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## Are immigrants living in France more reluctant to receive vaccines than native-born French citizens? findings from the national health Barometer study

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1 **Title:**

2 Are immigrants living in France more reluctant to receive vaccines than native-born French citizens?

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4

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26

27 **Highlights:**

- 28 - Immigrants in France were less hesitant toward vaccines than the host population
- 29 - Immigrant participants had the most extreme opinions on vaccination
- 30 - Opinions on vaccines become negative with time spent in France

31

32 **Abstract:**

33 **Background:** France is one of the world's most vaccine hesitant countries and vaccine hesitancy (VH)  
34 is considered one of the world's leading threats to global health. However, little is known about VH  
35 in immigrant populations in France. Using data from the 2016 Health Barometer, we examined VH  
36 among newcomers, more established immigrants, and the native-born population in France.

37 **Methods:** Data was collected from French speaking individuals aged from 15 to 75 years old, residing  
38 in France. Individuals were selected through randomly generated landline and mobile phone  
39 numbers. Vaccine hesitancy was assessed through four questions and a "time spent in France"  
40 variable was created, using the year of arrival in France. Associations were studied using logistic  
41 regression.

42 **Results:** A sample of 15,216 participants residing in France included 1,524 foreign-born immigrants  
43 and 13,692 native-born individuals, with a mean age of 46-years. Most participants (75.7%) reported  
44 being favorable to vaccination regardless of country of origin but immigrants were less hesitant  
45 toward vaccinations than the host population. Foreign-born immigrants from North Africa had the  
46 most favorable views whereas those from sub-Saharan Africa held most unfavorable views on  
47 vaccination. With time spent in France, the opinions towards vaccination became more negative  
48 (aOR= 0.57, 95%CI [0.40 - 0.79], p= 0.001) and the risk of vaccine refusal (aOR=2.34, 95%CI [1.45 –  
49 3.78] p= 0.001) and reluctant acceptance of vaccines increased (aOR=1.89 95%CI [1.20 – 2.99], p=  
50 0.006). Foreign-born individuals with the longest residency in France had more negative opinions  
51 than native-born individuals, regardless of region of origin.

52 **Conclusion:** Immigrants were less hesitant toward vaccinations than the host population, but  
53 vaccine hesitancy increased with time spent in France. The provision of appropriate information and  
54 awareness to facilitate critical thinking towards antivaccine theories is necessary for immigrants in  
55 France.

56

57 **Keywords:** Hesitancy, Vaccine, Immunization, Migrants

58

## 59 **1. Introduction**

60

61

62 Vaccination is one of the major public health contributions of the 20th century, allowing for the  
63 control, prevention and sometimes elimination of a number of diseases worldwide such as smallpox,  
64 poliomyelitis and measles. (1) Vaccination also has notably contributed to reducing mortality rates,  
65 increasing life expectancy and reducing public health expenditure. However, France and more  
66 generally, high-income countries, face the problem of vaccine hesitancy (VH).(2–4) The WHO  
67 Strategic Advisory Group of Experts (SAGE) Working Group on Vaccine Hesitancy has defined VH as  
68 a “delay in acceptance or refusal of vaccines despite availability of vaccination services”. (5)  
69 Attitudes towards vaccination range from “total acceptance” to “complete refusal”. Between these  
70 two extremes, heterogeneous groups of individuals express various motives supporting their  
71 hesitancy to get one or several types of vaccines. VH is a complex and context-specific motivational  
72 state that can be influenced by several factors including individual determinants, the type of vaccine,  
73 the historical time period and socio-political factors including spatial determinants (urban, rural,  
74 etc.).(6) Three major families of determinants are commonly distinguished: contextual influences,  
75 individual and group influences, and vaccine/vaccination specific issues. (7) France was identified as  
76 the world's most vaccine hesitant country after findings from a 2016 survey showed that 33%-41% of  
77 French parents disagreed that vaccines are safe for their children.(2,3) Some evidence suggest that

78 trust in vaccine safety and effectiveness has been improving in France since 2015.(8) However,  
79 according to data from the different Health Barometer surveys which are representative of the  
80 French population, it seems that attitudes towards vaccines have worsened in France between 2000  
81 and 2019 (those in favor were 91% in 2000 and 73.9% in 2019).(4,9) Despite this, in 2020, positive  
82 opinions towards vaccines were significantly higher than in previous years with 80.0% of the  
83 population declaring themselves in favor of vaccination in general.

84

85 According to the French High Council for Integration, an immigrant is “a person who is born a  
86 foreigner and abroad, and resides in France”.(10) In France, immigrants account for 6,8 million  
87 persons or 10.2% of the total population and according to 2018 figures from the French National  
88 Institute for Statistical and Economic Studies (Insee), 47.5 % of immigrants in France were born in  
89 Africa and 32.2% in Europe.(11–13) Half of the immigrants were from one of the seven following  
90 countries: Algeria (12.7%), Morocco (12.0%), Portugal (8.6%), Tunisia (4.5%), Italy (4.1%), Turkey  
91 (3.6 %) and Spain (3.5 %).(11)

92 Health disparities exist between the host population and immigrants with respect to health status  
93 and access to healthcare.(14) Several factors can explain different healthcare experiences, but the  
94 most influential of all is the socio-economic level given that a large proportion of immigrants in  
95 France tend to have lower socio-economic status in comparison to native French. (15–17) Although  
96 there is little available data on this topic in France, when considered as a whole, vaccination  
97 coverage among immigrants appears to be low.(18,19) Completing the vaccination schedule can be  
98 difficult for many reasons: loss to follow-up after uptake of first vaccine dose (18,19), lack of  
99 information on the vaccination status of immigrants and refugees (18–20) or difficult access to  
100 screening services for vaccine preventable diseases and vaccination. (18,19,21)

101 Different rates of vaccination and screening have been observed between the immigrant population  
102 and the host population in France. (22–26) Since the end of the 1980s, studies have found lower

103 rates of polio and tetanus vaccination in populations of Iberian Peninsula and North African origin  
104 when compared to the host population. (24,27) With limited peer-reviewed studies on the topic,  
105 data reported by Médecins du Monde (Doctors of the World) provides a snapshot of the state of  
106 vaccination coverage among newly arrived immigrants.(26) In the most recent Médecins du Monde  
107 observatory report, nearly 30% of children aged 15 years or younger who were seen for the first  
108 time in a health consultation were not up to date with their Diphtheria-Tetanus-Polio (DTP) vaccines,  
109 and the rate was even higher (40%) with regard to Pertussis and Measles-Mumps-Rubella  
110 (MMR).(26) These rates were worse among those aged 15 years and above. This can be partly  
111 explained by differences in vaccine schedules which in some countries stops at age 6.

112 In December 2019, the High Authority on Health (*Haute Autorité de Santé*) and the French Infectious  
113 Disease Society (SPILF) released guidelines to improve vaccination catch-up among immigrants  
114 which highlighted the priority of public health and the complexity of catching-up on vaccines among  
115 immigrants.(28) At the European level, the European Centre for Disease Prevention and Control has  
116 outlined strategies and provided guidance to target newly arrived immigrants for screening and  
117 vaccination for infectious diseases in order to improve the health and wellbeing of populations and  
118 reduce health inequalities. (29) However, studies demonstrate that immigrant groups may be under-  
119 vaccinated and that there is a lack of documentation on this topic.(30)

120 Vaccination coverage therefore appears to be lower among immigrants than among individuals born  
121 in France. Barriers to access health care services seem to be a factor of low vaccination coverage  
122 among immigrants in France. (15,16,19) However, given France's notoriety as the world's most  
123 vaccine hesitant nation, could VH also be a factor of low vaccination coverage in this population?  
124 Despite the existing literature on VH, few existing studies focus on VH among immigrants in France,  
125 whether newcomers or settled immigrants.(28,31,32) Hence, the main objective of the study is to  
126 describe VH among immigrants in France and to compare this population with the host population.  
127 Secondary objectives are to study associations between attitudes towards vaccination and the

128 length of time since first arrival in France and, finally, to explore the associations between VH and a  
129 person's migration status.

## 130 **2.Methods**

### 131 **2.1. Study design and data source**

132 We used data collected from the 2016 Health Barometer cross-sectional Study. (33) Since 1992,  
133 various Health Barometer studies have been carried-out by Public Health France (*Santé Publique*  
134 *France*) at regular intervals in order to better understand the health seeking behaviors of residents in  
135 France. (34) The questionnaire developed in this study included 52 multiple choice questions on  
136 vaccination, VH, as well as opinions and practices.

137 Data was collected from January 8<sup>th</sup> to August 1<sup>st</sup>, 2016. The study included a representative sample  
138 of 15,216 participants, ages 15-75 years, randomly recruited through landline and mobile phone  
139 numbers across France's mainland. Participants were selected using the Kish method which ensured  
140 that each in-scope individual has the same probability of being selected.(33) In the final sample, 50%  
141 of research participants were recruited from geographic landline telephone numbers and 50% were  
142 recruited from mobile telephone numbers. Participants were surveyed using the Computer Assisted  
143 Telephone Interviewing (CATI) system in which the interviewer conducts the interview over the  
144 telephone while following a pre-established script on a personal computer screen. The survey was  
145 administered in French and as such those who did not speak French were excluded from the  
146 study.(33)

147 Whereas the whole sample answered general questions on their attitudes toward vaccination along  
148 with socio-demographic and cross-sectional questions such as gender, age and country of birth,  
149 some vaccination-specific questions were only administered to a sub-sample. Questions on VH only  
150 concerned participants who were parents of children 15 years old or younger, participants between

151 the ages of 65 and 75, as well as one fifth of people between the ages of 18 and 64 without children  
152 between the ages of 1 and 15.

## 153 **2.2. Outcomes**

154 We focused on the variables relevant to vaccination among the foreign-born and native-born  
155 population. For participants who had at least one child between the ages of 1 and 15, interview  
156 questions focused on vaccinations of the children. Otherwise, they were also asked to answer a  
157 series of questions concerning their own vaccination attitudes.

158 We explored variables of interest through four questions. One question concerning the attitude  
159 towards vaccination in general: "Strongly in favor", "Somewhat in favor", "Somewhat not in favor",  
160 "Not at all in favor". The three other questions assessed VH: 1) "Have you ever refused a vaccine  
161 considering it useless or dangerous?" 2) "Have you ever delayed a vaccine while hesitating to get it?"  
162 3) "Have you ever accepted a vaccine despite doubts about its efficacy?" These three questions were  
163 selected based on the SAGE group definition of vaccine hesitant individuals who "may refuse some  
164 vaccines but agree to others, delay vaccines or accept vaccines but are unsure in doing so".(5)

165 Determinants of VH have been explored throughout several questions using the three levels of  
166 influence described on the Working Group Determinants of Vaccine Hesitancy Matrix (SAGE):  
167 Contextual influences: communication and media environment ("When you have questions about a  
168 vaccine, where do you look for information?"), politics/policies ("do you trust the information given  
169 on vaccines by the health minister?"), pharmaceutical industry ("do you trust the information given  
170 on vaccines by the pharmaceutical industry?"); individual and group influences: beliefs, attitudes  
171 about health and prevention: ("It is up to me to ask questions about the vaccinations recommended  
172 by my physician", "When my child gets sick, it is often due to bad luck or an accident"),  
173 knowledge/awareness ("When you vaccinate yourself, it's not just to protect yourself, but also to  
174 protect others"), health system and providers-trust and personal experience ("regarding vaccination,  
175 I always follow my physician's advice", "trust in the information given on vaccines by my



176 physician/pharmacist”, “Has a physician ever expressed doubts about a vaccine to you?”) and  
177 vaccine /vaccination-specific influences risk/ benefit (“It is difficult to form an opinion about vaccines  
178 because the information available is often contradictory”). (5,35)

### 179 2.2.1. *Foreign-born populations and length residency in France*

180 All participants were asked about their country of birth. Participants born in overseas departments  
181 and territories, as well as the French Polynesia (DOM/TOM) were included in the “native-born”  
182 group. The term “host population” is used to refer to participants born in France.

183 Foreign-born participants were grouped into nine categories depending on their country of birth:  
184 North Africa, sub-Saharan Africa, European Union, Europe not in European Union, Asia, South or  
185 Central America, North America, Middle East and Oceania. Furthermore, due to small sample size,  
186 some regions were grouped together and categories of regions were created as follows: North  
187 Africa, sub-Saharan Africa, Europe and the rest of the world, France.

188 For foreign-born participants we also created a variable that considered time spent in France. We  
189 estimated the number of years spent in France based on the recorded year of first arrival in France.  
190 To remove collinearity with age we standardized this variable to obtain a percentage of time spent in  
191 France as suggested by Bousmah et al. (36)

### 192 2.2.2. *Socio-demographic characteristics*

193 All the participants answered questions regarding socio-demographic characteristics such as age,  
194 gender, place of birth, health care coverage (public and private), degree level, employment status,  
195 job category, if they had children between the ages of 1 and 15, and whether they had a family  
196 doctor. All these variables were categorical.

197 Four main categories were used for health insurance coverage: a) *Social Security (Assurance*  
198 *maladie)* combined with a complementary private health insurance plan (reimbursement of the out-  
199 of-pocket expenses by a private insurance plan obtained through a work contract or an individual’s

200 subscription) b) *Social Security without complementary health insurance* c) the *Universal health*  
201 *insurance coverage (CMU-C) or State Medical Aid (AME, for undocumented people with at least*  
202 *three month residence in France) which allows 100% coverage without advance payment for*  
203 *individuals with financial resources below a determined threshold, and lastly d) no health insurance*  
204 *coverage.*

205

### 206 **2.3. Statistical analysis**

207 We compared the two groups “foreign-born” and “native-born” using a two-sample test of  
208 proportions for categorical variables and a two-sample t-test for continuous variables. A chi-square  
209 test was used to compare the current duration since first arrival in France as categorical variable  
210 with the outcomes of interest.

211 Data was weighted based on the probability of inclusion considering the population distribution of  
212 the INSEE Employment Survey 2014, based on gender, ten-year age group, size of town, region of  
213 residence, level of education and proportion of people living alone.(11)

214 Univariate and multivariate analyses were performed using logistic regression. Associations were  
215 expressed using odd ratios as well as 95% Confidence Intervals. In our final models, we included all  
216 statistically significant confounders using a threshold of 0.200 for the p-value, as well as age and  
217 gender.

218 Statistical analyses were completed using Stata 15.1 (StataCorp. 2017. *Stata Statistical Software:*  
219 *Release 15.* College Station, TX: StataCorp LLC.).

220

### 221 **3. Results**

222 A total of 15,216 individuals were included in the study. Mean age was 46.5 years old (95%CI [46.2 –  
223 46.7]). Characteristics of the population are presented in table 1.

224 The “foreign-born” group represented 1,524 individuals (11.5% of the sample) and the “native-born”  
225 group included 13,692 individuals (88.5% of the sample). The majority of foreign-born participants  
226 were from North Africa, sub-Saharan Africa or the European Union and the majority of native-born  
227 participants were born in mainland France. (Table 2) Among participants from North Africa (N= 539),  
228 the majority were from Algeria (54.0%), Morocco (28.7%) and Tunisia (16.6%). For sub-Saharan  
229 Africa (N=316), the most represented countries were: Ivory Coast (15.7%), Democratic Republic of  
230 the Congo (13.7%), Senegal (12.9%), Madagascar (9.0%, n=35) and Cameroun (5.5%, n=22).  
231 European Union (N= 431) was highly represented by Portugal (39.4%), Italy (14.5%), Spain (11.4%),  
232 Germany (9.7%, n=60) and Belgium (9.6%, n=49). The other regions were poorly represented in the  
233 sample: Asia (N=65) was mainly represented by Viet Nam (32.1%) and India (11.2%). For Europe  
234 outside of European Union (n=47) the participants were mainly from Switzerland (23.5%) and Russia  
235 (22.9%). For the Americas (N=72), individuals were mostly from Haiti (35.1%), Colombia (17.5%) and  
236 Canada (7.3%). Given the low representation of individuals outside North Africa, sub-Saharan Africa,  
237 European Union and France, we grouped the regions of origin as follows: North Africa, sub-Saharan  
238 Africa, Europe and other and France. Europe and other’ group comprising participants originating  
239 from Europe (other than France), Asia, the Americas, Middle East and Oceania.

### 240 **3.1. Description and comparison of the outcomes of interest**

#### 241 *3.1.1 Opinion on vaccination*

242 The majority of participants, including native and foreign-born, reported being favorable to  
243 vaccination (26.8% declared being very favorable and 48.9% somewhat favorable) regardless of the  
244 country of origin. (Table 3) Distributions by countries and regions are presented in supplementary  
245 file 1. Foreign-born participants answered more often being very favorable to vaccination (32.4 vs  
246 26.0% for those born in France,  $p<0.001$ ) and paradoxically, they were also more likely to answer  
247 that they were not at all favorable to vaccinations (11.2% vs 7.7%  $p<0.001$ ). These extremes views

248 were observed for individuals from sub-Saharan Africa, North Africa and to a lesser extent for people  
249 from Europe and the rest of the world. (Table 4)

250 When dividing the length of time since first arrival in France as a percentage of the age into four  
251 categories (foreign-born: [0% - 33% [, [33% - 66%[, [66% - 99%[ ; native-born: [99% - 100%]), the rate  
252 of participants who declared being favorable to vaccination decreased as time spent in France  
253 increased. (Table 4 and 5) The third category, which included the foreign-born individuals with the  
254 longest duration since first arrival in France, had higher rates of unfavorable opinion on vaccines  
255 than the category of those born in France ([99% - 100%]). In subgroup analyses by regions, the  
256 increase of unfavorable opinions on vaccinations over time was observed for individuals from sub-  
257 Saharan Africa as well as for those from Europe and other regions. For North Africa, no significant  
258 difference was observed. (Table 6) Furthermore, immigrants who had spent a greater proportion of  
259 their life in France were less favorable to vaccination (adjusted OR, aOR=0.57 95% confidence  
260 interval, 95%CI [0.40 – 0.79], p= 0.001). (Figure 1 and table 7)

261 Multivariate analyses using being “very favorable” versus all the other opinions as main outcome  
262 confirmed that immigrants who had spent a greater proportion of their life in France were less likely  
263 to be *very favorable* to vaccination ([33% - 66%] :aOR= 0.63 95%CI [0.44 – 0.90], p=0.011 and [66% -  
264 99%] :aOR= 0.41 95%CI [0.29 – 0.58], p<0.001 with [0% - 33%[ as reference category). (Table 8) No  
265 association was found with region of origin in multivariate analyses and similarly, no associations  
266 were found for being *not at all favorable* as main outcome. (Supplementary file 2)

267

### 268 3.1.2 Refusal, delay or doubt on vaccination

269 Less than a quarter of the study participants indicated that they already *refused a vaccine*  
270 *considering it useless or dangerous* (23.1%, n=1,865) with a higher rate among the native-born  
271 participants (23.5% vs 20.4 for foreign-born participants, p=0.034). (Table 3)

272 The rate of participants declaring *already having accepted a vaccine while having doubts about its*  
273 *efficacy* was higher among the native-born individuals (25.0% vs 20.0% for foreign-born participants,

274 p= 0.009). Only 16.8% (n=1,379) of all participants reported that they already delayed a vaccine  
275 because they were hesitant, with no differences between foreign-born and native-born participants.  
276 The rates of participants indicating that they already refused a vaccine considering it useless or  
277 dangerous increased with the duration since first arrival in France. (Table 5) Higher rates of vaccine  
278 refusal were observed for the third category (foreign-born individuals with the longest duration  
279 since first arrival in France) when compared to the category of those born in France ([99% - 100%]).  
280 (Table 5)  
281 Immigrants who had spent a greater proportion of their life in France were more likely to refuse to  
282 get vaccinated (aOR=2.34, 95%CI [1.45 – 93.78], p<0.001) or to get vaccinated while having doubts  
283 (aOR=1.89 95%CI [1.20 – 2.99], p= 0.006). (Figure 1 and supplementary files 3, 4 and 5) The  
284 likelihood to accept a vaccine while having doubts was lower among foreign-born individuals  
285 (aOR=0.79, 95%CI [0.63 – 0.99], p= 0.042). (Figure 2)

## 286 **3.2. Vaccine hesitancy determinants (Supplementary File 6)**

### 287 *3.2.1. Contextual influences*

288 In terms of seeking information for decision making on vaccination, most of the participants  
289 indicated that they trust the information given by a physician (93.8%, n= 7,555) and by a pharmacist  
290 (79.0%, n=6,280). In contrast, only two thirds reported that they trust the information given by the  
291 health minister (67.0%, n= 5,421), and this was found more often in the group of foreign-born  
292 participants (70.23% vs 66.5% for those born in France, p=0.032). When it comes to the  
293 pharmaceutical industry, over a third of all participants indicated trusting the information given by  
294 the pharmaceutical industry about vaccines (40.6%, n= 2981), with no differences observed between  
295 the two groups. When searching for information on vaccines, participants prioritized requesting  
296 information from a physician (39.8%, n= 6,215) followed by the internet (17.0%, n=2,817).  
297 Pharmacists and relatives were not reported as privileged sources of information (respectively 6.6%,  
298 n=1,044 and 8.8%, n= 1,443).

299

### 300 *3.2.2 Individual and group influence*

301 The majority (78.9%, n= 6,342) considered that it was up to them to ask questions about the  
302 vaccines recommended by their physician and no differences were observed between the two  
303 groups. Half of participants attributed their child's sickness to bad luck or an accident (50.9%,  
304 n=1,925), with a higher rate in the group of participants born in France as compared to the other  
305 group (respectively 51.9% vs 43.1%, p= 0.036). The majority of participants (88.8%, n= 7,136)  
306 declared that, when they get vaccinated, it is not just to protect themselves, but also to protect  
307 others, with no differences observed between the two groups. The native-born participants reported  
308 more often than the foreign-born participants that their physician had previously expressed doubts  
309 about vaccines (respectively 31.4% and 24.0%, p<0.001).

310

### 311 *3.3.3 Vaccine /vaccination-specific influences*

312 A majority (70.0%, n=5,562) declared that it was difficult to form an opinion on vaccines because the  
313 information available was often contradictory.

314

## 315 **3.3. Vaccination record**

316 An additional question was asked about the vaccination record. Native-born participants had more  
317 complete records than foreign-born participants (79.3% vs 61.5% for foreign-born participants,  
318 p<0.001).

## 319 **4. Discussion**

### 320 **4.1. Main findings**

321 The main findings of this study suggest that VH should be explored when addressing factors of  
322 immunization disparities among immigrants in France. Foreign-born participants had the most

323 extreme opinions on vaccination with higher proportions of “very favorable” and, inversely, “not at  
324 all favorable” when compared to native-born participants. This was related to differences in time  
325 since arrival (more hesitation with longer duration of presence in France) and possibly to the  
326 different subgroups of immigrants. Among the native-born group, we observed higher proportions  
327 of individuals declaring that they had already refused a vaccine because they considered it to be  
328 useless or dangerous. However, in the native-born group, we observed a higher proportion of  
329 individuals who reported that they had already accepted to get vaccinated despite having doubts  
330 about the vaccine’s efficacy.

#### 331 **4.1.1 Acculturation**

332 This study found that the more time spent in France after an immigrant’s first arrival, the more their  
333 opinions on vaccine safety and efficacy became negative, sapping their willingness to get vaccinated,  
334 ultimately resulting in increased refusal of vaccination. Similarly, a recent study examining measles  
335 vaccination coverage among children of Somali immigrants in Norway also found that the length of  
336 residency was negatively associated with vaccine coverage. (37) Children born to mothers residing in  
337 Norway for six years or more had lower vaccination coverage when compared to children whose  
338 mothers with less than two years of residence prior to their birth. Not only did our results suggest  
339 that individuals with a longer period of residency in France were more vaccine hesitant but they also  
340 suggest that this group tended to adhere to the same health perceptions as the host population. This  
341 concept is known as acculturation.

342 Although the definition varies, acculturation can be defined as “the process by which individuals  
343 adapt to a new living environment and potentially adopt the norms, values, and practices of their  
344 new host society”.(38–48) It is a complex and dynamic process that can be affected by many factors  
345 such as societal structures and policies. (49) In public health, proxies such as nativity or generational  
346 status, timespan since first arrival in the country or fluency in the host country language are used to  
347 measure acculturation. (40,45) Acculturation in health has been studied mostly among Hispanic

348 communities in North America. (50–53) These studies suggest that there is a relationship between  
349 the timespan spent in the country of immigration and health behaviors (either healthy behaviors or  
350 unhealthy behavior such as the adoption of a “Western diet” in favor of a plant-based diet). (54) Few  
351 studies focused on how acculturation can influence the attitudes towards vaccines. In one study  
352 conducted among Hispanic women in the United States (US), the number of years spent in the US  
353 was also associated with a lower confidence in the safety of vaccines, whereas health literacy and  
354 healthcare coverage were associated with greater confidence in the safety of vaccines.(55)  
355 Moreover, in this study “Acculturation to US attitudes” was associated with a decreased likelihood of  
356 being regularly vaccinated against influenza. A recent review of qualitative studies confirmed that  
357 the safety and effectiveness of vaccines, skepticism or mistrust towards the provider’s vaccine  
358 recommendations, as well as doubts on its necessity, were all important explanations for VH among  
359 immigrants. (5,56) Overall, our results can be compared with the few existing studies on VH among  
360 immigrants which suggest that the views of foreign-born individuals align with those of native-born  
361 individuals with time spent in the country of immigration. This implies a decrease of vaccine-  
362 adherence and an increase of vaccine-hesitancy with increased duration in the country of  
363 immigration. Our results do not suggest that acculturation was correlated with the region of origin.

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#### 365 ***4.1.2. Determinants of vaccine hesitancy***

366 Native-born individuals appeared to have a greater distrust toward information on vaccines provided  
367 by the Ministry of Health than foreign-born individuals, whereas the majority of both groups  
368 reported trusting the information given on vaccines by physicians. This aligns with previous research  
369 that suggests that trust in institutions is a determinant for VH and acceptance. (57–62) A recent  
370 study conducted in France suggested that during COVID-19, first and second-generation immigrants  
371 were more hesitant towards vaccinations and that this reluctance towards vaccinations was  
372 associated with less trust in institutions.(63) Lower trust in institutions can therefore partly explain  
373 the higher VH among minorities such as immigrants. (64)



374 When participants did seek information on vaccines, physicians were the main source of information  
375 on this topic, slightly ahead of the internet. Interestingly, a non-negligible proportion of participants  
376 declared that their physician expressed doubts on vaccines, which was more prevalently reported by  
377 the population born in France. It is possible that the population born in France was more likely to  
378 bridge the conversation on vaccines with their physician because of a potentially higher level of  
379 health literacy or fluency in the country's language, and therefore have doubts expressed by their  
380 physician. This suggests that those who were more at ease in speaking French may be more likely  
381 and able to exchange with physicians and ask more questions regarding vaccines. Several studies  
382 have suggested that health literacy was lower among the immigrant population when compared to  
383 the host population, but few were carried out among the immigrant population in France. (65–67) It  
384 is also possible that vaccination was perceived by physicians as more important for people recently  
385 arriving in France, as their vaccination records tend to be more incomplete, and therefore that  
386 physicians' doubts were less often verbalized. Another hypothesis that has not yet been studied is  
387 that vaccine-hesitant physicians may be less willing to express their doubts with patients who have  
388 more trust in vaccination than them.

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#### 390 **4.1.3. Vaccination records**

391 Overall, the use of vaccination records was more common among those born in France. When  
392 physicians receive newly arrived immigrants for vaccine catch-up appointments, the vaccination  
393 status is often unknown, incomplete, or incompletely known (18,59,68–70). The use of electronic  
394 vaccination records could be a potential solution, especially for individuals that have migrated  
395 between multiple countries.(23)

#### 396 **4.2. Strengths**

397 To the best of our knowledge, no previous research has been carried out on VH among the  
398 immigrant/foreign-born population in France. This study brings to light how this population, similar

399 to the population born in France, has a degree of hesitancy when it comes to vaccination and how  
400 the length of time since first arrival in France can influence this health behavior and decision making.  
401 VH therefore should be considered when analyzing the low vaccination coverage among the foreign-  
402 born population and to better design and develop strategies for vaccine catch-up.

### 403 **4.3. Limitations**

404 Among foreign-born individuals we were not able to distinguish between those who acquired French  
405 nationality through naturalization and those born with the French nationality. Both sets of  
406 individuals were characterized as "foreign-born", making this sample potentially closer to the  
407 "native-born" sample than it would otherwise be. As a consequence, the differences between the  
408 two groups in this study may be greater. However, the proportion of foreign-born participants was  
409 close to the proportion of immigrants residing in France and we can assume that the variable "place  
410 of birth" was a good proxy for the national origin of respondents. (12) Even if African-born  
411 individuals were slightly over-represented and Europe-born slightly underrepresented, the sample  
412 was close to the population residing in France in terms of region of origin, age and gender. (11) A  
413 limitation of the study, based on the data collected from the Health Barometer study, is the  
414 exclusion of non-French speaking participants (estimated at 10% of immigrants), which may have  
415 biased the participant selection.(11) This may have excluded potential participants immigrating from  
416 non-French speaking countries, or those who did not learn French upon arrival in France. The  
417 current study sample included a majority of foreign-born participants originating from North Africa,  
418 sub-Saharan Africa or the European Union. The exclusion of individuals who did not have a phone,  
419 may also had introduce a selection bias by excluding individuals with lower socio-economic status.  
420 When measuring the role of acculturation, the use of multi-dimensional models that consider  
421 societal contexts is encouraged. (54) Interaction between enculturation and acculturation is also  
422 encouraged by some authors. (71) Our study was limited in terms of indicators collected in the

423 original study and the data available did not allow to deepen the analysis on acculturation and  
424 enculturation.

425 The study design precluded data collection on vaccine confidence and VH before migration.  
426 Although analyses showed that the increase of VH with time spent in France was not influenced by  
427 the region of origin, the collection of the opinion and degree of confidence on vaccines prior to  
428 migration should be considered for further studies.

429 Finally, concerning the question asking participants their opinion about vaccination in general, the  
430 Likert scale had 4 propositions: "Strongly in favor", "Somewhat in favor", "Somewhat not in favor",  
431 "Not at all in favor". It would have been relevant to have a more neutral intermediate proposition to  
432 better reflect indecision/hesitation such as "no opinion".

#### 433 **4. Conclusions**

434 This study on vaccination attitudes reported by immigrants in France showed that although the  
435 immigrant population seemed less hesitant toward vaccinations than the host population, extreme  
436 opinions were also more frequent among this group. Another key finding was that with increased  
437 time spent in France, vaccination hesitancy among immigrants realigned with the French population.  
438 Acculturation to the French-born population's VH is a finding that warrants further research for in-  
439 depth explanations. Despite vaccination adherence among newly arrived immigrants, the  
440 vaccination coverage among the immigrant population is inferior to that observed among the native-  
441 born population in France. Many factors can influence vaccination coverage such as social  
442 inequalities in health, the approach to vaccination catch-up held by healthcare professional,  
443 individual priorities, and not only vaccine awareness. Further studies are needed to better  
444 understand the exact mechanisms that underlie VH among immigrants. In order to address VH  
445 among immigrants, information and education should be adapted for immigrants to improve their  
446 health literacy and provide tools for critical thinking about vaccine hesitation and fake news.(72)  
447 Language barriers should also be considered for future studies as well as health literacy campaigns

448 on vaccination. Improving access to health care and education, to social support, to professional  
449 interpreters and healthcare mediation should also be supported to better address VH among the  
450 immigrant population in France.

451

452 **Credit authorship contribution statement:**

453 Sohela Moussaoui: Statistical analyses, methodology, Writing – original draft

454 Nicolas Vignier: Supervision- Methodology – Review & editing

455 Simon Combes: Supervision- Methodology – Review & editing

456 Gladys Ibanez: Supervision – Review & editing

457 Bridget Relyea: Drafting- Review & editing

458 Declaration of Competing Interest: None

459

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462 **Ethical consideration:** Consent to participate in the study, as well as the recall, was collected orally  
463 over the phone. Consent was collected after the objectives of the study, its sponsor, Public Health  
464 France, and the agency conducting it, Ipsos Observer, were presented to potential research  
465 participants. Prior to beginning the study, research authorizations were obtained from both the  
466 National Committee of information technology and civil liberties (CNIL) and the Committee for the  
467 Protection of Persons. The data collected by this study was treated anonymously.

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 474 charge of the audit of the field of investigation, and all the people who took part in the investigation.

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482 **Figures and tables :**

483 **Table 1:** Characteristics of the population and comparison between foreign-born and native-born  
 484 participants, Health Barometer 2016

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	Total	Foreign-born		Native-born		p-value*
	n (%)	n	%	n	%	
Total	15,216	1,524	11.5	13,692	88.6	
Percentage of life spent in France since first arrival in France (% of the age)	15,216	1,524		13,692		
Mean (95%CI)	[95.9 - 96.4]	61.8 [60.3 - 63.3]		100 [100 - 100]		<0.001
Gender	15,216	1,524		13,692		
Women	8,322 (51.2)	798	49.8	7,524	48.6	0.054
Men	6,894 (48.8)	726	50.2	6,168	51.4	0.054
Age (years) n	15,216	1,524		13,692		
Mean (95%CI)	46.5 [46.2 - 46.7]	47.7 [46.9- 48.5]		46.3 [46.1 - 46.6]		0.002
Age category	15,216	1,524		13,692		
15- 24	1,758 (15.1)	128	10.5	1,630	15.7	<0.001
25-34	2,288 (16.8)	235	17.2	2,053	16.7	0.659
35-44	2,695 (18.0)	260	18.0	2,435	18.0	0.483
45-54	2,998 (18.8)	301	18.8	2,697	18.8	0.961
55-64	3,059 (17.5)	348	19.5	2,711	17.2	0.005
65-75	2,418 (13.8)	252	16.1	2,166	13.5	0.468
Level of education	15,192	1,513		13,679		
None	861 (15.0)	143	23.2	718	13.9	<0.001
Below the Baccalaureate	4,966 (37.7)	411	32.1	4 555	38.4	<0.001

Baccalaureate or equivalent	3,207 (19.1)	313	17.7	2,894	19.3	0.587
Superior to Baccalaureate	6,158 (28.2)	646	27.1	5,512	28.3	0.108
Employment status	15,216	1,524		13,692		
Employed	8,630 (52.8)	768	45.0	7,862	53.8	<0.001
Apprentice/internship	100 (0.8)	11	0.8	89	0.8	0.742
Student/training	1,219 (10.5)	129	9.7	1,090	10.6	0.492
Unemployed (welfare payments)	1,118 (9.8)	181	15.4	937	9.0	<0.001
Retired	3,432 (19.7)	320	19.7	3,112	19.7	0.125
At home	400 (3.7)	70	5.4	330	3.4	<0.001
Other situation	317 (2.7)	45	3.9	272	2.6	0.012
Socio-professional category	15,216	1,524		13,692		
Manual worker	1,990 (18.2)	237	24.0	1,753	17.5	0.003
Employee	4,990 (34.5)	495	34.2	4,495	34.6	0.783
Intermediate/associate professionals	2,248 (12.2)	176	9.0	2,072	12.6	<0.001
Executives	3,237 (15.0)	292	11.8	2,945	15.4	0.034
Other	2,751 (20.1)	324	21.0	2,427	20.0	0.001
Child aged 1 to 15 years old	15,216	1,524		13,692		
Yes	3,938 (26.5)	397	27.9	3,541	26.3	0.874
No	11,278 (73.6)	1,127	72.1	10,151	73.7	0.874
Health insurance	15,171	1,518		13,653		
Social security and complementary health cover	13,777 (86.4)	1,183	71.4	12,594	88.4	<0.001
Social security without complementary health cover	560 (5.0)	124	10.1	436	4.4	<0.001
Complementary universal health coverage (CMUC) or State Medical Assistance (AME)	722 (7.3)	171	14.8	551	6.4	<0.001
None	112 (1.23)	40	3.7	72	0.9	<0.001
Family doctor	14,875	1,503		13,372		
Yes	14,278 (95.3)	1,420	93.8	12,858	95.5	0.259
No	597 (4.7)	83	6.2	514	4.5	0.001

two-sample test of proportions

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**Table 2:** Region of birth for foreign-born and native-born participants, Health Barometer 2016

	n	%
Foreign-born	1,524	11.5
North Africa <sup>1</sup>	539	37.0
Sub-Saharan Africa <sup>2</sup>	316	22.4
European Union <sup>3</sup>	431	26.2
Europe not European Union (EU) <sup>4</sup>	47	3.3
Asia <sup>5</sup>	65	4.1
South America <sup>6</sup>	29	1.8
North America <sup>7</sup>	21	0.7
Central America <sup>8</sup>	22	1.8
Middle East <sup>9</sup>	49	2.6
Oceania <sup>10</sup>	5	0.3
Native-born	13,692	88.6
Mainland France	13,561	98.7
DOM-TOM <sup>11</sup>	131	1.3

1: Algeria, Egypt, Libya, Morocco, Tunisia

2: Angola, Benin, Burkina, Burundi, Cameroon, Cape Verde, Central African Republic, Comoros, Congo-Brazzaville, Democratic Republic of Congo, Djibouti, Gabon, Ghana, Guinea, Guinea-Bissau, Ivory coast, Kenya, Madagascar, Mali, Mauritania, Mauritius, Niger, Nigeria, Rwanda, Senegal, South Africa, Chad, Togo

3: Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Hungary, Italy, Lithuania, Luxembourg, Monaco, Netherlands, Poland, Portugal, Romania, Slovakia, Spain, Sweden, United Kingdom (at the time of the study in 2016)

4: Albania, Armenia, Bosnia and Herzegovina, Georgia, Moldova, Montenegro, Norway, Russia, Serbia, Switzerland, Ukraine

5: Afghanistan, Azerbaijan, Cambodia, China, India, Indonesia, Kazakhstan, Laos, Pakistan, Philippines, South Korea, Sri Lanka, Thailand, Viet Nam

6: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Peru, Venezuela

7: Canada, Mexico, United States

8: Cuba, Dominican Republic, El Salvador, Guatemala, Haiti, Trinidad and Tobago

9: Iran, Iraq, Israel, Lebanon, State of Palestine, Saudi Arabia, Syria, Turkey

10: Australia, New Zealand, Vanuatu

11: \* DOM-TOM: overseas departments and territories, and French Polynesia

Guadeloupe, French Guiana, French Polynesia, Martinique, Mayotte, New Caledonia, Reunion Island, Saint-Barthélemy

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**Table 3:** Description of vaccine hesitancy among foreign-born and native-born individuals, Health Barometer, 2016

	Total	Foreign-born		Native-born		p-value*
	n (%)	n	%	n	%	
<b>Total</b>	<b>15,216</b>	<b>1,524</b>	<b>11.5</b>	<b>13,692</b>	<b>88.6</b>	
General questions						
<b>In general, are you very, somewhat, somewhat not or not at all favorable to vaccinations</b>	<b>15,193</b>	<b>1,521</b>		<b>13,672</b>		
Not at all	1,041 (8.1)	139	11.2	902	7.7	<0.001
Somewhat not	2,551 (16.3)	212	13.0	2,339	16.7	0.002
Somewhat	7,660 (48.9)	706	43.4	6,954	49.9	0.001
Very	3,941 (26.8)	464	32.4	3,477	26.0	<0.001
<b>In general, are you very, somewhat, somewhat not or not at all favorable to vaccinations</b>	<b>15,193</b>	<b>1,521</b>		<b>13,672</b>		
Not favorable	3,592 (24.4)	351	24.2	3,241	24.4	0.577
Favorable	11,601 (75.6)	1,170	75.8	10,431	75.6	0.609
Three main questions to define vaccine hesitancy						
<b>Already refused a vaccine considering it useless or dangerous</b>	<b>8,066</b>	<b>817</b>		<b>7,249</b>		
Yes	1,865 (23.1)	161	20.4	1,704	23.5	0.034
No	6,201 (76.9)	656	79.6	5,545	76.5	0.055
<b>Ever delayed a vaccine while hesitating to do so</b>	<b>8,077</b>	<b>817</b>		<b>7,260</b>		
Yes	1,379 (16.8)	146	19.5	1,233	16.4	0.458
No	6,698 (83.2)	671	80.5	6,027	83.6	0.994
<b>Already accepted a vaccine while having doubts about its efficacy</b>	<b>8,076</b>	<b>814</b>		<b>7,262</b>		
Yes	2,046 (24.3)	172	20.0	1,874	25.0	0.009
No	6,030 (75.7)	642	80.0	5,388	75.1	0.036

\*two-sample test of proportions

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517 **Table 4:** Description of the opinion on vaccinations, Health Barometer, 2016  
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	Very favorable		Somewhat favorable		Somewhat unfavorable		Not at all favorable		P-value*
	N=15216	n	%						
Total	15,193	3,941	26.7	7,660	48.9	2,551	16.3	1,041	8.1
Gender	15,193	3,941/15,193		7,660/15,193		2,551/15,193		1,041/15,193	0.003
Women	8,310	2,121/8,310	26.5	4,231/8,310	49.6	1,437/8,310	16.7	521/8,310	7.3
Men	6,883	1,820/6,883	27.0	3,429/6,883	48.2	1,114/6,883	16.8	520/6,883	9.0
Age categories	15,193	3,941/15,193		7,660/15,193		2,545/15,193		1,041/15,193	<0.001
15-24	1,757	539/1,757	30.5	870/1,757	49.7	249/1,757	13.0	99/1,757	6.8
25-34	2,286	516/2,286	23.5	1,147/2,286	47.9	465/2,286	19.2	158/2,286	9.4
35-44	2,691	633/2,691	25.3	1,415/2,691	50.4	494/2,691	17.9	149/2,691	6.4
45-54	2,991	776/2,991	27.7	1,491/2,991	47.0	508/2,991	16.6	216/2,991	8.7
55-64	3,055	784/3,055	26.5	1,536/3,055	48.9	490/3,055	15.6	245/3,055	8.9
65-75	2,413	693/2,413	27.4	1,201/2,413	49.7	345/2,413	14.5	174/2,413	8.5
Region of origin	15,193	3,941/15,193		7,660/15,193		2,551/15,193		1,041/15,193	<0.001
North Africa	538	173/538	34.9	243/538	40.4	61/538	10.2	61/538	14.5
sub-Saharan Africa	315	122/315	40.3	132/315	40.8	34/315	7.9	27/315	11.1
Europe and other	668	169/668	25.8	331/668	47.6	117/668	18.4	51/668	8.2
France	13,672	3,477/13,672	26.0	6,954/13,672	49.6	2,339/13,672	16.7	902/13,672	7.7
Percentage of life spent in France since first arrival in France (% of the age)	15,193	3,941/15,193		7,660/15,193		2,551/15,193		1,041/15,193	<0.001
[0% - 33%[	339	145/339	42.9	135/339	39.6	31/339	8.1	28/339	9.4
[33% - 66%[	411	122/411	33.6	201/411	45.8	48/411	10.4	40/411	10.2
[66% - 99%[	644	157/644	25.0	318/644	45.0	108/644	16.7	61/644	13.3
[99% - 100%[	13,799	3,517/13,799	26.1	7,006/13,799	49.5	2,364/13,799	16.6	912/13,799	7.8
Level of education	15,169	3,930/15,169		7,653/15,169		2,548/15,169		1,038/15,169	<0.001
None	856	258/856	31.3	380/856	42.9	101/856	12.3	117/856	13.5
Below the Baccalaureate	4,957	1,306/4,957	26.8	2,422/4,957	47.7	785/4,957	15.9	444/4,957	9.6
Baccalaureate or equivalent	3,204	748/3,204	23.8	1,627/3,204	51.0	598/3,204	18.1	231/3,204	7.1
Superior to Baccalaureate	6,152	1,618/6,152	26.0	3,224/6,152	52.3	1,064/6,152	17.6	246/6,152	4.1
Employment status	15,193	3,941/15,193		7,660/15,193		2,551/15,193		1,041/15,193	<0.001
Employed	8,621	2,033/8,621	24.1	4,495/8,621	50.6	1,554/8,621	17.9	539/8,621	7.4
Student/Apprentice/internship	1,318	444/1,318	33.7	637/1,318	48.7	179/1,318	12.8	58/1,318	5.2

Unemployed (welfare payments)	1,113	292/1,113	28.2	491/1,113	42.0	210/1,113	16.5	120/1,113	13.3
Retired	3,426	949/3,426	26.8	1,716/3,426	49.5	509/3,426	15.1	252/3,426	8.6
At home	400	119/400	34.5	188/400	43.3	60/400	12.9	33/400	9.3
Other situation	315	104/315	33.3	133/315	43.5	39/315	12.9	39/315	10.3
Socio-professional category	12,486	3,192/12,486		6,357/12,486		2,086/12,486		851/12,486	<0.001
Manual worker/other	2,021	539/2,021	27.9	922/2,021	42.5	333/2,021	16.2	227/2,021	13.4
Employee	4,984	1,224/4,984	25.8	2,498/4,984	48.9	882/4,984	16.7	380/4,984	8.6
Intermediate/associate professionals	2,246	501/2,246	22.9	1,213/2,246	54.3	409/2,246	17.4	123/2,246	5.4
Executives	3,235	928/3,235	27.7	1,724/3,235	53.5	462/3,235	14.6	121/3,235	4.2
Child aged 1 to 15 years old	15,193	3,941/15,193		7,660/15,193		2,551/15,193		1,041/15,193	<0.001
Yes	3,931	947/3,931	25.9	2,083/3,931	50.1	693/3,931	17.2	208/3,931	6.8
No	11,262	2,994/11,262	27.0	5,577/11,262	48.5	1,858/11,262	15.9	833/11,262	8.6
Health insurance coverage	15,148	3,931/15,148		7,638/15,148		2,544/15,148		1,035/15,148	<0.001
Social security and complementary health coverage	13,757	3,529/13,757	26.0	7,039/13,757	50.1	2,309/13,757	16.5	880/13,757	7.4
Social security without complementary health coverage	559	141/559	26.5	234/559	41.3	117/559	19.7	67/559	12.5
Complementary universal health coverage (CMUC) or State Medical Assistance (AME)	720	229/720	36.5	325/720	41.7	101/720	11.4	65/720	10.4
None	112	32/112	22.0	40/112	37.7	17/112	12.6	23/112	27.7
Family doctor	14,852	3,812/14,852		7,498/14,852		2,514/14,852		1,028/14,852	<0.001
Yes	14,256	3,676/14,256	26.6	7,210/14,256	49.0	2,408/14,256	16.5	962/14,256	7.9
No	596	136/596	21.7	288/596	47.6	106/596	16.0	66/596	14.7

\*chi2 test

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532 **Table 5:** Description of vaccine hesitancy depending on the length of time since first arrival in France, Health  
 533 Barometer, 2016

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Percentage of life spent in France since first arrival in France (% of the age)	Total	[0% - 33%[		[33% - 66%[		[66% - 99%[		[99% - 100%[		p-value
		n (%)	n	%	n	%	n	%	n	
<b>Total</b>										
In general, are you very, somewhat, somewhat not or not at all favorable to vaccinations	15,193	339		411		644		13,799		
Not at all	1,041 (8.1)	28	9.4	40	10.2	61	13.3	912	7.8	<0.001
Somewhat not	2,551 (16.3)	31	8.1	48	10.4	108	16.7	2,364	16.7	
Somewhat	7,660 (48.9)	135	39.6	201	45.8	318	45.0	7,006	49.5	
Very	3,941 (26.8)	145	42.9	122	33.6	157	25.0	3,517	26.1	
In general, are you very, somewhat, somewhat not or not at all favorable to vaccinations	15,193	339		411		644		13,799		
Not favorable	3,592 (24.4)	59	17.5	88	20.7	169	30.01	3,276	24.4	0.003
Favorable	11,601 (75.6)	280	82.6	323	79.3	475	70.0	10,523	75.6	
Already refused a vaccine considering it useless or dangerous	8,066	152		250		359		7,305		
Yes	1,865 (23.1)	21	12.7	47	15.8	80	26.0	1,717	23.5	0.006
No	6,201 (76.9)	131	87.4	203	84.2	279	74.0	5,588	76.5	
Ever delayed a vaccine while hesitating to do so	8,077	153		250		359		7,316		
Yes	1,379 (16.8)	23	16.1	37	17.0	72	21.8	1,247	16.5	0.270
No	6,698 (83.2)	129	83.9	213	83.0	287	78.2	6,069	83.5	
Already accepted a vaccine while having doubts about its efficacy	8,076	152		247		359		7,318		
Yes	2,046 (24.3)	33	18.2	45	19.9	78	20.4	1,890	24.9	0.090
No	6,030 (75.7)	119	81.8	202	80.1	281	79.6	5,428	75.1	

\*chi2 test

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542 **Table 6:** Opinion on vaccination and length of time since first arrival: stratified analyses by regions of origin,  
 543 Health Barometer, 2016

		Very favorable		Somewhat favorable		Somewhat unfavorable		Not at all favorable		p-value*
	N=15216	n	%	n	%	n	%	n	%	
Region of origin	15,193	3,941/15,193	26.8	7,660/15,193	48.9	2,551/15,193	16.3	1,041/15,193	8.1	<0.001
North Africa (N=538)										
Percentage of life spent in France since first arrival in France (% of the age)	538	173/538	34.9	243/538	40.4	61/538	10.2	61/538	14.5	0.247
[0% - 33%[	105	43/105	42.6	43/105	37.8	8/105	8.2	11//105	11.4	
[33% - 66%[	107	32/107	37.3	53/107	43.4	9/107	6.4	13/107	12.8	
[66% - 99%[	284	84/284	30.3	126/284	38.8	38/284	12.6	36/284	18.3	
[99% - 100%[	42	14/42	36.4	21/42	48.3	6/42	12.7	1/42	2.6	
sub-Saharan Africa (N=315)										
Percentage of life spent in France since first arrival in France (% of the age)	315	122/315	40.3	132/315	40.8	34/315	7.8	27/315	11.1	0.006
[0% - 33%[	122	57/122	48.3	45/122	35.3	7/122	4.8	13/122	11.6	
[33% - 66%[	105	42/105	39.8	46/105	44.8	8/105	5.0	9/105	10.4	
[66% - 99%[	77	19/77	23.9	37/77	43.6	16/77	19.7	5/77	12.8	
[99% - 100%[	11	4/11	35.0	4/11	53.6	3/11	11.4	0/11	0.0	
Europe and other (N=668)										
Percentage of life spent in France since first arrival in France (% of the age)	668	169/668	25.8	331/668	47.6	117/668	18.4	51/668	8.2	0.001
[0% - 33%[	112	45/112	35.5	47/112	47.9	16/112	12.7	4/112	3.9	
[33% - 66%[	199	48/199	26.5	102/199	48.2	31/199	17.2	18/199	8.1	
[66% - 99%[	283	54/283	19.8	155/283	51.7	54/283	20.2	20/283	8.3	
[99% - 100%[	74	22/74	32.9	27/74	29.8	16/74	22.8	9/74	14.5	
France (N=13,672)										
Percentage of life spent in France since first arrival in France (% of the age)	13,672	3,477/13,672	26.0	6,954/13,672	49.6	2,339/13,672	16.7	902/13,672	7.7	
[99% - 100%[	13,799	3,517/13,799	26.0	/	49.6	2,364/13,799	16.7	/	7.7	

\*chi-square test/fisher exact test

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**Table 7:** Univariate and multivariate analyses with very or somewhat favorable to vaccinations in general as main outcome and length of time since first arrival in France as continuous variable - Logistic regression, Health Barometer , 2016

	n	%	p-value (chi-square test)	Univariate		Multivariate			
				OR	95%CI	p-value	aOR	95%CI	p-value
<b>Total</b>	<b>11,601/15,193</b>	<b>75.63</b>					<b>n=14,810</b>		
Percentage of life spent in France since first arrival in France (% of the age)	11,601/15,193			0.68	[0.49 - 0.93]	0.017	0.57	[0.40 - 0.79]	0.001
<b>Gender</b>	<b>11,601/15,193</b>								
Women	6,352/8310	76.03	0.361	1.04	[0.95 - 1.15]	0.361	0.99	[0.90 - 1.10]	0.911
Men	5,249/6,883	75.22		ref.	ref.	ref.	ref.	ref.	ref.
<b>Age categories</b>	<b>11,601/15,193</b>								
15- 24	1,409/1,757	80.21	<0.001	ref.	ref.	ref.	ref.	ref.	ref.
25-34	1,663/2,286	71.39		0.62	[0.51 - 0.74]	<0.001	0.70	[0.55 - 0.89]	0.003
35-44	2,043/2,691	75.69		0.77	[0.64 - 0.92]	0.003	0.86	[0.68 - 1.10]	0.235
45-54	2,267/2,991	74.71		0.73	[0.61 - 0.87]	<0.001	0.85	[0.66 - 1.08]	0.174
55-64	2,320/3,055	75.52		0.76	[0.64 - 0.90]	0.002	0.88	[0.68 - 1.13]	0.310
65-75	1,894/2,413	77.09		0.83	[0.69 - 1.00]	0.046	0.97	[0.71 - 1.33]	0.850
<b>Level of education</b>	<b>11,583/15,169</b>								
None	638/856	74.19	0.009	ref.	ref.	ref.	ref.	ref.	ref.
Below the Baccalaureate	3,728/4,957	74.54		1.02	[0.84 - 1.23]	0.852	0.96	[0.79 - 1.17]	0.706
Baccalaureate or equivalent	2,375/3,204	74.89		1.04	[0.85 - 1.27]	0.714	0.93	[0.75 - 1.13]	0.491
Superior to Baccalaureate	4,842/6,152	78.32		1.26	[1.04 - 1.52]	0.018	1.07	[0.87 - 1.33]	0.506
<b>Employment status</b>	<b>11,601/15,193</b>								
Employed	6,528/8,621	74.69	<0.001	ref.	ref.	ref.	ref.	ref.	ref.
Apprentice/internship	78/100	79.92		1.35	[0.76 - 2.40]	0.307	1.09	[0.59 - 2.02]	0.773
Student/training	1,003/1,218	82.63		1.61	[1.35 - 1.93]	<0.001	1.47	[1.11 - 1.94]	0.007
Unemployed (welfare payments)	783/1,113	70.23		0.80	[0.67 - 0.95]	0.011	0.88	[0.73 - 1.06]	0.187

Retired	2,665/3,426	76.35		1.09	[0.97 - 1.23]	0.137	0.97	[0.79 - 1.19]	0.744
At home	307/400	77.77		1.19	[0.87 - 1.62]	0.288	1.23	[0.88 - 1.71]	0.222
Other situation	237/ 315	76.76		1.12	[0.81 - 1.55]	0.499	1.21	[0.86 - 1.71]	0.269
<b>Socio-professional category</b>	<b>11,601/15,193</b>								
Manual worker	1,434/1,986	70.36	<0.001	ref.	ref.	ref.	ref.	ref.	ref.
Employee	3,722/4,984	74.71		1.24	[1.08 - 1.44]	0.003	1.23	[1.05 - 1.43]	0.010
Intermediate/associate professionals	1,714/2,246	77.28		1.43	[1.21 - 1.69]	<0.001	1.41	[1.18 - 1.68]	<0.001
Executives	2,652/3,235	81.18		1.82	[1.55 - 2.14]	<0.001	1.73	[1.43 - 2.08]	<0.001
None/Other	2,079/2,742	76.84		1.40	[1.19 - 1.65]	<0.001	1.08	[0.91 - 1.30]	0.374
<b>Child aged 1 to 15 years old</b>	<b>11,601/15,193</b>								
Yes	3,030/3,931	76.00	0.619	1.03	[0.92 - 1.15]	0.619	/	/	/
No	8,571/11,262	75.50		ref.	ref.	ref.	/	/	/
<b>Health insurance</b>	<b>11,569/15,148</b>								
Social security and complementary health cover	10,568/13,757	76.18		2.16	[1.33 - 3.49]	0.002	1.90	[1.15 - 3.15]	0.012
Social security without complementary health cover	375/559	67.74		1.42	[0.83 - 2.40]	0.197	1.27	[0.74 - 2.19]	0.381
Complementary universal health coverage (CMUC) or State Medical Assistance (AME)	554/720	78.21		2.42	[1.43 - 4.11]	0.001	2.37	[1.38 - 4.09]	0.002
None	72/112	59.72	<0.001	ref.	ref.	ref.	ref.	ref.	ref.
<b>Family doctor</b>	<b>11,310/14,852</b>								
Yes	10,886/14,256	75.54	0.008	1.37	[1.09 - 1.72]	0.008	1.22	[0.95 - 1.55]	0.116
No	424/596	69.30		ref.	ref.	ref.	ref.	ref.	ref.

ref. : reference category, OR: Odds Ratio, aOR: adjusted Odds Ratio, 95%CI : 95% Confidence interval , p: p-value

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**Table 8 :** Univariate and multivariate analyses with being very favorable to vaccinations in general as main outcome – logistic regression, Health Barometer 2016

				Univariate			Multivariate		
	n	%	p (chi square test)	OR	95%CI	p	aOR	95%CI	p
Total	3,941/15,193	26.8					n=12,440		
Gender	3,941/15,193		0.199						
Women	2,121/8310	26.5		ref.	ref.	ref.	ref.	ref.	ref.
Men	1,820/6,883	27.0		1.05	[0.98 - 1.13]	0.199	1.04	[0.95 - 1.14]	0.371
Age categories	3,941/15,193		<0.001						
15- 24	539/1,757	30.5		ref.	ref.	ref.	ref.	ref.	ref.
25-34	516/2,286	23.5		0.66	[0.57 - 0.76]	<0.001	0.82	[0.65 - 1.02]	0.068
35-44	633/2,691	25.3		0.70	[0.61 - 0.80]	<0.001	0.92	[0.73 - 1.15]	0.453
45-54	776/2,991	27.7		0.79	[0.69 - 0.90]	<0.001	1.06	[0.86 - 1.32]	0.584
55-64	784/3,055	26.6		0.78	[0.69 - 0.88]	<0.001	1.00	[0.80 - 1.26]	0.988
65-75	693/2,413	27.4		0.91	[0.80 - 1.04]	0.171	1.15	[0.87 - 1.52]	0.323
Region of origin	3,941/15,193		<0.001						
North Africa	173/538	34.9		1.39	[1.16 - 1.67]	<0.001	1.34	[0.83 - 2.16]	0.230
sub-Saharan Africa	122/315	40.3		1.85	[1.47 - 2.33]	<0.001	1.45	[0.85 - 2.45]	0.172
Europe and other	169/668	25.8		0.99	[0.83 - 1.19]	0.939	1.03	[0.65 - 1.63]	0.912
France	3,477/13,672	26.0		ref.	ref.	ref.	ref.	ref.	ref.
Percentage of life spent in France since first arrival in France (% of the age)	3,941/15,193		<0.001						
[0% - 33%[	145/339	42.9		ref.	ref.	ref.	ref.	ref.	ref.
[33% - 66%[	122/411	33.6		0.56	[0.42 - 0.76]	<0.001	0.63	[0.44 - 0.90]	0.011
[66% - 99%[	157/644	25.0		0.43	[0.33 - 0.57]	<0.001	0.41	[0.29 - 0.58]	<0.001
[99% - 100%[	3,517/13,799	26.1		0.46	[0.37 - 0.60]	<0.001	0.59	[0.35 - 0.99]	0.046

Level of education	3,930/15,169		<0.001						
None	258/856	31.3		1.21	[1.03 - 1.41]	0.018	1.22	[1.00 - 1.48]	0.050
Below the Baccalaureate	1,306/4,957	26.9		1.00	[0.92 - 1.09]	0.956	1.01	[0.90 - 1.14]	0.828
Baccalaureate or equivalent	748/3,204	23.9		0.85	[0.77 - 0.94]	0.002	0.89	[0.79 - 1.00]	0.057
Superior to Baccalaureate	1,618/6,152	26.0		ref.	ref.	ref.	ref.	ref.	ref.
Employment status	3,941/15,193		<0.001						
Employed	2,033/8,621	24.1		ref.	ref.	ref.	ref.	ref.	ref.
Student/Apprentice/internship	444/1,318	33.7		1.64	[1.45 - 1.86]	<0.001	1.38	[1.05 - 1.81]	0.022
Unemployed (welfare payments)	292/1,113	28.2		1.15	[1.00 - 1.33]	0.051	1.03	[0.87 - 1.21]	0.747
Retired	949/3,426	26.9		1.24	[1.13 - 1.36]	<0.001	1.08	[0.91 - 1.29]	0.363
At home	119/400	34.5		1.37	[1.10 - 1.71]	0.005	1.27	[0.98 - 1.65]	0.075
Other situation	104/ 315	33.3		1.60	[1.26 - 2.03]	<0.001	1.52	[1.16 - 2.00]	0.002
Socio-professional category	3,192/12,486		<0.001						
Manual worker/other	539/2,021	27.9		0.90	[0.80 - 1.02]	0.113	0.83	[0.71 - 0.96]	0.014
Employee	1,224/4,984	25.8		0.81	[0.73 - 0.89]	<0.001	0.80	[0.70 - 0.90]	<0.001
Intermediate/associate professionals	501/2,246	23.0		0.71	[0.63 - 0.81]	<0.001	0.72	[0.63 - 0.82]	<0.001
Executives	928/3,235	27.7		ref.	ref.	ref.	ref.	ref.	ref.
Child aged 1 to 15 years old	3,941/15,193		0.002						
Yes	947/3,931	25.9		1.43	[1.22 - 1.67]	<0.001	1.00	[0.89 - 1.12]	0.964
No	2,994/11,262	27.0		ref.	ref.	ref.	ref.	ref.	ref.
Health insurance	3,931/15,148		0.003						
Social security and complementary health cover	3,529/13,757	26.0		ref.	ref.	ref.	ref.	ref.	ref.
Social security without complementary health cover	141/559	26.5		0.98	[0.80 - 1.19]	0.820	0.91	[0.71 - 1.17]	0.465
Complementary universal health coverage (CMUC) or State Medical Assistance (AME)	229/720	36.5		1.35	[1.15 - 1.59]	<0.001	1.31	[1.07 - 1.60]	0.009



None	32/112	22.0		1.16	[0.77 - 1.75]	0.482	1.00	[0.60 - 1.66]	0.994
Family doctor	3,812/14,852		0.104						
Yes	3,676/14,256	26.6		1.18	[0.97 - 1.43]	0.105	1.21	[0.96 - 1.53]	0.098
No	136/596	21.7		ref.	ref.	ref.	ref.	ref.	ref.
ref. : reference category, OR: Odds Ratio, aOR: adjusted Odds Ratio, 95%CI : 95% Confidence interval , p: p-value									