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Network analysis of emotion regulation and moral injury symptoms among medical staff

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Abstract

Current research indicates that medical staff frequently experience potentially morally injurious events, leading to moral injury (MI), which is associated with adverse physical and mental health as well as occupational burnout. Using the conceptual model of MI, this study investigated the symptom-level connections between distinct emotion regulation (ER) strategies—cognitive reappraisal (CR) and expressive suppression (ES)—and MI symptoms among medical staff. Using network analysis, we assessed ER capacities and MI symptoms in a sample of 1,001 medical staff. An ER-MI network was constructed to depict the interplay between these variables, with additional analysis examining gender and professional differences in the ER-MI network characteristics. Results revealed that cognitive reappraisal was negatively correlated with various MI symptoms, while expressive suppression was positively correlated. Several critical connections were identified, such as connections between cognitive reappraisal and Loss of faith, cognitive reappraisal and Loss of trust, and ES and Feeling betrayed. Bridge centrality metrics indicated that cognitive reappraisal had a negative bridge expected influence (BEI) value, whereas expressive suppression had a positive BEI value. Network comparison tests revealed significant gender differences on two specific between-community connections: between cognitive reappraisal and Feeling betrayed and between cognitive reappraisal and Self-condemnation. There was no significant professional difference in ER-MI network characteristics in the current study. These findings may provide novel perspectives for understanding MI through the lens of ER and highlight potential targets for prevention and intervention strategies aimed at medical staff.

Keywords: Medical staff, Emotion regulation, Moral injury, Gender differences, Network analysis

Moral injury (MI) entails a complex process encompassing an individual's exposure to potentially morally injurious events (PMIEs) and subsequent psychological harm via psychophysiological processes[1]. PMIEs are defined as "perpetrating, failing to prevent, bearing witness to, or learning about acts that transgress deeply held moral beliefs and expectations"[1]. MI reflects the enduring psychological, physiological, spiritual, behavioral, and social consequences of PMIEs. From a syndromic perspective, Jinkerson (2016)[2] specified the symptomatology into core symptoms (guilt, shame, spiritual conflict, loss of trust) and secondary symptoms (anxiety, depression, anger, intrusive re-experiencing, self-harm, and social problems).

Medical staff routinely encounter diverse PMIEs, such as helplessly witnessing patient deaths[3,4] or facing moral dilemmas involving treatment delays[5]. These events precipitate varying degrees of moral distress or injury[1,6]. MI profoundly compromises well-being, manifesting as severe anxiety, depression, PTSD, and other mental disorders[7–10], while simultaneously impairing work efficiency, diminishing organizational commitment, exacerbating occupational burnout, and increasing turnover rates[10,11]. Consequently, controlling or reversing MI progression is critical for safeguarding medical staff welfare[1,12].

Emotion regulation (ER) strategies offer a viable intervention avenue for mitigating MI. First, theoretical models posit that mere exposure to PMIEs is insufficient for MI development; its progression hinges critically on cognitive appraisal of events,[13,14]. MI manifests when individuals attribute PMIEs through stable, internal, and global appraisals, triggering persistent cognitive dissonance and maladaptive emotional responses[15]. Aligning with Lazarus's cognitive-appraisal theory[15], individuals may engage in cognitive reappraisal (CR) to reconstruct event meanings, thereby modifying cognitive-emotional responses and alleviating MI severity. Thus, MI etiology is intrinsically linked to attributional style, and symptom remediation may occur through reappraising this process (i.e., ER). Second, evidence-based interventions—such as narrative restructuring, forgiveness cultivation, and meaning/value reconstruction[16]—operate by altering negative PMIEs appraisals and rebuilding compromised moral schemas (i.e., via ER mechanisms). Collectively, both etiological models and clinical interventions underscore ER's pivotal role in modifying MI trajectories.

To manage negative affect, individuals utilize ER strategies, which are broadly categorized as adaptive (e.g., cognitive reappraisal) or maladaptive (e.g., expressive suppression)[17]. cognitive reappraisal involves reinterpreting a situation's meaning to alter its emotional valence[18,19], correlating with reduced negative affect, attenuated physiological arousal, and enhanced resilience[17]. Conversely, ES entails inhibiting outward emotional expressions while suppressing authentic emotional experiences[19,20]. ES is widely deemed maladaptive due to its associations with elevated negative affect, heightened physiological stress responses, and increased cognitive load[21,22]. Although embodied cognition perspectives (e.g., Facial Feedback Hypothesis) suggest ES might

transiently dampen emotional intensity[23].Therefore, the role of expressive suppression in ER warrants further investigation.

Although ER strategies modulate general negative affect, their efficacy for trauma induced by PMIEs remains unclear, and their potential as protective factors against MI requires investigation[24,25]. Prior research rarely examines relationships between specific ER strategies and manifestations of MI[24,25]. Furthermore, gender and professional roles may shape the relationships between emotion regulation and moral injury. Males typically report greater use of expressive suppression than females, which could lead to divergent connections to moral injury[22]. Additionally, recent studies have demonstrated that physicians report higher MI levels than nurses, likely due to differing responsibilities and exposures[70]. Therefore, this study will also examine whether these relationships differ by gender and professional subgroup (physicians vs. nurses), in order to identify potential subgroup-specific patterns.

Existing studies typically use latent variable approaches (aggregating MI symptoms into total scores), reporting beneficial effects of adaptive strategies. This approach suffers from two limitations: 1) It masks the differential connections between ER strategies and distinct MI symptoms, limiting fine-grained, symptom-level insight and thereby hindering a comprehensive understanding of the complex interplay between ER and MI; 2) It ignores strategic diversity—cognitive reappraisal and expressive suppression represent distinct cognitive processes with potentially divergent efficacies, making their aggregation methodologically unsound.

To overcome the aforementioned limitations, we employed a symptom-based method known as network analysis[71-73]. This is a data-driven approach that does not depend on priori causal models of variables [74-75]. In network analysis, psychological phenomena are understood as emerging from interactions among their constituent components. Thus, it offers an innovative perspective by emphasizing the interplay of these components, rather than relying on latent variables to explain complex psychological systems[76-77]. Compared with traditional statistical models, network analysis provides several methodological advantages for this study: 1) Visualization. It presents relationships among variables in an intuitive visual format[78-80]; 2) Statistical benefits. Edges are estimated using regularized partial correlations, which control for all other variables and apply regularization to produce clearer and more interpretable multivariate networks[29,81]; 3) Bridge centrality index (BEI). This measure quantifies the bridging role of ER strategies in relation to MI symptoms[35]. Insights from the BEI may help identify potential targets for screening, prevention, and clinical intervention[82]; 4) Network comparison. Network comparison tests allow detection of potential differences in network characteristics across subgroups[39,41]. We can examine the gender (male vs. female) and professional (physician vs. nurse) differences in the ER-MI network characteristics.

This study constructs a network model examining symptom-level interrelationships between two ER strategies (i.e., cognitive reappraisal and expressive suppression) and MI symptoms. The study has three objectives: 1) Examine connections linking ER strategies to MI symptoms; 2) Identify the bridging roles of cognitive reappraisal and expressive suppression regarding MI symptoms cluster; 3) Investigate the gender and professional differences in the ER-MI network characteristics.

Method

Participants and procedures

Data were collected via the Chinese online survey platform Wenjuanxing (www.wjx.cn) from April 10 to 21, 2025. Initially, 1,425 healthcare workers from three Grade III-A general hospitals (the highest tier and quality rating within China's public hospital classification system) in southern China were recruited. We included only participants who gave informed consent. During data cleaning, 424 responses were excluded: 31 responses due to missing or inaccurate demographic information, and 393 for failing two embedded attention-check questions (e.g., not following the specific instruction "Please select the third option for this item"). Consequently, the final analytical sample comprised 1,001 participants.

Ethical statement

Approval for the data collection procedures was obtained from the Ethics Committee of the School of Psychology at Shaanxi Normal University (Approval No. HR2025-05-19), with all procedures conducted in accordance with the Declaration of Helsinki.

Measurements

Moral injury

The current study adapted the Moral Injury Symptom Scale Healthcare Professionals Version (MISS-HP) in accordance with the national conditions of China[6,26]. The scale consists of 10 items, which assess feeling betrayed, guilty, shamed, troubled, loss of trust, loss of meaning, unforgiveness, self-condemnation, feeling punished, and loss of faith. A sample item is: "I feel betrayed by other health professionals whom I once trusted". Among these, the items for feeling punished and loss of professional faith were adjusted in accordance with the national conditions of China. The scale uses a 10-point rating system, with four items scored in reverse. Higher total scores on the scale indicate more severe MI symptoms. Acceptable internal consistency was demonstrated by the MISS-HP in this study, with a Cronbach's alpha coefficient of 0.74.

Emotion regulation

The present study utilized the Chinese revised version of the Emotion Regulation Questionnaire (ERQ) developed by Gross[22,27,28]. The questionnaire comprises 10 items and employs a 7-point rating scale, where 1 indicates “strongly disagree” and 7 indicates “strongly agree”. The questionnaire assesses two dimensions: cognitive reappraisal and expressive suppression. The cognitive reappraisal subscale consists of 6 items, with higher scores indicating a greater propensity to utilize cognitive reappraisal strategies. A sample item is: “When I want to feel less negative emotion (such as sadness or anger), I change what I’m thinking about”. The expressive suppression subscale is composed of 4 items, with higher scores suggesting a stronger tendency to employ expressive suppression strategies. A sample item is: “When I am feeling negative emotions, I make sure not to express them”. In this investigation, the cognitive reappraisal subscale exhibited good internal consistency (Cronbach’s alpha = 0.86), while the ES subscale demonstrated an acceptable level (Cronbach’s alpha = 0.78).

Data analysis

R (version 4.2.1) and RStudio (version 2023.12.1+402) were used for network analysis[87]. Gaussian Graphical Model (GGM) was used to estimate the ER-MI network, along with the EBICglasso (Extended Bayesian Information Criterion combined with Graphical Least Absolute Shrinkage and Selection Operator) algorithm[29,30]. The EBIC hyperparameter (gamma) was fixed at 0.5[31]. Estimation of the network used the R package bootnet[38]. Within this network, edges represent partial (Spearman) correlations between pairs of nodes, calculated after adjusting for the influence of all other nodes[29,32]. Visualization of the network utilized the Fruchterman-Reingold algorithm, implemented via the R package qgraph[33,34].

To assess the bridging effects of nodes, particularly cognitive reappraisal and expressive suppression, the BEI was computed using the R package networktools[35]. A higher positive BEI value reflects a stronger capacity to positively bridge other communities, while a higher negative value denotes a greater capacity to negatively bridge other communities[35–37]. This enabled the examination of the bridging roles of cognitive reappraisal and ES on MI at the symptom-cluster level.

The accuracy of edge weights was estimated via computing 95% confidence intervals using non-parametric bootstrap analysis with 1,000 samples. The stability of node BEI was evaluated by computing the correlation stability coefficient (CSC) using a case-dropping bootstrap analysis with 1,000 samples[38]. As recommended by Epskamp et al. (2018), a CSC exceeding 0.5 is deemed optimal[38]. These analyses were performed utilizing the R package bootnet[38].

Potential gender (i.e., male vs. female) and professional (i.e., physician and nurse) differences in the ER-MI network characteristics were investigated through a network comparison test, executed with the R package NetworkComparisonTest and 1,000 permutations[39]. The analysis examined gender or professional differences in four tests:

1) network invariance test; 2) global strength invariance test; 3) edge invariance test; 4) centrality invariance test[39]. As for 3) and 4), we especially focused on the weight of between-community edges and the BEI values of cognitive reappraisal and expressive suppression. Given the exploratory nature of the study and the lack of prior predictions regarding edge-wise differences, adjustments for multiple comparisons were not applied in the statistical testing[39–41].

Results

The final sample consisted of 439 physicians (females = 240) and 562 nurses (females = 527) aged 19-75 years (mean age =34.86, SD =7.94) and worked 0-52 years (mean working years = 12.11, SD = 8.42). Table 1 displays the descriptive statistical results.

Insert Table 1

Figure 1a shows the ER-MI network structure. Cognitive reappraisal is negatively linked with 7 MI symptoms: MI10 ("Loss of faith", weight = -0.13), MI5 ("Loss of trust", weight = -0.10), MI9 ("Feeling punished", weight = -0.07), MI7 ("Unforgiveness", weight = -0.03), MI8 ("Self-condemnation", weight = -0.01), MI1 ("Feeling betrayed", weight = -0.01), and MI6 ("Loss of meaning", weight = -0.01). Expressive suppression is positively linked with 5 MI symptoms: MI1 ("Feeling betrayed", weight = 0.04), MI9 ("Feeling punished", weight = 0.04), MI2 ("Guilty", weight = 0.02), MI10 ("Loss of faith", weight = 0.02), and MI3 ("Shamed", weight = 0.01). All edge weights within the ER-MI network can be found in Table S1 (in Supplemental Material). The 95% confidence intervals are narrow, indicating that the edge weights are relatively accurate (Fig. S1 in the Supplementary Material).

Table 1 and Figure 1b show the raw value of BEI for each node within the ER-MI network. The cognitive reappraisal's BEI value is negative (value = -0.35), whereas the expressive suppression's BEI value is positive (value = 0.13). The CSC of node BEI is 0.75, indicating the BEI is adequately stable (Fig. S2 in the Supplementary Material).

Insert Figure 1

Figure 2a and 2b show the ER-MI networks for male and female groups, respectively. Network invariance (test statistic M = 0.140, $p = 0.690$) and global strength invariance tests show no significant difference (male = 4.665, female = 5.019, test statistic S = 0.354, $p = 0.575$). Edge invariance test between male and female groups reveals two between-community edges have significant differences in edge weights: CR-MI1 ("Feeling betrayed", weight = -0.14 in males, weight = 0 in females, $p < 0.001$) and CR-MI8 ("Self-condemnation", weight = -0.09 in males, weight = 0 in females, $p = 0.027$). All edge weights within the ER-MI network for male and female groups can be found in Table S2 and S3 (in Supplemental Material). Figure 2c shows the BEI values for female and male groups. The BEI values of cognitive reappraisal

and expressive suppression shows no significant differences between male and female medical staff (p = 0.700 and p = 0.627). Fig. S3-S6 (Supplementary Material) show the accuracy of edge weights and the stability of node BEI (CSC = 0.52 in male, CSC = 0.75 in female) within both male and female ER-MI networks.

Insert Figure 2

Figure 3a and 3b show the ER-MI networks for physician and nurse groups, respectively. Network invariance (test statistic M = 0.122, p = 0.605) and global strength invariance tests show no significant difference (physician = 4.426, nurse = 4.830, test statistic S = 0.404, p = 0.242). Edge invariance test between physician and nurse groups reveals no between-community edges have significant differences. All edge weights within the ER-MI network for physician and nurse groups can be found in Table S4 and S5 (in Supplemental Material). Figure 3c shows the BEI values for physician and nurse groups. The BEI values of cognitive reappraisal and expressive suppression shows no significant differences between physician and nurse groups (p = 0.917 and p = 0.443). Fig. S7-S10 (Supplementary Material) show the accuracy of edge weights and the stability of node BEI (CSC = 0.67 in physician, CSC = 0.67 in nurse) within both physician and nurse ER-MI networks.

Insert Figure 3

Discussion

To clarify the role of ER in MI symptoms and inform future intervention development, this study employed network analysis to examine the effects of distinct ER strategies—cognitive reappraisal and expressive suppression—on specific MI symptoms. Our findings demonstrate that cognitive reappraisal and expressive suppression exert differential effects across symptom manifestations and identify several critical connections. Bridge centrality analyses further support the distinct bridging roles of cognitive reappraisal and expressive suppression with respect to moral injury symptoms. Additionally, network comparison tests reveal gender differences moderation in two between-community connections: CR-feeling betrayed and CR-self-condemnation, indicating distinct regulatory patterns between males and females. There was no significant professional difference in ER-MI network characteristics in the current study.

In the ER-MI network, cognitive reappraisal correlated negatively with seven symptoms: MI1 (“Feeling betrayed”), MI5 (“Loss of trust”), MI6 (“Loss of meaning”), MI7 (“Unforgiveness”), MI8 (“Self-condemnation”), MI9 (“Feeling punished”), and MI10 (“Loss of faith”), indicating its positive bridging role in symptom reduction. According to Litz et al.’s (2009) working conceptual model of MI[1], these symptoms

stem from stable, internal (self-blaming), and global (context-independent) attributions[1,13,42]. cognitive reappraisal facilitates the reinterpretation of event contexts, meanings[43], motivations, and consequences, thereby enabling appraisal revision and reattribution. Empirical evidence confirms cognitive reappraisal effectively reduces negative affect[1], enhances positive affect[44], attenuates physiological reactivity[45], and mitigates MI symptoms[11]. The efficacy of cognitive reappraisal varies across symptoms. cognitive reappraisal demonstrated no association with symptom reduction for MI2 (“Guilty”), MI3 (“Shamed”), and MI4 (“Troubled”). These self-referential emotions stem from severe violations of personal moral standards, including failures to save critically ill patients, provide adequate medical care, or adhere to ethical principles during treatment. cognitive reappraisal’s inefficacy may relate to two mechanisms: 1) Given explicit action-outcome causality, individuals adopt self-focused strategies by maintaining a neutral stance toward emotionally salient stimuli[46]; and 2) Medical staff process PMIEs with high psychological distance[47] (abstract/generalized thinking), which impedes anxiety regulation[48]. Conversely, symptoms like loss of trust, feeling punished, and loss of faith reflect negative self-appraisals driven by attributional style. Here, Cognitive reappraisal could operate through: a) Subtype strategies (positive reappraisal emphasizing situational benefits or detached reappraisal employing psychological distancing) to potentially modify attributions[49]; and b) possibly Enhanced self-efficacy[50,51] and self-acceptance[52] to mitigate negative self-appraisals. One cultural consideration is that Chinese collectivism[53] and resilience[54]—which might be cultivated through professional training—could facilitate reframing moral dilemmas.

In the ER-MI network, expressive suppression correlated positively with five symptoms: MI1 (“Feeling betrayed”), MI2 (“Guilty”), MI3 (“Shamed”), MI9 (“Feeling punished”), and MI10 (“Loss of faith”), indicating its role in symptom exacerbation. This aligns with existing evidence: for MI1 (“Feeling betrayed”), MI2 (“Guilty”), MI3 (“Shamed”), MI9 (“Feeling punished”), and MI10 (“Loss of faith”), Expressive suppression reduces behavioral expression of negative emotions but fails to decrease subjective emotional intensity, potentially amplifying physiological arousal[14,22,55–57]. Chronic expressive suppression use sustains accumulation of negative affect and fosters rumination[58], reinforcing negative self-cognitions[59]—thereby explaining its associations with MI9 (“Feeling punished”) and MI10 (“Loss of faith”). Additionally, expressive suppression reduces interpersonal satisfaction and weakens social networks[22,60,61], partially accounting for its failure to alleviate MI1 (“Feeling betrayed”).

Using network analysis, we quantified the unique roles of cognitive reappraisal and expressive suppression through BEI index. In the ER-MI network, cognitive reappraisal exhibited a negative BEI while expressive suppression showed a positive BEI, confirming cognitive reappraisal as a positive bridging role and expressive suppression as a negative bridging role for MI among medical staff. These findings

not only support prior research characterizing cognitive reappraisal as an adaptive strategy and expressive suppression as a maladaptive strategy[14,22,36,60], but also extend the scope of these effects beyond general mental issues (e.g., anxiety, depression) to diverse manifestations of PMIE-induced MI.

This study compared gender differences in the ER-MI network, revealing significant effects on two between-community connections: CR-feeling betrayed and CR-self-condemnation. For males, cognitive reappraisal exhibited negative correlations with both symptoms, demonstrating potential protective effects, whereas no such effects emerged for females. Regarding the CR-feeling betrayed connection, females typically develop a "relational self"[62], viewing close relationships as core to self-worth and favoring internal attributions[63,64] (interpreting betrayal as personal failure), thereby diminishing reappraisal efficacy. In contrast, males employ external attributions[64], reframing betrayal as contextually constrained actions. For the CR-self-condemnation connection, gender differences stem from two factors: 1) Self-efficacy disparities, with males reporting significantly higher self-efficacy[50] while females show lower confidence in completing domain-specific tasks, potentially exacerbating self-condemnation; and 2) Females' greater reliance on emotion-focused strategies[36,65], which prolong negative affect processing[17], reinforcing beliefs of personal incompetence through sustained distress engagement. This study examined professional differences in the ER-MI network, finding no significant difference in ER-MI network characteristics. However, given the established literature indicating higher MI severity among physicians[70], this discrepancy suggests that the potential cause of this difference may lies in other factors. These may include greater exposure to morally injurious events, distinct occupational stressors, or variables not captured within the examined psychological network, all of which warrant further investigation.

This study carries several significant implications. Methodologically, using network analysis, we quantified the BEI of distinct ER strategies on MI symptoms and identified key connections, comprehensively revealing their unique effects on specific symptom manifestations. Theoretically, findings confirm cognitive reappraisal's positive bridging role and expressive suppression's negative bridging role for the MI symptoms cluster. This both supports the working conceptual model of MI by emphasizing cognition's critical role in symptom development, and extends affect differences between two ER processes by validating their potential protective/risk effects in MI contexts. Practically, cognitive reappraisal's positive bridging role suggests symptom alleviation through reappraising event contexts, motivations, and consequences. Previous studies demonstrate that integrating CR as a core technique in Cognitive Behavioral Therapy and Dialectical Behavior Therapy[66–69], effectively reduces clinical symptoms, notably by correcting moral event-related cognitive distortions (e.g., excessive self-blame)[83]. However, our study found no direct link between CR and self-referential emotions, suggesting that mitigating such

symptoms may require more advanced or precisely targeted reappraisal skills. Consequently, future research should define and train specific CR sub-skills to examine this relationship.

Limitations

Despite its contributions, this study has several limitations. First, while the cross-sectional survey design and network analysis identified associations between ER strategies and MI symptoms, they cannot establish causal relationships or elucidate the underlying psychological processes. To address this, future research should use longitudinal network analyses. Such approaches can model the temporal sequence of variables and test for Granger causality—where prior values of one variable predict subsequent values of another—thereby offering a much more detailed and credible exploration of the underlying psychological processes and potential causal pathways. Second, differential connections exist in the associations between ER strategies and MI symptoms. Future research should explore the intrinsic mechanisms of these differential associations. Third, the East-West cultural divergence in collectivism versus individualism systematically shapes preferences in emotion regulation strategies[84]. Specifically, individuals from collectivistic cultures demonstrate a greater propensity for employing expressive suppression and other-focused regulation strategies that prioritize interpersonal harmony. In contrast, those from individualistic cultures show a stronger preference for strategies like cognitive reappraisal[85]. Furthermore, this cultural framework cultivates distinct attributional styles (holistic versus analytic), which in turn determine the primary focus of cognitive reappraisal—whether it is directed toward maintaining social relationships or improving the self—and modulate its psychological efficacy[86]. These culturally embedded psychological and behavioral differences may predict systematic variations in the ER-MI network structure across different cultural contexts. Future studies should include multinational medical staff samples to test the universality of findings.

Conclusion

Using network analysis, this study examined the connections between ER strategies and MI symptoms among medical staff. Our findings highlight the distinct bridging roles of cognitive reappraisal and expressive suppression, while revealing key connections linking these ER strategies with specific MI symptoms. The gender and professional differences in ER-MI network characteristics are also discussed. These findings may provide novel perspectives for understanding MI via ER and suggest potential targets for developing psychological preventions and interventions to mitigate MI severity in medical staff.

Data availability

The data from this study can be obtained by requesting it from the corresponding author. Due to privacy or ethical restrictions, the data is not publicly available.

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Author contributions

Yu Zhou, Wenke Zhu and Lei Ren conceptualized the study and drafted the manuscript. Yu Zhou, Jun Wang, Kuiliang Li, Weiguo Wang, Jing Chen and Lei Ren completed the data collection work. Wenke Zhu, Kuiliang Li and Lei Ren undertook the statistical analysis. Kuiliang Li, Rui Zhi, Lu Zhao, Lijun Hao, Yusen Han, Jie Wang, Qianyu Wang, Xinyi Wang, Yue Cui, Weiguo Wang, Jing Chen revised the manuscript. Each author has thoroughly reviewed the draft and given their approval for the final version of the manuscript. All authors accepted responsibility for the entirety of the research presented.

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Declarations

Competing interests

The authors declare that they have no competing interests.

Informed consent

All participants supplied electronic informed consent form.

Figure legends

Figure 1. (a) Network structure of emotion regulation and moral injury. (b) Bridge expected influence plot.

Note: Blue edges represent positive connections and red edges represent negative connections. The thickness of the edges corresponds to the strength of the correlation.

Figure 2. Network structure of emotion regulation and moral injury for (a) male and (b) female groups. (c) Bridge expected influence plots for male and female groups.

Note: Positive correlations are depicted by blue edges, whereas negative correlations are shown by red edges. The thickness of the edges corresponds to the strength of the correlation.

Figure 3. Network structure of emotion regulation and moral injury for (a) physician and (b) nurse groups. (c) Bridge expected influence plots for physician and nurse groups.

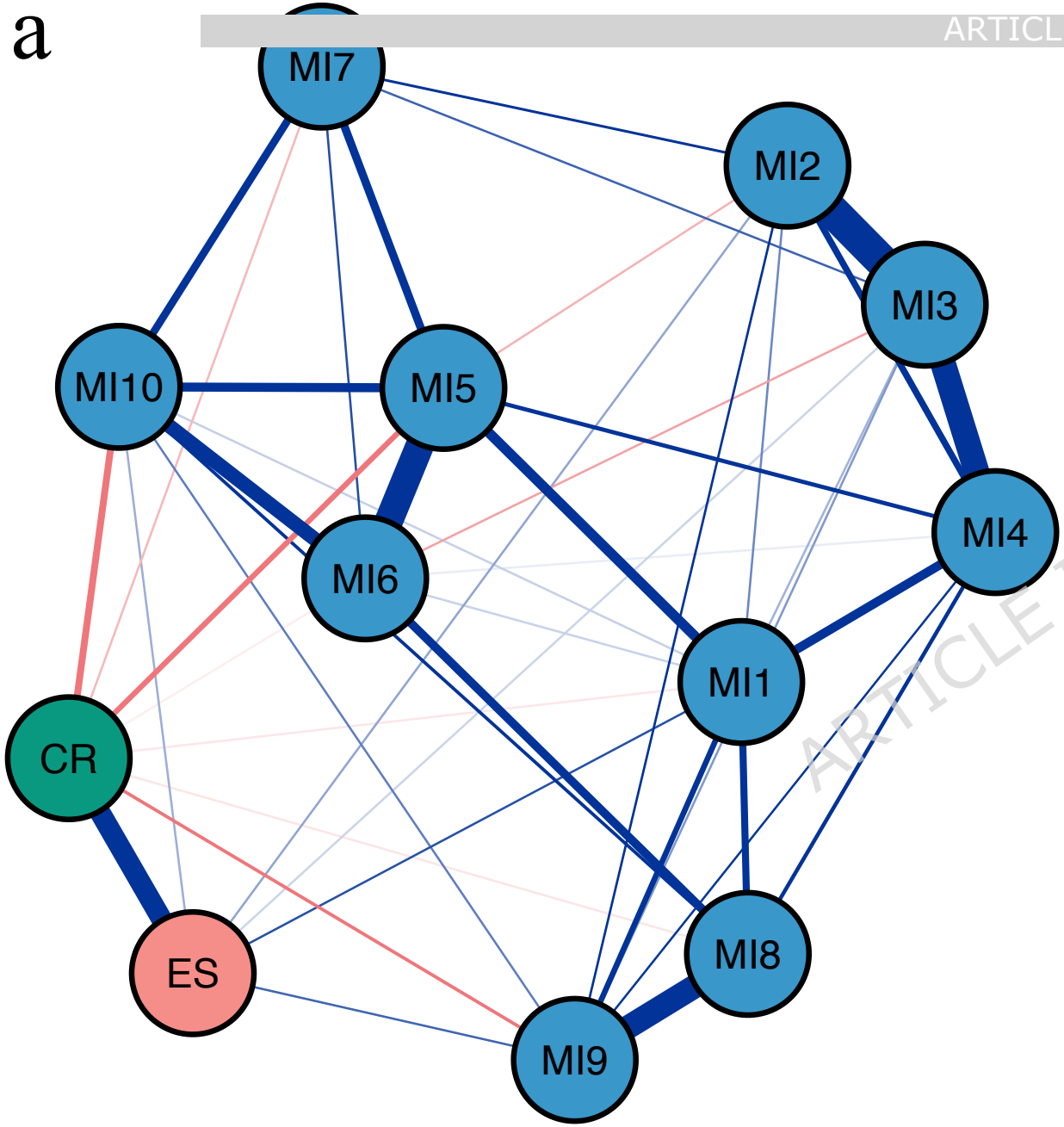
Note: Positive correlations are depicted by blue edges, whereas negative correlations are shown by red edges. The thickness of the edges corresponds to the strength of the correlation.

Table 1. Abbreviation, mean score, standard deviation and bridge expected influence for each variable selected in the present networks

Variables	Abbr	Mean	SD	BEI
Emotion regulation				
Cognitive reappraisal	CR	31.61	7.07	-0.35
Expressive suppression	ES	15.84	5.41	0.13
Moral injury symptoms				
Item1: Feeling betrayed	MI1	1.88	1.76	0.03
Item2: Guilty	MI2	3.24	2.89	0.02
Item3: Shamed	MI3	3.17	2.84	0.01
Item4: Troubled	MI4	2.64	2.59	0
Item5: Loss of trust	MI5	2.47	2.30	-0.10
Item6: Loss of meaning	MI6	2.48	2.31	-0.01
Item7: Unforgiveness	MI7	4.51	3.26	-0.03
Item8: Self-condemnation	MI8	1.50	1.35	-0.01
Item9: Feeling punished	MI9	1.50	1.50	-0.03
Item10: Loss of faith	MI10	3.11	2.91	-0.11

747 Abbreviations: Abbr, abbreviation; SD, standard deviation, BEI, Bridge Expected
748 influence.
749
750

a



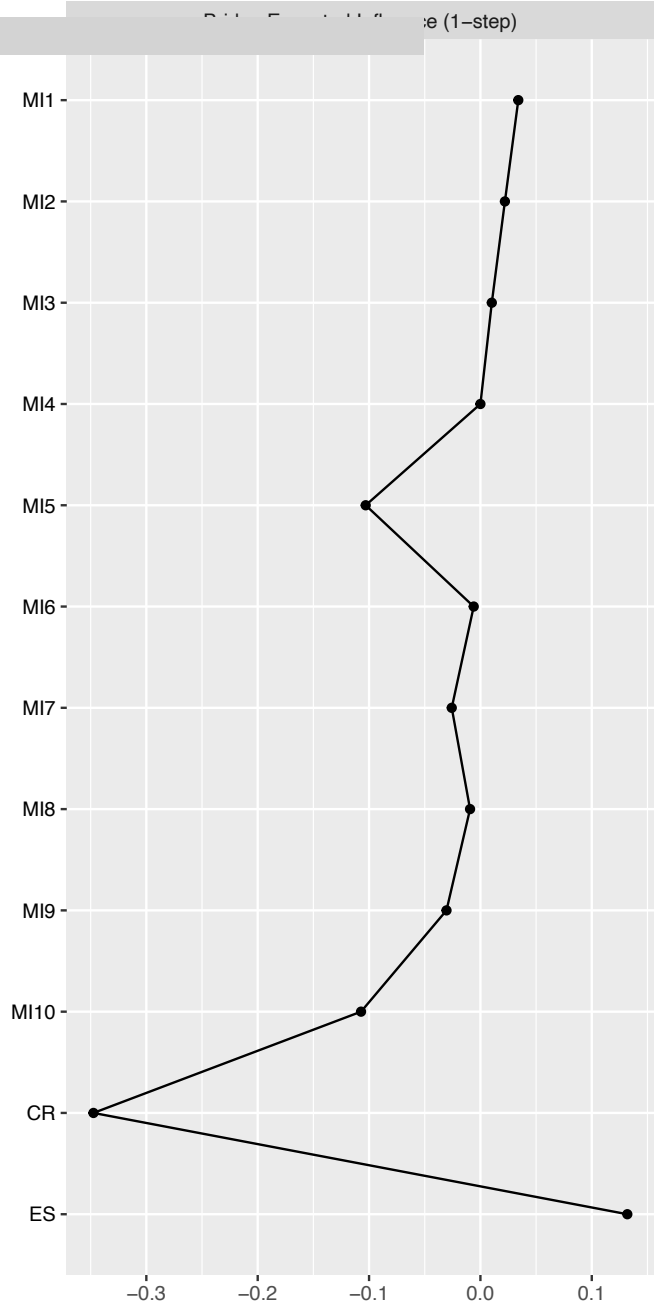
Moral injury

- MI1: Feeling betrayed
- MI2: Guilty
- MI3: Shamed
- MI4: Troubled
- MI5: Loss of trust
- MI6: Loss of meaning
- MI7: Unforgiveness
- MI8: Self–condemnation
- MI9: Feeling punished
- MI10: Loss of faith

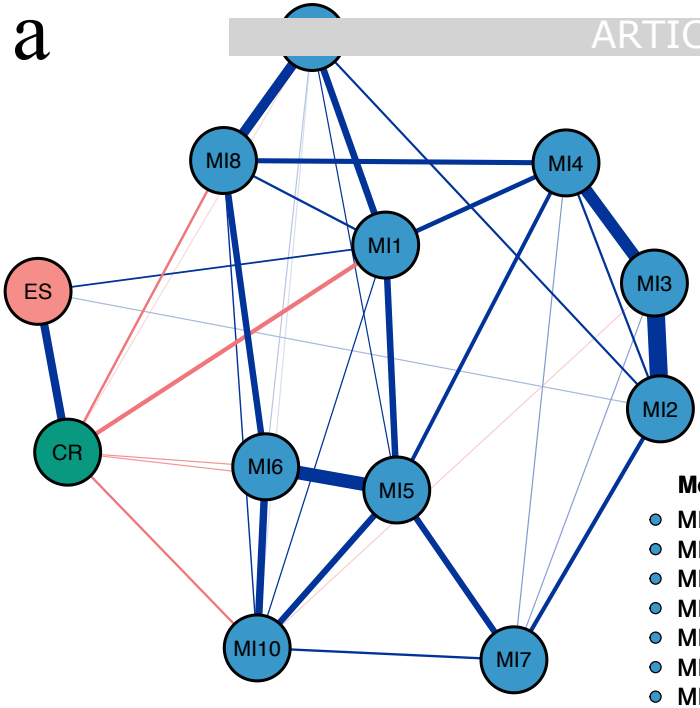
Emotion regulation

- CR: Cognitive reappraisal
- ES: Expressive suppression

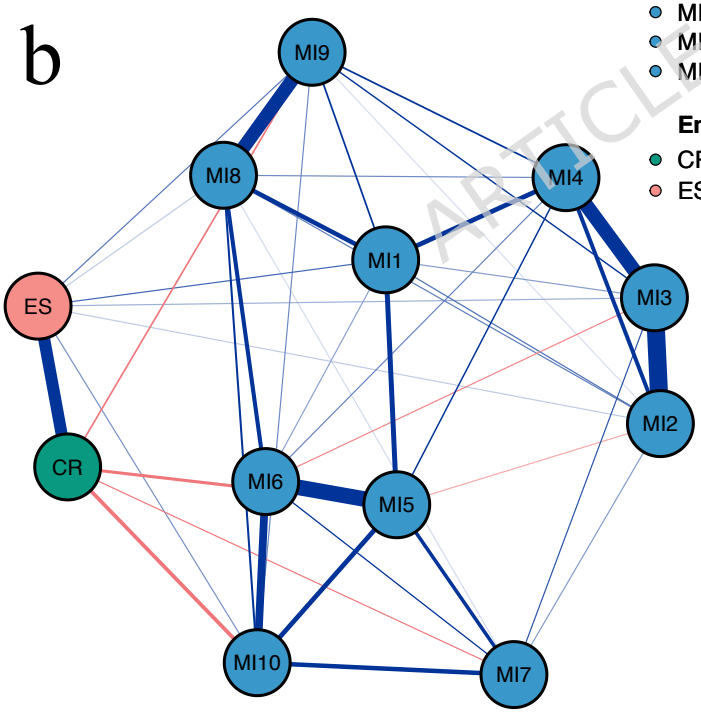
b



a



b



Moral injury

- MI1: Feeling betrayed
- MI2: Guilty
- MI3: Shamed
- MI4: Troubled
- MI5: Loss of trust
- MI6: Loss of meaning
- MI7: Unforgiveness
- MI8: Self−condemnation
- MI9: Feeling punished
- MI10: Loss of faith

Emotion regulation

- CR: Cognitive reappraisal
- ES: Expressive suppression