific contextual factors for these epidemics (new diseases; for COVID-19, new vaccines with new technologies; and, for the mpox epidemic in China, lack of available vaccine at the time of the study) may explain the higher prevalences of high VH specific for these diseases than for the HBV, HAV, and HPV vaccines.<sup>21</sup>

Conversely the prevalence of moderate specific VH, was quite high (74%). This is noteworthy as even moderate VH was associated with lower uptake of these vaccines (Table 4). When we considered the three vaccines separately, prevalence rates of moderate VH remained high (53% for HBV, 62% for HAV, and 66% for HPV). The detailed perceptions of MSMs regarding HBV and HPV vaccination could be compared with those found in the general population, based on the 2016 French Health Barometer, which used the same items<sup>14</sup> (see Appendix B). Strikingly, a perception of nonseverity was 4 times more frequent for HBV and 7 for HPV among MSM than among respondents to the 2016 French Health Barometer (adults for HBV and young women or parents of adolescent girls for HPV). At the same time, MSM were about twice as likely as these other groups to perceive the vaccines as safe (see Appendix B, Table B1). Caution is required in comparing these results from two studies conducted six years apart. Parents may be more risk-averse for their children – both for diseases that may affect them and health products that are injected into them – than adults might be for themselves.<sup>14</sup> However, some MSM, who engage in risky sexual practices without protection or prevention, may also be less averse to disease risks than the general population.<sup>1</sup>

In any case, our results suggest that significant fractions of MSM are not sufficiently aware of the risks and seriousness of sexually transmitted HBV, HAV, and HPV infections. Although prevention education about these STIs is of the utmost importance, it remains less than optimal. In France, until now prevention public policies targeting MSM have not included the vaccines specifically recommended for them. In particular, during young boys' schooling and their contacts with the health care system, questions related to sexual health are raised infrequently. Missed opportunities to receive appropriate information may be also frequent among MSM who do not have regular medical follow-up or have not informed their doctor that they are MSM, or hesitate about their sexual orientation, especially when young.<sup>10,31,32</sup>

The estimated prevalence of general VH in our study (54%) was higher than the 43% observed in 2016 among childless adults aged 18–64 years: 23% refusers (vs 13% among MSM), 7% delayers (vs 9%) and 13% unsure acceptors (vs 32%) (See Appendix B).<sup>14</sup> These figures suggest that MSM may be more likely than the general population to have uncertainties about vaccines. Devoting efforts to address their general vaccination concerns is thus highly necessary.

Several hypotheses might explain the higher prevalence of specific VH among MSM in our study (87% when combining the three vaccines of interest) than that of general VH, which concerns any vaccine. First, while our measure of specific VH was exclusively based on perceptions at the time of the survey, the WHO definition used to measure general VH considers mainly lifetime vaccination behaviors, an approach that may be subject to a memory bias. The latter measure may also consider the vaccines of interest, especially HBV vaccination, which took place in childhood or adolescence, when parents were responsible for vaccinations. Moreover, the dimensions measured by the general and specific VH variables (mainly behaviors for the former and exclusively perceptions/attitudes for the latter) do not necessarily overlap: perceptions and attitudes do not always translate into behavior. Participants may have doubts about the effectiveness of a vaccine without refusing or delaying it, or they may not find a disease very worrisome and still choose to be vaccinated.

### ***VH and MSMs' sociodemographic characteristics***

Our findings that both specific and general VH were lower among financially comfortable and more highly educated participants are in line with previous studies of VH among MSM and their acceptance of several vaccines.<sup>2,23,26,33</sup> The associations of specific and general VH prevalence rates varied inversely with the participants' ages. On the one hand, specific VH increased with age: doubts and fears may be more common among older MSM, because they are more likely to have been exposed to specific vaccine controversies. From the late 1990s through the first two decades of this century, successive controversies about vaccine safety, including HBV and then HPV, undermined public confidence in vaccines and might also have influenced the perceptions of the older MSM notably more than those of younger MSM.<sup>34,35</sup> General VH, on the other hand, decreased with age. The COVID-19 pandemic might

explain this difference: younger MSM were more likely to report unwillingness/reluctance to be vaccinated against COVID-19 than older MSM,<sup>26</sup> and COVID-19 vaccine uptake was lower among the younger group.<sup>36</sup> The questionnaire's administration during the COVID-19 vaccination period may have affected general VH measurement more among young than older MSM.

### ***Associations between VH and self-reported uptake of the vaccines of interest***

The strong associations between high grades of both specific and general VH with lower probabilities of self-reported uptake of the three vaccines of interest in our study highlight the importance of VH in the non-adoption of vaccines recommended to MSM. Previous studies among MSM for several vaccines, including those for mpox and HPV, showed that fear of contracting the disease and its perceived severity, as well as the vaccine's perceived effectiveness and benefits, and positive attitudes toward vaccines in general are associated with vaccination acceptance.<sup>2,23,37</sup> Our results confirm these findings and go further, as they indicate that the interactive combination, for a specific vaccine, of the two dimensions "lack of confidence in the vaccine" and "complacency" – what authors have recently termed "distrustful complacency" – is a stronger predictor of non-vaccination than the separate presence of these two dimensions.<sup>38</sup> This combination of VH dimensions calls for the development of information and education adapted simultaneously to MSM's level of information and their degree of worry about risky behaviors and vaccines.

### ***Strengths and limitations of the study***

This study has several strengths. First, the specific VH variable, based on BRB items and rooted in theoretical models (3C and HBM), allowed us to capture VH in its complexity – its different grades (moderate or high) and its main dimensions (complacency, lack of confidence in vaccine, or both). This measure, which showed good criterion validity (strong association with self-reported uptake), could thus be useful for future studies of VH among MSM and other population groups.

Second, our approach allowed us to emphasize the higher prevalence of VH when measured by perceptions rather than solely by past vaccination behavior (refusals, delays, or acceptance despite doubts). The latter approach underestimates VH prevalence, which may lead to missed opportunities to intervene with MSM who have legitimate questions about vaccines even though they are currently vaccinated.

Caution is required in generalizing our results to the entire French MSM population, because our sample, like those of all or nearly all studies of MSM, was not random. Despite the open recruitment strategy and the multiplication of recruitment channels in our study, participating MSM were on average older, more highly educated, and more likely to be employed and financially comfortable than those who participated in the most recent surveys in France, which were much larger than our sample.<sup>39,40</sup> As



in other studies among MSM, self-selection, linked to voluntary participation, cannot be ruled out. This may have led to an overrepresentation of MSM more assertive about their sexual identity and their exclusively homosexual practices, more motivated and interested in prevention issues, and less hesitant, as suggested by the high proportion of MSM with a high education level in our study.<sup>2,24,41</sup> However, this possible selection bias does not explain the differences observed with the results of the 2016 French Health Barometer, which is representative of the general adult population in France (random selection of the sampling frame, no over-representation of educated people). This selection bias could have led to an underestimation of the general prevalence of VH in our survey, and consequently also of the discrepancy between complacency prevalence in our study and the 2016 French Health Barometer. In addition, the cross-sectional design of the study makes it impossible to draw causal inferences.

## Conclusion

Nine out of 10 MSM showed more or less strong grades of hesitancy about the HBV, HAV and HPV vaccines that are recommended to them, and each of these grades was consistently associated with fewer vaccinations for at least one of the three diseases considered in this study. It is crucial to respond appropriately to the concerns of MSM, by taking their individual experiences, medical history and social characteristics into account.<sup>42</sup> Developing and implementing an ambitious public health strategy is thus needed to improve both MSM knowledge of the vaccine-preventable diseases to which they may be exposed, and their confidence in the vaccines recommended to them. One of the challenges of this strategy will be to reach both MSM who are involved in their community and those who live in hiding, often far from preventive healthcare. This strategy should be co-constructed with all stakeholders in the MSM community, in particular associations involved in sexual health prevention among MSM. Such strategies have already been implemented on other topics: the guidelines of the European AIDS Clinical Society, a not-for-profit organization, provide recommendations (such as the use of pre-exposure prophylaxis) to clinicians for the care of people living with HIV, including MSM.<sup>43,44</sup> Providers (doctors, specialists, nurses, and health mediators) need to acquire the skills to address questions relating to sexual practices, discuss these issues with their patients, and determine which men are eligible for vaccines. Providers should also be trained in personalized methods such as motivational interviewing, so that they are able to listen to and respectfully address MSM concerns, identify their degree of hesitancy, help them to improve their confidence in vaccines and motivate them to get vaccinated. Finally, it is important to facilitate access to vaccines and the vaccination process, particularly for the most disadvantaged MSM. Regular monitoring of the prevalence of general and specific VH among MSM, is important for developing this public health policy to prevent STIs among them and for adapting it to epidemic periods. Further research is needed to better understand the

determinants of VH specific to this population, including the conditions of their medical follow-up.

## Note

- [a] Baromètre de Santé publique France 2016 : Questionnaire [Internet]. Santé publique France. 2021 [cited 2023 Oct 18]. Available from: <https://www.santepubliquefrance.fr/etudes-et-enquetes/barometres-de-sante-publique-france/barometre-sante-2016/documents/barometre-de-sante-publique-france-2016-questionnaire>

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## Appendices

### Appendix A

**Table A1.** Prevalence of grades of specific and general vaccine hesitancy and associations with sociodemographic characteristics (2022 National French MSM survey,  $N = 3\,730$ ).

	All		Specific VH grade			General VH grade			
			No VH (13%)	Moderate (74%)	High (13%)	No VH (46%)	Unsure acceptor (32%)	Delayer (9%)	Refuser (13%)
	$N = 3730$	%	row %						
Age (quartiles)									
18–29	953	25.6	<b>20.2</b>	70.1	9.8	43.0	29.6	<b>10.3</b>	<b>17.1</b>
30–38	873	23.4	<b>13.3</b>	<b>75.7</b>	11.0	43.3	<b>33.3</b>	<b>9.9</b>	<b>13.5</b>
39–49	992	26.6	9.9	<b>75.1</b>	<b>15.0</b>	43.5	<b>34.7</b>	<b>9.3</b>	12.6
50–84	912	24.5	9.5	<b>76.0</b>	<b>14.5</b>	<b>52.4</b>	31.5	5.8	10.3
Geographic area of residence									
Ile-de-France	1185	31.8	13.9	74.0	12.1	<b>51.5</b>	29.3	9.0	10.2
Northwestern France	515	13.8	12.6	76.5	11.0	45.1	<b>33.0</b>	7.2	<b>14.8</b>
Northeastern France	599	16.1	12.7	73.0	14.4	41.4	<b>36.2</b>	8.2	<b>14.2</b>
Southwest France	606	16.3	12.1	73.6	14.4	40.1	<b>34.2</b>	<b>10.4</b>	<b>15.4</b>
Southeastern France	788	21.1	13.8	74.1	12.1	44.7	32.0	8.5	<b>14.9</b>
Overseas	35	0.9	14.3	77.1	8.6	31.4	31.4	<b>17.1</b>	<b>20.0</b>
Employment status									
Employed	2907	77.9	12.5	<b>74.5</b>	<b>13.0</b>	45.4	<b>32.4</b>	8.6	<b>13.6</b>
Unemployed	178	4.8	9.6	<b>74.7</b>	<b>15.7</b>	33.7	<b>36.0</b>	<b>10.1</b>	<b>20.2</b>
Not in labor force	645	17.3	<b>17.4</b>	72.6	10.1	<b>49.0</b>	30.9	<b>9.3</b>	10.9
Educational level									
Did not pass "Baccalaureate" <sup>a</sup> exam at the end of high school or lower	403	10.8	6.2	<b>76.4</b>	<b>17.4</b>	34.7	<b>37.5</b>	<b>10.7</b>	<b>17.1</b>
Passed "Bac" at the end of high school	454	12.2	10.1	72.9	<b>17.0</b>	35.5	<b>36.6</b>	7.9	<b>20.0</b>
2 to 4 years of post-secondary education	1512	40.5	13.0	<b>74.8</b>	12.2	45.1	<b>32.4</b>	<b>9.0</b>	<b>13.5</b>
Master's degree or higher	1361	36.5	<b>16.6</b>	73.3	10.1	<b>52.5</b>	29.2	8.4	10.0
Currently, you are financially ...									
Comfortable/OK	2612	70.0	<b>14.2</b>	74.1	11.7	<b>49.2</b>	31.1	8.4	11.3
Barely managing/in difficulty/in debt	1118	30.0	10.9	<b>74.3</b>	<b>14.8</b>	36.8	<b>35.0</b>	<b>9.8</b>	<b>18.4</b>
Complementary health insurance									
Yes	3495	93.7	13.4	74.1	12.5	<b>45.9</b>	<b>32.7</b>	<b>8.8</b>	12.6
No or don't know	235	6.3	10.2	75.7	14.0	39.6	26.4	8.5	<b>25.5</b>

<sup>a</sup>Exam at the end of high school.

VH = Vaccine hesitancy; HBV = hepatitis B virus; HAV = hepatitis A virus; HPV = human papillomaviruses.

- not significant \* $P \leq .05$  \*\* $P \leq .01$  \*\*\* $P \leq .001$ .

## Appendix B HBV- and HPV-specific vaccine hesitancy among the general population

### Characteristics of the Health Barometer 2016 study

The Health Barometer studies are cross-sectional, self-report surveys conducted repeatedly since 1992 by the French National Public Health Agency. They are based on telephone interviews with representative samples of the population. Both landline and mobile telephone numbers are randomly generated. Particular care is taken in interviewing individuals who are more difficult to reach (announcement letter, SMS announcement, number of calls and variation in times, reminders of refusals, website, hotline, etc.) to ensure that the image returned by the sample accurately reflects its proportions and includes all the profiles of individuals present in French society, including those less inclined to take part in this type of survey.

The Health Barometer 2016 survey took place from January 8 to August 1, 2016, in mainland France, among 15,216 people aged from 15 through 75. The questionnaire<sup>a</sup> covered a range of health topics, including perceptions and behaviors related to infectious diseases, with a large section devoted to vaccination, but also sexual health and screening for HIV and viral hepatitis. The telephone interview lasted an average of 37 minutes.

### Questions related to HBV and HPV vaccine hesitancy in the Health Barometer 2016 study (HB2016)

To measure their HBV- and HPV-specific vaccine hesitancy (VH), HB2016 participants were asked about their perceptions of HBV and HPV vaccines (effectiveness, concerns about severe side effects) and of the diseases they prevent (perceived frequency of the disease, severity) (scale answers from 0 = "Not at all" to 4 = "Totally").

### Results – Perceptions of vaccines of interest and related disease among Vaccigay and HB2016 participants

Among HB2016 participants, 8% perceived HBV disease as not severe and 6% of women aged 15 to 25 and parents of adolescent girls perceived HPV disease as not severe. Around 75% of HB2016 participants reported they perceived the HBV and HPV vaccines to be effective, while around 55% that they perceived them as unsafe (Table B1).



**Table B1.** Perceptions of HBV, HAV and HPV diseases and their vaccines, according to year and survey.

	2022 Vaccigay (n = 3,730)%	2016 Health Barometer (n = 15,216 <sup>a</sup> )%
Fear of being infected with HBV		
No	68.3	– <sup>b</sup>
Yes	31.7	–
HBV severe		
No	32.6	7.8
Yes	67.5	92.2
HBV vaccine effective		
No	25.0	24.8
Yes	75.0	75.2
HBV vaccine unsafe		
No	79.9	41.6
Yes	20.1	58.4
Fear of being infected with HAV		
No	75.9	–
Yes	24.1	–
HAV severe		
No	48.9	–
Yes	51.1	–
HAV vaccine effective		
No	35.9	
Yes	64.1	
HAV vaccine unsafe		
No	84.1	
Yes	15.9	
Fear of being infected with HPV		
No	53.4	–
Yes	46.6	–
HPV severe		
No	43.5	6.2
Yes	56.5	93.8
HPV vaccine effective		
No	46.3	27.7
Yes	53.8	72.3
HPV vaccine unsafe		
No	82.3	46.0
Yes	17.7	54.0

<sup>a</sup>Questions relative to HPV were only asked of women aged 15–25 or parents of girls aged 11–19, who had heard about the vaccine (n = 2168). Data are weighted to be representative of the French population in the Health Barometer. Items were dichotomized at the middle of the scale (>5 on the Vaccigay 0–10 scale, >2.5 on the Health Barometer 1–4 scale). “Don’t know” answers were recoded at 2.5 on the 1–4 scale in the Health Barometer survey, while they were recoded according to their correlations with other answers on the 0–10 scale in the Vaccigay survey.

<sup>b</sup>Items not present in the 2016 Health Barometer.

HBV = hepatitis B virus; HAV = hepatitis A virus; HPV = human papillomaviruses.