



Predictors of COVID-19 Vaccine Uptake in Teachers: An On-line Survey in Greece

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Abstract

COVID-19 vaccines are safe at a very high rate and protect against severe disease, hospitalization, and mortality. Schools are workplaces with high transmissibility of coronavirus and teachers are at risk of infection. The study aimed to find out the predictors of COVID-19 vaccine uptake in teachers. An on-line cross-sectional survey with a convenience sample was conducted, in Greece, during December 2021. We collected demographic data of teachers and we measured their attitudes towards COVID-19 vaccination and the pandemic. The sample included 513 teachers. The majority of them was vaccinated against COVID-19 (85.8%). The most important reasons for teachers' decline in COVID-19 vaccination were their concerns about safety, effectiveness and the side effects of COVID-19 vaccine. Also, furthermore they were characterized by strong self-assessment that they will not be infected by the COVID-19, and self-assessment that the COVID-19 vaccination will be useless for those who have already been diagnosed with COVID-19. After multivariable analysis, we found that increased age (OR 1.08, 95% CI 1.02–1.14, $p=0.011$), and trust in COVID-19 vaccination (OR 2.57, 95% CI 2.07–3.18, $p<0.001$) were related with an increased probability of a COVID-19 vaccine uptake. Also, teachers who lived with elderly people or vulnerable groups (OR 4.81, 95% CI 1.55–14.89, $p=0.006$) during the COVID-19 pandemic, demonstrated greater probability to take COVID-19 vaccine. The study highlighted the need for reliable and accurate public information on both the risks of coronavirus infection and the vaccines' safety and efficacy.

Keywords Teachers · COVID-19 · Vaccine uptake · Greece

Introduction

In the first year of the SARS-CoV-2 pandemic, governments worldwide used exclusively nonpharmaceutical practices to contain and control the outbreak. The first Coronavirus vaccines were marketed one year later in the United States and Europe. Nearly everywhere in the world was able to access the vaccines free of charge within a short period of time. COVID-19 vaccines have been shown to be safe at a very high rate, protect against infection thus limiting the transmission of coronavirus. Furthermore, they reduce severe disease, hospitalization, and mortality [1–3].

The elderly, immunocompromised, chronically ill, and healthcare professionals were initially given priority for vaccinations. Those who were more likely to come into contact with Coronavirus (healthcare professionals) also had a greater risk of serious illness, hospitalization, and mortality [4–6]. In spite of the fact that teachers were proposed to be vaccinated [7], as their work environment is characterized by high transmission [8, 9], only 10% of countries considered and placed

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them in the priority group, according to UNESCO [10]. Due to the fact that schools for students with special needs remained open during the pandemic, special education teachers were vaccinated ahead of other professionals. Priority was also given to the vaccination of healthcare professionals, who are required to be vaccinated.

Many studies have been conducted before the vaccines are released regarding teachers' attitudes, perceptions, and intentions regarding vaccination against COVID-19. Across countries, the percentage of people intending to vaccinate varies. In particular, vaccination intention rates ranged from 20.7 to 89.7%. The most important reasons for not taking the vaccine were the lack of knowledge about the vaccine and its possible side effects. Conversely, the principal factors associated with vaccination intention were the gender (men), history of medical care and higher health literacy. Additional factors include the use of reliable information sources on vaccination such as public health and healthcare providers, as well as a preexisting background in science or engineering [11–13]. A similar study was conducted in Greece, where the percentage of teachers who declared their intention to be vaccinated against COVID-19 was 38.1%. The most important reasons, which were independently associated with the intention to uptake the vaccine, included work experience for more than 15 years, prior influenza vaccine uptake together with the belief that COVID-19 vaccine should be mandatory, followed by the fact that school teachers are in a high-risk group for COVID-19 [14].

As far as we are aware, very few studies have been conducted on teachers' vaccination coverage and the factors affecting their acceptance of the vaccine. A study of Ghanaian teachers compared their intention to vaccinate against COVID-19 before and after its release, as well as their vaccination uptake after the vaccine was approved [15]. Although a relatively high percentage of teachers reported their intention to vaccinate (63%), in the end only 11% did. The main reasons for not accepting the vaccine reported that they felt uncomfortable getting it, as well as having doubts about the effectiveness of vaccination in reducing absenteeism from school. A lack of confidence in the COVID-19 vaccine and its unavailability were also reported as reasons. The high rate (86.5%) of vaccination coverage of teachers in Poland was highlighted in a study, where the principal driver for vaccine acceptance was the wish to avoid contracting the disease. On the contrary, the principal driver for vaccine refusal became the concern about side effects and safety [16].

The present study aimed to find out the predictors of COVID-19 vaccine uptake in teachers.

Methods

Study Sample

An on-line cross-sectional survey with a convenience sample of teachers was conducted in Greece during December 2021. From January 2021 until the time of the study, a free-of-charge COVID-19 vaccine was offered by the Greek government to all citizens throughout the country. The vaccine was offered voluntarily and independent of a history of COVID-19. Special education teachers were given priority to be vaccinated, while general education teachers were vaccinated with the rest of the population in a phased manner according to their age group. By July 2021, all citizens had the opportunity to be fully vaccinated.

We used Google forms to create an anonymous version of the study questionnaire. A convenience sample was used since the questionnaire was distributed via social media and e-mail. In particular, investigators posted the questionnaire on their Facebook wall and in specific groups which included primary and secondary education. Moreover, the questionnaire was sent to the investigators' electronic contacts by email. As a result, it was not possible to measure the response rate. The on-line questionnaire was accompanied by a detailed explanation of the study's aim and design, together with teachers' choice to provide us their informed consent to participate anonymously in the study. Teachers completed the questionnaire on a voluntary basis without receiving any financial reward.

Questionnaire

The following demographic data of teachers were collected: gender, age, marital status, children, MSc/PhD degree, type of teachers (permanents or deputies), level of education (primary or secondary), type of school (general or special), years of experience, self-perceived financial status, self-perceived health status, chronic disease, previous COVID-19 diagnosis, family/friends with previous COVID-19 diagnosis, living with elderly people or vulnerable groups during the COVID-19 pandemic and family member working in healthcare facilities. Financial status and self-perceived health status were measured on a five-point Likert scale from 1 to 5 (1 = "very poor", 2 = "poor", 3 = "moderate", 4 = "good", and 5 = "very good"). Also, we measured seasonal influenza vaccination in 2020 and COVID-19 vaccination with "yes/no" answers.

Moreover, we recorded possible reasons for the decline in COVID-19 vaccination. We used a reliable and valid questionnaire to measure attitudes towards COVID-19

vaccination and the pandemic [17]. The questionnaire consists of 20 items and a four-factor model has proven valid. A scale from 0 to 10 is used to measure the answers of participants in each item. Greater values denote a higher level of agreement. The four factors are the following: (a) fear of COVID-19 (five items), (b) information regarding the COVID-19 (two items), (c) compliance with hygiene measures during the pandemic (two items), and (d) trust in the COVID-19 vaccination (six items). Each factor is measured on a scale from 0 to 10 with higher values denoting greater fear and higher levels of information regarding COVID-19, compliance with hygiene measures, and trust in COVID-19 vaccination. Cronbach's coefficients alpha for the four factors were > 0.7 in our study indicating acceptable reliability of the questionnaire; 0.88 for the factor "fear against the COVID-19", 0.83 for the factor "information regarding the COVID-19", 0.72 for the factor "compliance with hygiene measures during the pandemic", and 0.91 for the factor "trust in COVID-19 vaccination".

Statistical Analysis

We use numbers (percentages) to present categorical variables and mean, standard deviation, median, minimum value, and maximum value to present continuous variables. COVID-19 vaccination was the dependent variable and we defined the outcome as 1 if a teacher took a COVID-19 vaccine. First, we performed a univariate logistic regression analysis and then we applied a multivariable logistic regression analysis to eliminate confounding. All variables were included in the multivariable model and those with a statistically significant relation were shown. We calculated unadjusted and adjusted odds ratios, 95% confidence intervals, and p-values. In the multivariate logistic regression model, p-values < 0.05 were considered significant. All tests of statistical significance were two-tailed. Statistical analysis was performed with the Statistical Package for Social Sciences software (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.).

Results

Detailed demographic characteristics of 513 teachers are shown in Table 1. The mean age of teachers was 40.9 years and the mean years of experience was 12.4. The majority of teachers were females (86.4%), were married (64.7%), had children (61%), and held a MSc/PhD degree (64.9%). Regarding job characteristics, 57.7% of teachers had a permanent job, 60.6% worked in primary education and 19.3% worked in special education schools. Regarding the COVID-19 pandemic, 17.3% of teachers were diagnosed

Table 1 Demographic characteristics of teachers

Characteristics	N	%
Gender		
Females	443	86.4
Males	70	13.6
Age (years) ^a	40.9	9.1
Marital status		
Singles	146	28.5
Married	332	64.7
Widowed	33	6.4
Divorced	2	0.4
Children		
No	200	39.0
Yes	313	61.0
MSc/PhD degree		
No	180	35.1
Yes	333	64.9
Teachers		
Permanent	296	57.7
Deputy	217	42.3
Level of education		
Primary	311	60.6
Secondary	202	39.4
Type of school		
General	414	80.7
Special	99	19.3
Years of experience (years) ^a	12.4	9.1
Self-perceived financial status		
Very poor	4	0.8
Poor	32	6.2
Moderate	342	66.7
Good	120	23.4
Very good	15	2.9
Self-perceived health status		
Very poor	1	0.2
Poor	8	1.6
Moderate	77	15.0
Good	274	53.4
Very good	153	29.8
Chronic disease		
No	438	85.4
Yes	75	14.6
Previous COVID-19 diagnosis		
No	424	82.7
Yes	89	17.3
Family/friends with previous COVID-19 diagnosis		
No	156	30.4
Yes	357	69.6
Living with elderly people or vulnerable groups during the COVID-19 pandemic		
No	400	78.0
Yes	113	22.0

Table 1 (continued)

Characteristics	N	%
Family member working in healthcare facilities		
No	383	74.7
Yes	130	25.3

^aMean, standard deviation

with COVID-19 and 69.6% had family/friends with a previous COVID-19 diagnosis.

Table 2 presents teachers' attitudes towards vaccination. The majority of teachers were vaccinated against COVID-19 (85.8%), while the respective percentage for seasonal influenza in 2021 was quite lower (42.3%). The most important reasons for teachers' decline in COVID-19 vaccination were concerns about the safety and effectiveness of COVID-19 vaccines (45.2%), concerns about the side effects of COVID-19 vaccines (20.5%), self-assessment that they will not be infected by the COVID-19 (13.7%), and self-assessment that the COVID-19 vaccination will

be useless for those who have already been diagnosed with COVID-19 (9.6%).

Descriptive statistics for the four factors of the questionnaire that assesses teachers' attitudes towards COVID-19 vaccination and pandemic are shown in Table 3. Teachers reported moderate levels of fear against COVID-19 and trust in COVID-19 vaccination. Also, information about COVID-19 was high and compliance with hygiene measures during the pandemic was very high.

Univariate and multivariable logistic regression analysis is shown in Table 4. According to univariate logistic regression analysis, increased age and number of years of experience were related to increased COVID-19 vaccine uptake. Also, teachers with previous seasonal influenza vaccination history, those without a previous COVID-19 diagnosis, and those without a MSc/PhD degree had a greater probability to take a COVID-19 vaccine. Increased fear against COVID-19, compliance with hygiene measures during the pandemic, and trust in COVID-19 vaccination were related to COVID-19 vaccine uptake. After multivariable analysis, we found that increased age and trust in COVID-19 vaccination were

Table 2 Teachers' attitudes towards vaccination

Characteristics	N	%
COVID-19 vaccination		
No	73	14.2
Yes	440	85.8
Seasonal influenza vaccination in 2021		
No	296	57.7
Yes	217	42.3
Reasons for the decline of COVID-19 vaccination		
I have doubts about the safety and effectiveness of COVID-19 vaccines	33	45.2
I am afraid of the side effects of COVID-19 vaccines	15	20.5
I believe that I will not be infected by COVID-19	1	13.7
I believe that even if I get infected with COVID-19, nothing bad will happen to me	4	5.5
I have already been diagnosed with COVID-19 and the vaccine will not be beneficial for me	7	9.6
I am afraid because I suffer from a chronic disease	3	4.1
Family physician does not allow me to take a COVID-19 vaccine due to my medical condition	2	2.7
My religion does not allow me to take a COVID-19 vaccine	2	2.7
I am trying to get pregnant	3	4.1
I am afraid because I am pregnant	3	4.1

Table 3 Descriptive statistics and Cronbach's coefficient alpha for the four factors of the questionnaire that assesses teachers' attitudes towards COVID-19 vaccination and pandemic

Factor	Mean	Standard deviation	Median	Minimum value	Maximum value	Cronbach's alpha
Fear against the COVID-19	6.7	2.0	7	0	10	0.88
Information regarding the COVID-19	8.6	1.4	9	1	10	0.83
Compliance with hygiene measures during the pandemic	9.4	1.0	10	3	10	0.72
Trust in COVID-19 vaccination	7.2	2.3	7.8	0	10	0.91

Table 4 Univariate and multivariable logistic regression analysis with COVID-19 vaccine uptake in teachers as the dependent variable (reference: COVID-19 vaccine denial)

Variable	Unadjusted OR (95% CI)	P-value	Adjusted OR (95% CI) ^a	P-value
Gender (males vs. females)	1.15 (0.54–2.42)	0.73	NS	
Age (years) ^b	1.04 (1.01–1.07)	0.008	1.08 (1.02–1.14)	0.011
Marital status (married vs. singles/widowed/divorced)	1.09 (0.65–1.82)	0.74	NS	
Children (yes vs. no)	0.97 (0.58–1.61)	0.91	NS	
MSc/PhD degree (yes vs. no)	0.52 (0.29–0.92)	0.02	NS	
Teachers (permanent vs. deputy)	1.08 (0.65–1.77)	0.77	NS	
Level of education (primary vs. secondary)	1.16 (0.70–1.92)	0.56	NS	
Type of school (special vs. general)	2.12 (0.98–4.57)	0.06	NS	
Years of experience	1.03 (1.00–1.06)	0.04	NS	
Self-perceived financial status			NS	
Good/very good	2.29 (0.88–5.92)	0.09		
Moderate	1.67 (0.72–3.87)	0.23		
Very poor/poor	1 (reference)			
Self-perceived health status			NS	
Good/very good	0.75 (0.09–6.11)	0.79		
Moderate	0.75 (0.09–6.60)	0.79		
Very poor/poor	1 (reference)			
Chronic disease (yes vs. no)	1.09 (0.53–2.24)	0.81	NS	
Previous COVID-19 diagnosis (no vs. yes)	3.06 (1.76–5.31)	<0.001	NS	
Family/friends with COVID-19 disease (no vs. yes)	1.82 (0.99–3.33)	0.05	NS	
Living with elderly people or vulnerable groups during the COVID-19 pandemic (yes vs. no)	1.70 (0.86–3.35)	0.12	4.81 (1.55–14.89)	0.006
Family member working in healthcare facilities (no vs. yes)	1.23 (0.71–2.13)	0.47	NS	
Seasonal influenza vaccination in 2021 (yes vs. no)	4.96 (2.54–9.68)	<0.001	NS	
Fear against the COVID-19	1.57 (1.38–1.78)	<0.001	NS	
Information regarding the COVID-19	1.04 (0.88–1.25)	0.63	NS	
Compliance with hygiene measures during the pandemic	1.23 (1.00–1.51)	0.048	NS	
Trust in COVID-19 vaccination	2.39 (2.02–2.82)	<0.001	2.57 (2.07–3.18)	<0.001

An odds ratio < 1 indicates a negative association, while an odds ratio > 1 indicates a positive association

CI confidence interval, NS not selected by the multivariable logistic regression analysis with a significance level set at 0.05, OR odds ratio

^aR² for the final multivariate model was 61%

^bOR refers to one year increase in age

related to an increased probability of COVID-19 vaccine uptake. Also, teachers living with elderly people or vulnerable groups during the COVID-19 pandemic had a greater probability to take a COVID-19 vaccine.

Discussion

In this study, 85.8% of teachers were vaccinated, which appears to be a high rate, considering that at the time of the study was conducted, adult vaccination rates were 77.2% in Greece [18]. Teachers in Poland (86.5%) and Wales (84.3%) had similar vaccination rates during the same period [16, 19]. Vaccination rates are higher than those recorded in studies investigating vaccination intentions. The reason for

this might be the fact that a year had passed since the vaccines were launched, and many teachers were now confident in their safety and effectiveness. Also, in December 2021, another wave of the pandemic started. The fact that there have been a high number of cases and deaths and that the existing prevention measures cannot contain the pandemic may have prompted people to take the vaccine. There have been studies that demonstrate that fear of Coronavirus and benefits of the vaccine drive the uptake of vaccines in both the general population and the healthcare professionals [20, 21].

Among the three statistically significant findings of this study, two were associated with an increased likelihood of vaccination: the participants' age and the fact that they live with elderly and vulnerable individuals. Based on these

findings, teachers were aware of the impact COVID-19 has on these two populations. The elderly, the frail, and those with chronic diseases are generally considered to be at greater risk of severe disease and mortality [22, 23].

Lastly, teachers' perceptions of COVID-19 vaccine confidence were associated with increased likelihood of vaccination. Study findings of healthcare professionals in Greece concur with these findings [24]. The vaccine is one of the most important scientific breakthroughs in the fight against diseases. Therefore, the anti-vaccine movement has become increasingly prevalent in recent years. Furthermore, many parents are refusing to vaccinate their children, resulting in 10 to 100 times more cases of some infectious diseases in countries with low vaccination rates, compared to those with high vaccine coverage [25, 26].

Antivaccine activists have also targeted Coronavirus vaccines. Consequently, false news was spread through social networks or video sharing platforms, followed by millions of users [27]. Social media users became more hesitant about vaccinations after getting information about the pandemic on social media. The importance of providing citizens with systematic and reliable information about vaccine safety and value is fundamental to ensuring their acceptance. As a result of the present study and other studies conducted in the general population and its specific subgroups, concerns about the safety and efficacy of COVID-19 vaccines and their side effects have been raised. [24, 28]. Parents have also expressed doubts about the safety of vaccines in the decision to vaccinate their children against COVID-19 [29]. Regardless of educational level or socioeconomic background, all citizens should be able to easily understand and access information. Researchers have shown that people who lack knowledge about Coronavirus are more likely to believe myths about the vaccine and avoid vaccination [30, 31].

Limitations

The present study has some limitations. Although, the study population was relatively large, we used a convenience sample that is not representative of the total population of teachers in Greece. Additionally, the response rate could not be calculated as we conducted an on-line study. Moreover, vaccine uptake and other information were self-reported and social desirability to bias responses may exist.

Conclusion

Coronavirus is highly transmissible in schools. Teachers' work in the classrooms, which involves close contact with pupils, puts them at risk of infection. It has been shown that COVID-19 vaccines are extremely safe and effective

at preventing serious disease and mortality. Vaccination intention rates and vaccination uptake rates differ, suggesting teachers didn't choose to get vaccinated right away after vaccines were approved. In spite of the high vaccination rates among teachers, there are still doubts about vaccination safety. Based on the results of this study, reliable and accurate public information is needed concerning the risks of Coronavirus infection as well as vaccine safety and efficiency.

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Data Availability The data and material are available.

Code Availability Not applicable.

Declarations

Conflict of interest The authors declare that they have no conflict/competing of interests.

Ethical Approval The study was approved by the Institute for Studies and Research in General and Special Education, Athens, Greece (reference number 10/2021, 26/11/2021).

Informed Consent The authors provided informed consent to the participants.

Consent for Publication The authors provide consent for publication.

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