

# Predictors of COVID-19 preventive behaviors based on the health belief model among pregnant women

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## Research Article

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# Abstract

## Background

COVID-19 is an infectious disease caused by the new coronavirus, and its widespread epidemic has caused many deaths and health, social, and economic consequences in the world. The purpose of this study was to explain self-care behaviors against COVID-19 based on the health belief model (HBM) in pregnant women.

## Method

The present study was conducted using a descriptive-analytical approach with the participation of 230 pregnant women referred to health centers in Urmia in 2021. The participants were selected using multi-stage random sampling. The data were collected using a valid and reliable questionnaire including participants' demographic characteristics, the HBM items, and items relating to self-care behaviors against COVID-19. The data were analyzed using descriptive and inferential statistical methods (frequency, mean, standard deviation, Pearson correlation coefficient, and linear regression) in SPSS software (version 25).

## Results

The results of this study showed that the rate of self-care behaviors against COVID-19 in the pregnant women participating in the present study was not very favorable. It was also shown that among the constructs of the HBM, awareness, self-efficacy, perceived barriers, and perceived severity were the most important predictors of self-care behaviors with a variance of 24% change among the pregnant women.

## Conclusion

Awareness, self-efficacy, perceived barriers, and perceived severity were found in this study as the strongest predictors of self-care behaviors among pregnant women. The results of the study can be useful in planning educational and behavioral interventions to increase the adoption of self-care behaviors against COVID-19 and institutionalize health-promoting behaviors in women.

## Introduction

COVID-19 is caused by a new type of coronavirus that was first identified in December 2019 in Wuhan, China. It has become a pandemic with far-reaching economic, social, and health consequences (1). One of the most important aspects of Covid-19 is its rapid spread through airborne droplets and surfaces and objects contaminated with these droplets, which indicates the need for greater personal and social hygiene (2).

A large number of people in different countries were infected with COVID-19 due to rapid spread of the virus (3). For instance, until May 25, 2021, 168104586 people worldwide have been infected with this virus and 3489640 people have lost their lives, and also up to the above-mentioned date, 2855396 people in Iran have been infected with this virus and 79056 people have died (4).

COVID-19 causes severe complications including thrombotic complications, cardiac dysfunction and arrhythmia, acute coronary syndrome, acute renal failure, gastrointestinal symptoms, hepatocellular damage, hyperglycemia, diabetic ketoacidosis, and neurological diseases (5, 6). People with immune deficiencies who are at a greater risk of developing COVID-19 need a lot of care and attention from related health and care organizations. Suppression of relative immunity in

pregnant women makes them more vulnerable to COVID-19. They experience immunological and physiological changes and may be more prone to viral respiratory infections (7). Caring for these pregnant women can be complicated and difficult because the infection may adversely affect the mother, fetus, and baby (8).

Some specific COVID-19 management advice for pregnant women is offered based on their previous experiences with previous coronaviruses. To prevent COVID-19 in pregnant women, they are recommended to avoid unnecessary travel, attending crowded places, using public transportation, and contacting suspicious or sick people. They also need to take personal and social health care and inform their doctor immediately if they experience early symptoms such as fever, cough, fatigue, muscle aches, sore throat, and shortness of breath (9). Some researchers have reported the risk of preterm delivery, premature rupture of membranes, fetal tachycardia, and fetal distress during the third trimester of pregnancy among women infected with coronavirus (10).

Many doctors are also afraid of congenital infection with the virus and decide to terminate the pregnancy, which imposes many psychological and physical complications on pregnant women (9).

Currently, effective training and strategies have been adopted to prevent this disease. However, we are witnessing an increase in the number of patients with this disease every day. Therefore, it seems that pure information is not enough and there should be a fundamental behavior (11). Planning and preparedness to deal with the COVID-19 crisis is one of the national and international necessities, and taking preventive measures at the community level to control the COVID-19 epidemics should be highly considered by policymakers and health officials (12). Preventive measures such as education, awareness promotion, and fostering prevention skills can be promoted through diseases prevention and control programs (13).

The use of health education model will help researchers recognize factors affecting health behaviors. The health belief model is one of the most effective health education models developed based on cognitive psychology and is used to determine health behaviors. It also shows the relationship between health beliefs and health behaviors and emphasizes the intrinsic factors of individuals, such as knowledge, attitudes, beliefs, and behavior (14).

This model encompasses four main concepts, including sensitivity, severity, benefits, and perceived barriers. According to the constructs of this model, to adopt preventive behaviors, people must first feel the danger (perceived sensitivity), then understand the depth and severity of the danger and the effects it may have on them and society. People should also believe in the effects and benefits of preventative measures and accept that taking preventive behaviors will cost less than getting the disease (13–16).

Due to the novelty and sudden prevalence of the COVID-19 disease and the lack of studies on predictors of preventive behaviors against this disease based on the HBM, this study aimed to determine the predictors of adopting preventive behaviors against COVID-19 based on the HBM constructs among the pregnant women.

## Methods

This descriptive-analytical cross-sectional study was performed on 230 pregnant women who referred to Urmia health centers. The sample size was estimated using the following equation (17):

$$n \geq 1 + \frac{p(1 - R_{adj}^2)}{\delta}$$

Where,  $p$  is the number of variables in the regression model,  $R_{2adj}$  is the adjustment coefficient, and  $\delta$  is the difference between the coefficient of determination and the adjusted coefficient of determination.

Due to the lack of a similar study in this field, preventive measures against the Zika virus in Thailand were used to estimate the value of the adapted coefficient of determination, and  $\delta$  showing the difference between the coefficient of determination and the coefficient of determination was estimated from a previous study by Siramanrate (18). Thus using the above equation ( $p = 11$ ;  $R^2 = 0.307$ ;  $\delta = 0.048$ ), the required sample size was estimated as 159 people. Given the concern of people to go to clinics during the COVID-19 outbreak and considering the 30% probability of not participating in the study, the sample size increased to 226 people.

The participants were selected using multi-stage sampling. First, all 66 health care centers in Urmia were listed based on the socioeconomic and cultural conditions of the regions hosting the centers. To this end, 26 health centers were classified at the high level, 20 health centers at the moderate level, and 20 health centers at a low level based on socioeconomic status and cultural conditions. In this study, 12 health centers in Urmia at three high, moderate, and low levels in terms of socioeconomic and cultural conditions were selected randomly. Then, according to the population covered by each of the socio-economic levels of those health centers, pregnant women were randomly selected as candidates with equal chances to enter the study.

The inclusion criteria were: 1) Being a resident of Urmia, 2) Pregnant mothers covered by health centers, 3) Literacy for reading and writing, 4) Willingness to participate in the study, and 5) Lack of a history of mental illness. The women who were unwilling to participate in the study were excluded. The first section of the questionnaire assessed the participants' socio-demographic information including their age, their number of pregnancies, job, and insurance status.

The second section of the questionnaire contained 22 items that assessed the participants' knowledge towards COVID-19 (e.g. COVID-19 can be asymptomatic). The responses were measured using the nominal scale of "True" and "False". One point was given for a correct answer and zero for an incorrect or no answer. The total score for each respondent varied from 0 to 22.

The third section consisted of items about the various constructs of the health belief model to perform self-care behaviors to prevent COVID-19: Perceived sensitivity (7 items): "If I do not wear a mask outdoors, I may become infected with the Coronavirus", perceived severity (7 items): "Mortality rate due to covid-19 is high", perceived benefits (7 items): "Washing my hands regularly prevents me from becoming infected with the coronavirus", Perceived barriers (6 items): "Masks are expensive for me", Self-efficacy (6 items): "I am confident in my ability to disinfect my environment", and Cues to action (10 items): "Have you read about the importance and necessity of disinfecting food and the environment through virtual space?" All constructs of the health belief model, except the cue to action, were scored on a five-point Likert scale (ranging from 1='strongly disagree' to 5='strongly agree'). However, the items on the Cues to action were scored as either zero or one. The responses were measured using the nominal scale of "Yes" and "No". One point was given for a "Yes" answer and zero for a "No" answer. The total score for each respondent varied from 0 to 10.

The fourth section consisted of 9 items about self-care behavior: "I observe a distance of at least 1.5 meters in dealing with others". The items were scored on a 4-point Likert scale (ranging from 0= 'Never' to 4='Always').

The participants' answers to all items were categorized as weak practice (if the participant scored < the mean score), moderate practice (if the participant scored 50-75% of the mean score), and good practice (if the participant scored > 75% of the mean score).

It should be noted that at the end, each person's score for all constructs was estimated based on a 100 score. Then the distance between the lowest and highest scores was conventionally classified into three categories: weak (0-50), medium (51-75), and good (76-100).

The content and face validity of the questionnaire were reviewed and verified by 10 health education and reproductive health professionals. To this end, the experts were asked to review and assess the items in terms of simplicity, clarity,

relevance, and necessity. The items were then revised based on the feedback provided by the experts and the validity of the tools was confirmed.

In the psychometric analysis of the instrument, the content validity ratio (CVR) and the content validity index (CVI) of the instruments were reported as 0.86 and 0.90, respectively. Cronbach's alpha coefficient was estimated to assess the internal consistency of the instrument in a pilot study of 30 pregnant women who were similar to the participants in the research sample in terms of demographic characteristics. Cronbach's alpha for perceived sensitivity, perceived severity, perceived benefits, perceived barriers, self-efficacy, Cues to Action, and self-care behaviors were estimated as 0.87, 0.7, 0.76, 0.71, 0.80, and 0.92, confirming the reliability of the tools was at the acceptable level.

Data analysis was performed in SPSS (version 22) using Pearson's correlation coefficient and linear regression analysis. Moreover, P-values less than 0.05 were considered statistically significant.

## Results

The participants in this study were 230 pregnant women with a mean age of  $29.57 \pm 5.82$ . Moreover, 214 women were housewives and 16 women were employed. Table 1 summarizes the participants' demographic characteristics.

Table 1  
Demographic characteristics of pregnant women who participated in the study

variables	no	percent
job		
Housewife	214	93
Employed	16	7
Having health insurance		
Yes	222	96.5
no	8	3.5
No of pregnancies		
1	68	29.6
2	94	40.9
3	52	22.6
4+	16	6.9
COVID-19 history		
yes	23	10
no	207	90

The mean score of the HBM constructs was moderate and the most challenges were related to perceived severity ( $61.82 \pm 11.18$ ), self-efficacy ( $71.65 \pm 9.06$ ), perceived barriers ( $72.26 \pm 10.09$ ), knowledge, and care and prevention strategies of COVID-19 ( $77.45 \pm 8.61$ ). The mean score of self-care behaviors associated with COVID-19 ( $63.97 \pm 20.14$ ) was not very favorable (Table 2).

Table 2  
Mean scores of knowledge, health belief model constructs and self-care behaviors regarding prevention of COVID-19

	mean	Standard Deviation	minimum	maximum
Awareness	77.5	8.6	50.0	95.5
perceived susceptibility	86.1	9.8	62.9	100.0
perceived severity	61.8	11.2	40.0	85.7
perceived benefits	82.5	9.7	65.7	100.0
perceived barriers to action	72.3	10.1	54.3	94.3
self-efficacy	71.7	9.1	56.7	96.7
cues to action	80.9	22.4	30.0	100.0
Self-care behavior	64.0	20.1	18.5	100.0

Pearson correlation coefficient showed a positive and significant relationship between the constructs of the health belief model and self-care behaviors related to prevention of COVID-19 except perceived benefits. A negative correlation was found between perceived barriers and self-care behaviors related to prevention of COVID-19. Other correlation coefficients of the HBM constructs and individual factors in relation to self-care behaviors are listed in Table 3.

Table 3

Pearson correlation coefficient between individual factors and structures of the health belief model in relation to self-care behaviors of coronary heart disease

		age	Awareness	perceived susceptibility	perceived severity	perceived benefits	perceived barriers to action	self-efficacy	cues to action
Self-care behavior	r	-0.018	0.346	0.147	0.275	0.019	-0.247	0.253	0.264
	P value	0.790	<0.001	0.26	<0.001	0.777	<0.001	<0.001	<0.001

To determine the predictive power of adopting self-care behaviors in confronting COVID-19, regression analysis and stepwise method were used. The regression analysis assessed the constructs of the HBM and some individual factors. Based on the results, awareness, self-efficacy, perceived barriers, and perceived severity were determined as the final predictors of changes in self-care behaviors. In total, these variables were able to explain about 24% ( $R^2 = 0.235$ ) of the variances in self-care behaviors related to COVID-19 prevention (Table 4).

Table 4  
Multivariate regression analysis steps in predicting self-care performance of pregnant women

Steps	Health Belief Model constructs	R	R <sup>2</sup>	Adjusted R <sup>2</sup>
1	Awareness	0.346	0.120	0.116
2	Awareness and self-efficacy	0.405	0.164	0.156
3	Awareness, self-efficacy and perceived barriers to action	0.464	0.215	0.205
4	Awareness, self-efficacy, perceived barriers to action and perceived severity	0.485	0.235	0.222

## Discussion

This study aimed to investigate the predictive factors associated with the adoption of self-care behaviors for preventing COVID-19 disease in pregnant women using the HBM. The results of this study confirmed a statistical model consisting of four variables including awareness, self-efficacy, perceived barriers, and perceived severity, which were able to account for about 24% of self-care behaviors associated with COVID-19 disease. Of course, these four variables varied in terms of their power to explain the adoption of self-care behaviors. Similarly, Khazaei Poor (13) reported that the constructs of the health belief model could explain 26% of self-care behaviors effective in the prevention of COVID-19.

The results of this study showed that the average score of adopting self-care behaviors in preventing COVID-19 was about 64, showing that self-care behaviors taken by the pregnant women to prevent COVID-19 disease were not desirable due to the high prevalence of the disease in Iran.

However, some studies (19–21) estimated preventive function of different study groups as desirable. Given the specific physiological conditions of pregnant women, they need to pay attention to the plans and strategies adopted to care for COVID-19 disease. Considering the possible beneficial effects of adopting self-care behaviors in health-promoting and reducing the risk of the COVID-19 epidemic, it is necessary to adopt an appropriate strategy to remove possible obstacles to managing this global epidemic.

To increase the effectiveness of interventions to promote the adoption of self-care behaviors against COVID-19 in pregnant women, it is necessary to identify the determinants of preventive and self-care behaviors in this population. Accordingly, the present study showed awareness, self-efficacy, perceived sensitivity, perceived severity, and the Cues to Action were positively correlated with the adoption of self-care behaviors. However, this correlation was reversed between perceived barriers and self-care behaviors, indicating that those with high perceived barriers are less likely to engage in self-care behaviors to prevent COVID-19. This finding is consistent with the results of previous studies (3, 22). There was no correlation between individual factors such as age, employment, and education of pregnant women with self-care behaviors.

In the present study, knowledge about the nature of coronavirus and self-care in confronting COVID-19 disease was the strongest and most effective variable, which could predict the relationship between self-care in pregnant women alone and with a variance of about 12%. It seems that due to the high prevalence of COVID-19 disease and also due to the widespread information by the mass media, radio and television channels, the Ministry of Health and the distribution of warning banners throughout the areas affected by the disease and public awareness, people are more likely to do optimal self-care behaviors to prevent COVID-19 disease (13).

The self-efficacy as the second construct of the HBM could explain the adoption of self-care behaviors in confronting COVID-19. Perceived self-efficacy had a positive and direct effect on preventive behaviors against COVID-19. The more people feel motivated, capable, and hoping to succeed in fighting the coronavirus, they show more willingness to do individual health behaviors (23). In the present study, self-efficacy was conceptualized to the extent to which a person feels that they can use self-care and preventive strategies to combat the coronavirus.

Perceived barriers construct as the third construct of the HBM was able to account for the adoption of self-care behavior. Perceived barriers represent the most important construct of the HBM with the high predictive power of behavior (24). It should be noted that the low perceived barriers are a privilege because the individuals believe that they face fewer obstacles and fewer problems in adopting self-care and preventive behaviors. Besides, the objective and psychological costs of the recommended activities are low or they are preferable due to the benefits of the behavior. Therefore, it can be suggested that by performing a series of interventions and adopting effective policies to reduce barriers as much as possible, the possibility of adopting self-care behaviors for preventing COVID-19 increases.

Perceived severity as the fourth construct of the HBM could predict the adoption of self-care behaviors in confronting COVID-19. Perceived severity is ultimately related to the perceived threat and refers to the extent to which individuals

perceive the danger and seriousness of the spread of coronavirus. This finding is consistent with the results of previous studies by Bates et al. (25), Khazae-Pool et al. (13), and Didarloo et al. (15).

Although the present study showed a positive and significant correlation between perceived sensitivity, perceived benefits, and Cues to Action in the adoption of self-care, these constructs in the model extracted from regression analysis were not confirmed as predictive constructs. In fact, if people are aware of the benefits of taking preventative behavior, they are better prepared to take activities and they more likely accept the mentioned behaviors. In other words, if a person believes that home quarantine and the use of personal protective equipment can reduce the risk of developing the disease or transmitting it to others, or have social benefits such as reducing treatment costs or potential costs to the health system of the country, they will be more likely to do self-care behaviors (26, 27).

Cues to Action can act as a stimulus received by people from the COVID-19 outbreak. This stimulus can be in the form of a clip, news of the death of people due to COVID-19, the effects and consequences of this disease on people's lives posted on mass media and social networks, or the advice and warnings of the staff of health centers (27, 28). The majority of the women in this study reported that the most important sources of information about COVID-19 were health workers and warnings from the Ministry of Health through the mass media.

Given the importance of mass media, especially in the period of growth of new technologies and virtual networks, and given the importance of non-aggregation to reduce the transfer of COVID-19, the high potentials of social media can be used for educational, awareness-raising, and behavior change purposes.

Of course, it should be noted that pregnant women's engagement in self-care can be affected by some non-behavioral environmental factors such as the availability of facilities and preventive devices, high cost of protective equipment and disinfectants, and strategies adopted nationwide, etc. By informing the community and officials and adopting useful policies and effective interventions, it is possible to increase the adoption of self-care and preventive behaviors against COVID-19. One of the limitations of this study was the use of a self-report questionnaire. Thus, by stating the objectives of the study and assuring the pregnant women that their information is confidential, an attempt was made to reduce this limitation.

## **Conclusion**

Awareness, self-efficacy, perceived barriers, and perceived severity were found in this study as the strongest predictors of self-care behaviors among pregnant women. The results of the study can be useful in planning educational and behavioral interventions to increase the adoption of self-care behaviors against COVID-19 and institutionalize health-promoting behaviors in women.

## **Declarations**

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### **Authors' contributions**

Study design: RB, AD

Data collection and analysis: RB, HN, SM

Manuscript preparation: AD, RB



## Funding

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## Availability of data and materials

The datasets generated during and/or analyzed during the current study are not publicly available due to confidentiality of data and subsequent research, but are available from the corresponding author on reasonable request.

## Ethics approval and consent to participate

Research has been presented in the ethics committee of Urmia University of Medical Sciences and has received the code of ethics (IR.UMSU.REC.1399.142). **informed** consent was obtained from all participants in this study, and all provisions of the Helsinki Statement on Research Ethics were considered.

## Consent for publication

Not applicable.

## Competing interests

None of the authors have any competing interests.

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