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Vaccine hesitancy of health care workers versus laypersons in an urban society of Iran, lessen learned from an epidemic

Running title: COVID-19 vaccine hesitancy in Iran

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Abstract: Background: Vaccine hesitancy in Coronavirus disease 2019 (COVID-19) pandemic, endangers attempts of health care organizations to fight against the global spread of the disease. To compare vaccine hesitancy in health care worker (HCW)s versus laypersons in an urban society of Iran

Methods: In this cross-sectional study, we investigated the acceptance rate of vaccination in Tehran among HCWs and laypersons (3 important sectors with different socioeconomic level in Tehran were evaluated). This estimated rate was analyzed to see whether there is any association with these study outcomes: basic demographic variables, occupation, socioeconomic status, education level, ethnicity, knowledge and attitude towards vaccination and previous history of COVID-19. All variables were compared between the 2 groups: HCWs versus laypersons.

Results: 421 HCWs and 297 laypersons were assessed in this study. The mean±SD of age was 38.09±12.37 and 35.81±11.56 respectively. Most participants were females in both groups (54.4% and 60.6% respectively). Vaccine hesitancy was lower in laypersons than HCWs (p-value<0.001).The hesitancy rate was higher in older participants in both groups (p-values not significant).
In both groups, the highest rates of vaccine hesitancy were observed in low and moderate socioeconomic states (p-value<0.05), in cases with an acceptable degree of education (diploma to master degree) (p-value<0.001) and in non-Fars ethnicity (p-value<0.05).Most hesitant cases in both groups believed that they did not need vaccination and vaccine was not effective in preventing COVID-19 (p-value<0.001).

Conclusions: Vaccine hesitancy was significantly lower in laypersons than HCWs. In both groups, the highest rate of vaccine hesitancy was observed in low and moderate socioeconomic states, in well-educated level (diploma to master degree) and in non-Fars ethnicity.

Key words: COVID-19, Vaccine hesitancy, health care worker, layperson

INTRODUCTION

After officially announcing the coronavirus disease-2019 (COVID-19) as a public health emergency and pandemic by World Health Organization (WHO) in 2020 (1, 2), many vaccines have been developed all around the world as the most effective way to prevent disease (3, 4).

Vaccine hesitancy (one of the 10th major global health threats in 2019) is identified by WHO and other sources as refusal or reluctance in acceptance despite its availability (5). This major health threat (6) causes a pivotal challenge in pandemic control.

According to conducted studies in the United States (US), 50 to 60% of Americans were willing to receive COVID-19 vaccine (7, 8). Based on reports from low and middle-income countries, more than 90% of residents in south Asia and east Africa perceived vaccination as both safe and effective. This study confirmed that the highest rate of presumed acceptance ratemight be in the low-income developing countries and among scientists and health care worker (HCW)s (9).Seemingly, various studies in different regions of the world have declared a hesitancy rate of 3 to 77% with the highest rate in the middle east namely Saudi Arabia and Kuwait (10). Russia and several European countries were mentioned to have the lowest acceptance rate in a systematic review in 2020 (10).

After COVID-19 outbreaks in Iran, the ministry of health started nationalplan for free vaccination. The priority of vaccination was determined based on person's risk factors, underlying diseases, age and occupation (HCWs). The priority then ended to all people in all age ranges. At the first phase, foreign vaccines were used (some limited types). By production and exploitation of Iranian vaccines, they entered national vaccination program. All these programs (even the boosters) were free of charge and implemented by the government.

Some reasons of vaccine hesitancy can be enumerated as: COVID-19 unknown identity, low perception of disease risk, fear to vaccination, insufficient data about vaccine impacts and side effects, religious beliefs or ethnic misconceptions, incorrect advertisement, low educational levels and limited type of vaccines available (11-14). Understanding the exact prevalence rate of vaccine hesitancy and its causes can obviously help us to fight this and other probable future pandemics and achieve herd immunity. Thus, Governments, researchers and physicians should adopt decisions and plan global strategies in order to

build trust among population and avoid hesitancy in vaccination acceptance.

METHODS AND MATERIALS

This cross-sectional study was designed to compare COVID-19 vaccination hesitancy in HCWs versus laypersons in 2020 in Tehran, Iran (6-month interval). The study was approved at the ethics committee of [anonymized for review](ID: IR.TUMS.CHMC.REC.1401.029). Three crowded geographical sectors of Tehran were selected with 3 different (low, middle and high) socioeconomic level and they generally represented an urban society of Iran. Important general hospitals in these sectors (either public or private hospitals)and heavy commuting areas (including principal squares, shopping or entertainment centers) were randomly selected. HCWs from 2 hospitals in each sector and laypersons from both high traffic passages and entertainment centers were enrolled in the study. All participants were older than 18 years and willing to participate in the study. Sampling was convenient (we collected the same number of participants from each low, middle and high socioeconomic level).

Self-reporting questionnaire was designed based on the presented WHO version (15).Basic demographic data, occupation, socioeconomic status, education level, ethnicity, knowledge and attitude towards vaccination and previous history of COVID-19 were all asked through questionnaires. The chief investigator helped all participants throughout filling out the questionnaire and answered the possible problems or misunderstandings of participants.

Statistical analysis:

All cases during a 6-month interval through convenient sampling were enrolled in the study. After gathering all data, they were inserted into SPSS (ver. 25.0) software. Data were assessed for normal distribution using a Kolmogorov-Smirnov test. The descriptive indices such as frequency (percentage) and mean (standard deviation (SD)) were used to express the results. Chi-square test, independent t-test or nonparametric tests were used as required.The level of significance was 0.05.

RESULTS

In the present study, we analyzed data of 421 HCWs and 297 laypersons. Most of participants in both groups were females (54.4% and 60.6% respectively). The mean±SD of age were 38.09±12.37 and 35.81±11.56 years old respectively. Most of our cases were married (73.9% and 78.8% respectively).

Most of HCWs reported their socioeconomic status to be moderate (47.0%), whereas most of laypersons reported this variable to be high (43.1%). The education level was mostly doctoral degree (32.1%) in the first group and below diploma (33.0%) in the second group. Most of participants' ethnicity in both groups was Fars (58.7% and 69.4% respectively). Previous history of COVID-19 was almost two times in HCWs in comparison to layperson (51.8% and 25.3% respectively). Data is shown in table 1.

Table 1 Basic demographic data in both groups

Variable		**Health care workers**	**Laypersons**	**P-value**
Age mean±SD		38.09±12.37	35.81±11.56	0.013
Gender N (%)	**Female**	229 (54.4)	180 (60.6)	0.098
	Male	192 (45.6)	117 (39.4)	
Marital status N (%)	**Married**	311 (73.9)	234 (78.8)	0.129
	Single	110 (26.1)	63 (21.2)	
Socioeconomic status N (%)	**High**	151 (35.9)	128 (43.1)	<0.001
	Moderate	198 (47.0)	89 (30.0)	
	Low	72 (17.1)	80 (26.9)	
Education level N (%)	**Below diploma**	59 (14.0)	98 (33.0)	<0.001
	Diploma	47 (11.2)	34 (11.4)	
	Associate/ bachelor's degree	68 (16.2)	61 (20.5)	
	Master's degree	112 (26.6)	35 (11.8)	
	Doctoral degree	135 (32.1)	69 (23.2)	
Ethnicity N (%)	**Fars**	247 (58.7)	206 (69.4)	<0.001
	Turk	64 (15.2)	39 (13.1)	
	Kurd	42 (10.0)	20 (6.7)	
	Lor	22 (5.2)	26 (8.8)	
	Baluch	8 (1.9)	42 (1.3)	
	Others	38 (9.0)	2 (0.7)	
Previous history of COVID-19 N (%)	**Yes**	218 (51.8)	75 (25.3)	<0.001
	No	203 (48.2)	222 (74.7)	

Both groups gathered most COVID-19 data on virtual platforms like Instagram, Twitter, WhatsApp, Telegram… (39.4% in HCWs and 51.9% in laypersons) (p-value=0.001). Vaccine hesitancy was significantly lower in laypersons than HCWs (p-value<0.001). In another word, 11.8% of laypersons definitely refused taking vaccine in comparison to 26.4% of HCWs. 55.2% of laypersons willingly accepted taking vaccine in comparison to 32.8% of HCWs. We considered the hesitancy rate as the sum of "definitely not" and "most probably not" taking vaccine. Thus, this rate was higher among HCWs in comparison to laypersons (38.0% versus 19.9%). Data is shown in table 2.

Table 2 General data and opinion about vaccination

Variable		Health care workers	laypersons	P-value
Source of data gathering about COVID-19 vaccines N (%)	Official social media (TV, newspaper…)	129 (30.6)	60 (20.2)	0.001
	Virtual platform (Instagram, Twitter…)	166 (39.4)	154 (51.9)	
	Family and friends	126 (29.9)	83 (27.9)	
Decision about vaccination N (%)	Definitely not	111 (26.4)	35 (11.8)	<0.001
	Most probably not	49 (11.6)	24 (8.1)	
	Not decided yet	52 (12.4)	27 (9.1)	
	Most probably yes	71 (16.9)	47 (15.8)	
	Definitely yes	138 (32.8)	164 (55.2)	

The hesitancy rate was higher in older participants in both groups (p-values not significant). The hesitancy rate in HCWs was significantly higher in males than females (p-value=0.005).

In HCWs the lowest rate of hesitancy was observed in high socioeconomic state (p-value=0.014) while in laypersons the lowest rate was in moderate socioeconomic state (p-value<0.001). Education level was also significantly related to hesitancy rate. In both groups, hesitancy rate was lower in the two ends of spectrum (p-value<0.001). In both groups, hesitancy rate was lower in Fars ethnicity in comparison to others (p-value<0.05). Data is shown in table 3.

Table 3 Hesitancy rate distribution in relation to study variables in both groups

-Variable		Health care workers Hesitancy to vaccination		Laypersons Hesitancy to vaccination	
		Yes	No	Yes	No
Age range N (%)	<25	19 (36.5)	33 (63.5)	11 (18.6)	48 (81.4)
	25-35	57 (35.8)	102 (64.2)	19 (17.1)	92 (82.9)
	35-45	42 (36.5)	73 (63.5)	16 (22.5)	55 (77.5)
	>45	42 (44.2)	53 (55.8)	13 (23.2)	43 (76.8)
P-value		**0.568**		**0.736**	
Gender N (%)	Female	73 (31.9)	156 (68.1)	38 (21.1)	142 (78.9)
	Male	87 (45.3)	105 (54.7)	21 (17.9)	96 (82.1)
P-value		**0.005**		**0.504**	
Socioeconomic status N (%)	High	45 (29.8)	106 (70.2)	24 (18.8)	104 (81.3)
	Moderate	89 (44.9)	109 (55.1)	8 (9.0)	81 (91.0)
	Low	26 (36.1)	46 (63.9)	27 (33.8)	53 (66.3)
P-value		**0.014**		**<0.001**	
Education level N (%)	Below diploma	17 (28.8)	42 (71.2)	12 (12.2)	86 (87.8)
	Diploma	26 (55.3)	21 (44.7)	4 (11.8)	30 (88.2)
	Associate/ bachelor's degree	25 (36.8)	43 (63.2)	25 (41.0)	36 (59.0)
	Master's degree	56 (50.0)	56 (50.0)	8 (22.9)	27 (77.1)
	Doctoral degree	36 (26.7)	99 (73.3)	10 (14.5)	59 (85.5)
P-value		**<0.001**		**<0.001**	
Ethnicity N (%)	Fars	66 (26.7)	181 (73.3)	32 (15.5)	174 (84.5)
	Turk	34 (53.1)	30 (46.9)	16 (41.0)	23 (59.0)
	Kurd	22 (52.4)	20 (47.6)	6 (30.0)	14 (70.0)
	Lor/Baluch/others	38 (55.9)	30 (44.1)	5 (15.6)	27 (84.4)
P-value		**<0.001**		**0.002**	
Previous history of COVID-19 N (%)	Yes	113 (51.8)	105 (48.2)	15 (20.0)	60 (80.0)
	No	47 (23.2)	156 (76.8)	44 (19.8)	178 (80.2)
P-value		**<0.001**		**0.973**	

In another step of the study, we asked the following items in participants who were hesitant in taking COVID-19 vaccine(the sum of "definitely not" and "most probably not"). Their attitude and knowledge were assessed and compared between the 2 groups (table 4). Most hesitant cases in both groups believed that they did not need vaccination and vaccine was not effective in preventing COVID-19 (p-value<0.001).

Table 4 Attitude and knowledge of participants with vaccine hesitancy in both groups

Variable N (%)		Health care workers	Laypersons	P-value
No need to vaccination (the probability of catching COVID-19 for me is very low)	**Totally disagree**	5 (3.3)	7 (12.1)	<0.001
	Disagree	31 (20.3)	16 (27.6)	
	No idea	14 (9.2)	13 (22.4)	
	Agree	70 (45.8)	22 (37.9)	
	Totally agree	33 (21.6)	0 (0.0)	
Vaccines have side effects and complications	**Totally disagree**	8 (5.0)	6 (10.3)	0.001
	Disagree	33 (20.6)	19 (32.8)	
	No idea	36 (22.5)	22 (37.9)	
	Agree	54 (33.8)	7 (12.1)	
	Totally agree	29 (18.1)	4 (6.9)	
Vaccine is not effective in preventing COVID-19	**Totally disagree**	3 (1.9)	0 (0.0)	<0.001
	Disagree	3 (1.9)	7 (12.1)	
	No idea	30 (18.9)	23 (39.7)	
	Agree	78 (49.1)	18 (31.0)	
	Totally agree	45 (28.3)	10 (17.2)	
There is risk of death after catching COVID-19 if you have vaccinated	**Totally disagree**	15 (9.7)	5 (8.6)	<0.001
	Disagree	11 (7.1)	6 (10.3)	
	No idea	22 (14.2)	20 (35.4)	
	Agree	66 (42.6)	27 (46.6)	
	Totally agree	41 (26.5)	0 (0.0)	
Having enough data in different vaccination aspects	**Totally disagree**	5 (3.2)	0 (0.0)	0.003
	Disagree	39 (24.8)	3 (5.1)	
	No idea	96 (61.1)	47 (79.7)	
	Agree	13 (8.3)	8 (13.6)	
	Totally agree	4 (2.5)	1 (1.7)	
Ways of getting accurate data about vaccination	**Family, friend and colleagues**	23 (14.6)	7 (11.9)	<0.001
	Health care systems' providers	94 (59.5)	13 (22.0)	
	Internet	38 (24.1)	38 (64.4)	
	Others	3 (1.9)	1 (1.7)	
Previous bad histories of any vaccination	**Yes**	36 (22.8)	33 (55.9)	<0.001
	No	122 (77.2)	26 (44.1)	
No trust on manufacturing companies	**Yes**	97 (60.6)	28 (47.5)	0.081
	No	63 (39.4)	31 (52.5)	
Social media are honest in broadcasting any data in vaccination	**Yes**	92 (57.5)	37 (62.7)	0.487
	No	68 (42.5)	22 (37.3)	

DISCUSSION

The present study stated that the hesitancy rate was significantly lower in laypersons than HCWs (p-value<0.001). In HCWs males were more reluctant to vaccination in comparison to females (p-value=0.005). Participants at high socioeconomic level accepted vaccination more significantly than other levels in both groups (p-value=0.014 in HCWs and p-value<0.001 in laypersons). Education and ethnicity were also significantly related to hesitancy rate. In both groups, hesitancy rate was lower in the two ends of education spectrum (p-value<0.001). In both groups, Fars ethnicity seemed to refuse vaccination more than others (p-value<0.05).

Vaccine hesitancy as a well-known phenomenon can cause resurgence of preventable infectious diseases (16, 17). In the era of COVID-19 pandemic, vaccine hesitancy was determined to be one of the major obstacles in reducing its rapid transmission and vast number of hospital admission (18).

Studies have proclaimed that vaccine hesitancy is attributed to 3 "C"s: confidence, complacency and convenient (5). "Lack of confidence" or insufficient trust in vaccine and manufactures, "complacency towards" the necessity and compulsion of vaccination and "vaccine inconvenience" in terms of financial factors have been mentioned through the literature (19-21).Most hesitant cases in both groups of our study, believed that they did not need vaccination and vaccine was not effective in preventing COVID-19 (p-value<0.001).

Sallam et al in 2021 performed a concise systematic review on vaccine hesitancy in 33 countries. They noticed that among adults in the general public, the highest acceptance rates belonged to Ecuador (97.0%), Malaysia (94.3%), Indonesia (93.3%) and China (91.3%) while the lowest rates were found in Kuwait (23.6%), Jordan (28.4%), Italy (53.7), Russia (54.9%), Poland (56.3%), US (56.9%), and France (58.9%). Limited surveys in HCWs published vaccine acceptance rates ranging from 27.7% in the Democratic Republic of the Congo to 78.1% in Israel(10). The hesitancy rates in our study were 38.0% in HCWs and 19.9% in layperson. Both of these statics can be remarked on the low acceptance rate of COVID-19 vaccination in Iran like many countries in the middle east.

Despite the high acceptance rate mentioned in the low and middle-income countries (more than 90%) (9), we spotted a low acceptance rate in Iran (less than 40%). Vaccine hesitancy and the attitude towards vaccination by using the Vaccine Conspiracy Belief Scale were assessed in Arab countries in 2021 (22). They concluded a low rate of 29.4% as the hesitancy rate. In their study, male respondents with higher educational levels had higher rates of vaccine acceptance. As emphasized earlier, we did not find the same results in Iran. Sallam et al (22) continued that misinformation and conspiracy beliefs had a massive effect on vaccine hesitancy.

Murphy et al in 2021 studied vaccine hesitancy in Ireland and United Kingdom (UK). Overall, 26% of Irish respondents and 25% of UK respondents were vaccine hesitant. Female gender and younger age were more likely to be vaccine hesitant. Like other researches, vaccine hesitancy was associated with lower income in both countries (23). In our study, the hesitancy rate was higher in older participants in both groups (p-value not significant) and among HCWs males were more hesitant than females.
Khunchandani et al in 2021 did a comprehensive and systematic national assessment about COVID-19 vaccine hesitancy in US. The hesitancy rate was approximated 22% (15% not likely and 7% definitely not willing to get immunization), the highest rate seen in individuals with lower education, income. Hesitancy rate was also higher in African-Americans and Hispanics (24).
Our study showed that most participants got their data about COVID-19 and its vaccination via internet and they believed that social media were honest in broadcasting different data. Previous research showed that relying on doctors, scientists and health system providers as the source of information was less related to vaccine hesitancy while as social media platforms significantly induced doubts and misbeliefs in public mind (25, 26).

LIMITATION

The major limitation of our study was accessing to participants in all districts of Tehran and many cases were reluctant to attend our survey. Further studies with larger sample sizes and more diversity of districts are needed to reliably generalize the results to all urban societies in Iran.

CONCLUSION

Vaccine hesitancy was significantly lower in laypersons than HCWs. In both groups, the highest rate of vaccine hesitancy was observed in low and moderate socioeconomic states, in well-educated level (diploma to master degree) and in non-Fars ethnicity. Most hesitant cases in both groups believed that they did not need vaccination and vaccine was not effective in preventing COVID-19.

Competing interest

Nothing to declare.

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