

## Supplementary Online Content

Obsessive-Compulsive Symptoms in At Risk Mental State for Psychosis:

A Network Perspective

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*This supplementary material has been provided by the authors to give readers additional information about their work.*

## **Appendix 1. Inclusion and Exclusion Criteria EU-GEI study**

Inclusion criteria for UHR and control participants were being aged 14 to 35 at the time of recruitment, ability to comprehend assessments and provide informed consent. UHR subjects had to meet at least one of the UHR criteria as defined by the following CAARMS criteria:<sup>13</sup>

(1) a schizotypal personality disorder or a first degree relative with psychosis in combination with a significant decline in functioning; (2) attenuated positive psychotic symptoms such as ideas of reference, odd beliefs, magical thinking, or unusual perceptual experiences; and (3) a brief psychotic episode of less than one-week duration that resolves without antipsychotic medication. The exclusion criteria were: (1) having a psychotic episode for more than one week, (2) symptoms relevant for inclusion are explained by a medical disorder or drugs or alcohol dependency, (3) intelligence quotient less than 60. Additional exclusion criteria for controls were the presence of an UHR status as defined above or ever treated with any antipsychotic medication.

## Appendix 2. Accuracy and stability checks

Using the R-package *bootnet* version 1.3. (Epskamp et al., 2018)<sup>†</sup> we performed several checks in order to investigate whether the estimated network associations and centrality measures were stable and accurate. These checks allowed us to estimate the accuracy of edge weights, as well as investigate the stability of centrality measures. First, to investigate the stability of the edge weights, participants were randomly resampled 1000 times, and the bootstrapped confidence intervals (CIs) of the edge weights were estimated. Second, to investigate whether the strength centrality was interpretable, we used case-drop bootstrapping, re-estimating the network with fewer cases. To quantify the stability of strength centrality indices, we used a correlation stability coefficient (CS), as recommended and described by Epskamp and colleagues (2018). Because betweenness is generally not a very stable centrality measure, we used both nonparametric and case-drop bootstraps to investigate the extent of variability of the node-specific predictive betweenness variability, as done in previous research<sup>‡</sup>. Further, we programmed an R function, based on the nonparametric bootstrap procedure described above, to allow investigating the stability of the shortest pathways. Supplementary Figures 1, 2, and 3 below showcase the bootstrap results, based on 1000 iterations, alongside the interpretation of these results. For further details on the procedure, please refer to Epskamp et al. (2018).

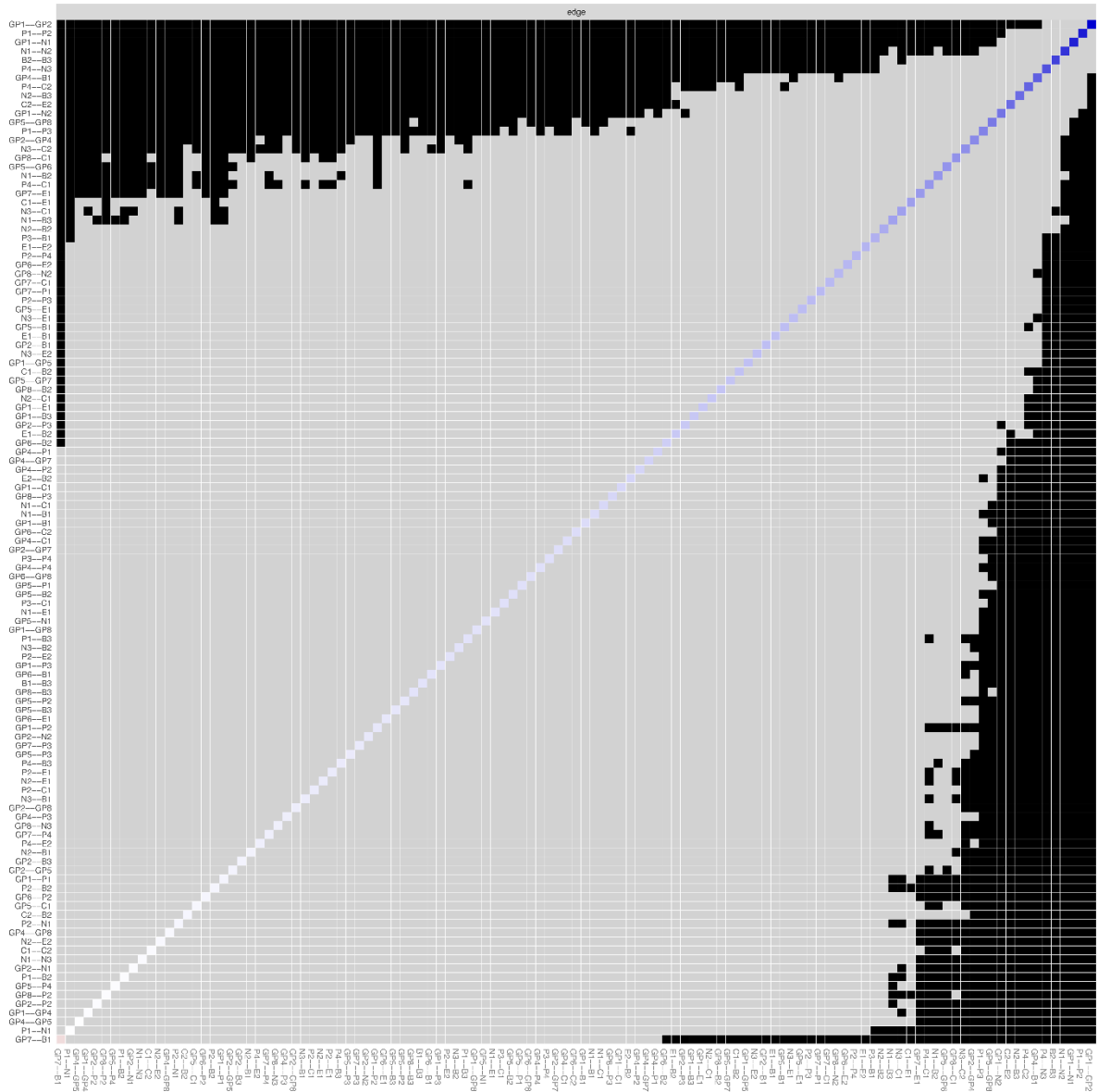
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<sup>†</sup>Epskamp, S., Borsboom, D., & Fried, E. I. (2018). Estimating psychological networks and their accuracy: A tutorial paper. *Behavior Research Methods*, *50*(1), 195-212.

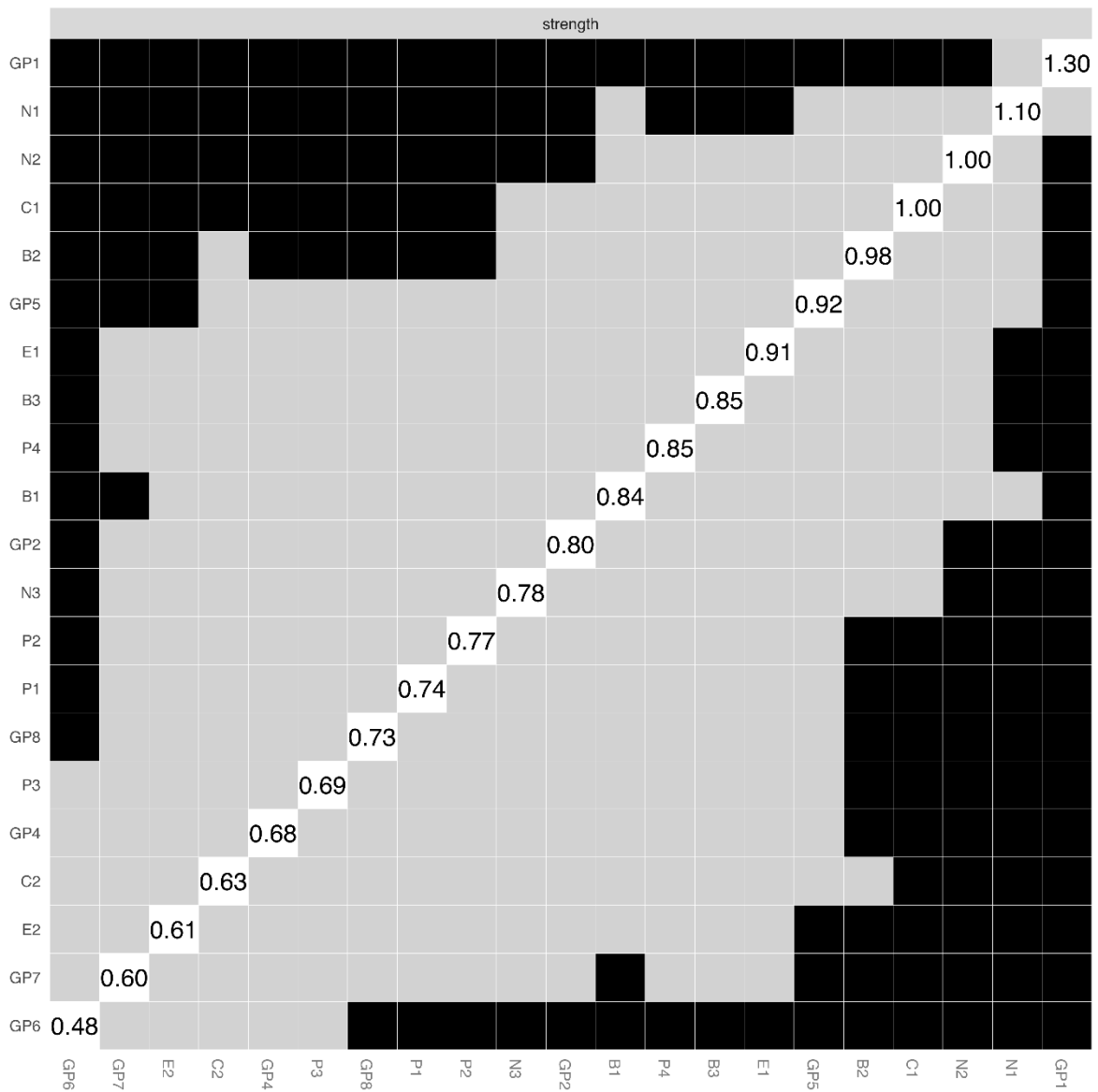
<sup>‡</sup>Isvoranu, A. M., Guloksuz, S., Epskamp, S., van Os, J., Borsboom, D., & Group Investigators. (2020). Toward incorporating genetic risk scores into symptom networks of psychosis. *Psychological Medicine*, *50*(4), 636-643.



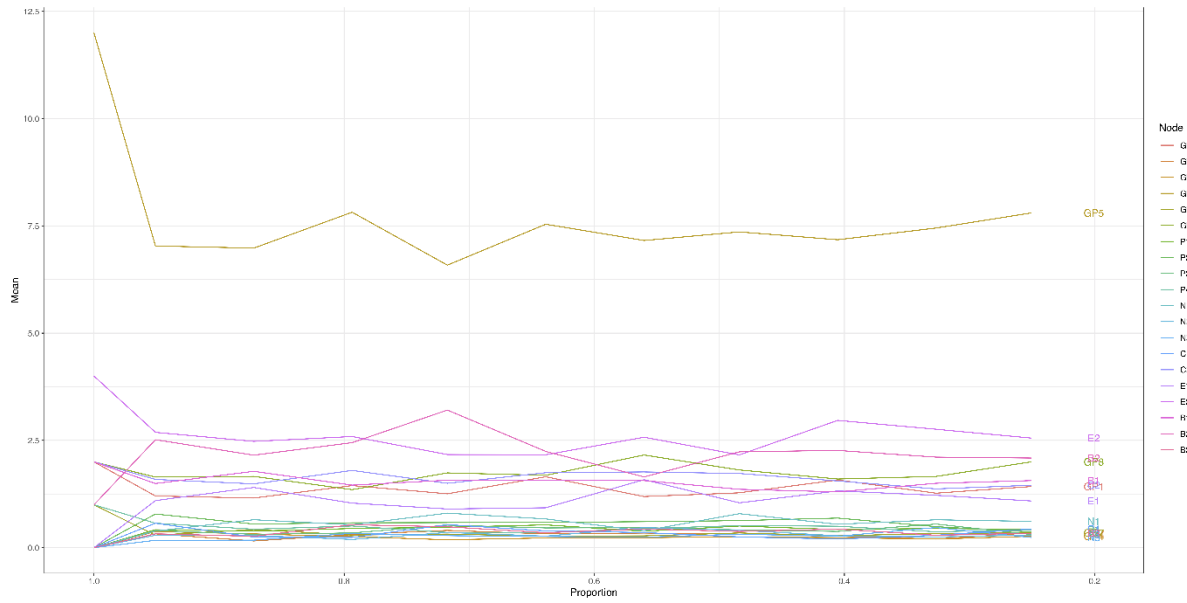
bootstrap mean values. The sample values lie within the bootstrapped confidence intervals and the bootstrap mean values are generally well-aligned with the sample values, thus indicating accurate estimations. Of note, the bootstrapped confidence intervals are relatively wide, thus some caution is recommended especially when interpreting the presence and strength of weaker edges.



**Supplementary Figure 2.** Bootstrapped difference test for edge weights. The significance difference testing ( $\alpha=0.05$ ) examines whether edges significantly differ from each other in terms of strength. The color of the boxes indicates whether there is a significant difference (i.e., grey boxes reflect no significant differences and black boxes reflect significant differences). Here most of the strongest edges generally significantly differ from the other edges in the network. The largest edge strength difference was identified between GP1 (depression) and GP2 (suicidality).



**Supplementary Figure 3.** Bootstrapped difference test for strength centrality. The significance difference testing ( $\alpha=0.05$ ) examines whether nodes significantly differ from each other in terms of strength centrality. The color of the boxes indicates whether there is a significant difference (i.e., grey boxes reflect no significant differences and black boxes reflect significant differences). Here most nodes do not significantly differ from each other in terms of strength centrality. Of note, the node with the highest strength, GP1 (depression), showed significantly larger node strength than most of the other nodes in the network.



**Supplementary Figure 4.** Average case-drop bootstraps of node-specific betweenness, based on 1000 iterations. The lines represent how node-specific betweenness (i.e., how often a node lies on the pathways between two other nodes, of which one is always the OCS) changes for each variable when dropping different proportions of the data. Overall the stability is not very reliable, but node GP5 retains very high node-specific betweenness across all case-drops.



**Supplementary Table 1. Mean and standard deviation of CAARMS\* scores for subjects at Clinical High-Risk (n=341) and controls (n=66)**

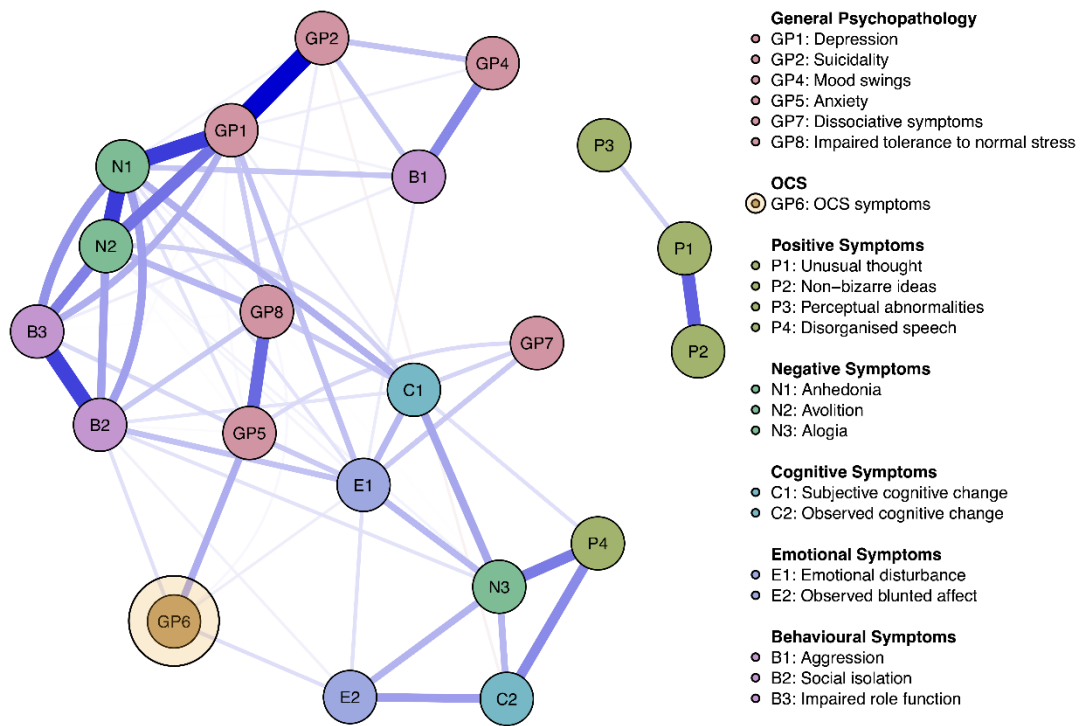
Item Label	Item Description	CHR		Controls	
		Mean	SD	Mean	SD
P1	Unusual thought	2.73	1.83	0.23	0.86
P2	Non-bizarre ideas	2.85	1.73	0.33	0.87
P3	Perceptual abnormalities	2.89	1.66	0.47	1.14
P4	Disorganised speech	1.62	1.43	0.09	0.42
N1	Anhedonia	2.87	1.72	0.48	1.17
N2	Avolition	2.91	1.55	0.62	1.33
N3	Alogia	1.17	1.24	0.24	0.63
C1	Subjective cognitive change	2.35	1.18	0.42	0.86
C2	Observed cognitive change	0.78	1.01	0.02	0.13
E1	Emotional disturbance	1.91	1.54	0.36	0.93
E2	Observed blunted affect	0.93	1.22	0.03	0.25
B1	Aggression	2.16	1.61	0.36	0.84
B2	Social isolation	2.47	1.61	0.38	1.20
B3	Impaired role function	2.89	1.82	0.62	1.49
GP1	Depression	3.25	1.35	0.71	1.31
GP2	Suicidality	1.85	1.56	0.17	0.60
GP4	Mood swings	1.44	1.54	0.14	0.55
GP5	Anxiety	3.06	1.60	0.64	1.16
GP6	OCD symptoms	1.35	1.68	0.27	0.78
GP7	Dissociative symptoms	1.29	1.67	0.03	0.25
GP8	Impaired tolerance to normal stress	2.12	1.79	0.47	1.18

\*CAARMS denotes *Comprehensive Assessment of At-Risk Mental States*<sup>§</sup>.

<sup>§</sup>Fusar-Poli, P., Hobson, R., Raduelli, M., & Balottin, U. (2012). Reliability and validity of the comprehensive assessment of the at risk mental state, Italian version (CAARMS-I). *Current pharmaceutical design*, 18(4), 386-391.

### **Appendix S3. UHR-only network structure of 21 CAARMS symptoms**

Supplementary Figure 5 below presents the network structure of the 21 CAARMS symptoms, in the UHR sample only. The network shows comparable results, with the note that many of the connections are weaker or missing, indicating a significant loss in power. The edges in the UHR sample only network were mainly—and as expected—a subset of the edges in the overall network structure.

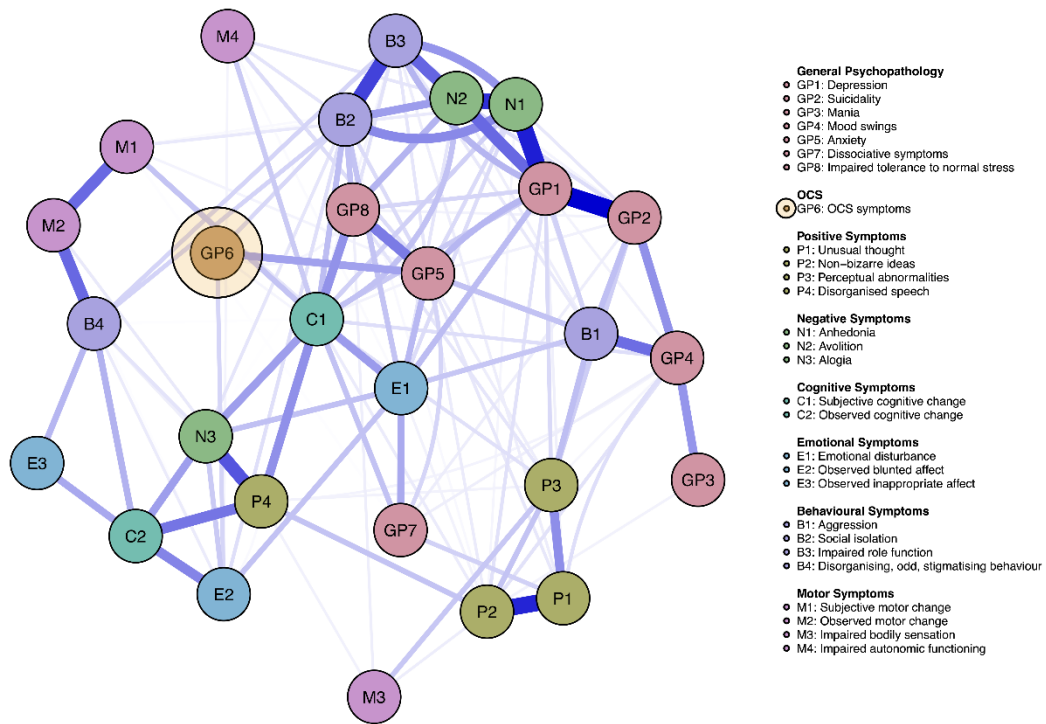


**Supplementary Figure 5.** Network structure of 21 CAARMS symptoms, in the UHR sample only. Item groups are differentiated by colour. The colour of the edge indicates the size of the association (blue for positive associations; red for negative associations).

#### **Appendix S4. Extended CAARMS network structure**

Supplementary Figure 6 below presents the full network structure of the CAARMS, including low variability items (i.e., items with more than 75% response of 0: never): GP3 (mania), E3 (observed inappropriate affect), B4 (disorganising, odd, stigmatising behaviour), M1 (subjective motor change), M2 (observed motor change), M3 (impaired bodily sensation), and M4 (impaired autonomic functioning). Within the main analysis of the paper, these items were excluded in an attempt to ensure more stable network estimates and avoid potential biased results (e.g., due to severe violations of normality assumption).

We therefore present the network structure below for reference only and recommend caution when interpreting this, as well as replication of results in larger samples. Of note and importance here, the same main associations between the OCS item and other items were identified (i.e., OCS was strongly associated to anxiety, observed blunted affect, and social isolation).



**Supplementary Figure 6.** Extended network structure of 28 CAARMS symptoms. Item groups are differentiated by colour. The colour of the edge indicates the size of the association (blue for positive associations; red for negative associations).