International Journal of Nursing and Health Care Research
Savin P and Clin B. Int J Nurs Health Care Res 9: 1712
www.doi.org/10.29011/2688-9501.101712
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Research Article

Reasons for Covid-19 Vaccine Acceptance, Hesitancy and Refusal Among Workers in a French Hospital Group

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Citation: Savin P and Clin B (2026) Reasons for Covid-19 Vaccine Acceptance, Hesitancy and Refusal Among Workers in a French Hospital Group. Int J Nurs Health Care Res 9:1712. DOI: https://doi.org/10.29011/2688-9501.101712

Received Date: 06 June 2026; **Accepted Date:** 15 June 2026; **Published Date**: 18 June, 2026

Abstract

Background: The aim of this study was to analyse the determinants of COVID-19 vaccination and booster dose acceptance, and the underlying reasons for hesitancy or refusal, among workers of in a French hospital. **Methods:** This prospective questionnaire study included 845 hospital workers who completed a questionnaire between 16 November 2021 and 10 January 2022. **Results**: The main reasons for vaccine hesitancy were insufficient hindsight on the vaccine, lack of information, and fear of side effects. Among respondents, 48.8% did not report vaccine hesitant, whereas 34.8% reported little hesitancy, and 16.4% significant hesitancy. Among auxiliary nurses, 35.9% reported strong vaccine hesitancy compared to 3.8% of medical practitioners ($p<0.001$). Acceptance of the vaccine booster dose was 78.0%. The main reasons for vaccination were personal conviction (61.7%), mandatory vaccination (38.6%) and sanitary pass implementation (23.8%). The main reasons for hesitancy were lack of data (40.1%) followed by fear of side effects (29.3%). For 78 of the 105 employees who refused the vaccine booster dose, the reasons were the same as those for initial vaccination. **Conclusion:** The employees expressing the highest COVID-19 vaccine hesitancy were women, hospital housekeepers, nurses and the 20-29-year age group. We must therefore focus our reinsurance and information efforts on these populations with greater vaccine hesitancy.

Keywords: Covid19; Vaccination; Acceptance; Hesitancy; Hospital workers; Healthcare professionals

Background

Since December 2019, a new coronavirus, SARS-CoV-2, has been responsible for a worldwide pandemic: COVID-19 (corona virus disease) [1]. Since the evolution of the pandemic could not be modified by detection, screening and/or isolation measures, all hopes then focused on the rapid development of an effective vaccine. New technologies and global support enabled the fast development and deployment of safe and effective vaccines targeting the Spike protein.

The vaccine campaign against SARS-CoV-2 began in France on 27 December 2020. Initially reserved for the elderly and for individuals with disabilities, vaccination was generalised as of 4 January 2021, to professionals working in healthcare or medico social establishments, aged 50 and over and/or presenting with comorbidities, then, from 6 February 2021, for all health and social service professionals, regardless of age.

Furthermore, the sanitary pass and mandatory COVID-19 vaccination for caregivers in France were implemented to fight against the COVID-19 pandemic. Introduced in May 2021, the sanitary pass was a document which proved that an individual was either vaccinated against COVID-19, tested negative or recovered from the disease (Law n°2021-689 of 31 May 2021 on management of the health crisis). Presentation of the pass was required to access certain public places, events and activities, in order to limit the spread of the virus. In France, health professionals were subjected to mandatory vaccination from 9 August 2021 (Law n°2021-1040 of 5 August 2021 on management of the health crisis). Caregivers had up to September 15, 2021 to undergo vaccination, under penalty of sanctions including the suspension of their employment contract. With the advent of increasingly contagious SARS-CoV-2 variants, a vaccine booster dose at least 6 months after the last injection was recommended for all health professionals as of 8 October 2021 (Recommendation N°2021_106 of 6 October 2021 from the Directorate-General for Health). This booster dose met with mixed reactions from health professionals. On 30 January 2022, the booster dose became mandatory for all health professionals in France (Decree no. 2022-51 of 22 January 2022).

The repercussions on public health of vaccine hesitancy are significant, and addressing this issue through education and awareness is crucial. Indeed, large-scale vaccination contributes to collective immunity and widespread hesitation can compromise protection, given that, the fewer individuals vaccinated, the more vulnerable the overall population to epidemics. Hesitation is often fuelled by misinformation and unfounded fears on vaccine safety. This highlights the importance of education and clear communication on the benefits of vaccines. It was within this context that we conducted this study, the main objective of which was to analyse acceptance and hesitancy to initial vaccination and vaccine booster among employees in a French hospital.

Methods

Study Design and Procedures

This study is a French prospective questionnaire study among employees in a French hospital, in which one of the authors was an occupational physician. This hospital is a private health institution of collective interest, with a capacity of around 830 beds, and a staff of approximately 5,800 employees. It is equipped with services including surgery, emergency room, medicine, obstetrics, neonatology and general and paediatric resuscitation.

Population Concerned

Inclusion criteria associated: employees of the studied French hospital, with an active professional email address or consulting for any reason at the institution's occupational health and prevention department. Subjects who did not comply with the previous conditions were excluded, as well as subjects unable to answer questions or refusing data processing.

The hospital employed a total staff of 5,798 at 31/12/2021 and belonged to the following socio-professional categories: support staff; auxiliary nurse; auxiliary nursing student; hospital housekeeper; medical practitioner; medical student; ward nurse; theatre nurse; nurse anaesthetist; student nurse and laboratory staff.

Data Collection

Data were collected using a questionnaire specifically designed for the study (**supplementary file**), which was previously tested by 16 employees from the occupational health department, who were not included in the final analysis. The questionnaire was then submitted to the CSSCT (commission for health, safety and working conditions) of the studied hospital, reviewed with the data protection officer (DPO) and presented to hospital management.

The questionnaire included data on: consent to data processing, sex, age group, occupational category (auxiliary nurse, hospital housekeeper, nurse, theatre nurse, nurse anaesthetist, student nurse, medical practitioner, laboratory staff, stretcher bearer, physiotherapist, imaging technologist, operating theatre, administrative staff, support staff), SARS-CoV-2 vaccination status, type(s) of vaccine received, COVID disease history, reason(s) for vaccination, initial vaccine hesitancy, possible reason(s) for hesitancy, acceptance of booster dose, reason(s) for non-acceptance of booster dose.

During the inclusion period, questionnaires were distributed to all hospital employees, regardless of their job position via the hospital employees' professional email addresses, accompanied by an explanatory message. The questionnaires were distributed via an internal mailing list including the professional mailboxes of the hospital's 5,798 employees. The distribution email contained a link on which participants could click to access the online questionnaire. This link led the participant to a first information page, where their consent was required in order to complete the rest of the questionnaire.

In order to reach as many employees as possible, the questionnaire was also distributed in paper format in the occupational health department, with an oral explanation of the purpose of our study and verification that the subjects had not already answered the computer version. Each visit to the occupational health and prevention department offered employees a further opportunity to complete the questionnaire.

Each questionnaire (both computer and paper) was accompanied by an information note on the objectives of the study, the fact that the database did not contain any data allowing the identification of employees and a consent form for processing recorded information. Employees who refused to information processing were excluded from the study. The computer form could only be filled out once per person, thanks to the software used.

In the absence of an answer to any given question, participants could still proceed to the following question on the questionnaire. However, only questionnaires with all items completed were included in the study.

The paper questionnaires were distributed as of 16 November 2021, and computer questionnaires were sent on 6 December 2021. The inclusion end date was 10 January 2022. No reminder was sent after initial questionnaire distribution.

Statistical Analyses

Demographic data on respondents and questionnaire responses are described in figures and percentages as well as by sex, age group, profession and history of COVID-19 infection. The comparison tests used were Pearson's Chi-2 (with Monte Carlo simulations if at least one staff category included less than 5 participants). The p-value threshold was set at 5%. Statistical analyses were carried out with R v4.1.2 software.

Ethics Approval and Consent to Participate

The study was approved by the CSSCT (commission for health, safety and working conditions), institutional review board and by the hospital data protection officer (DPO). Information regarding the objectives of the study and the choice of whether or not to complete the questionnaire was provided prior to paper or computer distribution. Informed consent to participate was obtained from all participants in the study, by means of a specific question on the questionnaire.

Participants received no gift nor monetary compensation for completing the questionnaire.

Results

Following distribution of paper format and computer questionnaires, 880 were returned, including 420 paper questionnaires and 460 computer questionnaires. After exclusion of 17 incomplete questionnaires and 18 refusals to respond, we were able to analyse 845 questionnaires. The response rate was 15.2%. The sex ratio between all-hospital employees (n=5798) and respondents was the same (p=1), almost three-quarters of respondents in our study being women, the same proportion as for all hospital employees (data not shown). Among respondents, support staff were statistically significantly overrepresented (31.4% vs 17.0%) and, conversely, auxiliary nurses were underrepresented in relation to the total hospital employee population (7.6% vs 15.7%; $p<0.001$) (data not shown). The profile of respondents by age group was not representative of the age distribution in all hospital employees, with statistically significantly older respondents ($p<0.001$): indeed, the 20–29-year age group was underrepresented (26,5% vs 35,2%) and, in contrast, staff aged 50 were overrepresented among respondents (11,4% vs 7,4%).

Sociodemographic Characteristics

The general characteristics of the 845 study participants are provided in Table 1. For age groups, no statistically significant difference was observed between men and women. The 20-29-year age group was the most represented (26.5%, n=224) and the under-20 age group was the least represented, with only 4 subjects (0.5%). Concerning occupational categories, statistically significant differences were observed between men and women ($p<0.001$), with women more frequently occupying nursing and auxiliary nursing positions.

In terms of vaccination status, 99.2% of respondents were vaccinated against SARS-CoV-2, 98.0% of respondents having received at least one dose of mRNA vaccine, with no statistically significant difference between men and women. Among the 845 respondents, 197 (23.3%) reported having contracted COVID-19, with no statistically significant difference between men and women.

	Total	Men	Women	p-value
	n=845 (100%)	n=218 (25,8%)	n=627 (74,2%)	
Age				0.032
≤ 20 years	4 (0.5%)	0 (0.0%)	4 (0.6%)	
> 20 years and ≤ 29 years	224 (26.5%)	54 (24.8%)	170 (27.1%)	
≥ 30 years and ≤ 39 years	218 (25.8%)	54 (24.8%)	164 (26.2%)	
≥ 40 years and ≤ 49 years	155 (18.3%)	38 (17.4%)	117 (18.7%)	
≥ 50 years and ≤ 54 years	96 (11.4%)	26 (11.9%)	70 (11.2%)	
≥ 55 years and ≤ 59 years	96 (11.4%)	22 (10.1%)	74 (11.8%)	
≥ 69 years	52 (6.1%)	24 (11.0%)	28 (4.5%)	
Position, n/N (%)				**<0.001**
- other	89 (9.0%)	22 (10.1%)	67 (10.7%)	
- support staff	265 (31.4%)	88 (40.4%)	177 (28.2%)	
- auxiliary nurse / auxiliary nurse student	63 (7.6%)	6 (2.7%)	58 (9.2%)	
- hospital housekeeper	10 (1.2%)	0 (0.0%)	10 (1.6%)	
- medical practitioner / medical student	156 (18.5%)	68 (31.2%)	88 (14.0%)	
- ward nurse / theatre nurse / nurse anaesthetist / student nurse	213 (25.2%)	22 (10.1%)	191 (30.5%)	
- laboratory staff	48 (5.7%)	12 (5.5%)	36 (5.7%)	
Vaccination SARS-Cov-2				0.68
Yes	838 (99.2%)	217 (99.5%)	621 (99.0%)	
No	7 (0.8%)	1 (0.5%)	6 (1.0%)	
COVID-19				0.619
Yes	197 (23.31%)	54 (24.77%)	143 (22.81%)	
No	648 (76.69%)	164 (75.23%)	484 (77.19%)	
SD: Standard Deviation				

Table 1: Population characteristics.

Concerning the main reasons for accepting vaccination, respondents expressed their personal conviction (61.7%, n=521), mandatory vaccination (38.6%, n=326) and then sanitary pass (23.8%, n=201). Statistically significant differences were found between men and women. Indeed, men responded significantly to being vaccinated by conviction ($p<0.001$), whereas women more often responded to being vaccinated after information from a healthcare professional ($p<0.001$) (data not shown).

The percentage of men and women who were vaccinated after an information session organised by the hospital or following advice from their close circle was equivalent ($p=1$).

Table 2 describes the main reasons for accepting vaccination in relation to occupational categories. Statistically significant differences were observed. Thus, personal conviction was a reason for vaccination for 87.8% of medical practitioners, compared to 30.0% of hospital housekeepers (p<0.001). Mandatory vaccination was reported as a reason for vaccination by 70% of hospital housekeepers, whereas it was a reason for vaccination for only 23.0% of medical practitioners (p<0.001). The sanitary pass was a reason for vaccination reported by 33.3% of laboratory staff, whereas it was reported by only 11.5% of medical practitioners, (p=0.012). Slightly over 20% of nurses reported that information provided by a health professional was a reason for vaccination, as did 6.25% of auxiliary nurses (p=0.011); however, no hospital housekeepers reported this reason. While the opinion of the participant's close circle represented an incentive for vaccination for 20% of hospital housekeepers, it was reported by only 2.6% of medical practitioners and 2.6% of other staff (p=0.010).

The introduction of the sanitary pass prompted 32.6% (73/224) of employees aged 20 to 29 to be accept vaccination, compared with 15.57% (38/244) of those aged over 50, p<0.001. Mandatory vaccination was reported as the reason for vaccination by 48.7% of employees aged 20 to 29 compared to 25.0% of employees aged 50 to 54 (p<0.001). Personal conviction was a reason for vaccination reported by all age groups, from 56.25% in the 20 -29-year age group to 75.0% in the 55-59-year age group (p=0.076) (data not shown). Employees aged 50 to 54 reported statistically significantly (p = 0.004), higher motivation after an information session organised by the hospital at 12.5% (12/96), while it was reported by only 1.3% (3/224) for the 20-29 age group. Similarly, 10.4% (10/96) participants in the 50-54-year age group reported information in the media as a source of motivation for vaccination, compared with 1.8% (4/224) in the 20- 29-year group. This difference was statistically significant (p=0.014) (data not shown).

Reason for vaccination n (%)	Other (N=89)	Support staff (N=265)	**Auxiliary nurse (N=64)**	**Hospital housekeeper (N=10)**	**Medical practitioner (N=156)**	**Nurses (N=213)**	**Laboratory staff (N=48)**	**p-value**
Mandatory vaccination	31 (34.8)	110 (41.5)	31 (48.4)	7 (70.0)	36 (23.1)	89 (41.8)	22 (45.8)	**<0.001**
Personal conviction	58 (65.2)	148 (55.8)	26 (40.62)	3 (30.0)	137(87.8)	123(57.7)	26 (54.2)	**<0.001**
Sanitary pass	21 (23.6)	69 (26.0)	16 (25.0)	3 (30.0)	18 (11.5)	58 (27.2)	16 (33.3)	**0.012**
Information session organised by the hospital	5 (5.6)	12 (4.5)	2 (3.1)	0 (0.0)	5 (3.2)	4 (1.9)	1 (2.1)	0.512
Information in the media (television, radio, press, Internet other than social media)	4 (4.5)	16 (6.0)	2 (3.1)	1 (10.0)	14 (9.0)	12 (5.6)	3 (6.2)	0.72
Information provided by a healthcare professional	14 (15.7)	32 (12.1)	4 (6.2)	0 (0.0)	13 (8.3)	43 (20.2%)	9 (18.7)	**0.011**

Close circle opinion	2 (2.2)	12 (4.5)	0 (0.0)	2 (20.0)	4 (2.6)	19 (8.9)	2 (4.2)	**0.010**
Information provided by the occupational physician	1 (1.1)	2 (0.7)	0 (0.0)	0 (0.0)	1 (0.6)	2 (0.9)	0 (0.0)	1.000
Information from social media	0 (0.0)	2 (0.7)	1 (1.6)	0 (0.0)	2 (1.3)	0 (0.0)	0 (0.0)	0.532
Other	12 (13.5)	14 (5.3)	4 (6.2%)	1 (10.0)	4 (2.6)	13 (6.1)	1 (2.1%)	**<0.001**
(a) Pearson's Chi-square								

Table 2: Main reasons for accepting vaccination according to occupational categories.

Concerning vaccine hesitancy, one question was designed to evaluate hesitancy, 'When the vaccine was available to you, were you hesitant about vaccination?', with 3 possible answers: 'Yes, a little', 'Yes, a lot', 'No, not at all'. Among respondents, 48.8% did not describe vaccine hesitancy when the vaccine was available, whereas 34.8% reported a little hesitancy, and 16.4% strong hesitancy. The main reasons for vaccine hesitancy reported by respondents were lack of data (insufficient hindsight on the vaccine and insufficient information), followed by fear of side effects. The extent and reasons for vaccination hesitancy according to occupational category are described in Table 3. As shown, 35.9% of auxiliary nurses felt strong vaccination hesitancy compared to 3.8% of medical practitioners ($p<0.001$).

Hesitancy in relation to political/governmental aspects, lack of data, fear of side effects, opposition to vaccination in general and fear of genome modification following vaccination were more often expressed by nurses and auxiliary nurses than medical practitioners.

Laboratory staff were more likely to mistrust the government than other occupational groups. Fear of sterility was reported as a reason for vaccination hesitancy by slightly over 12% of nurses.

Reasons for hesitancy also yielded statistically significant differences by respondent age group. The lack of hesitancy for initial vaccination increased from 39.91% for employees aged 30 to 39 years, to 73.1% for employees aged 60 years and over ($p < 0.001$) (data not shown).

Reason for vaccination hesitancy n (%)	Others (N=89)	Support staff (N=265)	**Auxiliary nurse (N=64)**	**Hospital housekeeper (N=10)**	**Medical practitioner mor (N=156)**	**Nurses (N=213)**	**Laboratory staffs (N=48)**	**TOTAL (N=845)**	**p-value**
When the vaccine was available to you, were you hesitant about vaccination?									
Yes, a little	33 (37.1)	90 (34.0)	24 (37.5)	3 (30.0)	37 (23.7)	91 (42.7)	16 (33.3)	**294 (34.8)**	**<0.001**
Yes, a lot	10 (11.2)	51 (19.2)	23 (35.9)	1(10.0)	6 (3.8)	41 (19.25)	7 (14.6)	**139 (16.4)**	
No, not at all	46 (51.7)	124 (46.8)	17 (26.6)	6 (60.0)	113 (72.4)	81 (38.0)	25 (52.1)	**412 (48.8)**	
You are opposed to vaccination in general	1 (1.1)	8 (3.0)	7 (10.9)	0 (0.0)	0 (0.0)	2 (0.9)	1 (2.1)	**19 (2.2)**	0.004
You are distrustful of the government	3 (3.4)	33 (12.4)	8 (12.5)	0 (0.0)	4 (2.6)	25 (11.7)	8 (16.7)	**81 (9.6)**	0.006
You believe the vaccine was developed in the interest of laboratories and not the population	3 (3.4)	32 (12.1)	12 (18.7)	2 (20.0)	4 (2.6)	11 (5.2)	9 (18.7)	**73 (8.6)**	<0.001
You are mistrustful of healthcare professionals	0 (0.0)	4 (1.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)	0 (0.0)	**5 (0.6)**	0.388
You prefer to use alternative methods to vaccination	0 (0.0)	13 (4.9)	3 (4.7)	0 (0.0)	2 (1.3)	8 (3.8)		**27 (3.2)**	0.270
You prefer to contract COVID rather than be vaccinated	0 (0.0)	5 (1.9)	1 (1.6)	0 (0.0)	1 (0.6)	9 (4.2)	0 (0.0)	**16 (1.9)**	0.153
You are afraid of injections	2 (2.2)	14 (5.3)	1 (1.6)	1 (10.0)	1 (0.6)	5 (2.3)	1 (2.1)	**25 (2.9)**	0.104

You believe you are at low risk of developing a severe form	8 (9.0)	22 (8.3)	4 (6.2)	2 (20.0)	9 (5.8)	25 (11.7)	2 (4.2)	**72 (8.5)**	0.280
You question the point of vaccination since you will still be required to apply protective measures	3 (3.4)	30 (11.3)	9 (14.1)	0 (0.0)	0 (0.0)	14 (6.6)	5 (10.4)	**61 (7.2)**	0.001
When everyone is vaccinated or has contracted the virus, group immunity will suffice and you believe that you will not need to be vaccinated	0 (0.0)	3 (1.1)	3 (4.7)	0 (0.0)	0 (0.0)	2 (0.9)	0 (0.0)	**8 (0.9)**	0.112
You believe there is insufficient hindsight on the vaccine	31 (34.8)	110 (41.5)	30 (46.9)	4 (40.0)	22 (14.1)	98 (46.0)	17 (35.4)	**312 (36.9)**	<0.001
You believe you have insufficient information on the vaccine	12 (13.5)	53 (20.0)	21 (32.8)	2 (20.0)	6 (3.8)	53 (24.9)	11 (22.9)	**158 (18.7)**	<0.001
The appointments proposed were never at the right time	0 (0.0)	2 (0.7)	1 (1.6)	0 (0.0)	1 (0.6)	1 (0.5)	0 (0.0)	**5 (0.6)**	0.939
The vaccine you wanted was not available	5 (5.6)	7 (2.6)	4 (6.2)	0 (0.0)	4 (2.6)	12 (5.6)	0 (0.0)	**32 (3.8)**	0.320
You fear that, after vaccination, you might pass the virus on to your close circle	0 (0.0)	6 (2.3)	2 (3.1)	0 (0.0)	1 (0.6)	6 (2.8)	0 (0.0)	**15 (1.8)**	0.486
You are afraid of the side effects, even rare	16 (18.0)	63 (23.8)	20 (31.5)	3 (30.0)	15 (9.6)	56 (26.3)	16 (33.3)	**189 (22.4)**	0.001
You were hesitant to receive a booster shot following the side effects of the first dose	5 (5.6)	14 (5.3)	4 (6.2)	1 (10.0)	3 (1.92)	9 (4.2)	2 (4.2)	**38 (4.5)**	0.722
You are afraid that the mRNA vaccine might alter your genetic code	2 (2.2)	14 (5.3)	7 (10.9)	1 (10.0)	1 (0.6)	4 (1.9)	3 (6.2)	**32 (3.8)**	0.013

You have heard that the vaccine can make you sterile, infertile, and that it can disturb the menstrual cycle	7 (7.9)	21 (7.9)	5 (7.8)	1 (10.0)	2 (1.3)	26 (12.2)	4 (8.3)	**66 (7.8)**	0.030
No paper response	1 (1.1)	0 (0.0)	14 (1.6)	0 (0.0)	0 (0.0)	4 (1.9)	0 (0.0)	**19 (2.2)**	0.261
Moral reason	1 (1.1)	8 (3.0)	7 (10.9)	0 (0.0)	0 (0.0)	2 (0.9)	1 (2.1)	**19 (2.2)**	0.004
Political, governmental aspects	4 (4.5)	39 (14.7)	13 (20.3)	0 (0.0)	4 (2.6)	27 (12.7)	9 (18.7)	**96 (11.4)**	<0.001
Doctor-patient reason	0 (0.0)	4 (1.51)	0 (0.0)	0 (0.0)	0 (0.00)	1 (0.5)	0 (0.0)	**5 (0.6)**	0.386
Alternative	0 (0.0)	18 (6.8)	4 (6.2)	0 (0.0)	2 (1.3)	14 (6.6)	1 (2.1)	**39 (4.6)**	0.052
Dangerous	2 (2.2)	14 (5.3)	1 (1.6)	1 (10.0)	1 (0.6)	5 (2.3)	1 (2.1)	**25 (2.9)**	0.106
Absence of legitimacy	10 (11.2)	45 (17.0)	12 (18.7)	2 (20.0)	9 (5.8)	37 (17.4)	6 (12.5)	**121 (14.3)**	0.024
Lack of data	32 (35.9)	119 (44.9)	36 (56.2)	4 (40.0)	24 (15.4)	106 (49.8)	18 (37.5)	**339 (40.1)**	<0.001
Socioeconomic aspects	5 (5.6)	8 (3.0)	5 (7.8)	0 (0.0)	5 (3.2)	13 (6.10)	0 (0.0)	**36 (4.3)**	0.285
Side effects	21 (23.6)	83 (31.3)	26 (40.6)	4 (40.0)	20 (12.8)	76 (35.7)	18 (37.5)	**248 (29.3)**	<0.001
Other	6 (6.7)	15 (5.7)	3 (4.7)	1 (10.0)	8 (5.1)	12 (5.6)	1 (2.1)	**46 (5.4)**	0.975

Table 3: Reasons for vaccination hesitancy according to occupational categories.

Concerning acceptance of the booster dose, the majority of employees, 77.99% (95% CI [75.04-80.74]) responded that they wished to receive the COVID-19 vaccine booster dose. The reasons for acceptance of the booster dose according to occupational category are described in Table 4. Vaccine booster dose was accepted by 96.8% of medical practitioners, compared to 60% of hospital housekeepers and 65.62% of auxiliary nurses ($p<0.001$). For the 105 employees who responded that they did not wish to take the booster dose, the reasons for not accepting the booster were similar to the reasons given in the questionnaire for 78 respondents. It was also suggested that 2 doses of vaccine were sufficient for 34 respondents, and that the booster dose was not yet mandatory for 16 respondents. Thirty-four employees replied, 'Other' to this question.

Acceptance of the vaccine booster dose varied by gender: 83.9% of men accepted the booster dose, while 75.9% of women accepted ($p=0.026$) (data not shown). Acceptance of the vaccine booster dose ranged from 71.0% for employees aged 20 to 29 years, to 90.6% for employees aged 55 to 59 years ($p=0.004$). Employees with a history of COVID-19 reported accepting the vaccine booster dose at 70.6% compared to 80.2% of employees with no history of the disease ($p=0.005$) (data not shown).

Reason for booster hesitancy n (%)	**Others (N=89)**	**Support staff (N=265)**	**Auxiliary nurse (N=64)**	**Hospital housekeeper (N=10)**	**Medical practitioner / (N=156)**	**Nurses (N=213)**	**Laboratory staff (N=48)**	**TOTAL (N=845)**	**p-value**
A booster is now recommended for all healthcare establishment staff. Do you wish to receive this booster?									
I don't know	10 (11.2)	22 (8.3)	10 (15.6)	1 (10.0)	3 (1.9)	31 (14.5)	4 (8.3)	**81 (9.6)**	**<0.001**
No	7 (7.9)	46 (17.4)	12 (18.7	3 (30.0)	2 (1.3)	28 (13.1)	7 (14.6)	**105 (12.4)**	
Yes	72 (80.9)	197 (74.3)	42 (65.6)	6 (60.0)	151 (96.8)	154 (72.3)	37 (77.1)	**659 (78.0)**	
Are your reasons the same as those for initial vaccination	4 (4.5)	32 (12.1)	10 (15.6)	1 (10.0)	3 (1.9)	22 (10.3)	6 (12.5)	**78 (9.2)**	**0.012**
You believe two vaccine doses to be sufficient	1 (1.1)	17 (6.4)	4 (6.2)	2 (20.0)	0 (0.0)	7 (3.3)	3 (6.2)	**34 (4.0)**	**0.007**
The booster is not mandatory	1 (1.1)	4 (1.5)	5 (7.8)	0 (0.0)	0 (0.0)	5 (2.3)	1 (2.1)	**16 (1.9)**	**0.048**
No paper response	1 (1.1)	0 (0.0)	1 (1.6)	0 (0.0)	1 (0.6)	5 (2.3)	1 (2.1)	**9 (1.1)**	0.366
Other	4 (4.5)	12 (4.5)	1 (1.6)	1 (10.0)	1 (0.6)	14 (6.6)	1 (2.1)	**34 (4.0)**	0.038

(a) Pearson's Chi-square

Table 4: Reasons for acceptance of the booster dose according to occupational categories.

Discussion

In our study, the main reasons for vaccine hesitancy were insufficient hindsight on the vaccine, lack of information, and fear of side effects. A statistically significant difference between auxiliary nurses and medical practitioners was observed, 35.9% of auxiliary nurses feeling strong vaccination hesitancy compared to 3.8% of medical practitioners ($p<0.001$). The main reasons reported for accepting vaccination were personal conviction (61.66%), mandatory vaccination (38.58%) and sanitary pass implementation (23.79%). Concerning the booster dose, almost 80% (77.99%) of responding hospital employees accepted the booster dose. Acceptance of both initial vaccination and vaccine booster was higher in men, medical practitioners and senior employees.

Worldwide, most healthcare workers have ultimately accepted COVID-19 vaccines; however, significant hesitancy persisted in 2020–2021 and varied by region. Early surveys (2020-2021) reported moderate acceptance (~60-70%) among healthcare workers in many countries, with lower rates in lower-income settings [2]. In a study conducted in the United States from February to March 2021 in health workers [3], the mean acceptance rate for a hypothetical annual booster dose to maintain immunity was 83.6%. As in our study, vaccine hesitancy was lower among older health workers and those with a higher education level. Acceptance of the vaccine booster was higher than that observed in our study. This may be explained by the fact that this study was carried out in the United States and not in France, where the acceptance of the initial vaccination was lower [3].

In France, the COVIREIVAC study [4] collected data from 10 to 23 May 2021 from a representative sample of the French population. Among respondents, 77% intended to accept vaccination against COVID 74.3%, and those vaccinated or intending to be vaccinated reported that they would 'definitely' accept a booster dose. Although slightly lower, this booster acceptance rate is comparable to our study: 77.99% (95% CI = [75.04-80.74]). Acceptance of the vaccine booster was lower in the 25-34-year age group (60%), reaching over 90% in the over 65-year category. Women more often refused vaccination. There was also variation in vaccination acceptance by socio professional category (highest among managers 80.4% versus 59.8% among manual workers) [4].

In a survey of COVID-19 vaccine acceptance across 23 countries in 2022, multi-country data showed healthcare workers' acceptance exceeding 90 [5]. In this study, acceptance of the vaccine was strongly correlated with belief in the vaccine's ability to prevent COVID-19, in vaccine safety and trust in vaccine science. Booster hesitancy among vaccinated respondents was significantly associated with younger age in France, Germany, Poland, South Korea, Spain and Sweden (aOR = 0.96-0.98) and with older age in Ecuador (aOR = 1.09); with male respondents in Ecuador (aOR = 5.69) and with female respondents in France and the United States (aOR = 0.53-0.57) [5].

In France, acceptance rates found in the literature among the general population or among health workers ranged from 49% to 77% [4-11]. In our study, slightly under half of respondents reported that they did not feel hesitant during the initial vaccination campaign, placing our results are within the range of those found in the literature. This great variability can be explained by a variation over time, depending on the phrasing of the survey question (questioning on perceived hesitancy and not on acceptance of vaccination) and on recent events.

As in our study, on several occasions in the general population, as among health care workers, in France and throughout the world, acceptance of vaccination is higher in men [4,8,12-22], higher age groups [4,8,12-22], higher education levels and higher incomes [5-6,13-14,18], and medical practitioners [9,11-12,19-21].

The decision to receive a vaccine is a complex one. In our study, we questioned respondents on the reason(s) that triggered vaccination acceptance. Personal conviction was the first reason for vaccination, followed by mandatory vaccination and the introduction of the sanitary pass. Personal conviction can be translated into a positive benefit/risk ratio. The expected benefits may be of different kinds (individual and/or collective protection, eradicating the pandemic, etc.). In our study, we observed the same reasons as those reported in the literature: fear of COVID-19 disease, perceived as dangerous [13.15,17,22], individual and collective protection [13-15,17], belief in vaccination and science [14], helping to stop the spread of the virus [14,17], for some more specifically in the workplace [15], and the exemption of epidemic measures (restricted travel, leisure, outings, etc.) [15,17]. In their May 2020 study in the United States and Canada, Taylor et al. confirmed that respondents were in favour of receiving the vaccine if they were convinced (reassurance about the safety and efficacy of the vaccine, confidence in health authorities). They then reported mandatory vaccination and the equivalent of the sanitary pass [15].

As in our study, the most common reasons for hesitancy in the literature were: concern about the safety of the COVID-19 vaccine [24,25] and its efficacy [25,27], which could include mistrust with respect to the development and marketing approval processes [27,29] and with respect to governments [30,31], concerns about rapid vaccine development [29,30]; belief that COVID-19 is not a serious disease, preferring to contract COVID rather than accepting vaccination [20]; potential side effects [29,30] and being opposed to vaccination in general [7,8].

In our study, lack of hindsight and lack of information were respectively the second and fourth reasons for reported hesitancy. In the literature, many vaccine-hesitant subjects expressed a willingness not to get vaccinated first, preferring to wait until the vaccine experiences of others were known [10,20,25], and lack of information or time to decide [20]. Mistrust in the government was a frequently observed reason for significant hesitancy [18,30,31]. In our study, this reason for hesitancy was less frequently reported than in other studies. Mistrust of the government was reported by only 9.59% (81/845) of respondents. Similarly, in the literature, mistrust of pharmaceutical firms was widely observed [16,27-29], whereas in our study this hesitancy was reported by only 8.64% (73/845) of respondents. These data were highly variable and influenced by the study design. In our study, six employees reported that mandatory vaccination or the sanitary pass represented a reason for hesitancy. In an Italian study, 4.9% of respondents stated that the Green Pass requirement was also a motivation towards vaccination [26].

Key drivers of hesitancy include safety and side-effect concerns, mistrust of government or pharmaceutical companies, perceived low personal risk, and speed of vaccine development [2,32]. Conversely, factors promoting acceptance include belief in vaccine efficacy, fear of contracting COVID-19 (especially direct patient care), prior flu vaccination history, and sense of professional duty to protect patients. Qualitative and survey studies repeatedly find that healthcare workers who hesitate often report worries about insufficient testing, rare adverse events, or changing guidance (e.g. on pregnancy or intervals). For instance, one systematic review reported that safety/efficacy worries and distrust of pharmaceutical motives were the top reasons for hesitancy in healthcare workers [32].

Misinformation and social media also impact healthcare workers: although they have better access to scientific data, they are not immune to misinformation. Some hesitant healthcare workers report hearing conflicting expert opinions or sensationalist media stories, which amplify uncertainty [33]. On the other hand, peer influence and workplace policies can sway healthcare workers: exposure to colleagues' choices and institutional campaigns often increase uptake. Vaccine mandates for healthcare workers (adopted in certain European countries and US health systems) have eventually driven very high coverage, though they have also sparked debate on personal rights [32]. Importantly, many healthcare workers have relied on scientific journals and official guidance as trusted information sources: one Italian study found 58% of healthcare workers quoting peer-reviewed journals as their main source of COVID-19 vaccine information [34].

Our study has some limitations. Two tail tests were used for analysis. Unfortunately, multivariate analysis was impossible to perform because of the large number of variables for which the modalities had very small or zero numbers. Another bias consists in the fact that, among the respondents to our study, the 20- 29-year age group was underrepresented, whereas the 50-year age group and employees in support functions were overrepresented. One of the hypotheses that may explain this discrepancy is that older employees and support functions have easier access to their professional mailbox, hence facilitating a higher response to our study. In order to reduce this gap and to encourage participation among employees who do not use their professional mailbox on a daily basis, we also distributed the questionnaire in paper format during any visit to the occupational health and prevention department, over a broader inclusion period (16 November to 10 January).The low participation rate (15.2%) is also a limitation. The absence of a reminder probably limited the participation rate, but as we have seen, this method of questioning mainly allows the recruitment of older employees, medical practitioners and support functions who have already largely responded to our study. A social desirability bias cannot be excluded in this population of healthcare workers.

Nevertheless, the employees of the hospital group to whom we offered an opportunity to respond were very much in favour of our study. It allowed them to express themselves and offered us improved knowledge of the population we follow on a daily basis, thus allowing better preparation for future vaccination campaigns. Although our study is exploratory, the results remain of interest. Facial validity, content validity by independent expert panel, internal consistency assessed by Cronbach's coefficient or Mc Donald's omega coefficient and response to items (Rasch model) could be evaluated in a future study.

Conclusion

Our study, conducted among healthcare workers in a hospital group, found that the majority (77.99%) of respondents accepted the vaccine and the booster dose, and that men, employees over the age of 55 and the medical practitioners were more often convinced of the need for initial vaccination and vaccination booster dose. The main reasons for hesitancy were lack of hindsight, fear of side effects, and lack of information on vaccination. These results highlight the need for targeted educational interventions and credible information dissemination. Scientific journals have played, and continue to play, a pivotal role in enhancing healthcare workers' knowledge and shaping positive attitudes toward vaccination. By fostering evidence-based understanding and counteracting misinformation, journals support informed decision-making and contribute to higher vaccine acceptance rates, ultimately reinforcing the healthcare system's resilience against

pandemics. The employees expressing the greatest hesitancy towards COVID-19 vaccination against COVID-19 were women, hospital housekeepers, auxiliary nurses and the 20-29-year age group. It is therefore on these populations with greater vaccine hesitancy that we must focus our reinsurance and information efforts.

Declarations

Ethics Approval and Consent to Participate

The study was approved by the CSSCT (commission on health, safety and working conditions), institutional review board and by the hospital data protection officer (DPO). Information regarding the objectives of the study and the choice of whether or not to complete the questionnaire was provided prior to paper format or computer distribution. All experiments were performed in accordance with relevant guidelines and regulations.

Consent to Publication

Not applicable.

Availability of Data and Materials

Yes

Disclosure of Potential Conflicts of Interest

All authors have declared no conflicts of interest.

Funding

None.

Author's Contributions

Conceptualisation PS, Methodology: PS, BC, Writing - original draft preparation: PS, BC , Writing - review & editing: PS, BC

Each author has been sufficiently involved in this work to take public responsibility for appropriate portions of its content.

Acknowledgements

We warmly thank all the hospital workers who agreed to be involved in the study.

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