The Replicability and Generalizability of Internalizing Symptom Networks

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Introduction

- Network theory suggests **Sx cause each other**[1]
  - e.g., Insomnia → Fatigue → Loss of interest
- Relationships between Sx have been estimated using network models
  - Edge = bivariate relationship *controlling for all other Sxs* (e.g., partial correlation)
  - Centrality = how strongly is a Sx connected to other Sxs?
- **Replicability of network parameters in internalizing disorders is unclear**
  - May depend on which metrics are used
    - Global metrics may be more replicable than specific metrics[2-4]

Aims

1. Examine **replicability** (i.e., similarities between nonclinical networks) using both global and specific metrics
2. Examine **generalizability** from nonclinical samples to a clinical sample

Participants (Total N = 2,573)

- Undergraduate Sample 1 (N = 1,176)
- Undergraduate Sample 2 (N = 578)
- Community Sample 1 (N = 277)
- Community Sample 2 (N = 276)
- Clinical Sample (N = 266)
  a. Treatment-seekers
  b. Subjects with MDD and/or Panic Disorder

Symptom Assessment

- Inventory of Depression and Anxiety Symptoms (IDAS)[5]
  - 11 subscales representing empirically distinct internalizing symptoms
  - Multiple items per symptom
  - No skip-outs

Network Analysis

Network Estimation

- Partial correlation networks
  - *Regularized* using GLASSO to adjust for multiple comparisons
    - Sets edges close to zero to exactly zero (eliminates spurious edges, resulting in high specificity[6])
- Centrality Indices
  - *Strength* = sum of absolute edge weights connected to a Sx
  - *Closeness* = length of the average shortest path between a Sx and all other Sxs
  - *Betweenness* = # of times a Sx is on the shortest path between two other Sx

Replicability/Generalizability Metrics

Global Metrics

- Correlation of edge weights
- Network Comparison Tests (NCTs) testing differences in:
  - Overall network structure
  - Global strength (sum of absolute edges)
  - Individual edges
- Correlation of centrality indices

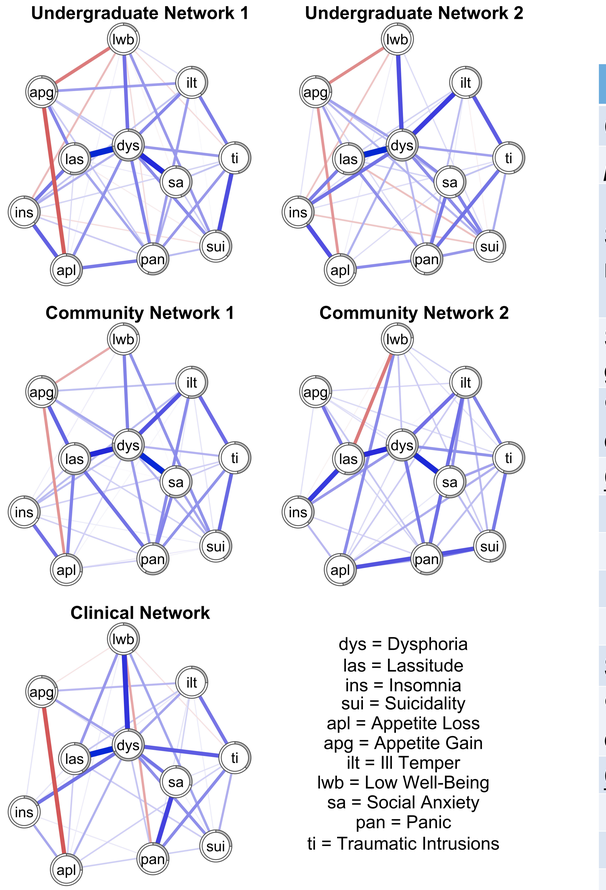
Specific Metrics

- % of edges that replicated (i.e., were estimated and had matching sign)
- Matches in centrality rank-order (1st, 2nd, 3rd, etc. most central symptom)

Discussion

- **Global metrics suggested moderate to strong replicability**
  - Generalizability to clinical network was weaker
- Specific metrics indicated **~80% of individual edges replicated** and the **most central Sx (dysphoria) was consistent**
  - Generalizability ≈ Replicability
  - Dysphoria may be a central component of internalizing disorders[7]
  - Poor replicability of other centrality rank-orders (e.g., 2nd, 3rd, etc. most central Sx)
    - Likely due to few *significant* differences in centrality rank-order
- Limitation → unable to examine replicability across clinical samples

Results

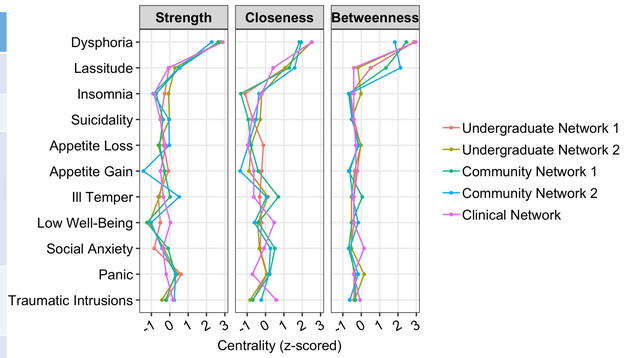


Blue line = positive association. Red line = negative association. Line thickness indicates strength of the association. Gray area in rings around each Sx = R^2 explained by neighboring Sx.

Replicability and Generalizability

	Replicability	Generalizability
Global Metrics		
*ρ*s of edge lists	.53-.84	.36-.66
Sig. differences in network structure?	Community network 2 different from all other networks	Community network 2 different from clinical network
Sig. differences in global strength?	none	none
% of sig. different edges	0-6%	0-4%
Centrality *ρ*s		
Strength	.37-.80	.04-.54
Closeness	.35-.79	.16-.47
Betweenness	.40-.78	-.19-.24
Specific Metrics		
% of replicated edges	75-85%	74-82%
Centrality rank-order matches (%)		
Strength	9-27%	9-27%
Closeness	18-46%	9-27%
Betweenness	18-73%	36-64%

Symptom Centrality



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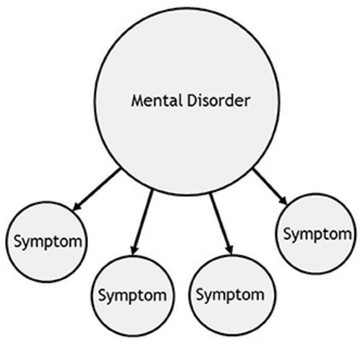
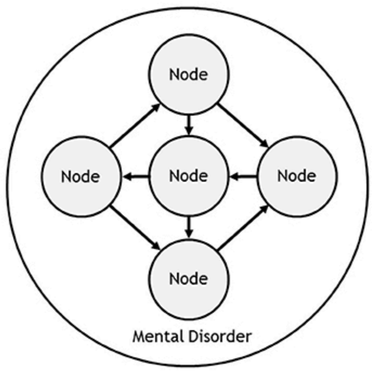
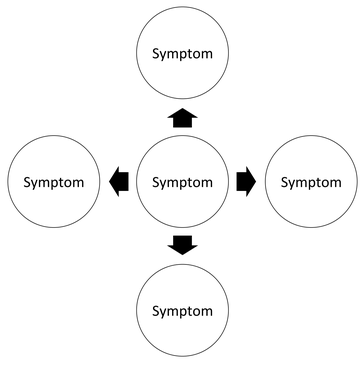
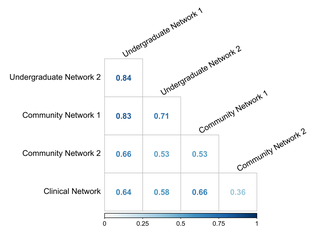
Latent Approach



Network Approach







- Network approach suggests symptoms causally interact[1]

Insomnia → Fatigue → Inattention

- Relationships between symptoms (“edges”) have been estimated using Markov random field (PMRF) models
  - Edge = bivariate relationship *after statistically controlling for all other symptoms*
  - Centrality = how strongly is a symptom connected to other symptoms?
- Replicability of PMRF networks is unclear
  - Preliminary evidence that global metrics are more replicable than specific metrics[2,3,4]

Sample	N	Description
Undergraduate Sample 1	1176	
Undergraduate Sample 1	578	
Community Sample 1	277	
Community Sample 2	276	
Clinical Sample	266	Treatment-seekers or recruited based on depression and/or panic diagnosis