

## Research paper

# Longitudinal evaluation of the psychological impact of the COVID-19 crisis in Spain



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## ABSTRACT

**Background:** Strict confinement and social distancing measures have been imposed due to the COVID-19 pandemic in many countries. The aim was to assess the temporal evolution of the psychological impact of the COVID-19 crisis and lockdown from two surveys, separated by one month, performed in Spain.

**Methods:** Symptoms of depression, anxiety and stress, and the psychological impact of the situation were longitudinally analyzed using the Depression Anxiety and Stress Scale (DASS-21) and the Impact of Event Scale (IES) respectively.

**Results:** There was a total of 4,724 responses from both surveys. Symptomatic scores of anxiety, depression and stress were exhibited by 37.22%, 46.42% and 49.66% of the second survey respondents, showing a significant increase compared to the first survey (32.45%, 44.11% and 37.01%, respectively). There was no significant longitudinal change of the IES scores, with 48.30% of the second survey participants showing moderate to severe impact of the confinement. Constant news consumption about COVID-19 was found to be positively associated with symptomatic scores in the different scales, and daily physical activity to be negatively associated with DASS-21 scores.

**Conclusions:** Results indicated a temporal increase of anxiety, depression and stress scores during the COVID-19 lockdown. Factors such as age, consumption of information about COVID-19 and physical activity seem to have an important impact on the evolution of psychological symptoms.

## 1. Introduction

The novel coronavirus disease (COVID-19) outbreak was firstly detected in China in December 2019, and it quickly spread with heavy impact to other Asian countries, Europe and finally America during the first half of 2020. Because of the pandemic, strict confinement and social distancing measures have been imposed on the population of most countries in the world.

Cross-sectional studies have been performed in several countries to assess the psychological impact of the COVID-19. For example, Wang et al. (2020a) conducted a study with more than 1,000 participants in China, during the outbreak, and identified that more than half of the respondents presented a moderate-to-severe psychological impact of the event, and that this impact was associated with high levels of stress, anxiety and depression. Other cross-sectional studies have highlighted that young women may be specially affected by depression, anxiety and stress (Odriozola-González et al., 2020a; Ozamiz-Etxebarria et al.,

2020; Özdin and Bayrak Özdin, 2020; Park et al., 2020).

Along the same lines, studies with college students in China and Spain have found relevant effects in emotional symptomatology and impact of the event. In a Chinese study, 20–25% of the participants showed at least mild anxiety scores (Cao et al., 2020), while this percentage was over 35% in a Spanish study (Odriozola-González et al., 2020b). In fact, in the last study, more than 35% of the Spanish participants showed symptomatic scores of depression, anxiety or stress, and more than 85% showed at least a slight psychological impact of the event. One month after the outbreak, Tang et al. (2020) found that post-traumatic stress disorder and depression symptoms were shown by 2.7% and 9.0%, respectively, in a sample composed by college students from China.

A deeper analysis would be necessary to determine possible risk and protective factors in the development of this symptomatology and its long-term repercussion. Longitudinal studies such as that of Wang et al., (2020b) in China seem to show that four weeks after the first

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assessment, the anxiety, depression and stress levels remained stable, while impact of event scores were reduced significantly, although without being clinically significant.

The main objective of this study was to analyze the longitudinal evolution of the levels of anxiety, depression, stress and the psychological impact of the COVID-19 crisis and confinement from the outbreak to the beginning of the relaxation of the lockdown measures in Spain. Results from the initial, cross-sectional data have been published elsewhere (Odriozola-González et al., 2020a, Odriozola-González et al., 2020b), and this paper incorporates results from a second wave of data gathering, with the intention to assess the longitudinal changes throughout the COVID-19 lockdown and the posterior comeback. We additionally aimed to analyze the role of other factors such as physical exercise, trust in the Government or scientists, or frequency of news consumption about COVID-19.

## 2. Methods

### 2.1. Study population

The adult population living in Spain at the time of the study was eligible for participation in both phases of the study. People under 18 years and living outside Spain when both surveys were conducted were excluded from this study. Respondents of the initial survey (March 28th – April 5th, 2020) of this study who accepted to participate in future phases were contacted to fulfill the next phase. The survey was announced through the communication channels of the University of Valladolid, a regional TV station and social media. Snowball sampling was also employed to recruit more participants, as there were no restrictions except those commented previously. New participants were also allowed to take part in the second phase. The participants who took part in the first survey willing to participate in the second phase were contacted via email. These participants provided their email address in the first phase and clearly stated their intention to answer to possible future surveys. Ethics approval was obtained from the Research Ethics Board of the University of Valladolid and the Ethics Committee of Hospital Clínico Universitario de Valladolid (PI: 20-1736).

### 2.2. Survey instrument

An online web-based survey was launched on April 28th, 2020, and remained open until May 15th, 2020. The answers from 63 questions were analyzed. The participants chose whether agreed to participate in the study at the beginning of the survey. COVID-19 situation in Spain, including data gathering from both surveys, is shown in Fig. 1. Forty-nine questions were also included in the previous survey, while the remaining 14 questions were added in this second phase. The survey took approximately 15 minutes to complete. Repeated questions referred to demographical data, personal situation during the confinement, present and/or past psychological/psychiatric treatment, present intake of psychoactive medication, and perceived impact of the confinement on personal and social relationships were included. New respondents in the second phase should answer additional questions related to data with no changes which were already asked to participants who completed the first survey (e.g. sex).

The new survey also included questions related to news consumption from the media about COVID-19, trust in the Government and scientists, aspects related to physical activity before and during the confinement, and self-perceived likelihood of being infected by COVID-19 (in the past or the future), of infecting other people (in the past or the future) and of survival in case of being infected by COVID-19.

The emotional impact and psychological symptoms associated with confinement due to the COVID-19 crisis were evaluated using two scales: Depression Anxiety Stress Scale (DASS-21; Antony et al., 1998) and the Impact of Event Scale (IES; Horowitz et al., 1979). Specific characteristics of these scales have been explained in the first phase of

our study (Odriozola-González et al., 2020a).

### 2.3. Statistical analysis

Group proportions were calculated for categorical variables, while mean and standard deviation were employed for the continuous variables. We used histograms to describe the distribution of the DASS-21 and IES subscales scores.

Longitudinal analysis of the DASS-21 and IES was performed with Generalized Linear Mixed Models (GLMM), considering each subject as random factor. The covariates included in this analysis were those which were assessed in both the first (T1) and second (T2) surveys. The survey (first-T1 or second-T2), our longitudinal variable, was included as a categorical covariate, and interactions with the other covariates were introduced to analyze whether the effect of covariates was time-dependent. Two analyses were performed. In the first one, all the answers from both surveys were included in the longitudinal analysis. In the second analysis, only the answers from the subjects who answered both surveys were included, in order to focus on the longitudinal progression.

Generalized Linear Models (GLM) with a Gaussian distribution were employed to analyze the association between the DASS-21 and IES scores with the covariates included only in the second survey (for the multivariate analysis, the covariates from the first survey were also included).

The final multivariate GLM was selected using the Akaike's Information Criterion (AIC) and an automatic stepwise strategy in the case of cross-sectional models, with forward and backward steps. For the longitudinal analysis, models based on the final cross-sectional models from the first survey (Odriozola-González et al., 2020a) were employed, additionally including the analysis of the interactions of the other covariates with the longitudinal variable, the survey (time-dependent covariates). The model with the lowest AIC was automatically selected for cross-sectional models, and manually searched in the case of longitudinal models. Diverse multivariate models were obtained. For the DASS-21 and IES scores, longitudinal models on the one hand, and cross-sectional models with all the covariates on the other hand, were obtained.

Pearson's correlation was obtained to measure the association between the DASS-21 subscales score and the IES total score.

P-values below 0.05 were considered to be statistically significant. The analysis was performed using R statistical software package, version 3.5.2.

## 3. Results

There were 3,550 respondents to the first survey, and the second survey was answered by 1,174 people. Of them, 1,056 respondents had also completed the first survey, and there were 118 new respondents. Therefore, 4,724 responses were employed for the longitudinal analysis. Characteristics of the samples of the first and second surveys are summarized in Table 1. Specific characteristics that were asked only in the second survey are shown in Supplementary Table 1.

### 3.1. DASS-21

37.22%, 46.42% and 49.66% of the second survey respondents exhibited signs of psychological symptoms according to anxiety, depression and stress scores, respectively, compared to 32.45%, 44.11% and 37.01% in the first survey. The percentage of respondents showing symptoms was higher with respect to the first survey, especially in the case of stress symptoms. A comparison of these percentages between both surveys can be found in Supplementary Fig. 1. Considering only the subjects who completed both surveys, the percentages were similar compared to the previous values, with 37.03% and 34.00% for anxiety, 46.88% and 44.41% for depression, and 49.34% and 39.30% for stress,

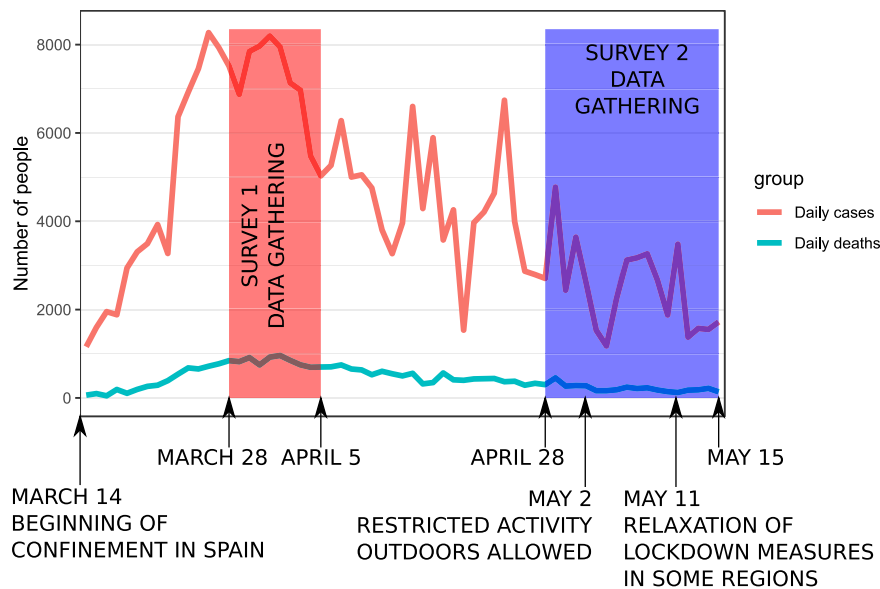


Fig. 1. Evolution of daily COVID-19 confirmed positive cases and deaths in Spain from the beginning of the confinement to the final date of data gathering.

in the second and first survey, respectively.

Mean values and standard deviations for each of the DASS-21 subscales for the second survey were  $5.55 \pm 5.04$  for depression,  $3.60 \pm 4.10$  for anxiety and  $7.94 \pm 4.90$  for stress. These values were slightly higher for depression and anxiety, and considerably higher for stress, in the second with respect to the first survey. Comparisons of DASS-21 mean scores between both surveys can be found in Fig. 2.

The multivariate longitudinal GLMM can be seen in Table 2. The results from Table 2 reflect the mean difference in the DASS-21 scores between categories, or the lower or higher score per each additional unit in the case of continuous variables such as age. For example, the participants presented -0.05 points in the stress subscale per each additional year (age), or people 10 years older presented -0.50 points. The “Survey” variable showed the mean DASS-21 score difference between the second and the first survey. An additional interaction term indicated the change of the effect of a specific variable from the first to the second survey. Using as example the DASS-21 stress model, people who have been tested for COVID-19 presented -1.18 points in the second survey (0.68 from the global term – 1.86 from the longitudinal interaction term) than people with no COVID-19 test. This result is explained by slight initial higher stress levels in people initially tested, and a significant reduction after a month. Following the same example, older people showed higher difference in the second with respect to the first survey (- 0.05 - 0.04 = - 0.09 points per each additional year) compared to younger participants. These results from multivariate models were adjusted by the effect of the other covariates in each model.

After adjusting for multiple covariates, scores of all the three subscales were significantly higher in the second survey (T2) compared to the first survey (T1). For the stress subscale, 2.75 additional points were obtained in the second survey, which reflects a change of the mean score from a normal (6.51) to a mild-moderate (9.26) level after a month, considering the multivariate adjustment. For the anxiety subscale, 1.56 points were increased in the second survey, showing a mean score change from a normal-mild (3.15) to a mild level (4.71). In the case of the depression subscale, the increase in the second survey was 1.05 points, with average scores showing mild levels in the first (5.06) and mild-moderate levels in the second (6.11) survey.

There was no significant interaction of any of the covariates with the longitudinal variable (Survey) for the three subscales simultaneously. Including the analyses with all subjects and only those who answered both surveys, for the anxiety and stress subscales, significant negative interaction with age was found, i.e., in older respondents

anxiety and stress levels were reduced in the second survey with respect to the first. This result shows a larger difference of anxiety and stress levels after a month between younger and older participants. Significant negative interaction was also found for health workers (anxiety), married people (depression), and having been tested for COVID-19 (stress). The health workers showed slightly higher anxiety scores in the first survey (0.13 points), and considerably lower scores after a month (0.13 - 0.80 = - 0.67 points). The depression scores in married (or with partner) people were slightly lower than the scores of the single subjects in the first survey (- 0.13 points) and a significant decrease was observed after a month (- 0.13 - 0.87 = - 1.00 points). The results including only the subjects who completed both surveys are shown in Supplementary Table 2.

Significant cross-sectional associations between some of the specific covariates of the second survey and the scores from the three subscales were found. For the three subscales, a significant positive association was found with self-reported stress related about going outdoors and intention to practice physical activity or sport when allowed (in Spain, no outdoors physical activity was allowed when the second survey was administered); a significant negative association was found with infrequent or no news consumption about COVID-19. These and other significant associations with the DASS-21 subscales can be found in Table 3. Multivariate GLM models can be seen in Supplementary Table 3.

### 3.2. IES

A percentage of 11.75% of the respondents from the second survey showed scores related to severe symptoms with the IES instrument, and around 75% of the sample presented mild or moderate symptomatic levels, with relatively higher avoidance than intrusion scores. These percentages were very similar in comparison with the first survey, with slightly lower percentage of respondents with severe scores in the second survey. Comparison of IES percentages between both surveys can be found in Supplementary Fig. 2.

Mean values and standard deviations were  $14.62 \pm 9.06$  for avoidance and  $10.53 \pm 7.52$  for intrusion. These means were almost equal with respect to the values from the first survey (slightly lower in the second survey). Comparisons of IES mean scores between both surveys can be found in Fig. 2.

No significant differences were found for IES intrusion and avoidance scores in the second with respect to the first survey. For the

**Table 1**  
Characteristics of the respondents of the first and second surveys.

Characteristics	First Survey (%)	Second Survey (%)
Age (1 <sup>st</sup> → mean = 32.1 ± 14.1; 2 <sup>nd</sup> → mean = 35.3 ± 14.4)		
18-25	1850 (52.1)	465 (39.6)
26-35	454 (12.8)	181 (15.4)
36-45	479 (13.5)	198 (16.9)
46-55	449 (12.6)	205 (17.5)
56-65	266 (7.5)	103(8.8)
66 or more	52 (1.5)	22 (1.9)
Sex		
Male	1246 (35.1)	380 (32.4)
Female	2304 (64.9)	794 (67.6)
Marital status		
Single	2344 (66.0)	684 (58.3)
Married or with partner	1087 (30.6)	431 (36.7)
Divorced or separated	105 (3.0)	52 (4.4)
Widowed	14 (0.4)	7 (0.6)
Health worker		
Yes	346 (9.7)	138 (11.8)
No	3204 (90.3)	1036 (88.2)
Living with		
Alone	247 (7.0)	92 (7.8)
1 person	751 (21.2)	273 (23.3)
2-4 people	2419 (68.1)	774 (65.9)
5 or more people	133 (3.7)	35 (3.0)
Changes in employment activity		
Yes	1316 (37.1)	463 (39.4)
No	854 (24.1)	333 (28.4)
No employment activity	1380 (38.9)	378 (32.2)
Tested for COVID-19		
Yes	28 (0.8)	58 (4.9)
No	3522 (99.2)	1116 (95.1)
Reported COVID-19 symptoms		
Yes	302 (9.0)	127 (10.8)
No	3248 (91.0)	1047 (89.2)
Acquaintance with a person with a COVID-19 diagnosis		
Yes	1971 (55.5)	845 (72.0)
No symptoms	46 (2.3)	91 (10.8)
Mild	602 (30.5)	214 (25.3)
Moderate	711 (36.1)	225 (26.6)
Severe	344 (17.5)	110 (13.0)
Dead	268 (13.6)	205 (24.3)
No	1579 (44.5)	329 (28.0)
Previous psychological or psychiatric treatment		
Yes	973 (27.4)	362 (30.8)
No	2577 (72.6)	812 (69.2)
Current psychological or psychiatric treatment		
Yes	275 (7.7)	98 (8.3)
No	3275 (92.3)	1076 (91.7)
Current intake of psychoactive medication		
Yes	258 (7.3)	101 (8.6)
No	3292 (92.7)	1073 (91.4)
Positive effects of confinement on relationships with confined people		
Yes	2414 (68.0)	862 (73.4)
No	1136 (32.0)	312 (26.6)
Negative effects of confinement on relationships with confined people		
Yes	1059 (29.8)	504 (42.9)
No	2491 (70.2)	670 (57.1)
Positive effects on social relationships		
None	1751 (49.3)	608 (51.8)
Little	1332 (37.5)	428 (36.5)
Some	383 (10.8)	118 (10.1)
Great	84 (2.4)	20 (1.7)
Negative effects on social relationships		
None	1428 (40.2)	377 (32.1)
Little	1250 (35.2)	461 (39.3)
Some	616 (17.4)	256 (21.8)
Great	256 (7.2)	80 (6.8)

intrusion subscale, significant positive longitudinal interaction was found with living alone, considering all subjects and the subjects who answered both surveys. In the first survey, participants living alone showed non-significant lower intrusion scores (- 0.71 points) compared to subjects living with 2-4 people, and after a month there was an increase of 1.28 points in the people living alone (- 0.71 + 1.28 = 0.57

points higher in single subjects). The multivariate longitudinal model including all the subjects can be found in [Table 4](#), and the results including only the subjects who completed both surveys in Supplementary Table 4. The results from [Table 4](#) are interpreted in the same way compared to results from [Table 2](#).

Significant cross-sectional associations between some of the specific

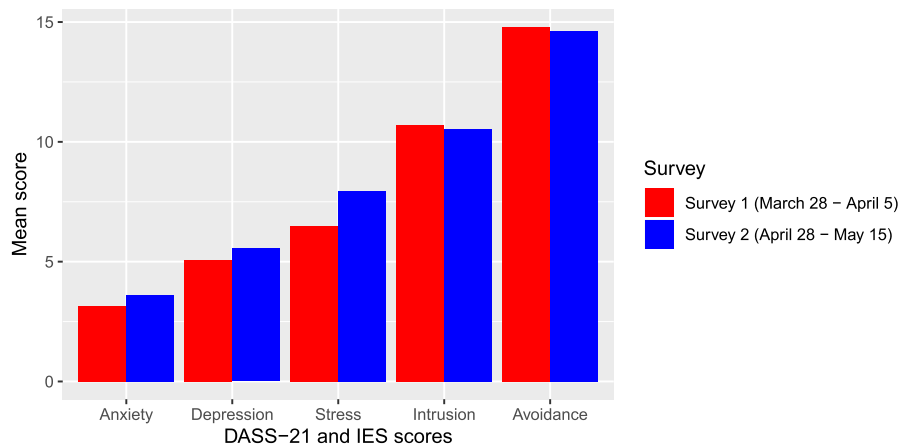


Fig. 2. Mean DASS-21 and IES subscales scores of the first and second surveys.

covariates of the second survey and the scores from the two subscales were found. For both subscales, a significant positive association was found with reported stress related to going outdoors and intention to practice physical activity or sport when allowed. These and other significant associations with the IES subscales can be found in Table 3. The multivariate GLM models can be found in Supplementary Table 5.

### 3.3. Correlation analysis

The correlation values between IES and DASS-21 were 0.62 for stress ([0.58, 0.65],  $p < 0.0001$ ), 0.58 for anxiety ([0.54, 0.61],  $p < 0.0001$ ) and 0.57 for depression ([0.53, 0.61],  $p < 0.0001$ ).

## 4. Discussion

This prospective longitudinal study has shown that the levels of anxiety, depression and (especially) stress have significantly increased throughout the confinement caused by COVID-19. The psychological impact of the event measured with the IES scale has not increased, in fact has even decreased, without being statistically significant.

In comparison to another longitudinal study about the psychological impact of the COVID-19 situation (Wang et al., 2020b), which was conducted in China, some important differences can be found. First, in contrast to our study, where there has been no significant decrease in the psychological impact of the event, the Chinese study reported significantly reduced scores. This result may indicate that the impact of the COVID-19 crisis on the Spanish population has been sustained, possibly related to the uncertainty and lack of any recent experience in epidemic outbreaks. In any case, we employed the IES scale, while its revised version (IES-R) was used in the Chinese study, so a direct comparison of the scores is not appropriate.

Also, we observed an increase in depression, anxiety and stress scores from the first to the second survey, while the Chinese study reported stable scores. From a clinical perspective, however, the percentage of participants with symptomatic scores in anxiety and depression in the second survey was similar with respect to the scores obtained from the first survey. The longitudinal rise in anxiety and depression scores are in line with a small increase in psychological distress in the post-lockdown situation in comparison with the pre-lockdown situation in New Zealand (Sibley et al., 2020).

Several factors may contribute to these differences. Aside from the cultural, demographic, and societal differences between both countries, the Chinese study collected responses from different cities with very diverse situations in terms of the seriousness of the COVID-19 crisis and the lockdown measures that were imposed. In our case, on the other hand, the situation in Spain was much more homogeneous in relation to lockdown measures. Furthermore, our sample size was notably higher.

In contrast, the time elapsed between both surveys was similar in the Chinese study and our case.

In this study, we observed that, in older people, anxiety and stress scores were significantly reduced from the outbreak to a later stage of the COVID-19 crisis, in contrast to younger people, who however composed a great part of our sample. Furthermore, we found that people with an acquaintance with a dead person because of COVID-19 presented lower anxiety, stress, and intrusion IES scores in the second with respect to the first survey. This result is in line with the decrease in symptoms in an uncomplicated bereavement and the common progress to restoration (Shear et al., 2011). Significant lower anxiety scores in the second survey were also found for health workers, which could be related to a positive evolution of the situation of the health system in Spain compared to the first survey, which was carried out at the peak of deaths and new COVID-19, as can be seen in Fig. 1.

Additionally, we found a negative association of previous and current physical activity (daily or almost daily frequency) with anxiety, depression, and stress scores. This result is in line with a review article that associated regular physical activity with the alleviation of symptoms of anxiety and depression (Paluska and Schwenk, 2000).

In this phase of the study, we also found that the frequency of news consumption about COVID-19 was a factor clearly associated with anxiety, depression, and stress scores. People who constantly consumed news about the crisis showed higher anxiety, stress, and depression scores. Hard news consumption has been previously associated with decreased mental well-being (Boukes and Vliegenthart, 2017), a result in line with our findings. The “stress” (related to fear or worry) about going out was another factor that we studied. We found that respondents reporting a moderate or high worry related to going out presented considerably higher stress, depression, and anxiety scores. This might be related to a maladaptive emotion-regulation strategy such as rumination or avoidance, more strongly associated with psychopathology (Aldao et al., 2010). As confinement and social distancing measures are being relaxed in many countries, this issue should be specifically analyzed in future studies, since results suggest that a considerable proportion of the population could be experiencing problems when facing a return to a somehow more normal lifestyle.

Our study presented some strengths and limitations. As a major strength, more than 1,000 respondents from the previous survey answered again to a second survey and allowed us to work with a considerable sample size, composed of a total of around 4,700 responses, including more than 100 new respondents in the second survey. Furthermore, we could pair respondents answers from both surveys to perform a proper analysis considering repeated measures and assigning a specific random factor to each subject.

There are some limitations in our study which should be remarked. Firstly, our sample is not completely representative of the Spanish

**Table 2**  
DASS-21 score differences between respondent characteristics.

Characteristics	DASS-21 Total	DASS-21 Stress	DASS-21 Anxiety	DASS-21 Depression
Independent term	<b>12.87****</b>	<b>5.50****</b>	<b>2.19****</b>	<b>4.86****</b>
Survey (2 <sup>nd</sup> vs. 1 <sup>st</sup> )	<b>5.44****</b>	<b>2.75****</b>	<b>1.56****</b>	<b>1.05***</b>
Age	<b>-0.15****</b>	<b>-0.05****</b>	<b>-0.03****</b>	<b>-0.05****</b>
Sex (Female vs. Male)	<b>4.58****</b>	<b>1.85****</b>	<b>1.48****</b>	<b>1.24****</b>
Marital status		n.i.	n.i.	
Married vs. Single	0.30			-0.13
Divorced vs. Single	-0.01			-0.09
Widowed vs. Single	-1.41			0.51
Health worker (Yes vs. No)	n.i.	0.48*	0.13	-0.63**
Living with	n.i.		n.i.	n.i.
Alone vs. 2-4 people		<b>-0.87***</b>		
1 vs. 2-4 people		-0.42**		
5+ vs. 2-4 people		0.26		
Changes in employment activity	n.i.		n.i.	
No employment activity vs. No		-0.27		<b>0.58**</b>
Yes vs. No		<b>0.22</b>		<b>0.46**</b>
COVID-19 test (Yes vs. No)	1.08	0.68	n.i.	n.i.
COVID-19 symptoms (Yes vs. No)	<b>3.51****</b>	<b>0.84****</b>	<b>1.75****</b>	<b>0.92****</b>
Acquaintance with a person with a COVID-19 diagnosis				
Asymptomatic vs. No	-1.09	-0.20	-0.84	0.07
Mild vs. No	0.35	0.31	0.05	-0.17
Moderate vs. No	0.42	0.38*	0.12	-0.05
Severe vs. No	1.46**	0.66**	<b>0.52**</b>	0.29
Person who has died vs. No	2.31****	<b>1.13****</b>	<b>0.64**</b>	0.51**
Previous treatment (Yes vs. No)	<b>2.87****</b>	<b>1.20****</b>	<b>0.96****</b>	<b>0.79****</b>
Current treatment (Yes vs. No)	1.87*	0.65*	n.i.	0.99**
Psychoactive medication (Yes vs. No)	<b>4.05****</b>	<b>1.18****</b>	<b>1.76****</b>	<b>1.16****</b>
Positive effect of confinement on relationships (Yes vs. No)	<b>-2.81****</b>	<b>-0.96****</b>	<b>-0.50****</b>	<b>-1.29****</b>
Negative effect of confinement on relationships (Yes vs. No)	<b>4.48****</b>	<b>1.89****</b>	<b>0.86****</b>	<b>1.77****</b>
Positive effect on social relationships	n.i.	n.i.	n.i.	
Little vs. None				-0.36**
Some vs. None				<b>-0.67***</b>
Great vs. None				-0.14
Negative effect on social relationships				
Little vs. None	<b>2.30****</b>	<b>0.86****</b>	0.29**	<b>1.00****</b>
Some vs. None	<b>4.88****</b>	<b>2.01****</b>	<b>1.02****</b>	<b>1.87****</b>
Great vs. None	<b>9.78****</b>	<b>3.50****</b>	<b>2.24****</b>	<b>3.65****</b>
Age: Survey	-0.05*	<b>-0.04****</b>	<b>-0.03****</b>	n.i.
Marital status: Survey		n.i.	n.i.	
Married vs. Single	<b>-1.58*</b>			<b>-0.87***</b>
Divorced vs. Single	-0.79			-0.68
Widowed vs. Single	-2.92			-1.76
Health worker: Survey (Yes vs. No)	n.i.	n.i.	<b>-0.80**</b>	n.i.
Test: Survey (Yes vs. No)	-3.12	<b>-1.86*</b>	n.i.	n.i.
Symptoms: Survey (Yes vs. No)	-1.46	n.i.	-0.73*	-0.66
Acquaintance with a person with a COVID-19 diagnosis: Survey				n.i.
Asymptomatic vs. No	0.89	0.22	0.88	
Mild vs. No	-1.47*	-0.61	-0.37	
Moderate vs. No	-0.79	-0.45	-0.37	
Severe vs. No	-1.22	-0.55	<b>-0.58</b>	
Person who has died vs. No	-1.84*	-0.93**	<b>-0.58*</b>	
Negative effect of confinement on relationships: Survey (Yes vs. No)	-1.06	-0.51*	n.i.	-0.44
Negative effect on social relationships: Survey		n.i.	n.i.	
Little vs. None	-0.81			-0.41
Some vs. None	-0.26			-0.41
Great vs. None	-2.11			-1.08*

\*\*\*\* p < 0.0001, \*\*\* p < 0.001, \*\* p < 0.01, \* p < 0.05. n.i. = not included in the model. Results in bold were significant when including only the participants who answered the two surveys. The results reported in the table correspond to the models with all the subjects.

population in terms of age, socio-economic level, or location. As can be seen in Table 1, because of the nature of this study, people younger than 35 composed more than half of sample. As mentioned earlier in this Discussion, people with different ages seemed to evolve differently in terms of their psychological symptoms during the COVID-19 crisis, which makes this factor worth considering when designing new studies. Secondly, other characteristics which may have biased the results were higher presence of female and single participants. The higher number of females may be related to the fact that women are more likely to participate in surveys (Moore and Tarnai, 2002). The use of an online survey instead of an in-person or paper survey might be related to the age of the participants, considering that younger people are also more

likely to participate in surveys (Moore and Tarnai, 2002), and a possible higher use of the internet and social media by young people in Spain. Thirdly, we were unable to determine whether the participants suffered any difficulties with accommodation or were displaced or non-Spanish, although they were living in Spain and were able to understand the survey in Spanish. In the analysis of the employment status, in those participants who commented that their employment status changed during lockdown, we could not distinguish between changes specifically related to COVID-19 and other possible reasons. Also, we did not analyze specific self-reported COVID-19 symptoms, but instead we just asked the respondents if they suffered any symptom, with no check of particular symptoms such as fever, cough or anosmia.

**Table 3**  
Summary of the specific significant associations found for DASS-21 and IES intrusion subscale in the second survey.

	DASS-21 Stress	DASS-21 Anxiety	DASS-21 Depression	IES Intrusion	IES Avoidance
Longitudinal interactions (modified effect from 1 <sup>st</sup> to 2 <sup>nd</sup> survey)					
Age	↓	↓			
Married			↓		
Living alone				↑	
Health worker		↓			
Having been tested for COVID-19	↓				
Specific variables from the 2 <sup>nd</sup> survey					
Constant news consumption about COVID-19	↑	↑	↑	↑	↓
High stress (worry) about going out	↑	↑	↑	↑	↑
High trust in scientists	↓		↓		
High intention to practice sport when allowed	↑	↑	↑	↑	↑
Partial disagreement with the statement of being healthy	↑			↑	
Perceived high or very high likelihood of past COVID-19 infection	↓			↑	
Perceived very low likelihood of having infected others with COVID-19	↓				↓
Perceived very high likelihood of future COVID-19 infection				↑	
Frequent exercise before lockdown		↓			
Daily exercise last two weeks	↓		↓		

Red and ↑ mean positive association (more symptoms with higher values), and green and ↓ mean negative association (less symptoms with higher values). The longitudinal interactions were significant in the analyses including all the subjects and including only the subjects who completed both surveys.

**5. Conclusions**

In a longitudinal study, we found a temporal increase of anxiety, depression and especially stress scores some weeks after the COVID-19

outbreak in Spain. Regarding the impact of the event, a large percentage of respondents showed at least mild impact of event scores that have not significantly changed from the first to the second survey. Among others, factors such as age, consumption of information about

**Table 4**  
IES score differences between respondent characteristics.

Characteristics	IES Total	IES Intrusion	IES Avoidance
Independent term	<b>16.20****</b>	<b>5.96****</b>	<b>11.80****</b>
Survey (2 <sup>nd</sup> vs. 1 <sup>st</sup> )	0.10	0.02	-0.30
Age	n.i.	n.i.	-0.05***
Sex (Female vs. Male)	<b>8.66****</b>	<b>3.75****</b>	<b>4.78****</b>
Marital status		n.i.	
Married vs. Single	<b>-1.83****</b>		<b>-1.23**</b>
Divorced vs. Single	-1.95		<b>-1.00</b>
Widowed vs. Single	<b>-6.88*</b>		<b>-4.58*</b>
Living with			
Alone vs. 2-4 people	<b>-1.69*</b>	-0.71	<b>-0.90</b>
1 vs. 2-4 people	<b>-2.03****</b>	-0.46	<b>-1.37****</b>
5+ vs. 2-4 people	0.18	-0.39	0.45
Changes in employment activity	n.i.		n.i.
No employment activity vs. No		-0.60*	
Yes vs. No		0.45	
COVID-19 symptoms (Yes vs. No)	<b>1.98**</b>	<b>1.53****</b>	n.i.
Acquaintance with a person with a COVID-19 diagnosis			
Asymptomatic vs. No	-0.97	-1.69	0.96
Mild vs. No	0.58	0.42	0.12
Moderate vs. No	<b>1.58**</b>	<b>0.81**</b>	<b>0.69*</b>
Severe vs. No	<b>2.02**</b>	<b>1.67****</b>	0.48
Person who has died vs. No	<b>3.20****</b>	<b>2.18****</b>	<b>0.86*</b>
Previous treatment (Yes vs. No)	<b>2.27****</b>	<b>0.66*</b>	<b>1.56****</b>
Psychoactive medication (Yes vs. No)	<b>3.59****</b>	<b>2.10****</b>	<b>1.58**</b>
Negative effect of confinement on relationships (Yes vs. No)	<b>2.74****</b>	<b>1.28****</b>	<b>1.46****</b>
Negative effect on social relationships			
Little vs. None	<b>2.18****</b>	<b>1.15****</b>	<b>1.01***</b>
Some vs. None	<b>4.48****</b>	<b>2.28****</b>	<b>2.15****</b>
Great vs. None	<b>8.52****</b>	<b>4.85****</b>	<b>3.74****</b>
Live with: Survey	n.i.		n.i.
Alone vs. 2-4 people		<b>1.28*</b>	
1 vs. 2-4 people		-0.41	
5+ vs. 2-4 people		0.38	
Acquaintance with a COVID-19 patient: Survey			n.i.
Asymptomatic vs. No	1.14	1.08	
Mild vs. No	-0.93	-0.41	
Moderate vs. No	-1.40	-0.90	
Severe vs. No	-0.91	-0.93	
Person who has died vs. No	<b>-2.79*</b>	<b>-1.85**</b>	
Negative effect on social relationships: Survey			
Little vs. None	-1.08	-0.59	-0.37
Some vs. None	-1.11	-0.35	-0.67
Great vs. None	<b>-3.84**</b>	<b>-1.56*</b>	<b>-2.22*</b>

\*\*\*\* p < 0.0001, \*\*\* p < 0.001, \*\* p < 0.01, \* p < 0.05. n.i. = not included in the model. Results in bold were significant when including only the participants who answered the two surveys. The results reported in the table correspond to the models with all the subjects.

the COVID-19 crisis and physical activity seem to have an important impact on the evolution of psychological symptoms in the population.

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**CRedit authorship contribution statement**

Álvaro Planchuelo-Gómez: Methodology, Formal analysis, Investigation, Writing - original draft. Paula Odriozola-González: Conceptualization, Methodology, Investigation, Writing - original draft, Supervision. María Jesús Irurtia: Conceptualization, Methodology, Investigation. Rodrigo de Luis-García: Conceptualization, Methodology, Investigation, Resources, Writing - original draft, Project administration.

**Declaration of Competing Interest**

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

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**Supplementary materials**

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