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Perception risk, preventive behaviors and assessing the relationship between their various dimensions: A cross-sectional study in the Covid-19 peak period

Ezat Samadipour a, Fatemeh Ghardashi a, *, Mina Nazarikamal b, MohammadHassan Rakhshani c

a Non-Communicable Diseases Research Center, School of Paramedical, Sabzevar University of Medical Sciences, Sabzevar, Iran
b Clinical Psychology, Islamic Azad University of Birjand, Iran
c Department of Biostatistics, School of Public Health, Sabzevar University of Medical Sciences, Iran

ABSTRACT
The Covid-19 epidemic is known as "the deadliest plague of the century" that has overshadowed various aspects of human life. Despite mutations in SARS-CoV-2, the development of new strains, and the escape of immunity, preventive health behaviors continue to play a key role in controlling this epidemic. The purpose of this study was to determine the relationship between risk perception and the performance of preventive behaviors of people in the Covid-19 peak period in society. This anonymous online survey was conducted with 1950 people in 30 provinces of Iran. The results showed that by increasing the score of cognitive, social and emotional aspects of people's perception of risk, their performance in following health recommendations increases.

1. Introduction
Perceptions and methods of adapting to disasters are critical to the sustainability and resilience of society. Risk perception and improving individual and collective resiliency are important components in disaster risk management [1,2]. The main role in risk management is played by risk perception [3-5]. Risk perception refers to people's beliefs, attitudes, judgments, and feelings, as well as the broader cultural and social tendencies they adopt in the face of risk. Individual and social processes influence risk perceptions and risk-aversion behaviors [6]. Although when determining indicators in risk management, a distinction should be made between risk awareness, perception and behavior, but in some cases only risk perception is considered [7,8]. In fact, risk perception has a psychological context that reveals people’s mental strategies for dealing with unfamiliar situations [9]. The perception of risk, including perceived vulnerability or the possibility of disease or health threat, is one of the factors that may influence the willingness and motivation to engage in precautionary behaviors. A perceived threat is formed by perceived vulnerability and perceived severity [10]. However, risk perception is not the only factor that influences and predicts self-care and protective behavior [11]. According to protection motivation theory (PMT), the other two main predictors of protection motivation are response effectiveness (i.e., the degree to which individuals believe in the effectiveness of protective measures against coronavirus) and self-efficacy (i.e., the degree to which individuals believe in their ability to perform such protective measures) [12]. Risk perception is frequently associated with bias.
Unrealistic optimism is frequently observed when confronted with familiar risks. In these cases, it is believed that the conditions are largely under the individual’s control and will. Some people believe they are less vulnerable than others their age and younger. For new risks that are considered uncontrollable, pessimistic risk bias (an understanding of risk that far outweighs the actual risk) is more likely to occur [13,14]. The latter is more likely to occur in emerging events such as the outbreak of coronavirus infectious disease. Individuals’ reactions in society are determined by perceived risk rather than actual risk, even if these perceptions are frequently biased [11,15]. The general public may be optimistic and understand familiar risks to a large extent because they have voluntary control over them. Pessimism, which can sometimes lead to widespread panic, is most likely the result of uncontrollable risks [12,16].

According to the findings of studies, people who considered themselves to be at risk of SARS engaged in precautionary and protective behavior when in close contact with people who could be a source of the virus [17]. Education and information obtained from various sources are critical for developing a realistic understanding of risk and effective precautions [16,18].

The general public’s behavioral responses are critical in reducing the prevalence of emerging diseases [16]. Previous research on this topic has been reviewed in various cultural contexts with the threats of COVID 19, SARS, and influenza [16,18–20]. These factors varied depending on the type of disease and how it was managed. For two main reasons, the current prevalence of COVID-19 provides a unique context for studying behavioral changes. First, the government’s unprecedented participation in controlling the disease’s spread, such as the closure of schools, universities, educational and administrative centers, and the launch of numerous public awareness campaigns. Second, people with disparate information, owing in part to evolving knowledge of the emerging disease or the time of its outbreak [21]. Both reasons may react differently to the disease’s prevalence. It is critical to assess psychological and behavioral responses to the epidemic, as well as the relationship between perceived risk and participation in protective behaviors. There is little evidence for psychological and behavioral responses in the early stages of previous epidemics [22]. Furthermore, risk perception is not an appropriate behavioral response, and the relationship between perception and behavior has been one of the complexities that scientists have faced [20,21]. As a result, in this situation, the methods for controlling the COVID-19 outbreak are focused on identifying, treating, and isolating infected people, tracking and quarantining close contacts and reducing travel, and promoting public participation to break the transmission chain [22,23], and the implementation of these proposed solutions is made possible by a high risk-perception and participation. The purpose of this study was to determine the relationship between risk perception and the performance of preventive behaviors of people in the Covid-19 peak period in society.

2. Methods

To prove or disprove the study hypothesis: "There is a relationship between risk perception and the performance of preventive behaviors in the peak period of Covid-19", cross-sectional online descriptive-analytical survey was conducted in Iran during the second wave of COVID-19 disease in July and August 2020.

Based on field observations, we believed that the minimum risk perception is 0.3 and based on the following formula

$$N = \frac{Z^2 (Pq) }{d^2}$$

At the confidence level of 0.95%, p equal to 0.3, q equal to 0.7 and accuracy of 2%, the sample size was equal to 1413 people. We decided to increase this volume to 2000 people to increase the accuracy, which according to the design conditions reached 1950 people.

All members of social networks (Telegram and WhatsApp) were included in the target community. The study used targeted and snowballing sampling, and participation was entirely voluntary.

To this end, the link to the online questionnaire “The COVID-19 General Risk Perception” was placed in the participants’ family and work groups on social networks, and the group administrators were asked to pin this link in the group page. Individuals were encouraged to complete the questionnaire with the group administrator’s emphasis and encouragement. The participants were asked to forward the questionnaire link to any other public social groups in which they were members. Thus, the targeted sampling morphed into a nationwide snowball sampling. Participants’ written consent was obtained at the start of the questionnaire.

Inclusion criteria: Being Iranian, being a cyberspace user over the age of 18, being literate, and being willing to participate in the project were all taken into account.

The data collection tool was a three-part questionnaire that collected demographic information (age, gender, education, place of residence, occupation), behavioral performance, and COVID-19 Risk Perception questions.

A researcher-created Behavioral Performance Questionnaire (6 questions) containing preventive behaviors, recommended by the World Health Organization was as follows: washing hands, wearing a face mask, staying at home, disinfecting surfaces, and observing workplace protocols, with Likert 5-choice questions from very high (5 points) to very low (1 point). Behavioral questions were created for the course of past month with no positive or negative bias.

Samadipour et al. has previously approved the COVID-19 General Risk Perception Questionnaire [24]. Its validity and reliability were adjusted and reconfirmed in this study. The questionnaire had 20 items with 5 subscales (cognitive, cultural, political, social, and emotional factors) and 5-choice Likert responses ranging from strongly agree (5 points) to strongly disagree (5 points) (1 point).

The cognitive factors subscale included four items about knowledge, awareness, and experience with COVID-19 disease.; the emotional factors included five items about fear and hope for effective disease prevention measures; the political factors included three items about the relationship between managers and people, mutual trust, and public participation, officials' commitment to risk reduction; the social factors included three items about the relationship between managers and people, mutual trust, and public participation, officials' commitment to risk reduction, and the social factors included three items about the relationship between managers and people, mutual trust, and data were analyzed using SPSS 16 (SPSS Inc., Chicago, IL) and descriptive statistics, Pearson
correlation coefficient, and rank logistic regression model. In all tests, the significance level was less than 0.05.

3. Results

According to the findings, the questionnaire was viewed 5180 times, and 1950 people from 30 Iranian provinces completed it (Graph 1). The following were the majority of the participants: 1065 (54%) women, 699 (35.8%) Tehran residents, 737 (37.8%) bachelor’s degrees, 855 (4308%) middle-aged (29–40 years old), and 563 (28.9%) civil servants (Table 1).

The findings showed that the mean perception score in the study population was 68.18 ± 9.22 and the mean performance score was 23.09 ± 4.39. The table below shows the frequency and percentage of responses to the behavioral performance questionnaire, "Which health behavior did you do in the last month?" (Table 2). The spider diagram shows the six preventive behaviors against the Covid-19 risk perception structures in the participants (Graph 2).

The Kolmogorov test for normality revealed that none of the risk perception model’s structural variables or behavioral performance were normal. Spearman’s correlation coefficient revealed a significant relationship between behavioral performance score and the cognitive, emotional, and social constructs of COVID-19 risk perception. However, this correlation was not significant in political and cultural structures (Table 3).

To analyze the data and estimate the predictive power of the COVID-19 risk perception questionnaire constructs in behavioral performance, a ranked logistic model was used. The ranked logistic regression model was as follows:

$$\ln(\theta_j) = \alpha_j - \beta X$$

where $$\alpha_j$$s were the choices of behavioral performance items and $$\beta$$s were the constructs of the COVID-19 risk perception model. Accordingly, the probability of an accident occurring was calculated in the ranked logistic model using the following formula.

$$\text{prob(eventj)} = \frac{1}{1 + \exp(-\alpha_j - \beta X)}$$

The results showed that changing the constructs of cognitive, social, and emotional factors changed behavioral performance, i.e., these questionnaire constructs could predict the behavior. Accordingly, the results showed that by increasing one score in risk perception structures, the probability of preventive behavior increased. For example, increasing one cognitive structure score increased the likelihood that a person would never wash hands, wash little, wash moderately, wash a lot, and wash extremely by 5.9%, 8.6%, 49.5%, 31.7%, and 4.3%, respectively, and this change in the person’s washing pattern was significant in cognitive structure. Table 4 displays the predictive results of other structures in the behavioral function of COVID-19 disease prevention (Table 4).

A summary of the probability of performing the behavior by increasing a score from each of the risk perception structures is given in Table 5.

4. Discussion

People’s behavior and reactions are influenced by their perception of risk [23]. The answer to the question 'How psychological factors affect behavior in severe pandemics like COVID-19' is critical to facilitating disease minimization strategies [25]. It is critical to

Table 1

Demographic characteristics of the participants.

| Variable | N (%) |
|----------|-------|
| Gender   |       |
| Male     | 855(43.8%) |
| Female   | 1065(54.6%) |
| Missing  | 30(1.5%) |
| Age      |       |
| <18      | 45(2.3%) |
| 18–28    | 349(17.9%) |
| 29–40    | 855(43.8%) |
| 41–60    | 630(32.3%) |
| 60+      | 56(2.9%) |
| Missing  | 15(0.8%) |
| Education|       |
| Less diploma | 137(7.0%) |
| Diploma  | 357(18.3%) |
| Associate| 141(7.2%) |
| Bachelor | 737(37.8%) |
| Master   | 430(22.1%) |
| Ph.D.    | 130(6.7%) |
| Missing  | 18(0.9%) |
| Job      |       |
| Student  | 161(8.3%) |
| Teacher  | 1568(0.0%) |
| Employee | 563(28.9%) |
| Unemployed| 152(7.8%) |
| Private job | 200(10.3%) |
| Healthcare| 167(8.6%) |
| Housewife| 342(17.5%) |
| Other    | 190(9.7%) |
| Missing  | 19(1.0%) |

Total sum:1950
monitor public perceptions and reactions in order to mitigate COVID-19 damages. This monitoring is based on public opinion polls and is accompanied by various bias-related questions. A direct question about risk is usually used to assess perceived risk. Minor changes in item formatting can have a significant impact on perceived risk rankings, rendering comparison defective [22]. The COVID-19 General Risk Perception Questionnaire, developed based on the natural disaster risk perception model (Samadipour 2019), was used in this study to assess risk perception of the COVID-19 epidemic. This model was created as a novel method for researching risk perception by presenting five cognitive, social, political, emotional, and belief frameworks [26]. The same authors were responsible for the questionnaire's validity and reliability in previous studies.

The findings of this study revealed that while Iranians perceived the risk of the COVID-19 crisis to be moderate at the time of the study, self-reported observance of health preventive behaviors was low. This finding was consistent with the findings of previous studies [18]. Moreover, the results showed that changing the constructs of cognitive, social, and emotional factors changed behavioral performance, i.e., these questionnaire constructs could predict the behavior.

Statistical analysis revealed that changes in perceptual structures had varying effects on health behaviors. The emotional structure

| Table 2 |
| --- |
| Frequency and percentage of answers to the Behavioral Performance Questionnaire “What health behavior did you do last month?” |
| Options Items | Never | Low | Medium | Much | Very much | Missing |
| Long and excessive hand washing | 17 (0.9%) | 28 (1.4%) | 333 (17.1%) | 1037 (53.2%) | 505 (25.2%) | 30 (1.5%) |
| Disinfection surfaces | 37 (1.9%) | 159 (8.2%) | 563 (28.9%) | 809 (41.5%) | 343 (17.6%) | 39 (0.2%) |
| wearing a face mask | 239 (12.3%) | 346 (17.7%) | 423 | 596 (30.6%) | 287 (14.7%) | 59 (0.3%) |
| staying at home | 85 (4.4%) | 120 (6.2%) | 203 (10.4%) | 856 (43.9%) | 646 (33.1%) | 40 (2.1%) |
| Eliminate going to a party | 107 (5.5%) | 79 (4.1%) | 116 (5.9%) | 846 (42.9%) | 771 (39.5%) | 41 (2.1%) |
| Do not travel | 185 (9.5%) | 21 (2.1%) | 30 (1.5%) | 761 (39.0%) | 908 (46.6%) | 45 (2.3%) |

Total: 1950

Graph 1. Frequency of participants in each province of Iran.
of risk perception had the greatest influence on health behavior. As shown in Table 4, increasing the score of this structure increased the likelihood of hand washing by 97.5%, surface disinfection by 84.8%, wearing a face mask by 68.8%, not going to public places and parties by more than 95%, and not going on a trip by 94.7%.

The main variables influencing risk perception and protective measures, according to most psychological studies of disaster risk perception, are emotional characteristics such as fear and insecurity, mental image, and internal and external control [27]. According to the findings of a study, emotions play a larger role in harm reduction measures than knowledge and awareness [28]. A qualitative study in Finland discovered that when an illness occurs, people who are often very emotional and have strong opinions contact the authorities [27]. Perceived risk in a given situation is usually associated with more cautious behavior and more negative emotions [29].

### Table 3
Results of Spearman correlation analysis of the relationship between risk perception structures and behavioral performance score.

| Risk perception structures | Behavioral performance score |
|---------------------------|-----------------------------|
|                           | R                  | P         |
| Cognitive                 | .126ᵇ              | 0.000     |
| Emotional                 | -.128ᵇ             | 0.000     |
| Social                    | .119ᵇ              | 0.000     |
| Political                 | -.026              | 0.260     |
| Cultural                  | -.040              | 0.90      |
| Risk perception score     | -.046ᵃ             | 0.050     |

ᵃ Correlation is significant at the 0.05 level (2-tailed).
ᵇ Correlation is significant at the 0.01 level (2-tailed).

Graph 2. Radar diagram of performance behaviors against perception structures Covid-19.
Thus, emotion appears to be the closest component to behavior.

In the COVID-19 epidemic, preventive health behaviors fall into both the individual and social domains. Individual health behaviors (hand washing and surface disinfection at home) appeared to increase with improved social and cognitive perceptions, whereas social health behaviors (commuting in public places, attending parties, and going on a trip) appeared to increase with improved political perceptions, which are influenced by government decisions. Individual health behaviors were promoted through social stimuli and increased awareness and cognition. This study was consistent with the findings of Wise et al. (2020), who reported the clearest predictors of behavior at perceived risk of infection and the widespread social consequences of the COVID epidemic, and the study by Kahan et al. (2012), who discovered that climate change concerns are best explained by collective values rather than scientific knowledge [31].

Other approaches to promoting individual health behaviors that should be considered include strengthening cultural-religious and political factors. The findings of the Wise et al. (2020), also revealed that a person’s beliefs about the likelihood of infection predict that he/she will engage in more self-reported protective behaviors. Although it appeared in this study that political and religious constructs of the perceived risk had no effect on promoting individual behaviors, this could be due to a lack of measures related to these areas in the context of the epidemic, or to the fact that they had their greatest impact at the beginning of the crisis. Religious and political factors were most associated with risk perception in a previous study by the same researchers, which was conducted 45 days after the official announcement of the disease’s outbreak in Iran in the first wave of COVID-19 (24). Hence, more research is needed to determine the role of political and religious structures in promoting individual behaviors.

Table 4

| Behavioral Functions | Options | Risk Perception Structures |
|----------------------|---------|-----------------------------|
|                      |         | institutional | Cultural | Social | Cognition | Emotion |
| Hand washing         | Never   | -             | -        | 4.01% | 5.92%     | 0.93%  |
|                      | Rarely  | -             | -        | 6.12% | 8.91%     | 1.00%  |
|                      | Sometimes | -             | -        | 43.8% | 49.0%     | 18.3%  |
|                      | Much    | -             | -        | 39.7% | 31.7%     | 0.7%   |
|                      | very much | -             | -        | 6.37% | 4.3%      | 23.5%  |
| Disinfection surfaces | Never  | -             | -        | 13.1% | 22%       | 2.79%  |
|                      | Rarely  | -             | -        | 35.3% | 41%       | 12.3%  |
|                      | Sometimes | -             | -        | 36.7% | 7.55%     | 36.5%  |
|                      | Much    | -             | -        | 12.6% | 7.55%     | 37%    |
|                      | very much | -             | -        | 2.31% | 1.3%      | 11.3%  |
| Apply the Mask       | Never   | 17.6%         | 16.8%    | 45.2% | 51.7%     | 12.6%  |
|                      | Rarely  | 22.7%         | 22.1%    | 27.1% | 25.6%     | 18.6%  |
|                      | Sometimes | 23.8%         | 23.7%    | 15%   | 12.7%     | 23.1%  |
|                      | Much    | 26.2%         | 27.1%    | 9.98% | 7.84%     | 31.7%  |
|                      | very much | 9.74%         | 10.4%    | 2.06% | 2.06%     | 14%    |
| Less going to public places | Never | 2.52%         | -        | 9.53% | 15.2%     | 1.62%  |
|                      | Rarely  | 4.01%         | -        | 12.5% | 17.7%     | 2.7%   |
|                      | Sometimes | 7.56%         | -        | 18.1% | 20.8%     | 5.4%   |
|                      | Much    | 43%           | -        | 44.3% | 36.7%     | 37.5%  |
|                      | very much | 42.8%         | -        | 15.5% | 9.56%     | 52.8%  |
| Eliminate going to a party | Never | 3.28%         | -        | 9.51% | 18.8%     | 2.46%  |
|                      | Rarely  | 2.66%         | -        | 6.79% | 11.3%     | 2.01%  |
|                      | Sometimes | 4.28%         | -        | 9.78% | 13.6%     | 3.34%  |
|                      | Much    | 39.9%         | -        | 49.6% | 43.7%     | 35.2%  |
|                      | very much | 49.9%         | -        | 24.3% | 12.6%     | 57%    |
| No traveling         | Never   | 5.16%         | 5.46%    | 12.2% | 15.3%     | 4.73%  |
|                      | Rarely  | 0.68%         | 0.71%    | 1.4%  | 1.76%     | 0.6%   |
|                      | Sometimes | 0.1%          | 0.05%    | 2.1%  | 2.5%      | 0.93%  |
|                      | Much    | 33%           | 33.8%    | 46.7% | 48.9%     | 31.4%  |
|                      | very much | 60.2%         | 59%      | 37.6% | 31.6%     | 62.4%  |

Table 5

| Behavioral performance | Risk perception structures |
|------------------------|----------------------------|
|                        | Institutional | Cultural | Social | Cognitive | Emotional |
| Hand wash              | -             | 89.9%    | 85.5% | 97.5%     | 97.5%     |
| Disinfection surface   | -             | 51.6%    | 36.5% | 84.8%     | 84.8%     |
| Wear a Mask            | 59.7%         | 61.2%    | 22.6% | 68.8%     | 68.8%     |
| No public places       | 93.4%         | -        | 67.1% | 95.7%     | 95.7%     |
| Eliminate going to a party | 94.1% | -        | 83.7% | 69.9%     | 95.4%     |
| Do not travel          | 93.3%         | 93.8%    | 86.4% | 83%       | 94.7%     |

[30,34,35]. Thus, emotion appears to be the closest component to behavior.
In our study, government policies and regulations had a strong influence on social behaviors such as commuting in public places, attending parties, and going on a trip, and the severity of lockdowns increased public compliance with public health guidelines. This finding is consistent with the findings of previous studies [32]. The interaction of emergencies with psychological, social, and cultural factors is thought to weaken or strengthen risk perception [33]. Since religious authorities asked people not to go on a trip during the study period, the impact of religious structures on this behavior was increased.

It appears that the type of harm reduction behavior expected in disasters plays an important role in adopting a method to increase risk perception. Therefore, it is recommended that relationships designed to promote risk reduction be first analyzed in the form of societal perceptual structures in order to improve public risk perception by selecting appropriate intervention methods.

5. Conclusion

The results showed that changing the constructs of cognitive, social, and emotional factors changed behavioral performance, i.e., the constructs of COVID-19 General Risk Perception Questionnaire could predict the behavior. To change societal behavior, a thorough understanding of risk must be promoted. Promoting all five perception domains, including culture, society, politics, cognition, and emotion, is effective in improving individual and social behavior.

5.1. Study limitations

Although sampling from different cities and provinces (30 provinces) was done in this study to increase sample size, online sampling does not represent the total population of Iran.

Another limitation was that, while the relationship between belief and political structures and risk perception was not significant in this study, due to the nature of the cross-sectional study, no relationship should be considered accidental. Future research may need to examine the issue of modifying data from online survey examples in order to provide more objective and in-depth research into the relationship among variables.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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