The Protection motivation theory for predict intention of COVID-19 vaccination in Iran: A structural equation modeling approach

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Abstract

Background

Many efforts are being made around the world to discover the vaccine against COVID-19. After discovering the vaccine, its acceptance by individuals is a fundamental issue for disease control. This study aimed to examine COVID-19 vaccination intention determinants based on the protection motivation theory (PMT).

Methods

We conducted a cross-sectional study in the Iranian adult population and surveyed study participants from the first to the 30th of June 2020 with a web-based self-administered questionnaire. We used Structural Equation Modeling (SEM) to investigate the interrelationship between COVID-19 vaccination intention and perceived susceptibility, perceived severity, perceived self-efficacy, and perceived response efficacy.

Results

SEM showed that perceived severity to COVID-19 ($\beta=.17$, $p < .001$), perceived self-efficacy about receiving the COVID-19 vaccine ($\beta=.26$, $p < .001$), and the perceived response efficacy of the COVID-19 vaccine ($\beta=.70$, $p < .001$) were significant predictors of vaccination intention. PMT accounted for 61.5% of the variance in intention to COVID-19 vaccination, and response efficacy was the strongest predictor of COVID-19 vaccination intention.

Conclusions

This study found the PMT constructs are useful in predicting COVID-19 vaccination intention. Programs designed to increase the vaccination rate after discovering the COVID-19 vaccine can include interventions on the severity of the COVID-19, the self-efficacy of individuals receiving the vaccine, and the effectiveness of the vaccine in preventing infection.

Background

Vaccines are one of the cost-effective measures of prevention (1). Immunization against infectious diseases annually prevents 2-3 million deaths by affecting the immune system (2). The spread of COVID-19 as an emerging disease in the world requires immediate action, including the production of vaccines, which can be an effective measure to protect people against this disease (3). Many efforts are being to

prevent individuals from getting COVID-19 through vaccination (4). After providing the vaccine, the critical issue is its acceptance by the individuals. A survey of American adults found that 69% of them will accept COVID-19 vaccination (5). A report from the Centers for Disease Control and Prevention found that less than half of American adults vaccinated against the flu in the 2018-2019 season (6).

Evidence shows that the rate of influenza vaccination is low in Asian populations (7), and this rate in Iran is much lower than expected by the World Health Organization (8); however, Iran is one of the countries that announced the highest agreement on the importance of the vaccine (9). The evidence shows that misconceptions are among the main reasons for not getting the flu vaccine (10).

According to a global report in 2017, more than 90% of countries report that people are hesitant about vaccination (11). Factors affecting COVID-19 vaccination acceptance may be as important as the discovery of the vaccine (12). It is unclear how effective the pandemic status is in accepting the COVID-19 vaccine, and doubts about the vaccine acceptance remain (13). Policymakers can identify factors related to vaccine acceptance to guide effective interventions to increase vaccination acceptance in the population (14). Behavioral change interventions widely use fear appeal to be useful. Fear appeals when messages contain a description of perceived susceptibility, perceived severity, and expressions of response efficacy can positively affect individuals' knowledge, attitude, and performance, especially in onetime behaviors (e.g., Covid-19 vaccination) (15, 16).

A recent study examining the effectiveness of the PMT in predicting seasonal influenza vaccination intent has shown that this model is a good predictor (17). To the best of our knowledge, no studies have so far examined the predictors of intention to vaccinate COVID-19 using the PMT. This study aimed to investigate the predictors of COVID-19 vaccination intention using the PMT in the Iranian population.

Methods

2.1. study design

We conducted a cross-sectional study in the Iranian adult population 18 years and older and surveyed study participants from the first to the 30th of June 2020 with a web-based self-administered questionnaire. We made a questionnaire based on the conceptual framework of the PMT on the Porsline, an online survey platform in Iran. The questionnaire began with an information letter about the study's purpose, how to answer questions, and informed consent to participate in the study.

2.2. Materials

We asked participants about their demographic characteristics, including age, gender, education, and marital status. Also, we asked the participants about the perceived severity of COVID-19, perceived

susceptibility to COVID-19, perceived self-efficacy in performing the COVID-19 vaccination and perceived response efficacy of COVID-19 vaccine, and intention to be vaccinated against COVID-19 whenever the vaccine was available. All answers were on 5-point Likert scales. The ethics committee of Zahedan University of Medical Sciences approved this study's protocol (IR.ZAUMS.REC.1399.015).

2.3. Data analysis

The analytical procedure consisted of two major tests: first, we performed confirmatory factor analysis (CFA), and also overall sample to check the goodness of fit of the hypothetical measurement model of each domain, postulated by protection motivation theory developers. We performed structural equation modeling (SEM) to test for the proposed model in the next step. For investigating the fit of each model, we calculated the chi-square (χ2) statistic. However, this well-known statistic is not a useful model fit index practically because of the detection of even trivial differences under a large sample size (18). Therefore, for more reliable results besides this test, we considered other goodness of fit indices like Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA) for a final decision about accepting or rejecting the hypothesis. A value of CFI≥0.90, TLI≥0.90, and RMSEA≤0.08 can support a good model fit (19). We chose full information maximum likelihood estimation as estimators. CFA and SEM run by Mplus 8.3 (20).

Results

3.1. Participant Characteristics

The average age of participants was 37.73±12.27 years; 46.2% of them were male. 83.7% of participants had a university degree, 47.3% had an undergraduate degree, and 36.4% had a graduate degree. We reported the descriptive statistics of measured variables in the model in table 1, including skewness and kurtosis, which are indicators for univariate normality. The mean score range of items ranges from 3.208 to 4.475, and standard deviation scores range from 0.723 to 1.164. All items' skewness and kurtosis scores fall in the acceptable ranges of normality suggested by Kline (skewness does not exceed |3| and kurtosis does not exceed |10|) (21).

Table1. Descriptive statistics of the items in the measure				
Construct and item	Mean	Standard deviation	Skewness	Kurtosis
Perceived susceptibility	17.478	1.164	-0.07	-0.278
SUS1	3.671	1.047	-0.699	-.064
SUS2	3.208	1.102	0.008	-0.777
SUS3	3.295	1.101	-0.125	-0.791
SUS4	3.292	1.164	-0.251	-0.867
SUS5	4.004	0.870	-0.915	0.943
Perceived severity	22.045	3.841	-1.957	5.088
SEV1	4.449	0.891	-2.144	4.962
SEV2	4.417	0.775	-1.863	4.982
SEV3	4.346	0.859	-1.568	2.437
SEV4	4.458	0.723	-1.738	4.454
SEV5	4.475	0.805	-2.002	4.655
Perceived self-efficacy	3.984	0.941	-0.9	0.783
Perceived response efficacy	8.220	3.751	-0.981	1.937
R.E1	4.064	0.827	-0.852	1.296
R.E2	4.155	0.833	-1.212	2.194
Intention	4.068	0.975	-1.161	1.457

We reported the Cronbach's alphas, the composite reliability (CR), and the average variance extracted (AVE) in table2. All Cronbach's alphas, CR and AVE, were greater than 0.70, indicating good reliability and validity of items within a construct (table2).

Table2. Reliability analysis		
Cronbach's alphas	Composite reliability	Average variance extracted
Perceived susceptibility	0.926	0.989	0.95
Perceived severity	0.772	0.986	0.944
Perceived response efficacy	0.848	0.969	0.941

3.2. Predictors of COVID-19 vaccination intention

As mentioned earlier, the first step in testing SEM is to check whether the overall sample data fit the measurement model or not. The CFA analysis for all domains showed approximately acceptable CFI, TLI, and RMSEA values. Perceived susceptibility, perceived severity, perceived self-efficacy, and perceived response efficacy were predictors of intention in model 1. As shown in table3, the goodness of fit incidence of the model was 655.911, P-value<0.001, CFI = 0.960, TLI = 0.950, and RMSEA =0.081. Although all goodness of fit indices were acceptable, perceived susceptibility was not significant, so we omitted perceived susceptibility to find a better model. Figure 1 also shows the graphical description of SEM analysis results. In this figure, you can see all coefficients for the measurement model and path analysis.

Table3. The goodness of fit index of models	Chi-square	df	P-value	RMSEA	CFI	TLI
Measurement Model	160.062	51	<0.001	0.091	0.941	0.923
Model 1	184.937	69	<0.001	0.081	0.948	0.932
Model 2	77.343	23	<0.001	0.096	0.966	0.947

In model 2, perceived severity, perceived self-efficacy, and perceived response efficacy were predictors of intention. As shown in table3 goodness of fit incidence of the model were 109.164, P-value<0.001, CFI = 0.952, TLI = 0.933, and RMSEA =0.096. In this model, all goodness of fit indices are acceptable, and this model can explain 61.5% of the variance of intention. Figure 2 also shows the graphical description of the results of the SEM analysis. In this figure, you can see all coefficients for the measurement model and path analysis. As shown in this figure, perceived severity to COVID-19 (β=.17, p < .001), perceived self-efficacy about receiving the COVID-19 vaccine (β=.26, p < .001), and the perceived response efficacy of the COVID-19 vaccine (β=.70, p < .001) were significant predictors of vaccination intention. Response efficacy was the strongest predictor of COVID-19 vaccination intention.

Discussion

Identification of factors influencing the acceptance of the COVID-19 vaccine should begin before a vaccine becomes available. The current study applies the PMT to identify predictors of COVID-19 vaccination intention in the Iranian adult population. We used SEM to investigate the interrelationship between COVID-19 vaccination intention and perceived susceptibility, perceived severity, perceived self-efficacy, and perceived response efficacy. The results showed that if the COVID-19 vaccine is available, the PMT could be a good predictor for vaccination intention. Previous studies that have used the PMT to predict vaccination intention have shown its effectiveness (22, 23). A study that examined the predictor of seasonal influenza vaccination intention based on the PMT showed that the PMT accounted for 62% of vaccination intention variance (17).

The current study showed that perceived susceptibility to COVID-19 was not a significant predictor of vaccination intention. Participants in this study received less than 70% of the total score of the perceived susceptibility construct, and this finding indicates that participants did not consider themselves high susceptible to COVID-19 infection. In studies examining the intention to vaccinate against H1N1 influenza, perceived susceptibility to influenza H1N1 virus did not predict vaccination intention (24, 25). Therefore, interventions should be designed and implemented by the health system to sensitize people to COVID-19. SEM showed that perceived severity to COVID-19, perceived self-efficacy about receiving the COVID-19 vaccine, and the perceived efficacy of the COVID-19 vaccine were significant predictors of vaccination intention. The three-factor model accounted for 61.5% of the total variance.

There is evidence that higher consideration of vaccination future consequences is associated with the perceived severity of the disease, greater perceived self-efficacy, and higher perceived effectiveness of the vaccine (26, 27). An extensive survey that examined the willingness to vaccinate against seven vaccine-preventable diseases in the United States showed that different degrees of risk are associated with the number of people willing to be vaccinated (28).

Additionally, a study examining the acceptability of the COVID-19 vaccine found that participants who reported higher levels of perceived severity of COVID-19 infection and perceived effectiveness of COVID-19 vaccine were more likely to be willing to get vaccinated (5). This study indicates that the perceived response efficacy is the strongest predictor of COVID-19 vaccination intention among the PMT construct. Regarding the effectiveness of the COVID-19 vaccine, other studies revealed that belief in vaccine efficacy was significantly the probability of COVID-19 vaccine acceptance (29, 30).

However, there is evidence that other factors can play a decisive role in influenza vaccination, despite understanding its effectiveness (31). The previous research shows that perceived self-efficacy is one of the most critical factors in adherence to COVID-19 preventive measures (32). Perceived self-efficacy refers to a sense of control over novel or difficult situations and challenges through decent behavior (33). In behaviors such as vaccination that do not involve long-term treatment adherence, self-efficacy is a determinant of intention and behavior (34). In a previous study that used PMT to predict staying at home during the COVID-19 pandemic in the Japanese population, self-efficacy was a predictor.

Like this study's results, perceived severity leads to threat appraisal more than perceived vulnerability, and perceived self-efficacy and perceived response efficiency leads to coping appraisal (35). Therefore, to encourage people to get vaccinated against COVID-19, more emphasis should be placed on perceived severity and perceived response efficiency. Because vaccination intention and actual vaccination uptake are related (36), identifying factors influencing vaccination intention before the availability of the COVID-19 vaccine can pave the way for community acceptance of the vaccine. Therefore, future intervention to increase COVID-19 vaccine acceptance can consider the PMT as a conceptual framework.

Readers should interpret our findings in light of the following study limitations. First, the COVID-19 vaccine is not yet available, and individuals' answers to questions about vaccine efficacy and self-efficacy related to the vaccine may differ when the vaccine is available. Also, the distribution and cost of

the vaccine are not known. If a vaccine provides in the future, the people who have access to the vaccine may have different characteristics from the participants in this study. Second, because we selected participants to study through an online survey platform, the findings may be prone to selection bias. Third, this study's data were self-reported, and participants' responses may be social desirability biased.

Conclusions

The current study identified factors associated with the COVID-19 vaccination intention. Understanding the factors influencing vaccination can help health policymakers increase vaccine acceptance. Programs designed to increase the vaccination rate after the availability of the COVID-19 vaccine can include interventions on the severity of the COVID-19, the self-efficacy of individuals receiving the vaccine, and the effectiveness of the vaccine in preventing infection.

Declarations

Ethics approval and consent to participate

The ethics committee of Zahedan University of Medical Sciences approved this study's protocol (IR.ZAUMS.REC.1399.015). Participants expressed informed consent to participate in the study before beginning to respond to the online questionnaire.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

HOA and MS participated in designing the study; ZS and MM participated in data analysis; HOA and AAM interpreted the results and prepared the manuscript. All authors read and approved the final manuscript.

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Abbreviation

PMT **=** Protection Motivation Theory, SEM = Structural Equation Modeling, CFA = Confirmatory Factor Analysis, CFI = Comparative Fit Index, TLI = Tucker-Lewis Index, RMSEA = Root Mean Square Error of Approximation**,** CR = Composite Reliability (CR), AVE = Average Variance Extracted

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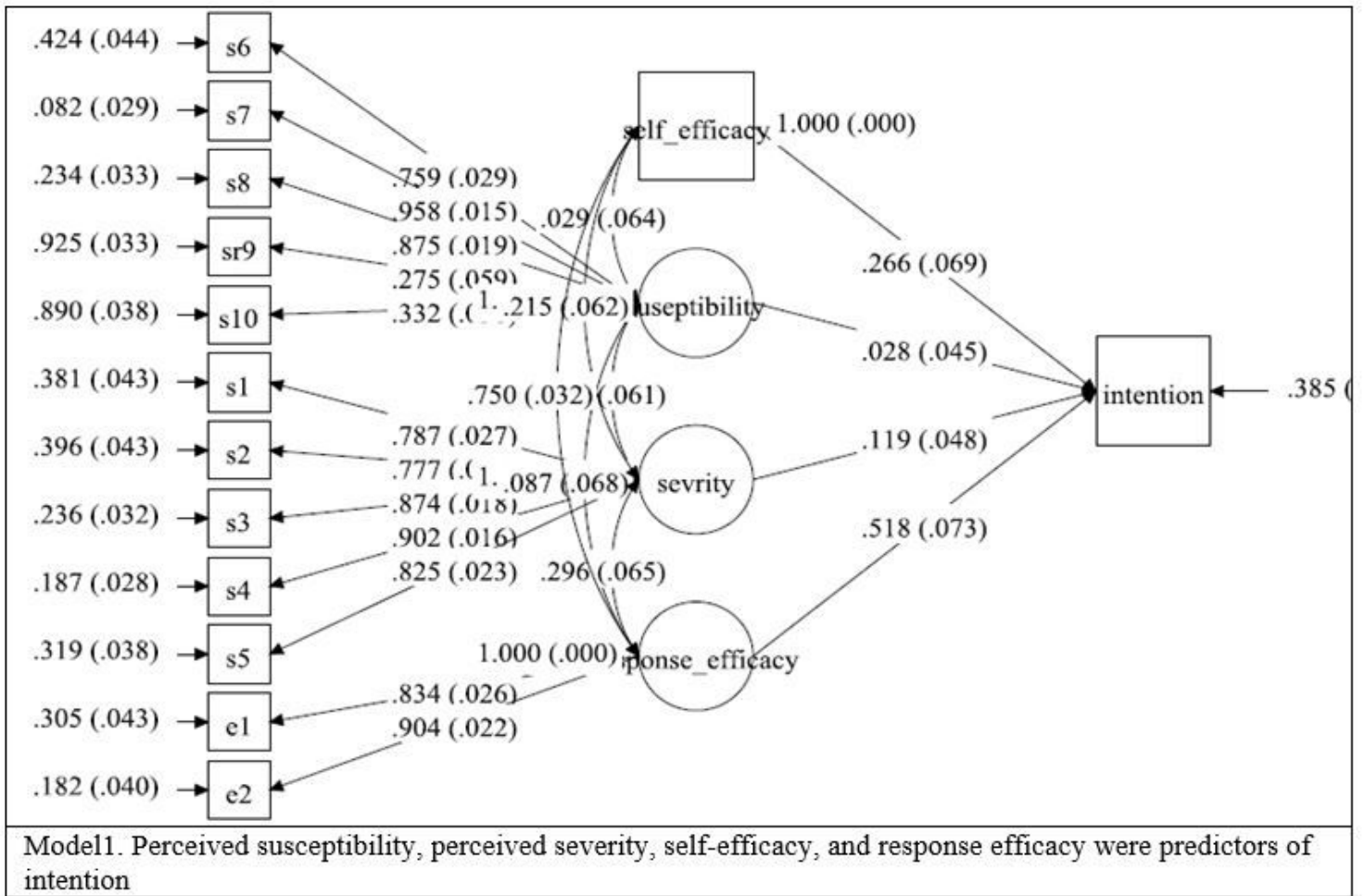
Figures

Figure 1

Perceived susceptibility, perceived severity, self-efficacy, and response efficacy were predictors of intention

Model 2. Perceived severity, perceived self-efficacy, and perceived response efficacy were predictors of intention
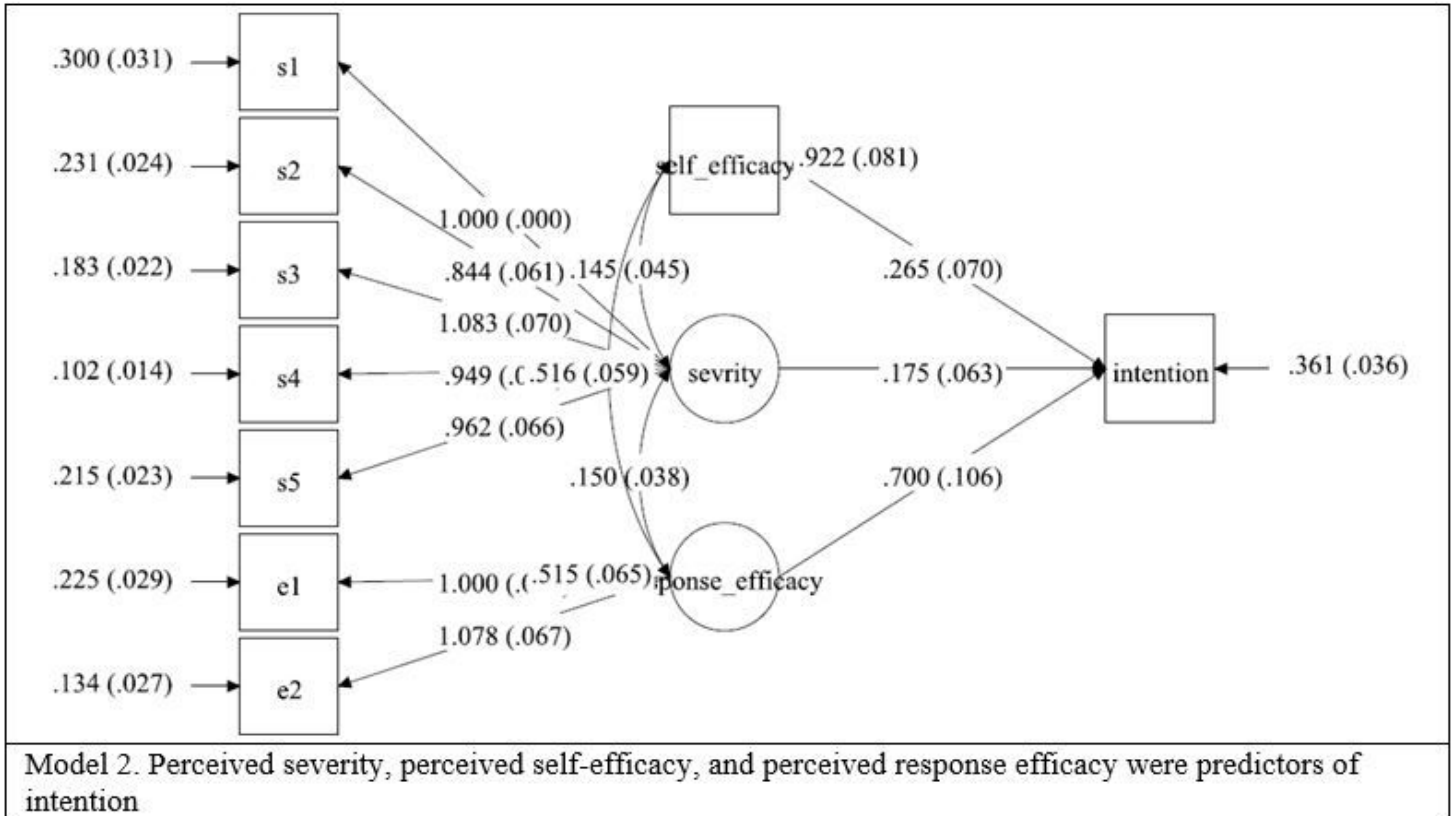
Figure 2

Perceived severity, perceived self-efficacy, and perceived response efficacy were predictors of intention