# Worry about COVID-19 contagion and general anxiety: Moderation and mediation effects of cognitive emotion regulation

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## ARTICLE INFO

## ABSTRACT

The global pandemic caused by coronavirus disease 2019 (COVID-19) occasioned that most of the population in Spain was confined to home to reduce the risk of contagion. This affected mental health, increasing anxiety and worry about COVID-19 contagion. The aim of this study was assessing the moderation and mediation effect of cognitive emotion regulation strategies (CERS) on general anxiety and whether the mediation effect was moderated by gender and/or age. A total of 1753 Spanish adults (78,6% female; M = 40.4 years, SD = 12.9) participated in an online survey that was available from March 26 to April 25 (2020) during the time period in which the population in Spain was confined. Participants completed measures of worry about COVID-19 contagion, the *Cognitive Emotion Regulation Questionnaire-Short* (CERQ-Short) and the *Generalized Anxiety Disorder-7* (GAD-7). Several models were tested through structural equation modelling. Moderation analyses reported that maladaptive strategies moderated positively anxiety, whereas adaptive strategies moderated negatively anxiety. Also, the best fitted mediation model found that worry about COVID-19 contagion and general anxiety was mediated by CERS in different directions. Maladaptive CERS increased anxiety, whereas adaptive CERS reduced anxiety. Age (not gender) also moderated this mediation, were younger adults presented an indirect effect only through maladaptive CERS, but older adults through both adaptive and maladaptive. Limitations are related to the study design which was a convenience sample. CERS moderated and mediated between worry about COVID-19 contagion and general anxiety. Prevention programs for mental health problems during the pandemic must be provided, especially for younger adults.

## 1. Introduction

The global pandemic caused by coronavirus disease 2019 (COVID-19) has resulted in an unprecedented situation in which most of the population has been confined to home to reduce the risk of contagion. In this stressful environment, there is an elevated risk of mental health issues in the population, which is directly related to the confinement (Brooks et al., 2020), the burden of stress on health care workers (Lai et al., 2020), financial issues (Galea et al., 2020), or fear of contagion (McKay et al., 2020).

In the last year, numerous studies have been conducted to assess the psychological impact of the disease and the response in the general population in several of the most affected countries, including China, (Qiu et al., 2020; Wang et al., 2020a, 2020b), Italy (Sani et al., 2020), Spain (González-Sanguino et al., 2020; Munoz-Navarro et al., 2020), USA (APA, 2020), among others. These studies consistently report an increase in emotional distress, especially anxiety, depression, post-traumatic symptoms, and panic attacks/disorders. For instance, in an online survey conducted in China, Wang et al. (2020a) reported a moderate to severe psychological impact of the outbreak in 53.8% of respondents (n = 1210), with 16.5% and a 28.8%, respectively, reporting moderate to severe anxiety or depressive symptoms. González-Sanguino et al. (2020) found that depressive symptoms were present in 18.7% of their sample (n = 3840), while 21.6% and 15.8%

reported symptoms of anxiety or post-traumatic stress disorder, respectively. On the other hand, Munoz-Navarro et al., 2020 found that 15.3% of their sample (n = 1753) met criteria for generalized anxiety disorder (GAD), 12.2% for major depression, and 17.2% for panic disorder, with 25.7% experiencing panic attacks. In some of these studies, the commonly reported risk factors for developing symptoms were being female, younger age, and being at risk of infection (González-Sanguino et al., 2020; Munoz-Navarro et al., 2020; Wang et al., 2020b). It is plausible then that worry and anxiety are common reactions to this pandemic, with the potential to cause mental health consequences in the general population. As it is reasonable to assume that the virus and its effects may remain for a long time, at least until a vaccine is developed, and new outbreaks may occur, there is a need to develop a comprehensive understanding of the psychological factors that help individuals to cope with worry about COVID-19 contagion. This would help to implement effective preventive programs to decrease the negative impact of the pandemic on public health (Galea et al., 2020).

Several studies have attempted to identify the psychological resources that can moderate and mediate symptoms and normal reactions that could otherwise lead to psychopathology, especially anxiety disorders such as GAD, panic disorders, and health-related anxiety. Along these lines, cognitive emotion regulation strategies (CERS) play a transdiagnostic role in the onset and maintenance of emotional disorders such as anxiety and depression (Aldao et al., 2010; Dryman and Heimberg, 2018; Naragon-Gainey et al., 2017; Pearl and Norton, 2017). Rumination, worry, and catastrophizing are maladaptive strategies used by some individuals, commonly leading to increased anxiety (McEvoy et al., 2013; McLaughlin and Nolen-Hoeksema, 2011); by contrast, more adaptive strategies would include reappraisal, acceptance and problem solving (Naragon-Gainey et al., 2017). It appears that some people tend to employ the same type of emotion regulation strategies, which may cause the onset of anxiety and depression symptoms (D'Avanzato et al., 2013). Indeed, worry as a strategy seems to be closely related to GAD and anxiety symptoms (Ellard et al., 2017), which suggests that worry about COVID-19 contagion is likely to influence this emotional state during the pandemic and that CERS could moderate and mediate this effect. Moreover, it seems that older people are better at regulating their emotions (Urry and Gross, 2010), which could explain why younger adults present more anxiety symptoms (Munoz-Navarro et al., 2020; Scheibe and Blanchard-Fields, 2009; Sims et al., 2015). In addition, gender differences in regulating emotions have been shown (Nolen-Hoeksema, 2012; Zimmermann and Iwanski, 2014), and these differences merit investigation in the context of COVID-19 and worry.

Clearly, a considerable amount of research has been performed to evaluate the relationship between onset of anxiety disorders and CERS, particularly the role of the moderation and mediation effects of emotion

*Moderation models (Model 1 and 2)*
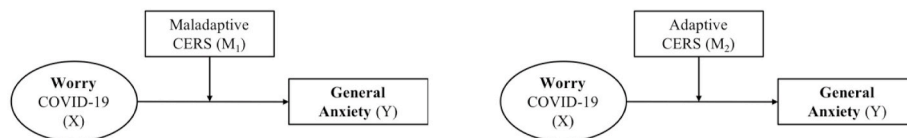


*Serial mediation models (Model 3 and 5)*
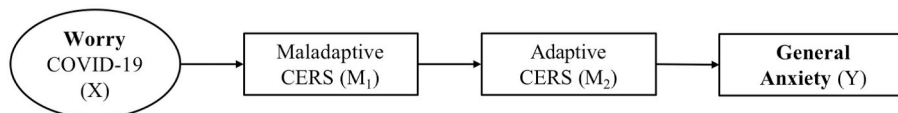


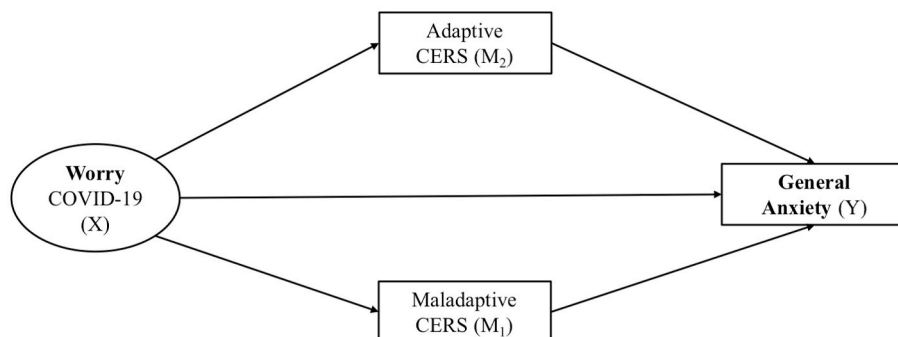*Indirect mediation models (Model 4 and 6)*



**Fig. 1.** Hypothetical models.

regulation and psychopathology. Research into moderation effects have mainly focused on determining whether individuals use the same CERS (D'Avanzato et al., 2013). By contrast, research into mediation frameworks has focused on prevention and treatment in which interventions are designed to change the outcome of interest by targeting mediating variables hypothesized to be causally related to outcomes (Agler and De Boeck, 2017; Edwards and Lambert, 2007; MacKinnon et al., 2007). Both models are plausible targets for study in the COVID-19 setting. However, more research is needed to explore the moderation and mediation effects of CERS between worry about COVID-19 contagion and general anxiety symptoms, and to determine whether mediation effects are moderated by other variables, such as gender and/or age. In this context, the aim of this study was to evaluate the following hypotheses (see Fig. 1 for the hypothetical models):

**H1**.  Worry about COVID-19 contagion will have a direct effect on general anxiety symptoms;

**H2**.  Maladaptive CERS will positively moderate the effect between worry about COVID-19 contagion and general anxiety symptoms;

**H3**.  Adaptive CERS will negatively moderate the effect between worry about COVID-19 contagion and general anxiety symptoms;

**H4**.  Maladaptive CERS will positively mediate between worry about COVID-19 contagion and general anxiety symptoms;

**H5**.  Adaptive CERS will negatively mediate between worry about COVID-19 contagion and general anxiety symptoms;

**H6**.  Age will moderate this mediation: younger people will use more maladaptive CERS and will have more general anxiety symptoms due to worry about COVID-19 contagion.

**H7**.  Gender will moderate this mediation: women will use more maladaptive CERS and have more general anxiety symptoms due to worry about COVID-19 contagion.

## 2. Methods

### 2.1. Participants and procedure

This research study was conducted in Spain during the first 6 weeks of the government-imposed confinement, which was declared on March 12, 2020. We conducted a cross-sectional survey using an online platform (*SurveyMonkey*), which was available online from March 26, 2020 to April 25, 2020. We recruited adults (≥age 18) from the Spanish population to participate in the survey. We used several tactics to reach as many participants as possible from all over Spain, relying on the professional and personal networks of the researchers, who reached out to social media audiences to broadcast and share the survey. The link was sent by email and two platforms (Facebook and WhatsApp) were used to disseminate the survey. A standardized general description about the survey was given in the email and messaging/social media postings. During the 4.5 weeks, a total of 2647 participants initiated the survey and 1753 (66.2%) completed the full survey, including all assessment measures. The study was approved by the clinical research ethics committee of Hospital University La Fe of Valencia. Participation was completely voluntary, the survey was anonymous, and confidentiality of all information provided was assured. Before starting the survey, all participants were required to read the instructions and provide informed consent and could abandon the survey at any time, for any reason.

### 2.2. Instruments

#### 2.2.1. Worry about COVID-19 contagion

Worry about COVID-19 contagion was evaluated through three questions: 1) *How worried are you about becoming infected with* SARS-CoV-

2 *virus?* 2) *How worried are you about getting sick and a deterioration in your health? and;* 3) *How worried are you that your life is in danger?* Participants answered these items on a scale ranging from 1 to 10 points. Although there was some redundancy between the items, they assessed three levels of intensity regarding worry about COVID-19 contagion; item 1: worrying about infection; item 2: worrying about deterioration of health; item 3: worrying about the risk of dying. In the current study, the Cronbach's alpha value was excellent (α = 0.91) but this variable was retained as a latent variable to test our models.

#### 2.2.2. Generalized anxiety disorder-7 (GAD-7)

The GAD-7 scale is used to measure general anxiety symptoms (Spitzer et al., 2006). Participants are asked to rate the frequency at which they have experienced seven general anxiety symptoms during the past 2 weeks on a four Likert scale, as follows: 0 = "*not at all*"; 1 = "*several days*"; 2 = "*more than half of the days*"; and 3 = "*nearly every day*"; the total score ranges from 0 to 21. We used the validated Spanish version of the GAD-7 scale (García-Campayo et al., 2010), which has shown excellent psychometric properties in the Spanish population (Moreno et al., 2019; Muñoz-Navarro et al., 2017), that presented an adequate internal consistency (α = 0.89).

#### 2.2.3. Cognitive Emotion Regulation Questionnaire-Short (CERQ-Short)

The CERQ-Short (Garnefski and Kraaij, 2006) is the short version of the full CERQ. It evaluates nine different cognitive strategies that individuals use to regulate emotions when face with a negative event. We used the validated Spanish version of the CERQ-Short (Holgado-Tello et al., 2018), with some modifications to the instructions due to the COVID-19 pandemic, as follows: "*In the following questions, you are asked to indicate what you think when you experience negative or unpleasant emotions related to the current crisis you are experiencing*". We assessed the asymmetry and kurtosis for all nine strategies, finding that *self-blame* presented both asymmetry (>2) and kurtosis (>6) (other data available upon request). Thus, we obtained two versions of the maladaptive ER factor with the sum score of the "maladaptive strategies" for our competing models; model 1 and 3: *rumination, catastrophizing, other-blame and self-blame* and model 2 and 4: *rumination, catastrophizing and other-blame.* For the adaptive ER factor, we used the sum score for "adaptive strategies" *positive refocusing, acceptance, positive reappraisal, refocus on planning, and putting into perspective.* Internal consistency was acceptable for both factors of the selected model (0.73 and 0.81).

#### 2.2.4. Statistical analyses

The SPSS statistical software, v.26 was used to calculate means and standard deviations and to perform correlation analysis to test associations among variables. Structural equations modelling (SEM) in *Mplus 6.1* (Muthén and Muthén, 2012) was employed to explore the moderation and mediation effects between worry about COVID-19 contagion and general anxiety by using two moderators/mediators; maladaptive and adaptive CERS. Several indices were studied for the 6 cross-sectional models tested; goodness-of-fit indices included chi-square divided by degrees of freedom ($\chi^2/df$), the Bentler Comparative Fit Index (CFI), and the Tucker–Lewis Index (TLI). The standardized root mean residual (SRMR) and root mean square error of approximation (RMSEA) were used to measure error (Hu and Bentler, 1999). To compare the models, we used the Bayesian Information Criterion (BIC) and the Akaike Information Criterion (AIC). Finally, indirect effects were tested using the bias corrected bootstrap confidence interval method in *Mplus* (Williams and MacKinnon, 2008).

First, we tested the moderation effects between worry about COVID-19 contagion and general anxiety by using two moderators; maladaptive (model 1) and adaptive (model 2) CERS. Also, we tested four different mediation models, all of which evaluated the relation between latent and observed variables in the same wave. The latent variable was worry about COVID-19 contagion and the observed variables were maladaptive and adaptive CERS and general anxiety. In models 3 and 4, the

maladaptive CERS included rumination, catastrophizing, self-blame, and other-blame; by contrast, in models 5 and 6, we removed the self-blame factor (maladaptive CERS) due to asymmetry and kurtosis. Furthermore, while models 3 and 5 captured only the direct relationships in a serial mediation model, models 4 and 6 captured the relationships between worry about COVID-19 contagion and general anxiety through CERS as indirect mediators. Model 6 was the best-fitting model and thus all further analyses were based only on this model. Specifically, this captured the relationships between worry about COVID-19 contagion and general anxiety (H1) and through maladaptive (H4) and adaptive (H5) CERS. The direct relationship between worry about COVID-19 contagion and maladaptive CERS and general anxiety (H4), and worry about COVID-19 contagion and adaptive CERS and general anxiety (H5) were studied.

We also tested a moderation of mediation model 6 using multi-group analyses to examine whether the patterns of associations differed according to age (H6) or gender (H7) in order to assess the potential moderation effect of these moderators on this mediation model. For age analyses, the sample population was divided into two groups according to age: 18–39 years; "young people" and ≥40 years; "older people". A chi-square difference test was conducted to examine significant change in the chi-square statistic for the constrained models (Muthén and Muthén, 2012).

## 3. Results

### 3.1. Descriptive statistics and correlational analyses

The following characteristics describe the "typical" participant: female (76.8% of sample), age 40–59 years (43.5%), married (37.9%),

**Table 1**
Demographics characteristics of sample.

| | Total sample ($n = 1753$) | |
|---|---|---|
| | *n* | *%* |
| *Gender* | | |
| Female | 1346 | 76.8 |
| Male | 354 | 22.9 |
| Diverse | 5 | 0.3 |
| *Age group, years* | | |
| 18–39 | 871 | 49.7 |
| 40 – ≥ 60 | 882 | 50.3 |
| *Marital status* | | |
| Married | 664 | 37.9 |
| Divorced | 144 | 8.2 |
| Widowed | 13 | 0.7 |
| Single | 612 | 34.9 |
| Living with unmarried partner | 320 | 18.3 |
| *Level of education* | | |
| No schooling | 1 | 0.1 |
| Basic education | 43 | 2.5 |
| Secondary education | 96 | 5.5 |
| High School | 222 | 12.7 |
| Bachelor | 699 | 39.9 |
| Master/doctorate | 692 | 39.5 |
| *Employment situation* | | |
| Employed full-time | 838 | 47.8 |
| Employed part-time | 152 | 8.7 |
| Unemployed, in search of work | 219 | 12.5 |
| Unemployed, not looking for work | 187 | 10.7 |
| Dismissed from work | 176 | 10.0 |
| Temporary incapacity to work | 94 | 5.4 |
| Permanent incapacity to work | 6 | 0.3 |
| Retired | 81 | 4.6 |
| *Level of income (per year)* | | |
| Less than €12,000 | 250 | 14.3 |
| Between €12,000 – €24,000 | 553 | 31.5 |
| Between €24,000 – €36,000 | 503 | 28.7 |
| Between €36,000 – €60,000 | 322 | 18.4 |
| More than €60,000 | 125 | 7.1 |

university studies (79.6%), employed full-time (47.8%), and earning between €12,000 – €24,000 per year (see Table 1 for details). When we divided the sample into younger and older people (cut-off: 40 years), the two group were roughly equal in size: young people: <40; n = 871, 49.7%; older people: ≥40; n = 882, 50.3%.

Table 2 presents means, standard deviations and results for the correlations matrix of the model 6. As shown in that table, general anxiety was negatively correlated with adaptive ER strategies and positively correlated with the other study variables, worry about COVID-19 contagion, and maladaptive ER strategies. Furthermore, maladaptive ER strategies were positively correlated with worry about COVID-19 contagion. Both ER strategies were positively correlated.

### 3.2. Moderation effects of the CERS on worry about COVID-19 contagion and general anxiety

Moderation models were evaluated to examine whether maladaptive and/or adaptive CERS moderated the relationships between worry about COVID-19 contagion and general anxiety. We found significant moderation effects for maladaptive CERS (Estimate = 0.26, $p = .000$) and adaptive CERS (Estimate = $-0.08$, p = .004) on the association between worry about COVID-19 and general anxiety. Model 2 presented a better fit than model 1, but no one presented an acceptable model fit; Model 1: $\chi^2$ (6) = 1845.33; CFI = 0.76; TLI = 0.40; RMSEA = 0.420; SRMR = 0.19; Model 2: $\chi^2$ (6) = 373.67; CFI = 0.92; TLI = 0.80; RMSEA = 0.188; SRMR = 0.07. Table 3 shows the fit indices obtained in all the models.

### 3.3. Mediation model between worry about COVID-19 contagion, CERS, and general anxiety

The results indicate a very good fit between the model and the empirical data: $\chi^2$ (6) = 51.65, $p = .000$. The following fit indices were obtained: CFI = 0.99 and TLI = 0.98, showing a very good fit. Finally, error measurements were calculated: RMSEA = 0.066. and SRMR = 0.02, indicating a very good fit (Kline, 2015). Fig. 2 shows the path values and Table 3 shows the fit indices of the model.

The results reveal a significant and positive direct effect of worry about COVID-19 contagion on general anxiety. Furthermore, the direct effects were also significant for the links between maladaptive and adaptive ER strategies and general anxiety, which were positive and negative, respectively.

A bias corrected bootstrap confidence interval test was conducted to examine indirect effects, showing a significant indirect effect from worry about COVID-19 contagion on general anxiety (estimate = 0.16; CI 95% = [0.26, 0.38]) via maladaptive ER strategies, but not adaptive strategies.

### 3.4. Moderation by age in the mediation model

There was a difference between models by age. In older people (>age 40), worry about COVID-19 contagion and adaptive ER strategies were

**Table 2**
Descriptive and Correlation Matrix for Worry about COVID-19 contagion, Maladaptive and Adaptive CERS and General Anxiety symptoms (Model 6).

| Variable | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1. Worry about COVID-19 contagion (latent) | – | | | |
| 2. Maladaptive CERS[a] (CERQ) | .33** | – | | |
| 3. Adaptive CERS (CERQ) | -.04 | .06* | – | |
| 4. General anxiety (GAD-7) | .32** | .54** | -.10** | – |
| *Mean* | 6.18 | 4.51 | 7.17 | 6.31 |
| *Standard Deviation* | 2.82 | 1.57 | 1.43 | 4.67 |
| *Cronbach's alpha* | .91 | .73 | .81 | .89 |

Note: *$p < .05$, **$p < .01$.
[a] This strategy was calculated without the self-blame factor.

**Table 3**
CFA adjustment indices of the competing models.

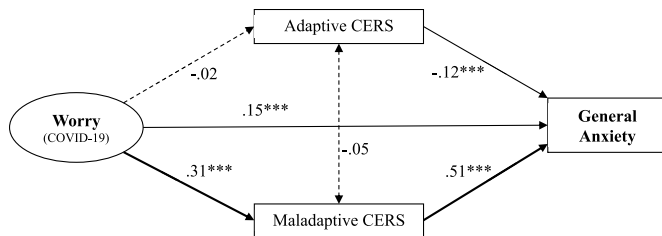| | $\chi^2$ | df | CFI | TLI | RMSEA (90% IC) | SRMR | AIC | BIC |
|---|---|---|---|---|---|---|---|---|
| Model 1 | 1845.33*** | 6 | .76 | .40 | .420 (.404–.437) | .19 | 52819.75 | 52934.37 |
| Model 2 | 373.67*** | 6 | .92 | .80 | .188 (.172–.204) | .07 | 57289.32 | 57403.94 |
| Model 3 | 4716.15*** | 15 | .83 | .72 | .223 (.210–.237) | .15 | 55641.98 | 55740.23 |
| Model 4 | 41.40*** | 6 | .99 | .98 | .058 (.042–.076) | .02 | 54902.01 | 55016.62 |
| Model 5 | 773.75*** | 9 | .83 | .72 | .221 (.208–.235) | .15 | 45702.23 | 45800.48 |
| Model 6 | 51.66*** | 6 | .99 | .98 | .066 (.050–.083) | .02 | 44986.14 | 45034.05 |

***$p < .001$.



**Fig. 2.** Path of the mediation model across the whole sample. Significant indirect effects are shown in bold.

significantly and negatively correlated (Estimate $= -0.15$, $p = .000$). However, in younger people, this relationship was not significant (Estimate $= 0.06$, $p = .07$). In testing moderation by age, the unconstrained model [$\chi^2$ (16) $= 75.27$] and the constrained model [$\chi^2$ (22) $= 93.88$] were significantly different as determined by a chi-square difference test [$\chi^2$ (6) $= 19.09$, $p = .004$], suggesting a moderation by age. The results indicate a very good fit for the multi-group by age: $\chi^2$ (16) $= 81.39$, $p = .000$; CFI $= 0.98$ and TLI $= 0.97$. Error measurements were as follows: SRMR $= 0.02$ and RMSEA $= 0.06$ (Kline, 2015). Bias corrected bootstrap confidence interval results showed two significant indirect effects: 1) worry about COVID-19 contagion on general anxiety (Estimate $= 0.70$; CI 95% $= [0.52, 0.88]$) via maladaptive ER strategies, and 2) worry about COVID-19 contagion on general anxiety (Estimate $= 0.09$; CI 95% $= [0.03, 0.14]$) via adaptive ER strategies (See Figs. 3 and 4).

### 3.5. Moderation by gender in the mediation model

In testing moderation by gender, the unconstrained model [$\chi^2$ (16) $= 52.54$] and the constrained model [$\chi^2$ (22) $= 54.38$] were not significantly different as determined by a chi-square difference test [$\chi^2$ (6) $= 3.15$, $p = .78$], suggesting no moderation by gender.

### 4. Discussion

The results of this study show that, on an individual basis, CERS moderated and mediated the effect of worry about COVID-19 contagion on general anxiety, but the best model fit showed that there was a mediation effect of CERS in different directions, which can also be moderated by age. We tested six competing models: two moderator
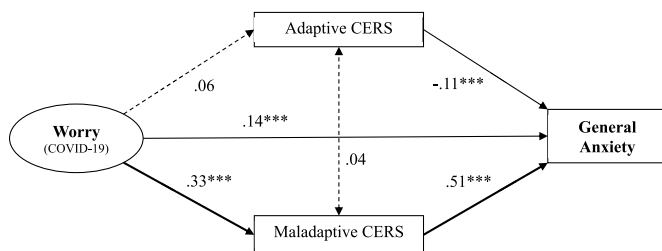


**Fig. 3.** Path of the mediation model moderated by age across young people (<40 years). Significant indirect effects are shown in bold.
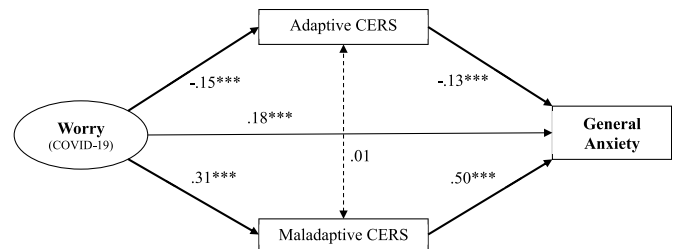


**Fig. 4.** Path of the mediation model moderated by age across older people (≥40 years). Significant indirect effects are given in bold text.

models and four mediation models. Of these, one of the mediation models presented the best fit. Our first hypothesis (H1) was confirmed, as we found that worry about COVID-19 contagion had a direct effect on general anxiety. This direct effect was moderated by CERS: maladaptive CERS had a positive moderation effect (H2) and adaptive CERS had a negative moderation effect (H3). For H4, we found a direct effect between worry about COVID-19 contagion and general anxiety, through the mediation effect of maladaptive ER strategies, which significantly increased general anxiety. However, we were unable to confirm H5. We expected that worry about COVID-19 contagion and general anxiety would be mediated by adaptive ER strategies, but we found that this strategy reduced general anxiety only with a direct effect. On the other hand, H6 was confirmed. In young adults, we only found an indirect effect between worry about COVID-19 contagion and general anxiety through maladaptive ER. By contrast, in older adults, we found an indirect effect between worry about COVID-19 contagion and general anxiety through both maladaptive and adaptive ER. We were unable to confirm H7 due to the observed gender invariance.

The direct effect of worry about COVID-19 contagion on general anxiety was an expected finding. The fear and worry about possible contagion in this pandemic are normal reactions, especially given the rapids spread of this highly contagious virus worldwide, with many transmission routes, and an unclear specific treatment. Several recent studies have reported an increase in anxiety in parents of hospitalized children during the COVID-19 epidemic in China (Yuan et al., 2020) and in health care workers (Wu et al., 2020), who showed a direct relationship between distress and fear of self- or family contagion. This stress could also be related to the so-called "*infodemic*" of social media, in which there was nonstop coverage of the pandemic (Gao et al., 2020). Given this situation, it is essential to determine the psychological factors that could help individuals to cope effectively with this specific stressor, especially considering that the pandemic may be with us for an extended period. This is especially relevant for health care workers (Wu et al., 2020), but also for the general population. The moderation effect was not unexpected: individuals using more maladaptive strategies had more anxiety while those using adaptive strategies presented less anxiety. These effects has been observed in other studies, which have found that individuals are more likely to employ the same type of emotion regulation strategies (D'Avanzato et al., 2013). However, these models did not present a good model fit.

These findings demonstrate why CERS are common targets of

psychological interventions, since they directly impact coping with general anxiety and depression, two disorders that seem to share transdiagnostic factors (McEvoy et al., 2013; McLaughlin and Nolen-Hoeksema, 2011; Pearl and Norton, 2017). The models tested as direct effects (model 3 and 5) did not fit the data well. By contrast, in our mediation model, we found a strong association between maladaptive ER strategies (e.g., rumination, catastrophizing, and other-blame) and general anxiety. This finding is consistent with the results of several studies, which have found that these maladaptive strategies present the most robust effect through general anxiety and emotional problems (Aldao et al., 2010; Dryman and Heimberg, 2018; Medrano et al., 2016; Naragon-Gainey et al., 2017). However, in our study, when we tested the mediation model including self-blame within the maladaptive ER strategies (model 6), the fit was worse than (model 4) when we omitted this strategy due to its asymmetry and kurtosis. This could happen perhaps be attributable to the type of crisis (i.e., a global pandemic), in which people do not blame themselves, as this situation would not be under self-control.

We found that adaptive strategies, which include positive reappraisal, acceptance, plan focusing (among others strategies) did not present an indirect effect on general anxiety, but rather a negative direct effect on general anxiety. This an interesting finding that suggests that, in the whole sample, adaptive ER work independently. The available evidence indicates that ER strategies are linked to specific neural areas and networks involving two distinct systems of cognitive and emotional processing (Ellard et al., 2017; Picó-Pérez et al., 2019; Picó-Pérez et al., 2017). The first system, known also as System 1 (Kahneman, 2011), is a bottom-up process involving subcortical neural areas such as the amygdala, cingulate cortex, thalamus, insula (Ellard et al., 2017; Picó-Pérez et al., 2019). The second system (System 2) is a top-down process, involving prefrontal cortical areas such as the dorsolateral, ventromedial, and ventrolateral prefrontal cortex, as well as the neural default mode network, which dysfunction has been directly linked to depression and anxiety disorders (Picó-Pérez et al., 2017). It is conceivable that our finding that worry had no direct effect on adaptive strategies but directly to maladaptive ER suggests this is a normal anxiety reaction where an automatic response is first activated (system 1). It may only be later, after some time has passed, that system 2 becomes activated, leading the individual to reappraise and accept the situation. The lack of correlation between these two ER strategies suggests that both strategies can be activated independently: first system 1 is activated (increasing general anxiety), and then system 2 is activated, reducing general anxiety.

The moderation effect of age on the mediation of CERS differed depending on the group. In the older group (>40 years), we observed a significant indirect effect from worry about COVID-19 contagion on adaptive strategies, reducing general anxiety. By contrast, the younger group (<40 years), presented a model similar to the whole sample, with no indirect effect on adaptive strategies. This finding could be attributed to the greater life experience among older people, who may thus have a more efficient way of using adaptive strategies (Scheibe and Blanchard-Fields, 2009; Sims et al., 2015; Urry and Gross, 2010). In other words, better cognitive control helps older people to regulate their emotions, as evidenced by greater prefrontal cortex activity when compared to younger adults engaging in emotion-processing tasks (Nashiro et al., 2012). Whereas, young adults would need more time and cognitive ability to regulate their emotions in front of worry about COVID-19 contagion. This could explain why it has been found that young people were more affected by general anxiety and other emotional disorders during this pandemic (González-Sanguino et al., 2020; Lai et al., 2020; Munoz-Navarro et al., 2020; Qiu et al., 2020). For this reason, we expected younger people would use more maladaptive strategies (H4), as these are associated with higher levels of general anxiety, which was confirmed.

However, we found no significantly variance for gender in our models (H5), suggesting that other factors may explain the emergence of general anxiety on gender. It seems that women would use more rumination than men when regulating their emotions, instead of worry (Nolen-Hoeksema, 2012). Other authors found neural differences on gender when regulating their emotions (McRae et al., 2008). Apparently, men may employ less effort when using CERS perhaps due to greater use of automatic emotion regulation. Another study found these same gender differences, which were also related with age (Zimmermann and Iwanski, 2014). In our study, we found contrary results, such as invariance in the moderation effect of the ER mediation. Thus, there is a need for more research to explain why women were more affected by anxiety and emotional disorders during the pandemic (González-Sanguino et al., 2020; Munoz-Navarro et al., 2020; Wang et al., 2020b). Future research could study other moderation models that delve deeper into these interactions.

### 4.1. Limitations

Some limitations should be considered in this work given that the data were obtained in the context of a cross-sectional research design. The use of a convenience sample may also limit the generalisability of our findings, as this sample cannot be taken as representative data for Spain or other countries. As a consequence of this data collection method, most of the sample was comprised of women, which is another study limitation that may have influenced our findings related to the moderation effect of gender. However, the large sample size supports the robustness of the results, which may be of value for preventive programs. Also, another limitation could be the use of worries and to study general anxiety symptoms, as anxiety has worry as a core symptom. Thus, the use of predicting worry with items assessing worry is a limitation as the criterion variable could be contaminated by the predictors. Nevertheless, worry for COVID-19 contagion may be a reaction worthy to assess, especially when studying mental health problems like general anxiety.

### 4.2. Conclusion

The COVID-19 pandemic is having a direct impact on well-being, with a major effect on mental health in the population. Sadly, the data suggest that this pandemic may be around for a long time, which means that the risk of contagion—and the worry associated with that risk—can affect general anxiety in the general population, especially among health care workers. We found that different CERS moderate and mediate general anxiety. Maladaptive strategies such as catastrophizing or rumination appear to increase general anxiety, while other strategies such as positive reappraisal, acceptance, and positive refocusing may decrease these negative symptoms. The mediation effect was moderated by age, which appears to have an indirect effect on maladaptive and adaptive strategies in older adults, whereas in younger adults this only indirectly effects maladaptive strategies; gender had no moderation effect on these strategies. Given these findings, selective preventive strategies focusing on improving ER strategies should be considered to reduce the negative impact on mental health of COVID-19 as we enter a new period of living with this virus for an extended period of time.

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### Author statement

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## Declaration of competing interest

The authors declare no conflict of interest.

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## References

Agler, R., De Boeck, P., 2017. On the interpretation and use of mediation: multiple perspectives on mediation analysis. Front. Psychol. https://doi.org/10.3389/fpsyg.2017.01984.

Aldao, A., Nolen-Hoeksema, S., Schweizer, S., 2010. Emotion-regulation strategies across psychopathology: a meta-analytic review. Clin. Psychol. Rev. https://doi.org/10.1016/j.cpr.2009.11.004.

American Psychiatric Association. New Poll: COVID-19 Impacting Mental Well-Being: Americans Feeling Anxious, Especially for Loved Ones; Older Adults are Less Anxious [WWW Document], n.d. URL. https://www.psychiatry.org/newsroom/news-releases/new-poll-covid-19-impacting-mental-well-being-americans-feeling-anxious-especially-for-loved-ones-older-adults-are-less-anxious (accessed 5.30.20).

Brooks, S.K., Webster, R.K., Smith, L.E., Woodland, L., Wessely, S., Greenberg, N., Rubin, G.J., 2020. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. Lancet. https://doi.org/10.1016/S0140-6736(20)30460-8.

D'Avanzato, C., Joormann, J., Siemer, M., Gotlib, I.H., 2013. Emotion regulation in depression and anxiety: examining diagnostic specificity and stability of strategy use. Cognit. Ther. Res. https://doi.org/10.1007/s10608-013-9537-0.

Dryman, M.T., Heimberg, R.G., 2018. Emotion regulation in social anxiety and depression: a systematic review of expressive suppression and cognitive reappraisal. Clin. Psychol. Rev. 65, 17–42. https://doi.org/10.1016/j.cpr.2018.07.004.

Edwards, J.R., Lambert, L.S., 2007. Methods for integrating moderation and mediation: a general analytical framework using moderated path analysis. Psychol. Methods. https://doi.org/10.1037/1082-989X.12.1.1.

Ellard, K.K., Barlow, D.H., Whitfield-Gabrieli, S., Gabrieli, J.D.E., Deckersbach, T., 2017. Neural correlates of emotion acceptance vs worry or suppression in generalized anxiety disorder. Soc. Cognit. Affect Neurosci. https://doi.org/10.1093/scan/nsx025.

Galea, S., Merchant, R.M., Lurie, N., 2020. The mental health consequences of COVID-19 and physical distancing: the need for prevention and early intervention. JAMA Intern. Med. https://doi.org/10.1001/jamainternmed.2020.1562.

Gao, J., Zheng, P., Jia, Y., Chen, H., Mao, Y., Chen, S., Wang, Y., Fu, H., Dai, J., 2020. Mental health problems and social media exposure during COVID-19 outbreak. PLoS One. https://doi.org/10.1371/journal.pone.0231924.

García-Campayo, J., Zamorano, E., Ruiz, M.A., Pardo, A., Pérez-Páramo, M., López-Gómez, V., Freire, O., Rejas, J., 2010. Cultural adaptation into Spanish of the generalized anxiety disorder-7 (GAD-7) scale as a screening tool. Health Qual. Life Outcome 8. https://doi.org/10.1186/1477-7525-8-8.

Garnefski, N., Kraaij, V., 2006. Cognitive emotion regulation questionnaire - development of a short 18-item version (CERQ-short). Pers. Indiv. Differ. https://doi.org/10.1016/j.paid.2006.04.010.

González-Sanguino, C., Ausín, B., ÁngelCastellanos, M., Saiz, J., López-Gómez, A., Ugidos, C., Muñoz, M., 2020. Mental health consequences during the initial stage of the 2020 coronavirus pandemic (COVID-19) in Spain. Brain Behav. Immun. https://doi.org/10.1016/j.bbi.2020.05.040.

Holgado-Tello, F.P., Amor, P.J., Lasa-Aristu, A., Domínguez-Sánchez, F.J., Delgado, B., 2018. Two new brief versions of the cognitive emotion regulation questionnaire and its relationships with depression and anxiety. An. Psicol. https://doi.org/10.6018/analesps.34.3.306531.

Hu, L.T., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct. Equ. Model. https://doi.org/10.1080/10705519909540118.

Kahneman, D., 2011. Thinking , Fast and Slow (Abstract), Book.

Kline, R.B., 2015. Principles and Practice of Structural Equation Modelling, fourth ed. (Methodol. Soc. Sci).

Lai, J., Ma, S., Wang, Y., Cai, Z., Hu, J., Wei, N., Wu, J., Du, H., Chen, T., Li, R., Tan, H., Kang, L., Yao, L., Huang, M., Wang, H., Wang, G., Liu, Z., Hu, S., 2020. Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. JAMA Netw. open. https://doi.org/10.1001/jamanetworkopen.2020.3976.

MacKinnon, D.P., Fairchild, A.J., Fritz, M.S., 2007. Mediation analysis. Annu. Rev. Psychol. https://doi.org/10.1146/annurev.psych.58.110405.085542.

McEvoy, P.M., Watson, H., Watkins, E.R., Nathan, P., 2013. The relationship between worry, rumination, and comorbidity: evidence for repetitive negative thinking as a transdiagnostic construct. J. Affect. Disord. 151, 313–320. https://doi.org/10.1016/j.jad.2013.06.014.

McKay, D., Yang, H., Elhai, J., Asmundson, G.J.G., 2020. Anxiety regarding contracting COVID-19 related to interoceptive anxiety sensations: the moderating role of disgust propensity and sensitivity. J. Anxiety Disord. 73, 102233. https://doi.org/10.1016/j.janxdis.2020.102233.

McLaughlin, K.A., Nolen-Hoeksema, S., 2011. Rumination as a transdiagnostic factor in depression and anxiety. Behav. Res. Ther. 49, 186–193. https://doi.org/10.1016/j.brat.2010.12.006.

McRae, K., Ochsner, K.N., Mauss, I.B., Gabrieli, J.J.D., Gross, J.J., 2008. Gender differences in emotion regulation: an fMRI study of cognitive reappraisal. Group Process. Intergr. Relat. https://doi.org/10.1177/1368430207088035.

Medrano, L.A., Muñoz-Navarro, R., Cano-Vindel, A., 2016. Procesos cognitivos y regulación emocional: aportes desde una aproximación psicoevolucionista. Ansiedad Estres 22, 47–54. https://doi.org/10.1016/j.anyes.2016.11.001.

Moreno, E., Muñoz-Navarro, R., Medrano, L.A., González-Blanch, C., Ruiz-Rodríguez, P., Limonero, J.T., Moretti, L.S., Cano-Vindel, A., Moriana, J.A., 2019. Factorial invariance of a computerized version of the GAD-7 across various demographic groups and over time in primary care patients. J. Affect. Disord. 252, 114–121. https://doi.org/10.1016/j.jad.2019.04.032.

Muñoz-Navarro, R., Cano-Vindel, A., Moriana, J.A., Medrano, L.A., Ruiz-Rodríguez, P., Agüero-Gento, L., Rodríguez-Enríquez, M., Pizà, M.R., Ramírez-Manent, J.I., 2017. Screening for generalized anxiety disorder in Spanish primary care centers with the GAD-7. Psychiatr. Res. 256, 312–317. https://doi.org/10.1016/j.psychres.2017.06.023.

Munoz-Navarro, R., Cano-Vindel, A., Schmitz, F., Cabello, R., Fernandez-Berrocal, P., 2020. Emotional distress and associated sociodemographic risk factors during the COVID-19 outbreak in Spain. medRxiv. https://doi.org/10.1101/2020.05.30.20117457.

Muthén, L., Muthén, B., 2012. Mplus Version 7 user's guide. Los Angeles, CA Muthén Muthén. https://doi.org/10.1111/j.1532-5415.2004.52225.x.

Naragon-Gainey, K., McMahon, T.P., Chacko, T.P., 2017. The structure of common emotion regulation strategies: a meta-analytic examination. Psychol. Bull. 143, 384–427. https://doi.org/10.1037/bul0000093.

Nashiro, K., Sakaki, M., Mather, M., 2012. Age differences in brain activity during emotion processing: reflections of age-related decline or increased emotion regulation? Gerontology. https://doi.org/10.1159/000328465.

Nolen-Hoeksema, S., 2012. Emotion regulation and psychopathology: the role of gender. Annu. Rev. Clin. Psychol. https://doi.org/10.1146/annurev-clinpsy-032511-143109.

Pearl, S.B., Norton, P.J., 2017. Transdiagnostic versus diagnosis specific cognitive behavioural therapies for anxiety: a meta-analysis. J. Anxiety Disord. https://doi.org/10.1016/j.janxdis.2016.07.004.

Picó-Pérez, M., Alemany-Navarro, M., Dunsmoor, J.E., Radua, J., Albajes-Eizagirre, A., Vervliet, B., Cardoner, N., Benet, O., Harrison, B.J., Soriano-Mas, C., Fullana, M.A., 2019. Common and distinct neural correlates of fear extinction and cognitive reappraisal: a meta-analysis of fMRI studies. Neurosci. Biobehav. Rev. https://doi.org/10.1016/j.neubiorev.2019.06.029.

Picó-Pérez, M., Radua, J., Steward, T., Menchón, J.M., Soriano-Mas, C., 2017. Emotion regulation in mood and anxiety disorders: a meta-analysis of fMRI cognitive reappraisal studies. Prog. Neuro Psychopharmacol. Biol. Psychiatr. https://doi.org/10.1016/j.pnpbp.2017.06.001.

Qiu, J., Shen, B., Zhao, M., Wang, Z., Xie, B., Xu, Y., 2020. A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations. Gen. Psychiatry. https://doi.org/10.1136/gpsych-2020-100213.

Sani, G., Janiri, D., Di Nicola, M., Janiri, L., Ferretti, S., Chieffo, D., 2020. Mental health during and after the COVID-19 emergency in Italy. Psychiatr. Clin. Neurosci. https://doi.org/10.1111/pcn.13004.

Scheibe, S., Blanchard-Fields, F., 2009. Effects of regulating emotions on cognitive performance: what is costly for young adults is not so costly for older adults. Psychol. Aging. https://doi.org/10.1037/a0013807.

Sims, T., Hogan, C.L., Carstensen, L.L., 2015. Selectivity as an emotion regulation strategy: lessons from older adults. Curr. Opin. Psychol. https://doi.org/10.1016/j.copsyc.2015.02.012.

Spitzer, R.L., Kroenke, K., Williams, J.B.W., Löwe, B., 2006. A brief measure for assessing generalized anxiety disorder: the GAD-7. Arch. Intern. Med. 166, 1092–1097. https://doi.org/10.1001/archinte.166.10.1092.

Urry, H.L., Gross, J.J., 2010. Emotion regulation in older age. Curr. Dir. Psychol. Sci. https://doi.org/10.1177/0963721410388395.

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C.S., Ho, R.C., 2020. Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. Int. J. Environ. Res. Publ. Health. https://doi.org/10.3390/ijerph17051729.

Wang, H., Xia, Q., Xiong, Z., Li, Zhi-xiong, Xiang, W., Yuan, Y., Liu, Y., Li, Zhe, 2020. The psychological distress and coping styles in the early stages of the 2019 coronavirus disease (COVID-19) epidemic in the general mainland Chinese population: a web-based survey. PLoS One. https://doi.org/10.1101/2020.03.27.20045807, 2020.03.27.20045807.

Williams, J., MacKinnon, D.P., 2008. Resampling and distribution of the product methods for testing indirect effects in complex models. Struct. Equ. Model. https://doi.org/10.1080/10705510701758166.

Wu, W., Zhang, Y., Wang, P., Zhang, L., Wang, G., Lei, G., Xiao, Q., Cao, X., Bian, Y., Xie, S., Huang, F., Luo, N., Zhang, J., Luo, M., 2020. Psychological stress of medical staffs during outbreak of COVID-19 and adjustment strategy. J. Med. Virol. https://doi.org/10.1002/jmv.25914.

Yuan, R., Xu, Q. hui, Xia, C. cui, Lou, C. yan, Xie, Z., Ge, Q. min, Shao, Y., 2020. Psychological status of parents of hospitalized children during the COVID-19 epidemic in China. Psychiatr. Res. https://doi.org/10.1016/j.psychres.2020.112953.

Zimmermann, P., Iwanski, A., 2014. Emotion regulation from early adolescence to emerging adulthood and middle adulthood: age differences, gender differences, and emotion-specific developmental variations. Int. J. Behav. Dev. https://doi.org/10.1177/0165025413515405.