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## ICD-11 PTSD and complex PTSD: structural validation using network analysis

The newly released ICD-11 includes two related diagnoses within the section on Disorders Specifically Associated with Stress: post-traumatic stress disorder (PTSD) and complex PTSD (CPTSD)<sup>1</sup>.

PTSD has been substantially refined relative to earlier ICD and DSM descriptions. Two symptoms each reflect the three “subdomains” of: a) re-experiencing the event in the here and now, b) avoidance of traumatic reminders, and c) a sense of current threat. The diagnosis now requires the endorsement of one symptom from each of these subdomains, plus evidence of functional impairment.

CPTSD includes the above-mentioned core PTSD symptoms plus three additional subdomains, each comprised of two symptoms, collectively referred to as “disturbances in self-organization” (DSO). These three subdomains are: a) affective dysregulation, b) negative self-concept, and c) disturbances in relationships. The diagnosis of CPTSD requires that the PTSD criteria be met, plus endorsement of one symptom in each of the DSO subdomains, and evidence of functional impairment associated with these latter symptoms. Importantly, a person may only qualify for a diagnosis of PTSD or CPTSD but not both.

Although initial psychometric work has supported the structure of the 12-indicator description of PTSD-CPTSD<sup>2</sup>, this model has yet to be empirically validated using diverse methodologies and samples. We used a novel and sophisticated network psychometric approach to examine the structure of this description of PTSD/CPTSD in two large, trauma-exposed samples.

The network approach conceptualizes psychopathology as a complex network of locally associated symptoms<sup>3</sup>. Under this interpretation, the effects of causal factors (e.g., a traumatic event) are proposed to spread throughout the network via direct, symptom-level interactions and reinforcement, and what we might consider to be psychiatric “disorders” are captured in densely connected groups/clusters of symptoms. By focussing on the direct associations between symptoms, the network approach may provide a more detailed and nuanced description of the structure of psychopathology, and help us ascertain how and where our diagnostic constructs overlap.

We analyzed two trauma-exposed samples: a representative sample from Israel<sup>4</sup> (N=1,003; 51.7% female; mean age 40.6±14.5 years), and a sample consisting of internally displaced persons from Ukraine<sup>5</sup> (N=1,790; 67% female; mean age 43.0±15.8 years). Symptoms of PTSD and CPTSD were self-reported using the recently developed International Trauma Questionnaire<sup>2</sup>, a 12-item measure designed to reflect the ICD-11 descriptors of PTSD/CPTSD.

Regularized partial correlation networks were estimated separately for both samples using the R package qgraph<sup>6</sup>. In order to determine whether symptoms clustered in a manner reflecting the new ICD-11 criteria for PTSD-CPTSD, exploratory graph analysis (EGA) was performed using the EGA package<sup>7</sup>. EGA uses the walktrap algorithm<sup>8</sup> to identify clusters of highly associated symptoms within networks, and recent simulation work has demonstrated that it outperforms traditional methods for uncovering the underlying structure of data (e.g., Horn's parallel analysis, Kaiser-Guttman rule), particularly when the correlations between the underlying dimensions are high, and the number of indicators per dimension is low<sup>7</sup>. The networks were then compared across samples using the NetworkComparisonTest package<sup>9</sup>, which tests for invariance in structure and connectivity using a permutation test procedure. Finally, to quantify and compare the overall importance/influence of individual symptoms across the two groups, three common measures of centrality were calculated: strength, betweenness and closeness.

The ICD-11 model of PTSD-CPTSD was supported in both samples. EGA identified two clusters corresponding to PTSD and DSO, and this solution was confirmed when the networks

were re-estimated using 1,000 bootstrapped draws (for network graphs, see <https://www.traumameasuresglobal.com/network-analysis-paper>). The five strongest item-level associations mirrored five of the six diagnostic subdomains of PTSD and CPTSD: re-experiencing, avoidance of traumatic reminders, sense of threat, negative self-concept, and disturbances in relationships. Symptoms of affective dysregulation (hypoactivation and hyperactivation) were not highly associated with one another.

The two networks did not differ significantly in terms of overall connectivity ( $p=0.06$ ). Structural invariance was not supported ( $p<0.001$ ); however, post-hoc permutation tests revealed that this was due to a significant difference in only one item pair: the two avoidance items were more strongly associated in the Israeli sample. All other item-level associations were not statistically different across the two samples, and thus the network structure was judged to be broadly consistent across the two groups. The centrality indices were also broadly similar across the two groups; however, “avoidance of external reminders” was notably higher in strength in the Israeli sample.

In summary, this is the first network psychometric study of the newly developed ICD-11 diagnostic criteria for PTSD and CPTSD. Across two trauma-exposed samples, the structural validity of these “sister disorders” was supported; symptoms formed two broad clusters corresponding to PTSD and DSO, and the strongest associations within these clusters were between symptoms from the established PTSD and DSO subdomains.

However, items measuring hypoactivation and hyperactivation were more strongly associated with other symptoms than with each other, which questions the idea of affective dysregulation as a unitary subdomain of CPTSD. Furthermore, despite consistency in overall network structure, differences in strength centrality were observed across the two samples.

Future research could explore whether such differences can be attributed to sample/trauma characteristics (e.g., type of trauma, length of time since trauma, demographic factors). The identification of symptoms that take on context-specific relevance may be a focal point for targeted interventions.

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