

# Symptom Networks of Depression and Anxiety in Patients With a History of Hemorrhoids: Evidence From the UK Biobank

RWD219



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## 1 Introduction

### The Problem

- While highly common, the psychological impact of hemorrhoidal disease is poorly understood. Traditional research methods often miss the complex interactions between individual depression and anxiety symptoms.

### Our Approach

- We use network analysis to model mental health as a system of interconnected symptoms. This allows us to identify the central symptoms that drive psychological distress.

### Study Aim

- This is the first study of its kind to identify these core symptoms in hemorrhoid patients, using UK Biobank data to inform personalized, mechanism-driven care.

## 2 Methods

### Population & Measures

- Participants:** This study utilized data from 10,482 individuals with hemorrhoidal disease (ages 37-73) sourced from the UK Biobank.
- Assessment:** Depression and anxiety symptoms were evaluated using the validated Patient Health Questionnaire-9 (PHQ-9) and the Generalized Anxiety Disorder-7 (GAD-7).

### Network Construction & Analysis

- Model:** We constructed a Gaussian Graphical Model (GGM) where nodes represent symptoms and edges represent their unique relationships after accounting for all other symptoms.
- Estimation:** The network was estimated using EBIC graphical lasso regularization to identify the most significant symptom connections.
- Centrality Analysis:** To identify the most influential symptoms, we calculated their Strength (direct influence), Betweenness (bridging role), and Closeness (propagation speed).
- Subgroup Comparisons:** We used the NetworkComparisonTest to analyze differences in network structure and strength based on gender, age, and time since diagnosis.

Figure 1. The flow diagram for exclusion and inclusion.

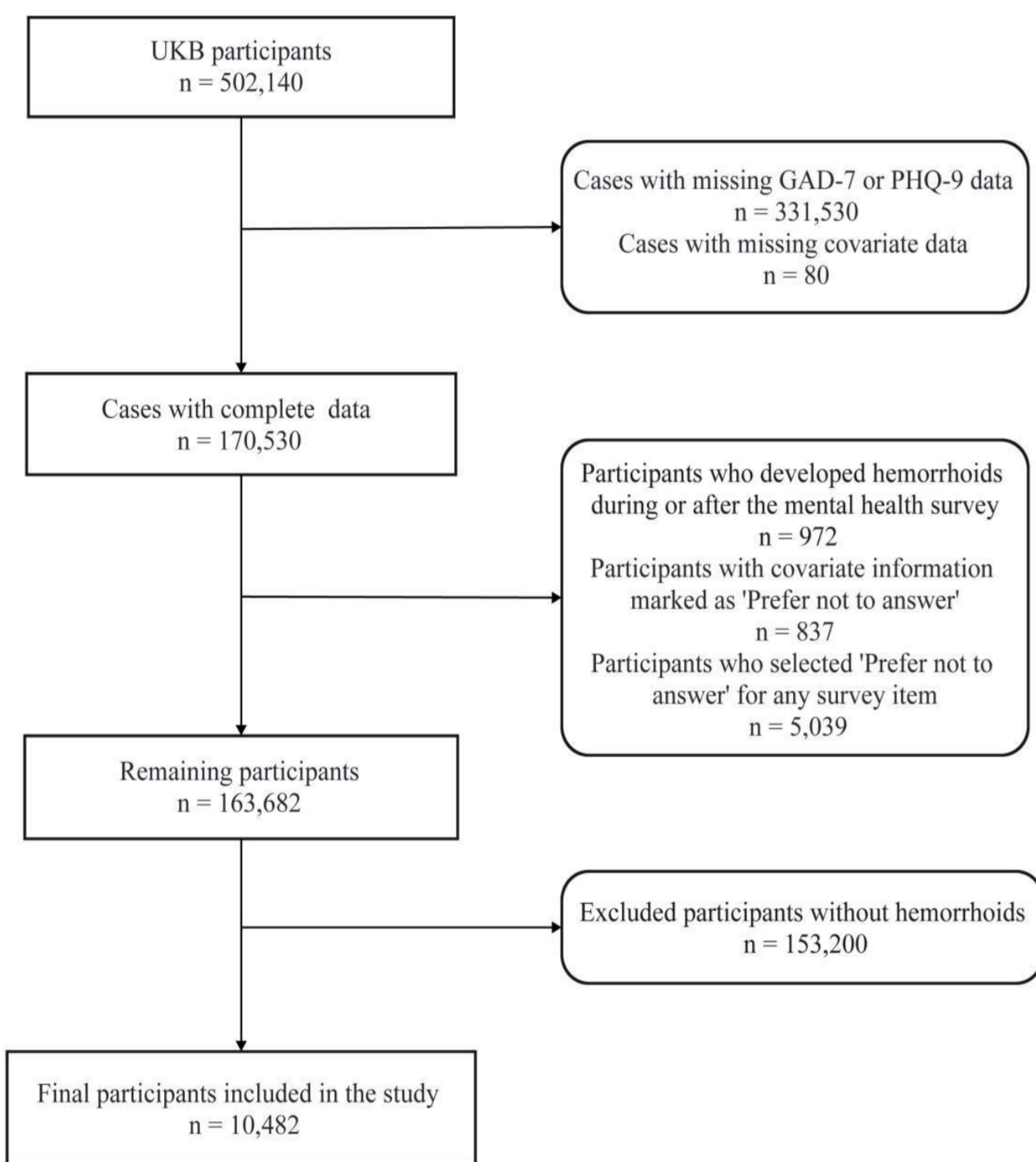


Figure 2. Heatmap of the Spearman correlation matrix.

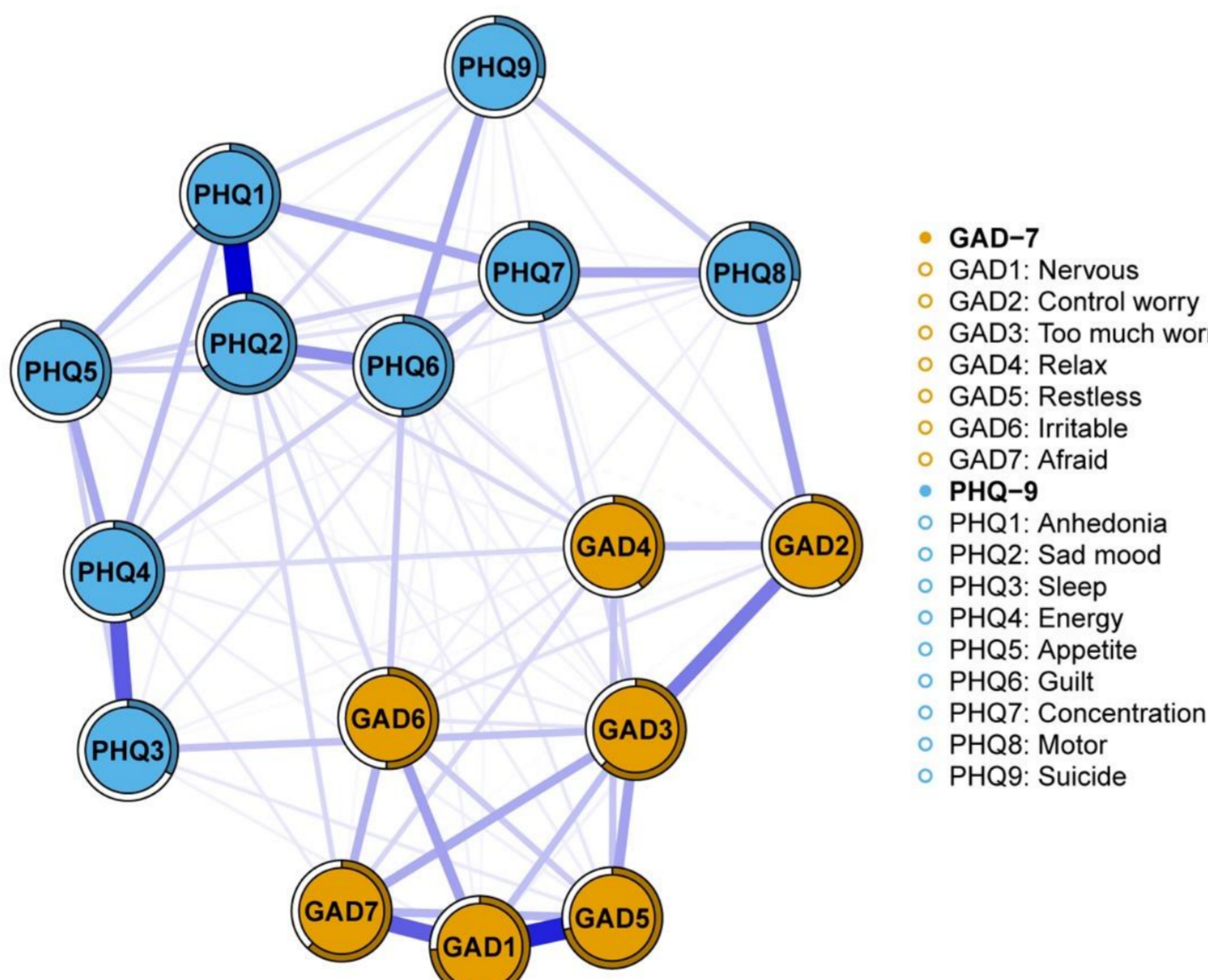
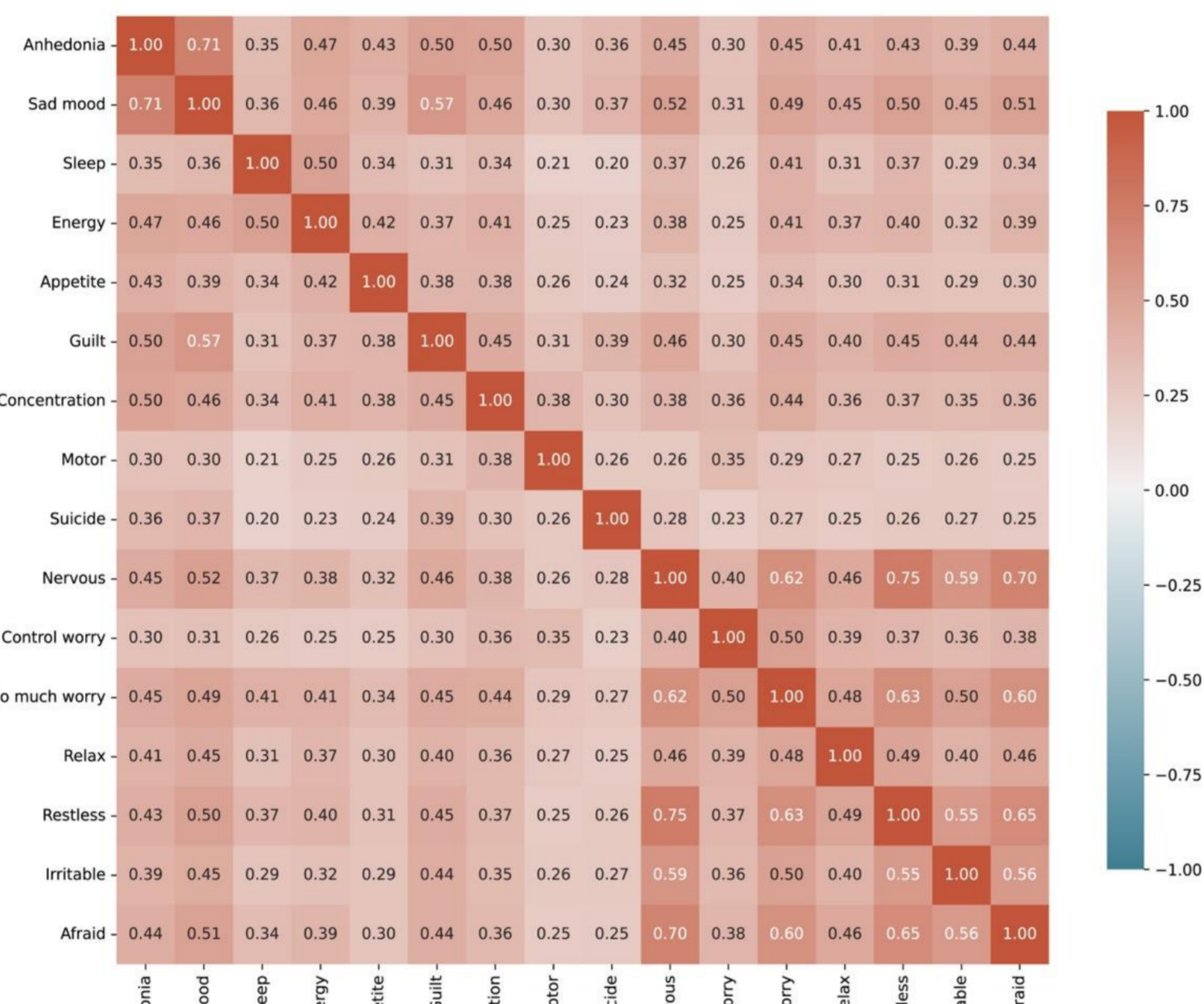


Figure 3. Network model of depression and anxiety in patients with hemorrhoids. Blue lines are positive connections. The thickness of the line represents the connection strength. Colored areas in the rings surrounding the nodes represent the node pre-dictability (percentage of the variance of a given node explained by surrounding nodes).

## 3 Results

### Network Structure & Centrality

- High Network Stability:** Symptom network showed robust stability (correlation stability coefficient = 0.75).

### Key Central Symptoms

- Sad Mood (PHQ-2):** highest strength centrality (1.41).
- Too Much Worry (GAD-3):** highest betweenness centrality (2.54), linking depression ↔ anxiety clusters.

### Strongest Edges

- Depression cluster:** "Anhedonia" (PHQ1) ↔ "Sad Mood" (PHQ2).
- Within the anxiety cluster:** "Nervous" (GAD1) ↔ "Restless" (GAD5).

### Subgroup Analyses (Gender)

METRIC	STATISTIC	P - VALUE	INTERPRETATION
Global Strength	S = 0.19	0.03*	Networks differ in overall connectivity
Network Structure	M = 0.10	0.01*	Topology significantly different

Women: stronger emotional–cognitive links

Men: stronger somatic–behavioral links

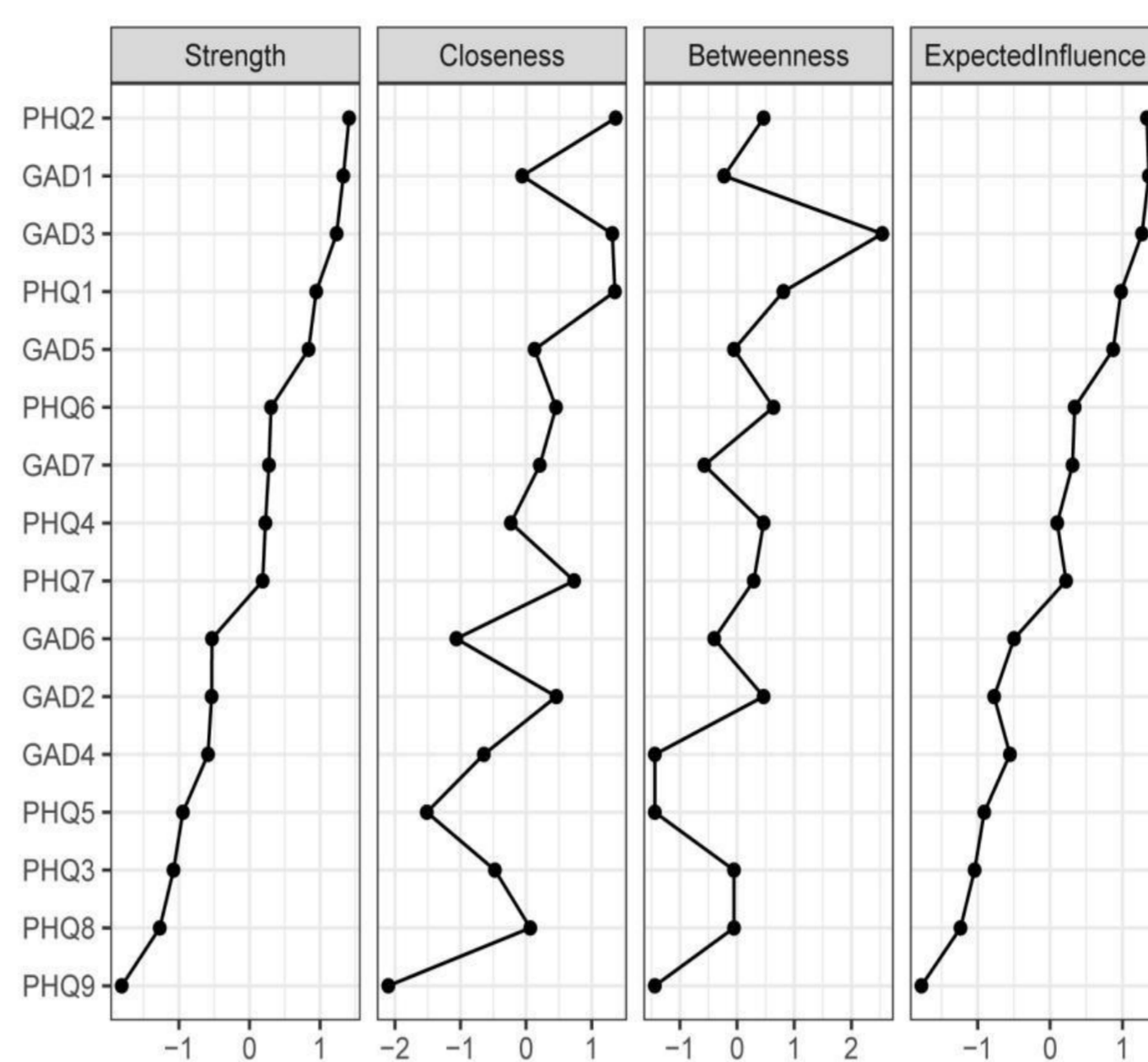


Figure 4. Centrality measures of depressive and anxiety symptoms within the symptom network among hemorrhoid patients. The figure displays centrality metrics (i.e., strength, betweenness, closeness, and expected influence) of depressive and anxiety symptoms in the network (z-scores).

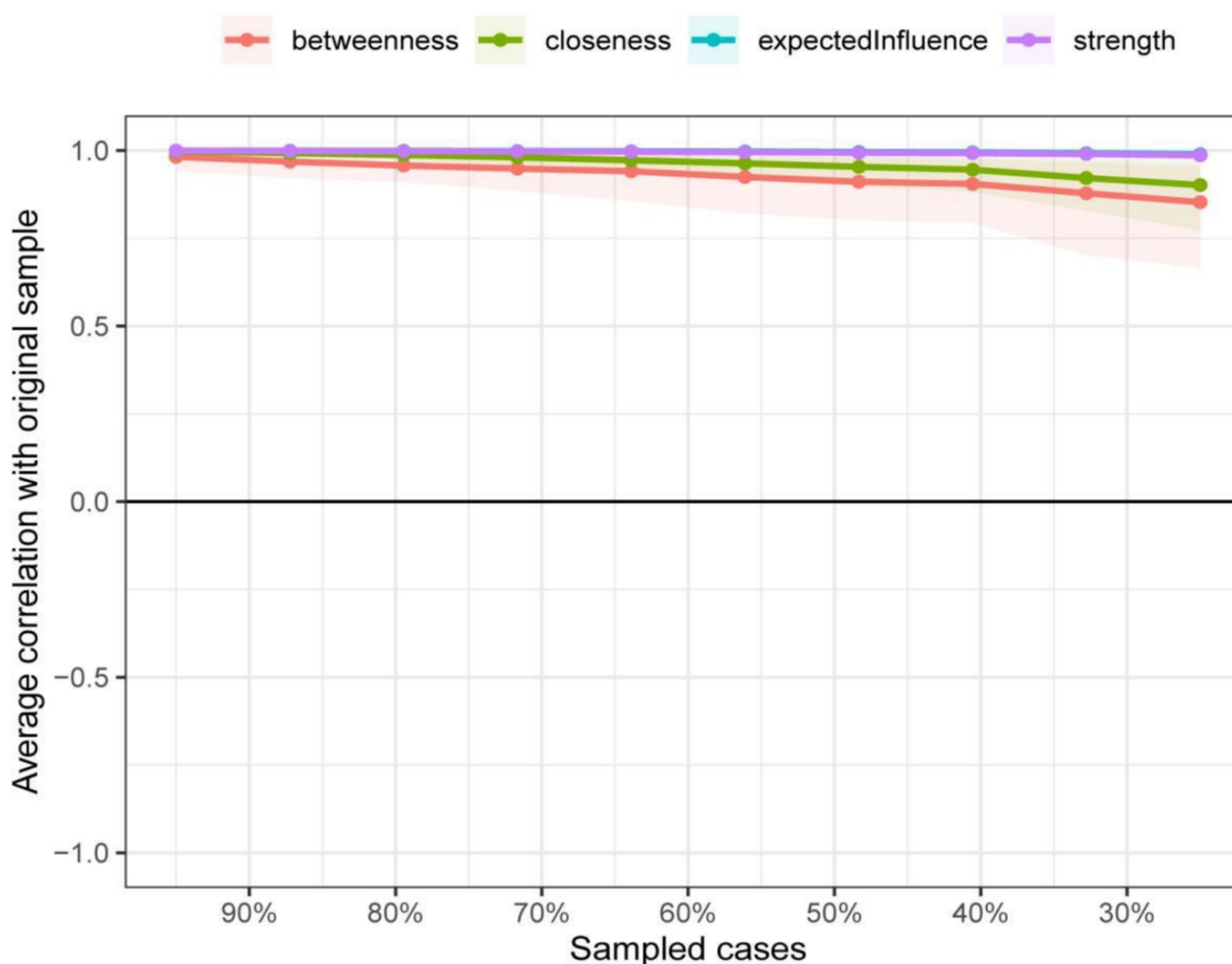


Figure 6. Stability of central indices

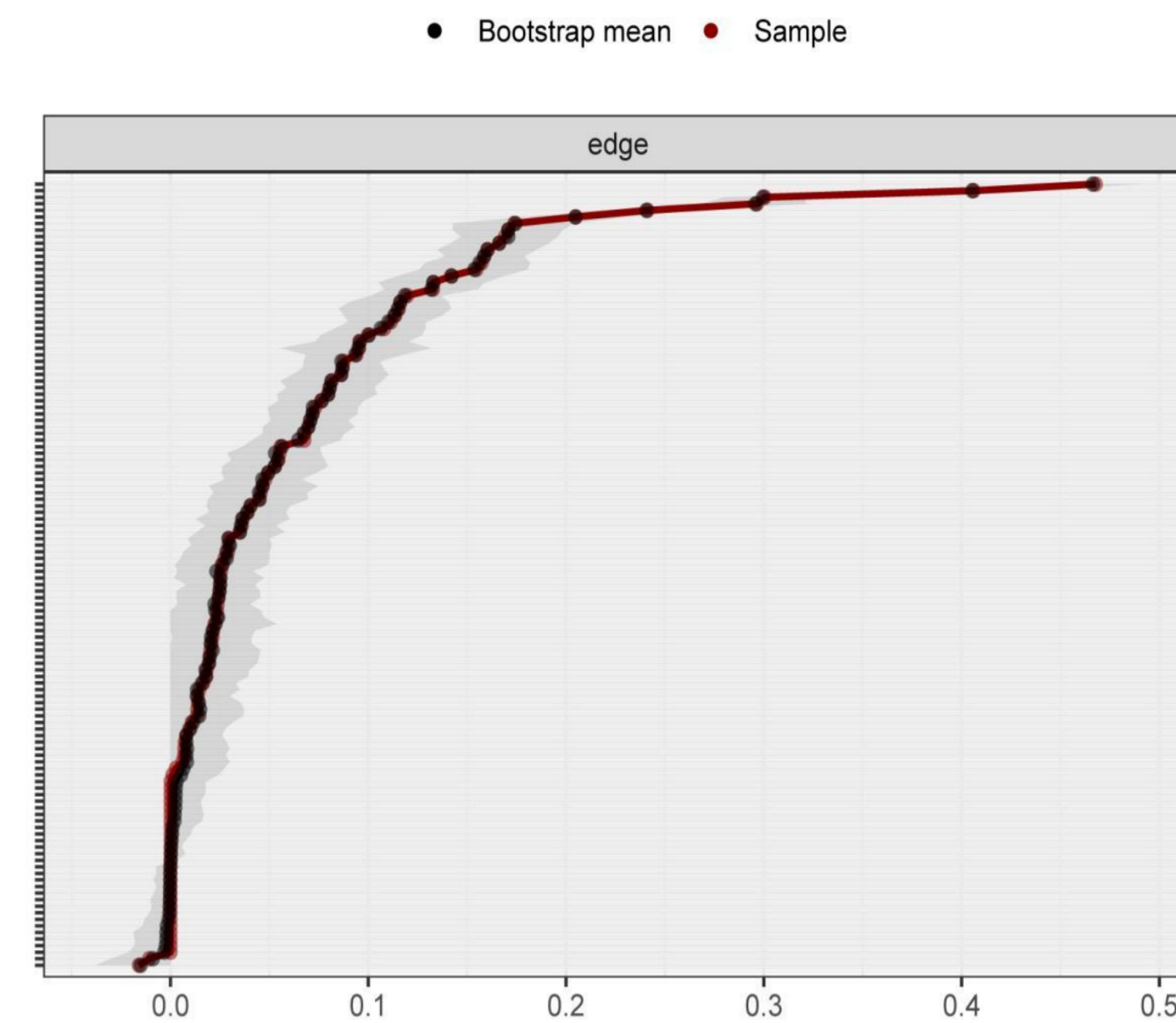


Figure 5. Bootstrapping of the 95% confidence intervals of the edge weights for the estimated network. The red line indicates the edge weight values, and the gray area indicates the 95% CIs.

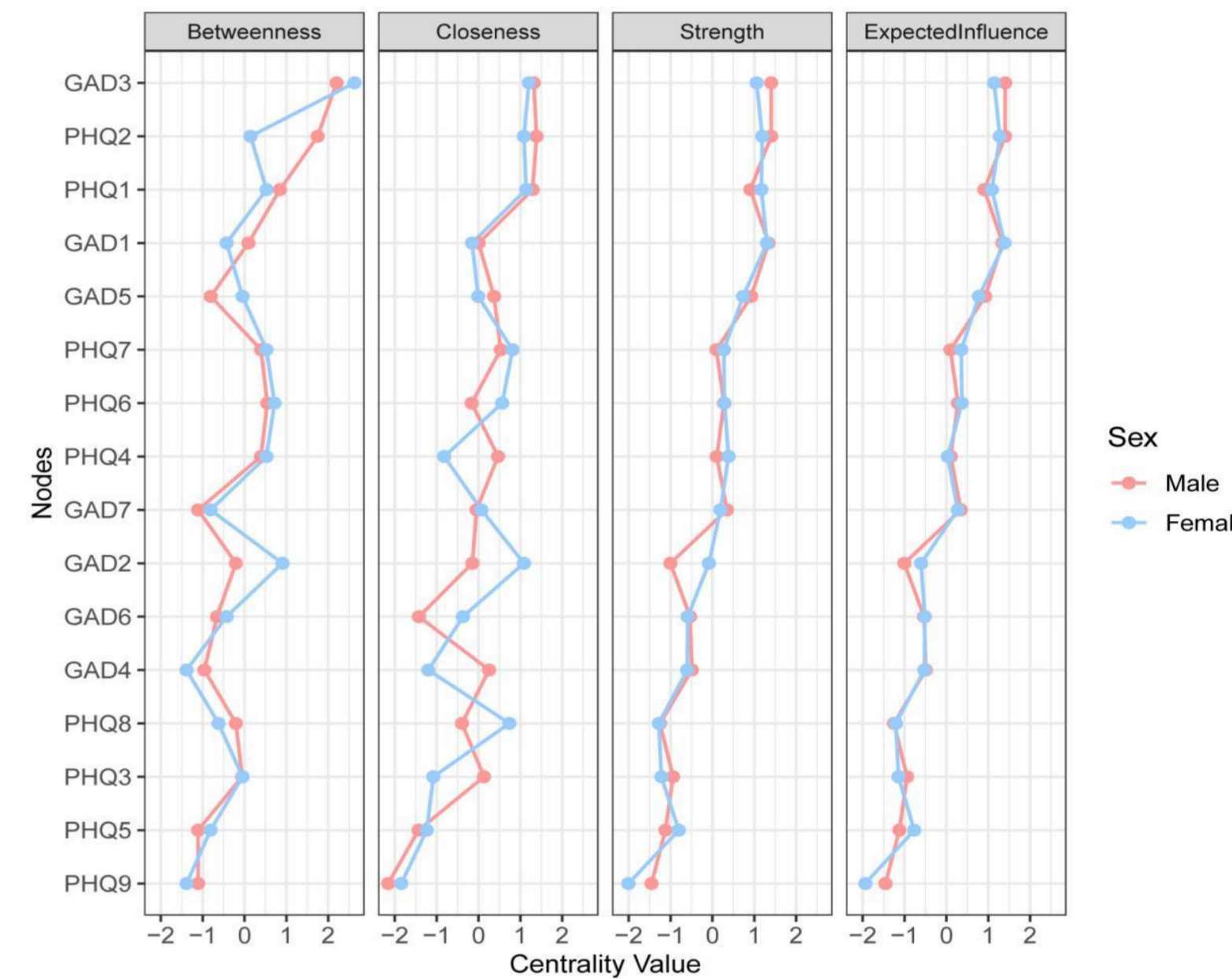
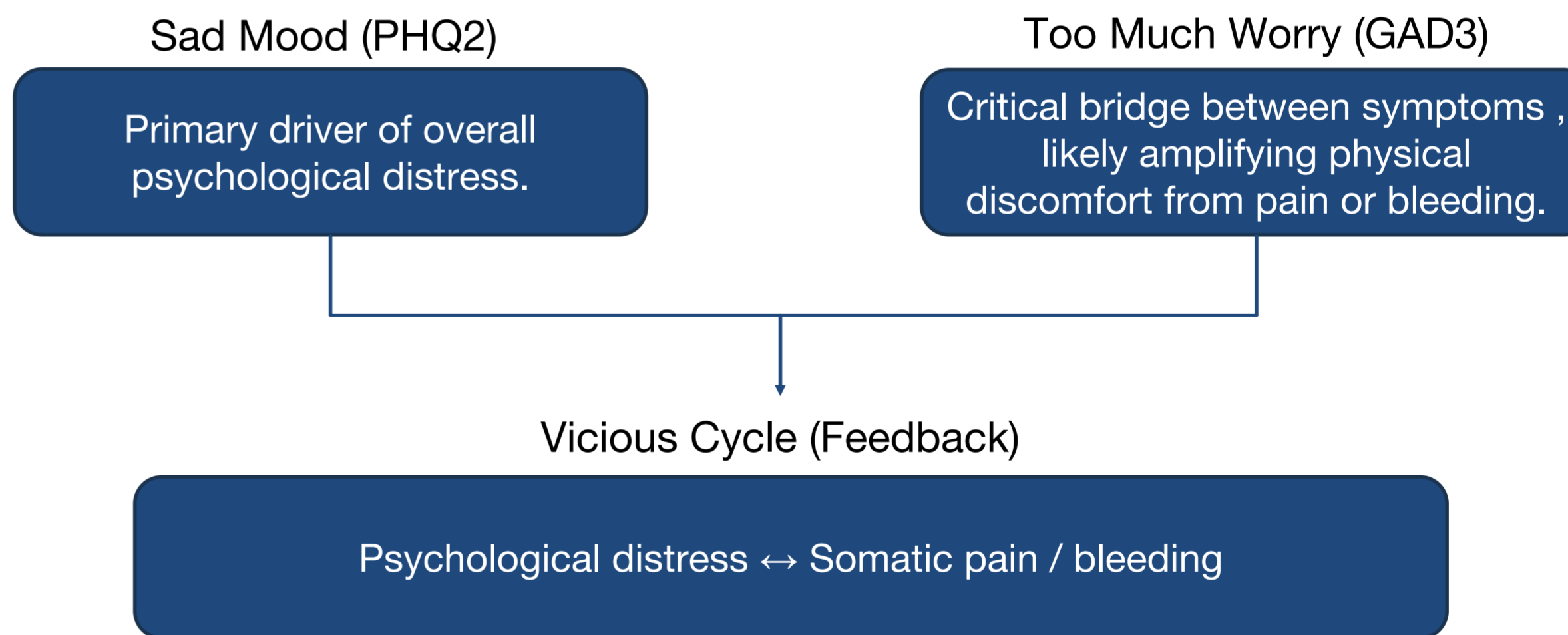


Figure 7. Comparison of network centrality indices between female and male hemorrhoid patients.

## 4 Discussion & Conclusion

### Interpretation of Core Symptoms



### Gender-Specific Topologies

- Women: denser emotion-cognition links (internalizing pattern).
- Men: stronger somatic-behavior links (externalizing pattern).

### Clinical Implications

- The central roles of "Sad Mood" and "Too Much Worry" suggest they are key targets for psychological intervention. Targeting these hubs may disrupt the entire symptom network more effectively.
- For women, emotion-focused therapies may be particularly effective.
- For men, behavioral activation strategies that target somatic symptoms may be more beneficial.

## References

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