Predictors of Intention to Receive the COVID-19 Vaccine using the Theory of Planned Behavior and the Health Belief Model among the Health Ambassadors of Kashan City in 2021

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Abstract

Aims: The purpose of the study was to examine the intention of the health ambassadors to receive the COVID-19 vaccine, and investigate predictors of intention using the theory of planned behavior (TPB) and health belief model (HBM). **Materials and Methods:** This was a descriptive study conducted on 500 health ambassadors. Simple randomized sampling was applied to select the participants. We called the participants and asked them to fill out our 28-item questionnaire. Univariate analyses were used to examine relationships between dependent and independent variables. We used the independent t-test to measure the relationship between quantitatively independent variables and the Chi-square or Fisher's exact test to measure the relationship between qualitative independent variables. Finally, significant independent variables were entered into a hierarchical logistic regression model and the results were interpreted. **Results:** Overall, 44.8% (224) of participants reported that they have the intention to receive the COVID-19 vaccine. The significant demographic predictors include age, having a chronic disease, Having COVID-19 in the last year, and perceived health status. According to the HBM, the dimensions of perceived susceptibility, perceived benefits, and cues to action. According to the TPB, the dimensions of the subject norm, perceived behavior control, and self-efficacy were significant predictors of vaccination. **Conclusion:** According to the low rate of COVID-19 vaccination, health educational programs together with encouraging/reinforcing programs may change perceived susceptibility, perceived benefits, perceived behavioral control, and intention. It is better to use various kinds of sources to implement the educational program.

Keywords: COVID-19, COVID-19 vaccines, health belief model, intention, predictors, theory of planned behavior, vaccination

INTRODUCTION

On January 30, 2020, the WHO announced the new coronavirus outbreak is a public health emergency.[1] At this time, no vaccine for COVID-19 was available.[2] In December 2020, the authorization was quickly issued for another vaccine by Pfizer-BioNTech, Moderna, AstraZeneca, and Jansen.[3] Although according to the ISNA report (https://www.isna.ir/news/99101914261), on January 8, 2021, Seyyed Ali Khamenei, the leader of the Islamic Revolution, announced a ban on the import of "American and British vaccines" to Iran. According to the independent Persian's report (https:// www.independentpersian.com/node/118326), in the middle of February 2021, the Islamic Republic issued an emergency license to import the Sputnik V vaccine from Russia. At the same time, the results of the third clinical phase of this vaccine have not been published yet. For this reason, it was criticized. Production of vaccines in the country faced many problems, which is why the people of Iran were facing a lack of variety and number of vaccines.

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However, some people are not expected to receive the vaccine, which is a significant reason is vaccine hesitancy.[4] Therefore, it is important to understand the beliefs, motivations, attitudes, benefits, and barriers that influence the general public to vaccinate against COVID-19. This understanding helps to design intervention programs based on public access.[5] The main reason was reported among individuals who were hesitant to receive the vaccine and those who did not intend, the side effects and the insecurity of the vaccine.[6] Furthermore, the participants who did not intend to receive the vaccine considered the COVID-19 pandemic an exaggerated threat, and those who were indifferent to the vaccine had lower health literacy.[7] Among adults in the US, the main reason for not having intended to get vaccinated was the high harm of the vaccine.[8]

Considering the factors related to the tendency to be vaccinated, they can be divided into predictors related to demographic and health based on models of behavioral.[5] Studies conducted on predictors of intention to COVID-19 vaccinated showed that participants over 55 years of age,[6] participants who knew they were at risk for the disease[9] and those whose health-care provider recommended that they be vaccinated[8] were more likely to accept to receive the vaccine. Several studies show that older people ≥65 years of age are more likely than younger patients willing to get vaccinated.[10-12] In addition, people who have higher education, high income, chronic disease, and perceived their health to be less good are more likely willing to get vaccinated. Some characteristics such as living without a spouse and children, and being unmarried, have negatively associated with willingness to get vaccinated.[11]

However, examining the impact of theoretical behavioral models is more practical than demographic and health predictors and provides more comprehensive results. The Theory of planned behavior (TPB) is a theoretical model to predict the intention of receiving vaccination. The dimensions of TPB include attitude, subjective norms/SN, perceived behavioral control/PBC, and intention is the thought of doing a behavior.[13]

The health belief model (HBM) is a model for understanding the decision-making factors.[14] The dimensions of the HBM include perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy.[15] HBM has been commonly used in vaccination.[16,17]

According to the importance of vaccination to prevent COVID-19 and the influencing factors of vaccination, this study was conducted to investigate predictors of intention to receive the COVID-19 vaccine in the future among health ambassadors using TPB and HBM.

MATERIALS AND METHODS

A descriptive study was conducted on 500 health ambassadors who have represented family health at the health centers in Kashan city in Iran in 2020. According to Shmueli's study[5] and using the relationship of ($n = 100 + 5*$ i) a sample size of 500 people was considered in this study. Simple randomized sampling was applied to select the participants. First, we received the name of health ambassadors at the total health centers, and then 500 participants were randomly selected. We called and asked them to fill out our 28-item questionnaire. The inclusion criteria consisted of those who had not gotten the COVID-19 vaccine and the exclusion criteria consisted of the questionnaire being incomplete. We used the questionnaires used in the previous study[5] to investigate the predictors of intention to receive the COVID-19 vaccine using based on the HBM and TPB.

The first section of the questionnaire contained 4 items to explore the predictors of demographic characteristics. The second section of the questionnaire contained 7 items to explore the predictors of health related and 1 item to explore the intention to receive the vaccine.

The fourth section of the questionnaire contained 11 items to explore the predictors of the HBM. The fifth section of the questionnaire contained 5 items to explore the predictors of the TPB. Each item was measured based on a five-point Likert scale (strongly agree to strongly disagree).

We translated the questionnaires from English into Persian and reviewed them by native speakers for sentence structure errors. Then, we applied the content validity ratio (CVR) and content validity index (CVI) for determining content validity. To calculate CVR, we requested 10 experts in the field of health education and promotion to detect whether an item is necessary or not.

According to the Lawshe table, the results of CVR showed that all items remained (≥0.62). To calculate CVI, we asked 10 experts to detect the criteria of simplicity, clarity, and relevance. The results of CVI showed that all items remained (≥0.79). The results of Cronbach's Alpha showed that all items had acceptable reliability (≥0.7). We asked 15 participants to complete the questionnaire for determining test–retest reliability. After 15 days, we asked to complete it again. The intraclass correlation coefficient (ICC) was applied to determine test–retest reliability. The results of ICC showed that all items were acceptable (0.87).

The statistical analysis was performed using SPSS 18. Univariate analyses were used to examine relationships between dependent and independent variables. Since the dependent variable (intention) is a two-state variable, we used the independent t-test to measure the relationship between quantitatively independent variables and the Chi-square or Fisher's exact test to measure the relationship between qualitative independent variables. Finally, significant independent variables were entered into a hierarchical logistic regression model and the results were interpreted. We obtained informed consent from all the participants.

RESULTS

Overall, 44.8% (224) of participants reported that they have the intention to receive the COVID-19 vaccine. The univariate analyses of the demographic characteristics, the predictors of

health-related and their intention of COVID-19 vaccination are shown in Table 1. We classified the age into three groups under 35, 35–50, and above 50 years; the level of education into two groups no academic as diploma and lower diploma and academic as above diploma; the personal status into four groups live alone, live with family, live with a spouse, live with a spouse and children; and the number of children divided into two groups no children and children, and the variables of having a chronic disease, smoking, having over weight, having COVID 19 in the last year, having influenza in the last year, and having received the flu vaccine last year into two groups yes and no. Perceived health status is into three groups very good, good, and not so good, the intention to receive the COVID-19 vaccine is into two groups yes and no. The results showed that there is a significant relationship between age and the intention of the COVID-19 vaccination (0.007). The age group between 35 and 50 years had more intention to the

COVID-19 vaccination. There was a significant relationship between having a chronic disease (0.005), having COVID-19 in the last year (0.002), and perceived health status (>0.001) with the intention of the COVID-19 vaccination. Only one-third of participants with the chronic disease and more than half the participants who had COVID-19 in the last year reported having more intention of the COVID-19 vaccination. More than half of the participants who assessed their health as good intentions to be vaccinated.

Most participants who assessed their health as very good or very bad did not intend to receive the vaccine. However, more than half of those who assessed their health as good intentions to be vaccinated.

Table 2 shows the univariate analyses between HBM and TPB variables and the intention of the COVID-19 vaccination. The

Table 1: Intention of the COVID-19 vaccination and its predictors

Demographic characteristics	Don't intention of vaccination	Intention of vaccination	P
Age			
>35	127 (53.8)	109 (46.2)	0.007
35-50	87 (49.4)	89 (50.6)	
<50	57 (70.4)	24 (29.6)	
Education			
No academic	208 (55.3)	168 (44.7)	0.76
Academic	65 (53.7)	56 (46.3)	
Personal status			
Live alone	13 (68.4)	6 (31.6)	0.76
Live with family	61 (53.5)	53 (46.5)	
Live with spouse	43 (61.4)	27 (38.6)	
Live with spouse and children	156 (53.1)	138 (46.9)	
Number of children			
No children	60 (56.1)	47 (43.9)	0.67
Children	200 (53.8)	172 (46.2)	
Having a chronic disease			
No	201 (51.8)	187 (48.2)	0.005
Yes	71 (67)	35 (33)	
Smoking			
No	246 (55.7)	196 (44.3)	0.38
Yes	23 (48.9)	24 (51.1)	
Having over-weight			
No	154 (52)	142 (48)	0.12
Yes	119 (59.2)	82 (40.8)	
Having COVID-19 in the last year			
No	200 (59.7)	135 (40.3)	0.002
Yes	72 (45)	88 (55)	
Having influenza in the last year			
No	229 (55.7)	182 (44.3)	0.44
Yes	44 (51.2)	42 (48.8)	
Received the flu vaccine last year			
No	259 (55.8)	205 (44.2)	0.25
Yes	14 (45.2)	17 (54.8)	
Perceived health status			
Very good	72 (67.3)	35 (32.7)	>0.001
Good	122 (46)	143 (54)	
Not good	79 (63.2)	46 (36.8)	

Table 2: Univariate analyses between health belief model and theory of planned behavior variables and the intention of the COVID-19 vaccination

	Mean±SD		*t*-test	P (two-tailed)	Effect size
	Do not intention of vaccination	Intention of vaccination			
HBM dimensions					
Perceived susceptibility	2.90±1.21	3.94±1.01	10.14	>0.001	0.92
Perceived severity	3.41±0.99	3.30±1.03	−1.22	0.22	0.11
Perceived benefits	2.99±1.08	3.91±0.73	10.81	>0.001	0.98
Perceived barriers	2.62±1.01	2.63±1.15	0.097	0.92	>0.01
Cues to action	2.98±0.96	3.73±0.74	9.71	>0.001	0.88
TPB dimensions					
Attitude	3.69±1.05	2.53±1.15	−1.60	0.11	0.14
SN	3.37±0.92	3.62±0.81	3.14	0.002	0.28
PBC	2.98±1.18	3.99±0.85	10.66	>0.001	0.97
Self-efficacy	3.52±1.20	2.61±1.36	−7.86	>0.001	0.72

HBM: Health belief model, TPB: Theory of planned behavior, SN: Subjective norms, PBC: Perceived behavioral control, SD: Standard deviation

results showed that there was a positive significant relationship between perceived susceptibility, perceived benefits, cues to action, subjective norm, and perceived behavior control and a negative significant relationship between self-efficacy with vaccine intention.

According to the HBM, those who intend to receive the COVID-19 vaccine, perceived if do not receive the vaccine, the possibility of getting COVID-19 will increase in themselves, their family and relatives, and perceived the COVID-19 vaccination has high effectiveness to prevent important complications of COVID-19 and will decrease the risk of having the COVID-19 in themselves or others. In addition, those who are informed about the benefits of the vaccine by social media, the ministry of health, and the general practitioner and whose family and friends support the vaccine are more likely to receive the vaccine.

According to the TPB, those who intend to receive the COVID-19 vaccine reported that most of their friends support the vaccine and have positively reacted. They agreed that in addition to precautions, vaccination is necessary.

Table 3 shows the hierarchical logistic regression analysis of the intention predictors receive the COVID-19 vaccine. To fit the hierarchical logistic regression model in the first model, the significant demographic variables (age) were included in the first block, and the variables of health status (having a chronic disease, having COVID-19 in the last years, and having a disease) were included in the second block. In the second model, in addition to age and health status variables, variables related to HBM dimensions were entered in the third block. In the third model, in addition to age and health status variables, variables related to TPB dimensions were entered in the third block. In the fourth model, in addition to age and health status variables, variables related to HBM dimensions in the third block and variables related to TPB dimensions were entered into the fourth block. In all models, the conditional forward method with 0.05 input and 0.1 exit criteria was used.

The results of these 4 models are shown in Table 3. The results showed that in the age variable, participants over 50 years old had a 0.57% lower chance of vaccination compared to those under 35 years old (0.04). In addition, in participants with a good perceive of health status compared to those with a very good perceive, the chance of the vaccination is 3.18 times higher ($P < 0.001$), but in participants with a not good perceive of health status compared to those with a very good perceive, the chance of the vaccination is 11% lower, which is not significant ($P = 0.75$). Of the HBM dimensions, each unit of increase in the perceived susceptibility increased the chance of vaccination intention by 46% (sig = 0.001), each unit increased in the perceived benefits by 32% (sig = 0.06), and each unit of increase in the cues to action 9% (0.09) increased the vaccination intention odds ratio. Of the TBP dimensions, each unit of increase in the PBC increased the chance of vaccination intention by 2.67 times (sig <.001), each unit increase in the self-efficacy by 28% (0.002) increased the chance of vaccination intention, and each unit of increase in the subjective norms by 31% (0.04) decreased the chance of vaccination intention.

DISCUSSION

The results showed that the significant demographic predictors include age, having a chronic disease, having COVID-19 in the last year, and perceived health status. Half of the participants aged 35–50 years reported that have the intention to receive vaccine and most of the participants aged above 50 reported that do not have the intention to receive the vaccine. The results are in agreement with the previous studies.[6,18] Furthermore, 67% of participants who had a chronic disease and more than half of the participants who did not have COVID-19 in the last year reported that do not have the intention of COVID-19 vaccination. Our results showed that more than half of the participants who perceived their health status as very good or not good reported that do not have the intention of COVID-19 vaccination. Overall, the intention to receive a

Table 3: Hierarchical logistic regression analysis: Predictors of intention to receive the COVID-19 vaccine

Covariate	Model 1: Demographic, health related		Model 2: Demographic, health related, HBM		Model 3: Demographic, health related, TPB		Model 4: Demographic, health related, HBM and TPB	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Block 1: Demographic								
Age								
>35	Reference							
35-50	1.13 (0.76-1.70)	0.55	1.23 (0.73-2.07)	0.44	1.35 (0.82-2.22)	0.23	1.02 (0.58-1.81)	0.94
<50	0.48 (0.27-0.84)	0.01	0.33 (0.16-0.67)	0.002	0.62 (0.31-1.26)	0.19	0.43 (0.2-0.95)	0.04
Block 2: Predictors of health related								
Having a chronic disease								
Yes	Reference							
No	0.46 (0.28-0.76)	0.002						
Having COVID-19 in the last year								
Yes	Reference							
No	1.99 (1.28-2.84)	0.001	1.59 (0.97-2.63)	0.065	1.81 (1.12-2.94)			
Perceived health status								
Very good	Reference							
Good	2.54 (1.57-4.13)	>0.001	2.58 (1.39-4.79)	0.001	2.71 (1.5-4.89)	0.001	3.18 (1.63-6.23)	0.001
Not good	1.48 (0.79-2.53)	0.18	0.97 (0.49-1.93)	0.93	0.97 (0.49-1.93)	0.93	0.96 (0.44-2.07)	0.96
Block 3: Model 1, HBM								
Susceptibility			1.48 (1.16-1.9)	0.002			1.46 (1.11-1.91)	0.01
Perceived benefits			1.80 (1.29-2.51)	0.001			1.32 (0.89-1.96)	0.06
Cuse to action			1.87 (1.41-2.48)	>0.001			1.09 (0.99-1.2)	0.09
Block 3: Model 2, TPB								
SN							0.69 (0.47-0.96)	0.04
PBC					2.67 (2.09-3.41)	>0.001	2.48 (1.78-3.46)	>0.001
Self-efficacy					0.59 (0.50-0.71)	>0.001	0.72 (0.58-0.89)	0.002
Block 3: HBM and Block 4: TPB								

Model 1: Cox-Snell R^2=0.073 and Nagelkerke R^2=0.097, Model 2: Cox-Snell R^2=0.32 and Nagelkerke R^2=0.43, Model 3: Cox-Snell R^2=0.31 and Nagelkerke R^2=0.41, Model 4: Cox-Snell R^2=0.37 and Nagelkerke R^2=0.5. OR: Odds ratio, CI: Confidence interval, HBM: Health belief model, TPB: Theory of planned behavior, SN: Subjective norms, PBC: Perceived behavioral control

vaccine was low. The possible explanations for the low rate are that there is not enough knowledge about the COVID-19 disease and the vaccine, not trust the vaccine, and perceived low risk for infection. A study showed that there is a significant relationship between attitude, critical literacy, and hesitance of the vaccine with vaccine acceptance.[19] Studies showed that there is a significant relationship between trust in the vaccine, manufacturers, and health officials,[20] vaccine hesitancy, and not being perceived risk[21] with vaccine acceptance. However, our results are disagreement with Shmueli's study. In her study, 93% of participants aged 65≥ and 87.9% of participants with chronic disease had intention the COVID-19 vaccination. Because they found that at higher risk of COVID-19.[5]

According to the HBM, the dimensions of perceived susceptibility, perceived benefits and cues to action were the significant predictors of the COVID-19 vaccination. The results show that those who intend to receive the vaccine as compared to those who do not intend perceived the vaccine impacts on preventive themselves and their family in COVID-19. This shows the necessity of a health education intervention to increase risk perception of the COVID-19 disease and the vaccine benefices among the community. Our results are in agreement with those of the Reiter et al.'s study, which found that the participants who perceived the COVID-19 vaccine's effectiveness had willing to receive the vaccine.[8]

Regarding cues to action, the predictors that increase the intention to COVID-19 vaccination include informing about the benefits of the vaccine through social media, recommendations by GPs, and the ministry of health, or support by family and friends. Our results are in agreement with those of Reiter et al.'s study, they found that recommendation by providers or GPs is a key factor for accepting vaccination,[8,22] and a study, found that social media users were more willing to receive vaccination.[23] Furthermore, another study showed that the participants with higher trust in information from government sources were more willing to receive vaccination.[24]

According to the TPB, the dimensions of the subject norm, perceived behavior control, and self-efficacy were the significant predictors of the COVID-19 vaccination.

Regarding SN, the predictor that increases the intention to the vaccine was the positive reaction of relatives and friends to the vaccine. Our results provide more evidence for the other study.[5] Regarding PBC, access to the vaccine was a significant predictor. The possible explanation for this significant predictor is that one's perception of the ease or difficulty of doing something has a major effect on the intention to do it. Regarding self-efficacy, the participants perceived that in addition take precautions (using a mask, hand sanitizer, hand washing, and social distancing), vaccination is necessary for prevention.

One limitation of our study was that due to the COVID-19 pandemic, data collection was impossible directly. Hence, it was done through calling them.

Conclusion

According to the low rate of vaccination intention, holding health educational programs on TV, social media, GPs, and health workers to increase and improve knowledge and attitude may not by itself result in adequate pressure to change the intention. They should be combined with other encouraging/reinforcing programs that their target is changing the behavior directly such as easy access to the vaccine, the existence of different types of vaccines, and the right to choose the type of vaccine. Thus, health educational programs together with encouraging/reinforcing programs may change perceived susceptibility, perceived benefits, perceived behavioral control, and intention. It is better to use various kinds of sources to implement the educational program. Thus, multi-approach programs are needed not only to inform people but also to encourage the COVID-19 vaccination. Participants who are, between 35 and 50 years of age or do not have a chronic disease are better target groups for such programs and their intention may change easier than the others.

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Conflicts of interest
There are no conflicts of interest.

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