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PREDICTIVE VARIABLES OF COMPLIANCE WITH PREVENTIVE BEHAVIORS DURING THE COVID-19 PANDEMIC

VARIABLES PREDICTORAS DEL CUMPLIMIENTO DE MEDIDAS PREVENTIVAS DURANTE LA PANDEMIA DE COVID-19

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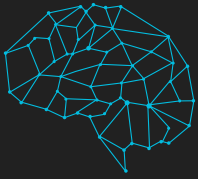
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ABSTRACT

With the spread of COVID-19 worldwide, preventive behaviors took on a key role in virus containment. In Spanish, the Ministry of Health approved a 14-week nationwide population lockdown from March 15th to June 20th, 2020. Approximately one month after the lockdown, from April 10th to 16th, the present study analyzed the risk perception based on age and gender and its relationship with preventive behavior compliance against the spread of COVID-19. The sample was constituted by 535 participants (67.9% women) distributed in two age groups: (42.4%) classified as young people (18-23 years) and (57.5%) as adults (40-65 years). Data were collected through an ad hoc online questionnaire. The results indicated that the perception of fear/anxiety and age predicted the adoption of preventive behaviors. Our study concludes that young people and people who experience less fear or anxiety of COVID-19 adopt fewer preventive health behaviors.

Keywords: COVID-19, preventive behavior, risk perception, age, gender.

RESUMEN

Con la propagación de la COVID-19 en todo el mundo, los comportamientos preventivos asumieron un papel clave en la contención del virus. En España, el Ministerio de Salud aprobó un confinamiento de la población de 14 semanas a nivel nacional, del 15 de marzo al 20 de junio de 2020. Aproximadamente un mes después del confinamiento, del 10 al 16 de abril, el presente estudio analizó la percepción de riesgo en función de la edad y el sexo y su relación con el cumplimiento de la conducta preventiva frente a la propagación de la COVID-19. La muestra estuvo constituida por 535 participantes (67,9% mujeres) distribuidos en dos grupos de edad: (42,4%) clasificados como jóvenes (18-23 años) y (57,5%) como adultos (40-65 años). Los datos se recopilaban a través de un cuestionario en línea ad hoc. Los resultados indicaron que la percepción de temor/ansiedad y la edad predecían la adopción de medidas preventivas. Nuestro estudio concluye que los jóvenes y las personas que experimentan menos emociones de temor/ansiedad ante la COVID-19 adoptan menos comportamientos preventivos para la salud.

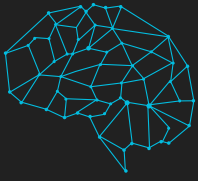
Palabras clave: COVID-19, comportamiento preventivo, percepción de riesgo, edad, género.

INTRODUCTION

On the 11th March 2020, the World Health Organization (WHO) declared COVID-19 a global pandemic (World Health Organization, 2020). Only one month later, in Spain 122,487 COVID-19 cases had already been recorded, of which 47.4% required hospitalization while 7.9% died (Instituto de Salud Carlos III, 2020). As COVID-19 cases increased, and in the absence of global vaccination or effective treatments, the authorities adopted various measures with the aim of reducing its transmission (Ministry of Health, 2020). However, despite being aware of the seriousness of the scenario, many citizens failed to comply with the measures imposed by the government, resulting in 696,653 fines and 6,216 arrests just 6 weeks after the pandemic declaration (Albor, 2020). In this alarming situation, news stories of rule flouting behavior were rife, with the young accounting for the majority of cases (Bécares, 2020). Many months enduring this crisis situation has led to a reduction in protective behavior rule compliance, defined by the WHO as "pandemic fatigue". This

implies a systematic decrease in the population's effort to follow the recommendations and restrictions (World Health Organization, 2020).

COVID-19 appears to have specific characteristics that make it spread faster than other diseases (Sarwar et al., 2020). This virus has a transmission period of 10-15 days in which the contamination is via speaking and/or breathing aerosols, not only in pre-symptomatic and symptomatic individuals but also in asymptomatic cases (Ministry of Health, 2020; Sarwar et al., 2020). As a result of the high rate of infections and the resulting unsustainable burden on the Spanish health system, the Ministry of Health (2020) approved a series of extraordinary mitigating measures, the first and most striking of which was a 14-week nationwide population lockdown from March 15th to June 20th, 2020 (Decree 463 of 2020). This measure's objective was to interrupt the transmission of the virus by limiting people's freedom of movement solely to the purchase of food, work activities, health center out-patient visits, relocation to a principal residence,



care activities for dependent people, travel to financial institutions, and events arising from a force majeure (Decree 463 of 2020). Other health-oriented recommendations were: to carry out frequent hand and surface washing; to avoid touching the eyes, nose and mouth; to use a mask in public places; to trap aerosols with the elbow when sneezing; to maintain a minimum 1.5-meter person-to-person separation, and for the individual to isolate in the case of exhibiting symptoms (Ministry of Health, 2020).

Until either an effective treatment against COVID-19 appears or the majority of the population is vaccinated, the only way to prevent the spread of this virus is to comply with these recommended sanitary measures, that is to say, general population behavior is the principal active agent in health promotion (Sohrabi et al., 2020). For people to comply with these measures, they must be made aware that a COVID-19 infection poses a considerable threat to their health (Sarwar et al., 2020). Risk perception has been a very important and widely investigated concept in numerous studies when analyzing the performance of preventive behaviors by the general population in areas such as vaccination uptake and social distancing (Brewer et al., 2007; Ferrer et al., 2016). In effect, a high-risk perception appears to encourage these healthy behaviors (Brewer et al., 2007).

Risk perception is defined as the subjective evaluation that each one makes of the danger and susceptibility to the threat (Rohrmann, 2008). It is a construct that is complex to define and operationalize, since there is a lack of consensus among researchers in this field (Aragónés et al., 2010). Although many of the studies reduce it to the estimated probability of a person to contract the disease (Urzúa et al., 2020), risk perception is a considerably more complex field with additional important factors that should be taken into account (Brewer et al., 2007; Rogers, 1975; Slovic et al., 2004).

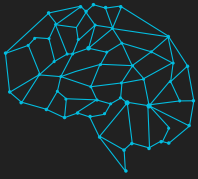
The variables of severity and perceived susceptibility are two factors highlighted by the Health Belief Model (Rosenstock, 1974) when evaluating individual perception of threat (Clark et al., 2020). Moreover, in a meta-analysis by Brewer et al. (2007) in which the relationships between risk perception and health behaviors were studied, the perceived probability (probability of contracting the disease) was an additional predictor that featured largely in the perception of risk. Furthermore, the Rogers Protection Motivation Model (1975) also assesses coping strategies, highlighting response effectiveness (the perception of the effectiveness of the be-

haviors) and perceived self-efficacy (the person's confidence in their ability to follow these measures/recommendations from professionals) (Martens et al., 2019).

In addition, risk perception researchers tend to usually focus on the rational aspect, however, it would be a mistake to underestimate the power of emotions as mechanisms of action orientation (Slovic et al., 2004). Researchers such as Harper et al. (2020) during the current COVID-19 pandemic situations, showed the predictive role of fear and anxiety when carrying out preventive health behaviors such as hand washing or social distance. For this reason, it is very important to know the fear caused by developing a disease, being on many occasions an equal or better predictor than the deliberate risk perception (Ferrer et al., 2016). In the present study, risk perception in the context of the COVID-19 pandemic is defined as the subjective psychological process of evaluating the probability, susceptibility and severity of being infected by the coronavirus; the perception of the behaviors' effectiveness and of the self-efficacy to carry them out; and the affective/emotional reaction to develop the disease (Brewer et al., 2007; Ferrer et al., 2016; Rogers, 1975).

Nevertheless, the possibility of a person becoming infected does not depend solely on their actions, but also on the actions of other citizens (Lunn et al., 2020). Decision-making about whether or not to carry out risky behaviors is carried out through a rational risk vs. benefits evaluation of an action, requiring cognitive maturity (Rhodes & Pivik, 2011). In the youth stage, people are not yet mature enough to carry out realistic representations of diseases, compared to adulthood (Schmidt & Fröhling, 2000) with the result that highest risks are taken during the younger years (Figner et al., 2009). Despite the younger population being viable transmitters of the infection, they have a lower severity of symptoms (Instituto de Salud Carlos III, 2020; Sohrabi et al., 2020). It comes as no surprise therefore, that young people have been identified as the group with the lowest compliance with preventive behaviors from COVID-19 (Nivette et al., 2020). However, contradictory results are found in the infectious disease literature. Some studies affirm that older people are more likely to conduct protective behaviors against infectious diseases (Li et al., 2020; Nivette et al., 2020) while others observe a greater frequency of hand washing, use of masks, etc. in the young (Rubin et al., 2009).

Another sociodemographic characteristic, namely gender has also been studied with regard to preventive behaviors. Several recent studies regarding COVID-19 and gender have



found that women are more likely to wash their hands, cover their nose and mouth when coughing, maintain social distance, stay home, and clean frequently, compared to their male counterparts (Li et al., 2020; Nivette et al., 2020).

To date, there has been no known Spanish population-based research concerning early COVID-19 pandemic phase preventive behavior changes in psychological variables such as risk perception, and socio-demographic equivalents such as age and gender. This study therefore aims to contribute data to this area in the context of our country by analyzing the perception of risk, age and gender as predictors of compliance with preventive behaviors against the spread of COVID-19 from April 10th to 16th, 2020. The present study made the following hypotheses: 1) those people with higher scores in risk perception would comply with preventive behaviors to a greater degree; 2) older people would comply with more preventive behaviors than younger ones; 3) women would carry out more preventive behaviors than men.

METHOD

PARTICIPANTS

The sample was of 535 participants, 363 women (67.9%) and 172 men, distributed in two age groups, i.e., 227 (42.4%) were classified as young people (18-23 years) and 308 (57.5%) classified as adults (40-65 years).

Regarding health issues related to the COVID-19, only 19.8% of the participants considered themselves as in the "at risk" group for the disease (over 60 years of age or with diseases such as diabetes, chronic lung diseases, cardiovascular diseases and high blood pressure, cancer, immunosuppression or pregnancy). However, 78.7% affirmed to have people close to them belonging to the risk population. At the time of data collection, only 11% of the participants had had symptoms/diagnosis of COVID-19.

MATERIALS

As there was no single validated instrument to assess risk perception, an ad hoc online questionnaire was developed (see Appendix A), based on previous work (Brewer et al., 2007; Ferrer et al., 2016; Rogers, 1975). This questionnaire contained six Likert-type items of six points each (where 1 represents the minimum score and 6 the maximum). It evaluated the perception of risk in an "holistic" sense, that is to say, the probability of getting infected (*Regardless of the*

preventive behaviors you take/what do you think your probability of being infected by the new coronavirus would be?), perceived vulnerability (*Do you think you are more vulnerable to the new coronavirus than other people of the same age and sex?*), perceived severity of the disease (*How serious do you think the new coronavirus is?*), emotion towards the disease (*When you think about the new coronavirus, how fearful/anxious do you feel?*), perceived efficacy of preventive behaviors (*How effective do you think the proposed behaviors are in preventing the spread of the virus? – hand washing, keeping a minimum distance, limiting mobility, etc. –*) and perceived self-efficacy (*Indicate the degree of veracity of the following sentence: "I think I can protect myself properly from the new coronavirus"*).

In order to determine compliance with preventive health behaviors, the participants were asked whether or not they regularly performed each of the eight preventive behaviors on a list (see Appendix B). These preventive behaviors were extracted from recommendations of national and international experts (Ministry of Health, 2020; World Health Organization, 2020).

PROCEDURE

For the present investigation, the participants were selected by carrying out an intentional non-probabilistic sampling with the accessibility criterion. The inclusion criteria of the participants in the study were to be between 18-23 years old or between 40-65 years old and to be living in Spain at the time of data collection. Data collection was carried out from April 10th to April 16th, 2020. Online questionnaires employed Google Forms, taking approximately five minutes to complete. All procedures were carried in accordance with the Declaration of Helsinki (World Medical Association, 2013) and its later amendments, and complied with the standards of the Ethics Committee of the Universitat Autònoma de Barcelona. Participants gave their informed consent to participate anonymously and voluntarily in the study. A contact email was provided for questions relating to completing the questionnaire or the research itself.

STATISTICAL ANALYSIS

For data analysis, we used the SPSS statistical package (version 23.0). Non-parametric tests were used after rejecting the null hypothesis of normality (K-S statistic = .001). For the comparison of the quantitative psychological variables of risk

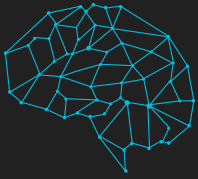


TABLE 1. Response frequency to the questionnaire "Compliance with Preventive Behaviors" (n = 535)

Preventive Behaviors	n	%
I respect lockdown	521	97.4
I wash my hands frequently	471	88
I maintain social distance of 1-2 meters	451	84.3
I cover my mouth and nose with my elbow flexed when I cough or sneeze	436	81.5
I avoid direct contact with someone who is sick	380	71
I use disinfectant when there is no soap and water	358	66.9
I avoid touching my eyes, nose and mouth with unwashed hands	301	56.3
I wear a mask	294	55

perception, Spearman's correlations were performed and for the comparison of qualitative sociodemographic variables the non-parametric contrast test of two groups (Mann-Whitney U) was used. Finally, a multiple linear regression analysis was performed to identify the independent factors related to compliance with preventive behaviors.

RESULTS

Table 1 describes the response frequency to the questionnaire assessing compliance with preventive behaviors. Almost all of the participants (97.4%) said they respected lockdown and a large majority affirmed at the time of data collection to wash their hands frequently (88%), maintain social distance (84.3%) and cover the mouth and nose with the elbow flexed (81.5%). Wearing a mask was the less frequent behavior (55%) (Table 1).

Subsequent data analysis was carried out using a new generated variable, called "Compliance" which was the summation of the preventive measures followed by each participant. In terms of risk perception, as shown in Table 2, the highest mean scores were obtained in relation to the perceived severity of COVID-19 followed by the perceived efficacy of preventive health behaviors. Contrarily, perceived vulnerability obtained the lowest mean score (Table 2).

Spearman's correlation between compliance with preventive behaviors and risk perception for the total sample shows that the only variables significantly correlated to compliance with preventive behaviors were the perceived severity ($r = .23$,

TABLE 2. Means and standard deviations of "Compliance" and Risk Perception variables (n = 535)

Variables	M	SD
Compliance	6	1.67
Risk Perception:		
Probability	3.18	1.36
Vulnerability	2.88	1.32
Severity	5.05	0.98
Fear/Anxiety	3.72	1.43
Measures' effectiveness	4.49	1.16
Self-efficacy	3.44	1.26

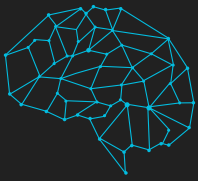
TABLE 3. Multiple linear regression analysis output of Compliance with Preventive Behaviors

Predictors	B	Standard error	p	CI 95%
Age	0.86	0.14	.001	0.582 - 1.137
Risk Perception (fear/anxiety)	0.20	0.05	.001	0.102 - 0.294
Constant	3.91	0.27	.001	

$p < .01$) and the perceived fear/anxiety regarding to COVID-19 ($r = .21$, $p < .01$). The rest of the variables showed correlation coefficients ranging .05 to .07.

Regarding sociodemographic variables and specifically age, results of the Mann-Whitney U test found statistically significant differences between young people and adults when carrying out preventive behaviors ($U = 22998.5$, $p = .001$), with the group of adults being those who comply with preventive behaviors to a greater degree. Regarding gender, statistically significant differences were also found between both genders ($U = 26684$, $p = .006$), with women performing preventive behaviors to a greater degree against COVID-19 (Table 3).

Finally, a multiple linear regression model was performed including the significant predictor variables found in the previous analyzes (perceived severity, perceived fear/anxiety, age and gender). Table 3 represents the final model in which age and the perceived fear/anxiety were the variables that best



predicted compliance with preventive behaviors, explaining 11% of the variance ($R^2 = .110$). Results indicated that compliance with preventive behaviors was predicted by older ages and higher levels of perceived fear/anxiety. The variables perceived severity and gender did not enter the model.

DISCUSSION

In the current pandemic situation, the adoption of preventive behaviors is a key factor in reducing the rate of COVID-19 infections. The present study analyzed the role of risk perception, age and gender in compliance with preventive behaviors during the first month of the pandemic in Spain.

The preventive behaviors carried out to a greater extent during this first month were: respecting the lockdown; washing hands frequently; maintaining social distance; and covering the mouth and nose when sneezing and coughing. The low frequency of mask use (55%) in relation to other behaviors can be explained by the fact that at that time the mask was only a recommendation, and the benefits of using it were not yet known. It is not surprising that the most respected measure was compliance with lockdown, since it was the only one imposed by the government at that time, i.e. with economic sanctions in cases of non-compliance (Ministry of Health, 2020).

Individuals experiencing fear of COVID-19 were the ones who adopted preventive behaviors the most. Although a relationship was expected between all risk perception variables and these preventive behaviors (Brewer et al., 2007; Ferrer et al., 2016; Van Bavel et al., 2020), the results of the present study did not show a predictive effect of the variables of perceived probability, vulnerability, severity, effectiveness of the behaviors and self-efficacy in relation to the adoption of these behaviors.

These results show the importance of the affective/emotional pathway versus a rational/cognitive one in the design of risk assessment (Ferrer et al., 2016; Slovic et al., 2004). Previous work such as that of Harper et al. (2020) are in line with what was found in this study, evidencing the important role of emotions when carrying out preventive behaviors. Aversive emotions play a protective and adaptive role, revealing what is safe and what is not when carrying out the risk assessment (Slovic et al., 2004). In addition, it should be taken into account that this aversion factor occurs within the first month of a pandemic due to an emerging, that is to say, unknown nature of the disease. Therefore, the information

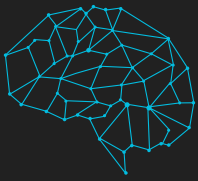
available to provide for an accurate, rational assessment was very limited due to the heightened fear and anxiety arising from the novel situation. It can be a reason why our results do not show relevant information in rational risk assessment.

In line with what was found by Nivette et al. (2020), the results showed age as a predictor of the performance of preventive behaviors, the young people group being those who adopted the least preventive behaviors. Risk taking is higher in the youth stage (Figner et al., 2009) and the representation of diseases is less elaborate than in adulthood (Schmidt & Fröhling, 2000). Moreover, this is coupled with the fact that young people usually have less severe symptoms when they become infected with COVID-19 (Instituto de Salud Carlos III, 2020).

On the other hand, contrary to expected, the results of this study do not present gender as a predictor of the adoption of preventive behaviors. Although studies such as those of Li et al. (2020) or Nivette et al. (2020) found that women carried out behaviors such as hand washing or maintaining social distance frequently. In the present study no differences were found between men and women for these preventive behaviors.

There are several limitations in this study. In the first place, due to the lack of a validated risk perception questionnaire in relation to COVID-19, information was collected through an *ad hoc* questionnaire, something that may influence the validity of the data collected. Secondly, the cohort is not totally representative sample of the Spanish population since the recruitment of participants was carried out online through non-probability sampling. The sample therefore does not include minors or elderly people, thus potentially skewing the results. In the third place, in relation to the statistical analysis, it should be noted that the regression model only explains 11% of the dependent variable, a force that could be considered weak. Lastly, it is known that the pandemic increased anxious and depressive symptoms in people with no history of prior mental health impairment. There is a lack of knowledge of the participants' previous symptoms of anxiety and depression that could have interfered with the results. It would be interesting to add some questions about it in the questionnaire.

On the other hand, this study is a pioneer when it comes to talk about risk perception in such a wide way. This concept was studied by bringing together emotional and rational assessment in a singular questionnaire. In addition, it can



be seen as an innovative study due to the unprecedented situation we have been going through while it was being carried out.

Finally, it should be noted that knowing predictor variables is not only important for theoretical psychology but also has great practical value for both the current situation of emerging disease and for any situation in which the behaviors of the population influence the health and well-being of all. Our study reveals young people as the best target population for preventive actions but also highlights the need to incorporate the emotion factor in preventive measure program design. Studies as this are useful tools when designing and implementing prevention strategies against infectious diseases such as COVID-19 and the new ones to come in the near future.

DECLARATION OF AUTHORSHIP, GOOD PRACTICES AND CESSION OF RIGHTS

FUNDING

The authors have no funding to disclose.

CONTRIBUTION

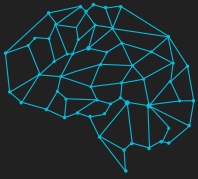
- Ana Campos-Aguilar: design, collection, analysis and interpretation of data, writing and drafting the article revising it critically for important intellectual content.
- Borja Farré-Sender: analysis and interpretation of data, article review.
- Josep M^a Farré: article review.
- Montserrat Gomà-i-Freixanet: design, interpretation of data, article review.

CONFLICTS OF INTEREST

The authors declare they have no conflict of interest.

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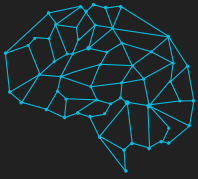
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APPENDIX A

COVID-19 RISK PERCEPTION QUESTIONNAIRE

Please, select the answer that is more correct to you. Being 1 the lowest level and 6 the highest.

	1	2	3	4	5	6
Regardless of the preventive behaviors you take/what do you think your probability of being infected by the new coronavirus would be?						
Do you think you are more vulnerable to the new coronavirus than other people of the same age and sex?						
How serious do you think the new coronavirus is?						
When you think about the new coronavirus, how fearful/anxious do you feel?						
How effective do you think the proposed behaviors are in preventing the spread of the virus? –hand washing, keeping a minimum distance, limiting mobility, etc. –						
Indicate the degree of veracity of the following sentence: "I think I can protect myself properly from the new coronavirus".						



APPENDIX B

COMPLIANCE QUESTIONNAIRE

Which of these activities are you currently doing to prevent getting infected? Please, mark the activities that you have done REGULARLY:

	I DO	I DON'T
I respect lockdown		
I wash my hands frequently		
I maintain a minimum distance of 1-2 meters		
When I cough or sneeze, I cover my mouth and nose with my elbow flexed		
I avoid direct contact with someone who is sick		
I use disinfectant when there is no soap and water		
I avoid touching my eyes, nose and mouth with unwashed hands		
I wear a mask		