

COVID-19 Risk Perception and its Related Factors and Outcomes in Vulnerable Groups: A Systematic Review

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Abstract

Background: The COVID-19 disease has worse outcomes in individuals with underlying diseases and elderly individuals. Therefore, identifying COVID-19 risk perception and its related factors and outcomes in vulnerable groups is essential for the health system.

Objectives: This study aimed to determine COVID-19 risk perception, its related factors, and outcomes in vulnerable groups (individuals with underlying diseases, smokers, opioid addicts, the elderly, and pregnant women).

Methods: This systematic review was conducted based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The search was carried out using the keywords “Risk perception” and “COVID-19” in PubMed, Scopus, Science Direct, SID, Proquest, and Magiran databases in the period from 2019 to July 3, 2021. The quality of selected studies was checked by two authors independently according to Newcastle-Ottawa Scale adapted for cross-sectional.

Results: In the initial search, 640 articles were found, of which 56 remained in the screening phase. Then, the full text of 56 articles was studied. Eventually, based on the inclusion and exclusion criteria of the articles, 8 articles were reviewed. This systematic review showed that suffering from an underlying disease, more anxiety, younger age, and female gender are associated with higher COVID-19 risk perception. The outcomes of COVID-19 risk perception were higher COVID-19 risk perception, delayed treatment sessions, increased anxiety and fear, increased ineffective safety behaviors, and greater compliance with health protocols.

Conclusion: Creating sensitivity and proper COVID-19 risk perception is necessary to follow health protocols, but high COVID-19 risk perception can endanger vulnerable groups’ mental and physical health. Besides, reducing the sensitivity of vulnerable groups toward COVID-19 can expose them to the disease.

Keywords: COVID-19, risk, perception, vulnerable populations

Introduction

The word "risk" refers to uncertainty that originates from different events [1]. Risk perception is a subjective judgment that individuals have about the characteristics and severity of a risk [2,3]. Individual's reaction is

based on their perception of risk and not based on an objective risk level or a scientific evaluation of risk [4]. Risk perception and individual reactions are different from real risks, because it is influenced by a wide range of emotional factors,

individual factors, and the unknown nature of the risk and its catastrophic nature [3,5].

Following the outbreak of COVID-19 in December 2019, the World Health Organization (WHO) declared this disease a pandemic in March 2020 [6]. The lockdown and isolation caused by the continuous exacerbation of the COVID-19 disease caused some individuals to worry and distress [7]. Due to the lack of a medical protocol or a universal vaccine, countries implemented lifestyle changes and lockdown protocols. The degree of acceptance of these protocols by individuals depends on their COVID-19 risk perception of outcomes of contracting the COVID-19 disease [8].

COVID-19 risk perception is the subjective judgment of individuals about its negative results [9]. COVID-19 is likely to induce high risk perception, because it is a new disease that spreads rapidly and its prognosis is unknown [5,10]. COVID-19 risk perception depends not only on the outcomes of the disease in the individual, but also on how others are affected by the individual. The possibility of being a carrier and infecting others causes a sense of guilt and blame in a person and affects COVID-19 risk perception [11].

The increase or decrease in the prevalence rate and the number of infected individuals depends on the degree of individuals' COVID-19 risk perception and, following that, protective behaviors towards COVID-19 disease [12]. Among individuals of society, vulnerable groups can have a different COVID-19 risk perception. Based on studies and the objective experience of individuals in the community, vulnerable groups with underlying diseases, elderly individuals, pregnant women, overweight individuals and heavy smokers have been the victims of this disease [13-15]. Therefore, COVID-19 risk perception and its related factors in the vulnerable groups are probably different from healthy individuals. Identifying the level of COVID-19 risk perception and its related factors makes easier management of the crisis and reduces its negative

consequences in vulnerable groups [5,10,16,17]. Compared to other areas of risk perception, any systematic review study was not found on COVID-19 risk perception in vulnerable groups. Due to the emergency situation of this pandemic and the importance of its control, it is necessary to investigate COVID-19 risk perception and its related factors and outcomes in different groups. In the field of risk perception, two systematic review studies have been conducted on women with a high-risk pregnancy and cancer risk perception in high risk populations [18,19]. The knowledge gap regarding COVID-19 risk perception is felt especially in vulnerable groups. Therefore, according to the aim of this study, the research question of the study was formulated as follows: What is the level of COVID-19 risk perception in vulnerable groups and what are its related factors and outcomes? Therefore, the research question was set based on Population, Exposure, and Outcome (PEO). Research community; vulnerable groups (individuals with underlying disease, smoking and opioid use, elderly individuals and pregnant women), exposure to COVID-19 and its outcomes; risk perception was considered. Therefore, this study was conducted with the aim of COVID-19 risk perception, its related factors and outcomes in vulnerable groups.

Methods

This study has been designed in the context of Preferred Reporting Items for Systematic Reviews and Misanalyses (PRISMA) statement.

1. Eligibility Criteria

The inclusion criteria for articles in the study were access to the full text, having Farsi or English language, and a cross-sectional study design. In this study, vulnerable groups were individuals with underlying disease, smoking and opioid use, elderly individuals and pregnant women. If the article had a different design, such as qualitative and controlled trials, or the research community of the article was the general public, they were excluded from the study (Figure 1).

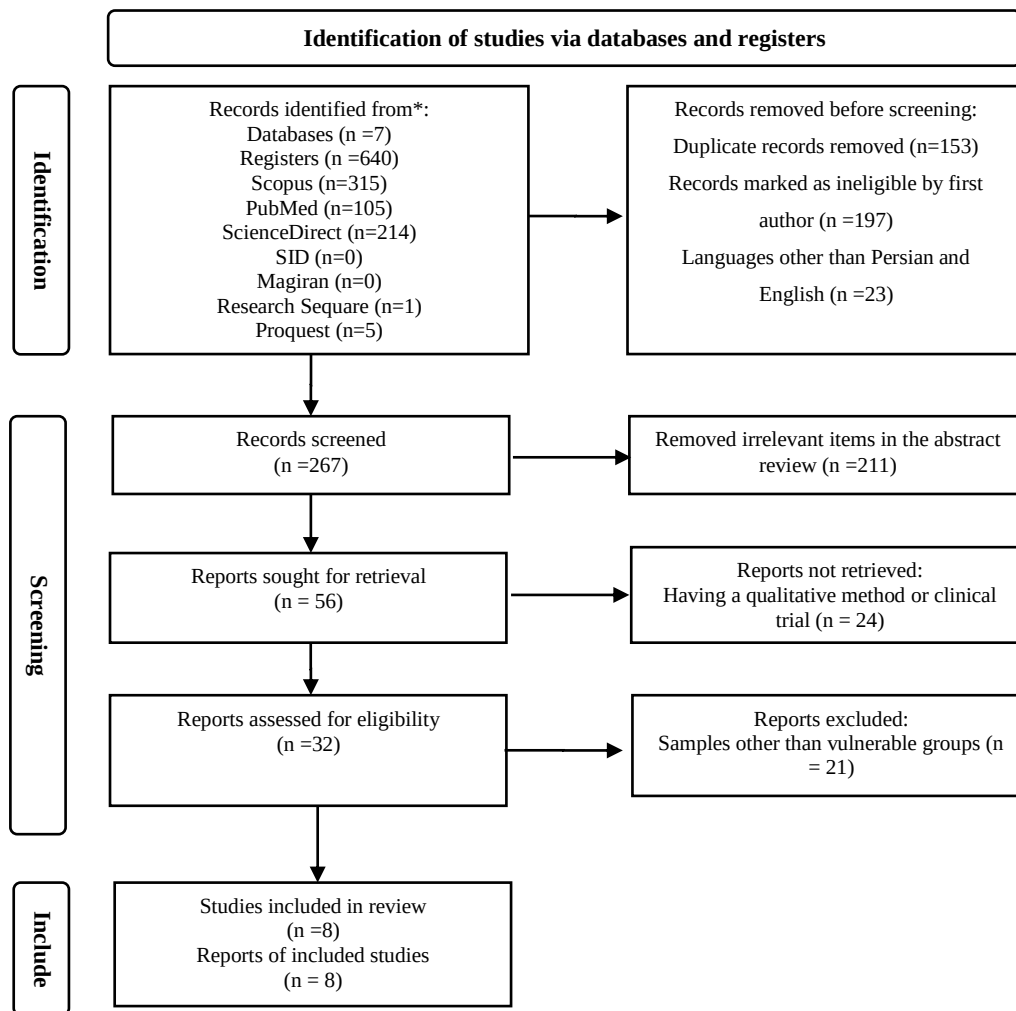


Figure 1: Flow Diagram for Identification of Studies Via databases and Registers

1. Search strategy

Related studies were searched in the PubMed, Scopus, Proquest, Science Direct and the Iranian databases of SID and Magiran in the period of 2019 to July 3, 2021, in both English and Farsi languages. To assess the gray literature, Research Square and Proquest databases were searched, but any study was not found. In this study, Mesh was used to find suitable keywords. The search strategy was carried out according to the keywords Risk AND Perception AND COVID-19 in the aforementioned databases. Farsi keywords included risk perception, COVID-19 and corona.

2. Quality assessment

Quality assessment was done by two authors independently (M.N, N.H) according to the Newcastle-Ottawa Scale adapted for cross-

sectional [20]. In cases of disagreement, the review of the article was done by a third and fourth person (N.B, MM.G) (Table 1). Based on this checklist, none of the selected articles was removed.

3. Study selection and data extraction

Two reviewers (M.N, N.H) extracted the data from included articles into a specifically designed template using the same method in the screening phase independently. The third (N.B) and fourth (MM.G) authors assessed the probable discrepancies between data extraction files, and any disagreements were resolved by consensus.

Results

The reviewed articles were chosen among studies on the outbreak of the COVID-19 disease

published in 2020 and 2021. In the initial search, 640 articles were found, of which 56 remained in the screening phase. Next, the full text of 56 articles was studied. Based on the inclusion and exclusion criteria of the articles, 8 articles were reviewed. In addition, based on the Newcastle-Ottawa Scale adapted for cross-sectional, the quality of the articles was in the range of 7 to 9, indicating their high quality (Table 1). Publication bias was acceptable in eight studies (Table 2). These eight studies were conducted in the United States (3 studies), Germany (2 studies), Italy (1 study), and a multi-center area (2 studies). In total, the number of participants in these studies was 191,771. COVID-19 risk perception and its related factors and outcomes in vulnerable groups were investigated in these eight studies. As shown in Table 3, two studies were conducted on patients with multiple sclerosis (MS), two studies

on patients over 50 years old, one on individuals with underlying diseases (e.g., diabetes, hypertension, chronic respiratory and cardiovascular disease), one on patients with diabetes, one on patients with celiac disease, and one on smokers or nicotine users suffering from Opioid Use Disorder (OUD). Not all these 8 studies used the same risk perception instrument. In some studies, researcher-made questionnaires were used, while others used only one question to assess risk perception on the Likert scale. Some articles considered risk perception as an outcome of exposure to COVID-19, and some articles measured other outcomes (Table 3). In the present study, the results based on the findings of these studies were grouped into three categories of 1) COVID-19 risk perception, 2) factors related to COVID-19 risk perception, and 3) the outcomes of COVID-19 risk perception.

Table 1: Quality Assessment of Studies Included in the Systematic Review Using a Newcastle-Ottawa Scale Adapted for Cross-Sectional

Quality	Sum (Max.10)	Outcome (Max.3 Stars)	Comparability (Max.2 Stars)	Selection (Max.5 Stars)	Authors
Alschuler et al.[21]	3	1	3	7	High
Zhang et al.[22]	3	1	3	7	High
Guastafierro et al. [23]	3	1	3	7	High
Lu et al.[24]	3	1	3	7	High
Kohler et al.[25]	4	2	3	9	High
Musche et al.[26]	4	2	3	9	High
Streck et al.[27]	3	2	2	7	High

Cross-sectional studies (range of total points 0–10): 0 to 3 points— low-quality study, 4 to 6 points— medium-quality study, and 7 to 10 points—high-quality study

Table 2: Source of Bias in Studies

Authors	Selection bias		Information bias		
	Investigator	Self (Study subjects)	Exposure (s)	Outcome(s)	Confounding factor(s)
Alschuler et al. [21]	++	+	-	-	+
Guastafierro et al. [23]	++	+	+	+	+
Kohler et al.[25]	++	+	-	-	+
Lu et al.[24]	++	+	-	+	+
Musche et al. [26]	++	+	-	+	+
Streck et al.[27]	++	+	-	+	+
Zhang et al.[22]	++	+	-	+	+
Zhen et al.[28]	++	+	-	-	+

1.COVID-19 risk perception

In a study by Alschuler et al. 36.18% of patients with MS considered the risk of exposure to

COVID-19 higher than the risk of hospitalization, needing critical care, and dying due to COVID-19 [21]. Zhang et al. reported that, 88% of patients

were worried about exposure to COVID-19, and more than half believed that MS and the drugs related to this disease put them at risk of COVID-19 [22]. In the study by Guastafierro et al. on individuals over 60 years old, the risk of COVID-19 was estimated to be lower than influenza and higher than food poisoning [23]. In the study by Lu et al. elderly individuals reported the risk of COVID-19 to the community and the risk of the resulting infection as above average; however, they reported the severity of the resulting infection to be above average [24]. Kohler et al. reported that individuals with an underlying disease overestimated the COVID-19 risk perception of symptoms and the severity of the disease and death caused by it more than healthy individuals. et al.[25]. Musche et al.. reported a lack of a statistically significant difference in COVID-19 risk perception in diabetic individuals compared to healthy individuals. Nevertheless, individuals with diabetes estimated the occurrence of symptoms and severity of COVID-19 more than healthy individuals [26]. About 80% of individuals with opioid use disorder (OUD) in the study by Streck et al. believed that smoking and vaping nicotine increases the risk of contracting COVID-19 [27]. The results of Zhen et al.'s study in 9 countries showed that celiac patients who were not members of the celiac association evaluated the risk of contracting COVID-19 more than the member patients (Table 3) [28].

2. Factors related to COVID-19 risk perception in vulnerable groups

These 8 articles investigated the relationship between COVID-19 risk perception in vulnerable groups with demographic characteristics and background factors predisposing to COVID-19.

2.1. Factors related to demographic characteristics

Alschuler et al. reported that younger individuals had a higher risk perception of exposure to COVID-19 [21]. Also, Zhen et al. reported that older individuals and men had higher COVID-19 risk perceptions [28]. In the study by Guastafierro et al. individuals over 60 years of age estimated the risk of COVID-19 to be lower than influenza and higher than food poisoning [23].

Another result of this study was a positive relationship between the higher risk perception with the number of information sources used by the participants and the patient's knowledge and

understanding of the COVID-19 disease. However, there was no difference between COVID-19 risk perception with the gender variable and living alone or with others; however, a significant negative relationship was found between age and COVID-19 risk perception; as a result, COVID-19 risk perception of individuals decreased with increasing age. Also, COVID-19 risk perception was higher among those who knew infected individuals [23]. Lu et al.. used structural equation modeling (SEM) to predict the factors and consequences of COVID-19 risk perception. These researchers reported that education, sex, age, not having perfect health, living in the city, having knowledge about vaccination and treatment of COVID-19, knowing someone with a positive COVID-19 test and the daily statistics of COVID-19 infection and death were significant predictors of COVID-19 risk perception in participants aged over 50 years. According to Table 3, among all the significant predictors, having incorrect knowledge of the treatment and vaccine for COVID-19 had the highest standardized path coefficient with COVID-19 risk perception [24].

2.2. Factors related to the underlying disease and predisposing factors for contracting COVID-19

Alschuler et al.. found that MS-related variables were not correlated with COVID-19 risk perception in these patients; however, if individuals had the risk factors for COVID-19 defined by the Centers for Disease Control and Prevention (CDC) and had symptoms consistent with COVID-19, they would feel a greater COVID-19 risk perception. The authors also reported that participants' perceived risk of death from COVID-19 was positively correlated with higher anxiety, more disability from MS, more CDC-defined risk factors for COVID-19, less positive affect, and less well-being (Tables 2 and 3)[21]. Zhang et al.. also reported that subjects receiving disease-modifying therapies (DMT) had higher COVID-19 risk perception [22]. According to Kohler et al., patients with high-risk diseases reported a higher COVID-19 risk perception than healthy individuals. COVID-19 risk perception in individuals with an underlying disease was higher in terms of the severity of symptoms during the course of the disease and death compared to healthy individuals. In addition, individuals with

two underlying diseases had more COVID-19 fear than those with one underlying disease [25]. Musche et al. showed that diabetic patients had COVID-19 fear, and the COVID-19 risk perception of diabetic patients was higher than the control group. Also, diabetic patients reported a higher perception of the severity of symptoms and the course of illness and death caused by COVID-19 [26]. Zhen et al.. stated that following a gluten-free diet (GFD) was correlated with low COVID-19 risk perception. In contrast, the presence of comorbidities such as chronic lung and heart diseases and diabetes was correlated with high COVID-19 risk perception. However, the use of corticosteroids and immunosuppressants did not lead to any change in COVID-19 risk perception (Table 3) [28].

3. The outcome of COVID-19 risk perception

Zhang et al.. reported that individuals with higher levels of worry and COVID-19 risk perception delayed their treatment sessions and laboratory tests more. Also, younger individuals delayed treatment sessions more than older individuals, and women delayed their laboratory tests more than men [22]. Kohler et al. showed that individuals with an underlying disease had higher adherence to safety and ineffective safety behaviors than healthy ones. In addition, individuals with various underlying diseases (e.g., respiratory disease, diabetes, and hypertension)

had higher anxiety scores than healthy individuals. The COVID-19 fear was higher in individuals with diabetes mellitus, cardiovascular disease, hypertension, and respiratory problems than in healthy individuals [25]. In another study, Musche et al. showed that diabetic patients had a higher level of safety behaviors than the control group [26]. Streck et al.. reported that individuals who believed that smoking and nicotine use increased the risk of exposure to COVID-19 and individuals with anxiety symptoms were more likely to quit smoking. According to their results, heavy smokers had fewer attempts to quit smoking as a risk factor for COVID-19, but those with depression had more attempts to quit [27]. Lu et al.. reported risk perception as a predictor of preventive behaviors, adherence, and commitment to self-care. Women, the elderly, individuals with poor health living in the city, knowing someone who tested positive, and having correct knowledge about the vaccine and treatment had higher levels of COVID-19 risk perception and obeying more preventive behaviors. These behaviors included observing social distancing, washing hands, wearing masks, and avoiding medical visits. Among these results, the perception of a higher risk greatly influenced the way of wearing the mask and its compliance and had the highest standard coefficient (Table 3) [24].

Table 3: Studies included in a systematic review

Authors	Year	Location	Sample size	Participants Characteristics	Age	Gender	Instrument for Risk perception	Design	Related factor	out come
Alschuler et al.(21)	April to May 2020	United States	499	Individuals with multiple sclerosis	55.77±12.60	Female: 399 (81%) Male: 85 (17.3%)	4 Question were asked: Contracting COVID-19, being hospitalized due to COVID-19, requiring ICU care due to COVID-19, and dying from COVID-19.	A cross-sectional online survey	Demographic variable Clinical condition of the patient Depression Anxiety Affect and Well-being	
Guastafiero et al.(23)	March to April 2020	Italy	514	participants older than 60	71.44±5.41	Female: 288 (56.03%) Male: 226 (43.97%)	the perceived risk of COVID-19 with other potential threats (cancer, Common flu, Domestic	A cross-sectional online survey	Total number of sources information about COVID-19 Age	Avoiding action

Kohler et al. (25)	March to May 2020	Germany	16 983 Healthy:12885 Having comorbidity:3735	Individuals with having comorbidity (diabetes, hypertension, chronic respiratory and cardiovascular diseases) and healthy individual	18 years old to +75	Female: 11614 (70.39%) Male: 4917 (29.65%) Other: 51 (0.307%)	accidents, Road accidents and Food poisoning)
							4 Question were asked: Risk perception of presenting symptoms of COVID-19, Risk perception of having severe course of COVID-10, Risk perception of dying of COVID-19
Lu et al.(24)	July to October 2020	67 countries	4395	Older adults (aged 50 years or more)	51 years old to +80	Female: 2706(61.58%) Male: 1688 (38.42%)	Three items were used to measure risk perception: Risk to community Risk of infection Infection severity
							Female gender, older age, poorer self-reported health, city residency, personally knowing someone who had tested positive for COVID-19, and having incorrect knowledge of COVID-19 vaccine/treatment
Musche et al.(26)	April to June 2020	Germany	506: Diabetes patient:253 Control:253	Individuals with Diabetes	18 years old to +75	Female: 188 (74.3%) Male: 65 (25.7%)	4 item were asked: concerning the subjective risk perception of infection with COVID-19, probability of the occurrence of symptoms having a severe course, and dying of COVID-19
							Fear Adherent Safety Behavior Dysfunction al Safety Behavior
Streck et al.(27)	February to July 2020	United state	323	Individuals with opioid use disorder (OUD)	44+10.5	Female: 136(46.9%) Male: 154(53.1%)	3 item were asked: vaping nicotine increased their risk of contracting COVID-19 or having a more severe case, vaping nicotine no differences their risk of contracting COVID-19 or having a
							A cross-sectional telephone survey

							more severe case, vaping nicotine lower their risk of contracting COVID-19 or having a more severe case,			
Zhang et al.(22)	April 2020	United state	529	multiple sclerosis patient	18 years old to +80	Female: 111(21.1 %) Male: 416(78.9 %)	3 item were asked: I am or was concerned about becoming infected with COVID-19, I am or was concerned my diagnosis of MS or related disorder alone puts me at higher risk for infection with COVID-19, I am or was concerned my medication for MS or related disorder puts me at higher risk for infection with COVID-19	A cross-sectional on line survey	Gender Educational information from the CGD Center about COVID-19: Exposure to someone with suspected COVID-19 infection Exposure to someone with confirmed COVID-19 infection Testing for COVID-19: Disease-modifying therapies (DMT)	Postponed appointment. Postpone laboratory studies. Postpone MRIs. Postpone or not schedule a follow-up appointment for laboratory studies. Postpone or stop taking your disease-modifying therapy for MS.
Zhen et al.(28)	March to June 2020	Argentina, Australia, Canada, Italy, Mexico, New Zealand, Spain, Uruguay, or the United States	18022 celiac population	celiac and non-celiac population	Median (IQR) 41(28-57)	Female: 9017 (84.17%) Male: 1575 (14.8 %)	the relationship between COVID-19 and Celiac	A cross-sectional web-based survey	Membership in celiac associations Age Gender Strict adherence to a gluten-free diet comorbidities	

Discussion

The results of this systematic review study with the aim of determining COVID-19 risk perception, its related factors and outcomes in vulnerable groups, showed that a young age, having an underlying disease, having higher anxiety and female gender were associated with higher levels of COVID-19 risk perception. The outcomes of higher COVID-19 risk perception were seen in positive and negative ways in individuals. Postponing treatment sessions and follow-ups related to the underlying disease,

increasing anxiety and fear about the COVID-19 disease, and increasing ineffective safety behaviors were among the negative outcomes of higher COVID-19 risk perception. Its positive outcomes were the increase in safety behaviors and greater adherence to health protocols, the reduction in the risk factors of exposure to COVID-19, such as smoking cessation.

In this systematic review study, vulnerable groups include patients with multiple sclerosis, diabetes, hypertension, and chronic respiratory and cardiovascular disease, celiac disease, smokers,

opioid use disorders and individuals over 50 years. Except for one study published in 2020 [29], all studies were published in 2021. As the COVID-19 pandemic continues, studies on COVID-19 risk perception have increased, but COVID-19 risk perception in vulnerable groups is limited compared to the studies that have been conducted in this field on the general population. In all the studies conducted in this field, the sampling was online except for one study where the sampling and completion of the questionnaires was done by phone [27]. The emergence of the COVID-19 disease caused a revolution in the use of virtual space and the Internet [30,31]. Use of virtual space and the Internet to collect data accelerates sampling and data analysis, but sometimes it can reduce the validity of the data. Most of the participants in these studies were women (60%). The greater participation of women shows their greater sensitivity to COVID-19. The studies conducted in this review were on vulnerable groups, including individuals with underlying diseases, opioid use, and old age. All these groups, according to the CDC, were high-risk individuals for contracting COVID-19 [32].

The instruments used in all these studies for COVID-19 risk perception were different. Validity of COVID-19 risk perception questionnaires has not been investigated except for one study that developed new instruments using exploratory analysis [29]. One study used single-item questions to investigate related or predictive variables [25], which can greatly affect the validity of the obtained data. The statistical methods used in these studies were different. In some studies, the mean difference [25, 29], and frequency [22,27] in one of the correlation coefficients [23], in some of the regressions [21,27,28], and in one study, the structural equation model [24] was used, which made difficult the statistical comparison of the results.

1. Factors related to demographic characteristics

In the conducted studies, COVID-19 risk perception in vulnerable groups was reported as a percentage and mean. Kohler et al. reported that comparing COVID-19 risk perception with healthy groups, COVID-19 risk perception was higher in vulnerable individuals [25]. In vulnerable groups, COVID-19 risk perception was

lower in older individuals [21-23,28], Kim et al. reported that individuals nearing the age of 20 reported higher COVID-19 risk perception than those nearing the age of 50 [33]. But unlike these studies, Asnakew et al. showed that the perception of susceptibility to COVID-19 increased with increasing age [34]. Also, the studies of Jahangiry et al. and Kabito et al. also reported a positive relationship between increasing age and COVID-19 risk perception [35,36]. In other studies on healthy individuals, there was a positive relationship between age and COVID-19 risk perception [37,38]. According to the results of the present study, women had a higher COVID-19 risk perception compared to men [22,28]. In the study by Dryhurst et al. and Hotle et al. men had a lower COVID-19 risk perception [39,40]. In the study of Rana et al. and Rivas et al. female gender was correlated in a higher COVID-19 risk perception [41,42]. The study by Shao et al. also confirmed this finding [38]. However, in the study of Domínguez et al. this difference was insignificant, but it was still consistent with the above studies [37]. In some studies, the gender variable was not correlated with COVID-19 risk perception [23,24, 33].

In two studies that were conducted on multiple sclerosis patients, COVID-19 risk perception in these two studies was different from each other. According to the results of Zhang et al. et al. [22] COVID-19 risk perception was higher than the study of Alschuler et al. [21]. et al. et al. In the study of Alschuler et al. compared to the study of Zhang et al. women participated more than men.

The difference in COVID-19 risk perception in these two studies can be because of the difference in the number of men and women participating in the study. However, none of these studies have compared the COVID-19 risk perception between men and women. In the reviewed studies, having information about COVID-19 disease and how to treat it caused increased COVID-19 risk perception [23,24]. Orte et al. reported, there was also a significant difference between factors that increased knowledge and COVID-19 risk perception [29]. Some studies have confirmed this finding; thus, obtaining information from scientific and official sites and personal knowledge was associated with a higher COVID-19 risk perception [37,39,41].

2. Factors related to the underlying disease and predisposing factors for contracting COVID-19

Individuals who had an underlying disease or a risk factor for contracting COVID-19 had a higher COVID-19 risk perception [21,24,25,27,28]. In the study by Zhen et al. the presence of comorbidities such as chronic lung and heart diseases and diabetes was associated with higher COVID-19 risk perception [28].

Streck et al. showed that the presence of symptoms of mental disorders such as anxiety and depression was one of the factors that increased COVID-19 risk perception and, as a result, increased smoking cessation [27]. Kohler et al. reported the presence of an underlying disease was associated with increased COVID-19 risk perception [25]. Among the similar studies that were conducted on individual health, Hotle et al. reported that having influenza in the last 6 months in family members caused higher COVID-19 risk perception [40]. However, Jahangiri et al. founded that individuals without chronic disease had higher COVID-19 risk perception scores [35].

3. The outcome of COVID-19 risk perception

The negative outcomes of COVID-19 risk perception in the studies were delaying treatment sessions and follow-ups related to the underlying disease, increasing anxiety and fear about COVID-19, and increasing ineffective safety behaviors [22,25]. Qian et al. also found that higher COVID-19 risk perception was associated with increased fear and anxiety [43]. These conditions can lead to a feeling of insecurity and uncertainty for individuals and lead to an increase in the level of anxiety and fear of patients and endanger their immune system. The positive outcome of COVID-19 risk perception consists of increasing safety behaviors and more adherence to health protocols, reducing the risk factors of exposure to COVID-19 such as quitting smoking [24,27]. In other studies, conducted on healthy individuals, it was reported that higher COVID-19 risk perception was associated with higher safety and self-care behaviors [44-46].

Conclusion

The results of this study showed that in vulnerable groups, age, gender, underlying disease and risk factors related to COVID-19 and having knowledge related to COVID-19 are related to COVID-19 risk perception. Higher COVID-19

risk perception can lead to a positive outcome and increase safety behaviors to avoid exposure to COVID-19. Increasing the awareness of COVID-19 sometimes has negative outcomes for clients; so that in some individuals, it leads to an increase in fear, anxiety, and feeling of insecurity and lack of medical visits to prevent infection with COVID-19. Regarding the continuation of the COVID-19 pandemic and the increase in the vaccination process in most countries, COVID-19 risk perception is changing. Therefore, continuous investigation of COVID-19 risk perception and its related factors and outcomes is recommended for better control of health behaviors of vulnerable groups using standard instruments. By identifying the factors related to COVID-19 risk perception, health care workers can strive to improve self-care behaviors in enhancing COVID-19 risk perception in vulnerable groups. On the other hand, by carrying out effective interventions and informing vulnerable individuals, the physical and psychological injuries of these individuals are reduced.

This study provided an overview of COVID-19 risk perception in vulnerable groups and identified some related factors and outcomes of exposure of these individuals to COVID-19. One of the limitations of this study was the small number of studies, the non-uniformity of the instruments used to measure COVID-19 risk perception and its related factors. Also, the social, economic and cultural conditions of the countries in control of the COVID-19 pandemic are effective on COVID-19 risk perception. On the other hand, in cross-sectional studies, it is not possible to achieve a cause and effect relationship, and the related factors and outcomes of COVID-19 risk perception are affected by many confounding variables. For the same reason, it is difficult to draw general conclusions from this systematic review study, and its generalizability is also reduced. It is recommended that due to the publication of many articles in the field of COVID-19, systematic review studies should be conducted separately for vulnerable groups.

Co-authorship

All the authors participated in the initial writing of the article or its revision, and all of them accept the responsibility for the accuracy and correctness of the contents of this article with the final approval of this article.

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Conflict of interest

The authors declare no conflicts of interest.

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