

RESEARCH PAPER



Attitudes of health care professionals towards COVID-19 vaccine - a sequence from Turkey

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ABSTRACT

The purpose of this study is to evaluate the attitudes of healthcare professionals toward the COVID –19 vaccine, which has been introduced to healthcare professionals at the beginning of 2021 and give information to them on the disease and vaccine. This cross-sectional analytical study has been performed by conducting an online survey to the healthcare professionals who work at the healthcare institutions in the province of Samsun in Turkey between December 2020 and January 2021. In addition to sixteen questions about the demographic characteristics, the “Attitudes towards the COVID –19 vaccine” scale has been used. MANOVA test and Spearman rho correlation coefficient were used in analytical examinations. A total of 1426 healthcare professional have been reached. 64.3% of participants were female, 44.1% were nurse/midwife and 66.6% were public employees. Regarding the questions in the sub-dimension of positive attitude, the rate of response of “I agree/I strongly agree” was between 40.6% and 54.6%. Positive attitude mean values differ according to gender, age, institution, presence of children, smoking status, being a relative who died due to COVID –19, and profession (respectively $p < .001$, $p < .001$, $p < .001$, $p < .001$, $p = .002$, $p = .019$, $p < .001$). It has been observed that positive and negative attitudes toward COVID –19 vaccination are almost equally distributed and some demographic factors affect the attitude. The opinions of healthcare professionals on the safety and effectiveness of the vaccine, which are the main elements of the vaccination effort, may affect the public perception of vaccination.

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Introduction

Although some advances have been made during the COVID-19 pandemic thanks to social distancing, hand washing, wearing face mask and self-isolation, more serious steps should be taken to stop the epidemic. The high contagiousness of the virus, its unprecedented negative impact on the health system of countries, and the lack of treatments that can improve the prognosis of the disease to date have indicated the importance of developing an effective and reliable vaccine against this disease.¹

As a result of intense efforts, some vaccines have been developed against COVID-19, and several different vaccines can still be used worldwide. However, we have not yet been able to reach a sufficient amount of vaccination. In addition, it has been suggested that the 60–72% community immunity can only be achieved with vaccines to end the pandemic.² In Turkey, the Ministry of Health has signed an agreement for 50 million doses of Chinese Sinovac vaccine, and these inactivated virus vaccines developed through conventional vaccine production technology (CoronaVac) are administered.

It is important how the COVID-19 vaccination looks from the eyes of the healthcare workers, because the attitude of healthcare professionals on this issue has the potential to be a role model for the public and there are not enough studies on this subject. Healthcare professionals who are considered to be at risk in our country have been planned to be vaccinated in the first place. The purpose of this study is to evaluate the attitudes of healthcare professionals

toward the COVID-19 vaccine, which has been introduced to healthcare professionals at the beginning of 2021 and give information to them on the disease and vaccine.

Methods

Procedure and participants

This cross-sectional analytical study has been performed by conducting an online (by sending mails) survey to the healthcare professionals who work at the healthcare institutions in the province of Samsun (Figure 1)³ in Turkey (public, private, university) between December 2020 and January 2021. While working as a health professional in this city is the inclusion criterion, not taking active duty is the exclusion criterion. The study included only the volunteers and those who answer the questions completely.

There are 12382 people working in the health institutions in Samsun based on the ‘November 2020’ data of Samsun Health Directorate. The sample calculation has revealed that we need to reach a minimum of 983 people with a confidence interval of 95% and an acceptable error margin of 3%.

Measures

In order to guide further studies and in-service training models, attitude differences between the demographic characteristics of



Figure 1. Samsun's location in the world.

the participants were tested by sixteen questions (gender, profession, institution, marital status, having a child, living with someone, chronic disease, smoking, to have risk for COVID-19, recovered from the COVID-19, etc.). Besides, "Attitudes towards the COVID-19 vaccine" scale (which was developed by an old scale with some psychometric properties against swine flu in 2011 to COVID-19) with a Cronbach's alpha value of 0.80 has been used. This scale has 9 items and has two sub-dimensions (positive and negative attitude). Expressions included in the scale were as follows: "I strongly disagree (1)", "I disagree (2)", "I am uncertain (3)", "I agree (4)" and "I strongly agree (5)". The items under the sub-dimensions of negative attitude are scored inversely. A value between 1 and 5 is obtained by dividing the total score obtained by the sum of the item scores in the scale sub-dimension by the number of items in that sub-dimension. High scores from the sub-dimension of positive attitude indicate that the attitude toward vaccination is positive. The items in the sub-dimension of negative attitude are calculated after reversing. The higher scores in these sub-dimensions indicate less negative attitude toward the vaccine.⁴

Data analysis

Data were analyzed with IBM SPSS V23. Whether positive and negative attitudes had normal distribution according to demographic characteristics was examined by Kolmogorov Smirnov and Shapiro Wilk tests. Since the data were compatible with normal distribution, the effect of demographic characteristics on positive and negative attitudes was examined using the MANOVA test. Confidence interval adjustment with Bonferroni

as a result of the MANOVA test was performed to compare the main effects in multiple comparison tests. Since the number of chronic diseases and age did not conform to the normal distribution, the relationship between positive and negative attitudes and age and the number of chronic diseases was evaluated with the Spearman rho correlation coefficient. The significance level was taken as $p < .05$.

Ethical approval

The present study was confirmed by the Ministry of Health and approved by the noninvasive ethics committee of Samsun Training and Research Hospital (no GOKA/2021/1/21). Participants had provided an informed consent.

Results

A total of 1426 healthcare professional have been reached. The mean age was 37.2 (min. 20 – max. 81) years and the working experience was 14 ± 10.1 years.

64.3% of participants were female, 44.1% were nurse/midwife and 66.6% were public employees. 70.1% were married, 66.1% have child, 57.5% were living with their spouses and children and 25.3% had a chronic disease. 32.4% were smokers, 63.5% had a family member who is considered to be at high risk for COVID-19, 21.3% had a relative who died due to COVID-19, 77.2% were working with COVID-19 patients during the pandemic and 27.4% have recovered from COVID-19 disease (Table 1).

Table 1. Descriptive statistics.

	Frequency	Percent
Gender		
Male	509	35.7
Female	917	64.3
Profession		
Nurse/midwife	629	44.1
General Practitioner	161	11.3
Healthcare Technician/ATT	272	19.1
Dentist	31	2.2
Specialist Physician	186	13.0
Other	147	10.3
Institution		
1st Stage Public Health Organization	337	23.6
2nd Stage Public Health Organization	420	29.5
3rd Stage Public Health Organization	193	13.5
1st Stage Private Health Organization	161	11.3
2nd Stage Private Health Organization	267	18.7
University	48	3.4
Marital Status		
Single	426	29.9
Married	1000	70.1
Having a child		
Yes	943	66.1
No	483	33.9
Living with someone		
Parents	201	14.1
Other	35	2.5
Spouse	151	10.6
Spouse and children	820	57.5
Housemate	47	3.3
Only children	31	2.2
Alone (I was alone before the pandemic as well)	90	6.3
Alone (I live alone during the pandemic)	51	3.6
Chronic disease		
No	1065	74.7
Yes	361	25.3
Hypertension	141	34
Asthma/COPD	54	13
Diabetes	54	13
Chronic Heart Disease	37	8.9
Obesity	29	7
Cancer	16	3.9
Chronic Kidney Disease	5	1.2
Other	201	48.4
Smoking		
Yes	462	32.4
No	964	67.6
Do you have a family member who is considered to be at high risk for Covid-19 (elderly, chronic illness, children, disabled etc.)?		
Yes	905	63.5
No	521	36.5
Do you have a relative who died due to Covid-19 during the pandemic?		
Yes	304	21.3
No	1122	78.7
Have you worked/do you work with Covid-19 patients during the pandemic?		
Yes	1101	77.2
No	325	22.8
Have you recovered from the Covid-19?		
Yes	391	27.4
No	1035	72.6
Profession Group		
Group 1 (Practitioner, Specialist, Dentist)	378	26.5
Group 2 (Nurse/Midwife)	629	44.1
Group 3 (Healthcare technician/ATT)	274	19.2
Other	145	10.2

Regarding the questions in the sub-dimension of positive attitude, the rate of response of “I agree/I strongly agree” was between 40.6% and 54.6%. Regarding the questions in the sub-dimension of negative attitude, the rate of response of “I

disagree/I strongly disagree” was between 27.5% and 58.9%. The rate of “I am uncertain” was between 30% and 41.2%. The mean value of the positive attitude dimension was 3.54. The mean values of 4 items under this dimension varied between 3.29 and 3.64. The Cronbach’s Alpha value of positive attitude dimension was 0.944. The mean value of the negative attitude dimension was 3.42. The mean values of 5 items under this dimension varied between 2.86 and 3.66. The Cronbach’s Alpha value of negative attitude dimension was 0.801 (Table 2).

The positive and negative attitude scores of males were higher than women ($p < .001$, $p < .001$, respectively). The mean values of positive and negative attitudes differ based on the institution ($p < .001$, $p = .002$, respectively). The mean values of positive and negative attitudes differ based on the presence of child ($p < .001$, $p = .007$, respectively). The mean values of positive and negative attitudes differ based on the smoking status ($p = .002$, $p < .001$, respectively). The mean values of positive and negative attitudes differ in those with a relative that died due to COVID-19 during the pandemic ($p = .019$, $p = .031$, respectively). The mean values of positive and negative attitudes differ based on their professions ($p < .001$, $p < .001$, respectively). Marital status, the presence of a chronic disease, the presence of a family member that is considered to be high risk for COVID-19, working with the COVID-19 patients and having recovered from the disease have no significant effect on both positive and negative attitudes (Table 3).

There was no significant correlation between the number of chronic diseases and positive attitude and negative attitude scores. There is a positive correlation between age and both positive and negative attitudes ($r = 0.360$; $p < .001$).

Discussion

Despite the general reliance on vaccines, the majority of healthcare professionals have expressed concern about a new coronavirus vaccine. This article has obtained some of the factors that affect the attitude toward the vaccine administration.

In our study, the half of participants gave positive answers to questions. The attitude of physicians, males, older people, those working in public hospitals, those who have children, those who do not smoke and those with a relative who died due to the disease was more positive. A study conducted in Congo has showed that only 27.7% of healthcare professionals said they would accept the COVID-19 vaccine. Physicians, males and older people are more willing to get vaccinated.⁵

A study conducted with healthcare professionals in Los Angeles has showed that 47.3% of the participants stated that they were reluctant to get a coronavirus vaccine and 66.5% intend to delay the vaccination. Physicians have a more positive attitude than other healthcare professionals.⁶ A study with healthcare professionals in New Mexico has revealed that 36% of the participants are willing to get the vaccine as soon as possible and 56% are uncertain. Vaccine acceptance increases as age, education status and income increase. Males are more positive about the vaccination. The vaccine acceptance is higher among healthcare professionals with chronic medical problems.⁷

Table 2. The distribution of frequency and the reliability analysis of the “attitudes towards the Covid-19 vaccine” scale.

	I strongly disagree	I Disagree	Uncertain	I agree	I strongly agree	Mean	Standard Deviation	Cronbach's Alpha
Positive Attitude						3.54	1.05	
1. I want my family to get the vaccine developed/to be developed for this disease.	92 (6.5)	80 (5.6)	476 (33.4)	377 (26.4)	401 (28.1)	3.64	1.14	
2. I want to get the vaccine developed/to be developed for this disease as soon as possible.	108 (7.6)	110 (7.7)	450 (31.6)	360 (25.2)	398 (27.9)	3.58	1.19	
3. I think everyone should get the vaccine developed/to be developed for this disease.	83 (5.8)	98 (6.9)	467 (32.7)	389 (27.3)	389 (27.3)	3.63	1.12	0.944
4. I trust the statements about the vaccine developed/ to be developed.	108 (7.6)	153 (10.7)	587 (41.2)	373 (26.2)	205 (14.4)	3.29	1.08	
Negative Attitude						3.42	0.76	
5. The vaccine developed/to be developed may cause transmission of the disease.	306 (21.5)	534 (37.4)	428 (30)	122 (8.6)	36 (2.5)	3.67	0.99	
6. I think the vaccine developed/to be developed had/ will have no protective effect.	241 (16.9)	499 (35)	503 (35.3)	133 (9.3)	50 (3.5)	3.52	0.99	
7. The vaccine developed/to be developed is dangerous.	274 (19.2)	523 (36.7)	530 (37.2)	71 (5)	28 (2)	3.66	0.91	0.801
8. I think the effectiveness of the vaccine has not been/ will not be sufficiently tested.	93 (6.5)	299 (21)	512 (35.9)	355 (24.9)	167 (11.7)	2.86	1.08	
9. I think I can survive the epidemic without getting a vaccine.	247 (17.3)	411 (28.8)	475 (33.3)	229 (16.1)	64 (4.5)	3.38	1.08	
Total Scale Score						3.47	0.82	0.913

Overall, it has been observed that males are more willing to get vaccinated.^{5,8} This may be due to the higher mortality and morbidity rates in males during the COVID-19 pandemic. The rates and numbers from China support this conclusion.^{9,10} The lower rate in females may also be due to that immune responses are suitable for producing more antibodies.¹¹ The positive attitude with increasing age may be due to the risk that the increase in comorbidity has the potential to cause worse consequences due to the disease.^{6,12} The attitude of physicians is more positive compared to other healthcare professionals. It is known that increased education level is associated with increased vaccine confidence.⁶ It may be necessary to consider this sequence when organizing in-service trainings.

The safety, effectiveness, and rate of development/validation have been cited as common concerns on the COVID-19 vaccination.⁷ Before the COVID-19 pandemic, it took an average of 10–15 years to develop a vaccine. However, with the isolation of the virus from the first cases of viral pneumonia in China and making the entire genome available to researchers, the strategies of developing genetically-based vaccines that can be produced in a shorter time and cheaper than inactive vaccines such as mRNA, viral vector which have been intensively researched in the last one or two decades and their adaptation to SARS-CoV-2 vaccine development has reduced this time to 12–18 months. In addition, an unprecedented financial support and the allocation of manpower for the epidemic, which causes the death of thousands of people per day and causes life to halt both socially and economically, has accelerated the vaccine trials.^{1,13} These developments are capable of increasing confidence in vaccines. Similarly, our study has revealed that the concern on the limited number of trials about the vaccine is at a considerable level, which causes a negative attitude toward and uncertainty on the vaccination. As scientific researches increase, the attitude of healthcare professionals may change. However, it is interesting that the vaccine acceptance rates were much higher (75–90%) in some studies conducted before the production of vaccines. This suggests that most doubts have arisen upon the production of vaccine.^{14–16}

Some studies have been conducted on a public level. The study by Fisher et al. has reported that the COVID-19 vaccine was accepted at a rate of 67% among adults.¹⁷ The study by Largent et al. has found the vaccine acceptance rate to be 61.4%.¹⁸ A study in France showed that this rate is 77.6%.⁸ Although the vaccination has successfully reduced the global burden of disease and death, the public confidence in vaccines may be affected by a variety of concerns. The difference of opinion between the scientists, the spread of voluntary or involuntary misinformation in social networks, the unfamiliarity of the society with the vaccine, the suspicion of poor vaccine quality, the delusion that some societies will be destroyed by sterilization, the idea that the rich will make a secondary gain and the political climate play a significant role in this issue.^{19–21} This study on vaccine attitude in healthcare professionals is valuable. Healthcare professionals are at the forefront of this war. The study by Carla Felice et al. has showed that 10% of infected people in Italy are healthcare professionals.²² In addition, healthcare professionals are considered to be the most reliable source of vaccine information. However, the studies show that healthcare professionals have less confidence in the vaccination of their children, themselves or their patients. As an example of previous periods in this regard, it is known that most healthcare professionals did not have the flu vaccine because of lack of time, they did not feel at risk, they thought they did not have medical indications for the vaccine, or because of their concerns about safety and effectiveness.^{23–25}

Vaccine hesitancy has been defined as “a behavior influenced by various factors such as trust, apathy and comfort”. Healthcare professionals who are hesitant about vaccination can blow a strong headwind over vaccination decisions. This is because they may recommend vaccines less frequently to their patients and/or otherwise undermine confidence and contribute to vaccine hesitancy in the general population.^{26–28} Vaccine hesitations can lead to delays and refusal and sometimes contribute to disease outbreaks.²⁹ One of the most serious examples is the 2003–04 Northern Nigeria boycott of polio

Table 3. Descriptive statistics and determination of the factors that affect for positive and negative attitudes based on demographic characteristics.

	Positive Attitude	Negative Attitude
<i>Gender</i>		
Male	3.76 ± 1.05	3.57 ± 0.77
Female	3.41 ± 1.02	3.33 ± 0.73
F	2.576	4.655
P	0.109	0.031
η^2	0.002	0.003
<i>Institution</i>		
1st Stage Public Health Organization	3.62 ± 1.06 ^{ab}	3.47 ± 0.76 ^{ab}
2nd Stage Public Health Organization	3.68 ± 0.99 ^a	3.52 ± 0.74 ^a
3rd Stage Public Health Organization	3.29 ± 1.06 ^b	3.26 ± 0.78 ^b
1st Stage Private Health Organization	3.47 ± 1.1 ^{ab}	3.33 ± 0.76 ^{ab}
2nd Stage Private Health Organization	3.35 ± 1.01 ^{ab}	3.31 ± 0.73 ^{ab}
University	3.95 ± 1.06 ^a	3.67 ± 0.72 ^a
F	2.971	2.200
P	0.011	0.052
η^2	0.010	0.008
<i>Marital Status</i>		
Single	3.23 ± 1.00	3.23 ± 0.66
Married	3.67 ± 1.04	3.50 ± 0.78
F	2.528	0.230
P	0.112	0.632
η^2	0.002	0.000
<i>Having a child</i>		
Yes	3.70 ± 1.04	3.52 ± 0.77
No	3.22 ± 0.99	3.21 ± 0.68
F	8.133	3.934
P	0.004	0.048
η^2	0.006	0.003
<i>Living with someone</i>		
Parents	3.32 ± 0.94	3.24 ± 0.63
Other	3.45 ± 0.89	3.16 ± 0.66
Spouse	3.6 ± 1.08	3.44 ± 0.75
Spouse and children	3.67 ± 1.04	3.52 ± 0.78
Housemate	3.05 ± 1.03	3.12 ± 0.66
Only children	3.67 ± 1.06	3.48 ± 0.73
Alone (I was alone before the pandemic as well)	3.18 ± 1.08	3.26 ± 0.68
Alone (I live alone during the pandemic)	3.11 ± 0.99	3.16 ± 0.76
F	1.754	0.407
P	0.093	0.898
η^2	0.009	0.002
<i>Chronic disease</i>		
Yes	3.71 ± 1.05	3.51 ± 0.77
No	3.48 ± 1.04	3.39 ± 0.75
F	1.795	0.227
P	0.181	0.634
η^2	0.001	0.009
<i>Do you smoke?</i>		
Yes	3.38 ± 1.06	3.28 ± 0.75
No	3.61 ± 1.03	3.49 ± 0.75
F	2.000	8.726
P	0.157	0.003
η^2	0.001	0.006
<i>Do you have a family member who is considered to be at high risk for Covid-19 (elderly, chronic illness, children, disabled etc.)?</i>		
Yes	3.48 ± 1.04	3.37 ± 0.75
No	3.63 ± 1.06	3.50 ± 0.76
F	0.231	1.803
P	0.631	0.180
η^2	0.000	0.001
<i>Do you have a relative who died due to Covid-19 during the pandemic?</i>		
Yes	3.37 ± 1.06	3.30 ± 0.75
No	3.58 ± 1.04	3.45 ± 0.75
F	5.163	4.245
P	0.023	0.040
η^2	0.004	0.003
<i>Have you worked/do you work with Covid-19 patients during the pandemic?</i>		
Yes	3.50 ± 1.06	3.39 ± 0.77

(Continued)

Table 3. (Continued).

	Positive Attitude	Negative Attitude
No	3.67 ± 1.00	3.53 ± 0.71
F	3.614	5.160
P	0.058	0.023
η^2	0.003	0.004
<i>Have you recovered from the Covid-19?</i>		
Yes	3.43 ± 1.00	3.37 ± 0.70
No	3.58 ± 1.06	3.44 ± 0.78
F	0.338	0.199
P	0.561	0.656
η^2	0.000	0.000
<i>Profession</i>		
Group 1 (Practitioner, Specialist, Dentist)	4.11 ± 0.85 ^c	3.78 ± 0.65 ^a
Group 2 (Nurse/Midwife)	3.25 ± 1.03 ^b	3.25 ± 0.74 ^b
Group 3 (Healthcare technician/ATT)	3.33 ± 0.95 ^{ab}	3.27 ± 0.70 ^b
Other	3.67 ± 1.15 ^a	3.50 ± 0.85 ^b
F	36.823	24.030
P	<0.001	<0.001
η^2	0.073	0.049

^aThere is no difference between groups with the same letter in each column.

vaccination, which led to a relapse of the disease. The fundamental breakdown in public trust has impacted efforts to eradicate polio in Nigeria for a long time.^{30,31} Maintaining confidence in vaccination depends on the interaction between vaccines and providers. The attitude of those who govern the society and the scientists lead the society in this regard.³² Lazarus et al.'s findings show that trust in government is strongly associated with vaccine acceptance and can contribute to public compliance with recommended actions.³³ In addition, vaccine authorities have attracted attention due to growing concerns that voluntary COVID-19 vaccination rates will be insufficient to halt transmission.³⁴ Mandatory vaccination of the whole society or risky groups, just like the mandatory childhood vaccinations, can be considered as a suggestion.

There are some limitations in our study. Despite the high number of participants, a single-city example prevents our study from being generalized. The online application of the survey may have restricted the participation of some of the target audience. There is one type of vaccine in Turkey, and this may affect the vaccination rate. The facts that the data collection was squeezed into two months and the uncertainty about the date of arrival of the vaccine at these dates may have affected the responses. The interpretation of the collected data of the variables without comparing them with the control groups that may include non-healthcare professionals can also be considered as a limitation.

Conclusion

It has been observed that positive and negative attitudes toward COVID-19 vaccination are almost equally distributed and some demographic factors affect the attitude. The opinions of healthcare professionals on the safety and effectiveness of the vaccine, which are the main elements of the vaccination effort, may affect the public perception of vaccination. Therefore, it is essential to understand and address any potential hesitations before the vaccination is administered. It is clear that there is

need for more studies on every conceivable topic regarding the COVID-19 vaccine. Future researchers can use the survey we use to assess willingness to get COVID-19 vaccinated.

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Disclosure of potential conflicts of interest

No potential conflicts of interest were disclosed.

Authors' contribution

Muhammet A Oruç, contributed to the study design and data collection, performed the analysis, provided tools, and interpreted the results. Onur Öztürk, contributed to the study design and data generation, performed the analysis, and interpreted the results. All authors participated in the design or implementation or analysis, and interpretation of the study; and the development of this manuscript. All authors had full access to the data and gave final approval before submission. The authors are solely responsible for the final content and received no financial support or other form of compensation related to the development of the manuscript.

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References

1. Yavuz E. COVID-19 vaccines. *Türk Aile Hek Derg.* 2020;24:227–34.
2. Anderson RM, Vegvari C, Truscott J, Collyer BS. Challenges in creating herd immunity to SARS-CoV-2 infection by mass vaccination. *Lancet.* 2020;396(10263):1614–16. doi:10.1016/S0140-6736(20)32318-7.
3. Samsun. [accessed 2021 Apr 03]. <https://www.google.com/maps>.
4. Geniş B, Gürhan N, Koç M, Ç G, Şirin B, Çirakoğlu OC, Coşar B. Development of perception and attitude scales related with COVID-19 pandemic. *Pearson J Soc Sci.* 2020;5(7):306–28. doi:10.46872/pj.127.
5. Kabamba Nzaji M, Kabamba Ngombe L, Ngoie Mwamba G, Banza Ndala DB, Mbidi Miema J, Luhata Lungoyo C, Lora Mwimba B, Cikomola Mwana Bene A, Mukamba Musenga E. Acceptability of vaccination against COVID-19 among health-care workers in the Democratic Republic of the Congo. *Pragmat Obs Res.* 2020 Oct 29;11:103–09. doi:10.2147/POR.S271096. PMID: 33154695; PMCID: PMC7605960.
6. Gadoth A, Halbrook M, Martin-Blais R, Gray A, Tobin NH, Ferbas KG, Aldrovandi GM, Rimoin AW. Cross-sectional Assessment of COVID-19 Vaccine Acceptance Among Health Care Workers in Los Angeles. *Ann Intern Med.* 2021 Feb 9:M20-7580. doi:10.7326/M20-7580. Epub ahead of print. PMID: 33556267; PMCID: PMC7926184.
7. Shekhar R, Sheikh AB, Upadhyay S, Singh M, Kottewar S, Mir H, Barrett E, Pal S. COVID-19 vaccine acceptance among health care workers in the United States. *Vaccines.* 2021;9:119. doi:10.3390/vaccines9020119.
8. Detoc M, Bruel S, Frappe P, Tardy B, Botelho-Nevers E, Gagneux-Brunon A. Intention to participate in a COVID-19 vaccine clinical trial and to get vaccinated against COVID-19 in France during the pandemic. *Vaccine.* 2020 Oct 21;38(45):7002-7006. doi:10.1016/j.vaccine.2020.09.041. Epub 2020 Sep 17. PMID: 32988688; PMCID: PMC7498238.
9. Chang D, Lin M, Wei L, Xie L, Zhu G, Dela Cruz CS, Sharma L. Epidemiologic and clinical characteristics of novel coronavirus infections involving 13 patients Outside Wuhan, China. *JAMA.* 2020 Mar 17;323(11):1092–93. doi:10.1001/jama.2020.1623. PMID: 32031568; PMCID: PMC7042871.
10. Zhi ZLXBZ. The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China. *Chin J Epidemiol.* 2020;41(2):145–51. doi:10.3760/cma.j.0254-6450.2020.02.003.
11. Biswas R. Are men more vulnerable to covid-19 as compared to women? *Biomed J Sci Tech Res.* 2020;27(2). doi:10.26717/BJSTR.2020.27.004481.
12. Shaw J, Stewart T, Anderson KB, Hanley S, Thomas SJ, Salmon DA, Morley C. Assessment of U.S. health care personnel (HCP) attitudes towards COVID-19 vaccination in a large university health care system. *Clin Infect Dis.* 2021;ciab054. doi:10.1093/cid/ciab054.
13. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, Zhao X, Huang B, Shi W, Lu R, et al. A novel coronavirus from patients with pneumonia in China, 2019. *N Engl J Med.* 2020 Feb 20;382(8):727–33. doi:10.1056/NEJMoa2001017. Epub 2020 Jan 24. PMID: 31978945; PMCID: PMC7092803.
14. Parajuli J, Mishra P, Sharma S, Bohora KB, Rathour PS, Joshi J, Kamar SB, Pandey H, Chaudhary A. Knowledge and attitude about COVID 19 among health care workers working in seti provincial hospital. *J Nepal Health Res Counc.* 2020 Nov 14;18(3):466–71. doi:10.33314/jnhrc.v18i3.2816. PMID: 33210642
15. Asaad AM, El-Sokkary RH, Alzamanan MA, El-Shafei M. Knowledge and attitudes towards Middle East respiratory syndrome-coronavirus (MERS-CoV) among health care workers in south-western Saudi Arabia. *East Mediterr Health J.* 2020;25:0.
16. Gagneux-Brunon A, Detoc M, Bruel S, Tardy B, Rozaire O, Frappe P, Botelho-Nevers E. Intention to get vaccinations against COVID-19 in French healthcare workers during the first pandemic wave: a cross-sectional survey. *J Hosp Infect.* 2021;108:168e173. doi:10.1016/j.jhin.2020.11.020.
17. Fisher KA, Bloomstone SJ, Walder J, Crawford SL, Fouayzi H, Mazor KM. Attitudes toward a potential SARS-CoV-2 vaccine. *Ann Intern Med.* 2020;173:964–73. doi:10.7326/M20-3569.
18. Largent EA, Persad G, Sangenito S, Glickman A, Boyle C, Emanuel EJ. US public attitudes toward COVID-19 vaccine mandates. *JAMA Netw Open.* 2020 Dec 1;3(12):e2033324. doi:10.1001/jamanetworkopen.2020.33324. PMID: 33337490; PMCID: PMC7749443.
19. Boyd K. Beyond politics: additional factors underlying skepticism of a COVID-19 vaccine. *Hist Philos Life Sci.* 2021 Jan 27;43(1):12. doi:10.1007/s40656-021-00369-8. PMID: 33502602; PMCID: PMC7839285.
20. Puri N, Coomes EA, Haghbayan H, Gunaratne K. Social media and vaccine hesitancy: new updates for the era of COVID-19 and globalized infectious diseases. *Hum Vaccin Immunother.* 2020 Nov 1;16(11):2586–93. doi:10.1080/21645515.2020.1780846. Epub 2020 Jul 21. PMID: 32693678; PMCID: PMC7733887.
21. Kata A. Anti-vaccine activists, Web 2.0, and the postmodern paradigm—an overview of tactics and tropes used online by the anti-vaccination movement. *Vaccine.* 2012;30(25):3778–89. doi:10.1016/j.vaccine.2011.11.112.
22. Felice C, Luca G, Tanna D, Zanusi G, Grossi U. Impact of COVID-19 outbreak on healthcare workers in Italy: results from a national E-survey. *J Community Health.* 2020;45(123456789):675–83. doi:10.1007/s10900-020-00845-5.
23. Qureshi AM, Hughes NJM, Murphy E, Primrose WR. Factors influencing uptake of influenza vaccination among hospital-based health care workers. *Occup Med.* 2004;54(3):197–201. doi:10.1093/occmed/kgq087.
24. Wicker S, Rabenau HF, Doerr HW, Allwinn R. Influenza vaccination compliance among health care workers in a German University Hospital. *Infection.* 2009;37(3):197–202. doi:10.1007/s15010-008-8200-2.
25. Barriere J, Vanjak D, Kriegel I, Otto J, Peyrade F, Esteve M, Chamoire E. Acceptance of the 2009 A(H1N1) influenza vaccine among hospital workers in two French cancer centers. *Vaccine.* 2010;28(43):7030–34. doi:10.1016/j.vaccine.2010.08.021.

26. European Centre for Disease Prevention and Control. Communication on immunisation - building trust. Stockholm: ECDC; 2012. ISBN: 978-92-9193-333-4. doi:10.2900/20590.
27. Verger P, Fressard L, Collange F, Gautier A, Jestin C, Launay O, Raude J, Pulcini C, Peretti-Watel P. Vaccine hesitancy among general practitioners and its determinants during controversies: a national cross-sectional survey in France. *EBioMedicine*. 2015;2(8):889–95. doi:10.1016/j.ebiom.2015.06.018.
28. Karafillakis E, Dinca I, Apfel F, Cecconi S, Würz A, Takacs J, Suk J, Celentano LP, Kramarz P, Larson HJ. Vaccine hesitancy among healthcare workers in Europe: a qualitative study. *Vaccine*. 2016 Sep 22;34(41):5013–20. doi:10.1016/j.vaccine.2016.08.029. Epub 2016 Aug 26. PMID: 27576074.
29. Larson HJ, Smith DMD, Paterson P, Cumming M, Eckersberger E, Freifeld CC, Ghinai I, Jarrett C, Paushter L, Brownstein JS, et al. Measuring vaccine confidence: analysis of data obtained by a media surveillance system used to analyse public concerns about vaccines. *Lancet Infect Dis*. 2013;13(7):606–13. doi:10.1016/S1473-3099(13)70108-7.
30. Heymann DL, Sutter RW, Aylward RB. Polio eradication: interrupting transmission, towards a polio-free world. *Future Virol*. 2006;1(2):181–88. doi:10.2217/17460794.1.2.181.
31. Larson HJ, Ghinai I. Lessons from polio eradication. *Nature*. 2011;473(7348):446–47. doi:10.1038/473446a.
32. Asma S, Akan H, Uysal Y, Poçan AG, Sucaklı MH, Yengil E, Ç G, Korur A, Başhan İ, Erdogan AF, et al. Factors effecting influenza vaccination uptake among health care workers: a multi-center cross-sectional study. *BMC Infect Dis*. 2016;1–9. doi:10.1186/s12879-016-1528-9.
33. Lazarus JV, Ratzan SC, Palayew A, Gostin LO, Larson HJ, Rabin K, Kimball S, El-Mohandes A. A global survey of potential acceptance of a COVID-19 vaccine. *Nat Med*. 2021 Feb;27(2):225–28. doi:10.1038/s41591-020-1124-9.
34. Mello MM, Silverman RD, Omer SB. Ensuring uptake of vaccines against SARS-CoV-2. *N Engl J Med*. 2020;383(14):1296–99. doi:10.1056/NEJMp2020926.