

# Network Structure and Core Features of Cognitive Emotion Regulation Strategies in Chinese Adolescents with NSSI

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**Purpose:** Little research has focused on identifying the dynamic relationship and core features of cognitive emotion regulation strategies (CERS) that critically contribute to the onset and maintenance of NSSI. This study aims to investigate the CERS network structure in Chinese adolescents with NSSI through network analysis, identifying the core strategies within this network.

**Patients and Methods:** A total of 2711 Chinese adolescents (50.5% female, mean age =  $12.89 \pm 0.73$  years) were assessed using the CERQ. Independent *t*-tests were conducted to compare CERS scores between adolescents with and without NSSI. Network analysis was performed to identify core CERS and to explore differences in the networks between the two groups.

**Results:** A total of 1065 adolescents (39.28%) reported engaging in NSSI at least once within the past six months. Among adolescents with NSSI, catastrophizing (strength = 1.32, betweenness = 1.98, closeness = 0.45) and rumination (strength = 1.18, betweenness = 1.10, closeness = 2.02) emerged as the most central CERS. In contrast, among adolescents without NSSI, catastrophizing (strength = 1.79, betweenness = 1.00, closeness = 0.08), rumination (strength = 0.34, betweenness = 1.00, closeness = 1.02), and positive reappraisal (strength = 0.57, betweenness = 1.50, closeness = 1.50) were identified as central CERS. Significant differences in network structure, global strength, and centrality were observed between the two groups, reflecting distinct patterns of CERS.

**Conclusion:** NSSI is associated with tightly connected, rigid CERS networks. Targeted interventions should focus on reducing catastrophizing and enhancing positive reappraisal to disrupt these rigid cognitive emotion regulation patterns, ultimately mitigating the risk of NSSI.

**Keywords:** non-suicidal self-injury (NSSI), cognitive emotion regulation strategies (CERS), network analysis, Chinese adolescents

## Introduction

Adolescents have yet to develop stable and adaptive psychological functioning, and are often exposed to various stressors from academic, social, and familial domains, making them the high-risk population for various mental disorders.<sup>1,2</sup> Non-suicidal self-injury (NSSI) refers to the behavior in which an individual repeatedly inflicts physical harm on the body surface, such as burning, cutting, or hitting, without suicidal intent.<sup>3</sup> In recent years, the prevalence of NSSI among adolescents has risen sharply. Recent studies indicate that the global prevalence of NSSI among adolescents is approximately 17.7%,<sup>4</sup> with lifetime prevalence rates as high as 24.7% among Chinese adolescents.<sup>5</sup> NSSI not only directly leads to physical harm and an increased risk of disability but also significantly raises the likelihood of lifelong psychopathological symptoms, substance abuse, and suicidal behaviors, in addition to causing social withdrawal and academic impairment.<sup>6–8</sup> Thus, investigating the related factors of NSSI and developing effective prevention and intervention strategies are essential for reducing its impact and supporting adolescents' healthy development.

## Associations Between Cognitive Emotion Regulation Strategies and NSSI

The Cognitive-Emotional Regulation Model (CERM) of NSSI suggests that the interplay between emotion dysregulation and cognitive distortions heightens the risk of NSSI.<sup>9</sup> Cognitive emotion regulation refers to the process by which individuals, when confronted with stress or adverse experiences, employ specific strategies to understand, manage, and effectively respond to their emotional states. Cognitive emotion regulation strategies (CERS) are approaches based on the emphasis of CERM, which focus specifically on the cognitive aspects of emotion regulation, emphasizing the role of cognitive processes in modulating emotions.<sup>10</sup> CERS can be generally categorized into adaptive and maladaptive CERS. Adaptive CERS commonly include acceptance, which involves acknowledging reality and understanding one's emotions; positive refocusing, which shifts attention from negative situations to more pleasant ones; and refocusing on planning, where the emphasis is placed on developing strategies to address and resolve problems.<sup>11,12</sup> Other adaptive CERS include positive reappraisal, where situations are reinterpreted to find positive meaning, and analyzing, which involves thoroughly examining the details of a situation to understand its causes.<sup>13,14</sup> In some studies, analyzing is also described as Putting into perspective.<sup>15</sup> On the other hand, maladaptive CERS include self-blame, which attributes negative emotions to personal faults; rumination, characterized by repeatedly dwelling on negative situations without effectively resolving them; catastrophizing, which exaggerates problems to their worst possible outcomes; and blaming others, which shifts responsibility for negative emotions onto others or external circumstances.<sup>16,17</sup> Research found that individuals with higher maladaptive CERS scores reported the highest frequency of NSSI.<sup>18</sup> Other studies showed that adaptive CERS were negatively correlated with NSSI, while maladaptive CERS were positively correlated.<sup>18,19</sup> Specifically, higher use of self-blame and lower use of refocusing on planning were linked to NSSI.<sup>20</sup> Previous studies suggest that maladaptive CERS may elevate the risk of NSSI among adolescents, whereas adaptive CERS could mitigate this risk by acting as a protective buffer. Cognitive emotion regulation is a complex and dynamic process, characterized by the interaction of multiple strategies. The Network Theory of Mental Disorders (NTMD) is an emerging theoretical framework for understanding the complexity of mental disorders and related psychological characteristics.<sup>21</sup> Unlike traditional etiological models, NTMD conceptualizes mental disorders as the result of interactions between symptoms, rather than being caused by a single underlying factor, emphasizing the interactions and dynamic changes among symptoms. According to the NTMD, the factors related to NSSI are interconnected, forming a network that influences its onset, progression, and outcomes. However, most existing research has focused primarily on the relationship between individual strategy and adolescent NSSI or has examined the effects of maladaptive and adaptive strategies in isolation. It has largely overlooked the intricate and dynamic interrelationships among CERS in adolescents with NSSI.

## Network Analysis of CERS in Adolescents with NSSI

Network analysis, an emerging research method, provides new perspectives and tools to explore the complex and dynamic relationships among CERS in adolescents with NSSI.<sup>22</sup> This method situates the CERS of NSSI adolescents within an interconnected network, illustrating how these strategies interact. Through network centrality metrics, core strategies within the network can be identified.<sup>23</sup> It not only enhances the understanding of NSSI pathogenesis through the CERS but also identifies potential targets for intervention.<sup>24</sup> If certain strategies play a central role in the network, interventions targeting these strategies may be more effective than generalized treatments. For instance, a study found that refocus on planning was the core CERS among Australian adolescents with a history of NSSI, whereas positive reappraisal was central among those without NSSI history.<sup>25</sup> Contrary to most traditional regression analysis results, this network analysis study indicates that the core feature of CERS in adolescents with NSSI is a positive strategy, similar to that of healthy controls, rather than a negative one.<sup>19</sup> It raises an important question: why do these adolescents still engage in NSSI? One possible explanation is that, although refocus on planning occupies a central position in the network, adolescents may still rely on NSSI as a means of coping with negative emotions due to difficulties in implementing these strategies, insufficient emotion regulation capacity, and the immediate emotional relief that NSSI provides.<sup>26</sup> These results suggest that, rather than solely focusing on correcting irrational beliefs or targeting features such as rumination and catastrophizing in CERS, there may be potential in directing clinical interventions toward the development of positive CERS strategies in NSSI patients.<sup>27</sup> This perspective is consistent with the principles of positive

psychology.<sup>28</sup> However, further research is needed to substantiate these findings from the perspective of the network relationships of CERS in individuals with NSSI. Besides, it is noteworthy that individuals' emotion regulation and expression strategies vary across different sociocultural contexts.<sup>29</sup> And due to the lack of research on the CERS network structure and core strategies among Chinese adolescents with NSSI, it remains unclear how the network findings from Australian samples can be generalized to populations with Chinese cultural and linguistic background.

## The Current Study

The present study aimed to investigate the network structure and core features of CERS among Chinese adolescents with and without NSSI. Furthermore, it compared the similarities and differences of the two networks. It will help to understand the differences in the CERS network structure between Chinese adolescents with and without NSSI, and to identify the core cognitive emotion regulation strategy among those with NSSI. It is essential for developing more effective NSSI prevention and intervention strategies that are tailored to the Chinese cultural context.

## Materials and Methods

### Participants

A total of 2807 adolescents from two junior high schools in Yunnan Province, China, participated in this study. All participants completed the Non-Suicidal Self-Injury Questionnaire (NSSIQ) and the Cognitive Emotion Regulation Questionnaire (CERQ). After excluding invalid responses, the final sample consisted of 1369 boys (50.50%) and 1342 girls (49.50%), with a mean age of  $12.89 \pm 0.73$ , totaling 2711 valid samples were analyzed in this study (96.57%).

This study was reviewed and approved by the Medical Ethical Committee of Kunming Medical University, School of Haiyuan (No. KMMUHYC2024MEC00005). Informed consent from parents and informed assent from participants were obtained before the commencement of study. All procedures were conducted in accordance with the Declaration of Helsinki.

### Measures

#### Non-Suicidal Self-Injury Questionnaire (NSSIQ)

The NSSIQ was used for the preliminary screening of non-suicidal self-injury (NSSI) in Chinese community populations. It included seven items, each assessing the frequency of common NSSI behaviors over the past six months, such as inserting objects, self-cutting, biting, burning, punching, scratching skin, and banging the head or other parts of the body against the wall.<sup>30</sup> Each item was rated on a 4-point scale ranging from 0 (never) to 3 (six times or more). Adolescents who reported any of the seven NSSI items one or more times in the past 6 months were classified as adolescents with NSSI, and adolescents who never reported any of the seven items in the past 6 months were classified as adolescents without NSSI. The NSSIQ has been widely used among Chinese adolescents and has demonstrated good reliability and validity.<sup>31</sup> In the current study, the Cronbach's  $\alpha$  was 0.81. The content of the NSSIQ is shown in [Table S1](#). The correlation coefficients of NSSIQ items are presented in Table S6.

#### Cognitive Emotion Regulation Questionnaire (CERQ)

The Chinese version of CERQ consisted of 36 items, with every four items representing one dimension, totaling nine dimensions.<sup>32</sup> These dimensions included adaptive CERS (five dimensions: acceptance, positive refocusing, refocus on planning, positive reappraisal, analyzing) and maladaptive CERS (four dimensions: self-blame, rumination, catastrophizing, and blaming others). The questionnaire was rated on a 5-point Likert scale ranging from 1 (never) to 5 (always). Each dimension represented a specific type of CERS, and the dimension score was calculated by summing the item scores and dividing by the number of items in that dimension. The reliability and validity of CERQ among Chinese adolescents were found to be satisfactory.<sup>33</sup> In the current study, the Cronbach's  $\alpha$  was 0.93. The content of the CERQ is shown in [Table S2](#).

## Data Analysis

### Descriptive Statistical Analysis

Descriptive statistical analysis was conducted using SPSS 22.0 to examine the demographic information of all participants, while independent samples t-tests were performed to examine the differences in CERS between adolescents with and without NSSI.

## Network Analysis

Network analysis was conducted using R 4.4.1 to explore the network structure of the nine dimensions of CERQ. According to the standardized guidelines, the network analysis procedure included five components: network estimation, network visualization, centrality estimation, network accuracy and stability estimation, and network comparison.<sup>34</sup>

Network estimation and visualization were performed using the *qgraph* package in R, applying the EBICglasso function and Spearman correlation analysis.<sup>35</sup> Separate network structures for the nine CERS dimensions were generated for adolescents with and without NSSI. In the two networks, each CERS dimension is depicted as a node, with edges representing the connections between nodes. Thicker edges denote stronger correlations, with green edges indicating positive correlations and red edges indicating negative correlations.

Centrality metrics—strength, closeness, and betweenness—were employed to evaluate the importance of core nodes.<sup>22</sup> Higher centrality values indicate a more central role within the network. Strength is defined as the sum of the absolute weights of all edges connected to a node, with higher strength values indicating greater influence within the network. Betweenness measures the number of times a node lies on the shortest path between other nodes, highlighting its influence as a network bridge. Closeness represents the inverse of the sum of the shortest path distances from a node to all other nodes, indicating its overall accessibility within the network.

Network accuracy and stability were assessed using the *bootnet* package in R.<sup>34</sup> The precision of edge weights was evaluated by bootstrapped 95% confidence intervals, with narrower intervals reflecting higher accuracy. Node centrality was re-assessed by reducing the network's sample size, and the Centrality Stability Coefficient (CS) was calculated. A CS value above 0.25 is considered acceptable, with values above 0.5 preferred for stability.

Network comparison was conducted using the *NetworkComparisonTest (NCT)* package in R.<sup>36</sup> Permutation tests, involving 1000 iterations, were employed to examine the invariance of network invariance, global strength, and edge strength between CERS networks in adolescents with and without NSSI.

## Results

### Descriptive Statistical Analysis and Difference Test

Based on the NSSIQ detection criteria (total score > 0), a total of 1065 adolescents (39.28%) in this study were identified as adolescents with NSSI.

Independent samples t-tests were conducted to compare scores on the nine CERS between adolescents with and without NSSI. The results indicated that adolescents with NSSI scored significantly higher on the acceptance, analyzing, self-blame, rumination, catastrophizing, and blaming others compared to those without NSSI (all  $p < 0.05$ ). In contrast, they scored significantly lower on the refocus on planning and positive reappraisal (both  $p < 0.05$ ). No significant difference was found between the two groups in positive refocusing ( $p > 0.05$ ). Detailed results are presented in [Figure 1](#) and [Table S3](#).

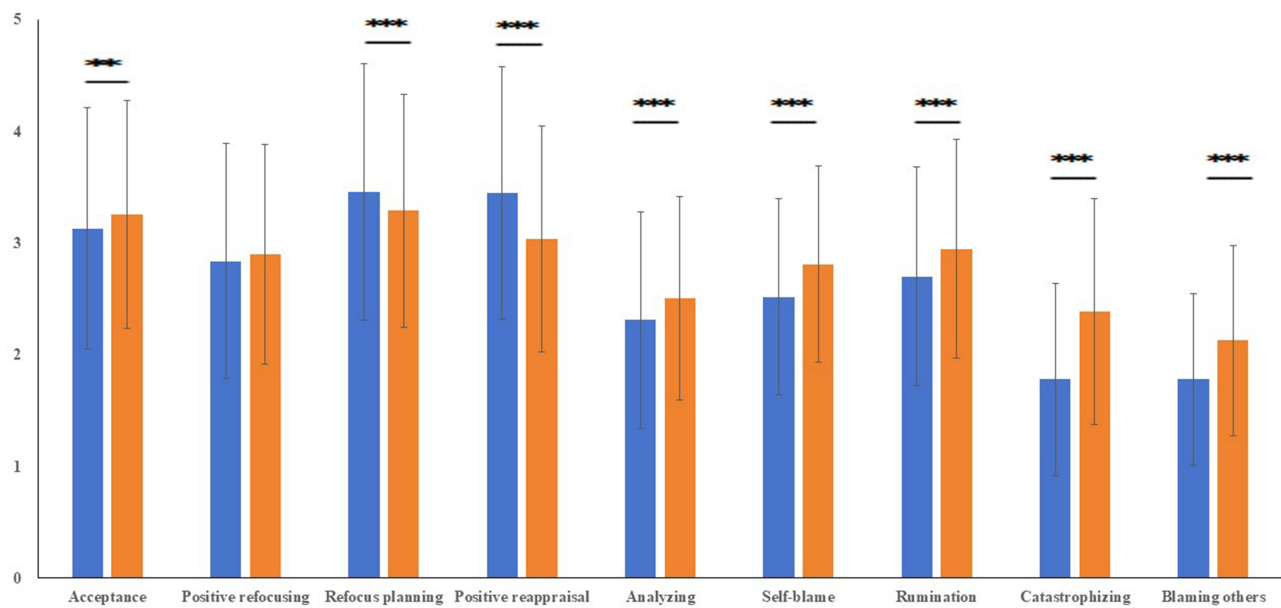
### Network Estimation

[Figure 2a](#) illustrates that the CERS network in adolescents with NSSI consists of 9 nodes, generating a total of 24 non-zero edges (24/36) with a mean edge weight of 0.10. Overall, the CERS components are interconnected, reflecting moderate mutual influence. The strongest edge weights were observed between refocus on planning and positive reappraisal (Edge weight = 0.44).

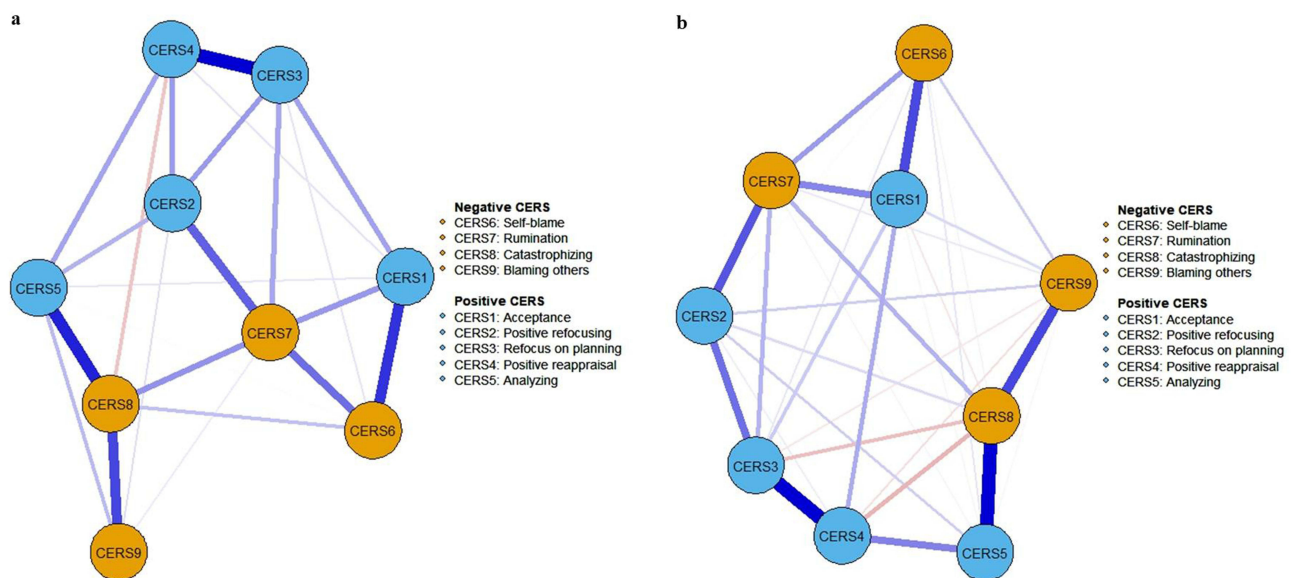
[Figure 2b](#) illustrates that the CERS network in adolescents without NSSI consists of 9 nodes, generating a total of 33 non-zero edges (33/36) with a mean edge weight of 0.10. Overall, the CERS components are highly interconnected, reflecting substantial mutual influence. The strongest edge weights were observed between refocus on planning and positive reappraisal (Edge weight = 0.49), as well as between catastrophizing and analyzing (Edge weight = 0.49). The edge weight values for two visualization networks can be found in [Table S4](#).

### Centrality Estimation

[Figure 3a](#) illustrates the centrality of each node in the CERS network model among adolescents with NSSI. The node with the highest strength centrality is catastrophizing (1.32), indicating its significant influence within the network, while



**Figure 1** Differences in CERS between adolescents with/without NSSI. \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

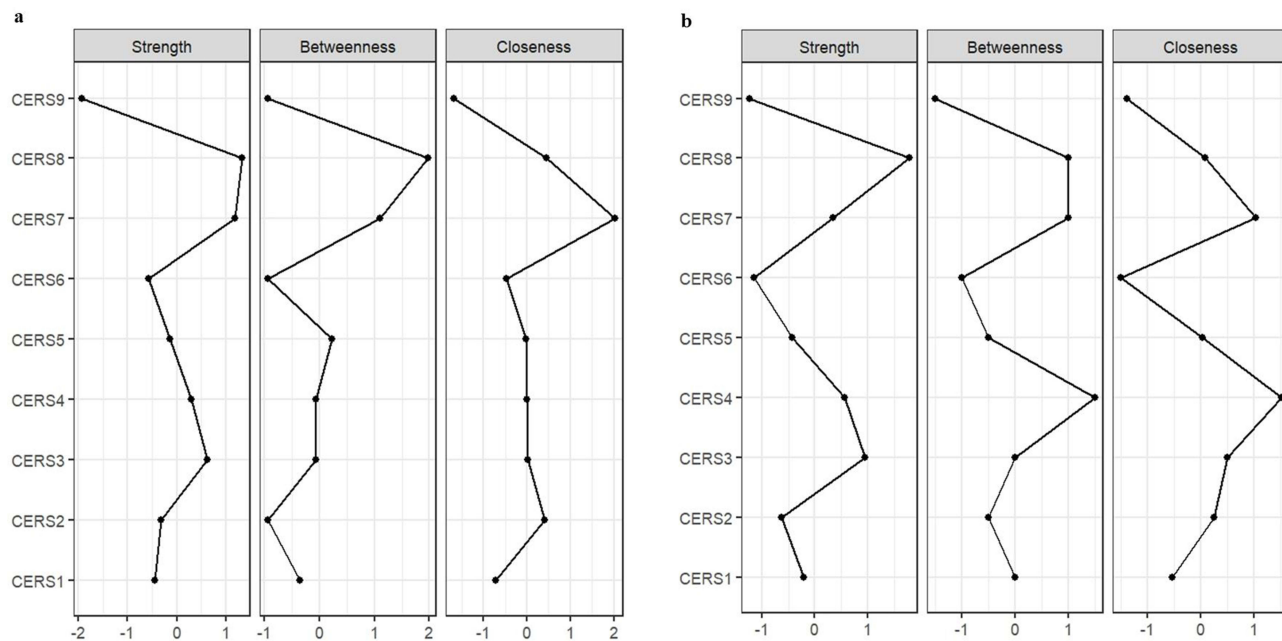


**Figure 2** Estimated networks of CERS.P. (a) Estimated network of CERS in adolescents with NSSI. (b) Estimated network of CERS in adolescents without NSSI.

also being heavily impacted by other nodes. Additionally, catastrophizing exhibited the highest betweenness centrality (1.98), positioning it as the critical bridging variable that facilitates connections among different nodes in the network. Rumination had the highest closeness centrality (2.02), suggesting it is the most central node in terms of proximity to all other nodes.

Figure 3b presents the centrality of each node in the CERS network model among adolescents without NSSI. Here, catastrophizing also had the highest strength centrality (1.79), reaffirming its significant role within the network. Both catastrophizing (1.00) and rumination (1.00) shared the highest betweenness centrality, indicating that they jointly serve as bridging variables, mediating connections across the network. Positive reappraisal showed the highest closeness centrality (1.50), highlighting its central role in connecting with other nodes. All centrality estimation results can be found in [Table S5](#).





**Figure 3** Centrality indices of CERS networks, shown as standardized values z scores. (a) Centrality indices of CERS network in adolescents with NSSI. (b) Centrality indices of CERS network in adolescents without NSSI.

**Abbreviations:** CERS, Acceptance; CERS2, Positive refocusing; CERS3, Refocus on planning; CERS4, Positive reappraisal; CERS5, Analyzing; CERS6, Self-blame; CERS7, Rumination; CERS8, Catastrophizing; CERS9, Blaming others.

## Network Accuracy and Stability Estimation

The edge weight bootstrap results showed narrow 95% CIs in the CERS networks for both adolescents with and without NSSI, indicating precise accuracy for both networks (Figure S1). In the CERS network for adolescents with NSSI, the CS coefficients were 0.68 for strength, 0.60 for closeness, and 0.52 for betweenness; whereas in the network for adolescents without NSSI, the CS coefficients were 0.75 for strength, 0.60 for closeness, and 0.28 for betweenness. All CS coefficients exceeded 0.25, indicating acceptable stability for both networks (Figure S2). The bootstrapped difference test of edges and centrality indices can be found in Figures S3 and S4.

## Comparison of CERS Networks for Adolescents with and without NSSI

The network structure invariance test showed significant differences between the CERS networks in adolescents with and without NSSI ( $M = 0.14$ ,  $p = 0.01$ ).

The global strength invariance test indicated that adolescents with NSSI ( $GS=4.62$ ) had significantly higher network strength compared to those without NSSI ( $GS=3.87$ ,  $S = 0.75$ ,  $p < 0.001$ ).

The centrality estimation results above have suggested that catastrophizing and rumination were core dimensions of CERS in adolescents with NSSI, while positive reappraisal was core dimensions of CERS in adolescents without NSSI. Further analysis of the centrality invariance test revealed significant differences ( $p < 0.05$ ) in the centrality of certain strategy between adolescents with and without NSSI. Specifically, catastrophizing demonstrated significant differences in both strength and betweenness, while positive reappraisal showed significant differences in strength and closeness. However, rumination did not show the significant difference (all  $p > 0.05$ ) in strength, betweenness, or closeness between adolescents with and without NSSI.

## Discussion

### The Characteristics of CERS in Chinese Adolescents

The results demonstrate that Chinese adolescents with NSSI scored significantly lower than adolescents without NSSI on some adaptive CERS (refocus on planning, positive reappraisal, and analyzing), and significantly higher than adolescents

without NSSI on the most maladaptive CERS (self-blame, rumination, catastrophizing, and blaming others). Consistent with previous research findings, these results suggest that adolescents with NSSI exhibit a reduced tendency to employ adaptive CERS in response to negative emotions, coupled with a higher propensity to adopt maladaptive strategies.<sup>37</sup> This pattern might exacerbate their emotional distress and behavioral problems, thereby increasing the likelihood of NSSI.

The results also indicate that adolescents with NSSI scored significantly higher on the acceptance strategy compared to those without NSSI, consistent with the findings of Madjar et al (2019). While acceptance is generally considered an adaptive cognitive emotion regulation strategy, for adolescents with NSSI, it may not always indicate healthy emotion regulation. Instead, it may serve as a coping mechanism when they feel powerless to change their situation or experience hopelessness. This could explain why, despite their higher scores on acceptance, they still resort to NSSI, as it may reflect a coping mechanism driven by feelings of powerlessness or hopelessness.

Notably, this study found that adolescents with NSSI scored significantly higher on analyzing compared to those without NSSI. Similarly, Lang et al (2024) reported that although NSSI adolescents had higher analyzing scores than healthy controls, the group difference was not statistically significant. Our findings further validate this observation, suggesting that while NSSI adolescents may be more inclined to use analyzing, difficulties in emotion regulation may lead to rumination or catastrophizing of negative emotions, exacerbating emotional distress and increasing the risk of NSSI.<sup>38,39</sup>

## CERS Network in Chinese Adolescents with NSSI

This study revealed that catastrophizing and rumination occupy central positions in the CERS network of adolescents with NSSI, with a significant positive association between the two (Table S6). These findings support the Network Theory of Mental Disorders by demonstrating how these strategies, as core components, interact dynamically to create a reinforcing cycle of negative emotions, known as an emotional cascade.<sup>21,40</sup> This exacerbates emotional distress, making it difficult for NSSI adolescents to alleviate negative emotions through conventional strategies. Consequently, NSSI serves as a mechanism to quickly interrupt the emotional cascade via intense physical pain, providing temporary relief from psychological distress.<sup>41</sup> This underscores the importance of clinicians focusing on the roles of catastrophizing and rumination in cognitive emotion regulation when treating NSSI adolescents. Evidence-based interventions, such as Dialectical Behavior Therapy (DBT), has been shown to effectively reduce tendencies toward catastrophizing and rumination, thereby preventing or breaking the emotional cascade, facilitating more effective emotion regulation, and alleviating NSSI behaviors.<sup>27,42</sup>

Nevertheless, this result contrasts with Duncan-Plummer et al (2023), who identified refocus on planning as the core CERS in Australian adolescents engaging in NSSI, underscoring the complexity and diversity of NSSI behaviors across cultural contexts. Western cultures, which often promote emotional expression, tend to favor adaptive strategies like refocus on planning.<sup>29</sup> In contrast, Eastern cultures, where emotional expression is often suppressed, may lead to greater internalization of emotions, making rumination and catastrophizing more prevalent among NSSI adolescents.<sup>43</sup> Future research should explore CERS patterns across diverse cultures to better understand emotion regulation mechanisms in NSSI adolescents.

## CERS Network in Chinese Adolescents Without NSSI

The present study found that catastrophizing, rumination, and positive reappraisal occupy central positions within the CERS network of adolescents without NSSI. Unlike adolescents with NSSI, those without NSSI were more inclined to use positive reappraisal, suggesting this difference may be a key factor distinguishing NSSI adolescents from healthy controls. This finding indicates that fostering positive reappraisal could be essential in cognitive emotion regulation. The significant positive association between catastrophizing and rumination underscores the potential risk of reinforcing negative emotional cycles, which could increase distress. The negative association between positive reappraisal and catastrophizing suggests that positive reappraisal may help mitigate the adverse effects of catastrophizing. From a positive psychology perspective, preventing and intervening in NSSI should not only focus on reducing risk factors such as negative cognitive emotion regulation strategies but also emphasize the role of positive cognitive emotion

regulation strategies in reshaping negative cognition and helping individuals manage their emotions effectively. Thus, psychological interventions should focus on reducing the use of catastrophizing and rumination, while actively promoting adaptive strategies like positive reappraisal.

## Network Comparisons

This study highlights significant differences in the CERS network structure, global strength, and centrality estimation between Chinese adolescents with and without NSSI. While prior research noted differences in the use of adaptive and maladaptive CERS, this study provides further insight into their internal organization, supporting the Network Theory of Mental Disorders (NTMD), which links NSSI to alterations in network structure.<sup>18,21</sup> The CERS network in adolescents with NSSI exhibited significantly higher connectivity, suggesting tighter interconnections between CERS. This heightened connectivity may indicate a rigid emotional cycle, where adolescents are trapped in fixed patterns of thinking and behavior, limiting their ability to flexibly adjust their strategies. This rigidity could exacerbate emotional distress, perpetuating NSSI behaviors. Therefore, clinical interventions should focus on disrupting or reorganizing these rigid emotional networks, promoting flexibility through strategies like positive reappraisal, to more effectively prevent and treat NSSI.

Further centrality estimation showed that while catastrophizing and rumination are key strategies in adolescents with NSSI, positive reappraisal is central in those without NSSI. Catastrophizing plays a more critical role in the NSSI group, whereas positive reappraisal is more pivotal in the non-NSSI group. Rumination, however, displayed consistent effects across both groups, suggesting it operates similarly regardless of NSSI presence. This may be attributed to the fact that adolescents, whose emotional and cognitive development is not yet fully mature, are more prone to ruminative thinking patterns when facing stress. And this thinking mode, characterized by repetitive and prolonged focus on negative events, can lead to similar emotional distress across adolescents, regardless of whether they engage in NSSI behaviors.<sup>44,45</sup> These findings underscore the need for targeted interventions, emphasizing the importance of addressing catastrophizing in NSSI adolescents and reinforcing positive reappraisal strategies in those without NSSI.

## Limitations and Implications

This study enhances the understanding of CERS in Chinese adolescents with NSSI, highlighting the unique relationship between NSSI and the structure of CERS networks. The identification of tightly connected and rigid CERS networks as key features of NSSI supports the Network Theory of Mental Disorders (NTMD), emphasizing the critical role of internal organization and interaction patterns in NSSI. Clinical interventions should focus on enhancing adaptive strategies like positive reappraisal and reducing reliance on maladaptive strategies, such as catastrophizing and rumination, through targeted therapies like DBT, to improve emotional regulation flexibility and reduce NSSI risk. Future research should explore the efficacy of these interventions across diverse populations.

When interpreting the findings of this study, several limitations must be considered. First, the cross-sectional design limits our ability to examine the developmental trajectory of CERS in adolescents and makes it difficult to establish causal relationships between CERS and NSSI. Future research should employ longitudinal designs to further validate these findings. Additionally, while this study focused on the CERS network characteristics of Chinese adolescents with NSSI, it did not explore how difficulties in emotion regulation may mediate the relationship between CERS and NSSI. Future studies could incorporate emotion regulation difficulties to better understand the role of strategy implementation in the network relationship between strategy choice and NSSI. Finally, the sample was drawn from only one province in China, limiting the generalizability of the findings. Future research should consider larger and more diverse samples to enhance the external validity of the results.

## Conclusion

As far as we know, this is the first study to apply network analysis to explore the central strategies of CERS in Chinese adolescents with NSSI, and compare their CERS networks with those of adolescents without NSSI. This study identified catastrophizing and rumination as core CERS in both groups, with positive reappraisal also central in adolescents without NSSI. These findings highlight significant differences in network structure, global connectivity, and core strategies



between the two groups. The tightly connected and rigid cognitive emotion regulation networks characteristic of NSSI adolescents underscore the need for targeted prevention and clinical interventions aimed at enhancing positive reappraisal and reducing reliance on catastrophizing to improve emotional regulation flexibility and reduce the risk of NSSI.

## Abbreviations

NSSI, Non-suicidal self-injury; CERS, Cognitive emotion regulation strategies; CERQ, Cognitive emotion regulation Questionnaire; NTMD, Network Theory of Mental Disorders.

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## Disclosure

The authors report no conflicts of interest in this work.

## References

- Kieling C, Buchweitz C, Caye A, et al. Worldwide prevalence and disability from mental disorders across childhood and adolescence. *JAMA Psychiatry*. 2024;81(4):347–356. doi:10.1001/jamapsychiatry.2023.5051
- Krokstad MA, Sund E, Rangul V, et al. Secular trends in risk factors for adolescent anxiety and depression symptoms: the Young-HUNT studies 1995-2019, Norway. *Eur Child Adolesc Psych*. 2024;33(11):3819–3827. doi:10.1007/s00787-024-02373-2
- Nock MK, Joiner TE, Gordon KH, et al. Non-suicidal self-injury among adolescents: diagnostic correlates and relation to suicide attempts. *Psychiatry Res*. 2006;144(1):65–72. doi:10.1016/j.psychres.2006.05.010
- Moloney F, Amini J, Sinyor M, et al. Sex differences in the global prevalence of nonsuicidal self-injury in adolescents: a meta-analysis. *JAMA Network Open*. 2024;7(6):e2415436. doi:10.1001/jamanetworkopen.2024.15436
- Qu D, Wen X, Liu B, et al. Non-suicidal self-injury in Chinese population: a scoping review of prevalence, method, risk factors and preventive interventions. *Lancet Reg Health Western Pacific*. 2023;37:100794. doi:10.1016/j.lanwpc.2023.100794
- Luo D, Tan L, Huang X, et al. Functions of nonsuicidal self-injury and repeated nonsuicidal self-injury among adolescents: a moderating role of addictive features. *J Psychiatr Res*. 2024;175:251–258. doi:10.1016/j.jpsychires.2024.04.049
- Park Y, Qu W, Ammerman BA. Characteristics and functions of non-suicidal self-injury that inform suicide risk. *Arch Suicide Res*. 2024;28(4):1403–1416. doi:10.1080/13811118.2024.2310556
- Zhang M, Liu X, Xia W, et al. Network analysis of childhood maltreatment, anxiety, and addictive non-suicidal self-injury in adolescents. *Int J Mental Health Addict*. 2024;2024:1. doi:10.1007/s11469-024-01344-7
- Hasking P, Whitlock J, Voon D, et al. A cognitive-emotional model of NSSI: using emotion regulation and cognitive processes to explain why people self-injure. *Cognition Emotion*. 2017;31(8):1543–1556. doi:10.1080/02699931.2016.1241219
- Dawkins JC, Hasking PA, Boyes ME, et al. Applying a cognitive-emotional model to nonsuicidal self-injury. *Stress Health*. 2019;35(1):39–48. doi:10.1002/smi.2837
- Kohl A, Rief W, Glombiewski JA. How effective are acceptance strategies? A meta-analytic review of experimental results. *J Behav Ther Exp Psychiatry*. 2012;43(4):988–1001. doi:10.1016/j.jbtep.2012.03.004
- Wang QQ, Fang YY, Huang HL, et al. Anxiety, depression and cognitive emotion regulation strategies in Chinese nurses during the COVID-19 outbreak. *J Nurs Manag*. 2021;29(5):1263–1274. doi:10.1111/jonm.13265
- Motevalli S, Salahshour HM, Bailey RP. The mediating role of cognitive flexibility in the relationship between cognitive emotion regulation strategies and mindfulness in patients with type 2 diabetes. *J Affective Disorders*. 2023;339:676–682. doi:10.1016/j.jad.2023.07.043
- Vlasenko VV, Tucker WK, Waugh CE. Temporal orientation of positive reappraisal. *Emotion*. 2024;2024:1. doi:10.1037/emo0001331
- Madjar N, Segal N, Eger G, et al. Exploring particular facets of cognitive emotion regulation and their relationships with nonsuicidal self-injury among adolescents. *Crisis*. 2019;40(4):280–286. doi:10.1027/0227-5910/a000566
- Doric TM, Zivcic-Becirevic I, Smojver-Azic S. Anxiety in early adolescents during the covid-19 pandemic the role of intolerance of uncertainty and cognitive emotion regulation. *Eur J Psychol Open*. 2023;82(2):45–55. doi:10.1024/2673-8627/a000035
- Nurdag FT, Inan FS. Investigation of the role of cognitive emotion regulation strategies on depressive symptoms in mothers of children given A Diagnosis of cancer. *Cancer Nurs*. 2024;47(5):349–57. doi:10.1097/NCC.0000000000001221
- Myntti WW, Muehlenkamp JJ. Body regard disrupts emotional cascade processes in nonsuicidal self-injury. *J Clin Psychol*. 2023;79(9):1957–1967. doi:10.1002/jclp.23513
- Han X, Zhang Y, Chen D, et al. The impact of negative cognitive bias on NSSI: mediating non-adaptive cognitive emotion regulation strategies. *BMC Nursing*. 2024;23(1):358. doi:10.1186/s12912-024-02006-8
- Kelada L, Hasking P, Melvin G. Adolescent NSSI and recovery: the role of family functioning and emotion regulation. *Youth Soc*. 2018;50(8):1056–1077. doi:10.1177/0044118X16653153
- Borsboom D. A network theory of mental disorders. *World Psychiatry*. 2017;16(1):5–13. doi:10.1002/wps.20375
- Borsboom D, Deserno MK, Rhemtulla M, et al. Network analysis of multivariate data in psychological science. *Nat Rev Method Prim*. 2021;1(1):58. doi:10.1038/s43586-021-00055-w
- Borsboom D, Cramer AOJ. Network analysis: an integrative approach to the structure of psychopathology. *Ann rev clin psychol*. 2013;9:91–121. doi:10.1146/annurev-clinpsy-050212-185608

24. Robinaugh DJ, Hoekstra RHA, Toner ER, et al. The network approach to psychopathology: a review of the literature 2008-2018 and an agenda for future research. *Psychol Med*. 2020;50(3):353–366. doi:10.1017/S0033291719003404
25. Duncan-Plummer T, Hasking P, Tonta K, et al. Cognitive-emotional networks in students with and without a history of non-suicidal self-injury. *J Affect Disord*. 2023;329:394–403. doi:10.1016/j.jad.2023.02.054
26. Boccagno CE. The Self, Emotions, and Self-Injury: Links Between Self-Oriented Cognition and Emotion Processes in Non-Suicidal Self-Injury. Ph.D. Harvard University; 2022. Available from: <https://www.proquest.com/docview/2892632873/abstract/A41F7B50A7044089PQ/1>. Accessed May 30, 2024.
27. DeCou CR, Comtois KA, Landes SJ. Dialectical behavior therapy is effective for the treatment of suicidal behavior: a meta-analysis. *Behav Ther*. 2019;50(1):60–72. doi:10.1016/j.beth.2018.03.009
28. Sin NL, Lyubomirsky S. Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: a practice-friendly meta-analysis. *J Clin Psychol*. 2009;65(5):467–487. doi:10.1002/jclp.20593
29. Hampton RS, Varnum MEW. The cultural neuroscience of emotion regulation. *Cult Brain*. 2018;6(2):130–150. doi:10.1007/s40167-018-0066-2
30. You J, Lin MP, Fu K, et al. The best friend and friendship group influence on adolescent nonsuicidal self-injury. *J Abnorm Child Psychol*. 2013;41(6):993–1004. doi:10.1007/s10802-013-9734-z
31. Gu H, Chen W, Cheng Y. Longitudinal relationship between harsh parenting and adolescent non-suicidal self-injury: the roles of basic psychological needs frustration and self-concept clarity. *Child Abuse Negl*. 2024;149:106697. doi:10.1016/j.chiabu.2024.106697
32. Zhu X, Auerbach RP, Yao S, et al. Psychometric properties of the cognitive emotion regulation questionnaire: Chinese version. *Cognition Emotion*. 2008;22(2):288–307. doi:10.1080/02699930701369035
33. Chu Q, Wang X, Yao R, et al. Childhood trauma and current depression among Chinese university students: a moderated mediation model of cognitive emotion regulation strategies and neuroticism. *BMC Psychiatry*. 2022;22(1):90. doi:10.1186/s12888-021-03673-6
34. Epskamp S, Borsboom D, Fried EI. Estimating psychological networks and their accuracy: a tutorial paper. *Behav Res*. 2018;50(1):195–212. doi:10.3758/s13428-017-0862-1
35. Epskamp S, Fried EI. A tutorial on regularized partial correlation networks. *Psychol Meth*. 2018;23(4):617–634. doi:10.1037/met0000167
36. van Borkulo CD, van Bork R, Boschloo L, et al. Comparing network structures on three aspects: a permutation test. *Psychol Meth*. 2023;28(6):1273–1285. doi:10.1037/met0000476
37. Lang AN, Zhong Y, Lei W, et al. Neural mechanism of non-adaptive cognitive emotion regulation in patients with non-suicidal self-injury. *Compr Psychiat*. 2024;133:152487. doi:10.1016/j.comppsy.2024.152487
38. Egan SJ, Greene D, Callaghan T, et al. Worry and rumination as a transdiagnostic target in young people: a co-produced systematic review and meta-analysis. *Cogn Behav Ther*. 2025;54(1):17–40. doi:10.1080/16506073.2024.2369936
39. Mitchell E, Rosario-Williams B, Yeshchenko I, et al. Cognitive emotion regulation strategies among emerging adults with different self-harm histories. *J Affect Disord Rep*. 2023;14. doi:10.1016/j.jadr.2023.100638.
40. Selby EA, Bender TW, Gordon KH, et al. Non-suicidal self-injury (NSSI) disorder: a preliminary study. *Personal Disorders*. 2012;3(2):167–175. doi:10.1037/a0024405
41. Di Pierro R, Sarno I, Gallucci M, et al. Nonsuicidal self-injury as an affect-regulation strategy and the moderating role of impulsivity. *Child Adolesc Ment Health*. 2014;19(4):259–264. doi:10.1111/camh.12063
42. Ip JWY, Mcmain SF, Chapman AL, et al. The role of emotion dysregulation and interpersonal dysfunction in nonsuicidal self-injury during dialectical behavior therapy for borderline personality disorder. *Behav Res Ther*. 2024;180:104594. doi:10.1016/j.brat.2024.104594
43. Qu Y, Telzer EH. Cultural differences and similarities in beliefs, practices, and neural mechanisms of emotion regulation. *Cult Divers Ethn Minor Psychol*. 2017;23(1):36–44. doi:10.1037/cdp0000112
44. DiGiovanni AM, Fagle T, Vannucci A, et al. Within-person changes in co-rumination and rumination in adolescence: examining heterogeneity and the moderating roles of gender and time. *J Youth Adolesc*. 2022;51(10):1958–1969. doi:10.1007/s10964-022-01647-9
45. Monroe S, Simons A. Diathesis stress theories in the context of life stress research - implications for the depressive-disorders. *Psychol Bull*. 1991;110(3):406–425. doi:10.1037/0033-2909.110.3.406

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