

Predicting Covid-19 Prevention Behaviors Based on the Health Belief Model among the Students of Nursing and Midwifery Faculty of Zanjan City

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Abstract

Background: The epidemic of respiratory diseases and their complications and mortalities have always been considered one of the health threats to humans.

Objectives: This study aimed to identify the predictors of Covid-19 prevention behaviors based on the health belief model among the students of the Nursing and Midwifery Faculty of Zanjan City in 2021.

Methods: This cross-sectional descriptive study was conducted on 294 nursing students recruited using the convenience sampling method. A three-part questionnaire addressing demographic characteristics, the health belief model, and preventive behaviors were used. The questionnaire was provided to the participants via sharing on social media. For statistical analysis, the independent t-tests, ANOVA, Pearson's correlation, and regression were conducted in SPSS v.22 software.

Results: The mean (SD) of preventive behaviors and health belief scores were 42.36 (3.23) and 113.11 (10.07), respectively. The highest and lowest scores were related to the constructs of perceived benefits (3.82 from 5) and perceived barriers (3.003 from 5), respectively. According to Pearson's correlation coefficient, preventive behaviors had a direct and statistically significant correlation with the perceived sensitivity, perceived intensity, perceived benefits, self-efficacy, and action guide constructs ($P < 0.05$). The constructs of perceived sensitivity, perceived intensity, self-efficacy, and action guide predicted 13%, 9.7%, 22%, and 19.4% of the variance in preventive behaviors, respectively.

Conclusion: Based on the findings of the present study, self-efficacy was the most prominent construct predicting COVID-19 prevention behaviors among students. Therefore, methods that enhance self-efficacy, such as boosting awareness and empowerment strategies, can be employed to manage the preventive behaviors of students during infectious emerging diseases.

Keywords: *health belief model, health behavior, preventive behavior, covid-19, student*

Introduction

Acute respiratory syndrome is a virus-caused disease affecting the respiratory system and rendering a high mortality rate [1,2]. In December 2019, patients were identified with pneumonia of unknown origin in Wuhan, China. The investigations carried out by the experts of the

World Health Organization (WHO) confirmed the causative agent of this pneumonia to be the SARS-CoV-2 virus, which was then referred to as Covid-19. The Covid-19 disease has posed a considerable threat to public health, nurturing deep concerns among people with regard to its extent and severity. Finally, this disease was

declared a pandemic by the WHO [3]. According to WHO statistics, 599 million contractions and 6.48 deaths were approved to be caused by Covid-19 from December 2019 to the end of May 2022, of which 7.52 million contractions and 144,000 deaths were related to Iran [4].

Studies on previous epidemics, such as influenza and SARS, have shown that factors such as perceived risk, transmission rate, mortality rate, and disease-related stress experienced can role as important players in the adaptation of preventive behaviors by people [5]. On the other hand, strategic plans for boosting adherence to preventive behaviors during epidemics can help health policymakers in various countries improve public health in society [6]. One of the communicable disease prevention programs is to boost the awareness of at-risk people of health precautions and preventive behaviors [7], such as the proper use of personal protective equipment (PPE), including choosing the appropriate PPE, being trained on how to wear, remove, and discard them, and other preventive measures [8]. Besides, evaluating people's awareness and perception of Covid-19 prevention and protective measures can be an important part of management strategies against this disease [9], further highlighting the importance of recognizing the predictors of preventive behaviors for proper health planning and preventing and controlling this disease [10].

The first step in health planning is to choose a suitable model for training preventive behaviors [11]. Various models have already been developed for risk understanding and control, as well as identifying factors related to protective behaviors in such conditions to help implement health recommendations and control the disease [12]. One of these frameworks repeatedly used to advance health promotion programs and predict disease prevention behaviors is the health belief model (HBM). This model is able to predict and explain individuals' changes in health-related behaviors [13]. The HBM reiterates that people's perception of a threat increases their motivation to adopt preventive behaviors. According to the HBM model, in order to adopt preventive behaviors, a person must first feel endangered by a problem (perceived sensitivity), then perceive the severity and seriousness of the threat (perceived severity), and based on the positive

signs receiving from the environment (action guide), acquire trust in the applicability of preventive measures (perceived benefits) and the cost-effectiveness of benefits over obstacles (perceived obstacles), finally leading to the adopting of the preventive behavior. In addition, a positive judgment about one's abilities in adopting preventive behaviors can expedite the process by nurturing the feeling of the need to adhere to preventive behaviors [14].

Numerous studies have been conducted investigating the predictive power of HBM constructs in predicting adherence to preventive behaviors among different social groups, but fewer studies have been conducted on students [15-17]. Khazaei Pool et al. (2020) explored the predictors of Covid-19 prevention behaviors in Mazandaran province of Iran based on HBM constructs, reporting that the constructs of this model could plausibly predict these preventive behaviors [11]. Karl et al. (2021), in their study on Covid-19 prevention behaviors, showed that there was a direct and significant relationship between preventive behaviors and HBM constructs [18].

Considering the nature of their job, it is essential for healthcare workers to adhere to disease prevention behaviors. As members of health teams, medical students should be aware of and believe in the principles of preventive behaviors so that they can protect their own and their patient's health and prevent the transmission of infection to others. Korina et al. (2020), in a study on Indonesian nursing students, argued that these students needed to improve their performance in terms of preventive behaviors [19]. Since we found no study on the factors affective the adherence of medical students to preventive measures during the covid-19 pandemic, this study was designed to ascertain the predictors of Covid-19 prevention behaviors based on HBM constructs among our students in the Nursing and Midwifery Faculty of Zanjan city in 2021.

Methods

We employed a cross-sectional descriptive study design. The formula specialized for determining the sample size based on the correlation coefficient ($r=0.10$) was used to estimate the number of students required. Considering adjustments for a given population (470 students), the sample size was determined as $n=294$. Finally,

taking into account an attrition rate of 20%, the total sample size was extended to $n = 353$.

After acquiring the necessary permits from the Zanjan University of Medical Sciences and ethical approval from the institutional ethics committee (ethics code: IR.ZUMS.REC.1400.397), participants were recruited by convenience sampling online. Via a WhatsApp group created by the representative of each class, the objectives of the research were shared with nursing, operation room, anesthesia, and midwifery students. Then the researcher shared the link to the questionnaire in the WhatsApp group. Students suffering from Covid-19 (self-reporting) were not included in the study. The data were collected between February to May 2021. A total of 129 nursing students, 67 operating room students, 57 anesthesia students, and 100 midwifery students participated in the study. Completing the questionnaire was regarded as consent to participate in the research. Students who did not respond to more than 20% of the items were excluded from the study.

In order to collect data, a three-part questionnaire was used. The first part addressed demographic data (age, sex, the student's or his/her family members' history of contact with a Covid-19 patient, history of vaccination, history of consuming immunosuppressive drugs, etc.). The other parts of the data collection instrument included the HBM questionnaire and the preventive behavior scale.

The HBM questionnaire's validity and reliability were approved by Khazai-Pool et al. (Cronbach's alpha coefficient= 85.7) [11]. In the present study, we used the revised and extended version of this questionnaire developed by Khazai-Pool et al. This modified tool included 34 items and six constructs scored on a 5-point Likert scale ranging from 1 to 5 (i.e., completely agree, agree, no idea, disagree, and completely disagree). The constructs included perceived sensitivity (scores 5 to 25, cutoff point = 15), perceived intensity (scores 8 to 40, cutoff point = 24), perceived benefits (scores 6 to 30, cutoff point = 18), perceived barriers (scores 10 to 50, cutoff point = 30), self-efficacy (scores 2 to 10, cutoff point = 6), and action guide (scores 3 to 15, cutoff point = 9). The items related to perceived barriers were reverse-scored. The lowest score for each person was 34, and the highest score was 170. A mean

score above the cutoff point for each construct was considered a high level. The reliability of the tool in the present study was confirmed based on Cronbach's alpha coefficient, which was obtained as 0.85 for perceived sensitivity, 0.86 for perceived intensity, 0.93 for perceived benefits, 0.87 for perceived barriers, and 0.90 for perceived self-efficacy.

The revised, extended version of the Covid-19 preventive behavior questionnaire was developed according to the Covid-19 preventive behaviors scale of Shahnazi et al. and tailored to the principles and preventive measures issued by the WHO to confine the spread of this disease. Shahnazi et al. reported a reliability coefficient of 0.89 and acceptable validity [20]. The tool used in this study contained 19 items, which were scored on a 3-point Likert scale (never = 1, sometimes = 2, always = 3). The lowest obtainable score on this scale was 19, and the highest score was 57. A mean score above 38 indicated a desirable level of preventive behaviors. In the present study, the tool's reliability was confirmed based on Cronbach's alpha coefficient of 0.93. Also, the quantitative content validity of both questionnaires was approved (CVR=0.61 and CVI=0.82 for the health belief questionnaire; CVR=0.78 and CVI=0.85 for the preventive behaviors questionnaire). The qualitative content validity of both questionnaires was also confirmed based on the opinions of 15 experts.

The data collected were analyzed using SPSS version 22 software. According to the Kolmogorov-Smirnov test, the data had a normal distribution. In order to compare means, the independent t-test and one-way ANOVA were used. The relationship between quantitative variables was assessed using Pearson's correlation coefficient, and multiple regression was used to adjust for background variables. A significance level of $P < 0.05$ was considered for all statistical tests.

Results

A total of 294 students of the Nursing and Midwifery Faculty of Zanjan University of Medical Sciences, with an average age of 22.21 (2.4) years, participated in this study. Most of the students were female (74.8%) and single (95.6%) and had sufficient income (64.7%). Most of the students were studying nursing (36.4%) in the

second semester (21.1%), living in a dormitory (57.8%) (Table 1).
(56.5%), and were non-natives to Zanjan province

Table 1: Individual and Social Characteristics of the Students of the Nursing and Midwifery Faculty of Zanjan University of Medical Sciences

Variables	category	Frequency	Percentage
Gender	Male	74	25.2
	Female	220	74.8
Marital Status	Single	281	95.6
	Married	13	4.4
Occupation besides studying	Yes	42	14.3
	No	252	85.7
Income	Adequate	190	64.7
	Somehow adequate	93	31.6
	Inadequate	11	3.7
Field of study (Bachelor of Science)	Nursing	107	36.4
	Midwifery	83	28.25
	Operation room	56	19
	Anesthesia	48	16.35
Semester	2 nd	62	21.1
	3 rd	19	6.5
	4 th	60	20.4
	5 th	19	6.5
	6 th	60	20.4
	7 th	18	6.1
	8 th	56	19
Homeland	City	280	95.2
	Village	14	4.8
Residence	Dormitory	166	56.5
	Own house	128	43.5
Native of Zanjan Province	Yes	124	42.2
	No	170	57.8

Most students had a history of direct contact with Covid-19 patients (77.9%) and had already contracted Covid-19 (66.3%). In 76.9% of the students, at least one of their family members had

a history of contracting Covid-19. The majority of the participants had been vaccinated for Covid-19 (99%), and about 63% of them had injected three doses of Covid-19 vaccines (Table 2).

Table 2: Health-Related Characteristics of the Students of the Nursing and Midwifery Faculty of Zanjan University of Medical Sciences

Variables	Category	Frequency	Percentage
Covid-19 vaccination history	Yes	291	99
	No	3	1
Dose of vaccine received	0	3	1
	1	5	1.7
	2	101	34.4
	3	185	62.9
Underlying disease	No	284	96.5
	Asthma	4	1.4
	Allergy	2	0.7
	Diabetes	4	1.4
	None	235	79.9
Underlying disease in family members	Hypertension	23	7.8
	Cardiovascular disease	9	3.1
	Renal disease	3	1
	Diabetes	17	5.8
	Asthma	3	1
	Pulmonary disease	1	0.35
	Rheumatoid arthritis	2	0.7
	Malignancy	1	0.35
History of using immunosuppressive drugs	Yes	10	3.4
	No	284	96.6
History of contracting Covid-19	Yes	195	66.3
	No	99	33.7
History of contracting Covid-19 in family members	Yes	226	76.9
	No	68	23.1

In this study, the mean (SD) of the total HBM score was 113.1 (10.07) out of the attainable range of 34-170. Regarding normalized means, the highest and lowest scores were related to the constructs of perceived benefits (3.82 out of 5)

and perceived obstacles (3.003 out of 5), respectively. Also, the mean (SD) of the total preventive behavior score was obtained as 42.36 (3.23) out of the achievable range of 19-57 (Table 3).

Table 3: Mean and Standard Deviation of the Total Scores of the Health Belief Model, Its Constructs, and Preventive Behaviors in the Students of the Nursing and Midwifery Faculty of Zanjan University of Medical Sciences

Construct	Attainable score range	Min	Max	Mean	SD	Adjusted mean*
Perceived sensitivity	5-25	5	24	18.96	2.47	3.79
Perceived intensity	8-40	15	40	27.81	3.5	3.47
Perceived benefits	6-30	9	30	22.95	3.4	3.82
Perceived barriers	10-50	10	50	30.03	6.14	3.003
Self-efficacy	2-10	3	10	7.33	2.15	3.66
Action guide	3-15	3	15	11.07	2.3	3.68
Total HBM score	34-170	66	168	113.11	10.07	-
Total preventive behavior score	19-57	33	56	42.36	3.23	-

HBM: health belief model

*Adjusted mean: the sum of the scores of each subscale divided by the number of its items

According to our findings, the total HBM score was interpreted as high in most of the students

(87.4%). Regarding the construct of perceived obstacles, 52.7% of the participants attained low

scores; however, most of the students achieved high scores in terms of perceived intensity, sensitivity, benefits, and self-efficacy, as well as

action guide constructs. Finally, the majority of the students (89.1%) had satisfactory performance regarding preventive behaviors (Table 4).

Table 4: The Categorical Distribution of the Total Health Belief Score and the Scores of Its Constructs

Variables	Frequency	Percentage
Perceived sensitivity	Low (5)	102
	High (25)	192
Perceived intensity	Low (8)	40
	High (40)	254
Perceived benefits	Low (6)	32
	High (30)	262
Perceived barriers	Low (10)	155
	High (50)	139
Self-efficacy	Low (2)	97
	High (10)	197
Action guide	Low (3)	75
	High (15)	219
Total score of health belief model	Low (34)	37
	High (170)	257
Preventive behaviors	Non-satisfactory (19)	32
	Satisfactory (57)	262

According to the results, there was a statistically significant difference in the mean preventive behavior score only based on gender ($p=0.022$), history of contracting Covid-19 ($p=0.037$), and vaccination history ($p=0.011$), so females, those with a negative history of Covid-19 contraction, and students vaccinated for Covid-19 obtained the highest mean scores.

According to the results of Pearson's correlation, there was a direct and significant correlation between the mean scores of HBM and preventive behaviors ($r=0.161$, $p=0.006$). Among HBM constructs, perceived sensitivity ($r=0.187$, $p<0.001$), perceived intensity ($r=0.186$, $p<0.001$), perceived benefits ($r=0.213$, $p>0.001$), perceived barriers ($r=-0.086$, $p=0.141$), self-efficacy

($r=0.472$, $p<0.001$), and action guide ($r=0.321$, $p<0.001$) were positively and significantly correlated with preventive behaviors.

Based on the results of multiple regression analysis, HBM constructs were able to predict 31.9% of the variance of Covid-19 prevention behaviors. The self-efficacy construct was the strongest predictor for adopting Covid-19 prevention behaviors, and the constructs of perceived sensitivity, perceived intensity, self-efficacy, and action guide could predict 13%, 9.7%, 22%, and 19.4% of the variance of preventive behaviors, respectively. Other predictors of Covid-19 prevention behaviors were disease-related variables such as the history of Covid-19 contraction and vaccination (Table 5).

Table 5: The Predictive Value of the Health Belief Model Constructs, Demographic Variables, Vaccination History, and History of Covid-19 Contraction for Adapting Preventive Behaviors Among the Students of the Nursing and Midwifery Faculty of Zanjan University of Medical Sciences

Dependent variable	Variables	Regression coefficient	Standard error	Adjusted R	P value
Preventive Behaviors	Intercept	32.98	2.72	-	0.000
	Perceived sensitivity	0.13	0.059	0.119	0.028
	Perceived intensity	0.97	0.05	0.104	0.046
	Perceived benefits	0.043	0.043	0.045	0.559
	Perceived barriers	-0.018	0.03	-0.034	0.417
	Self-efficacy	0.22	0.112	0.364	0.000
	Action guide	0.194	0.067	0.152	0.004
	Gender	-0.693	0.375	-0.093	0.065
	Vaccination history	-3.613	1.61	-0.112	0.026
	History of Covid-19 contraction	0.846	0.437	0.124	0.015
	F=14.76, R²=0.319, R=0.656				

Discussion

The aim of this research was to identify the predictors of Covid-19 preventive behaviors in the students of the Nursing and Midwifery Faculty of Zanjan University of Medical Sciences based on the health belief model. We found that the HBM constructs of perceived sensitivity, perceived intensity, self-efficacy, and action guide could explain the variance of Covid-19 preventive behaviors, among which the self-efficacy construct was the strongest predictor.

The results of our study showed that most of our participants had a high level of perceived sensitivity. In line with this observation, Khazaeipool et al. (2020), in a study in the Mazandaran province of Iran, reported that the majority of their participants had high levels of perceived sensitivity [11]. In the study of Noughabi et al. (2021), most participants had high perceived sensitivity as well [21]. A high level of perceived sensitivity indicates a high perception of the Covid-19 threat. Therefore, people's perception of the risk of exposure to Covid-19 encourages them to adopt preventive behaviors.

The perceived severity score was high in most of the students participating in this. This finding was consistent with the observations of Khazaeipool et al. (2020), Noughabi et al. (2021), and Najimi et al. (2010) [11,21,22]. The high perceived intensity observed in this study can be due to the fact that medical and nursing students, due to direct contact with Covid-19 patients and witnessing their death, perceive the risk of this disease as

imminent. Also another possible reason for this finding can be the high awareness of medical students of the Covid-19 infection and its complications.

The findings of the present study showed that most students acquired high scores in the construct of perceived benefits, which was in line with the results of previous studies [11,23,24]. It seems that medical students' adequate knowledge about the Covid-19 disease has been able to deviate their beliefs and attitudes toward the benefits of adopting preventive behaviors against this disease. Another reason for this can be the extensive sharing and broadcasting of information about the Covid-19 disease in universities, national TV, and social media, stressing that the only effective measure against this disease is to observe personal hygiene [25,26].

According to the results obtained, most of our participants attained low scores in the construct of perceived barriers. In agreement, Tsai et al. (2021), in a study on nursing students in Taiwan, reported that the mean score of perceived barriers was low [27]. The low score in the construct of perceived barriers can be considered an advantage, meaning that people believe that they would encounter fewer obstacles and problems when adopting preventive behaviors and face not much objective and psychological costs by performing the activities recommended. In other words, they consider these measures to be cost-effective. Therefore, there is a need for suitable interventions and futuristic policies to reduce the

barriers to adopting preventive behaviors as much as possible [11].

The self-efficacy score was high in most of our participants. In another study, Tsai et al. reported that the self-efficacy score of nursing students was high [27], which was in agreement with the results of the present study. It appears that the high self-efficacy score of medical students can be attributed to their knowledge, clinical experiences, skills, and professional capabilities in dealing with the Covid-19 disease.

According to our results, most of the students enrolled in this study obtained high scores in the action guide construct. Similar to our finding, Han et al. (2021), in their study conducted on nursing students, reported a high score for the action guide construct of the HBM [28]. Most of the students participating in this study reported that their main source of obtaining information about Covid-19 was social media, which was in accordance with the reports of Shahnazi et al. and Khazaipool et al. [11,21]. Considering the importance of mass media, especially in the era of expansion of new technologies and social networks, it is essential to use the potential of social media and cyberspace to deter large gatherings and confine the transmission of Covid-19, as well as to educate the public and increase people's awareness so that they adapt health-promoting and preventive behaviors against this disease.

Our results also showed that most of the students participating in the present study had satisfactory adherence to preventive behaviors. In line with this finding, Albaqawi et al. (2020) studied 1226 nursing students from seven universities in Saudi Arabia and declared that most of these students always adhered to Covid-19 preventive behaviors [29]. The reason for the high level of adherence to preventive behaviors among medical students can be their awareness and positive attitudes regarding the effectiveness of these behaviors. Besides, these students have had the experience of direct contact with Covid-19 patients in hospitals, witnessing large inflows of Covid-19 patients during pandemic waves in the country.

Also, the results of Pearson's correlation showed that there was a direct and significant correlation between preventive behaviors and the construct of perceived sensitivity, which was in line with the reports of Rabin et al. (2022), Fattahian-Dastgerdi

et al. (2021) and Mirzaei et al. [17,30,31]. Also, Teymouri et al. (2021), in a study in the Kermanshah province of Iran, confirmed a direct and significant correlation between preventive behaviors and perceived sensitivity [32]. In the creation of perceived sensitivity, people's levels of knowledge and awareness contribute a key role, justifying the correlation observed between perceived sensitivity and preventive behaviors among our students.

The findings of the present study showed that preventive behaviors had a significant positive relationship with the construct of perceived intensity, which was in line with the findings of a previous study [17]. The perceived intensity construct of the health belief model reflects an individual's belief in the consequences of a disease or a harmful condition [33]. Therefore, people's perceived risk of exposure to Covid-19 can encourage them to adopt preventive behaviors.

Our findings in the present study revealed a direct and significant relationship between the mean scores of preventive behaviors and perceived benefits. Evidence shows that behavior change occurs when perceived benefits surpass perceived barriers [31,32]. In the present study, the mean score of the perceived benefits in our students was higher than their mean score of perceived barriers. The results of previous studies agree with ours, noting that most of their participants believed that following Covid-19 preventive health guidelines (e.g., not attending parties or commuting to crowded places, wearing a face mask, keeping social distance, etc.) was effective and applicable in reducing the risk of contracting the Covid-19 disease [11,15,23,33]. It required extensive informing of society and creating appropriate public awareness regarding not only the personal benefits of following Covid-19 preventive health instructions but also consequential familial and social benefits. In this way, it will be possible to improve people's attitudes toward and elucidate for them the benefits of preventive behaviors.

In this study, the self-efficacy construct attained the strongest relationship with Covid-29 preventive behaviors. Consistent with this finding, Khazaipool et al. and Nougabi et al. also reported that the self-efficacy construct had the strongest correlation with preventive behaviors [11,21], confirming our observation. The explanation for

this phenomenon can be related to the fact that people with high self-efficacy feel more commitment to their interests and a sense of contribution to their activities.

Based on the results of regression analysis, the constructs of the health belief model were able to predict 31.9% of the variance of Covid-19 preventive behaviors. The perceived sensitivity, perceived intensity, self-efficacy, and action guide constructs predicted 13%, 9.7%, 22%, and 19.4% of preventive behaviors, respectively. As noted, the construct of perceived self-efficacy was the strongest predictor of adherence to Covid-19 preventive behaviors. Likewise, Khazaipool et al. reported that the constructs of the health belief model were able to predict 26% of the variance of Covid-19 preventive behaviors, where the construct of self-efficacy was found to be the strongest predictor [11], which was in parallel with our finding. Fattahian et al. also showed that the health belief model was able to predict Covid-19 preventive behaviors in adolescents, with the self-efficacy construct being the strongest predictor [30], affirming our observation. It seems that the relatively high awareness of medical students regarding the Covid-19 disease could enhance their self-efficacy and positive beliefs with regard to preventive behaviors, influencing their behaviors and escalating their adherence to preventive measures.

Among the limitations of the present study, one can note the effect of some personality traits, interpersonal differences, and mental and psychological states of the participants on their responses to the questionnaires. So, adequate time was given to the participants for completing and returning the questionnaires so that they could respond to questions in a desirable mental and physical condition. It is recommended that other behavior modification models, such as the protection motivation and planned behavior theories, be used to predict Covid-19 preventive behaviors in future studies, and finally, appropriate health plans and modifications be implemented based on the strongest predicting model.

Conclusion

The findings of the present study showed that our students benefited from desirable levels of adaptation to Covid-19 preventive behaviors, and

these behaviors could be predicted based on the HBM constructs of perceived sensitivity, perceived intensity, and self-efficacy. Therefore, it is recommended to evoke this model for designing theory-based health interventions and managing preventive behaviors.

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Conflict of interest

The authors declared that they have no conflict of interest regarding this article.

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Authors' contributions

All authors contributed equally to this study.

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