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## COVID-19 vaccine hesitancy among healthcare workers

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**Keywords.** COVID-19; vaccine; healthcare workers; vaccine hesitancy; influenza.

## **ABSTRACT**

**Objective.** To characterize healthcare workers' (HCWs) intention to receive the COVID-19 vaccine by the beginning of the vaccine campaign in France.

**Methods.** Data were collected on a self-administered questionnaire through the website of a tertiary care center (February 9-18, 2021).

**Results.** Among 1,965 respondents, 1,436 (73.1%), 453 (23.1%), and 76 (3.9%) declared themselves in favor, hesitant, or against the COVID-19 vaccine: <60% of auxiliary nurses and technicians intended to be vaccinated, as compared to 60-79% of nurses and support staff, and >80% of medical staff. On multivariate analysis, age, occupation, flu vaccine history, and controversy over the AstraZeneca vaccine tolerability were independently associated with COVID-19 vaccine intention.

**Conclusions.** Patterns of vaccine hesitancy related to the COVID-19 and influenza vaccines are similar among HCWs. Media communication on vaccine side effects have a dramatic effect on vaccine hesitancy. Efforts are requested to inform HCWs about the risk/benefit balance of COVID-19 vaccines.

**Keywords.** COVID-19; vaccine; healthcare workers; vaccine hesitancy; influenza.

## **1. Introduction**

Since the emergence of SARS-CoV-2, healthcare workers (HCWs) have been on the front line in caring for COVID-19 patients, and consequently are at high risk of infection. According to the European center for disease prevention and control (eCDC), the proportion of HCWs among COVID-19 cases varied from 2.2% to 29% in countries with available data [1]. In France, 67,811 HCWs have been infected by SARS-CoV-2 between March 2020 and February 2021, of whom 19 died from COVID-19 [2]. At the same time, opposition to control measures such as lockdown or wearing mask is growing. In this context, the availability of several vaccines is a major step forward to protect HCWs. However, progress in HCW immunization may be compromised by vaccine hesitancy, characterized by the lack of confidence in or the fear of vaccines [3].

In France, striking heterogeneities have been reported in the proportion of HCWs who receive seasonal influenza vaccines, with a socio-occupational gradient from physicians (67%) to auxiliary nurses (27%) [4]. However, vaccine hesitancy may vary dramatically over time, from one location to another, and according to vaccines. To date, only a few studies focused on COVID-19 vaccination intention in HCWs. A study in Hong-Kong found that young age, confidence in the vaccine, and a sense of collective responsibility were associated with intention to receive the COVID-19 vaccine [5]. In France, a survey among 2,047 HCWs reported that 76.9% of them (95% CI, 75.1-78.9%) intended to get the COVID-19 vaccine, with discrepancies according to age, gender, occupation, and influenza vaccination during the previous campaign (2019-2020) [6]. Of note, these two studies were conducted before COVID-19 vaccines became available. We aimed to assess COVID-19 vaccine intention among HCWs at the beginning of the French campaign, when three vaccines were available (i.e. Pfizer, Moderna, and AstraZeneca).

## **2. Methods**

The Rennes University Hospital is a 1,500-bed tertiary care center in western France. For one week, between February 9 and February 18, an anonymous self-administered questionnaire was proposed on the website of our institution for non-vaccinated HCWs, on a voluntary basis. We collected demographic characteristics, occupation, chronic medical

conditions at risk of serious COVID-19 (obesity, cancer, diabetes, hypertension), influenza vaccination, and COVID-19 history. HCWs were invited to categorize their intention to be vaccinated against COVID-19 as 'in favor', 'hesitant', or 'against'.

During our survey, a large controversy emerged on February 14 following reports of flu-like symptoms with high-grade fever and pain, with inability to work during the first 24 hours following AstraZeneca COVID-19 vaccine first shot. The controversy received broad media coverage, and the vaccine was temporarily discontinued in several hospitals. We analyzed COVID-19 vaccine intention of HCWs in relation with their age, occupation, chronic medical conditions at risk of serious COVID-19, history of influenza vaccination, and the timing of questionnaire according to the February 14 controversy, thereafter considered as a cut-off. We conducted a univariate analysis, followed by a multivariate analysis based on logistic regression model, including all precedent variables. The outcome 'to be hesitant or against the COVID-19 vaccine' was modelled in a binary approach. Statistical analyses were performed using the SAS® package, v9.4. Results are presented as odds ratio (OR) with their 95% confidence intervals. A P value below 0.05 was considered significant.

### **3. Results**

The number of HCWs in our hospital during the study period was 8,375 not including students. As 647 had previously tested positive for SARS-CoV-2, and 2,063 had already received at least one dose of COVID-19 vaccine, the eligible population was 5,655. Of them, 1,965 (34.7%) completed the questionnaire: 453 HCWs (23.1%) categorized themselves as 'hesitant', and 76 (3.9%) as 'against' the COVID-19 vaccine (Table 1). Strong differences among COVID-19 vaccine profiles were observed according to occupations, with <60% of administrative staff, cleaners, auxiliary nurses, workers, and technicians intending to be vaccinated, as compared to 60-79% for nurses, pharmacists, laboratory technicians, and support staff, and >80% for health executives, residents, students, and medical staff. Conversely, no relation was observed between COVID-19 vaccine profiles and allergy, COVID-19 history, and at-risk conditions. The controversy over the adverse effects of the AstraZeneca vaccine was followed by a dramatic decrease in intention to get the COVID-19 vaccine, from 74.8% before to 58.3% after February 14. The multivariate analysis demonstrated that age, occupation, flu vaccine

profiles, and the controversy of February 14 were independently associated with the intention to get the COVID-19 vaccine.

Administrative staff (OR=4.41[95% CI 2.78-6.97]), cleaners, auxiliary nurses, and stretcher-bearers (OR=3.37 [95% CI 2.06-5.50]), nurses (OR=2.14 [95% CI 1.42-3.22]), pharmacy and laboratory staff (OR=2.26 [95% CI 1.32-3.90]), as well as workers or technicians (OR=3.42 [95% CI 1.48-7.93]) were more likely to be hesitant or against the COVID-19 vaccine, as compared to medical staff. A strong correlation was also reported across influenza vaccine and COVID-19 vaccine profiles, with a proportion of HCWs intending to get the COVID-19 vaccine at 46.4% in never-flu vaccinated HCWs, to 89.3% in those regularly vaccinated. HCWs never vaccinated against influenza were much more likely to be hesitant or against COVID-19 vaccine (OR 6.17 [95% CI 4.55-8.37]).

The distribution of influenza and COVID-19 vaccine profiles were similar among the various occupations (Table 2). Interestingly, the proportion of HCWs intending to get a COVID-19 vaccine (mean, 73.2%) was superior to the proportion of HCWs regularly vaccinated against influenza (mean, 51.4%). Finally, the controversy over the severity of common adverse effects of the AstraZeneca COVID-19 vaccine was also associated with hesitancy or opposition against COVID-19 vaccine (OR 1.77 [95% CI 1.22-2.56]). This negative impact was observed across all occupations, but was only significant in administrative staff, nurses, and support staff (Table 3).

#### **4. Discussion**

This study confirms the strong differences in COVID-19 vaccine intention among HCWs, mainly according to occupations, and the high correlation with influenza vaccine profiles. Of note, the proportion of HCWs declaring that they would receive the COVID-19 vaccine was higher than the proportion of HCWs who regularly receive the influenza vaccine. To the best of our knowledge, it is the first study performed after COVID-19 vaccines became available in France. This study also documents the dramatic decrease in the proportion of HCWs intending to get the COVID-19 vaccine immediately after the first controversy over the AstraZeneca vaccine tolerability arose. This should be kept in mind by colleagues, institutions, and media: premature communication about suspected side effects carries its own risk of adverse event, namely the progression of vaccine hesitancy.

Discrepancies concerning vaccine hesitancy according to socio-economic characteristics (income, education level, occupations) have been previously reported [7-9], including among HCWs [5,10]. We found that striking differences across occupations were also valid for COVID-19 vaccine. The linear gradient across HCWs according to their qualification level (blue collars, auxiliary nurses, nurses to medical staff) [4] was not always retrieved in the literature, and some authors suggested the existence of an inverse U curve across qualification levels [11]. Our findings confirm such interpretation, as for instance administrative staff had higher rate of vaccine hesitancy and opposition than blue collars or cleaners. These differences are probably the expression of vaccine hesitancy [12] and of the complexity of the multiple determinants of vaccine hesitant behaviors, both at the individual and collective levels [13]. Several large categories of determinants have been described, such as individual or collective influences, contextual influences, and specific issues on vaccination [14]. Each of these groups contains several factors such as influential leaders, religion or cultural issues, knowledge/awareness ratio, perception of risk-benefit balance, role of healthcare providers, etc. Accordingly, different health behavior models (such as Health Belief Model or the Protection Motivation Theory) [5,15] were developed to better explain vaccine hesitancy, and as a goal to reduce this behavioral pattern. Applications of these models to fight the COVID-19 pandemic is a major public health challenge.

Among the determinants of vaccine hesitancy, communication and media environment are of paramount importance. To date, the long-term negative effect of such communication is poorly characterized. However, Raude *et al.* highlighted that it requires only a few media events to observe a durable effect on vaccine hesitancy in France, as documented by the controversy over the association between the measles vaccine and autism, or between the hepatitis B vaccine and multiple sclerosis [16]. As a result, considerable efforts are needed from stakeholders and health providers [10,17] to positively communicate on the risk/benefit balance of vaccines to a broad scope of media, including social networks [18]. Indeed, information is demonstrated to be an effective tool, rather than a determinant to address vaccine hesitancy [19]. Finally, we observed a strong correlation between influenza and COVID-19 vaccine profiles, as previously reported [4,5].

Our study has limitations. First, the recruitment of subjects on a voluntary basis implies that representability may not be guaranteed. However, we were able to collect COVID-19 vaccine intention on approximately the third of the unvaccinated population during the study

period. Moreover, characteristics of our sample were comparable to the whole structure of our hospital staff in terms of occupation and age (data not shown). Second, our study was performed in a single center over one week, and its findings may not apply to any setting. This limitation is particularly salient given the variability of vaccine hesitancy over time, and from one country to another. Lastly, we only collected declarative data, and no control of answer accuracy could be performed.

## **Conclusion**

We found that the patterns of vaccine hesitancy or opposition among HCWs are quite similar between COVID-19 vaccine and influenza vaccine. Although the proportion of HCWs intending to get the COVID-19 vaccine was higher than that related to the influenza vaccine, any controversy over vaccine tolerability may dramatically boost vaccine hesitancy. A few weeks after our study, the worldwide documentation of severe vaccine-related thrombosis events following the AstraZeneca COVID-19 vaccine has further complicated the situation, despite the low incidence (i.e. around one case per one million doses), and the highly beneficial risk-benefit ratio [20]. Considerable efforts, particularly in terms of information and communication to HCWs, other hospital staff, and *in fine* the public are requested to reduce vaccine hesitancy. Failure to do so may jeopardize our capacity to finally control the COVID-19 pandemic.

**Conflicts of Interest.** All authors, none.



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**Table 1.** Characteristics of healthcare workers depending on COVID-19 vaccine intention (n=1,965)

Variables	COVID-19 vaccine intention			Multivariate analysis Odds ratio P value <sup>2</sup>
	In favor n (%)	Hesitant n (%)	Against n (%) P value <sup>1</sup>	
<b>Age, years</b>			<b>0.002</b>	<b>0.004</b>
<30	319 (70.7)	107 (23.7)	25 (5.5)	1.00
30-39	499 (73.6)	155 (22.9)	24 (3.5)	0.91 [0.65-1.26]
40-49	473 (77.7)	122 (20.0)	14 (2.3)	<b>0.56 [0.40-0.79]</b>
50-64	138 (63.0)	68 (31.1)	13 (6.0)	0.99 [0.64-1.52]
65+	7 (87.5)	1 (12.5)	0 (0)	1.25 [0.14-10.8]
<b>Occupation</b>			<b>&lt;0.0001</b>	<b>&lt;0.0001</b>
Administrative staff	138 (51.3)	115 (42.8)	16 (6.0)	<b>4.41 [2.78-6.97]</b>
Cleaners, auxiliary nurses, stretcher-bearers	119 (54.8)	78 (35.9)	20 (9.2)	<b>3.37 [2.06-5.50]</b>
Health executives	58 (89.2)	6 (9.2)	1 (1.5)	0.78 [0.32-1.94]
Nurses/other care staff	429 (76.2)	117 (20.8)	17 (3.0)	<b>2.14 [1.42-3.22]</b>

Medical staff, residents, students	437 (90.9)	37 (7.7)	7 (1.5)	1.00
Pharmacy/laboratory staff	100 (69.9)	40 (28.0)	3 (2.1)	<b>2.26 [1.32-3.90]</b>
Workers, technicians	21 (56.8)	11 (29.7)	5 (13.5)	<b>3.42 [1.48-7.93]</b>
Support staff	94 (79.7)	22 (18.6)	2 (1.7)	1.51 [0.81-2.81]
Other staff	40 (55.6)	27 (37.5)	5 (6.9)	<b>4.30 [2.26-8.20]</b>
<b>Comorbidities</b>			0.14	0.80
Yes	78 (71.6)	23 (21.1)	8 (7.3)	0.93 [0.55-1.60]
No	1358 (73.2)	430 (23.2)	68 (3.7)	1.00
<b>Allergy history</b>			>0.20	0.83
Yes	143 (70.8)	53 (26.2)	6 (3.0)	1.04 [0.71-1.52]
No	1293 (73.3)	400 (22.6)	70 (4.0)	1.00
<b>COVID-19 history</b>				0.96
Yes	155 (76.0)	42 (20.6)	7 (3.4)	0.99 [0.66-1.49]
No	1281 (72.7)	411 (23.3)	69 (3.9)	1.00
<b>Flu vaccine</b>			<b>&lt;0.0001</b>	<b>&lt;0.0001</b>
Never	228 (46.4)	212 (43.2)	51 (10.4)	<b>6.17 [4.55-8.37]</b>
Sometimes, but not this winter	70 (59.8)	41 (35.0)	6 (5.1)	<b>4.00 [2.55-6.23]</b>
Sometimes, including this winter	179 (74.3)	57 (23.6)	5 (2.1)	<b>2.43 [1.67-3.54]</b>

Regularly	802 (89.3)	86 (9.6)	10 (1.1)	1.00
<b>Impact of the controversy over the AstraZeneca vaccine tolerability</b>			<b>&lt;0.0001</b>	<b>0.0025</b>
Before Feb 14, 2021	1316 (74.8)	375 (21.3)	68 (3.9)	1.00
After Feb 14, 2021	120 (58.3)	78 (37.9)	8 (3.9)	<b>1.77 [1.22-2.56]</b>

<sup>1</sup>: P value, univariate analysis

<sup>2</sup>: P value, Multivariate analysis, Logistic regression model

**Table 2.** Associations between influenza and COVID-19 vaccine intention among healthcare workers (n=1,965)

Occupations	Flu vaccine profiles				COVID-19 vaccine profiles	
	Never n (%)	Sometimes, but not this winter n (%)	Sometimes, including this winter n (%)	Regularly n (%)	Hesitant or against n (%)	In favor n (%)
Medical staff, residents, students	21 (4.5)	18 (3.9)	42 (9.0)	385 (82.6)	44 (9.2)	437 (90.1)
Administrative staff	123 (53.0)	23 (9.9)	32 (13.8)	54 (23.3)	131 (48.7)	138 (51.3)
Cleaners, auxiliary nurses, stretcher- bearers	91 (50.8)	12 (6.7)	26 (14.5)	50 (27.9)	98 (45.2)	119 (54.8)
Nurses/other care staff	107 (21.8)	36 (7.4)	88 (18.0)	259 (52.9)	134 (23.8)	429 (76.2)
Health executives	15 (24.2)	4 (6.5)	11 (17.7)	32 (51.6)	7 (10.8)	58 (89.2)
Pharmacy/laboratory staff	47 (39.2)	10 (8.3)	20 (16.7)	43 (35.8)	43 (30.1)	100 (69.9)
Support staff	34 (34.3)	6 (6.1)	15 (15.2)	44 (44.4)	24 (20.3)	94 (79.7)
Workers, technicians	18 (54.5)	3 (9.1)	2 (6.1)	10 (30.3)	16 (43.2)	21 (56.8)
Other	35 (53.0)	5 (7.6)	5 (7.6)	21 (31.8)	32 (44.4)	40 (55.6)

**Table 3.** Effects of the controversy over the AstraZeneca vaccine tolerability on COVID-19 vaccine intention by occupations (n=1,965)

	Hesitant or 'against'		P value
	Before Feb. 14	After Feb. 14	
	n (%)	n (%)	
Medical staff, residents, students	40 (8.9)	4 (12.5)	0.49
Administrative staff	118 (47.0)	13 (72.2)	<b>0.04</b>
Cleaners, auxiliary nurses, stretcher-bearers	75 (42.9)	23 (54.8)	0.16
Nurses/other care staff	109 (22.2)	25 (34.7)	<b>0.01</b>
Health executives	5 (8.5)	2 (33.3)	0.10 <sup>1</sup>
Pharmacy/laboratory staff	32 (26.9)	11 (45.8)	0.06
Support staff	20 (17.9)	4 (66.7)	<b>0.01</b> <sup>1</sup>
Workers, technicians	12 (38.7)	4 (66.7)	0.16 <sup>1</sup>
Other	32 (44.4)	-	NA

1 : Fisher's exact test