Early maladaptive schemas and borderline personality disorder features in a non-clinical sample: A network analysis

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Abstract

Borderline personality disorder (BPD) is a challenging problem. Early Maladaptive Schema (EMSs) are considered as important vulnerability factors for the development and maintenance of BPD. Literature suggests a complex relationship between BPD and EMSs. The current study employed network analysis to model the complex associations between central BPD features (i.e. Affective Instability, Identity Problems, Negative Relations, and Self-harm) and EMSs in 706 undergraduate students. The severity of BPD symptoms was assessed using the Personality Assessment Inventory–Borderline Subscale (PAI-BOR); the Young Schema Questionnaire-Short Form (YSQ-SF) was used to assess EMSs. Results suggest that specific EMSs show unique associations with different BPD features. Interestingly, Affective Instability showed no unique associations with EMSs. Identity problems were uniquely associated with Abandonment, Insufficient Self-control, Dependence/Incompetence, and Vulnerability to Harm/Illness schemas. Negative Relations in BPD showed unique connections with Mistrust/Abuse and Abandonment. Finally, BPD Self-harm was connected to Emotional Deprivation and Failure. These findings indicate potential pathways between EMSs and specific BPD features that could improve our understanding of BPD theoretically and clinically.

Keywords: borderline personality disorder, early maladaptive schemas, network analysis, BPD

Key practitioner message:

- We modeled the unique associations between borderline personality disorder (BPD) symptoms and early maladaptive schemas (EMSs).

- Specific EMSs were uniquely linked to distinctive BPD features (Dysfunctional Relations, Identity Problems, Self-Harm).

- Affective Instability showed no unique associations with EMSs.

- Identity Problems showed the most unique associations with EMSs.

Introduction

Borderline personality disorder (BPD) is one of the most chronic, serious, and challenging mental disorders characterized by core symptoms such as emotional instability, impulsivity, identity disturbance, problematic interpersonal relationships, and self-harming behaviors (American Psychiatric Association [APA], 2013; Bach & Sellbom, 2016). Epidemiological studies show that prevalence rates for BPD vary between 0.5 to 5.9% in the general population, running up to 25% in clinical populations (Grant, Chou, & Goldstein, 2008; Gunderson, 2009). BPD is a heterogeneous disorder, where people diagnosed with this disorder may represent one of the many different combinations of nine diagnostic criteria in DSM-5 (APA, 2013). In the ICD-11 (International Classification of Diseases), the Borderline Pattern Qualifier includes at least 5 out of 9 features from DSM-5 criteria for the diagnosis of Borderline Personality Disorder (Bach & First, 2018; World Health Organization, 2018). Despite its' heterogeneity, BPD is characterized by a chronic pervasive pattern of affective, interpersonal, identity, cognitive and behavioral instability, causing functional impairments in different aspects of life (APA, 2013; McMain & Pos, 2007). Therefore, understanding and managing the symptoms of BPD is a key challenge.

Several structured psychotherapeutic interventions show success in managing BPD symptoms, including schema therapy (ST), dialectical behavior therapy (DBT), mentalisation-based treatment (MBT), and transference-focused psychotherapy (TFP). Each of these therapies have demonstrated efficacy to reduce the severity of BPD symptoms in randomized controlled clinical trials (Farrell, Shaw, & Webber, 2009; Leppnen, Vuorenma, Lindeman, Tuulari, & Hakko, 2016; Zanarini, 2009). However, meta-analyses of psychotherapeutic treatments for BPD report small to moderate effects (e.g., Barnicot, Katsakou, Marougka, & Priebe, 2011; Cristea et al., 2017;

Kliem, Kroger, & Kosfelder, 2010; Sempértegui, Karreman, Arntz, & Bekker, 2013). Still, psychotherapy can be considered the best practice in the treatment of BPD (Bateman et al., 2015), with ST being one of the most effective psychotherapeutic approaches to decrease BPD symptoms (Sempértegui et al., 2013; Barazandeh, Kissane, Saeedi, & Gordon, 2016; Zanarini, 2009).

Extending Beck's schema model, Young's (1999) ST provides a promising integrative approach for the treatment of individuals with BPD symptoms and combines elements from cognitive-behavioral therapy, attachment theory, Gestalt theory, object relations theory, constructivism, and psychoanalytic schools (Bamelis, Evers, Spinhoven, & Arntz, 2014; James, Southam, & Blackburn, 2004; Kellogg & Young, 2006; Lockwood & Shaw, 2012; Taylor & Arntz, 2016). Early Maladaptive Schemas (EMSs) form a central concept in ST, referring to patterns of negative beliefs regarding oneself, others, and the world, which are long-standing, and give meaning to novel experiences (Young, 1999). EMSs are considered to be persistent dysfunctional patterns developed during childhood or adolescence, consisting of memories, emotions, cognitions, and bodily sensations. They influence how one views oneself and one's relationships with others, and prevent one from adequate development in the emotional-interpersonal field (Young, Klosko, & Weishaar, 2003). As such, EMSs are an essential factor in the conceptualization and treatment of BPD (Arntz, 2015; Barazandeh et al., 2016; Sempertegui et al., 2013; Young et al., 2003). A detailed description of all EMSs can be found in Young (2014) and Sempertegui and colleagues (2013).

Young (1999, 2014) originally suggested that several EMSs are particularly relevant to BPD, including those related to Abandonment, Dependence, Mistrust, Subjugation, Emotional Deprivation, and Insufficient Self-control. Although Young's original theory has received initial

support, empirical findings have shown mixed results. Indeed, most studies support the primary significance of schemas related to Abandonment, Dependence/Incompetence, Mistrust/Abuse, Defectiveness/Shame, Subjugation, Emotional deprivation, and Insufficient Self-control in the context of BPD (Arntz & Jacob, 2012; Bach & Farrell, 2018; Barazandeh et al., 2016; Young et al., 2003). Abandonment and Mistrust/Abuse schemas are the most consistent and reliable EMSs associated to BPD psychopathology in both clinical and nonclinical samples, but findings on the relationships between BPD and other EMSs are less consistent. Research mainly shows that BPD is related to Abandonment, Mistrust/Abuse, Social Isolation, Emotional Deprivation, Defectiveness/Shame, Dependence/Incompetence, and Insufficient Self-control schemas in clinical samples (Bach & Farrell, 2018; Bach et al., 2017; Frias et al., 2017; Gilbert & Daffern, 2013; Jovev & Jackson, 2004; Lawrence, Allen, & Chanen, 2011; Loper, 2003; Nilsson, Jorgensen, Straarup, & Licht, 2010; Shorey, Anderson, & Stuart, 2014; Specht et al. 2009).

Exploring the association between EMSs and BPD symptoms in non-clinical samples (e.g., healthy and at-risk samples) is of interest as it may shed more light on the early developmental trajectories of BPD symptoms without being confound by high levels of concurrent psychopathology. In this context, research suggests that Abandonment, Social Isolation, Insufficient Self-control and Enmeshment schemas are associated with BPD symptoms (e.g., Reeves & Taylor, 2007). Yet, in one study, after controlling for concurrent symptoms, Carr and Francis (2010) observed no associations between BPD symptoms and EMSs. In general, although most studies support an association between EMSs and BPD symptoms, the controversy concerning the specificity of EMSs in this context remains (for a recent review see Barazandeh et al., 2016). In particular, although previous studies suggest an association between BPD symptoms

and EMSs it remains unclear how specific EMSs relate to different BPD features (e.g., Self-harm/Impulsivity, Identity Problems, Affective Instability, and Interpersonal Relationships). Given the heterogeneity of BPD, we need a better conceptualization and treatment of specific BPD features in relation to ST and EMSs.

The complexity and multifaceted nature of the relationship between BPD features and EMSs requires novel techniques to better understand this intricate relationship. In this context, network analysis provides a comprehensive view on the unique associations between EMSs and different BPD symptoms. Network analysis refers to an analytical technique where the complex interplay between different constructs is mapped in a data-driven manner based on graph theory (Borsboom & Cramer, 2013; Costantini et al., 2015). In a network model, each variable included in the analysis is represented by a node. The unique associations between nodes are depicted by edges connecting one another. In addition, based on the Fruchterman-Reingold's algorithm, influential nodes gain a more central role in the network model (Fruchterman & Reingold, 1991). As a result, examination of the topological structure of a network may offer unique insights into the complex interplay between different constructs. Indeed, this technique has been increasingly used to map complex patterns of connectivity between psychological variables (e.g., Bernstein, Heeren, & McNally, 2017; Hoorelbeke, Marchetti, De Schryver, & Koster, 2016; Pereira-Morales, Adan, & Forero, 2017).

In the context of BPD, two recent studies have relied on network analysis to model the interconnectivity of BPD symptoms (Richetin, Preti, Costantini, & De Panfilis, 2017; Southward & Cheavens, 2018). However, as to date no studies have mapped the unique associations between EMSs and BPD features. This would be of particular interest given the central role of EMSs in ST

for BPD, and the inconsistencies in the prior literature linking EMSs to BPD symptoms, suggesting a complex relationship between both. To address this gap, the current study uses network analysis to model the unique associations between central BPD features (Affective Instability, Identity Problems, Negative Relations, and Self-harm) and EMSs in a non-clinical sample showing strong heterogeneity in BPD features.

Method

Participants

Participants were 706 undergraduate students (*Female*= 416, *Male*= 290) who were recruited from three big universities in Tehran, Iran. To be eligible for inclusion in the study, students had to be between 18 to 24 years old (*M*= 19.48, *SD*= 1.32), fluent in Persian, and should not use psychiatric medication. The students were excluded if they had used any substance or were on psychiatric medication. Eleven participants (1.5%) were excluded due to a previous diagnosis or use of medication. All participants provided informed consent prior to completing the survey. This study was approved by the Shahid Beheshti University Research Ethics Committee.

Measures

A battery of self-report measurements that have demonstrated good validity and reliability in Iranian samples were administered.

Demographic Characteristics. Demographic data was obtained using a self-report questionnaire in which the students provided information about their age, gender, history of psychiatric disorders, and use of psychiatric medication.

Personality Assessment Inventory–Borderline Subscale (PAI-BOR). The PAI-BOR (Morey, 1991) consists of 24 items rated on a 4-point scale ranging from 0 (false) to 3 (very true), and is made up of four subscales representing core features of BPD: Affective Instability, Self-harm/Impulsivity, Interpersonal Relationships, and Identity Problems. It includes items that directly map on to DSM–5 (APA, 2013) diagnostic criteria for BPD (e.g., DSM–5: chronic feelings of emptiness; PAI-BOR: "Sometimes I feel terribly empty inside") and items that describe features relevant but not identical to these criteria (e.g., PAI-BOR: "People once close to me have let me down"). Studies have demonstrated the validity and reliability of the PAI-BOR for use in nonclinical samples for assessing BPD features (Trull, 1995; Trull, Useda, Conforti, & Doan, 1997). Thus, this inventory served as an indicator of BPD features. The PAI-BOR inventory has been translated in Persian and indicated good concurrent validity (the correlation coefficients ranged between 0.68 to 0.89) in an Iranian sample (Esmailian, Dehghani, Khatibi, & Moradi, under review). In the current sample, the PAI-BOR demonstrated good internal consistency, with Cronbach's α for the subscales ranging between 0.69 and 0.82.

Young Schema Questionnaire - Short Form (YSQ-SF). The YSQ-SF consists of 75 items, designed in 1988 on the basis of Young's clinical observations to assess 15 EMSs. The 15 schemas include Emotional Deprivation, Abandonment, Mistrust/Abuse, Social Isolation, Defensiveness/Shame, Failure, Dependence/Incompetence, Vulnerability to Harm/Illness, Enmeshment, Subjugation, Self-sacrifice, Emotional Inhibition, Unrelenting Standards, Entitlement, and Insufficient Self-control. In the English version, each item is rated on a 6-point scale (1= Completely untrue of me; 2= Mostly untrue of me; 3= Slightly more true than untrue; 4= Moderately true of me; 5= Mostly true of me; 6= Describes me perfectly). In the English version

of the YSQ-SF, the mean score of subscales is used. In this context, a score above 3 will be considered problematic (Young et al., 2003). Adequate psychometric properties have been demonstrated for the English version of the YSQ-SF (Glaser, Campbell, Calhoun, Bates, & Petrocelli, 2002; Welburn, Coristine, Dagg, Pontefract, & Jordan, 2002). Given the specific sample characteristics, the current study used a Persian version of the YSQ-SF. In the Persian version of this questionnaire, every schema is evaluated using 5 items. In this version, response options range from 1 (completely untrue of me) to 5 (completely true of me). Furthermore, instead of using mean scores for subscales, subscale scores are typically obtained in this version of the YSQ-SF using the sum of responses for the relevant items. As such, the total numerical scores range between 5 and 25. Higher scores reflect stronger maladaptive schemas. The Persian version of the YSQ-SF has demonstrated adequate validity and reliability in Iranian samples (Ahi, Mohammadifar, & Besharat, 2007; Mojallal et al., 2015). Cronbach's alphas for the YSQ-SF subscales were estimated between 0.69 – 0.90 for all subscales (Ahi et al., 2007). Indeed, in the current study Cronbach's alphas for the EMSs ranged between 0.61 and 0.90.

Procedure

Upon signing the consent form, participants provided demographic information and completed a battery of self-report questionnaires including the PAI-BOR and YSQ-SF. These questionnaires were administered by trained psychology students who were blind to the purpose of the research project. We trained these students to be able to answer questions the participants might have about the questionnaires. At the same time, they were kept blind to the purpose of the research project to prevent possible biases in responding to participants' questions. The data were gathered over the course of six months. All participants who completed the questionnaire were

entered in the analysis. The questionnaires used in the current study were checked by the experimenters for missing data immediately after completion, so there was no missing data in these questionnaires. This study was part of a bigger project for the purpose of which additional measures were administered (which included indicators of anger rumination, sad rumination, pain catastrophizing, difficulties in emotion regulation, and affective dysfunctioning). Provided that these measures had no bearing to the current purposes they are not further discussed here.

Data analysis

Data-analysis was conducted in R version 3.5.0 (see supplemental material for version information of relevant R packages). As a first step, to improve normality, we conducted a nonparanormal transformation using the *huge* package (Zhao et al., 2015; for a more elaborate discussion on this method, see Epskamp & Fried, 2018).

Second, we used the *qgraph* package (Epskamp, Cramer, Waldorp, Schmittmann, & Borsboom, 2012) to estimate a Gaussian Graphical Model (GGM; cf. Epskamp & Fried, 2018). To remove spurious edges, we relied on the Graphical Least Absolute Shrinkage and Selection Operator (gLASSO; Friedman, Hastie, & Tibshirani, 2014) with Extended Bayesian Information Criterion model selection (EBIC; $\gamma = 0.5$). In particular, we implemented thresholding to maximize model specificity (Thresholded EBIC gLASSO), resulting in a sparse regularized partial correlation network. Next, we used the *mgm* package (Haslbeck & Waldorp, 2015) to estimate the variance of each node that is explained by its neighboring nodes. This is referred to as the 'predictability' of a node within the network.

We then conducted bootstrapping procedures to assess the accuracy of the edge weights and stability of the main centrality indices using the *bootnet* package (Epskamp & Fried, 2017). In

particular, we plotted sampling variability in edge weights, providing 95% confidence intervals for all edges included in the model, and mapped significant differences between edge weights. In addition, a case-dropping subset bootstrap was used to assess the stability of the order of centrality indices within subsets of the data. In this context, the obtained correlation stability coefficient should not be below 0.25 and preferably exceed 0.50 to be considered stable (Epskamp, Borsboom, & Fried, 2018). As main centrality indices we included indicators of node strength (i.e., the sum of absolute edge weights connected to each node), closeness (i.e., the inverse of the sum of distances between connected nodes), and betweenness (i.e., the amount of times a node lies on the shortest path between two other nodes; Costantini et al., 2015).

The obtained GGM was plotted with the *qgraph* package using a modification of the Fruchterman-Reingold's algorithm (Fruchterman & Reingold, 1991). This results in a network in which nodes are positioned in the model based on their connectivity: strongly connected nodes hold a more central position in the model whereas less connected nodes are positioned in the periphery of the model. Edges reflect the unique association between two given nodes, where the thickness and color of the edge reflects the strength and valence of this association (blue = positive, red = negative). The dimension of predictability of nodes is added to the network as a pie-chart in the outer ring of each node. For each node, the dark section in the outer ring of the node reflects the percentage of variance explained by its neighboring nodes. Finally, to facilitate our understanding of the relation between specific BPD features and EMSs, we plotted a flow diagram for each of the BPD features (Affective Instability, Identity Problems, Negative Relations, and Self-harm) based on the obtained GGM network structure. These flow diagrams depict the unique associations between a given BPD feature and the other nodes included in the model.

Results

Descriptive statistics for the variables of interest are reported in Table 1. Figure 1 depicts the GGM model, showing that the four BPD features (nodes 1 – 4) cluster together within the network. In addition, with the exception of Affective Instability (node 1) which only shows direct associations with the other BPD features, the different BPD features show unique patterns of associations with EMSs (see supplemental material Table 1 for the weight matrix). Moreover, a significant portion of variance in borderline symptoms is explained by the neighboring nodes.[1] That is, the predictability of Identity Problems, Negative Relations, and Self-Harm approached 50% (see Table 2). It is noteworthy that only 25% of variance in Affective Instability was explained by the neighboring nodes, among which were none of the EMSs. In addition, Affective Instability was the least central node in the network. Dependence/Incompetence was ranked highest both in terms of strength and closeness. Social Isolation and Insufficient Self-control were ranked highest in terms of betweenness, followed by Mistrust / Abuse and Negative Relations.

Stability analyses of the centrality indices suggest good stability for Strength (.67), acceptable stability for Closeness (.28), and poor stability for Betweenness (.21; see supplemental material Figures 1 – 3 for the stability analysis, analysis of edge weights accuracy, and significant edge differences). As such, Betweenness should not be interpreted.

Borderline symptom features schema connectivity

Based on the GGM, we plotted flow charts for each of the BPD features, which illustrate the unique patterns of connectivity with EMSs (Figure 3; supplemental material Table 1): (1) Affective Instability was most closely connected to Negative Relations. However, we observed no

direct association between Affective Instability and specific EMSs (Figure 3A). (2) Self-reported Identity Problems showed the strongest connection with Negative Relations. In addition, self-reported Identity Problems was uniquely connected to a multitude of EMSs, among which Abandonment, Insufficient Self-control, Dependence/Incompetence, and Vulnerability to Harm/Illness (Figure 3B). (3) Self-reported Negative Relations was most strongly connected to Self-Harm, but also showed unique connections with the EMSs Mistrust/Abuse and Abandonment (Figure 3C). (4) Finally, Figure 3D depicts the observed pattern of connectivity for self-reported Self-Harm symptoms. In line with the other BPD features, Self-Harm was most strongly connected to Negative Relations, representing the second strongest edge observed in the entire network (edge weight = .37, cf. supplemental material Table 1). In addition, Self-Harm was connected to Affective Instability, and early maladaptive schemas Emotional Deprivation and Failure.

Discussion

EMSs are considered to play a key role in BPD. Prior studies have typically explored the associations between EMSs of Abandonment, Mistrust/Abuse, Social Isolation, Emotional Deprivation, Defectiveness/Shame, Dependence/Incompetence, Insufficient Self-control and BPD as a whole (e.g., using total scores) in both clinical and non-clinical samples. For instance, Bach and Farrell (2018) showed that schemas of Mistrust/Abuse and Defectiveness/Shame differentiate BP patients from patients with other PDs, whereas Reeves and Taylor (2007) found relations between Abandonment, Social Isolation and Enmeshment while controlling for other PD symptoms. Furthermore, several studies have explored relations between severity of BPD symptoms and schema domains. For example, Frias and colleagues (2017) discovered direct

associations between Disconnection/Rejection and Other-directedness domains and occurrence of psychopathology among BPD patients. Other researchers proposed themes related to Impaired Autonomy and Over-vigilance would be common among individuals with BPD (e.g., Lawrence et al., 2011). However, previous studies exploring the associations between EMSs and BPD symptoms have typically yielded mixed findings. This pattern of results may have been influenced by the use of different schema questionnaires (many were developed by Young and his colleagues; short vs. long form), sample characteristics (e.g., clinical vs. nonclinical samples), and especially the heterogeneous nature of BPD. In particular, it remains unclear how specific EMSs are linked to distinctive BPD features such as Identity Problems, Affective Instability, Negative Relationships, and Self-Harm. In this context, network analysis shows the potential to significantly increase our understanding of the interrelations between EMSs and BPD symptoms. That is, network analysis allows to model how each of these given BPD features uniquely relate to specific EMSs, and identify which EMSs or BPD features are most central in the model. For this purpose, in a large non-clinical sample, we conducted a series of network analyses to explore the unique associations between four main BPD features and specific EMSs after controlling for the other features simultaneously. To our best knowledge, this is the first study modeling the interconnectivity between BPD features and specific EMSs using network analysis.

In order to explain how specific EMSs relate to BPD features, the current study used a non-clinical sample showing high heterogeneity in BPD features. Importantly, our findings suggest that the different BPD features show unique associations with specific EMSs. That is, the Identity Problems feature was associated with EMSs Abandonment, Insufficient Self-control, Dependence/Incompetence, and Vulnerability to Harm/Illness schemas; BPD Negative Relations

showed unique connections with Mistrust/Abuse and Abandonment, and BPD Self-harm was uniquely connected to Emotional Deprivation and Failure. These findings were partially consistent with prior studies linking the BPD with EMSs (e.g., Ball & Cecero, 2001; Bach & Farrell, 2018; Barazandeh et al., 2016; Butler, Brown, Beck, & Grisham, 2002; Frias et al., 2017; Gilbert & Daffern, 2013; Jovev & Jackson, 2004; Lawrence et al., 2011; Nilsson et al., 2010; Nordahl et al., 2005; Reeves & Taylor, 2007; Shorey et al., 2014; Specht et al., 2009). However, most of these studies have typically explored the association between BPD symptoms as a whole and the main EMSs, rather than exploring the distinctive relations between specific BPD features and schemas.

One of the influential schemas, according to our study, is Abandonment/Instability. Abandonment/Instability was specifically associated with Identity Problems and Negative Relations as BPD features. Here, it is noteworthy that Abandonment/Instability is the most consistently associated EMS with BPD psychopathology both in clinical and non-clinical populations (Ball & Cecero 2001; Jovev & Jackson 2004; Lawrence et al., 2011; Nilsson et al., 2010; Nordahl et al., 2005; Reeves & Taylor 2007). Abandonment/Instability is related to expectations that significant others are not able to continue providing emotional support, connection, strength, or practical protection because they are emotionally unstable, unpredictable or unreliable, and abandon the person in favor of someone better (Young et al., 2003). Clinically, this may be reflected in the observation that individuals suffering from BPD typically show heightened sensitivity signals of rejection (APA, 2013), while at the same time experiencing a strong need for emotional support. As such, the interpersonal style of people with BPD is characterized by a paradoxical, seemingly contradictory combination of strong needs for closeness and attention with an equally intense fear of abandonment (Gunderson & Lyons-Ruth,

2008). This paradoxical phenomenon contributes to the development of difficulties in forming and maintaining relationships. This paradox may also explain the association between Abandonment/Instability schema, interpersonal- (cf. Negative Relations), and Identity Problems.

Consistent with previous research, the Mistrust/Abuse schema was linked to Interpersonal problems (Negative Relations) in our sample. This early maladaptive schema reflects expectations of being abused or mistreated by others (Young et al., 2003). The identification of Mistrust/Abuse schema as a reliable indicator of BPD suggests that this EMS captures underlying mistrustful features including sensitivity to signs of interpersonal harm, and mistreatment as often experienced by BPD people (Bach & Farrell, 2018). Further, contemporary theories suggest that mistrust is a core symptom of BPD emerging from interference with the normal attachment process early in life, due to the unavailability or inconstancy of significant others who were supposed to be trustworthy (Oldham, 2010). Indeed, increased vigilance for interpersonal threats might contribute to the interpersonal difficulties in BPD individuals (Donges et al., 2015).

The Insufficient Self-control, Dependence/Incompetence, and Vulnerability to Harm/Illness schemas were particularly associated with Identity Problems. Insufficient Self-control reflects the inability to tolerate any frustration in reaching goals, as well as an inability to restrain the expression of impulses or feelings. Research showed that parents who do not model self-control or families who ignore and devaluate their children's emotions and thoughts may predispose them to acquire this schema (Young et al, 2003). Many people with BPD symptoms come from families with chaotic and abusive backgrounds. As such, people with BPD symptoms often report that they have no idea who they are or what they believe in. Sometimes they change whom they depend on their circumstances and what they think others want from them in order to

avoid abandonment. So, internal experiences and outward actions show lower consistency in these people, which may result in an unstable sense of self.

In the current study we also found an association between the Dependence/Incompetence schema and Identity Problems. The Dependence/Incompetence schema is characterized by the feeling of not being capable of getting by on your own in everyday life (Jovev & Jackson, 2004). In other words, people with high scores on this schema believe that they are unable to handle their own everyday responsibilities in a competent style without considerable help from others (Young, 1999). Zanarini and colleagues conceptualized the identity of people with BPD as overvalued ideas of inner worthlessness and/or badness with only brief periods of feeling positive about oneself (Zanarini et al., 2009). One rational for our finding about the unique associations between Identity Problems and Dependence/Incompetence is that if people persistently feel worthless, they may not be motivated to act, handle their responsibilities, or even reach a goal on their own. So, they may experience failure frequently and lose their confidence in taking adequate action.

Vulnerability to Harm/Illness also emerged as an important early maladaptive schema in this study, which is associated with Identity Problems in BPD individuals. This schema refers to the belief that one is always on the eve of experiencing a major catastrophe (financial, natural, medical, criminal, etc.). It supports the idea that the identities of people with BPD are defined by persistent negative opinions (Zanarini et al., 2009). When people with BPD symptoms believe that they are vulnerable to harm in most aspects of their life, they may lack confidence regarding their problem-solving skills and may instead rely on unpredictable people and external circumstances. This may further increase the probability of harm and strengthen negative self-views and Identity Problems.

Finally, we found that Emotional Deprivation and Failure to Achieve are related to Self-harm. Furthermore, Self-harm was most strongly connected to Negative Relations. The Emotional Deprivation schema reflects the expectation that significant others will not protect, show empathy, or be nurturing when in need (Young et al., 1999). This EMS can be related to the emotional invalidation construct in Linehan's Biosocial theory of BPD (Linehan, 1993). Linehan (1993) asserted that individuals who develop BPD are surrounded by an invalidating environment, one in which communication of emotional experience is met by inappropriate, and extreme responses by others. Although we did not observe a direct link between Emotional Deprivation and Failure to Achieve EMSs and Affective Instability, the observed association with Self-harm supports a link between these specific EMSs and the development of subsequent behavioral dysregulation. Our results are in line with the results of Lawrence and colleagues (2011) and Nilsson and colleagues (2010), according to which Failure to achieve was associated with BPD symptomatology. The Failure to achieve schema refers to an expectation of inevitable failure (Young, 1999). Believing in inevitable failure threatens self-esteem, decreases efforts, and results in helplessness. Helplessness, along with other BPD symptoms (e.g., rejection sensitivity and negative relations) may result in self-harm.

To our best knowledge, this study was the first to model specific associations between EMSs and BPD features using network analysis. Here, it is noteworthy that only some specific EMSs are exclusively associated with different BPD features, providing potential therapeutic targets and eliciting novel research hypotheses. These findings are of particular interest for clinicians as they allow a more detailed understanding of how specific BPD symptoms relate to EMSs. In particular, identifying and targeting these EMSs could be key in treatments of BPD such

as ST. As Sempertegui and colleagues (2013) in their review study showed, ST is associated with many positive outcomes, among which improvements at the level of different BPD symptoms.

Obviously there are a number of limitations and future challenges. First, based on previous research, schema modes (referred to as "modes") are also considered essential in the conceptualization and treatment of BPD with Schema therapy (Arntz, 2015; Farrell and Shaw, 2012). So, future research needs to take schema modes (measured with the Schema Mode Inventory) into consideration to investigate BPD features. Second, it should be noted that the current study is based on cross-sectional data, which does not allow to make causal inferences. Hence, further work is needed to elucidate the causal role of different ESMs. For now, the obtained network structure does allow generating hypotheses about the causal structure in the data for future longitudinal and experimental research. Third, participants in this sample were aged 18 to 24 years (early adulthood), a common period for the onset of BPD symptoms (APA, 2013; Reeves & Taylor, 2007). Assessing these associations in a non-clinical sample showing strong heterogeneity in BPD symptoms and EMS (cf. Table 1) has the advantage that the self-report measures are less likely to be biased by patterns of co-occurring psychopathology. However, at the same time this means that some of the observed interactions may not generalize to a clinical BPD sample. In sum, future studies should include longitudinal assessments of EMSs and BPD features during different developmental stages to determine how early maladaptive schemas are involved in the development of BPD symptoms. Moreover, the sample is predominantly female, which may potentially limit generalizability of our findings to male populations. The current study lacks power to split the sample based on gender. However, it would be interesting for future studies to model the influence of gender on the relation between BPD symptoms and EMSs. Finally, future

studies should include structured clinical interviews which allow diagnosing BPD. Nonetheless, this first exploratory study offers important insights regarding patterns of connectivity between specific BPD features and EMSs, which should be followed up in future research.

Conclusion

The current study set out to model the unique associations between borderline personality disorder (BPD) symptoms and early maladaptive schemas (EMSs). For this purpose, we conducted network analysis, estimating regularized partial correlation networks (Gaussian Graphical Models) depicting the unique associations between the constructs of interest in a non-clinical sample. Importantly, our results suggest that specific BPD features are associated with distinctive EMSs. Interestingly, Affective Instability showed no unique associations with EMSs. These findings suggest potential pathways between EMSs and specific BPD features and as such are of great theoretical and clinical interest.

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Footnotes

(1) Estimations of predictability of nodes within a network are based on network models estimated via *mgm* which uses as node-wise regression approach to estimate the network structure. Instead, the main analysis presented in this manuscript uses *qgraph*, which relies on inversion of the covariance matrix to estimate network models. As such, the aggregated model relies on two different methods where edges are estimated via *qgraph* and predictability via *mgm*. Importantly, the weight matrices for both estimation methods show a strong correlation ($r = .84$). This suggests that similar models were obtained using different estimation methods.

Table 1. *Descriptive statistics*

	Min.	*Max.*	*M*	*SD*
Borderline Personality Disorder features				
Affective Instability	3.00	16.00	7.64	2.46
Identity Problems	0.00	17.00	6.64	3.06
Negative Relations	0.00	16.00	6.85	2.78
Self-harm	1.00	14.00	5.99	2.63
Early Maladaptive Schemas				
Emotional Deprivation	5.00	24.00	11.31	4.40
Abandonment	5.00	25.00	13.20	4.57
Mistrust Abuse	6.00	25.00	12.46	3.48
Social Isolation	5.00	23.00	12.02	4.09
Defectiveness / Shame	5.00	20.00	9.38	3.95
Failure	5.00	24.00	9.63	4.36
Dependence / Incompetence	5.00	21.00	8.89	4.00
Vulnerability to Harm / Illness	5.00	25.00	10.99	3.99
Enmeshment	5.00	21.00	10.55	3.74
Subjugation	5.00	24.00	10.45	4.79
Self-sacrifice	5.00	24.00	13.60	4.40
Emotional Inhibition	5.00	25.00	11.71	5.01
Unrelenting Standards	5.00	25.00	15.42	3.98
Entitlement	5.00	25.00	15.03	4.12
Insufficient Self-control	5.00	24.00	13.28	3.69

Table 2. *Predictability of nodes*

Scale	R^2
Affective Instability [1]	.25
Identity Problems [2]	.48
Negative Relations [3]	.53
Self-Harm [4]	.50
Emotional Deprivation [5]	.46
Abandonment [6]	.35
Mistrust Abuse [7]	.38
Social Isolation [8]	.64
Defectiveness / Shame [9]	.74
Failure [10]	.72
Dependence/Incompetence [11]	.74
Vulnerability to Harm/Illness [12]	.52
Enmeshment [13]	.57
Subjugation [14]	.67
Self-sacrifice [15]	.33
Emotional Inhibition [16]	.47
Unrelenting Standards [17]	.30
Entitlement [18]	.45
Insufficient Self-control [19]	.56

Note: Variables 1-4 refer to BPD features assessed using the Personality Assessment Inventory

(PAI), whereas 5-19 refer to EMSs assessed using the Young Schema Questionnaire (YSQ-SF)
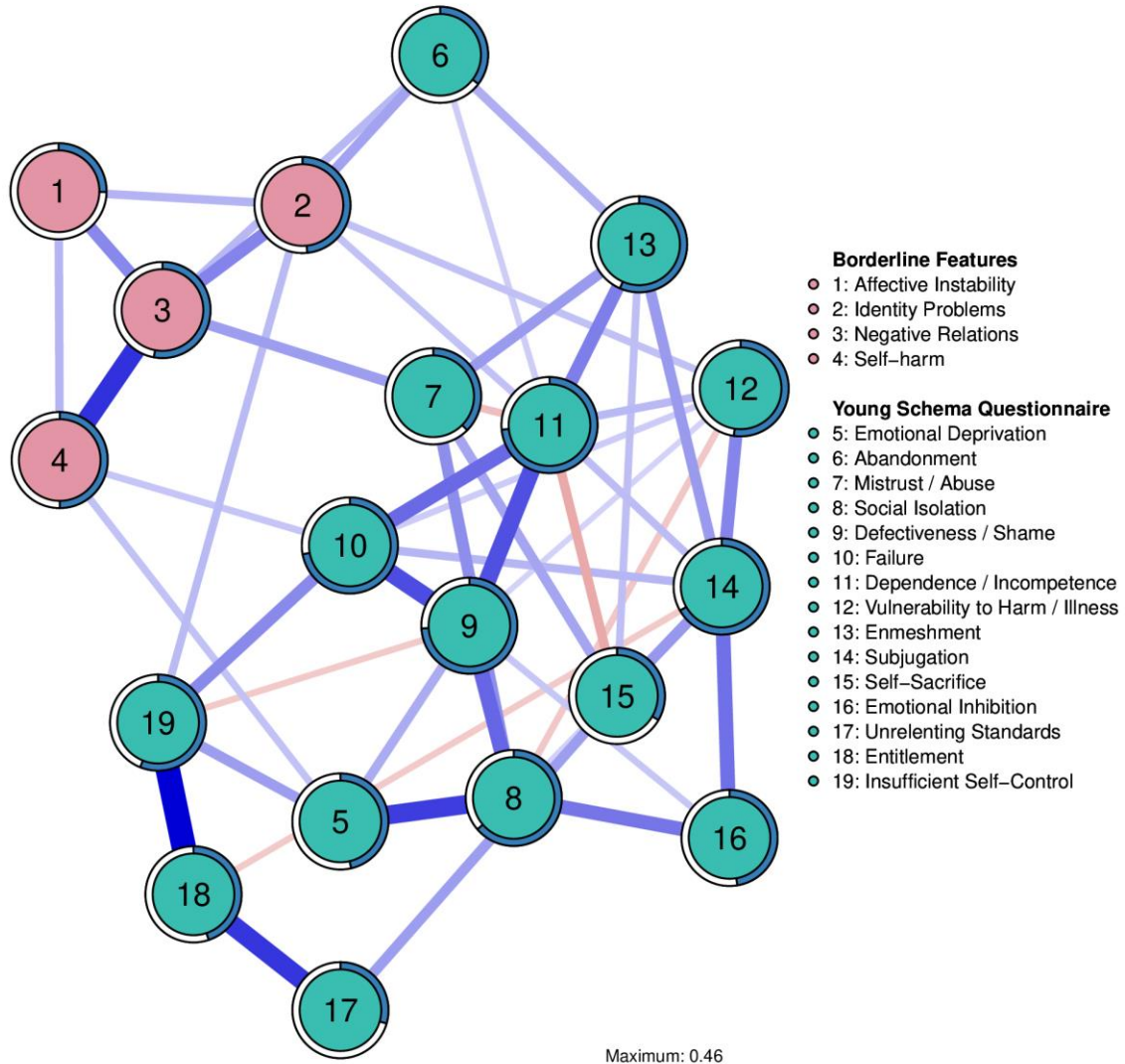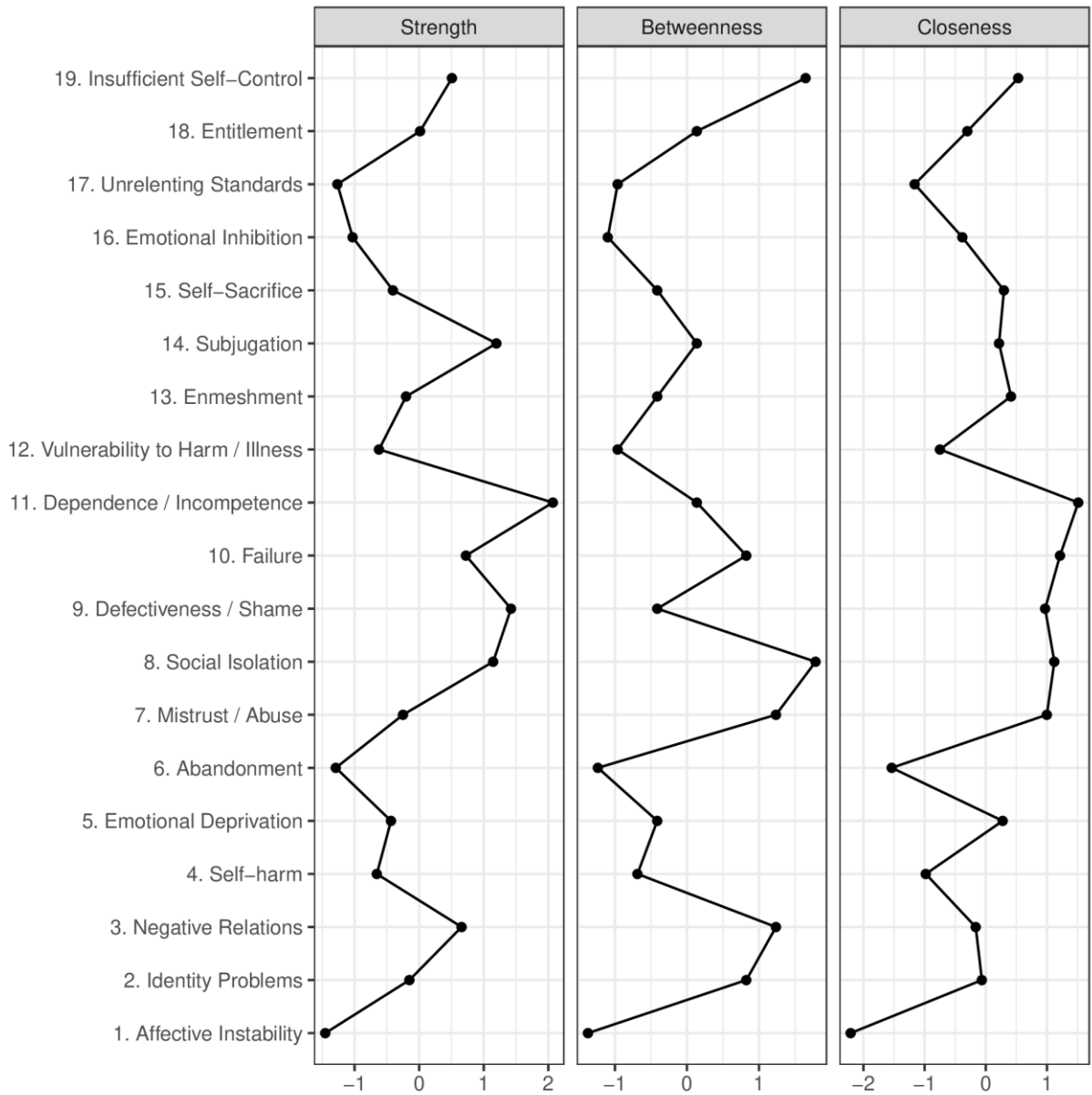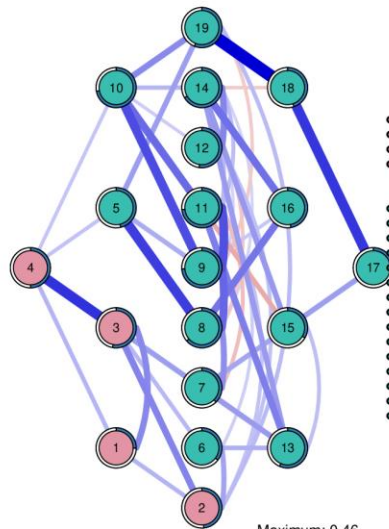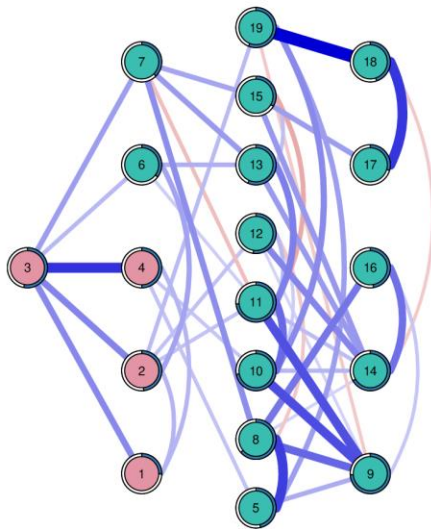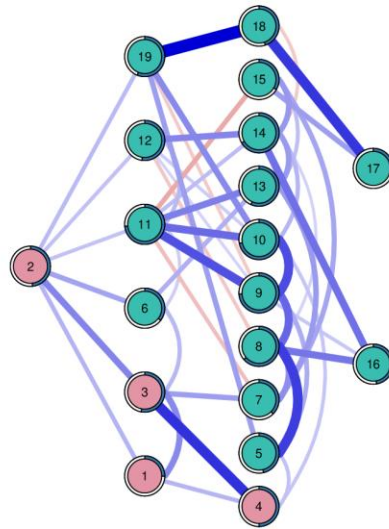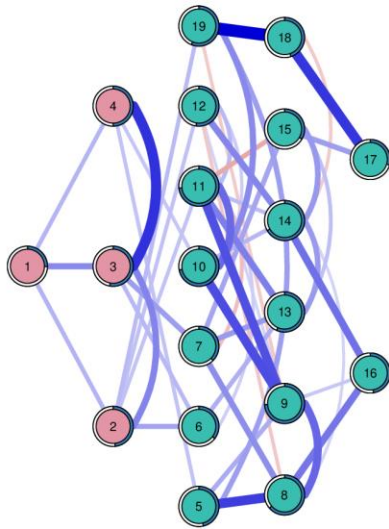
Borderline Features
- 1: Affective Instability
- 2: Identity Problems
- 3: Negative Relations
- 4: Self–harm

Young Schema Questionnaire
- 5: Emotional Deprivation
- 6: Abandonment
- 7: Mistrust / Abuse
- 8: Social Isolation
- 9: Defectiveness / Shame
- 10: Failure
- 11: Dependence / Incompetence
- 12: Vulnerability to Harm / Illness
- 13: Enmeshment
- 14: Subjugation
- 15: Self–Sacrifice
- 16: Emotional Inhibition
- 17: Unrelenting Standards
- 18: Entitlement
- 19: Insufficient Self–Control

Maximum: 0.46