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Network analysis of depression and anxiety symptoms and their associations with cognitive fusion among pregnant women

Haiyan Liu[1†], Fanyan Huang[1†], Yaqing Gao[1†], Muyao Wang[1], Qianzhi Lin[1], Youjing Kong[1], Rufang Zhou[1], Chichen Zhang[2,3*] and Yu Chen[1*]

Abstract

Background Pregnant women often exhibit comorbidities of depression and anxiety, adversely affecting maternal and foetal health. Cognitive fusion is a cognitive process in which individuals excessively identify with ideas, and it is closely related to depression and anxiety; however, their symptom-level associations are still unclear. Network analysis provides a robust method to reveal important associations between symptoms. This study employed network analysis to explore the characteristics of depression and anxiety symptoms in pregnant women and their relationship with cognitive fusion.

Methods This cross-sectional study was conducted from June 2021 to August 2023 at two Asian hospital obstetric outpatient clinics in Guangzhou and Zhongshan, Guangdong Province, China, and included a total of 1691 pregnant women. Depression, anxiety symptoms and cognitive fusion were measured with the Edinburgh Postpartum Depression Scale (EPDS), the seven-item Generalized Anxiety Disorder Scale (GAD-7), and the Cognitive Fusion Questionnaire-Fusion (CFQ-F), respectively. Central and bridge symptoms were identified via centrality indices and bridge centrality indices. Network stability and accuracy were estimated.

Results The prevalence of depression (EPDS score ≥ 9) was 43.00% (95% confidence interval [CI]: 40.60–45.40%), the prevalence of anxiety (GAD-7 score ≥ 7) was 31.70% (95% CI: 29.50–33.90%), and the prevalence of comorbid depression and anxiety (EPDS score ≥ 9 and GAD-7 score ≥ 7) was 25.00% (95% CI: 22.90–27.10%). "Sad or miserable", "trouble relaxing" and "scared or panicked" were the central symptoms in the whole depression–anxiety network. "Feeling afraid", "scared or panicked" and "trouble relaxing" were the key bridge symptoms linking depression and

†Haiyan Liu, Fanyan Huang and Yaqing Gao contributed equally to this work.

*Correspondence:
Chichen Zhang
zhangchichen@sina.com
Yu Chen
958977423@qq.com

Full list of author information is available at the end of the article

anxiety. Three symptoms ("excessive worry", "nervousness" and "sleep difficulties") were the strongest edges connected to cognitive fusion.

Conclusions This study identified the central and bridging symptoms of depression and anxiety in pregnant women using network analysis, as well as their relationships with cognitive fusion. The results highlight the clinical relevance of these symptoms in perinatal mental health management. Close monitoring of these symptoms may be crucial for reducing depression and anxiety in pregnant women. Further research is needed to verify whether these symptoms are actionable treatment priorities.

Clinical trial number Not applicable.

Keywords Pregnant people, Depression, Anxiety, Cognitive fusion, Network analysis

Background

Perinatal mental disorders are important complications in the perinatal period [1], among which depressive symptom (depression hereafter) and anxiety symptom (anxiety hereafter) are the most common. Meta-analysis reported that the prevalence of prenatal depression determined through self-assessment questionnaire (22.4%, 95% CI: 21.0-23.8%) was higher than structured clinical interviews (12.6%, 95% CI: 10.3–14.9%) [2], and self-reported pregnancy anxiety prevalence is 37.0% [3]. The global perinatal prevalence of comorbid anxiety and depression was approximately 9% [4]. Depression and anxiety share genetic and neurobiological similarities [5], and their comorbidity brings greater negative health impacts such as increased suicide risk [6]. The diagnosis of anxiety and depression often occurs simultaneously, and their symptoms are highly correlated [7]. Prenatal depression and anxiety adversely affect maternal–foetal health, increasing the risk of preterm birth and hypertensive disorders [8], and predisposing offspring to developmental impairments, including cognitive deficits and immune dysfunction [9]. Therefore, it is important to pay attention to the disease mechanisms and treatment factors associated with the comorbidities of depression and anxiety.

Cognitive fusion is one of the components of the psychological case model of acceptance commitment therapy, which refers to individuals' excessive identification with thinking content leading to restricted behavior and loss of awareness of reality [10]. Cognitive fusion can exacerbate negative emotional experiences and is an important cause of psychological disorders such as depression [11]. Cognitive fusion is a risk factor for depression in late pregnancy and postpartum period [12]. Reducing the degree of cognitive fusion is the key to improving the degree of depression in depressed patients [13]. However, the previous studies explored the relationship between depression and anxiety and cognitive integration from the perspective of the total scores. The deep relationship between cognitive fusion and symptoms of depression and anxiety still needs to be explored from the perspective of symptoms. These findings may provide new ideas for exploring the psychological mechanisms and intervention measures of depression and anxiety in pregnant women.

According to Borsboom [14], mental illness develops and persists via symptom interactions, forming feedback loops. In classic theories of psychopathology, the total score on standardised assessments is typically employed to reflect the severity of mental symptoms [15], however, this does not consider the distinctions between symptoms or the connections between them [16]. Network analysis, widely used to explore the relationships between symptoms of various diseases [17, 18], takes the observed variables as the primary index to establish a relationship network among variables, in which symptoms are "nodes" and partial correlation coefficients account for node interactions [14]. Moreover, calculations of node centrality can quantify the degree of importance of each node in the network [19], helping identify core symptoms that strongly influence network activation and mental illness progression.

In summary, this study used network analysis to (1) identify the characteristics of depression and anxiety networks, (2) explore the differences in depression and anxiety network structures between first-time and non-first-time pregnant women and (3) examine the relationships between depression and anxiety in pregnant women and cognitive fusion, thereby assisting health care professionals in developing effective and targeted interventions to prevent or reduce the occurrence of depression and anxiety in pregnant women.

Methods

Study setting and participants

This was a cross-sectional study in which data were collected at two Asian hospital obstetric outpatient clinics, Guangzhou and Zhongshan, in Guangdong Province, China, from June 2021 to August 2023. A total of 1691 pregnant women (13–40 weeks of gestation) were administered the Edinburgh Postnatal Depression Scale, the seven-item Generalized Anxiety Disorder Scale and the Cognitive Fusion Questionnaire-Fusion online and offline. To be eligible, participants needed to meet the

following inclusion criteria: (1) aged above 20 years and (2) at 12 or more weeks gestation. The exclusion criteria were as follows: (1) family history of psychiatric disorders in first-degree relatives (defined as parents or siblings diagnosed with schizophrenia, bipolar disorder, or other psychotic disorders); (2) diagnosed with depression disorder or anxiety disorder by a psychiatrist before pregnancy; and (3) serious physical illnesses, including neurological diseases (such as brain injury, epilepsy, brain tumours) and endocrine system disorders (such as thyroid dysfunction). This study followed the Helsinki Declaration and was approved by the ethics committee of Nanfang Hospital, Southern Medical University (approval number: NFCE-2021-086). All participants signed informed consent forms. This study was reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist.

Measurements

Basic demographic information

A self-designed general information questionnaire was used for the survey and included basic demographic information, such as age, gestational week, place of residence, number of pregnancies, educational level, and occupation. The demographic information was self-reported by pregnant women.

Edinburgh postpartum depression scale (EPDS)

Depressive during the previous week were measured with the Edinburgh Postpartum Depression Scale (EPDS) developed by Cox et al. in 1978 [20]. The scale is suitable for prenatal and postpartum depression screening [21]. The scale contains 10 items, and the sum of the scores of each item ranges from 0 to 30 points. Studies by the author of the Chinese version found that 9 or 10 was a suitable cut-off value for primary care screening, at which the sensitivity of the scale was 82%, specificity was 86%, positive predictive value was 44%, and negative predictive value was 97% for the study population (area under the receiver operating characteristic curve = 0.91) [22]. In this study, the Chinese version of the Edinburgh Postpartum Depression Scale introduced by Lee et al. in 1998 was used, and the Cronbach's α coefficient of this scale was 0.881. An EPDS score ≥ 9 indicates potential depression, and higher scores indicate a more severe degree of depression.

The seven-item generalized anxiety disorder scale (GAD-7)

Our study focused on antenatal generalized anxiety disorder (GAD) screening only and excluded other anxiety disorders, such as social anxiety disorder and panic disorder. Anxiety during the previous two weeks were measured with the Generalized Anxiety Disorder Scale (GAD-7) developed by Spitzer et al. in 2006 according to the diagnostic criteria of the fourth edition of the American Diagnostic and Statistical Manual of Mental Disorders [23]. The scale contains 7 items, and the total score ranges from 0 to 21 points. The Chinese version of the GAD-7 has shown good psychometric properties in pregnant Chinese women. At the maximum Youden Index of 0.53, the optimal cutoff score for the GAD-7 among pregnant women was 7, with an area under the curve (AUC) of 0.83, a sensitivity of 96.8%, and a specificity of 56.1% [24]. In this study, a score ≥ 7 points indicates that patients have anxiety. Higher scores indicate more severe symptomatology. The Cronbach's α coefficient of this scale was 0.916 in this study.

Cognitive fusion questionnaire-fusion (CFQ-F)

Cognitive fusion is defined as the tendency for inappropriate and excessive regulation of behaviour by language rules, leading to a decrease in personal negative evaluation and self-demeaning thoughts [10]. Gillanders et al. constructed a cognitive fusion questionnaire with two dimensions: a cognitive fusion dimension and a cognitive dissociation dimension [25]. In this study, the Chinese version of the Cognitive Fusion Scale (CFQ-F), consisting of 9 items with a 7-point scale for each entry, was used to investigate the degree of cognitive fusion of the participants. The scale uses seven grades ranging from "manifestly incompatible" to "manifestly compatible" to assign points. The higher the score is, the greater the degree of cognitive functioning is [26]. In this study, the Cronbach's α coefficient of this scale was 0.949.

Statistical analyses

Network estimation

Descriptive statistics were analysed using SPSS 24.0, and the comorbid depression and anxiety network analysis was conducted using R studio (version 4.1.2). The extended Bayesian information criterion (EBIC) model and the graphical Gaussian model (GGM) with the visual least absolute shrinkage and selection operator (LASSO) from the R packages "qgraph" and "bootnet" were used to determine the polychoric correlations between depressive and anxiety [27, 28]. Symptoms are nodes in the network. In this study, each entry and CFQ-F of the EPDS and GAD-7 represent a node, and a line between nodes is an edge in the network. The network edge can be understood as the partial correlation coefficient [27]. A blue edge indicates a positive correlation between nodes, whereas a red edge indicates a negative correlation between nodes. The "mgm" package was used to calculate the predictability [29]. The "ggplot2" package was used for optimised visualisation of the network [27, 30]. The graphics function "flow" of the R package "qgraph" was used to clearly display which depression and anxiety

symptoms were directly or indirectly correlated with cognitive fusion [17, 28].

Centrality and bridge centrality estimation

The R package "qgraph" was used to calculate the expected influence (EI), which represents the central symptom in the network [28]. For each node, the EI represents the total weight of all its edges, including positive and negative associations with directly adjacent nodes in the network. The EI considers the sign of the association connecting two nodes by adding the sizes of the edges connected to the node (i.e., the negative and positive partial correlations). The higher the EI of a node is, the more central the symptom in the network is [31]. The R package "networktools" was used to calculate the bridge expected influence (bEI), which represents the bridging effect of a symptom between depression and anxiety [32]. The bEI of a node is the sum of the edge weights of all other symptom nodes, which reflects the importance of connecting two clusters of mental symptoms or a single symptom of two mental illnesses. The nodes with a greater bEI between two types of mental disorders indicate a greater chance of comorbidity between these two mental disorders [33].

Network stability and accuracy

The "bootnet" package was used to examine the stability and accuracy of the network model. Network stability is represented by the stability of the centrality index (EI in this study). In this study, the correlation stability (CS) coefficient was used to reflect the stability of centrality, which was calculated for a subset of cases using a bootstrap method. In general, the CS coefficient is at least 0.25, and a CS coefficient greater than 0.5 indicates sufficient stability [27]. The network accuracy is represented by the edge weight accuracy. Although the regularised edge estimates are sufficiently accurate, a nonparametric bootstrap was used to estimate 95% confidence intervals (CIs) for the edge weights [27]. To further demonstrate the accuracy of the edges, the CS coefficients for the edges were also calculated. The difference between the EI and the edge weights was tested using a bootstrap difference test.

Table 1 Sociodemographic characteristics of the participants ($N = 1691$)

Characteristics	*N* (%)/mean (SD)
Age (years)	30.87 (3.45)
Gestational week	28.39 (7.85)
Number of pregnancies	
First pregnancy	1017 (60.14)
Nonfirst pregnancy	674 (39.86)
Place of residence	
Urban area	1461 (86.40)
Rural area	230 (13.60)
Occupation	
Full-time jobs	1291 (76.35)
Part-time jobs	89 (5.26)
Jobless	174 (10.29)
Other situations	137 (8.10)
Educational level	
Bachelor's degree or above	1107 (65.60)
Junior college	423 (25.01)
Senior high school	107 (6.33)
Middle school	54 (3.19)

Network comparison

Previous studies have shown that gravidity is a contributing factor to depression and anxiety in pregnant women [34]. To examine whether the network structure observed in pregnant women changes depending on gravidity, we compared women with first-time pregnancies with nonfirst-pregnancy women in terms of network structure, global strength, and significant edges. A p value of less than 0.05 was considered statistically significant. The "Network Comparison Test" R package was used to conduct network comparisons [35].

Results

Study sample

A total of 1691 pregnant women were included in this study. The mean age of the participants was 30.87 years (SD = 3.45 years). The average gestational week of the participants was 28.39 weeks (SD = 7.85). Among the pregnant women, 60.14% ($N = 1017$) had their first pregnancy, 86.40% ($N = 1461$) lived in cities, 76.35% ($N = 1291$) had full-time jobs, and 65.60% ($N = 1107$) had a bachelor's degree or above. The detailed characteristics of the samples are summarised in Table 1. The prevalence rates of depression (EPDS score ≥ 9), anxiety (GAD-7 score ≥ 7) and comorbid depression and anxiety (EPDS score ≥ 9 and GAD-7 score ≥ 7) were 43.00% (95% confidence interval [CI]: 40.60–45.40%), 31.70% (95% CI: 29.50–33.90%), and 25.00% (95% CI: 22.90–27.10%), respectively. The mean score of cognitive fusion was 28.90 (SD = 11.05). The descriptive statistics of the measurement items are shown in Table 2. The skewness and kurtosis of the EPDS, GAD-7 and CFQ-F are shown in Table S1.

Network structure

Figure 1 shows the network structure of depression and anxiety among pregnant women. The ring pie chart around each node shows the predictability of each symptom. The average predictability was 0.516, meaning that surrounding nodes typically explain 51.6% of each node's variance.

In the symptoms of the depression network, the strongest edges (in descending order) were between EPDS1

Table 2 Descriptive statistics of the measurement items

Item abbreviation	Item content	Mean (SD)	Expected influence	Predictability
EPDS1	able to laugh	0.30 (0.56)	-0.597	0.421
EPDS2	looking forward to things with enjoyment	0.29 (0.55)	-0.445	0.426
EPDS3	blaming myself	0.98 (0.89)	-1.741	0.326
EPDS4	anxious or worried	1.44 (0.79)	0.623	0.586
EPDS5	scared or panicked	1.12 (0.84)	0.743	0.586
EPDS6	things getting to me	0.94 (0.75)	-0.139	0.434
EPDS7	sleep difficulties	0.94 (0.82)	0.071	0.532
EPDS8	sad or miserable	0.78 (0.69)	1.696	0.633
EPDS9	crying	0.83 (0.79)	0.260	0.531
EPDS10	self-harming	0.17 (0.45)	-2.465	0.235
GAD1	nervousness	0.70 (0.59)	-0.205	0.551
GAD2	uncontrollable worry	0.65 (0.63)	0.639	0.632
GAD3	excessive worry	0.67 (0.66)	0.641	0.625
GAD4	trouble relaxing	0.60 (0.63)	1.210	0.642
GAD5	restlessness	0.47 (0.61)	0.101	0.580
GAD6	irritability	0.70 (0.67)	-0.294	0.504
GAD7	feeling afraid	0.47 (0.62)	-0.100	0.523

SD: standard deviation; EPDS: Edinburgh Postpartum Depression Scale; GAD-7: seven-item Generalized Anxiety Disorder scale

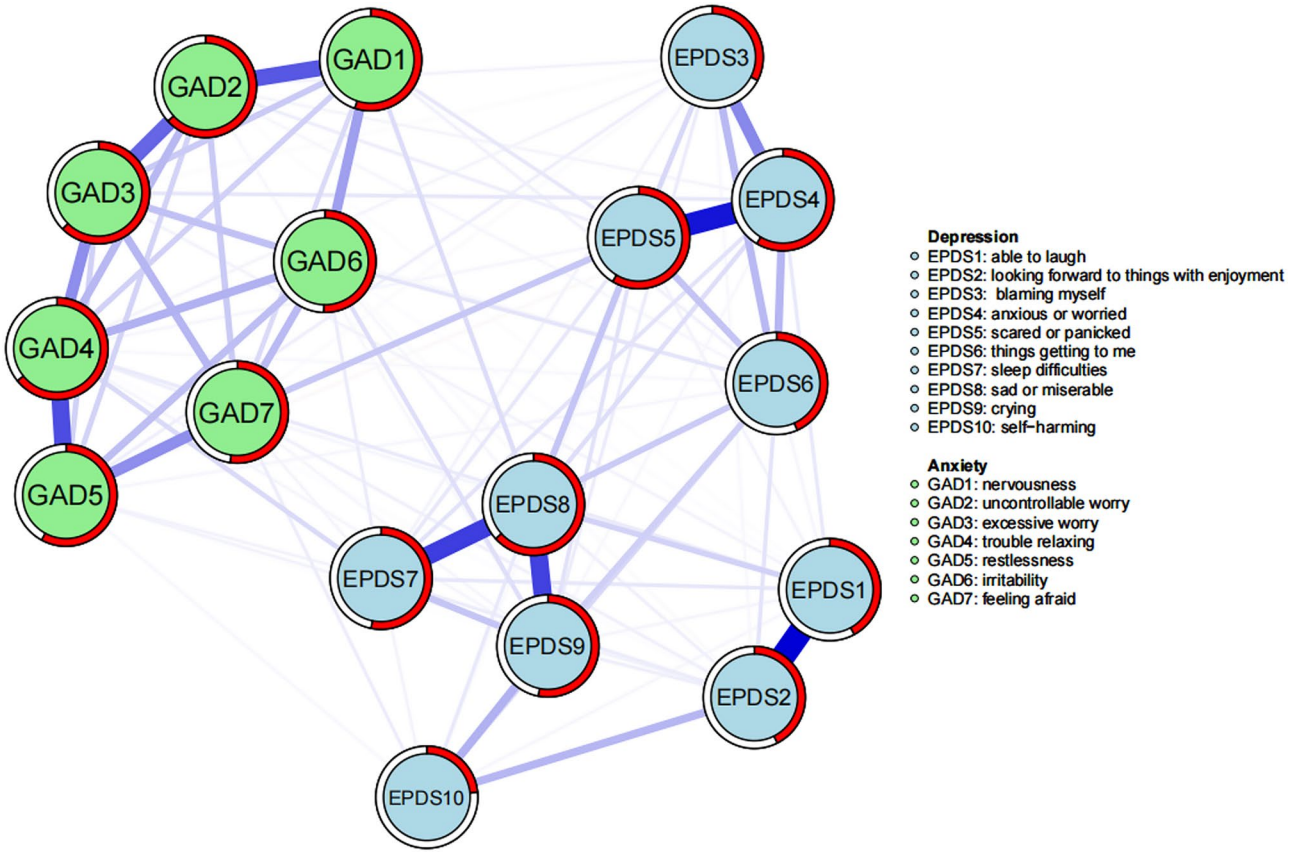

Fig. 1 Network of anxiety and depressive symptoms among pregnant women

(able to laugh) and EPDS2 (looking forward to things with enjoyment), between EPDS4 (anxious or worried) and EPDS5 (scared or panicked), and between EPDS7 (sleep difficulties) and EPDS8 (sad or miserable). In the symptoms of the anxiety network, the strongest edges (in descending order) were between GAD4 (trouble relaxing) and GAD5 (restlessness), between GAD1 (nervousness) and GAD2 (uncontrollable worry), and between GAD2

(uncontrollable worry) and GAD3 (excessive worry). In the symptoms of the depression and anxiety network, the strongest edges (in descending order) were between EPDS5 (scared or panicked) and GAD7 (feeling afraid), between EPDS7 (sleep difficulties) and GAD4 (trouble relaxing), and between EPDS8 (sad or miserable) and GAD1 (nervousness). The weight matrix of the network of the total sample is shown in Table S2.

The EI and bEI values of symptoms in the depression and anxiety network are shown in Fig. 2. The most central symptom was EPDS8 (sad or miserable), followed by GAD4 (trouble relaxing) and EPDS5 (scared or panicked) (Fig. 2, left). To understand the network of depression and anxiety in pregnant women, it is crucial to understand these three symptoms. The main symptoms bridging the depression and anxiety communities were GAD7 (sleep difficulties), EPDS5 (scared or panicked), and GAD4 (trouble relaxing) (Fig. 2, right).

Network stability and accuracy

The symptoms in the depression and anxiety network had good stability and accuracy. Figure 3 shows that the stability of the EI CS coefficient was 0.75, and the bEI CS coefficient was 0.594, indicating that the network did not significantly change when 75.0% of the sample was excluded. The central symptoms were significantly distinct from those of the other nodes, according to the bootstrapped stability test for EI (Figs. S1, S2, S3).

Flow network of cognitive fusion

The flow network of cognitive fusion with depression and anxiety is shown in Fig. 4. The 16 individual symptoms located in the middle of the figure are directly related to cognitive fusion, and the remaining symptoms are indirectly related to cognitive fusion. The depression and anxiety with the strongest connections to cognitive fusion included GAD3 (excessive worry), GAD1 (nervousness) and EPDS7 (sleep difficulties).

Network comparison

A network comparison of anxiety and depressive according to gravidity is shown in Fig. 5. No significant differences in global network strength were observed (first pregnancy: 7.66 vs. nonfirst pregnancy: 7.69; S: 0.030, $p = 0.789$) (Fig. S4, left panel). Significant differences in the network structure distribution of edge weights were noted (M = 0.205, $p = 0.010$) (Fig. S4, right panel). Considering individual edges, those connecting EPDS4 (anxious or worried) and EPDS5 (scared or panicked) ($p < 0.01$), EPDS8 (sad or miserable) and EPDS9 (crying) ($p < 0.01$), EPDS5 (scared or panicked) and GAD3 (excessive worry) ($p < 0.05$), EPDS4 (anxious or worried) and GAD4 (trouble relaxing) ($p < 0.05$), EPDS6 (things getting to me) and GAD4 (trouble relaxing) ($p < 0.05$), EPDS5 (scared or panicked) and GAD7 (feeling afraid) ($p < 0.05$), GAD5 (restlessness) and GAD7 (feeling afraid), and GAD6 (irritability) and GAD7 (feeling afraid) ($p < 0.05$) were

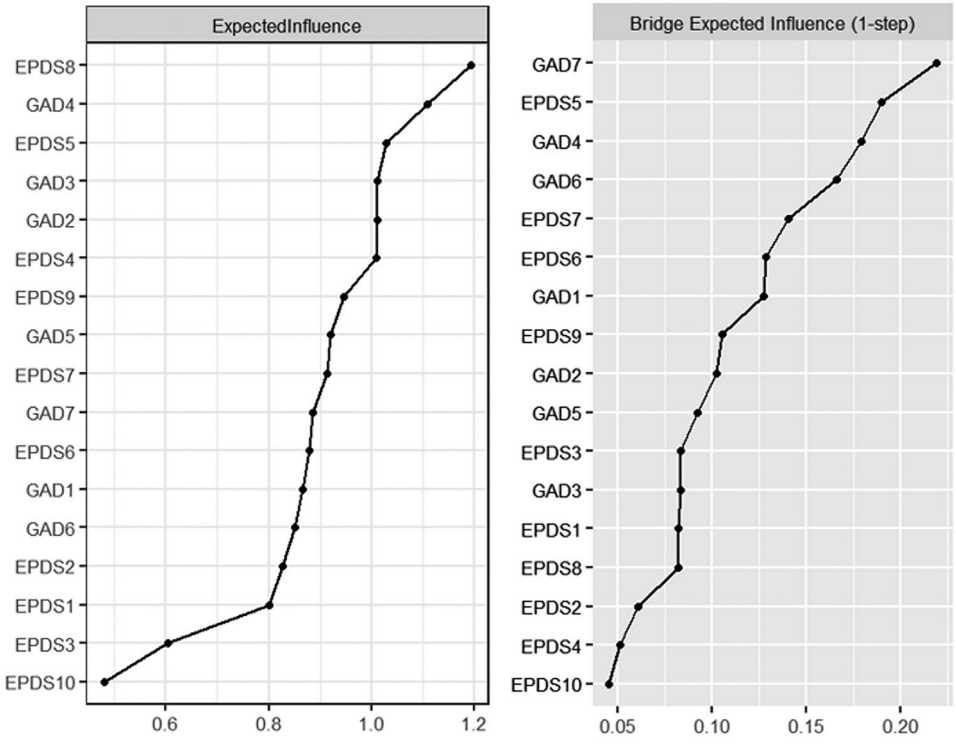

Fig. 2 Centrality indices: expected influence and bridge expected influence values

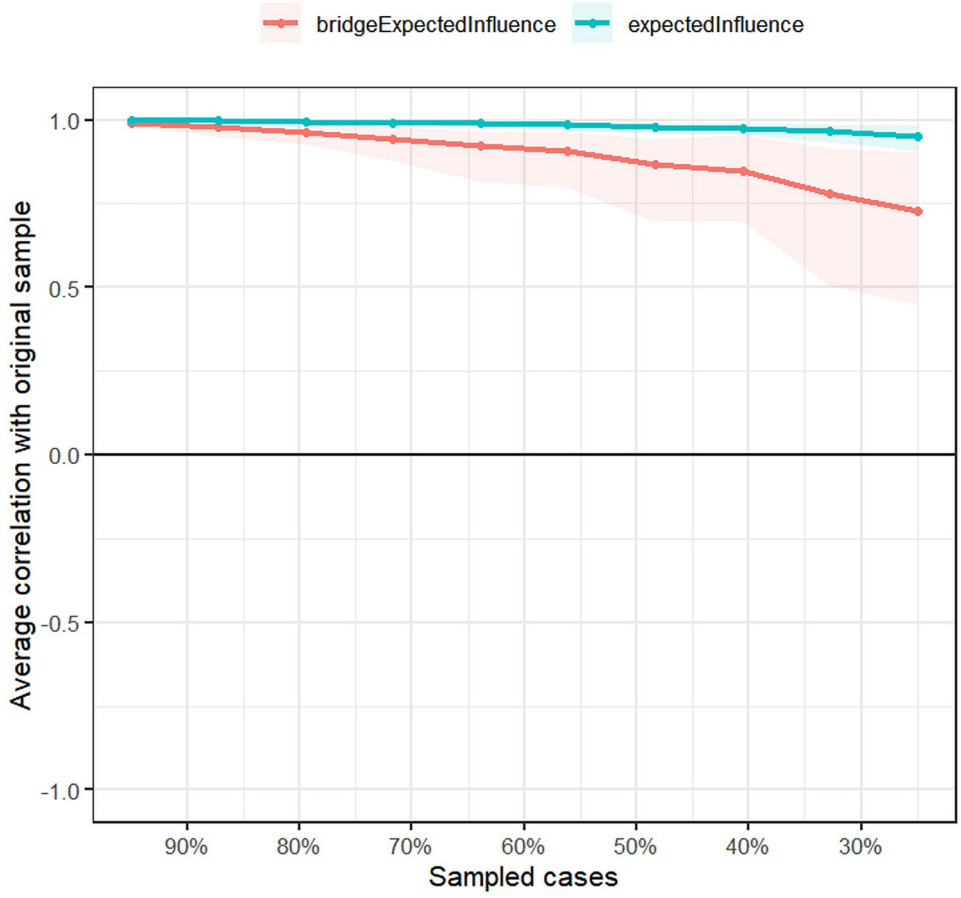

Fig. 3 Stability of centrality and bridge centrality indices using a case-dropping bootstrap method

significantly greater in women experiencing their first pregnancy.

Discussion

To our knowledge, this is the first study to use network analysis to examine the relationships between depression and anxiety and their associations with cognitive fusion. In our study, the prevalence rates of depression (EPDS score ≥ 9), anxiety (GAD-7 score ≥ 7) and comorbid depression and anxiety (EPDS score ≥ 9 and GAD-7 score ≥ 7) were 43.00%, 31.70% and 25.00%, respectively. Systematic reviews reported that the prevalence of generalized anxiety disorder was 22.9% versus 4.1% [36], and the prevalence of prenatal depression was 22.4% versus 12.6% when comparing questionnaire assessments to the Structured Clinical Interview [2]. This diagnostic variance is corroborated by a Chinese cohort study using the Mini International Neuropsychiatric Interview (MINI), revealing 27.1% anxiety prevalence and 9.4% comorbid depression-anxiety cases [24]. The prevalence of depression and anxiety among Chinese pregnant women determined through screening tools is higher than the global level, possibly due to differences in economic level and screening tools. It should be pointed out compared with providing a formal diagnosis with the Structured Clinical Interview for DSM-5 mental disorders (SCID), the Mini International Neuropsychiatric Interview (MINI) or the Composite International Diagnostic Interview (CIDI), screening tools have a risk of overestimating the prevalence [37]. In our network of depression and anxiety, the most central symptom was EPDS8 (sad or miserable), followed by GAD4 (trouble relaxing) and EPDS5 (scared or panicked). Furthermore, the bridge symptoms linking depression and anxiety communities were GAD7 (feeling afraid), EPDS5 (scared or panicked) and GAD4 (trouble relaxing). The strongest edges between cognitive fusion and depression and anxiety were GAD3 (excessive worry), GAD1 (nervousness) and EPDS7 (sleep difficulties).

In this network analysis, EPDS8 (sad or miserable) had the highest EI strength, and the predictability value was second highest within the symptom network. These findings indicate that "sad or miserable" is a hallmark symptom of depression and anxiety in pregnant women in the network model; this is consistent with the conventional understanding of the network model of depression and

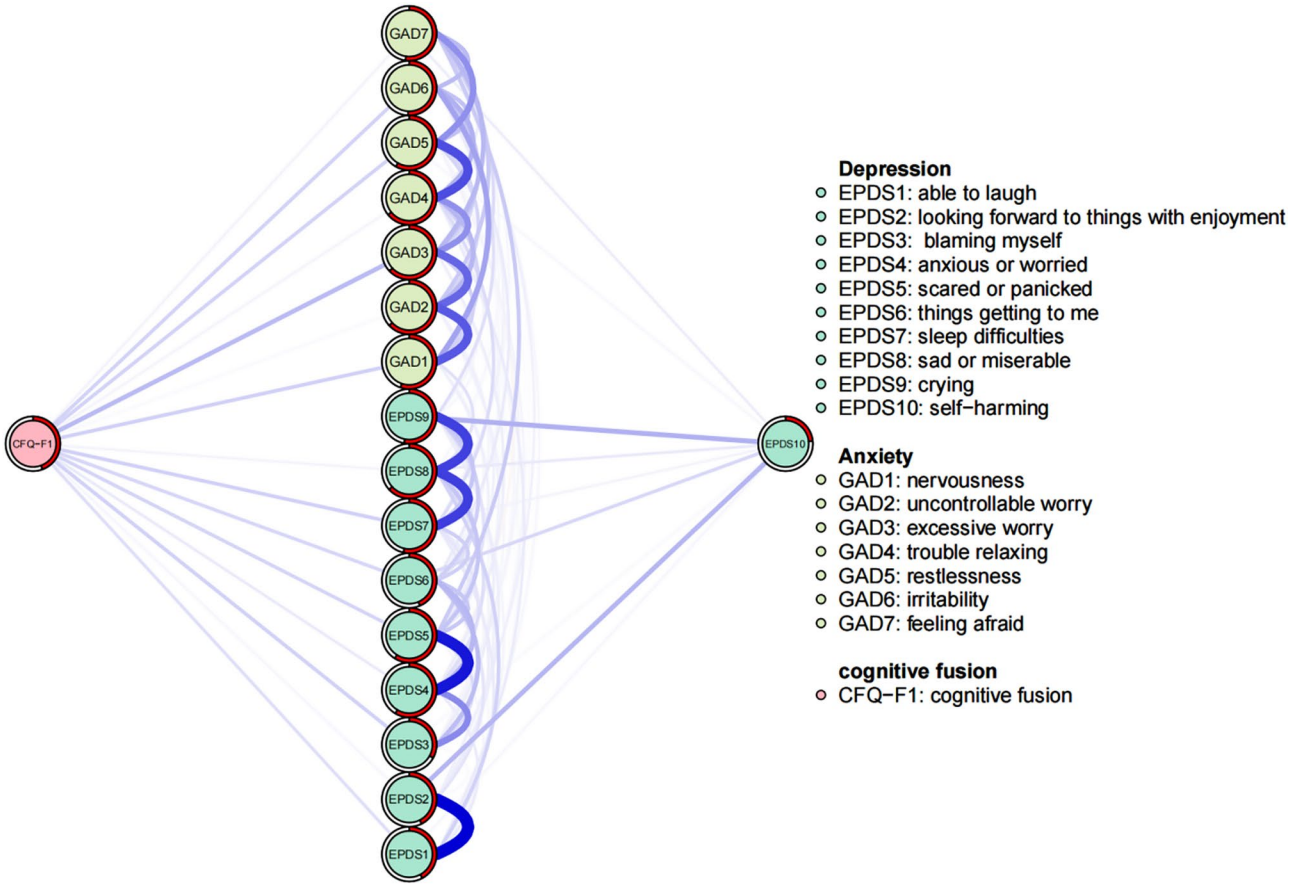

Fig. 4 Flow network of cognitive fusion with depression and anxiety

anxiety, in which "sad mood" is often seen as the most central symptom of people with mental disorders [38]. The second and third highest EI strengths are GAD4 (trouble relaxing) and EPDS5 (scared or panicked). Thus, the activation or deactivation of these symptoms may play a role in dynamic changes in other nodes [31]. Notably, these central symptoms differ from those reported in other populations. Specifically, restlessness emerged as a core depression symptom in Chinese adolescents [39], whereas suicide ideation dominated the depression cluster in adults with disabilities [40]. Pregnant women have unique physiological and psychological reactions during pregnancy, such as paying careful attention to their diet, avoiding overwork, and worrying about foetal health and pregnancy complications. These concerns make it difficult for them to relax and cause them to be afraid and fearful [41]. According to network theory, central symptoms play an important role in maintaining the psychopathological network [42]. Therefore, these symptoms potentially represent a key focus for psychiatrists to identify the mental health of pregnant women and provide potential symptom targets for interventions for depression and anxiety, but further clinical interventions are needed to validate their effectiveness.

Bridge strength is the best index for identifying nodes that, if deactivated, prevent one disorder from inducing another [32]. We found that bridge symptoms connecting depression and anxiety among pregnant women included GAD7 (feeling afraid) and EPDS5 (scared or panicked), and these symptoms could effectively prevent widespread activation of symptoms. In contrast, the bridge symptoms of depression and anxiety among elderly people in the community were "irritability" and "sad mood" [43]. The bridge symptoms of depression and anxiety among Chinese university freshmen were "feeling afraid" and "irritability" [44]. We found that the symptoms of depression and anxiety among pregnant women are mainly feelings of fear. The reason is that pregnant women encounter many unknowns and new experiences at each stage of pregnancy, such as different physical and mental reactions, worries about their own health and that of the foetus, fears of childbirth, and postpartum parenting [45, 46], causing fear. Therefore, it is particularly important to promote the spread of knowledge regarding pregnancy health and newborn care. In addition, it is unclear whether first-time pregnant women experience more severe anxiety and depression during pregnancy than women with multiple pregnancies do. Previous studies

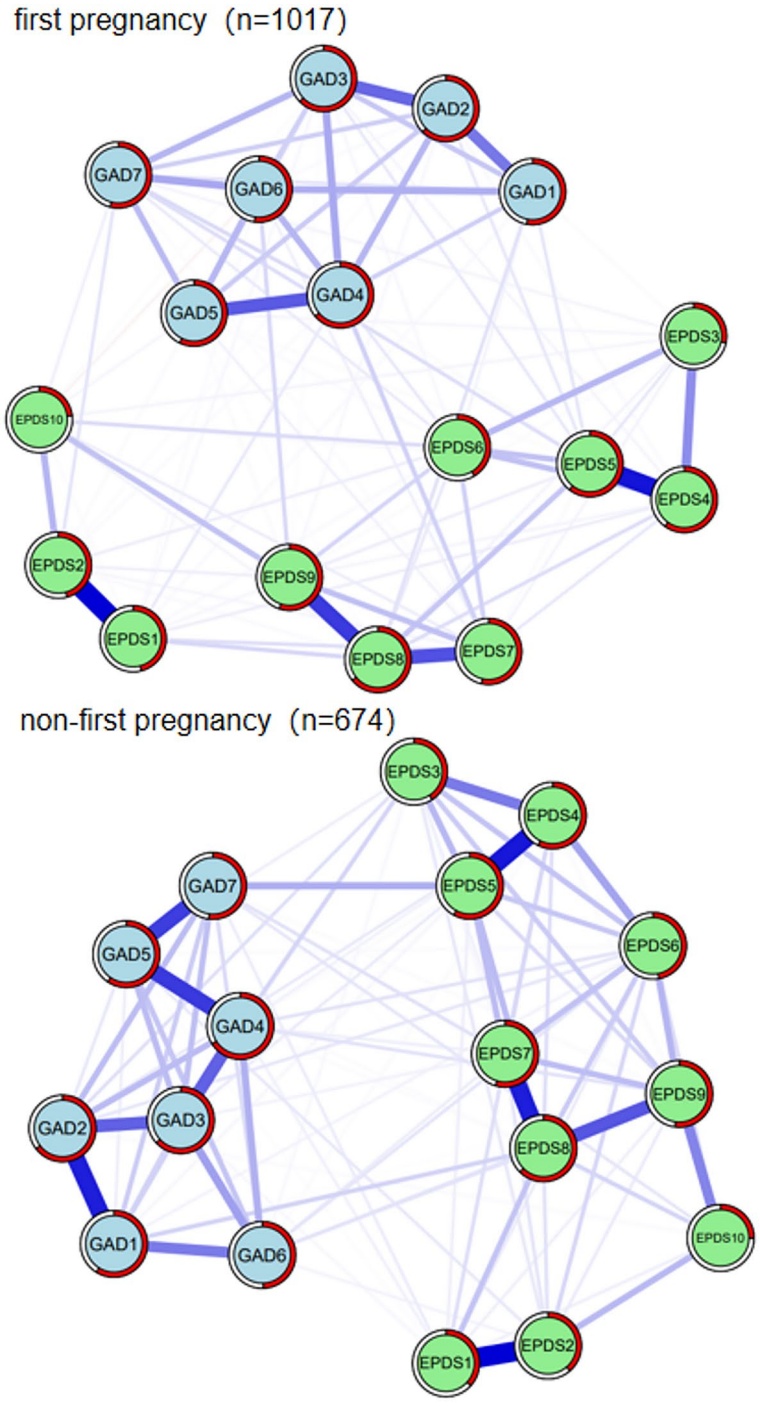

Fig. 5 Network comparison of anxiety and depressive symptoms between different gravidity groups

have shown that women with multiple pregnancies have higher levels of depression and anxiety than primiparous women do [34]; however, another study reported the opposite trend [47]. Our research findings indicated no significant differences in terms of global network strength between primiparous and multiparous women, indicating that the network was relatively stable between the subgroups. However, our research revealed significant differences in terms of the network structure distribution of edge weights, especially the edges connecting EPDS4 (anxiety or worry) and EPDS5 (fear or panic), with these symptoms being more severe in primiparous women than in multiparous women. Individuals who lack childbirth and parenting experience are more anxious about childbirth and postpartum parenting [47]. Therefore, we

need to pay more attention to symptoms such as worry and panic in primiparous women.

As a core acceptance and commitment therapy (ACT) construct, cognitive fusion is the primary role of verbal relations in controlling behaviour in direct experience, which can promote negative behaviours and thought patterns, such as taking ineffective actions, becoming overly concerned, and feeling frustrated [10]. This is consistent with the results of this study. The GAD3 (excessive worry), GAD1 (nervousness) and EPDS7 (sleep difficulties) scores had the strongest positive associations with cognitive fusion in pregnant women. Pregnant women pay special attention to their own health and that of the foetus, which may lead to excessive worry and tension [41]. This aligns with pregnancy-specific psychopathology patterns where health vigilance amplifies catastrophic cognitions [48]. A previous study revealed that the bidirectional relationship between cognitive fusion and experiential avoidance accounts for a significant proportion of the associations between rumination and depression and between stressful life events and anxiety and depression. Specifically, a persistent tendency to become entangled with difficult thoughts, coupled with excessive attempts to avoid unwanted experiences, may constitute a common pathway contributing to distress [49]. This finding suggests that avoiding stressful events that cause worry and nervousness increases the degree of cognitive integration. ACT and mindfulness-based approaches may disrupt the cognitive fusion-experiential avoidance cycle by enhancing psychological flexibility [50, 51]. Notably, anxiety demonstrated stronger connectivity to cognitive fusion than depressive. This finding supports prioritising anxiety-related targets (e.g., worry reduction) in perinatal interventions. Further experimental research is needed to verify the causal relationship between cognitive fusion and depression and anxiety.

This study provides clinically insights for perinatal mental health interventions. The development of multidimensional symptom psychological intervention management methods for pregnant women should pay more attention to EPDS8 (Sad or miserable) and GAD4 (trouble relaxing) symptoms while also considering the bridging effect of GAD7 (feeling afraid) symptoms and considering GAD3 (excessive worry) symptoms that are most closely related to cognitive fusion. Cognitive behavioural therapy is used to correct pregnancy-related misconceptions and alleviate their sadness or pain [51]. Mindfulness therapy is used to alleviate relaxation difficulties [50]. The community should advocate for prenatal health education for pregnant women, reducing fear caused by a lack of knowledge about prenatal health [49]. Acceptance commitment therapy should be used to alleviate cognitive fusion and excessive worry symptoms [51].

Limitations

First, because our study was cross-sectional, we could not identify causal relationships. Future longitudinal studies can be conducted across the entire perinatal period to explore the dynamic changes in maternal perinatal depression and anxiety. Further intervention research is needed in the future to validate intervention symptom targets for comorbid depression and anxiety in pregnant women. Second, our study relied solely on self-reported psychological measurement data and did not use clinical diagnoses, such as applying the Structured Clinical Interview for DSM-5 mental disorders (SCID) to assess symptoms. Although screening instruments are practical for population-level research, they may overestimate the prevalence compared to such gold standard assessments. Future research can validate our findings based on the same symptoms identified through professional clinical diagnosis. Third, because the data were collected from two hospitals in Guangdong Province, the representativeness of the sample was limited; a multisample study will be conducted in the future. Finally, although our exclusion criteria aimed to minimise genetic confounding, the generalisability of these findings may be limited to populations with familial psychiatric histories beyond psychotic disorders.

Conclusion

In this study, the relationships between depressive and anxious symptoms and their associations with cognitive fusion were analysed using network analysis for the first time. The central symptoms (e.g., sad or miserable, trouble relaxing, scared or panicked) and bridge symptoms (e.g., feeling afraid, scared or panicked and trouble relaxing) identified in the network analysis help psychiatrists identify mental health in pregnant women more effectively and provide potential symptom targets for interventions for depression and anxiety in pregnant women. Furthermore, GAD3 (excessive worry), GAD1 (tension), and EPDS7 (sleep difficulties) are closely related to cognitive fusion. However, these observational findings need to be experimentally validated using intervention studies before efficacy can be claimed. We recommend that individuals with positive EPDS/GAD-7 results be referred to specialized mental health services for diagnostic confirmation. Additionally, healthcare provider training should emphasize proper communication of screening outcomes to avoid misinterpretation.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12888-025-06978-y.

Supplementary Material 1

Supplementary Material 2

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Author contributions
HL (Haiyan Liu), FH (Fanyan Huang), and YG (Yaqing Gao) designed the method of the current study. MW (Muyao Wang), QL (Qianzhi Lin), YK (Youjing Kong), and RZ (Rufang Zhou) were in charge of collecting and analysing the data of the participants. HL (Haiyan Liu) was responsible for the algorithm and visualization of the network analysis. HL (Haiyan Liu) wrote the original manuscript. Yu Chen (YC) and Chichen Zhang (CZ) provided suggestions for publication. All authors contributed to revising and approved the final version of the paper.

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Data availability
The data supporting this study can be obtained from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
This study was supported by the hospital Ethics Committee (NFCE2021-086), and all data from pregnant women were kept strictly confidential.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Author details
[1]School of Nursing, Southern Medical University, Guangzhou, China
[2]School of Health Management, Southern Medical University, Guangzhou, China
[3]Key Laboratory of Philosophy and Social Sciences of Colleges and Universities in Guangdong Province for Collaborative Innovation of Health Management Policy and Precision Health Service, Guangzhou, China

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