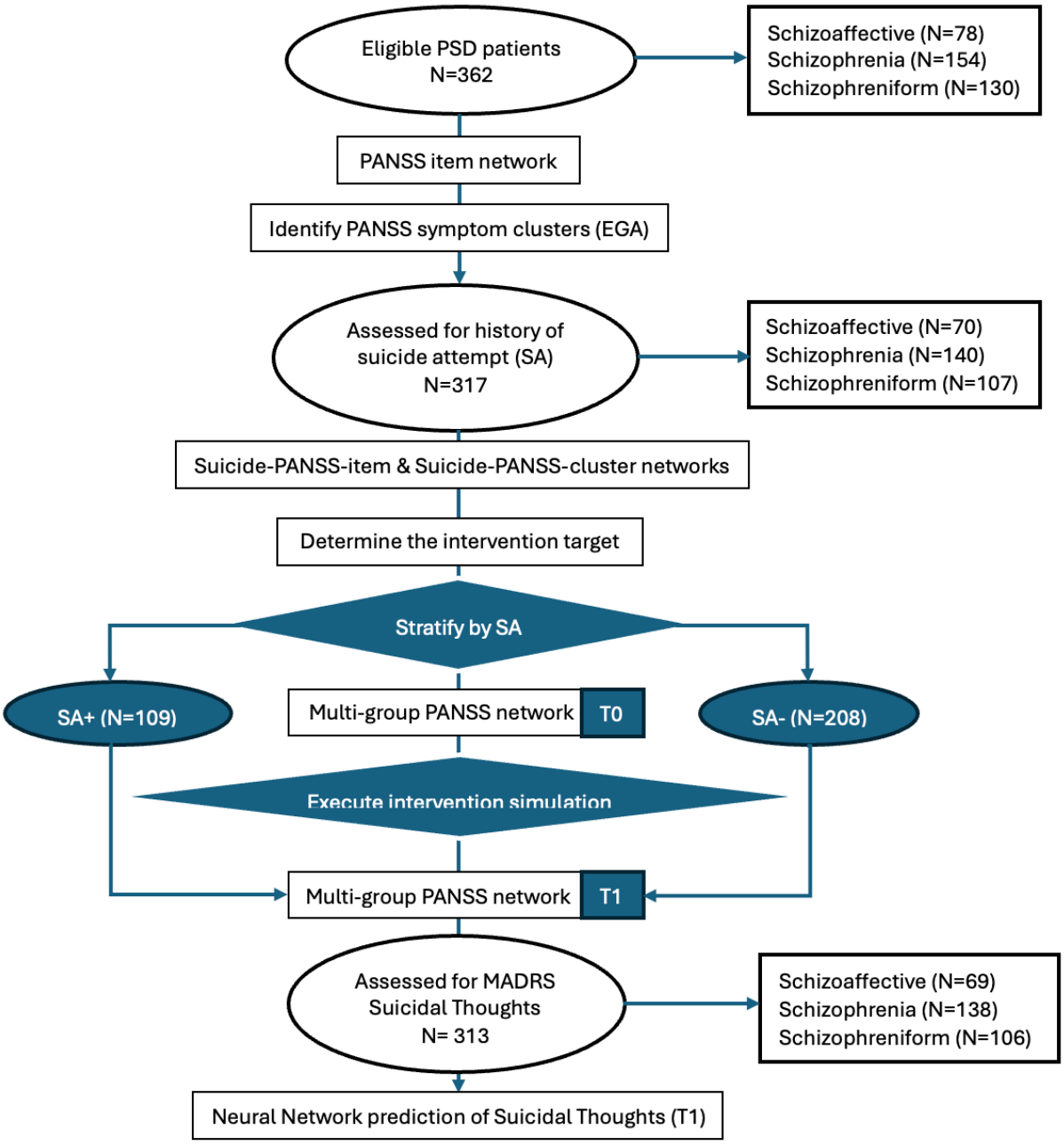
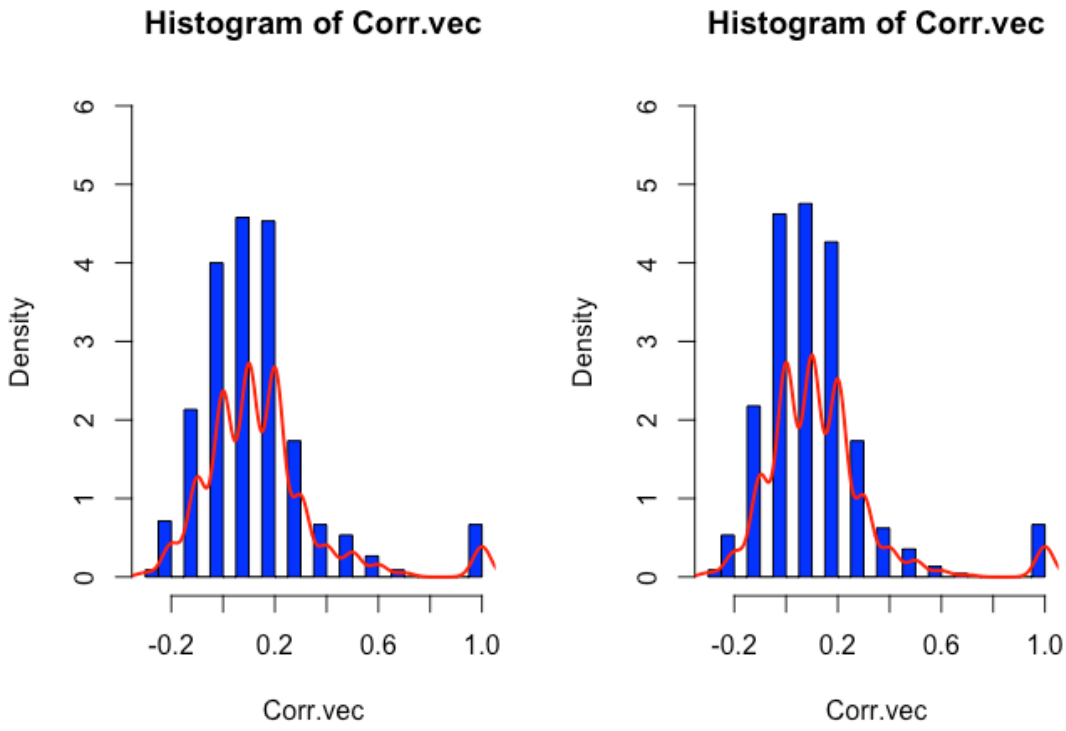
Supplemental Figure 1. Diagram of the study design.



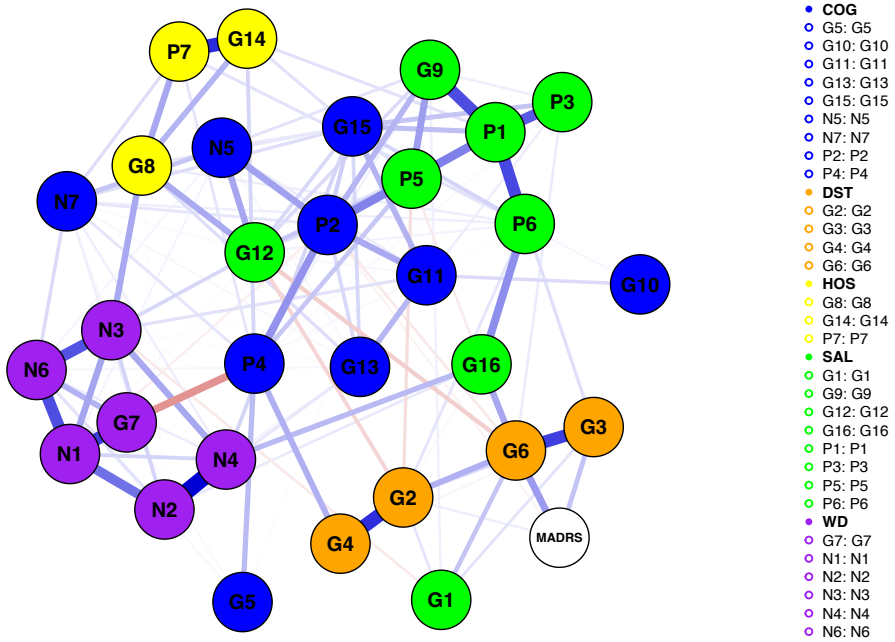
N: sample size; EGA: Exploratory Graph Analysis; MADRS: Montgomery-Asberg Depression Rating Scale

Supplemental Figure 2. Histograms of psychopathology symptom or item correlations in the SA-group comparing T0 (left) and T1 (right) from the synthetic data generation algorithm.

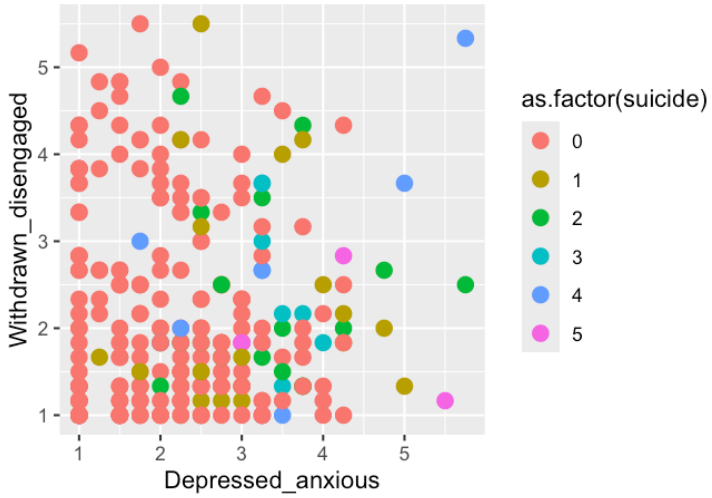


Supplemental Figure 3.

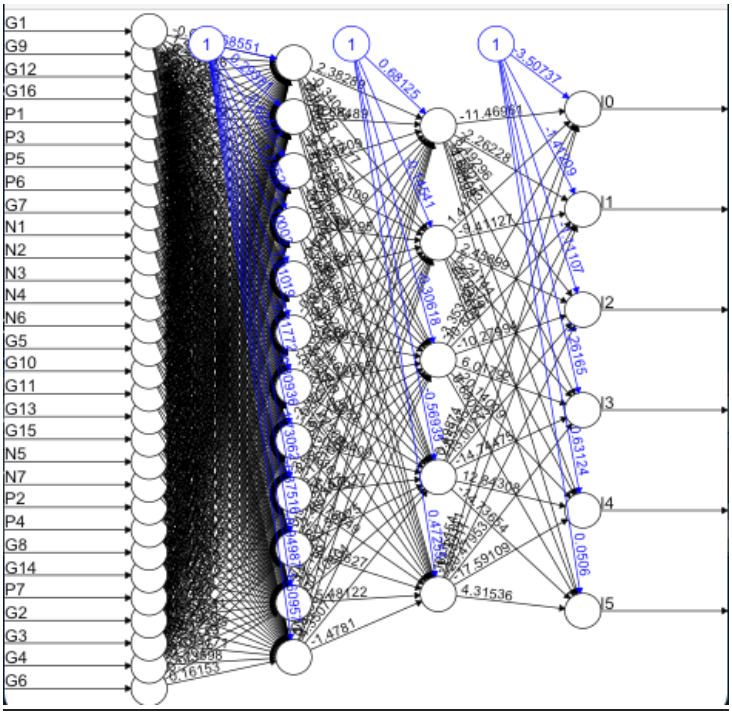
a. PANSS-suicide ideation network with MADRS “Suicidal Thoughts” item.



b. Scatterplot of all patients’ Distress (DST) and Negative/Withdrawn-Disengaged (NEG) cluster scores, colored by their suicidal thought from MADRS (levels: 0-5)

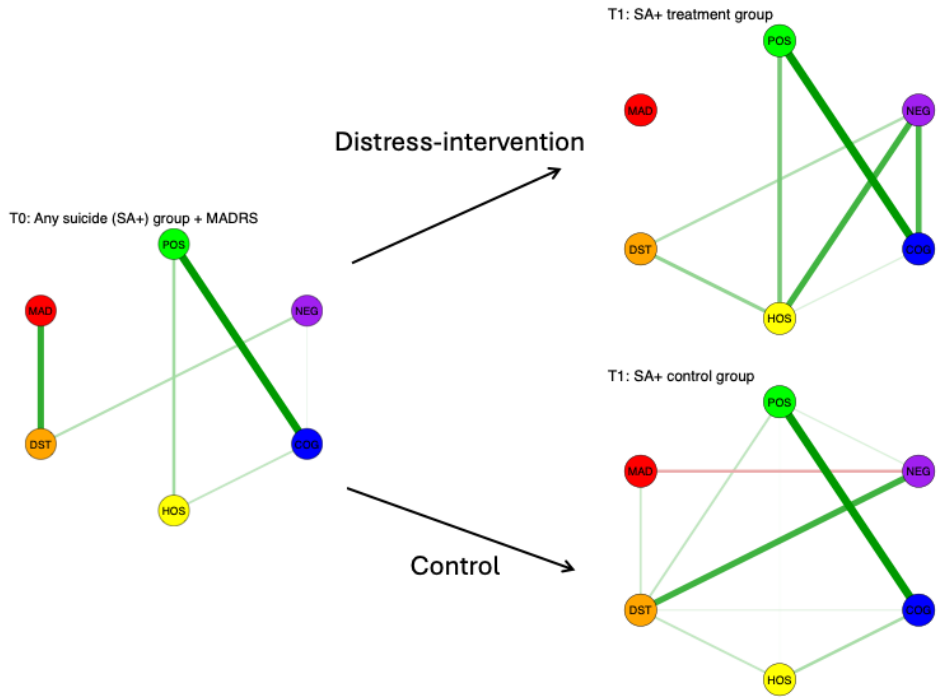


Supplemental Figure 4. Neural Network with two hidden layers using the psychopathology symptom scores to predict suicidal thoughts (levels: 0-5).

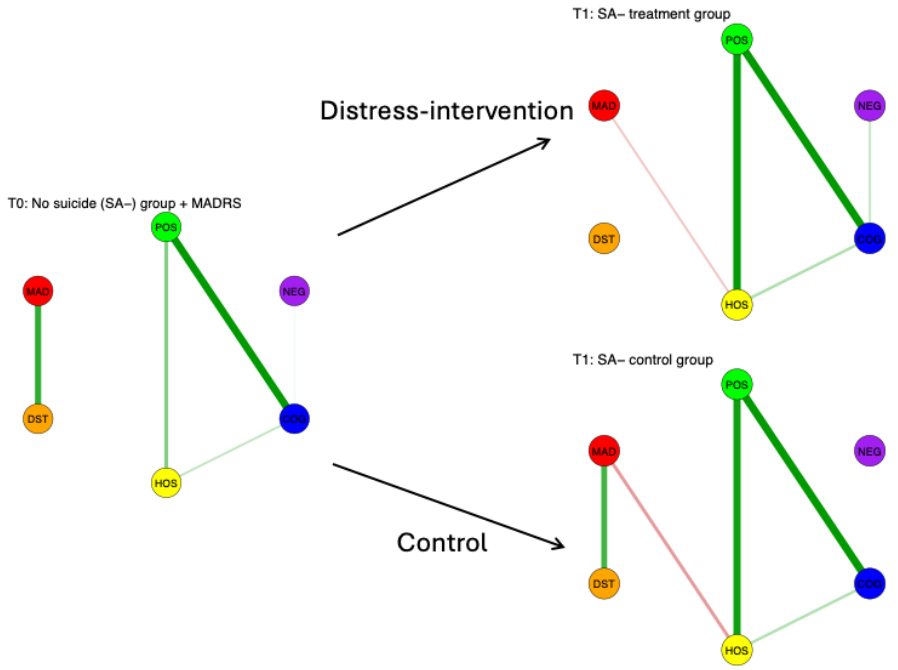


Supplemental Figure 5. Comparison of Cluster-level network with MADRS suicidal thoughts for intervention and control arm.

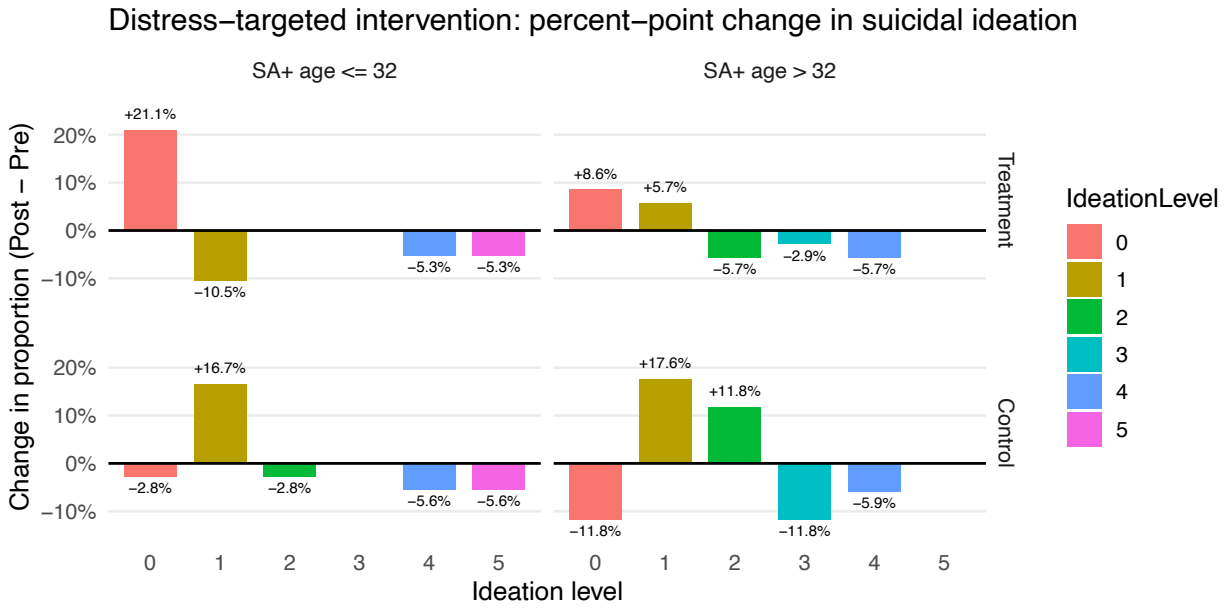
a. SA+

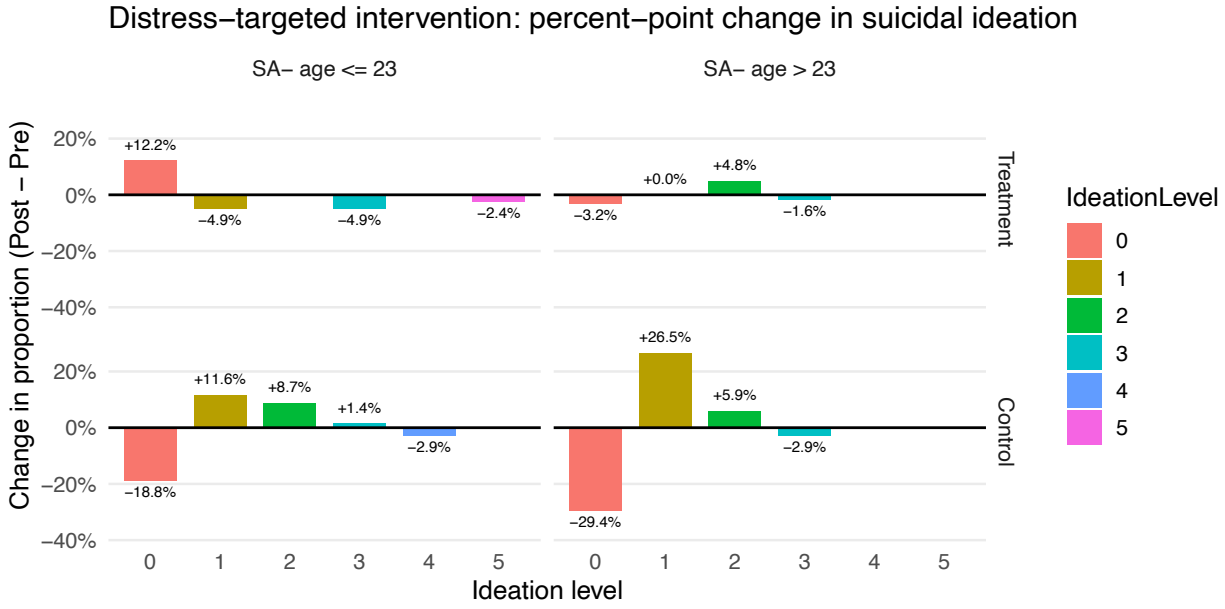


b. SA-



Supplemental Figure 6. Percent-point changes in predicted suicidal ideation following simulated distress-targeted intervention versus control, stratified by suicide attempt history and median age within each stratum (32 in SA+ and 23 in SA-).





Supplemental Table 1. The comparison between Mohr's 5-Factor Model and Exploratory Graph Analysis-derived clusters.

Domain	*Mohr's 5-Factor Model*	*EGA (Exploratory Graph Analysis)*
Positive Symptoms/Impaired Salience (POS)	G9, P1, P3, P5, P6	G9, P1, P3, P5, P6, G1, G12, G16
Negative Symptoms/Withdrawn-disengaged (NEG)	G7, G16, N1, N2, N3, N4, N6	G7, N1, N2, N3, N4, N6
Cognitive Impairment/Impaired cognition and control (COG)	G5, G10, G11, G12, G13, G15, P2, N5, N7	G5, G10, G11, G13, G15, P2, N5, N7, P4
Hostility/Impulsive-Hostile (HOS)	G8, G14, P4, P7	G8, G14, P7
Mood/Distress (DST)	G1, G2, G3, G4, G6	G2, G3, G4, G6

Supplemental Table 2. Baseline age and sex characteristics by suicide attempt (SA) stratum and treatment arm.

Stratum	*Group*	*N*	*Age, mean (SD)*	*Age, median [Q1, Q3]*	*Female, N (%)*	*Male, N (%)*
SA−	Control	103	23.0 (5.42)	22.0 [19.0, 25.0]	25 (24.3%)	78 (75.7%)
	Treatment	103	31.2 (12.2)	26.0 [21.0, 41.5]	28 (27.2%)	75 (72.8%)
SA+	Control	53	30.1 (11.0)	27.0 [20.0, 38.0]	18 (34.0%)	35 (66.0%)
	Treatment	54	38.9 (11.7)	39.0 [28.2, 48.0]	24 (44.4%)	30 (55.6%)
Overall	Control	156	25.4 (8.45)	23.0 [20.0, 28.0]	43 (27.6%)	113 (72.4%)
	Treatment	157	33.8 (12.5)	31.0 [22.0, 45.0]	52 (33.1%)	105 (66.9%)

N: the number of participants in the subgroup. SA+: participants with a lifetime history of suicide attempt; SA−: participants with no lifetime history of suicide attempt. Age is summarized using mean (SD) and median, first quartile (Q1), and third quartile (Q3). Sex is reported as counts and percentages.

Supplemental Table 3. Between-group difference pre-intervention (SA+ vs. SA− at T0).

Cluster-wise centrality indices	*Clusters*	*SA+*	*SA-*	*% difference*
Edge weights	POS	0.035	0.029	19%
	NEG	0.073	0.095	-23%
	COG	0.002	0.005	-59%
	HOS	0.067	0.059	14%
	DST	0.047	0.035	33%
Closeness	POS	0.008	0.004	88%

	NEG	0.006	0.003	121%
	COG	0.006	0.003	93%
	HOS	0.003	0.001	145%
	DST	0.000	0.001	-100%
Betweenness	POS	154	336	-54%
	NEG	213	196	9%
	COG	220	189	16%
	HOS	55	62	-11%
	DST	4	21	-81%

SA+: patients with any suicide attempts; SA-: patients with no suicide attempts; % difference: percentage difference between SA+ and SA- that exceeding SA-.

Supplemental Table 4. Within-suicide-group change (SA+: T0 vs. T1).

Cluster-wise centrality indices	***Clusters***	***T0***	***T1***	***% difference***
Edge weights	POS	0.035	0.029	-15%
	NEG	0.073	0.010	-87%
	COG	0.002	0.000	-100%
	HOS	0.067	0.050	-25%
	DST	0.047	0.013	-72%
Closeness	POS	0.008	0.024	199%
	NEG	0.006	0.000	-100%
	COG	0.006	0.011	98%
	HOS	0.003	0.006	115%
	DST	0	0	/
Betweenness	POS	154	76	-51%
	NEG	213	0	-100%
	COG	220	16	-93%
	HOS	55	9	-84%
	DST	4	1	-75%

SA+: patients with any suicide attempts; T0: pre-intervention; T1: post-intervention; % difference: difference between post- and pre- exceeding pre-intervention values.

Supplement:

Lifetime suicide attempt (SA) assessment (in-house, interview-rated instrument directly following the Structured Clinical Interview for DSM-IV or DSM-5)

Psychiatric Genotype/Phenotype Project

VANDERBILT UNIVERSITY DEPARTMENT OF PSYCHIATRY

Subject Number:	**Rater:**
Date (mm/dd/yyyy):	

SUICIDE SCALE (Revised)

1. Number of suicide attempts: _____ 2. Number of hospitalizations to prevent suicide: _____

3. Age at first suicide attempt: _____† 4. Age at first hospitalization to prevent suicide: _____†

5. Estimated date of last suicide attempt: _____/_____ (Month/Year)†

†Mark "N/A" if not applicable

Evaluating most serious attempt, Please circle the most appropriate ratings

Guide for rating most serious attempt:

1 - *Non-violent attempt with low probability of completion

2 - **Violent attempt with low probability of completion

3 - *Non-violent attempt with high probability of completion‡

4 - **Violent attempt with high probability of completion‡

‡Rate if suicide completed via this method

Please circle the method used:

*Non-Violent	** Violent	
1- Overdose	1- Hanging	2- Drowning
2- Wrist cutting (superficial)	3- Weapons	4- Leap from bldg. (etc.)
3- Carbon Monoxide poisoning	5- Crushing injury	6- Cutting (deep)
4- Other: Explain:_____	7- Other: Explain:_____	

_____ _____

_____ _____

SUICIDE RATING SCALE

		Current	**Most Serious Lifetime**
1.	**Does the patient want to die?** 1 No 2 Yes, mild, passive, or very intermittent 3 Yes, moderate 4 Yes, serious	_____	_____
2.	**Does the patient intend to die?** 1 No 2 Yes, intermittent, mild 3 Yes, moderate 4 Yes, serious	_____	_____
3.	**Is there a plan?** 1 No 2 Yes, non-serious (e.g., mild self-injury) 3 Yes, serious, unlikely to be lethal 4 Yes, serious, likely to be lethal	_____	_____

		Current	Most Serious Lifetime
4.	**How often do suicide thoughts occur?** 1 None 2 Fleetingly, rare 3 Occasionally 4 Frequently 5 Constantly (or nearly so)	_____	_____
5.	**How does the patient feel about suicide?** 1 Opposed 2 Opposed, but willing to commit suicide 3 Accepts, but resists action 4 Accepts and wants to take action	_____	_____
6.	**Does the patient have a reason to live?** 1 No suicidal thoughts 2 Suicidal thoughts, but sufficient reasons to deter suicide 3 Minimal reasons to live 4 No reasons to live	_____	_____
7.	**Method of suicide** 1 No suicidal thoughts 2 Suicidal thoughts, non-lethal 3 Suicidal thoughts, non-violent, lethal 4 Suicidal thoughts, violent, lethal	_____	_____
	Total, suicide items:	_____	_____

SUICIDE SCALE: HOMICIDE ITEMS

1.	**Injury to others** 1 No thoughts of injuring others 2. Thinking of minor injury to others 3 Thinking of serious injury to others 4 Actual injury to others	_____	_____
2.	**Homicidal ideation§** 1 No homicidal ideation 2 Wishes someone dead without intent or plan 3 Wishes someone dead without intent but with plan 4 Intends to kill someone	_____	_____
3.	**Homicidal+suicidal ideation** 1 No homicidal+suicidal ideation 2 Wishes self and other dead without intent or plan 3 Wishes self and other dead without intent but with plan 4 Intends to kill self and other	_____	_____
	Total, homicide items:	_____	_____

§If currently homicidal+suicidal, also rate on homicidal ideation item

Deactivating the treatment group. We developed the *deactivation algorithm* in R that mimics clinical interventions by applying targeted node manipulation followed by structural changes in the network. The algorithm takes a dataset containing PANSS symptom scores and relevant individual characteristics as input, with three key parameters specified by users:

- **`strata`**: Specifies the target subpopulation (e.g., patients with a history of suicide attempts: `SA > 0`);
- **`cluster`**: Indicates which symptom(s) or symptom cluster(s) to deactivate;
- **`intensity`**: Controls the severity of symptom reduction (e.g., levels 1, 2, or 3), reflecting varying degrees of intervention effectiveness.

To preserve a realistic network structure post-intervention, we incorporated the weighting mechanism using the expected influence centrality, which has been recognized as the most robust**.** Specifically, centrality values for the selected symptoms were normalized to guide a proportional reduction of symptom severity. For example, for the Distress symptom cluster including items G2, G3, G4, and G6, if the normalized expected influence proportions are 40%, 30%, 20%, and 10%, respectively, with an intervention intensity specified as level 2, the new (T1) symptom scores would be generated as:

- G2 × (0.40/2),
- G3 × (0.30/2),
- G4 × (0.20/2),
- G6 × (0.10/2), with some random noises.

This approach preserves the internal centrality structure of the cluster while exerting a greater effect on more central symptoms.