



When the first vaccine arrived: An investigation of factors that influenced the intention of health care workers in the national health system of Greece to be vaccinated against the SARS COV-2 virus during the first trimester of vaccine arrival

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Abstract

Background: COVID-19 vaccination started in Greece in the last days of December 2020. Health care workers (HCWs) of the public national health system (NHS) were on the frontline and they would be role models for all the citizens.

Aim: Investigation of the intention and hesitation of HCWs (doctors, nurses, and nursing assistants) of the NHS of Greece, regarding the vaccine against SARS COV-2 virus and the factors that affect them, during the first trimester of the availability of vaccines, in the country.

Methods: A multicenter cross-sectional study was conducted in Greece among health professionals ($n = 2484$) of the NHS. Data were collected with the use of an online questionnaire through snowballing sampling.

Results: Acceptance of a safe and effective COVID-19 vaccines was higher among doctors (85.6%), followed by nurses (66.3%), and nursing assistants (64.1%). This study confirms pre-existing research on the interaction of gender, age, quality of personal information, educational level, training by the employer, and cognitive background regarding viruses and vaccines.

Conclusion: In conclusion, our study showed that once a vaccine was available, most HCWs were willing to be vaccinated. These findings could be used in the future to tailor communication and promotion campaigns, using anthropocentric strategies.

KEYWORDS

COVID-19 vaccine, health care workers, vaccine hesitancy, vaccine intention

1 | INTRODUCTION

Vaccination has historically proven effective and was one of the most useful public health achievements in the 20th century.¹ As of January 2021, more than 290 candidate vaccines were introduced in

preclinical and clinical phases using both classic and next-generation platforms against SARS COV-2.² In Phase III trials, several vaccines show up to 95% efficacy in preventing symptomatic infections. The efficacy rate ranged from 62% to 96% for different COVID-19 vaccine products.³

2 | BACKGROUND

The first emergency vaccination authorization from the Food and Drug Administration (FDA) was issued in December 2020 for two new types of vaccines, based on messenger RNA (mRNA) technology.⁴ These were the BNT162b2 formulations of the pharmaceutical companies Pfizer and BioNTech (December 11, 2020)⁵ and the mRNA-1273 of the pharmaceutical company Moderna (December 18, 2020).⁶ In addition, non-mRNA vaccines (ChAdOx1 nCoV-19/AstraZeneca,⁷ and Ad26.COV2.S/Janssen Pharmaceuticals)⁸ were licensed over the next 2 months.⁹ The European Medicines Agency and the European Commission have authorized Pfizer-BioNTech COVID-19 vaccine, Moderna COVID-19 vaccine, COVID-19 Vaccine AstraZeneca, and COVID-19 Vaccine Janssen in European countries.¹⁰ In Greece, the first doses of the BNT162b2 vaccine were given on December 27, 2020, and from the beginning to the middle of February, the vaccination with mRNA-1273 and ChAdOx1 nCoV-19 started. On May 5, 2021, the first Ad26.COV2.S vaccines were administered in the country.¹¹

The arrival of the first vaccines could not cover all the existing demand and for this reason, priority lists would have to be created. Based on the Strategic Advisory Group of Experts (SAGE) on Immunization values framework, WHO recommends vaccine priority for health care workers (HCWs), citizens with a serious underlying disease, and the elderly,^{12,13} and the government of Greece argued this through the guidance of the National Organization of Public Health.¹⁴ When it comes to HCWs, many ethics researchers confirm that they should have priority access to a vaccine in a flu pandemic,^{15–18} and this has happened in the current health crisis of COVID-19.

The rationale for prioritizing HCWs lies primarily in the fact that they play an important advisory role and serve as role models in vaccination programs, building trust.^{11,19,20} Their knowledge and attitudes regarding vaccination significantly affect citizens.²¹ They are also sources of nosocomial infections, which could have been avoided,²² and often act as superspreaders transmitting the infection to their already vulnerable groups of patients.²³ In addition, they work in the frontline and are in high-risk locations. According to the European center for disease prevention and control, the proportion of HCWs among COVID-19 cases varied from 2.2% to 29% in countries with available data.²⁴ A 1 year study among nine European countries found that the risk of HCWs being hospitalized and dying was 1.8 and 1.9 times higher than non-HCWs.²⁵ Finally, infection, disease, and possible death of HCWs equal loss of critical resources of health systems, which are already at a critical juncture.²³

The experience from the past of influenza and H1N1 inherited several studies, which informed us about the reluctance of health professionals to be vaccinated.²⁶ The SAGE Working Group on Vaccine Hesitancy, concluded that vaccine hesitancy refers to delay in acceptance or refusal of vaccination despite the availability of vaccination services²⁷ and WHO proposed the “3C” model of vaccine hesitancy, which includes three aspects: confidence, convenience, and complacency. In 2019, Vaccine hesitancy has been considered by

WHO as “one of the top ten threats to global health” causing serious problems in achieving coverage for population immunity²⁸ and the hypothesis that it would adversely affect HCWs' vaccination, was obvious.

The purpose of this study was to record the trends of vaccination hesitation against the SARS COV-2 virus among professional doctors, nurses, and nursing assistants of the national health system of Greece, during the first quarter of the availability of vaccines, in the country. In addition, an attempt is made to clarify the possible correlation of various factors that affect reluctance (socio-demographic factors, media about the pandemic, behavioral attitudes, beliefs, level of knowledge about the disease, and vaccination, etc.). We chose this time period, as we considered it important to record the first image at the arrival of the vaccines and because we assumed that the initial acceptance tendency would determine the continuation.

3 | METHODS

3.1 | Study design and population

A multicentre cross-sectional study was conducted in Greece among professional doctors, nurses, and nursing assistants. The study was conducted under the scientific supervision of the Nursing Department of Greece. Data were collected with the use of an online questionnaire which was administered to the participants via email (sent by relevant nurses' associations and councils), newsletters, and social networks. A convenience snowballing sampling was utilized to recruit the participants. The inclusion criteria in this study were participants who were (1) professional doctors, nurses, or nursing assistants (2) working exclusively in the National Health System of the country in any health structure of primary, secondary, or tertiary health care, and (3) able to read and write in Greece. Exclusion criteria were self-employed, private HCWs, as well as unemployed health professionals of the above groups.

3.2 | Procedure

Data were collected through a pretested (in two hospitals among a separate group of 40 HCWs—not included in the study) for clarity, length, validity, and reliability. The results were used to improve the questionnaire. Specifically, the content validity of the instrument was designed based on the already existing relevant knowledge of the writing team, and all the questions were checked for content validity ratio (minimum content validity ratio: 0.85). The reliability of the internal consistency of the questionnaire was assessed by estimating the Cronbach's α value (dichotomous questions) and the Kuder-Richardson's value (Likert's scale questions), with results >0.70, which was considered acceptable. The test–retest reliability was assessed over a period of 2 weeks and yielded a strong positive correlation between the responses. However, the research team has

reservations about the “memory effect” phenomenon, as the time period was relatively short. On the other hand, we could not increase the retest time, as the evolution of the pandemic may have affected the responses. The finalized survey instrument was adapted for administration via the Typeform online platform.

The questionnaire consisted of six sections. The first section contained information about sociodemographic characteristics, while the second 26 dichotomous questions with answers “yes” or “no,” present data on vulnerable groups, sources of information, and data on the disease, hospitalization, and death from COVID-19 of the participants. In the third section, there were six questions regarding participants' beliefs about the risk, disease, hospitalization, and death from the virus in the future as well as the adoption of coronavirus conspiracy theories, while the fourth included 18 questions about beliefs about the COVID-19 vaccines, views on the vaccination intention, the type of vaccine, information on the vaccine, the obligation and the factors influencing the vaccination intention. Most questions in both sections were 10-point Likert (0 = not at all 10 = too much), except for two questions in Section 4, which were 5-point Likert (0 = strongly disagree to 5 = totally agree). The fifth section consisted of six questions about vaccination beliefs in general, views on vaccine hesitancy, influenza vaccination, and refusal to vaccinate themselves and the children of participants. The 10-point Likert-type questions were recorded for the purposes of the study as categorical variables of three classes (0–3 = not at all, 4–7 = moderate, and 8–10 = very much).

The last two sections were about COVID-19 disease (four questions) and SARS COV-2 vaccination (seven questions). All questions were “right,” “wrong,” and “I do not know,” except for two multiple choices. To assess the cognitive background, a scale was created based on the score of the correct answers to each question. The “I do not know” answers were considered wrong. The correct answers received a grade of 3 and the incorrect ones a score of 0. The range of scores was 0–9 for the cognitive background regarding the disease and 0–21 for the vaccination. A higher score also indicated a better cognitive background. For the specific analyses and for the knowledge regarding the disease, the score was used as a categorical variable of three classes based on the limits of the score 0–2 = lack of knowledge, 3–6 = moderate knowledge, and 7–9 = excellent knowledge, while respectively used and the knowledge rating for vaccination (0–9 = lack of knowledge, >9–15 = moderate knowledge, and >15–21 = excellent knowledge).

3.3 | Statistical analysis

Categorical data of descriptive statistics are presented as numbers and percentages. χ^2 goodness-of-fit test, or an asymptotic Likelihood ratio test, in the case where more than 20% of cells had less than five expected counts, was applied to determine the correlation between the dichotomous variable of intention to vaccination and other categorical variables of interest. Z-test was used to compare the

proportions between the cells of two variables. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 24.0 (IBM Corp). The threshold for statistical significance was defined as $p < .05$.

3.4 | Ethical considerations and human protection

This study, which is in line with the Helsinki Declaration (1964) and follows the guidelines of the European Network of Research Ethics Committees²⁹ and the National Commission for Bioethics and Technoethics,³⁰ was approved by the Committee on Research, Ethics, and Deontology (Reference Number: 36/14.01.2021) and consequently by the Scientific Council of the university hospital, where the first author works. Before completing the questionnaire, the participants were informed about the purposes of the study and provided informed consent, while they knew that their participation was voluntary. In addition, complete anonymity and noncollection of personal information (such as name, email, IP) were ensured.

4 | RESULTS

4.1 | Basic demographics

The study was administered from January 1 to March 1, 2021. Of a total of 6786 respondents, 3645 completed the questionnaire (response rate 53.71%), and 1161 of them were excluded, as they did not meet the inclusion criteria. Population consisted of 2484 HCWs, who were doctors ($n = 785$, 31.6%), registered nurses ($n = 1699$, 55.4%), and nursing assistants ($n = 323$, 13.0%) who worked in the seven health districts of the country. Regarding their education level, 1269 (51.1%) were graduates of higher education, 709 (28.8%) holders of postgraduate degrees, and 181 (7.35%) holders of a doctoral degree. The largest percentage of participants ($n = 933$, 37.6%) were 40–49 years old, while the majority were women ($n = 1901$, 76.6%). Also, most of them (68.8%) were married or had entered into a cohabitation agreement, with children (64.3%) of which 927 (37.3%) had two children. All the sociodemographic characteristics are presented in Table 1-4.

The correlation of sociodemographic factors with the intention of the sample to be vaccinated showed a statistically significant difference depending on age ($\chi^2(4) = 49.43$, $p < .001$). Specifically, individuals belonging to the age group 40–49 (75.5%), 50–59 (79.35%), and ≥ 60 (80.6%) showed a higher rate of vaccination intention compared to that of individuals aged 30–39 (65.3%) and 20–29 (63%). In addition, a statistically significant correlation emerged between gender ($\chi^2(1) = 14.47$, $p < .001$), occupational group ($\chi^2(2) = 104.66$, $p < .001$) and education ($\chi^2(4) = 69.03$, $p < .001$). In particular, men (78.3%) had a higher rate of vaccination intention compared to women (70.2%), as well as doctors (85.6%) compared to

TABLE 1 Sociodemographic characteristics and their influence on the intention of health professionals to be vaccinated

Characteristics	N (%)
Age	
20–29	332 (13.4)
30–39	636 (25.6)
40–49	933 (37.6)
50–59	516 (20.8)
≥60	67 (2.7)
Gender	
Male	581 (23.4)
Female	1901 (76.6)
Occupation	
Physician	785 (31.6)
Nursing staff	1699 (68.4)
Registered nurses	1376 (55.4)
Nursing assistants	323 (13.0)
Education	
Secondary	325 (13.1)
Tertiary	1269 (51.1)
Technological	715 (28.8)
University	554 (22.3)
Postgraduate	709 (28.5)
Doctorate	181 (7.3)
Health regions	
First	554 (22.6)
Second	266 (10.9)
Third	343 (14.0)
Fourth	303 (12.4)
Fifth	202 (8.2)
Sixth	667 (27.2)
Seventh	115 (4.7)
Health structure	
Primary	660 (26.6)
Secondary	660 (26.6)
Tertiary	1164 (46.9)
Working in COVID-19 ward	
Yes	1116 (46.7)
No	1277 (53.4)
Marital status	
Single	566 (22.80)
Married/cohabitation	1710 (68.80)
Agreement/coexist	
Widowed/divorced	208 (8.4)

TABLE 1 (Continued)

Characteristics	Vaccine intention			N (%)	Statistical test
	Total, N (%)	Willing, N (%)	Hesitant, N (%)		
Parental status					
Yes				1598 (64.3)	
No				886 (35.7)	
Number of children					
1				443 (17.8)	
2				927 (37.3)	
3				185 (7.4)	
4				43 (1.7)	
Age					
20–29	332 (13.4)	209 (63) ^a	123 (37) ^a		$\chi^2 = 49.43$ $p < 0.001$
30–39	636 (25.6)	415 (65.3) ^a	221 (34.7) ^a		
40–49	933 (37.6)	704 (75.5) ^b	229 (24.5) ^b		
50–59	516 (20.8)	409 (79.3) ^b	107 (20.7) ^b		
≥60	68 (2.7)	54 (80.6) ^{a,b}	14 (19.4) ^{a,b}		
Total	2844 (100)	1791 (72.1)	693 (27.9)		
Gender					
Male	581 (23.4)	455 (78.3) ^a	126 (21.7) ^a		$\chi^2 = 14.47$ $p < 0.001$
Female	1901 (76.6)	1335 (70.2) ^b	566 (29.8) ^b		
Total	2482 (100.0)	1790 (72.1)	692 (27.9)		
Occupation					
Physician	785 (31.6)	672 (85.6) ^a	113 (14.4) ^a		$\chi^2 = 1046$ $p < 0.001$
Registered nurses	1376 (55.4)	912 (66.3) ^b	464 (33.7) ^b		
Nurse assist.	323 (13.0)	207 (64.1) ^b	116 (35.9) ^b		
Total	2484 (100.0)	1791 (72.1)	693 (27.9)		
Education					
Secondary	325 (13.1)	207 (63.7) ^a	118 (36.3) ^a		$\chi^2 = 69.03$ $p < 0.001$
Technological	715 (28.8)	457 (63.9) ^a	258 (36.1) ^a		
University	554 (22.3)	445 (80.3) ^b	109 (19.7) ^b		
Postgraduate	709 (28.5)	530 (74.8) ^b	179 (25.2) ^b		
Doctorate	181 (7.3)	152 (84.0) ^b	29 (16.0) ^b		
Total	2484 (100.0)	1791 (72.1)	693 (27.9)		
Education of nursing staff					
Secondary	323 (19.0)	207 (64.1) ^a	116 (35.9) ^a		$\chi^2 = 7.61$ $p = .107$
Technological	711 (41.8)	453 (63.7) ^a	258 (36.3) ^a		
University	123 (7.2)	80 (65.0) ^a	43 (35.0) ^a		
Postgraduate	510 (30.0)	360 (70.6) ^a	150 (29.4) ^a		
Doctorate	32 (1.9)	19 (59.4) ^a	13 (40.6) ^a		
Total	1699 (100)	1119 (65.9)	580 (34.1)		

(Continues)

TABLE 1 (Continued)

	Vaccine intention			Statistical test
	Total, N (%)	Willing, N (%)	Hesitant, N (%)	
Education of physicians				
University	437 (55.7)	369 (84.4) ^a	68 (15.6) ^a	$\chi^2 = 2.10$ $p = .349$
Postgraduate	199 (25.4)	170 (85.4) ^a	29 (14.6) ^a	
Doctorate	149 (19.0)	133 (89.3) ^a	16 (10.7) ^a	
Total	785 (100.0)	672 (85.6)	113 (14.4)	

Note: Different superscript letters symbolize subcategories of socio-demographic characteristics (columns) whose percentages differ statistically significantly, at the level of statistical significance $\alpha < 0.05$ (z-test comparison of percentages).

TABLE 2 Vaccination intention of HCWs in relation to personal data related to COVID-19

	Vaccine intention			Statistical test
	Total, N (%)	Willing, N (%)	Hesitant, N (%)	
Number of tests				
0-3	1043 (44.1)	758 (72.7) ^a	285 (27.3) ^a	$\chi^2 = 1.45$ $p = .693$
4-6	823 (34.8)	607 (73.8) ^a	216 (26.2) ^a	
7-9	218 (9.2)	160 (73.4) ^a	58 (26.6) ^a	
≥ 10	281 (11.9)	197 (70.1) ^a	84 (29.9) ^a	
Total	2365 (100.0)	1722 (72.8)	643 (27.2)	
Personal positive test history				
Yes	174 (7.0)	99 (56.9) ^a	75 (43.1) ^a	$\chi^2 = 21.50$ $p < .001$
No	2310 (93.0)	1692 (73.2) ^b	618 (26.8) ^b	
Total	2484 (100.0)	1791 (72.1)	693 (27.9)	
Personal COVID-19 hospitalization history				
Yes	21 (0.8)	12 (57.1) ^a	9 (42.9) ^a	$\chi^2 = 2.35$ $p = .125$
No	2463 (99.2)	1779 (72.2) ^a	684 (27.8) ^a	
Total	2484 (100.0)	1791 (72.1)	693 (27.9)	
Positive person in the family (or friend) in the past				
Yes	1353 (54.5)	1016 (75.1) ^a	337 (24.9) ^a	$\chi^2 = 13.21$ $p < .001$
No	1131 (45.5)	775 (68.5) ^b	356 (31.5) ^b	
Total	2484 (100.0)	1791 (72.1)	693 (27.9)	
Death from COVID-19 in the family (or friend) in the past				
Yes	447 (18.0)	351 (78.5) ^a	96 (21.5) ^a	$\chi^2 = 11.17$ $p < .001$
No	2037 (82.0)	1440 (70.7) ^b	597 (29.3) ^b	
Total	2484 (100.0)	1791 (72.1)	693 (27.9)	

Note: Different letters symbolize subcategories of sociodemographic characteristics (columns) whose percentages differ statistically significantly, at the level of statistical significance $\alpha < .05$ (z-test comparison of percentages).

nurses (66.3%) and nursing assistants (64.1%). Also, the higher level of education was associated with a higher intention to vaccinate, as the graduates of secondary education (63.7%) and technological education (63.9%) had lower percentages compared to the graduates

of university education (80.3%), holders of a postgraduate degree (74.8%) and holders of a doctoral degree (84.0%). Finally, the relationship between the intention to vaccinate was not independent of the Health District in which the nurses worked ($\chi^2(6) = 19.93$,

TABLE 3 Vaccination intention of HCWs in relation to personal data related to COVID-19

	Vaccine intention			Statistical test
	Total, N (%)	Willing, N (%)	Hesitant, N (%)	
Feeling of danger of the virus (all HCWs)				
Yes	2140 (86.2)	1635 (76.4) ^a	505 (23.6) ^a	$\chi^2 = 142.07$ $p < .001$
No	344 (13.8)	156 (45.3) ^b	188 (54.7) ^b	
Total	2484 (100.0)	1791 (72.1)	693 (27.9)	
Feeling of danger of the virus (physicians)				
Yes	681 (86.8)	605 (88.8) ^a	76 (11.2) ^a	$\chi^2 = 43.65$ $p < .001$
No	104 (13.2)	67 (64.4) ^b	37 (35.6) ^b	
Total	785 (100.0)	672 (85.6)	113 (14.4)	
Feeling of danger of the virus (registered nurses)				
Yes	1169 (85.0)	831 (71.1) ^a	338 (28.9) ^a	$\chi^2 = 80.35$ $p < .001$
No	207 (15.0)	81 (39.1) ^b	126 (60.9) ^b	
Total	1376 (100.0)	912 (66.3)	464 (33.7)	
Feeling of danger of the virus (nursing assistants)				
Yes	290 (89.8)	199 (68.6) ^a	91 (31.4) ^a	$\chi^2 = 25.35$ $p < .001$
No	33 (10.2)	8 (24.2) ^b	25 (75.8) ^b	
Total	323 (100.0)	207 (64.1)	116 (35.9)	

Abbreviation: HCWs, health care workers.

Note: Different letters symbolize subcategories of personal data (columns) whose percentages differ statistically significantly, at the level of statistical significance $\alpha = .05$ (z-test comparison of percentages).

TABLE 4 Attitudes of HCWs about the SARS COV-2 virus and its influence in a family member in the future

	Vaccine intention			Statistical test
	Total, N (%)	Willing, N (%)	Hesitant, N (%)	
Possibility of future infection of a family member				
Not at all/little	186 (7.5)	117 (62.9) ^a	69 (37.1) ^a	$\chi^2 = 14.92$ $p < .001$
Enough	1544 (62.6)	1103 (71.4) ^b	441 (28.6) ^b	
Very	737 (29.9)	563 (76.4) ^c	174 (23.6) ^c	
Total	2467 (100.0)	1783 (72.3)	684 (27.7)	
Possibility of future death of a family member				
Not at all/little	542 (22.9)	348 (64.2) ^a	194 (35.8) ^a	$\chi^2 = 32.12$ $p < .001$
Enough	1471 (62.1)	1082 (73.6) ^b	389 (26.4) ^b	
Very	356 (15.0)	288 (80.9) ^c	68 (19.1) ^c	
Total	2369 (100.0)	1718 (72.5)	651 (27.5)	

Note: Different letters symbolize subcategories of the sense of danger of the virus (columns) whose percentages differ statistically significantly, at the level of statistical significance $\alpha = .05$ (z-test comparison of percentages).

$p = .003$), the working department ($\chi^2(1) = 23.09$, $p < .001$), as well as the parental status ($\chi^2(1) = 10.57$, $p = .008$), in all the participants. Corresponding results are recorded for those nurses who worked in COVID-19 departments (43.6%) compared to those who worked in non-COVID-19 (56.4%).

4.2 | General and personal factors

Regarding the vulnerable groups of the sample ($n = 444$, 17.9% of the total), a statistically significant difference was found with respect to pregnant women ($\chi^2(1) = 26.72$, $p < .001$), who had a lower rate of

TABLE 5 The role of conspiracy theories

	Vaccine intention			Statistical test
	Total, N (%)	Willing, N (%)	Hesitant, N (%)	
<i>Question: How much do you embrace conspiracy theories about the new coronavirus?</i>				
All HCWs				
Not at all/little	2134 (85.9)	1626 (76.2) ^a	508 (23.80) ^a	$\chi^2 = 143.80$ $p < .001$
Moderate	272 (11.0)	142 (52.2) ^b	130 (47.8) ^b	
Very	77 (3.1)	22 (28.6) ^c	55 (71.4) ^c	
Total	2483 (100.0)	1790 (72.1)	693 (27.9)	
Physicians				
Not at all/little	735 (93.6)	642 (87.3) ^a	93 (12.7) ^a	$\chi^2 = 32.32$ $p < .001$
Moderate	42 (5.4)	27 (64.3) ^b	15 (35.7) ^b	
Very	8 (1.0)	3 (37.5) ^b	5 (62.5) ^b	
Total	785 (100.0)	672 (85.60)	113 (14.4)	
Registered nurses				
Not at all/little	1148 (83.5)	812 (70.70) ^a	336 (29.3) ^a	$\chi^2 = 75.29$ $p < .001$
Moderate	172 (12.5)	86 (50.0) ^b	86 (50.0) ^b	
Very	55 (4.0)	13 (23.60) ^c	42 (76.4) ^c	
Total	1375 (100.0)	911 (66.3)	464 (33.7)	
Nursing assistants				
Not at all/little	251 (77.7)	172 (68.5) ^a	79 (31.5) ^a	$\chi^2 = 9.89$ $p = .007$
Moderate	58 (18.0)	29 (50.0) ^b	29 (50.0) ^b	
Very	14 (4.3)	6 (42.9) ^{a,b}	8 (57.10) ^{a,b}	
Total	323 (100.0)	207 (64.1)	116 (35.9)	

Abbreviation: HCWs, health care workers.

Note: Different letters symbolize subcategories of COVID-19 disease beliefs (columns) whose percentages differ statistically significantly, at the level of statistical significance $\alpha = .05$ (z-test percentage comparison).

vaccination intention (25.0%) compared to those who were not pregnant (72.6%). Physicians and registered nurses who had been diagnosed with coronavirus in the past had a statistically significantly lower rate of vaccination intention ($\chi^2(1) = 11.48$, $p < .001$) and ($\chi^2(1) = 11.60$, $p < .001$), respectively. The reverse was true for both health professionals who previously had a COVID-19 positive family member ($\chi^2(1) = 13.21$, $p < .001$), as well as for physicians and registered nurses who had experienced a death from COVID-19, in their families ($\chi^2(1) = 3.12$, $p = .088$) and ($\chi^2(1) = 7.38$, $p = .007$), respectively. Finally, nursing assistants who had performed >10 diagnostic tests for the virus, intend to be vaccinated at a higher rate than the other health professionals ($\chi^2(1) = 7.98$, $p = .046$) (Table 2).

4.3 | Attitudes and beliefs

HCWs who consider the virus to be dangerous, and those who consider it very likely to get coronavirus ($\chi^2(2) = 14.92$, $p < .001$) or to have a

family member die in the future ($\chi^2(2) = 32.12$, $p < .001$), show higher rates of vaccination intention (Tables 2–5). Doctors ($\chi^2(2) = 32.32$, $p < .001$), nurses ($\chi^2(2) = 75.29$, $p < .001$), and nursing assistants ($\chi^2 = 9.89$, $p = .007$), who embrace conspiracy theories to a great extent, evoke increased hesitation (Table 6). Regarding the vaccine they would choose against the coronavirus, HCWs who would choose a type of mRNA vaccine has a statistically significantly greater intention to be vaccinated ($\chi^2(2) = 299.62$, $p < .001$), as well as health professionals who consider that the vaccine against the new coronavirus should be mandatory for health professionals ($\chi^2(1) = 292.10$, $p < .001$) (Table 7). Statistically significantly higher percentage of vaccination intention is shown by health professionals who state that they were greatly influenced in their decision to be vaccinated by the effectiveness of the vaccine ($\chi^2(2) = 471.74$, $p < .001$), by its safety ($\chi^2(2) = 39.35$, $p < .001$), from the duration of protection provided ($\chi^2(2) = 127.39$, $p < .001$), from the number of infected ($\chi^2(2) = 501$, 96 , $p < .001$) and deaths ($\chi^2(2) = 457.45$, $p < .001$), as well as by those who are greatly encouraged by family and friends ($\chi^2(2) = 32.06$, $p < .001$). Those HCWs who are

TABLE 6 Opinions on the possibility of mandatory vaccination

	Vaccine intention			Statistical test
	Total, N (%)	Willing, N (%)	Hesitant, N (%)	
<i>Question: Do you agree to a possible mandatory vaccination in the future?</i>				
All HCWs				
I totally agree/I agree	914 (36.8)	666 (26.8) ^a	248 (27.1) ^a	$\chi^2 = 0.92$ $p = .628$
I totally disagree/I disagree	1187 (47.8)	856 (34.5) ^a	331 (27.9) ^a	
Do not know	383 (15.4)	269 (10.8) ^a	114 (29.8) ^a	
Total	2484 (100.0)	1791 (72.1)	693 (27.9)	
Physicians				
I totally agree/I agree	311 (39.6)	262 (84.2) ^a	49 (15.8) ^a	$\chi^2 = 1.48$ $p = .477$
I totally disagree/I disagree	354 (45.1)	309 (87.3) ^a	45 (12.7) ^a	
Do not know	120 (15.3)	101 (84.2) ^a	19 (15.80) ^a	
Total	785 (100.)	672 (85.6)	113 (14.4)	
Registered nurses				
I totally agree/I agree	500 (36.3)	333 (66.6) ^a	167 (33.4) ^a	$\chi^2 = 0.03$ $p = .982$
I totally disagree/I disagree	672 (48.8)	444 (66.1) ^a	228 (33.9) ^a	
Do not know	204 (14.8)	135 (66.2) ^a	69 (33.8) ^a	
Total	1376 (100.0)	912 (66.3)	464 (33.7)	
Nursing assistants				
I totally agree/I agree	103 (31.9)	71 (68.9) ^a	32 (31.1) ^a	$\chi^2 = 2.75$ $p = .252$
I totally disagree/I disagree	161 (49.8)	103 (64.0) ^a	58 (36.0) ^a	
Do not know	59 (18.3)	33 (55.9) ^a	26 (44.1) ^a	
Total	323 (100.0)	207 (64.1)	116 (35.9)	

Abbreviation: HCWs, health care workers.

Note: Different letters symbolize the subcategories of the adoption of conspiracy theories about the new coronavirus (columns) whose percentages differ statistically significantly, at the level of statistical significance $\alpha = .05$ (z-test comparison of percentages).

strongly influenced by their religious beliefs show less intention to be vaccinated ($\chi^2(2) = 26.35, p < .001$) (Table 7).

4.4 | Knowledge about SARS COV-2 virus and COVID-19 vaccination

HCWs of the National Health Service inform about COVID-19 in a larger percentage (62.8%) from scientific articles and follow as sources of information the instructions of the National Public Health Organization (54.6%) and the internet (49.3%). The smallest percentage as a source of information corresponds to the newspapers (6.2%). Those who were informed by social media and television programs had the lower vaccination intention, while those who chose information from WHO, had the highest. Regarding the degree of information about SARS COV-2 vaccination from the organization where HCWs worked, those who considered themselves to be moderately and very well informed were more likely to

be vaccinated than those who were not feeling that they were adequately informed ($\chi^2(2) = 88.84, p < .001$). In terms of the knowledge background about the virus, doctors gather the largest percentage of sufficient knowledge ($n = 316, 40.3\%$), followed by nurses ($n = 326, 23.8\%$) and nursing assistants ($n = 50, 15.5\%$). Corresponding results are obtained for the cognitive background for the coronavirus vaccine, with the doctors having the highest percentage of sufficient knowledge ($n = 414, 52.7\%$) followed by the nurses ($n = 277, 20.2\%$) and nursing assistants ($n = 43, 13.3\%$). Also, HCWs who were university graduates showed a higher level of adequate knowledge about COVID-19 disease ($\chi^2 = 77.89, p < .001$), while PhD holders had a higher rate of vaccination ($\chi^2(2) = 283, 95, p < .001$). Physicians with adequate knowledge of COVID-19 disease intend to be vaccinated at a higher rate ($\chi^2(2) = 10.91, p < .005$), while in terms to the SARS COV-2 vaccine cognitive background, doctors ($\chi^2(2) = 13.52, p < .002$), nurses ($\chi^2(2) = 55.09, p < .001$) and nursing assistants ($\chi^2(2) = 13.30, p < .001$), who have sufficient knowledge show lower rates of hesitancy (Tables 8–10).

TABLE 7 Critical factors influencing the decision to be vaccinated

	Vaccine intention			Statistical test
	Total, N (%)	Willing, N (%)	Hesitant, N (%)	
Vaccine effectiveness				
Not at all/little	329 (13.2)	102 (31.0) ^a	227 (69.0) ^a	$\chi^2 = 471.74$ $p < .001$
Moderate	1055 (42.5)	698 (66.2) ^b	357 (33.8) ^b	
Very	1100 (44.3)	991 (90.1) ^c	109 (9.9) ^c	
Total	2484 (100.0)	1791 (72.1)	693 (27.9)	
Vaccine safety				
Not at all/little	480 (19.3)	298 (96.2) ^a	182 (37.9) ^a	$\chi^2 = 39.35$ $p < .001$
Moderate	1077 (43.4)	771 (71.6) ^b	306 (28.4) ^b	
Very	926 (37.3)	721 (77.9) ^c	205 (22.1) ^c	
Total	2483 (100.0)	1790 (97.2)	693 (92.7)	
Increasing number of infected				
Not at all/little	336 (13.5)	98 (29.2) ^a	238 (70.8) ^a	$\chi^2 = 501.96$ $p < .001$
Moderate	1018 (41.0)	677 (66.5) ^b	341 (33.5) ^b	
Very	1130 (45.5)	1016 (89.9) ^c	114 (10.1) ^c	
Total	2484 (100.0)	1016 (72.1) ^c	693 (27.9)	
Increasing number of deaths				
Not at all/little	380 (15.3)	129 (33.9) ^a	251 (66.1) ^a	$\chi^2 = 457.45$ $p < .001$
Moderate	1040 (41.9)	703 (67.6) ^b	337 (93.2) ^b	
Very	1064 (42.8)	959 (90.1) ^c	105 (15.2) ^c	
Total	2484 (100.0)	1791 (72.1)	693 (27.9)	
Duration of vaccine protection				
Not at all/little	550 (22.2)	294 (53.5) ^a	256 (46.5) ^a	$\chi^2 = 127.39$ $p < .001$
Moderate	1261 (50.8)	954 (75.7) ^b	307 (24.3) ^b	
Very	672 (27.1)	542 (80.7) ^c	130 (19.3) ^c	
Total	2483 (100.0)	1790 (72.1)	693 (27.9)	
Encouragement from the family				
Not at all/little	1308 (52.7)	896 (68.5) ^a	412 (31.5) ^a	$\chi^2 = 32.06$ $p < .001$
Enough	892 (35.9)	654 (73.3) ^b	238 (26.7) ^b	
Very	284 (11.4)	241 (84.9) ^c	43 (15.1) ^c	
Total	2484 (100.0)	1791 (72.1)	693 (27.9)	
Degree of influence from religious beliefs				
Not at all/little	418 (65.3)	289 (69.1) ^a	129 (30.9) ^a	$\chi^2 = 26.35$ $p < .001$
Enough	166 (25.9)	83 (50.0) ^b	83 (50.0) ^b	
Very	56 (8.8)	25 (44.6) ^b	31 (55.4) ^b	
Total	640 (100.0)	397 (62.0)	243 (38.0)	

Note: Different letters symbolize subcategories of vaccination obligation (columns) whose percentages differ statistically significantly, at the level of statistical significance $\alpha = .05$ (z-test percentage comparison).

TABLE 8 Vaccination intention in relation to information sources

	Vaccine intention			Statistical test
	Total, N (%)	Willing, N (%)	Hesitant, N (%)	
Social media				
Yes	832 (33.5)	577 (69.4) ^a	255 (30.6) ^a	$\chi^2 = 4.70$ $p = .030$
No	1652 (66.5)	1214 (73.5) ^b	438 (26.5) ^b	
Total	2484 (100.0)	1791 (72.1)	693 (27.9)	
Internet				
Yes	1224 (49.3)	878 (71.7) ^a	346 (28.3) ^a	$\chi^2 = 0.16$ $p = .686$
No	1260 (50.7)	913 (72.5) ^a	347 (27.5) ^a	
Total	2484 (100.0)	1791 (72.1)	693 (27.9)	
Television				
Yes	670 (27.0)	455 (67.9) ^a	215 (32.1) ^a	$\chi^2 = 8.01$ $p = .005$
No	1814 (73.00)	1336 (73.6) ^b	478 (26.4) ^b	
Total	2484 (100.0)	1791 (72.1)	693 (27.9)	
Newspaper				
Yes	153 (6.2)	114 (74.5) ^a	39 (25.5) ^a	$\chi^2 = 0.47$ $p = .493$
No	2331 (93.8)	1677 (71.9) ^a	654 (28.1) ^a	
Total	2484 (100.0)	1791 (72.1)	693 (27.9)	
Scientific articles				
Yes	1561 (62.8)	1210 (77.5) ^a	351 (22.5) ^a	$\chi^2 = 61.19$ $p = .001$
No	923 (37.2)	581 (62.9) ^b	342 (37.1) ^b	
Total	2484 (100.0)	1791 (72.1)	693 (27.9)	
National Organization of Public Health				
Yes	1357 (54.6)	1049 (77.3) ^a	308 (22.7) ^a	$\chi^2 = 40.22$ $p < .001$
No	1127 (45.4)	742 (65.8) ^b	385 (34.2) ^b	
Total	2484 (100.0)	1791 (72.1)	693 (27.9)	
World Health Organization				
Yes	1059 (42.6)	794 (75.0) ^a	265 (25.0) ^a	$\chi^2 = 7.58$ $p = .006$
No	1425 (57.4)	997 (70.0) ^b	428 (30.0) ^b	
Total	2484 (100.0)	1791 (72.1)	693 (27.9)	
Degree of information from the hospital				
Not at all/small	1093 (44.0)	685 (62.7) ^a	408 (37.3) ^a	$\chi^2 = 88.84$ $p < .001$
Moderate	844 (34.0)	658 (78.0) ^b	186 (22.0) ^b	
Large	547 (22.0)	448 (81.9) ^b	99 (18.1) ^b	
Total	2484 (100.0)	1791 (72.1)	693 (27.9)	

Note: Different letters symbolize subcategories of personal data (columns) whose percentages differ statistically significantly, at the level of statistical significance $\alpha = .05$ (z-test comparison of percentages).

5 | DISCUSSION

During our study, a vaccine against the SARS COV-2 virus was available in Greece and HCWs were among those that would be given priority. According to our findings, 72.1% were willing to

receive a safe and effective vaccine, which is very close to the reported vaccine coverage of HCWs in Greece (72.6%) at the end of May 2021.³¹ Also, at the time of our study was completed, a scoping review of 35 studies globally reported an average rate hesitancy of 22.51%,³² that is, 7% lower compared to our study.

TABLE 9 Correlation of knowledge background about COVID-19 and intention to be vaccinated

	Vaccine intention			Statistical test
	Total, N (%)	Willing, N (%)	Hesitant, N (%)	
COVID-19 knowledge background (All HCWs)				
Incomplete	54 (2.2)	33 (61.1) ^a	21 (38.9) ^a	$\chi^2 = 21.89$ $p < .001$
Moderate	1733 (69.9)	1212 (69.9) ^a	521 (30.1) ^a	
Adequate	692 (27.9)	544 (78.6) ^b	148 (21.4) ^b	
Total	2479 (100.0)	1789 (72.2)	690 (27.8)	
COVID-19 knowledge background (physicians)				
Incomplete	11 (1.4)	6 (54.5) ^a	5 (45.5) ^a	$\chi^2 = 10.91$ $p < .005$
Moderate	458 (58.3)	387 (84.5) ^b	71 (15.5) ^b	
Adequate	316 (40.3)	279 (88.3) ^b	37 (11.7) ^b	
Total	785 (100.0)	672 (85.6)	113 (14.4)	
COVID-19 knowledge background (registered nurses)				
Incomplete	33 (2.4)	23 (69.7) ^a	10 (30.3) ^a	$\chi^2 = 4.28$ $p = .116$
Moderate	1013 (73.8)	656 (64.8) ^a	357 (35.2) ^a	
Adequate	326 (23.8)	231 (70.9) ^a	95 (29.1) ^a	
Total	1372 (100.0)	910 (66.3)	462 (33.7)	
COVID-19 knowledge background (nursing assist.)				
Incomplete	10 (3.1)	4 (40.0) ^a	6 (60.0) ^a	$\chi^2 = 2.87$ $p = .259$
Moderate	262 (81.4)	169 (64.5) ^a	93 (35.5) ^a	
Adequate	50 (15.5)	34 (68.0) ^a	16 (32.0) ^a	
Total	322 (100.0)	207 (64.3)	115 (35.7)	

Note: Different letters symbolize subcategories of information sources (columns) whose percentages differ statistically significantly, at the level of statistical significance $\alpha = .05$ (z-test comparison of percentages).

Vaccination hesitation can be triggered by various factors. This study confirms pre-existing research on the interaction of gender, age, quality of personal information, educational level, training by the employer, and cognitive background regarding viruses and vaccines. Also, parenting, family history of illness or death, as well as the adoption of conspiracy theories and religious beliefs, proved to be critical factors in our study. Below, we will seek to negotiate some of the above factors.

5.1 | The influence of demographic characteristics

The study showed that men are more willing to be vaccinated than women. This is completely in line with the results of a number of previous studies in Greece,^{33,34} Hong Kong,³⁵ Israel,³⁶ France,³⁷⁻³⁹ Congo,⁴⁰ USA,⁴¹⁻⁴³ Spain,⁴⁴ and Italy.⁴⁵ A study in five European countries (three European Union—Greece, Spain, Cyprus, and two non EU Albania and Kosovo, report that women HCWs show higher rates of vaccination hesitation.⁴⁶ This female reluctance has also been reported in a 2017 review of tetanus, diphtheria, pertussis, and influenza vaccinations.⁴⁷ The increased chance of serious illness or

even death due to COVID-19, which is observed in men, and the unfounded rumors about vaccines having detrimental effects on fertility, pregnancy, and breastfeeding, are probably interpretive factors. All of the above advocate the development of a targeted strategy aimed at increasing the percentage of vaccinated women.

An additional demographic factor influencing vaccination intention was age. Older HCWs were more likely to be vaccinated, and this finding is confirmed by several studies.^{38,48-52} However, we believe that the explanation is quite related to the increased risk of age-related infection and the fact that the elderly are associated with higher rates of serious illness and mortality compared to the young.⁵³

In addition, our study showed a positive correlation between parenthood and vaccination intention, a finding that is in line with other studies.^{20,54} The sense of a parent's uniqueness in raising their children, and the potential fear of hospitalization and/or death, as well as their impact on children, are possible reasons.

Also, professional status has been shown to affect the willingness to vaccinate. Doctors were more willing to be vaccinated than nurses, while nurses' assistants were even less willing. This is confirmed by many studies on COVID-19,^{34,36,55,56} but has been demonstrated in the past and in studies on influenza.⁵⁷⁻⁵⁹ Maybe

TABLE 10 Correlation of knowledge background about COVID-19 vaccines and intention to be vaccinated

	Vaccine intention			Statistical test
	Total, N (%)	Willing, N (%)	Hesitant, N (%)	
Vaccines knowledge background (all HCWs)				
Incomplete	425 (17.1)	226 (53.2) ^a	199 (46.8) ^a	$\chi^2 = 146.03$ $p < .001$
Moderate	1322 (53.3)	932 (70.5) ^b	390 (29.5) ^b	
Adequate	734 (29.6)	630 (85.8) ^c	104 (14.2) ^c	
Total	248 (100.0)	1788 (72.1)	693 (27.9)	
Vaccines knowledge background (physicians)				
Incomplete	28 (3.6)	19 (67.9) ^a	9 (32.1) ^a	$\chi^2 = 13.52$ $p = .002$
Moderate	343 (43.7)	284 (82.8) ^a	59 (17.2) ^a	
Adequate	414 (52.7)	369 (89.10) ^b	45 (10.9) ^b	
Total	785 (100.0)	672 (85.6)	113 (14.4)	
Vaccine's knowledge background (Registered Nurses)				
Incomplete	798 (58.1)	525 (65.8) ^b	273 (34.2) ^b	$\chi^2 = 55.09$ $p < .001$
Moderate	277 (20.2)	227 (81.9) ^c	50 (18.1) ^c	
Adequate	1373 (100.0)	909 (66.2)	464 (33.8)	
Total				
Vaccine's knowledge background (nursing assist.)				
Incomplete	99 (30.7)	50 (50.5) ^a	49 (49.5) ^a	$\chi^2 = 13.30$ $p = .001$
Moderate	181 (56.0)	123 (68.0) ^b	58 (32.0) ^b	
Adequate	43 (13.3)	34 (79.1) ^b	9 (20.9) ^b	
Total	323 (100.0)	207 (64.1)	116 (35.9)	

Note: Different letters symbolize the subcategories of the cognitive background for COVID-19 (columns) whose percentages differ statistically significantly, at the level of statistical significance $\alpha = .05$ (z-test percentage comparison).

there are some reasons for this phenomenon, as our study showed that doctors have a higher awareness of the risk of the virus and a more adequate cognitive background compared to the nursing staff, which more often adopts conspiracy theories and consists mainly of women.

Finally, our study proves and confirms the existing data from other studies^{33,36,37,40,43} that a higher level of education favors a greater intention to vaccinate. Studies found that HCWs' confidence in the safety and benefit of vaccines was related to their educational level.^{60,61} Holders of PhD and postgraduate degrees and university graduates show lower rates of hesitancy compared to graduates of technology or secondary schools.

5.2 | The influence of vulnerability

There are studies that confirmed high rates of intention in HCWs with chronic diseases,^{35,39,45,62} but our study confirms a strong positive effect in participants with underlying heart disease (82.7%) or oncological history (79.7%). The other vulnerable groups of participants did not differ significantly compared to the healthy

ones. At the same time, pregnant women had the lowest intention rates (25%). We consider the initial reluctance of pregnant women to be completely normal, because WHO, in the context of the initial prioritization plan for the distribution of vaccines, excluded pregnant women and children.

Also, HCWs who had been infected with the coronavirus in the past had a statistically significantly lower rate of vaccination intention than their noninfected colleagues. A study from Spain,⁴⁴ is in line with this.

5.3 | The influence of attitudes and beliefs

Our multicenter study seals the clear and decisive role that other similar studies^{36,44,63,64} have shown in the fact that there is a strong negative impact of historical seasonal vaccination for influenza, as well as HCWs who report a history of hesitation and have postponed and/or refused in the past one of the general vaccines.

Another fact that highlights the impact of beliefs is the increased intention to vaccinate those who consider the virus dangerous, as well as those who feel very likely in the future to

become infected and/or die a member of their family, due to the SARS COV-2 virus. In addition, HCWs who say they are encouraged to be vaccinated, to a large extent by family and friends, as well as those who agree on the obligation to HCWs, show low levels of vaccination hesitation. There are already published studies^{44,64,65} that have shown the correlation between conspiracy theories and the effect of religious beliefs on vaccination reluctance. Our study proves the above correlation.

5.4 | The influence of knowledge

A final subject of discussion, which emerged from our study and we cite, is the HCWs' cognitive background on the virus and its vaccination and its positive effect on the willingness to vaccinate. Although there was a difference in the level of knowledge of the three occupational categories, with physicians having the highest rates and nursing assistants having the lowest, all participants with adequate knowledge of both virus and vaccination subjects, were shown to have the intention to get vaccinated at a higher rate, which has been confirmed by other studies.^{40,66}

6 | LIMITATIONS AND STRENGTHS

A major limitation of our study is that it was a cross-sectional one and used a convenience sampling method with snowballing samples method. The above limits the generalization of conclusions for all HCWs in the country. Moreover, at the time of the study, the only vaccines which were available for the country, were mRNA vaccines, although we tried to improve the balance by asking what kind of vaccine they would intend to do.

On the other hand, an important strength was the very large sample and its origin, as it concerned all health districts and all levels of health care. We also consider, the time of the study very important. Before our study and as no vaccines were available, there was only discussion in theory, and a few months after our study, vaccination for HCWs, was mandatory. We believe that we have managed to record the intention, but also the hesitancy at a very critical point in time.

7 | CONCLUSIONS

This study assessed the intention of doctors, nurses, and nursing assistants who were working in the public health system of Greece, to get vaccinated with a COVID-19 vaccine in the first 2 months after vaccine availability. 72.1% of HCWs were willing to get vaccinated, while the rest 27.9% were hesitant. Variables associated with reduced vaccination intention are female gender, age (<40), pregnancy, conspiracy theories, reluctance to refuse or postpone vaccination in the past, low level of education, invalid individual

information, low level of training from the employer, and low level of knowledge about the virus and the vaccine. Also, special attention should be paid to the low vaccination rates of health professionals for seasonal flu, as this factor is also negatively related. Conversely, physicians (compared to nursing staff), university graduates, post-graduate and doctoral students, HCWs who were informed through EODY and WHO, as well as those who had experienced a congenital disease or death due to the virus, and increased intention to be vaccinated.

In conclusion, our study showed that once a vaccine was available, most HCWs were willing to be vaccinated, and it also identified several reasons for hesitation. These findings could be used in the future to tailor communication and promotion campaigns, using anthropocentric strategies.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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REFERENCES

1. Ten great public health achievements—United States, 1900–1999. Accessed January 26, 2022. <https://www.cdc.gov/mmwr/preview/mmwrhtml/00056796.htm>
2. Li XH, Chen L, Pan QN, et al. Vaccination status, acceptance, and knowledge toward a COVID-19 vaccine among healthcare workers: a cross-sectional survey in China. *Hum Vaccin Immunother*. 2021;17(11):4065–4073. doi:10.1080/21645515.2021.1957415
3. Nasir M, Zaman MA, Majumder TK, et al. Perception, preventive practice, and attitude towards vaccine against COVID-19 among health care professionals in Bangladesh. *Infect Drug Resist*. 2021;14:3531–3540. doi:10.2147/IDR.S326531
4. FDA. FDA approves first COVID-19 vaccine. 2020. Accessed January 31, 2022. <https://www.fda.gov/news-events/press-announcements/fda-approves-first-covid-19-vaccine>
5. Polack FP, Thomas SJ, Kitchin N, et al. Safety and efficacy of the BNT162b2 mRNA Covid-19 vaccine. *N Engl J Med*. 2020;383(27):2603–2615. doi:10.1056/NEJMOA2034577
6. Baden LR, el Sahly HM, Essink B, et al. Efficacy and safety of the mRNA-1273 SARS-CoV-2 vaccine. *N Engl J Med*. 2021;384(5):403–416. doi:10.1056/NEJMOA2035389
7. Voysey M, Clemens SAC, Madhi SA, et al. Safety and efficacy of the ChAdOx1 nCoV-19 vaccine (AZD1222) against SARS-CoV-2: an interim analysis of four randomised controlled trials in Brazil, South Africa, and the UK. *Lancet*. 2021;397(10269):99–111. doi:10.1016/S0140-6736(20)32661-1
8. Ledford H. J&J's one-shot COVID vaccine offers hope for faster protection. *Nature*. 2021. Advance online publication. doi:10.1038/D41586-021-00119-7
9. Al-Sanafi M, Sallam M. Psychological determinants of Covid-19 vaccine acceptance among healthcare workers in Kuwait: a cross-sectional study using the 5c and vaccine conspiracy beliefs scales. *Vaccines*. 2021;9(7):701. doi:10.3390/VACCINES9070701/S1
10. European Medicines Agency. Authorised COVID-19 vaccines. Accessed January 26, 2022. <https://www.ema.europa.eu/en/human->

- regulatory/overview/public-health-threats/coronavirus-disease-covid-19/treatments-vaccines/vaccines-covid-19/covid-19-vaccines-authorised#authorised-covid-19-vaccines-section
11. Fotiadis K, Dadouli K, Avakian I, et al. Factors associated with Healthcare Workers' (HCWs) acceptance of COVID-19 vaccinations and indications of a role model towards population vaccinations from a cross-sectional survey in Greece, May 2021. *Int J Environ Res Public Health*. 2021;18:10558. doi:10.3390/ijerph181910558
 12. WHO SAGE Roadmap for prioritizing uses of COVID-19 vaccines. 2022. Accessed February 1, 2022. <https://www.who.int/publications/i/item/who-sage-roadmap-for-prioritizing-uses-of-covid-19-vaccines>
 13. Li M, Luo Y, Watson R, et al. Healthcare workers' (HCWs) attitudes and related factors towards COVID-19 vaccination: a rapid systematic review. *Postgrad Med J*. 2021. Advance online publication. doi:10.1136/POSTGRADMEDJ-2021-140195
 14. Εμβολιασμός COVID-19. Προτεραιοποίηση εμβολιασμού κατά της Covid-19. 2021. Accessed February 1, 2022. <https://emvolio.gov.gr/proteraioiisi-emvoliasmoy-kata-tis-covid-19>
 15. Selgelid MJ. Pandethics. *Public Health*. 2009;123(3):255-259. doi:10.1016/J.PUHE.2008.12.005
 16. Emanuel EJ, Wertheimer A. Public health. Who should get influenza vaccine when not all can. *Science*. 2006;312(5775):854-855. doi:10.1126/SCIENCE.1125347
 17. McLachlan Hv. On the random distribution of scarce doses of vaccine in response to the threat of an influenza pandemic: a response to Wardrope. *J Med Ethics*. 2015;41(2):191-194. doi:10.1136/MEDETHICS-2013-101516
 18. Gostin LO. Medical countermeasures for pandemic influenza: ethics and the law. *JAMA*. 2006;295(5):554-556. doi:10.1001/JAMA.295.5.554
 19. Holzmann-Littig C, Braunisch MC, Kranke P, et al. Covid-19 vaccination acceptance and hesitancy among healthcare workers in Germany. *Vaccines*. 2021;9(7):777. doi:10.3390/VACCINES9070777
 20. Pataka A, Kotoulas S, Stefanidou E, et al. Acceptability of healthcare professionals to get vaccinated against COVID-19 two weeks before initiation of national vaccination. *Medicina (Kaunas, Lithuania)*. 2021;57(6):611. doi:10.3390/medicina57060611
 21. Qattan AMN, Alshareef N, Alsharqi O, al Rahahleh N, Chirwa GC, Al-Hanawi MK. Acceptability of a COVID-19 vaccine among healthcare workers in the Kingdom of Saudi Arabia. *Front Med*. 2021;8:644300. doi:10.3389/FMED.2021.644300/FMED_08_644300_PDF.PDF
 22. Squeri R, di Pietro A, la Fauci V, Genovese C. Healthcare workers' vaccination at European and Italian level: a narrative review. *Acta Biomed*. 2019;90(suppl 9):45-53. doi:10.23750/ABM.V90I9-S.8703
 23. Grochowska M, Ratajczak A, Zdunek G, Adamiec A, Waszkiewicz P, Feleszko W. A comparison of the level of acceptance and hesitancy towards the influenza vaccine and the forthcoming COVID-19 vaccine in the medical community. *Vaccines*. 2021;9(5):475. doi:10.3390/VACCINES9050475
 24. Paris C, Bénézit F, Geslin M, et al. COVID-19 vaccine hesitancy among healthcare workers. *Infect Dis Now*. 2021;51(5):484-487. doi:10.1016/J.IDNOW.2021.04.001
 25. Ferland L, Carvalho C, Gomes Dias J, et al. Risk of hospitalization and death for healthcare workers with COVID-19 in nine European countries, January 2020–January 2021. *J Hosp Infect*. 2022;119:170-174. doi:10.1016/J.JHIN.2021.10.015
 26. Elsevier Enhanced Reader. Factors influencing pandemic influenza vaccination of healthcare workers—a systematic review. 2012. Accessed February 2, 2022. <https://reader.elsevier.com/reader/sd/pii/S0264410X12007190?token=EA9FEE0146E6D10BA62552D75DBF507856DAC98B8A77DAC6DE133904B0213FE91F345068B823FD656D5DD139B87B61FC&originRegion=eu-west-1&originCreation=20220202073530>
 27. MacDonald NE, SAGE Working Group on Vaccine Hesitancy. Vaccine hesitancy: definition, scope and determinants. *Vaccine*. 2015;33(34):4161-4164. doi:10.1016/J.VACCINE.2015.04.036
 28. Ten threats to global health in 2019. 2020. Accessed February 2, 2022. <https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019>
 29. EUREC—Home. 2012. Accessed February 8, 2022. <http://www.eurecnet.org/index.html>
 30. Εθνική Επιτροπή Βιοηθικής και Τεχνοηθικής | Ελληνική Δημοκρατία. 2021. Accessed February 8, 2022. <https://bioethics.gr/en>
 31. WHO/Europe Covid-19 vaccine programme monitor. 2022. Accessed February 15, 2022. https://worldhealthorg.shinyapps.io/EURO_COVID-19_vaccine_monitor/
 32. Biswas N, Mustapha T, Khubchandani J, Price JH. The nature and extent of COVID-19 vaccination hesitancy in healthcare workers. *J Community Health*. 2021;46(6):1244-1251. doi:10.1007/S10900-021-00984-3
 33. Papagiannis D, Malli F, Raptis DG, et al. Assessment of knowledge, attitudes, and practices towards new coronavirus (SARS-CoV-2) of health care professionals in Greece before the outbreak period. *Int J Environ Res Public Health*. 2020;17(14):1-14. doi:10.3390/IJERPH17144925
 34. Maltezou HC, Pavli A, Dedoukou X, et al. Determinants of intention to get vaccinated against COVID-19 among healthcare personnel in hospitals in Greece. *Infection, Disease and Health*. 2021;26(3):189-197. doi:10.1016/J.IDH.2021.03.002
 35. Wang K, Wong ELY, Ho KF, et al. Intention of nurses to accept coronavirus disease 2019 vaccination and change of intention to accept seasonal influenza vaccination during the coronavirus disease 2019 pandemic: a cross-sectional survey. *Vaccine*. 2020;38(45):7049-7056. doi:10.1016/J.VACCINE.2020.09.021
 36. Dror AA, Eisenbach N, Taiber S, et al. Vaccine hesitancy: the next challenge in the fight against COVID-19. *Eur J Epidemiol*. 2020;35(8):775-779. doi:10.1007/S10654-020-00671-Y
 37. Detoc M, Bruel S, Frappe P, Tardy B, Botelho-Nevers E, Gagneux-Brunon A. Intention to participate in a COVID-19 vaccine clinical trial and to get vaccinated against COVID-19 in France during the pandemic. *Vaccine*. 2020;38(45):7002-7006. doi:10.1016/J.VACCINE.2020.09.041
 38. Gagneux-Brunon A, Detoc M, Bruel S, et al. Intention to get vaccinations against COVID-19 in French healthcare workers during the first pandemic wave: a cross-sectional survey. *J Hosp Infect*. 2021;108:168-173. doi:10.1016/J.JHIN.2020.11.020
 39. Schwarzingler M, Watson V, Arwidson P, Alla F, Luchini S. COVID-19 vaccine hesitancy in a representative working-age population in France: a survey experiment based on vaccine characteristics. *The Lancet Public health*. 2021;6(4):e210-e221. doi:10.1016/S2468-2667(21)00012-8
 40. Kabamba Nzaji M, Kabamba Ngombe L, Ngoie Mwamba G, et al. Acceptability of vaccination against COVID-19 among healthcare workers in the democratic republic of the Congo. *Pragmat Obs Res*. 2020;11:103-109. doi:10.2147/POR.S271096
 41. Kuter BJ, Browne S, Momplaisir FM, et al. Perspectives on the receipt of a COVID-19 vaccine: a survey of employees in two large hospitals in Philadelphia. *Vaccine*. 2021;39(12):1693-1700. doi:10.1016/J.VACCINE.2021.02.029
 42. Shekhar R, Sheikh AB, Upadhyay S, et al. COVID-19 vaccine acceptance among health care workers in the United States. *Vaccines*. 2021;9(2):1-18. doi:10.3390/VACCINES9020119
 43. Gadoth A, Halbrook M, Martin-Blais R, et al. Cross-sectional assessment of COVID-19 vaccine acceptance among health care workers in Los Angeles. *Ann Intern Med*. 2021;174(6):882-885. doi:10.7326/M20-7580
 44. Eguia H, Vinciarelli F, Bosque-Prous M, Kristensen T, Saigí-Rubió F. Spain's hesitation at the gates of a COVID-19 vaccine. *Vaccines*. 2021;9(2):1-8. doi:10.3390/VACCINES9020170

45. Ledda C, Costantino C, Cuccia M, Maltezo HC, Rapisarda V. Attitudes of healthcare personnel towards vaccinations before and during the COVID-19 pandemic. *Int J Environ Res Public Health*. 2021;18(5):1-11. doi:10.3390/IJERPH18052703
46. Patelarou A, Saliq A, Galanis P, et al. Predictors of nurses' intention to accept COVID-19 vaccination: a cross-sectional study in five European countries. *J Clin Nurs*. 2021;31:1258-1266. doi:10.1111/jocn.15980
47. Flanagan KL, Fink AL, Plebanski M, Klein SL. Sex and gender differences in the outcomes of vaccination over the life course. *Annu Rev Cell Dev Biol*. 2017;33:577-599. doi:10.1146/ANNUREV-CELLBIO-100616-060718
48. El-Sokkary RH, el Seifi OS, Hassan HM, et al. Predictors of COVID-19 vaccine hesitancy among Egyptian healthcare workers: a cross-sectional study. *BMC Infect Dis*. 2021;21(1):762. doi:10.1186/S12879-021-06392-1
49. Maraqa B, Nazzal Z, Rabi R, Sarhan N, Al-Shakhrak K, Al-Kaila M. COVID-19 vaccine hesitancy among health care workers in Palestine: a call for action. *Prev Med*. 2021;149:149. doi:10.1016/J.YPMED.2021.106618
50. Qunaibi E, Basheti I, Soudy M, Sultan I. Hesitancy of arab healthcare workers towards covid-19 vaccination: a large-scale multinational study. *Vaccines*. 2021;9(5):475. doi:10.3390/VACCINES9050446
51. Dzieciolowska S, Hamel D, Gadio S, et al. Covid-19 vaccine acceptance, hesitancy, and refusal among Canadian healthcare workers: a multicenter survey. *Am J Infect Control*. 2021;49(9):1152-1157. doi:10.1016/J.AJIC.2021.04.079
52. Spinewine A, Péteïn C, Evrard P, et al. Attitudes towards COVID-19 vaccination among hospital staff-understanding what matters to hesitant people. *Vaccines*. 2021;9(5):469. doi:10.3390/VACCINES9050469
53. Li X, Xu S, Yu M, et al. Risk factors for severity and mortality in adult COVID-19 inpatients in Wuhan. *J Allergy Clin Immunol*. 2020;146(1):110-118. doi:10.1016/J.JACI.2020.04.006
54. Kaplan AK, Sahin MK, Parildar H, Adadan Guvenc I. The willingness to accept the COVID-19 vaccine and affecting factors among healthcare professionals: a cross-sectional study in Turkey. *Int J Clin Pract*. 2021;75(7):14226. doi:10.1111/IJCP.14226
55. Agyekum MW, Afrifa-Anane GF, Kyei-Arthur F, Addo B. Acceptability of COVID-19 vaccination among health care workers in Ghana. *Adv Public Health*. 2021;2021. doi:10.1155/2021/9998176
56. Shaw J, Stewart T, Anderson KB, et al. Assessment of US healthcare personnel attitudes towards coronavirus disease 2019 (COVID-19) vaccination in a large university healthcare system. *Clin Infect Dis*. 2021;73(10):1776-1783. doi:10.1093/CID/CIAB054
57. Çiftci F, Şen E, Demir N, Çiftci O, Erol S, Kayacan O. Beliefs, attitudes, and activities of healthcare personnel about influenza and pneumococcal vaccines. *Hum Vaccines Immunother*. 2018;14(1):111-117. doi:10.1080/21645515.2017.1387703
58. Reda Alenazi B, Mohamed Hammad S, Elwan Mohamed A. Prevalence of seasonal influenza vaccination among primary healthcare workers in Arar city, Saudi Arabia. *Electron Physician*. 2018;10(8):7217-7223. doi:10.19082/7217
59. Lu P, O'Halloran AC, Ding H, Williams WW, Black CL. Influenza vaccination of healthcare personnel by work setting and Occupation-U.S., 2014. *Am J Prev Med*. 2016;51(6):1015-1026. doi:10.1016/J.AMEPRE.2016.08.038
60. Verger P, Dubé E. Restoring confidence in vaccines in the COVID-19 era. *Expert Rev Vaccines*. 2020;19(11):991-993. doi:10.1080/14760584.2020.1825945
61. Karlsson LC, Lewandowsky S, Antfolk J, et al. The association between vaccination confidence, vaccination behavior, and willingness to recommend vaccines among Finnish healthcare workers. *PLoS One*. 2019;14(10):e0224330. doi:10.1371/JOURNAL.PONE.0224330
62. Mohamed Hussein AAR, Galal I, Makhlof NA, et al. Acceptance of COVID-19 vaccines among medical teams in Egypt. *Arab J Gastroenterol*. 2021;22(4):323-324. doi:10.1016/J.AJG.2021.09.001
63. Verger P, Scronias D, Dauby N, et al. Attitudes of healthcare workers towards COVID-19 vaccination: a survey in France and French-speaking parts of Belgium and Canada, 2020. *Euro Surveill*. 2021;26(3):2002047. doi:10.2807/1560-7917.ES.2021.26.3.2002047
64. Kose S, Mandiracioglu A, Sahin S, Kaynar T, Karbus O, Ozbel Y. Vaccine hesitancy of the COVID-19 by health care personnel. *Int J Clin Pract*. 2021;75(5):e13917. doi:10.1111/IJCP.13917
65. Unroe KT, Evans R, Weaver L, Rusyniak D, Blackburn J. Willingness of Long-Term care staff to receive a COVID-19 vaccine: a single state survey. *J Am Geriatr Soc*. 2021;69(3):593-599. doi:10.1111/JGS.17022
66. Sonmezer MC, Sahin TK, Erul E, et al. Knowledge, attitudes, and perception towards COVID-19 vaccination among the adult population: a cross-sectional study in Turkey. *Vaccines*. 2022;10(2):278. doi:10.3390/VACCINES10020278

How to cite this article: Kipourgos G, Kourtis G, Papatheodorou M, et al. When the first vaccine arrived: an investigation of factors that influenced the intention of health care workers in the national health system of Greece to be vaccinated against the SARS COV-2 virus during the first trimester of vaccine arrival. *Nurs Forum*. 2022;1-16. doi:10.1111/nuf.12791