

ARTICLE



## A comparative online survey on the intention to get COVID-19 vaccine between Greek and Cypriot healthcare personnel: is the country a predictor?

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### ABSTRACT

Vaccine hesitancy amongst healthcare personnel (HCP) is a critical issue. The aim was to explore the factors that determine the intention to opt for COVID-19 vaccine among HCP from two southern European countries. An anonymous online self-administered survey using Google Forms has been conducted between December 1st to December 15th, 2020 among the HCP in Greece and the Republic of Cyprus. A total of 2,238 HCPs participated in the study (1,220/54.5% from Republic of Cyprus and 1,018 from Greece). Overall 1,082 (48.3%) stressed their intention to get vaccinated (64.4% for Greece and 34.9% for Republic of Cyprus). The main reasons for those who intend to get the COVID-19 vaccine include self (94.2%), family (98.7%), and patients protection (95.2%) as well as mitigation of COVID-19 pandemic (95.4%). The multivariate logistic regression that was performed for the total sample revealed that the following variables were significantly associated with an increased probability to get vaccinated against COVID-19: being a physician, a member of the nursing personnel, paramedical staff, working in Greece, age, the belief that influenza vaccination should be mandatory for HCP, and the rating of the overall management of COVID-19 pandemic in the country and from the public hospitals. Physicians were more likely to get vaccinated against COVID-19 than other HCP. The age was a predictor of COVID-19 uptake intention in the Republic of Cyprus. The belief that there was a successful management of the COVID-19 pandemic contributed to the intention to COVID-19 vaccination uptake.

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## Introduction

SARS-CoV-2 pandemic and its consequences have negatively affected societies, and severely challenged the consistency of healthcare systems around the world. As of February 4, 2021, >103.4 million laboratory-confirmed COVID-19 cases have been notified, and >2.2 million have died worldwide<sup>1</sup>. Healthcare personnel (HCP) score high between the aforementioned confirmed cases and deaths worldwide<sup>2</sup>, due to their active involvement in the care of these patients<sup>2</sup> and the lack of optimal pharmaceutical treatment.

Social distancing and quarantine were found to slow down the spread of the COVID-19 infection however their effectiveness is waned as soon as measures are being lifted. The only way of returning to normality seems to be the development of herd immunity gained by natural infection or vaccination.<sup>3</sup> The effective vaccination is linked to the return back to the way of life before the pandemic and could provide society the panacea of the COVID-19. Several vaccine trials have reported promising results, indicating that the vaccine for the new coronavirus is safe and produces a good immune response in almost all the individuals.<sup>4,5</sup> Comirnaty vaccine (developed by BioNTech and Pfizer) granted a conditional marketing authorization across the EU by the European Commission on December 21, 2020 after the recommendation of European

Medicines Agency followed by COVID-19 vaccine Moderna on January 6, 2021 and by the vaccine developed by AstraZeneca and Oxford University on January 31, 2021. Greece (<https://emvolio.gov.gr>) and Republic of Cyprus ([www.pio.gov.cy/coronavirus](http://www.pio.gov.cy/coronavirus)) have already vaccinated more than 360,000 (until 2/2/21) and 19,600 (29/1/21) persons, respectively, using the comirnaty vaccine.

Even though immunization due to vaccination proved to mankind its effectiveness in the past, by eliminating or tackling the transmission of infectious diseases, HCP often tends to hesitate, delay, or refuse vaccination<sup>6,7</sup> despite the availability of vaccination services free of charge in the majority of countries.<sup>8</sup> This is a phenomenon very well described worldwide, in terms of definition and its determinants,<sup>8</sup> and can have a serious impact on public health, especially in the middle of a pandemic era. World Health Organization (WHO) included vaccine hesitancy amongst the top 10 threats for global health;<sup>9</sup> a phenomenon that also concerns HCP.<sup>10–12</sup> In Greece, influenza vaccination rates in HCP are considered unsatisfactory given that the mean vaccination uptake rates during the 2017–18 influenza season was 24.9% in hospitals and 40.2% in the primary healthcare settings. The huge increase of influenza vaccination rates in both primary and secondary

healthcare sector during 2017–18 compared to 2015–2016 was attributed to the use of rewards (one day off to the vaccinated HCP), the vaccination of the heads of the departments and the promotion of a sense of safety and ethical duty.<sup>13</sup> Evidence from a tertiary care pediatric hospital in Greece suggested that the main reason for the participants to get the influenza vaccine was the protection of themselves and their family followed by the protection of the patients and colleagues. On the contrary, the main barriers were concerns about the side effects of influenza vaccine, its effectiveness, and several issues regarding the logistics of vaccination such as the timing and the accessibility.<sup>14</sup> In the primary healthcare settings during the 2008–09 influenza season the main reason for vaccination was self-protection, while the reasons for hesitation to vaccination were the belief that they are not at risk for getting influenza, doubts about vaccine effectiveness, and fear of vaccine adverse effects.<sup>15</sup> In the Republic of Cyprus, there is no published evidence regarding the vaccination rates among HCP and the attributed reasons for acceptance or refusal of the influenza vaccine.

Therefore, the literature on the factors that predict vaccination intention could be used to improve the compliance with vaccination recommendations or governmental strategy, but first, the intention on vaccination must be documented as well as the reasons for hesitation especially amongst HCP.<sup>16–19</sup>

In order to investigate the intention to get a vaccine against COVID-19 in the Greek and Cypriot HCP and nursing and medical students, we conducted a comparative study between the two Greek-speaking populations.

## Method

An anonymous online self-administered survey using Google Forms has been conducted between December 1st to December 15th, 2020 among the HCP and medical and nursing students in Greece and the Republic of Cyprus. The survey was in the form of an electronic questionnaire, circulated through social networks, the website of the Euro-Mediterranean Institute for Quality and Safety in Health Services Avedis Donabedian (<https://eiqsh.eu/>) in all available HCP teams, Universities, and hospital webpages, as well as in the specialized COVID-19 establishments across public and private healthcare entities, after a personal communication of the research team. It was addressed to hospital-based HCP as well as to the health science students' blogs.

A total of 3,431 nurses and 1,000 physicians work in the public hospitals in the Republic of Cyprus while 1,224 and around 900 work in the private hospitals, respectively (personal communication with Republic of Cyprus Ministry of Health). In Greece, the relevant number of HCP in the National Healthcare System is estimated to be 100,000 (personal communication with the Greek Ministry of Health).

HCP was defined as persons employed in the healthcare facilities with or without direct contact with patients and regardless of their employment status (permanent, casual, or contract HCP). Furthermore, HCP was grouped as follows: physicians (with or without a medical specialty), nursing personnel (nurses, midwives), paramedical scientific staff (pharmacists, physiotherapists, biologists, laboratory technicians,

health visitors, social workers), supportive staff, and administrative personnel.

The questionnaire was developed by our research team, based on our previous experience in the field of HCP vaccination against influenza. It was divided into three major sections: the first part included several questions to elicit information on the socio-demographic and working characteristics of the participants; the second part included questions on vaccination history, attitudes toward mandatory COVID-19 and influenza vaccination, intention to get vaccinated against COVID-19 and reasons for its acceptance or refusal; and the third part collected information of the ratings of the HCP regarding the management of the pandemic from the country, the European Union (EU), the Ministry of Health, the mass media, as well the effectiveness of the undertaken measures and the self-perceived compliance of the HCP and the public with these measures. The two parts of the questionnaire have been already used in a hospital-based survey in eight major tertiary-care hospitals in Greece [Maltezou et al, 2020 unpublished data].

## Ethical approval

Participation of the HCP was voluntary following a written informed consent. Approval or the protocol of the survey was obtained from the Ethics Committee of the EIQSH (reference number EIQSH-1/20). The data were managed in accordance with national and European laws.

## Statistical analysis

Frequencies and percentages were used for the categorical variables. Comparisons between groups and the two countries were performed by using the t-test for continuous variables with normal distribution, and the chi-square test for categorical variables. In order to explore the factors that predict HCP's intention to get vaccinated against COVID-19, and control confounding factors, threemultivariate logistic regression analyses (one for the total sample, one for the sample from Greece, and one from the Republic of Cyprus) have been conducted by integrating them into the model as independent only the variables with a *p*-value of  $\leq 0.05$  in the univariate analyses. Odds ratio (OR) and confidence intervals (CIs) were estimated. Additionally, we have checked the multicollinearity of the variables. *P*-values of  $\leq 0.05$  were considered statistically significant. The statistical analysis was conducted using the IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp.

## Results

A total of 2,238 HCPs participated in the study (1,220/54.5% from the Republic of Cyprus and 1,018 from Greece). In total 65 medical and nursing students have also completed the questionnaire but they were excluded from the analysis due to their small sample size. Table 1 shows the sociodemographic characteristics of the sample as well as their vaccination history and their willingness to get vaccinated against COVID-19. The majority of the participants from the Republic of Cyprus were

**Table 1.** Characteristics of the 2,238 HCP.

Characteristic (total number of responses)	HCP N (%)		p-value
	Greece	Rep Cyprus	
Profession			<0.001
Physician <sup>a</sup>	324 (31.8)	104 (8.5)	
Nursing personnel	360 (35.4)	986 (80.8)	
Paramedical personnel	236 (23.2)	96 (7.9)	
Supportive personnel	8 (0.8)	2 (0.2)	
Administrative personnel	90 (8.8)	32 (2.6)	
Comorbidities	142 (13.9)	164 (13.4)	0.728
Family member with a comorbidity	545 (53.5)	630 (51.6)	0.371
Vaccination against hepatitis B	889 (87.3)	1128 (92.5)	<0.001
HBV disease	7 (0.7)	10 (0.8)	0.720
Vaccination against MMR	887 (87.1)	1122 (92.0)	<0.001
Measles disease	254 (25.0)	170 (13.9)	<0.001
Vaccination against pandemic A (H1N1) <sup>b</sup>	292 (28.7)	220 (18.0)	<0.001
Influenza vaccination in 2019–2020	617 (60.6)	328 (26.9)	<0.001
Intention to get influenza vaccination in 2020–2021	739 (72.6)	440 (36.1)	<0.001
Involvement in care of a COVID-19 case	433 (42.5)	662 (54.3)	<0.001
History of COVID-19	52 (5.1)	68 (5.6)	0.626
The COVID-19 pandemic has increased my trust to the vaccines	332 (32.6)	248 (20.3)	<0.001
Intention to get COVID-19 vaccine	656 (64.4)	426 (34.9)	<0.001
Mean age	40.56 ± 9.64 (n = 1018)	35.54 ± 8.81 (n = 1220)	<0.001
Mean working experience	14.72 ± 9.45 (n = 915)	12.15 ± 8.24 (n = 1123)	<0.001

COVID-19: coronavirus disease 2019; N: the number of HCP who answered the specific question.

<sup>a</sup>Of the 324 Greek physicians, 299 (92.3%) had a medical specialty while of the 104 Cypriots 76 (73%) had a specialty.

<sup>b</sup>In 2009–2010

nursing personnel as opposed to those from Greece who were physicians and nursing personnel (986/80.8% and 684/67.2%, respectively). In addition, the participants from the Republic of Cyprus reported a statistically significant lower age and working experience.

The vast majority (64.4%) of the participants from Greece stressed that they intend to get vaccinated against COVID-19 as opposed to 34.9% of those from the Republic of Cyprus. A subanalysis of the data revealed that, in Greece, the relevant percentages for the physicians, nursing personnel, paramedical, supportive, and administrative staff were 81.5%, 56.7%, 62.7%, 25%, and 42.2%, respectively ( $p < .001$ ). The relevant percentages for the sample from the Republic of Cyprus were 61.5%, 32%, 35.4%, 0%, and 37.5%, respectively ( $p < 0.001$ ). In the total sample, physicians reported a statistically significant ( $p < 0.001$ ) higher rate of vaccination against HBV, MMR, pandemic influenza 2009 A (H1N1), influenza (2019–2020), intention to get influenza vaccination (2020–2021), the belief that influenza and COVID-19 vaccination should be mandatory for HCP, followed by the nursing personnel. Almost two out of three Greek participants were vaccinated against influenza in 2019–2020 or intended to get vaccinated in 2020–2021 whereas the relevant percentages for the Cypriots were 27% and 36%, respectively. A similar number of the Greek (142/13.9% and 545/53.5%) and Cypriot (164/13.4%

**Table 2.** Reasons for accepting or refusing COVID-19 vaccination among HCP in two countries.

Reasons for accepting COVID-19 vaccination among HCP	N = 656		N = 426	
	Greece	Rep Cyprus	p-value	
To protect themselves	631 (96.2)	388 (91.1)	<0.001	
To protect their family	650 (99.1)	418 (98.1)	0.171	
To protect their patients	626 (95.4)	404 (94.8)	0.657	
To contribute to the control of the pandemic	624 (95.1)	408 (95.8)	0.617	
Reasons for refusing COVID-19 vaccination among HCP	N = 362		N = 794	
Concerns about vaccine efficacy	172 (47.5)	510 (64.2)	<0.001	
Concerns about vaccine safety	296 (81.8)	672 (84.6)	0.221	
Perception that COVID-19 is not a life threatening disease	85 (23.5)	382 (48.1)	<0.001	
Not enough information about the vaccine	332 (91.7)	726 (91.4)	0.875	
Perception of not being at risk for infection	97 (26.8)	268 (33.8)	0.018	
Fear for severe complications onset in the future	296 (81.8)	670 (84.4)	0.266	

and 630/51.6%) participants reported at least one comorbidity or a person with a comorbidity in their family.

According to **Table 2**, almost all the participants who intend to get the COVID-19 vaccine will do it in order to protect themselves (total sample 94.2%), their families (total sample 98.7%), their patients (total sample 95.2%), and to control the pandemic (total sample 95.4%). On the contrary, the main reasons for refusing vaccination were: the lack of adequate information about the vaccine (total sample 91.5%), concerns about the safety (total sample 83.7%), and potential complications in the future (total sample 83.6%). Compared to the participants from Greece, the participants from the Republic of Cyprus were statistically significant more reluctant about the COVID-19 vaccine regarding the efficacy (64.2% vs 47.5%), the self-perceived severity of illness (48.1% vs 23.5%), and the infection risk perception (33.8% vs 26.8%).

**Table 3** summarizes the findings regarding the intention of the participants to get vaccinated in relation to their characteristics. In both two countries, statistically significant higher rates of intention to get COVID-19 vaccine were observed in: physicians, staff with at least one comorbidity, a history of vaccination against HBV, MMR, pandemic H1N1, influenza 2019–2020, belief that influenza and COVID-19 vaccination should be mandatory, the recommendation of influenza and COVID-19 vaccination to the vulnerable persons, the belief that COVID-19 pandemic has increased their trust to the vaccines, higher mean age, and working experience.

According to **Table 4**, the participants from the Republic of Cyprus were less satisfied with the management of the COVID-19 pandemic as a whole, the undertaken measures and their effectiveness for its control, and the measures undertaken by

**Table 3.** Intention of HCP from two countries to opt for COVID-19 vaccine by attitudes and practices.

Intention to get COVID-19 vaccine	% Yes		p-value	% Yes	
	Greece			Rep of Cyprus	p-value
Profession			<0.001		<0.001
Physician <sup>a</sup>	81.5			61.5	
Nursing personnel	56.7			32.0	
Paramedical personnel	62.7			35.4	
Supportive personnel	25.0			-	
Administrative personnel	42.2			37.5	
Comorbidities (yes/no)	74.6/62.8	0.006		42.7/33.7	0.025
Family member with a comorbidity (yes/no)	63.5/65.5	0.495		37.1/32.5	0.092
Vaccination against hepatitis B (yes/no)	65.7/55.8	0.029		36.2/19.6	0.001
HBV disease (yes/no)	100/64.2	0.049		60.0/34.7	0.091
Vaccination against MMR (yes/no)	63.5/71.0	0.091		35.8/24.5	0.024
Measles disease (yes/no)	63.8/64.7	0.800		34.1/35.0	0.813
Vaccination against pandemic A (H1N1) (yes/no)	80.2/40.1	<0.001		65.5/28.2	<0.001
Influenza vaccination in 2019–2020 (yes/no)	80.4/22.2	<0.001		57.9/26.5	<0.001
Influenza vaccination should be mandatory for HCP (yes/no)	86.0/41.1	<0.001		74.1/20.8	<0.001
You recommend influenza vaccination to high risk persons (yes/no)	66.5/10.8	<0.001		39.9/4.7	<0.001
Intention to get influenza vaccination in 2020–2021 (yes/no)	80.4/22.2	<0.001		65.0/17.9	<0.001
Involvement in care of a COVID-19 case (yes/no)	71.4/59.3	<0.001		36.3/33/3	0.286
History of COVID-19 (yes/no)	63.5/64.5	0.880		32.4/35.1	0.648
You will recommend COVID-19 vaccination to high risk persons (yes/no)	73.8/3.0	<0.001		51.5/0.5	<0.001
COVID-19 vaccination should be mandatory for HCP (yes/no)	95.8/37.1	<0.001		91.8/14.9	<0.001
The COVID-19 pandemic has increased my trust to the vaccines (yes/no)	90.4/51.9	<0.001		79.8/23.5	<0.001
Mean age (yes/no)	41.82 ± 9.45/ 38.27 ± 9.56	<0.001		37.90 ± 9.51/ 34.27 ± 8.15	<0.001
Mean working experience	15.57 ± 9.14/ 13.09 ± 9.82	<0.001		13.68 ± 8.83/ 11.32 ± 7.78	<0.001

the public hospitals. Accordingly, in Greece, the willingness of the staff to get vaccinated was positively correlated with a higher rating of all the dimensions of COVID-19 management except for the rating of the staff compliance with the standard precautions and the management of the pandemic from the private hospitals. Similar were the findings for the Republic of Cyprus, with the exception of the management of the pandemic from the public.

The multivariate logistic regression that was performed for the total sample revealed that the following variables were significantly associated with an increased probability to get vaccinated against COVID-19: being a physician (OR: 7.27, 95%CI: 2.80–18.90), a member of the nursing personnel (OR: 6.91, 95%CI: 2.63–18.11), paramedical staff (OR: 6.91, 95%CI: 2.63–18.11), working in Greece (OR: 1.65, 95%CI: 1.14–2.39), older age (OR: 1.03, 95%CI: 1.01–1.05), the belief that influenza vaccination should be mandatory for HCP (OR: 2.04, 95%CI: 1.32–3.14), and the rating of the overall management of COVID-19 pandemic in the country (OR: 1.21, 95%CI: 1.03–1.41) and from the public hospitals (OR: 1.12, 95%CI: 1.03–1.23) (Table 5). In the separate analysis for the sample from Greece only, the predictors were: being a physician, a member of the nursing personnel, paramedical staff, the belief that influenza vaccination should be mandatory for HCP, the rating of the effectiveness of lockdown and the rating of the overall management of COVID-19 pandemic from the public hospitals. Additionally, in the sample from the Republic of Cyprus, the predictors were: the age, the belief that influenza vaccination should be mandatory for HCP, the rating of the overall management of COVID-19 pandemic in the country, and the rating of HCP's compliance with standard precautions.

The age, the HBV vaccination, and Hepatitis B disease onset, the vaccination against pandemic A (H1N1), the belief that COVID-19 vaccination should be mandatory for HCP, the involvement in the care of a COVID-19 case, the rating of the overall management of the COVID-19 pandemic in the country and the rating of HCP's compliance with standard precautions were not statistically significant predictors in the sample from Greece. In line with Greece, in the sample from the Republic of Cyprus, the presence of at least one comorbidity, the profession, the Hepatitis B disease onset, the involvement in the care of a COVID-19 case, the recommendation of COVID-19 vaccination to high-risk persons, and the rating of the overall management of the COVID-19 pandemic from the public hospitals were not statistically significant predictors.

In addition, in the total sample the following factors were significantly associated with a lower probability to get vaccinated against COVID-19: the presence of at least one comorbidity, the vaccination against HBV, the onset of HBV disease, the vaccination against pandemic A (H1N1), against influenza in 2020–2021, the belief that the COVID-19 vaccination should be mandatory for HCP, the involvement in the care of a COVID-19 case, the recommendation of COVID-19 vaccination to vulnerable persons, the belief that the pandemic has increased the trust to the vaccines and the rating of the measures for the control of the pandemic.

In the Greek sample, the protective factors were: the presence of at least one comorbidity, the vaccination against influenza 2019–2020 and 2020–21, the recommendation of COVID-19

**Table 4.** Mean rating of the management of COVID-19 pandemic in two countries by their intention to get COVID-19 vaccine.

Mean rating			Intention to get COVID-19 vaccine				
	Greece	Rep Cyprus	p-value	Greece	Rep Cyprus	p-value	Greece
	N = 1018	N = 1220		Yes/No	Yes/No		Yes/No
Rating of the management of COVID-19 in your country as a whole	5.47 ± 2.19	4.96 ± 2.09	<0.001	5.93 ± 2.04 4.63 ± 2.20	<0.001	5.64 ± 1.80 4.59 ± 2.15	<0.001
Rating of the management of COVID-19 in the EU as a whole	5.23 ± 1.69	5.19 ± 1.82	0.593	5.40 ± 1.67 4.92 ± 1.68	<0.001	5.55 ± 1.58 5.00 ± 1.91	<0.001
Rating of the undertaken measures for the control of COVID-19 pandemic	5.50 ± 2.20	4.62 ± 2.18	<0.001	5.83 ± 2.08 4.91 ± 2.28	<0.001	5.26 ± 1.99 4.28 ± 2.21	<0.001
Rating of lockdown effectiveness	5.51 ± 2.32	5.70 ± 2.76	0.088	5.94 ± 2.14 4.74 ± 2.43	<0.001	6.74 ± 2.28 5.14 ± 2.84	<0.001
Rating of the effectiveness of the measures undertaken from the Ministry of Health	5.24 ± 2.35	4.61 ± 2.30	<0.001	5.70 ± 2.23 4.40 ± 2.33	<0.001	5.39 ± 2.03 4.19 ± 2.33	<0.001
Rating of HCP's compliance with the standard precautions	7.56 ± 1.68	7.80 ± 1.64	0.001	7.55 ± 1.62 7.56 ± 1.80	0.977	7.86 ± 1.44 7.77 ± 1.74	0.320
Rating of the compliance of the public with the standard precautions	5.34 ± 1.81	5.24 ± 1.85	0.171	5.18 ± 1.70 5.64 ± 1.96	<0.001	5.12 ± 1.66 5.30 ± 1.95	0.116
Rating of the mass media communication management of the COVID-19 pandemic	3.96 ± 2.50	3.81 ± 2.35	0.148	4.42 ± 2.44 3.11 ± 2.39	<0.001	4.50 ± 2.29 3.44 ± 2.29	<0.001
Rating of the COVID-19 pandemic management from the public hospitals	6.68 ± 2.19	5.86 ± 2.35	<0.001	6.91 ± 2.09 6.26 ± 2.33	<0.001	6.56 ± 2.01 5.48 ± 2.43	<0.001
Rating of the COVID-19 pandemic management from the private hospitals	5.05 ± 2.43	4.87 ± 2.40	0.078	5.11 ± 2.44 4.94 ± 2.40	0.297	4.94 ± 2.37 4.83 ± 2.42	0.435

vaccination to high-risk persons, the belief that the COVID-19 pandemic has increased their trust to the vaccines and the rating of the undertaken measures for the control of COVID-19 pandemic. On the other side in the sample from the Republic of Cyprus, the factors that were significantly associated with a lower probability to get vaccinated against COVID-19 were: HBV vaccination, the vaccination against pandemic A (H1N1), the vaccination against influenza 2019–2020, the belief that the COVID-19 vaccination should be mandatory for HCP, the belief that the COVID-19 pandemic has increased their trust to the vaccines, the rating of the undertaken measures for the control of COVID-19 pandemic, the rating of the effectiveness of lockdown.

## Discussion

This was a large-scale cross-sectional online and comparative study conducted in two South European countries: Greece and the Republic of Cyprus, that share a common language and cultural background, in order to assess the intention of HCP to get the COVID-19 vaccine. We have also explored the associated predictors for vaccination acceptance that could be an evidence for decision-makers in two countries to design or re-engineer their vaccination campaigns. The timing of this research is crucial given that it took place at the peak of the global conversation for COVID-19 vaccination and a few days before the approval of the first vaccine in the European Union. To the best of our knowledge, this is the first research conducted concomitantly in two countries and one of the few similar studies published so far.<sup>16–19</sup> A strength of this study was the relatively large sample from the Republic of Cyprus given that our sample accounted for 22% of the total nursing personnel working in the country. On the contrary, the participation rate was much lower in Greece.

According to our findings, almost two out of three (64.4%) participants from Greece intended to get the vaccine against

COVID-19 as opposed to only one out of three (34.9%) of those from the Republic of Cyprus. The proportion of HCP who intend to opt COVID-19 vaccine in total was 48.3%. In the literature<sup>16,18,20–22</sup> the percentages ranged from 27.7% to 81.5%. Moreover, regression analysis revealed that the country was a predictor of vaccine acceptance. This finding should be interpreted in conjunction with the following: (1) the Cypriots were statistically significant more skeptical about vaccine efficacy, the self-perceived severity of the infection and reported a lower self-perceived risk of infection compared to the Greek sample, (2) the nursing personnel was over presented in the sample from the Republic of Cyprus, (3) the healthcare care system in the Republic of Cyprus is in the middle of a wide transition accompanied by instability due to the high rates of physicians' turnover from the public hospitals and the allocation of resources (4) the study was performed during a period of time that was very close to the approval of the first vaccine as well as to the presentation of the national strategic plan for the management of population vaccination starting with the HCP as a priority group.

The category of HCP was a predictor of the intention to opt for the COVID-19 vaccine when it becomes available, for the Greek but not for the Cypriot sample. In general, physicians were more likely to accept the COVID-19 vaccine compared to other healthcare professionals, a finding that is also supported by other published literature.<sup>20,23,24</sup> Besides, physicians retain a more favorable attitude toward vaccination in general, followed by the nursing personnel.<sup>25,26</sup> Although we do not have empirical data from the current study, we speculate that, potentially, physicians due to their role they are directly involved in the process of providing consultation and furthermore recommendation of the vaccines to their patients and so they actually perceive themselves as an active paradigm for their patients. This, combined with an anecdotal higher access of physicians to information related to the vaccine

**Table 5.** Multiple logistic regression analyses of the factors that predict the intention of HCP to get COVID-19 vaccine in total sample and separately for each country.

Variable	Total	Greece	Republic of Cyprus
	OR (95%CI)	OR (95%CI)	OR (95%CI)
Physician	7.27 (2.80–18.90)	15.29 (4.64–50.36)	NS
Nurse	6.24 (2.46–15.79)	11.21 (3.48–36.09)	NS
Paramedical	6.91 (2.63–18.11)	11.86 (3.77–37.36)	NS
Greece	1.65 (1.14–2.39)	-	-
Age	1.03 (1.01–1.05)	NS	1.05 (1.03–1.08)
Comorbidities (yes)	0.59 (0.37–0.95)	0.24 (0.10–0.55)	NS
HBV vaccination (yes)	0.47 (0.23–0.96)	NS	0.24 (0.07–0.79)
Hepatitis B diseases (yes)	0.01 (0.01–0.07)	NS	NS
Vaccination against pandemic A(H1N1) (yes)	0.50 (0.34–0.74)	NS	0.36 (0.20–0.65)
Vaccination against influenza 2019–20 (yes)	NS	0.43 (0.23–0.82)	NS
Vaccination against influenza 2020–21 (yes)	0.11 (0.08–0.15)	0.11 (0.05–0.21)	0.13 (0.07–0.23)
Influenza vaccination should be mandatory for HCP (yes)	2.04 (1.32–3.14)	2.09 (1.06–4.13)	4.33 (2.14–8.75)
COVID-19 vaccination should be mandatory for HCP (yes)	0.02 (0.01–0.03)	NS	0.02 (0.01–0.03)
Involvement in care of a COVID-19 case (yes)	0.66 (0.47–0.93)	NS	NS
Recommendation of COVID-19 vaccination to high risk persons (yes)	0.02 (0.01–0.04)	0.02 (0.01–0.08)	NS
The COVID-19 pandemic has increased my trust to the vaccines (yes)	0.18 (0.12–0.28)	0.14 (0.07–0.28)	0.14 (0.07–0.25)
Rating of the management of COVID-19 in your country as a whole	1.21 (1.03–1.41)	NS	1.38 (1.12–1.70)
Rating of the undertaken measures for the control of COVID-19 pandemic	0.85 (0.75–0.97)	0.77 (0.61–0.95)	0.73 (0.60–0.89)
Rating of the effectiveness of lockdown	NS	1.48 (1.20–1.82)	0.89 (0.79–0.99)
Rating of the COVID-19 pandemic management from the public hospitals	1.12 (1.03–1.23)	1.19 (1.03–1.37)	NS
Rating of HCP's compliance with the standard precautions	NS	NS	1.32 (1.10–1.58)

NS: Non statistically significant

(effectiveness, safety, side effects) may explain the phenomenon although there is a need for more empirical data to support this proposition.

In the relevant published literature, the percentages of nursing personnel intention to get COVID-19 vaccine were 63% and 40% for the nurses from Hong Kong,<sup>19,21</sup> 48.2% for the nursing personnel from Malaysia,<sup>27</sup> and 64.7% for the nurses in France.<sup>16</sup> In our study, 56.7% of the Greek nursing personnel intended to get the COVID-19 vaccine. On the other hand, the acceptance of COVID-19 vaccination from the nursing personnel from the Republic of Cyprus was very low (32%) in comparison with the aforementioned rate in similar studies and exceeds even that for the seasonal flu (2019–2020 & 2020–2021), HBV, MMR. The hesitancy of the nursing personnel from the Republic of Cyprus on vaccinations, in general, is higher in comparison to other HCP.<sup>19</sup> This finding in conjunction with the lower age of the sample from the Republic of Cyprus (the physicians and the nursing personnel from the Republic of Cyprus were statistically significantly younger compared to those from Greece) may explain the low acceptance of the COVID-19 vaccine. Besides the age was a predictor of COVID-19 uptake intention in the Republic of Cyprus. The univariate analysis revealed that weaker COVID-19 vaccination intention was associated with younger age and lower mean working experience. Some studies have reported the same results<sup>16–18</sup> as it seems that younger age and some antecedents of vaccination refusal (such as the low self-perceived risk for infection, and the belief that the infection is not life-threatening) were associated with weaker intention to opt for COVID-19 vaccine in two countries. This is a contradicted finding compared to another study.<sup>19</sup>

The HCP who rated higher the whole management of the COVID-19 pandemic, including the undertaken measures, the communication management of the pandemic from the mass media, and the management of the pandemic from the public hospitals was more likely to accept COVID-19 vaccination. The findings of the univariate analyses in both two countries are an indication that the intention of HCP to get the COVID-19 vaccine is associated with a relatively more positive attitude of HCP toward the way the country as a whole, the mass media, the ministry of health, the public hospitals have managed the COVID-19 pandemic. On the other hand, the multiple regression analysis showed that the rating of the management of COVID-19 from the country, as well as HCP's compliance with the standard precautions, were the prerequisites of vaccination acceptance in the Republic of Cyprus as opposed to Greece for which the rating of the effectiveness of lockdown and that of the pandemic management from the public hospitals were the positive predictors for the vaccination intention. Although there is a need for more qualitative research in the field, it seems that the intention of the HCP is a direct reflection of whether the HCP believes that the official State and the Ministry of Health add value to them as professionals and as citizens and whether their actions are evidence of an active and real interest and understanding for their needs. As members of the EU, HCP from the two countries perceive the EU policy and strategy regarding the management of the pandemic as an element of the corporate image HCP hold about the leading role of EU in the resolution pandemic that influences their COVID-19 vaccination intention. The low acceptance of the vaccine from the HCP and as a result their skepticism may influence patients' vaccination intention rates.<sup>7</sup> The findings of the study cannot reflect the non-HCP population intention on

COVID-19 vaccination acceptance but is widely accepted that HCP is probably more prone to get vaccinated against COVID-19 than non-HCPs.<sup>28</sup> Therefore, the uptake of the COVID-19 vaccine in the non-HCP population is expected to be lower.

It is notable that the satisfaction with the way the mass media covered the pandemic was very low in both two countries. This should be taken into account by the public health authorities given that mass media will be involved in the promotion of the communication campaign of the ministry of health for increasing the acceptance of the COVID-19 vaccine from the public and the HCP. National vaccination plan should consider identifying the local determinants of hesitancy and then develop the strategies in accordance with the barriers identified.<sup>7</sup> It seems that mass media is not the vehicle for persuading the HCP to opt for COVID-19 vaccine in these two South European countries. A qualitative study may be able to broaden our understanding and inform promotion campaigns and interventions. Additionally, the overload of the HCP with scientific information on the COVID-19 vaccine, through several routes (coronavirus blogs, scientific articles peer-reviewed or not, reports of local or international scientific bodies) may confuse and make them more skeptical. Potentially the peer, as well as the provision of creative time to the HCP to conceptualize the vaccine effectiveness and safety through the vaccination of their patients and their relatives may contribute to the increase of vaccination uptake in the next months.

According to the published literature, there was a noticeable increase in influenza vaccination intention in comparison with previous seasons from the same.<sup>21,29,30</sup> This phenomenon may be associated with COVID-19 and influenza infection symptoms similarity.<sup>22</sup> Consequently, HCP tends to promote influenza vaccination in a way to prevent co-infection or/and to prevent severe infection symptoms manifestation.

We noticed an increased willingness to get vaccinated against influenza among the participating HCP compared to the previous years,<sup>21</sup> which may be attributed to their behavioral change under the urgency of COVID-19. If this is the case, then we do believe that the prolongation of the timeframe for the vaccination of the HCP may project the wider acceptance rate of the vaccine.

In Greece HCP involved in the care of COVID-19 patients, and those who indicated as a reason for vaccination the protection of themselves were more likely to accept COVID-19 vaccination. This is in accordance with the findings of a similar study in Israel.<sup>28</sup>

The multivariate logistic analysis showed that the presence of at least one comorbidity was not a positive predictor of vaccination intention of the HCP. Although this finding is questionable and contradicted with the international literature,<sup>21</sup> we consider that the self-perceived severity of their comorbidity was low enough to interfere with their intention to opt for COVID-19 vaccine.

## Limitations

This study has certain limitations. Firstly, in order to reach more HCP, the sample population was collected using a convenience sampling methodology. Consequently, the sample data may not reflect the entire HCP population in both two

countries. Second, the survey was in the form of an electronic questionnaire, circulated through social networks, hence the participants' age is relatively low since younger age groups have a higher technology literacy. Third, the study was conducted in the middle of a pandemic era, and this may positively interfere with the intentions of vaccination. Fourth, the region of residence was not reported, consequently, acceptance might be higher in regions where the infected rate of the population was increased.

## Conclusions

Our study revealed that two out of three HCPs from Greece intended to get the vaccine against COVID-19 as opposed to only one out of three of those from the Republic of Cyprus, and physicians were more likely to accept COVID-19 vaccination than the other HCPs, followed by nurses. Greek nursing personnel intention rate to opt for COVID-19 vaccine is in line with the published literature, while Cypriots are more skeptical, and consequently, their intention is much lower. The nurses' age was a predictor of COVID-19 uptake intention in the Republic of Cyprus, meaning that younger ages are more vaccine-hesitant.

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## Contributors

All authors conceived and contributed to study design. VR, SI, AK contributed to data collection. VR performed the statistical analysis and interpreted the results. VR, SI drafted the first version of the manuscript with the support of HM. All authors contributed to manuscript editing. All authors read and approved the final manuscript.

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