



**HAL**  
open science

## Vaccine hesitancy and self-vaccination behaviors among nurses in southeastern France

Rose Wilson, Anna Zaytseva, Aurelie Bocquier, Amale Nokri, Lisa Fressard, Patrick Chamboredon, Christian Carbonaro, Stéphane Bernardi, Eve Dubé, Pierre Verger

### ► To cite this version:

Rose Wilson, Anna Zaytseva, Aurelie Bocquier, Amale Nokri, Lisa Fressard, et al.. Vaccine hesitancy and self-vaccination behaviors among nurses in southeastern France. *Vaccine*, 2020, 38 (5), pp.1144-1151. 10.1016/j.vaccine.2019.11.018 . hal-02465210

**HAL Id: hal-02465210**

**<https://amu.hal.science/hal-02465210>**

Submitted on 7 Mar 2022

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

1 **Vaccine hesitancy and self-vaccination behaviors among nurses in southeastern France**

2 Rose Wilson<sup>1,2</sup>, Anna Zaytseva<sup>1</sup>, Aurélie Bocquier<sup>1,2</sup>, Amale Nokri<sup>1</sup>, Lisa Fressard<sup>1</sup>, Patrick  
3 Chamboredon<sup>3</sup>, Christian Carbonaro<sup>3</sup>, Stéphane Bernardi<sup>3</sup>, Eve Dubé<sup>4</sup>, Pierre Verger<sup>1,2\*</sup>

4 **Affiliations**

- 5 1. ORS PACA, Southeastern Health Regional Observatory, Marseille, France  
6 2. Aix Marseille Univ, IRD, AP-HM, SSA, VITROME, IHU-Méditerranée  
7 Infection, Marseille, France  
8 3. CIROI PACA – Corse, (Conseil Inter-Régional de l'Ordre des Infirmiers, Provence-  
9 Alpes-Côte d'Azur-Corse), Marseille, France  
10 4. CHU Québec - Laval University, Quebec, Canada  
11 Corresponding author: Observatoire Régional de la Santé, Faculté de médecine, 27 bd Jean  
12 Moulin, 13005 Marseille – France. Tel: +33 4 91 32 47 50. E-mail address:  
13 pierre.verger@inserm.fr (P. Verger).

14

15 **Abstract N=298 (limit: 300)**

16 Background: Health care worker vaccine uptake rates are below official targets, and studies  
17 demonstrate some are vaccine hesitant. We assessed self-vaccination behavior, vaccine  
18 hesitancy (VH), and associated factors in a representative sample of nurses.

19 Methods: Cross-sectional questionnaire survey in 2017-18 in southeastern France (5 million  
20 inhabitants): community nurses were randomly selected from a list provided by the Inter-  
21 Regional Nurses' Council (stratified by gender and district of practice) and interviewed by  
22 telephone. Because no such list exists for hospital nurses (74% of all nurses in southeastern  
23 France), we randomly selected hospitals, taking their size into account and stratifying by  
24 district. Hospital nurses practicing in medicine, surgery, obstetrics, and gynecology  
25 departments and present at the time of the survey were included and interviewed face-to face.  
26 We measured VH according to the WHO definition (refusal, delay, or acceptance with doubts  
27 about at least one vaccine). Interviewers administered the questionnaires. We used  
28 multivariable logistic regression to analyze potential associations between VH, vaccine risk  
29 perceptions and trust in health authorities.

30 Results: Interviews were completed with 1539 nurses (response rate: 85%). Self-reported  
31 vaccine coverage ranged from 27% (seasonal influenza vaccine, recommended, 2016/17  
32 season) to 96% (Bacillus Calmette–Guérin vaccine, mandatory). The VH prevalence rate was  
33 44% (95% confidence interval: 38.7–48.4) and most often concerned seasonal influenza or  
34 A(H1N1) vaccines (54%) and the hepatitis B vaccine (18%). VH was significantly more  
35 frequent among nurses with low trust in health authorities or high vaccine risk perceptions.

36 Conclusion: Nurses in southeastern France have low levels of self-vaccination acceptance for  
37 most recommended vaccines. In addition, they have a high VH prevalence focused on the  
38 same vaccines as among the general population. These are important findings given that

39 nurses are in regular contact with patients vulnerable to vaccine-preventable diseases and their  
40 VH could negatively influence patients' vaccination acceptance.

41 **Keywords:** Health care workers; Vaccination perceived risks; Trust; Self-Vaccination  
42 behavior; Vaccine hesitancy

## 43 **Introduction**

44 Like many other countries in the world, France faces a crisis of confidence in vaccination and  
45 vaccines. The debate in France dates back to the 1990s when a controversy about an alleged  
46 link between hepatitis B vaccination and multiple sclerosis led the Ministry of Health (MoH)  
47 to stop a mass vaccination campaign in schools in 1998. Vaccine coverage against hepatitis B  
48 in infants only attained the levels achieved in other European countries years later [1]. Since  
49 then, several other vaccine controversies have spread into French media (print, broadcast, and  
50 social), some initiated by physicians (e.g., concerning the human papilloma virus [HPV]  
51 vaccine [2]). In 2016, almost 50% of parents of children were vaccine hesitant (VH) [3],  
52 according to the WHO definition (delay in acceptance or refusal of at least one vaccine  
53 despite availability of vaccine services) [4], one of the highest rates of VH documented in a  
54 Western country [5]. One of its most prominent determinants appears to be the public  
55 perception that the risks of vaccines exceed their perceived benefits [3,5].

56 Health care professionals (pediatricians, general practitioners [GPs], nurses, and pharmacists,  
57 depending on the type of vaccination service and the country) play a pivotal role in explaining  
58 vaccine benefits and risks, recommending vaccines, and vaccinating the population. They are  
59 the cornerstone of maintaining vaccine acceptance. In France, most vaccines are prescribed by  
60 GPs and then delivered by community pharmacies to patients, who take them to their GP or  
61 nurse for administration. Nurses are not currently allowed to prescribe vaccines (except for  
62 seasonal influenza vaccine in target groups), but they may discuss vaccination with patients.  
63 Studies in various countries have shown that health care workers (HCWs) may, like the  
64 general population, be vaccine hesitant [6–10]. This can affect their vaccine recommendation  
65 behaviors toward patients and their ability to convince hesitant individuals.

66 Changes in the demography of HCWs are expected to modify their role in vaccination. The  
67 French MoH has already decided to authorize community pharmacists to vaccinate at-risk

68 patients against seasonal influenza at their pharmacy, starting in autumn 2019, and is  
69 considering allowing nurses to prescribe childhood vaccines as well as seasonal influenza  
70 vaccine among adults. However, little is known about nurses' attitudes regarding vaccines in  
71 France, and studies elsewhere, as in Quebec, show they may feel uncertain about their risks  
72 [11–13]. At the same time, nurses' self-vaccination behavior regarding vaccines that are  
73 recommended to HCWs, notably but not only that against seasonal influenza, has been shown  
74 to be less than optimal in many countries [14–16]. As nurses already play an important role in  
75 promoting vaccination and influencing patients' vaccination decisions in some countries and  
76 may soon do so in others [17], it is important to understand their concerns about vaccination  
77 for both patients and themselves.

78 We conducted a cross-sectional to study the behavior and attitudes towards vaccination and  
79 vaccines among hospital nurses and community nurses [18]. It sought to describe and  
80 quantify: 1) nurses' self-reported vaccination behaviors regarding mandatory and  
81 recommended vaccination for themselves; 2) the prevalence of VH among them, according to  
82 the WHO definition, and its associated factors, especially risk perceptions of vaccines and  
83 trust of the MoH.

## 84 **Methods**

85 We conducted the survey from October 2017 to March 2018 in southeastern France (5 million  
86 inhabitants). Its methods have been published elsewhere [19]. In brief, the study population  
87 included community and hospital nurses who had been working in southeastern France for at  
88 least three months before the survey started. Community nurses account for 26% of all nurses  
89 practicing in this region and hospital nurses, 74%. We randomly selected community nurses  
90 from the virtually exhaustive list for southeastern France provided by the Inter-Regional

91 Nurses' Council (CIROI), stratifying by gender and administrative *département* (district) of  
92 practice.

93 Hospital nurses practicing in departments of medicine, surgery, obstetrics, or gynecology  
94 were included. We excluded those working in emergency departments and intensive care  
95 units because the feasibility of recruiting participants from these units is poor. We also  
96 excluded temporarily employed nurses, students, and those on long-term sick leave. As no  
97 reliable sampling database exists for hospital nurses, they were directly recruited onsite by  
98 student nurses from eight partner Nursing Training Institutes (NTIs), to ensure geographical  
99 representativeness. To identify the hospitals to be included, we randomly selected those in the  
100 districts where these NTIs were located, taking into account the numbers of practicing nurses  
101 in each hospital and stratifying by district. We included 17 hospitals of 160 eligible in  
102 southeastern France [20]. In each hospital, all of the nurses at work during the study period  
103 were invited to participate in the study.

104 We developed a standardized questionnaire based on a literature review and discussion with  
105 nurses, experts in epidemiology, vaccination, and social sciences. We pilot-tested the  
106 questionnaire for clarity, length, and face validity with 20 nurses and made only minor  
107 changes afterwards. The questionnaire addressed: 1) nurses' professional characteristics; 2)  
108 their self-reported behavior regarding vaccination for themselves: like all HCWs in France,  
109 nurses are required to receive the Bacillus Calmette–Guérin (BCG), diphtheria-tetanus-  
110 poliomyelitis (dTPolio) and hepatitis B vaccines [21]. Other vaccines are recommended for  
111 them, specifically, those against seasonal influenza, pertussis, varicella, and measles, mumps  
112 and rubella (MMR) [21]; 3) nurses' self-reported VH according to the WHO definition  
113 (declining a vaccine considered dangerous or unnecessary; delaying a vaccine because of  
114 doubts about it, accepting a vaccine despite doubts about its efficacy or safety [4]) and the  
115 vaccines associated with it. The questionnaire also included the following items to be

116 answered on a 5-level Likert scale including a “don’t know” option: perceived risks of various  
117 vaccines (perceived likelihood of causal links between severe adverse effects and certain  
118 vaccines or vaccine components, 5 items, Table 4); trust in the MoH as a reliable source of  
119 information on vaccination (1 item); and discussing risks and benefits of vaccines with their  
120 patients as a proxy for interactions with patients about vaccination.

121 Data collection differed for community and hospital nurses. For the former, professional  
122 interviewers conducted telephone interviews using computer-assisted telephone interview  
123 software. For the latter, trained nursing students from the partner NTIs conducted face-to face  
124 interviews, using the same questionnaire as that for community nurses.

125 The study complied with the data privacy laws of the National Commission for Informatics  
126 and Civil Liberties and was approved by the Aix-Marseille University Ethics Committee.

#### 127 Statistical analysis

128 We weighted data for age, gender, place of nurses’ practice (community or hospital) and its  
129 geographical location (district) to match the nursing population in southeastern France.

130 Nurses were considered vaccine-hesitant if they answered “yes” to one at least of the three  
131 items operationalizing the WHO definition of VH (see above); we used this definition to  
132 construct a binary VH variable (Yes/No) [3]. We calculated a perceived vaccine risk score  
133 (range (5;20); Cronbach’s alpha=0.72) by adding up nurses’ responses on the Likert scale to  
134 the five questions about the perceived risks of various vaccines (Table 4).

135 Finally, we tested a logistic regression model adjusted for age, gender, and area of practice,  
136 using binary VH status as a dependent variable to analyze its association with place of  
137 practice (community versus hospital), the perceived vaccine risk score, and trust in the MoH.



138 All analyses were based on two-sided *P*-values, with statistical significance defined by  $P \leq$   
139 0.05, and conducted with SAS 9.4 statistical software (SAS Institute, Cary, North Carolina,  
140 US).

## 141 **Results**

142 Four hundred community (response rate: 79%) and 1139 hospital nurses (87%) completed the  
143 questionnaire (overall response rate: 85%); 84% were women. The mean age was 43, with  
144 community nurses generally older and more frequently male than the hospital nurses (Table  
145 1). Only 9% had attended a training session on vaccination in the past three years (hospital  
146 nurses: 12%; community nurses: 2%) (Table 1).

### 147 Self-reported vaccination behavior

148 Among the mandatory vaccines, 96% of nurses reported having received the BCG vaccine,  
149 73% the dTPolio booster vaccine in the past 10 years (it is recommended at 25, 45 and 65  
150 years), and 61% three or more doses of the hepatitis B vaccine (at least one dose: 90.4%,  
151 Table 2). Among the recommended vaccines, self-reported uptakes were: 58% for pertussis,  
152 64% for measles, 39% for varicella, and 27% for seasonal influenza during the last season  
153 (2016-17). Community nurses reported lower vaccination uptake than hospital nurses for all  
154 vaccines except for varicella and seasonal influenza. Occupational physicians performed the  
155 vaccinations for 55% of hospital nurses (versus 44% of community nurses).

### 156 Prevalence of VH and vaccines of concern

157 The VH prevalence rate among nurses was 44% (95% confidence interval [CI]: 38.7–48.4),  
158 with more VH among hospital than community nurses (Table 3). Prevalence rates for those  
159 who accepted vaccines while doubtful and those who declined vaccination were respectively  
160 24% and 23%. The vaccines most frequently the object of VH were those against seasonal

161 influenza and the A(H1N1) pandemic (54% of nurses with VH), hepatitis B (18%), and HPV  
162 (10%). VH extended to all vaccines for 2%.

### 163 Risk perception about various vaccines

164 A causal link between the hepatitis B vaccine and multiple sclerosis was considered likely or  
165 very likely by 57% of the nurses (Table 4); the corresponding percentages were 34% for a  
166 link between aluminum adjuvants and Alzheimer's disease, and 14% for a link between the  
167 measles vaccine and autism. "Don't know" answers were frequent; 41% so responded about  
168 the alleged link between measles vaccine and autism. The distribution of answers about links  
169 between the hepatitis B vaccine and multiple sclerosis and between aluminum adjuvants and  
170 Alzheimer's disease did not differ between hospital and community nurses. For the other  
171 items (Table 4), "not at all" or "not very likely" answers were significantly more frequent  
172 among community nurses than among hospital nurses while "don't know" answers were more  
173 frequent among the latter. After adjustment for gender and place of practice, we found a  
174 significant association between age and risk perceptions (i.e., considering that a link between  
175 vaccination and severe adverse effects for hepatitis B and seasonal influenza vaccines is  
176 likely). Compared with older nurses, the youngest nurses more frequently answered "I don't  
177 know" for these two vaccines. For the seasonal influenza vaccine, the younger nurses also  
178 believed that this link is likely more frequently than older nurses (Table S1).

179 Apart from risk perceptions, trust in the MoH as a reliable source of information about  
180 vaccination benefits and risks was significantly higher among community than hospital nurses  
181 ( $P < 0.001$ , Table 1).

182 In all, 26% of nurses stated that they often/always discussed risks and benefits of vaccines  
183 with their patients. This percentage was significantly higher among community than hospital  
184 nurses ( $P < 0.001$ , Table 1).

185 Factors associated with VH

186 VH prevalence was significantly higher in hospital than community nurses (public hospitals:  
187 adjusted odds ratio, 95% confidence interval (aOR 1.39, 95%CI 1.07; 1.81, Table 5)); it  
188 increased with the vaccine risk perception score (aOR 1.12; 95% CI 1.07; 1.17) and was  
189 lower among nurses trusting the MoH (aOR 0.67; 95% CI 0.53; 0.86). VH prevalence also  
190 decreased significantly as age increased but did not differ significantly according to gender.

191 **Discussion**

192 We found that nurses reported low uptake rates for themselves of vaccines recommended for  
193 HCWs. Furthermore, our study, which is the first to address VH among French nurses,  
194 showed a high prevalence of VH (44%), with hesitancy focused mainly on the vaccines  
195 against seasonal influenza, hepatitis B, and HPV; VH was significantly and independently  
196 more prevalent among hospital compared with community nurses and among those with high  
197 vaccine risk perception or low trust in the MoH.

198 Our results are in line with those of previous articles about nurses' vaccine behaviors in  
199 various countries, which have shown that uptake rates among nurses are most often below  
200 health authorities' targets and lower than among physicians [14,22–25] (targets in France:  
201 75% for seasonal influenza vaccine and 95% for the others [26,27]). Self-reported vaccine  
202 uptake rates were especially low in our study for vaccines against seasonal influenza and  
203 varicella. Moreover, our results for these vaccines are of the same order of magnitude as those  
204 reported a decade ago [16], despite numerous information campaigns about influenza  
205 vaccination aimed at hospital HCWs [28]. By contrast, we found an important increase in  
206 vaccine uptake against measles and pertussis (Table 2) that suggests, at least for some  
207 vaccines, that nurses' vaccine behaviors may be amenable to change.

208 The paradox of higher self-reported uptake rates for recommended vaccines among hospital  
209 nurses than community nurses (except for the influenza vaccine) despite higher VH  
210 prevalence among the former, as discussed below, may be explained by the easier access of  
211 hospital nurses to occupational health services in their workplace. Access issues must also be  
212 addressed when trying to reach vaccine coverage targets for HCWs [29]. On the other hand,  
213 community nurses (who are self-employed) may choose to vaccinate themselves more  
214 frequently against influenza than hospital nurses (who are salaried) to protect themselves from  
215 falling ill and having to take time off work; unlike salaried workers, they do not receive sick  
216 pay [19]. We have found similar results for private GPs compared to hospital physicians [30].

217 The hepatitis B vaccine has been mandatory for HCWs in France since 1991. The self-  
218 reported uptake rate for a complete course of hepatitis B vaccination (65.8% for 3 doses or  
219 more) in our study was very close to the self-reported rate observed 10 years earlier in another  
220 study (65.7%, Table 2) [16]. Its authors demonstrated that this rate reflected a memory bias  
221 regarding the number of injections received; they compared self-reported data to the number  
222 of injections recorded in hospital occupational health files and found the latter approach  
223 produced a 91% rate. The difference between the self-reported uptake rate for the boosters  
224 against diphtheria-tetanus-poliomyelitis and the corresponding rate a decade earlier (Table 2)  
225 may reflect, in part, the recommendation change in 2013 for adults [31]: since then, booster  
226 injections are to be performed at fixed ages (25, 45, and 65 years) compared to the previous  
227 recommendation of every 10 years.

228 The high VH prevalence among nurses in this study (44%) is close to the prevalence of VH  
229 among parents of children found in 2016 in a nationwide study in France (42%) [3]. Both  
230 groups' VH focused on the same three vaccines (against seasonal influenza, hepatitis B, and  
231 human papilloma virus), in the same order of importance [32]. The high risk perception for

232 specific vaccines, strongly associated with nurses' VH (Table 5), echoes the numerous vaccine  
233 controversies in France — most of which focused on these three vaccines and their safety —  
234 and elsewhere (Wakefield controversy on measles vaccination in England) over the past two  
235 decades. It is noteworthy that the impact of the hepatitis B vaccine controversy in the 1990s  
236 [9] was still perceptible among more than half the nurses two decades later, as among the  
237 French general population in 2016 [32] (Table 4). Neither the mandatory status of the  
238 hepatitis B vaccine for HCWs — since 1991 — nor the large body of epidemiological  
239 evidence against the claimed link between this vaccine and multiple sclerosis has allayed  
240 persistent fears about its safety (Table 4). These results underscore the potential limitations of  
241 vaccine mandates in view of the need to restore trust in some vaccines [33]. They also call  
242 into question the adequacy of nurses' initial training and continuous education in the field of  
243 vaccination and whether these provide them with the knowledge and skills necessary for their  
244 practice. Our result that uncertainties and/or doubts about the safety of hepatitis B and  
245 seasonal influenza vaccines were more frequent in young nurses than in older ones provides  
246 some evidence that nurses' initial training in the field of vaccination is inadequate. Currently  
247 in France, vaccination training for student nurses covers techniques of vaccine administration,  
248 immunology, and the health benefits of vaccination. Once qualified, some may be offered an  
249 online video (optional), funded by a pharmaceutical company, that addresses various myths  
250 surrounding vaccination [34]. Our findings showed that only a small minority of nurses had  
251 had continuing medical education in vaccines and vaccination in the three years before their  
252 participation in our study.

253

254 Several hypotheses may explain the higher prevalence of VH among hospital than community  
255 nurses. First, community nurses are more frequently involved in prevention and vaccination  
256 tasks, as indirectly shown by their higher level of interactions with patients about vaccination.

257 Second, hospital nurses had a significantly lower level of trust in the MoH than did  
258 community nurses. This might reflect their perceptions of the policy changes enacted by  
259 successive governments to control hospital health expenses and their consequences on  
260 hospital working organization and conditions [35]). Third, barriers to hospital nurses'  
261 vaccination acceptance should be analyzed more holistically, that is, considering as well other  
262 hospital HCWs' vaccination beliefs and behaviors, relationships between nurses and the other  
263 HCWs, and the role of hospital administrators and patient behavior [36].

#### 264 Strengths and Limitations

265 Our study has several strengths. First, it addresses the attitudes and behaviors of both  
266 community and hospital nurses regarding vaccination, showing that they differ substantially.  
267 Second, it enabled us to quantify VH prevalence among a large, representative sample of  
268 nurses by methods allowing the comparison of VH levels between nurses and other  
269 population groups [3]. Moreover, the questionnaire allowed nurses to specify their hesitancy  
270 for individual vaccines.

271 This study has several limitations, however. It took place in southeastern France, which  
272 accounted for only 7.5% of the national French population in 2018: caution is thus required  
273 regarding the generalization of its results to France as a whole and to other countries.

274 Hospital nurses, because they were interviewed face-to-face by other (albeit, student) nurses,  
275 may have been more guarded in their responses than community nurses, who were questioned  
276 by professional interviewers on the telephone. A social desirability bias may thus be more  
277 marked in the hospital compared with among community nurses; this might have induced  
278 some underestimation of risk perceptions and VH among hospital nurses and reduced the  
279 differences between them and community nurses. Such differences were nonetheless clear and  
280 the main conclusions of our study are thus unlikely to be affected. Additionally, self-reported

281 behavior might overestimate vaccine uptake rates, although other studies have shown that the  
282 size of this bias is limited for seasonal flu vaccination [37,38]. Inversely, however, a memory  
283 bias is also possible, especially when people are asked about the number of injections they  
284 have previously had of the same vaccine [16]. Finally, as we used a cross-sectional design, no  
285 causal conclusion can be drawn from the associations found in the regression model in our  
286 study.

## 287 **Conclusion**

288 Nurses in southeastern France had low levels of uptake for recommended vaccines and high  
289 levels of VH; their risk perceptions and trust in the MoH differed systematically between  
290 hospital and community nurses. These are important findings in view of the current  
291 discussions at the French MoH to give nurses more responsibility for vaccination, as the  
292 physician per population ratio declines [39] and in view of the major role nurses play in  
293 vaccinating the population in other countries (including Canada, Australia, the USA, and the  
294 UK) [17]. Measuring and understanding the determinants of VH among health care  
295 professionals is a research priority in view of the need to address doubts and concerns among  
296 health care providers themselves, for they play a crucial role in promoting vaccine acceptance  
297 among patients [8,42].

298 Efforts should be devoted to reinforcing the study of vaccination in the curriculum of student  
299 nurses. The results of our study may help in designing training tailored to nurses' perceptions  
300 of vaccines and vaccination. Nonetheless, educational interventions on their own might not  
301 improve vaccine uptake rates and vaccine acceptance among nurses [40]. This, and the fact  
302 that pressure from above can lead to further rejection of vaccines, means that educational  
303 initiatives should be coupled with empowering nurses through promoting decision-making  
304 skills (integrated through training curricula, their work place, and further education) [41].

305 Finally, further research — especially qualitative — is needed to better understand nurses’  
306 vaccination perceptions and to identify their specific vaccination concerns. This research is  
307 necessary to design effective interventions specifically directed at nurses.

### 308 **Acknowledgements**

309 The study was conducted at the request of the Conseil Interrégional de l’Ordre des Infirmiers  
310 PACA-Corse and in partnership with the Région Sud Provence Alpes Côte d’Azur. We would  
311 like to thank the eight nursing training institutes (IFSI de Cannes, IFSI de Digne-les-Bains,  
312 IFSI de Martigues, IFSI la Blancarde, Marseille, IFSI d’Avignon, IFSI la Garde, Toulon,  
313 IFSI la Gaude, Nice, IFSI de Gap) who participated in the field survey and Michael Huart and  
314 Gwenaëlle Maradan and her survey team from Observatoire Régional de la Santé.

### 315 **Funding statement**

316 This study was supported by the French National Research Agency (ANR - grant nb ANR-15-  
317 CE36-0008-01); Agence Régionale de Santé PACA; the Institut Hospitalo-Universitaire  
318 (IHU) Méditerranée Infection; the ANR under the program « Investissements d’avenir », nb  
319 ANR-10-IAHU-03; the Région Sud Provence-Alpes-Côte d’Azur; European funding FEDER  
320 PRIM1.

### 321 **Conflicts of interest**

322 None to declare.

### 323 **Contributors' statements**

324 RW participated in results interpretation and drafted the manuscript; AZ, AN and LS  
325 performed the statistical analysis and drafted the methods and results sections; AB, PC, CC,  
326 SB and ED, participated in the design of the study and revised the manuscript; PV designed



327 the study and its questionnaire, coordinated the study and its analysis, and revised the  
328 manuscript.

329

330 **References**

- 331 1. Mouchet J, Salvo F, Raschi E, Poluzzi E, Antonazzo IC, De Ponti F, et al. Hepatitis  
332 B vaccination and the putative risk of central demyelinating diseases – A  
333 systematic review and meta-analysis. *Vaccine*. 2018 Mar 14;36(12):1548–55.
- 334 2. Collange F, Fressard L, Pulcini C, Sebbah R, Peretti-Watel P, Verger P. General  
335 practitioners’ attitudes and behaviors toward HPV vaccination: A French national  
336 survey. *Vaccine*. 2016 Feb;34(6):762–8.
- 337 3. Rey D, Fressard L, Cortaredona S, Bocquier A, Gautier A, Peretti-Watel P, et al.  
338 Vaccine hesitancy in the French population in 2016, and its association with  
339 vaccine uptake and perceived vaccine risk–benefit balance. *Eurosurveillance*.  
340 2018;23(17).
- 341 4. WHO | Addressing Vaccine Hesitancy [Internet]. WHO. [cited 2017 Feb 13].  
342 Available from:  
343 [http://www.who.int/immunization/programmes\\_systems/vaccine\\_hesitancy/en/](http://www.who.int/immunization/programmes_systems/vaccine_hesitancy/en/)
- 344 5. Larson HJ, Figueiredo A de, Xiaohong Z, Schulz WS, Verger P, Johnston IG, et al.  
345 The State of Vaccine Confidence 2016: Global Insights Through a 67-Country  
346 Survey. *EBioMedicine*. 2016 Oct 1;12:295–301.
- 347 6. Karafillakis E, Dinca I, Apfel F, Cecconi S, Würz A, Takacs J, et al. Vaccine  
348 hesitancy among healthcare workers in Europe: A qualitative study. *Vaccine*. 2016  
349 22;34(41):5013–20.
- 350 7. Dubé E, Laberge C, Guay M, Bramadat P, Roy R, Bettinger JA. Vaccine hesitancy:  
351 An overview. *Human Vaccines & Immunotherapeutics*. 2013;9(8):1763–73.
- 352 8. Leask J. Target the fence-sitters. *Nature*. 2011 May 26;473(7348):443–5.
- 353 9. Verger P, Fressard L, Collange F, Gautier A, Jestin C, Launay O, et al. Vaccine  
354 Hesitancy Among General Practitioners and Its Determinants During  
355 Controversies: A National Cross-sectional Survey in France. *EBioMedicine*. 2015  
356 Aug;2(8):891–7.
- 357 10. Verger P, Collange F, Fressard L, Bocquier A, Gautier A, Pulcini C, et al.  
358 Prevalence and correlates of vaccine hesitancy among general practitioners: a  
359 cross-sectional telephone survey in France, April to July 2014. *Eurosurveillance*.  
360 2016;21(47):30406.
- 361 11. Dubé È, Defay F, Kiely M, Sauvageau C, Gilca V, Guay M, et al. Connaissances,  
362 attitudes et pratiques d’infirmiers, d’infirmières de pédiatres et d’omnipraticiens  
363 québécois sur la grippe A (H1N1) et la grippe saisonnière. Montréal: Institut  
364 national de santé publique du Québec; 2011.
- 365 12. Dubé E, Gagnon D, Kiely M, Boulianne N, Landry M. Acceptability of live  
366 attenuated influenza vaccine by vaccine providers in Quebec, Canada. *Hum Vaccin*  
367 *Immunother*. 2015;11(4):956–60.

- 368 13. Kiely M, Defay F, Sauvageau C, Gilca V, Guay M, Boulianne N, et al. Grippe  
369 A(H1N1) et saisonnière : bilan de campagnes. *Perspective infirmière*.  
370 2012;9(1):61–4.
- 371 14. Zhang J, While AE, Norman IJ. Knowledge and attitudes regarding influenza  
372 vaccination among nurses: a research review. *Vaccine*. 2010 Oct 18;28(44):7207–  
373 14.
- 374 15. Haut conseil de la santé publique. Objectifs de santé publique. Evaluation des  
375 objectifs de la loi du 9 août 2004 [Internet]. [cited 2019 Jul 11]. Available from:  
376 <https://www.hcsp.fr/docspdf/avisrapports/hcspr20100317ObjectifsSP.pdf>
- 377 16. Guthmann J-P, Fonteneau L, Bonmarin I, Lévy-Bruhl D. Influenza vaccination  
378 coverage one year after the A(H1N1) influenza pandemic, France, 2010–2011.  
379 *Vaccine*. 2012 Feb 1;30(6):995–7.
- 380 17. Wilson RJ, Chantler T, Lees S, Paterson P, Larson H. The Patient–Healthcare  
381 Worker Relationship: How Does it Affect Patient Views towards Vaccination  
382 during Pregnancy? In: *Health and Health Care Concerns Among Women and  
383 Racial and Ethnic Minorities* [Internet]. Emerald Publishing Limited. Jennie Jacobs  
384 Kronenfeld; 2017 [cited 2019 Jul 11]. p. 59–77. (*Research in the Sociology of  
385 Health Care*; vol. 35). Available from: [/insight/content/doi/10.1108/S0275-  
386 495920170000035004/full/html](https://doi.org/10.1108/S0275-495920170000035004/full/html)
- 387 18. Drees. Tableau 1. Effectifs des infirmiers par zone d’activité principale, mode  
388 d’exercice global, sexe et tranche d’âge [Internet]. [cited 2019 Jul 11]. Available  
389 from:  
390 <http://www.data.drees.sante.gouv.fr/TableViewer/tableView.aspx?ReportId=3704>
- 391 19. Wilson R, Scronias D, Zaytseva A, Ferry M-A, Chamboredon P, Dubé E, et al.  
392 Seasonal influenza self-vaccination behaviours and attitudes among nurses in  
393 Southeastern France. *Hum Vaccin Immunother*. 2019 Mar 4;1–11.
- 394 20. Drees. Distribution SAE [Internet]. [cited 2019 Jul 11]. Available from:  
395 <https://www.sae-diffusion.sante.gouv.fr/sae-diffusion/recherche.htm>
- 396 21. Ministère des Affaires Sociales et de la Santé. Calendrier des vaccinations et  
397 recommandations vaccinales 2016 [Internet]. Paris; 2016 [cited 2017 Mar 7].  
398 Available from: [http://social-sante.gouv.fr/IMG/pdf/calendrier\\_vaccinal\\_2016.pdf](http://social-sante.gouv.fr/IMG/pdf/calendrier_vaccinal_2016.pdf)
- 399 22. Giannattasio A, Mariano M, Romano R, Chiatto F, Liguoro I, Borgia G, et al.  
400 Sustained low influenza vaccination in health care workers after H1N1 pandemic: a  
401 cross sectional study in an Italian health care setting for at-risk patients. *BMC  
402 Infect Dis*. 2015 Aug 12;15:329.
- 403 23. Brandt C, Rabenau HF, Bornmann S, Gottschalk R, Wicker S. The impact of the  
404 2009 influenza A(H1N1) pandemic on attitudes of healthcare workers toward  
405 seasonal influenza vaccination 2010/11. *Euro Surveill*. 2011 Apr 28;16(17).
- 406 24. Dubé E, Gagnon D, Kiely M, Defay F, Guay M, Boulianne N, et al. Seasonal  
407 influenza vaccination uptake in Quebec, Canada, 2 years after the influenza  
408 A(H1N1) pandemic. *Am J Infect Control*. 2014 May;42(5):e55-59.

- 409 25. Dubé È, Kiely M, Ouakki M, Guay M, Institut national de santé publique du  
410 Québec, Direction des risques biologiques et de la santé au travail. Enquête  
411 québécoise sur la vaccination contre la grippe saisonnière et le pneumocoque et sur  
412 les déterminants de la vaccination: 2016 : rapport d'enquête [Internet]. 2017 [cited  
413 2019 Jul 11]. Available from: <http://collections.banq.qc.ca/ark:/52327/2797225>
- 414 26. Haute Autorité de Santé. Recommandation vaccinale sur l'extension des  
415 compétences des professionnels de santé en matière de vaccination contre la grippe  
416 saisonnière [Internet]. 2018 [cited 2019 May 21]. Available from: [https://www.has-sante.fr/jcms/c\\_2867268/fr/recommandation-vaccinale-sur-l-extension-des-competences-des-professionnels-de-sante-en-matiere-de-vaccination-contre-la-grippe-saisonniere](https://www.has-sante.fr/jcms/c_2867268/fr/recommandation-vaccinale-sur-l-extension-des-competences-des-professionnels-de-sante-en-matiere-de-vaccination-contre-la-grippe-saisonniere)
- 420 27. Cour des comptes. La politique vaccinale : un enjeu de santé publique, une  
421 confiance à conforter. In: Rapport public annuel. 2018. p. 205–42.
- 422 28. Recommandations vaccinales spécifiques - Professionnels de santé [Internet].  
423 Vaccination info service. 2019 [cited 2019 Jul 11]. Available from:  
424 <https://professionnels.vaccination-info-service.fr/Recommandations-vaccinales-specifiques/Professionnels-exposes-a-des-risques-specifiques/Professionnels-de-sante>
- 427 29. Hollmeyer HG, Hayden F, Poland G, Buchholz U. Influenza vaccination of health  
428 care workers in hospitals—A review of studies on attitudes and predictors.  
429 *Vaccine*. 2009 Jun 19;27(30):3935–44.
- 430 30. Verger P, Flicoteaux R, Schwarzingler M, Sagaon-Teyssier L, Peretti-Watel P,  
431 Launay O. Pandemic Influenza (A/H1N1) Vaccine Uptake among French Private  
432 General Practitioners: A Cross Sectional Study in 2010. *PloS one*.  
433 2012;7(8):e41837.
- 434 31. Ministère des Affaires Sociales et de la Santé. Calendrier vaccinal et  
435 recommandations vaccinales 2013 [Internet]. [cited 2019 Jul 11]. Available from:  
436 [https://solidarites-sante.gouv.fr/IMG/pdf/Calendrier\\_vaccinal\\_detaille\\_2013\\_ministere\\_Affaires\\_sociales\\_et\\_Sante-.pdf.pdf](https://solidarites-sante.gouv.fr/IMG/pdf/Calendrier_vaccinal_detaille_2013_ministere_Affaires_sociales_et_Sante-.pdf.pdf)
- 439 32. Gautier A, Verger P, Jestin C, Groupe Baromètre Santé 2016. Parents' source of  
440 information, opinions and practices on immunization in France in 2016. *Bulletin  
441 Épidémiologique Hebdomadaire*. 2017 Nov;Hors-série Vaccination:28–35.
- 442 33. Ward JK, Colgrove J, Verger P. Why France is making eight new vaccines  
443 mandatory. *Vaccine*. 2018 27;36(14):1801–3.
- 444 34. Fédération Nationale des Infirmiers, Sanofi Pasteur MSD. Idées reçues sur la  
445 vaccination [Internet]. [cited 2018 Jul 4]. Available from: <https://www.fni.fr/wp-content/uploads/2015/10/COMMUNIQUE-FNI-VACCINATION.pdf>
- 447 35. Gheorghiu MD, Moatty F. L'hôpital en mouvement. Changements organisationnels  
448 et conditions de travail [Internet]. Reuil-Malmaison: Liaisons (Editions); 2013  
449 [cited 2019 Jul 11]. 303 p. (Liaisons sociales). Available from:  
450 <http://journals.openedition.org/lectures/13553>

- 451 36. Lorenc T, Marshall D, Wright K, Sutcliffe K, Sowden A. Seasonal influenza  
452 vaccination of healthcare workers: systematic review of qualitative evidence. *BMC*  
453 *Health Serv Res.* 2017 Nov 15;17(1):732.
- 454 37. Brien S, Kwong JC, Buckeridge DL. The determinants of 2009 pandemic A/H1N1  
455 influenza vaccination: A systematic review. *Vaccine.* 2012 Feb 8;30(7):1255–64.
- 456 38. Llupià A, García-Basteiro AL, Mena G, Ríos J, Puig J, Bayas JM, et al.  
457 Vaccination behaviour influences self-report of influenza vaccination status: a  
458 cross-sectional study among health care workers. *PLoS ONE.* 2012;7(7):e39496.
- 459 39. Comité interministériel pour la santé. Priorité Prévention : Rester en bonne santé  
460 tout au long de sa vie [Internet]. 2018 [cited 2018 Jul 9]. Available from:  
461 [https://solidarites-sante.gouv.fr/IMG/pdf/180326-  
dossier\\_de\\_presse\\_priorite\\_prevention.pdf](https://solidarites-sante.gouv.fr/IMG/pdf/180326-<br/>462 dossier_de_presse_priorite_prevention.pdf)
- 463 40. Friedl A, Aegerter C, Saner E, Meier D, Beer JH. An intensive 5-year-long  
464 influenza vaccination campaign is effective among doctors but not nurses.  
465 *Infection.* 2012 Feb;40(1):57–62.
- 466 41. Pless A, Shaw D, McLennan S, Elger BS. Nurses' attitudes towards enforced  
467 measures to increase influenza vaccination: A qualitative study. *Influenza Other*  
468 *Respir Viruses.* 2017;11(3):247–53.
- 469 42. Ward JK, Peretti-Watel P, Bocquier A, Seror V, Verger A. Vaccine hesitancy and  
470 coercion: all eyes on France. *Nature Immunology,* 2019;20(10):1257-59.

1 **Tables**

2 Table 1. Demographic and professional characteristics, and exposure to vaccine-preventable  
 3 diseases among nurses in southeastern France, n=1539.

	Community (n=400)		Hospital (n=1139)		All (n=1539)		P- value†
	N	w%	N	w%	N	w%	
Gender <sup>a</sup>							0.04
Male	71	<b>19.4</b>	116	14.9	187	16.1	
Female	329	80.7	1018	<b>85.1</b>	1347	83.9	
Age [22; 69 years] - mean (SD) <sup>b</sup>	395	<b>45.6 (10.3)</b>	1137	41.5 (12.2)	1532	42.5 (11.9)	<.0001
Experience [0; 48 years] - mean (SD) <sup>c</sup>	399	<b>18.4 (11.3)</b>	1136	15.1 (12.1)	1535	16.0 (12.0)	<.0001
Secondary/complementary activity in retirement home, nursing home, health facility	20	4.7	69	6.0	89	5.7	0.33
Specialty <sup>d</sup>	55	13.3	171	17.2	226	16.2	0.07
Professional training on infectious diseases and vaccination in the past 3 years <sup>e</sup>	7	1.8	151	<b>12.1</b>	158	9.4	<.0001
Discuss risks and benefits of vaccines with patients <sup>e</sup>							<.0001
Never	28	6.7	420	<b>37.5</b>	448	29.4	
Sometimes	134	33.8	529	<b>47.2</b>	663	43.7	
Often	141	<b>36.3</b>	130	10.5	271	17.2	
Always	97	<b>23.3</b>	45	4.0	142	9.0	
Don't know	0	0.0	9	0.8	9	0.6	
Trust the reliability of information provided by the Ministry of Health about vaccination <sup>f</sup>							<.0001
Distrust	21	5.8	135	<b>13.3</b>	156	11.3	
Distrust somewhat	65	15.4	203	<b>16.9</b>	268	16.5	
Trust somewhat	222	<b>56.1</b>	576	50.2	798	51.7	
Strongly trust	89	<b>22.4</b>	198	17.7	287	19.0	
Don't know	1	0.3	19	<b>1.9</b>	20	1.5	

4 Abbreviations. w% = weighted percentages. Boldface indicates percentages significantly higher than average

5 † Chi<sup>2</sup> tests.

6 <sup>a</sup> 5 missing values

7 <sup>b</sup> 7 missing values

8 <sup>c</sup> 4 missing values

9 <sup>d</sup> 1 missing value; specialty in anesthesia, operating room, health executive, else

10 <sup>e</sup> 9 missing values

11 <sup>f</sup> 10 missing values

12

13 Table 2. Self-reported vaccination coverage rates (nurses in southeastern France, n=1539)

	Community (n=400)		Hospital (n=1139)		All (n=1539)		2009 national data‡
	N	w%	N	w%	N	w%†	
BCG <sup>a</sup>						<i>P</i> =0.05	<i>P</i> =0.52
Yes	385	96.0	1087	<b>96.3</b>	1472	96.3	94.8
No	11	<b>2.8</b>	13	1.3	24	1.7	4.7
Cannot remember	4	1.2	28	<b>2.4</b>	32	2.1	0.5
Last diphtheria-tetanus-polio (dTPolio) booster <sup>b</sup>						<i>P</i> <.0001	<i>P</i> =0.012
<10 years	275	70.3	836	<b>74.1</b>	1111	73.1	85.4
10-20 years	67	<b>16.9</b>	148	12.5	215	13.6	
>20 years	19	<b>3.5</b>	19	1.6	38	2.1	4.2
No	6	<b>1.7</b>	0	0.0	6	0.5	
Cannot remember	33	7.6	127	<b>11.9</b>	160	10.8	10.4
Hepatitis B <sup>c</sup>						<i>P</i> <.0001	<i>P</i> =1.00
Yes, 3 or more doses	199	49.1	736	<b>65.8</b>	935	61.4	65.7
Yes, fewer than 3 doses	154	<b>41.3</b>	296	25.8	450	29.8	28.8
Not vaccinated	18	<b>3.6</b>	18	1.4	36	2.0	0.7
Cannot remember	25	6.0	73	<b>7.1</b>	98	6.8	4.8
Contraindication	4		8		12		-
Pertussis <sup>d</sup>						<i>P</i> <.0001	<i>P</i> <.0001
Yes, up to date	198	52.5	720	<b>59.3</b>	918	57.5	11.6
No	119	<b>27.5</b>	151	16.3	270	19.2	33.3
Cannot remember	83	20.1	256	<b>24.5</b>	339	23.3	55.1
Measles <sup>e</sup>						<i>P</i> <.0001	<i>P</i> =0.002
Yes	228	60.5	795	<b>64.6</b>	1023	63.5	42.0
No	148	<b>34.5</b>	214	24.1	362	26.9	12.3
Cannot remember	24	5.1	115	<b>11.3</b>	139	9.6	45.7
Varicella <sup>f</sup>						<i>P</i> =0.0002	<i>P</i> =1.00
Yes	49	<b>50.8</b>	232	36.5	281	38.5	36.7
No	30	30.7	308	<b>52.8</b>	338	49.7	3.7
Cannot remember	20	<b>18.5</b>	72	10.8	92	11.9	59.6
Not concerned (childhood experience of varicella)	301		513		814		-
Seasonal influenza during last season <sup>g</sup>						<i>P</i> <.0001	<i>P</i> =0.73
Yes	158	<b>37.9</b>	221	22.6	379	26.6	24.4
No	241	61.9	897	<b>76.7</b>	1138	72.8	75.6
Cannot remember	1	0.2	5	<b>0.7</b>	6	0.6	0.0

14 Abbreviations. w% = weighted percentages. BCG = Bacillus Calmette–Guérin. Boldface indicates percentages significantly  
 15 higher than average

16 † Chi<sup>2</sup> tests were performed to compare community and hospital nurses self-reported vaccination coverage rates.

17 ‡ Source: Guthmann, 2011 (n=110, France, self-reported vaccination coverage rates among hospital nurses only). Chi<sup>2</sup> tests  
18 were performed between hospital nurses from our study and the 2009 national data, testing each time the first modality  
19 (respectively yes, <10 years, yes 3 or more doses, yes up to date, yes, yes, yes) against the other(s).  
20 <sup>a</sup> 11 missing values in our study  
21 <sup>b</sup> 9 missing values in our study  
22 <sup>c</sup> 8 missing values in our study. In the 2009 national data, exclusion of nurses reporting experience of VHB infection in the  
23 past; 5 missing values; when calculated from occupational health vaccination files, 90.9 % of nurses had received 3 or more  
24 doses.  
25 <sup>d</sup> 12 missing values in our study  
26 <sup>e</sup> 15 missing values in our study. In the 2009 national data (at least one dose), exclusion of nurses reporting experience of  
27 measles; N=48  
28 <sup>f</sup> 14 missing values in our study. In the 2009 national data (at least one dose), exclusion of nurses reporting experience of  
29 varicella; N=19  
30 <sup>g</sup> 16 missing values in our study. Season 2016-2017 in our study, 2008-2009 in the 2009 national data.  
31



32 Table 3. Prevalence and subjects of vaccine hesitancy according to the WHO SAGE  
 33 definition (nurses in southeastern France, n=1539).

	Community (n=400)	Hospital (n=1139)	All (n=1539)	P-value†
	w % [95% CI]	w % [95% CI]	w % [95% CI]	
Declined a vaccine they considered dangerous or useless <sup>a</sup>	14.6 [11.1;18.1]	<b>25.3 [21.1;29.6]</b>	22.5 [18.4;26.6]	<.0001
Delayed a vaccine because of doubts about it <sup>b</sup>	8.4 [5.7;11.1]	<b>8.6 [5.8;11.3]</b>	8.5 [5.8;11.3]	0.91
Vaccinated despite doubts about its efficacy or safety <sup>c</sup>	20.6 [16.6;24.6]	<b>25.4 [21.1;29.6]</b>	24.1 [19.9;28.3]	0.06
Vaccine hesitancy (VH, defined as a 'yes' response to at least one of these three questions) <sup>d</sup>	34.8 [30.1;39.4]	<b>46.7 [41.8;51.5]</b>	43.6 [38.7;48.4]	<.0001
Main vaccines subject to VH <sup>e</sup>	w % (n=139)	w % (n=531)	w % (n=670)	
Seasonal influenza/A(H1N1)	47.5	55.8	54.1	0.08
Hepatitis B	<b>27.2</b>	15.8	18.1	0.002
Human papilloma vaccine	4.6	<b>11.9</b>	10.4	0.012
BCG	2.2	2.8	2.7	0.69
Meningitis	3.3	1.3	1.7	0.12
MMR	1.1	1.7	1.6	0.59
All vaccines	1.7	1.5	1.6	0.91
Pertussis	1.1	1.5	1.4	0.75

34 Abbreviations. Abbreviations. w% = weighted percentages. CI = confidence interval. BCG = Bacillus Calmette–Guérin.

35 MMR = Measles, mumps and rubella. Boldface indicates percentages significantly higher than average

36 † Chi<sup>2</sup> tests.

37 <sup>a</sup> 8 missing values

38 <sup>b</sup> 7 missing values

39 <sup>c</sup> 9 missing values

40 <sup>d</sup> 5 missing values

41 <sup>e</sup> Collected using an open-ended format

42 Table 4. Perceived likelihood of links between specific vaccines and potential severe adverse  
 43 effects (nurses in southeastern France nurses, n=1539).

	Not at all likely	Not very likely	Somewhat likely	Very likely	Don't know	P-value†
	w%					
Hepatitis B vaccine & multiple sclerosis <sup>a</sup>						0.60
Community (n=400)	7.6	20.8	41.5	14.9	15.2	
Hospital (n=1139)	7.1	18.1	42.8	14.1	17.9	
All (n=1539)	7.3	18.8	42.5	14.3	17.2	
Aluminum adjuvants & Alzheimer's disease <sup>b</sup>						0.06
Community (n=400)	7.3	23.2	29.6	6.2	33.7	
Hospital (n=1139)	8.4	18.4	25.9	7.6	39.7	
All (n=1539)	8.1	19.7	26.9	7.2	38.1	
Human papilloma vaccine & multiple sclerosis <sup>c</sup>						0.03
Community (n=400)	<b>9.6</b>	<b>29.2</b>	<b>23.3</b>	4.2	33.7	
Hospital (n=1139)	9.3	22.5	22.4	<b>6.1</b>	<b>39.8</b>	
All (n=1539)	9.3	24.2	22.6	5.6	38.2	
Measles vaccine & autism <sup>d</sup>						0.001
Community (n=400)	19.1	<b>31.6</b>	<b>11.1</b>	2.3	35.8	
Hospital (n=1139)	<b>22.4</b>	21.1	10.6	<b>3.5</b>	<b>42.4</b>	
All (n=1539)	21.5	23.9	10.7	3.2	40.7	
Seasonal influenza vaccine & severe adverse effects <sup>a</sup>						<.0001
Community (n=400)	<b>13.6</b>	<b>49.2</b>	27.2	6.0	4.0	
Hospital (n=1139)	7.7	35.2	<b>33.2</b>	<b>11.7</b>	<b>12.3</b>	
All (n=1539)	9.2	38.8	31.6	10.2	10.1	

44 Abbreviations. w% = weighted percentages. Boldface indicates percentages significantly higher than average

45 † Chi<sup>2</sup> tests.

46 <sup>a</sup> 9 missing values

47 <sup>b</sup> 10 missing values

48 <sup>c</sup> 11 missing values

49 <sup>d</sup> 17 missing values

Table 5. Univariable and multivariable logistic regression analyses of factors associated with vaccine hesitancy (nurses in southeastern France, n=1539) †

	Vaccine hesitancy (ref. No)	
	Univariable	Multivariable
	(n=1539)	(n=1508 <sup>a</sup> )
	OR [95% CI]	ORa [95% CI]
Gender (ref. Female)		
Male	<b>0.67 [0.49;520.92]</b>	0.75 [0.53;1.04]
Age (ref. < 30 years)		
30-47 years	<b>0.52 [0.40;0.68]</b>	<b>0.58 [0.44;0.76]</b>
...> 47 years	<b>0.44 [0.33;0.59]</b>	<b>0.47 [0.34;0.64]</b>
Place of practice (ref. Community)		
Hospital	<b>1.72 [1.36;2.18]</b>	<b>1.39 [1.07;1.81]</b>
Strongly or somewhat trust the Ministry of Health as a reliable source of information about vaccination (ref. No)		
Yes	<b>0.58 [0.46;0.72]</b>	<b>0.67 [0.53;0.86]</b>
Score of perceived likelihood of links between vaccines and severe adverse effects [5;20]		
	<b>1.15 [1.10;1.20]</b>	<b>1.12 [1.07;1.17]</b>

† Unweighted data. Multivariable analyses adjusted on area of practice.

Abbreviations. OR [95% CI] = odds-ratio [95% confidence interval], aOR = adjusted odds-ratio. Boldface indicates statistical significance ( $P \leq 0.05$ )

<sup>a</sup> 31 missing values.

Hosmer–Lemeshow goodness-of-fit test:  $P > 0.05$ . We found no issue of multicollinearity.