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Application of health belief model to predict COVID-19-preventive behaviors among a sample of Iranian adult population

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Abstract:

BACKGROUND: The novel coronavirus (COVID-19) has infected nearly 9.5 million people in 216 countries, areas, or territories in the world. The fight against the COVID-19 has become a very serious international challenge. The aim of this study was to determine the predictors of COVID-19-preventive behaviors using the health belief model (HBM).

MATERIALS AND METHODS: This cross-sectional study was conducted with the participation of 558 samples from the adult population of Iran. The online convenience sampling was conducted in this research. The online 68-item questionnaire link was published all over Iran through social networks including Telegram and WhatsApp, which are common in Iran. The data were analyzed using SPSS software version 19. Descriptive statistics, bivariate Pearson's correlation test, and multiple linear regression were used to analyze the data.

RESULTS: The mean age of the subjects was 33.3 ± 10.01 years. The participants were often female (61.3%), married (57.9%), and resident of the city (81.0%) with university educational level (78.8%). The results showed that the HBM structures predicted 29.3% of the preventive behaviors of COVID-19 in the subjects. The perceived benefits, perceived barriers, and self-efficacy significantly predicted the preventive behaviors, but the perceived susceptibility and perceived severity were not significant in the regression model. The internet and virtual social networks (49.8%), broadcast (33.5%), and healthcare providers (15.8%) were the most important sources of information related with COVID-19. In response to COVID-19-related internal cues to action, 36.6% did not pay attention and 34.7% tried to self-medicate. Only 28.5% of the subjects referred to the hospital, healthcare center, or physician.

CONCLUSION: Self-efficacy, perceived barriers, and perceived benefits were the key determinants of COVID-19-preventive behaviors in the subjects. It can be concluded that the HBM is a good tool to predict COVID-19-preventive behaviors in Iranian population.

Keywords:

Behavior, coronavirus disease-2019, health belief model, prevention

Introduction

Coronavirus disease-2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus (SARS-CoV)-2 occurred in Wuhan city, China, in December 2019.^[1] On January 31, 2020, the World

Health Organization announced the coronavirus outbreak as an international threat to public health.^[2] COVID-19 has become a pandemic disease that now affects 216 countries, areas, or territories around the world.^[3,4] Until July 20, 2020,

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the total number of confirmed cases and deaths of COVID-19 was 14,215,771 and 600,039 worldwide, respectively.^[4,5] Ten countries with the most confirmed cases of COVID-19 are the United States (3,771,101), Brazil (2,049,140 cases), India (1,053,552 cases), Russian Federation (765,437 cases), Peru (345,537 cases), South Africa (337,594 cases), Mexico (331,298 cases), Chile (326,539 cases), Spain (307,335 cases), the United Kingdom (293,239 cases), and Iran (271,306 cases).^[4,5] Iran is the seventh country with the highest mortality of COVID-19 with 13,979 deaths.^[5] COVID-19 is transmitted through direct contact with the infected person's respiratory secretions and has high transmission ability. An infected person on an average can spread the disease to three other people.^[2] Earlier studies have expressed the mortality rates of 2.5%–3% for COVID-19.^[6,7]

With regard to this fact that there is no definitive treatment or vaccine for COVID-19, people's behaviors are very important to disease control and prevention.^[1] In the current situation, health education interventions are the most significant approach for COVID-19 prevention. However, to increase the effectiveness of educational interventions for the disease, the proper evaluation should be carried out. It is necessary to assess people's beliefs about COVID-19 prevention and control and their motivation to engage the preventive behaviors, such as personal hygiene, use of personal protective equipment (PPE), maintaining social distance, and staying at home.^[1] Therefore, the psychological and behavioral responses of the general population play an important role in the prevention and control of COVID-19 outbreak.^[8] There are several psychological theories including the health belief model (HBM),^[9] the Theory of Planned Behavior,^[10,11] the Stages of Change Model,^[12,13] and the Protection Motivation Theory,^[13,14] which can be applied to predict people's health behaviors. The HBM is commonly used to predict preventive behaviors when prevention of a disease or health problem is considered a priority.^[9,15,16] The HBM was introduced in the 1950s by social researchers at the U.S. Public Health Service and proposed as an appropriate model to describe and predict people's health-related behaviors.^[17,18]

The HBM comprises five main constructs including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action which effect health behaviors.^[15,16] According to the HBM, people should consider the health threat (e.g., COVID-19) as serious problem to participate in preventive behaviors. It means that they think themselves vulnerable to the threat (perceived susceptibility) and perceive its risks and complications (perceived severity). Moreover, perceiving the effectiveness of preventive behavior and trying to diminish barriers to preventive behavior can enhance the possibility of doing these behaviors.^[9,18]

Further, the HBM suggests that a cue or trigger is needed for motivating participation in health-behaviors.^[9,18] Cues to action are symptoms, strategies, or information sources that support implementation of a behavior. Cues to action can be internal (e.g., pain, symptoms) or external (e.g., events or information from close persons, various media, or healthcare providers).^[17,18] In 1988, to better explain long-term behavior change, self-efficacy was jointed to the HBM.^[9,19] Self-efficacy denotes to a person's confidence to successfully perform a behavior.^[18,20]

Before planning and implementation of health education programs to prevent and control of COVID-19 outbreak, educational need assessment is essential and should be correctly conducted. Hence, the aim of this study was to determine the predictors of COVID-19 prevention behaviors among a sample of Iranian adult population using the HBM.

Materials And Methods

Study sampling

This cross-sectional study with the participation of 558 samples from the adult population of Iran (24 provinces from all over the country) was conducted from March 27 to April 10, 2020. The online convenience sampling was conducted in this research. The online questionnaire link (<https://survey.porsline.ir/s/IN0soHH/>) was published all over Iran through social media networks including Telegram and WhatsApp, which are common in Iran. Sample size was calculated by online software (Raosoft sample size calculator: <http://www.raosoft.com/samplesize.html>). The calculated sample size was 383 with a considered margin of error of 5% and a 95% confidence interval. However, to increase the reliability of the findings, due to the high volume of the population size, it means almost two-thirds of Iranian population (about 55,000,000 people); the sample size of 558 was considered. During the 15 days, 1131 people visited the questionnaire, of which 637 participants (56.32%) completed the questionnaire after confirming informed consent form. Because the answer for each of the questions was optional, 79 people (12.4%) of the persons who did not response more than 30% of the questions were excluded from the final analysis. Finally, the data of 558 participants were analyzed. The purpose of the research and the necessary explanations about complete the questionnaire were sent to the individuals along with the questionnaire link as captions. It took an average of 10 min for each participant to response the questionnaire. The criteria to entrance the research were read and write skills and satisfaction with participation in the study. The persons with lack of access to a smartphone or computer as well as lack of the internet service and no responses to more than 30%

of the questions and persons with 17 years of age and younger (because parental consent is mandatory for this age group) were excluded in the study.

Measurements

The data were collected online by a researcher-made 68-item questionnaire. The first part of the questionnaire determined participants' demographic information using seven items, including age, gender, education level, marital status, employment status, place of residence (city/village), and family economic status.

The second part (39 items) was based on the HBM. The perceived susceptibility was assessed with six items (e.g., I am at risk for COVID-19) and perceived severity was evaluated with seven items (e.g., the news of death from the COVID-19 scares me). The perceived benefits with four items (e.g., If I stay at home, I can reduce the risk of the COVID-19) and perceived barriers through nine items (e.g., It is difficult to provide health items such as masks and gloves) were assessed. Self-efficacy with nine items (e.g., I can keep at least one meter away from people with COVID-19 symptoms) and cues to action with four questions (e.g., what is the main information source used by you to get the news of COVID-19?) were assessed. The responses to the items of the perceived susceptibility, perceived severity, perceived benefits, and perceived barriers were according to five-point Likert scale from strongly agree = 5 to strongly disagree = 1. Further, the response to self-efficacy items was from absolutely sure = 5 to absolutely unsure = 1.

The third part evaluated the preventive and cautious behaviors of COVID-19. This part was assessed with 20 items (e.g., not attending at crowded place). The responses to the items were scored using a five-point Likert scale from never = 1 to always = 5.

The questionnaire validity was qualitatively evaluated by an expert panel (including two health education and promotion, two environmental health, one occupational health, and one clinical psychology specialists) comments about simplicity, proportionality, ambiguity, necessity, and scoring of items. The necessary corrections were carried out on the questionnaire based on their comments. The questionnaire reliability was also measured by Cronbach's alpha. The Cronbach's alpha values for the different parts of the questionnaire are separately shown in Table 1.

Data analysis

The data were analyzed using SPSS software version 19, IBM CO. New York, (USA). Descriptive statistics, bivariate Pearson's correlation test, and multiple linear regression were used to analyze the data. The value of 0.05 was considered as a significant level in this study.

Table 1: Sociodemographic characteristics of study participants

Characteristics	n (%)
Gender	
Male	216 (38.7)
Female	342 (61.3)
Marital status	
Single	231 (41.4)
Married	323 (57.9)
Divorced/widowed	4 (0.7)
Educational level	
Primary school	13 (2.3)
Secondary school	55 (9.9)
University graduated/students	490 (78.8)
Occupational situation	
Householder	112 (20.1)
Employee	190 (34.1)
Self-employment	72 (12.9)
Laborer	12 (2.2)
Unemployed	154 (27.6)
Retired	18 (3.2)
Place of residence	
City	491 (81.0)
Village	67 (12.0)
SES	
High	187 (33.5)
Intermediate	310 (55.6)
Low	61 (10.9)

SES=Socioeconomic status

Results

A total of 558 subjects aged 18–67 years with a mean age of 33.3 ± 10.01 years participated in this study. Table 1 shows the sociodemographic characteristics of the subjects. As seen, the most of the subjects were female (61.3%), married (57.9%), and resident of the city (81.0%) with university educational level (78.8%).

The mean and standard deviation of the HBM structures as well as the preventive behaviors related to COVID-19 are presented in Table 2.

The findings of the Pearson's correlation test indicated a significant correlation of all the HBM structures with the preventive behaviors of COVID-19. As listed in Table 3, self-efficacy ($P < 0.001$; $r = 0.447$), perceived barriers ($P < 0.001$; $r = -0.373$), and perceived benefits ($P < 0.001$; $r = 0.333$) were more strongly correlated with the behavior, respectively.

The results of multiple linear regression analysis [Table 4] showed that the HBM structures totally predicted 29.3% of the preventive behaviors of COVID-19 in the subjects. The perceived benefits, perceived barriers, and self-efficacy significantly predicted the behaviors,

Table 2: Means, standard deviations and internal consistency of health belief model constructs and the coronavirus disease-2019-preventive behaviors

Variables	Mean±SD	Number of items	Obtainable score range	Internal consistency*
Perceived susceptibility	25.24±3.04	6	6-30	0.79
Perceived severity	28.42±5.12	7	7-35	0.87
Perceived benefits	18.67±1.79	4	4-20	0.84
Perceived barriers	24.61±4.58	9	9-45	0.66
Self-efficacy	37.74±5.89	9	9-45	0.92
Preventive behaviors	85.48±9.57	20	20-100	0.91

*Cronbach's alpha (α), $n=558$. SD=Standard deviation

Table 3: Intercorrelation of health belief model constructs and the disease-preventive behaviors

Variables	1	2	3	4	5	6
Perceived susceptibility	1					
Perceived severity	0.450**	1				
Perceived benefits	0.288**	0.302**	1			
Perceived barriers	-0.100*	-0.204**	-0.161**	1		
Self-efficacy	0.089	0.078	0.312**	-0.348**	1	
Preventive behaviors	0.121*	0.144*	0.333**	-0.373**	0.447**	1

*Significant at the 0.05 level (two-tailed), **Significant at the 0.01 level (two-tailed), $n=558$

but the perceived susceptibility and perceived severity were not significant in the regression model.

The relative frequency of the external cues to action of the participants is exhibited in Figure 1. As it can be seen, the most important sources of information related with COVID-19 were obtained by the internet and virtual social networks (49.8%), broadcast (33.5%), and healthcare staffs (15.8%). Further, on the basis of participants' opinions, the internet and virtual social networks (46%), healthcare staffs (35.7%), and broadcast (17.9%) were the reliable sources of information related to COVID-19.

Figure 2 shows the findings of the relative frequency of participants' reactions to internal cues to action related to COVID-19 (such as cough, fever, fatigue, headache, sore throat, or unprotected close contact with suspected or confirmed cases). As seen, of 558 participants in the study, 213 persons (38.17%) reported at least one internal cue to action during the COVID-19 outbreak. In response to these internal cues to action, 36.6% did not pay attention and 34.7% tried to self-medicate. Only 28.5% of the subjects referred to hospital, healthcare center, or physician

Discussion

The aim of the present study was to determine the predictors of protective behaviors against COVID-19 in the adult population of Iran using the HBM. The HBM

structures generally explained 29.2% of the variance of preventive behaviors of COVID-19. Of the five studied structures, perceived benefits, perceived barriers, and self-efficacy significantly predicted the protective behaviors of the disease. However, the perceived susceptibility and perceived severity in the regression model were not significant. In previous studies, the HBM has been proposed as a useful model for predicting the preventive behaviors against infectious diseases such as SARS-CoV,^[15,21] the coronavirus Middle East respiratory syndrome (MERS),^[22] H₁N₁ flu,^[23] and other respiratory infections.^[24] In a study by Wong and Tang (2005), the structures of HBM predicted 20.3% of the volitional health behaviors. In their study, the perceived threat of disease and the environmental cues to action were the strongest predictors of SARS-preventive behaviors.^[21] In a study by Tang and Wong, the perceived susceptibility, the perceived benefits, and the cues to action were the most important predictors of the wearing facemask behavior to prevent SARS.^[15] In another study by Sim *et al.*, (2014) the perceived susceptibility and perceived benefits were reported as major determinants of wearing facemask to prevent the respiratory infections.^[24]

In the present study, the participants obtained high scores from perceived susceptibility and perceived severity. However, these two structures were not significant determinants to conduct the preventive behaviors against COVID-19. On the other hand, in several similar studies^[1,8,25] to assess the risk perception of COVID-19 in communities involved with this outbreak, the perceived susceptibility and perceived severity had a high correlation with the protective behaviors of COVID-19. Since all the studies have been performed in the early stages of COVID-19 outbreak, the increased susceptibility and perceived severity of COVID-19 at this stage may lead to precautionary behavior by the publics. The results of various studies also showed that the risk perception of the disease has a positive effect on follow the instructions for prevention and control of the disease, especially in the early stages of the disease.^[1,8,15] However, our study was carried out nearly 50 days after the report of the first cases of COVID-19 in Iran.^[5,26,27] It seems during the times that Iran has been involved with COVID-19, people have become extreme vulnerable

Table 4: Multiple linear regression analysis of the health belief model variables predicting the coronavirus disease-2019-preventive behaviors

Variables	B	SE	β	R	R ²	F	Significant
Constant	60.02	5.03					
Perceived susceptibility	0.097	0.128	0.031				0.449
Perceived severity	0.131	0.079	0.070				0.097
Perceived benefits	0.996	0.217	0.187				0.001
Perceived barriers	-0.521	0.083	-0.249				0.001
Self-efficacy	0.489	0.065	0.301	0.541	0.293	45.80	0.001

n=270, Dependent variable: The COVID-19-preventive behaviors. SE=Standard error, COVID-19=Coronavirus disease-2019

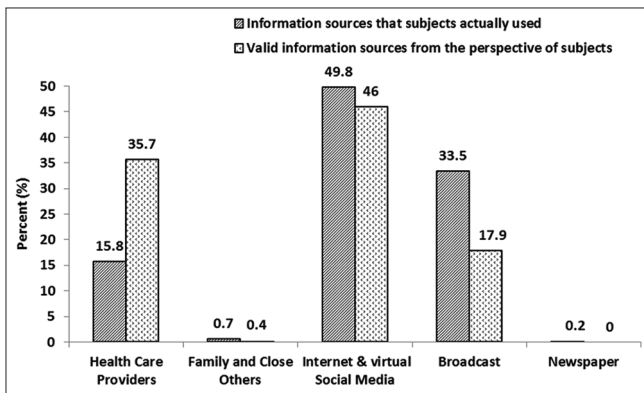


Figure 1: Relative frequency (%) of the external cues to action related to coronavirus disease-2019 in the participants (n = 558)

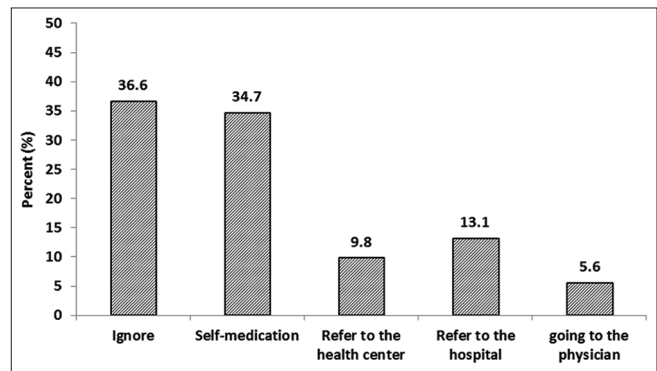


Figure 2: Relative frequency (%) of participants' reactions to internal cues to action related to coronavirus disease-2019 (n = 213)

to the disease and understand its risks. However, the findings of the present study showed that the increment of risk perception of a disease in order to prevent and control is necessary, but it may be gradually decreased its effectiveness. According to the results of the present study, self-efficacy, perceived barriers, and perceived benefits were the main determinants of the COVID-19 prevention, respectively. Based on the HBM, to observe a health behavior, in addition to perceiving the threat of a health problem (such as COVID-19), individuals should perceive the benefits of performing the behavior and be able to overcome the barriers of the behavior. In addition, they should be confident in their ability to perform healthy behaviors.^[9,15,18,20] Alsulaiman and Rentner emphasized the crucial role of high perceived benefits, low perceived barriers, and high self-efficacy to follow the recommended precautionary measures of MERS prevention.^[22] However, on the contrary of the present study, Tang and Wong reported that the perceived barriers did not significantly predict the wearing of facemask to prevent SARS in Chinese adults.^[15] In addition, in Wong and Tang's research, self-efficacy did not play a role in precautionary behavior to prevent SARS in Chinese adolescents.^[21] Depending on the study methodology, the target group, the type of disease and its severity, as well as the type of studied behavior, the results may be different. However, the perceived barriers and self-efficacy have always played a noticeable role in determining health behaviors.^[15,18,28-30]

The most important perceived barriers in the present study include lack or difficult access to PPE (masks, gloves, and disinfectants), fatigue and anxiety due to prolonged quarantine, confusing information about the COVID-19, and not paying attention to stay at home because of work and income. The fact is that COVID-19 is now a complex threat in Iran and other countries. Due to the involvement of all countries in the world to COVID-19, access to PPE has become very difficult. On the other hand, actions such as home quarantine and personal hygiene practices such as hand washing, surface disinfection, and maintaining social distance for a long time seem to be difficult and exhausting. Therefore, to maintain long preventive behaviors time against COVID-19, the individuals should have high self-efficacy.^[18-20]

In the present study, 213 people (38.17%) had at least one of the internal cues to action (such as cough, fever, fatigue, and headache) or high-risk behaviors such as unprotected contact with suspected persons with COVID-19. However, only 28.5% of the subjects had appropriate response to the internal cues to action (refer to healthcare centers or physicians). The study also found that most of people ignored the internal cues to action or resorted to self-medication. According to the HBM, the internal cues to action should lead to healthy behavior.^[17,18] The external cues to action such as healthcare staffs and reliable social media can play a major role to introduce the internal cues to action about

COVID-19 and teach the appropriate reaction methods to these cues.

In the present study, internet and virtual social networks (49.8%), broadcast (33.5%), and healthcare professionals (15.8%) were the main sources of people's information related to COVID-19, respectively. Based on the participants' opinions, the validity of information sources of the internet and virtual social networks, healthcare professionals, and broadcast was 46.0%, 35.7%, and 17.9%, respectively. This finding showed that the internet and virtual social networks are extensively used to obtain the information.^[22,31,32] The virtual social networks allow people to access health information in the shortest time. However, this media can create misconceptions and unauthorized recommendations for the prevention and treatment of COVID-19 by invalid information, such as using hair dryer to mouth heating, antibiotic use, mouthwash by salt water, rubbing sesame oil on the skin, and eating garlic and alcohol.^[8,31] These falsehoods can lead to serious disruption in the management of the COVID-19.^[8,33,34] Pennycook *et al.* expressed that people with less analytical thinking and scientific knowledge do not make the right decisions about whether information is true or false and therefore are more likely to share unsure messages.^[35]

People mostly follow the health advices presented by healthcare centers.^[1,15,22,31] Therefore, to minimize the impact of various misconceptions, it is suggested that the international, national, and local healthcare organizations set up and update the health advices and guidelines related to COVID-19 on official and reputable websites.^[31] For example, given that a significant percentage of people (34.7%) seek self-medication,^[31] pharmacologists can use the HBM to improve public's knowledge, beliefs, and behaviors associated with COVID-19.^[16]

Study limitation

In the present study, people could participate who had both smartphone and internet access. According to the latest population census of Iran in 2016, about 26% of Iranian people live in the rural areas.^[36] However, in this study, only 12% of the subjects lived in the village. The main reason of lower rural people participation in the study can be due to their limited access to the internet.^[37,38] 78.8% of the participants in the study were students or university graduated, while about 20% of people aged 18 years and older in Iran are academic (student and graduate). According to various studies in developing countries including Iran, the internet penetration rates are higher in urban areas, people with higher incomes, and people with higher education.^[37,38] Therefore, it is not possible to generalize the findings to illiterate people and people who do not have access to the internet. Despite the

above limitations, online data collection method, while Iranians are being involved in COVID-19, is a rational and moral choice.

Conclusion

The HBM structures predicted 29.2% of the preventive behaviors of COVID-19 in the adult population of Iran. The subjects performed a good level of the preventive behaviors of COVID-19. Self-efficacy, perceived barriers, and perceived benefits were the strongest determinants of COVID-19-protective behaviors, respectively. The internet and virtual social media were the major sources of information about COVID-19 in the study. The inadvertence and self-medication were also the main responses of individuals to the internal cues to action of COVID-19. The findings of the present study showed the effectiveness of the HBM to predict the preventive behaviors of COVID-19 in the general population of Iran.

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Conflicts of interest

There are no conflicts of interest.

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