UNIVERSIDADE BEIRA INTERIOR

Could the perception of risk increase adherence to preventive measures to control the pandemic COVID-19? A study with elderly people

Rafaela Brás Gonçalves

Dissertação para obtenção do Grau de Mestre em
Medicina
(mestrado integrado)

Orientadora: Prof.ª Doutora Rosa Marina Lopes Brás Martins Afonso
Coorientadora: Prof.ª Doutora Maria da Assunção Morais e Cunha Vaz Patto
Coorientadora: Prof.ª Doutora Luisa Maria Jota Pereira Amaral

abril de 2021

“The highest reward for a person's toil is not what they get for it, but what they become by it”

John Ruskin

Dedicatória

Ao avô Miro, a minha estrelinha…

Agradecimentos

À Professora Rosa, por ter aceitado tão prontamente ser minha orientadora, mesmo quando já tinha tantos orientandos. Por estar sempre disposta a ajudar e ter sempre uma palavra positiva para dizer. Por toda a dedicação e tempo que despendeu neste trabalho. Muito obrigada!

À Professora Assunção, por todos os sábios conselhos. Por toda a dedicação. Por enriquecer ainda mais este trabalho. Foi um prazer trabalhar consigo. Muito obrigada!

À Professora Luísa, por toda a dedicação e ajuda na parte da estatística.

Ao Doutor Nuno, pela fantástica ajuda com a base de dados.

À minha família, por me apoiarem incondicionalmente ao longo de todos estes anos. Por me terem proporcionado ser quem eu sou e estar onde estou hoje. Sem vocês nunca teria conseguido. Muito obrigada a todos, especialmente aos meus pais!

Ao meu namorado, por tornares este caminho tão mais fácil de suportar. Por toda a força e apoio que me dás sempre que eu preciso. Por moveres o mundo só para me fazeres feliz. Muito obrigada!

À Luna, a minha filha de quatro patas. Por todo o amor incondicional. Por tornar os meus dias ainda mais felizes. Por tudo de bom que acrescentou à minha vida.

A todos os amigos que a Covilhã me deu, por me fazerem sentir em casa quando estava tão longe dela. Por trilharmos juntos este longo e árduo caminho. Por fazerem jus à palavra amizade. Vocês são incríveis!

A todos, muito obrigada!

Resumo

Objetivo: O presente estudo foi concebido para avaliar a perceção de risco de infeção por SARS-CoV-2 em pessoas idosas, identificar quais as medidas preventivas adotadas e examinar o papel do risco percebido na adoção destas medidas.

Métodos: Os dados foram recolhidos através de entrevista telefónica, de 15 a 30 de abril de 2020, durante a primeira vaga de COVID-19, em Portugal. Os participantes foram questionados sobre o nível de risco a que pensavam estar expostos relativamente à infeção por SARS-CoV-2 e quais as medidas preventivas adotadas. A correlação de *Spearman* foi utilizada para avaliar a relação entre a perceção de risco e o "número de medidas preventivas adotadas".

Resultados: A amostra consistiu em 85 participantes do "Estudo do Envelhecimento da Covilhã" com uma idade média de 79,54 (± 5,04) anos. Cerca de 36,5% dos nossos participantes reportaram o seu risco como sendo elevado ou muito elevado, e os homens mais frequentemente do que as mulheres perceberam este risco como elevado ou muito elevado. A perceção de risco correlacionou-se positivamente com a idade (rS=0,289, p=0,004), "nível significativo de depressão" (rS=0,281, p=0,005) e "número de medidas preventivas adotadas" (rS=0,178, p=0,05). A maioria dos participantes (94,1%) referiram ter ficado em casa o máximo de tempo possível, 49,4% utilizavam máscara facial, 55,3% lavavam as mãos e 17,6% usavam luvas. Aproximadamente 55% consideraram a idade um fator de vulnerabilidade.

Conclusão: A perceção de risco pode contribuir para explicar a adoção de medidas preventivas na população idosa. Os resultados deste estudo podem ser utilizados pelas autoridades de saúde de forma a poderem adaptar a comunicação de riscos aos grupos mais vulneráveis, nomeadamente os idosos.

Palavras-chave

COVID-19; perceção de risco; medidas preventivas; população idosa

Resumo alargado

O mundo tem sido assolado pelos efeitos da pandemia de COVID-19, a doença provocada pelo novo coronavírus: SARS-CoV-2, o qual já contabilizou mais de 2 milhões e 783 mil mortes e cerca de 127 milhões e 150 mil casos de infeção (março de 2021, WHO). A nível internacional e nacional, as medidas preventivas de controlo da pandemia que se destacam são o distanciamento social, a utilização de equipamentos de proteção individual, as medidas de higiene pessoal como a lavagem das mãos e a etiqueta respiratória, a higiene ambiental e o autocontrolo de sintomatologia com isolamento social caso surjam sintomas sugestivos de infeção por SARS-CoV-2. As medidas preventivas desempenham um papel crucial na prevenção da propagação de doenças infeciosas como a COVID-19, especialmente durante a primeira vaga da doença em Portugal, quando ainda não havia vacina e o conhecimento acerca do assunto era escasso.

As intervenções e comunicações que recomendam estas medidas podem ser ineficazes se não tiverem em conta a forma como os indivíduos avaliam as caraterísticas da situação, nomeadamente a sua perceção de risco, uma vez que o facto de a pessoa ter consciência dos riscos é essencial para ter comportamentos preventivos e aderir às recomendações.

Os grupos considerados em risco de desenvolver doença severa com mais frequência do que os restantes incluem pessoas de idade avançada (≥ 65 anos), devido às comorbilidades que podem estar presentes e pessoas com doenças crónicas e/ou imunocomprometidas. Deste modo, é imprescindível que os idosos, enquanto grupo vulnerável à COVID-19, adotem medidas de proteção individual para prevenir a infeção pelo SARS-CoV-2, uma vez que, tal como mencionado acima, podem estar sob maior risco de ter doença severa, que poderá requerer hospitalização (algumas em terapia intensiva), ventilação invasiva, ou mesmo resultar na sua morte.

Assim, o presente estudo foi concebido para avaliar a perceção de risco de infeção pelo SARS-CoV-2 nos idosos, identificar quais as medidas de proteção adotadas pelos mesmos e avaliar se a perceção de risco pode prever a adoção de medidas preventivas.

Relativamente aos métodos, optámos por aplicar o questionário através de chamada telefónica, devido ao facto de estarmos em confinamento e para assim conseguirmos atingir o nosso público alvo, uma vez que através de questionário online não seria

possível. As entrevistas foram realizadas de 15 a 30 de abril, e, para além do objetivo da recolha dos dados, tiveram outro intuito: apoiar os idosos neste momento de incerteza e solidão, e, ao mesmo tempo educar, pois inerentemente foi prestado aconselhamento médico geral e relacionado com a COVID-19.

Os participantes foram questionados acerca da sua perceção de risco de serem infetados pelo SARS-CoV-2 (com as possibilidades de resposta: muito baixo, baixo, moderado, elevado e muito elevado) e relativamente às medidas preventivas que adotavam para se protegerem. Para identificação de sintomatologia depressiva foi utilizada a versão reduzida da *Geriatric Depression Scale* (GDS), composta por 4 itens. A correlação de *Spearman* foi utilizada para avaliar a relação entre a perceção de risco e o "número de medidas preventivas adotadas", e entre a perceção de risco e outras variáveis de interesse.

A amostra consistiu em 85 participantes do "Estudo do Envelhecimento da Covilhã" com uma idade média de 79,54 (± 5,04) anos. Observou-se que durante a primeira vaga de COVID-19 os idosos residentes na Covilhã tinham uma perceção de risco moderado de serem infetados pelo SARS-CoV-2 e os homens mais frequentemente do que as mulheres perceberam este risco como elevado ou muito elevado. Relativamente às medidas preventivas adotadas, a maioria dos participantes (94,1%) referiram ter ficado em casa o máximo de tempo possível, 49,4% utilizavam máscara facial, 55,3% lavavam as mãos e 17,6% usavam luvas. Em relação aos fatores que os participantes consideraram torná-los mais vulneráveis à COVID-19, cerca de 55,3% referiram a idade.

A perceção de risco correlacionou-se positivamente com a idade e com um "nível significativo de depressão", o que pode significar que pessoas com essa condição podem ser mais vulneráveis ao impacto negativo da pandemia e, portanto, mais atenção deve ser dada aos indivíduos mentalmente vulneráveis. Constatou-se também que quanto maior a perceção de risco de ser infetado pelo SARS-CoV-2, maior o número de medidas preventivas adotadas pelos participantes. Este resultado mostra-nos que a perceção de risco individual desempenha um papel crucial na adoção de medidas preventivas entre os idosos e, portanto, é extremamente importante otimizar as ações e comunicações de forma a consciencializar as pessoas acerca dos riscos, levando a uma maior adesão a comportamentos preventivos. No entanto, é necessário compreender melhor a relação entre a perceção de risco e sintomatologia depressiva para garantir que a adoção de medidas preventivas se baseia numa perceção de risco adequada e

funcional e que não seja influenciada por uma sintomatologia psicopatológica que pode comprometer seriamente a saúde e o bem-estar de uma pessoa.

Os resultados deste estudo podem ser utilizados pelas autoridades de saúde de forma a poderem adaptar a comunicação de riscos aos grupos mais vulneráveis, nomeadamente os idosos.

Abstract

Purpose: The present study was designed to evaluate the risk perception of being infected by SARS-CoV-2 in elderly people, identify what preventive measures they take and to examine the role of perceived risk in the adoption of these measures.

Methods: Data were collected by telephone interviews, April 15th to April 30th, 2020 during the first wave of COVID-19 in Portugal. Participants were asked the level of risk they thought they were exposed to regarding infection with SARS-CoV-2 and what preventive measures they took to protect themselves. *Spearman's* correlation was used to assess the relationship between risk perception and "number of preventive measures adopted".

Results: The sample consisted of 85 participants from the "Covilhã Aging Study" with a mean age of 79.54 years (SD = 5.04). About 36.5% of our participants reported their risk as being high or very high, and men more often than women perceived this risk as high or very high. The risk perception is positively associated with age (rS=0.289, p=0.004), "significant level of depression" (rS=0.281, p=0.005) and "number of preventive measures adopted" (rS=0.178, p=0.05). Most participants (94.1%) reported they stayed at home as much as possible, 49.4% wore a facemask, 55.3% washed their hands and 17.6% wear gloves. Approximately 55% considered age as a vulnerability factor.

Conclusion: Risk perception could contribute to explain the adoption of preventive measures in elderly people. The results of this study can be used by health policy makers to focus on effective risk communication, especially for vulnerable groups such as the elderly.

Keywords

COVID-19, risk perception, preventive measures, elderly people

Index

List of Figures

List of Tables

Acronym List

AIDS	Acquired Immunodeficiency Syndrome
CAS	Covilhã Aging Study
CDC	Centers for Disease Control and Prevention
COVID-19	Coronavirus Disease 2019
GDS	Geriatric Depression Scale
HIV	Human Immunodeficiency Virus
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SD	Standard Deviation
USA	United States of America
WHO	World Health Organization

1. Introduction

The world has been plagued by the effects of the COVID-19 pandemic, the disease caused by the new coronavirus SARS-CoV-2, having already accounted for more than 2 million and 783 thousand deaths and more than 127 million and 150 thousand cases of infection (WHO) [1] in March 2021. Considering the alarming levels of virus spread since December 2019, when it was first described in Wuhan, the WHO declared the disease as a pandemic on March 11, 2020. [2] In Portugal, the first cases of infection were confirmed in March 2020, starting the first wave of the disease [3].

The transmission of SARS-CoV-2 occurs through close contact with people infected by it (direct transmission), or through contact with contaminated surfaces or objects (indirect transmission), with the majority of those infected being asymptomatic or showing only mild symptoms, namely fever, cough, tiredness, and muscle pain [3,4]. A minority of cases develop severe symptoms, with severe pneumonia, severe acute respiratory syndrome, septic shock and eventual death [3,4].

Preventive measures play a crucial role in preventing the spread of epidemic infectious disease [5] like COVID-19, especially during the first wave of the disease in Portugal, when there was still no vaccine and knowledge about the subject was scarce. At the international and national level, the following preventive measures stand out: social distancing; the use of protective equipment; personal hygiene measures such as hand washing and respiratory etiquette; environmental hygiene, specifically cleaning and disinfection, and self-monitoring of symptoms, abstaining from work, and social isolation if symptoms suggestive of COVID-19 appear [3,4,6]. It is important to mention that during the data collection period in this first wave, the use of a mask was not yet mandatory in public establishments.

Interventions and regulations that recommend preventive measures to control the pandemic may be ineffective if they do not consider how individuals assess the situation, namely their perception of personal risk [7]. Being aware of the risk is indispensable to preventive behavior adherence [7]. According to several studies, people with a higher risk perception regarding SARS-CoV-2 infection tend to significantly increase their involvement in preventive behaviors [8-17]. Furthermore, people with a lower risk perception, in addition to being less likely to adhere to preventive measures, tend to adopt risky behaviors [18]. It was found that “the female gender” [8-10, 13, 19- 26], “a higher education level” [9, 25], “to have a better

perception of health" [20] and "having higher COVID-19 knowledge" [17], were variables associated with a greater compliance with preventive behaviors against COVID-19. The variables related to a higher perception of risk regarding SARS-CoV-2 infection are also "the female gender" [9, 10, 11, 14, 29, 30], "being single" [31], "a higher education level" [9, 12, 29], the fact of "having a family member or friend who is or has been infected with COVID-19" [29, 30], or even him/herself [32], "having higher COVID-19 knowledge" [17, 26] and "to have a worse perception of health" [30].

Another variable that is positively related to risk perception are "depressive states" [33, 34, 35]. According to Zhong et al.'s study, this may mean that people with mental health problems, namely depression, may be more vulnerable to the negative impact of the pandemic COVID-19 and therefore it is important that public health interventions target mentally vulnerable individuals at risk of COVID-19 infection [33]. Fear of contracting the virus was also strongly associated with depression [36]. In another study, risk perception mediated the relationship between the duration of attention to pandemic news and depression, the longer individuals watched pandemic news, the higher is the perceived risk, which in turn leads to increased levels of depression [37].

According to the Centers for Disease Control and Prevention (CDC) and the WHO, groups considered at risk of developing serious illnesses more often than others include people of advanced age (≥ 65 years), due to the comorbidities that may be present, people with chronic illnesses (heart, lung, cancer, diabetes, and hypertension), and people with compromised immune systems (chemotherapy treatments, immunosuppression treatments, HIV / AIDS, and transplant patients) [4, 6]. Being a vulnerable group to COVID-19, it is essential that the elderly [6, 19, 34, 35] adopt individual protection measures to prevent infection by SARS-CoV-2 since, as mentioned above, they may be at greater risk of having the severe form of the disease, which may require hospitalization (some in intensive care), invasive ventilation, or even result in their death [6].

With this in mind, it would be expected that the adherence to preventive measures by the elderly would be high [39], however, the results are not consensual. Barari et al. [20], in Italy, found that participants over 60 years old were the most disciplined regarding preventive measures. Seale et al. [21], in Australia, also concluded that old age was associated with the adoption of preventive measures, however, the relationship with age was not direct. A study conducted in Serbia stated that age was demonstrated to be the most important predictor of preventive measures [40]. On the other hand, in a study developed with a representative sample of 29 countries, Daoust [39] found that

among the different age groups there was no substantial differences in adherence to prophylactic measures, even observing a decrease in mask use with advancing years (20-80 years), and then stabilizing. A study conducted in Portugal also during the first outbreak of COVID-19 (rural-urban population aged 18-85 years), which focused on age-related differences in the adoption of preventive measures, also concluded that the engagement in these measures decreases with advancing age and that older adults have a lower risk perception compared to middle-aged adults. [41].

Regarding the risk perception of being infected by SARS-CoV-2 among the elderly people, the results are also not consensual. One of the first studies carried out in the USA concluded that older people were more likely to perceive COVID-19 as a "significant crisis" and as a health threat [42]. In the same context, a study carried out in China showed that the elderly were more likely to have higher risk perceptions regarding contracting COVID-19 [12] and another study determined that the most important predictor of risk perception was age [40]. On the other hand, the results of the study by Bruine de Bruin [43], which evaluated the differences in risk perception according to age, showed that the elderly perceive themselves to have a lower risk of being infected by SARS-CoV-2, despite understanding that they have the greatest risk of dying if they are indeed infected by it. Van der Velden [9] concluded in the same way, that people with advanced age, compared to younger people, reported less often a higher risk perception of being infected. In relation to the probability of becoming ill if they were infected by the new coronavirus, elderly people recognized that they had a higher risk.

This study aims to: (1) assess risk perception of being infected by SARS-CoV-2 in the elderly people; (2) analyze the relationship between the risk perception of being infected by SARS-CoV-2 and age; (3) evaluate if there are differences in risk perception according to gender, marital status, and education level; (4) analyze the relationship between depressive symptoms and risk perception; (5) identify which protective measures against COVID-19 are adopted by the elderly people; (6) analyze if there are differences in the adoption of preventive measures according to gender, marital status, and educational level; (7) assess if risk perception predicts the adoption of preventive measures; (8) describe the factors that the participants consider to make them more vulnerable to SARS-CoV-2 infection.

2. Methods

2.1. Procedures and participants

This study is part of the "Covilhã Aging Study" (CAS) [44], started in 2012, which aimed to assess different aspects related to aging, and counted on the participation of 226 people, a randomly extracted sample from the population aged 65 or over, residing in the city of Covilhã (Portugal). In April 2020, CAS participants who had authorized further contact were invited to participate in this study.

Since the data collection took place during the first wave of COVID-19 pandemic, while Portugal was under lockdown, it was decided to conduct the interviews by telephone. Of the 226 CAS participants in 2012, 107 answered the questionnaire for this follow-up study, 17 did not accept to participate, 33 participants could not be reached by telephone, and 69 had died. Of the participants who responded to the questionnaire, 22 did not answer the whole questionnaire due to their health or dependence, so only the social-demographic data and their general status were updated, and 85 responded to the entire questionnaire. The inclusion criteria for this study were CAS participants who entirely answered the questionnaire in 2020, meaning that the sample of this study was 85 participants (N=85).

Telephone interviews were conducted by two researchers, from April 15th to April 30th, with an average call duration approximately 18 minutes.

2.2. Measures

As a part of this study, a brief questionnaire was prepared and applied by telephone to collect data. In the initial part of the questionnaire, relevant information was collected for the social-demographic and functional characterization of the sample (gender, age, education level, marital status, residence, living situation, and basic and instrumental activities of daily living).

To assess the presence of depressive symptoms, we used the reduced version of the Geriatric Depression Scale (GDS) [45] composed of 4 items and developed to assess the presence of moods that are indicative/suggestive of depressive symptoms in the elderly population. It is a scale of Yes or No answers the maximum score of which is 4 points (each "yes" answer is scored with 1 point), and for this study a cut-off of ≥2 was considered for the identification of symptomatologic relevance.

It was asked: "What do you consider to be your personal risk of being infected with SARS-CoV-2?" and that risk was measured by a 5-point Likert scale (very low, low, medium, high, and very high).

An open question was presented in order to find out what preventive measures were taken by the participants: "What do you do to protect yourself from COVID-19?".
The “number of preventive measures adopted” was assessed using four criteria – (1) “Stay at home”, (2) “Wear a mask”, (3) “Wash hands” and (4) “Wear gloves” – and for each positive answer it was attributed 1 point (Yes = 1), adding up to a total score of 4.
To perceive the factors that the participants consider to make them more vulnerable to SARS-CoV-2 infection, it was asked: “What do you think may make you more vulnerable to SARS-CoV-2 infection?”.

2.3. Data analysis

The statistics software SPPS 24.0 was used for data analysis. Descriptive statistics, using frequencies, percentages, means, and standard deviations, were conducted for general characteristics, risk perception and vulnerability factors pointed out by the participants.
Spearman’s correlation was used to establish the relationship between risk perception and “number of preventive measures adopted”, and between risk perception and major variables of interest. A Chi-square test was used to find out if there was an association between risk perception and social-demographic and functional characteristics (gender, education level, marital status, living situation, basic and instrumental activities of daily living) and between preventive measures and social-demographic and functional characteristics (gender, education level, marital status, living situation, and basic and instrumental activities of daily living).
The statistical significance of all tests was defined as bilateral $p<0.05$.

3. Results

As reported in Table 1, there was a balance in participants' gender (55.3% women), with age predominantly between 75 and 84 years (79.54 ± 5.04), and a medium-low education level (61.9% elementary school; 25.0% middle school). Almost all volunteers resided in their private homes (89.3%) and not alone (78%); 63.5% of participants were married or had a partner. Slightly more than half of the sample (54.1%) was not staying at home during lockdown, 76.5% and 74.1% were independent in what concerns to the basic and instrumental activities of daily living, respectively.

The mean GDS score was 1.16±1.22, with 27.1% exceeding the threshold score indicative of a significant level of depression.

Table 1- Distribution of sociodemographic and functional characteristics (N= 85)

	Sample size	**Percentage**	**Mean±SD**
Gender			
- Female	47	55.3	
- Male	38	44.7	
Age, years			
- 70-74	15	17.6	
- 75-84	51	60.0	79.54±5.04
- ≥ 85	19	22.4	
Education level			
- Illiterate	2	2.4	
- Elementary school	52	61.9	
- Middle school	21	25.0	
- High school	9	10.7	
Marital status			
- Married/Partner	54	63.5	
- Unmarried*	31	36.5	
Residence			
- Own home	75	88.3	
- Family home	4	4.7	
- Nursing home	3	3.5	
- Other	3	3.5	
Living situation			
- Alone	18	22.0	
- Not alone	64	78.0	

Basic activities of daily living			
- Independence	65	76.5	
- Some dependence	20	23.5	
Instrumental activities of daily living			
- Independence	63	74.1	
- Some dependence	20	23.5	
- Complete dependence	2	2.4	

*single, divorced, separated, or widowed.

Regarding the risk perception of being infected by SARS-CoV-2, 35.3% reported it as being low or very low, 28.2% considered their risk to be medium and 36.5% reported that their risk was high or very high (Figure 1).

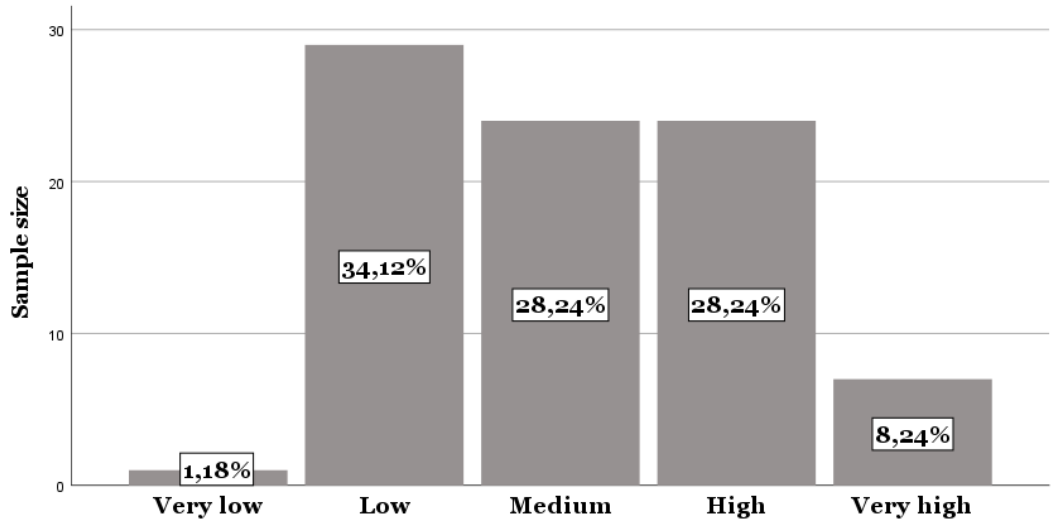

Figure 1- Risk perception of being infected by SARS-CoV-2

To find out if there was an association between risk perception and social-demographic characteristics (gender, age, education level, marital status, living situation, and basic and instrumental activities), a Chi-square test was used. The results are presented in Table 2. They show that men more often than women perceived the risk of infection as high or very high. Moreover, women more often than men perceived the risk of infection as low. No relationship was found between risk perception and the remaining variables.

Table 2- Risk Perception and social-demographic and functional characteristics.

	Risk Perception			**Statistic value**	**p-value**
	Very low/ Low	**Moderate**	**High, very high**		
Gender					
- Female	22	12	13	6.459	**0.04**
- Male	8	12	18		
Education level					
- Elementary school	19	16	16	2.166	0.705
- Middle school	8	4	9		
- High school	2	3	4		
Marital status				0.41	0.815
- Married/Partner	18	15	21		
- Unmarried*	12	9	10		
Living situation				0.438	0.803
- Alone	7	4	7		
- Not alone	21	19	24		
Basic activities of daily living				0.493	0.781
- Independence	22	18	25		
- Some dependence	8	6	6		
Instrumental activities of daily living	21	18	24	0.302	0.86
- Independence	8	5	7		
- Some dependence					

*single, divorced, separated, or widowed.

Table 3 shows *Spearman's* correlations between risk perception and risk-related variables. Risk perception is positively associated with age (r_S=0.289, p=0.004), "significant level of depression" (r_S=0.281, p=0.005) and "number of preventive measures adopted" (r_S=0.178, p=0.05). Thus, the higher the risk perception, the greater the number of preventive measures adopted. No relationship was found between risk perception and remaining variables.

Table 3- *Spearman's* correlations among risk perception and risk-related variables

Spearman correlations	Risk perception (rs)	p-value
Age	0.289	**0.004**
Basic activities	-0.077	0.242
Instrumental activities	-0.085	0.219
Significant level of depression (GDS)	0.281	**0.005**
Number of preventive measures adopted	0,178	**0.05**

Regarding the adoption of preventive measures in order to control the pandemic, most participants (94.1%) reported to "stay at home as much as possible", 49.4% "wear a facemask", 55.3% "wash hands" and 17.6% "wear gloves".

To find out if there was an association between preventive measures taken ("stay at home", "wear a facemask", and "wash hands") and social-demographic and functional characteristics (as gender, education level, marital status, living situation, and basic and instrumental activities of daily living), a Chi-square test was used. No relationship was found between preventive measures taken and the social-demographic variables.

Table 4- Preventive measures ("stay at home", "wear a facemask" and "wash hands") and social-demographic and functional characteristics.

General characteristics	**Stay at home**			**Wear a facemask**			**Wash hands**		
	n/N	Chi-square	p-value	n/N	Chi-square	p-value	n/N	Chi-square	p-value
Gender - Male - Female	37/38 43/47	1.312	0.374	34/65 6/16	0.01	0.922	19/38 28/47	0.779	0.377
Education level - Elementary school - Middle school - High school	49/52 21/21 8/9	1.919	0.383	24/52 13/21 4/9	1.609	0.447	30/51 11/21 5/9	0.258	0.879
Marital status - Married/Partner - Unmarried	52/54 28/31	1.269	0.26	28/54 14/31	0.353	0.553	29/54 18/31	0.152	0.697
Living situation - Alone - Not alone	18/18 61/64	0.876	0.349	10/18 32/64	0.174	0.667	9/18 36/64	0.222	0.638
Basic activities - Independence - Some dependence	63/65 18/20	0.801	0.371	33/65 9/20	0.204	0.652	34/65 13/20	0.997	0.318
Instrumental activities - Independence - Some dependence	60/62 17/19	1.651	0.233	33/63 8/20	0.931	0.335	32/63 14/20	2.267	0.132

*single, divorced, separated, or widowed.

Regarding the factors that the participants consider to make them more vulnerable to COVID-19, about 55.3% consider age as a vulnerability factor (Table 5).

Table 5- Vulnerability factors to COVID-19 indicated by the participants.

Vulnerability factors	**Sample size**	**Percentage**
Age	47	55,3
Having respiratory disease	6	7,1
Heaving heart disease	5	5,9
Having diabetes	3	3,5
Having hypertension	1	1,2
Others	6	7,1

4. Discussion

The present study was designed to evaluate the risk perception of being infected by SARS-CoV-2 in elderly people and examined the role of perceived risk in explaining preventive behaviors towards COVID-19 and the influence of social-demographic characteristics in risk perception and in preventive measures adopted.

It was observed that during the first wave of COVID-19 pandemic, elderly people residing in Covilhã had a moderate risk perception of being infected by SARS-CoV-2, and men more often than women perceived this risk as high or very high. Risk perception was positively associated with age and "significant level of depression", and the higher the risk perception of being infected by SARS-CoV-2, the greater the number of preventive measures adopted.

Regarding the risk perception of being infected by SARS-CoV-2, only 36.5% of our participants (mean age 79.54 ± 5.04 years) reported their risk as being high or very high, whereas in the Wang X study [12] carried out in China (mean age 33.0 ± 12.5 years), 49.4% reported the same. Our risk perception may be lower due to the fact that at the time of data collection, Portugal was still at the beginning of the first wave and the number of deaths and infected was still low, while China had already crossed the peak of the first wave. Another potential explanation for this, according to Brewer [28], is that some people may perceive their risk of being infected as being lower because they had already adopted the recommended preventive measures. In agreement, another study found that people may perceive the risk as high and therefore take measures, however, the opposite may also be true, people may perceive the risk as lower because they take measures [9]. This is in line with our study since 94.1% of the participants reported staying home as much as possible to protect themselves.

We found a significant positive correlation between risk perception and age, which may be due to the fact that in Portugal the news are very focused on the risk to the elderly population and deaths in nursing homes. Our results are consistent with other studies, showing that the elderly were more likely to have higher risk perception regarding contracting COVID-19 [12, 17, 33, 40, 46]. In contrast, Bruine de Bruin found that the elderly considered themselves to have a lower risk of being infected with SARS-CoV-2 but reported having a higher risk of dying if infected [43]. Factually, the death rate from COVID-19 is higher among the elderly than among the young and middle-aged [47].

We also found that men perceived the risk of infection as high or very high more often than women, which is not consistent with previous findings showing higher levels of

risk perception among the “female gender” [9, 10, 11, 14, 29, 30]. One explanation for this result may be that men have spent more time exposed to pandemic-related news, which may lead to a higher risk perception, according to the study by Lanting Wu et al. [37] which reported that the duration of attention to pandemic-related news has a predictive effect on people’s risk perception. Furthermore, according to the results of Ahrenfeldt LJ et al. in 10 regions of Europe (including Portugal), the relative risk of dying from COVID-19 was higher for men than for women in almost all age groups and in all regions [48]. Thus, if men had access to such information, it could justify their higher risk perception.

On the other hand, risk perception did not vary with marital status or education level in our sample, contrasting with the results of previous studies which showed that “single people” [31] and those with “a higher education level” [9, 12, 29] had a higher risk perception. Most of our participants have a medium-low education level, which may justify the fact that the education level did not significantly influence risk perception in our sample. Furthermore, only 10.6% of our participants are single (a very reduced sample), so that may be the reason why significant results were not achieved.

Another finding of this study was that risk perception was positively associated with “a significant level of depression”. A possible explanation for this may be related to the fact that people with depressive symptomatology tend to focus more on the negative aspects, which may lead to a greater concern and awareness about the pandemic situation, instilling a greater perception of risk. Our result is in agreement with another study conducted among COVID-19 patients, which concluded that risk perception was positively related to “depressive states” [33]. In addition, as mentioned by Zhong Y. et al. [33], this can mean that people with mental health issues could be more vulnerable to the negative impact of the COVID-19 pandemic, so it is crucial that risk-related communications are adapted to mentally vulnerable individuals.

Moreover, a positive correlation between risk perception and “number of preventive measures adopted” was observed, showing that the higher the risk perception of being infected by SARS-CoV-2, the greater the number of preventive measures adopted. This is consistent with other studies, which showed that people with a higher perception of risk tend to significantly increase their involvement in preventive behaviors [e.g., 8-17]. This result is extremely important, because it demonstrates the role that risk perception plays in the adoption of preventive measures. It is therefore crucial that risk-related communications focus on increasing our personal perception of risk in order to increase adherence to preventive measures, while simultaneously not leading to a "pathological fear" that can restricts the one's life.

Regarding the adoption of preventive measures to control the pandemic, most participants (94.1%) reported they stayed at home as much as possible, 49.4% wore a facemask, 55.3% washed their hands and 17.6% wear gloves. Comparing to a research with elderly people carried out in Brazil (May 2020) [49], we noticed that, in our study, the percentage of the participants who reported staying at home was higher and the percentage of mask use and hand washing was lower. It is important to highlight that at the time of data collection the use of a mask was not yet mandatory in public establishments and there was some difficulty in accessing protective equipment due to the high demand. Moreover, the country was under mandatory lockdown, which may have "encouraged" people to stay at home.

In our sample, the number of preventive measures taken did not vary with gender or education level, contrary to other studies, which showed that "female gender" [8-10, 13, 19- 26], and "a higher education level" [9, 25] were associated with greater adherence to preventive measures. As aforementioned, most of this study's participants had a medium-low education level, which may justify the fact that the education level did not significantly influence the number of preventive measures taken in our sample.

Regarding the factors that the participants consider to making them more vulnerable to COVID-19, about 55.3% considered age as a vulnerability factor (Table 5). A higher percentage was expected as it has been widely reported that the elderly are included in vulnerable groups [6, 19, 38, 39], not only because it is well established that immune responses decrease with aging [50], but also because the mortality rate of COVID-19 is higher among the elderly than among the young and middle-aged [47] and the highest mortality is observed among older patients [50]. However, it is important to note that age in itself does not mean a higher risk, but rather that with advancing age it is common to suffer from more comorbidities.

Lastly, regarding the remaining vulnerability factors, as it was not possible to access the participants' clinical data, we were unable to compare their individual diagnoses (namely those that can make participants more vulnerable to COVID-19) with the vulnerability factors that they themselves mentioned (respiratory and heart disease, having diabetes or hypertension), which is one of the limitations of our study. Second, the sample used is smaller than what is desirable, since it is part of a longitudinal study, in which we had to restrict ourselves to the participants of CAS. Furthermore, other dimensions that affect both risk perception and the adoption of preventive measures were not considered. It should be noted that the data was collected during the initial phase of the pandemic in Portugal, when the number of infected people and consequent

deaths was reduced, with no deaths from SARS-CoV-2 in the city of Covilhã, which may have influenced the risk perception and the adoption of preventive measures.

The potential of this study lies in the random sample stratified by gender and age group, being inserted in a longitudinal study, and having been carried out via telephone interviews, because through online questionnaires it would not be possible to reach the target population, who is unable to use them. In addition to collecting the data, these interviews had other roles: to support the elderly in this moment of uncertainty and loneliness, and to educate, as inherently it was provided general and COVID-19-related medical advice.

5. Conclusion

In conclusion, during the first wave of COVID-19 pandemic, elderly people residing in Covilhã had a moderate risk perception of being infected by SARS-CoV-2, and men more often than women perceived this risk as high or very high. Risk perception was positively associated with “significant level of depression”, which may mean that people with this condition could be more vulnerable to the negative impact of the pandemic, and thus, more attention should be paid to mentally vulnerable individuals. Furthermore, it was observed that the higher the risk perception of being infected by SARS-CoV-2, the greater the number of preventive measures adopted. This shows that personal risk perception plays an important role in the adoption of preventive measures among older people and, therefore, it is important to optimize communications and actions in order to make people aware of the risks, leading to the more frequent adoption of preventive behaviors. However, it is necessary to better understand the relationship between risk perception and depressive symptomatology to ensure that the adoption of preventive measures is based on an adequate and functional risk perception and not influenced by a psychopathological symptomatology that can seriously compromise a person's well-being and health.

The results of this study can be used by health policy makers to focus on effective risk communication, especially for vulnerable groups such as the elderly and mentally vulnerable individuals.

6. References

1. World Health Organization. WHO Coronavirus Disease (COVID-19) Dashboard [Internet]. 2020. [cited 2021 Mar 30]. Available from: https://covid19.who.int/
2. World Health Organization. Timeline: WHO's COVID-19 response [Internet]. 2020. [cited 2020 Nov 17]. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/interactive-timeline#event-6
3. Direção-Geral da Saúde [Internet]. 2020. [cited 2020 Dec 05]. Available from: https://covid19.min-saude.pt/
4. World Health Organization. Coronavirus disease (COVID-19) advice for the public [Internet]. 2020. [cited 2020 Dec 05]. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public
5. Brug J, Aro AR, Richardus JH. Risk perceptions and behaviour: towards pandemic control of emerging infectious diseases : international research on risk perception in the control of emerging infectious diseases. Int J Behav Med. 2009;16(1):3-6.
6. Centers for Disease Control and Prevention. Older Adults [Internet]. 2020. [cited 2020 Nov 10]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/older-adults.htm
7. Princípios orientadores para a comunicação de riscos e crise, baseados na perceção de riscos- Doença Respiratória Aguda por 2019-nCoV [Internet]. 2020. [cited 2020 Nov 15]. Available from: https://covid19.min-saude.pt/wp-content/uploads/2020/03/Principios-Orientadores-Comunicac%CC%A7a%CC%830-Crise-2020-.pdf
8. Dai B, Fu D, Meng G, Liu B, Li Q, Liu X. The effects of governmental and individual predictors on COVID-19 protective behaviors in China: a path analysis model. Public Adm Rev. 2020 May 19:10.1111/puar.13236.
9. van der Velden PG, Marchand M, Cuelenaere B, Das M. Pre-outbreak determinants of perceived risks of corona infection and preventive measures taken. A prospective population-based study. PLoS One. 2020 Jul 1;15(7):e0234600.
10. Yıldırım M, Geçer E, Akgül Ö. The impacts of vulnerability, perceived risk, and fear on preventive behaviours against COVID-19. Psychol Health Med. 2021 Jan;26(1):35-43.

11. Bruine de Bruin W, Bennett D. Relationships Between Initial COVID-19 Risk Perceptions and Protective Health Behaviors: A National Survey. Am J Prev Med. 2020 Aug;59(2):157-167.
12. Wang X, Lin L, Xuan Z, Xu J, Wan Y, Zhou X. Risk communication on behavioral responses during COVID-19 among general population in China: A rapid national study. J Infect. 2020 Dec;81(6):911-922.
13. Soltan EM, El-Zoghby SM, Salama HM. Knowledge, Risk Perception, and Preventive Behaviors Related to COVID-19 Pandemic Among Undergraduate Medical Students in Egypt. SN Comprehensive Clinical Medicine. 2020 Nov 9; 2.
14. Zeballos Rivas DR, Lopez Jaldin ML, Nina Canaviri B, Portugal Escalante LF, Alanes Fernández AMC, Aguilar Ticona JP. Social media exposure, risk perception, preventive behaviors and attitudes during the COVID-19 epidemic in La Paz, Bolivia: A cross sectional study. PLoS One. 2021 Jan 22;16(1):e0245859.
15. Duan T, Jiang H, Deng X, Zhang Q, Wang F. Government Intervention, Risk Perception, and the Adoption of Protective Action Recommendations: Evidence from the COVID-19 Prevention and Control Experience of China. Int J Environ Res Public Health. 2020 May 13;17(10):3387.
16. Asefa A, Qanche Q, Hailemariam S, Dhuguma T, Nigussie T. Risk Perception Towards COVID-19 and Its Associated Factors Among Waiters in Selected Towns of Southwest Ethiopia. Risk Manag Healthc Policy. 2020 Nov 13; 13:2601-2610.
17. Iorfa SK, Ottu IFA, Oguntayo R, Ayandele O, Kolawole SO, Gandi JC, Dangiwa AL, Olapegba PO. COVID-19 Knowledge, Risk Perception, and Precautionary Behavior Among Nigerians: A Moderated Mediation Approach. Front Psychol. 2020 Nov 20;11:566773.
18. Adefuye AS, Abiona TC, Balogun JA, Lukobo-Durrell M. HIV sexual risk behaviors and perception of risk among college students: implications for planning interventions. BMC Public Health. 2009 Aug 4;9:281.
19. Sun Z, Yang B, Zhang R, Cheng X. Influencing Factors of Understanding COVID-19 Risks and Coping Behaviors among the Elderly Population. Int J Environ Res Public Health. 2020 Aug 13;17(16):5889.
20. Barari S, Caria S, Davola A, Falco P, Fetzer T, Fiorin S, et al. Evaluating COVID-19 Public Health Messaging in Italy: Self-Reported Compliance and Growing Mental Health Concerns.2020 Mar 27.

21. Seale H, Heywood AE, Leask J, Sheel M, Thomas S, Durrheim DN, Bolsewicz K, Kaur R. COVID-19 is rapidly changing: Examining public perceptions and behaviors in response to this evolving pandemic. PLoS One. 2020 Jun 23;15(6):e0235112.
22. Faasse K, Newby J. Public Perceptions of COVID-19 in Australia: Perceived Risk, Knowledge, Health-Protective Behaviors, and Vaccine Intentions. Front Psychol. 2020 Sep 30;11:551004.
23. Asnakew Z, Asrese K, Andualem M. Community Risk Perception and Compliance with Preventive Measures for COVID-19 Pandemic in Ethiopia. Risk Manag Healthc Policy. 2020 Dec 8;13:2887-2897.
24. Ning L, Niu J, Bi X, Yang C, Liu Z, Wu Q, Ning N, Liang L, Liu A, Hao Y, Gao L, Liu C. The impacts of knowledge, risk perception, emotion and information on citizens' protective behaviors during the outbreak of COVID-19: a cross-sectional study in China. BMC Public Health. 2020 Nov 23;20(1):1751.
25. Carlucci L, D'Ambrosio I, Balsamo M. Demographic and Attitudinal Factors of Adherence to Quarantine Guidelines During COVID-19: The Italian Model. Front Psychol. 2020 Oct 21;11:559288.
26. Yang XY, Gong RN, Sassine S, Morsa M, Tchogna AS, Drouin O, Chadi N, Jantchou P. Risk Perception of COVID-19 Infection and Adherence to Preventive Measures among Adolescents and Young Adults. Children (Basel). 2020 Dec 21;7(12):311.
27. Brug J, Aro AR, Richardus JH. Risk perceptions and behaviour: towards pandemic control of emerging infectious diseases : international research on risk perception in the control of emerging infectious diseases. Int J Behav Med. 2009;16(1):3-6.
28. Brewer NT, Chapman GB, Gibbons FX, Gerrard M, McCaul KD, Weinstein ND. Meta-analysis of the relationship between risk perception and health behavior: the example of vaccination. Health Psychol. 2007 Mar;26(2):136-45.
29. Ding Y, Du X, Li Q, Zhang M, Zhang Q, Tan X, Liu Q. Risk perception of coronavirus disease 2019 (COVID-19) and its related factors among college students in China during quarantine. PLoS One. 2020 Aug 13;15(8):e0237626.
30. Mansilla Domínguez JM, Font Jiménez I, Belzunegui Eraso A, Peña Otero D, Díaz Pérez D, Recio Vivas AM. Risk Perception of COVID-19 Community Transmission among the Spanish Population. Int J Environ Res Public Health. 2020 Dec 2;17(23):8967.
31. Harapan H, Anwar S, Nainu F, Setiawan AM, Yufika A, Winardi W, Gan AK, Sofyan H, Mudatsir M, Oktari RS, Wagner AL. Perceived Risk of Being Infected

With SARS-CoV-2: A Perspective From Indonesia. Disaster Med Public Health Prep. 2020 Sep 10:1-5.

32. Qian D, Li O. The Relationship between Risk Event Involvement and Risk Perception during the COVID-19 Outbreak in China. Appl Psychol Health Well Being. 2020 Dec;12(4):983-999.
33. Zhong Y, Liu W, Lee TY, Zhao H, Ji J. Risk perception, knowledge, information sources and emotional states among COVID-19 patients in Wuhan, China. Nurs Outlook. 2021 Jan-Feb;69(1):13-21.
34. Li X, Lyu H. Epidemic Risk Perception, Perceived Stress, and Mental Health During COVID-19 Pandemic: A Moderated Mediating Model. Front Psychol. 2021 Feb 10;11:563741.
35. Feng Y, Zong M, Yang Z, Gu W, Dong D, Qiao Z. When altruists cannot help: the influence of altruism on the mental health of university students during the COVID-19 pandemic. Global Health. 2020 Jul 10;
36. Lam SC, Arora T, Grey I, Suen LKP, Huang EY, Li D, Lam KBH. Perceived Risk and Protection From Infection and Depressive Symptoms Among Healthcare Workers in Mainland China and Hong Kong During COVID-19. Front Psychiatry. 2020 Jul 15;11:686.
37. Wu L, Li X, Lyu H. The Relationship Between the Duration of Attention to Pandemic News and Depression During the Outbreak of Coronavirus Disease 2019: The Roles of Risk Perception and Future Time Perspective. Front Psychol. 2021 Feb 11;12:564284.
38. Shahid Z, Kalayanamitra R, McClafferty B, Kepko D, Ramgobin D, Patel R, Aggarwal CS, Vunnam R, Sahu N, Bhatt D, Jones K, Golamari R, Jain R. COVID-19 and Older Adults: What We Know. J Am Geriatr Soc. 2020 May;68(5):926-929.
39. Daoust JF. Elderly people and responses to COVID-19 in 27 Countries. PLoS One. 2020 Jul 2;15(7):e0235590.
40. Cvetković VM, Nikolić N, Radovanović Nenadić U, Öcal A, K Noji E, Zečević M. Preparedness and Preventive Behaviors for a Pandemic Disaster Caused by COVID-19 in Serbia. Int J Environ Res Public Health. 2020 Jun 9;17(11):4124.
41. Pasion R, Paiva TO, Fernandes C, Barbosa F. The AGE Effect on Protective Behaviors During the COVID-19 Outbreak: Sociodemographic, Perceptions and Psychological Accounts. Front Psychol. 2020 Oct 16;11:561785.
42. Pew Research Center. Worries About Coronavirus Surge, as Most Americans Expect a Recession-or Worse [Internet]. 2020 March 26 [updated 2020 Apr 2; cited 2020 Oct 13]. Available from:

https://www.pewresearch.org/politics/2020/03/26/worries-about-coronavirus-surge-as-most-americans-expect-a-recession-or-worse/

43. Bruine de Bruin W. Age Differences in COVID-19 Risk Perceptions and Mental Health: Evidence From a National U.S. Survey Conducted in March 2020. J Gerontol B Psychol Sci Soc Sci. 2021 Jan 18;76(2):e24-e29.
44. Loureiro MJ, Afonso RM, Loureiro M, Vaz Patto M. Estudo Envelhecer na Covilhã: Apresentação de um Estudo Interdisciplinar. International Journal of Developmental and Educational Psychology, INFAD Revista de Psicologia. 2012; 2(1), 143-148.
45. Nguyen, HV., Inderjeeth, CA., Tang, E., Barnabas, L. and Merriam, M. Screening for depression in hospitalised and community-dwelling elderly: the use of the 4-item, 5-item and 15-item geriatric depression scales. Australasian Journal on Ageing. 2006; 25(4):204 – 208.
46. Commodari E, La Rosa VL, Coniglio MA. Health risk perceptions in the era of the new coronavirus: are the Italian people ready for a novel virus? A cross-sectional study on perceived personal and comparative susceptibility for infectious diseases. Public Health. 2020 Oct;187:8-14.
47. Liu K, Chen Y, Lin R, Han K. Clinical features of COVID-19 in elderly patients: A comparison with young and middle-aged patients. J Infect. 2020 Jun;80(6):e14-e18.
48. Ahrenfeldt LJ, Otavova M, Christensen K, Lindahl-Jacobsen R. Sex and age differences in COVID-19 mortality in Europe. Wien Klin Wochenschr. 2020 Dec 22:1–6.
49. Tavares DM, Oliveira N, Marchiori GF, Guimarães M, Santana L. Elderly individuals living by themselves: knowledge and measures to prevent the novel coronavirus. Rev Lat Am Enfermagem. 2020 Nov 6;28:e3383.
50. Vellas C, Delobel P, de Souto Barreto P, Izopet J. COVID-19, Virology and Geroscience: A Perspective. J Nutr Health Aging. 2020;24(7):685-691.