

# Network analysis of acute symptoms of schizophrenia

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## INTRODUCTION

Schizophrenia is a chronic and very heterogeneous mental disorder with diverse clinical manifestation and multiple symptom dimensions at different stages. Positive and Negative Symptom Scale (PANSS) based factor analysis has been described by Marder [1] addressing the different symptom domains, such as positive, negative, cognitive along with disorganized thinking, hostility, and depression/anxiety. The negative symptom domain was further divided into subdomains by Khan/Fervaha [2, 3] such as negative factor for experiential deficit and negative factor for expressive deficit. Meltzer has described the so-called cognitive symptom factors [4].

In network analysis, symptoms are investigated as a network, or as a system of entities that have connections with each other. It allows a new conceptualization of mental disorders where symptoms can be ranked by their centrality and where the close or loose relationship between individual symptoms can be visualized.

## STUDY OBJECTIVE

The aim of the present post-hoc analysis was to map the network of single PANSS items in acute schizophrenia.

## METHODS

- The network analysis was performed on the pooled baseline PANSS Total Score data from four cariprazine clinical trials in patients (N = 2,193) with acute exacerbation of schizophrenia [5, 6, 7, 8].
- To investigate the relations and the connectedness/node strength of the different PANSS items and to investigate previously described factors, a centrality network analysis by Epskamp et al. [9] was performed.
- The edges are shown by lines connecting the nodes. The width of the lines represents the strength of the association. Green lines represent positive correlations while red lines show negative ones. Nodes with more and stronger connections between each other are located closer to each other, reflecting their relationships in the disease.

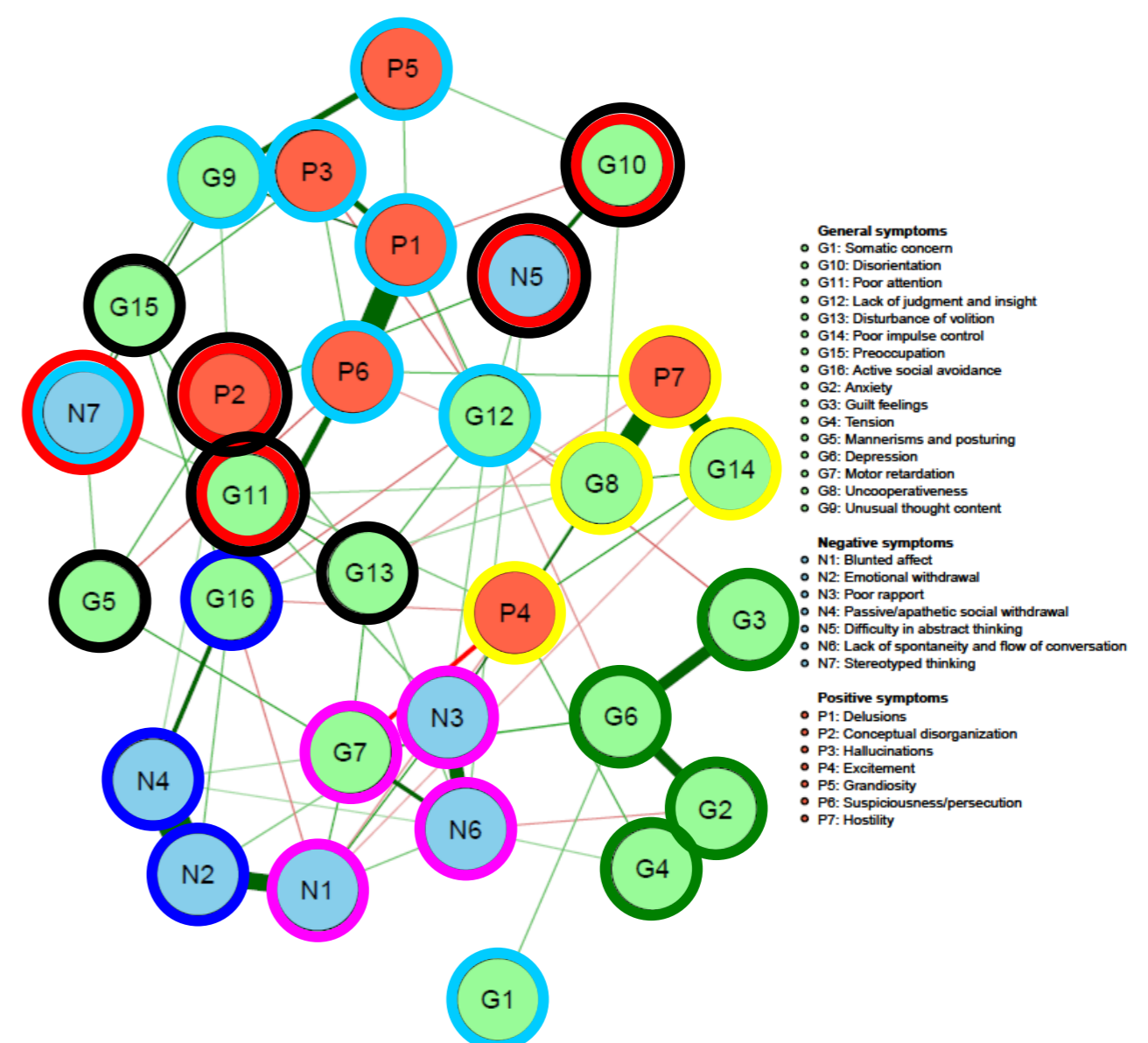
## RESULTS

- Factors of the Marder model and the Kahn subfactors of negative symptoms (experiential and expressive deficit) are easily recognizable in the network analysis.
- Five domains of psychopathology are visible as clusters in **Figure 1**:
  - Positive symptoms (Marder factor)
  - Anxiety and depression (Marder factor)
  - Uncontrolled hostility and excitement (Marder factor)
  - Negative symptoms (Khan negative factor for experiential deficit, Khan negative factor for expressive deficit)
  - Cognitive domain (Marder disorganized thought factor and Meltzer cognitive factor)
- Among the positive factor items, delusions (P1) and suspiciousness (P6) had the strongest connection with each other. Somatic concern (G1) was not connected to the group, and was the least connected item generally. Tension (G4) and anxiety (G2) appeared to be in a close relationship with each other. In terms of uncontrolled hostility, poor impulse control (G14) and uncooperativeness (G8) were both strongly connected to hostility (P7), while excitement was slightly detached. In the cognitive domain, the relationship between conceptual disorganization (P2) and poor attention (G11) was the strongest, as shown by the Marder disorganized thought and the Meltzer cognitive factors. Preoccupation (G15) and disturbance of volition (G13) were loosely connected to other symptoms of the corresponding group. Difficulty in abstract thinking (N5) and stereotyped thinking (N7) were well connected to cognitive symptoms but not to the negative symptoms.
- In terms of between-group structure, depression and the experiential negative symptom domain were more peripheral, having less connection to other domains, while positive and cognitive domains seemed more connected.

## CONCLUSIONS

- The presented network analysis well reflects the separate clusters of the Marder 5-factor model obtained by a different method (factor analysis) and confirms the multidimensional symptom presentation in patients with acute exacerbation of schizophrenia.
- The subdivision of experiential and expressive negative symptoms was also seen in the examined acute patient population.

**Figure 1** Network of PANSS symptoms in patients with acute exacerbation of schizophrenia



Marder factor for positive symptoms: P1, P3, P5, P6, N7, G1, G9, G12

Khan negative factor for expressive deficit: N1, N3, N6, G7

Khan negative factor for experiential deficit: N2, N4, G16

Marder factor for uncontrolled hostility/excitement: P4, P7, G8, G14

Meltzer cognitive factor: N5, N7, P2, G10, G11

Marder factor for depression/anxiety: G2, G3, G4, G6

Marder factor for disorganised thoughts: N5, P2, G5, G10, G11, G13, G15

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