Differences between networks of cognitive emotion regulation strategies in medical students with and without a history of non-suicidal self-injury

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Abstract:

BACKGROUND: Non-suicidal self-injury (NSSI) is deliberate self-harm without the intent to die. NSSI is associated with mental health issues and has a higher prevalence among medical students. Understanding the cognitive emotion regulation strategies in NSSI is important for intervention and prevention. Network analysis provides a holistic perspective on these strategies.

MATERIALS AND METHODS: Participants were 405 individuals (68.6% female) with a mean age of 22.7 years (standard deviation: 3.97, range: 17–55 years), recruited from Tehran, Iran. Upon conducting an initial screening, it was found that 68 individuals from our sample acknowledged a prior history of NSSI.

RESULTS: A network analysis showed that that students with a history of NSSI perceived themselves to have difficulties in putting into perspective, positive reappraisal, and self-blame. Compared to students without NSSI, those with NSSI exhibited negative associations between putting into perspective and rumination (PIP__RUM: −0.240) and positive associations between positive refocusing and catastrophizing (PR__Catast: 0.61).

CONCLUSIONS: This study discovered notable distinctions in the cognitive processing and coping strategies of medical students with and without a history of NSSI. These findings contribute to the existing literature on the link between cognitive-emotional processes and NSSI, informing the development of interventions to decrease such behaviors.

Keywords:

Emotion regulation, medical, psychological models, self-injurious behavior, students

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Introduction

Non-suicidal self-injury (NSSI) refers to deliberate acts of self-harm without the intent to die.[1] It is a significant concern among adolescents and young adults, with prevalence rates ranging from 17% to 35% in college populations.[2] NSSI has been associated with increased risk for various mental health issues, including depression, anxiety, borderline personality disorder, and suicide.[3,4] Medical students represent a unique population for studying NSSI and its related cognitive processes. They undergo significant academic and emotional stress during their training, making them vulnerable to psychological distress and the potential adoption of maladaptive coping mechanisms, such as NSSI.[5] Understanding the cognitive emotion regulation strategies employed by individuals with a history of NSSI is crucial for developing effective interventions and preventive measures.[6]

Conventional research approaches have typically focused on examining individual emotion regulation strategies in isolation, rather than considering the complex interactions among them. However, recent

How to cite this article: Zadehparizi R, Kianimoghadam AS. Differences between networks of cognitive emotion regulation strategies in medical students with and without a history of non-suicidal self-injury. J Edu Health Promot 2024;13:457.

advancements in network analysis have enabled a more comprehensive understanding of the interconnectedness among cognitive emotion regulation strategies.[7] Network analysis allows us to visualize the associations and strengths of these connections, offering a holistic perspective on the cognitive processes involved in emotion regulation.[8,9]

This study hypothesized that medical students with a history of NSSI would exhibit distinct differences in their cognitive emotion regulation network compared to those without a history of NSSI. These differences could manifest as alterations in the overall connectivity patterns, as well as specific strategies being more central or less influential within the network.[10,11] Understanding such differences may help uncover cognitive vulnerabilities specific to individuals with NSSI histories and guide the development of targeted interventions to prevent NSSI and promote healthier coping strategies among medical students.

In summary, this study aimed to investigate the differences in the networks of cognitive emotion regulation strategies in medical students with and without a history of NSSI. By employing network analysis, we sought to identify unique network characteristics associated with NSSI, providing valuable insights into the cognitive processes underlying NSSI in a high-risk population. These findings have the potential to inform preventive interventions and support medical students' mental well-being during their training.

Materials and Methods

Study design and setting
This was a cross-sectional study conducted among the medical students of Tehran, Iran.

Study participants and sampling
To conduct this cross-sectional design, 405 individuals (68.6% female) with a mean age of 22.7 years (standard deviation: 3.97, range: 17–55 years) completed the study questionnaires. Informed consent was obtained from the medical students. Upon conducting an initial screening, it was found that 68 individuals from our sample acknowledged a prior history of NSSI. Regarding marital status, the sample consisted of mainly singles (84%). The remaining participants were in a relationship (8.1%), married (7.4%), and divorced (0.5%).

Data collection tool and technique
The Cognitive Emotion Regulation Questionnaire Short Form (CERQ-short): CERQ-short is an 18-item questionnaire developed by Garnefski and Kraaij in 2006.[12] Its aim is to assess nine cognitive emotion

regulation strategies, including positive refocusing, planning, positive reappraisal, putting into perspective, acceptance, self-blame, other-blame, rumination, and catastrophizing.[13] Each subscale of the questionnaire consists of two items, and respondents rate their agreement with each item on a 5-point Likert scale ranging from 1 (never) to 5 (almost).[12] The highest score on each subscale indicates a higher frequency of using that particular emotion regulation strategy. The reliability and validity of CERQ-short have been supported.[13] In the Persian version of the questionnaire, a preliminary examination of the psychometric properties of the questionnaire was conducted with a general population sample comprising 478 individuals, including 252 females and 226 males. The calculated Cronbach's α coefficients for the subscales ranged from 0.73 to 0.90, indicating robust internal consistency for this questionnaire. The content validity of CERQ was assessed through the judgment of 10 psychological experts, and the calculated Kendall's coefficient of agreement for the subscales ranged between 0.73 and 0.87. These findings underscore the reliability and validity of CERQ in the Iranian population.[14]

In the current study, a visualized network analysis was conducted using Jeffrey's Amazing Statistics Program (JASP) 0.16.4.0 to examine the connections within the network. To visualize cognitive emotion regulation networks, we used partial correlation network analysis for both individuals with and without a history of NSSI separately.

Partial correlation networks are a type of network analysis that estimate the partial associations between variables while controlling for the effects of other variables.[15,16] Partial correlation networks are used to identify and analyze patterns of statistical association in multivariate data.[16] They are most commonly used to estimate correlation matrices in settings where variables are directly interacting with each other rather than being caused by an unobserved latent entity. Regularization techniques can be used to efficiently estimate a parsimonious and interpretable network structure in psychological data.[17] The connections between nodes were represented by edges, where the thickness of the edges was used to indicate the strength of the association between the nodes. Blue edges were used to indicate positive correlations. The centrality of nodes in the network, which represented study variables, was calculated using measures of betweenness, closeness, and strength. Betweenness measures the degree of connectivity, closeness measures distance centrality, and strength measures degree centrality. These centrality measures are commonly used in social network analysis to investigate the position of nodes in the network. Note that the choice of centrality measure depends on

the context of the network, the type of relation being analyzed, and the underlying network morphology.[18]

Ethical consideration

The study procedures were approved by the Research Ethics Committee of the Vice-Chancellor in Research Affairs, Shahid Beheshti University of Medical Sciences (IR.SBMU.RETECH.REC.1400.462).

Results

Network visualization

The cognitive emotion regulation strategies networks of individuals without and with a history of NSSI are presented in Figures 1 and 2, respectively. Both networks were visualized using the qgraph package in JASP 0.16.4.0. Thin and faint lines between nodes indicate weaker edge weights, while thicker and bolder lines represent stronger edge weights.

Edge weights in the network of medical students without a history of NSSI ranged from −0.18 (self-blame–other-blame) to 0.47 (refocus on planning–positive reappraisal). Edge weights in the network of medical students with a history of NSSI ranged from −0.33 (self-blame–other-blame) to 0.51 (refocus on planning–positive reappraisal).

There were some plain differences between networks of medical students who had a history of NSSI and those who did not. For example, in the networks of medical students who had a history of NSSI, we could see a negative relationship between putting into perspective and rumination edge (−0.24), but this relationship was positive (0.011) in the group of students who did not have a history of NSSI. Also, the relationship between positive refocusing and catastrophizing edge in the group of medical students who had a history of NSSI was positive (0.06), but for medical students who did

not a history, it was negative (−0.13) [see Table 1 for more details].

Characteristics of edges and nodes

Centrality measures, including betweenness centrality and closeness centrality, aim to pinpoint the most influential or central nodes within a network. By providing insights into the overall network structure, these measures assist in the identification of key variables that play a pivotal role.

Figure 3 and Table 2 show the study variables' betweenness, closeness, strength (degree), and expected influence differences between two groups in the domain-level network. The three most central nodes in the network of medical students without NSSI history were *rumination*, *positive refocusing*, and *self-blame*. These nodes were significantly stronger than each other. The most central nodes in the network of medical students with NSSI history were *putting into perspective*, *positive reappraisal*, and *self-blame*. These nodes were significantly stronger than each other.

Discussion

The present study aimed to investigate the cognitive emotion regulation strategies networks of medical students with and without a history of NSSI. The results showed that the cognitive-emotional networks of medical students with and without NSSI history differ in terms of the strategies they use to regulate negative emotions. This discernment of distinct patterns in cognitive-emotional networks underscores the critical nuances in cognitive emotion regulation within the context of medical student populations, providing invaluable insights that can significantly enhance the precision and effectiveness of targeted interventions.

The findings of this study showed that, for medical students without NSSI history, rumination, positive
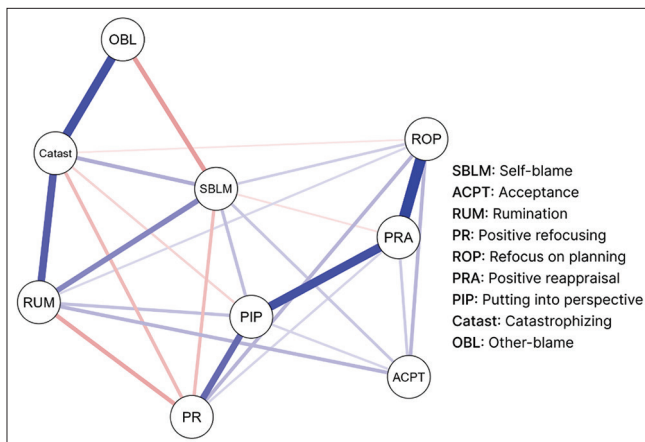

Figure 1: Cognitive emotion regulation strategies networks in medical students without a history of NSSI. NSSI = non-suicidal self-injury
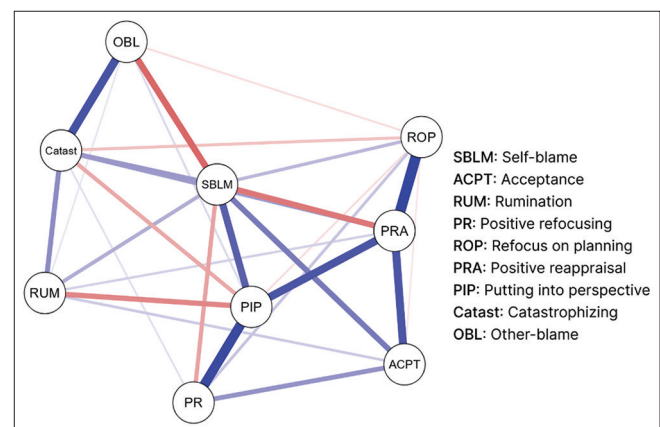

Figure 2: Cognitive emotion regulation strategies networks in medical students with a history of NSSI. NSSI = non-suicidal self-injury

Table 1: Cognitive emotion regulation strategies weights matrix

Variable	Without history of NSSI									With history of NSSI								
	SBLM	ACPT	RUM	PR	ROP	PRA	PIP	Catast	OBL	SBLM	ACPT	RUM	PR	ROP	PRA	PIP	Catast	OBL
SBLM	0.000	0.103	0.222	-0.123	0.091	-0.061	0.119	0.149	-0.183	0.000	0.259	0.160	-0.186	0.138	-0.270	0.332	0.204	-0.303
ACPT	0.103	0.000	0.137	0.000	0.135	0.097	0.079	0.000	0.000	0.259	0.000	0.104	0.213	-0.051	0.380	0.000	0.000	0.000
RUM	0.222	0.137	0.000	-0.166	0.074	0.000	0.117	0.319	0.000	0.160	0.104	0.000	0.000	0.000	0.091	-0.240	0.226	0.050
PR	-0.123	0.000	-0.166	0.000	0.137	0.079	0.275	-0.130	0.000	-0.186	0.213	0.000	0.000	0.115	0.000	0.468	0.061	0.000
ROP	0.091	0.135	0.074	0.137	0.000	0.477	0.000	-0.050	0.000	0.138	-0.051	0.000	0.115	0.000	0.514	-0.066	-0.124	-0.066
PRA	-0.061	0.097	0.000	0.079	0.477	0.000	0.378	0.000	0.000	-0.270	0.380	0.091	0.000	0.514	0.000	0.378	0.198	0.000
PIP	0.119	0.079	0.117	0.275	0.000	0.378	0.000	-0.081	0.000	0.332	0.000	-0.240	0.468	-0.066	0.378	0.000	-0.174	0.072
Catast	0.149	0.000	0.319	-0.130	-0.050	0.000	-0.081	0.000	0.374	0.204	0.000	0.226	0.061	-0.124	0.198	-0.174	0.000	0.394
OBL	-0.183	0.000	0.000	0.000	0.000	0.000	0.000	0.374	0.000	-0.303	0.000	0.050	0.000	-0.066	0.000	0.072	0.394	0.000

ACPT=acceptance, Catast=catastrophizing, NSSI=non-suicidal self-injury, OBL=other-blame, PIP=putting into perspective, PR=positive refocusing, PRA=positive reappraisal, ROP=refocus on planning, RUM=rumination, SBLM=self-blame
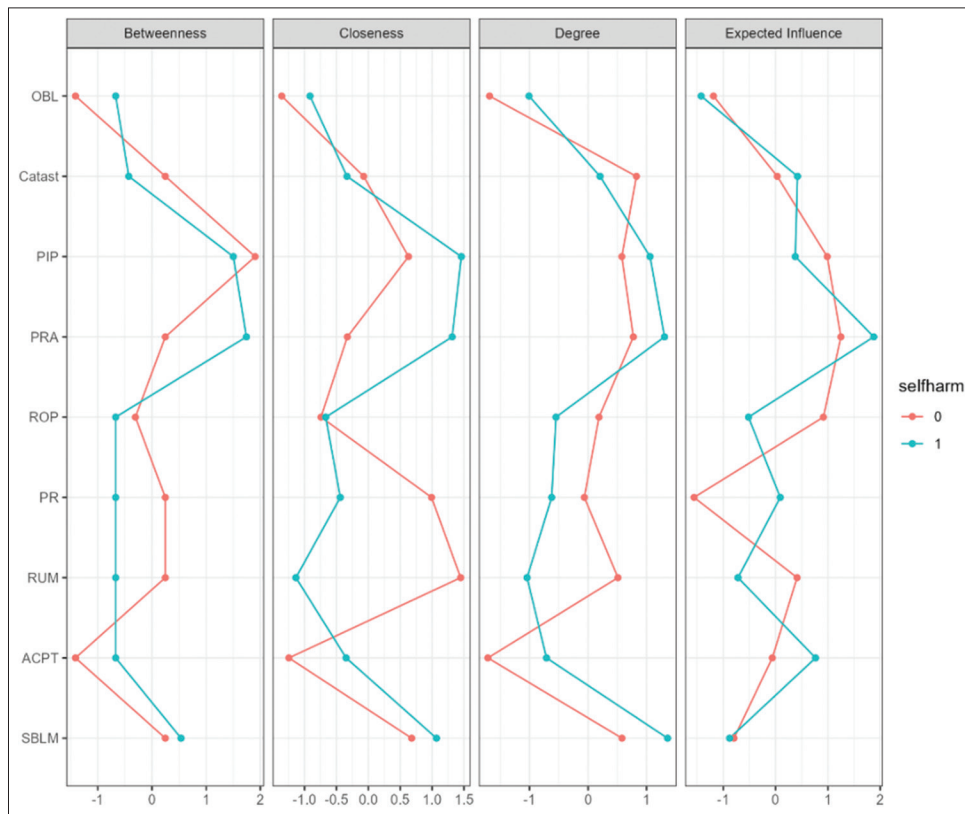

Figure 3: Centrality indices of node betweenness, closeness, degree, and expected influence of the estimated network. Indices are shown as standardized z-scores.
Note: 0: No NSSI, 1: NSSI. ACPT = acceptance, Catast = catastrophizing, NSSI = non-suicidal self-injury, OBL = other-blame, PIP = putting into perspective, PR = positive refocusing, PRA = positive reappraisal, ROP = refocus on planning, RUM = rumination, SBLM = self-blame

refocusing, and self-blame emerged as central nodes, highlighting the dominance of these strategies. However, medical students with NSSI history exhibited a different pattern, with putting into perspective, positive reappraisal, and self-blame playing pivotal roles in their cognitive-emotional networks.

The increased strength of rumination in medical students without NSSI history may indicate a propensity toward self-reflective thought processes.[19,20] On exploring the prevalence of self-blame as a cognitive emotion regulation strategy among medical students without NSSI history, our findings underscored its significant role within their networks. The prominence of self-blame suggests that these individuals may tend to internalize negative events and attribute responsibility to themselves when faced with adversity.[21] This tendency could stem from various factors such as high levels of self-criticism,[22-24] perfectionistic tendencies,[25,26] or societal pressures[27-29] to excel in their academic and professional endeavors. On the contrary, positive refocusing emerged as a key protective factor. Medical students who engaged in positive refocusing were less likely to engage in NSSI behaviors, highlighting the importance of adaptive coping

Table 2: Centrality measures per variable

Variable	Without history of NSSI				With history of NSSI			
	Betweenness	Closeness	Strength	Expected influence	Betweenness	Closeness	Strength	Expected influence
SBLM	0.245	0.680	0.580	-0.793	0.536	1.069	1.358	-0.877
ACPT	-1.412	-1.246	-1.710	-0.062	-0.670	-0.348	-0.709	0.765
RUM	0.245	1.448	0.510	0.412	-0.670	-1.136	-1.041	-0.716
PR	0.245	0.991	-0.063	-1.555	-0.670	-0.440	-0.621	0.090
ROP	-0.307	-0.742	0.187	0.914	-0.670	-0.669	-0.547	-0.516
PRA	0.245	-0.329	0.774	1.249	1.742	1.315	1.305	1.877
PIP	1.903	0.630	0.577	0.988	1.501	1.459	1.059	0.378
Catast	0.245	-0.073	0.826	0.033	-0.429	-0.335	0.205	0.420
OBL	-1.412	-1.359	-1.681	-1.186	-0.670	-0.915	-1.008	-1.420

ACPT=acceptance, Catast=catastrophizing, NSSI=non-suicidal self-injury, OBL=other-blame, PIP=putting into perspective, PR=positive refocusing, PRA=positive reappraisal, ROP=refocus on planning, RUM=rumination, SBLM=self-blame

strategies in mitigating self-harm tendencies.[30] These results underscore the potential value of interventions targeting positive cognitive restructuring techniques to promote psychological well-being and resilience among medical students.[31]

On delineating the networks of medical students with a history of NSSI, our study revealed a distinctive pattern characterized by the central roles of putting into perspective, positive reappraisal, and self-blame as key cognitive emotion regulation strategies. This divergence from the cognitive-emotional profiles of their counterparts without NSSI history suggests unique adaptive and maladaptive coping mechanisms employed by individuals with a history of NSSI. The prominence of putting into perspective and positive reappraisal may reflect efforts to reinterpret distressing experiences in a more positive light or to gain a broader perspective on their challenges.[32,33] However, the continued presence of self-blame within their cognitive-emotional networks highlights persistent negative self-evaluative tendencies, potentially contributing to ongoing psychological distress.[34]

The findings of this study were in line with the majority of research conducted in the field of cognitive emotion regulation. For example, previous studies revealed that students with NSSI reported higher levels of acceptance, but lower levels of refocus on planning and putting into perspective,[6] These findings are further corroborated by previous research (e.g. Bucknell *et al.*[19] and Takano and Tanno[20]), where individuals with a history of NSSI were found to perceive themselves as more reactive to negative emotions.

These findings suggest that medical students with and without NSSI history differed in their cognitive processing of negative emotions and strategies used to deal with these emotions.[35,36] The present study contributes to the growing body of literature on the association between cognitive-emotional processes and NSSI. A deeper understanding of cognitive emotion regulation strategy preferences among people with NSSI has important implications for clinical intervention approaches. For instance, the present findings suggest that targeting interventions toward cognitive strategies such as putting into perspective, positive reappraisal, and addressing self-blame may be more beneficial for individuals with a history of NSSI. These results resonate with previous research in the field. The work of Nock and Prinstein[37] emphasizes the importance of a functional approach in assessing self-mutilative behavior, shedding light on the nuanced intricacies of strategies that may be targeted in interventions. In addition, the study by Selby *et al.* (2013) delves into the role of emotional cascades and self-injury, providing insights into the instability of rumination and negative emotion, which further supports the relevance of targeting specific cognitive strategies.[22]

However, there are some limitations to this study. First, the study was conducted on a sample of medical students, which may limit the generalizability of the findings to other populations. Second, the study relied on self-report measures, which may be subject to social desirability bias. Furthermore, the group size of individuals with NSSI was small.

Conclusion

This study illuminates the intricate landscape of cognitive emotion regulation strategies among medical students, highlighting distinct patterns between those with and without a history of NSSI. The findings underscore the pivotal role of rumination, positive refocusing, and self-blame in the cognitive-emotional networks of medical students without NSSI history, while individuals with NSSI history exhibit a different constellation marked by putting into perspective, positive reappraisal, and persistent self-blame. These results emphasize the importance of tailored interventions that address the specific cognitive strategies employed by individuals with NSSI history, such as promoting positive cognitive restructuring techniques and targeting maladaptive

self-blame tendencies.[33] Future studies could investigate generalizability of the findings to other populations.

Conflicts of interest

There are no conflicts of interest.

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