

# COVID-19 Preventive Behaviors in Pre-hospital Emergency Personnel: Application of Protection Motivation Theory

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## Research

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## Abstract

**Background:** Pre-hospital emergency personnel plays a critical role in providing communities with essential medical care during the corona pandemic. Emergency medical services (EMS) are at the forefront of the health care system, and they are the first treatment group associated with COVID-19 patients to transfer suspected and known COVID-19 patients to medical centers. This study aims to investigate the factors affecting COVID-19 preventive behaviors in pre-hospital emergency personnel in Fars province, Iran based on protection motivation theory.

**Methods:** This cross-sectional, web-based survey was conducted on 650 pre-hospital emergency personnel in Fars province in 2020. Data were collected by a questionnaire consisting of demographic information, protection motivation theory, and COVID-19 preventive behaviors.

**Results:** 650 employees of Fars pre-hospital emergency and emergency bases participated in the study. The average age of participants in the study  $45.14 \pm 10.37$  years. There was a positive and significant correlation between preventive behaviors and constructs of the PMT model, including perceived susceptibility, severity, response efficacy, self-efficacy, response cost, and protection motivation. The response cost and protection motivation (behavioral intention) had the lowest and highest percentage of the mean from the maximum obtainable score among structures of the model, respectively. Perceived vulnerability, perceived severity, self-efficacy, and protection motivation (behavioral intention) are the strongest predictor of behavior. The variables predicted 61.3% of the variance of coronavirus preventive behaviors.

**Conclusion:** The results of this study confirm the role of protection motivation theory in adopting preventive behavior of pre-hospital emergency personnel, it is suggested that interventional training be held with this theory, and facilitating protective behaviors as a principle in education should be considered.

## Background

Coronavirus (COVID-19) is a new respiratory system disease that causes an epidemic with influenza-like symptoms such as fever, cough, runny nose, sore throat, shortness of breath, and excessive fatigue[1]. The virus is transmitted through direct contact with the respiratory drops of the infected person (sneezing and coughing) and contact with the infected surface of the virus[2]. The virus can survive on surfaces for a long time. But simple disinfection can eliminate it[3]. The virus was first detected in December 2019 in Wuhan, China's Hubei Province. Coronaviruses belong to the family of viruses that cause disease in humans (and a small number of them in other mammals) and may be transmitted to humans or humans through animals[4]. The Director-General of the World Health Organization (WHO) declared the coronavirus outbreak a public health emergency and international concern[5]. The virus has now spread in many countries. While there is still insufficient information about the covid19 virus, the number of patients caused by the virus is increasing and the mortality rate is 4.63%, and this rate varies in different countries[2]. Countries with shortages of healthcare equipment may be at greater risk of the disease[6].

In the Middle East and North Africa region, Iran is the country with the most conflict with COVID-19[7–9]. And is one of the countries where the virus spreads rapidly. As of January 10, 2021, 1,286,406 infections and 56,171 deaths in Iran were confirmed due to COVID-19[10, 11], the Iranian Ministry of Health reported.

Emergency medical services (EMS) are at the forefront of the health care system, and they are the first treatment group associated with COVID-19 patients to transfer suspected and known COVID-19 patients to medical centers[12]. According to the official statistics of the Emergency Organization of Iran, contact with the emergency services has quadrupled since the outbreak of the coronavirus. 4300 emergency personnel infected with covid-19, and four emergency personnel have died serving COVID-19 patients[13].

The safety of health care personnel, including emergency medical technicians (EMT), is also very important in protecting them from the virus and preventing virus transmission. Therefore, understanding the behaviors of health care personnel in wearing appropriate personal protective equipment (PPE) is very important in preventing COVID-19.[14–16].

Many studies have been conducted in this field. Lynch et al. conducted a study of the American Infectious Diseases association's recommendations on using PPE to protect healthcare personnel from suspected or known COVID-19 patients. As a result, using direct and indirect evidence, was able to provide 8 specific questions about the use of PPE for health care personnel to care for suspected or known COVID-19 patients. However, in the future PPE recommendations in response to new evidence may need to be corrected[13].

The Centers for Disease Control and Prevention (CDC) in the United States conducted a similar study on the use of PPE to prevent COVID-19 in health devices. As a result, since Health Care Personnel (HCP) are at greater risk in caring for COVID-19 patients, appropriate PPE should be provided, including gloves, masks, and gowns by standards. And be trained in this regard[2].

Michael Holland et al. conducted a study on the use of PPE for emergency physicians in cases of COVID-19 exposure. As a result, EMS doctors and emergency medical technicians (EMT) must meet PPE standards while caring for suspected or known COVID-19 patients, and after completing the duties of caring and transferring patients and before entering clean areas, personnel must take out and dispose of their PPE. Hand hygiene to prevent contamination of clean areas[17].

Sun Huh conducted a study on how to train health personnel to protect themselves against new coronavirus infections when caring for patients and suspected cases of the disease. As a result, health personnel should use personal protective equipment for their safety, and since they are psychologically stressed due to increased working hours and reduced rest time, they should be psychologically supported, and guidelines should be integrated into medical institutions to train health personnel[18].

In this regard, the World Health Organization (WHO) has identified education as one of the most important components of prevention programs[19].

Experts also believe that one of the reasons for failure in educational programs is the lack of attention to analytical studies and their lack of ability to consider psychosocial patterns as an intellectual framework in educational planning. Protection motivation theory is one of the theories of health education and health promotion that has been used in various studies to predict health-related behaviors. This theory was proposed by Rogers in 1975 to explain the effects of fear on health attitudes and behaviors. In this model, it is assumed that the acceptance of health behavior (protective behavior) recommended against health risk is a direct act of motivation to protect oneself[20]. Rogers argued that fear, through the five constructs, influences protective

motivation (or intent to engage the technician in protective behavior against health hazards), and ultimately the protective motivation triggers health behavior[20].

These five constructs are: (1) Perceived vulnerabilities; a person's belief that he or she is vulnerable to a health hazard. (2) Perceived severity; the belief in the danger is serious; (3) Perceived response efficiency; one expects that a consistent response (protective behavior against health risk) can eliminate the risk; (4) Perceived response costs; a person's estimate of any costs (such as money, person, time, and effort) associated with engaging in protective behavior. (5) Perceived self-efficacy; belief that one can successfully perform protective behavior[21].

Bashirian et al. conducted a study to predict preventive behaviors of health care personnel (HCWs) toward COVID-19 based on protection motivational theory (PMT). This cross-sectional and analytical study was conducted on 761 health care personnel in Hamadan using multistage random sampling method, and this study showed that there are protective behaviors toward COVID-19 in relatively favorable amounts among HCWs, and therefore, based on PMT, employees' self-efficacy and their knowledge about the effectiveness of protective behaviors in designing employee training programs were recommended[22].

Considering the importance of coronavirus and the increasing prevalence of covid-19 and the risk of emergency personnel, this study aimed to determine the factors affecting COVID-19 preventive behaviors in pre-hospital emergency personnel based on protection motivation theory.

## Method

### Study design, and selection of the sample size

This cross-sectional study was conducted on 650 pre-hospital emergency personnel in Fars province in 2020. According to Prasetyo et al.[23] and Bashirian et al.[22] studies and considering 95% confidence level and 90% test power, 650 subjects were studied. Inclusion criteria: The inclusion criteria included being employed in pre-hospital emergency and emergency bases of Fars province and not contracting the coronavirus and the exclusion criteria were incomplete completion of the questionnaire. The subjects were selected by convenience sampling.

Because of the possibility of transmitting the coronavirus through paper questionnaires, the authors decided to distribute the electronic form of the questionnaire through the WhatsApp application in pre-hospital emergency and emergency groups. The questionnaire link was placed in the information groups of Fars University of Medical Sciences.

In this study, the data collection tool was a questionnaire designed based on other studies [5, 6, 18, 23–25].

The questionnaire consisted of two parts: demographic characteristics (age, sex, education, sources of information, and work experience) and the theory of protection motivation and preventive behaviors of corona disease were investigated. The theory of protection motivation constructs was investigated by 23 questions in six main structures:

The PMT constructs were assessed by 32 questions composed under six major constructs: (1) perceived vulnerability; (2) perceived severity; (3) self-efficacy; (4) response efficacy; (5) response cost; and (6) protection

motivation. The items were rated on a three-point scale ranging 0 (disagree), (1) neither agree nor disagree and (2) Agree. The construct perceived susceptibility was assessed by five items, i.e. "It is unlikely that I will be infected with the coronavirus". The perceived severity was assessed by five items, i.e. "Coronavirus disease can lead to death". The perceived self-efficacy was assessed by six items, i.e. "I can use the mask constantly in my work environment". The response efficacy was assessed by six items, i.e. "Disinfecting surfaces and equipment prevent coronavirus." The response cost was evaluated by five items, i.e. "I feel that protecting yourself against coronavirus is time-consuming." And finally, the protection motivation (behavioral intention) was assessed by five items, i.e. "I intend to observe the recommended precautions until the end of the coronavirus pandemic." According to the theoretical assumptions, the threat appraisal score is the sum of the perceived susceptibility and severity scores. Also, the coping appraisal score is the sum of the self-efficacy and response efficacy scores minus the response cost score.

COVID-19 preventive behaviors were measured by eight items rated by a three-point Likert scale ('always', 'sometimes' and 'never' scored 2, 1, and 0, respectively).

To determine the face validity of the instrument, a list of items was selected by 30 pre-hospital emergency personnel with demographic, economic, and social characteristics similar to the population. For this purpose, the opinions of twelve experts (outside the research team) in the field of health education and health promotion (7 people), infectious disease specialist (2 people), emergency medicine (2 people), and epidemiology (1 person) were used.

Using the Lawshe table index each item (0.56 for 12 people) was larger, that item was considered necessary and important and was preserved for further analysis. The calculated values in this study were higher than 0.70 in the majority of items. The overall reliability of the research instrument was 0.89 by calculating Cronbach's alpha. Perceived susceptibility reliability was 0.86; perceived severity 0.88, perceived self-efficacy 0.86, response efficacy 0.85, response cost 0.83, protection motivation 0.86 and preventive behaviors 0.87 were confirmed. Since Cronbach's alpha values calculated for each of the dimensions and structures studied in this study were greater than 0.7, therefore, the reliability of the instrument was evaluated and confirmed. To observe ethical considerations in this study, while obtaining permission from the ethics committee of Fasa University of Medical Sciences and justifying the subjects and obtaining their approval, their goals, importance, and necessity of conducting research projects for samples were recounted through the WhatsApp application and the samples were assured that the information would remain confidential.

## Data Analysis

The collected data were analyzed using SPSS software version 22 and descriptive statistics (frequency, mean and standard deviation) and analytical statistics (Pearson correlation coefficients of linear regression), and the significance level of  $p > 0.05$  was considered.

### Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

## Results

650 employees of Fars pre-hospital emergency and emergency bases participated in the study. The average age of participants in the study  $45.14 \pm 10.37$  years. 88% of the subjects were male and 57.85% had postgraduate education. 58.92% of the subjects had 10 years and more work experience. The most important sources of coronavirus information were the internet and virtual networks (44.21%), health personnel (29.56%), radio and TELEVISION (15.38%), family, and friends (6.45%), and scientific journals and articles (4.4%) (Table 1).

In Table 2, there is a correlation between preventive behaviors of corona disease and protection motivation theory constructs. There was a positive and significant correlation between preventive behaviors and constructs of the PMT model, including perceived susceptibility, severity, response efficacy, self-efficacy, response cost, and protection motivation ( $P < 0.001$ ). The response cost and protection motivation (behavioral intention) had the lowest and highest percentage of the mean from the maximum obtainable score among structures of the model, respectively.

Table 3, shows predictors of coronavirus preventive behaviors based on protection motivation theory. Perceived vulnerability, perceived severity, self-efficacy, and protection motivation (behavioral intention) are the strongest predictor of behavior. In general, the studied variables predicted 61.3% of the variance of coronavirus preventive behaviors.

**Table 1** Demographic Characteristics of Participants (N=650)

Qualitative variables		number (percent))
Sex	Female	78(12)
	Man	572(88)
Education	Diploma and Associates degree	236(36.31)
	B.Sc.	376(57.85)
	MSc and above	38(5.84)
Work experience	less than 10 years	267(41.08)
	10 years and over	383(58.92)

**Table 2** Correlation between Preventive Behaviors of Corona Disease and Protection Motivation Theory Constructs

Variable	1	2	3	4	5	6	7	Average (SD)	Min-Max
perceived vulnerability	1							85.5(12.1%)	10-0
perceived severity	r =0.579	1						99.6(60.1%)	10-0
	P =0.000								
self-efficacy	r =0.592	r =0.526	1					15.7(62.1%)	12-0
	P =0.000	P =0.000							
response efficacy	r =0.515	r =0.422	r =0.486	1				86.6(56.1%)	12-0
	P =0.000	P =0.000	P =0.000						
response cost	r =0.342	r =0.391	r =0.403	r =0.324	1			12.3(02.1%)	10-0
	P =0.000	P =0.000	P =0.000	P =0.000					
protection motivation (behavioral intention)	r =0.596	r =0.582	570/0=r 00/0=P	585/0=r 00/0=P	322/0=r 00/0=P	1		10.7(01.1%)	10-0
	P =0.000	P =0.000							
preventive behaviors	624/0=r 00/0=P	593/0=r 00/0=P	559/0=r 00/0=P	610/0=r 00/0=P	214/0=r 00/0=P	588/0=r 00/0=P	1	12.8 (72.1%)	16-0

**Table 3** Linear Regression Analysis for Behavior Prediction Based on Protection Motivation Theory Constructs

Variable	95% confidence interval	Beta	t	P
perceived vulnerability	0.34, 0.58	0.192	1.434	0.000
perceived severity	0.31, 0.51	0.176	0.516	0.000
self-efficacy	0.32, 0.56	0.225	3.125	0.000
response efficacy	0.27, 0.46	-0.144	-1.232	0.215
response cost	0.20, 0.38	-0.141	-10.148	0.274
protection motivation (behavioral intention)	0.64, 0.87	0.260	4.461	0.000

## Discussion

Pre-hospital emergency personnel as the front line are at risk of COVID-19, and adopting preventive behaviors plays an important role in reducing the rate of disease and mortality. This study aimed to determine the factors affecting preventive behaviors of covid-19 among pre-hospital emergency personnel in Fars province using the protection motivation theory. Various studies have been conducted regarding the efficiency of protection motivation theory in preventive and protection-related behaviors, the results of which indicate the effectiveness of this theory[26, 27]. Therefore, in the present study, this theory was considered as a framework in investigating the mean score of theory constructs, it was found that the protection motivation (the intention to perform protective behavior) had the strongest predicting power, so it can be concluded that the intention of the studied personnel to perform protective behavior was desirable. This can be due to high awareness, continuous use of PERSONAL PROTECTIVE EQUIPMENT including medical masks, eye protectors, gloves, and gowns, based on clinical risk assessment inappropriate size and quality, and adherence to other health behaviors in the workplace. In line with the results of this study, Barati et al. had relatively favorable preventive behaviors of covid-19 among health personnel[28]. However, the results of the study by Nga et al. showed that 30.8% of Hong Kong health personnel had attempted to receive the vaccine at the time of the seasonal influenza outbreak[29]. Protective measures against influenza were reported to be 48% among Irish health personnel[30]. Protective behaviors against diseases and workplace injuries among health care personnel and students such as physicians and nurses were also reported unfavorable in other studies[31-33]. These findings are not consistent with the results of this study. It seems that the difference in the findings of the studies is related to factors such as awareness level, not getting used to masks and gloves, interfering with tasks, especially lack time in pre-hospital missions, emergencies, perceived threat to disease, and training provided in the workplace. According to the results of this study, 44.21% of respondents considered the internet and virtual networks as the most important source of information about covid-19. It seems that social networks were better informed in implementing covid-19 disease prevention training programs than other sources such as personnel, mass media, including television, radio, or magazines, and articles. In the present study, only 4.4% of people reported receiving information about covid-19 from scientific papers, which shows that pre-hospital emergency personnel does not follow up scientific papers well in this study and learn more through cyberspace. In the study of Jaffar et al.[34] and Zare [35], cyberspaces were the most important source and reference for receiving information that is closely related to the results of the present study.

In the present study, the perceived vulnerability construct was relatively high, which was consistent with the results of the study of Ezati Rad et al. [36] which was performed on 2032 people using protection motivation

theory to predict covid-19 preventive behaviors and there was a significant positive relationship between preventive behaviors and perceived vulnerability, perceived severity, response efficiency, self-efficacy and protection motivation, and of course, in this study, there was a significant positive relationship between preventive behaviors and perceived vulnerability, perceived severity, response efficiency, self-efficacy and protection motivation. And there was no significant relationship between the cost of perceived response and it was not consistent with our study. The results of this study were also consistent with the results of Najimi et al. [37], Sharifirad et al. [38], and Ezati Rad et al. [36]. Therefore, it can be said that by increasing the sensitivity of personnel to being vulnerable, increasing the fear of repeated contact and exposure to people with symptoms and vectors of the disease and showing the deterioration and seriousness of the disease in protective behavior and on the other hand, by reducing the response costs and internal and external rewards of personnel, it is likely that the intention to perform more protective behaviors in personnel will lead. The study of Cui et al. [39] on avian influenza showed that people understand the severity of avian influenza, but do not see themselves as vulnerable, which was inconsistent with the findings of the present study. It seems that for groups such as pre-hospital emergency departments due to the potential risk of COVID-19, this issue is more serious.

In the present study, self-efficacy and preventive behavior of covid-19 were significant and personnel achieved relative confidence about the ability to perform disease prevention behaviors by understanding that the ways of disease prevention are simple and low cost. In many studies, self-efficacy is the most important prerequisite for behavior change and the strongest predictor of protection motivation [40, 41]. In the study, Ahmadi Jouybari et al. [42], emphasized self-efficacy about preventive behaviors of influenza, which is in line with the results of this study. Also, in the study of Morovvati Sharifabad et al. [26], based on the theory of protection motivation, there was a significant relationship between the constructs of this theory and the intention to perform physical activity in diabetic patients, the constructs of this theory predicted 60% of the variance of physical activity intention, the most important constructs affecting self-efficacy and intention behavior and are consistent with the present study.

In the present study, there is a significant correlation between preventive behaviors and perceived severity and since personnel is aware of the consequences of the disease, they adopt preventive behaviors more carefully. These findings are consistent with a study conducted by Prasetyo et al. [23] on 649 people in Luzon Philippines. In this study, it was found that vulnerability and perceived severity constructs have a significant indirect effect on intention and intention has a significant effect on behavior and also is consistent with a study conducted by Okuhara et al. [43] on 1980 people in Japan, in this study the structures of perceived severity and self-efficacy were strong predictors, but the structures of perceived vulnerability and effectiveness were not predictors. And it also matches the study result of Tazval et al. [40] But it is inconsistent with the study of Zare et al. [44].

In the present study, there was a statistically positive and significant correlation between preventive behaviors and response efficiency, this shows that preventive behaviors are associated with increased self-esteem and increase motivation (intention) in people and are consistent with the results of Malak al Rasheed cross-sectional study conducted on 679 people in Kuwait using PMT, in this study the constructs of perceived severity, perceived vulnerability, response efficiency, and self-efficacy. There was a positive relationship with the intention of preventive behaviors from COVID-19 and in this study; the cost of response construct had a negative relationship with preventive behavior intention which is not consistent with the present study Zare Sakhvidi et al. [45].

In the present study, covid-19 preventive behavior has a significant relationship with protection motivation, which was predictive of protection motivation (intention of behavior) with the results of Bashirian et al. [22] study conducted on 761 hospital personnel in Hamadan based on PMT and its results showed that perceived vulnerability constructs and perceived severity and perceived self-efficacy and response self-efficacy were predictors of protection motivation (intention of behavior) and the intention to predict covid-19 preventive behaviors. Also, it is consistent with the study of Ezati Rad et al. [36], but the results of the study were not consistent with the study. The results of this study showed that there was a significant correlation between all constructs of protection motivation theory and behavior.

In the present study, there was a significant correlation between response cost and behavior, indicating a decrease in behaviors consistent with an increased cost of protective behaviors. Increasing the cost of protection behaviors can be an obstacle against it. Therefore, identifying behavioral barriers and eliminating them may have an impact on increasing adaptive behaviors. In line with the results of this study, 46 colleagues showed that there was a significant correlation between the protection motivation construct and perceived vulnerability, self-efficacy, response efficiency, and reward.

In the present study, behavior showed a significant correlation with all constructs of protection motivation theory. In general, the variables predicted 61.3% of the variance of coronavirus preventive behaviors. The results of this study showed that the theoretical constructs of protection motivation predicted 39% intention and 64% behavior. Also, the results of Alla et al.[46] showed that PMT structures have a considerable ability to define pro-environmental behavior, PMT constructs are "self-efficacy" and "response efficiency" with intrinsic and external rewards predicting environmentally friendly behaviors.

In the study conducted by Williams et al.[47] on 239 people based on PMT, the results showed that none of the PMT constructs had a significant prediction on social distancing behavior that was not consistent with the present study and only the constructs of self-efficacy and self-efficacy of response and fear were significant predictors of intention to address social distancing behavior and in general PMT constructs predicted 21.2% intention. In the study of Morovvati Sharifabad et al.[26] about unsafe behavior in driving, there was a significant correlation between all the constructs of protection motivation theory except fear and perceived vulnerability with unsafe driving (behavior) and unsafe driving intention (motivation) in some other researches, as well as preventive behaviors of cancer at work, response costs were very important [45].

The Study Adunlin et al. [48] showed that PMT is a useful framework for stimulating motivation to observe social distancing during the Coronavirus crisis to stop or slow the spread of COVID-19 in rural areas and need to be used in future research. The emergence of COVID-19 is a rare opportunity to use theoretical frameworks to understand social distancing behavior during this pandemic, to reduce adverse health outcomes among rural and low populations.

One of the limitations of this study was collecting information about the questionnaire through self-report and virtually that people may not have completed the information, although they were given sufficient explanations. Besides, the cross-sectional of this study is another limitation that it is suggested to design and implement interventional studies to accurately determine the effect of protection motivation theory constructs on the protective behavior of laboratory personnel. Therefore, it seems that this theory can be used as a framework for developing educational programs to improve protective behaviors in health centers and hospitals.

# **Conclusion**

The rate of COVID-19 prevention behaviors in pre-hospital emergency personnel in Fars province is relatively desirable. The results of this study confirm the role of protection motivation theory in adopting preventive behavior of pre-hospital emergency personnel, it is suggested that interventional training be held with this theory, and facilitating protective behaviors as a principle in education should be considered. Well-developed and integrated planning, which is based on the requirements of clients, is the most important tool for doing COVID-19 prevention behaviors. Thus, the interventions of the pre-hospital emergency staff need to be based on this principle. Comprehensive educational programs through mass media such as educational courses, TV, and newspapers would be so helpful in this regard. One of the limitations of this study was self-reporting answers of subjects

## **Abbreviations**

COVID-19: Coronavirus Disease 2019;

PB: preventive behaviors;

PHEP; pre-hospital emergency personnel;

PMT: protection motivation theory;

## **Declarations**

### **Ethics approval and consent to participate**

The study was approved by the Ethics Committee of the Fasa University Medical Sciences under number IR.FUMS.REC.1399.177. All participants were informed about the study and only those providing written informed consent were enrolled in the study.

### **Consent to publish**

All participants consented verbally to the publication of the interview data.

### **Availability of data and materials**

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

### **Competing interests**

The authors declare that they have no competing interests.

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### **Authors' Contributions**

AKJ and AY, conceptualized and designed the study. AZ, ZE, and AAK collected the data and conducted the formal analysis. AY, AKJ and ZB drafted the manuscript. AY and AZ critically reviewed the manuscript. All authors approved the final version of this manuscript.

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