

Knowledge and Attitudes Related to COVID-19 Vaccine Uptake and Hesitancy of Attendants of a Healthcare Center in North Cyprus

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Abstract

BACKGROUND/AIMS: Vaccination is the most effective method for controlling infectious diseases, including coronavirus disease-2019 (COVID-19). The aim of this study was to investigate COVID-19 vaccine uptake status as related to knowledge and attitudes, including vaccine hesitancy, in a healthcare center in North Cyprus, where no previous data among the general population was available during the study period.

MATERIALS AND METHODS: This descriptive study included 428 patients and their companions presenting to a healthcare center between October 4, 2021 and October 31, 2021. The data collection tool was a questionnaire designed by the researchers that utilized international documents. The data were analyzed using SPSS 18.0.0 software.

RESULTS: Of the participants, 52.3% were female, 50.0% were 25-44 years of age and 25.2% were in the 45-64 age group, with a median age of 36. Regarding vaccine coverage, we have 93% had received at least one dose of the COVID-19 vaccine and 64.5% had received two doses. The one-dose vaccination rate was higher than the global average. Of the vaccinated, 64.5% had received CoronaVac and 37.6% received Comirnaty. The majority believed that vaccines are effective, and correct knowledge of COVID-19 vaccines was a predictor of higher vaccine uptake. Nevertheless, most of the participants displayed hesitancy for a variety of reasons, led by the speedy authorization of the vaccines by the World Health Organization (40%), adverse effects (22%), and speedy development of the vaccines (18%), while 42.1% indicated no hesitancy.

CONCLUSION: This study clarified the factors influencing COVID-19 vaccination uptake among the general population in this region.

Keywords: COVID-19 vaccine intention and uptake, knowledge and attitudes, COVID-19 vaccine hesitancy, North Cyprus, general population

INTRODUCTION

Vaccination is the most effective method for controlling morbidity and mortality due to infectious diseases, including coronavirus disease-2019 (COVID-19).

A total of 13.4 billion vaccine doses had been administered by May 2023 according to World Health Organization (WHO) data¹ and 70% of the

world population had received at least one dose of a COVID-19 vaccine. According to other international data, only 29.9% of low-income people had received at least one dose of the vaccine as of May 2023.²

By 2022, the percentages of vaccinated people were 88.95% in China, 88.67% in Cuba, 86.48% in Portugal, 80.96% in Italy, 76.02% in Germany, 75.13% in the United Kingdom, 62.67% in Türkiye, and 67.18% in the USA.³

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However, vaccination problems continue to occur in low- and middle-income countries.⁴ According to data from Cyprus in general, 50.2% of the population were fully vaccinated, whereas 64.6% had received at least the first dose in 2021.⁵

Vaccine hesitancy should be monitored in all countries by relevant measures according to WHO.^{6,7} Vaccine hesitancy was previously defined as “the delay in acceptance or refusal of vaccination services despite their availability” which was modified in May 2022 by the WHO as “a motivational state of being conflicted about, or opposed to getting vaccinated”.⁸

In high-income countries with adequate vaccination services, vaccine hesitancy is the most important factor in decreasing vaccination rates, ranging from 7 to 77.9%.⁹⁻¹² However, data from low- and middle-income countries on this issue are limited.¹³ A study conducted in Türkiye among the general population found that 37.9% were not willing to have a COVID-19 vaccine.¹⁴ A similar study conducted in Cyprus illustrated vaccination hesitancy among nurses and midwives as 70.0%.¹⁵

To the best of our knowledge, no previous study has been conducted to establish COVID-19 vaccine uptake, vaccination intention, and vaccine hesitancy in North Cyprus among the general population. The COVID-19 epidemic was continuing at a moderate level in Cyprus at the time of the study. The leading COVID-19 variant in North Cyprus was the Delta variant (B.1.617.2), a severe acute respiratory syndrome-coronavirus-2 strain. The number of weekly cases increased from 562 in the 1st week to 798 in the 4th week of the study. Cases per 100,000 were 147.12 in the 1st week and 208.9 in the 4th week. The case fatality rate was 0.26 per 100,000 in the last week.^{16,17}

CoronaVac and Comirnaty vaccines have been available in the country since February 2021. CoronaVac, Comirnaty, AstraZeneca, Janssen, and Moderna vaccines are available from time to time. The main reason for getting the specific vaccine types was the availability of the vaccines at the time of need.

Objective

The current study aimed to investigate COVID-19 vaccine uptake status in terms of knowledge and attitudes, including vaccine hesitancy, in a healthcare center in North Cyprus.

MATERIALS AND METHODS

This study was carried out during 4-31 October 2021 at a central healthcare facility in Nicosia, North Cyprus.

This descriptive epidemiological study included patients and their companions who applied to the healthcare center for any reason. The dependent variables were knowledge and attitudes regarding COVID-19 vaccination, including acceptance of vaccination and vaccine hesitancy. Independent variables included age, gender, nationality, marital status, occupation, unemployment, educational status, socioeconomic status, history of chronic disease, and knowledge of COVID-19 and vaccines.

Sampling

A non-probability convenience sampling method was used, and individuals 15 years of age and older who were attending the healthcare center during the study period were included. A total of 503 people were approached, but 75 were refused to participate in the study.

The selected healthcare unit is a comprehensive primary healthcare center in the region. The people visiting the health facility included all age groups, nationalities, ethnicities, and genders, resembling the population distribution of the city.

Outcome Measurement

The primary outcome of the study was the uptake frequency of COVID-19 vaccines.

Data Collection Tools and Methods

The data collection tool was a questionnaire designed by the researchers based on international documents (Supplementary 1)¹⁸⁻²². The first 12 questions are about the participants' sociodemographic characteristics. Occupations were classified according to the International Labor Organization classification.¹⁸ During the evaluation, participants were grouped as health professionals and others for comparison.

The following 10 questions are about the COVID-19 history and vaccination status of the participants. The type of COVID-19 vaccine and the number of doses was discussed in this section. The intention or willingness was measured by Question 23, which covers 11 items: protection of oneself, family, and community; belief in science, returning to normal life, and reducing the costs of the pandemic.

The hesitancy data were derived from the answers to question 24 of the questionnaire (“the reasons for not being vaccinated”). This question included 13 items as reasons for not receiving the vaccine, including adverse effects, novelty of the vaccines, suspicion of effectiveness, and false or non-relevant perceptions.

The next section comprises 25 questions about the participants' attitudes (17Qs) and knowledge (8Qs) of the COVID-19 vaccination. The attitude questions (Qs26-43) are in Likert format and cover questions on vaccine benefits, efficacy, and side effects, involvement in a vaccine trial, and belief in public health professionals and community leaders.

The last 8 questions (Qs44-51) are on the knowledge of COVID-19 and vaccines. Correct knowledge of COVID-19 vaccines was obtained from questions 28, 48, and 51.

Q28: This is a Likert-type question asking about the influence of the vaccine on preventing the spread of the disease. The answer was accepted as satisfactory if the respondent responded “I strongly agree” or “I agree”.

Q48: The response was accepted as satisfactory if the participant answered “yes” to Q48, inquiring about the vaccination necessity for people who recovered from a COVID-19 infection. Q51 tested the opinion of the participant about the effectiveness of COVID-19 vaccines. If the participant responded “very effective” or “effective”, the response was considered satisfactory.

Pre-test: The pre-test was conducted on 20 patients and their companions who were attending a hospital in Nicosia. Minor revisions were made in the revised manuscript. The pre-test questions were understood sufficiently by the participants, and the questionnaire was completed in about 10 minutes on average.

Questionnaires were completed anonymously under observation after obtaining written informed consent. Permission to conduct the

research was provided by the Ministry of Health. The study protocol was approved by Near East University Faculty of Medicine Scientific Research Ethics Committee (approval number: 2021/95-1416, date: 30.09.2021). The Declaration of Helsinki was complied with.

Statistical Analysis

Data were analyzed using SPSS 18.0.0 (Statistical Package for the Social Sciences). For the analysis, descriptive statistics were calculated and marginal and cross-tabulated. The categorical data were evaluated using the chi-square test, with the significance level set as $p < 0.05$.

RESULTS

Of the total of 503 participants, 428 were accepted to participate and 75 were rejected to be included in the study. The acceptance rate is 85%.

The sociodemographic characteristics of the participants are presented in Table 1. The majority of the participants were citizens of North Cyprus and Türkiye. Of the total, 52.3% were female, 50.0% were 25-44 years of age and 25.2% were in the 45-64 age group, with a median age of 36. The 65 age group comprised 5.9% of the participants.

The participants' history of chronic diseases and COVID-19 is presented in Tables 2, 3. Of the participants, 12.9% stated that they had recovered from a COVID-19 of, and 61.4% stated that they knew people who had died of COVID-19. There was no statistically significant difference between participants with chronic disease and those with COVID-19.

The vaccination uptake status of the participants according to demographic variables is presented in Table 4. A total of 93.2% of those aged below 45 years and 92.5% of those aged 45 and above were vaccinated for COVID-19. The differences between age groups were not statistically significant. Similarly, the differences between the groups regarding some categorical variables, such as vaccination status according to nationality, sex, having a chronic disease, having children, economic and employment status, and education, were not found statistically significant. The difference between health workers and members of other occupations in vaccine uptake was also not significant. The only demographic variable found to be significant was marital status, with married people being significantly more vaccinated compared to single people.

The knowledge of COVID-19 vaccination was inquired by 3 questions and satisfactory responses were compared between vaccinated and unvaccinated participants. The results indicated that there was a significant difference between participants with satisfactory responses and those with non-satisfactory responses regarding vaccination rates. People who answered these questions satisfactorily were vaccinated significantly more than those in the other group:

1. Vaccination will prevent the spread of the disease: $\chi^2=92.14$, $p=0$.
2. Vaccination is necessary for people who have had COVID-19: $\chi^2=40.625$, $p=0$.
3. COVID-19 vaccination is effective: $\chi^2=73.93$, $p=0$.

Table 5 presents the COVID-19 vaccination status of the participants. Of the total, 93.0% were vaccinated with one or more doses for COVID-19, 64.5% had 2 doses, 19.4% had 3 doses, and 10.3% received only one dose.

Table 1. Socio-demographic characteristics of the participants (Nicosia, October 2021) (n=428)

Socio-demographic characteristic	n	%
Gender		
Female	224	52.3
Male	204	47.7
Age group		
15-24	81	18.9
25-44	214	50.0
45-64	108	25.2
≥65	25	5.9
Mean ± SD: 38.3±14.8; median: 36; min.-max.: 15-83		
Country of origin		
North Cyprus	237	55.4
Türkiye	184	43.0
Other countries	7	1.6
Marital status		
Married	225	52.6
Single	193	45.1
Divorced/Widower	10	2.3
Having children		
Yes	227	53.0
No	201	47.0
Educational status		
Primary school and below	68	15.9
Junior high school: The students' voices were heard	51	11.9
High school	132	30.8
University and above	177	41.4
Work status		
Working	216	50.5
Not working	161	37.6
Retired	51	11.9
Number of household members		
1-2	140	32.7
3-4	222	51.8
≥5	66	15.5
Mean ± SD: 3.2±1.4; median: 3; min.-max.: 1-8		
The economic status of households		
High	31	7.2
Middle	312	72.9
Low	85	19.9
SD: Standard deviation, min.: Minimum, max.: Maximum.		

Table 2. Chronic disease history of the participants (Nicosia, October 2021) (n=428)

Chronic disease distribution	n	%*
Cardiovascular system	48	11.2
Endocrine system	31	7.2
Respiratory system	24	5.6
Gastrointestinal system	5	1.2
Other	8	1.9
Total number of participants with chronic diseases	86	20.1
*Row percentages over 428.		

Among the vaccinated participants, 64.5% had received the CoronaVac COVID-19 and 37.6% received the Comirnaty vaccine. The reasons for being vaccinated were expressed as personal protection from the infection (79.6%), protecting family members (79.1%), normalizing life (72.0%), protecting the community (67.3%), believing in science (53.5%), to be able to travel again (46.4%), and to be able to participate in social activities (40.5%).

Of the participants, 22.4% expressed no concern about acquiring the COVID-19 infection while 16.1% were seriously concerned. However, most (61.4%) of the participants were moderately concerned. Similar

to the rationale for being vaccinated, confidence in some leaders, as expressed by the participants, was 71.1% for public health workers, 36.7% for politicians, and 29.9% for religious leaders. Regarding the source of information about COVID-19 vaccines, 46.7% stated that they received information from television and newspapers, 40.2% from social media and the internet, 31.1% from the Ministry of Health, 7.2% from primary healthcare physicians, or 4.7% from universities.

Factors related to hesitancy about vaccines (question 24) were indicated as concerns about adverse effects by 22.4%, the rapid development of the COVID-19 vaccines by 18.0%, vaccine ineffectiveness for prevention

Table 3. Past-COVID-19 infection status among participants with chronic diseases compared with patients without chronic diseases (n=428)

Chronic disease status	Past-COVID-19 (+), (n, %)	Past-COVID19 (-), (n, %)	Total, (n, %)*
Participants with chronic disease (n=86)	11 (12.8)	75 (87.2)	86 (20.1)
Participants without chronic disease (n=342)	44 (12.9)	298 (87.1)	342 (79.9)
Total	55 (12.8)	373 (87.2)	428 (100)
			$\chi^2=0, p=0.98$

*Column%; others row%, COVID-19: Coronavirus disease-2019.

Table 4. The vaccination uptake status of the participants according to demographic variables (Nicosia, October 2021) (n=428)

Variable	COVID-19 vaccination status			χ^2	p
	Vaccinated	Not vaccinated	Total		
	n (%)	n (%)		0.08	0.78
Age (years)					
Under 45	275 (93.2)	20 (6.8)	295		
45 & over	123 (92.5)	10 (7.5)	133		
Marital status					
Married	195 (96.1)	8 (3.9)	203	55.58	0.018
Single	203 (90.2)	22 (9.8)	225		
Gender				0.42	0.52
Male	188 (92.2)	16 (7.8)	204		
Female	210 (93.8)	14 (6.3)	224		
Chronic disease				0.24	0.63
Yes	317 (92.7)	25 (7.3)	342		
No	81 (94.2)	5 (5.8)	86		
Having children				7.23	0.07
Yes	204 (89.9)	23 (10.1)	227		
No	194 (96.5)	7 (3.5)	201		
Economic status				0.25	0.62
Total of high and medium response	320 (93.3)	23 (6.7)	343		
Low responses	78 (91.8)	7 (8.2)	85		
Employment				1.41	0.23
Employed	204 (94.4)	12 (5.6)	216		
Unemployed	194 (91.5)	18 (8.5)	212		
Occupation				0.55	0.46
Health professionals	8 (88.9)	1 (11.1)	9		
Others	196 (94.7)	11 (5.3)	207		
Education				0.342	0.56
Junior high & <	228 (92.3)	19 (7.7)	247		
High school & >	166 (93.8)	11 (6.2)	177		

COVID-19: Coronavirus disease-2019.

by 9.6%. Of the total, 58% expressed some kind of hesitancy about the vaccines, whereas 42% displayed no hesitancy.

The factors influencing confidence in vaccines negatively (question 25) were the speedy emergency use authorization by the WHO (40.2%), use of new technologies in producing the vaccines (28.7%), the speedy development of new measures and techniques (24.1%), and some misleading or fake information (19.6%).

Regarding vaccine efficacy, 81.8% believed vaccines are beneficial for protection from the infection. and 68.9% of the respondents expressed that vaccination should be mandatory for all people, and 79.9% thought vaccines should be mandatory for health professionals.

Likert-type attitudes and knowledge questions showed that higher education would not indicate better knowledge and attitude in general,

except for better knowledge of the fatality rate and incubation period of the disease (Table 6).

Of the participants, 23.5% of those whose education level was junior high school and below and 46.6% of those with education of high school and above stated that they received information about COVID-19 vaccines from social media and the internet. The difference between the groups according to education levels regarding receiving information on vaccines from social media and the Internet was statistically significant. Higher educated people received information from social media and the internet significantly more frequently than the less educated group.

DISCUSSION

In this study, 93.0% of the participants were vaccinated with one or more vaccine doses for COVID-19. The overall one-dose rate was much

Table 5. The vaccination status of the participants according to vaccine type and the number of doses uptaken (Nicosia, October 2021) (n=428)

COVID-19 vaccination status	n	%
At least one dose	398	93.0
Vaccine type		
CoronaVac (Sinovac)	276	64.5
Comirnaty (Pfizer-BioNTech)	161	37.6
Janssen	22	5.1
AstraZeneca (Vaxzevria)	13	3.0
Moderna	4	0.9
Number of vaccine doses		
1	44	10.3
2	276	64.5
3	83	19.4
4	2	0.5
No difficulty in accessing the vaccines	304	71.0

COVID-19: Coronavirus disease-2019.

Table 6. Attitudes and knowledge about COVID-19 and COVID-19 vaccines by educational status (Nicosia, October 2021) (n=428)

Attitude, knowledge	Educational status					
	Junior high school and below		High school and above		χ ²	p
	n*	%*	n	%		
Would you like to learn more about vaccines	111	93.3	289	93.5	0.72	0.70
COVID-19 vaccination is important for curbing the spread of the disease	102	85.7	275	89.0	0.9	0.64
COVID-19 vaccines are important for community health	109	91.6	267	86.4	2.16	0.34
I received COVID-19 vaccination because it is mandatory	63	52.9	118	38.3	12.6	0.02
COVID-19 vaccination is unnecessary because most people will contract COVID-19	25	21.0	52	16.8	7.3	0.26
Correct knowledge of the COVID-19 fatality rate	56	47.1	179	57.6	24.1	0.04
Correct knowledge of the COVID-19 incubation period	24	20.2	96	31.1	5.1	0.02

*n and (%) reveal the sum of the number and percentage of people who strongly agreed and agreed with the statements below (Likert scale).

higher than the global average of 70%.² Of the participants in the study, 81.8% indicated that vaccines are beneficial and effective for protection from infection.

Our findings are in compliance with a broad survey of low- and middle-income countries. A survey of 15 studies in 2020-2021 compared low-income, lower-middle-income, and upper-middle-income countries with Russia and the USA.⁴ Similar to the 93% vaccine uptake rate in our study, the average acceptance rate in all studies in low and middle income countries was 80.3%, higher than samples from the United States (64.6%) and Russia (30.4%).⁴ Another study covering 15 African countries found that the majority of the respondents (79%) were willing to receive a COVID-19 vaccine.¹³ The highest acceptance rates were found in Malaysia (94.3%), Indonesia (93.3%), and China (91.9%). In the Eastern Mediterranean Region, confidence rates in the general population ranged from 29.4% to 64.7%.^{21,23} The lowest rates of vaccine confidence in the general population were found in Hong Kong, the Middle East, and the Democratic Republic of Congo in a systematic review of 2021.¹⁹

Our findings revealed that 79.6% of the respondents expressed the reason for being vaccinated as being protected personally from the infection, followed by protection of family members (79.1%). Data from other surveys indicated similar results in that vaccine acceptance and uptake are related to the intention for protection against COVID-19. However, contrary to our survey, higher vaccine acceptance was associated with sociodemographic factors such as older age, male gender, higher education, high income, having older children with vaccine coverage, health insurance coverage, and not having any chronic illnesses.²⁴ In our study, only the marital status among sociodemographic features was found to affect vaccine uptake.

Suspicion about safety and efficacy, hasty development of vaccines, and cost-effectiveness were among the main predictors of both vaccine acceptance and vaccine hesitancy,²⁴ similar to our study. Other factors like trust in authorities and vaccine safety, risk perception of COVID-19, and previous influenza vaccination positively affected vaccine acceptance positively.²⁵

In our study, hesitancy was indicated even by people who were vaccinated, which might have prevented full-dose vaccination. Thus, although the one-dose vaccination rate was high, hesitancy findings rates were also high: 22.4% of the participants indicated concern about adverse effects, 18% were concerned that the COVID-19 vaccines had been hastily developed, and 9.6% believed that vaccines may be ineffective for protection from the infection. In total, 42% of the participants expressed no hesitancy. In the literature, concerns about adverse effects are the most common reasons for hesitancy.^{4,13,23}

Of the participants in our study, 46.7% stated that they received information about COVID-19 from television and newspapers, 40.2% from social media and the internet, and 31.1% from the Ministry of Health.

However, according to the literature, healthcare professionals are considered the most reliable sources for vaccination against COVID-19.^{10,15} A systematic review on COVID-19 uptake intention found that the leading confidence factor was physician recommendations, influencing 80% of the Chinese population and 62% of the Americans.²⁴ Health workers were found to be the most trusted sources for COVID-19 vaccines in another study.⁷ The higher proportion of media and social media influences may be due to the younger age of the study

population. As the group of people involved is a young population, this might be the reason for the social media impact, and as isolation was a reality, many of them could not go to the hospitals or primary care, which might have influenced the result.

The influence of knowledge about COVID-19 vaccines on vaccination uptake was also investigated. People who answered the relevant questions satisfactorily were vaccinated significantly more than the other group. Similarly, in another study, half of the participants stated that they would reconsider getting vaccinated if they were more informed about the vaccine.⁹ However, even if health messages are adequate, opinions of people about the vaccine may change over time.²⁶

Our findings are in compliance with other research on COVID-19 vaccination issues in Cyprus.²⁷

Study Limitations

The study is a convenience sample and thus not representative of the North Cyprus population. The study size is small, from a single country during a certain short period of the pandemic. The vaccine uptake rate is based on one dose of COVID-19 vaccination. Hesitancy questions were asked to all participants, including those who were vaccinated. The vaccine type was not questioned. The economic status question is subjective, relying on self perception of the economic status of the participant.

CONCLUSION

This study on COVID-19 vaccination in North Cyprus revealed the vaccination uptake and associated factors among the general population in this region, illustrating findings similar to those in the medical literature. In summary, the one-dose vaccination rate was high, but the full-dose vaccination rate was lower than the world average.

The predictors of higher vaccine acceptance and uptake were marital status and correct knowledge of COVID-19 vaccination. A closer monitoring and implementation of COVID-19 vaccination and achievement of full-dose vaccination are needed among the general population of the people of North Cyprus, given the uncertain progress of the COVID-19 epidemic worldwide.

MAIN POINTS

- Vaccination is the most effective method for controlling infectious diseases, including COVID-19.
- No previous data on COVID-19 vaccine uptake and associated factors among the general population of North Cyprus were available during the study.
- Regarding vaccine coverage, 93% had received at least one dose of a COVID-19 vaccine, a rate higher than the world average, and 64.5% had received two doses.
- The majority believed that vaccines are effective and that correct knowledge of COVID-19 vaccines, together with concern for personal protection from the infection, were predictors of higher vaccine intention and uptake.
- Most participants displayed hesitancy for a variety of reasons, including speedy authorization of the vaccines by the WHO (40%),

adverse effects (22%), and speedy development of the vaccines (18%), whereas 42.1% stated no hesitancy for vaccination.

ETHICS

Ethics Committee Approval: The study protocol was approved by Near East University Faculty of Medicine Scientific Research Ethics Committee (approval number: 2021/95-1416, date: 30.09.2021).

Informed Consent: It was obtained.

Footnotes

Authorship Contributions

Concept: Ö.A., S.V., G.A., S.C., Design: Ö.A., S.V., G.A., S.C., Data Collection and/or Processing: Ö.A., S.V., G.A., S.C., Analysis and/or Interpretation: Ö.A., S.V., G.A., S.C., Literature Search: Ö.A., S.V., G.A., S.C., Writing: Ö.A.

Conflict of Interest: No conflict of interest was declared by the authors.

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REFERENCES

- WHO Coronavirus (COVID-19) Dashboard. 2023. Available from: covid19.who.int. Accessed 15 May 2023.
- Our World in Data, Coronavirus (COVID-19) Vaccination. 2023. Available at: <https://ourworldindata.org/covid-vaccinations>. Accessed 25 May 2023.
- Our World in Data, Coronavirus (COVID-19) Vaccination. 2022. Available at: <https://ourworldindata.org/covid-vaccinations>. Accessed 11 Aug 2022.
- Solís Arce JS, Warren SS, Meriggi NF, Scacco A, McMurry N, Voors M, et al. COVID-19 vaccine acceptance and hesitancy in low- and middle-income countries. *Nat Med*. 2021; (8): 1385-94.
- Konstantinou N, Nicolaou SA, Petrou C, Pieri M. Trust in authorities and demographic factors affect vaccine acceptance during the COVID-19 Pandemic in Cyprus. *European Journal of Psychology Open*. 2021; 80(1-2): 88-97.
- Soares P, Rocha JV, Moniz M, Gama A, Laires PA, Pedro AR, et al. Factors associated with COVID-19 vaccine hesitancy. *Vaccines*. 2021; 9(3): 300.
- Oduwole EO, Pienaar ED, Mahomed H, Wiysonge CS. Overview of tools and measures investigating vaccine hesitancy in a ten year period: a scoping review. *Vaccines*. 2022; 10: 1198.
- World Health Organization. Understanding the behavioral and social drivers of vaccine uptake WHO position paper—May2022. *Weekly Epidemiological Record* 2022. pp. 209–24 Available online: <https://apps.who.int/iris/bitstream/handle/10665/354458/WER9720-eng-fre.pdf> Accessed 10 June 2022.
- Ashworth M, Thunström L, Cherry TL, Newbold SC, Finnoff DC. Emphasize personal health benefits to boost COVID-19 vaccination rates. *Proc Natl AcadSci USA*. 2021; 118(32): 2108225118.
- Dinga JN, Sinda LK, Titanji VPK. Assessment of vaccine hesitancy to a COVID-19 vaccine in Cameroonian adults and its global implication. *Vaccines*. 2021; 9(2): 175-88.
- Jin Q, Raza SH, Yousaf M, Zaman U, Siang JMLD. Can communication strategies combat COVID-19 vaccine hesitancy with trade-off between public service messages and public skepticism? Experimental evidence from Pakistan. *Vaccines*. 2021; 9(7): 757.
- Aw J, Seng JJB, Seah SSY, Low LL. COVID-19 vaccine hesitancy—a scoping review of literature in high-income countries. *Vaccines*. 2021; 9(8): 900.
- Maching A, Wiysonge CS. Understanding COVID-19 vaccine hesitancy. *Nat Med*. 2021; 27(8): 1338-9.
- Yılmaz H, Turgut B, Çıtlak G, Mert O, Paralı B, Engin M, et al. The perceptions of the Turkish people about COVID-19 vaccine. *Dicle Med J*. 2021; 48(3): 583-94.
- Fakonti G, Kyprianidou M, Toumbis G, Giannakou K. Attitudes and acceptance of COVID-19 vaccination among nurses and midwives in Cyprus: a cross-sectional survey. *Front Public Health*. 2021; 9: 656138.
- Ministry of Health of the Turkish Republic of Northern Cyprus. Available at: www.saglik.gov.ct.tr/Portals. Accessed 28 Sep 2023.
- Cuschieri S, Hatzizianni A, Kantaris M, Kontemeniotis A, Theodorou M, Pallari E. Same pandemic yet different COVID-19 vaccination roll-out rates in two small European islands: A comparison between Cyprus and Malta. *Healthcare*. 2022; 10(2): 222.
- International Labor Organization. International Standard Classification of Occupations. 2008. <https://www.ilo.org/public/english/bureau/stat/isco/docs/publication08.pdf>
- Kuter BJ, Browne S, Momplaisir FM, Feemster KA, Shen AK, Green-McKenzie J, 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): 1693-700.
- Kittle B. A Practical Guide to Conducting a Barrier Analysis. Helen Keller International, New York. 2013. Available online: https://pdf.usaid.gov/pdf_docs/PA00JMZW.pdf
- World Health Organization Behavioral considerations for acceptance and uptake of COVID-19 vaccines: WHO technical advisory group on behavioral insights and sciences for health, meeting report. 15 October 2020. World Health Organization 2020. License:CC BY-NC-SA 3.0 IGO. Available online: <https://apps.who.int/iris/handle/10665/337335>
- Salomoni MG, Valerio Z D, Gabrielli E, Montalti M, Tedesco D, Guaraldi F, et al. Hesitant or not hesitant? A systematic review on global COVID-19 vaccine acceptance in different populations. *Vaccines*. 2021; 9(8): 873.
- Zewude B, Habtegiorgis T. Willingness to take COVID-19 vaccine among people most at risk of exposure in southern Ethiopia. *Pragmat Obs Res*. 2021; 27(12): 37-47.
- Lin C, Tu P, Beitsch LM. Confidence and receptivity for COVID-19 vaccines: A rapid systematic review. *Vaccines*. 2020; 9(1): 16.
- Joshi A, Kaur M, Kaur R, Grover A, Nash D, El-Mohandes A. Predictors of COVID-19 vaccine acceptance, intention, and hesitancy: A scoping review. *Front Public Health*. 2021; 9: 698111.
- Borchering RK, Viboud C, Howerton E, Smith CP, Truelove S, Runge MC, et al. Modeling of future COVID-19 cases, hospitalizations, and deaths, by vaccination rates and nonpharmaceutical intervention scenarios - United States. *MMWR Morb Mortal Wkly Rep*. 2021; 70(19): 719-24.
- Guzoglu N, Daneshvar Z, Hamrang E, Kayisbudak ID, Khasawneh H, Omar Yasser Mahmoud OY, et al. General attitudes toward and awareness of vaccines among students at a university in Northern Cyprus. *Hum Vaccin Immunother*. 2021; 17: 2647-51.

Supplementary 1 Links:

<https://l24.im/9Ej3Zm>