Supplemental online material for

Identifying core deficits in a dimensional model of Borderline Personality Disorder features: A

network analysis.
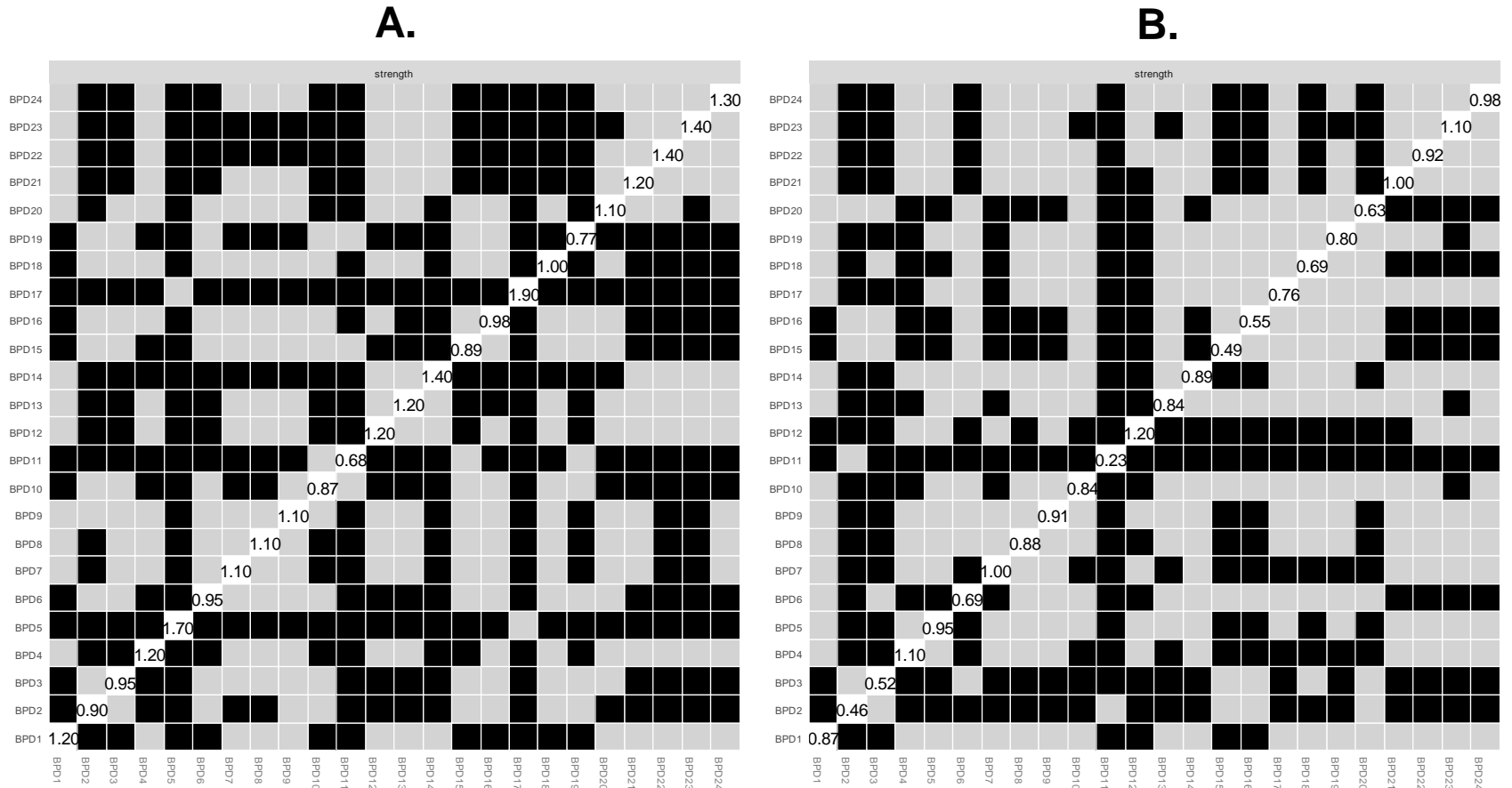
Bootstrapped Node Strength Results

Figure S1. Bootstrapped node strength of all PAI-BOR items for the full sample. Black squares = significant difference between item strength, $p < .05$. Grey squares = nonsignificant difference between item strength, $p > .05$. PAI-BOR = Personality Assessment Inventory – Borderline subscale.

A.

B.

Figure S2. A) Bootstrapped node strength of all PAI-BOR items among people in the Low BPD group. B) Bootstrapped node strength of all PAI-BOR items among people in the High BPD group. Black squares = significant difference between item strength, *p* < .05. Grey squares = nonsignificant difference between item strength, *p* > .05. PAI-BOR = Personality Assessment Inventory – Borderline subscale.
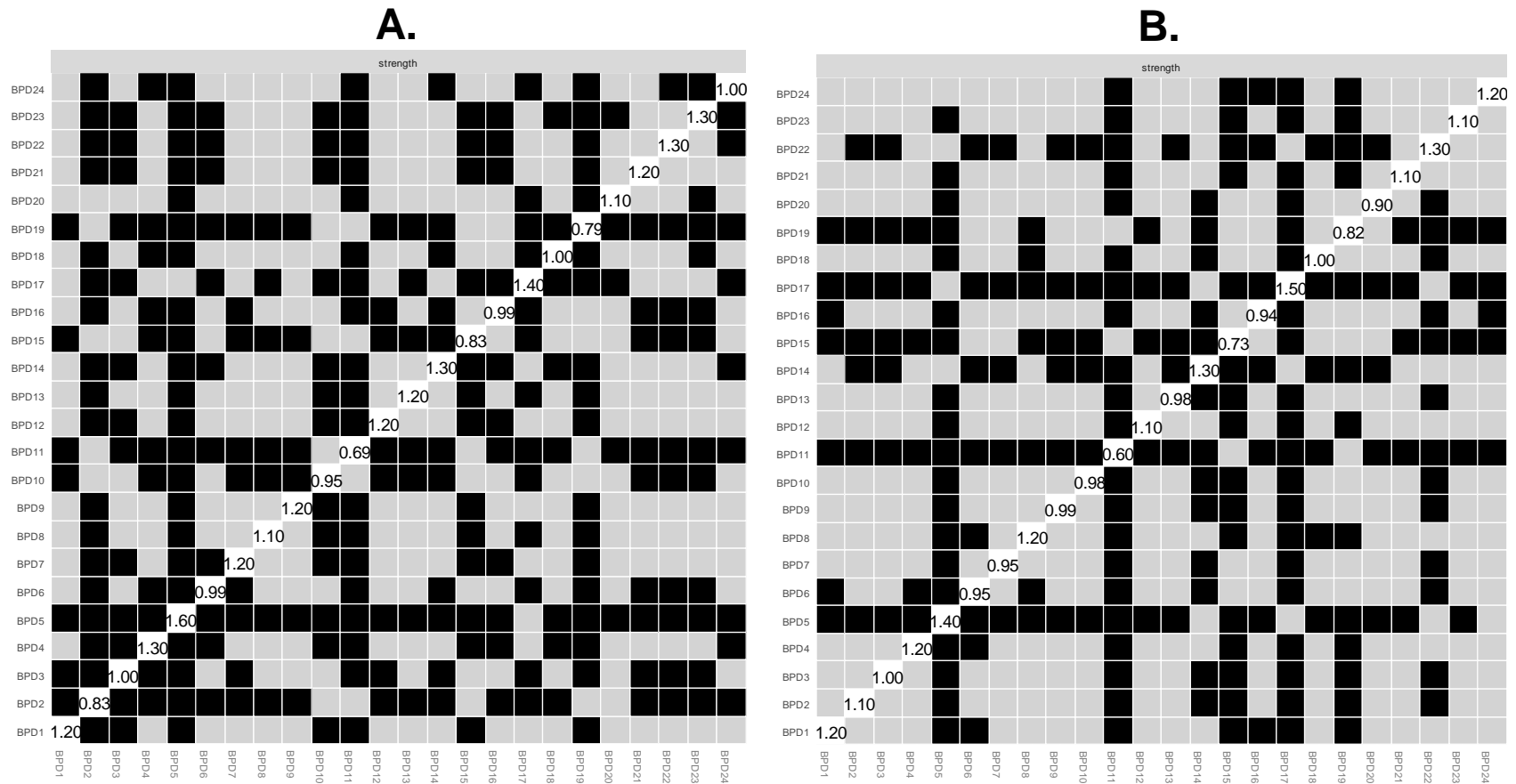
Figure S3. A) Bootstrapped node strength of all PAI-BOR items among women. B) Bootstrapped node strength of all PAI-BOR items among men. Black squares = significant difference between item strength, *p* < .05. Grey squares = nonsignificant difference between item strength, *p* > .05. PAI-BOR = Personality Assessment Inventory – Borderline subscale.
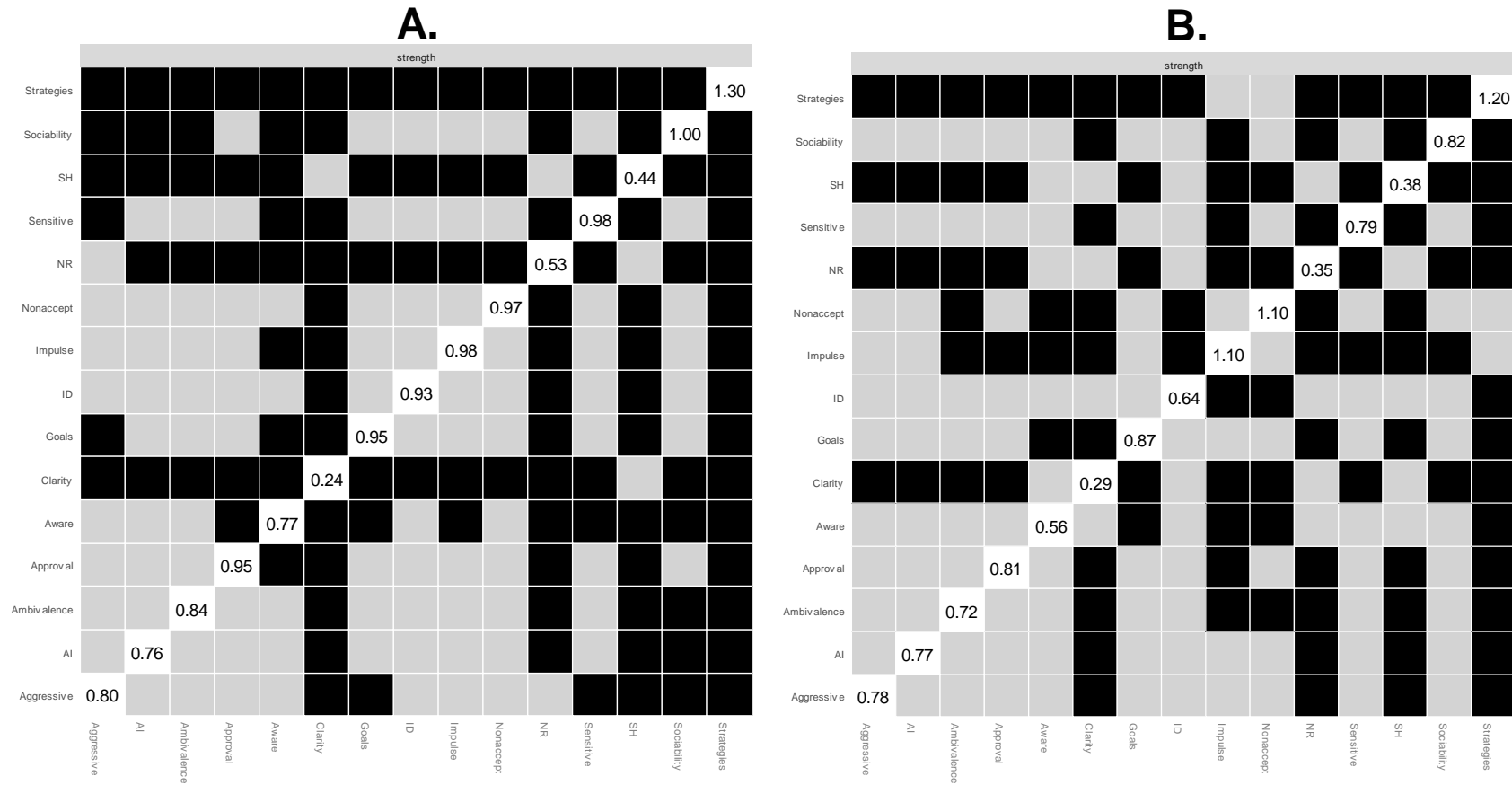
Figure S4. A) Bootstrapped node strength of all representative items from the PAI-BOR, DERS, and IIP in the Low BPD group. B) Bootstrapped node strength of all representative items from the PAI-BOR, DERS, and IIP in the High BPD group. Black squares = significant difference between item strength, *p* < .05. Grey squares = nonsignificant difference between item strength, *p* > .05. PAI-BOR = Personality Assessment Inventory – Borderline subscale. DERS = Difficulties in Emotion Regulation Scale. IIP = Inventory of Interpersonal Problems. AI = Affective Instability. ID = Identity Disturbance. NR = Negative Relationships. SH = Self-Harm.

Closeness and Betweenness Results

Aim 1: The Network Structure of BPD Features

After BPD5 (chronic emptiness; $z = 2.79$), BPD4 (intense moods; $z = 1.24$) and BPD14 (happy person [reverse-scored]; $z = 1.15$) from the Affective Instability subscale demonstrated high closeness, the weighted sum of all direct and indirect associations between nodes. BPD8 (worry about people leaving; $z = -0.52$) from the Identity Disturbance subscale and BPD22 (spending money too easily; $z = -1.48$) from the Self-Harm subscale both demonstrated relatively lower levels of closeness, despite relatively higher strength scores, suggesting that these items exhibit relatively weaker associations with the majority of the network but relatively stronger associations with a few items.

Finally, BPD17 (hurt self when upset; $z = 1.52$) from the Self-Harm subscale demonstrated a relatively higher betweenness score but lower strength score. This suggests that BPD17 is relatively more important to the overall connectivity of the network than its direct or indirect associations with other nodes.

These estimates were relatively stable, with *CS*-coefficients for closeness (.74), and betweenness (.75) both above .50. Node centrality was relatively unrelated to item variability. Correlations between item standard deviation and closeness ($r = .04$, $p = .84$), and betweenness ($r = -.06$, $p = .78$) were both small sized associations (Cohen, 1977).
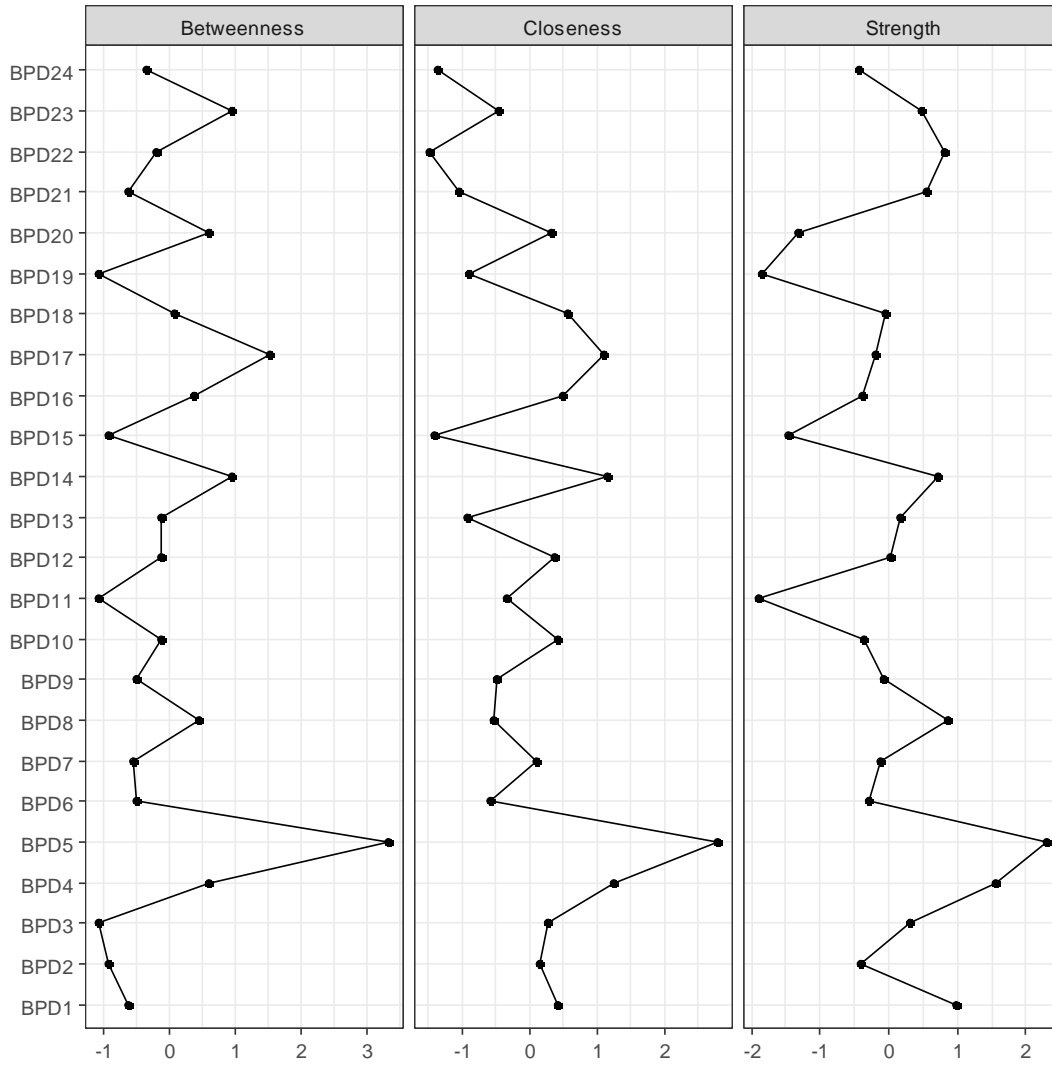
Figure S5. Centrality plots for the full sample of node betweenness, closeness, and centrality for the PAI-BOR. PAI-BOR = Personality Assessment Inventory – Borderline subscale.
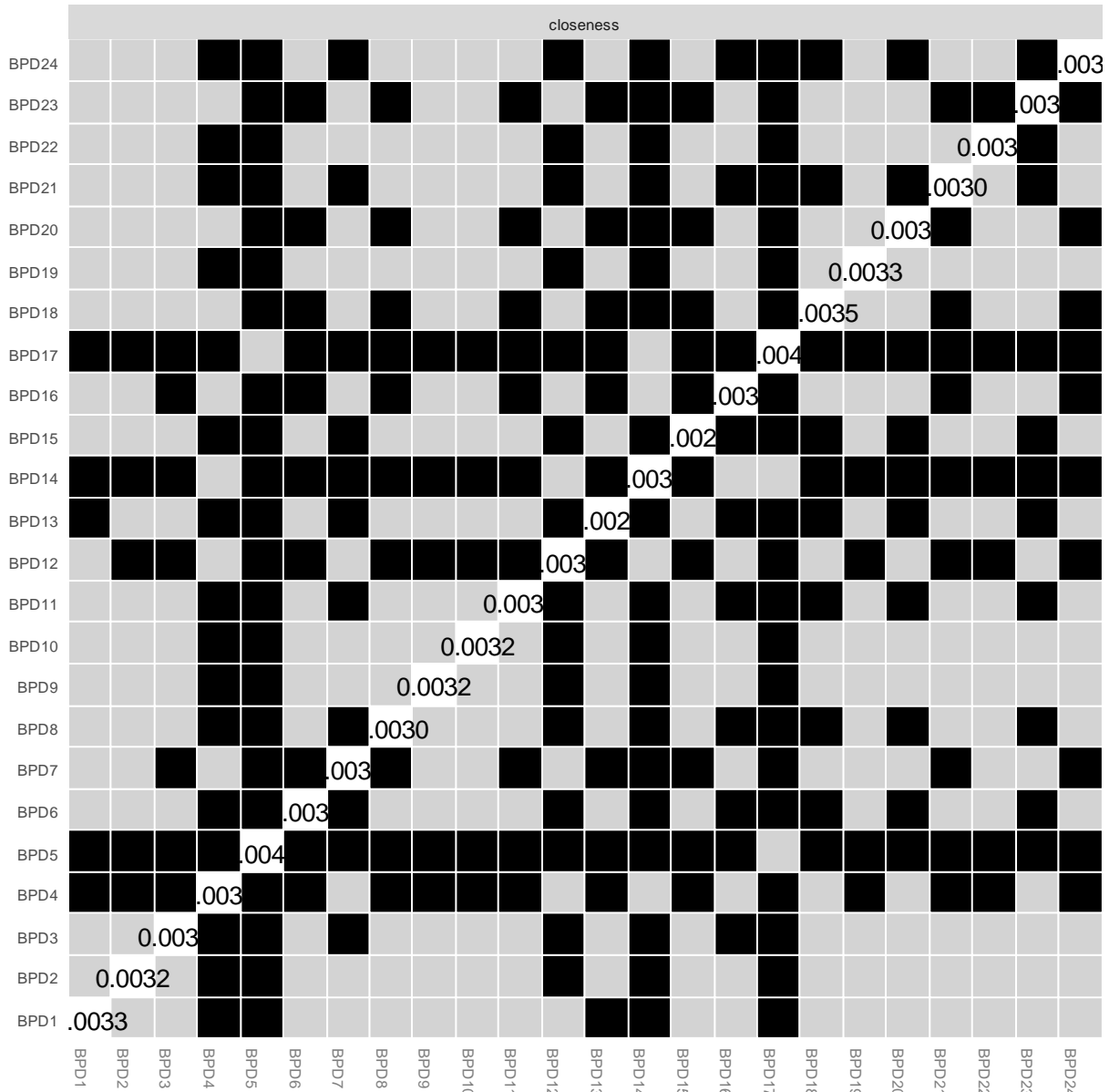
Figure S6. Bootstrapped node closeness of all PAI-BOR items in the full sample. Black squares = significant difference between item strength, *p* < .05. Grey squares = nonsignificant difference between item strength, *p* > .05. PAI-BOR = Personality Assessment Inventory – Borderline subscale.

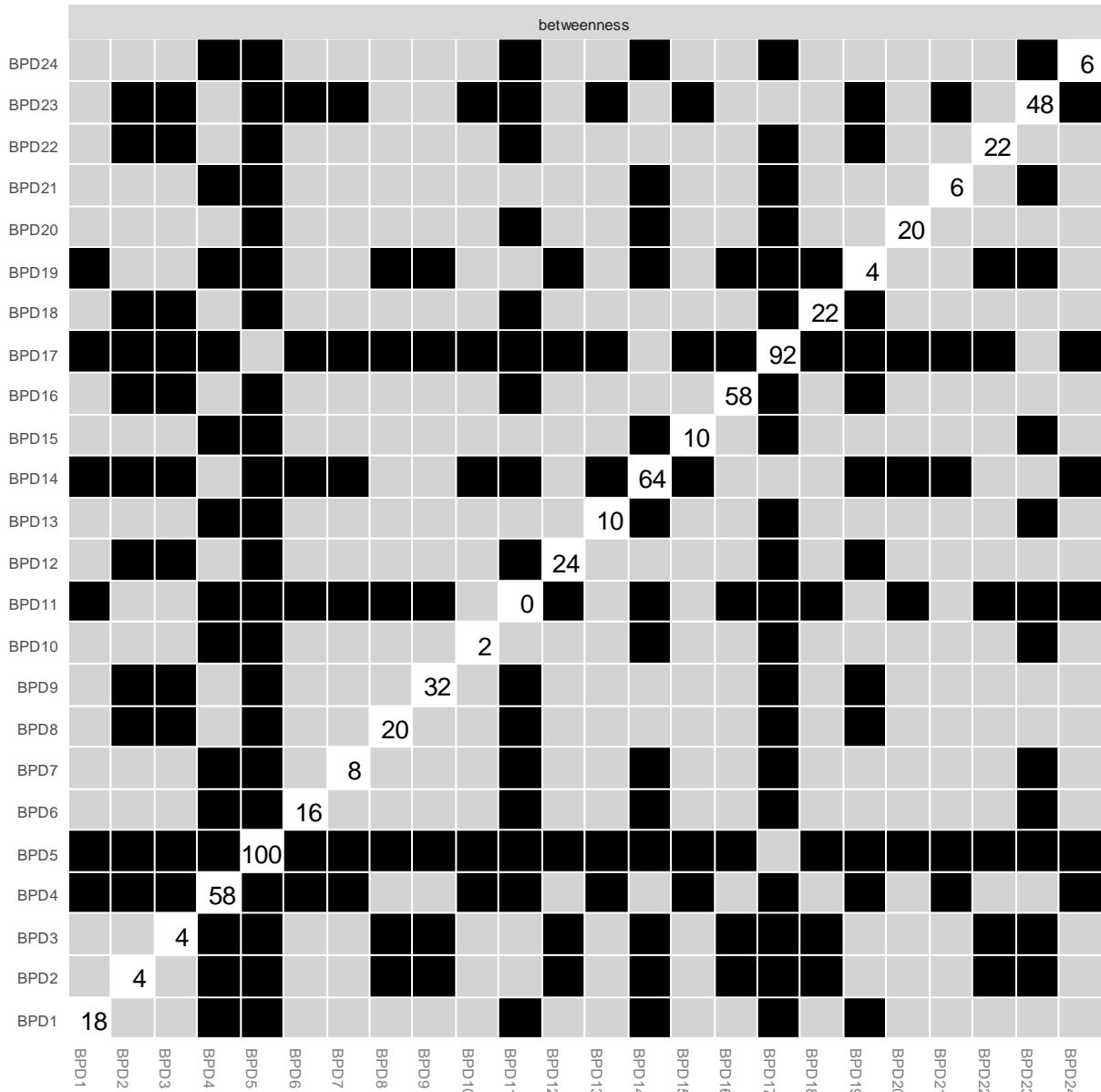*Figure S7*. Bootstrapped node betweenness of all PAI-BOR items in the full sample. Black squares = significant difference between item strength, *p* < .05. Grey squares = nonsignificant difference between item strength, *p* > .05. PAI-BOR = Personality Assessment Inventory – Borderline subscale.

Aim 2: Comparing the Network Structure of BPD Features Between Participants with Low and High BPD Features

The items with the greatest node closeness were similar between the two groups. Both BPD5 (chronic emptiness) from the Identity Disturbance subscale and BPD4 (intense moods) from the Affective Instability subscale demonstrated the greatest node closeness in the High BPD group ($z_{BPD5} = 1.84$, $z_{BPD4} = 1.72$) and the Low BPD group ($z_{BPD5} = 2.46$; $z_{BPD4} = 1.61$). However, the items with the next greatest node closeness in the High BPD group were BPD23 (reckless person; $z = 1.11$) and BPD17 (hurt self when upset; $z = 1.05$), both from the Self-Harm subscale, while the items with the next greatest node closeness in the Low BPD group were BPD14 (happy person [reverse-scored]; $z = 1.18$) and BPD18 (can't express all of anger; $z = 1.03$), both from the Affective Instability subscale. As with node strength, there was strong evidence that BPD5 (chronic emptiness) demonstrated significantly greater node closeness than most other items but only in the Low BPD group, $ps < .05$. In the High BPD group, BPD12 (rarely lonely [reverse-scored]) demonstrated significantly greater node closeness than most other items, $ps < .05$.

BPD5 (chronic emptiness) from the Identity Disturbance subscale and BPD4 (intense moods) from the Affective Instability subscale demonstrated relatively high node betweenness in both the High BPD group ($z_{BPD5} = 0.89$, $z_{BPD4} = 2.34$) and the Low BPD group ($z_{BPD5} = 3.54$, $z_{BPD4} = 0.80$). However, in the High BPD group, BPD23 (reckless person; $z = 1.79$) from the Self-Harm subscale and BPD7 (steady mood [reverse-scored]; $z = 1.65$) from the Affective Instability subscale demonstrated relatively high betweenness. In the Low BPD group, BPD14 (happy person [reverse-scored]; $z = 1.38$) from the Affective Instability subscale and BPD17 (hurt self when upset; $z = 0.86$) from the Self-Harm subscale demonstrated relatively greater

node betweenness scores. However, there was only strong evidence that BPD5 (chronic emptiness) demonstrated significantly greater node betweenness than most other items in the Low BPD group, $ps < .05$.

These estimates were relatively stable, with *CS*-coefficients in the High BPD group for closeness (.61) and betweenness (.61) above .50. Similarly, *CS*-coefficients in the Low BPD group for closeness (.74) and betweenness (.75) were also both above .50. Node centrality was relatively unrelated or negatively related to item variability in both the High BPD group and the Low BPD group. In the High BPD group, item standard deviation was negatively related to node closeness ($r = -.21, p = .33$) and betweenness ($r = -.33, p = .12$). In the Low BPD group, correlations between item standard deviation and node closeness ($r = -.16, p = .47$), and betweenness ($r = -.03, p = .88$) were negative and small-to-medium sized associations (Cohen, 1977).
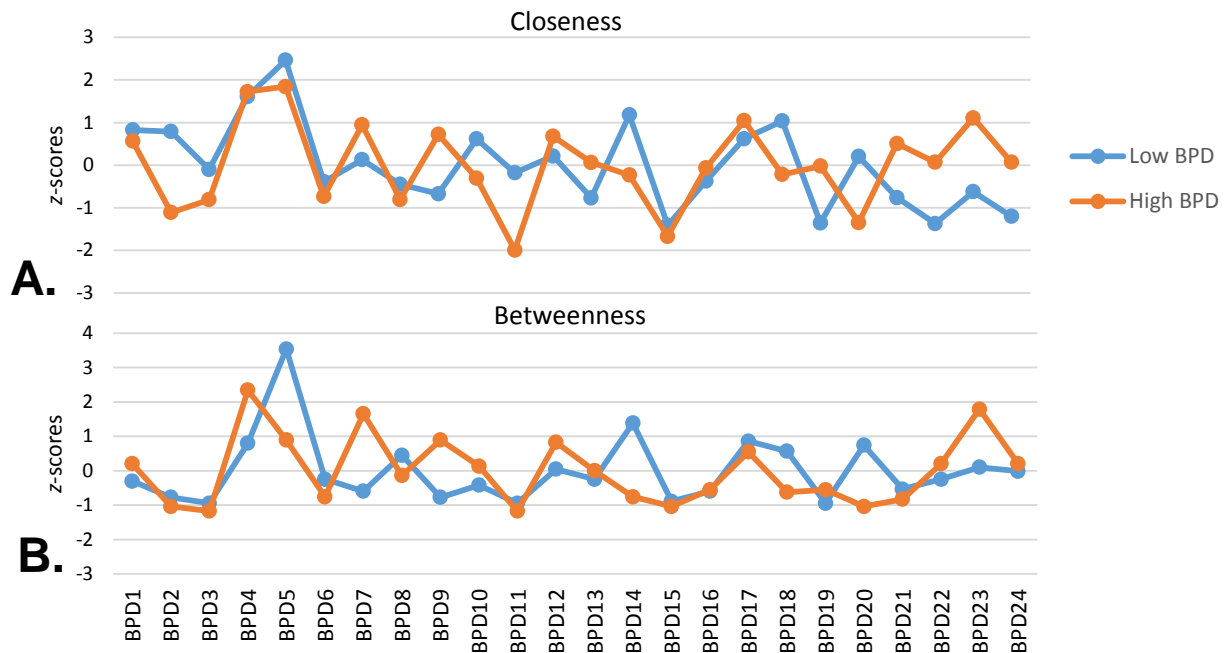

Figure S8. A) Closeness centrality plot for all PAI-BOR items between the Low BPD group and the High BPD group. B) Betweenness centrality plot for all PAI-BOR items between the Low BPD group and the High BPD group. PAI-BOR = Personality Assessment Inventory − Borderline subscale.
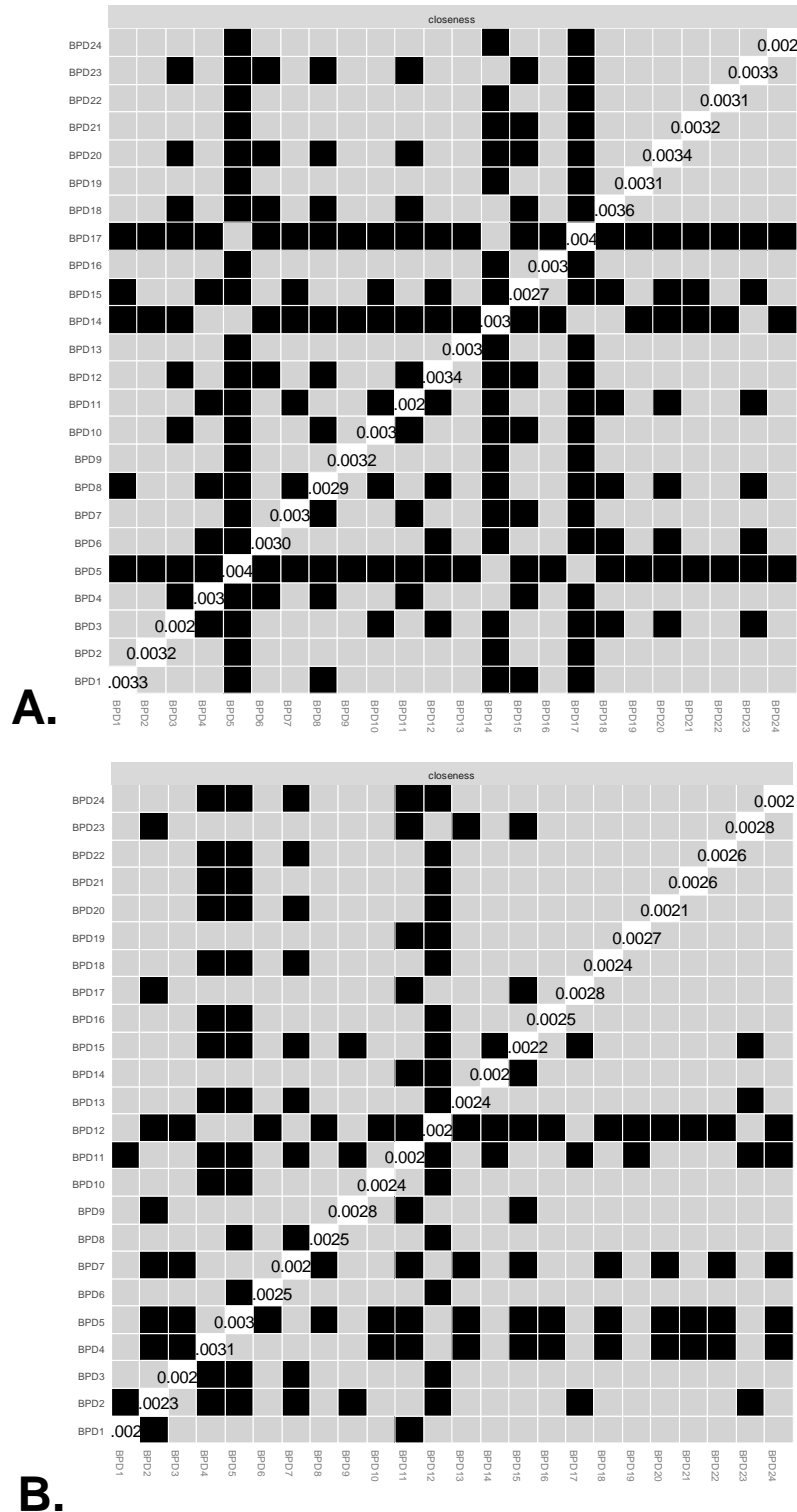
Figure S9. A) Bootstrapped node closeness of all PAI-BOR items in the Low BPD group. B) Bootstrapped node closeness of all PAI-BOR items in the High BPD group. Black squares = significant difference between item strength, *p* < .05. Grey squares = nonsignificant difference between item strength, *p* > .05. PAI-BOR = Personality Assessment Inventory – Borderline subscale.
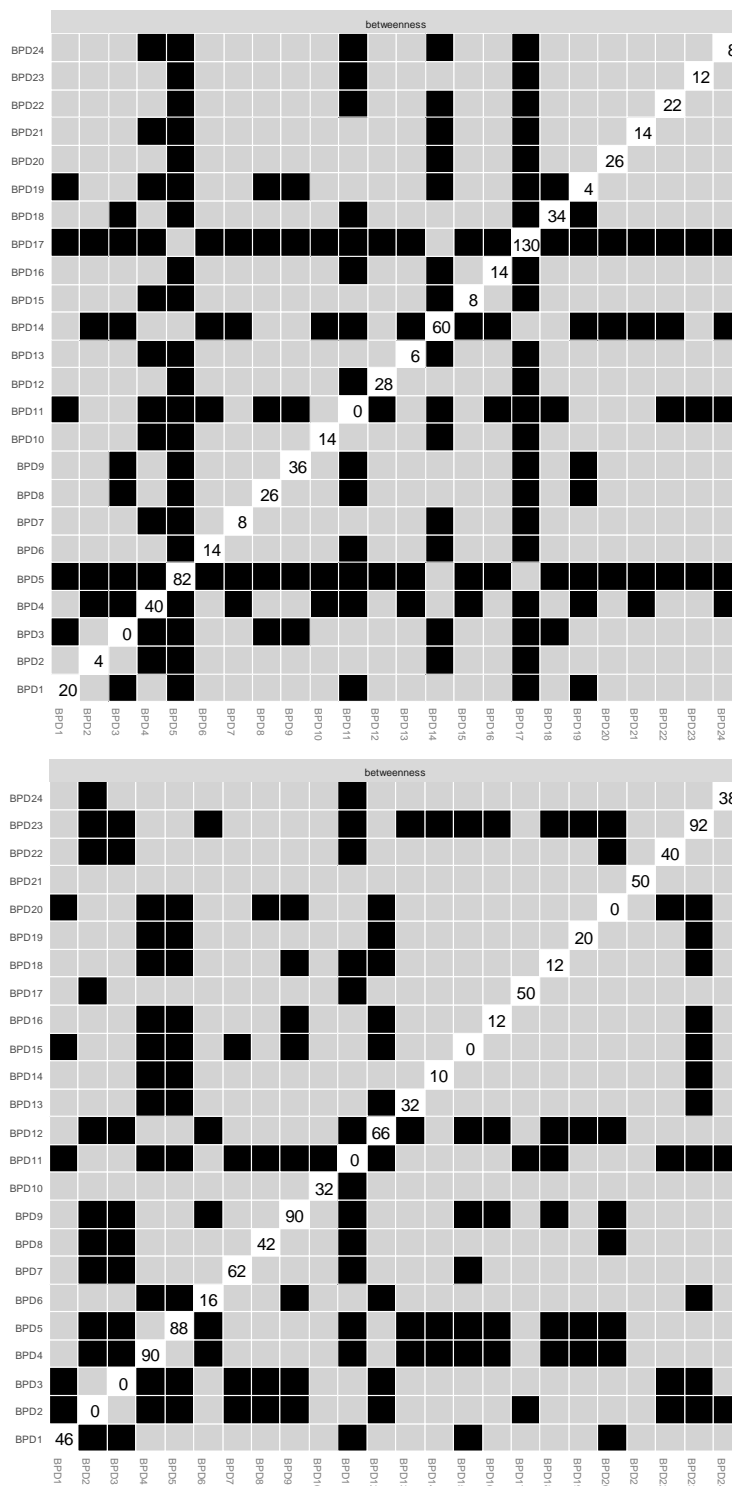
Figure S10. A) Bootstrapped node betweenness of all PAI-BOR items in the Low BPD group. B) Bootstrapped node betweenness of all PAI-BOR items in the High BPD group. Black squares = significant difference between item strength, $p < .05$. Grey squares = nonsignificant difference between item strength, $p > .05$. PAI-BOR = Personality Assessment Inventory – Borderline subscale.

**Aim 3: Comparing the Network Structures of BPD Features Between Women and Men**

Among men and women, the items with the highest node closeness were BPD5 (chronic emptiness; $z_{women} = 2.67$; $z_{men} = 2.68$) from the Identity Disturbance subscale, and BPD4 (intense moods; $z_{women} = 1.52$; $z_{men} = 1.67$) and BPD18 (can't express all of anger; $z_{women} = 0.87$; $z_{men} = 1.19$) from the Affective Instability subscale. Finally, while BPD5 (chronic emptiness; $z_{women} = 3.77$; $z_{men} = 3.46$) from the Identity Disturbance subscale demonstrated the greatest node betweenness among women and men, BPD23 (reckless person; $z = 1.35$) and BPD17 (hurt self when upset; $z = 1.19$), both from the Self-Harm subscale, demonstrated the next highest node betweenness among women, while BPD14 (happy person [reverse-scored]; $z = 1.35$) and BPD4 (intense moods; $z = 0.93$), both from the Affective Instability subscale, demonstrated the next highest node betweenness among men.

These estimates were relatively stable, with *CS*-coefficients among women for closeness (.74) and betweenness (.75) both above .50. Similarly, *CS*-coefficients for men for closeness (.59) and betweenness (.74) were both above .50.

Node centrality was relatively unrelated to item variability for both women and men. Among women, correlations between item standard deviation and node closeness ($r = .14$, $p = .51$) and betweenness ($r = .02$, $p = .94$) were small-to-medium sized associations (Cohen, 1977). Among men, correlations between item standard deviation and node closeness ($r = -.03$, $p = .89$), and betweenness ($r = .02$, $p = .94$) were either negative or small sized associations (Cohen, 1977).
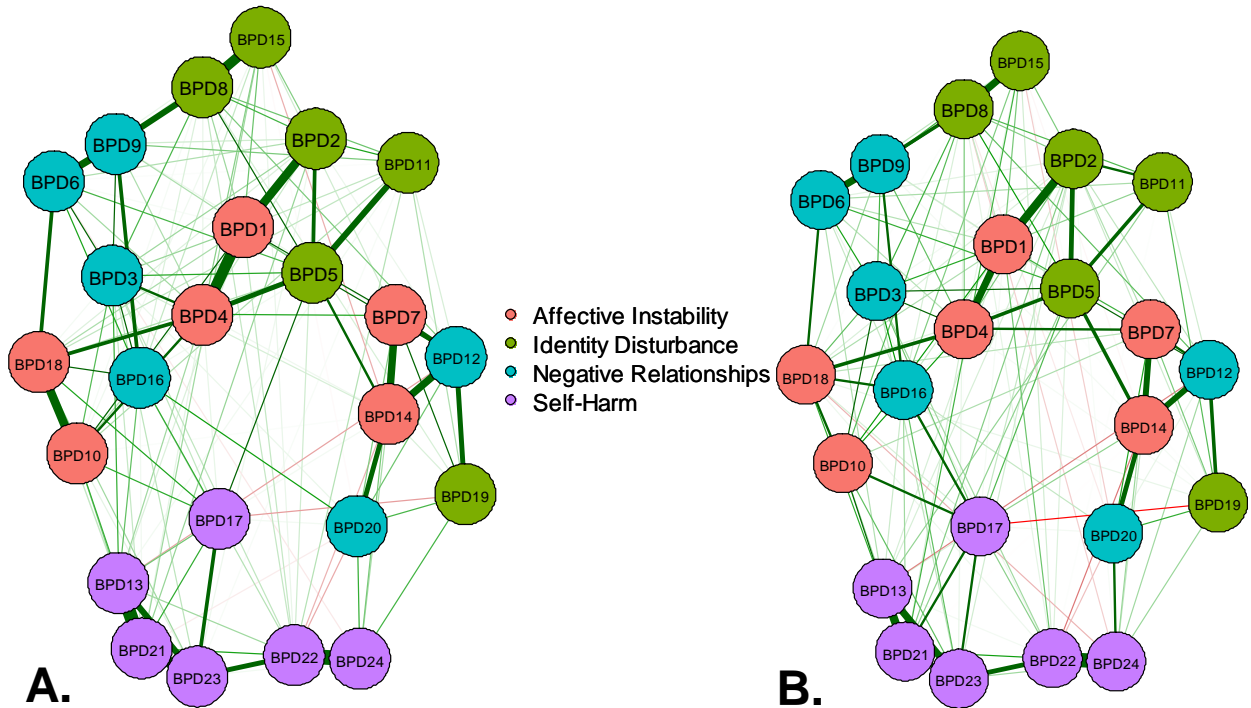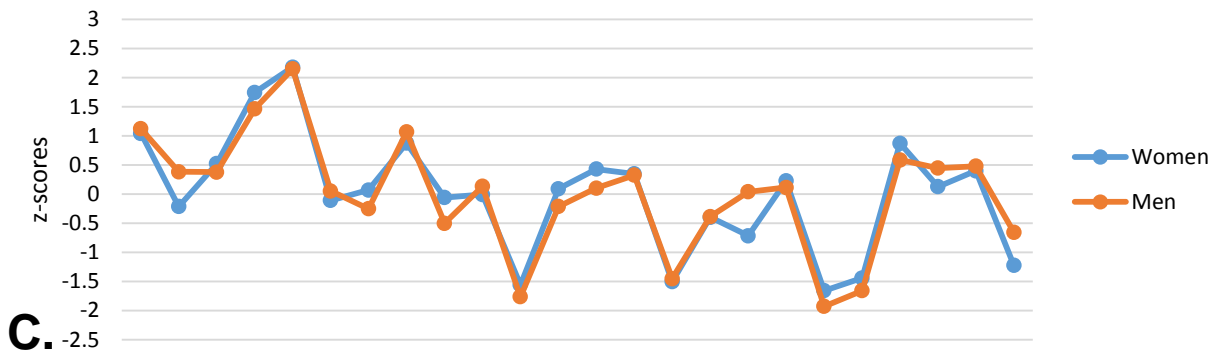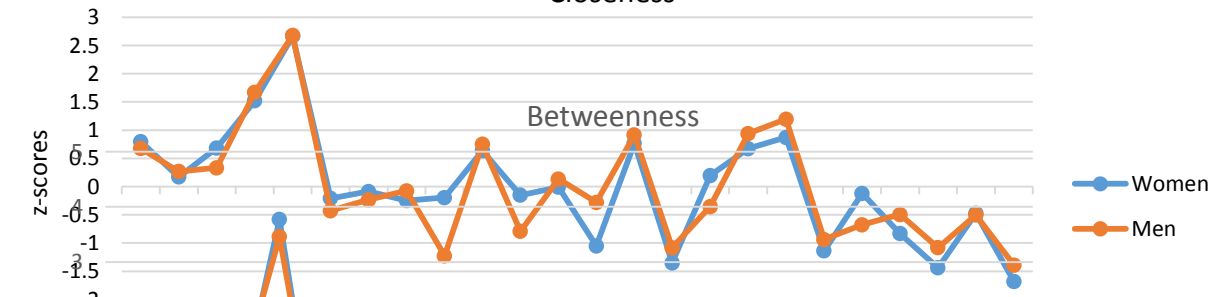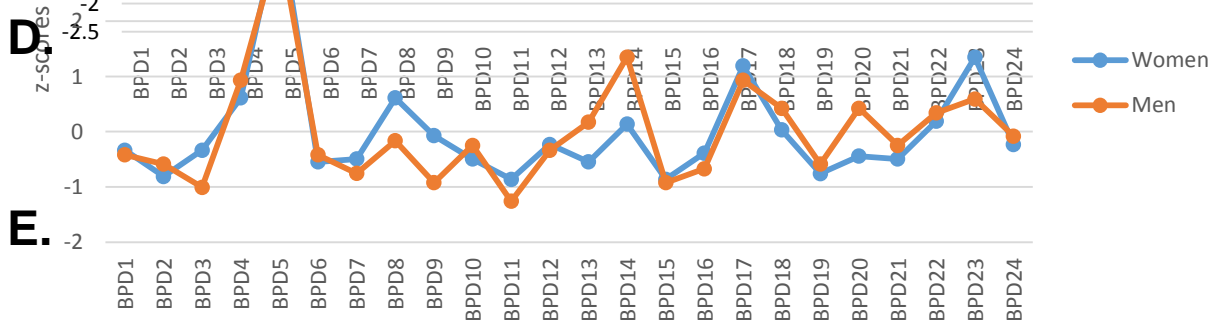
Figure S11. A) Network structure of BPD features among women. B) Network structure of BPD features among men. C) Node strength centrality indices for BPD features in both groups. D) Node closeness centrality indices for BPD features in both groups. E) Node betweenness centrality indicies for BPD features in both groups.

Aim 4: Comparing the Networks of BPD Features in Relation to Emotion Dysregulation

and Interpersonal Problems Between Participants with Low and High BPD Features

DERS-Strategies ($z_{\text{High BPD}} = 1.40$; $z_{\text{Low BPD}} = 1.65$) and DERS-Nonaccept ($z_{\text{High BPD}} = 1.22$; $z_{\text{Low BPD}} = 1.04$) demonstrated relatively greater node closeness in both groups. In the High BPD group, DERS-Impulse also demonstrated relatively greater node closeness ($z = 1.63$), while in the Low BPD group, PAIBOR-ID (Identity Disturbance) demonstrated relatively greater node closeness ($z = 1.16$). After bootstrapping the network, DERS-Strategies demonstrated significantly greater node closeness than some, but not all, items among those in the High BPD group, ps < .05. In the Low BPD group, DERS-Strategies demonstrated significantly greater node closeness than all items except PAIBOR-ID, ps < .05.

There were no similarities in the items with relatively greater node betweenness in both groups. In the High BPD group, the items with the greatest node betweenness were DERS-Impulse ($z = 2.01$), DERS-Nonaccept ($z = 1.08$), and IIP-Approval (chronic anxiety about the evaluation of others; $z = 0.95$). In the Low BPD group, the items with the greatest node betweenness were DERS-Strategies ($z = 2.08$), PAIBOR-ID ($z = 1.07$), and DERS-Aware (lack of emotional awareness; $z = 1.07$). In the High BPD group, there were few significant differences between the node betweenness of any items. In the Low BPD group, DERS-

Strategies again demonstrated significantly greater node betweenness than some, but not all, items, ps < .05.

These estimates were relatively stable, with *CS*-coefficients for the High BPD group node strength (.75), node closeness (.54), and node betweenness (.48) near or above .50. *CS*-coefficients for the Low BPD group node strength (.75), node closeness (.75), and node betweenness (.65) were all above .50.

Item variability, however, demonstrated medium-to-large sized associations (Cohen, 1977) with node strength (r = .58, p = .02), closeness (r = .45, p = .10), and betweenness (r = .42, p = .12) in the High BPD group. In the Low BPD group, item variability demonstrated small-to-large sized associations (Cohen, 1977) with node strength (r = .51, p = .05), closeness (r = .25, p = .37), and betweenness (r = .25, p = .38).
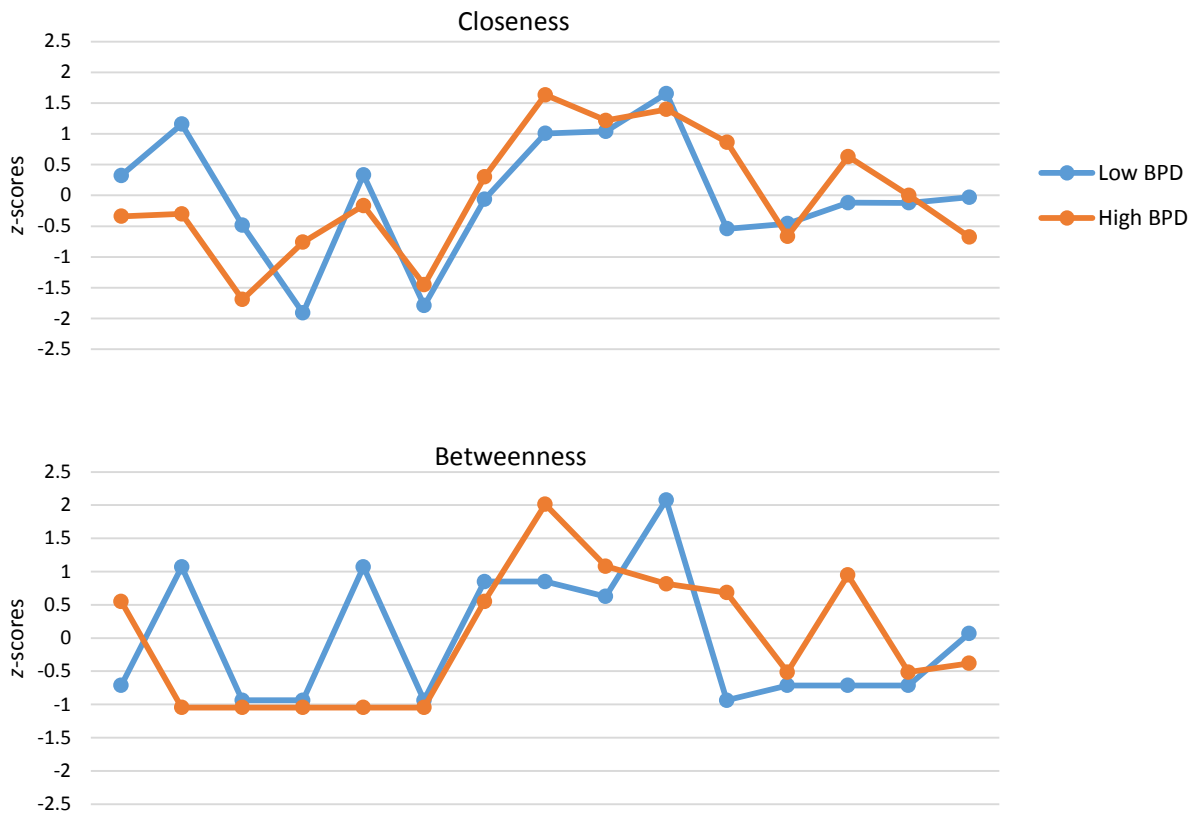
Figure S12. A) Node closeness centrality indices for BPD features, emotion dysregulation, and interpersonal problems in the Low and High BPD groups. B) Node betweenness centrality indices for BPD features, emotion dysregulation, and interpersonal problems in the Low and High BPD groups. AI = Affective Instability. ID = Identity Disturbance. NR = Negative Relationships. SH = Self-Harm.
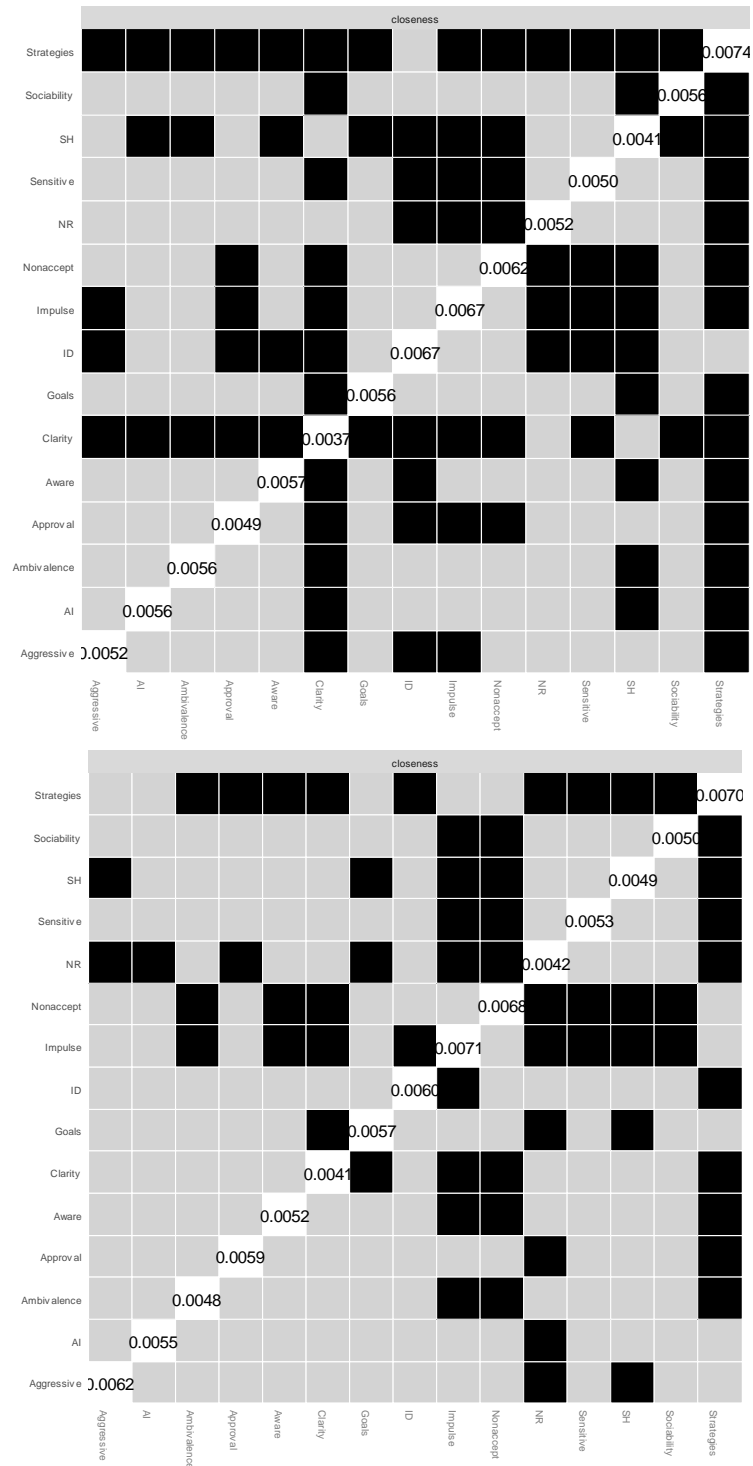
Figure S13. A) Bootstrapped node closeness of all representative items from the PAI-BOR, DERS, and IIP in the Low BPD group. B) Bootstrapped node closeness of all representative items from the PAI-BOR, DERS, and IIP in the High BPD group. Black squares = significant difference between item strength, *p* < .05. Grey squares = nonsignificant difference between item strength, *p* > .05.
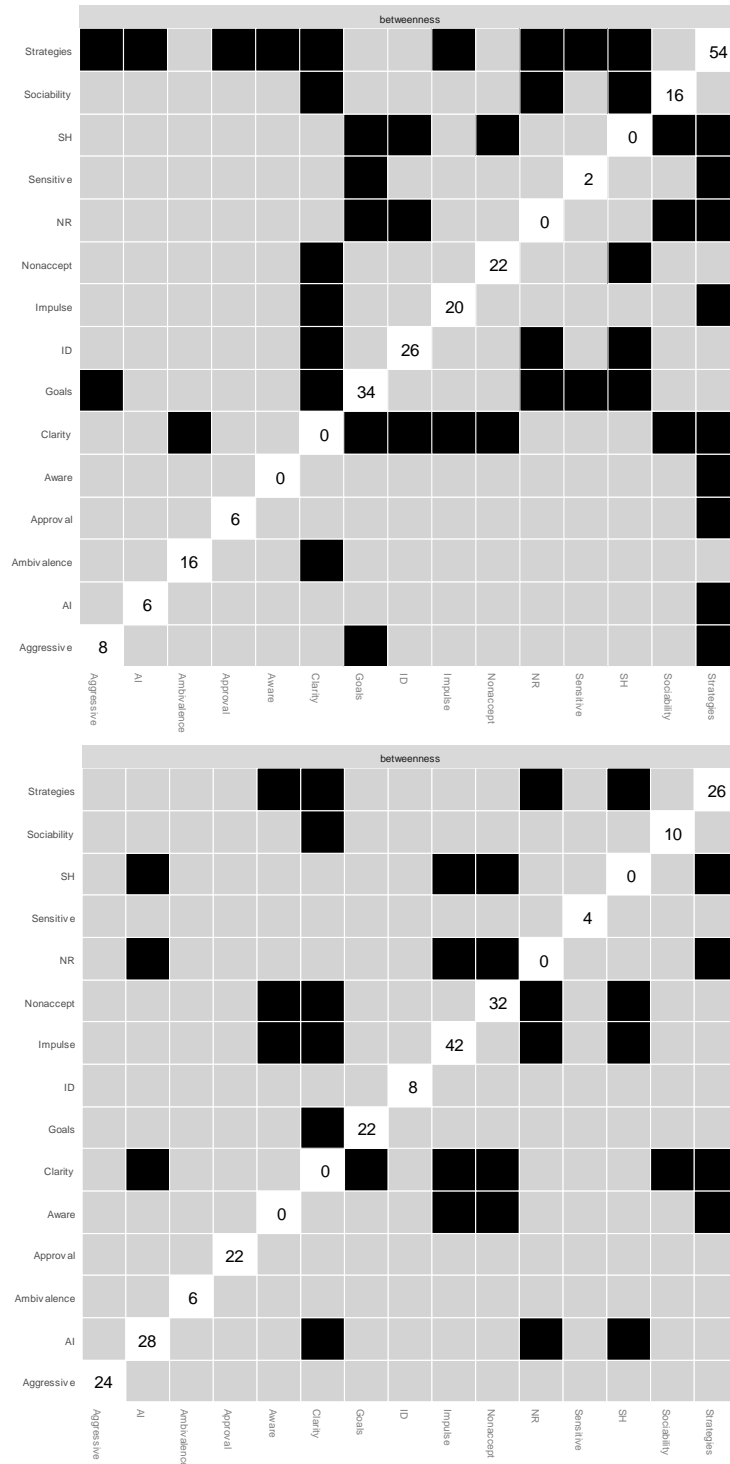
Figure S14. A) Bootstrapped node betweenness of all representative items from the PAI-BOR, DERS, and IIP in the Low BPD group. B) Bootstrapped node betweenness of all representative items from the PAI-BOR, DERS, and IIP in the High BPD group. Black squares = significant difference between item strength, $p < .05$. Grey squares = nonsignificant difference between item strength, $p > .05$.

CFA Results for Identifying Representative Items of PAI-BOR, DERS, and IIP Subscales

PAI-BOR. The four-factor model identified by Morey (1991) did not fit the current data

well, χ^2(246, N = 1794) = 3464.16; Root-Mean-Squared Error of Approximation (RMSEA) =

.09; Comparative Fit Index (CFI) = .80; non-normed fit index (NNFI) = .77.

Table S1.

Standardized factor loadings.

Item	AI	ID	NR	SH
BPD1	.72			
BPD2		.60		
BPD3			.77	
BPD4	.85			
BPD5		.86		
BPD6			.69	
BPD7	.64			
BPD8		.73		
BPD9			.71	
BPD10	.52			
BPD11		.60		
BPD12			.47	
BPD13				.68
BPD14	.48			
BPD15		.52		
BPD16			.57	
BPD17				.28
BPD18	.65			
BPD19		.28		
BPD20			.23	
BPD21				.69
BPD22				.54
BPD23				.57
BPD24				.35

Table S2.

Standardized factor intercorrelations.

	AI	ID	NR
ID	.87		
NR	.83	.89	
SH	.55	.49	.50

DERS. The six-factor model identified by Gratz and Roemer (2004) did not fit the current data well, $\chi^2(579, N = 1794) = 14317.54$; RMSEA = .12; CFI = .67; NNFI = .64.

Table S3.
Standardized factor loadings.

Item	Aware	Clarity	Goals	Impulse	Nonaccept	Strategies
DERS1		.82				
DERS2	.69					
DERS3				.48		
DERS4		-.05				
DERS5		.81				
DERS6	-.18					
DERS7		.80				
DERS8	.55					
DERS9		.72				
DERS10	.66					
DERS11					.66	
DERS12					.70	
DERS13			.89			
DERS14				.81		
DERS15						.81
DERS16						.10
DERS17	.57					
DERS18			.92			
DERS19				.00		
DERS20			.66			
DERS21					-.07	
DERS22						.70
DERS23					-.07	
DERS24			.65			
DERS25					.72	
DERS26			.87			
DERS27				.81		
DERS28						.74
DERS29					.84	
DERS30						.75
DERS31						.70
DERS32				.70		
DERS33			.14			
DERS34	.72					
DERS35						.80
DERS36						.51

Table S4.
Standardized factor intercorrelations.

Factor	Aware	Clarity	Goals	Impulse	Nonaccept
Clarity	-.08				
Goals	.65	-.21			
Impulse	.84	-.02	.62		
Nonaccept	.85	.09	.53	.88	
Strategies	.88	-.03	.75	.93	.90

IIP. The five-factor model identified by Pilkonis, Kim, Proietti, and Barkham (1996) did not fit the current data well, $\chi^2(1024, N = 1794) = 19550.00$; RMSEA = .10; CFI = .60; NNFI = .58.

Table S5.
Standardized factor loadings.

Item	Aggressive	Ambivalence	Approval	Sensitivity	Sociability
IIP1				.61	
IIP2			.56		
IIP3					.63
IIP4					.45
IIP5			.49		
IIP6		.60			
IIP7		.71			
IIP8			.61		
IIP9					.61
IIP10					.54
IIP11					.46
IIP12		.52			
IIP13		.54			
IIP14		.48			
IIP15					.54
IIP16		.57			
IIP17				.44	
IIP18				.48	
IIP19		.51			
IIP20		.44			
IIP21		.72			
IIP22				.53	
IIP23					.75
IIP24			.52		
IIP25					.72
IIP26	.66				
IIP27				.73	
IIP28	.52				
IIP29				.59	
IIP30	.74				
IIP31			.53		
IIP32				.65	
IIP33	.66				
IIP34			.75		

IIP35					.71
IIP36			.73		
IIP37			.56		
IIP38			.53		
IIP39	.70				
IIP40				.48	
IIP41				.59	
IIP42	.48				
IIP43				.68	
IIP44		.62			
IIP45					.50
IIP46				.38	
IIP47	.45				

Table S6.
Standardized factor intercorrelations.

Factor	Aggressive	Ambivalence	Approval	Sensitivity
Ambivalence	.82			
Approval	.75	.73		
Sensitivity	.87	.84	1	
Sociability	.74	.82	.92	.97