Determinants of Participation in Immunization against COVID-19 before Distribution of Vaccine in Iran

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Research Article

Keywords: COVID-19, Immunization, Vaccination, Coronavirus, Public Willingness

Posted Date: July 13th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-645571/v1

Abstract

Background: In each immunization program, the public participation is a key factor. So, we studies determinants of participation in immunization against Coronavirus disease 2019 (COVID-19) in Iran before distribution of vaccine.

Methods: This cross-sectional study conducted in February 2021. It had two formats; interview and online. The questionnaire comprised socio-demographic information, past medical history, perceived susceptibility to COVID-19 infection, and tendency for participating in vaccination against COVID-19.

Results: Of 2071 participants, 1020 (49.2%) were men, and 1803 (87.1%) were determined to participate in COVID-19 vaccination program. There was a significant association between positive attitude toward vaccination against COVID-19 and the respondent's socio-economic status (SES), educational level, reporting non-communicable diseases (NCDs) in themselves/ their first-degree families, perceived susceptibility toward getting COVID-19 infection in the following months in themselves/close family members, and being a healthcare worker. Most respondents were determined to participate in the COVID-19 vaccination because they believed vaccination would be effective in preventing mortality and decreased COVID-19 transmission.

Conclusions: SES, educational level, positive history of NCDs, perceived susceptibility toward getting COVID-19 infection, and being a healthcare worker had a significant positive association with the respondents' intention to participate in COVID-19 vaccination program.

Background

Novel Coronavirus 2019 (COVID-19) emerged from Wuhan in China and spread worldwide [1]. More than one hundred million people got infected and over three million people deceased by COVID-19; about 3% mortality rate [2, 3]. For controlling an infectious disease without a definitive treatment, non-pharmaceutical interventions (NPIs) are the only measures [4] and almost all countries adopted a kind of NPIs, including lockdowns to control the epidemic [5]. Although lockdown would remarkably contribute to control the COVID-19 epidemic [6–8], due to its great impact on the countries' economy, it could not be continued [6, 9, 10]. Hence, vaccination had to be considered as the other preventive method for controlling COVID-19.

Several vaccines against COVID-19 from different companies and countries have been developed. They have different mechanisms of action, including inactivated vaccines [11, 12], attenuated live virus vaccines, recombinant protein vaccines [11], vectored vaccines [13, 14], and DNA[15] or RNA vaccines[16, 17] that have shown different efficacy and safety [13, 17–20]. Although the approval of the efficacy and safety of the COVID-19 vaccines were expedited due to the emergency situation, most countries accepted them [21, 22]. However, in each immunization program, the public participation is a key factor or the vaccination program would inevitably be failed, what was seen in previous vaccination programs [23, 24]. Studies have shown several factors could affect public willingness to participate in the immunization

programs including vaccination against COVID-19 infection [23–25]. Some of these factors are reassurance about the safety and efficacy of the COVID-19 vaccines, cultural and religious believes, social capita, and trust toward the healthcare system [23, 25, 26]. Considering the factors mentioned above are mainly culture dependent, we conducted this study to determine whether Iranian population would participate in vaccination program against COVID-19, and what would be the drivers of their participation.

Methods

This cross-sectional study was conducted among Iranian population in February 2021 before the COVID-19 vaccine distributed in Iran. The study was conducted in two formats; face to face interviewing and the online format. The protocol of this study was approved by the Ethics Committee of Shiraz University of Medical Sciences (SUMS) encoded IR.SUMS.REC.1399.1151.

Sample size and sampling

Face to face interview

This part of study was conducted between February 1st and 13th, 2021 in Shiraz, the fifth populous city in Iran and the capital of Fars province.

Since no similar study with face-to-face interviewing method was available at the time this study was started the sample size for this section was calculated by using Raosoft sample size website program. Hence, considering the confidence interval (95%), error type II (80%), drop out (60%) and response distribution (50%), the sample size was estimated 1232 that rounded to 1245 [27]. Multistage cluster sampling method was used. We decided to interview the passersby so that the interviewees could trust us more easily as they could not be tracked later. So, at first, we divided Shiraz into five zones; North, South, East, West and the center. Then for defining the proportion sample size of each zone, we measured the pedestrian traffic at the three main streets of each zone during rush hours. For extrapolation of the study results to Shiraz, we used the age and gender distribution of population in Shiraz yield through the last National Population Census in 2016.

Online interview

For online part of this study, the questionnaire was distributed to a convenience sample of WhatsApp and Telegram online communities from February 14th to 17th 2021. No incentives were provided for this survey participation.

Data gathering tool

The questionnaire had three parts. First part was socio-demographic information (16 questions) that included gender, age, living status (living alone versus living with others including spouse, children, parents, friends or their acquaintances), residential area (urban versus rural), education level, employment

status, being a healthcare worker, monthly income and expenditure congruency (three choices; expenditure more, less or in balance with income), self-reported socio-economic status (SES), and health insurance status.

Second section comprised 7 questions about the health status of participants and their families and how they perceived susceptibility of themselves and their close family to COVID-19 infection during the following months. The third section was asking whether they would like to participate in immunization program against COVID-19. In this part three scenarios were introduced to the participants. In scenarios some simple information was mentioned about the COVID-19 vaccine mechanism of action, dosage, and the most frequent potential side effects. Then the participants were asked whether they would like to participate in immunization program against COVID-19. The validity of this questionnaire was evaluated by three health economists, a Community Medicine specialist, an epidemiologist, and a health policymaker. The reliability of questionnaire was determined in a pilot study that was conducted among 50 individuals (Cronbach alphas was 0.86)

Statistical analysis

Data were analyzed with the Statistical Package for Social Sciences (SPSS) software version 24 (IBM, Armonk, NY, USA). Mean (± standard deviation) and frequency (percentage) were used for reporting quantitative and qualitative variables, respectively. Chi- square test and T test were used as a univariate analysis for associations between the outcome variable and the independent ordinal and scale variables, respectively. Variables with P- value < 0.2 were include in binary logistic regression model to get analyzed their relationship with inclination to participate in immunization program against COVID-19. The final model was reported with adjusted odds ratios (aORs) and 95% confidence intervals (CIs). A p-value < 0.05 was considered significant.

Result

Participant characteristics

A total number of 2071 participants, including 1020 (49.2%) males and 1051 (50.8%) females, were included in the present study. The number of individuals who participate in the study through face-to-face interview and online survey were 1245 (60.1%) and 826 (39.9%), respectively. All participants were categorized into two groups, including 1803 (87.1%) individuals who were determined to participate in the immunization program against COVID-19, and 268 (12.9%) participants who were indecisive or reluctant in this regard. In the present study, the higher percentage of participants (n = 1956, 94.4%) lived with others, including spouse and/or children and/or parents and/or friends and/or acquaintance than living alone (n = 115, 5.6%). Also, 1970 (95.1%) participants were from urban and 101 (4.9%) were from rural residential areas.

Univariable Analysis

Univariable analysis revealed that in total study population, education level (*P* value = 0.01), SRH (*P* value = 0.04), positive history of Non-communicable diseases)NCDs(in respondents' first degrees (*P* value = 0.004), positive COVID-19 infection in the respondents' family (*P* value = 0.02), the risk of getting COVID-19 infection in the next few months in respondents (*P* value < 0.001) and their close family members (*P* value < 0.001), and being a healthcare worker (*P* value = 0.03) had a positive association with intention to take the vaccine.

In respondents who were interviewed, variables such as education level (*P* value = 0.004), positive history of NCDs in respondents' first degrees (*P* value < 0.001), positive COVID-19 infection in the respondents' family (*P* value = 0.002), the risk of getting COVID-19 infection in the next few months in respondents (*P* value < 0.001) and their close family members (*P* value < 0.001), and being a healthcare worker (*P* value = 0.003) had a positive association with intention to take the vaccine.

In respondents who filled the online questionnaire, variables such as having a positive history of NCDs (*P* value = 0.001), and the risk of getting COVID-19 infection in the next few months (*P* value = 0.03) had a positive association with intention to take the vaccine. Other variables such as age, gender, living status, residential area, Job, income and expenditure correlation, SES, and health insurance had no statistically significant association with the respondents' decision to take vaccine. (Table 1)

Table 1
Health characteristics of participants, their attitude toward transmissibility of COVID-19 and their intention to take the COVID-19 vaccine.

		Univariable analysis			Multivariable logistic regression	
Demographics		**Definitely Yes (n = 1803)**	**indecisive/ Definitely no (n = 268)**	**P value**	**Definitely yes vs. Indecisive/ Definitely no Adjusted OR (95% CI)**	**P value**
	Age groups (years)					
Total	**18–44**	1288 (87.7)	181 (12.3)	0.40		
	45–60	352 (85.2)	61 (14.8)			
	> 60	163 (86.2)	26 (13.8)			
Interview	**18–44**	770 (89.5)	90 (10.5)	0.29		
	45–60	228 (86.0)	37 (14.0)			
	> 60	107 (89.2)	13 (10.8)			
Online	**18–44**	518 (85.1)	91 (14.9)	0.67		
	45–60	124 (83.8)	24 (16.2)			
	> 60	56 (81.2)	13 (18.8)			
	Gender					

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 SES: Socio-economic status according to the participants' claim

§If the response was "At least one", the respondent could choose one or more choices including outpatient, hospitalized, deceased, and currently under treatment if applicable

		Univariable analysis			Multivariable logistic regression
Total	**Male**	895 (87.7)	125 (12.3)	0.39	
	Female	908 (86.4)	143 (13.6)		
Interview	**Male**	621 (88.6)	80 (11.4)	0.85	
	Female	484 (89.0)	60 (11.0)		
online	**Male**	274 (85.9)	45 (14.1)	0.43	
	Female	424 (83.6)	83 (16.4)		
	Living status				
Total	**Alone**	98 (85.2)	17 (14.8)	0.56	
	With others**	1705 (87.20)	251 (12.8)		
Interview	**Alone**	64 (88.9)	8 (11.1)	0.99	
	With others**	1041 (88.7)	132 (11.3)		
Online	**Alone**	34 (79.1)	9 (20.9)	0.28	
	With others**	664 (84.8)	119 (15.2)		
	Residential area				
Total	**Urban**	1710 (86.8)	260 (13.2)	0.17	
	Rural	93 (92.1)	8 (7.9)		
Interview	**Urban**	1052 (88.5)	137 (11.5)	0.19	

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		Univariable analysis			Multivariable logistic regression	
	Rural	53 (94.6)	3 (5.4)			
Online	**Urban**	658 (84.3)	123 (15.7)	0.52		
	Rural	40 (88.9)	5 (11.1)			
	Education level					
Total	**Below high school**	434 (90.4)	46 (9.6)	0.01	2.6 (1.7–3.9)	< 0.001
	High school diploma	618 (88.2)	83 (11.8)		2.1 (1.4–2.9)	< 0.001
	Under graduate	418 (85.1)	73 (14.9)		1.4 (1.01–2.1)	0.04
	Post graduate	333 (83.5)	66 (16.5)		Reference	
Interview	**Below high school**	337 (92.3)	28 (7.7)	0.04		
	High school diploma	461 (87.5)	66 (12.5)			
	Under graduate	239 (86.0)	39 (14.0)			
	Post graduate	68 (90.7)	7 (9.3)			
Online	**Below high school**	97 (84.3)	18 (15.7)	0.10		
	High school diploma	157 (90.2)	17 (9.8)			
	Under graduate	179 (84.0)	34 (16.0)			
	Post graduate	265 (81.8)	59 (18.2)			

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		Univariable analysis			Multivariable logistic regression	
Job						
Total	**Employed**	974 (86.9)	147 (13.1)	0.84		
	Unemployed	829 (87.3)	121 (12.7)			
Interview	**Employed**	664 (88.4)	87 (11.6)	0.71		
	Unemployed	441 (89.3)	53 (10.7)			
Online	**Employed**	310 (83.8)	60 (16.2)	0.63		
	Unemployed	388 (85.1)	68 (14.9)			
	Healthcare worker					
Total	**Yes**	255 (91.1)	25 (8.9)	0.03	2 (1.2–3.1)	0.004
	No	1548 (86.4)	243 (13.6)		Reference	
Interview	**Yes**	113 (96.6)	4 (3.4)	0.003	4.1 (1.4–11.3)	0.009
	No	992 (87.9)	136 (12.1)		Reference	
Online	**Yes**	142 (87.1)	21 (12.9)	0.33		
	No	556 (83.9)	107 (16.1)			
	Correlation between income and expenditure					

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		Univariable analysis			Multivariable logistic regression	
Total	**Income > expenditure**	626 (87.4)	90 (12.6)	0.85		
	Income = expenditure	1126 (86.9)	169 (13.1)			
	Income < expenditure	51 (85)	9 (15)			
Interview	**Income > expenditure**	415 (90.0)	46 (10.0)	0.23		
	Income = expenditure	665 (87.7)	93 (12.3)			
	Income < expenditure	25 (96.2)	1 (3.8)			
Online	**Income > expenditure**	211 (82.7)	44 (17.3)	0.22		
	Income = expenditure	461 (85.8)	76 (14.2)			
	Income < expenditure	26 (76.5)	8 (23.5)			
	SES					
Total	**High**	208 (88.5)	27 (11.5)	0.06	0.7 (0.53–0.96)	0.02
	Middle	889 (85.3)	153 (14.7)		1.2 (0.70–1.80)	0.60
	Low	706 (88.9)	88 (11.1)		Reference	
Interview	**High**	96 (93.2)	7 (6.8)	0.07		
	Middle	590 (87.0)	88 (13.0)			

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		Univariable analysis			Multivariable logistic regression
	Low	419 (90.3)	45 (9.7)		
Online	**High**	112 (84.8)	20 (15.2)	0.21	
	Middle	299 (82.1)	65 (17.9)		
	Low	287 (87.0)	43 (13.0)		
	Health insurance				
Total	**Yes**	1478 (86.8)	225 (13.2)	0.49	
	No	323 (88.3)	43 (11.7)		
Interview	**Yes**	859 (88.6)	110 (11.4)	0.91	
	No	245 (89.1)	30 (10.9)		
Online	**Yes**	619 (84.3)	115 (15.7)	0.88	
	No	78 (85.7)	13 (14.3)		
	Self-rated health				
Total	**Good**	1276 (85.9)	209 (14.1)	0.04	
	Fair	486 (90)	54 (10)		
	Poor	41 (89.1)	5 (10.9)		
Interview	**Good**	749 (88.0)	102 (12.0)	0.46	

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		Univariable analysis			Multivariable logistic regression	
	Fair	333 (90.2)	36 (9.8)			
	Poor	23 (92.0)	2 (8.0)			
Online	**Good**	527 (83.1)	107 (16.9)	0.12		
	Fair	153 (89.5)	18 (10.5)			
	Poor	18 (85.7)	3 (14.3)			
	Positive history of chronic diseases in the respondent					
Total	**Yes**	287 (89.1)	35 (10.9)	0.24		
	No	1516 (86.7)	233 (13.3)			
Interview	**Yes**	172 (86.0)	28 (14.0)	0.18	1.8 (1.1–2.9)	0.01
	No	933 (89.3)	112 (10.7)		Reference	
Online	**Yes**	115 (94.3)	7 (5.7)	0.001	3.3 (1.5–7.2)	0.003
	No	583 (82.8)	121 (17.2)		Reference	
	Positive history of chronic diseases in the respondent's first-degree family					
Total	**Yes**	733 (89.7)	84 (10.3)	0.004	1.4 (1.1–1.8)	0.02

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		Univariable analysis			Multivariable logistic regression
	No	1070 (85.3)	184 (14.7)		Reference
Interview	**Yes**	388 (92.8)	30 (7.2)	0.001	
	No	717 (86.7)	110 (13.3)		
Online	**Yes**	345 (86.5)	54 (13.5)	0.14	
	No	353 (82.7)	74 (17.3)		
	History of COVID-19 infection in respondents				
Total	**Not yet**	1394 (86.7)	214 (13.3)	0.09	
	Yes (outpatient)	321 (86.5)	50 (13.5)		
	Yes (hospitalized)	77 (95.1)	4 (4.9)		
	currently under treatment	11 (100.0)	0		
Interview	**Not yet**	871 (88.0)	119 (12.0)	0.19	
	Yes (outpatient)	164 (90.1)	18 (9.9)		
	Yes (hospitalized)	65 (95.6)	3 (4.4)		
	currently under treatment	5 (100.0)	0		
Online	**Not yet**	523 (84.6)	95 (15.4)	0.57	

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		Univariable analysis			Multivariable logistic regression	
	Yes (outpatient)	157 (83.1)	32 (16.9)			
	Yes (hospitalized)	12 (92.3)	1 (7.7)			
	currently under treatment	6 (100.0)	0			
	§COVID-19 infection in the respondent's family					
Total	**Nobody**	1075 (85.7)	180 (14.3)	0.02	Reference	
	At least one	728 (89.2)	88 (10.8)		1.4 (1.1–1.9)	0.03
	At least one outpatient	558 (88.6)	72 (11.4)			
	At least one hospitalized	173 (89.2)	21 (10.8)			
	At least one deceased	69 (92.0)	6 (8.0)			
	At least one currently under treatment	33 (94.3)	2 (5.7)			
Interview	**Nobody**	741 (86.9)	112 (13.1)	0.002	Reference	
	At least one	364 (92.9)	28 (7.1)		1.8 (1.2–2.9)	0.01

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		Univariable analysis			Multivariable logistic regression
	At least one outpatient	267 (91.8)	24 (8.2)		
	At least one hospitalized	91 (92.9)	7 (7.1)		
	At least one deceased	43 (91.5)	4 (8.5)		
	At least one currently under treatment	25 (96.2)	1 (3.8)		
Online	**Nobody**	334 (83.1)	68 (16.9)	0.23	
	At least one	364 (85.8)	60 (14.2)		
	At least one outpatient	291 (85.8)	48 (14.2)		
	At least one hospitalized	82 (84.4)	114 (15.6)		
	At least one deceased	26 (92.9)	2 (7.1)		
	At least one currently under treatment	8 (88.9)	1 (11.1)		

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		Univariable analysis			Multivariable logistic regression	
	Risk of getting COVID-19 in the next few months					
Total	**High**	898 (88.2)	120 (11.8)	< 0.001	1.7 (1.1–2.7)	0.03
	Intermediate	729 (88.9)	91 (11.1)		1.8 (1.1–2.7)	0.01
	Low	176 (75.5)	57 (24.5)		Reference	
Interview	**High**	564 (88.8)	71 (11.2)	< 0.001		
	Intermediate	444 (92.5)	36 (7.5)			
	Low	97 (74.6)	33 (25.4)			
Online	**High**	334 (87.2)	49 (12.8)	0.03	2.1 (1.2–3.6)	0.01
	Intermediate	286 (83.8)	55 (16.2)		1.6 (1.02–2.7)	0.04
	Low	79 (76.7)	24 (23.3)		Reference	
	Risk of getting COVID19 in the next few months in your close family members					
Total	**High**	808 (88.2)	108 (11.8)	< 0.001	1.6 (1.1–2.6)	0.03

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		Univariable analysis			Multivariable logistic regression	
	Intermediate	785 (89.3)	94 (10.7)		1.9 (1.2–2.9)	0.002
	Low	210 (76.1)	66 (23.9)		Reference	
Interview	**High**	480 (89.10	59 (10.9)	< 0.001	2.6 (1.3–4.8)	0.004
	Intermediate	508 (93.2)	37 (6.8)		3.3 (1.9–5.9)	< 0.001
	Low	117 (72.7)	44 (27.3)		Reference	
Online	**High**	328 (87.0)	49 (13.0)	0.17		
	Intermediate	277 (82.9)	57 (17.1)			
	Low	93 (80.9)	22 (19.1)			

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Multivariable Logistic Regression

Multivariable logistic regression showed that in the total study population, healthcare workers had two times more inclination to participate in vaccination program (aOR = 2, 95% CI = 1.2, 3.1. *P* value = 0.004). Also, in the interview group, healthcare workers had more than a fourfold tendency to be vaccinated against COVID-19 (aOR = 4.1, 95% CI = 1.4, 11.3. *P* value = 0.009).

In total study population, respondents with high-SES had lower tendency of participation in vaccination compared with middle or low SES group (aOR = 0.7, 95% CI = 0.53, 0.96. *P* value = 0.02). Moreover, we found the higher educational level were associated with the lower inclination toward vaccination. Comparing to participants with postgraduate degrees, those participants whose educational level was below high-school had the highest intention toward vaccination (aOR = 2.6, 95% CI = 1.7, 3.9, *P* value < 0.001), then those with high-school diploma (aOR = 2.1, 95% CI = 1.4, 2.9, *P* value < 0.001), and the lowest

inclination found among those with undergraduate degree (aOR = 1.4, 95% CI = 1.01, 2.1, *P* value = 0.04) groups in total study population.

Additionally, in interview group respondents with positive history of NCDs, had more than 1.5 times propensity toward vaccination (aOR = 1.8, 95% CI = 1.1, 2.9. *P* value = 0.01). In online group participants with positive history of NCDs reported 3.3 times positive attitude toward vaccination (aOR = 3.3, 95% CI = 1.5, 7.2. *P* value = 0.003).

In total study population, respondents with the positive history of NCDs in their first-degree family and at least one family member with COVID-19 disease had both 1.4 times more intention to vaccination than other groups. (aOR = 1.4, 95% CI = 1.1, 1.8. *P* value = 0.02 and aOR = 1.4, 95% CI = 1.1, 1.9. *P* value = 0.03, respectively). In interview group, those with positive history of COVID-19 infection in their family had 1.8 times more intention to be vaccinated (aOR = 1.8, 95% CI = 1.2, 2.9. *P* value = 0.01).

Testing the association between perceived susceptibility toward getting COVID-19 infection in the next few months and tendency toward vaccination, we found that in total and online groups, those who thought they were at risk of getting infection in the following months had a higher tendency toward vaccination. Of note in both total and interview groups participants who considered themselves at intermediate risk of getting infection had a higher tendency toward being vaccinated. Also, the similar pattern was seen in total group and interview group respondents who believed their family members were at high- or intermediate- risk of getting COVID-19 infection in the next few months. (Table 1).

Main reasons of participation in COVID-19 vaccination

We asked those who were determined to participate in the immunization program against COVID-19 what was the main drivers. In total study group, around half of the respondents believed that vaccination was effective in preventing COVID-19 mortality (n = 940, 52.1%), and vaccination against COVID-19 decreased the transmissibility of COVID-19 (n = 880, 48.8%), and would decrease economical loss (n = 718, 39.8%). Other mentioned reasons were fear of getting COVID-19 infection (n = 397, 22%) and being hospitalized due to corona virus morbidities (n = 397, 22%). Other stated drivers for inclination toward vaccination are in Table 2.In respondents who were interviewed, the three most common reasons of intention to take a vaccine were believed that vaccination was effective in preventing COVID-19 mortality (n = 682, 61.7%), it decreased both economic loss (n = 494, 44.7%) and transmissibility of COVID-19 (n = 449, 40.6%). In respondents who filled the online questionnaire, three most common reasons of intention to participate in vaccination included their belief that vaccination decreased transmissibility of COVID-19 (n = 431, 61.7%), its effectiveness in preventing COVID-19 mortality (n = 258, 37%), and also decreased economic loss (n = 224, 32.1%). Other stated reasons are in Table 2.

Table 2

The reasons mentioned by the respondents who were determined to participate in vaccination program against COVID-19

	Total (n = 1803)	Interview (n = 1105)	Online (n = 698)
I am sure vaccination is effective and prevent COVID-19 mortality	940 (52.1)	682 (61.7)	258 (37.0)
Vaccination against COVID-19 decreases transmissibility of COVID-19	880 (48.8)	449 (40.6)	431 (61.7)
Vaccination against COVID-19 decreases economical loss	718 (39.8)	494 (44.7)	224 (32.1)
I afraid of getting COVID-19	397 (22.0)	202 (18.3)	195 (27.9)
I afraid of hospitalization due to COVID-19	360 (20.0)	250 (22.6)	110 (15.8)
Vaccination against COVID-19 is better than being passive	234 (13.0)	91 (8.2)	143 (20.5)
I believe that vaccination against COVID-19 is effective	108 (6.0)	42 (3.8)	66 (9.5)
I want to prove that I am a risk taker person	18 (1.0)	15 (1.4)	3 (0.4)
All data is reported as frequency (%)			

Main reasons made study population indecisive or reluctant to participate in the COVID-19 vaccination

In total study population, the two most common reasons that made participants reluctant toward COVID-19 vaccination was that they thought they had a strong immune system which protected them from getting COVID-19 (n = 155, 57.8%), and vaccination against COVID-19 would not decrease the risk of disease transmissibility (n = 118, 44%). Other less frequent mentioned reasons were the vaccines immediate (n = 38, 14.2%) and long-term side effects (n = 38, 14.2%), and lack of efficacy (n = 36, 13.4%). other less frequent mentioned reasons are in Table 3.

Table 3
The reasons mentioned by the respondents who were indecisive or were determined not to participate in vaccination program against COVID-19

	Total (n = 268)	Interview (n = 140)	Online (n = 128)
My immune system is enough to protect me from getting COVID-19	155 (57.8)	72 (51.4)	83 (64.8)
Vaccination against COVID-19 will not decrease its risk of transmissibility	118 (44.0)	64 (45.7)	54 (42.2)
Vaccination against COVID-19 has lots of side effects	38 (14.2)	18 (12.9)	20 (15.6)
Vaccination against COVID-19 has unknown post marketing side effects	38 (14.2)	25 (17.9)	13 (10.2)
Vaccination against COVID-19 has no efficacy	36 (13.4)	24 (17.1)	12 (9.4)
I have negative attitude regarding any kinds of vaccine	27 (10.1)	7 (5.0)	20 (15.6)
I prefer natural immunization through getting infection	21 (7.8)	11 (7.9)	10 (7.8)
I will not get COVID-19 because I use all preventive measure	20 (7.5)	10 (7.1)	10 (7.8)
In the scarcity of vaccine, high risk groups have higher priority comparing to me	18 (6.7)	6 (4.3)	12 (9.4)
I believe in destiny, so vaccination does not protect me	12 (4.5)	3 (2.1)	9 (7.0)
I do not care about COVID-19	12 (4.5)	3 (2.1)	9 (7.0)
Vaccination is contraindicated for me because I am immune comprised	11 (4.1)	6 (4.3)	5 (3.9)
I am immune against COVID-19 because I have natural immunity by getting COVID-19	10 (3.7)	5 (3.6)	5 (3.9)
Vaccination against COVID-19 is not affordable for me	4 (1.5)	2 (1.4)	2 (1.6)

All data is reported as frequency (%)

In respondents who were interviewed, the most frequently mentioned reasons for reluctant or indecisive toward vaccination were their trust on their strong immune system (n = 72, 51.4%), their belief vaccination would not decrease the risk of COVID-19 transmissibility (n = 64, 45.7%), the vaccine unknown post-marketing side effects (n = 25, 17.9%), and unreliable vaccine efficacy (n = 24, 17.1%).

In respondents who filled the online questionnaire, four most common reasons which made them reluctant toward vaccination, were that they believed their strong immune system would protect them from getting COVID-19 (n = 83, 64.8%), vaccination would not decrease the risk of transmissibility (n = 54, 42.2%), the vaccine side effects (n = 20, 15.6%), and their negative attitude regarding any kinds of vaccine (n = 20, 15.6%). (Table 3)

Discussion

The results of present study revealed that there was a significant association between having a positive intention to be vaccinated against COVID-19 and the respondent's SES, level of education, having a positive history of NCDs in themselves and/ or their first-degree families, perceived susceptibility toward getting COVID-19 infection in the next few months in themselves and their close family members, and being a healthcare worker. Additionally, we found that respondents who were interviewed had more intention to take vaccine than those who filled the online questionnaire. In the mentioned three study groups, approximately most of the respondents were determined to participate in the COVID-19 vaccination because they believed that vaccination was effective in preventing mortality and decreased the transmissibility of COVID-19 infection.

However, some recent studies observed a relationship between the participants' gender and their positive attitude toward vaccination [28–30]. Consistent with our result, Olagoke et al., Malik et al., and Eguia et al. reported no significant differences between men and women in their tendency toward receiving COVID-19 vaccination [31–33]. A possible explanation for these findings could be because of people's characteristics and cultural diversities in different countries.

Although Fonzo et al. reported that level of education in family members does not impact on intention to take vaccine [34], our survey revealed that respondents with a lower level of education had more than two-fold intention to take vaccine than those with a higher level of education. Additionally, Fonzo et al. and Askarian et al. reported that being a healthcare at least in one parent do not impact the respondents' intention to take vaccine [34, 35], while in line with the study by Detoc et al. [28], the present study showed that healthcare workers had two folds more intention to take vaccine. The reason could be that healthcare workers' higher information about the process of vaccination, efficacy, and the safety of the COVID-19 vaccine resulted in increasing their willingness to be vaccinated.

We observed that respondents with high SES have a lower tendency toward participation in immunization program compared with participants from middle or low socio-economic groups. In contrast to our results, Lazarus et al. investigated more than 13.000 people in 19 countries to assessed the potential acceptance of a COVID-19 vaccine and reported that respondents with higher income were more intended to take vaccine than respondents with lower income [30]. Additionally, Paul et al. reported that UK adults with low SES were less willing to take vaccine than adults with high SES [36]. One hypothesis in this regard could be that the participants with high SES were more concern about the side effects of the vaccine as the current study was conducted before distribution of COVID-19 vaccine in Iran.

The results of current survey revealed that many respondents wanted to participate in immunization program because they believed that vaccination is effective in preventing COVID-19 mortality, decreasing the transmissibility of COVID-19, and would reduce economical loss. In line with this result, Wang et al. reported that COVID-19 vaccination is an effective way to avoid and manage COVID-19 infection [37].

Concern about vaccine hesitancy is not a new phenomenon and the incidence of concerns about vaccine safety is growing worldwide, particularly for COVID-19 vaccine [35]. Several previous studies reported that the low rate of intention to take vaccine against infections in pandemics such as influenza A (H1N1) and non-pandemics like human papillomavirus (HPV) mostly was lack of trust about vaccine efficacy, safety, and side effects [35, 38–40]. On the other hand, we observed that the main reasons that respondents indecisive or reluctant to participate in the COVID-19 vaccination were they thought it had a strong immune system which protected them from getting COVID-19 and vaccination would not decrease the risk of disease transmissibility; while in contrast with these results, Eguia et al. investigated about COVID-19 vaccine hesitancy in Spanish population by online questionnaires, and reported that concerns about the effectivity, safety, and major side effects of the vaccination were the main reasons of respondents answered [33]. However, Paul et al. reported major causes of UK adults' unwillingness to take vaccine were due to unpredictable adverse effects and advantages of the COVID-19 vaccine [36]. In the current study, the immediate and long-term side effects of vaccines, and lack of efficacy were the less frequent reasons that respondents indecisive or reluctant to participate in the COVID-19 vaccination.

One of the strong points in our survey is that we reported three groups of respondents (online, interviewed, and total) who were intend or reluctant toward vaccination. We observed that overall, respondents who were interviewed had more intention to take vaccine due to the positive association of variables (such as being a healthcare worker, respondents with a positive history of NCDs, positive COVID-19 infection in the respondents' family, high- and intermediate- risk of getting COVID-19 infection in the next few months in their family member) with willingness to be vaccinated.

The present study has several limitations. The most important limitations was using online format for other provinces except Fars, in which a convenience sample of online social network groups participated. So, the sampling was convenience so most participants were from younger age groups or those who were using social media, so that the result cannot be extrapolated to all Iranian population. Besides, this study was conducted before distribution of COVID-19 vaccine in Iran, so most participants were not aware of the real pros and cons of the vaccine. Another limitation was that the interview format was conducted in Shiraz the fifth populous city in Iran and the study population is not representative of Iranian population as it covered nether other cities nor rural population.

Our findings demonstrated that several variables might be affected respondents' intention or reluctance to take vaccine. We recommend that policymakers, health professionals, and international organizations of each country should be prepared to address hesitancy and build vaccine literacy for their population based on their knowledge, job, SES, and other significant variables in this study. Moreover, we suggest a

larger study with different types of questionaries (online and interviewed) in different countries to compare the association of mentioned variables to intention to take COVID-19 vaccine.

Conclusion

The study results revealed that several variables such as SES, level of education, having a positive history of NCDs, perceived susceptibility toward getting COVID-19 infection, and being a healthcare worker had a positive association with intention to be vaccinated against COVID-19. Additionally, many respondents wanted to participate in immunization program because they believed that vaccination is effective in preventing COVID-19 mortality, decreasing the transmissibility of COVID-19, and would decrease economical loss.

Abbreviations

COVID-19: Coronavirus disease 2019; **NPIs**: Non-pharmaceutical interventions; **SES:** Socio-economic status; **NCDs**: Non-communicable diseases; **aOR**: adjusted Odds ratio

Declarations

Ethics and consent to participate: The study protocol was written based on the Helsinki ethical principles for medical researches and approved by the Ethics Committee affiliated to Shiraz University of Medical Sciences (SUMS) (IR.SUMS.REC.1399.1151). Informed consent was obtained from those individuals participates in interview.

Consent of publication: Not applicable.

Availability of data and material: The datasets used and/or analysed during the current study available from the corresponding author on reasonable request.

Competing interests: All authors declare no conflict of interest.

Funding: We would like to express our special gratitude to Vice-chancellor for Research of Shiraz University of Medical Sciences that financially supported this Study (Grant No: 22574).

Authors' contributions: Conceptualization, K.B.L; methodology, N.M, L. Z; formal analysis, P.K, M.H.Z; writing-original draft preparation, N.M. P.K. M.H.Z.; writing-review and editing, L.Z. K.B.L.; visualization, P.K., M.H.Z; supervision, K.B.L; project administration, N.M., L.Z. All authors have read and agreed to the published version of the manuscript.

Acknowledgements: The authors would like to express their gratitude to the Vice Chancellor for Research of Shiraz University of Medical Sciences for financially supporting the project (Project code: 22574).

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