Optimism as a protective factor against the psychological impact of COVID-19 pandemic through its effects on perceived stress and infection stress anticipation

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Abstract

The 2019 coronavirus disease (COVID-19) and the recommended social isolation presented a challenge to people's mental health status. Optimism is a psychological factor that plays a key role in the evaluation of stressful situations. The purpose of this study was to investigate the mediating role of perceived stress and Covid-19-related stress anticipation in the relationship between optimism and post-traumatic stress symptoms. Our sample included 1015 participants ranging in age from 18 to 79 years, 80% of whom were Spaniards. At the beginning of the worldwide pandemic, participants were confined to their homes for at least seven days and completed an online survey measuring various sociodemographic and psychological variables. We found an indirect effect of optimism on intrusion and hyperarousal through perceived stress and stress anticipation. In addition, we observed an indirect effect of optimism on avoidance through perceived stress. Finally, the results showed a significant indirect effect of optimism on the total post-traumatic stress symptoms score through perceived stress and stress anticipation. Our results indicate that positive beliefs inherent to optimism are related to less psychological impact of the COVID-19 outbreak.

Keywords Optimism · COVID-19 · Psychological impact · Post-traumatic stress symptoms · Perceived stress · COVID-19-related stress anticipation

Introduction

A novel coronavirus disease (COVID-19) was reported in Wuhan (China) in late December 2019. It subsequently spread throughout the world and was declared an international Public Health Emergency by the World Health Organization on January 30, 2020 (WHO, 2020a). The quick transmission of COVID-19, its potentially serious health outcomes, and the lack of an effective vaccine led the WHO to recommend social and physical distancing measures to break the chains of COVID-19 transmission in order to slow the spread of the disease (Situation Report 72 WHO, 2020b). The COVID-19 outbreak put entire cities and countries under widespread quarantine, as occurred during the severe acute respiratory syndrome (SARS) outbreak in China and Canada in 2003, or during the Ebola outbreak in West African countries in 2014 (Brooks, et al., 2020).

The COVID-19 outbreak has been recognized as a global threat affecting various vital aspects of people's lives (Wang et al., 2020). This global threat endangers one's health and the possibility of survival in case of infection, and it produces stress, a negative process characterized by an emotional, psychophysiological, cognitive, and behavioral response to demanding/stressful situations (Baum, 1990). In fact, both the COVID-19 outbreak and the recommended social isolation involve unpredictable, uncontrollable, and life-threatening challenges, which are characteristics of stress processes (Koolhaas et al., 2011) and present a challenge to the person's mental health status (Wang et al., 2020).

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A review that analyzed the psychological impact of quarantine and isolation concluded that these measures should be used carefully due to their long-term consequences for the psychological health of isolated people and for healthcare systems (Brooks et al., 2020). Specifically, people under quarantine have reported high perceived stress (DiGiovanni et al., 2004), depression, irritability, other emotional disturbances, and insomnia (Hawryluck et al., 2004; Lee et al., 2005; Yoon et al., 2016). Particularly, post-traumatic stress symptoms (PTSS) have been highlighted as one of the common psychological consequences of previous outbreaks (Liu et al., 2020). For example, during the SARS outbreak in 2003, more time spent in quarantine was related to higher PTSS (Hawryluck et al., 2004; Reynolds et al., 2008). In fact, 28% of quarantined adults showed sufficient symptoms to be diagnosed with a trauma-related mental health disorder, compared to 6% of non-quarantined adults (Sprang & Silman, 2013). Moreover, PTSS was observed as much as three years after the SARS outbreak in hospital employees, and those who had been quarantined were more likely to have PTSS than those who had not been quarantined (Wu et al., 2009). The link between quarantine and PTSS can be explained by the fact that quarantine entails exposure to different stressors, with fear of self-infection being one of the most important (for review, see Brooks et al., 2020). Indeed, during the Middle East Respiratory Syndrome (MERS) epidemic, 46% of the general population reported emotional distress, and over 80% reported fear of being infected (Jeong et al., 2016). The effects of the fear of infection can have long-term consequences for psychological health lasting up to several months (Jeong et al., 2016). Previous studies highlighted the mental health effects of diseases that were not as widespread as the COVID-19 pandemic, which means that the expected results of the current pandemic and its effects on health would be even higher. In fact, in these previous studies and quarantines, health services were not as saturated as during COVID-19, which could be another stressful factor: the fear of lacking or having worse medical attention due to healthcare saturation. Therefore, the situation elicited by the COVID-19 outbreak is quite important in the study of the individual stress experience and its outcomes for individual health. In this line, it has been suggested that a silent secondary pandemic could spread as a consequence of COVID-19, that is, a global mental health problem. In this regard, studies that focus on identifying the psychological constructs of mental health problems stemming from highly stressful situations such as COVID-19 are crucial.

Stress anticipation is an element of the stress process that is especially relevant in inducing negative long-term consequences for health. According to the perseverative cognition hypothesis (Brosschot et al., 2006), individuals make cognitive representations of stressful situations that may occur in the future (Ottaviani et al., 2016). They often imagine the future through the lens of the present (Gilbert, 2019), and they predict the way they will feel based on how they feel right now (Gilbert & Wilson, 2007). Hence, people who perceive more stress are expected to anticipate that the future will also be more stressful. According to the transactional approach to stress, the extent to which individuals envision future events as stressful can depend on the cognitive appraisal of these events, which is composed of interrelated primary and secondary appraisals. During the primary appraisal, the demands are categorized as sources of threat (i.e., perception that one might experience harm), challenge (i.e., perception of potential gain or growth accompanied by eagerness or excitement) (Lazarus & Folkman, 1984), or both (Folkman, 1997; Kozusznik et al., 2016). During the secondary appraisal, individuals evaluate "what might and can be done" (Lazarus & Folkman, 1984, p.35) about the demanding event, which can be operationalized by the person's "self-concept of one's own abilities" and "control expectancies" (Gaab et al., 2005) when dealing with the demanding situation.

Perseverative cognition implies chronic activation of the cognitive representation of a stressor (Brosschot et al., 2006) or feared situation in the future, and it can have important negative physical consequences. Indeed, a prolonged state of high levels of arousal can be a potential health risk. There is research showing that perseverative cognition is a mediator through which stressors can affect body systems (Brosschot et al., 2006), and that it is associated with higher levels of PTSS (Zawadzki et al., 2018). Considering the explanation above, and in line with Jeong et al. (2016), the perception of the fear of being infected by COVID-19 could be one of the key psychological constructs that acts on the appearance and severe development of PTSS symptomatology, which makes it essential in studies that focus on the psychological impact of COVID-19, as in this study. However, no studies have examined the relationship between perceived stress and COVID-19-related stress anticipation during the COVID-19 pandemic.

The psychological impact of stress is even more relevant if we consider the cost of mental health problems for a country's economy. These problems account for over 4% of the gross domestic product (GDP) in all the EU countries (Organización para la Cooperación y el Desarrollo Económicos–OECD & European Union, 2018). Considering the rise in mental health problems due to COVID-19 observed in previous studies (Passavanti et al., 2021; Prati & Mancini, 2021), the pandemic has increased health service costs in two ways: (a) directly, due to medical attention for infected COVID-19 patients; and (b) indirectly, due to mental health problems of infected and non-infected COVID-19 populations. According to the behavioral self-regulation theory (Carver & Scheier, 2000), the way people deal with challenges or difficulties influences how they cope

Fig. 1 Hypothesized model in the present study. Note: H=hypothesis
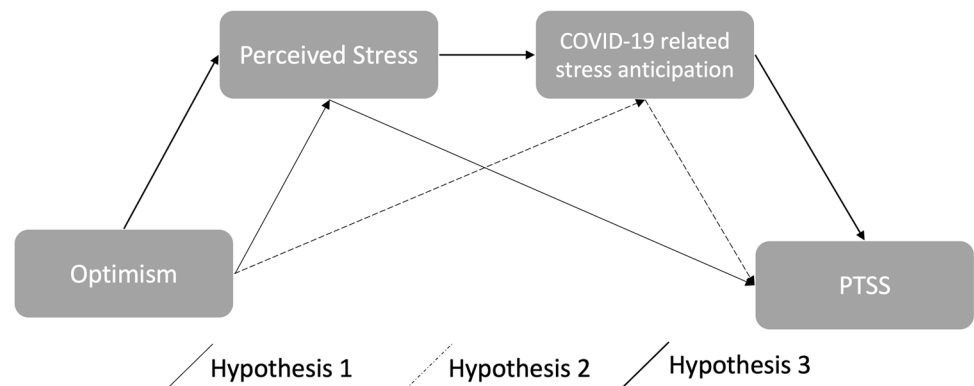
with stress (Carver et al., 2010). Thus, psychological factors such as optimism may play a key role in the way people appraise and approach stressors, which in turn may affect how stressors are dealt with and their psychophysiological health consequences (Brydon et al., 2009; Endrighi et al., 2011; Puig-Perez et al., 2015, 2017). In fact, research supports the protective role of optimism in perceived stress as a potential "buffer" of the adverse impact of stressful events on individuals (Solberg, 2016). It has been proposed that optimism is essential for adequate functioning and survival because it increases motivation to improve well-being and reduces existential crises that put survival at risk (Varki, 2009). Previous studies argued that optimism may buffer stress-induced immune alterations in response to acute stress (Segerstrom et al., 1998), and that it would be related to less severe common cold symptomatology due to Rhinovirus 39 (Puig-Perez et al., 2018). Moreover, the stress literature relates optimism to the ability to manage the demands of a potentially traumatic event (Benight & Bandura, 2004; Prati & Pietrantoni, 2009), and it suggests that it could promote traumatic growth through its effects on threat appraisal (Zoellner & Maercker, 2006).

Taking into account previous evidence of the negative consequences of isolation as stressful stimuli in other pandemic outbreaks, and the importance of the appraisal and optimism in the management of a stressful situation, the purpose of this study is to analyze the mediating role of perceived stress and COVID-19-related stress anticipation in the relationship between optimism and PTSS in the general population affected by the COVID-19 pandemic. Recent studies related trait optimism to the COVID-19 pandemic (Sheetal et al., 2020; Jovančević & Milićević, 2020; Asimakopoulou et al., 2020; Biber et al., 2020), but these studies did not test the ways optimism affects negative outcomes during the COVID-19 pandemic through its association with the stress appraisal of the situation. We hypothesized that higher optimism would be associated with less perceived stress (Hypothesis 1), leading, in turn, to lower PTSS. Moreover, we hypothesized that

higher levels of optimism would be related to lower levels of COVID-19-related stress anticipation (Hypothesis 2), which, in turn, would be associated with lower levels of PTSS. Finally, we hypothesized that optimism would be related to less perceived stress, which would lead to lower levels of COVID-19-related stress anticipation and, in turn, associated with lower PTSS levels (Hypothesis 3). Figure 1 graphically represents the model to be tested in the study.

Materials and Methods

Participants

The participants in this cross-sectional study were recruited during the COVID-19 outbreak to complete an online survey. The inclusion criteria were: a) a chronological age of at least 18 years; b) volunteering for the survey; c) a minimum of seven days spent following government social isolation guidelines; and d) being fluent in either Spanish or Polish. We ensured that the participants could submit survey responses using the same IP address only once. The participants provided their informed consent.

The sample was composed of 1015 volunteers ranging from 18 to 79 years old (Total sample: M = 37.33, SD = 12.46; Men: M = 40.99, SD = 14.00; Women: M = 36.35, SD = 11.83) with a medium subjective socioeconomic status (SES) (M = 6.59, SD = 1.48). All the participants were confined in their homes for at least seven days during the quarantine due to the COVID-19 prevention measures (M = 12.3, SD = 6.68).

Participants reported that they were strictly following the government guidelines and isolation requirements (on average on 6.64 of the past 7 days, SD = 0.726). They referred to living in homes measuring an average of 111.24 m^2 (SD = 58.12), and their family units were composed of around three members (M = 2.91, SD = 1.31). Table 1 shows the characteristics of the study sample.

Table 1 Characteristics of the sample

Characteristics	n (%)
Gender	
Men	216 (21.3)
Women	799 (78.7)
Country of Residence	
Spain	813 (80.1)
Argentina	19 (1.9)
Portugal	1 (0.1)
UK	7 (0.7)
Bolivia	1 (0.1)
Germany	1 (0.1)
Mexico	9 (0.9)
Netherlands	1 (0.1)
Belgium	8 (0.8)
Canada	2 (0.2)
Chile	1 (0.1)
Colombia	8 (0.8)
Croatia	1 (0.1)
Czech Republic	1 (0.1)
Ecuador	3 (0.3)
Slovenia	1 (0.1)
United States of America	3 (0.3)
France	11 (1.1)
Guatemala Republic	2 (0.2)
Italia	3 (0.3)
Dominican Republic	1 (0.1)
Malta	1 (0.1)
Poland	114 (11.2)
Peru	1 (0.1)
Romania	1 (0.1)
Switzerland	1 (0.1)
Marital Status	
Single	469 (46.2)
Married/Unmarried partner	475 (46.8)
Divorced	64 (6.3)
Widowed	7 (0.7)
Education	
Basic Education	23 (2.3)
High School and Professional Education	223 (22.1)
University–Graduated	339 (33.4)
University – Master	329 (32.2)
University–PhD	101 (10.0)

Procedure

The procedure was conducted in accordance with the Declaration of Helsinki and approved by the University Ethics Committee (blinded for review).

An online survey was designed using SurveyMonkey in Spanish and Polish. We gathered information on sociodemographic data and psychological variables: optimism, perceived stress, primary and secondary appraisals, and PTSS. The survey was launched between 21 March and 10 April 2020, after the WHO declared the COVID-19 pandemic to be a public health emergency. The survey was forwarded to university students on university websites and to social networks; respondents were encouraged to re-send it to others following a snow-ball sample collection method.

Instruments

Optimism

We measured optimism with the *Life Orientation Test-Revised* (LOT-R; Scheier et al., 1994). The LOT-R is composed of 10 items rated on a five-point scale ranging from 0 (strongly disagree) to 4 (strongly agree). Three items measure optimism (e.g., "In uncertain times, I usually expect the best"), three items measure pessimism (e.g., "If something can go wrong for me, it will"), and the remaining items are distractors. This instrument provides a total score for dispositional optimism (ranging from 0 to 24 points), with higher scores indicating greater optimism and possible scores ranging from 0 to 40. The internal consistency (Cronbach's alpha) in this sample was 0.78.

Perceived Stress

Perceived stress in the past month was measured using a 14-item *Perceived Stress Scale* (PSS-14; Cohen et al., 1983). Items are rated on a five-point scale ranging from 0 (never) to 4 (very often), focusing on how unpredictable, uncontrollable, and overloaded respondents find their lives to be. Following Cohen et al. (1983), a total score was computed by reversing the scores on negative items 4–7, 9, 10, and 13, and subsequently adding up the scores on the 14 items. This total score is a global measure of perceived stress, with higher scores indicating higher perceived stress. The internal consistency (Cronbach's alpha) in this sample was 0.88, with possible scores ranging from 0 to 56.

COVID-19-Related Stress Anticipation

COVID-19-related stress anticipation was measured with a Visual Analogue Scale used by Gaab et al. (2005) to evaluate cognitive appraisal processes (i.e., primary and secondary appraisals), adapted to the context of COVID-19. Specifically, the items asked about the expected levels of anticipated stress and challenge with regard to the possibility of getting infected, as well as about the person's self-concept of his/her own abilities and perceived expected control over being

infected by the virus in the following seven days, with scores ranging from 0 (nothing) to 100 (a lot). The global COVID-19-related stress anticipation index combines the two scales (i.e., primary and secondary appraisal) using the following formula: (primary appraisal: stress + challenge)–(secondary appraisal: self-concept + control expectancy) (Kuebler et al., 2015). Higher scores indicate higher anticipated stress, with possible scores ranging from -200 to 200.

Post-traumatic Stress Symptoms

PTSS during the past seven days was measured using a 22-item *Impact of Event Scale-Revised* (IES-R; Weiss & Marmar, 1997). Items are rated on a five-point response scale ranging from 0 (not at all) to 4 (extremely). The instrument provides three subscales related to the Post-Traumatic Stress Disorder dimensions proposed by the DSM-5 (APA, 2013): Intrusion (8 items; e.g., "any reminder brought back feelings about it"), avoidance (8 items; e.g., "I avoided letting myself get upset when I thought about it or was reminded of it"), and hyperarousal (6 items; e.g., "I felt irritable and angry"). Higher scores indicate higher severity of PTSS. Additionally, a total score was computed to assess the psychological impact of the stressor (total-PTSS), which was considered normal in a range from 0 to 23, mild from 24 to 32, moderate from 33 to 36, and severe > 37 (Creamer et al., 2003). In this sample, the IES-R showed satisfactory internal consistency indices for both the subscales ($\alpha = 0.82$ on all three subscales) and the total-PTSS ($\alpha = 0.92$). PTSS total scores were categorized only to provide descriptive data of the psychological impact of COVID-19 in the results section.

For the Spanish version, we used validated Spanish versions of these questionnaires (LOT-R: Otero-López et al., 1998; PSS14: Remor, 2006; IES-R: Requena & Moncayo, 2007). In the case of the Polish version, scales were translated from the original English version into Polish by bilingual psychologists proficient in both languages and then back-translated (Brislin, 1970).

Statistical Analyses

First, we calculated univariate ANOVAs to investigate gender differences in optimism, perceived stress, COVID-19-related stress anticipation, and PTSS. Bonferroni tests were performed when a factor was significant in the univariate ANOVAs.

Pearson correlations were performed to explore the association between continuous demographic (age and SES) and psychological variables.

Mediation models were used to investigate the indirect effect of optimism on PTSS (total PTSS and the three dimensions of PTSS) via perceived stress and COVID-19-related stress anticipation, using Model 6 of the PROCESS (v3.4.) macro in SPSS. In these models, optimism was included as the independent variable, perceived stress and COVID-19-related stress anticipation as the mediator variables, and total PTSS or intrusion PTSS or hyperarousal PTSS or avoidance PTSS scores (depending on the model) as dependent variables. Age, gender, and SES were included as covariates.

We detected one multivariate outlier by means of the Mahalanobis procedure. Because the statistical conclusions remained the same with and without the outlier, we did not exclude the participant from the analyses. A bias-corrected 95% bootstrap-confidence interval CI (5,000 iterations) was used to determine the statistical significance of the mediators, generating 95% confidence intervals. Finally, Structural Equation Model (SEM) analyses were carried out with AMOS v.26 to support the results observed in the mediation analyses performed with Model 6 of the PROCESS (v3.4.) macro in SPSS. To evaluate the fit of the empirical SEM with the proposed theoretical models, we considered the goodness of fit indices of χ^2/df, the comparative fit index (CFI), the goodness of fit index (GFI), the incremental fit index (IFI), the non-normalized fit index (TLI), the normalized fit index (NFI), and the root mean square error of approximation (RMSEA). The rest of the indices were examined but are not presented in this study. Values less than 3 are considered a good fit using the χ^2/df value. The cut-off points for the rest of the indices were > 0.95 for CFI, GFI, IFI, and TLI to show an optimal fit, and values greater than 0.90 for the NFI value (Hu & Bentler, 1998). For RMSEA, values less than 0.06 are considered an optimal fit (Hu & Bentler, 1998).

Results

Preliminary Analyses

Univariate ANOVAs revealed that women showed higher perceived stress (men: $M = 32.95$, $SD = 8.91$; women: $M = 36.43$, $SD = 9.50$), intrusion PTSS (men: $M = 6.579$, $SD = 5.912$, women: $M = 10.325$, $SD = 7.566$), hyperarousal PTSS (men: $M = 5.074$, $SD = 5.524$; women: $M = 8.364$, $SD = 7.199$), avoidance PTSS (men: $M = 7.958$, $SD = 7.653$; women: $M = 12.538$, $SD = 8.516$), and total PTSS (men: $M = 19.611$, $SD = 17.16$; women: $M = 31.22$, $SD = 20.73$) than men (for all, $p < 0.001$). There were no gender differences in optimism ($F_{1,1013} = 76.704$, $p = 0.062$) or COVID-19-related stress anticipation ($F_{1,1013} = 1.106$, $p = 0.293$).

Table 2 Correlations among psychological variables

	2	3	4	5	6	7	8	Psychological Impact
1. Optimism	-0.285*	-0.349*	-0.252*	-0.511*	-0.208*	-0.153*	0.155*	-0.326*
2. Intrusion PTSS		0.805*	0.630*	0.520*	0.288*	0.302*	-0.098**	0.896*
3. Hyperarousal PTSS			0.695*	0.614*	0.323*	0.345*	-0.106**	0.919*
4. Avoidance PTSS				0.464*	0.192*	0.228*	-0.034	0.879*
5. Perceived Stress					0.314*	0.245*	-0.213*	0.589*
6. COVID-19-related Stress Anticipation						0.796*	-0.642*	0.293*
7. Primary Appraisal							-0.047	0.320*
8. Secondary Appraisal								-0.085**

* $p < 0.001$; ** $p < 0.05$

Pearson correlation analyses showed that age was positively related to optimism ($r_{(1015)} = 0.14$, $p < 0.001$) and negatively related to perceived stress ($r_{(1015)} = -0.23$, $p < 0.001$) and avoidance PTSS ($r_{(1015)} = -0.07$, $p = 0.025$). Additionally, SES was positively related to optimism ($r_{(1015)} = 0.18$, $p < 0.001$) and negatively related to perceived stress ($r_{(1015)} = -0.17$, $p < 0.001$), COVID-19-related stress anticipation ($r_{(1015)} = -0.14$, $p < 0.001$), total PTSS ($r_{(1015)} = -0.12$, $p < 0.001$), intrusion PTSS ($r_{(1015)} = -0.08$, $p = 0.011$), hyperarousal PTSS ($r_{(1015)} = -0.14$, $p < 0.0001$), and avoidance PTSS ($r_{(1015)} = -0.11$, $p < 0.0001$). No other significant associations were found.

Optimism was negatively related to total PTSS and the three dimensions of PTSS (intrusion, hyperarousal, and avoidance), perceived stress, primary appraisal, and COVID-19-related stress anticipation; and positively related to secondary appraisal (for all, $p < 0.001$). The total PTSS score and the three dimensions of PTSS (intrusion, hyperarousal, and avoidance) were positively correlated with each other, positively related to perceived stress, primary appraisal, and COVID-19-related stress anticipation (for all, $p < 0.001$), and negatively related to secondary appraisal (for all, $p < 0.05$) (Table 2).

Psychological Impact of COVID-19

Total PTSS scores showed that the psychological impact of COVID-19 was normal for 47.6% of the participants (n = 483), mild for 14.6% (n = 148), moderate for 6.2% (n = 63), and severe for 31.6% (n = 321). None of the volunteers had received confirmation about COVID-19 infection, but 9.4% (n = 95) thought they were infected. Moreover, 16.2% (n = 164) confirmed that someone close to them was infected with COVID-19, 4.5% (n = 46) reported that someone close to them was receiving intensive medical care, 2.5% (n = 25) reported that someone close to them had died from COVID-19, and 5.2% (n = 53) had received a medical discharge. Finally, 1.1% (n = 11) of the participants were living with someone infected with COVID-19.

ANOVAs showed significant differences in optimism, perceived stress, and COVID-19-related stress anticipation

Table 3 Differences in optimism, perceived stress, and COVID-19-related stress anticipation depending on the total PTSS score (psychological impact)

	TOTAL	Psychological Impact				
		Normal	Mild	Moderate	Severe	
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	ANOVA
Optimism	22.23 (4.69)	23.46 (4.09)	23.09 (4.19)	21.70 (4.14)	20.09 (5.08)	$F_{1,1011} = 39.36$, $p < 0.0001$
Perceived Stress	35.69 (9.48)	30.74 (7.76)	35.27 (7.59)	38.58 (8.13)	42.75 (8.11)	$F_{1,1011} = 152.554$, $p < 0.001$
COVID-19-related stress anticipation	-59.54 (80.03)	-79.84 (75.14)	-60.59 (74.81)	-56.03 (79.28)	-28.69 (80.24)	$F_{1,1011} = 28.09$, $p < 0.001$
Primary appraisal	69.66 (61.50)	52.31 (53.85)	69.21 (57.93)	73.55 (59.10)	95.44 (65.47)	$F_{3,1011} = 34.68$, $p < 0.001$
Secondary appraisal	128.85 (48.71)	132.21 (49.89)	129.80 (45.11)	129.59 (49.56)	123.22 (48.05)	$F_{3,1011} = 2.211$, $p = 0.085$

between participants with a normal, mild, moderate, and severe psychological impact (for all, $p < 0.001$) (Table 3). Specifically, participants with high total PTSS scores had lower scores on optimism than those with normal, mild, and moderate PTSS scores (for all, $p < 0.05$). In turn, those with moderate total PTSS scores had lower scores on optimism than those with normal total PTSS scores ($p = 0.019$). In the case of perceived stress, all two-way comparisons were significant, with higher perceived stress found in participants with higher total PTSS scores. Additionally, participants with severe total PTSS score levels had higher scores on COVID-19-related stress anticipation than those with normal and mild levels (for all, $p < 0.0001$), and those with mild total PTSS scores had higher COVID-19-related stress anticipation than those with normal total PTSS scores ($p = 0.048$).

Mediation Analyses

Mediation analyses were carried out with optimism as a predictor (X) of the three dimensions of PTSS (intrusion, hyperarousal, and avoidance) and total PTSS (Y) through two mediation variables: (i) past perceived stress and (ii) COVID-19-related stress anticipation-primary and secondary appraisal. We included age, gender, and SES variables as covariates (see Table 4).[1]

Model 1 (see Fig. 2) showed that optimism was indirectly associated with lower intrusion PTSS (path $a_1d_{21}b_2$: B = -0.03, SE = 0.01, 95% CI = -0.04, -0,01). Specifically, optimism had a significant relationship with perceived stress (path a_1: B = -0.95, SE = 0.06, t = -17.35, $p < 0.001$), perceived stress was related to COVID-19-related stress anticipation (path d_{21}: B = 2.48, SE = 0.30, t = 8.23, $p < 0.001$), and COVID-19-related stress anticipation was associated with intrusion PTSS (path b_2: B = 0.01, SE = 0.01, t = 4.57, $p < 0.001$). Additionally, perceived stress was related to intrusion PTSS (path b_1: B = 0.37, SE = 0.03, t = 14.72, $p < 0.001$). Moreover, a significant total effect of optimism on intrusion PTSS was found (path c_1: B = -0.44, SE = 0.05, t = -9.20, $p < 0.001$), but not a significant direct effect (path c'_1: B = -0.05, SE = 0.05, t = -1.03, $p = 0.30$).

Table 4 Models tested of relationships among psychological variables

	Perceived Stress			COVID-19-related stress anticipation			MODEL 1 PTSS–Intrusion			MODEL 2 PTSS–Hyperarousal			MODEL 3 PTSS–Avoidance			MODEL 4 Psychological Impact		
	Coeff	SE	p	Coeff	SE	p	Coeff	SE	p	Coeff	SE	p	Coeff	SE	p	Coeff	SE	p
Constant	60.223	2.057	<0.001	-122.771	26.612	<0.001	-10.637	2.180	<0.001	-10.250	1.908	<0.001	-7.010	2.662	0.009	-27.897	5.739	0.001
X (Op)	-0.949	0.055	**<0.001**	-0.977	0.593	0.099	-0.050	0.048	0.302	-0.063	0.042	0.132	-0.034	0.059	0.565	-0.147	1.27	0.246
M₁ (PS)	-	-	-	2.483	0.300	**<0.001**	0.370	0.025	**<0.001**	0.407	0.022	**<0.001**	0.376	0.031	**<0.001**	1.153	0.066	**<0.001**
M₂ (SA)	-	-	-	-	-	-	0.012	0.003	**<0.001**	0.011	0.002	**<0.001**	0.005	0.003	0.127	0.028	0.007	**<0.001**
C₁ (Gender)	2.430	0.619	**<0.001**	0.376	5.929	0.949	2.791	0.481	**<0.001**	2.106	0.421	**<0.001**	3.476	0.587	**<0.001**	8.373	1.265	**<0.001**
C₂ (Age)	-0.111	0.020	**<0.001**	0.648	0.198	**0.001**	0.085	0.016	**<0.001**	0.064	0.014	**<0.001**	0.036	0.020	0.064	0.185	0.042	**<0.001**
C₃ (SES)	-0.555	0.172	**<0.001**	-4.311	1.640	**0.009**	0.089	0.133	0.504	-0.109	0.117	0.350	-0.214	0.163	0.190	-0.234	0.351	0.506
	$R^2=0.303$, $F_{4,1003}=109.052$, $p<0.001$			$R^2=0.118$, $F_{5,1002}=26.808$, $p<0.001$			$R^2=0.324$, $F_{6,1001}=79.809$, $p<0.001$			$R^2=0.419$, $F_{6,1001}=120.219$, $p<0.001$			$R^2=0.393$, $F_{6,1001}=53.574$, $p<0.001$			$R^2=0.392$, $F_{6,1001}=107.532$, $p<0.001$		

X Predictor Variable, M_1 and M_2 Mediator variable, C_1, C_2 and C_3 covariates, Op Optimism, PS Perceived Stress, SA COVID-19-related stress anticipation
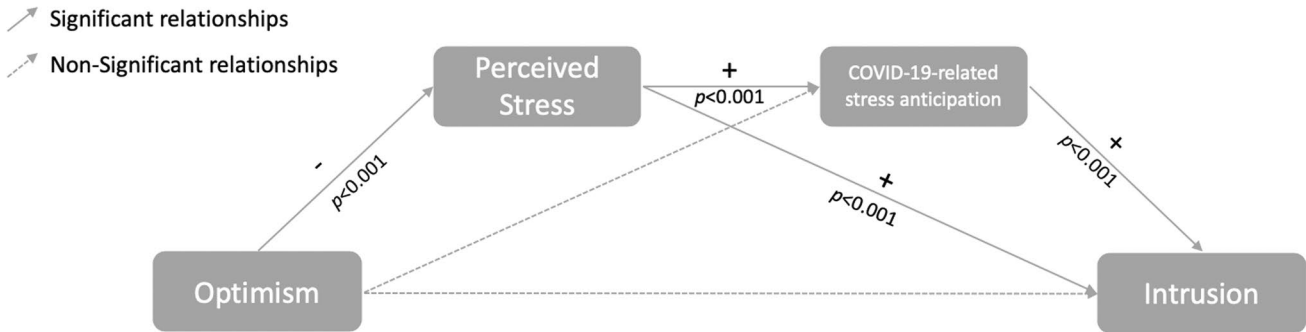
MODEL 1

Fig. 2 Mediation relationship between optimism and intrusion through perceived stress and COVID-19-related stress anticipation

Model 2 (see Fig. 3) demonstrated that optimism was indirectly related to hyperarousal PTSS (path $a_1d_{21}b_2$: B = -0.03, SE = 0.01, 95% CI = -0.04, -0,01). Specifically, optimism was related to perceived stress (path a_1: B = -0.95, SE = 0.06, t = -17.35, $p < 0.001$), perceived stress had a significant relationship with COVID-19-related stress anticipation (path d_{21}: B = 2.48, SE = 0.30, t = 8.28, $p < 0.001$), and COVID-19-related stress anticipation was associated with hyperarousal PTSS (path b_2: B = 0.01, SE = 0.01, t = 18.52, $p < 0.001$). Furthermore, perceived stress was related to hyperarousal PTSS (path b_1: B = 0.41, SE = 0.02, t = 18.52, $p < 0.001$). Additionally, a significant total effect of optimism on hyperarousal PTSS was found (path c_1: B = -0.49, SE = 0.04, t = -11.02, $p < 0.001$), but not a significant direct effect (path c'_1: B = -0.06, SE = 0.04, t = -1.50, $p = 0.13$).

Model 3 (see Fig. 4) showed that optimism was indirectly related to avoidance PTSS via lower perceived stress (path a_1b_1: B = -0.36, SE = 0.03, 95% CI = -0.43, -0.29). Thus, optimism had a significant relationship with perceived stress (path a_1: B = -0.95, SE = 0.06, t = -17.35, $p < 0.001$), and perceived stress was related to avoidance PTSS (path

b_1: B = 0.38, SE = 0.03, t = 12.25, $p < 0.001$). Additionally, a significant total effect of optimism on avoidance PTSS was found (path c_1: B = -0.41, SE = 0.06, t = -7.30, $p < 0.001$), but not a significant direct effect (path c'_1: B = -0.03, SE = 0.06, t = -0.58, $p = 0.56$). Although perceived stress had a significant relationship with COVID-19-related stress anticipation (path d_{21}: B = 2.48, SE = 0.30, t = 8.28, $p < 0.001$), COVID-19 related stress anticipation did not mediate the relationship between optimism and avoidance PTSS (path $a_1d_{21}b_2$: B = -0.01, SE = 0.01, 95% CI = -0.03, 0.01).

Model 4 (see Fig. 5) showed that optimism was indirectly associated with lower total PTSS (path $a_1d_{21}b_2$: B = -0.07, SE = 0.02, 95% CI = -0.11, -0.03). Specifically, optimism was significantly associated with perceived stress (path a_1: B = -0.95, SE = 0.06, t = -17.35, $p < 0.001$), perceived stress was related to COVID-19-related stress anticipation (path d_{21}: B = 2.48, SE = 0.30, t = 8.28, $p < 0.001$), and COVID-19-related stress anticipation was associated with total PTSS (path b_2: B = 0.03, SE = 0.01, t = 4.13, $p < 0.001$). Additionally, perceived stress was directly related to total PTSS (path b_1: B = 1.15, SE = 0.07, t = 17.43, $p < 0.001$). Moreover, a significant total effect of optimism on total PTSS was found
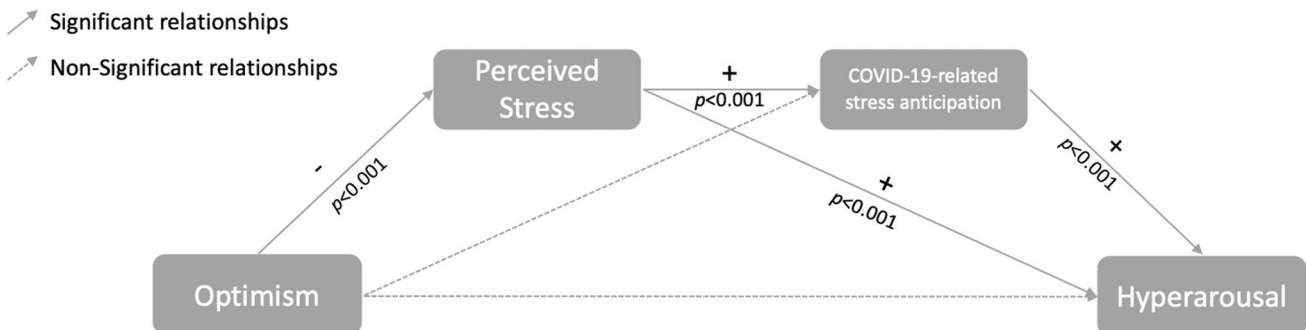
MODEL 2

Fig. 3 Mediation relationship between optimism and hyperarousal through perceived stress and COVID-19-related stress anticipation
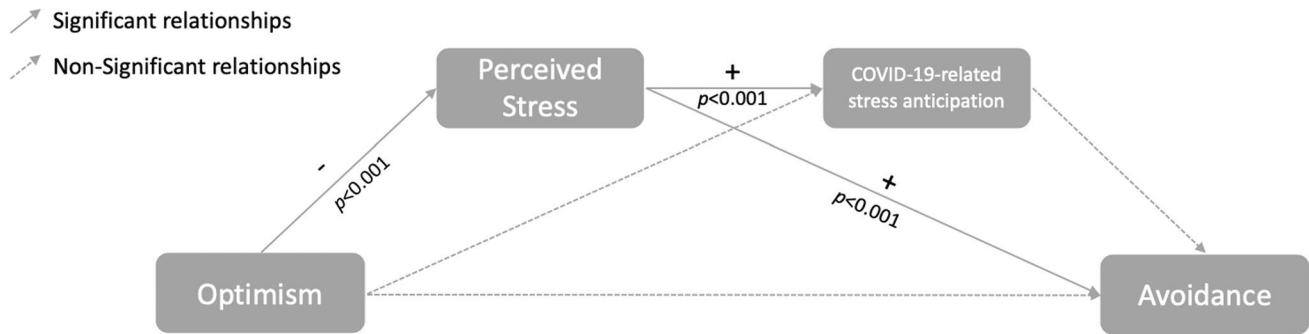
MODEL 3

Fig. 4 Mediation relationship between optimism and avoidance through perceived stress and COVID-19-related stress anticipation

(path c_1: B = -1.33, SE = 0.13, t = -10.25, $p < 0.001$), but not a significant direct effect (path c'_1: B = -0.14, SE = 0.13, t = -1.16, $p = 0.25$)[2]*.

Discussion

The results of this study indicate that optimism is related to reduced PTSS during the COVID-19 outbreak through its relationship with perceived stress and COVID-19-related stress anticipation.

In this study, one-third of the sample showed moderate to severe psychological distress. This high percentage coincides with findings from other studies that reported trauma-related mental health disorders in 28% of quarantined individuals (Sprang & Silman, 2013), and it falls within the percentage range (35%-60%) reported by nationwide surveys on psychological distress during the COVID-19 outbreak (Jahanshahi et al., 2020; Qiu et al., 2020). Although COVID-19 is primarily a physical health crisis (United Nations, 2020), our data support the idea that a mental health crisis is also possible, especially if clinically significant distress cases are

not detected and managed appropriately. In fact, the WHO, in its 74th session of the World Health Assembly, warned of the need for an improved response to the mental health impact of COVID-19 and future health emergencies, given the current evidence of the high mental costs of these stressful situations and their consequences. Thus, many people were distressed due to the immediate impact of the virus and the direct consequences of the outbreak (e.g. isolation, changes in daily activities). Moreover, we observed that individuals with higher levels of PTSS were more worried about the future and afraid of infection, death, and losing family members, even when they did not have symptoms or a confirmed diagnosis of COVID-19 infection, compared to those with lower psychological impact levels. It is possible that their fears and emotions could be influenced by mass media messages focused on shaping healthy attitudes and behaviors (Rowbotham et al., 2020), such as persuasive messages, information based on social evidence, or the phenomenon of conformism (Pratkanis, 2007). Thus, frequent misinformation about COVID-19 and repeated exposure to media images of severely ill people, coffins, or overwhelming numbers of people infected or dying every day worldwide may increase psychological distress.

When considering demographic characteristics, we found that women showed higher perceived stress and PTSS than men (according to Brougham et al., 2009; Tolin & Foa, 2008), but there were no differences in the levels of optimism (in line with Puig-Perez et al., 2016) or COVID-19-related stress anticipation. Additionally, psychological and demographic variables showed weak but significant relationships. Thus, age was positively associated with optimism (as in Puig-Perez et al., 2016) and negatively related to perceived stress (in line with Hamarat et al., 2001) and avoidance PTSS. Moreover, SES was positively related to optimism (as in Puig-Perez et al., 2016), but negatively associated with perceived stress (Senn et al., 2014), COVID-19-related stress anticipation, and PTSS (as in Kolltveit et al., 2012).

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[2] In order to further examine the mediating relationships, we performed additional analyses taking into account the primary and secondary dimensions of COVID-19-related stress anticipation separately. The results show that optimism is related to all three dimensions of PTSS (intrusion, hyperarousal, and avoidance) and total PTSS, and that this relationship is mediated by past perceived stress and primary appraisal of COVID-19-related stress anticipation. In contrast, secondary appraisal of COVID-19-related stress anticipation is not a significant mediator in this relationship. Although these results indicate that primary appraisal is more important than secondary appraisal in understanding the relationship between optimism and PTSS, it is important to emphasize that, according to Lazarus and Folkman (1984), primary and secondary processes are mutually dependent. As Gaab et al. (2005) suggested, in order to acknowledge this assumed interaction, we need to model them together in an integrated tertiary scale.
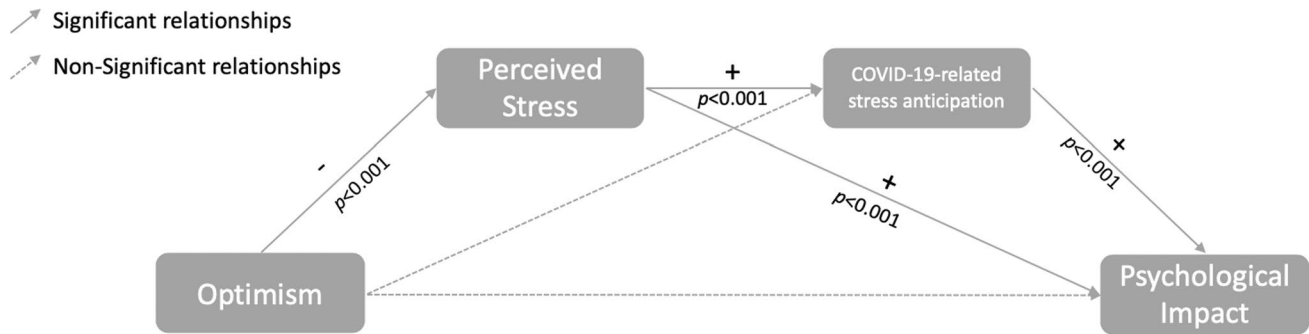
MODEL 4

Fig. 5 Mediation relationship between optimism and total PTSS score (psychological impact) through perceived stress and COVID-19-related stress anticipation

Together, these results indicate that age, gender, and SES are important factors in understanding the interindividual differences in PTSS. However, not all of them were considered or included in previous studies on this topic, with studies only focusing on a specific age range, such as older people (Sardella et al., 2021) or young students (Genç & Arslan, 2021; Kapoor & Singhal, 2021).

Regarding our main research question, optimism did not have a significant direct effect on PTSS dimensions. However, in line with our hypotheses, we observed a significant indirect effect of optimism on all the PTSS dimensions (i.e., intrusion and hyperarousal and global psychological impact) via perceived stress and COVID-19-related stress anticipation, adjusted for age, gender, and SES. First, the negative relationship between optimism and perceived stress agrees with the research by Zoellner and Maercker (2006), Brydon et al. (2009), Endrighi et al. (2011), and Puig-Perez et al. (2015, 2017), who showed that optimism was associated with lower perceived stress. This relationship can be explained by the fact that optimism may enhance the individual capability to manage the demands of a potentially traumatic event (Benight & Bandura, 2004; Prati & Pietrantoni, 2009), which suggests that optimism can be a protective factor against stress. Second, the positive relationship between perceived stress and COVID-19-related stress anticipation is consistent with research showing that individuals imagine the future through the lens of the present (Gilbert, 2019) and predict the way they will feel based on how they feel right now (Gilbert & Wilson, 2007). Recent studies with smaller samples highlighted the role of optimism as a protective factor against distress because it reduces the health risk perception (Cervera-Torres et al., 2021; Kolioulli & Canellopoulos, 2021). However, Cervera-Torres et al. (2021) measured the psychological cost, but not PTSS, as the prevalent mental health problem that usually arises in health emergencies. Moreover, Kolioulli and Canellopoulos (2021) did not

include anticipatory stress of infection, even though it is a key factor in the stress process that can impair health over time. Therefore, we think our results contribute to expanding and consolidating the current evidence by explaining the association between optimism and PTSS through its influence on anticipatory stress of infection and stress perception. Thus, an important implication of this study is that individuals with lower optimism may be at higher risk of developing PTSS in confinement situations. Importantly, several months after the first confinement, countries are still taking measure to control the spread of the virus (e.g., light lockdowns, reduced number of people at work or in family celebrations, etc.). Identifying individuals with higher psychological distress and lower optimism could help detecting individuals at higher risk of developing mental health problems. These individuals may benefit from stress management programs, especially those based in cognitive-behavioral therapy (Benjet, 2020), and stress reappraisal strategies (Hagger et al., 2020), which have shown good efficacy in helping people to cope with COVID-related psychological stress, anxiety, and depression.

In addition, the relationship between stress anticipation and the PTSS dimensions is consistent with the research showing that the fear of getting infected can have long-term effects on psychological health, lasting up to several months (Jeong et al., 2016). Overall, the mediation chain from perceived stress through COVID-19-related stress anticipation to PTSS (intrusion, hyperarousal, and general psychological impact) coincides with the perseverative cognition hypothesis (Brosschot et al., 2006). This hypothesis proposes that chronic activation of the cognitive representation of a stressor (Brosschot et al., 2006) or of feared situations in the future, which involves a prolonged state of arousal, can be a potential risk factor for health, as in the case of higher levels of PTSS (Zawadzki et al., 2018). Furthermore, our results are consistent with previous studies showing that

perseverative cognition is a mediator through which stressors can affect body systems (Brosschot et al., 2006), and that maladaptive cognitive appraisal in response to a traumatic event is one of the risk factors for the development of PTSS (Bryant & Guthrie, 2007).

Additionally, perceived stress was related to intrusion, hyperarousal, and total PTSS. Our findings suggest that during the COVID-19 outbreak, participants who were more likely to perceive the situation as uncontrollable and threatening had greater vulnerability to developing PTSS. In this context, the transactional model of stress highlights the relevance of stress perception in the relationship between stressful events and psychological symptoms (Lazarus & Folkman, 1984); thus, a stressor tends to trigger a stress response when it is perceived as threatening. These results are in line with those found by Lee et al. (2014) with other samples exposed to traumatic events.

Finally, we should emphasize that there was no double-mediation effect of COVID-19-related stress anticipation in the impact of optimism on avoidance PTSS. Specifically, optimism was indirectly related to avoidance PTSS only via perceived stress. We can explain this result by drawing on information-processing theories, according to which PTSS emerges from a memory network that depicts the stressful event as threatening, unpredictable, and uncontrollable, which leads directly to employing avoidance behaviors characteristic of PTSS (Chemtob et al., 1988; Foa & Kozak, 1986).

Taken together, our findings are consistent with research that finds optimism to be a determinant of adequate functioning (Varki, 2009), showing the role it plays in psychophysiological consequences for health (Brydon et al., 2009; Puig-Perez et al., 2015, 2017) and in facilitating post-traumatic growth (Zoellner & Maercker, 2006). Thus, optimism can increase confidence, motivate individuals to achieve goals, and increase positive affect and well-being (Solberg Nes et al., 2005).

This study makes several contributions. First, we found that the psychological impact was severe in more than three out of ten participants quarantined during the COVID-19 outbreak, highlighting the relevance of promoting mental health in this population. In fact, our results are consistent with the WHO's warning to address the emergent mental health problems due to the COVID-19 pandemic as soon as possible. Second, the present study expands on previous research by demonstrating that the COVID-19 outbreak has a significant impact on PTSS via perceived stress and COVID-19-related stress anticipation. Third, our results show that optimism is related to lower perceived stress and higher adaptive cognitive appraisal in response to a traumatic event, acting as a protective factor against PTSS. It is important to highlight that this study included a larger sample than similar previous studies (e.g. Carvera-Torres et al., 2021; Genç & Arslan, 2021;

Mead et al., 2021; Koliouli & Canellopoulos, 2021), and it included people from different countries and age groups. Moreover, the model, tested using two methodological techniques, has a solid background and previous evidence that includes key psychological factors (future and past stress perception) as mediators of the influence of personality on a prevalent mental health problem in emergency situations. Finally, we study the role of anticipation of future stressful events and their consequences for health, thus complementing the main body of research in this area, which focuses on stressors or individual experiences and their appraisals (Brosschot et al., 2005) when they occur.

Despite the timely and relevant findings of this study, they should be viewed with caution due to some limitations. Specifically, our study identifies perceived stress and COVID-19-stress anticipation as central mechanisms in understanding the relationship between optimism and PTSS. However, due to the cross-sectional nature of the data and the results should be interpreted with caution, even though we used two statistical methods to ensure the reliability of our results. Further research should include longitudinal studies that investigate whether optimism might decrease perceived stress, which, in turn, would increase stress anticipation, leading to an increase in PTSS over time. Moreover, our study relied exclusively on self-report questionnaires, and although they were all validated, standardized interviews or observational methods would provide more detailed information about PTSS. Finally, despite the large number of participants, women were over-represented, which may lead to an overestimation of the general levels of PTSS due to COVID-19. Future studies would benefit from using a gender-balanced sample.

In conclusion, our results indicate that optimism is related to reducing the psychological impact of the COVID-19 outbreak (i.e., PTSS) through its relationship with perceived stress and COVID-19-related stress anticipation. These findings could have clinical implications for the management of PTSS during and after the pandemic. Specifically, they point out the key role of positive beliefs promoted by optimism in decreasing perceived stress and stress anticipation. Fomenting people's mental health during and after the COVID-19 outbreak should be a priority. As the United Nations (2020) points out, good mental health is critical to society's functioning, and it must be an essential part of every country's response to and recovery from the COVID-19 pandemic.

Declarations

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Moreover, the study was and approved by the University of Silesia in Katowice Ethics Committee.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Conflicts of Interest The authors report no conflicts of interest. Moreover, they have read and followed the *Current Psychology* instructions for authors, and they alone are responsible for the content and writing of the paper. The paper has been seen and approved by all authors. Authors has full control of all primary data and agree to allow the journal to review their data if requested. There were no previous published research about the topic of this manuscript. Moreover, there were no potential conflicts of interest with the organization that sponsored the research. This reported research is unpublished and not under consideration for publication elsewhere, and it does not contain data that are currently submitted or published elsewhere.

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