Associations Between a Transdiagnostic Core Vulnerability and Internalizing Symptoms: A Network Analysis

Supplementary Material

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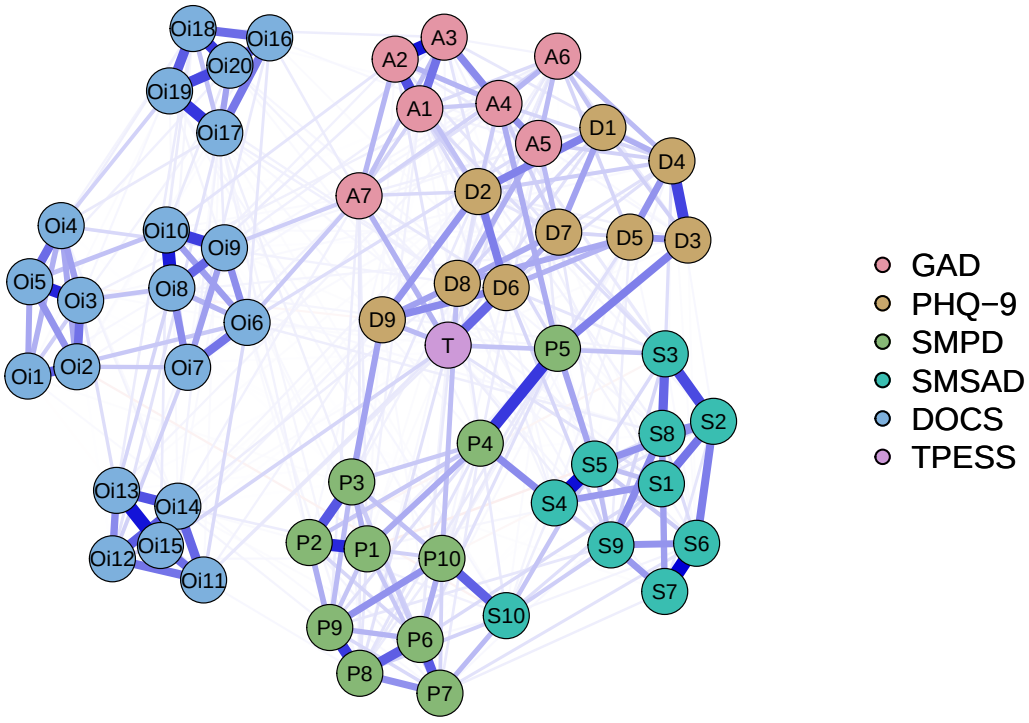
1 Appendix 1: Preliminary fitting of 57-node network model

1.1 Estimated network

Please see table in next section for a description of each node label.



1.2 Summary of nodes included in the 57-node network

Table 1: Item content for 57-node network

Node Label	Description
GAD-7	
A1	Anxious feelings
A2	Control of anxiety
A3	Multiple anxiety foci
A4	Difficulty relaxing
A5	Restlessness
A6	Irritability
A7	Anxious anticipation
PHQ-9	
D1	Anhedonia
D2	Depressed
D3	Sleep
D4	Fatigue
D5	Appetite
D6	Failure
D7	Concentration
D8	Psychomotor
D9	Suicidality
SMPD	
P1	Panic attacks
P2	Anxiety about panic attacks
P3	Thoughts about negative consequences
P4	Physiological reactions
P5	Restlessness and trouble sleeping
P6	Situational avoidance
P7	Disengagement
P8	Overpreparation or procrastination
P9	Distraction to avoid thoughts about panic attacks
P10	Needing help to cope with panic attacks
SMSAD	
S1	Fear of social situations
S2	Anxiety about social situations
S3	Thoughts of rejection, embarrassment, or offending others
S4	Physiological reactions to social situations
S5	Restlessness in social situations
S6	Physical avoidance of social situations
S7	Disengagement in social situations
S8	Overpreparation for social situations
S9	Thought avoidance of social situations
S10	Needing help to cope with social situations
DOCS	
Oi1	Contamination: Time spent
Oi2	Contamination: Avoidance
Oi3	Contamination: Distress
Oi4	Contamination: Interference
Oi5	Contamination: Control
Oi6	Responsibility: Time spent
Oi7	Responsibility: Avoidance

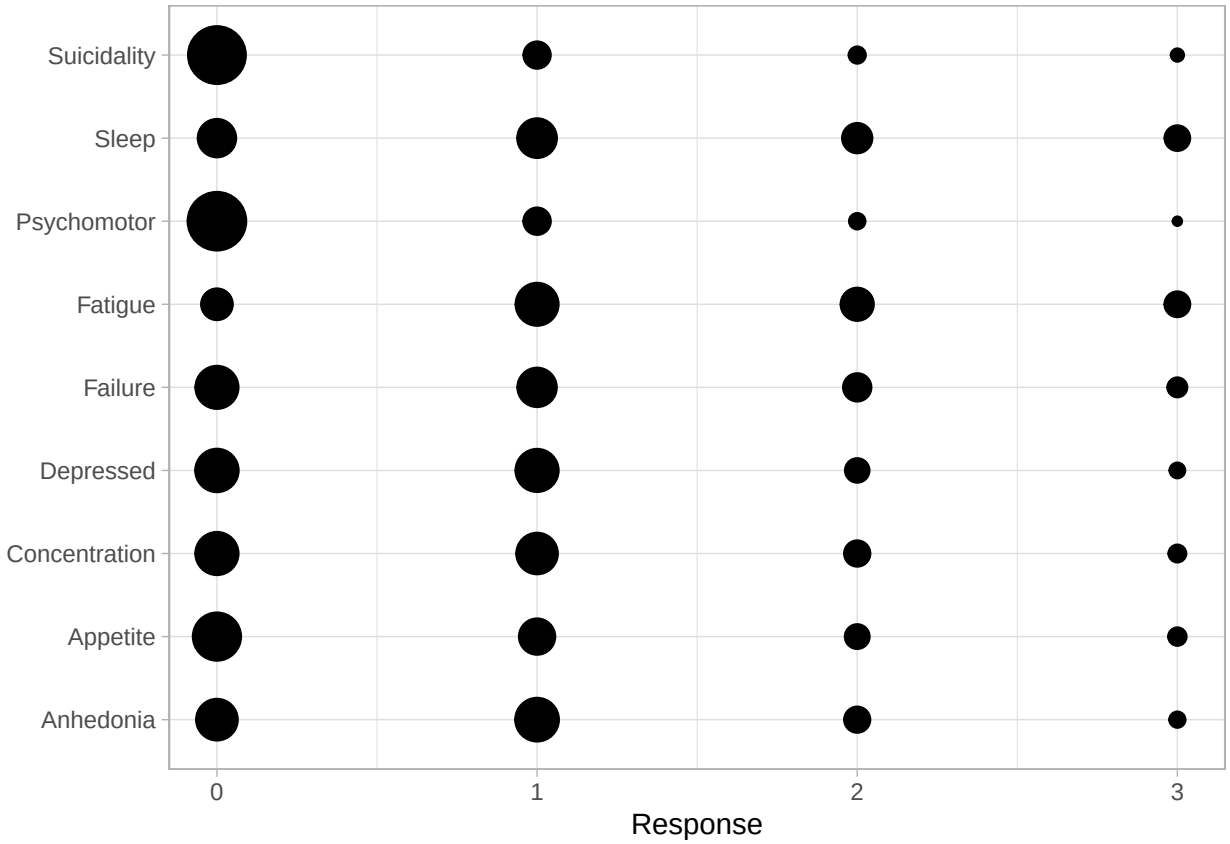
Oi8	Responsibility: Distress
Oi9	Responsibility: Interference
Oi10	Responsibility: Control
Oi11	Unacceptable Thoughts: Time spent
Oi12	Unacceptable Thoughts: Avoidance
Oi13	Unacceptable Thoughts: Distress
Oi14	Unacceptable Thoughts: Interference
Oi15	Unacceptable Thoughts: Control
Oi16	Symmetry: Time spent
Oi17	Symmetry: Avoidance
Oi18	Symmetry: Distress
Oi19	Symmetry: Interference
Oi20	Symmetry: Control
TPESS	
T	TPESS mean score

Note. GAD-7 = Generalized Anxiety Disorder-7; PHQ-9 = Patient Health Questionnaire-9; SMPD = Severity Measure for Panic Disorder-Adult; SMSAD = Severity Measure for Social Anxiety Disorder-Adult; DOCS = Dimensional Obsessive-Compulsive Scale; TPESS = Transdiagnostic Processes of Emotional Symptoms Scale; Item descriptions for PHQ-9, GAD-7, and DOCS adapted from Hsu et al. (2022), Mossman et al. (2017), and Abramowitz et al. (2010) respectively.

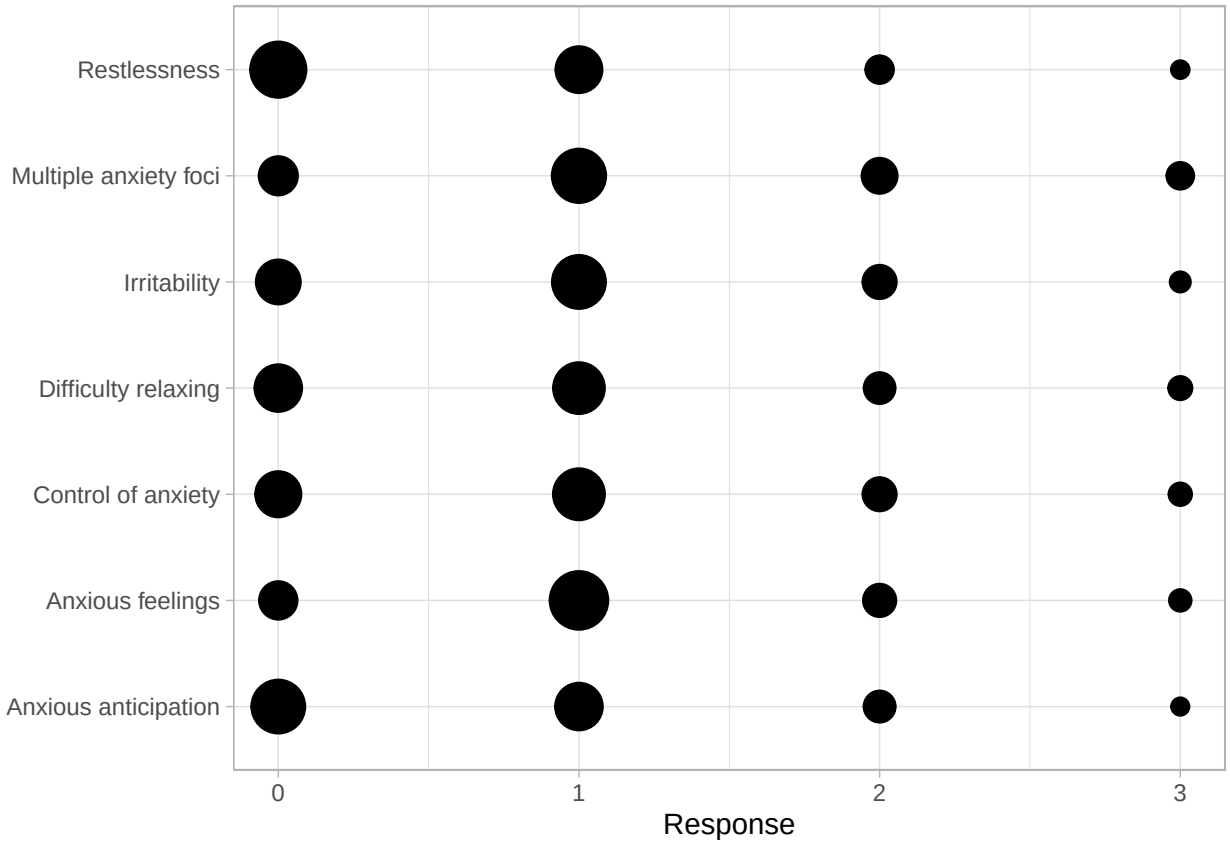
2 Appendix 2: Distribution of responses to PHQ-9, GAD-7, SMPD, and SMSAD items

The size of the circles in each plot reflects the proportion of the sample that selected the corresponding item response.

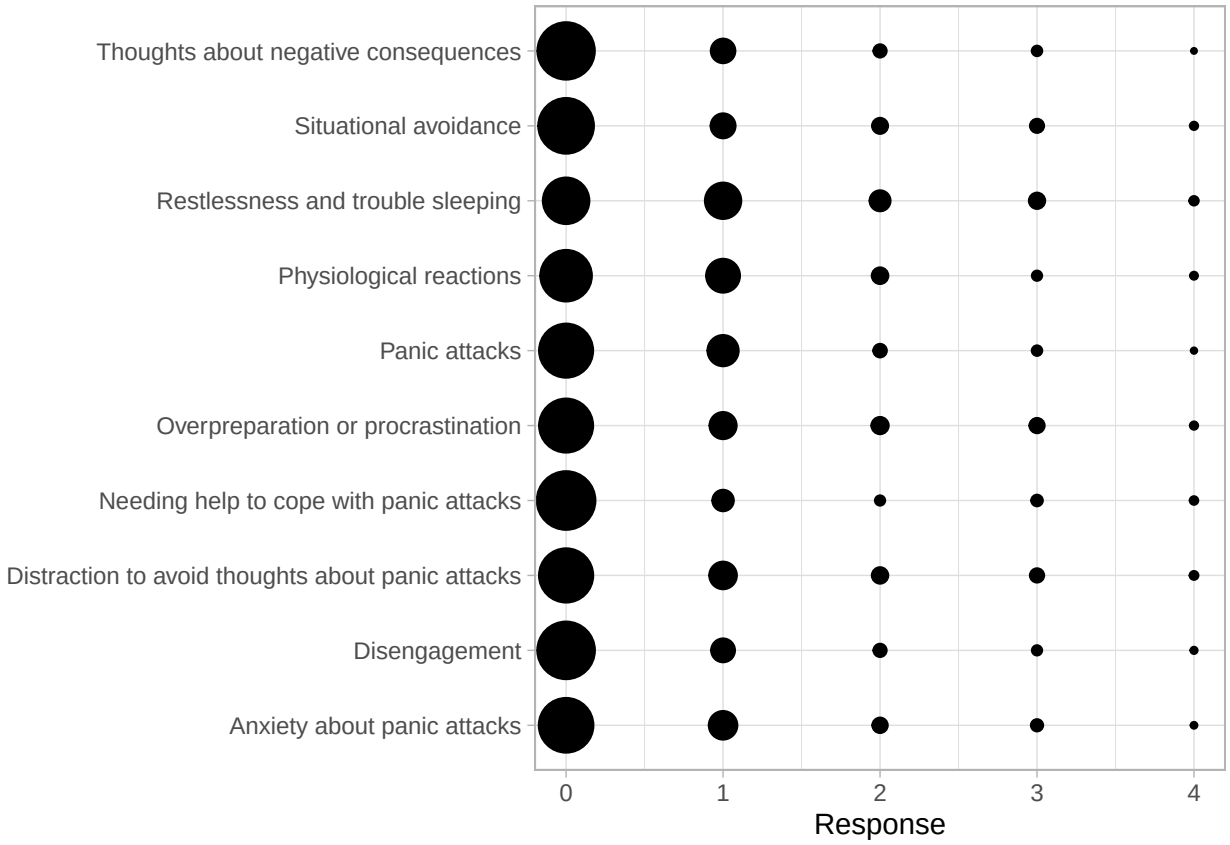
2.1 Patient Health Questionnaire-9 (PHQ-9)



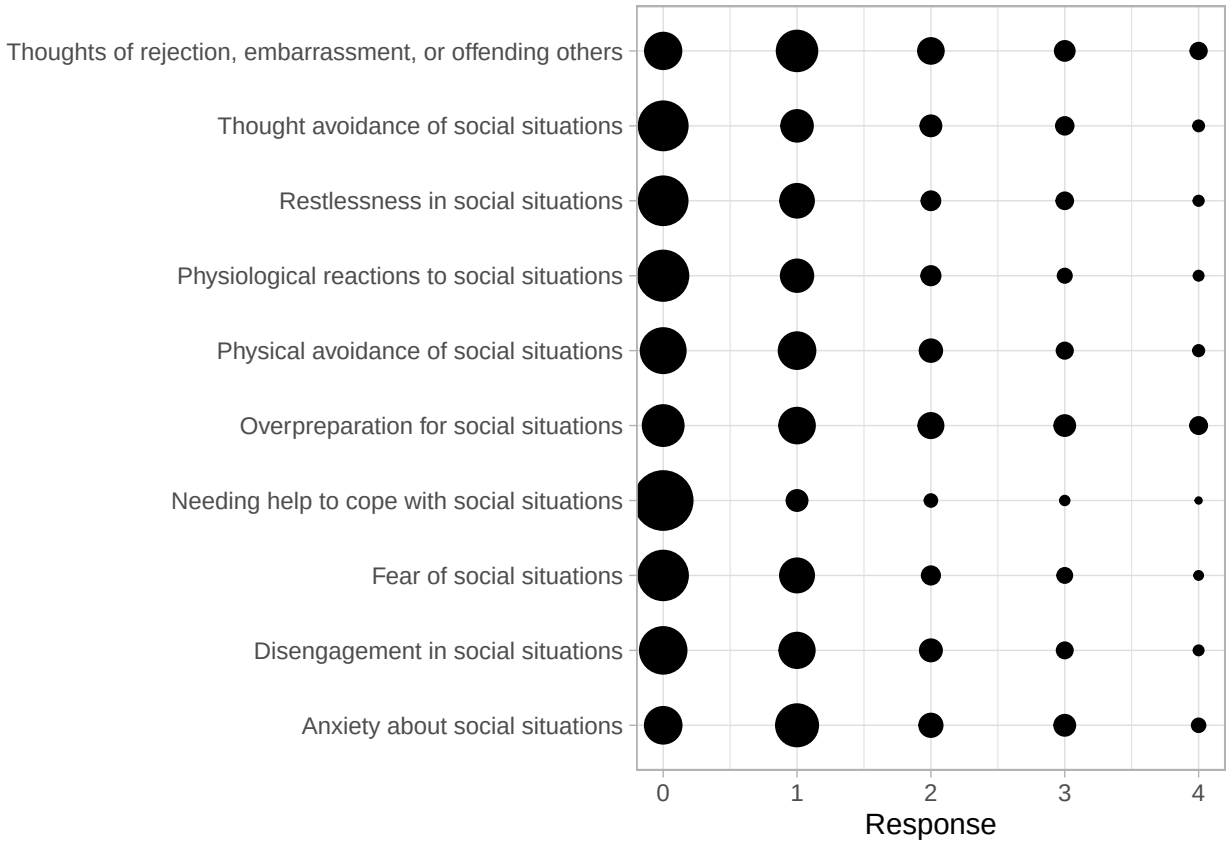
2.2 Generalized Anxiety Disorder-7 (GAD-7)



2.3 Severity Measure for Panic Disorder-Adult (SMPD)

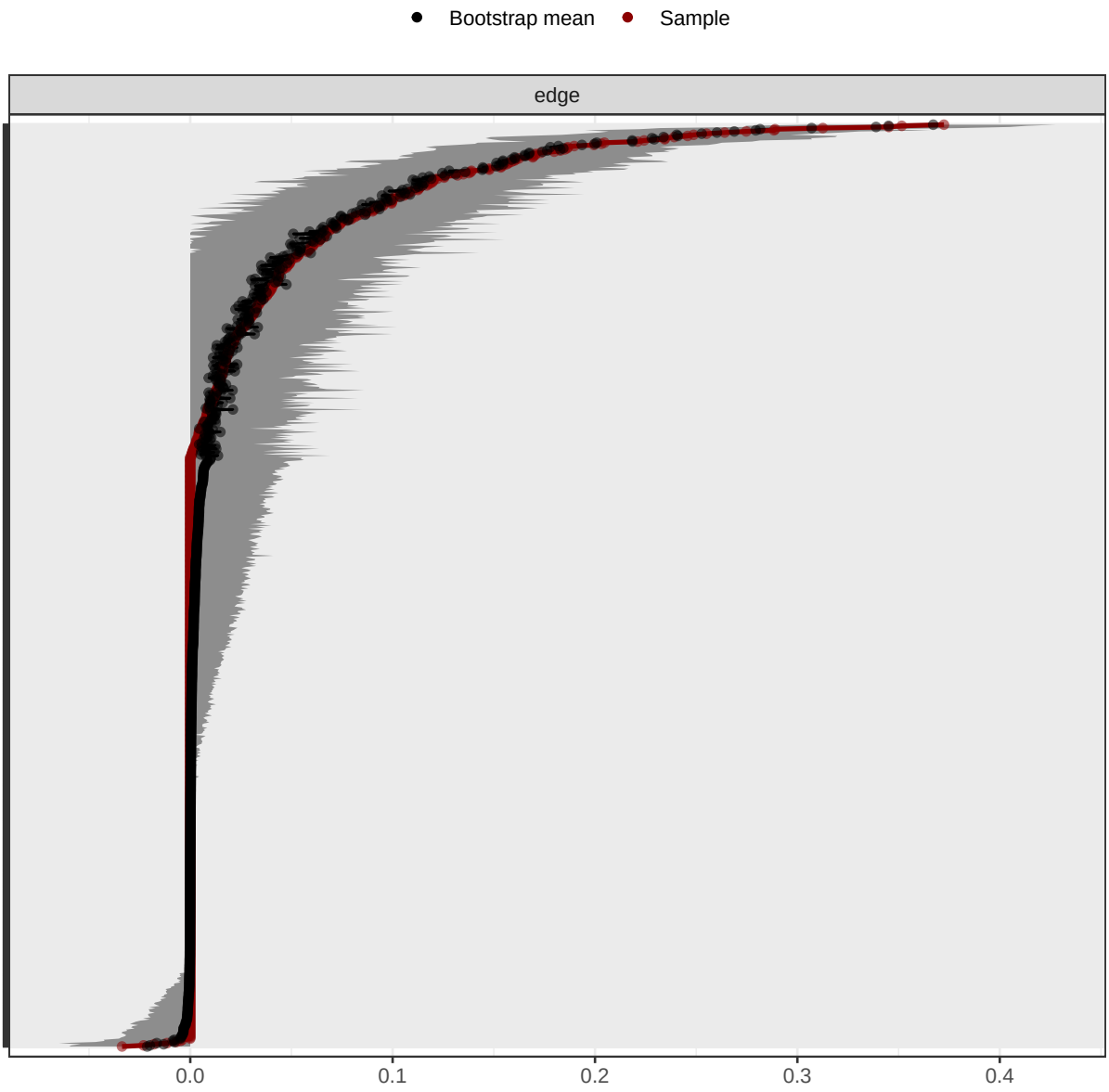


2.4 Severity Measure for Social Anxiety Disorder-Adult (SMSAD)



3 Appendix 3: Robustness Analysis (Bootstrapped Confidence Intervals of Edge Weights)

Each horizontal line represents an edge in the network; lines were ordered in descending order (highest edge weight to lowest edge weight). Red dots indicate sample values and the grey areas indicate bootstrapped confidence intervals. Axis labels have been removed to avoid clutter.



4 Appendix 4: Confirmatory Network Analysis for US community Sample

4.1 Methods

4.1.1 Participants and Procedure

We used data gathered from a US community sample via Prolific ($n = 595$). After removing duplicate responses and data from participants who had failed attention checks, the final sample size used for the present analysis was 534. Of the 534 participants, 293 participants were male, 236 were female, and 5 preferred not to indicate their gender. Most participants were ethnically Caucasian (69.7%) – the remaining participants were either African American (15.0%), Hispanic (3.4%), Asian (8.2%), or others/mixed (3.7%). The mean age of this sample was 37.08 ($SD = 10.21$). Participants were tasked to complete a battery of self-report questionnaires online at their convenience and were reimbursed with cash for their participation.

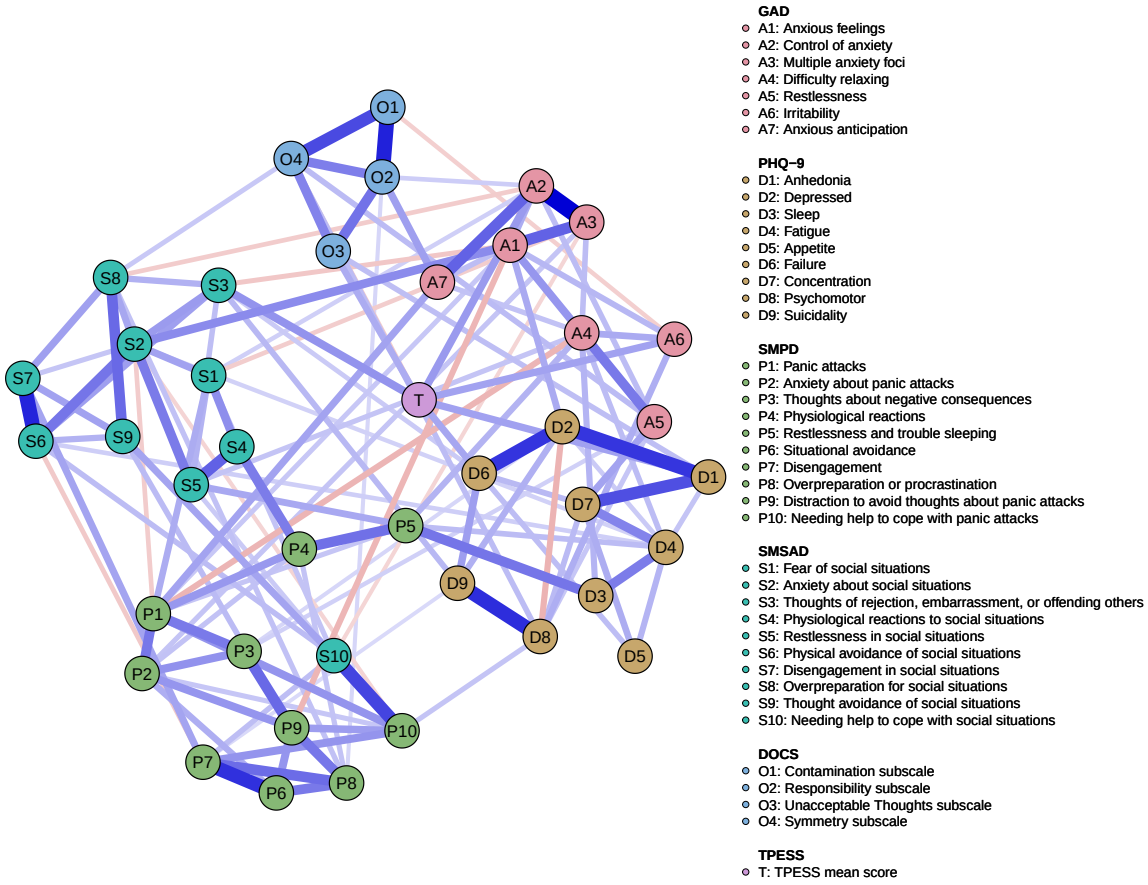
4.1.2 Measures

The same measures administered to the Singaporean student sample were administered to the US community sample. The internal consistency of the TPESS, DOCS contamination subscale, DOCS responsibility subscale, DOCS unacceptable thoughts subscale, and DOCS symmetry subscale in the US sample was $\alpha = 0.98$, $\alpha = 0.89$, $\alpha = 0.9$, $\alpha = 0.91$, and $\alpha = 0.92$ respectively.

4.1.3 Data Analysis

We estimated a confirmatory network model with the R package *psychonetrics* (version 0.11.5; Epskamp, 2023), fixing the structure of this model to that of the exploratory network detailed in the main paper (indicated by the adjacency matrix, which captures the presence/absence of edges between nodes in the exploratory network) but allowing network parameters to be freely estimated based on the US community sample data. This confirmatory model was based on Spearman correlations with pairwise estimation – a Spearman correlation matrix (which encoded the Spearman correlations between the same 41 nodes used in the exploratory network model) and average pairwise sample size was used as input. The fit of this confirmatory model was evaluated with the following fit indices (Schermelleh-Engel et al., 2003): root mean square of approximation (RMSEA; ≤ 0.05 = good fit, 0.05 to 0.08 = adequate fit, 0.08 to 0.10 = mediocre fit, and > 0.10 = unacceptable), Tucker-Lewis index (TLI), and comparative fit index (CFI; TLI and CFI: > 0.97 = good fit and 0.95 to 0.97 = acceptable fit). The plot of this confirmatory network model was thresholded (using an alpha value of .05), such that only statistically significant edges ($p < .05$) were visually presented. We also imposed the structural layout (i.e. visual position of the nodes within a network) of the exploratory network model onto the confirmatory network model plot, so that the visual position of nodes in both plots were the same.

4.2 Results



The figure above depicts the confirmatory network model fit to data from the US community sample. The confirmatory model – $\chi^2(517) = 823.2$, $p < .001$; RMSEA = 0.03; TLI = 0.97; CFI = 0.98 – fit the data excellently. This indicates that the general network structure of associations between the core vulnerability and internalizing symptoms extracted from the Singaporean student sample in our exploratory analysis was replicated in the US community sample. The symptoms with statistically significant edges with the core vulnerability are presented in the table below.

The edges between the core vulnerability and three cognition-related symptom nodes – feeling like a failure, thoughts of rejection, embarrassment, or offending others, and the unacceptable thoughts subscale – were prominent in the exploratory network and statistically significant in the confirmatory network. As the fit of the confirmatory model is excellent, we may conclude that these edges replicated across our datasets.

Table 2: Confirmatory Network: Weights of Edges between the Core Vulnerability and Internalizing Symptoms

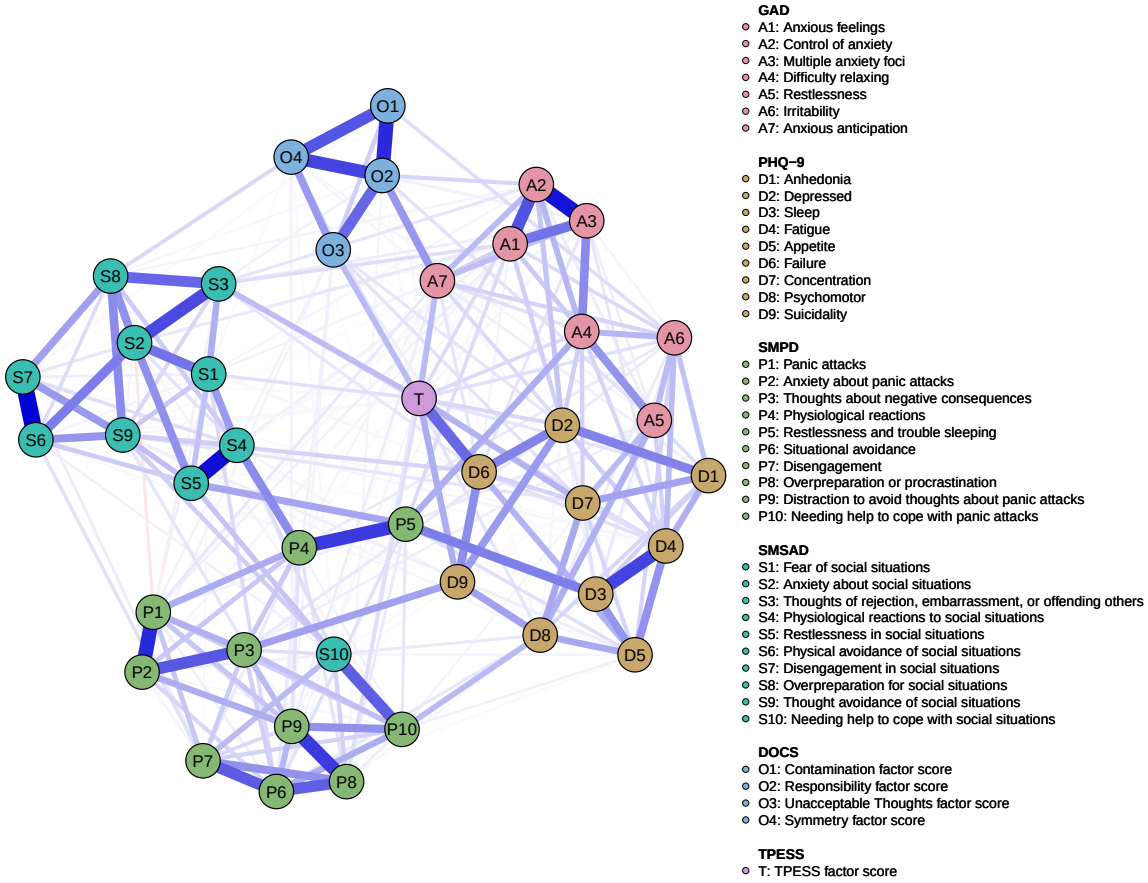
Node Label	Description	Edge Weight
S3	Thoughts of rejection, embarrassment, or offending others	0.16
A2	Control of anxiety	0.15
A6	Irritability	0.14
D1	Anhedonia	0.14
D6	Failure	0.13
O3	Unacceptable Thoughts subscale	0.13
O4	Symmetry subscale	-0.08

Note. All edges included in this are significant at $p < .05$. Values in the edge weight column indicate the partial spearman correlation between the core vulnerability node and the corresponding symptom node.

5 Appendix 5: Factor Score Network

A reviewer suggested that we consider a factor score approach: using the factor scores of the core vulnerability and the four DOCS subscales instead of their sum scores to estimate the network we reported in the main manuscript. We report this network here for the interested reader. As detailed below, we decided to retain our use of sum scores for the core vulnerability and the DOCS subscales in our network analysis because the factor score yielded an almost identical network.

The layout of the factor score network was constrained to that of the network reported in the main manuscript (i.e. the original network) for ease of comparison. Factor scores (for both the core vulnerability and the DOCS subscales) were computed using the regression method. Said factor scores were highly correlated with the sum scores (~.98 to .99).



To assess how similar this factor score network is to the original network, we computed the correlation between the edge weights of the factor score network and that of the original network.

The edge weights of the factor score network was highly correlated ($r = 0.996$) with that of the "main" network, indicating that both networks were highly similar. For this reason, we decided to retain our use of sum scores for the core vulnerability and the DOCS subscales in our network analysis.