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COVID-19 Vaccine Hesitancy and Its Relationship With Illness Risk Perceptions, Affect, Worry, and Public Trust: An Online Serial Cross-Sectional Survey From Turkey

Melike Kuçukkarapinar[1], Filiz Karadag[1], Irem Budakoglu[2], Selçuk Aslan[1], Onder Ucar[1], Ayşegul Yay[1], Utku Timurcin[3], Selim Tumkaya[4], Cicek Hocaoglu[5], Ilknur Kiraz[5]

[1]Psychiatry Department, Gazi University School of Medicine, Ankara, Turkey; [2]Department of Medical Education and Informatics, Gazi University School of Medicine, Ankara, Turkey; [3]Student, Phase V, Gazi University School of Medicine, Ankara, Turkey; [4]Psychiatry Department, Pamukkale University School of Medicine, Denizli, Turkey; [5]Psyhiatry Department, Recep Tayyip Erdoğan University School of Medicine, Rize, Turkey

ABSTRACT

Objective: A better understanding of public attitudes towards vaccination and recognition of associated factors with vaccine hesitancy or refusal is important regarding the control of the pandemic. Our aim was to analyze the public's attitudes toward COVID-19 vaccines and to identify factors affecting them.
Materials and Methods: Data were drawn from the Turkish COVID-19 Snapshot Monitoring, between July-December 2020, a serial online cross-sectional survey. The sample comprised 3888 adult respondents. Attitudes to vaccines and trust were investigated in 3 periods corresponding to the timeline of pandemic-related events in Turkey.
Results: In the third period of our study, in parallel with the increase in the spread of COVID-19, vaccine hesitancy/refusal increased significantly from 43.9% to 58.9% ($P < .001$). The significant predictors of vaccine refusal were female gender, being elder, and conspiracy thinking. Having a chronic illness, worrying more about loved ones and the health system being overloaded were significant predictors of vaccine willingness. Less compliance with preventive measures, less knowledge of prevention, reduced risk perception, and higher perception of media hype were COVID-19 variables that correlated with vaccine refusal. Trust in the Ministry of Health and medical professional organizations (e.g., Turkish Medical Association) was the lowest in the third period and vaccine refusal was significantly related to the decreased trust ($P < .001$, $P = .002$).
Conclusion: Most respondents (approximately 60%) refused or hesitated to get a COVID-19 vaccine, though acceptability should be monitored when a vaccine becomes available. Health authorities should consider public trust, risk perception, and behavioral factors to improve COVID-19 vaccine acceptability.

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INTRODUCTION

Vaccine hesitancy is defined as a refusal or reluctance to have oneself or their child vaccinated against a contagious disease, mainly caused by concerns about vaccine safety and necessity. Throughout history, the people opposing vaccination have always existed. It dates to the first vaccine in the 1800s. Even before the vaccine was released, the anti-vaccine movement appeared, and we have observed anti-vaccine protests around the world. Previous research determined that vaccine acceptability is correlated with perceived likelihood about infectious disease, perceived severity, perceived vaccine effectiveness, and perceived potential vaccine harms.[1] Moreover, self-efficacy for vaccination[2] and exact knowledge about how a virus spread is were other identified cognitive factors. The literature review shows that loss of public confidence,[3] public opinions about vaccines such as unnaturalness, and lack of certainty about their effectiveness and risks,[4] affective factors[5] and trust in institutions[6] also play an important role in vaccine willingness.

Even though the world needed a vaccine against COVID-19, some studies conducted at the beginning of the pandemic showed that a significant amount of people would not use one, even if an effective vaccine were available. The factors that call forth vaccine hesitancy might be philosophical and religious objections to vaccination, heuristic thinking.[7] Besides, public perceptions might

Corresponding author: Melike Kuçukkarapinar, E-mail: melikekkpinar@gazi.edu.tr

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change in response to emerging conspiracy theories and trust in institutions during pandemics.[8] The literature review shows that personality traits, cognition, emotions, beliefs, and sense of trust affect vaccine willingness. Therefore, during the vaccine development process, it is essential to monitor changes in vaccine hesitancy of the public and reveal the significant factors that intensify the negative attitudes towards a vaccine to take precautions before vaccination begins. To our knowledge, although there are some cross-sectional studies about vaccine attitudes, there is no study investigating changing public perception of COVID-19 and possible effective vaccine against it. The aims of this study are:

1. To determine what proportions of the general adult populations of Turkey were accepting of, hesitant about, or refusal to a vaccine for COVID-19.
2. To identify the psychological characteristics that distinguish individuals who are hesitant/refuse to take a COVID-19 vaccine from those who are accepting. A better understanding of the psychology of vaccine-hesitant and refusal individuals affords public health officials a complete understanding of why these individuals view a COVID-19 vaccine the way that they do.
3. To determine the changes in the level of trust in institutions that effectively control the outbreak overtime.
4. By recognizing the broader demographic patterns and public health priorities of this population, public health officials will reach a better understanding of this population and establish accurate information to assist the vaccination process.

Thus, an effective health behavioral message about the COVID-19 pandemic and vaccines can be given, considering the sociodemographic and psychological profiles of individuals who are vaccine-hesitant and refusal.

MATERIALS AND METHODS

Study Design and Participants

Data were driven from the Turkish COVID-19 Snapshot Monitoring (COSMO), a serial cross-sectional study of the psychological, sociological experiences of adults (aged 18 and above) in Turkey between July 2020 and December 2020. The sample consisted of 3888 participants (2365 female, 1516 male; M age = 36.07, standard deviation [SD] age = 13.62). The detailed study protocol and the questionnaire of the World Health Organization's (WHO) for COVID-19 on the following links.[9] First, the survey targeted all users who live in Turkey and the ones who are 18 and older. The snowball technique was used to reach out to the respondents via email and official correspondence, social media, universities, municipalities, institutions, and workplaces. Social media users who viewed the advertisement of the study were able to click on an embedded link that took them to the survey (hosted on Google Forms). Second, one of the focuses of the study was to assess the thoughts of the low-income and not well-educated people. Therefore, telephone interviews also were conducted.

The Ethics approval for this study was obtained from the Gazi University Faculty of Medicine Committee on Ethics in Research involving Humans with the number 409 on July 6, 2020. All participants provided electronic informed consent to participate.

Demographic variables included age, gender, education, occupation in the health sector, having mental/physical chronic illnesses, household characteristics (i.e., living with under 18 years of age/people above 65 years of age).

Measurement Tools

In this study, we used the standard questionnaire for COVID-19 pandemic developed by researchers for WHO in accordance with the literature.[9] With the permission of the WHO regional office, the whole questionnaire was translated by an expert translator familiar with the terminology of COVID-19, behavioral sciences, and interview skills in Turkish. The questionnaire was adapted to the cultural context and the evolving situation over time. Participants responded to each of the items described below using a 7-point Likert scale except for the items examining protective behaviors, which used multiple-choice questions (yes, no, do not know). The questionnaire consisted of the topics described below.

Attitudes Towards COVID-19 Vaccines: Attitudes towards COVID-19 vaccines were measured by an item (If a vaccine becomes available and is recommended for me, I would get it). This item ranged from strongly disagree to agree strongly. The response options were grouped as follows: point 1-2 as vaccine refusal, point 3-5 as vaccine hesitancy, point 6-7 as vaccine acceptance. This measure served as the significant dependent variable and a key outcome of the study. Moreover, this dependent variable was used as both categorical and parametric variables.

The perceived knowledge about the prevention of spreading COVID-19 was assessed with a question (How would you rate your knowledge level on preventing the

MAIN POINTS

Important predictors of COVID-19 vaccines refusal:

- Female gender, being old, having no chronic disease
- Low level of knowledge about the pandemic, belief in conspiracy theories, low perception of illness severity
- Low level of trust in health authorities
- Low compliance with prevention behavior

It might be appropriate for health authorities to adopt crisis management that takes these factors into account.

spread of the novel coronavirus?[9] ranging from "very poor knowledge" to "very good knowledge."

Risk Perception: The 3 dimensions of risk perception were examined with validated items adopted from a metanalysis.[9] The perceived probability of COVID-19 was determined using an item (What is your probability of getting infected with the novel coronavirus?) ranging from "extremely unlikely" to "extremely likely." The perceived severity of COVID-19 was measured using an item (How severe would contracting the novel coronavirus be for you?) ranging from "not severe" to "very severe." Finally, the perceived susceptibility of COVID-19 was determined using an item (How susceptible do you consider yourself to an infection with the novel coronavirus?) with responses ranging from "not at all susceptible" to "very susceptible."

The perceived self-efficacy and perceived preparedness were measured by 2 items. The perceived preparedness was determined using an item (I know how to protect myself from coronavirus) with responses ranging from "not at all" to "very much so."[9] Second, the perceived self-efficacy was measured by another item (For me avoiding an infection with the novel coronavirus in the current situation is…) ranging from "extremely difficult" to "extremely easy."[9]

Prevention Measures: Prevention measures (handwashing, using disinfectants, covering coughing, physical distancing, flu vaccine, face mask, using antibiotics, herbal supplements, vitamin and mineral supplements, self-quarantine) were examined. These items were adapted from a study about the H1N1 pandemic[9] and differentiated between appropriate protective behaviors and actionism (useless measures to prevent disease such as herbal supplements, using antibiotics).

Affect Related to COVID-19 Pandemic: Affect related to COVID-19 pandemic (close, spreading, constant, fear-inducing, media-hyped, worrying, helpless, stressful) was measured by 8 items (e.g., The novel coronavirus to me feels spreading slowly to spreading fast).[9]

Worry Related to COVİD-19 Pandemic: Worry related to COVİD-19 pandemic was measured by crisis specific 9 items (e.g., "At the moment, how much do you worry about losing someone you love 'don't worry at all' to 'worry a lot'"); these items were adapted from the Worry Domains Questionnaire.[9]

Resilience: Perception related to coping with stress and recovering was measured using 3 items adapted from the Brief Resilience Scale.[9] Each item ranged from "strongly disagree" to "strongly agree" (e.g., It does not take me long to recover from a stressful event).

Beliefs in Conspiracy Theories: Generic beliefs in conspiracy theories were measured using the 5-item Conspiracy Mentality Questionnaire,[9] with responses ranging from "undoubtedly not true" to "certainly true". This questionnaire allows detecting the possible trends during the pandemic.

Trust in the Ministry of Health, Turkish Health Association, and Media: Trust in the Ministry of Health, Turkish Health Association, and media were questioned (How much confidence do you have in the below individuals and organizations that they can handle the novel coronavirus well?) with responses ranging from "very low confidence" to "very high confidence."[9] To observe the change of the level of trust in institutions, the 6-month study was divided into 3 parts. The important events of the parts were as follows: Just before the first part (July 17, 2020 to August 31, 2020), intercity travel restrictions were ended, barbers and grocery stores were reopened, rotational, flexible, and remote working in institutions and organizations started, the curfew on people aged 65 and older and people aged 20 and younger ended. The second part (September 01, 2020 to October 31, 2020) includes the period starting to give data on the number of patients instead of cases in new reports, despite the rumor that the cases are increasing. The last part (November 01, 2020 to December 15, 2020) includes the stage in which the number of cases is announced again, the number of tests and hospitalizations performed in the cases is in a record number, reinstating the curfew on people aged 65 and older and people aged 20 and younger, and negotiations with vaccine companies.

Statistical Analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 22.0 (IBM SPSS Corp.; Armonk, NY, USA). Initially, the difference between the categorical variables (e.g., gender, education, having a chronic illness, and attitudes towards vaccine) was investigated by using Chi-square tests. Second, 1-way analysis of variance (ANOVA) was used to compare the parametric variables (e.g., risk perception, conspiracy thinking, worries about coronavirus differences, trust in institutions responsible for controlling the process of pandemics among the vaccine willingness groups). An overall *P*-value of less than .05 was considered to show a statistically significant result. When an overall significance was observed, pairwise post hoc tests were performed using Tukey's test. Then η^2 (Eta squared) was calculated for ANOVA in SPSS to understand how much the independent variables have affected the dependent variable. Multiple linear regression analysis was used to identify independent predictors of negative vaccine willingness. A 5% type-I error level was used to infer statistical significance.

Characteristics of the Sample

The study included 3888 (61% female, 39% male) participants of the Turkish national COSMO study. The mean age ± SD of those respondents was 36.07 ± 13.62 years. Of those, 85.2% of them have completed 13 years of education and above, whilst 68% of the participants were not healthcare

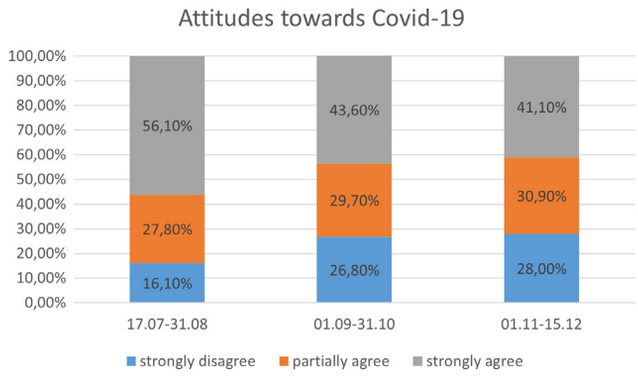


Figure 1. The change of attitudes towards COVID-19 vaccines, Turkey (July 17, 2020 to December 15, 2020).

workers. In this study, 62% of the respondents have children under 18 years of age, and 14.1% live with one or more individuals over 65 years old in the household. Also, 20.7% of the respondents had at least 1 chronic disease.

RESULTS

In this study, 21.5% of the participants refused to be vaccinated, and 29% were unsure about getting it themselves. Interestingly, vaccine hesitancy has been increasing since the outbreak. In the third period of our study, in parallel with the increase in the spread of COVID-19, vaccine hesitancy/refusal increased significantly from 43.9% to 58.9% ($x^2(4, N=3888)=97.65$, $P < .001$) (Figure 1).

There was a significant difference between gender ($x^2(2, N=3888)=42.49$, $P < .001$); age (($x^2(6, N=3888)=63.01$, $P < .001$); education level ($x^2(2, N=3888)=6.37$, $P=.04$); being healthcare worker or not ($x^2(2, N=3888)=8.88$, $P=.01$); having children under 18 years of age ($x^2(2, N=3888)=7.81$, $P=.02$), having a chronic illness that increases the risk of getting COVID-19 ($x^2(2, N=3888)=10.56$, $P=.005$), and vaccination acceptancy. Also, the chi-square test showed that there is no significant difference between living with an elderly person and attitudes toward COVID-19 vaccines ($x^2(2, N=3888)=1.60$, $P=.45$) (Table 1).

ANOVA was conducted to compare the age, the level of perceived knowledge, self-efficacy, risk perception about coronavirus, affect related with the pandemic, worries about coronavirus pandemic, conspiracy theories and preventive measure in vaccine refusal, vaccine hesitancy, and vaccine acceptance group. The results are presented in Table 2. All post hoc comparison was performed using the Tukey HSD (honestly significant difference) test.

The Effects of Perceived Knowledge, Self-Efficacy, and Perceived Risk on Vaccine Attitudes

We found that there was a significant effect of the perceived level of knowledge on how to prevent the spread of coronavirus infection [$F(2, 3884)=42.39$, $P < .001$] and perceived self-efficacy on vaccine attitudes [$F(2, 3884)=5.53$, $P=.004$]. Post hoc comparisons using the Tukey HSD test indicated that the mean score of the perceived level of knowledge for the vaccine-refusal group ($M=4.33$) was significantly lower than the vaccine hesitancy ($M=4.52$) and acceptancy groups ($M=4.74$). The vaccine acceptancy group represented a higher mean value ($M=4.21$) than the vaccine refusal group ($M=3.99$), but not the vaccine hesitancy group ($M=4.13$) for the level of perceived self-efficacy. There was also a significant effect of the levels of each dimension of perceived risk (possibility, susceptibility, severity) on vaccine attitudes; for the level of perceived possibility [$F(2, 3884)=17.50$, $P < .001$], for the level of perceived susceptibility [$F(2, 3884)=11.24$, $P < .001$], and for the perceived severity of coronavirus infection [$F(2, 3884)=19.03$, $P < .001$].

Post hoc comparisons showed that the mean score of the vaccine acceptancy group ($M=4.74$) and vaccine refusal ($M=4.33$) groups were significantly different for perceived possibility. In post hoc comparisons, the vaccine refusal group ($M=4.38$) was significantly different from vaccination acceptance ($M=4.71$) and vaccine hesitancy group ($M=4.61$) for the mean score of the perceived level of susceptibility. However, there was no significant difference regarding the mean scores of perceived possibility and perceived susceptibility between vaccine acceptancy ($M=4.74$, $M=4.71$, respectively) and vaccine hesitancy group ($M=4.52$, $M=4.61$, respectively). The mean score of the vaccine refusal ($M=3.75$), vaccine hesitancy ($M=4.01$), and vaccine acceptancy groups ($M=4.16$) significantly differed from each other for the level of perceived severity.

The Effects of Conspiracy Thinking, Outbreak Related Worry, Affect Related to the Pandemic and Resilience

Belief in Conspiracy Theories: It has been found that the effects of 3 conspiracy beliefs have significant effects on vaccination attitudes. First, the belief that many very important things happen in the world which the public are never informed [$F(2, 3884)=19.03$, $P=.011$]; second the belief that the events which superficially seem to lack a connection [$F(2, 3884)=9.99$, $P < .001$]; and lastly the belief that there are secret organizations that greatly influence political decisions [$F(2, 3884)=4.54$, $P=.011$] have significant effects on vaccination attitudes. In post hoc comparison, the mean score of the vaccine hesitancy ($M=4.98$) group differed from the vaccine acceptancy group ($M=4.75$) for the first-mentioned conspiracy belief above. The mean score of the second conspiracy belief mentioned above was significantly higher in the vaccine refusal group ($M=4.25$) than the participants who accept the vaccination ($M=3.90$). And lastly, the vaccine refusal group ($M=4.30$) was also more likely to believe that there are secret organizations that greatly influence political

Q1 **Table 1.** Sociodemographic Characteristics Associated With Attitudes of Vaccination, Turkey, 2020

Characteristics of the Participants		If a Vaccine Becomes Available and Is Recommended for Me, I Would Get It					
		VR % (*n*)	VH %(*n*)	VA % (*n*)	Value	*df*	*P* Value*
Gender	Female	23.3 (550)	31.5 (744)	45.3 (1071)	**42.50**	**4**	**<.001**
	Male	18.9 (287)	25.1(380)	56.00 (849)			
Age	18-25	14.1 (269)	31.4 (375)	54.5 (651)	**63.01**	**6**	**<.001**
	26-35	27,00 (232)	28.4 (244)	44.6 (383)			
	36-65	23.6 (417)	27.6 (489)	48.8 (864)			
	>65	30.2 (19)	30.2 (19)	39.7 (25)			
Education	Up to 12 years of schooling	25.3 (145)	26.2 (150)	48.5 (278)	**6.37**	**2**	**.041**
	At least 13 years of schooling	20.9 (692)	29.5 (976)	49.7 (1645)			
Employment status	Being healthcare worker	19.4 (244)	27.8(349)	52.8 (663)	**8.88**	**4**	**.012**
	Not being healthcare worker	22.5 (593)	29.6 (778)	47.9 (1260)			
Chronic illness that increases the risk of getting COVID-19	Yes	19.7 (94)	24.1 (115)	56.3 (269)	10.56	2	**.005**
	No	21.8 (743)	29.7 (1012)	48.5 (1654)			
Children <18 years in household	Yes	23.6 (351)	29.3 (435)	47.1 (699)	**7.81**	**2**	**.02**
	No	21.5 (486)	29.0 (692)	49.5 (1224)			
People >65 years in household	Yes	20.8 (114)	27.2 (149)	51.9 (284)	1.60	2	.449
	No	21.7 (720)	29.3 (972)	49.1 (1629)			

*Chi-square test, VR: vaccine refusal; VH: vaccine hesitancy; VA: vaccine acceptance; *n*: number of respondents.

decisions compared to the vaccine acceptancy group ($M=3.84$).

Worrying Related to Pandemic: ANOVA analyzes indicated that there was a significant effect of the worrying levels on different issues related to the pandemic on vaccination attitudes. The worries that had a significant impact on vaccination attitudes were: Worrying about losing loved one [$F(2, 3884)=40.21$, $P < .001$], worrying about losing mental health [$F(2, 3884)=18.99$, $P < .001$], worrying about losing physical health [$F(2, 3884)=15.06$, $P < .001$], worrying about not visiting people who need help [$F(2, 3884)=4.36$, $P=.013$], worrying about health system being overloaded [$F(2, 3884)=37.68$, $P < .001$], and worrying about the restriction of freedom [$F(2, 3884)=6.04$, $P=.002$]. There was no significant difference regarding the worrying about the recession and the restricted access to food supplies between the groups. Post hoc analyses revealed that the participants of the vaccine acceptancy group reported that they worried about losing someone they love ($M=6.28$) more likely than vaccine hesitancy ($M=6.10$) and vaccine refusal ($M=5.75$) groups. The refusal group ($M=4.37$) worry about losing mental health less than the vaccine hesitancy group ($M=4.77$) and vaccine acceptancy group ($M=4.83$). The mean score of the vaccine refusal group ($M=4.54$) was significantly different than vaccine hesitancy ($M=4.89$) and vaccine acceptancy groups ($M=4.94$) for worrying about losing physical health. There was no significant difference between vaccine hesitancy and vaccine acceptancy groups on the mean score of the worrying about losing mental and physical health. The mean score of the vaccine refusal group ($M=4.94$) was different from the vaccine acceptancy group ($M=5.18$) regarding worrying about not visiting people who need help. The mean score of the vaccine hesitancy group ($M=5.11$) did not differ from the other 2 groups for this variable. The mean scores of worrying about health systems being overloaded were significantly different in the vaccine refusal ($M=5.28$) group compared to those of vaccine hesitancy ($M=5.61$) and vaccine acceptancy ($M=5.83$) group. The vaccine refusal ($M=5.08$) and the vaccine hesitancy ($M=5.13$) groups significantly worry about the restriction of freedom less than the vaccine acceptancy group ($M=5.30$).

Affect Related to the Coronavirus Pandemic: ANOVA revealed that the perception that "coronavirus is close" has a significant effect on the vaccine attitudes [$F(2, 3884)=19.20$, $P < .001$]. For this variable, the mean score of the vaccine hesitancy group ($M=3.29$) was significantly different from the vaccine refusal group ($M=3.02$) and the vaccine acceptancy groups ($M=2.95$), with no significant difference between vaccine refusal and vaccine acceptancy groups.

The perception of spreading coronavirus also has a significant effect on vaccine attitudes [$F(2, 3884)=29.96$ $P < .001$].

Table 2. The Risk Perception, Conspiracy Theories, Affect, and Worry Related to Pandemic, Turkey, 2020

Knowledge	VR (Mean ± SD)	VH (Mean ± SD)	VA (Mean ± SD)	*F*	*P* Value***	η^2	Tukey
Level of knowledge on how to prevent the spread of coronavirus infection	5.46 ± 1.58	5.74 ± 1.22	5.93 ± 1.12	42.39	**<.001**	0.021	VR < VH** VR < VA** VH < VA**
Perceived self-efficacy	3.99 ± 1.77	4.13 ± 1.47	4.21 ± 1.63	5.53	**.004**	0.003	VR < VA*
Risk perception							
The possibility of getting infected with coronavirus	4.33 ± 1.92	4.52 ± 1.61	4.74 ± 1.72	17.51	**<.001**	0.009	VR < VH* VR < VA** VH < VA*
The susceptibility to coronavirus	4.38 ± 1.81	4.65 ± 1.59	4.71 ± 1.75	11.24	**<.001**	0.006	VR < VH* VR < VA**
The severity of coronavirus	3.75 ± 1.76	4.01 ± 1.46	4.16 ± 1.67	19.03	**<.001**	0.010	VR < VH** VR < VA** VH < VA*
Conspiracy theories							
Many very important things happen in the world. which the public is never informed about	4.88 ± 2.22	4.98 ± 1.76	4.75 ± 2.06	4.54	**.011**	0.002	VH > VA*
Politicians usually do not tell us the true motives for their decisions	5.31 ± 2.10	5.48 ± 1.64	5.48 ± 1.83	2.73	.065	0.001	ns
Government agencies closely monitor all citizens	3.37 ± 2.03	3.44 ± 1.75	3.37 ± 1.94	.74	.478	0.000	ns
Events which superficially seem to lack a connection are often the result of secret activities.	4.26 ± 2.14	4.09 ± 1.72	3.90 ± 2.02	15.04	**<.001**	0.005	VR > VA** VH > VA*
There are secret organizations that greatly influence political decisions	4.30 ± 2.21	4.09 ± 1.88	3.85 ± 2.11	9.99	**<.001**	0.008	VR > VA** VH > VA*
At the moment. how much do you worry about							
Losing loved one	5.75 ± 1.83	6.10 ± 1.33	6.28 ± 1.27	40.21	**<.001**	0.020	VR < VH** VR < VA** VH < VA*
Health system being overloaded	5.29 ± 1.89	5.61 ± 1.39	5.83 ± 1.141	37.68	**<.001**	0.019	VR < VH** VR < VA** VH < VA**
Losing mental health	4.37 ± 2.11	4.78 ± 1.73	4.84 ± 1.88	18.99	**<.001**	0.010	VR < VH** VR < VA**
Losing physical health	4.54 ± 2.03	4.89 ± 1.66	4.94 ± 1.81	15.06	**<.001**	0.008	VR < VH** VR < VA**
Restriction of freedom	5.08 ± 1.96	5.13 ± 1.71	5.31 ± 1.74	6.05	**.002**	0.003	VR < VA* VH < VA*
Not being able to visit people who need help	5.11 ± 2.05	5.18 ± 1.72	5.32 ± 1.83	4.36	**.013**	0.002	VR < VA*
Recession	5.70 ± 1.79	5.71 ± 1.50	5.82 ± 1.53	2.61	.074	0.001	ns
Restricted access to food supplies	4.84 ± 2.09	4.91 ± 1.83	5.01 ± 1.91	2.43	.088	0.001	ns
The novel coronavirus to me feels ...							
1 close to me-7 far away from me	3.02 ± 1.55	3.29 ± 1.37	2.95 ± 1.48	19.20	**<.001**	0.010	VR < VA** VH < VA**
1 Spreading slowly-7 Spreading fast	5.72 ± 1.63	5.96 ± 1.25	6.14 ± 1.23	29.96	**<.001**	0.015	VR < VH** VR < VA** VH < VA**
1 Fear-inducing-7 Not fear-inducing	2.83 ± 1.65	3.13 ± 1.45	2.88 ± 1.57	11.45	**<.001**	0.006	VR < VH** VH>VA**
1 Media hyped-7 Not media hyped	4.44 ± 2.02	4.84 ± 1.67	5.11 ± 1.74	41.70	**<.001**	0.021	VR < VH** VR < VA** VH < VA**

(*Continued*)

Knowledge	VR (Mean ± SD)	VH (Mean ± SD)	VA (Mean ± SD)	*F*	*P* Value***	η^2	Tukey
1 Worrying-7 Not worrying	2.48 ± 1.52	2.68 ± 1.38	2.38 ± 1.42	15.08	**<.001**	0.008	VR < VH* VH>VA**
Finding difficult to cope with stressful events (1: strongly disagree, 7: strongly agree	3.47 ± 1.99	3.82 ± 1.83	3.79 ± 1.98	9.46	**<.001**	0.005	VR < VH** VR < VA**
Finding hard to get back when so-mething bad happens	3.40 ± 1.99	3.65 ± 1.78	3.62 ± 1.93	4.95	**.007**	0.001	VR < VH* VR < VA*

***ANOVA, **P < .001, *P < .05, ns, nonsignificant, we presented the significant results in post hoc comparisons. VR: vaccine refusal; VH: vaccine hesitancy; VA: vaccine acceptance.

The scores of the vaccine acceptancy group (M=6.14), vaccine hesitancy (M=5.96), and vaccine refusal groups (M=5.72) differed significantly from each other in post hoc analyses. The vaccine refusal group and hesitancy group perceived spreading coronavirus slowly than the vaccine acceptancy group.

It was revealed that finding coronavirus fear-inducing has a significant effect on vaccine attitudes [F(2, 3884)=11.49 P < .001]. The vaccine hesitancy group (M=3.13) found coronavirus more likely fear-inducing than the vaccine refusal (M=2.82) and vaccine acceptancy groups (M=2.90). The mean scores of the vaccine refusal and vaccine acceptance groups were not significantly different for this variable. There was a significant effect of finding coronavirus as media-hyped on vaccine attitudes [F(2, 3884)=41.70 P < .001]. The mean score of the vaccine acceptancy (M=5.11), vaccine hesitancy (M=4.84), and the vaccine refusal (M=4.44) groups were significantly different from each other groups. The vaccine-refusal group and vaccine hesitancy group found coronavirus as media-hyped more likely than the vaccine acceptancy group. It was established that the perception of coronavirus has a worrying effect on vaccine attitudes [F(2, 3884)=15.08 P < .001]. The mean score of the vaccine hesitancy group (M=2.68) differed from the vaccine refusal (M=2.48) and vaccine acceptancy (M=2.38) groups. There was no significant difference between the vaccine refusal and vaccine acceptancy groups for this variable. The vaccine hesitancy group significantly perceived the coronavirus as worrying than the other 2 groups.

Resilience: The analysis revealed that coping with stressful events affects vaccine attitudes [F(2, 3884)=9.46 P < .001]. The mean score of the vaccine refusal group (M=3.47) differed from those of the vaccine hesitancy (M=3.82) and the vaccine acceptancy group (M=3.79), whereas those of vaccine hesitancy and the vaccine acceptancy groups were similar. The vaccine acceptancy group found it more challenging to cope with stressful events (P < .001) than vaccine refusal and vaccine hesitancy groups. It was established that the perception of the easy to get back when something happens affects vaccine attitudes [F(2, 3884)=40.21 P < .001]. The mean score of the vaccine refusal group (M=3.49) differed from the mean score of the vaccine hesitancy (M=3.65) and the vaccine acceptancy group (M=3.62). There was no significant difference between the scores of the vaccine hesitancy and the vaccine acceptancy groups. The vaccine-refusal group found it easy to get back when something happens than vaccine hesitancy and acceptancy groups.

A chi-square test showed that the participants who refused to get vaccination were less likely to wash hands (x^2 (2, N=3888)=3.30, P=.008), wear a face mask (x^2 (2, N=3888)=41.37, P < .001), and pay attention to social distancing (x^2 (2, N=3888)=10.76, P=.005), while they take vitamins/minerals (x^2 (2, N=3888)=30.36, P < .001), take herbal supplements (x^2 (2, N=3888)=43.86, P < .001) more likely as preventive measures of coronavirus. Table 3 shows the preventive measures of the participant related to vaccination attitudes.

Table 4 presents the level of trust in the Ministry of Health, medical professional organizations (e.g., Turkish Medical Association), and Media during the pandemic.

An ANOVA suggested, the level of trust in the Ministry of Health significantly differed according to periods [F(2, 3884)=128.6 P < .001]. The level of trust in the Ministry of Health was higher in the first period (M=5.03) than the second (M=3.78) and third (M=3.84) periods. There was no significant difference between the level of trust in the Ministry of Health in the second and third periods. It was revealed that the level of trust in media differed according to the periods [F(2, 3884)=37.16 P < .001]. The level of trust in media was higher in the first period (M=3.12) than in the second (M=2.83) and third periods (M=2.86). There was no significant difference between the level of trust in media in the second and third periods. It was established that the level of trust in the medical professional organizations (e.g., Turkish Medical Association) differed according to periods [F(2, 3884)=34.75 P=.02]. The level of trust in the medical professional organizations (e.g., Turkish Medical Association) was lower in the third period (M=4.77) than in the first (M=5.09) and second period (M=5.08). There was no significant difference between the level of trust in the medical professional organizations (e.g., Turkish Medical Association) in the first and second periods. Lastly, it was determined that vaccine attitudes differed according to the periods [F(2, 3884)=49.90 P < .001]. The vaccine

Table 3. Preventive Measures of the Participant Related With Vaccination Attitudes, Turkey, 2020

Preventive Measures		If a Vaccine Becomes Available and Is Recommended for Me, I Would Get It					
		VR % (*n*)	VH % (*n*)	VA % (*n*)	Value	*df*	*P* Value*
Handwashing	Yes	16.2 (785)	23.8 (1103)	60 (1875)	**13.727**	**4**	**.008**
	No	50 (52)	0 (24)	50 (48)			
Taking supplements (vitamin, minerals)	Yes	26.1 (370)	28.8 (409)	45.1 (639)	**30.345**	**2**	**<.001**
	No	18.9 (467)	29.1 (718)	52.0 (1284)			
Wearing a face mask	Yes	20.9 (793)	29.2 (1107)	50.0 (1897)	41.366	2	**<.001**
	No	48.9 (44)	22.2 (20)	28.9 (26)			
Social distancing	Yes	20.9 (756)	29.2 (1056)	49.8 (1799)	10.761	2	**.005**
	No	29.3 (81)	25.7 (71)	44.9 (124)			
Herbal supplements (garlic, ginger, lemon)	Yes	25.8 (499)	28.5 (552)	45.7 (884)	43.858	2	**<.001**
	No	17.3 (338)	29.5 (575)	53.2 (1039)			

*Chi-square test; VR, vaccine refusal; VH, vaccine hesitancy; VA, vaccine acceptance; *n*, number of respondents.

willingness was higher in the first period ($M=5.15$) than in the second ($M=4.53$) and third period ($M=4.38$). The level of vaccine willingness was not different in the second and third periods. Table 4 shows vaccine attitudes for 6 months.

Finally, we conducted a multiple linear regression model to examine the independent effects of different vaccination predictors (Table 5). As a result of the analysis, it was found that a significant regression model, $F(33, 3846)=17.772$, $P < .001$, and 13% (adjusted $R^2=0.13$) of the variance in vaccination attitudes were explained by independent variables. Age ($b=-0.05$, $t(3846)=-2.73$, $P=.004$), gender ($b=0.12$, $t(3846)=7.63$, $P < .001$), being healthcare worker ($b=0.03$, $t(3846)=2.06$, $P=0.040$), having children <18 years in a household ($b=0.04$, $t(3846)=2.50$, $P=.013$), and having a chronic illness that increases the risk of getting COVID-19 ($b=0.04$, $t(3846)=-2.60$, $P=.010$) significantly predicted vaccine acceptancy.

Level of perceived self-efficacy ($b=0.07$, $t(3846)=3.84$, $P < .001$) and knowledge on how to prevent the spread of coronavirus infection ($b=0.05$, $t(3846)=2.73$, $P=.006$), the perceived severity of getting infected with coronavirus ($b=0.04$, $t(3846)=2.34$, $P=.019$) significantly predicted vaccine acceptancy. The lower levels of 2 conspiracy theories significantly predicted vaccine acceptance. These were as follows: "Events which superficially seem to lack a connection are often the result of secret activities" ($b=-0.06$, $t(3846)=-2.55$, $P=.011$); "There are secret organizations that greatly influence political decisions" ($b=-0.06$, $t(3846)=-2.59$, $P=.009$). But the belief that "Politicians usually do not tell us the true motives for their decisions" ($b=0.06$, $t(3846)=3.084$, $P=.002$) was a positive predictor of vaccine acceptance. Worrying more about losing a loved one ($b=0.06$, $t(3846)=2.75$, $P=.006$), worrying more about overloading of the health system ($b=0.07$, $t(3846)=3.46$, $P < .001$), and worrying less about the recession ($b=-0.04$, $t(3846)=-2.43$, $P=.015$) significantly predicted vaccine acceptancy. The perception of coronavirus as media-hyped significantly predicted vaccination intention ($b=0.08$, $t(3846)=4.99$, $P < .001$). Trust in Ministry of Health and medical professional organizations (e.g., Turkish Medical Association) variables significantly predicted vaccination intention ($b=0.12$, $t(3846)=7.40$, $P < .001$; $b=0.07$, $t(3846)=4.11$, $P < .001$, respectively).

Table 4. The Changes in Trust Related to Ministry of Health, Medical Professional Organizations and Media, and Vaccination Intention for 6 months, Turkey, 2020

	First Period (*n*: 2008) Mean ± SD	Second Period (*n*: 964) Mean ± SD	Third Period (*n*: 915) Mean ± SD	*F*	*P* value***	η^2	Tukey
Trust in Ministry of Health	5.03 ± 2.375	3.78 ± 2.34	3.84 ± 2.41	128.60	**<.001**	**0.062**	1>2**, 1>3**
Trust in medical professional organizations (e.g., Turkish Medical Association)	5.09 ± 2.30	5.08 ± 2.44	4.77 ± 2.50	6,12	**.002**	0.003	1>3*, 2>3*
Trust in Media	3.13 ± 2.16	2.84 ± 2.16	2.86 ± 2.20	7,88	**<.001**	0.004	1>2*, 1>3*
If a vaccine becomes available and is recommended for me, I would get it	5.15 ± 2.10	4.53 ± 2.31	4.38 ± 2.28	49.900	**<.001**	0.025	1>2**, 1>3**

***ANOVA, ** $P < .001$, * $P < .05$, First period: July 17, 2020 to August-31, 2020, Second: September 1, 2020 to-October 31, 2020, Third: November 01, 2020 to December 15, 2020.

Table 5. Multiple Linear Regression Results for Predicting Vaccination Intention, Turkey, 2020

	Estimates	SE	95% CI		Sig.
			LL	UL	
Age	-0.050	0.003	-0.014	-0.003	**0.004**
Gender[a]	0.119	0.071	0.403	0.682	**0.000**
Education level[b]	-0.010	0.098	-0.257	0.129	0.515
Being healthcare worker[c]	0.032	0.075	0.007	0.301	**0.040**
Children <18 years in household[d]	0.039	0.071	0.037	0.316	**0.013**
Chronic illness that increases the risk of getting COVID-19[e]	0.042	0.111	0.070	0.503	**0.010**
Knowledge					
Level of knowledge on how to prevent the spread of coronavirus infection	0.050	0.28	0.014	0.125	**0.006**
Perceived self-efficacy	0.073	0.033	0.062	0.192	**0.000**
Risk Perception					
The possibility of getting infected with coronavirus	0.033	0.022	-0.001	0.086	0.056
The susceptibility to coronavirus	-0.013	0.023	-0.062	0.029	0.471
The severity of coronavirus	0.044	0.026	0.010	0.111	**0.019**
Conspiracy Theories					
Politicians usually do not tell us the true motives for their decisions	0.057	0.022	0.025	0.112	**0.002**
Events that superficially seem to lack a connection are often the result of secret activities.	-0.057	0.025	-0.113	-0.015	**0.011**
There are secret organizations that greatly influence political decisions	-0.058	0.024	-0.109	-0.015	**0.009**
At the moment. how much do you worry about					
Losing someone I love	0.056	0.032	0.025	0.149	**0.006**
Health system being overloaded	0.071	0.030	0.044	0.160	**0.001**
Losing mental health	0.047	0.031	-0.005	0.115	0.073
Losing physical health	-0.036	0.030	-0.104	0.015	0.145
Restriction of freedom	0.014	0.023	-0.027	0.062	0.445
Not being able to visit people who need help	0.014	0.023	-0.027	0.062	0.445
Recession	-0.047	0.027	-0.119	-0.013	**0.015**
The novel coronavirus to me feels					
1 Media hyped-7 Not media hyped	0.080	0.020	0.060	0.138	**0.000**
Finding difficult to cope with stressful events (1: strongly disagree, 7: strongly agree	0.019	0.020	-0.017	0.061	0.269
Finding hard to get back when something bad happens	0.012	0.019	-0.022	0.051	0.438
Trust in institutions					
Trust in Ministry of Health	0.123	0.015	0.082	0.141	**0.000**
Trust in medical professional organizations (e.g., Turkish Medical Association)	0.068	0.015	0.033	0.094	**0.000**
Trust in Media	0.016	0.022	-0.050	0.018	0.359
Preventive measures					
Handwashing[f]	0.037	0.200	0.075	0.860	**0.020**
Taking supplements (vitamin, minerals)[g]	-0.036	0.076	-0.314	-0.016	**0.030**
Wearing a face mask[h]	0.036	0.237	0.072	1.002	**0.024**
Social distancing	0.014	0.143	-0.160	0.399	0.402
Herbal supplements (garlic. ginger. lemon)[i]	-0.071	0.075	-0.461	-0.169	**0.000**

SE, standard error; LL, lower limit; UL, upper limit.
[a]0, female; 1, male. [b]0, high school and lower; 1; university. [c]0, not being a healthcare worker. 1, being a healthcare worker. [d]0, not having; 1, having children <18 years in the household. [e]0, not having. 1, having a chronic illness that increases the risk of getting COVID-19. [f]0, not handwashing. 1, handwashing. [g]0, not taking supplements; 1, taking supplements. [h]0, not wearing a face mask; 1, wearing a face mask. [i]0, not taking herbal supplements; 1, taking herbal supplements.

The higher compliance of handwashing ($b=0.04$, $t(3846)=0.223$, $P=.020$) and wearing a face mask ($b=0.04$, $t(3846)=-2.27$, $P=.024$) significantly predicted vaccine acceptancy. Taking supplements (vitamins, minerals) ($b=-0.04$, $t(3846)=2.17$, $P=.030$) and taking herbal supplements (garlic, ginger, lemon) were negative predictors of vaccine acceptance ($b=-0.07$, $t(3846)=4.22$, $P < .001$).

DISCUSSION

Preventative vaccination is one of the most effective ways to control the pandemic. The results of the survey provide information on perceived risk and worry, conspiracy beliefs, trust in institutions related to taking measurements during the pandemic, health-protective behaviors, and their relationship with vaccine willingness in the pandemic period when worldwide researches of vaccination started to give results and just before the application of vaccination started in Turkey. Previous studies show that while vaccine refusal was low at the beginning of the pandemic[10] as the pandemic progressed, vaccine refusal increased time.[11] In our study, we determined the noticeable increase of vaccine refusal over time. Moreover, 54% of the participants refused to be vaccinated. Considering that at least 70% of the population should be vaccinated to ensure herd immunity as well as the production of the vaccine in controlling the pandemic,[12] it is crucial to identify the factors that may be associated with vaccine willingness to make appropriate interventions and increase vaccine willingness.

The Sociodemographic Profile of Vaccine Hesitancy and Refusals

These demographic factors were significantly related to vaccine resistance: sex, age, employment status, having a chronic disease that increases the risk of getting infected with coronavirus disease. Consistent with previous research,[8] women are more likely to be vaccine refusing than accepting. Females develop more frequent and severe adverse effects after vaccination.[13] This may cause the approach of the COVID-19 vaccines more hesitantly. We found that younger age groups (18-25 years) had higher vaccination willingness, and vaccine refusal increased with aging whereas having a chronic illness that increases getting coronavirus disease was more associated with vaccine acceptance. Although there is an increasing global concern that high-level educated individuals hesitate about the vaccine,[14] there are contrary findings.[15] Our study reported that highly educated individuals were more likely to be accepting of COVID-19 vaccination. Despite the growing rejection of vaccines around the world over the years, the public still relies on healthcare professionals' vaccine recommendations. The finding that being a healthcare worker positively affected vaccine willingness. This also means a positive effect on public choices about vaccines. Therefore, knowing the sociodemographic profile of vaccine-hesitant and vaccine-refusing individuals can guide policies to increase vaccination willingness.

The Perceived Knowledge, Self-Efficacy, Risk Perception of Vaccine-Hesitant/Refusals

Perceived risk, perceived knowledge, and self-efficacy are cognitive factors that contribute to engagement to health-protective behaviors,[16] such as vaccination during disease outbreaks, including the current pandemic. As parts of the risk perception dimension, perceived susceptibility and the probability did not show any significant relationship in predicting COVID-19 vaccine willingness even though the significance level of perceived possibility was 0.057 and close to the significance level. In previous studies, the existence of high perceived self-efficacy, knowing and applying effective protection methods, the perceived severity of infection about the disease are significant positive predictors of willingness to take a COVID-19 vaccine. It was revealed that people might be infectious and asymptomatic during the incubation period[17]; also, although they are asymptomatic and infected can still transmit the virus to others.[18] People believe they are well when they have no symptoms. This may lead to a decrease in risk perceptions and preventive measures such as vaccination, which control the spread of infection in the whole community. Considering the severity of the public health problem caused by COVID-19, our findings suggest that risk perception in the community should be managed correctly.

Affective Factors and the Worry-Related Beliefs of Coronavirus Vaccines Hesitancy and Refusal

Previous studies on pandemics determined that besides risk perception and self-efficacy, emotional aspects like worry play a role in decision-making about vaccination.[19] In this study, the relationship between the person's concerns not only about himself/herself but also about others and the vaccination behavior was evaluated. Our findings generally suggest that those who refuse the vaccine have low anxiety levels, were less concerned about the pandemic, found the pandemic as media-hyped and less fear-inducing; moreover, the level of their perception about resilience was high. In addition, the worry about losing loved ones due to the coronavirus disease, the worry about overloading the health system are positive predictors of vaccine willingness. Establishing a delicate balance between the perceptions of the pandemic and the emotional response to the pandemic is thought to be important to affect the vaccination behavior necessary to control the pandemic positively. Increased anxiety decreased risk perception of the illness which may lead to avoiding sources of information. This may negatively affect vaccine acceptance.

Beliefs in Conspiracy Theories

Beliefs in conspiracy theories are known to be associated with mistrust of scientific claims. The interventions of scientists and medical professionals may be ignored by those sympathetic to the various conspiracy claims.[20] Our findings show that there is a relationship between vaccine refusals and vaccine hesitancy, and belief in general conspiracy theories. It is difficult to predict the infectiousness of the disease, the case fatality rate, and the course of the epidemic at the beginning of the pandemic. This uncertainty may have facilitated the spread of conspiracy theories. Health authorities should update the information to the public on what is known about the pandemic as well as uncertain ones. Thus, it increases confidence in health authorities, the beliefs in conspiracy theories decrease whereas the public is motivated to take appropriate preventive measures.

Trust in Institutions

Another finding is that, at the beginning of the study, trust in the Ministry of Health, medical professional organizations such as Turkish medical associations and trust in media is higher and anti-vaccination is lower, while trust in these institutions decreases and the anti-vaccination increases in the following period. As the Ministry of Health and Turkish medical associations have the responsibility for public health messaging during the pandemic, providing clear information on the course of the pandemic and working collaboratively with multiple societal stakeholders are most important to increase the acceptance of vaccination during the vaccination process. The significant decline in trust between August and October may be related to the management of the pandemic and the inadequate public awareness. With the transparency of sharing the data since November and the planned progress of the vaccination process since January, a decrease in vaccine hesitancy is expected.

Strengths of this study include a large sample, the standard questionnaire form developed for WHO, the focus on risk perception, behavior changes during the pandemic, conspiracy theories and trust in responsible institutions controlling the outbreak that might explain vaccine refusal and hesitancy, and multivariate modeling to identify the most salient predictors. These findings can help develop appropriate interventions to improve vaccine willingness and control the coronavirus pandemic and future pandemics. The other strength of the study was the possibility to show the changes in vaccine attitudes over time. Finally, we believe that the findings of this study reflect the relationship between the variables and attitudes towards a vaccine because the study involves the periods that the more significant restrictions have been put in place in Turkey.

Limitations

The study was conducted online by using the snowball sampling method which is a special nonprobability method; hence it did not allow to reach out to the participants randomly. Additionally, low-income, low-educated people, or elderly people might not have accessed the online survey. Therefore, our samples were not representative of the Turkish population. Second, we assessed the intention of the rejection of the COVID-19 vaccine rather than the general attitudes about vaccines and actual vaccination behavior. In this study, we examined the effect of general conspiracy theories on vaccine hesitancy. The conspiracy theories related to vaccination should also be examined to find out its effect on vaccination.

In conclusion, attitudes towards vaccination cannot be isolated from risk perception of disease, affect and worries related to the pandemic, belief in general conspiracy theories, and trust in media and health institutions. We suggest increasing vaccine acceptance; it is essential to ensure that both the healthcare workers and the public have access to reliable and sufficient information about vaccines.

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