


Event centrality and post-traumatic stress symptoms among college students during the COVID-19 pandemic: the roles of attention to negative information, catastrophizing, and rumination

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ABSTRACT

Background: The coronavirus disease 2019 (COVID-19) pandemic has affected college students' mental health and caused post-traumatic stress symptoms (PTSS). Event centrality is thought to play a key role in the development of PTSS, but it is not yet clear by what mechanism. Theoretically, event centrality may affect the retrieval of traumatic memories and further prompt post-traumatic cognitions to understand events, and so may in turn be associated with PTSS in college students. However, few empirical studies have examined the mediating role of post-traumatic cognitions in the relationship between event centrality and PTSS, especially among college students during the COVID-19 pandemic.

Objectives: The objective of this study was to examine the mediating roles of post-traumatic cognitive factors (e.g. attention to negative information, catastrophizing, and rumination) in the relationship between event centrality and PTSS among college students during the COVID-19 pandemic.

Methods: We recruited 1153 college students who completed the pandemic experiences scale, the centrality of event scale, the attention to positive and negative information scale, the cognitive emotion regulation questionnaire, and the PTSD Checklist for DSM-5 during the COVID-19 pandemic in May 2020.

Results: In this sample of college students, event centrality directly predicted PTSS, and PTSS was also indirectly predicted by event centrality through attention to negative information, catastrophizing, and rumination.

Conclusions: These findings support the existing literature on the relationship between event centrality, proposed cognitive variables, and PTSS, and shed light on the mechanisms underlying PTSS. Our findings also highlight the importance and applicability of targeted cognitive interventions for PTSS in college students during the COVID-19 pandemic.

Centralidad del evento y síntomas de estrés postraumático entre estudiantes universitarios durante la pandemia de COVID-19: Los roles de la atención a la información negativa, catastrofización y rumiación

Antecedentes: La pandemia de enfermedad coronavirus 2019 (COVID-19) ha afectado la salud mental de los estudiantes universitarios y causado síntomas de estrés postraumático (PTSS por sus siglas en inglés). Se cree que la centralidad del evento juega un rol importante en el desarrollo de PTSS, pero aún no está claro por qué mecanismo. Teóricamente, la centralidad del evento podría afectar la recuperación de los recuerdos traumáticos y estimular cogniciones postraumáticas para comprender los eventos y así su vez, podría estar asociada con PTSS en estudiantes universitarios. Sin embargo, pocos estudios empíricos han examinado el rol mediador de las cogniciones postraumáticas en la relación entre centralidad del evento y PTSS, especialmente entre estudiantes universitarios durante la pandemia de COVID-19.

Objetivos: El objetivo de este estudio fue examinar los roles mediadores de los factores cognitivos postraumáticos (ej.: atención a información negativa, catastrofización y rumiación) en la relación entre centralidad del evento y PTSS entre los estudiantes universitarios durante la pandemia de COVID 19.

Método: Reclutamos 1.153 estudiantes universitarios que completaron la escala de experiencias pandémicas, la escala de centralidad del evento, la escala de atención a la información positiva y negativa, el cuestionario de regulación cognitiva de las emociones y la lista de chequeo de TEPT para el DSM-5 durante la pandemia de COVID-19 en mayo del 2020.

Resultados: En esta muestra de estudiantes universitarios, la centralidad del evento predijo directamente PTSS, y PTSS fueron también predichos indirectamente también por la centralidad del evento través de la atención a la información negativa, catastrofización y rumiación.

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PALABRAS CLAVE

Centralidad del evento; PTSS; atención a la información negativa; catastrofización; rumiación

关键词

事件中心性; PTSS; 关注负面信息; 灾难化; 反刍

HIGHLIGHTS

- The COVID-19 pandemic has caused post-traumatic stress symptoms among college students.
- Event centrality is a risk factor of post-traumatic stress symptoms among college students during the COVID-19 pandemic.
- Attention to negative information, catastrophizing and rumination mediate the relationship between event centrality and post-traumatic stress symptoms.

Conclusiones: Estos hallazgos apoyan la literatura existente en la relación entre centralidad del evento, las variables cognitivas propuestas y PTSS y arrojan luz sobre los mecanismos subyacentes a PTSS. Nuestros hallazgos destacan también la importancia y aplicabilidad de las intervenciones cognitivas dirigidas a los PTSS en estudiantes universitarios durante la pandemia de COVID-19.

COVID-19疫情期间大学生的事件中心化和创伤后应激症状：消极注意偏向、灾难化和反刍的作用

背景: 2019年新型冠状病毒肺炎(COVID-19)疫情影响了大学生的心理健康,并引发其创伤后应激症状(PTSS)。事件中心化被认为在PTSS的发展中起关键作用,但其内在机制尚不清楚。理论上,事件中心化可能会影响创伤记忆的提取,并进一步促进个体的创伤后认知来理解事件,因此可能与大学生的PTSS相关。然而,较少有实证研究考查创伤后认知在事件中心化与PTSS之间的中介作用,尤其是在COVID-19疫情期间的大学生群体当中。

目的: 本研究旨在探究COVID-19疫情期间大学生的创伤后认知因素(例如,消极注意偏向、灾难化和反刍)在事件中心化和PTSS之间的中介作用。

方法: 我们在2020年5月COVID-19疫情期间招募了1153名大学生,并采用疫情暴露量表、事件中心化量表、积极/消极注意偏向量表、认知情绪调节问卷和DSM-5 PTSD核查表对大学生进行测试。

结果: 在该大学生样本中,事件中心化可以直接预测PTSS,也可以通过消极注意偏向、灾难化和反刍来间接预测PTSS。

结论: 这些结果支持了事件中心化、创伤后认知变量和PTSS之间关系的现有文献,并阐明了PTSS的潜在机制。本研究结果还强调了在COVID-19疫情期间对大学生PTSS进行有针对性的认知干预的重要性和适用性。

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic is a threatening and potentially traumatic stressor (Karatzias et al., 2020; Kira et al., 2021). It has not only affected individuals' lives, but has also caused mental health problems, such as anxiety, depression, and post-traumatic stress symptoms (PTSS) (Peng et al., 2020; Wen, Ma, Ye, Qi, & Zuo, 2020). The International Classification of Diseases (11th Revision, ICD-11; WHO, 2018) defines PTSD as a disorder that occurs after 'exposure to an extremely threatening or horrific event or series of events.' As the most severe public health crisis since the outbreak of Severe Acute Respiratory Syndrome (SARS) in 2003, COVID-19 has caused substantial fear of infection and death, and thus meets the criteria for a traumatic event (Sun & Zhou, 2022). PTSS has been reported to be a common negative psychological response during the COVID-19 pandemic (Carmassi et al., 2020), and thus it has received much attention from those engaged in trauma research. However, these studies have not considered college students. College students are more susceptible to mental health problems because of their lack of life experience, unstable mental state, or emotional instability (Shu, Liao, & Qin, 2021). As the COVID-19 pandemic continues, strict isolation measures have been adopted and the start of school has been delayed, and this has greatly affected the mental health of college students (Cao et al., 2020). Researchers have found that the prevalence of PTSS among college students is between 2.7% and 29.8% (Batra, Sharma, Batra, Singh, & Schvaneveldt, 2021; Tang et al., 2020). Considering this high prevalence of PTSS among college students, and that they may be more

prone to develop PTSS, it is of practical significance to explore the matter further.

Although PTSS is a common psychological problem experienced by many people during the COVID-19 pandemic, not everyone develops PTSS. Drawing from Brooks et al.'s (2017) cognitive growth and stress model, we considered a key risk factor to be event centrality. Event centrality refers to the extent that individuals construct the traumatic event as a reference point to understand oneself and the world (Berntsen & Rubin, 2007). When a traumatic event is central to a person's life or becomes an important part of their identity, event-related memories are more readily available, which facilitates cognitive processes involved in the development of PTSS, and contributes to PTSS (Brooks, Graham-Kevan, Lowe, & Robinson, 2017). Empirical studies have supported the viewpoint of Brooks et al. (2017), showing that event centrality can positively predict PTSS (Boykin, Anyanwu, Calvin, & Orcutt, 2020; Webermann et al., 2020). Therefore, event centrality may explain why certain college students develop PTSS and others do not.

Furthermore, post-traumatic cognitions are also key factors in the development of PTSS. Cognitive theories of PTSS (Ehlers & Clark, 2000; Foa, Ehlers, Clark, Tolin, & Orsillo, 1999) have suggested that cognitive risk factors, such as attentional bias, could put individuals at risk for developing PTSS. Attentional bias usually manifests as a tendency to focus on threatening stimuli or information, difficulty in withdrawing attention from relevant stimuli, or trying to avoid stimuli (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007). According to the cognitive framework of PTSS, trauma-related cues trigger negative emotions and activate the fear system

in an individual's brain, which orients attention to trauma-related information and makes it difficult for an individual to disengage from threatening stimuli (Foa, Feske, Murdock, Kozak, & McCarthy, 1991; Pineles, Shipherd, Mostoufi, Abramovitz, & Yovel, 2009; Weierich, Treat, & Hollingworth, 2008). This can reinforce an individual's negative emotional experience and further exacerbate PTSS (Mazidi, Vig, Ranjbar, Ebrahimi, & Khatibi, 2019; Schafer, Zvielli, Hofler, Wittchen, & Bernstein, 2018). Although both event centrality and attentional bias are related to PTSS, attentional bias may play a mediating role between event centrality and PTSS. According to research, when individuals regard an event as central to their lives, the event is easily incorporated into their existing schema; this makes event-related memories easier to retrieve, which may lead an individual to employ additional cognitive mechanisms to understand the event (Brooks et al., 2017; Lancaster, Klein, Nadia, Szabo, & Mogerma, 2015). When an individual engages in reasoning and judgment with reference to negative events, it is easier for them to pay attention to information that negatively affects or threatens their current situation than other information (Berntsen & Rubin, 2006; Boykin & Teng, 2019). It is possible that event centrality may direct attention to negative information, and thereby further contribute to the development of college students' PTSS during the COVID-19 pandemic.

In addition to discussing the impact of attention to negative information, Ehlers and Clark's (2000) cognitive model proposed that the negative cognitions associated with both an event and its consequences would make individuals feel threatened. This prompts them to adopt a series of maladaptive cognitive strategies to cope with the event, which could ultimately impact PTSS (Chukwuorji, Ifeagwazi, & Eze, 2017; Kulkarni, Pole, & Timko, 2013). Following a traumatic experience, individuals commonly experience two maladaptive cognitive strategies, (i.e. catastrophizing and rumination) (Hiller et al., 2019; Müller et al., 2019). When perceiving an event, those individuals who catastrophize tend to exaggerate the threat of an event and overestimate its severity (Ellis, 1962); this reinforces their traumatic experience and thus can exacerbate PTSS (Avishai-Cohen & Zerach, 2020). Furthermore, catastrophizing may also mediate the effect of event centrality on PTSS among college students. The negative emotions and cognitions associated with a particular event can distort an individual's perception of subsequent events (Keshet, Foa, & Gilboa-Schechtman, 2019).

As another maladaptive cognitive strategy strongly associated with PTSS (Moulds, Bisby, Wild, & Bryant, 2020), rumination causes traumatized individuals to think passively and repeatedly about their own distress and its causes and consequences (Nolen-Hoeksema,

1991). This increases focus on the negative aspects of the event and hinders effective cognitive and emotional processing of traumatic information (Foa & Kozak, 1986; Teasdale, 1999), thereby exacerbating psychological distress and increasing the risk of PTSS (Zhu, Zhang, Zhou, Li, & Yang, 2021). Like catastrophizing, rumination may also mediate the association between event centrality and PTSS in college students. Event centrality can cause immersion in post-traumatic negative emotions and memories and facilitate the retrieval of traumatic memories (Deprince, Zurbriggen, Chu, & Smart, 2010; Ehlers & Clark, 2000). As this can then result in intrusive feelings and thoughts, it may trigger rumination. Rumination is not only unhelpful in alleviating PTSS, but it can also exacerbate PTSS (Berntsen & Rubin, 2007).

Furthermore, previous studies have reported relationships between attention to negative information, catastrophizing, and rumination. For example, attentional bias of traumatized individuals is related to their cognitive emotional regulation (Bardeen, Daniel, Hinnant, & Orcutt, 2017; Swick & Ashley, 2017). The attentional bias causes individuals to focus on negative aspects of events, which intensify their negative emotional experience (Bardeen & Orcutt, 2011; Xie et al., 2020), thus allowing them to exaggerate the event's negative outcomes. In addition, after negative cognitive bias has been generated, traumatized individuals will try to inhibit attention to traumatic cues and the resulting negative emotions, but this inhibition often leads to the opposite effect (Dunn, 2004). This instead increases the likelihood that these cues and emotions intrude into their cognition (Shipherd & Beck, 1999), leading to rumination. It suggests that attention to negative information can elicit catastrophizing and rumination, wherein catastrophizing may also be a risk factor for rumination. For example, when individuals make negative inferences about events, such as exaggeration and catastrophizing, they may experience a greater sense of threat and other negative experiences. These emotions and experiences may induce intrusive feelings and thoughts, as well as rumination (Michael, Halligan, Clark, & Ehlers, 2007).

Each of the above cognitive factors has a separate effect on PTSS, and these factors interrelate to form the underlying cognitive mechanism that affects PTSS. Although Lancaster, Rodriguez, and Weston (2011) did in fact explore the mediating role of post-traumatic cognition in the association between event centrality and PTSS, they treated post-traumatic cognition as a broad and integrated concept. In comparison, our research explores post-traumatic cognition from a more granular and specific perspective, and considers attentional bias and cognitive regulation separately. Moreover, while some key theoretical

models have been proposed, few studies have integrated and tested the existing models. To this end, we integrated Brooks et al.'s model and Ehlers and Clark's cognitive model of PTSS to examine the relationships between event centrality and post-traumatic cognitions, as well as their impact on PTSS. Specifically, our aim was to examine the roles of event centrality, attention to negative information, catastrophizing, and rumination in PTSS in college students during the pandemic.

A number of researchers have investigated PTSS caused by the COVID-19 pandemic in both medical professionals and the general population. Nevertheless, there have been relatively few studies on the cognitive mechanisms underlying PTSS in college students in this context. Given that they may be more prone to stress symptoms like PTSS, it is necessary to understand the psychological response of college students to the COVID-19 pandemic and its underlying mechanisms. This will in turn inform clinicians about possible treatment and intervention. Based on the above theories and studies, we hypothesized that event centrality would directly predict PTSS, and that attention to negative information, catastrophizing, and rumination would play a mediating role in the relationship between event centrality and PTSS among college students (see Figure 1).

2. Methods

2.1. Participants and procedures

This study was conducted from 9 May to 15 May 2020, during the COVID-19 pandemic, and participants were college students. Given that universities were closed during this period to reduce COVID-19 transmission in teachers and students, we conducted an Internet-based survey to assess college students' psychological responses to the COVID-19 pandemic. Using the WeChat platform (a free messaging and calling app that is popular in China), we sent the questionnaires to college counsellors and asked them to send questionnaires to their students to fill in. In this way, we collected data from 1153 students in several provinces in China. The mean age of participants was 20.2 years ($SD = 1.38$), and the age range was 17–25 years. Among these participants, 602 (52.2%) were female, and 551 (47.8%) were male; 665 students (57.7%) came from a rural area, and 488 (42.3%) lived in a city; 313 (27.1%) had been in love, and 475 (41.2%) were an only child.

This project was approved by the Research Ethics Committee of Department of Psychology and Behavioural Sciences, Zhejiang University. Participation was completely voluntary, and participants could choose to withdraw from the study at any time. Informed consent was obtained from all participants.

No compensation was provided for any participants, and graduate students were excluded in this study.

2.2. Measures

2.2.1. Pandemic exposure

Zhen and Zhou's (2020) Pandemic Experiences Scale was used to assess pandemic exposure. This scale has 10 items (e.g. 'I have been infected during the COVID-19 pandemic' and 'I have been quarantined during the COVID-19 pandemic'), each of which is rated as 'No' (1) or 'Yes' (2). The total score ranges from 0 to 20, whereby a higher score indicates higher pandemic exposure severity. The scale showed good reliability in this study (Cronbach's $\alpha = 0.68$).

2.2.2. Centrality of events

Berntsen and Rubin's (2006) Centrality of Event Scale was used to assess event centrality. The scale includes seven items (e.g. 'I feel that this event has become a central part of my life story'), each of which is rated on a 5-point scale, wherein 1 represents 'totally disagree' and 5 represents 'totally agree'. The overall score ranges from 7 to 35, whereby a higher score indicates a higher level of event centrality. In this study, we translated the original English version of the scale into Chinese, and rewrote items to ensure that the meaning was consistent before and after translation. In this study, the scale showed good reliability (Cronbach's $\alpha = 0.82$).

2.2.3. Attention to negative information

The attention to negative information subscale is derived from the Attention to Positive and Negative Information Scale revised by Lv, Guo, and Zhang (2016). This subscale has 11 items (e.g. 'I worry that bad things may happen to me'), and each item is rated on a 5-point Likert scale, wherein 1 represents 'totally disagree' and 5 represents 'totally agree'. The total score of the scale ranges from 11 to 55, whereby a higher score indicates a higher level of attention to negative information. This subscale showed good reliability (Cronbach's $\alpha = 0.90$) in this study.

2.2.4. Catastrophizing and rumination

Catastrophizing and rumination were assessed by the catastrophizing and rumination subscales of the Chinese version of Cognitive Emotion Regulation Questionnaire, respectively (Zhu, Luo, Yao, Auerbach, & Abela, 2007). The two subscales each have four items (e.g. 'I am immersed in feelings and thoughts about my pandemic experiences'; 'I think my pandemic experience is worse than other people's'), which are rated on a 5-point Likert scale ranging from 0 ('completely disagree') to 4 ('completely agree'). For the catastrophizing subscale, the total score ranges from 0 to

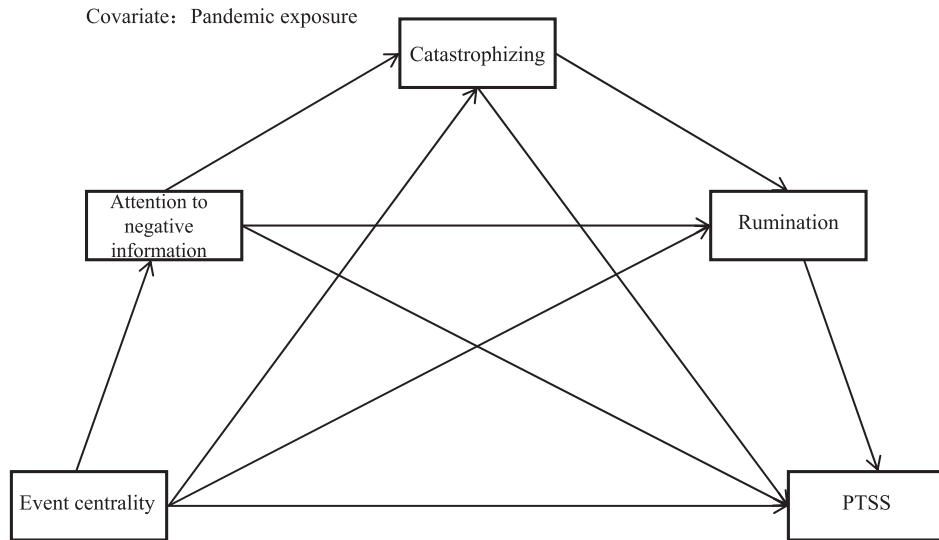


Figure 1. Hypothesis and conceptual model of the multiple mediation effect.

16, whereby a higher score indicates a higher level of catastrophizing. The same is true for the rumination subscale. The current study showed that these two subscales had good reliability (Cronbach’s alpha = 0.92 for catastrophizing and rumination).

2.2.5. PTSS

The PTSD Checklist for DSM-5 (Weathers et al., 2013) was used to assess PTSS caused by the pandemic. The scale has 20 items, and it is composed of the following four subscales: intrusions, negative cognition and emotion alteration, avoidance, and hyperarousal. In the present study, all respondents rated the frequency of symptoms during the last 2 weeks on a 5-point Likert scale that ranged from 0 (‘not at all/only once’) to 4 (‘almost every day’). The overall score ranges from 0 to 80, whereby a higher score indicates a higher PTSS severity. In this sample, the scale demonstrated good internal consistency (Cronbach’s alpha = 0.96).

2.3. Data analysis procedures

All questions were set to be mandatory in this Internet-based survey, so there were no missing data. Descriptive analysis of all data was performed using

SPSS 19.0, and Mplus 7.0 software was used to build the multiple mediation model. To evaluate the model fit, we used chi-square values, the comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). The general cutoffs for model acceptance were ≥ 0.90 for the CFI and TLI, and < 0.08 for the SRMR and RMSEA.

Based on Brooks et al.’s (2017) cognitive growth and stress model and Ehlers and Clark’s (2000) cognitive model, we constructed a conceptual model (see Figure 1) and tested the following hypotheses: (1) that event centrality directly predicts PTSS; and (2) that attention to negative information, catastrophizing, and rumination mediate the relationship between event centrality and PTSS. First, we built a model to investigate the direct predictive effect of event centrality on PTSS. Then, we constructed a multiple mediating effect model (Hayes, 2013) to investigate the roles of attention to negative information, catastrophizing, and rumination in mediating the relationship between event centrality and PTSS. Next, we performed bias-corrected bootstrap tests with 95% confidence intervals (CIs) (Preacher & Hayes, 2008) to evaluate the significance levels of the indirect effects observed in the

Table 1. Correlations between pandemic exposure, centrality of events, attention to negative information, catastrophizing, rumination, and PTSS.

Variables	<i>M</i> ± <i>SD</i>	1	2	3	4	5
1. Pandemic exposure	12.43 ± 1.68	1.00				
2. Event centrality	19.98 ± 4.73	0.09**	1.00			
3. Attention to negative information	29.72 ± 7.98	0.09**	0.45***	1.00		
4. Catastrophizing	6.21 ± 2.99	0.02	0.31***	0.42***	1.00	
5. Rumination	6.76 ± 3.10	0.03	0.36***	0.44***	0.79***	1.00
6. PTSS	44.73 ± 13.34	0.07*	0.42***	0.69***	0.60***	0.58***

**p* < .05.
 ***p* < .01.
 ****p* < .001.

parsimonious model. We controlled for pandemic exposure as a covariate in all models.

3. Results

3.1. Descriptive statistics and correlations between the main variables

Table 1 shows the correlation analysis results. Pandemic exposure was significantly associated with event centrality, attention to negative information, and PTSS; therefore, it was controlled for as a covariate in the following analyses. Event centrality was positively correlated with attention to negative information, catastrophizing, rumination, and PTSS. There were also significant positive correlations between attention to negative information, catastrophizing, rumination and PTSS. Catastrophizing was significantly and positively correlated with rumination and PTSS, and rumination was also significantly and positively correlated with PTSS.

3.2. Examination of the multiple mediation effect

Based on the hypothesized multiple mediation model, structural equation modelling was used to examine the mediating effect of attention to negative information, catastrophizing, and rumination in the indirect model of event centrality predicting PTSS. Before examining the mediating effect, we first analyzed the direct effect of event centrality on PTSS. The model had good fitting indices ($\chi^2/df = 0.00$, CFI = 1.00, TLI = 1.00, RMSEA (90% CI) = 0.00 (0.00–0.00), SRMR = 0.00). The path analysis revealed that event centrality significantly predicted PTSS after controlling for pandemic exposure ($\beta = 0.42$, $p < .01$).

Next, attention to negative information, catastrophizing, and rumination were added to the direct effect model of event centrality to predict PTSS, and a multiple indirect effect model was constructed. The model fit well ($\chi^2/df = 0.00$, CFI = 1.00, TLI = 1.00, RMSEA = 0.00, SRMR = 0.00). All the paths were significant after controlling for pandemic exposure. Event centrality had both a direct and indirect effect on PTSS. Attention to negative information, catastrophizing, and rumination partially mediated the relationship between event centrality and PTSS (Figure 2).

To assess the significance of these pathways, we used bias-corrected bootstrap CIs, where a pathway was considered significant if the 95% CI for the pathway coefficient did not include zero. Following this criterion and the bootstrap results (see Table 2), we found that the path from event centrality to PTSS did not include zero, which further confirmed its significance.

4. Discussion

This study explored the mechanisms underlying PTSS in college students during the COVID-19 pandemic from a cognitive perspective. Our results support the models proposed by Brooks et al. (2017) and Ehlers and Clark (2000), confirming their applicability to this population. These findings highlight the important role of post-traumatic cognitions in college students with PTSS, and deepen our understanding of the cognitive mechanisms that contribute to the students' reactions to trauma. They also illustrate that, despite the fact, college students made an effort to recognize and understand the events that occurred during the COVID-19 pandemic, this may have been counterproductive because of maladaptive coping mechanisms. Therefore, interventions should help college students to establish positive and adaptive cognitive strategies, so as to alleviate their negative reactions.

Our finding that event centrality directly predicted PTSS supports the theory of Brooks et al. (2017) and previous findings (Boykin et al., 2020; Webermann et al., 2020). Together, this suggests that regarding the COVID-19 pandemic as a central event to understand oneself and the world is likely to trigger PTSS. During the pandemic, event centrality may strengthen the pandemic-related memory of college students, which may trigger their negative emotional experience and increase the appearance of intrusive thinking (Boals, Griffith, & Southard-Dobbs, 2020; Mordeno, Galela, Nalipay, & Cue, 2018), thereby leading to PTSS.

In addition, event centrality had an indirect effect on PTSS through attention to negative information, catastrophizing, and rumination. This not only supports the view of PTSS-related models (Ehlers & Clark, 2000), but also shows that post-traumatic cognitions play an intermediary role in the relationship between event centrality and PTSS (Vermeulen, Brown, Raes, & Krans, 2019). That is, event centrality promotes the occurrence of related cognitive mechanisms (Lancaster et al., 2015), and thus affect PTSS. Specifically, when college students understand the COVID-19 pandemic event as central to life or identity, it will cause them to focus on threatening information related to their current situation, and thus to ignore other information (Berntsen & Rubin, 2006; Boykin & Teng, 2019). This could lead to excessive alertness to potential dangers and ultimately trigger PTSS (Bardeen & Orcutt, 2011). Moreover, as individuals develop event-centered cognitions, event-related negative emotions and cognitive content may distort their perception of subsequent events (Keshet et al., 2019). On the one hand, this may make them overestimate the likelihood of the event happening again and lead to catastrophizing, which in turn triggers a

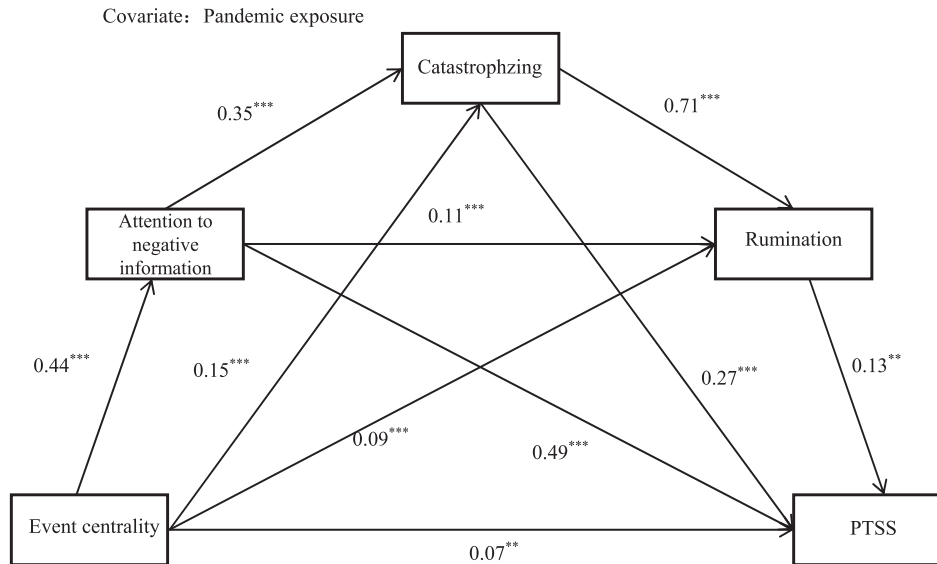


Figure 2. Mediating roles of attention to negative information, catastrophizing, and rumination in the relationship between event centrality and PTSS.

persistent sense of threat and maintains PTSS (Ehlers & Clark, 2000). On the other hand, this also means individuals will engage in rumination to understand the meaning of negative events, even if they do not think about the event itself (Ehlers & Steil, 1995), which induces negative emotions and thoughts, and increases the risk of persistent PTSS.

We also found that attention to negative information, catastrophizing, and rumination were associated with each other in pairs, and that these three factors played multiple mediating roles in the relationship between event centrality and PTSS. This supports the viewpoint that individuals with negative attentional bias also exhibit negative interpretation bias (Rozenman, Amir, & Weersing, 2014; Yang, 2019). These findings also support the theoretical views of Ehlers and Clark (2000) and Brooks et al. (2017), and suggest that negative cognitions may influence one another to increase the risk of PTSS (Elwood, Hahn, Olatunji, & Williams, 2009). When college students with event centrality focus their attention on threatening information, their fears and concerns about the pandemic may intensify, promoting catastrophizing of the event, and thus enhance their threat perception. To cope with such negative perception, individuals may subsequently adopt ruminative cognitive avoidance strategies (Michael et al., 2007).

However, this can intensify their intrusive memories, produce negative cognitions and emotions, and trigger PTSS.

This study has some limitations that should be noted. First, our study was cross-sectional and self-reported. Thus, future longitudinal or experimental studies should examine the relationship between the cognitive variables examined in this study. Second, this study explored PTSS on a symptom level, and did not compare the possible differences between the clinical PTSS group and the non-clinical PTSS group. Third, we did not measure other traumatic events that participants may have experienced, so the impact of these experiences is unknown. Fourth, given that participants could opt out if they felt uncomfortable answering questions, this could have led to sampling bias. Finally, research findings may differ according to backgrounds, cultures, and groups. This study explored PTSS in college students in China during the COVID-19 pandemic, so our conclusions are only applicable to this group.

Notwithstanding these limitations, this study contains implications for both further research and clinical practice. Our study integrated the models of Brooks et al. and Ehlers and Clark to examine the cognitive mechanisms of PTSS, and suggested that event centrality, attention to negative information,

Table 2. Bias-corrected Bootstrap test of mediating effects.

Indirect path	Standardized estimates	95% CI	
		Lower	Upper
Event centrality-Attention to negative information-PTSS	0.21	0.18	0.25
Event centrality-Catastrophizing-PTSS	0.04	0.02	0.06
Event centrality-Rumination-PTSS	0.01	0.003	0.02
Event centrality-Attention to negative information-Catastrophizing-PTSS	0.04	0.03	0.06
Event centrality-Attention to negative information-Rumination-PTSS	0.01	0.002	0.01
Event centrality-Catastrophizing-Rumination-PTSS	0.01	0.004	0.03
Event centrality-Attention to negative information-Catastrophizing-Rumination-PTSS	0.01	0.005	0.02

catastrophizing, and rumination may reinforce each other to worsen PTSS, supporting and extending the viewpoints of prior models. In addition, previous research tended to explore post-traumatic cognition as a general construct rather than its specific forms; therefore, our findings further deepen and expand our understanding of post-traumatic cognition. Nonetheless, we hope that future studies, especially those using longitudinal methods like cross-lagged panel models, will further validate our results.

This study also has implications for clinical practice, and it could provide clinicians with insights into PTSS treatments and interventions. The existing literature revealed that treatments such as cognitive processing therapy, prolonged exposure therapy, and eye movement desensitization and reprocessing have all been used to relieve symptoms in individuals with PTSS (Asmundson et al., 2019; Lee & Cuijpers, 2013; Powers, Halpern, Ferenschak, Gillihan, & Foa, 2010). Our findings further emphasize the importance of post-traumatic cognitions, suggesting that interventions aimed at alleviating negative cognitions (e.g. cognitive processing therapy) among college students could help them recover from trauma. Although our findings suggest that post-traumatic cognitions are a key element in interventions for college students at risk of PTSS during the COVID-19 pandemic, the model needs further support. Future research could test the applicability of the model in other trauma populations and age groups, and explore the mechanisms underlying PTSS using longitudinal methods.

Data availability statement

The data that support the findings of this study are openly available in [osf.io] at <https://mfr.osf.io/render?url=https%3A%2F%2Fosf.io%2Fdeg54%2Fdownload>.

Disclosure statement

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