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## Original Research

## Factors associated with COVID-19 vaccination intentions and attitudes in France



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## ABSTRACT

**Objectives:** The objective of the study is to investigate the factors associated with COVID-19 vaccination intentions and attitudes in France.

**Study design:** An online cross-sectional study was conducted among a representative sample of the French population between November 20th and 23rd 2020 (N = 1146).

**Methods:** Factors associated with the intention to get vaccinated and with COVID-19 vaccine attitudes were estimated using ordered logistic and multinomial logistic regressions, respectively. Independent variables of interest include COVID-19 and vaccine perceptions, trust, endorsement of COVID-19 conspiracy theories and time/risk preferences.

**Results:** Only 30.5% of our respondents would agree to get vaccinated against COVID-19 during the first semester of 2021 while 31.1% declare being unsure of their vaccination intentions. COVID-19 risk perceptions are associated with vaccination intentions and attitudes. Individual and collective benefits of the vaccine and the concerns over its safety are strongly associated with COVID-19 vaccination intentions and attitudes. Vaccine acceptors are more willing to take risks in the health domain compared with vaccine hesitant respondents which indicates that the COVID-19 vaccine is perceived as a greater health risk than the COVID-19 itself by some respondents. We also find a positive association between future preference and the willingness to get vaccinated.

**Conclusion:** Awareness campaigns should be conducted to enhance vaccination uptake among vaccine hesitant individuals. These campaigns could highlight the positive benefit-risk balance of the COVID-19 vaccines or the short-term benefits of vaccination and should reinsure the public on the safety of the COVID-19 vaccines.

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## Introduction

In France, the COVID-19 vaccination campaign has started in January 2021. After the vaccination of high-risk individuals, the vaccination campaign has been scaled-up to the rest of the French population from spring 2021 onward. Despite the low initial COVID-19 vaccination intentions among the French population before the launch of the vaccination campaign (only 53%<sup>1</sup> and 39%<sup>2</sup> of respondents from nationally representative samples of the French adult population were willing to get vaccinated in November and December 2020, respectively) and the growing vaccine hesitancy since the H1N1 influenza pandemic vaccination

campaign of 2009,<sup>3–6</sup> half of the French population had received at least one dose of COVID-19 vaccine at the beginning of summer 2021. Nevertheless, the rhythm of first doses administration is currently slowing down while it is estimated that a 60%–90% level of COVID-19 vaccination uptake is needed to create herd immunity.<sup>7</sup>

Convincing vaccine hesitant populations to get vaccinated against COVID-19 is now crucial to reduce the level of circulation of the virus, to prevent the emergence of variants and to reach herd immunity. In this context, studying the factors associated with the willingness to get vaccinated against COVID-19 appears crucial to design effective awareness campaigns enhancing vaccination uptake. Previous studies have shown that COVID-19 vaccination intentions are lower among women, unemployed and less educated respondents<sup>8–10</sup> and that they are positively associated with COVID-19 risk perceptions<sup>11,12</sup> and with the perceived benefit of the vaccine.<sup>13,14</sup> On the other hand, concerns over the efficacy or the

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safety of the vaccine were stated as reasons for not wanting to get vaccinated against COVID-19 in several studies.<sup>10,14–16</sup> Lack of trust in vaccine development or testing processes and in scientific research was also found to be prevalent among vaccine hesitant respondents in the United States and Italy,<sup>16,17</sup> whereas COVID-19 misinformation or endorsement of COVID-19 conspiracy theories were found to be negatively associated with vaccination intentions.<sup>18–20</sup>

In France, several studies have investigated the factors associated with COVID-19 vaccination intentions among the general population during or just after the first wave of the epidemic in spring 2020.<sup>21–25</sup> These studies, conducted either in representative<sup>22–24</sup> or non-representative<sup>21,25</sup> samples of the French adult population, have found that vaccination intentions are lower among female, older (>65 years old) and low-income respondents. Respondents declaring to be 'afraid of the new coronavirus' or feeling 'at risk of getting infected by the new coronavirus' were more likely to declare they will get vaccinated if a vaccine was available in a study conducted among a non-representative sample of the French adult population.<sup>21</sup> Being very concerned about getting infected with COVID-19 was found to be negatively correlated with COVID-19 vaccine refusal, i.e., declaring 'probably not' or 'certainly not' agreeing to get vaccinated against COVID-19 if a vaccine was available, among a representative sample of the French population.<sup>23</sup> Vaccination history and risk factors of a severe form of COVID-19 were also shown to be significantly associated with vaccine outright refusal (never choosing to get vaccinated whatever the vaccine characteristics) and vaccine hesitancy (choosing to get vaccinated or not depending on the vaccine characteristics) in a discrete choice experiment conducted among a representative working-age population.<sup>24</sup> COVID-19 conspiracy beliefs, measured through the level of agreement with nine items such as 'a vaccine against the coronavirus exists, but it is kept secret by those who have it in order to increase its value', were also found to be negatively associated with COVID-19 vaccination intentions in a study conducted among a non-representative sample of the French population in spring 2020.<sup>25</sup> Finally, a study on COVID-19 vaccination intentions among French healthcare workers found that COVID-19 fear or perceived risk and previous flu vaccination were associated with vaccination intentions.<sup>26</sup>

Using data of an online survey conducted among a sample representative of the adult population living in France with regard to gender, age, region and socio-professional category between November 20th and 23rd 2020 (N = 1146), we study the factors associated with COVID-19 vaccination intentions and attitudes at a time the first efficacy results from phase 3 trials of COVID-19 vaccines were publicly released. Our objective is to study how COVID-19 risk perceptions, perceived efficacy and concerns over the COVID-19 vaccine, trust, endorsement of COVID-19 conspiracy theories and time and risk preferences are associated with the willingness to get vaccinated against COVID-19 during the first semester of 2021.

## Methods

### Design and sample

The sample is composed of 1268 French-speaking adults living in France. Respondents' recruitment was operated by an independent panellist ([www.panelabs.com](http://www.panelabs.com)) over three days (November 20–23, 2020) using a quota sampling design to create a sample representative of the population living in France with regard to gender, age, region and socio-professional category. The questionnaire was hosted on Limesurvey®. Participants were presented with an information letter about the purpose of the study before

being asked whether they agreed to participate. The information letter mentioned the strict anonymity of collected data and the eligibility criteria (aged more than 18 years and living in France). Given strict anonymity of collected data, the study did not need authorization of the Commission Nationale de l'Informatique et des Libertés (CNIL).

### Dependent variables of interest

Respondents were asked whether they would agree to get vaccinated against COVID-19 if a vaccine were to be approved by the French national health authorities during the first semester of 2021. Intentions to get vaccinated was measured on a Likert-type scale ranging from 1 ('I would definitely not agree') to 5 ('I would definitely agree').

Participants were also asked after how much time they will be willing to get vaccinated once a COVID-19 vaccine will be available in France. Participants had to choose between the following responses: 'as soon as possible', 'in less than a month', 'between one and three months', 'between three and six months', 'between six months and one year', 'between one and two years', 'unsure' and 'I would never get vaccinated'. Using respondents' answers to this question, we created a three-category vaccine attitude variable based on the continuum of vaccine hesitancy developed by the SAGE Working Group on Vaccine Hesitancy.<sup>27</sup> Participants were categorized in the 'vaccine acceptance' category if they declared they would get vaccinated in less than three months, in the 'vaccine hesitancy' category if they declared they would get vaccinated after three months or if they declared being unsure of whether they would get vaccinated and in the 'vaccine outright refusal' category if they declared they would never get vaccinated.

### Independent variables of interest

The theoretical framework based on the Health Belief Model (HBM)<sup>28</sup> and used to investigate the factors associated with COVID-19 vaccination attitudes and intentions is presented in Fig. 1. The HBM has been widely used in the literature to study vaccination beliefs and behaviours,<sup>29</sup> including vaccination uptake in epidemic contexts.<sup>30–32</sup>

The independent variables of interest were assessed by several questions with ordinal responses and factorial analyses were conducted to create scores for the different HBM constructs.

#### COVID-19 perceived threat

COVID-19 risk perceptions were measured using three one-item variables: the level of agreement with the assertion that 'experts who say that COVID-19 is dangerous should be believed' (from 1 – 'totally disagree' to 5 – 'totally agree'), the perceived individual health consequences in case of infection and the perceived health impacts of the COVID-19 epidemic in France (both from 1 – 'not serious at all' to 5 – 'very serious'). A risk perception score was created by averaging the answers to these three items ( $\alpha = 0.67$ ).

#### Perceived benefits of COVID-19 vaccination

The perceived efficacy of the COVID-19 vaccine was measured using three items. Participants were asked to rate their level of agreement with the following statements on a scale from 1 ('totally disagree') to 5 ('totally agree'): 'Getting vaccinated against COVID-19 would be a good way to protect myself against COVID-19', 'Getting vaccinated against COVID-19 would be important for the health of others in my community' and 'Vaccination against COVID-19 will help end the current pandemic'. A vaccine perceived efficacy score was created by averaging the answers to these three items ( $\alpha = 0.92$ ).

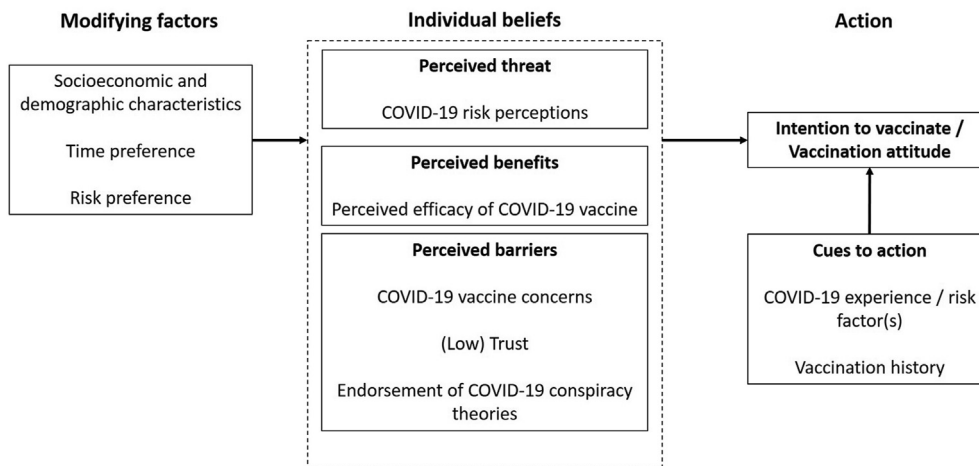


Fig. 1. Theoretical framework.

*Perceived barriers to COVID-19 vaccination*

COVID-19 vaccine concerns were measured using two items. Participants were asked how much they worried about the side-effects and the rapidity of development of the new COVID-19 vaccine on a scale from 1 ('not worried at all') to 5 ('very worried'). A vaccine concern score was created by averaging the answers to these two items ( $\alpha = 0.81$ ).

On a scale from 1 ('totally disagree') to 5 ('totally agree'), respondents were asked whether they agreed with three assertions stating that they trust the government, the pharmaceutical industry and science to fight the COVID-19 epidemic and to limit its negative effects and with one assertion stating that they trust official information regarding the number of COVID-19 infections, hospitalizations and deaths in France. The answers to these four questions were averaged to create a trust score ( $\alpha = 0.78$ ).

To measure the tendency to endorse COVID-19 conspiracy theories, respondents were asked to rate their level of agreement (from 1 – 'totally disagree' to 5 – 'totally agree') with following three statements chosen based on previous literature.<sup>20,21</sup>

1. COVID-19 was created in a laboratory to reduce the world's population.
2. A vaccine against COVID-19 is available for a long time, but it is being kept secret by the pharmaceutical industry to increase its value.
3. The COVID-19 pandemic is part of a global effort to impose compulsory vaccination.

A mean COVID-19 conspiracy score was calculated by averaging the responses to these three questions ( $\alpha = 0.84$ ).

*Cues to action*

We collected information on experience of COVID-19 symptoms (with or without medical confirmation), experience of close contact(s) with COVID-19 cases, risk factors for a severe form of COVID-19 and vaccination history (frequency of uptake of recommended vaccines and uptake of seasonal flu vaccination over the past three years).

*Modifying factors*

Respondents' risk preference was measured by a single question asking them to rate their willingness to take risk in the health domain on a scale from 0 ('extremely careful') to 10 ('extremely adventurous'). The French-validated 7-item short version of the

Consideration of Future Consequences Scale<sup>33</sup> was used as a measure of future preference ( $\alpha = 0.71$ ).

Individual control factors include socio-economic and demographic characteristics (gender, age, region, matrimonial status, education level, whether the respondent works as a health professional, income and size of the residency city, and perceived health status.

*Data analysis*

A total of 1146 observations were available after quality checks (see Appendix A for details on quality checks performed and participants discarded). The final sample was slightly reweighted to match French official census statistics for gender, age, region, education level and size of residency city. Factors associated with the intention to get vaccinated were estimated using an ordered logistic model. Factors associated with the vaccine attitude categorization ('vaccine acceptance', 'vaccine hesitancy' and 'vaccine outright refusal') were estimated using multinomial logistic regressions using the 'vaccine acceptance' category as the base outcome. All regression analyses were run using Stata®, version 15.

**Results**

Table 1 presents the summary statistics for the dependent and independent variables used in regression analyses. Among our respondents, 30.5% declare they would probably or definitely agree to get vaccinated against COVID-19 if a vaccine were to be approved in France during the first semester of 2021, whereas 31.1% declare being unsure whether they would be willing to get vaccinated. Regarding the COVID-19 vaccine attitude, 25% of respondents are classified in the 'vaccine acceptance' category, 60.6% in the 'vaccine hesitancy' category and 14.4% in the 'vaccine outright refusal' category.

Table 2 presents the regression analysis results for vaccination intentions and attitudes. Full regression results are available in Table S1 of Appendix B.

Male and respondents with COVID-19 risk factors other than age report a higher willingness to get vaccinated. Previous vaccination history is strongly associated with the intention to get vaccinated against COVID-19. The COVID-19 risk perception score is positively and significantly associated with vaccination intentions. The vaccine perceived efficacy score is strongly and positively associated with the willingness to get vaccinated, whereas the vaccine concern

**Table 1**  
Descriptive statistics.

Characteristic	Mean (SD) [Min; Max]	N (%)
<b>Gender</b>		
Female		637 (55.6%)
Male		509 (44.4%)
<b>Age</b>		
20–24		79 (6.9%)
25–34		175 (15.3%)
35–44		206 (18.0%)
45–54		198 (17.3%)
55–64		195 (17.0%)
>65		293 (25.6%)
<b>Region</b>		
Auvergne-Rhône-Alpes		161 (14.0%)
Bourgogne-Franche-Comté		50 (4.4%)
Bretagne		60 (5.2%)
Centre-Val de Loire		41 (3.6%)
Grand Est		88 (7.7%)
Hauts-de-France		118 (10.3%)
Île-de-France		231 (20.2%)
Normandie		37 (3.2%)
Nouvelle-Aquitaine		92 (8.0%)
Occitanie		93 (8.1%)
Pays de la Loire		79 (6.9%)
Provence-Alpes-Côte d'Azur		96 (8.4%)
<b>Size of residency city</b>		
Less than 10,000 inhabitants		544 (47.5%)
10,000 inhabitants or more		602 (52.5%)
<b>Matrimonial status</b>		
Single		202 (17.6%)
Civil union or married		502 (43.8%)
In a relationship		287 (25.0%)
Divorced or separated		133 (11.6%)
Widow or widower		22 (1.9%)
<b>Education</b>		
< A level		280 (24.4%)
A level		277 (24.2%)
Two-year university diploma		241 (21.0%)
>Two-year university diploma		348 (30.4%)
<b>Monthly income</b>		
<1000 euros		86 (7.5%)
1000–2000 euros		393 (34.3%)
2000–4000 euros		443 (38.7%)
>4000 euros		123 (10.7%)
Not applicable or not wishing to answer		101 (8.8%)
<b>Health worker</b>		
No		1073 (93.6%)
Yes		73 (6.4%)
<b>Perceived health</b>		
Poor or very poor		101 (8.8%)
Fair		406 (35.4%)
Good		465 (40.6%)
Very good		174 (15.2%)
<b>Risk factors for a severe form of COVID-19</b>		
No risk factor		699 (61.0%)
65 years old or more		293 (25.6%)
Other risk factors (chronic diseases, pregnant)		154 (13.4%)
<b>COVID-19 symptoms</b>		
No symptoms		960 (83.8%)
Symptoms without medical confirmation		131 (11.4%)
Symptoms with medical confirmation		55 (4.8%)
<b>COVID-19 close contact</b>		
No		1046 (91.3%)
At least once		100 (8.7%)
<b>Flu vaccination</b>		
No		728 (63.5%)
At least once in the past three years		418 (36.5%)
<b>Recommended vaccine</b>		
Never		94 (8.2%)
Hardly		130 (11.3%)
Sometimes		226 (19.7%)
Often		296 (25.8%)
Always		400 (34.9%)
<b>COVID-19 vaccination intentions</b>		
I would not agree at all		241 (21.0%)

(continued on next page)

**Table 1** (continued)

Characteristic	Mean (SD) [Min; Max]	N (%)
I probably would not agree		200 (17.5%)
I would agree or maybe not		356 (31.1%)
I would probably agree		197 (17.2%)
I would definitely agree		152 (13.3%)
<b>COVID-19 vaccine attitude</b>		
Vaccine acceptance		287 (25.0%)
Vaccine hesitancy		694 (60.6%)
Vaccine outright refusal		165 (14.4%)
<b>COVID-19 risk perception score</b>	3.59 (0.73) [1; 5]	
<b>COVID-19 vaccine concern score</b>	3.91 (0.98) [1; 5]	
<b>COVID-19 vaccine efficacy score</b>	3.37 (1.10) [1; 5]	
<b>Trust score</b>	3.08 (0.90) [1; 5]	
<b>COVID-19 conspiracy score</b>	2.31 (1.11) [1; 5]	
<b>Health risk propensity</b>	3.38 (2.64) [0; 10]	
<b>Consideration of Future Consequences scale</b>	3.33 (0.66) [1; 5]	
Observations	1146	1146

score is strongly and negatively associated with COVID-19 vaccination intentions. We find a positive and significant association between the trust score and the willingness to get vaccinated. Future preference is significantly associated with COVID-19 vaccination intentions.

Women are more often vaccine hesitant compared to men. Respondents who got vaccinated against seasonal flu at least once in the last three years and those who more often get vaccinated when recommended are less likely to belong to the 'vaccine hesitancy' or 'vaccine outright refusal' categories. Respondents who consider their health as very good are more likely to belong to the 'vaccine outright refusal' category. The COVID-19 risk perception score is lower among vaccine hesitant respondents than among vaccine acceptors. Respondents in the 'vaccine hesitancy' or 'vaccine outright refusal' categories tend to have a higher vaccine concern score and a lower vaccine efficacy score than vaccine acceptors. Finally, we find that respondents in the 'vaccine acceptance' category declare being more willing to take risks in the health domain compared to vaccine hesitant respondents.

## Discussion

Only 30.5% of our respondents would probably or definitely agree to get vaccinated against COVID-19, whereas 31.1% declare being unsure whether they would be willing to get vaccinated. In line with studies available for France,<sup>21–23</sup> we find that women have lower COVID-19 vaccination intentions which is problematic as they are overrepresented among caregivers of dependent elderly in France.<sup>34</sup> Moreover, given the key role played by women in childhood vaccinations, COVID-19 vaccine hesitancy among women is of worry at the time COVID-19 vaccination is opening to children under 18 in France. Among respondents at risk of a severe form of COVID-19, vaccination intentions are higher for pregnant women and for respondents with chronic diseases but not for respondents older than 65 years. Respondents who frequently get vaccinated also express higher intentions to get vaccinated against COVID-19 and are less likely to be vaccine hesitant. However, the pool of people getting vaccinated against COVID-19 needs to be extended far beyond at-risk individuals and those usually in favour of vaccination to create herd immunity in France.

Similar to Detoc et al.<sup>21</sup> or Ward et al.,<sup>23</sup> we find higher vaccination intentions and lower COVID-19 vaccine hesitancy among respondents with elevated COVID-19 risk perception. Moreover, the perceived individual and collective benefits of the vaccine and the concerns over its safety are strongly associated with COVID-19 vaccination intentions. The magnitude and level of significance of

the associations between the intention and lower COVID-19 vaccine hesitancy vaccine perceptions and COVID-19 vaccination intentions/attitudes are higher than those observed for COVID-19 risk perceptions. This seems to indicate that vaccine perceptions play a greater role in the willingness to get vaccinated than COVID-19 risk perceptions. Similar to results obtained in the United States<sup>16</sup> or Italy,<sup>17</sup> we also find that distrust in the government, the pharmaceutical industry or science for the management of the COVID-19 epidemic is associated with lower vaccination intentions.

Our results are in line with previous studies using the HBM to investigate vaccination intentions. Indeed, a meta-analysis of studies using the HBM found that risk likelihood, susceptibility, and severity significantly predicted vaccination behaviours<sup>35</sup> while we also find that the perceived threat is significantly associated with COVID-19 vaccination intentions. Moreover, the strong associations we find between the perceived efficacy/concerns regarding the COVID-19 vaccines and vaccination intentions/attitudes are consistent with a recent scoping review which highlighted that of the four main HBM constructs, perceived barriers and perceived benefits were the strongest predictors of health-related behavioural changes.<sup>36</sup> More specifically, as found for COVID-19 vaccination intentions and attitudes in this study, previous literature on vaccination behaviours during epidemic contexts, such as H1N1 or influenza, highlighted the importance of the perceived barriers<sup>31,37</sup> and perceived benefits<sup>38,39</sup> of the vaccine on vaccination uptake. Very recently, and in concordance with our results, other studies investigating COVID-19 vaccination intentions using the HBM theoretical framework also emphasized the importance of perceived severity, perceived vaccine benefits and perceived barriers to vaccination on vaccination acceptance.<sup>30,40,41</sup>

Taken together, our results on the HBM variables suggest that targeted communication campaigns should be launched to enhance trust in the newly developed vaccines and to increase vaccination uptake among vaccine hesitant populations. Convincing vaccine hesitant populations to get vaccinated against COVID-19 is indeed crucial to reduce the level of circulation of the virus and to prevent the emergence of variants against which the currently available vaccines might be less effective. Given the observed concern over the rapidity of development, these campaigns could explain how the rapid progresses on the COVID-19 vaccines were made possible by unprecedented research efforts and financing (including government financing), by previous scientific knowledge on coronaviruses and on vaccine development for other pathogens and by the rapid genetic sequencing of this new coronavirus that allowed the subsequent development of messenger RNA vaccines. Public health authorities should also



**Table 2**  
Results of regression analyses.

	Vaccination intentions	Vaccine attitude (Ref: Vaccine acceptance)	
		Vaccine hesitancy	Vaccine outright refusal
<b>Male</b> (Ref: Female)	1.471* [1.091, 1.984]	0.606* [0.374, 0.982]	0.595 [0.281, 1.258]
<b>Perceived health (Ref: Poor or very poor)</b>			
Fair	1.516 [0.816, 2.819]	0.717 [0.294, 1.748]	0.576 [0.129, 2.568]
Good	1.274 [0.676, 2.401]	1.096 [0.418, 2.872]	2.881 [0.637, 13.035]
Very good	0.923 [0.464, 1.835]	1.290 [0.421, 3.949]	7.205* [1.447, 35.876]
<b>COVID-19 risk factors (Ref: none)</b>			
65 years old and more	1.569 [0.759, 3.245]	1.123 [0.359, 3.515]	0.370 [0.074, 1.854]
Other risk factors (chronic disease, pregnant)	1.817* [1.085, 3.042]	0.812 [0.401, 1.645]	0.650 [0.211, 2.003]
<b>Flu vaccination (Ref: Not in the past 3 years)</b>			
At least once in the past 3 years	2.004*** [1.406, 2.857]	0.406** [0.236, 0.698]	0.209** [0.073, 0.597]
<b>Recommended vaccines (Ref: Never)</b>			
Rarely	1.637 [0.857, 3.127]	0.262 [0.051, 1.352]	0.0654** [0.010, 0.413]
Sometimes	1.915* [1.023, 3.584]	0.276 [0.068, 1.116]	0.0485*** [0.009, 0.268]
Often	3.194*** [1.805, 5.653]	0.201* [0.054, 0.753]	0.0248*** [0.005, 0.125]
Always	3.734*** [2.003, 6.959]	0.141** [0.038, 0.528]	0.0157*** [0.003, 0.085]
<b>COVID-19 risk perception score</b>	1.342* [1.001, 1.799]	0.537** [0.353, 0.818]	0.589 [0.320, 1.084]
<b>COVID-19 vaccine concern score</b>	0.343*** [0.280, 0.420]	3.668*** [2.741, 4.908]	5.632*** [3.216, 9.863]
<b>COVID-19 vaccine efficacy score</b>	4.848*** [3.612, 6.506]	0.307*** [0.192, 0.492]	0.0485*** [0.026, 0.091]
<b>Trust score</b>	1.344* [1.067, 1.693]	0.866 [0.622, 1.205]	0.704 [0.414, 1.195]
<b>COVID-19 conspiracy score</b>	1.101 [0.944, 1.284]	0.864 [0.680, 1.098]	1.070 [0.748, 1.531]
<b>Health risk propensity</b>	1.022 [0.968, 1.080]	0.890* [0.809, 0.979]	0.978 [0.845, 1.132]
<b>Consideration of Future Consequences Scale</b>	1.267* [1.012, 1.588]	1.239 [0.841, 1.826]	0.946 [0.502, 1.783]
Observations	1146	1146	1146
Pseudo R-squared	0.377	0.509	0.509

Results are presented as odd ratios with 95% confidence interval in brackets. An odd ratio between 0 and 1 indicates a negative association. An odd ratio greater than 1 indicates a positive association.

\**P* < 0.05, \*\**P* < 0.01, \*\*\**P* < 0.001.

explain that, while accelerated trial procedures allowed for a rapid assessment of COVID-19 vaccines by health technology agencies, safety and efficacy routine checks were performed as scrupulously as done for any other drugs or vaccines seeking market authorisation.

The positive association we find between the propensity to take risk in the health domain and the willingness to get vaccinated quickly (i.e., in less than three months) is worrisome as it indicates that the COVID-19 vaccine is perceived by some respondents as a greater health risk than the COVID-19 itself. Then, it appears important for information campaigns to underline the positive benefit-risk balance of the COVID-19 vaccines by stressing out the risks associated with a COVID-19 infection and how much these risks can be reduced thanks to vaccination. Such information campaigns will enhance vaccination uptake among both individuals with a low COVID-19 risk perception and those currently perceiving the COVID-19 vaccine as a greater health risk than the COVID-19 itself.

As previously found for flu vaccination<sup>42–44</sup> or H1N1 influenza vaccination<sup>38</sup> our regression results also point to a positive association between future preference and COVID-19 vaccination intentions. This indicates that respondents who are more present-oriented are less likely to get vaccinated against COVID-19. To heighten vaccination uptake among present-oriented individuals, information campaigns could stress out the short-term benefits of the COVID-19 vaccination, for example by highlighting how COVID-19 vaccination will allow travelling across Europe and attending large gatherings or events. Reducing the short-term opportunity cost of the COVID-19 vaccination, for example by offering vaccines at the workplace or at the location of summer holidays, could also enhance vaccination uptake among present-oriented individuals.

Our study is not without limitation. First, the cross-sectional design used in this study does not allow the identification of causal effects. Second, our results regarding the intentions to get vaccinated are not directly comparable to those of previous studies<sup>2,23</sup> as we included a neutral response modality ('I would maybe agree to get vaccinated or maybe not') to this question,

whereas previous studies did not. Further studies, preferably using longitudinal designs, should be conducted to study the factors associated with COVID-19 vaccination intentions in France.

Carefully designing targeted vaccination awareness campaigns appears crucial for public decision-makers to enhance vaccination uptake among vaccine hesitant individuals to reach herd immunity in France. These campaigns could stress out the positive benefit-risk balance of the COVID-19 vaccines, reinsure the public on the safety of the vaccine and highlight the short-term benefits of the vaccination.

## Author statements

### Ethical approval

Given strict anonymity of collected data, the study did not need authorization of the Commission Nationale de l'Informatique et des Libertés (CNIL).

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This research benefited from a funding from the research unit of the authors, Montpellier Recherche en Economie, for data collection. The funding source had no role in study design, data analysis, interpretation of data, nor in the writing of the manuscript or in the decision to submit the article for publication.

### Competing interests

None declared.

### Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

## Appendix. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhe.2021.07.035>.

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