



## Regular Article

## Reduced sense of danger following two years of COVID-19: Fear inoculation or growing recklessness?

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## ABSTRACT

The COVID-19 pandemic led to sudden changes in many people's lives, due to the risky and unpredictable nature of the disease and the consequences of public policies aimed at controlling its spread. As the pandemic progressed, people became more aware of what to do, and restrictions were relaxed. Our aim was to investigate the impact of the COVID-19 pandemic on individuals' psychological reactions and to examine differences due to long-term exposure between the start of the pandemic in early 2020 and the lifting of restrictions in mid-2022. We used an anonymous online survey at two different points in the COVID-19 pandemic - early 2020 and mid-2022 - and collected data from two independent samples of Portuguese individuals (194 in 2020 and 220 in 2022). Measures of the psychological impact of trauma, emergency response, anxiety and sensation seeking were collected. Participants reported significantly lower levels of negative effects of COVID-19, anxiety and sensation seeking in 2022 compared to 2020. The negative impact of the COVID-19 pandemic on individuals appears to have gradually decreased between 2020 and 2022.

## 1. Introduction

The COVID-19 outbreak shocked the world in early 2020 and spread rapidly internationally, resulting in major public health challenges and a global emergency. While an emergency can be defined as a dangerous or serious situation that is sudden and unexpected and requires immediate action (Zsido, Csokasi, et al., 2020), the pandemic continued to grow from its start in late December 2019 to a peak in January 2022, transforming into a different, prolonged emergency (World Health Organization, 2022). The nature of the pandemic presented a form of adversity that would otherwise be difficult to study and was stressful in its own right (e.g., Coelho et al., 2020). The additional measures to prevent and control the spread of the virus added to the stress. Several countries imposed strict control measures, such as the closure of educational

institutions and non-essential businesses, travel restrictions, home quarantine, social distancing, mandatory wearing of face masks in public places, and community-wide containment (Wang, Wang, et al., 2022). Until recently, these restrictions have forced dramatic changes in people's daily lives, adversely affecting mental health, such as increased fear, distress, anxiety, depression, negative mood changes, isolation, and intolerance of uncertainty, and/or physical health, such as chest pain, fatigue, and insomnia (Coelho et al., 2020; Labadi et al., 2022; Lai et al., 2020; Zsido et al., 2022; Şimşir et al., 2021). In summary, both COVID-19 itself, which is highly contagious and infectious, and the challenges of controlling it have become serious global health threats (e.g., Mahamid et al., 2022; Sahu et al., 2021). Among the many challenges faced by the majority of humanity during these years, anxiety and fear were expressed through thoughts, beliefs and behaviours, and were

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particularly triggered by the novelty and unpredictable possibility of contact with COVID-19, of which at one point no one was sure how dangerous it was (Holmes et al., 2020). This unpredictable nature of COVID-19 and its detrimental effects on an infected individual instills fear in individuals (Holmes et al., 2020). Psychological trauma can result from witnessing or experiencing an event that is perceived as life threatening. It is often accompanied by intense fear, horror and helplessness (Sherin & Nemeroff, 2011).

Although classified as a negative emotional response, fear functions as a fundamental element of the adaptive defence mechanism against potential threats to ensure survival (Coelho & Purkis, 2009; Gao et al., 2020). During the COVID-19 pandemic, fear helped people to comply with health regulations and restrictions, such as social distancing and home quarantine. However, excessive fear impairs rational thinking and affects behaviour, leading to various mental health problems such as stress, anxiety, depression, emotional disturbance, irritability, panic disorder, post-traumatic stress symptoms, decreased life satisfaction and resilience (Abdelrahman & Ismail, 2022; Ahorsu et al., 2020; Belen, 2021; Labadi et al., 2022; Zsido et al., 2022). These mental health problems are common among adults of all ages during the COVID-19 outbreak (Islam et al., 2021). Critically, the negative psychological impact of the COVID-19 outbreak on an individual can persist long after the event (Alnazly et al., 2021). The main effects of the COVID-19 pandemic on anxiety are generated by several aspects (Coelho et al., 2020; Wand et al., 2022); such as (1) the high transmission rate of infectious individuals and the high contagiousness and rapid spread of the virus (Giesecke, 2020; Sanche et al., 2020); (2) the indirect consequences of restrictions, regulations and quarantine measures (Rajkumar et al., 2022); underlying medical conditions (Sakib et al., 2021); (3) individual characteristics such as tolerance of the unknown (Gallagher et al., 2014; Mertens et al., 2020); fear of illness (Asmundson & Taylor, 2020); tolerance of social isolation (de Boer et al., 2021; Islam et al., 2021; Zsido, Csokasi, et al., 2020); disgust sensitivity (Cisler et al., 2007); and (4) social supportive responses such as financial support (Pakpour & Griffiths, 2020); lack of medical assistance (Thombs et al., 2020); COVID-19 media coverage (Erbiçer et al., 2021; Mertens et al., 2020); and efficacy training (Jørgensen et al., 2021). Attention should be paid to those whose anxiety did not subside. Anxiety is a mental state characterised by persistent tension, apprehension, fear and hypervigilance about future adversity. Anxiety can be an adaptive response that guides an individual's coping behaviour when faced with potential dangers. However, when anxiety becomes excessive and chronic, it becomes a disorder (Tian et al., 2022). The unpredictable and chaotic nature of the COVID-19 pandemic increased the level of anxiety through the constant anticipation of an imminent threat and uncertainty about the possible future (Ahorsu et al., 2020; Andrade et al., 2020; Thombs et al., 2020; Çikrikçi, Çikrikçi, & Griffiths, 2022). However, as governments communicate that the current strain of the virus is less dangerous, that the pandemic is under control, and as they lift restrictions, it can be expected that the fear level of the general population will decrease.

The COVID-19 pandemic has features that induce both state and trait anxiety, but at different stages over the nearly three years of its duration. State anxiety is defined as a temporary, intense emotional response to adverse events or environments, while trait anxiety is defined as stable anxious traits, the tendency in an individual's personality to be anxious when dealing with various problems and concerns (Saviola et al., 2020). On the one hand, the nature of COVID-19 became a ubiquitous trigger of state anxiety for most people, and an additional stressor for those already affected by anxiety. On the other hand, frequent exposure to dangerous situations may reduce anxiety in the long term. Recently, Coelho and colleagues (2021) reported that frequent exposure to snakes seems to immunise people against fear of these animals, despite them being considered highly biologically prepared evolutionary threats. Similar results have been reported for fear of dogs and fear of dentists (Doogan & Thomas, 1992; Berge Ten, Veerkamp, & Hoogstraten, 2002). Another study by Kircanski and colleagues (2012) concluded that

traditional exposure to contamination-related fears is sufficient to produce clinical improvements. Forcadell et al. (2017) also showed that improving fear extinction learning was associated with exposure therapy analogue outcomes for adults with a fear of spiders, and that individual differences in fear extinction may have an impact on fear reduction. More recently, an online survey of three repeated cross-sectional studies of 2324 Polish participants (Chudzicka-Czupala et al., 2022) found a significant reduction in the Impact of Event Scale-Revised (IES-R), suggesting a reduction in the level of measured subjective distress during the pandemic in Poland between surveys 1 and 3 (19 and a half months after the first survey).

In summary, repeatedly presented stimuli, in this case the COVID-19 pandemic, can lead to a decrease in an individual's response, as can be seen in the adaptation to the 'new normal' lifestyle (Dan & Brosius, 2021; Jankowski, 2021). Thus, it might be expected that people in 2022 would show lower levels of fear of COVID-19 compared to 2020 due to a habituation effect, i.e. a reduced response to a repeatedly presented stimulus (Groves & Thompson, 1970). At the beginning of the lockdown period, it was expected that people would experience low levels of stress, which would then increase, leading to a spike in anxiety and other negative consequences. Finally, after some time, these levels of stress and anxiety would decrease due to habituation (van Mulukom et al., 2021). Our hypothesis is that most people (without very high trait anxiety) will initially manifest high state anxiety, but will eventually adapt to this adverse situation and their anxiety and discomfort will diminish over time (fear inoculation).

Gender is also considered to be a predictive factor for levels of fear and anxiety. During the pandemic, women's psychological vulnerability has been found to be greater than that of men. This may be related to women's sensitivity to stress and their role as caregivers, which causes them to worry about themselves and their family members (Broche-Pérez et al., 2020). A study by Rezende et al. (2020) also found a link between age and levels of anxiety. Young adults appear to be more affected by anxiety than adults and the elderly. As young adults are likely to live with their parents, this could lead to fear of becoming infected and infecting other family members who may be at risk of serious complications. Furthermore, young adults have been found to be the most negatively affected by the COVID-19 lockdown. Fear of contamination, excessive contact through social networks and a high intolerance of uncertainty increase their anxiety (Glowacz & Schmits, 2020; Huang & Zhao, 2020).

Despite all these fearful and stressful factors associated with COVID-19, differences in perception lead to differences in individual responses to the COVID-19 pandemic (Giordani et al., 2020). The automatic activation of the nervous system due to fear and stress is responsible for increased heart rate, rapid breathing, heightened senses and sweating (Khan et al., 2022). All of these processes, commonly referred to as fear-related, have a high degree of automaticity and biological readiness and can be referred to as defensive responses (LeDoux, 2014), but they are not fully automatic as the prefrontal cortex plays a key role in modulating fear-related processing (Adolphs, 2013). Therefore, we can expect large individual differences even for a major chronic stressful event such as the COVID-19 pandemic. One way to account for these differences is to assess individuals' susceptibility to sensation seeking. Sensation seeking is a trait defined by a person's general desire for novel and intense experiences and a willingness to take risks for the sake of such experiences (Zuckerman, 1994). Individuals who score high on sensation seeking often desire varied, novel, exciting, complex and intense sensations and experiences; and are willing to take risks, both physical and social, to obtain such experiences (Wang, Wang, et al., 2022). Sensation-seeking individuals tend to engage in behaviours that increase the amount of stimulation and arousal (Roberti, 2004) and accept risk as a possible outcome of achieving this arousal (Roberti, 2004; Zuckerman, 1994). We expect that people who are more prone to sensation seeking will feel less anxious about the overall COVID-19 situation.

While numerous studies have examined the immediate psychological effects of the COVID-19 pandemic, research on how these effects evolved over time as people adapted to the pandemic remains limited. Many early studies focused on the acute phase of the crisis, highlighting increased anxiety, psychological distress, and uncertainty. Fewer studies, however, have examined whether and how these psychological responses changed as the pandemic progressed, restrictions were lifted, and people adapted to the "new normal". Comparing how people reacted to COVID-19 as it developed into a global pandemic in 2020 and after most countries lifted all COVID restrictions in 2022 may shed light on the exact nature of the pandemic, and also allow us to explore how people react and cope with adversity in general. Our study aims to fill this gap by providing a comparative analysis of psychological responses at two key time points—early 2020 and mid-2022—using independent samples from the same population. In doing so, we provide empirical evidence on the long-term trajectory of psychological adaptation to the pandemic.

Therefore in the current study, our aim was to investigate the impact of the COVID-19 pandemic on individuals' psychological responses and to examine differences due to long-term exposure between the start of the pandemic in early 2020 and the lifting of regulations in mid-2022. We wanted to test whether the effects of trauma, individual responses to the pandemic, levels of anxiety and sensation seeking change over time. With a better understanding of the virus, the implementation of COVID-19 safety measures, and the availability and further development of vaccines, we predicted that the negative psychological impact of COVID-19 on individuals should have diminished in recent years. Also, the anxiety caused by the perceived threat of COVID-19 and the tendency to be reckless should decrease over time. Thus, we expected that individuals would be better able to cope with COVID-19 and act in a more organised manner in the present compared to early 2020.

## 2. Materials and methods

### 2.1. Research design

Our study employed a cross-sectional design with two independent samples collected at different time points (early 2020 and mid-2022). Data were gathered through an anonymous online survey targeting Portuguese individuals, allowing us to assess changes in psychological responses to the COVID-19 pandemic over time. The study design enables a comparison of psychological measures—including trauma impact, emergency response, anxiety, and sensation seeking—across two distinct phases of the pandemic.

### 2.2. Participants and procedure

We recruited a total of 414 participants (328 female) aged 18–77 years ( $M = 31.6$ ,  $SD = 13.6$ ) via the internet by posting on social media, mailing lists and various forums. Participation was voluntary. The study used convenience sampling. The online-based survey was conducted in Portugal in March–May 2020 (Time 1) and April–June 2022 (Time 2) on two independent samples. Detailed information on the age, gender, marital status and education of our samples is presented in Table 1. To ensure the confidentiality of the participants, an anonymous online survey was developed and published through social media, mailing lists and various forums. Prior to completing the survey, participants were informed that participation was voluntary and that their responses would be kept confidential and secure. The research was carried out

**Table 1**

Demographic characteristics of the participants in Time 1 (2020) and Time 2 (2022) and in total.

| Characteristics | 2020 (n = 194) | 2022 (n = 220) | Total (N = 414) |
|-----------------|----------------|----------------|-----------------|
| Age (years)     |                |                |                 |
| Mean (SD)       | 25.1 (8.63)    | 37.3 (14.5)    | 31.6 (13.6)     |
| Min - max       | 14–77          | 14–77          | 14–77           |
| Gender          |                |                |                 |
| Male            | 38 (20 %)      | 48 (22 %)      | 86 (21 %)       |
| Female          | 156 (80 %)     | 172 (78 %)     | 328 (79 %)      |
| Marital status  |                |                |                 |
| Single          | 150 (77 %)     | 101 (46 %)     | 251 (61 %)      |
| In relationship | 25 (13 %)      | 24 (11 %)      | 49 (12 %)       |
| Married         | 16 (8 %)       | 69 (31 %)      | 85 (21 %)       |
| Divorced        | 1 (1 %)        | 21 (10 %)      | 22 (5 %)        |
| Widow           | 2 (1 %)        | 4 (2 %)        | 6 (1 %)         |
| Education       |                |                |                 |
| Elementary      | 4 (2 %)        | 1 (0 %)        | 5 (1 %)         |
| Highschool      | 92 (47 %)      | 72 (33 %)      | 164 (40 %)      |
| BA/BSc          | 78 (40 %)      | 95 (43 %)      | 173 (42 %)      |
| MA/MSc          | 17 (9 %)       | 44 (20 %)      | 61 (15 %)       |
| PhD             | 3 (2 %)        | 8 (4 %)        | 11 (3 %)        |

following the Code of Ethics of the World Medical Association (Declaration of Helsinki). Informed and written consent was obtained from all participants.

### 2.3. Measures<sup>2</sup>

#### 2.3.1. The Impact of Events Scale (IES)

The IES (Sundin & Horowitz, 2002) is a 22-item questionnaire that was also validated during the COVID-19 pandemic (Wang et al., 2020). The questionnaire has two subscales (Intrusion and Avoidance) designed to measure the psychological impact of a variety of traumas. The scale includes items such as "I thought about it when I didn't mean to". Items are rated on four-point Likert-type scale from 0 (not at all) to 5 (often). A higher score means a greater perceived impact and trauma. The Cronbach's alphas were .78 and .82 respectively.

In the present study, we used the following instructions: "Below is a list of difficulties that people sometimes experience during stressful life events. Read each item and then indicate how stressful each situation has been for you during the past seven days in relation to something unpleasant that has happened to you in connection with COVID-19 that has occurred since the start of the pandemic or in relation to the situation generally. Please tell us how much you feel distressed or uncomfortable with the difficulties that follow?".

#### 2.3.2. The Emergency Reaction Questionnaire (ERQ)

The ERQ (Zsido, Csokasi, et al., 2020) is a 30-item questionnaire with four subscales (General Readiness, Specific Readiness, General Helplessness, and Specific Helplessness) designed to measure to predict an individual's reaction in an emergency. Items are rated on five-point Likert-type scale from 1 (not true at all) to 5 (absolutely true). The scale includes items such as "I feel that I would be able to stay calm and capable of acting even in the middle of a panicking crowd". A higher total score means a greater readiness to act in dangerous and emergency situations. the Cronbach's alphas for the four subscales were .86, .86, .80, and .84 respectively. For the overall test, the Cronbach's alpha was .92.

<sup>2</sup> Please note that English versions of all measures used in this study are available from the publications cited in the measure description (or from the authors of the publication). We do not share the measures attached to this paper because the original authors are the copyright holders and we have no right to publish them.

### 2.3.3. The short version of the State-Trait Anxiety Inventory (STAI)

The STAI-short version (Zsido, Teleki, et al., 2020) is a 5-item questionnaire, based on the State-Trait Anxiety Inventory (Spielberger, 1970). We used the STAIT-5 scale that was designed to measure trait anxiety. The scale includes items such as “I feel that difficulties are piling up so that I cannot overcome them”. Responses in the STAI-trait are rated on four-point Likert-type scale from 1 (almost never) to 4 (almost always). A higher score means higher levels of anxiety. The Cronbach’s alpha was .82.

### 2.3.4. The Brief Sensation Seeking Scale (BSSS)

The BSSS (Hoyle et al., 2002) is an eight-item questionnaire designed to measure sensation seeking. The scale includes items such as “I like to do frightening things.”. Items are rated on five-point Likert-type scale from 1 (Strongly disagree) to 5 (Strongly agree). A higher score means higher levels of sensation-seeking behavior. The Cronbach’s alpha was .76.

### 2.4. Data analysis

First, we used independent samples Student’s t-tests to compare the two groups (who completed the survey in 2020 and 2022) on IES, STAI, BSSS and ERQ scores. We then used a general linear model (GLM) to determine whether time (2020, 2022), gender, age, ERQ score, BSSS score, STAI score, relationship status and education affected IES scores. The criteria for using these statistical tests were met, the questionnaire scores did not violate normality (skewness and kurtosis values fell between -2 and 2) and the equality of variances of the groups was not violated. All analyses were performed using Jamovi V2.0 for Windows (The jamovi project, 2022). The data that support the findings of this

study are available from the OSF page of the study: <https://osf.io/2gqjz/>

## 3. Results

### 3.1. Comparison of 2020 and 2022

Fig. 1 illustrates the results of the group comparison. The group of participants in 2020 compared to those in 2022 scored higher on IES, reporting higher levels of the psychological impact of trauma ( $t [412] = 2.73, p = .007$ , Cohen’s  $d = .268$ ). They also reported higher levels of trait anxiety ( $t [412] = 2.50, p = .013$ , Cohen’s  $d = .247$ ) compared to the 2022 participant group. In addition, we found that the BSSS score was higher in the 2020 participant group ( $t [412] = 2.34, p = .020$ , Cohen’s  $d = .231$ ), indicating higher levels of sensation seeking when compared to the 2022 participant group. We did not find a significant difference in ERQ scores between the groups ( $t [412] = 1.52, p = .130$ ).

### 3.2. Perceived impact of event

The GLM model was significant predicting a large part of the variance observed on the IES scale ( $F [8, 404] = 27.50, p < .001, R^2 = .35$ ). We found that ERQ had a strong negative effect on IES scores ( $\beta = -.229, p < .001$ ). Furthermore, STAI ( $\beta = .470, p < .001$ ) and BSSS ( $\beta = .099, p < .040$ ) were strong positive predictors of the IES scores. Exact statistical results are presented in Table 2.

Since there were differences between the 2020 (Time 1) and the 2022 (Time 2) participant groups (as shown by the t-tests), in the GLM we also tested the interaction between Time-ERQ, Time-STAI, and Time-BSSS. The results remained the same, and all interactions were

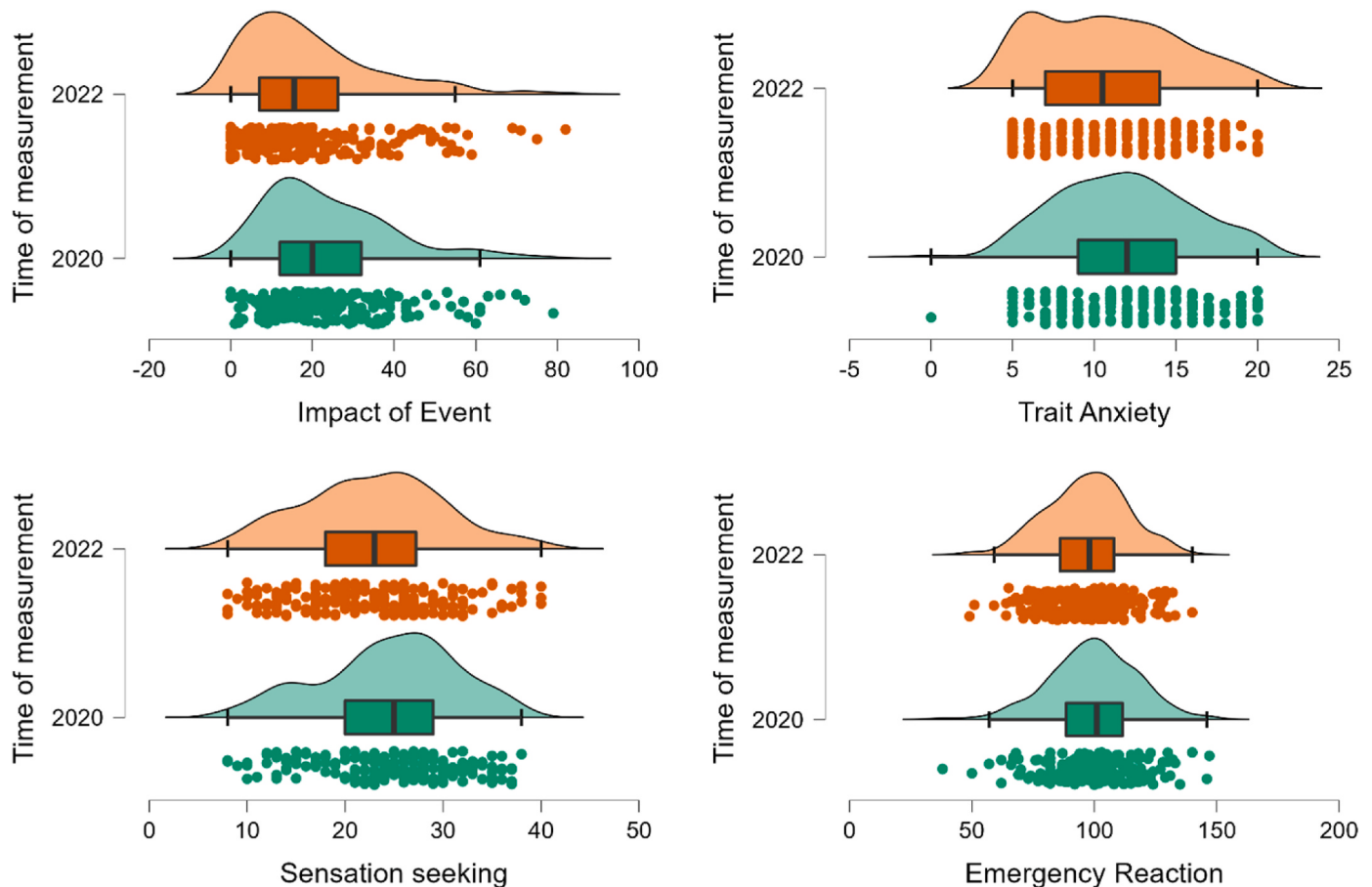


Fig. 1. Visualization of the differences between the groups on the Impact of Events Scale, the State-Trait Anxiety Inventory-trait, the Brief Sensation Seeking Scale, and the Emergency Reaction Questionnaire, including means and standard deviations.

**Table 2**

The results of the General Linear Model. The effects of Time, Gender, Age, Emergency Reaction Questionnaire (ERQ), State-Trait Anxiety Inventory (STAI), and Brief Sensation Seeking Scale (BSSS), relationship status, and education level on Impact of Events Scale (IES).

| Variable              | t      | p     | $\beta$        |
|-----------------------|--------|-------|----------------|
| Time (2020, 2022)     | 6.047  | .014  | −2.224         |
| Gender (Male, Female) | .001   | .972  | −.003          |
| Age                   | 1.141  | .286  | .074           |
| ERQ                   | 19.371 | <.001 | −.229          |
| STAI                  | 98.258 | <.001 | .470           |
| BSSS                  | 4.235  | .040  | .099           |
| Relationship          | .090   | .764  | .018           |
| Education             | .958   | .328  | −.043          |
|                       | F      |       | R <sup>2</sup> |
| Total model           | 27.504 | <.001 | .35            |

nonsignificant (ERQ:  $F [11, 401] = .298, p = .585$ ; STAI:  $F [11, 401] = .690, p = .406$ ; BSSS:  $F [11, 401] = .259, p = .611$ ).

#### 4. Discussion

The COVID-19 pandemic led to various sudden changes in a large number of people, due to the unknown, unpredictability and risk, as well as the social and economic closure, which predisposed to psychological symptoms (Coelho et al., 2020; Dubey et al., 2020), but with large individual differences (Duay et al., 2021; Labadi et al., 2022; Zsido et al., 2022). As the years have passed since the outbreak, people have become more aware of what to do, and restrictions have eased. Therefore, in the current study, we investigated and compared the psychological impact of the COVID-19 pandemic on individuals in 2020 and 2022. We measured people's self-reported anxiety, sensation seeking, their tendency to act during the pandemic and how strongly they felt the impact of the pandemic. As predicted, individuals reported significantly lower levels of negative impact of the COVID-19, anxiety and sensation seeking in 2022 compared to 2020. As the IES was designed to measure the psychological impact of trauma, it appeared that the negative impact of the COVID-19 pandemic on individuals was greater in 2020 than in 2022. As we hypothesised, the COVID-19 pandemic seemed to have a greater negative impact on individuals in 2020 than in 2022. Compared to the 2022 participants, the 2020 participants scored significantly higher on the IES, STAI and BSSS questionnaires. Thus, it seems that people tend to feel less anxious, less stressed and return to their pre-pandemic lifestyle, which may be due to the reduced fear of the COVID-19.

Exposure to traumatic events can have lifelong effects on an individual's psychological and physical health, leading to a decrease in life satisfaction, which can lead to negative mental health outcomes (e.g., Brooks et al., 2022). Our study found that individuals in 2020 were less able to cope with anxiety and were more distressed by the negative effects of COVID-19 compared to those in 2022. The majority of people may have become inoculated to the anxiety and chronic risk of contagion associated with COVID-19 (see e.g. Coelho et al., 2021). This is likely to have happened only to those people who were not severely affected by COVID-19 in late 2019 or early 2020, as fear inoculation by definition requires a fair amount of prior benign exposure to a potentially dangerous situation. However, it is likely that over time more and more people will be vaccinated and their overall fear and caution will decrease. It is also important to note that the vaccines became available to the general public and were administered to a large number of people, especially in Portugal where we collected the data. In the present study, the IES results show that people in 2020 perceived the COVID-19 pandemic to be significantly more dangerous and life-threatening - with a consequent negative impact on their mental health - than those in 2022. This is consistent with previous studies, such as Lahav's (2020), which showed that most participants reported experiencing at least one

COVID-19-related psychiatric symptom in 2020. After three years of living through the pandemic, people seem to learn to cope and adjust their lives around the virus, leading to a change in perspective and a reduction in anxiety levels in 2022, possibly developing fear inoculation.

We also found that individuals in 2020 exhibited higher levels of sensation seeking compared to those in 2022. This may be in line with Zuckerman and Aluja's (2015) theory, which argues that the degree of expression of sensation-seeking traits may be affected by a prolonged period of restricted activity. It is also possible that people perceived their behaviour as more sensation-seeking due to the general lack of knowledge about the pandemic, lack of vaccines and extreme safety measures. For example, in April 2020, going shopping in person may have been perceived as an extreme risk, whereas in the summer of 2022, even travelling across countries seemed to be part of everyday life again. Furthermore, during the prolonged COVID-19 pandemic period, the vaccination effect in unaffected individuals may have favoured most people accepting a new lifestyle as part of their everyday lives in 2022 (Dan & Brosius, 2021). In particular, the more sensation-seeking individuals may have experienced increased boredom with following safety measures (Zhang et al., 2022). This has contributed to increased confidence in vaccination (e.g., Latkin et al., 2021) and knowledge of the transformation of the virus, which appears to be less lethal. Ongoing updated information and the evolution of vaccination seem to reassure individuals to some extent, making them more willing to accept vaccination (e.g. Bono et al., 2021), which in turn helps to reduce the negative impact of the situation. Gradually, people learned to cope and live with the COVID-19 pandemic (e.g. Hadfield, 2022). The few most fearless individuals were probably also the most likely to be reported in the news as having parties and not wearing masks, and the general lack of fear may have been responsible for the fluctuations in the epidemiology and incidence of COVID-19. This reluctance to comply with COVID-19 measures could be explained by a number of factors, such as alarm fatigue caused by constant information and rule changes, the need for these individuals to have some control over their lives (Williams et al., 2021), the belief that they were not vulnerable to COVID-19 (Hills & Eraso, 2021), among others.

There are also some limitations that may affect the generalisability of the results of our study. We used a convenience sampling method to collect the data, which may limit the strength of the conclusions. However, the study has a relatively large sample size and the results seem to be in line with previous studies and theories. Furthermore, this study is not a true longitudinal study as we used two independent groups, as we were not able to follow up after more than two years. Nevertheless, the two samples from 2020 to 2022 are very similar in terms of demographics and come from the same region. Future research will benefit greatly from a more generalised sample pool and a follow-up procedure with greater reliability. A final notable limitation of the current study was the lack of investigation of COVID-related burnout. As a recent study pointed out (Lau et al., 2022), burnout caused by the pandemic was a significant public health issue during the COVID-19 pandemic, causing a lack of motivation, feelings of helplessness, loneliness, even depersonalization, and non-compliance with health protective measures. As we move into the post-pandemic "New Norm Era", there is an urgent need to study burnout caused by adverse events and situations.

#### 5. Conclusions

In conclusion, the negative impact of the COVID-19 pandemic on individuals appears to have gradually diminished over time. Three years of living through the pandemic, together with knowledge, vaccination and safety measures, seem to help reduce the novelty, uncertainty and complexity of the situation, leading to a decrease in anxiety and psychological distress. In the face of life's adversities, reliable information, effective interventions and support can be important strategies for

building individual resilience. Prolonged exposure to adversity demonstrates the adaptive capacity of humanity, and although such situations are initially stressful and uncomfortable, they can lead to positive growth. However, the loneliness caused by the lack of face-to-face communication and normal social interaction, as well as the worsening socio-economic consequences, are risk factors that lead to a decline in individual well-being. It may be worthwhile for future research to investigate the impact of other emergencies on individuals, and to explore risk factors and strategies that may provide further understanding. This study contributes to the literature by demonstrating that the psychological impact of a global health crisis is not static but evolves as individuals and societies adapt to new circumstances. Understanding this trajectory is critical for informing future public health responses, particularly the design of mental health interventions that consider not only the immediate effects of a crisis but also its long-term psychological consequences.

### CRediT authorship contribution statement

**Carlos M. Coelho:** Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Panrapee Suttiwan:** Writing – review & editing, Writing – original draft, Validation, Investigation, Funding acquisition, Conceptualization. **Nisara Jaroenkajornkij:** Writing – review & editing, Writing – original draft, Software, Project administration, Funding acquisition, Formal analysis, Data curation. **Ana S. Araújo:** Writing – review & editing, Validation, Investigation, Funding acquisition, Data curation. **Pedro Dias:** Writing – review & editing, Validation, Investigation, Funding acquisition. **Célia B. Carvalho:** Writing – review & editing, Validation, Investigation, Funding acquisition. **Andras N. Zsido:** Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

### Disclosure statement

The authors report there are no competing interests to declare.

### Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

### Ethical statement

The research adhered to the Declaration of Helsinki and informed consent was obtained from all participants.

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### Declaration of competing interest

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

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