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From promise to practice: showcasing the perceived clinical utility of idiographic networks for eating disorders with complex post-traumatic sequelae

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Abstract

Background Eating Disorders (EDs) are highly heterogeneous and often comorbid conditions that likely contribute to the suboptimal recovery rates achieved with manualized treatments. EDs with complex Post-Traumatic Stress Disorder (cPTSD) are particularly challenging, as these disorders may reinforce one another. Compassion-Focused Therapy for EDs (CFT-E) recently showed optimistic long-term efficacy in a randomized controlled trial (RCT) for EDs with cPTSD; however, the individual pathways to change vary, even within the ED-cPTSD subgroup. One method for tailoring treatment to the individual is through idiographic symptom networks from longitudinal data. However, it is to date indefinite how personalized networks can be clinically applied to the treatment of ED-cPTSD.

Aim We aim to discuss the perceived clinical utility and implications of personalized networks in routine clinical care for patients with ED-CPTSD.

Methods This perspective paper presents a case series illustrating the use of personalized network dynamics based on data from five female inpatients receiving CFT-E in an RCT. We examined 13 symptom trajectories, resulting in individual network visualizations that highlight closely aligned symptom trajectories over time.

Results The five personalized networks showed substantial heterogeneity in symptom dynamics, with each patient displaying a distinct pattern of central symptoms, ranging from tightly interconnected affect-avoidance clusters to more differentiated networks.

Discussion The clinical value of personalized networks lies in their systematic and efficient approach; however, their methodological, translational, and technical challenges, as well as their capacity to capture the complexity of individual therapeutic processes and predictive utility in clinical practice require further investigation in naturalistic settings.

Trial registration: Clinical Trials: NCT02649114.

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Plain English summary

Personalized symptom networks are promising for treating highly comorbid psychiatric conditions, but have not to date been sufficiently explored in applied settings. We discuss clinical applications of symptom networks for eating disorders with psychiatric sequelae following childhood abuse and neglect, and highlight the importance of improving clinical usefulness and advancing research in naturalistic settings.

Keywords Eating disorders, Childhood trauma, Personalized psychiatry, Idiographic symptom networks

Introduction

Eating disorder (ED) recovery rates have remained largely unchanged for several decades [1]. EDs can be life-threatening, particularly Anorexia Nervosa (AN), which is associated with a mortality rate about five times higher than that of the general population. Although Cognitive-Behavioural Therapy (CBT) [2, 3] remains the first-line ED treatment, recovery rates hover around 50% [1]. This limited effectiveness may reflect substantial heterogeneity in illness and the fluctuation of ED symptoms over time (Fält [4]).

The likelihood of recovery decreases with illness duration [5, 6]. Approximately 50% of individuals in transdiagnostic ED samples are chronically ill after 17 years [7]. Some have to ultimately refocus their goals from cure to care [1, 5]. The societal costs are high, and the human toll is beyond quantification.

Among the most challenging-to-treat EDs are those with comorbid sequelae after prolonged abuse and neglect during childhood [6–8]. Childhood trauma precariously elevates the risk of food- and weight-related problems, disordered eating, obesity, and other weight-related problems, as well as complex posttraumatic stress disorder (cPTSD) [9]. PTSD resulting from a single-event trauma incorporates sequelae such as re-experiencing, avoidance, and hyperactivation. In addition, cPTSD includes disturbances in self-organization (DSO). These disturbances include difficulties with self-concept, emotion regulation, and relational quality, and are clinically associated with greater difficulties in achieving recovery [10]. Also, dissociative experiences are common [11].

Some studies have focused on the occurrence of childhood trauma in ED patients regardless of their psychological consequences whereas some have focused on PTSD without DSO, and some on cPTSD, making the knowledge base difficult to summarize [12]. Nevertheless, development of ED-cPTSD in the aftermath of trauma is more likely to occur if there is defectiveness and abandonment beliefs [13], insecure attachment and low reflective functioning [14], dysregulated feelings [15, 16], dissociation [17], avoidance [18], self-criticism [19], shame and psychological distress [20], or if the victim identifies with the offender [21]. Shared *biological* vulnerabilities occurring in both CPTSD and EDs are

neuroendocrine disturbances, gut-brain axis disruptions, and immune-inflammatory problems [22].

EDs and cPTSD may reinforce one another negatively through maladaptive coping, affective symptoms (irritability, depression, dysregulated emotions), cognitive pathology (reexperiencing, concentration, and memory issues), and physiological dysregulation [23, 24]. Mirroring this, clinicians treating ED-CPTSD commonly view trauma exposure as crucial to ED recovery, yet they encounter barriers for successful integration when attempting trauma-informed ED treatment, such as fearing patients' deterioration or experiencing methodological uncertainty [25]. On the patient's behalf, poor outcomes associate to low proactive agency and affective intolerance [26], as well as an inability to sustain positive changes post-discharge [27], all of which can be related to DSO.

There are several evidence-based PTSD treatments, such as CBT, Prolonged Exposure (PE) [28], Eye Movement Desensitization and Reprocessing (EMDR) [29], and Cognitive Processing Therapy (CPT) [30]. The evidence base is weaker for cPTSD than for single-incident PTSD. However, there is general support for exposure-based interventions [31], and recent studies indicate that trauma exposure is central in promising integrated approaches for ED-CPTSD [32–34], also for patients in the 14–16 BMI range [35]. Notably, these approaches are in their infancy.

Despite these developments, treatment outcomes remain variable, suggesting that further refinement and individual tailoring of interventions may still be needed. To meet the urgent need for improved ED outcomes, the field has turned toward a personalized psychiatry, i.e. away from a nomothetic approach to mental health problems (group averages) towards individually (i.e., idiographic) tailored treatments [36–38]. «Personalized» is sometimes used interchangeably with «precision», although «precision psychiatry» includes empirical, algorithmic, or quantitative methods. A «personalized psychiatry» on the other hand, includes any systematic attempt to tailor treatment to the patient's unique profile to optimize outcomes and minimize iatrogenic effects [39–41]. Tailored, person-centered approaches are promising in search for improved outcomes, especially in light of the high occurrence of comorbidities and intergroup heterogeneity. Research to advance the development of

individually tailored treatments was recently called for [40], however, challenges that may arise during their clinical implementation have been cautioned against [42].

Network theory aligns with these initiatives since it offers a flexible framework for identifying individual symptom dynamics and interactions while remaining empirically grounded in quantitative analysis. Specifically, network theory posits that mental disorders are a set of chain reactions that create a cycle of symptoms, rather than illness being caused by latent factors. This symptom cycle is mutually dependent, and a change in the most central symptom may lead to a change in other symptoms and alter the network, i.e., lead to symptom relief for the individual [42, 43]. Idiographic networks are based on repeated self-report measures and may pinpoint central drivers of the individual's pathology, and thus guide clinicians as to which symptoms to target for a favorable outcome [37, 42].

Traumatic experiences pose a risk for developing ED or cPTSD, but may lead to a myriad of late effects, and sometimes even none [44]. At the same time, there seems to be a dose-response relationship when it comes to sustained and prolonged childhood trauma [10]. Importantly, it is the trauma symptoms that are predictive of EDs, not the experiences in and of themselves [12], still the traumatic experience is a diagnostic prerequisite, indicating a cause-and-effect relationship in the criteria [45, 46]. Personalized networks, on the other hand, are conceptualizations that directly focus on the mutually dependent relations between symptoms rather than potential underlying causes of mental health issues. This may make sense since it is not the traumatic event in itself that is treated, but its consequences [12].

This paper builds on a randomized controlled trial (RCT; Clinical trials: NCT02649114) comparing inpatient Compassion-Focused Therapy for EDs (CFT-E) [47, 48] with CBT for EDs with or without childhood abuse/neglect [49]. CFT-E specifically targets shame, self-criticism, and emotion regulation, and the ED is theorized as a strategy to cope with debilitating cognitions and emotions. A key focus is thus on managing ED behaviors and understanding underlying functions. See Goss and Allan (2012) [48].

The RCT results revealed that CBT and CFT-E were equally effective in reducing compulsive exercise [50], restriction, bingeing, and purging, however, with CFT-E providing more long-term ED-related changes for ED-cPTSD [51]. ED severity also predicted patients' levels of self-compassion on a within-person level, and for CFT-E, ED-cPTSD were more strongly linked to low self-compassion and ED pathology [52]. When interviewed, a small sample of improved patients emphasized showing vulnerability, their own active role, and therapists' beliefs in their ability to change, whereas non-improved patients

described significant dysregulation, avoidance, and relational dynamics marked by extremes in their desire for closeness or distance for sharing sensitive content. Non-improved patients also handled alliance ruptures with covert self-effacement, submission, and passivity rather than authentically, and they were also unable to express vulnerability and seek support, and attributed their sense of safety to others [26, 53].

Temporal group-level networks from RCT data moreover revealed potential mediators for treatment responses. Patients' «dissatisfaction with weight» preceded bingeing; «overvaluation of weight» and «feeling fat» were prominent in ED-cPTSD, whereas changes in «overvaluation of shape» preceded and predicted «overvaluation of weight» in the non-trauma counterparts [54]. Other RCT networks showed that patients' acceptance of their disliked traits and reduced hopelessness both preceded and predicted improved self-compassionate abilities and ED behavioural change in ED-cPTSD [55].

Although useful for subgroup comparisons, this knowledge is not sufficiently fine-grained to guide individual treatment planning. We therefore aim to address the perceived clinical utility of personalized ED-cPTSD networks in routine clinical care, and we do this with CFT-E examples from five female ED inpatients with emotional, physical, and/or sexual childhood trauma from the RCT. The complex psychological and social processes involved in recovery pathways are not mirrored in one-size-fits-all ED treatments, and hence, the initiative to close this universal-to-individual translational gap is timely. The application of networks in individual cases ($n = 1$) demonstrates a potential for identifying central symptoms and key drivers of a person's unique, complex condition [56]. As such, it has promising implications for tracking changes in individual symptoms over time and for clinical purposes, aligning with the notion of treatment personalization.

Ethics and reflexivity

All procedures were approved by the Norwegian Regional Committee for Medical Research Ethics REK (2014/836) and adhered to the Helsinki declaration. The authors are six Caucasian, cisgender clinicians/researchers (5 females, 1 male) with considerable and relevant clinical/research competence. EJJ and MCK have particular expertise in network theory, Dynamic Time Warping (DTW) and their applications. KV, MCK, and MEO were involved in the RCT, where MEO and HPE were also trial therapists. HWO has a professorship in clinical psychology with expertise in psychotherapy process research; in this study, she secured an outside perspective on data and discussion.

Method

Network theory

Psychotherapy is grounded in the clinician's and patient's shared understanding of the patient's condition. It examines how the dynamics or patterns of patients' thoughts, feelings, and behaviors contribute to distress and identifies what needs to change to improve well-being. Historically, such formulations have relied primarily on the clinician's in-session judgment in addition to nomothetic approaches such as common, structured assessments and diagnostics. Change in this descriptive study would be detected in a difference in symptom patterns, e.g. that symptoms are less strongly connected, and symptoms would have weaker edges.

DTW was used to generate individual networks based on the patients' repeated measurements on a range of questions, for instance regarding ED symptoms, shame, guilt, and sorrow [57, 58]. DTW constitutes a non-linear alignment technique that quantifies the similarity between two time-series by identifying the optimal match between their trajectories, even when their timing differs [57]. Pairwise DTW distances were computed between 13 symptom and stressor items across 7–13 assessment waves for each of five inpatients (P1–P5) undergoing CFT-E. This yielded one symmetric 13×13 distance matrix per participant, showing which symptoms covary in severity over time. Smaller distances reflecting stronger alignment were visualized as edges in individual undirected network plots. Hierarchical clustering was applied to the DTW distance matrices, producing dendrograms and heatmaps of standardized symptom scores. Such visualizations reveal which symptom changes and most closely resemble one another within each individual. They also illustrate how specific symptoms tend to co-vary and evolve together during treatment, demonstrating the potential utility of person-specific network modelling in psychotherapy research. Specifically, when we are able to see how different symptoms change together, the network theory allows us to think that targeting a symptom in a cluster could potentially destabilize the network and ultimately provide symptom relief.

In this study, DTW was applied in an undirected manner to capture co-fluctuation rather than temporal precedence between symptoms. Pairwise DTW distances were computed for all symptom time series within each individual, yielding a symmetric distance matrix that served as the sole input for network visualization and clustering. No assumptions were made regarding directionality or causality, and identical analytic steps were applied across participants. Visually, this means that symptoms whose trajectories rise and fall together over treatment are positioned closer and connected more strongly

in the network, whereas symptoms with dissimilar change patterns appear more weakly connected or even unconnected.

Statistical analyses were conducted using the main R packages *dtw* (version 1.23-1.23.23), *parallelDist* (version 0.2.7), and *qgraph* (version 1.9.8) in R Studio (version 4.3.2; R Foundation for Statistical Computing, Vienna, Austria, 2016; <https://www.R-project.org/>). For further methodological details and a tutorial with sample code, see Kopland and Giltay, 2025 [58].

Case selection

Since networks are especially suitable for exploring comorbid conditions, we exemplify the development of five distinct networks from the CFT-E arm of the RCT. The five cases were selected from the inclusion criteria of having any ED with childhood trauma sequelae and having received CFT. Since this is a proof-of-concept paper in which we aim to illustrate the heterogeneity of change processes on the individual level as well as to showcase their clinical utility, the cases were also selected on the basis of having enough measure points in order to create symptom networks for illustrative purposes. Two of the six networks that were ultimately derived showed similar change patterns, and thus, only one of these was reported in the paper.

Item selection

A unique network based on 7–13 repeated self-report measures was developed for each patient. The questions were the same for all patients, but the number of waves per week differed. Items from the Self-kindness subscale of the Self-compassion Scale [59], Beck's Depression Inventory [60], the Eating Disorder Examination Interview [61], PTSD Self-Report [62], and various affective measures measured across the treatment course were used. Measures of depression and self-compassion were specifically included since previous studies have shown that hopelessness about the future has predicted non-change in ED-cPTSD [54, 55]. All measures had acceptable internal consistency, reliability and validity: for further information, see the trial protocol [49] and the main study [51].

Example networks

Patient 1

The dendrogram for patient 1 (P1) identified three prominent nodes: avoidance of trauma memories, feelings of shame (wanting to hide), and unclear feelings (Fig. 1). Across the 13 assessments, overall symptom intensity gradually decreased, although several items remained elevated over time, including hypervigilance ("always being on guard") (Panel B). The corresponding network (Panel C) showed that avoidance of memories,

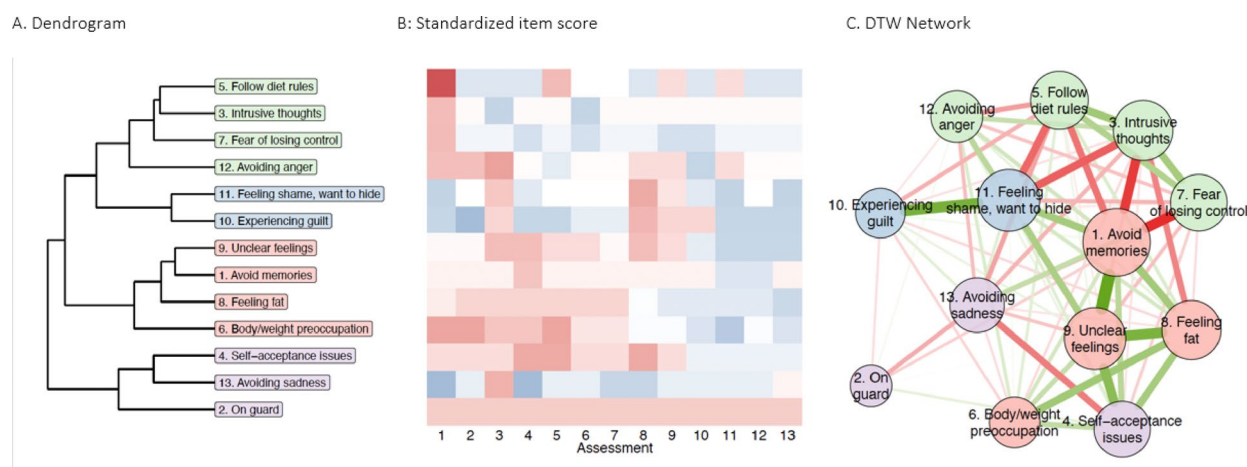


Fig. 1 Unidirectional network for P1. The most central nodes indicate high centrality and significant influence within the network. Red edges represent negative correlations, while green edges represent positive correlations. Node colours denote clusters of symptoms that exhibit similar patterns of change during therapy. Panels **A–C** illustrate the hierarchical clustering, heatmap, and corresponding undirected DTW network for one example patient. In the heatmap (Panel **B**), colours represent standardized symptom severity within the individual over time, with warmer red colours indicating higher severity and cooler blue colours indicating lower severity. Symptoms are ordered according to hierarchical clustering based on DTW distances, such that symptoms with similar trajectories across treatment are positioned closer together. In the network (Panel **C**), edges reflect the degree of co-fluctuation between symptom trajectories, with stronger connections indicating greater similarity in change patterns. Node colours denote clusters of symptoms with comparable longitudinal trajectories.

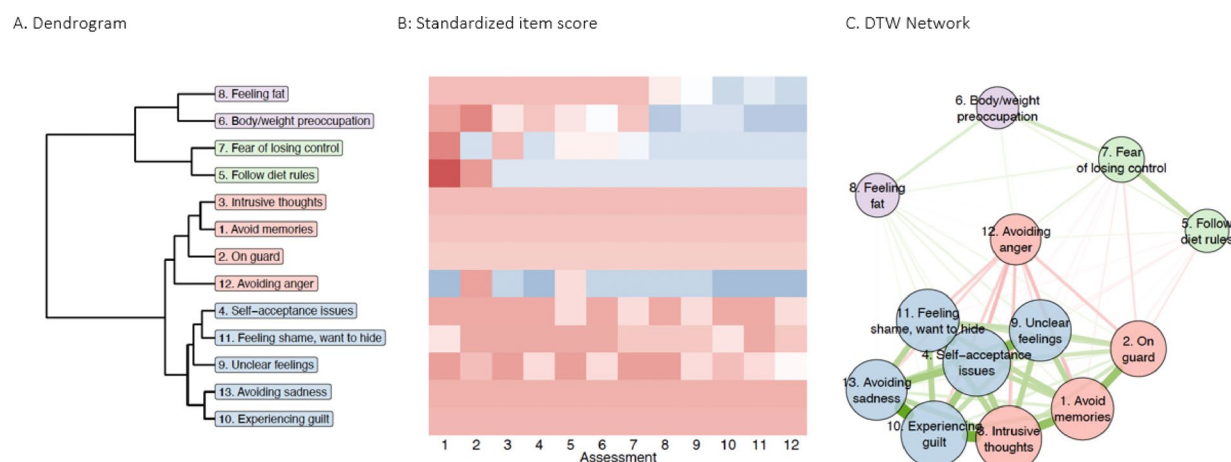


Fig. 2 Unidirectional network for P2. The most central nodes indicate high centrality and significant influence within the network. Red edges represent negative correlations, while green edges represent positive correlations. Node colours denote clusters of symptoms that exhibit similar patterns of change during therapy. Panels **A–C** illustrate the hierarchical clustering, heatmap, and corresponding undirected DTW network for one example patient. In the heatmap (Panel **B**), colours represent standardized symptom severity within the individual over time, with warmer red colours indicating higher severity and cooler blue colours indicating lower severity. Symptoms are ordered according to hierarchical clustering based on DTW distances, such that symptoms with similar trajectories across treatment are positioned closer together. In the network (Panel **C**), edges reflect the degree of co-fluctuation between symptom trajectories, with stronger connections indicating greater similarity in change patterns. Node colours denote clusters of symptoms with comparable longitudinal trajectories.

sadness, shame, and unclear feelings were among the most strongly connected nodes (i.e., highest strength centrality). These findings suggest that avoidance, shame, and low emotional clarity are closely interconnected within P1's symptom network. While centrality does not imply causal primacy or treatment priority, these processes may represent clinically relevant domains to

consider in case formulation, particularly given their integration across both ED and cPTSD symptoms.

Patient 2

Patient 2 (P2) demonstrated a densely interconnected network (Fig. 2), with most symptoms showing high and relatively stable standardized scores across the 12 assessments (Panel B). Examination of the DTW network

topology (Panel C) indicated that self-acceptance difficulties, unclear feelings, and avoidance of trauma memories were among the most strongly connected nodes. These nodes formed a cohesive and densely interconnected subnetwork with strong bidirectional associations, suggesting that they tended to co-vary over time.

The relative stability observed in the heatmap, together with the high density of the network, may reflect limited differentiation among symptoms within this patient's presentation. For P2, self-acceptance difficulties, trauma-related avoidance, and affect clarity may represent clinically relevant domains to consider in case formulation.

Patient 3

Patient 3 (P3) showed marked symptom improvement across treatment (Fig. 3), reflected in a shift from warmer (higher) to cooler (lower) values in the heatmap (Panel B). In the corresponding network (Panel C), avoidance of sadness showed the highest strength centrality. Self-acceptance difficulties, avoidance of anger, adherence to diet rules, and hypervigilance ("being on guard") were also among the most strongly connected nodes connected within the network. With the exception of diet rules, ED-specific symptoms were not among the most strongly connected nodes. Instead, processes consistent with affect avoidance appeared to be prominently embedded in this network. These findings suggest that difficulties accessing and tolerating anger and sadness may represent clinically relevant processes within this patient's symptom presentation.

Patient 4

The network for patient 4 (P4) appears to be characterized by a cluster of avoidance- and control- related processes, in which trauma-related avoidance and body-focused distress are strongly interconnected (Fig. 4). The strength centrality plot indicates that feeling shame (wanting to hide), adherence to diet rules and feeling fat are among the most strongly connected nodes. In contrast, the ED symptom "fear of losing control" shows relatively weaker connections to other nodes, suggesting that it does not have similar change structure as the rest.

Patient 5

The network for patient 5 (P5) showed that unclear feelings, guilt, and avoidance of anger and sadness were among the most strongly connected nodes (Fig. 5, Panel C), suggesting that difficulties in identifying, tolerating, and expressing emotions are closely interconnected within this patient's symptom network. These processes may represent clinically relevant domains to consider in individualized case formulation and are theoretically consistent with key components of CFT.

Discussion

Clinicians find the ED-cPTSD comorbidity challenging, and outcomes are poor when manualized treatments are utilized. Even though idiographic networks hold considerable promise for identifying individual symptom dynamics (especially for comorbid and complex conditions) and tailoring treatment accordingly, their clinical potential remains underutilized. Here, we showcase how

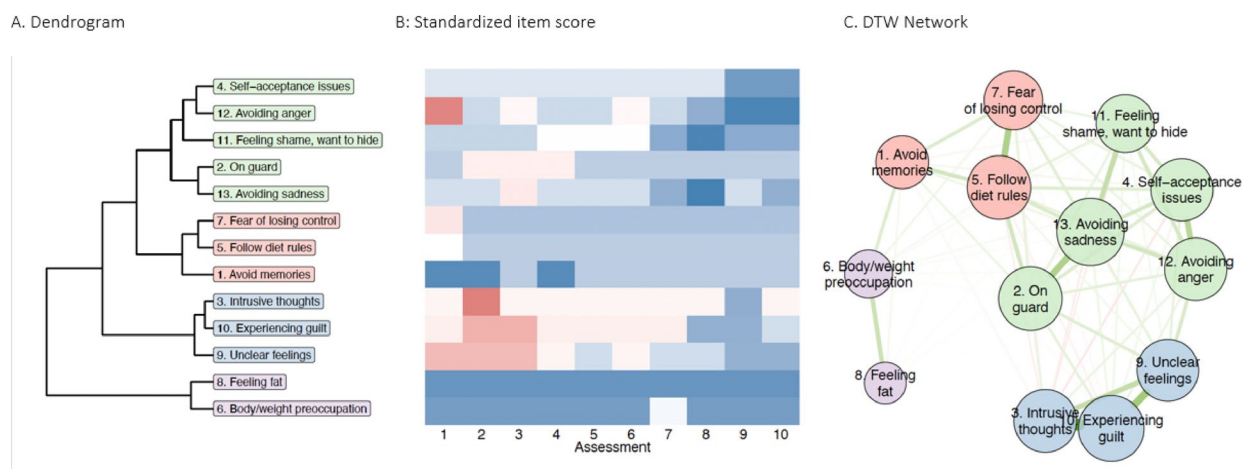


Fig. 3 Unidirectional network for P3. The most central nodes indicate high centrality and significant influence within the network. Red edges represent negative correlations, while green edges represent positive correlations. Node colours denote clusters of symptoms that exhibit similar patterns of change during therapy. Panels **A–C** illustrate the hierarchical clustering, heatmap, and corresponding undirected DTW network for one example patient. In the heatmap (Panel **B**), colours represent standardized symptom severity within the individual over time, with warmer red colours indicating higher severity and cooler blue colours indicating lower severity. Symptoms are ordered according to hierarchical clustering based on DTW distances, such that symptoms with similar trajectories across treatment are positioned closer together. In the network (Panel **C**), edges reflect the degree of co-fluctuation between symptom trajectories, with stronger connections indicating greater similarity in change patterns. Node colours denote clusters of symptoms with comparable longitudinal trajectories

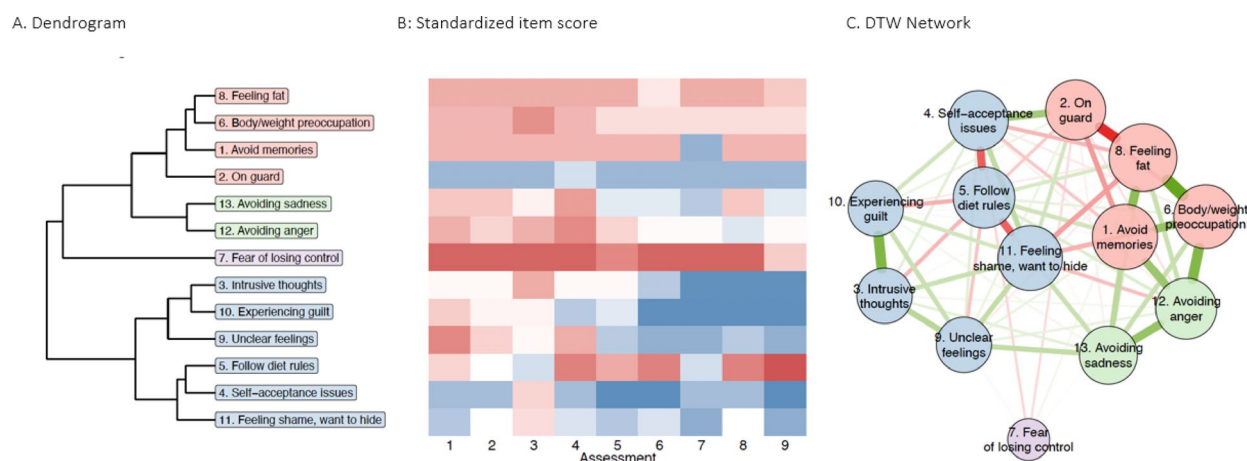


Fig. 4 Unidirectional network for P4. The most central nodes indicate high centrality and significant influence within the network. Red edges represent negative correlations, while green edges represent positive correlations. Node colours denote clusters of symptoms that exhibit similar patterns of change during therapy. Panels **A–C** illustrate the hierarchical clustering, heatmap, and corresponding undirected DTW network for one example patient. In the heatmap (Panel **B**), colours represent standardized symptom severity within the individual over time, with warmer red colours indicating higher severity and cooler blue colours indicating lower severity. Symptoms are ordered according to hierarchical clustering based on DTW distances, such that symptoms with similar trajectories across treatment are positioned closer together. In the network (Panel **C**), edges reflect the degree of co-fluctuation between symptom trajectories, with stronger connections indicating greater similarity in change patterns. Node colours denote clusters of symptoms with comparable longitudinal trajectories

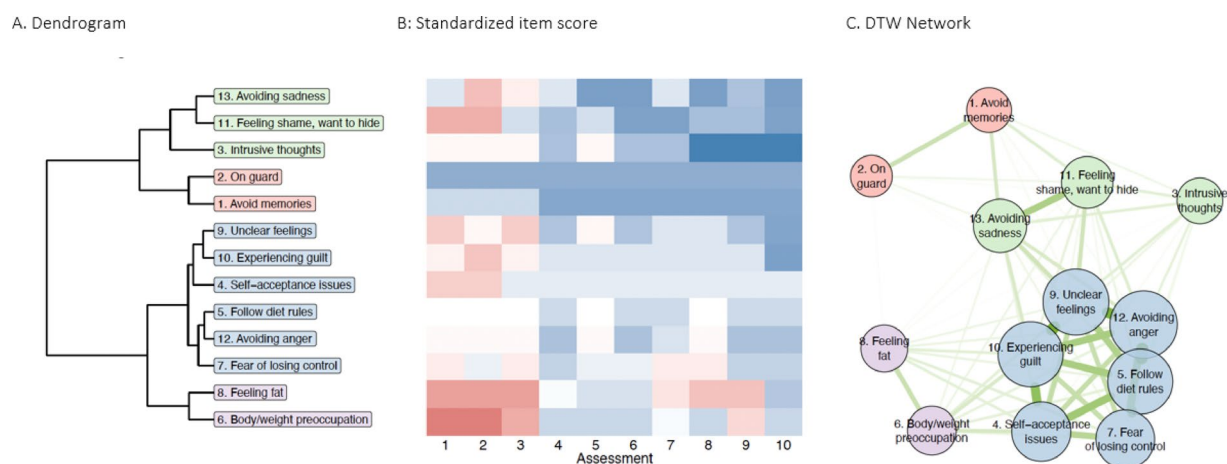


Fig. 5 Unidirectional network for P5. The most central nodes indicate high centrality and significant influence within the network. Red edges represent negative correlations, while green edges represent positive correlations. Node colours denote clusters of symptoms that exhibit similar patterns of change during therapy. Panels **A–C** illustrate the hierarchical clustering, heatmap, and corresponding undirected DTW network for one example patient. In the heatmap (Panel **B**), colours represent standardized symptom severity within the individual over time, with warmer red colours indicating higher severity and cooler blue colours indicating lower severity. Symptoms are ordered according to hierarchical clustering based on DTW distances, such that symptoms with similar trajectories across treatment are positioned closer together. In the network (Panel **C**), edges reflect the degree of co-fluctuation between symptom trajectories, with stronger connections indicating greater similarity in change patterns. Node colours denote clusters of symptoms with comparable longitudinal trajectories

idiographic networks derived from repeated self-report data during five cases of inpatient CFT-E may help illuminate symptom dynamics in ED-cPTSD treatment. Specifically, we aim to provide a proof-of-concept exemplifying the contribution of networks to a more precise, responsive clinical formulation for patients with ED-cPTSD. To strengthen the clinical relevance, it is important to link network patterns with therapeutic decision-making. In

this regard, networks can be interpreted as indicators of when emotional processing, trauma integration, or eating disorder-specific work should be prioritized in the session.

The five case-level networks illustrate how person-specific symptom structures may provide clinically meaningful insight into individual change patterns of distress during treatment. The networks differed somewhat from

one another, revealing that ED symptoms may be more or less peripheral. P1's network was primarily driven by trauma-memory avoidance, shame, and unclear feelings, suggesting that potential fruitful targets for change may be trauma exposure and emotion experiencing/differentiation. P2 showed a more globally interconnected system dominated by self-acceptance issues and emotional ambiguity, which suggests that self-compassion and affective experiencing could be appropriate therapy targets for alleviating ED symptoms. For P3, affect-phobic processes (avoiding sadness and anger) seem to be suitable targets since they were most central, while ED symptoms seemed rather peripheral; P4's network instead highlighted ED-specific symptoms and shame. Lastly, P5's network centered on emotional avoidance and feelings of guilt, indicating a strong presence of trauma-related symptoms. Taken together, these examples illustrate that different network constellations may call for different therapeutic emphases. Rather than following a uniform treatment algorithm, clinicians may use the networks to dynamically adjust focus, for example, prioritizing trauma exposure when avoidance is central, or emotion labelling when affect ambiguity is dominant.

These divergent profiles underscore that mechanisms maintaining ED-cPTSD presentations vary considerably across individuals, which supports the potential of idiographic networks to inform more precise and patient-specific intervention strategies. Networks could thus be useful pinpoint pathways for the clinicians who may feel uncertain of *how* to integrate elements from the respective evidence-based treatments [25]. Noteworthy is that the patients were not asked about their experience with frequent self-report completion, which may have clinical drawbacks. Particularly, low-functioning individuals who would apply to many of those suffering from ED-cPTSD pathology, have reported feeling overwhelmed by answering questions repeatedly, and by trying to understand the sometimes complicated networks that are generated from their data [63]. This clearly points to the need for the therapist to facilitate their interpretations, and perhaps more research is needed for adjustments to increase the actual feasibility of networks for more vulnerable patient groups. In practical terms, this means that networks can support clinicians in treatment planning, not by replacing clinical judgment, but by sharpening it. As highlighted by McNally [64], network approaches to psychopathology hold conceptual promise but face substantial methodological and translational challenges, particularly when moving from group-level models to clinically actionable insights at the individual level. Therefore, while idiographic networks may eventually enable timely, person-specific interventions in response to early maladaptive symptom dynamics, substantial empirical, technological, and ethical work is still

required before such approaches can be implemented in routine clinical practice.

We further suggest that idiographic networks hold prognostic value for differentiating between ED subgroups, which may guide the selection of interventions. Interestingly, patients in one study considered networks useful therapeutic tools, although the generated individual models differed noticeably from their intuitive predictions of change. On the $n = 1$ level, networks may thus hold potential for adjusting or even augmenting patients' interpretations of their unique pathology, and be used as a means to direct the therapeutic course [56, 65, 66]. Notably, the need to disentangle idiographic ED as well as cPTSD functions and their interplay aligns with ED-cPTSD treatment recommendations [32, 67], and for this purpose, personalized networks may be highly suitable for joint case formulation processes.

There is also robust evidence that routine outcome monitoring (ROM) may improve outcomes across psychiatric disorders [68]. While changes in overall symptom severity remain clinically important, network analyses uniquely emphasize the relationships between symptom changes, providing additional clinically meaningful information that may better guide individualized intervention. For this purpose, personalized networks may be used therapeutically to monitor progress and accelerate the detection of real-time positive change, treatment non-responses, iatrogenic effects, or sudden changes in patients' clinical presentations [69]. This may hypothetically be important for the ED-cPTSD comorbidity, where preliminary evidence indicates that DSO plays a prominent role [70] and undetected and thus unrepaired alliance ruptures seem to relate to poor outcomes [26].

Further, and particularly for the ED-cPTSD patient group, where DSO is part of the pathology and emotional-relational problems tend to aggravate favorable outcomes, it may be fruitful to include relational experiences, e.g. therapeutic alliance measures [67]. Measures of dissociative states could also be included since such states are known to hinder habituation and inhibitory learning processes that typically contribute to good outcomes of exposure therapy.

Future studies may also investigate whether conducting symptom network analyses prior to or alongside treatment can inform personalized treatment targets, while acknowledging that central symptoms should be conceptualized as components of an interconnected system rather than as isolated interventions [64]. Also, since ED symptoms tend to fluctuate over the course of the day, with patients' anxiety levels commonly peaking around mealtimes, it is important to be mindful of how often and when data should be collected to ensure appropriate symptom variation in the network. One way to achieve this is through the addition of Ecological Momentary

Assessment (EMA), which allows for registration of experiences as they occur during different time points [37, 71]. Also, although there are uncertainties around the accuracy of networks due to the symptom fluctuation, systematic attempts to understand individual pathology have proven more accurate than clinician judgement alone. See for instance Cusack and colleagues (2025) for a more thorough discussion of symptom variability and network theory [72].

A potential and unexplored clinical use of personalized networks is to register patients' symptoms prior to entering treatment, and in that way, increase individual treatment efficacy in terms of pre-identified treatment targets. Such extensions of the current literature will be implemented by the research group in the previously mentioned naturalistic setting. Patients will be asked to finish EMA x 4 daily for 2 weeks before inpatient admission, and a personalized network will be constructed to guide the first weeks of treatment. Patients then continue to register EMA 4 times daily during the 4 first weeks of treatment to allow for adjustments mid-treatment. This makes the exploration of symptom change and feasibility possible in a population with complex symptomatology and poor functioning in general.

Overall, the varied positions and level of detail in the RCT studies [26, 50, 51, 53–55] demonstrate symptom heterogeneity even within the ED-cPTSD subgroup, and speak in favor of methodological pluralism in efficacy research for such complex mental health disorders. They additionally underscore the clinical need for person-centered formulations of individual change mechanisms. However, to launch personalized networks as a therapeutic tool in routine clinical care, clinicians need to obtain sufficient background knowledge and training (including network limitations) to allow for adequate interpretations of data. Their implementation also requires precise, accurate, efficient, and user-friendly software in order for the benefits to outweigh the costs in an increasingly strained healthcare sector. This is perhaps particularly important since clinician attitudes towards the clinical use of networks have generally been described as «tempered» [43].

DTW provides a flexible way to capture similarity between symptom trajectories in single-case data; however, the undirected networks that are presented in this study should be interpreted cautiously, as they reflect co-fluctuation rather than causal influence and are sensitive to noise, alignment artifacts, and limited data length. DTW is also a bivariate analysis and compares a time series of two symptoms at a time, and thus, does not control for all other symptoms in the same analysis. Consequently, there might be confounding effects that were not captured by this model. We also would like to address

the fact that data were collected *during* CFT treatment, which may have provided a bias in how the patients rated their symptoms; a focus on key CFT aspects may have brought attention to certain symptoms over others, and networks may therefore have an inherent bias.

We also wish to caution that networks are built on self-report top-down data that is predetermined, which is also true for node selection in the analysis. As such, there is a risk for therapist confirmation bias, and relatedly, interactions unfolding in therapy build on complex human experiences that are not fully captured through quantitative methods alone. Therefore, the study of psychotherapeutic processes can never completely avoid qualitative elements [69, 73]. For instance, it is suggested that a personalized psychiatry cannot attain its goal without taking into account a broad array of determinants of psychological health, including the experiences of the self or social relationships, which may be especially relevant in complex conditions such as ED-cPTSD.

Despite these limitations, DTW-based single-case networks offer several advantages for exploratory clinical research; they for instance allow for the analysis of fine-grained temporal data even where observation lengths differ across symptoms or sessions, as DTW accommodates phase shifts and unequal timing between trajectories. This flexibility makes it particularly suitable for psychotherapy contexts where change processes are most often asynchronous and nonlinear. Moreover, DTW provides an intuitive way to visualize co-fluctuation patterns among symptoms, highlighting which symptoms tend to move together over the course of treatment. When combined with complementary indicators such as heatmaps or qualitative session data, DTW-based networks can yield clinically meaningful insights into individual dynamics that are not easily captured by traditional group-level models.

We suggest that further research explore the feasibility of personalized networks for this and other vulnerable and highly comorbid patient groups in naturalistic settings in order to increase external validity and clinical usefulness. The accuracy of networks in capturing patients' own narratives of therapeutic processes could be explored in a qualitative, bottom-up manner. Also, since EDs span across age, gender, sexual orientation, ethnicity, and social class, and current ED research uses mostly cisgender women and Caucasian samples, we also call for research that advances knowledge on idiographic networks and ED-cPTSD treatment monitoring in less ED stereotypical populations, e.g. males, ethnic minorities, and non-cisgender patients. In addition, the acceptability of network utility from the clinicians' perspective

ought to be studied further to inform successful implementation processes and adequate use.

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Author contributions

All authors have read and approved the final manuscript. MEO and MCK designed the study. MEO, EJG, KV, HWO, HPE, and MCK were responsible for data analysis and drafting/revising the manuscript. EJK and MCK developed the networks.

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Data availability

See Clinical trials: NCT02649114.

Declarations

Ethics approval and consent to participate

The Norwegian Regional Committee for Medical Research Ethics approved all procedures (2015/2160).

Consent for publication

All authors have approved the publication.

Competing interests

The authors declare no competing interests.

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