

The impact of stressful events on mental health among college students during the COVID-19 pandemic a study of the chain-mediated effects of cognitive mood and sense of meaning in life

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Abstract: To investigate the impact of stressful events during the COVID-19 pandemic on the mental health of contemporary college students and explore whether there is a mediating effect between emotional perceptions and the sense of meaning in life, we conducted a study. A self-administered questionnaire on post-pandemic stress events, a cognitive emotion regulation questionnaire, a questionnaire on the sense of meaning in life, and a psychological questionnaire on public health emergencies were administered to 1,644 college students (mean age (18.99 ± 1.18) years old) in Hunan Province from February 29 to March 2, 2023. The results revealed the following findings: ① College students generally experienced stressful events related to epidemics; ② Cognitive emotions and the sense of meaning in life partially mediated the effects between stressful events and college students' mental health; ③ The sense of meaning in life partially counteracted the harms of stressful events on mental health. The sense of meaning in life predicted negative cognitive emotions negatively but positively predicted mental health status. Additionally, the sense of meaning in life was positively predicted for negative cognitive emotions but negatively predicted mental health status; it was negatively predicted for negative cognitive emotions but positively predicted mental health status. The study highlights the crucial mediating role of cognitive emotions and the sense of meaning in life in the impact of stressful events on mental health. Therefore, colleges and universities should enhance education on the meaning of life and mental health to help students cope with stressful events and improve their psychological adaptability.

Keywords: COVID-19; Cognitive emotions; Sense of meaning in life; Mental health; Chain mediation

1. Introduction

The current epidemic of novel coronavirus pneumonia (Corona Virus Disease 2019, COVID-19) is under control but no clear end is in sight. The so-called post-epidemic era is an era in which the epidemic ebbs and flows, migrates for a longer period of time, and has far-reaching impacts on all aspects^[1]. In this context, it would be incomplete to focus only on the virus and the vaccine, rather than looking at the epidemic from a holistic perspective. According to the current study, some of the psychological symptoms experienced by patients with neo coronavirus pneumonia are not caused by the virus itself^[2]. Puertas-Gonzalez noted that pregnant women with COVID-19 have a higher prevalence of psychiatric disorders compared to patients with a range of other medical events, such as the general population of pregnant women.

Researchers have assessed the impact of the epidemic on the mental health of individuals^[3-5]. Surveys have shown that the prevalence of anxiety and depression among college students during the epidemic was 7.7% and 12.2%^[6]. Another survey showed that the prevalence of post-traumatic stress disorder (PTSD) and depression among college students was 2.9% and 9%^[7]. Most of the above psychological problems were triggered by epidemic-related stressful events, such as delayed start of school, prolonged home isolation, inability to go out, and disruption of daily life rhythm. Stress is an important risk factor for an individual's mental health and includes both sources of major life events (e.g., natural disasters) and daily stressful events (e.g., arguments)^[8]. It can be hypothesized that the accumulation of epidemic-

related stressful events predisposes individuals to more psychological risks and feelings of hopelessness about the future, and significantly predicts future psychological distress. In this context, college students are a particularly vulnerable group who face not only epidemic-related stress, but also stress related to academics, future employment prospects, and social relationships. These stresses may affect their cognitive mood and sense of meaning in life, which in turn may affect their mental health. For example, prolonged home isolation may lead individuals to feel lonely and helpless, which may affect their sense of meaning in life and mental health^[9]. Therefore, it is important to understand how epidemic-related stressful events affect individuals' cognitive emotions and sense of meaning in life, and how these factors affect their mental health.

Cognitive emotion is a complex psychological process involving attention, interpretation, and memory of emotional information^[10]. These processes can influence how individuals react to stressful events, which can affect their mental health. For example, individuals may attend to negative information, interpret events as threatening, or remember negative events, which may increase their levels of anxiety and depression^[11]. On the other hand, a sense of meaning in life refers to an individual's awareness of the purpose, value, and significance of their life^[12]. Individuals with a strong sense of meaning in life may be better able to cope with stressful events and maintain psychological well-being because they are able to find meaning and purpose in them.

However, it is unclear whether cognitive emotions and sense of meaning in life influence the impact of epidemic-related stressful events on the mental health of college students. Most studies have focused on the direct effects of epidemics on mental health without considering these potential mediators^[13]. Therefore, the present study aimed to fill this research gap by examining the mediating role of cognitive emotions and sense of meaning in life in the relationship between epidemic-related stressful events and college students' mental health. It is important to understand the impact of the COVID-19 pandemic on college student's mental health and the potential mechanisms by which this impact occurs. By examining the mediating role of cognitive emotions and sense of meaning in life, this study will contribute to a more comprehensive understanding of the relationship between stressful events and mental health. This knowledge can inform the development of interventions and support services for college students to help them better cope with the challenges posed by pandemics and other stressful events.

2. Research design

During the COVID-19 pandemic, the mental health of people around the globe was severely affected, especially college students as a group. Not only did they face changes in their curriculum and pressure to find employment, but they also had to cope with isolation from their families and friends, which put a great deal of stress on their mental health. Therefore, this study aimed to investigate the impact of stressful events on the mental health of college students during the COVID-19 pandemic and the chain-mediated effects of cognitive emotions and sense of meaning in life in this process.

3. Ethics procedures

In conducting this study, we will strictly adhere to the principles of research ethics. and through the review of the Ethical Governance Committee for Science and Technology (EGCST). First, we will clearly explain the purpose, process, possible risks, and benefits of the study to all participants before the study begins, and inform them of their right to withdraw from the study at any time. Second, we will ensure that the personal information of all participants is strictly protected and not disclosed to third parties. Finally, we will respect the wishes and decisions of all participants and will not exert any pressure on them.

4. Demographic

The subjects of this study were college students in a regional college in China.

5. Sample size, sample selection, and form of participation

This study conducted an online survey of 1,644 college students from four colleges and universities in a region of China from February 29 to March 2, 2023, using a convenience sample. Among them, 924 (56.2%) were male students and 720 (43.8%) were female students. The mean age of the overall sample

was 18.99 ± 1.18 years.

6. Sample size, sample selection, and form of participation Acquisition

6.1. Epidemic-related stress events

The self-administered epidemic-related stress events questionnaire was used to investigate the stress situation of college students in the past two weeks. In this study, an online questionnaire was first administered to 300 students in a university in Hunan province to screen out the eight most frequent epidemic-related stress events that occurred during the home isolation period. The final questionnaire consisted of the eight stressful events (see Table 1 for details of the eight stressful events). During the formal survey, the participating college students judged whether each stressful event brought them impactful stress according to their own situation (1=yes, 0=no), and the higher the total score, the more epidemic-related stressful events the college students experienced. The 8-entry questionnaire had acceptable internal consistency with a Cronbach alpha coefficient of 0.76.

Table 1: Status of epidemic-related stressful events among college students n (%).

Stressful event	Detection rate
1. Large number of web classes/online learning tasks	1240(75.4)
2. Information on the outbreak is overwhelming	1083(65.9)
3. Fear of contracting an epidemic	1067(64.9)
4. Long-term coexistence with parents	653(39.7)
5. You can't go out at will.	1290(78.5)
6. You must clock in every day to report on your health	892(54.3)
7. No meeting with friends/parties	1088(66.2)
8. Confirmed cases in the region	622(37.8)

6.2. Mental health status

The Psychological Questionnaires for Emergent Events of Public Health (PQEEPH)^[14] was used to investigate the psychological status of college students during the epidemic. The questionnaire was divided into two parts with 27 entries into five dimensions: depression, neurosis, near obsessive-compulsive anxiety, and hypochondriasis. In this study, the mean scores of the five dimensions were summed to obtain a total mental health status score; the higher the total score, the more pronounced the mental health problem. The Cronbach alpha coefficient of this questionnaire was 0.93.

6.3. Cognitive-emotional status

The Cognitive Emotion Regulation Questionnaires (CERQ) were used to investigate the cognitive emotions of college students towards the epidemic event^[15]. The questionnaire contains 36 items, including 9 subscales. Among them, the negative cognitive emotion regulation (CERQ-N) includes self-blame, contemplation, blaming others, and catastrophizing. 4 subscales were summed to obtain a total score, the higher the total score, the more negative the cognitive emotion of the college students, and its Cronbach's α coefficient was 0.91.

6.4. Meaning of life

Meaning in Life Scale (MLQ) was used to investigate the level of college students' sense of meaning in life^[16]. The questionnaire consists of 10 entries and contains two dimensions, Present Meaning in Life (Present Meaning in Life,) and Search Meaning in Life (Search Meaning in Life,). The Cronbach alpha coefficient of this questionnaire in this study was 0.98.

7. Data collection and transformation

Data will be collected through a questionnaire. The questionnaire will consist of a series of questions designed to understand the stressful events faced by college students during the COVID-19 pandemic and the impact of these events on their mental health, cognitive mood, and sense of meaning in life. The questionnaire will be distributed to 1,644 college students at four universities in a region of China and

collection will be completed between February 29 and March 2, 2023. The collected data will be pre-processed, including data cleaning, data transformation, and data integration. Data cleansing includes removing or correcting incomplete, inconsistent, or erroneous data. Data transformation includes converting raw data into a format suitable for analysis. Data integration involves bringing together data from different sources.

8. Literature review and hypothesis

Previous research has identified emotional cognition as an important mediating variable between adolescent life events and mental health^[17], and subjective cognitive appraisal of an individual's exposure to a stressor influences an individual's mental health^[18]. Cognitive emotion regulation refers to the cognitive efforts made by individuals when dealing with stressful stimuli^[19]. The theory of depressive hopelessness also supports the idea that negative cognitive styles increase an individual's risk of hopelessness when stress is perceived, leading to the development of negative emotions^[20]. Therefore, the present study hypothesized that emotional cognition may have a mediating effect between epidemic-related stressful events and college students' mental health (H1).

The relationship between stressful events and mental health is also influenced by individual differences^[21,22]. As an individual factor, a sense of meaning in life is a synthesis of a sense of purpose, meaning, and value in an individual's life^[23]. Previous studies have found that a sense of meaning in life plays a protective and predictive role in individual mental health^[24-27]. A sense of meaning in life also plays an important role in trauma recovery after a major event^[28]. It has also been found that a sense of meaning in life moderates the relationship between negative life events and suicide among college students^[29]. Therefore, the present study hypothesized that there is a mediating effect of a sense of the meaning of life between epidemic stress on individual mental health (H2).

In addition, an explanation based on the psychological phenomenon of "psychological resilience" reveals the ability of an individual to adapt and recover in the face of adversity. This ability can be cultivated and is closely related to an individual's cognitive emotions and sense of meaning in life. Stressful events are very common among college students, not to mention in the context of disease epidemics such as fear of infection outbreaks and the pressure of extensive online classes/online learning tasks. These stressful events may affect the mental health of college students. However, if college students have high levels of cognitive emotions, they may be more aware and in control of their emotions and thus better able to cope with stressful events. If college students have a high sense of meaning in life, they may have a more positive attitude toward their own lives and thus cope better with stressful events. In summary, we can conclude the hypothesis that cognitive emotion and a sense of meaning in life play a chain mediating role between stressful events on mental health among college students (H3).

This study intends to investigate college students in an attempt to explore the relationship between epidemic-related stressful events and college student's mental health, to examine the role of cognitive emotion and sense of meaning in life, and the results of the study will provide scientific references for the psychological recovery of college students in the post-epidemic era. In recent years, some scholars have argued that the sense of the meaning of life is not a unidimensional variable, but has different components: the experience of the sense of the meaning of life (PRESENT) and the search for the sense of the meaning of life (SEARCH), with the former focusing on the results and the latter emphasizing the process^[30]. Domestic scholars have also confirmed that the experience and search for a sense of meaning in life are independent of each other and that there may be different mechanisms of action in the relationship between the two on other variables. Therefore, this study will examine the moderating role of these two types of sense of the meaning of life separately. Meanwhile, although the concepts of cognitive emotion and sense of meaning in life have been gradually applied in psychotherapy and school education, and related studies have mostly focused on their effects on mental health, their specific mechanisms of action may be more complex, and little attention has been paid to the interactions between them, which will also be explored somewhat in this study.

9. Results

9.1. Common methodological biases

Harman's one-way test was used and the results showed that there were 12 factors with eigenroots greater than 1. The first factor explained 19.34% of the variance, which is less than the critical criterion

of 40%, indicating that the study data did not suffer from serious common method bias.

9.2. Status of epidemic-related stress events among college students

The descriptive statistics showed that college students generally experienced stressful events related to the epidemic, with "not being able to go out at will" (78.5%) being the most frequently reported stressful event and "having a confirmed case in my area" (37.8%) being the least frequently reported stressful event, as shown in Table 1.

9.3. Descriptive statistics and correlation analysis

The descriptive statistics and correlation analyses of the variables are detailed in Table 2. Pearson correlation showed that college students' mental health status was significantly negatively correlated with epidemic-related stressful events and negative cognitive emotions, and significantly positively correlated with the experience of a sense of meaning in life.

Table 2: Descriptive statistics and correlation analysis of variables.

	M±SD	1	2	3	4
1. Stressful event	4.83±2.47	1			
2. Emotion Cognition	62.50±15.85	-0.06*	1		
3. Sense of the meaning of life	22.13±5.20	-0.02*	0.10***	1	
4. Mental health	7.08±2.01	-0.11***	0.44***	0.06*	1

Note: ***P < 0.001, **P < 0.01, *P < 0.05

9.4. Regression analysis of variable relationships

Model 6 of PROCESS 3.4 was adopted to test the effects of stressful events on mental health among college students, as well as the chained mediating effects of cognitive mood and sense of meaning in life. Prior to testing the mediation model, we standardized the raw data to eliminate the possible effects of different variable scoring methods. (Table 3) We used a bias-corrected nonparametric percentile Bootstrap method and estimated 95% confidence intervals for the chained mediation effect by sampling a sample of 5000 times. The results of the regression analysis reveal a number of important findings. First, in Model 1, we observed a significant negative effect of stressful events on cognitive mood ($\beta = -0.33$, $t = 6.21$, $p < 0.01$), which demonstrated a significant negative correlation between increased stressful events and decreased cognitive mood. This may be due to the fact that stressful events tend to trigger a negative emotional response, which in turn affects an individual's cognitive mood. The R^2 value of the model was 0.10, indicating that the model was able to explain 10% of the variance in cognitive mood and the significance of the model was supported by the F value (14.52, $p < 0.01$).

Table 3: Regression analysis of variable relationships.

Predictor variables	Model 1 (cognitive emotions)		Model 2 (sense of meaning in life)		Model 3 (Mental Health)	
	β	t	β	t	β	t
Stressful event	-0.33	6.21**	-0.11	2.39**	-0.45	11.32**
Emotion Cognition			0.15	2.98**	0.34	10.10**
Sense of the meaning of life					0.26	8.23**
R	0.32		0.24		0.82	
R ²	0.10		0.05		0.67	
F	14.52**		11.35**		185.49**	

Note: **P<0.01

Second, in Model 2, we found that stressful events had a significant negative effect on the sense of meaning in life ($\beta = -0.11$, $t = 2.39$, $p < 0.01$), while cognitive emotions had a significant positive effect on the sense of meaning in life ($\beta = 0.15$, $t = 2.98$, $p < 0.01$). This suggests that although stressful events may reduce an individual's sense of meaning in life, positive cognitive emotions may have a positive effect on the sense of meaning in life, thus counteracting the negative effects of stressful events to some extent. The model had an R^2 value of 0.05, indicating that the model explained 5% of the variance in the sense of the meaning of life, and the significance of the model was supported by the F value (11.35, $p < 0.01$).

Finally, in Model 3, we found that stressful events, cognitive emotions, and sense of meaning in life all had a significant effect on mental health ($\beta = -0.45$, $t = 11.32$, $p < 0.01$; $\beta = 0.34$, $t = 10.10$, $p < 0.01$; $\beta = 0.26$, $t = 8.23$, $p < 0.01$). This suggests that the negative effects of stressful events on mental health may be offset by the positive effects of cognitive mood and sense of meaning in life. This finding highlights the important role of cognitive emotions and sense of meaning in life in maintaining mental health. The R^2 value of the model was 0.67 indicating that the model explained 67% of the variance in mental health and the significance of the model was supported by the F value (185.49, $p < 0.01$). The results of the analysis suggest that stressful events have a significant negative impact on the mental health of college students, but this impact can be offset by the positive effects of cognitive mood and sense of meaning in life. This finding has important practical implications for designing interventions to enhance the mental health of college students.

9.5. Analysis of chain mediation effects

According to Table 4 the detailed presentation of the effect values, 95% confidence intervals (CI), and relative effect values for the different mediating pathways. The effect value of the total indirect effect is 0.32 with a 95% confidence interval of 0.22 to 0.35 excluding 0, which means that we can assert with 95% confidence that the true value of the total indirect effect lies within this interval. The relative effect value of 51.29% indicates that this pathway accounts for more than half of the total effect on mental health. The indirect effect value of 0.17 from stressful events to cognitive emotions to mental health has a 95% confidence interval of 0.09 to 0.18 excluding 0, which accounts for 25.37% of the total effect. This suggests that the effect of stressful events through affecting cognitive mood and then mental health is significant. The indirect effect value from stressful events to a sense of meaning in life and then to mental health was 0.12 with a 95% confidence interval of 0.07 to 0.15 excluding 0, which accounted for 22.62% of the total effect. This suggests that the effect of stressful events on affecting sense of meaning in life and then mental health is also significant.

Finally, the value of the chained indirect effect from stressful events to cognitive emotions, to a sense of meaning in life, and ultimately to mental health was 0.03, with a 95% confidence interval of 0.01 to 0.04 excluding 0, accounting for 3.3% of the total effect. This suggests that this chained indirect effect, although significant, has a relatively small effect on mental health. Considered together, these results suggest that the effects of stressful events on mental health are multi-pathway, with significant indirect effects through cognitive mood and sense of meaning in life, but a relatively small chained indirect effect. This implies that while cognitive mood and sense of meaning in life play a significant mediating role in the effects of stressful events on mental health, the interaction effect between these two has a smaller effect on mental health. This finding has important theoretical and practical implications for understanding how stressful events affect mental health and for designing appropriate interventions. Path coefficients are shown in figure 1 and figure 2

Table 4: Analysis of chained mediation effects

Intermediation effect pathway	Efficacy value	95%CI	Relative effect value
Total indirect effect	0.32	0.22,0.35	51.29%
Stressful event \rightarrow Emotion Cognition \rightarrow Mental Health	0.17	0.09,0.18	25.37%
Stressful event \rightarrow Sense of the meaning of life \rightarrow Mental Health	0.12	0.07,0.15	22.62%
Stressful event \rightarrow Emotion Cognition \rightarrow Sense of the meaning of life \rightarrow Mental Health	0.03	0.01,0.04	3.3%

10. Deliberations

This study showed that college students commonly experienced epidemic-related stressful events, with the inability to go out as much as they wanted and a large number of online classes/online learning tasks being the main sources of stress. A national survey in China at the beginning of the epidemic outbreak showed that 53.8% of the country's population believed that the epidemic had a moderate or higher impact on their psychology, and 8.1% perceived moderate to severe stress ^[31]. Meanwhile, the

associated stressful events were closely related to the level of psychological well-being of college students, which is consistent with the results of previous studies ^[32,33]. Stress is an important risk affecting individual mental health, which not only directly predicts the occurrence of adverse psychological outcomes, but also consistently enhances the susceptibility to psychological and behavioral abnormalities ^[34], and there are also studies confirming that stress can lead to changes in individuals' brain mechanisms, which affects the development of their mental health ^[35].

Mediation analysis showed that negative cognitive emotion regulation had a partial mediating effect between stressful events and college students' mental health. There is a close relationship between stress and negative cognitive emotion regulation, and the accumulation of multiple stresses in an epidemic can lead individuals to be more inclined to negative cognitive emotions, which adversely affects their mental health ^[36]. Similar studies have also shown that negative cognitive emotions can modulate stress brought about by parental control affecting adolescent depression ^[37]. Stressful life events influence freshmen's depression levels through negative cognitive emotion regulation ^[38]. Beck's schema theory suggests that individuals will have higher susceptibility characteristics, consume more cognitive resources, and be prone to mental health abnormalities than other individuals based on the information processing schemas formed during negative life experiences ^[39]. College students who have been living at home for a long time are prone to friction with their families and lack of effective interaction with their peers, which can easily lead to conflict in emotional expression, thus habitually adopting negative information processing schemas to cope with external stimuli ^[40].

This study also found that the sense of the meaning of life is an important protective factor for college students' mental health during the epidemic, and a high level of experience of the sense of the meaning of life is a manifestation of the sufficiency of positive psychological resources of individuals, which can provide a sense of purpose and value ^[41], as well as improve the sense of control in the face of stress, and obtain more positive emotions so that the experience of the sense of meaning of life has a more direct impact on the mental health of college students. However, some studies have also shown that meaning-seeking is a process in which an individual strives to establish and improve his or her understanding of the value of life's goals, in which meaning-seeking does not necessarily result in the acquisition of the experience of a sense of meaning in life ^[42, 43]. Boyraz et al. argued that the transition from meaning-seeking to the acquisition of the experience of a sense of meaning needs to be made through cognitive reappraisal and that it is only through constructive reappraisal of meaning (e.g., rational regurgitation) that the experience of a sense of meaning is gained. Meaningfulness experience is gained, whereas non-constructive reappraisal of meaning (e.g., neurotic rumination), does not help individuals to gain susceptible experience ^[44]. Therefore, this study hypothesized that the value of meaning in life needs to be prioritized through cognitive emotion regulation. College students with higher education tend to have good cognitive judgment and assessment abilities, and the protective role of the sense of meaning in life is to provide individuals with a sense of purpose, a sense of value, and a heightened sense of control over their lives. Individuals with a higher sense of control have a stronger sense of control over their lives and are able to effectively choose coping strategies to deal with stressful situations, reduce anxiety levels, and promote psychological health ^[45]. Therefore, colleges and universities can strengthen the education and guidance of meaning of life after students resume their studies to help students gain more meaning in life in order to promote the development of college students' psychological health and recovery of psychological adaptation. Thus high levels of meaning-seeking may enhance college students' positive cognition and reduce negative cognition, thus affecting their psychological health.

11. Conclusion

The present study reveals the significant negative impact of stressful events on college student's mental health during the epidemic and the important role of negative cognitive emotion regulation and sense of meaning in life in this relationship. Specifically, the interaction term between different components of the sense of the meaning of life and stressful events significantly predicted negative cognitive emotion regulation. This means that when the sense of meaning of life is experienced or sought at a low level, the more epidemic-related stressful events college students experience, the more severe their negative cognitive emotions are. Conversely, when the sense of the meaning of life experience or seeking was at a high level, the prediction of negative cognitive emotions by epidemic events disappeared. This supports the idea that there is a protective effect of a sense of meaning in life on individuals.

Therefore, this study infers that the value of meaning in life needs to be prioritized through cognitive emotion regulation. College students in higher education typically possess good cognitive judgment and appraisal skills, and thus high levels of meaning-seeking may enhance positive and reduce negative

cognitions among college students, thereby impacting their mental health. This finding is an important guide for developing effective mental health interventions. Finally, this study suggests that colleges and universities should strengthen education and guidance on the meaning of life to help students acquire more meaning in life, in order to promote the development of mental health and the recovery of psychological adaptation among college students. Mental health education should also be strengthened to improve students' psychological quality, help them better cope with stress, and develop positive cognitive emotion regulation strategies, so as to improve their mental health.

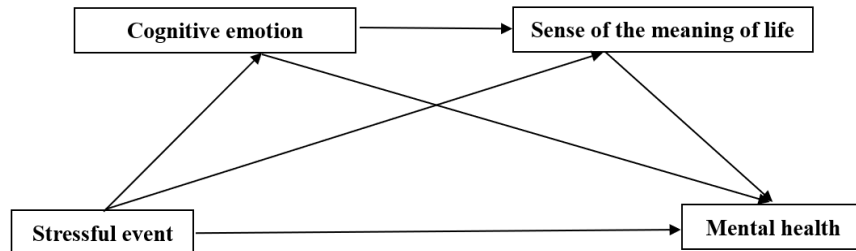


Figure 1: Conceptual diagram of the model.

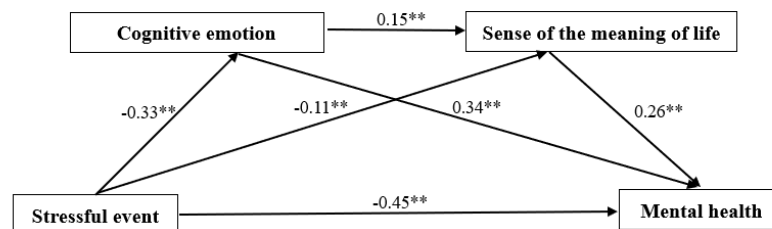


Figure 2: Chain mediation model effect.

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