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Research Article

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Network connectivity between psychological resilience and depression in patients with adhesive intestinal obstruction

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Abstract

Background: Adhesive intestinal obstruction (AIO) is a common complication after abdominal surgery, and a substantial proportion of affected patients experience depression. However, symptom-level links between depression and psychological resilience remain unclear in this population.**Objectives:** We examined the symptom-level network connecting depressive symptoms and dimensions of psychological resilience in patients with AIO and identified the central nodes within that network.**Methods:** This retrospective analysis included 282 patients with AIO admitted to the First Hospital of Hebei Medical University between August 2023 and June 2024. Patient Health Questionnaire-9 (PHQ-9) and Connor-Davidson Resilience Scale (CD-RISC) scores were extracted from medical records. Regularized partial correlation networks were estimated with the bootnet and qgraph packages in R 4.3.0.**Results:** Mean PHQ-9 and CD-RISC scores were 5.44 (SD = 4.91) and 67.43 (SD = 14.76), respectively. Notable edges connected CD-RISC Strength with concentration problems (weight = 0.15) and with anhedonia (weight = -0.10), and CD-RISC Strength showed the highest node strength. Network structure and global strength did not differ significantly by sex or age.**Conclusions:** These findings suggest that CD-RISC Strength is a central bridge between resilience and depressive symptoms in AIO and may be a useful target for psychological intervention.

Keywords: Adhesive intestinal obstruction; Depression; Psychological resilience; Network analysis

Introduction

Adhesive intestinal obstruction (AIO) is a common acute abdominal condition after abdominal and pelvic surgery and a major source of postoperative morbidity [1]. Its characteristic symptoms include abdominal pain, vomiting, abdominal distension, and cessation of flatus and defecation. Beyond the unpredictable course of the disease, patients face demanding treatment burdens and financial costs, as well as substantial psychological distress [2–4]. Depression is one of the most common psychological problems in this population. A survey of patients with AIO found that a substantial proportion experienced depression, which interfered with recovery and treatment outcomes [5].

Psychological resilience is the capacity to adapt to and recover from adversity, trauma, or stress [6]. Higher resilience predicts lower anxiety and depression and can attenuate negative emotions [7]. Existing studies of resilience and depression have focused mainly on psychiatric, cardiovascular and cerebrovascular, and oncologic conditions [8–10], with limited work in patients with AIO. In inflammatory bowel disease (IBD), lower resilience is associated with more anxiety and depressive symptoms [11,12]. In prostate cancer, different resilience dimensions show distinct associations with depression [13]. Whether these findings generalize to AIO remains unclear. Clarifying how depression and resilience are connected in AIO may inform interventions that strengthen resilience and reduce depression.

Network analysis offers a complementary framework for studying interactions between psychological dimensions and symptoms [14,15]. Rather than treating depression and resilience as latent variables, network models represent symptoms and dimensions as nodes and their associations as edges, making it possible to identify central nodes [13,16]. This study examined the status of depression and psychological resilience in patients with AIO and used network analysis to identify core nodes in their shared network. The findings may provide a reference for emotion-focused interventions in patients with AIO.

Materials and Methods

Participants

Sample size estimation. Network sample sizes should exceed the number of estimated parameters, that is, the threshold parameters plus the pairwise association parameters [17]. With 12 nodes, the threshold parameters are 12 and the pairwise parameters are $12 \times 11 / 2 = 66$, giving 78 parameters. To stabilize network estimation, 3 to 5 participants per parameter were required, so at least 234 participants were needed. A total of 282 patients were included in the analysis.

Patients with a confirmed diagnosis of AIO at the First Hospital of Hebei Medical University between August 2023 and June 2024 were identified retrospectively from hospital medical records. Inclusion criteria were (1) a confirmed diagnosis of AIO; (2) diagnosis supported by laboratory and imaging examinations; (3) clinical symptoms such as abdominal pain and vomiting; (4) clear consciousness; (5) complete admission medical records; and (6) complete PHQ-9 and CD-RISC

scores. Exclusion criteria were (1) visual or hearing impairment; (2) diagnosed mental illness; (3) imaging findings of mesenteric thrombosis, ascites, or peritoneal inflammation; (4) continuous severe abdominal pain; (5) manifestations of toxicosis; and (6) shock. Demographic data and questionnaire scores were extracted from the medical records. The study was approved by the Ethics Committee of the First Hospital of Hebei Medical University (approval reference [2026]Y263).

Measures

Demographic questionnaire

Age, sex, and education level were extracted from the medical records.

Depression assessment

The Patient Health Questionnaire-9 (PHQ-9) is a self-report depression measure derived from the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) [18,19]. It contains nine items, each scored from 0 (not at all) to 3 (nearly every day), giving a total score from 0 to 27. Scores of 0 to 4, 5 to 9, 10 to 14, 15 to 19, and 20 to 27 indicate minimal, mild, moderate, moderately severe, and severe depression, respectively. The Chinese version has demonstrated adequate reliability and validity in Chinese adults [20]. In this sample, Cronbach's alpha was 0.804.

Psychological resilience assessment

The Connor-Davidson Resilience Scale (CD-RISC) was used to assess psychological resilience [21], using the Chinese version translated and revised by Yu and Zhang [22]. The scale comprises 25 items across three dimensions, Tenacity,

Strength, and Optimism, with a total score from 0 to 100; higher scores indicate greater resilience. In this sample, Cronbach's alpha was 0.846.

Ethics statement

The study protocol complied with the Declaration of Helsinki and was approved by the Medical Ethics Committee of the First Hospital of Hebei Medical University (approval reference number: [2026]Y263). Because this was a retrospective analysis of existing medical records, the requirement for informed consent was waived by the ethics committee.

Statistical analyses

Descriptive statistics were computed with SPSS 26.0, and network analyses were performed in R 4.3.0. Following current recommendations for psychological network analysis [14], a regularized partial correlation network was estimated with the EBICglasso algorithm [23]. The bootnet package was used to estimate network decomposition, node centrality, and the accuracy and stability of the network and its attributes [17]. The qgraph package was used for visualization; green edges indicate positive associations, red edges indicate negative associations, and thicker edges indicate stronger associations [24]. Because closeness and betweenness are less reliable in psychometric networks, node strength was used as the centrality index [25]. The correlation stability (CS) coefficient was calculated with bootnet; values above 0.25 were considered acceptable and values above 0.5 optimal [17]. Differences between groups in network structure and global strength were tested with the network comparison test [26].

Results

Descriptive analysis

The sample comprised 282 patients with AIO (123 men, 159 women; age range 18 to 97 years; mean age 55.28 years, SD = 14.44). For education, 155 patients (55.0%) had primary school or less, 84 (29.8%) had vocational or secondary schooling, and 43 (15.2%) had a college degree or higher. The mean PHQ-9 score was 5.44 (SD = 4.91), and 130 patients (46.1%) had at least mild depressive symptoms: 76 (26.9%) mild, 31 (11.0%) moderate, 20 (7.1%) moderately severe, and 3 (1.1%) severe. The mean CD-RISC score was 67.43 (SD = 14.76), with subscale scores of 34.48 (SD = 8.25) for Tenacity, 22.54 (SD = 4.99) for Strength, and 10.41 (SD = 2.83) for Optimism (Table 1).

Network analysis of depression and psychological resilience

Figure 1A shows the network comprising nine PHQ-9 items and three CD-RISC factors. The estimated network contained 42 non-zero edges, including 30 positive and 12 negative edges. Table 2 reports the sample edge weights. Notable edges connected CD-RISC Strength with concentration problems (weight = 0.15) and with anhedonia (weight = -0.10).

Node centrality

Figure 1B shows standardized centrality values. CD-RISC Strength had the highest node strength, followed by low self-worth and concentration problems, indicating that these nodes were the most strongly connected to other nodes in the network. The CS coefficient for node strength was 0.518 (Figure 2).

Network comparison tests

Network comparison tests showed no significant sex differences in network structure (M = 0.283, P = 0.296) or global strength (S = 0.223, P = 0.475). No significant age-related differences were found between younger-to-middle-aged and older patients in network structure (M = 0.211, P = 0.852) or global strength (S = 0.01, P = 0.972).

Discussion

The prevalence of depressive symptoms in this AIO cohort was notable: 46.1% of patients scored above the minimal range on the PHQ-9. Several disease-related factors may explain this burden. Patients often face prolonged fasting, poor nutritional status, and water-electrolyte and acid-base disturbances, together with poor sleep quality [27]. Repeated hospital visits, ineffective conservative or surgical treatment, and substantial resource use add to this stress [2–4]. In Chinese culture, stigma around mental health may discourage patients from expressing emotional distress and seeking support, leaving them with few strategies for managing negative emotions and stress [28,29].

The mean CD-RISC score in this cohort was 67.43 (SD = 14.76), which is below scores reported in some Chinese adult samples [22]. Direct comparison is limited by differences in populations and sampling. Intestinal obstruction can substantially reduce quality of life, and some patients lose social functioning and struggle to adapt to changed social roles [2,30]. Such losses may leave patients with inadequate coping strategies and contribute to lower resilience [30]. Prolonged

physical pain and pressure from illness and family can also undermine self-efficacy, a protective factor for resilience [31]. Healthcare professionals should therefore monitor patients' psychological changes and support resilience.

The network analysis identified CD-RISC Strength as the most central node in the depression-resilience network of patients with AIO. Strength refers to the robustness of thought and inner world, as well as the capacity for self-cognition and self-change. Prolonged exposure to disease challenges and concerns about surgical risk and outcome may reshape patients' cognitive appraisals, foster negative thoughts, and reduce acceptance of their health status [32]. Repeated hospitalization and long-term constraints on physical and social functioning may further diminish Strength. Low self-worth was the second most central node. Psychological distress, including anxiety, is common in older patients with intestinal obstruction [33], and patients who see themselves as a burden may develop feelings of inferiority and reduced self-worth. Concentration problems were the third most central node. Patients with AIO often have intestinal microbiota dysbiosis [34–36], which may affect cognition through the gut-brain axis [37,38].

Psychological resilience was negatively associated with depressive symptoms in this network. Psychological and nursing interventions can reduce negative emotions and improve resilience [39,40]. Meta-analytic evidence suggests that mindfulness-based nursing interventions may improve psychological outcomes in oncology patients, although heterogeneity was high [41]. In surgical patients with rectal cancer, a narrative therapy and cognitive behavioral therapy program reduced

depression and anxiety after abdominoperineal resection [42]. Recent reviews also emphasize mechanism-focused and scalable resilience interventions [43]. The prominent edges connecting Strength with concentration problems and with anhedonia suggest that patients with a weak mental resource may focus excessively on symptoms, lose the ability to experience pleasure, and become depressed.

The network structure and global strength of depression and resilience did not differ significantly by sex or age. This suggests that network-based interventions for patients with AIO may focus on the core nodes identified here rather than tailoring the network by sex or age. Because the network comparison test has adequate power mainly in larger samples, this result should be interpreted cautiously [26].

Limitations

This study has several limitations. First, network analysis generally requires a substantial sample for accurate and stable estimates, and the present sample, although above the a priori minimum, remains modest. Second, the single-center, retrospective design relied on self-report questionnaire data, so causal inference is not possible. Third, data collection was limited to a single hospital, which constrains generalizability. Finally, we did not test interventions to enhance resilience. Future studies with larger multicenter samples and longitudinal designs are needed to examine whether interventions targeting CD-RISC Strength reduce depressive symptoms in patients with AIO.

Conclusions

In conclusion, depression and psychological resilience were closely connected in patients with AIO, and CD-RISC Strength was the most central node in their shared network. These findings suggest that interventions that strengthen resilience, particularly the Strength dimension, may help reduce depressive symptoms in this population. Because this was a retrospective single-center study, causal and generalizable conclusions require further investigation.

Author Contributions

Xingsheng Li and Zheng Liu wrote the main manuscript text and contributed equally to this work. Wei Li and Ning Yang performed the surgery and perioperative treatment. Xingsheng Li collected the data and performed the follow-up. Ning Yang supervised the study and contributed equally as corresponding author. All authors read and approved the final manuscript.

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Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Medical Ethics Committee of the First Hospital of Hebei Medical University (approval reference number: [2026]Y263).

Informed Consent Statement

Informed consent was waived because this was a retrospective analysis of existing medical records.

Data Availability Statement

The data presented in this study are available on request from the corresponding author because of privacy and ethical restrictions related to the protection of participants' personal and clinical data.

Conflicts of Interest

No potential conflict of interest was reported by the author(s).

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Table 1. Demographic characteristics and PHQ-9 and CD-RISC scores of 282 patients with adhesive intestinal obstruction.

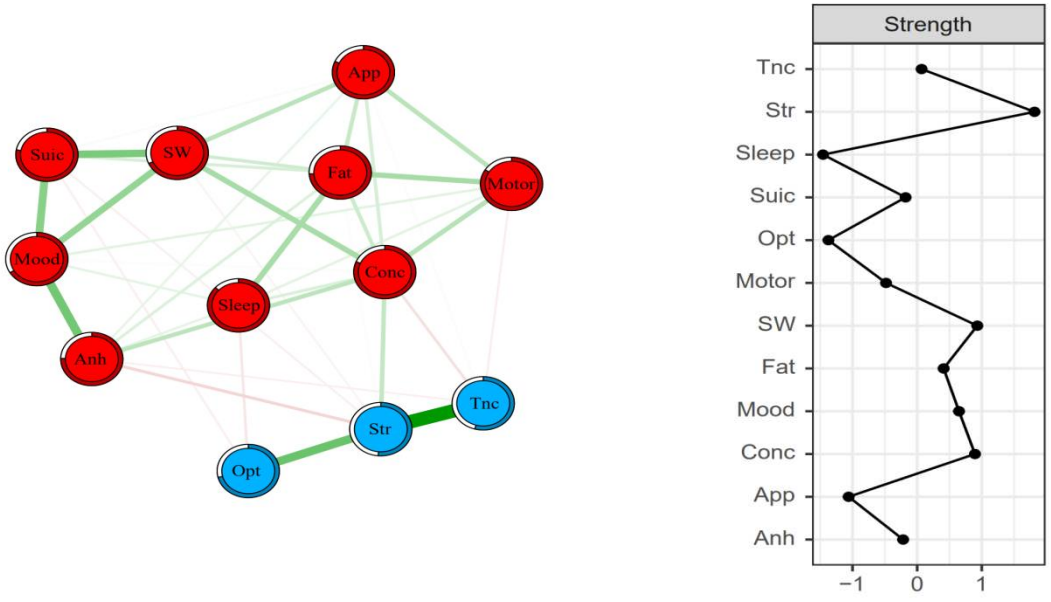
Variable	Sample characteristics
Age	M = 55.28 years (SD = 14.44 years), range = 18-97 years
Gender	
Female	56.4%
Male	43.6%
Education	
Primary school or less	55.0%
Vocational high school or secondary school	29.8%
College degree or higher	15.2%
PHQ-9	M = 5.44 (SD = 4.91)
Depression severity	
Minimal	53.9%
Mild	26.9%
Moderate	11.0%
Moderately severe	7.1%
Severe	1.1%
CD-RISC	M = 67.43 (SD = 14.76)
Tenacity	M = 34.48 (SD = 8.25)
Strength	M = 22.54 (SD = 4.99)
Optimism	M = 10.41 (SD = 2.83)

Table 2. Sample edge weights for the depression-resilience network.

Edge	Sample edge-weight
Tenacity to concentration problems	-0.07991
Tenacity to motor problems	-0.04314
Tenacity to anhedonia	-0.04006
Tenacity to appetite problems	-0.01052
Tenacity to depressed mood	-0.00059
Strength to concentration problems	0.152144
Strength to anhedonia	-0.10498
Strength to low self-worth	-0.03005
Strength to fatigue/lethargy	-0.00765
Optimism to sleeping problems	-0.06328

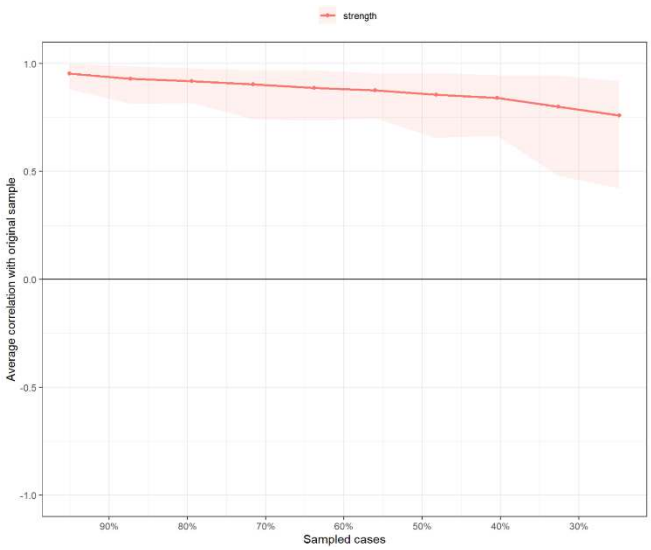
Optimism to suicidal ideation	-0.04187
Strength to suicidal ideation	-0.03994

Note: Edges in Network A are first sorted by the CD-RISC factor, then sorted by the magnitude of their sample edge-weights (Spearman partial correlations).



(A) (B)

Figure 1. (A) Network of depression and psychological resilience; (B) standardized node centrality values. Green edges indicate positive correlations; red edges indicate negative correlations. Anh = anhedonia; Mood = depressed mood; Sleep = sleeping problems; Fat = fatigue or lethargy; App = appetite problems; SW = low self-worth; Conc = concentration problems; Motor = motor problems; Suic = suicidal ideation; Tnc = Tenacity; Str = Strength; Opt = Optimism.



406 Figure 2. Stability trend of the network when repeated bootstrap samples are progressively reduced.