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# Predictive Factors of Adopting COVID-19 Preventive Behaviors Among the Urban Population: An Application of the PRECEDE Model

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## Abstract

COVID-19 is an emerging viral disease. To prevent this disease, it is necessary to investigate the factors related to its behavior. The purpose of this study was to determine the factors related to COVID-19 based on the PRECED model in patients referred to health centers in Torbat Heydariyeh in 2021. This cross-sectional study was performed among 365 individuals who were referred to healthcare centers. Data were collected using a researcher-made questionnaire based on the PRECEDE model. Data analysis was done in SPSS, applying analysis of variance and linear regression tests. Moreover, a P-value of 0.05 was considered statistically significant. This study examined demographic characteristics and their impact on behavioral factors. The mean age of participants was 32.01 ± 9.81 years, with the majority being women (72%) and married (83%). The results showed that 46% of participants were aged between 18 and 30 years, and 35.5% were aged between 30 and 40 years. The highest scores were related to the constructs of knowledge and self-efficacy, with means of 90.61 ± 16.95 and 86.39 ± 19.39, respectively, while the lowest score was related to the enabling factor, with a mean of 59.98 ± 11.49. The Kolmogorov-Smirnov test confirmed the normal distribution of the data (P>0.05). Linear regression analysis indicated that knowledge, attitude, self-efficacy, and reinforcing factors were significant predictors of behavioral factors (P<0.05). Specifically, an increase of one unit in these factors resulted in increases of 0.15, 0.33, 0.16, and 0.34 in behavioral factors, respectively. These variables were able to predict 27% of behavioral changes. The results of this study showed that women's knowledge, attitude, and practice were at a desirable level. Moreover, social support, provision of facilities and health services, and the cooperation of organizations should increase with the help of proper management to break the disease's transmission chain.

**Keywords:** COVID-19, PRECEDE Model, Human Behavior

## Introduction

The prevalence of various types of infectious respiratory diseases has always been one of the most important risk factors for human health, with the latest being the novel COVID-19 virus (3). In 2019, the first case of COVID-19 was detected in Wuhan, China, and quickly turned into a pandemic with extensive social, economic, and health consequences (1, 2). The World Health Organization (WHO) declared the disease a global epidemic on January 30th, 2020 (3, 4). One of the key factors of COVID-19 is its rapid transmission through airborne droplets, aerosols, contaminated objects and surfaces, as well as infected people's coughs and sneezes. This highlights the importance of adhering to personal and social hygiene rules (5, 6). The COVID-19 epidemic has not only been associated with a high mortality rate due to viral infection, but has also caused a psychological crisis worldwide. As of December 5, 2021, nearly 2 years since the first cases emerged, COVID-19 has infected over 265 million people in over 200 countries and territories, with at least 5.2 million deaths. Iran's first official COVID-19 case was recorded on February 19th, 2020. Based on the latest reports, there have been 6,236,567 confirmed cases and 132,152 coronavirus-related deaths reported in Iran since the start of the pandemic (7). Various studies have emphasized the role of factors affecting COVID-19 prevention behaviors. For instance, Movahed et al (8) evaluated the role of models in changing COVID-19 prevention behaviors. Notably, factors that influence and determine COVID-19 prevention methods must be identified to take preventive and control measures in this regard (9, 10). The Crisis of COVID-19 can be considered as an opportunity to identify the weaknesses of countries' treatment systems, lack of facilities, and lack of sufficient training and preparation of some people, which caused this awareness and recognition to be formed in managers and decision-makers. For this reason, it is necessary to equip hospitals more, provide medical staff with special training, and a budget should be considered for the better preparation of medical centers in countries in the post-corona period and other epidemic diseases. In this regard, it has been suggested to use behavior study models, one of the most applicable of which is the PRECEDE model. Developed by Green and Kreuter, the model has been introduced as a planning framework to identify health education and promotion requirements. According to the model, behavior change and correction should not just be emphasized from individual perspectives, and environmental and other factors affecting people's behaviors should also be taken into consideration (11, 12). The model's components include predisposing (any characteristics of a person or population that motivate making decisions about health behaviors), reinforcing (spiritual and material rewards or punishments that lead to the repeating and persistence of a health behavior) and enabling constructs (those characteristics of the environment that facilitate action and any skill or resource required to attain health behaviors) (15,16). According to educational-environmental assessment, predisposing factors are those that precede a behavioral change and motivate the performance of a behavior. These factors include knowledge, beliefs, attitudes, and values. On the other hand, enabling constructs are recognized as preliminaries of behavioral change that allow the realization of motivation or environmental policy. Examples include availability, access to resources, rules and regulations, and capabilities. Finally, reinforcing factors lead to the reinforcement of behavior and provide lasting reward to maintain the behavior (e.g., family, friends, teachers, employers, and employees). Therefore, the PRECEDE model can improve performance in preventive behaviors and can be used as a health promotion model. The model is mainly applied to determine factors related to behaviors (13, 14). This study aimed to determine the factors associated with COVID-19 disease based on the

PRECEDE model in clients of healthcare centers.

## Methods

*Study design and setting*

The present study was conducted from May to November 2021. The sample size was calculated to be 350, taking into account a type I and type II errors at 0.05 and 0.1, respectively, and d=0.05 with a P-value of 0.5 (equation below). To account for attrition and increase test power, a total of 365 individuals were included in the study. Initially, Torbat Heydariyeh city was divided into four districts. Subsequently, one healthcare center was randomly chosen from each district using stratified sampling, and the sample size was determined proportionally to the population of each center. The inclusion criteria were residency in Torbat Heydariyeh city, age over 18 years, willingness to participate in the research, and literacy. Exclusion criteria included incomplete questionnaires, inability to communicate properly, effectively, and a diagnosis of cognitive disorders.

*Data collection tool and technique*

The research tool consisted of two sections. One section focused on demographic characteristics such as age, gender, occupational status, level of education, and marital status. The other section was based on the constructs of the third stage of the PRECEDE model. The instruments included 41 "Yes/No/Don't know" questions, covering knowledge (six items), attitude (seven items), and self-efficacy (six items). Responses of yes, don't know, and no were scored with two, one, and zero, respectively. Additionally, enabling, reinforcing, predisposing (knowledge, attitude, and self-efficacy), and behavioral factors were assessed with six, five, seven, and eleven items, respectively, using a five-point Likert scale. Responses ranged from "always, frequently, sometimes, rarely, and never were scored five-zero, respectively. It is worth mentioning that some of the inverse questions were scored reversely. The primary versions of the instruments were developed based on the latest guidelines of the WHO and the Disease Management Center of the Ministry of Health of Iran. This was done by assessing relevant texts and using the opinions of eight experts in areas of health education and promotion, epidemiology, healthcare service management, infectious diseases, and environmental health. Afterwards, the content validity ratio (CVR) and content validity index (CVI) were evaluated. Some experts assessed and corrected the items, confirming their face validity from a qualitative perspective in terms of simplicity and clarity. To carry out the content quality assessment process, experts were asked to provide feedback following a qualitative evaluation of the tools based on criteria such as grammar observance, use of appropriate words, proper placement of items, and correct scoring to identify and rectify errors. Moreover, internal consistency of the constructs was evaluated, and reliability was confirmed with a Cronbach's alpha of 0.72, 0.75, 0.82, 0.80, 0.71, and 0.81 for variables of knowledge, attitude, behavioral factors, reinforcing factors, enabling factors, and self-efficacy, respectively (15).

Due to the COVID-19 situation and in adherence to healthcare protocols, the research team decided to distribute the questionnaires electronically to the participants instead of in person. As a result, two members of the research team installed the online tool and reached out to the designated healthcare centers. Upon arranging with the healthcare providers, the research objectives were explained to the clients, who were then asked to complete the questionnaires.

*Statistical analysis*

Data analysis was conducted in SPSS version 22 using frequency, mean, standard deviation, linear regression, analysis of variance, and the Kolmogorov-Smirnov test. Additionally, a P-value of 0.05 was considered statistically significant.

## Results

The mean age of the participants was 32.01 ± 9.81 years. Most of the participants were women (72%) and married (83 %). 46% of the study participants were aged between 18 and 30, 35.5% were aged between 30 and 40, and the remaining were aged between 40 and 72. 42.3% of the participants were housewives, 27% were a self-employed, 19% were employees and the rest were students. 31.4% of the participants had a university education, 35.2% had an undergraduate degree and the rest had a diploma. The highest and lowest scores, mean, and standard deviation of all constructs of the questionnaire are shown in Table 1. After equalizating scores based on a score of 100, the highest score was reported for the knowledge and self-efficacy constructs with a mean of 90.61±16.95 and 86.39±19.39, respectively. On the other hand, the lowest score was related to the enabling factor with a mean of 59.98±11.49 (Table 1). Data normality was assessed, and the Kolmogorov-Smirnov test results confirmed the normal distribution of the data (P>0.05).

In this study, linear regression was used to evaluate demographic characteristics related to the model's constructs. According to the results, there was a significant relationship between the Behavioral factor and Marital status(P=0.04). In the single group, the mean attitude score was 0.99 lower than the married group. There was a significant relationship between enabling constructs and variables of age and occupational status (P<0.05). The mean score of enabling factors was 1.70 in the age range of 18-30, and the mean score of the enabling factor in the age range of 30-40 was 1.34 higher than the age range of 40-72. Additionally, the mean score of enabling factors in housewives was 1.80 lower employees. Moreover, the linear regression results indicated a significant relationship between reinforcing construct and gender, such that the mean score of reinforcing factors in males was 0.90 higher than in females (P=0.032). A significant relationship was observed between the attitude construct and variables of age, marital status, occupational status, and level of education (P<0.05). The mean attitude score in the age group of 18-30 years was 1.23 lower than the age group of 40-72 years. In the single group, the mean attitude score was 1.06 lower than the married group. The mean score of Attitude in free work was 1.47 lower than employees (P<0.05). It is important to note that no significant relationship was observed between the knowledge construct and demographic characteristics (Table 2).

The results of the linear regression model indicate that knowledge, attitude, self-efficacy, and reinforcing factors were all significant predictive factors for behavioral factors (P<0.05) (Table 3).

**Table 1. Mean and standard deviation of standardized scores for model structures**

| Variables | Minimum | Maximum | Mean+SD |
|---|---|---|---|
| Knowledge | 0 | 100 | 90.61±16.95 |
| Attitude | 0 | 100 | 62.98±28.38 |
| Self-efficacy | 0 | 100 | 86.39±19.39 |
| Enaling factor | 20 | 85 | 59.98±11.49 |
| Reinforcing factor | 32 | 100 | 78.38±11.59 |
| Behavioral factor | 57 | 97 | 79.11±7.40 |

Table 3 shows that an increase of one unit in knowledge, attitude, self-efficacy, and reinforcing factor corresponded to a respective increase in behavioral factors of 0.15, 0.33, 0.16, and 0.34. Collectively, these variables were able to predict 27% of behavioral changes.

**Table 2. Significant demographic factors related to model structures using linear regression**

| The dependent variable | The independent variable | Category variables | The regression coefficient | p-value | Confidence interval (95%) |
|---|---|---|---|---|---|
| **Behavioral factor** | **Marital status** | Single | -0.99 | 0.04 | (-2.01, 0.02) |
| | | Married | | | |
| | **Age** | 18-30 | 1.47 | 0.005 | (0.37, 2.91) |
| | | 30-40 | 1.21 | 0.04 | (0.17, 2.45) |
| | | 40-72 | - | - | - |
| | **Profession** | self-employed | -1.21 | 0.11 | (-1.50, 0.17) |
| | | House keeper | -1.60 | 0.02 | (-2.13, -0.41) |
| | | Student | -0.48 | 0.01 | (-2.21, 1.03) |
| | | Employee | -1.11 | 0.11 | (-2.50, 0.27) |
| **Enabling factor** | **Age** | 18-30 | 1.70 | 0.007 | (0.47, 2.93) |
| | | 30-40 | 1.34 | 0.02 | (0.15, 2.54) |
| | | 40-72 | - | - | - |
| | **Job** | self-employed | -1.11 | 0.11 | (-2.50, 0.27) |
| | | House keeper | -1.80 | 0.008 | (-3.13, -0.47) |
| | | Student | -0.58 | 0.49 | (-2.25, 1.09) |
| | | Employee | - | - | - |
| **Reinforcing factor** | **Gender** | Male | 0.90 | 0.032 | (0.08, 1.72) |
| | | Female | - | - | - |
| **Attitude** | **Marital status** | Single | -1.06 | 0.040 | (-2.07, -0.05) |
| | | Married | - | - | - |
| | **Age** | 18-30 | -1.23 | 0.018 | (-2.24, -0.21) |
| | | 30-40 | -0.70 | 0.16 | (-1.69, 0.28) |
| | | 40-72 | - | - | - |
| | **Profession** | self-employed | -1.47 | 0.01 | (-2.62, -0.33) |

| | | | | | |
|---|---|---|---|---|---|
| | | House keeper | -0.99 | 0.07 | (-2.09, 0.10) |
| | | Student | -0.25 | 0.72 | (-1.62, 1.13) |
| | | Employee | - | - | - |
| **Self-efficacy** | **Education** | Less than Diploma | 0.22 | 0.95 | (-0.71, 0.75) |
| | | Diploma | 0.86 | 0.01 | (1.17, 1.55) |
| | | Academic | - | - | - |
| **Knowledge** | **Age** | 18-30 | 1.47 | 0.43 | (0.37, 1.93) |
| | | 30-40 | 1.24 | 0.17 | (0.25, 2.23) |
| | | 40-72 | - | - | - |
| | **Education** | Less than Diploma | 0.25 | 0.75 | (-0.61, 0.85) |
| | | Diploma | 0.76 | 0.32 | (1.27, 1.44) |
| | | Academic | - | - | - |
| | **Gender** | Male | 0.70 | 0.24 | (0.11, 1.72) |
| | | Female | - | - | - |

**Table 3. Investigating the relationship between behavior structures and other model constructs**

| **Model Constructs** | **B** | **Std. Error** | **Beta** | **t** | **P** | **$R^2$** |
|---|---|---|---|---|---|---|
| **Knowledge** | 0.148 | 0.072 | 0.107 | 2.06 | 0.04 | 0.277 |
| **Attitude** | 0.330 | 0.050 | 0.339 | 6.61 | <0.001 | |
| **Self-efficacy** | 0.157 | 0.071 | 0.110 | 2.21 | 0.02 | |
| **Enabling factor** | -0.185 | 0.044 | 0.102 | -1.94 | 0.05 | |
| **Reinforcing factor** | 0.337 | 0.057 | 0.293 | 5.95 | <0.001 | |

*** Significance at 95% confidence level**

## Discussion

According to the results, there was, no significant association between knowledge and the variables of age, level of education, and gender. This finding is consistent with the results obtained by Ranjbar Roghani et al (16) Zhong et al (17) and Albahri et al (18). A study in Egypt showed that the level of knowledge among women was significantly higher than that of men. This difference could be attributed to various factors such as education, access to healthcare, and social norms (19). In contrast, a study in India found no significant difference in knowledge scores between men and women, suggesting that other factors may be influencing this context (20).

Our findings demonstrated a significant difference between the attitudes and demographic characteristics of the participants, such as age, educational status, and marital status. These findings align with those of Salahshouri et al (21) and Roghani et al (16). In a study by Kasemy et al (19) and Albahri et al (18), there was no significant difference between different age groups regarding attitude scores. Self-employed, retired, and unemployed individuals exhibited lower level of knowledge and attitude scores compared to other occupational groups. Furthermore, a significant relationship was found between COVID-19 prevention behaviors and variables such as age, occupational status, and marital status of the participants. It was observed that adherence to COVID-19 prevention behaviors was more pronounced in individuals aged 30-40 years and government employees. This could be attributed to the higher level of education among government employees, as well as the increased communication and specific regulations regarding the disease in the workplace. These results are consistent with findings from Shams Ghahfarokhi et al., who also demonstrated higher performance scores among employees compared to other occupational groups. The mean score for COVID-19 prevention behaviors was at a favorable level, aligning with previous studies (22, 23). This high level of preventive performance might be attributed to the subjects' extensive knowledge, as they scored 90% on the knowledge assessment, which likely influenced their behavior positively. This effect could be even more pronounced when coupled with a positive attitude. Furthermore, the subjects achieved a high self-efficacy score, indicating their confidence in their ability to engage in preventive behaviors. In the present research, the score of reinforcing factors was favorable. These factors can generally lay the foundation for creating motivation to repeat and continue preventive behaviors. Social support, the influence of peers, important individuals, references, and alternative rewards are among these factors. The majority of subjects believed that their family members would warn them if they did not adhere to health protocols outside the house, or they would follow their physician's recommendations if diagnosed with underlying diseases such as diabetes, cardiovascular diseases, and cancer. Several studies have emphasized the role of reinforcing factors in promoting preventive behaviors (11, 12, 24, 25).

In the current research, the mean score of enabling factors was at a moderate level, with 59% of participants achieving the full score. Enabling factors represent the preliminary stage of environmental change or behavior that fosters motivation for such changes. These factors can directly and indirectly influence behaviors, as well as overall environmental behavior. New skills for altering behaviors, along with programs, services, and resources necessary to achieve behavioral and environmental outcomes, are included among these factors. In this study, 70% of individuals had access to personal protective equipment (masks and gloves) at their residence, and 22.4% indicated that the necessary facilities and health services had been provided by relevant organizations following the onset of the COVID-19 epidemic. Therefore, it can be inferred that to control and prevent COVID-19 disease and encourage preventive behaviors, there must be significant cooperation among organizations, managers, policymakers, and religious leaders, especially in Iranian society, in addition to the role of individuals. Various studies have emphasized the role of enabling factors in promoting preventive behaviors (26, 27). In the present study, the most important predictors of behavior were attitude and knowledge, respectively, which align with other studies (12, 28). One of the major drawbacks of the present study was that female subjects who had infants when visiting the center faced challenges in completing the questionnaire due to their childcare responsibilities. Although women’s knowledge, attitude, and practice were at a favorable level, the results regarding social support and the provision of health facilities and services, along with the contributions of other organizations,

suggest that these factors should be more prominent to effectively halt the transmission of this disease through proper management.

Differences in data and results can lead to discrepancies for several reasons. One of the main reasons is the existence of unobservable confounding variables that were not included in our analyses and could have a large impact on behavior or results. Also, data collection methods, such as using different questionnaires or different samples, can lead to discrepancies. In addition, cultural and social factors also influence people's attitudes and beliefs and can influence how they respond. Finally, the strengths and weaknesses of the models used in the analyses can also affect the accuracy of predictions. Therefore, understanding these differences and examining them carefully can help to better analyze the data and results and provide necessary improvements in future studies.

## Conclusion

The results confirm the role of predisposing factors (knowledge, attitude, self-efficacy) and reinforcing factors for COVID-19 preventive behaviors according to the PRECEDE Model. Raising awareness of people's abilities as well as reinforcing factors such as healthcare workers, family members, friends, and relatives, and providing appropriate role models for them can be used as factors to promote preventive behaviors from COVID-19.

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## Conflicts of Interest

No potential conflict of interest was reported by the authors

## Ethics approvals

This study was approved by the Ethics Committee of Torbat Heydariyeh University of Medical Sciences (Code: IR.THUMS.REC.1399.018). All phases of this study were based on the ethical principles of human medical research (Helsinki Declaration). Each patient or their respective families provided informed consent.

## Authorship statement

All authors contributed equally to this study by providing substantial input to the conceptualization or design of the research, analysis, and interpretation of data; drafting the manuscript; and giving final approval for the publication of the manuscript's final version.

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