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RESEARCH ARTICLE

The impact of COVID-19 trauma on healthcare workers: Examining the relationship between stress and growth through the lens of memory

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Abstract

The COVID-19 pandemic constituted tremendous traumatic stress among the frontline healthcare workers. In the present study, we investigated relationships of two types of rumination, namely brooding and reflection, with traumatic stress and post-traumatic growth and the mediating role of recollective experience in these relationships. A total of 88 healthcare workers (75% female, M_{age} = 54.91) actively providing service to COVID-19 patients reported two memories of events that impacted them the most at the first peak of the pandemic and rated their recollective experience (i.e., phenomenological characteristics of memories). We used structural equation modelling to test whether recollective experience mediated the link of brooding and reflection with post-trauma reactions of stress and growth. The findings showed that brooding and reflection were associated with higher levels of traumatic stress and post-traumatic growth. Importantly, recollective experience mediated the relationship of rumination with traumatic stress but this differed for the type of rumination. Higher brooding was associated with greater traumatic stress and that relationship was independent of how well the memories were recollected, while for reflection, high reflection was associated with stronger recollective experience, which predicted higher traumatic stress and post-traumatic growth. The present study shows the functional dimensions of reflective rumination and presents novel findings that demonstrates the discrete mnemonic mechanisms underlying the association between brooding, reflection, and post-trauma reactions.

KEYWORDS
autobiographical memory, post-traumatic growth, post-traumatic stress, rumination

1 | INTRODUCTION

The COVID-19 pandemic has had a significant impact on mental health. The uncertainty and fear caused by the virus, as well as the strict lockdown measures and restrictions on daily life, have led to increased stress, anxiety, and depression (for a review, see Manchia et al., 2022). In particular, the pandemic has caused traumatic stress for frontline healthcare workers. They have been working long hours in hospitals, often with limited access to personal protective equipment, which has led to increased worry about their own health and

the health of their significant others (Cohen & van der Meulen Rodgers, 2020). The stress of witnessing patients' suffering and the risk of infection have made them vulnerable to developing mental health problems. Studies have shown a high prevalence of burnout (Wu et al., 2020), anxiety (Elridge et al., 2022) and post-traumatic stress disorder (PTSD) (Johnson et al., 2020; Ouyang et al., 2022; Yuan et al., 2021) among healthcare workers treating patients with COVID-19.

Despite the well-documented negative consequences of traumatic stress, it has been observed that individuals may also experience positive psychological outcomes in the aftermath of a traumatic event. For example, positive transformation after trauma, often referred to as Post-Traumatic Growth (PTG) (Tedeschi & Calhoun, 1996), is characterised as a growth experience in which individuals turn their traumatic suffering into strength and wisdom. More research is needed to understand the factors that contribute to such growth in the context of pandemic-related stress and trauma.

Rumination, defined as self-focused repetitive thinking about the same thoughts and events (Nolen-Hoeksema, 1991), has been linked to PTSD and post-traumatic growth (Kim & Bae, 2019; Millon et al., 2018; Wang et al., 2020; Xu et al., 2022). Ruminating on intrusive memories may exacerbate traumatic stress and lead to PTSD but can also impede the path to traumatic growth. However, there is limited research on the characteristics of trauma memories and their relationship with rumination, traumatic stress and post-traumatic growth. The current study aims to explore these relationships and investigate the factors that affect pandemic-related traumatic stress and traumatic growth.

1.1 | Traumatic stress, anxiety and fear

Traumatic stress is a distinct type of stress that occurs after a traumatic incident (Wilson & Sigman, 2000). It is a reaction to an unusual situation that exceeds an individual's ability to cope and can result in the development of Post-Traumatic Stress Disorder (PTSD) by harming psychological, behavioural, and cognitive functioning. According to the American Psychiatric Association's Diagnostic and Statistical Manual (DSM-V; APA, 2022), PTSD symptoms can be categorised into four groups: (a) intrusion, (2) avoidance, (3) negative thoughts and mood, and (4) hyperarousal. Intrusion symptoms include reexperiencing the trauma through flashbulbs and unwanted memories. Avoidance symptoms involve avoiding memories and emotions tied to the trauma. Negative thoughts dominate cognition and increase negative mood states. The state of hyperarousal leads to heightened anxiety and stress leading to sleep deprivation and impaired concentration, all of which could further trigger immune-inflammatory abnormalities (Serafini et al., 2020). Risk factors for PTSD include emotional and physical exhaustion, lack of social support, and unsafe work conditions (d'Ettorre et al., 2020).

Healthcare workers are at a higher risk of pandemic-related traumatic stress due to the prolonged nature of the pandemic and high demands placed on them (d'Ettorre et al., 2020). A meta-analysis has shown a high prevalence of PTSD among frontline healthcare workers (Sahebi et al., 2021).

Furthermore, many studies have found that healthcare workers experienced severe emotional distress (Li et al., 2020), sleeping problems (Qi et al., 2020) and burnout (Wu et al., 2020) during the pandemic. Healthcare workers have also struggled with a lack of knowledge about the virus and uncertainty in treatments, which contributed to feelings of anxiety and fear (Sun et al., 2020).

1.2 | Post-Traumatic growth

Although traumatic stress has significant negative consequences on mental health, it may lead to positive transformation, namely, post-traumatic growth (Tedeschi & Calhoun, 1996). Traumatic growth refers to a favourable transformation due to a psychological battle after an adverse event (Tedeschi & Calhoun, 1996). The development of interpersonal relationships, personal resilience, and spiritual growth are positive changes experienced after traumatic events (Tedeschi & Calhoun, 2004). People may become more mindful of their mental and physical health, and the emotional and social support that they receive may increase following a trauma (Lau et al., 2006; Marjanovic et al., 2007).

There are mixed findings on the relationship between traumatic stress and post-traumatic growth. Some research indicates that traumatic stress and post-traumatic growth can co-exist. For example, Engelhard et al. (2015) found that people with higher post-traumatic growth had also higher PTSD symptoms, showing a positive association between these two. According to the post-traumatic growth theory (Tedeschi & Calhoun, 2004), post-traumatic growth results from the need to overcome the burden of traumatic stress, leading people to find meaning in their suffering and seek intimacy in their interpersonal relationships. Therefore, it could be suggested that greater PTSD symptoms can predict post-traumatic growth, thus making severe PTSD symptoms necessary for post-traumatic growth (see Tomich & Helgeson, 2004; Wild & Paivio, 2004). However, other research shows a negative association between PTSD and post-traumatic growth (Kirkner et al., 2019).

1.3 | Rumination

Rumination plays a role in the development and maintenance of PTSD and post-traumatic growth. Nolen-Hoeksema (1991) suggests that an individual's response to adverse life events can predict their mental health outcomes. One response is rumination, which involves repetitive and persistent thoughts about a traumatic event with the intention of reducing negative emotions. However, excessive rumination can be detrimental to mental health by excessively focussing on negative aspects of the event and self-focused negative emotions, thereby reducing its ability to regulate emotions effectively. Rumination has been found to be a key component of the relationship between stressful events and the symptoms of depression, anxiety (Arditte Hall et al., 2019; Cooney et al., 2010; Papageorgiou & Siegle, 2003), PTSD (Xu et al., 2022), and post-traumatic growth as well (Xu et al., 2022). Some studies have shown that frontline healthcare workers with high levels of rumination are more likely to show

symptoms of post-traumatic stress (García et al., 2016; Portoghese et al., 2021).

While rumination has traditionally been viewed as a negative and maladaptive response, research has shown that it can also have adaptive forms. Treynor et al. (2003) identified two distinct forms of rumination: brooding and reflection. Brooding involves dwelling on negative aspects of past experiences and engaging in negative self-criticism and self-judgement without taking any action to solve problems. This type of rumination has been linked with mood disorders (Dell' Osso et al., 2019) and depressive symptoms (Treynor et al., 2003). On the other hand, reflection is a more adaptive form of rumination that involves critically evaluating past experiences and actively working to analyse and understand them. Reflective rumination helps distance the self from negative emotions associated with traumatic events and promotes the ability to cope with stress. Studies have also found that reflective rumination is positively associated with post-traumatic growth, while brooding is not (Stockhton et al., 2011).

Importantly, research on the specific effects of brooding and reflective rumination on PTSD and post-traumatic growth is limited. A study by Cui et al. (2021) investigating the link between rumination and post-trauma reactions showed that components of brooding rumination were associated with the severity of the PTSD symptoms, while those of reflective rumination were linked to post-traumatic growth. However, the mechanism by which rumination influences post-trauma responses has not been fully understood, and there is a lack of evidence addressing how the relationship between rumination, trauma, and growth may change depending on whether rumination is brooding or reflective.

1.4 | Rumination, memory and PTSD

Research on rumination has traditionally focused on its effects on emotions and mental health, but it has been found to be closely linked with memory processes as well. Rumination may lead to the encoding, consolidation, and retrieval of negative information, making it more accessible in memory and thus contributing to depressive symptoms (Arditte Hall et al., 2019; Birrer & Michael, 2011; Nolen-Hoeksema, 2000). Indeed, research has shown that people with depression tend to ruminate more, leading to an increased recall of depression-related memories and persistence of negative emotions (for a review, see Gaddy & Ingram, 2014). Some argue that ruminative thinking can also worsen post-traumatic stress disorder (PTSD) by making trauma memories more available and important in memory (Rubin et al., 2008; Berntsen et al., 2003; for a review, see Berntsen, 2015).

According to the memory-based perspective of trauma (Berntsen et al., 2003; Rubin et al., 2008, 2011), traumatic events are deeply encoded in memory and frequently recalled, which negatively impacts the interpretation of other experiences and damages the self-image. This perspective argues that PTSD results from disorganization of autobiographical memory and thus leads to vivid flashbacks and intrusive thoughts. Indeed, PTSD memories have higher ratings in reliving, emotional intensity, and frequency of recall (Berntsen, 2001; Blix et al., 2020; Rubin et al., 2008). However, no research has so far investigated the relationship between recollective properties of trauma memories and post-traumatic growth.

1.5 | The present study

In the present study, we investigated the relations between rumination, recollective properties of autobiographical memories, traumatic stress and post-traumatic growth in the context of the COVID-19 pandemic. We collected data from healthcare workers who were actively providing care for COVID-19 patients. Our rationale was that healthcare workers have been exposed to a high level of stress and trauma due to the ongoing pandemic, but despite all difficulties, they have persisted in their duties. These challenges have the potential to lead to both negative effects such as traumatic stress and positive effects such as post-traumatic growth. By examining the experiences of healthcare workers, we aimed to shed light on the psychological impacts of the pandemic.

In line with previous research (Berntsen et al., 2003; Rubin et al., 2008, 2011), we adopted a memory-based perspective to explain post-trauma reactions and aimed to answer three questions: (a) What are the relationships between recollective properties of memories, rumination, traumatic stress and post-traumatic growth, (2) How do different types of rumination relate to traumatic stress and post-traumatic growth? (3) Do recollective properties of memories have a role in the relation of rumination with traumatic stress and post-traumatic growth? In line with the memory-based perspective of trauma (Berntsen et al., 2003; Rubin et al., 2008, 2011), we expected that higher recollective properties of memories would be associated with higher rumination and traumatic stress, but lower post-traumatic growth. As the memory for the traumatic event becomes more salient, the emotional impact of the event increases, which exacerbates the traumatic stress reactions. With a similar line of reasoning, post-traumatic growth is associated with a vague, abstracted representation of the trauma memory, by which the event is perceived as less negative (Huang & Gan, 2018) and disturbing. However, in cases in which the vivid, emotional re-experiencing for the traumatic memory persists, it would be more difficult to distance from the event and move towards the traumatic growth.

Based on the differences of brooding and reflection in thinking about and processing negative events (Treynor et al., 2003), their relations with recollection, traumatic stress and traumatic growth may be different. Brooding tendencies can prevent individuals from finding closure and moving on from negative experiences, leading to a perpetuation of the negative emotions associated with events. We therefore expected brooding to be associated with increased recollection of pandemic memories, which can lead to increased stress and reduced post-traumatic growth. On the other hand, individuals with reflective tendencies engage in rumination, but at the same time, they find alternative perspectives and interpretations of events. By

doing so, they process negative events in a way that reduces their negative impact and promotes positive outcomes. Accordingly, we expected reflection to be associated with reduced recollection, which in turn reduces traumatic stress and increases post-traumatic growth.

2 | METHOD

2.1 | Participants

The data for the current study were collected at two time points when the pandemic intensity peaked in Turkey. . The first session was in April-May 2020 and the second session was in October-November 2020. The sample consisted of healthcare workers who worked actively to treat COVID-19 patients since the beginning of the pandemic. We recruited healthcare workers from the two largest pandemic hospitals in Istanbul where COVID-19 patients were mainly referred. We particularly focused on these hospitals as they were extremely busy, and this put extra strain on healthcare workers.

Individuals were informed about the study through e-mail and flyers and the individuals who agreed to participate were included in the study. Our final sample included 88 individuals (75% female) with an age range between 26 and 70 ($M = 54.91$, $SD = 11.21$) and a mean year of occupation is 10.7 ($SD = 10.5$). Sample characteristics are presented in Table 1.

2.2 | Measures

Autobiographical Memory Recall. We used the items from the Autobiographical Memory Questionnaire (AMQ, Rubin et al., 2003) to measure the phenomenological characteristics of the reported events. Participants were asked to report 2 events from April-May 2020 in the first session of the data collection. For each event, the following prompt was given:

> "During the peak of the pandemic (April-May), we would like to know events, either you experienced or witnessed, that had the most impact on you. These events must include those that took place only once in a specific place and time. These events could be any pandemic related events".

Then, participants rated the phenomenological characteristics of events including emotional intensity and imagery on a 5-point scale (1: never—5: always). Item for valence was rated on a 5-point scale (1: very negative—5: very positive). Higher ratings represented more positively valenced events, whereas lower ratings represented more negatively valenced events. For visual perspective, participants were asked whether they remember the reported event from the field or observer perspective. For psychological distance, they were asked the extent that they felt how much time passed since the reported event took place. Participants marked their responses on a continuum using a slider ranging from 0 (I feel as if it just happened) to 100 (I feel as if it happened a very long time ago). Higher ratings represented distant events, whereas lower ratings represented closer events.

In the mediation model we tested, we focused on the recollection component of remembering, which previous research has described as a higher-order construct encompassing the sensory-perceptual qualities of remembering (Fitzgerald & Broadbridge, 2013; Öner & Gülgöz, 2016). We selected specific items from the Autobiographical Memory Questionnaire (AMQ) that tap into recollection, such as emotional intensity, reliving, and imagery, as these features have been proposed to make an event episodic (Rubin & Umanath, 2015) and determine the saliency of recall (Öner & Gülgöz, 2018). These items are also relevant to the PTSD literature (Berntsen et al., 2003; Rubin et al., 2008, 2011).

In the mediation model, we used recollection as a latent variable that is indicated by reliving, emotional intensity, and imagery. More information about the model structure was provided in the (see Model Specification).

Ruminative Response Scale. Ruminative Response Scale (Treynor et al., 2003) measures ruminative coping. The scale shows the types of rumination that people adopt when they have repetitive thoughts on negative events and emotions. We used the short version of the 10-item scale including two subscales: reflection (e.g., "I analyse recent events to try to understand why I'm depressed") and brooding (e.g., "I think "Why do I have problems other people don't have?"). We asked participants to rate how relevant each item was on a five- point Likert scale (1: never—5: very often) in the first session of the data collection. Both subscales had high inter-item consistency reliability (Cronbach alphas = 0.86 and 0.79 for brooding and reflection, respectively). A higher score from each subscale indicated which type of rumination is more likely to be used.

Secondary Traumatic Stress Scale. We assessed the extent healthcare workers have been traumatised due to the negative experiences of COVID-19 patients and focused on the secondary traumatic stress, which has been widely studied in individuals who have been affected due to their work with traumatised individuals (Molnar et al., 2017). Secondary Traumatic Stress Scale (Bride et al., 2004) measures traumatic symptoms associated with secondary trauma exposure (e.g., intrusion, avoidance, and arousal). It

TABLE 1 Descriptives for the study variables.

Profession	Gender	N	Age	Years in occupation
Doctor	Female	19	58.25 (*7.89*)	10.75 (*9.94*)
	Male	23	60.56 (*7.54*)	11.69 (*8.28*)
	Total	42	60.31 (*7.50*)	10.81(*9.06*)
Nurse	Female	42	49.15 (*12.98*)	*16.31* (*12.43*)
	Male	4	53.03 (*10.94*)	12.15 (*11.43*)
	Total	46	51.17(*11.96*)	12.02 (*11.82*)

consists of 17 items (e.g., "It seemed as if I was reliving the traumas experienced by my clients/patients"). We used the original scale items but asked participants to specifically consider the period starting from the outbreak of the pandemic in Turkey and rate how relevant each item was on a five- point Likert scale (1: never—5: always) in the second session of the data collection. The scale had high inter-item consistency reliability, Cronbach alpha = 0.92. The total score of secondary traumatic stress was calculated by summing up the item scores. A higher score indicated more traumatic symptoms and negative outcomes.

Post-traumatic Growth Inventory. Post-traumatic Growth Inventory (Tedeschi & Calhoun, 1996) aims to assess whether people can develop positive outcomes after they experience traumatic events. The inventory has 21 items (e.g., "I have a greater appreciation for the value of my own life"). We asked participants to rate how relevant each item on a five- point Likert scale (1: not at all– 5: very much) in the second session of the data collection. Inter-item consistency reliability was found high with a Cronbach alpha of 0.95. The total score of post-traumatic growth was calculated by summing up the item scores. A higher score indicated more positive outcomes and recovery from trauma.

2.3 | Procedure

The study protocol has been approved by the Kadir Has University IRB committee. We announced the study in the two major hospitals devoted to the pandemic care in Istanbul, Turkey. The link of the online survey administered through Qualtrics (Provo, UT) was sent to healthcare workers who were willing to participate. We obtained an informed consent form from all participants and provided monetary benefits in return for their participation. The survey was completed in two sessions. Participants were compensated separately for each session with 50 Turkish liras to avoid undue influence on participants to participate in both sessions (see Figure 1).

At the first session held between April and May 2020, participants were first asked to recall two memories that occurred at the peak of the pandemic in Turkey. After describing each memory, they answered questions about the phenomenological characteristics of each memory. Following the memory recall task, participants completed Ruminative Response Scale (Treynor et al., 2003) and provided demographic information. This session lasted approximately half an hour. Participants were contacted again for the second session held between October and November 2020. If they agreed to participate, survey links were sent for them to complete Secondary Traumatic Stress Scale (Bride et al., 2004) and Post-traumatic Growth Inventory (Tedeschi & Calhoun, 1996). This session took about 15 min.

2.4 | Data analytic approach

Before starting data analysis, we checked each event report to ensure the events reported constitute specific event reports. Notably, all the reported memories were pandemic-related, particularly focussing on the vicarious experiences of patients' trauma or pandemic-related difficulties healthcare workers experienced. First, we conducted independent samples *t*-tests to check whether phenomenological properties of reported memories (AMQ) differed across sample characteristics (e.g., gender, occupation). Next, we examined bivariate correlations to test how phenomenology was associated with the ruminative tendencies of brooding and reflection, and with the post-trauma reactions of stress and growth. Last, in the mediation model we proposed, we used each ruminative tendency (brooding and reflection) as the predictors and the latent variable of recollection with the sensory-perceptual items of AMQ as the mediator, we tested for the factors predicting post-trauma reactions of stress growth.

Structural equation modelling (SEM) tested the specified model using the maximum likelihood estimation procedure in AMOS 22.0. Model fit was assessed first with the Chi-square ($\chi 2$) and the degrees of freedom (df) values, for which $\chi 2/df$ values between 1 and 5 are considered acceptable. We also evaluated the model using other absolute and incremental fit indices including Comparative Fit Index (CFI), Normed Fit Index (NFI) (Bentler, 1990) and Root-Mean-Square Error of Approximation (RMSEA; Steiger, 1998). We considered a

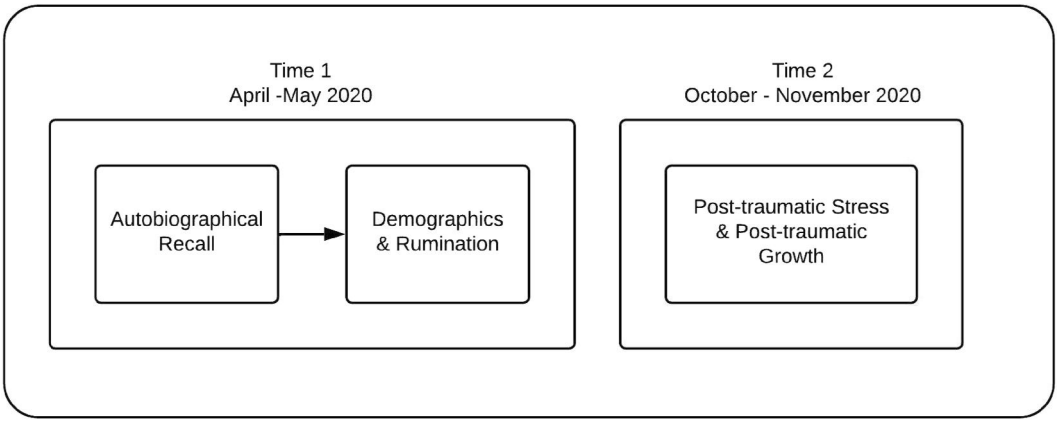

FIGURE 1 Study procedure.

good fit when χ2/df < 3.00; CFI, NFI >0.90, and RMSEA <0.08 (Kline, 2005).

In the mediation model, direct and indirect effects were tested using Bootstrapping method since it does not assume normality and provided more accurate confidence intervals (Shrout & Bolger, 2002). We requested 1000 bootstrap samples, generating bias-corrected percentile-based bootstrap with 95% confidence intervals. If the confidence interval for the direct and indirect effect being tested does not include zero, it suggests that the effect is statistically significant, and significant indirect effect when the direct effect is not significant indicates a full mediation.

3 | RESULTS

We collapsed the data and used all the events reported in the subsequent analyses. A total of 176 events were provided. Means and standard deviations of the target variables are presented in Table 2. Independent samples *t*-tests comparing gender and occupation-related (medical doctors vs. nurses) differences showed no differences in these target variables (*p*s > 0.05).

3.1 | Bivariate relations among the variables

To examine how different types of rumination are related to traumatic stress and traumatic growth, and how rumination, traumatic stress, and traumatic growth are related to phenomenological characteristics of memories, we conducted a bivariate correlation analysis including all events ($N = 176$). The two forms of rumination, brooding and reflection, were positively correlated with traumatic stress, r (86) = 0.41, $p < 0.001$, r (86) = 0.31, $p < 0.001$, but their correlations with post-traumatic growth were not significant, r (86) = 0.13 $p = 0.19$, r (86) = 0.20 $p = 0.06$. All these variables were related to phenomenological characteristics of memories. Specifically, brooding was positively correlated with emotional intensity, r (86) = 0.32, $p = 0.002$, imagery, r (86) = 0.23, $p = 0.02$, and reliving, r (86) = 0.26, $p = 0.01$, reflection was positively correlated with emotional intensity, r (86) = 0.30, $p = 0.004$, imagery, r (86) = 0.27, $p = 0.001$, and reliving, r (86) = 0.33, $p = 0.001$, traumatic stress was positively correlated with, emotional intensity, r (86) = 0.36 $p < 0.001$, imagery, r (86) = 0.36, $p = 0.001$, and reliving, r (86) = 0.38, $p = 0.001$, and post-traumatic growth was positively correlated with emotional intensity, r (86) = 0.30, $p = 0.005$, and reliving, r (86) = 0.33, $p = 0.002$. There was also a positive correlation between traumatic stress and post-traumatic growth, r (86) = 0.15 $p = 0.031$ (see Table 2).

3.2 | Measurement model

We first tested the measurement model to ensure the latent variable of recollection was adequately represented by its indicators and then conducted structural equation modelling testing the mediation model. The measurement model included one latent variable and three observed variables of memory phenomenology (emotional intensity, reliving, imagery).[1] In line with previous studies (e.g., Fitzgerald & Broadbridge, 2013; Öner & Gülgöz, 2018), we did not include valence and psychological distance as a part of the recollection in the measurement model as they represent distinct features of remembering.

Factor loadings for all the indicators on the latent variable of recollection were significant ($p < 0.001$), indicating that the latent construct was well represented by its indicators.

3.3 | Structural model

We proposed a model testing the mediational role of recollection on the link between brooding and reflection with traumatic stress and post-traumatic growth (see Figure 2). We used maximum likelihood estimation in AMOS 22.

The model resulted in a good fit to the data, χ^2 (9) = 0.93, $p = 0.495$, RMSEA = 0.012, CFI = 0.991, NFI = 0.974. Mediation model was supported only for the relationship of reflection with traumatic stress and post-traumatic growth while for brooding, only the direct link to recollection was significant. More specifically, higher reflection was linked to the recall of memories with greater

TABLE 2 Descriptives and bivariate correlations for the study variables.

	M (SD)	1	2	3	4	5	6	7	8	9
1.Brooding	2.34 (*0.83*)	-								
2.Reflection	2.25 (*0.79*)	0.83**	-							
3.Intensity	3.30 (*1.00*)	0.32**	0.30**	-						
4.Imagery	3.31 (*1.02*)	0.23*	0.27**	0.65**	-					
5.Reliving	3.91 (*0.91*)	0.26*	0.33**	0.79**	0.78**	-				
6.Valence	3.49 (*0.98*)	−0.09	−0.02	−0.12	−0.22*	−0.13	-			
7.Distance	37.33 (*27.77*)	−0.23*	−0.22*	−0.31**	−0.32**	−0.36**	0.22*	-		
8.Stress	11.27 (*2.57*)	0.41**	0.32**	0.36**	0.36**	0.39**	−0.17	−0.17	-	
9.Growth	10.47 (*2.47*)	0.14	0.2	0.30**	0.18	0.33**	0.17	−0.2	0.17	-

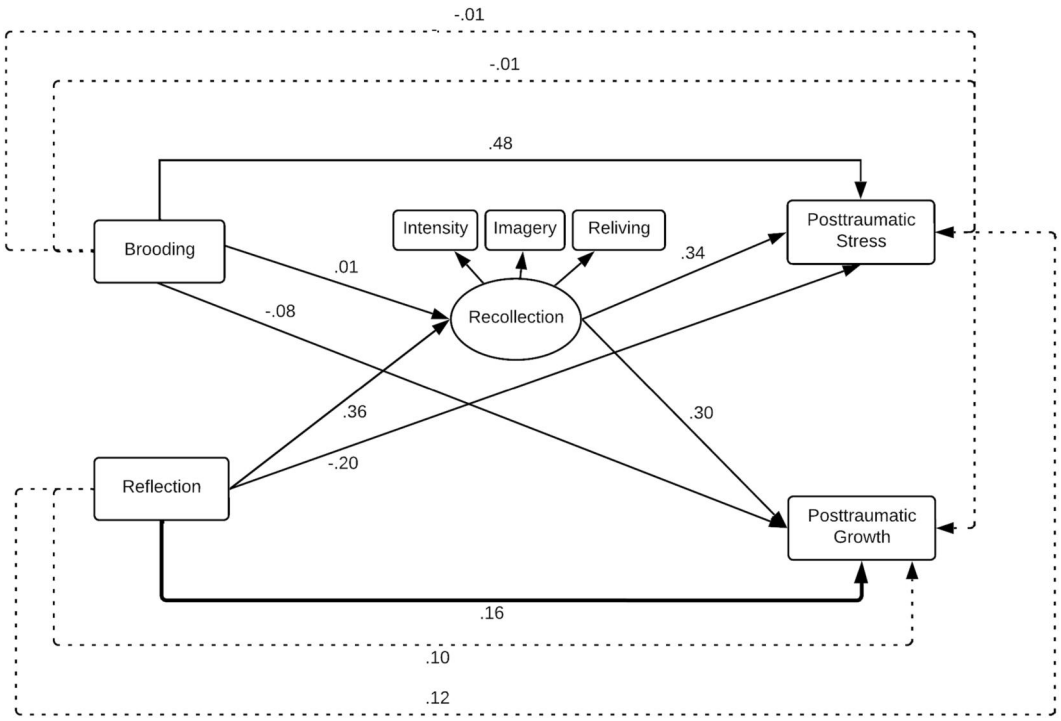

FIGURE 2 Structural model testing the role of recollection on the link between rumination and post-trauma reactions.

recollection, which was linked to higher traumatic stress and also to post-traumatic growth. On the other hand, the direct link from brooding to recollection was not significant. But with traumatic stress, brooding has a positive association such that individuals with higher brooding tend to experience greater traumatic stress and that relationship was not mediated by the recollection, suggesting that brooding by itself is a strong predictor of the emotional strain that individuals experience in the aftermath of traumatic experiences of how well the memories were recollected. Table 3 presents the standardized estimates for the direct and indirect effects in the model and indices of the mediation model are presented in Figure 2.

4 | DISCUSSION

The current study investigated the relationship of rumination with traumatic stress and post-traumatic growth among healthcare workers on the frontlines of COVID-19. This study is the first to examine the role of recollection on the link between rumination and post-trauma reactions. In line with the memory-based perspective of trauma (Rubin & Berntsen, 2008; Rubin et al., 2011), the findings showed that recollection shaped how ruminative tendencies were associated with traumatic stress and post-traumatic growth.

4.1 | Remembering and post-trauma reactions

As an event involving a variety of negative events in the context of uncertainty, the global COVID-19 can be considered as an extended trauma, especially for the healthcare workers directly witnessing the suffering of other people. In line with the memory-based perspective of trauma (Rubin & Berntsen, 2008; Rubin et al., 2011), we argued that the processes involved in the formation and maintenance of memories determine the intensity and longevity of the emotional responses to traumatic events. Accordingly, we expected that greater recollection of events experienced during the initial peak of the pandemic would be associated with more intense traumatic stress reactions in the healthcare workers. On the other hand, as the events are abstracted more, with the lessons taken and the decline in vividness, post-traumatic growth may be more pronounced. Thus, we expected that greater recollection of events would be associated with lower levels of post-traumatic growth.

The results confirmed our expectations about the relationship of recollection with traumatic stress but not with post-traumatic growth. We found that an increased sense of reliving, vividness, and intensity of the pandemic memories were not only associated with higher traumatic stress but also higher post-traumatic growth. In addition, higher traumatic stress correlated with increased post-traumatic growth, supporting the post-traumatic growth theory (Tedeschi & Calhoun, 2004).

With respect to traumatic stress, current findings are consistent with the previous evidence that individuals recall vivid episodes of the pandemic that act like trauma reminders (Ehlers, 2015). These memories, even though they cause severe distress (Ehlers, 2015; Watson & Berntsen, 2015), can also be beneficial in that they offer specific details and help resolve highly emotional and traumatic events (Berntsen, 2009). Vivid recollections may also prevent avoidance from the reminders of the traumatic event. This could

TABLE 3 Direct and indirect effects for the structural links in the mediation model.

		95% confidence intervals	
Direct effects	**Estimates**	**Lower bound (BC)**	**Upper bound (BC)**
Brooding → Recollection	−0.01	−0.33	0.26
Reflection →Recollection	0.36*	0.09	0.67
Brooding → Stress	0.48**	0.19	0.78
Brooding → Growth	−0.08	−0.44	0.29
Reflection → Stress	−0.20	−0.55	0.05
Reflection → Growth	0.16	−0.26	0.54
Recollection → Stress	0.34**	0.17	0.50
Recollection → Growth	0.30**	0.13	0.45
Indirect effects			
Brooding → Stress	−0.01	−0.36	0.31
Brooding → Growth	−0.01	−0.34	0.28
Reflection → Stress	0.12*	0.12	1.00
Reflection → Growth	0.10*	0.09	0.80

allow individuals to gradually understand and make sense of the event in a more constructive way. In turn, individuals can reconsider core beliefs concerning the event and alter them if necessary or develop alternative interpretations, all of which are related to the reappraisal process initiating post-traumatic growth (Tedeschi & Calhoun, 2004). However, since traumatic events lead to conflict in identity and disrupt positive evaluations of the self, their frequent recall also leads to tremendous stress, thus playing a significant role in the occurrence of post-traumatic reactions (Berntsen et al., 2003; Rubin et al., 2011). Critically, not all individuals having traumatic stress can adopt a positive psychological perspective following the event and experience post-traumatic growth. There are individual differences found in rumination, which may affect the reaction to traumatic stress and its management (Wang et al., 2015).

4.2 | Ruminative thinking & post-trauma reactions

Rumination has been conceptualised as self-focused, repetitive thoughts particularly about negative experiences (Nolen-Hoeksema, 1991). One form of rumination, brooding, involves more rigid thinking over negative information while the other form, reflection, utilises a more distanced stance, serving to make meaning over the event (Treynor et al., 2003). Although both forms are repetitive, there are distinct cognitive processes involved in brooding and reflection, changing their influence on the event representations. Accordingly, we expected differences in the way brooding and reflection mediate the relation of rumination with traumatic stress and post-traumatic growth.

We found different patterns of relationships for brooding and reflection. The effect of brooding was independent of recollection and highly robust on traumatic stress. Individuals with high brooding reported more traumatic stress regardless of how vivid they remember the pandemic memories. Current evidence is in line with event versus person distinction proposed by Rubin et al. (2008), suggesting that although events evoke fear and helplessness, not all individuals develop severe negative reactions, and individual vulnerabilities such as ruminative thinking has a substantial role that mitigates emotional responses in the aftermath of traumatic experiences. As the maladaptive form of rumination, brooding over negative experiences activates negatively biased, rigid, self-focused thoughts, which strengthens the self-event connection. As the event is perceived more central to one's identity, the emotional impact of the event persists and could magnify the traumatic stress reactions.

On the other hand, for reflection, we demonstrated a full mediation. While the direct effect of reflection on traumatic stress and growth was nonsignificant, its indirect effect over recollective experience was significant. High reflection was associated with the more vivid recollection of negative experiences, which predicted higher levels of traumatic stress but also higher traumatic growth. Although we expected that reflection would help self-regulation by allowing individuals to abstract negative experiences and thus reduce their recollection, the findings revealed that reflection actually enhanced recollection. However, this is not surprising because reflection, while providing an emotionally detached perspective, may also serve as a rehearsal that consolidates the event information. This consolidation process may enhance recollection of the event, making it more vivid and accessible. As a result, the individual may experience greater levels of stress related to the traumatic event, but at the same time, the process of reflection can also lead to growth and positive change. The enhanced recollection thus serves as a catalyst for the individual to revisit, process, and make meaning of their experiences. These results extend previous findings on the positive relationship between reflective components of rumination and post-traumatic growth (e.g., Cui et al., 2021) and reveal a potential mechanism by which rumination has been linked to post-traumatic reactions.

Furthermore, it is critical that reflection has indirect links with both traumatic stress and traumatic growth. One reason for this could be that, when the data was collected, the pandemic was not over. Since the context that triggered the stress reactions was active, emotional stress may persist although individuals experience the positive outcomes of the post-traumatic growth. The other reason could be that we measured stress and growth reactions at the same time, 3 months after we asked for the pandemic memories. This 3-month time frame may allow for the processing of immediate, intense reactions to the traumatic event, but it may not be enough to observe the long-term effects of post-traumatic growth. Given that post-traumatic growth is a process that follows traumatic stress, it is reasonable to argue that 3 months may not allow individuals to fully overcome the negative impact of traumatic experiences. Recent research has shown that frontline healthcare workers displayed symptoms of post-traumatic growth 7 months after the first peak of the pandemic (Feingold et al., 2022). The simultaneous occurrence of stress and growth could indicate a period of reconciliation and adaptation to the ongoing adverse situation.

It is important to note that our focus was on rumination as a cognitive style, which may either make individuals vulnerable or provide protection when dealing with adverse experiences. While some studies have explored the extent of rumination for specific events (e.g., Cann et al., 2011), we suggest that the prolonged duration of the pandemic and its recurring events make ruminative tendencies more relevant in characterising long-term cognitive responses to such events. Additionally, event-related rumination can distinguish between intrusive and deliberate rumination in the aftermath of emotionally intense experiences. While deliberate rumination has been associated with posttraumatic growth, intrusive rumination can increase vulnerability to posttraumatic stress. Although different from reflection and brooding in concept, deliberate rumination functions similarly to prevent avoidance and facilitate event processing, while intrusive rumination is less flexible and uncontrolled, operating through a mechanism similar to brooding. Consequently, we posit that both types of rumination would have similar effects on stress and growth responses to trauma.

Finally, an alternative model could be proposed that more vivid, emotionally intense memories may activate ruminative tendencies, which may then enhance emotional responses to trauma. However, rather than this model in which rumination acts as the mediator, we believe the model we tested makes conceptually more sense for two main reasons. First, in our study, we utilised a conceptual formulation which proposes that individual differences, such as rumination as a cognitive style, are associated with the processing of events, subsequently predicting the emotional and behavioural outcomes of these events. While we did not test other theoretically relevant constructs, such as emotion regulation style or anxiety sensitivity, we chose to focus on brooding and reflection as distinct ruminative tendencies for their potential long-term effects. In our model, individual-specific variables precede event formation, which is why we utilised rumination as a predictor rather than a mediator. Additionally, an alternative model may be more appropriate for examining event-related rumination. It is possible that the vivid representation of negative events triggers event-focused ruminative rehearsals. However, the Ruminative Response Scale (RRS) used in our study does not specifically measure individuals engaged in rumination over a reported event. Furthermore, recollection is a dynamic process, and depending on the extent of rehearsal and rumination, the content and strength of recollection may vary. In contrast, RRS measures a relatively stable form of rumination, such as cognitive style. Thus, we propose that the model is conceptually more meaningful when recollection serves as the mediator, however, future studies could test alternative explanations, using both relevant measures of individual-level (e.g., emotion regulation) and event-level differences (e.g., event-related rumination).

4.3 | Limitations and implications

The current study has several limitations. First, we collected data at two time points to see how memory processes would influence the traumatic stress and growth reactions over time. Although the first data collection was done during the height of the pandemic in Turkey, the emotional context of the pandemic had not yet subsided within the 3 months between data collection. This may have resulted in traumatic stress reactions still being present alongside the growth process. Future studies should explore the long-term emotional responses to the pandemic to address this limitation.

Second, we focused on the impact of vicarious traumatic stress and growth, rather than the effect of direct experiences. The pandemic has led to a collective psychological trauma caused by both personal experiences, such as isolation and health-related worries, and the experiences of others. In this sense, healthcare workers on the frontlines have been exposed to some of the most dramatic experiences. Thus, we believe that the trauma and subsequent growth observed in this study may be a result of vicarious experiences. Indeed, current findings support previous research showing that responses to vicarious trauma are similar to those to direct trauma in the context of the pandemic (Holmes et al., 2021; Li et al., 2020).

Third, we tested the role of recollection as the mechanism underlying the link between brooding and post-trauma reactions; however, this link could operate through event centrality as well since the importance attached to events may shape how events are represented in the mind and affect subsequent behaviours (see Berntsen & Rubin, 2006a, b). Future research could test the relative contribution of recollection and event centrality to the rumination-related changes in traumatic stress and growth.

Last, we investigated rumination as a cognitive style to cope with adverse life events; however, we did not assess the degree to which individuals engage in rumination over those experiences that had a significant impact on their lives. Although existing evidence sheds light on the role of rumination in shaping memory processes and emotional responses to traumatic experiences, future studies could examine rumination as a self-regulation technique and evaluate its impact on emotional responses to distressing events.

Our findings have important implications. The different patterns of relationships for brooding and reflection highlight the importance of considering the role of both forms in understanding post-trauma reactions. The strong link between brooding and traumatic stress may suggest an alternative or clinicians that rather than working on reframing the trauma, they may address brooding in their therapeutic work. Especially in the context of extended trauma, as brooding declines, individuals may be better able to engage in more productive forms of processing, allowing them to reconstruct a more adaptive event representation. In addition, the evidence of reflection predicting traumatic growth suggests that reflection could not only be a resilience factor but also it may positively influence an individual's recovery from traumatic events. Thus, by understanding an individual's particular brooding and reflection patterns, it becomes possible to tailor and improve treatment approaches for individuals after they experience a traumatic event.

Taken together, the understanding of an individual's specific pattern of brooding and reflection can inform the development of personalised and effective treatment approaches in the aftermath of traumatic events. Critically, it is important to note that our findings are based on a specific traumatic event (i.e., COVID-19 pandemic) and may not be generalised to other types of traumatic events. Additionally, the pandemic has not affected everyone in the same way. Research has shown the disproportionate effects of the pandemic depending on geography, gender, race, socioeconomic status, and age (e.g., Odone et al., 2020; Ruprecht et al., 2021). Further research is needed to understand the broader implications of these findings and to inform the development of evidence-based treatments and intervention studies.

5 | CONCLUSION

In the present study, we considered the COVID-19 pandemic as a trauma for healthcare professionals not only because of the uncertainty in their personal lives and professional practice, but also because they witnessed how patients have been suffering, which put them under excessive emotional strain for a long period of time. Our findings provided support for the relationship of rumination with traumatic stress and post-traumatic growth. However, current evidence also demonstrated the distinct mechanisms for the two types of rumination. While brooding by itself is a strong vulnerability factor that enhances traumatic stress, reflection operates over memory representations and has an indirect effect over post-trauma reactions. Reflection which acts as a further elaboration over the event influences the recollective features, such as the intensity and vividness of memories, and the altered memory representations predicted the extent of traumatic stress and growth. Although current findings showing a comparable pattern of relationships for traumatic stress and growth are inconsistent with previous evidence, we believe future studies conducted when the effects of the pandemic subside will further expand our understanding of the role of memory processes in how individuals respond to the traumatic experiences.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author [SÖ]. The data are not publicly available due to restrictions that could compromise the privacy of the participants (e.g., detailed experiences with patients).

ETHICS STATEMENT

Procedures performed in our study were in accordance with the ethical standards of the institutional and/or national research committees and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. The study protocol reported in this article were approved by the Institutional Board of Ethics of the Kadir Has University.

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ENDNOTE

[1] Valence and psychological distance were measured as part of the memory characteristics, but they were not included in the structural model. The sample consisted of medical professionals who had experienced intense and uncertain events and witnessed serious losses, resulting in no positively valenced memories being reported. Furthermore, valence is not considered a feature of recollection (Fitzgerald & Broadbridge, 2013). For the psychological distance, despite being an important feature that represents the saliency of an event (Janssen et al., 2022), it has been conceptualized as a metacognitive feature of memory. For these reasons and also for model parsimony, these variables were not included in the model.

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