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PERSON-CENTERED ANALYSIS OF ADHD COMORBIDITIES AND DIFFERENTIAL CHARACTERISTICS AND OUTCOMES

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PERSON-CENTERED ANALYSIS OF ADHD COMORBIDITIES AND DIFFERENTIAL CHARACTERISTICS AND OUTCOMES

DISSERTATION

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the College of Arts and Sciences at the University of Kentucky

By Christine Anne Lee

Lexington, Kentucky

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2018

ABSTRACT OF DISSERTATION

PERSON-CENTERED ANALYSIS OF ADHD COMORBIDITIES AND DIFFERENTIAL CHARACTERISTICS AND OUTCOMES

Attention-deficit/hyperactivity disorder (ADHD) is one of the most prevalent and impairing childhood disorders (5%; American Psychiatric Association, 2013), yet it is often studied in isolation. Such an approach is at odds with the clinical reality, where ADHD has a high comorbidity with oppositional defiant disorder, anxiety, and depression (Jensen, Martin, & Cantwell, 1997). Based on the possible presentations of ADHD with both externalizing and internalizing symptoms, there may be differences in associated characteristics, areas of impairment, and resulting assessment interventions. Therefore, the present study investigated how ADHD comorbidities manifested in a population of 233 elementary age children and how these profiles varied in already established characteristics (i.e., traits, social behaviors) and areas of deficit for children with ADHD (i.e., social functioning, academics, narrative comprehension). Characteristics and outcomes were examined using rating scales, behavior observations, laboratory tasks, and grades. Based on latent profile analyses, different patterns of comorbidity were identified using both parent and teacher ratings of ADHD. Based on parent and teacher report, those with high ADHD/ODD symptoms had more negative characteristics and outcomes. Network analyses corroborated these results, showing that internalizing symptoms were less relevant for associated characteristics and outcomes compared to ADHD and ODD symptoms. Overall, these results suggest that ADHD comorbidities may be primarily driven by ADHD and ODD symptoms, with this profile displaying more severe negative characteristics and outcomes.

KEYWORDS: attention-deficit/hyperactivity disorder, oppositional defiant disorder, internalizing, comorbidity, network analysis

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PERSON-CENTERED ANALYSIS OF ADHD COMORBIDITIES AND DIFFERENTIAL CHARACTERISTICS AND OUTCOMES

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This dissertation is dedicated to my family Stephen, Elaine, and Michelle Lee who have supported me throughout this journey. This would not have been possible without them. I also wish to dedicate this to Tom and Lillian Tang and Fred and Rose Lee, whose leadership and guidance over our family have served as a model for my own life.

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Chapter One: Introduction

Attention-deficit/hyperactivity disorder (ADHD) is one of the most common childhood disorders, affecting 5% of children in the United States with similar prevalence worldwide (American Psychiatric Association, 2013; Polanczyk, de Lima, Horta, Biederman, & Rohde, 2007). It is associated with high public health costs ($36-$52 billion for children and adolescents with ADHD per year; Pelham, Foster, & Robb, 2007), displays robust associations with multiple domains of impairment (i.e., social, academic), and predicts worse outcomes over a ten-year period (Hinshaw et al., 2012). Though there is an extensive literature examining the impairments of those with ADHD, this work often focuses on ADHD in isolation. This is in direct contrast to what is known about ADHD, which is that it is frequently comorbid with oppositional defiant disorder (ODD), anxiety, and depression (Jensen, Martin, & Cantwell, 1997; Souza, Pinheiro, Denardin, Mattos, & Rohde, 2004). Since each of these disorders have unique deficits, it is unclear how closely ADHD comorbidities will align with a "pure" (ADHD alone) presentation, especially if there are multiple comorbid disorders. Therefore, work is needed to better understand both ADHD comorbidities and their characteristics and areas of impairment in relation to "pure" ADHD.

ADHD and Comorbidity

Herman and colleagues (2007) stated that "diagnostic comorbidity is the rule for most childhood disorders" (p. 716). This statement is particularly true for ADHD, with estimates of comorbidity approximately 50% for ODD, 25% for anxiety, and 15% for depression (Jensen et al., 1997). In fact, one longitudinal study reported that 87% of those with ADHD or subthreshold levels of ADHD had at least one other diagnosis (Kadesjö &

Gillberg, 2001), leading the authors to conclude that “pure” ADHD is the atypical presentation, not the norm. Yet it remains unclear if and how comorbid presentations are distinct from “pure” presentations.

One possible framework for understanding comorbidity is through categorizing the effects as exacerbation, attenuation, or no effect (Becker, Luebbe, & Langberg, 2012; Becker, Luebbe, Stoppelbein, Greening, & Fite, 2012). The exacerbation effect suggests that similar disorders may display additive effects, such as increased impulsivity for those with ADHD/ODD. In contrast, the combination of externalizing and internalizing disorders, such as anxiety and ADHD, may have an attenuation effect, where the inhibitory effects of anxiety are hypothesized to curb impulsivity from ADHD (Becker, Luebbe, Stoppelbein, et al., 2012). Lastly, it also is possible that there is no effect of comorbid conditions. For example, those with ADHD/depression may look similar to those with ADHD alone and share comparable outcomes. These theories guide how ADHD comorbidities may differ from “pure” ADHD presentations in both characteristics, such as traits and social behaviors, as well as common areas of impairment, such as academic and social outcomes.

The permutations of ADHD comorbidities speak to the scientist-practitioner gap: researchers focus on “pure” presentations but clinicians are assessing and treating comorbid presentations (Doss & Weisz, 2006; Jensen et al., 1997). The scientist-practitioner gap is especially striking since, based on the mix of disorders, certain treatments may be contraindicated. For example, cognitive-behavior therapy is the firstline treatment for those with anxiety or depression but is not effective for those with ADHD (Bloomquist, August, & Ostrander, 1991; Herman et al., 2007). Previous work

also suggests that those with ADHD/anxiety have a better response to behavior therapy compared to those with ADHD only and a worse response to the stimulant methylphenidate (Jensen et al., 1997; Pliszka, 1989). However, those with ADHD, anxiety, and conduct disorder (CD) or ODD responded best to medication management rather than combined treatment (i.e., medication management and behavior therapy), though combined treatment is the current gold standard treatment for ADHD (Becker, Luebbe, Stoppelbein, et al., 2012; Jensen et al., 1997; Jensen et al., 2001). In contrast, those with ADHD/ODD/CD did not have a differential treatment response compared to those with ADHD only (Jensen et al., 2001). In fact, Doss & Weisz (2006) found that comorbidity in a community sample did not significantly affect treatment outcomes. Though the presentations of ADHD comorbidity have clear implications for assessment and treatment approaches, more work is needed to better delineate what these implications may be.

Person-Centered Analyses

Latent profile analysis. Previous research on ADHD comorbidities has been limited by its focus on ADHD with only one other comorbid disorder and its use of a priori, categorical analyses based on whether participants meet diagnostic criteria. There are several flaws with this approach. First, based on prevalence estimates (Jensen et al., 1997), it is unlikely that any given sample has only one type of comorbidity, thus clouding conclusions. Further, more recent conceptualizations suggest that disorders, particularly ADHD (Levy, Hay, McStephen, Wood, & Waldman, 1997) are best represented dimensionally, rather than categorically, in order to better capture the variability within disorders (Hudziak, Achenbach, Althoff, & Pine, 2007; Krueger &

Piasecki, 2002). This approach contrasts previous work that usually describes samples as mutually exclusive profiles, such as an ADHD profile, an anxiety profile, and an ADHD/anxiety profile. Lastly, such a priori profiles, though based in theory, may not be truly representative of the population studied. Therefore, more data-driven statistical approaches may be more useful in understanding this population (von Eye & Bergman, 2003). One such approach is latent profile analysis.

Latent profile analysis (LPA) is used to examine patterns across individuals based on shared characteristics and probabilities, forming discrete profiles based on these patterns. In other words, each profile represents an underlying latent variable, tying together comorbidity much more naturalistically than using multiple cut-off scores (Herman et al., 2007; Ostrander, Herman, Sikorski, Mascendaro, & Lambert, 2008). Based on theory, previous empirical work, and fit statistics, the investigator determines how many profiles best fit the data. By using LPA, ADHD and comorbid presentations naturally occurring in the sample can be identified on a more nuanced level than previous a priori, categorical approaches.

Only four previous studies have used LPA to examine ADHD comorbidity with ODD, anxiety, and depression. One population-based latent profile analysis of 2904 adolescent females found six profiles, with profiles falling into discrete disorders rather than combined presentations (i.e., inattentive, inattentive/ODD, ODD, separation anxiety, depression, mild hyperactive/impulsive, and all symptoms; Neuman et al., 2001). Two studies focusing primarily on clinical samples with internalizing disorders found comorbid ADHD profiles, with one study identifying disruptive/anxiety and highly disruptive profiles (Herman et al., 2007) and the other study identifying ADHD/irritable,

high irritable and mild ADHD/anxiety/depression, and high ADHD/anxiety/depression/irritable profiles (Kircanski et al., 2017). Lastly, and perhaps most relevant to our current sample, an analysis of 271 community children oversampled for ADHD identified six profiles, the majority of which were comorbid presentations: inattentive, inattentive/internalizing, inattentive/hyperactive/impulsive, moderately disruptive/depressed, severely disruptive/depressed, and moderate levels of all symptoms (Ostrander et al., 2008). Despite the limited amount of previous work, particularly within samples focused on ADHD, it appears that multiple ADHD comorbid profiles are found when using LPA. Moreover, there is evidence that some profiles may be similar in symptomology but differ in severity. Surprisingly, no work, to my knowledge, has been done to further examine these profiles once formed, leaving a clear gap in understanding how these presentations may manifest in relation to "pure" ADHD and each other. Rather, previous work has focused on distinguishing profiles based on ADHD subtypes (Hudziak et al., 1998) or personality traits (Martel, Goth-Owens, Martinez-Torteya, & Nigg, 2010). Therefore, I propose an extension of prior work by not only identifying comorbid presentations, but also exploring how these presentations may differ in both characteristics and outcomes commonly associated with ADHD.

Network analysis. Network analysis is a novel, data-driven approach that focuses on the interrelations among variables as a causal model of psychopathology (Borsboom & Cramer, 2013). The core data analytic method for network analysis is the examination of correlations among variables. The theory underlying network analysis is that symptoms are not simply indicators of a latent disorder, but that they instead directly influence each other, with correlations among symptoms reflecting these reciprocal

interactions. Networks can also extend beyond symptoms. For example, hyperactivity/impulsivity may lead to poor social skills, which can then lead to depression and peer rejection. If so, those processes will be reflected in stronger correlations and connectivity among variables. Networks are interpreted by focusing on variables, indicated by nodes, and the strength and directionality of their connections, called edges. Highly influential, or central, nodes to the network can be identified based on their interrelatedness to multiple other nodes in the network (Borsboom & Cramer, 2013). Notably, network analysis differs from regression analyses since centrality of nodes is not related to mean symptom levels (Mullarkey, Marchetti, & Beevers, 2018). Rather than symptom severity, network analysis is instead focused on the overall structure of relations among variables and their simultaneous interdependence (Galderisi et al., 2018). Similar to LPA, this approach does not require a priori hypotheses or assignment of predictor or outcome variables. Instead, this approach represents the existing interrelations among variables of interest.

Previous work using network analysis and ADHD has identified key, or core, symptoms of ADHD. Martel and colleagues (2016) found that ADHD symptom structure becomes less tightly clustered over time, with “easily distracted” and “difficulty sustaining attention” identified as the core symptoms of the network. Another study by Martel and colleagues (2017) found that impulsivity was core to ADHD and ODD symptom networks across childhood to young adulthood. Similar work identifying central symptoms and strong edges has been done on anxiety and depression (Hofmann, Curtiss, & McNally, 2016; Mullarkey et al., 2018). Yet, little work has examined comorbidity across different internalizing and externalizing disorders or how symptoms

may be related to common characteristics and outcomes. Recent work has explored anxiety and depression in a comorbidity network with bulimia nervosa (Levinson et al., 2017) whereas Garderisi and colleagues (2018) examined a network of schizophrenia symptoms and how these symptoms may relate to areas of impairment. However, to my knowledge, no work has examined ADHD networks in relation to both internalizing and externalizing comorbidities, common characteristics, and/or outcomes (Fried & Cramer, 2017). This work is key because identifying which aspects of ADHD comorbidities may be most strongly related to common characteristics and impairments can lead to better targeted interventions (Martel et al., 2016).

Characteristics of ADHD

Decades of research have firmly established the common characteristics associated with ADHD, such as aggressive behavior or lack of effortful control. However, it is unclear which of these hallmark features of ADHD may still be relevant when investigating ADHD comorbidities. Therefore, the current study focused specifically on traits, positive social behaviors, and negative social behaviors, including emotion regulation, and how they may differentially relate to ADHD comorbidities.

Traits. There is a robust literature connecting ADHD to traits across the lifespan. Temperament traits, defined as biologically based differences in reactivity and self-regulation, are commonly conceptualized into three main categories: negative affect, surgency, and effortful control (Eisenberg et al., 2001; Martel & Nigg, 2006; Rothbart & Bates, 1998; Tackett, Balsis, Oltmanns, & Krueger, 2009). Specific to ADHD symptoms, inattention is related to lower effortful control and hyperactivity/impulsivity is related to higher surgency (Martel & Nigg, 2006; Martel, Nigg, & von Eye, 2009). When

conceptualizing traits using the Five-Factor Model of personality traits (McCrae & Costa, 1987), inattention is related to higher neuroticism, lower openness, and lower conscientiousness whereas hyperactivity/impulsivity is related to higher neuroticism, higher extraversion, lower agreeableness, and lower conscientiousness (Martel et al., 2009). Overall, across both conceptualizations of traits, inattention appears related to lower effortful control or conscientiousness with hyperactivity/impulsivity related to higher surgency or extraversion and higher negative affect or neuroticism.

Studies have also examined relationships between traits and ADHD comorbidities. Negative affect is common to both ADHD/ODD (Martel, 2009) and ADHD/anxiety comorbidities (Baldwin & Dadds, 2008), with those with comorbid ADHD, ODD, and CD symptoms showing more anger compared to controls (Harty, Miller, Newcorn, & Halperin, 2009). Effortful control may also be common across ADHD comorbidities. A previous latent profile analysis of children with and without ADHD found that those in the poor control and extraverted profiles were more likely to have comorbid disorders (Martel et al., 2010). Overall, negative affect and effortful control may not only be associated with hyperactivity/impulsivity and inattention respectively, but with ADHD comorbidities as well.

Social behaviors. During peer interactions, those with ADHD display a range of both negative and positive social behaviors. Children with ADHD have been found to be more disruptive, noncompliant, and verbally and physically aggressive than comparison children (Erhardt & Hinshaw, 1994). They have difficulty following rules and volunteer to help less than comparison children (Barkley, 2010). These negative social behaviors also include high levels of emotion dysregulation, defined as an inability to display

appropriate behavior in response to strong positive and negative emotion (Barkley, 2010; Graziano & Garcia, 2016; Martel, 2009). Children with ADHD are emotionally labile when reacting to external stimuli, have difficulty returning to their baseline levels of emotionality, and cannot hide their emotions, even when explicitly told to do so (Barkley, 2010; Bunford, Evans, & Wymbs, 2015; Walcott & Landau, 2004). However, these higher rates of negative behaviors may be specific to the ADHD-combined presentation (i.e., symptoms of hyperactivity/impulsivity and inattention; Maedgen & Carlson, 2000; Wheeler & Carlson, 1994). Those with predominantly inattention symptoms may instead be more withdrawn or solitary and display less emotion dysregulation (Martel, 2009; Wheeler & Carlson, 1994).

Surprisingly, children with ADHD also display a high frequency of positive behaviors (Erhardt & Hinshaw, 1994) and are able to use competent group entry strategies (Ronk, Hund, & Landau, 2011). Thus, their social difficulties are not due to a lack of prosocial behaviors but may instead be attributed to their elevated concurrent negative behaviors.

Comorbid ADHD and ODD or CD symptoms are related to elevated levels of aggression, though it is unclear if it is ODD or ADHD symptoms driving differences in aggression (Becker, Luebbe, Stoppelbein, et al., 2012; Harty et al., 2009). Those with comorbid ADHD/ODD and ADHD/depression also struggle with emotion regulation (Barkley, 2010; Martel, 2009; Seymour et al., 2012; Seymour, Chronis-Tuscano, Iwamoto, Kurdziel, & MacPherson, 2014; Sobanski et al., 2010). In fact, some work has suggested that depressive symptoms may account entirely for the relationship between

ADHD and emotion regulation, with no relation found between ADHD and emotion regulation at high levels of depression (Seymour et al., 2012; Seymour et al., 2014).

Outcomes Associated with ADHD

ADHD has already been robustly associated with multiple areas of impairment. Children with ADHD struggle socially and academically as well as in narrative comprehension, a domain focused on recognizing characters' goals and motivations. What is less understood is the exacerbating or attenuating effect that ADHD comorbidities may have on these outcomes.

Social. Children with ADHD experience frequent and persistent peer rejection and struggle with having close friendships (Becker, Luebbe, & Langberg, 2012; Erhardt & Hinshaw 1994; Ronk et al., 2011). Children state that they would least like to be friends with children with ADHD compared to typically developing peers (Erhard & Hinshaw, 1994), with such dislike occurring as quickly as within five minutes of interaction (Diener & Milich, 1997). Such peer rejection is detrimental since children's reputations with peers are hard to change once established (Hoza, 2007). Subtype presentations may have differential relations with social functioning. Poor social functioning may relate more to the ADHD-combined presentation and social passivity may relate more to the ADHD-inattentive presentation (Karustis, Power, Rescorla, Eiraldi, & Gallagher, 2000; Maedgen & Carlson, 2000).

Previous work has found an exacerbating effect of comorbid ADHD/ODD, a result that has been replicated in both clinic and community samples (Gadow & Nolan, 2002). However, exacerbation effects of ADHD and externalizing problems appear to be more specific to parent and teacher reports of social functioning rather than peer reports

(Becker, Luebbe, & Langberg, 2012). The literature is mixed on the effects, if any, of comorbid anxiety and depression with ADHD (Becker, Luebbe, & Langberg, 2012; Becker, Luebbe, Stoppelbein, et al., 2012; Becker et al., 2014). Some studies have suggested an exacerbating effect of anxiety and depression (Karustis et al., 2000), with Mikami and colleagues (2011) finding that anxiety symptoms were significantly related to poorer social functioning even after controlling for ADHD and ODD. A literature review also concluded that anxiety may have an exacerbating effect on social skills and lower teacher rated social status with limited effects for depression (Becker, Luebbe, & Langberg, 2012). In contrast, other studies have found that this exacerbating effect was specific to depression (Becker et al., 2014; Blackman, Ostrander, & Herman, 2005), but not anxiety (Becker et al., 2014; Lee, Falk, & Aguirre, 2012; Ray, Evans, & Langberg, 2017). Though comorbid ADHD/ODD symptoms appear to exacerbate social outcomes, it is unclear the effect, if any, of comorbid anxiety and depression.

Academic. Children with ADHD have clear academic difficulties: they are more likely to drop out of school, less likely to complete higher education degrees, and more likely to be in special education classes **(**Hinshaw et al., 2012; Loe & Feldman, 2007; Mannuzza, Klein, Bessler, Malloy, & LaPadula, 1993**)**. Those with ADHD have worse grades and experience more disciplinary action in schools (e.g., expulsion, detention; Loe & Feldman, 2007). In fact, even those who have a subthreshold number of ADHD symptoms still experience similarly poor academic outcomes (Loe & Feldman, 2007). Some work has identified inattention, rather than hyperactivity/impulsivity, as particularly related to worse academic outcomes, such as lower grades and achievement scores (DuPaul et al., 2004; Hudziak et al., 1998; Milich, Balentine, & Lynam, 2001).

Similar to social outcomes, results have been mixed about how ADHD comorbidities may be associated with academic outcomes. There is evidence that comorbid ADHD/ODD has an exacerbating effect (Cuffe et al., 2015) or is unrelated (Liu, Huang, Kao, & Gau, 2017) to academic outcomes. Work has also found that internalizing symptoms have a minimal exacerbating effect on academic outcomes (Becker et al., 2014; Blackman, Ostrander, & Herman, 2005; Karustis et al., 2000) after accounting for ADHD and ODD symptoms, though one study found a ten-fold effect of comorbid ADHD/internalizing, albeit with large confidence intervals (Cuffe et al., 2015). There is evidence both for comorbid ADHD/anxiety leading to more impaired academic performance (Jensen et al., 2001) and no relationship between anxiety and academic problems once ADHD, ODD, and depression symptoms were accounted for in the model (Becker et al., 2014). Clearly more study is needed to better understand the effects of ADHD comorbidities on academic outcomes.

Narrative comprehension. Narrative comprehension focuses on children's understanding of goal structure in a story, such as characters' motivations, attempts to reach goals, and the outcomes of these attempts. Children with ADHD have displayed robust difficulties in these domains when recalling previously heard or seen stories and when creating their own stories. Compared to typically developing peers, children with ADHD have trouble remembering important events from a story, creating inferences about important story information not explicitly stated, and re-telling stories in a coherent manner (Bailey, Lorch, Milich, & Charnigo, 2009; Berthiaume, Lorch, & Milich, 2010; Flake, Lorch, & Milich, 2007; Van Neste, Hayden, Lorch, & Milich, 2015). When creating their own stories, children included fewer goal-based events and had less

coherent stories overall (Freer, Hayden, Lorch, & Milich, 2011; Leonard, Lorch, Milich, & Hagans, 2009). These difficulties persisted over time and were not ameliorated by medication (Bailey, Derefinko, Milich, Lorch, & Metze, 2011; Bailey et al., 2009; Lorch, Milich, Flake, Ohlendorf, & Little, 2010). Flory and colleagues (2006) have found that difficulty with sustained attention accounts for much of the variance in story comprehension difficulties, which is unsurprising given the relevance of narrative comprehension to academics. No work to my knowledge has examined narrative comprehension difficulties and ADHD/comorbidities; thus, it is unknown how ADHD comorbidities may relate to narrative comprehension performance.

Purpose

The purpose of this study was to understand ADHD and its comorbid presentations using data driven statistical approaches. Latent profile analysis was used to determine what patterns of comorbidity were found in a sample of elementary age children who were oversampled for ADHD symptoms. These profiles were further delineated by examining how they may differ in both levels of transdiagnostic characteristics (i.e., traits, social behaviors) as well as in key areas of impairment for children with ADHD (i.e., academics, social outcomes, narrative comprehension). Lastly, network analysis was conducted to investigate what symptoms of comorbidity may be central to networks of characteristics and outcomes. Using these statistical approaches to identify symptoms that may cross-cut different disorders ties in with current Research Domain Criteria initiatives from the National Institute of Health focusing on dimensional views of psychopathology (Garvey, Avenevoli, & Anderson, 2016), which may be more representative of disorders (Doss & Weisz, 2006).

Chapter Two: Method

Participants

Children between the ages of 8 – 10 (M = 8.83, SD = 0.81, 46% white, 42% black; see descriptives in Table 1) and their caregivers were recruited from the community in both Ohio and South Carolina (e.g., schools, pediatric offices, parent support groups, media advertisements) as part of a larger project studying social skills in children with ADHD. Those recruited from Ohio reported higher levels of anxiety and both parent and teacher rated ODD ($p < .05$) with no other significant differences in psychopathology between sites. Of the 372 children initially assessed, 322 children were eligible to participate in the study with 11 (3%) ineligible due to medications, 29 (8%) ineligible due to IQ, 5 (1%) ineligible due to an incomplete evaluation, and 5 (1%) ineligible due to other reasons. Those who were ineligible due to IQ were significantly more anxious than those who were eligible ($p < .03$) and those who were ineligible due to medications had more symptoms of parent-rated ODD ($p < .03$). There were no other significant differences in psychopathology between those who were and were not eligible for the study. From the eligible sample, 233 children participated in the full procedure, comprised of both an individual session and playgroup session. Those with ADHD were oversampled, resulting in 51% of the sample positive for ADHD diagnoses. Boys (70%) were also oversampled to better match the prevalence rate of ADHD. Those who were eligible but did not complete the full procedure were more anxious and had higher parent ratings of oppositionality ($p < .05$) compared to those who were eligible and did complete the full procedure. There were no significant differences in psychopathology based on race/ethnicity.

Diagnoses were based on the Children's Interview for Psychiatric Syndromes-Parent Version (P-ChIPS; Fristad, Teare, Weller, Weller, & Salmon, 1998) and parent- and teacher-report on both the Disruptive Behavior Disorders Rating Scale (DBD; Pelham, Gnagy, Greenslade, & Milich, 1992) and the Impairment Rating Scale (Fabiano et al., 2006). Based on this procedure, five children (2%) met criteria for ADHD-hyperactive/impulsive presentation, 35 children (15%) for ADHD-inattentive presentation, and 79 children (34%) for ADHD-combined presentation. Moreover, 23 children (10%) met criteria for generalized anxiety disorder, 6 children (3%) met criteria for a major depressive disorder, and 28 children (12%) met criteria for ODD.

All participants scored above 80 on the Wechsler Abbreviated Scale of Intelligence Second Edition, were fluent in English, and were not diagnosed with medical diagnoses that could also account for academic or social impairment (e.g., head injuries, physical deformities) or interfere with completing research procedures (e.g., severe visual or hearing impairment). Those with other comorbid conditions that could also account for social skills difficulties, such as pervasive developmental disorders, bipolar disorder, and schizophrenia, were excluded from the study. Those with learning disorders (12%) were not excluded from the study. Further, those on psychiatric medications that could not be stopped during study participation were also excluded (e.g., non-stimulants, selective serotonin reuptake inhibitors). Those taking stimulant medications (22%) were unmedicated the days of testing sessions.

Procedure

Children and caregivers first participated in an individual session with informed consent/assent obtained from all caregivers/children. Parents filled out rating scales

regarding children's symptoms of ADHD and ODD as well as any associated impairment. Parents also participated in a semi-structured interview about children's symptoms of psychopathology and completed a rating scale about their children's traits. Children completed ratings scales about their symptoms of anxiety and depression and an IQ screen. They also participated in narrative comprehension tasks by listening to two short, audiotaped fables and watching one half-hour episode of the family sitcom *Growing Pains*. After each fable and at the end of the *Growing Pains* episode, children were asked to recall as much of the story as possible. Examiners gave two prompts asking children to elaborate more on the story. Children also answered 20 open-ended questions about the *Growing Pains* episode. Teachers were invited to complete ratings scales about children's ADHD and ODD symptoms, academic competence, and to provide grades through email invitations.

Children who were still eligible to participate in the study after the initial session then were invited to a three-hour, same gender playgroup with unfamiliar peers. There were 30 playgroups run (22 boy groups, 8 girl groups, $M = 8$ children per group). Within each playgroup, about half the children were diagnosed with ADHD and half were not. The playgroup consisted of five 20-minute tasks, ranging from structured to unstructured, designed to elicit a variety of social behaviors. For the first task, children communally chose a group name and decorated a banner. This task required cooperation, communication, and compromise for children to complete a joint product. Then, children had a free play period where they could play with whomever they wanted using a variety of toys (e.g., basketball hoop, Lincoln logs). This task represented a naturalistic play environment where there were no rules or restrictions. After the free play, children

needed to work together on a problem-solving task using four mousepads to cross the room. The room was too wide for children to simply walk across and children had to start the task over if anyone stepped off the mousepads. Therefore, children needed to work together to create and implement a strategy. Then, children were each given a group of puzzle pieces to complete one, large puzzle. Children were not allowed to touch each other's pieces, so children needed to communicate with one another to complete the task. Lastly, there was a second free play period. At the conclusion of the playgroup, children individually met with a staff member to anonymously rate themselves and their peers on various social questions (e.g., likeability, cooperation). Adult staff supervising the playgroup also rated the children on the same questions.

Measures

Psychopathology. *Disruptive Behavior Disorders Rating Scale.* Parents and teachers rated the severity of symptoms of ADHD and ODD using a 0 (*Not at all*) – 3 (*Very much*) scale on the Disruptive Behavior Disorders Rating Scale (Pelham et al., 1992). The DBD displayed acceptable internal consistency for this sample (α = .86-.94) with previous work indicating strong negative and positive predictive validity (Owens & Hoza, 2003; Pelham et al., 1992). The total number of inattention symptoms, hyperactivity/impulsivity symptoms, and ODD symptoms endorsed by parents and teachers were used with separate analyses run for parent and teacher reports.

Children's Depression Inventory-2. Children reported on symptoms of depression using a 3-point scale on the Children's Depression Inventory-2 (CDI-2; Smucker, Craighead, Craighead, & Green, 1986). The scale demonstrated adequate internal consistency in this sample (α = .82) with previous work providing evidence for the CDI-

2's discriminant and construct validity (Saylor, Finch, Spirito, & Bennett, 1984). The total sum T-score was used with a T score of 61 and above considered above average.

Screen for Child Anxiety Related Emotional Disorders. Children also reported on their anxiety symptoms using a 0 (*Not true or hardly ever true)* – 2 (*Very true or often true*) scale on the Screen for Child Anxiety Related Emotional Disorders (SCARED; Birmaher et al., 1997). The SCARED has previously demonstrated good discriminant validity between anxiety and other disorders as well as within anxiety disorders (Birmaher et al., 1997; Birmaher et al., 1999). Questions covered the following domains: anxiety disorder, panic disorder or significant somatic symptoms, generalized anxiety disorder, separation anxiety, social anxiety, and significant school avoidance. The total sum score was used and demonstrated sufficient internal consistency (α = .92). A sum score of 25 or above indicated a possible anxiety disorder.

Characteristics. *Temperament in Middle Childhood Questionnaire.* Parents completed the Temperament in Middle Childhood Questionnaire (TMCQ) using a 1 (*Almost always untrue*) – 5 (*Almost always true*) scale (Simonds, 2006; Simonds, Kieras, Rueda, & Rothbart, 2007). The current study used the scales activity level, affiliation, anger/frustration, assertiveness/dominance, fear, high intensity pleasure, impulsivity, inhibitory control, sadness, shyness, and soothability/falling reactivity as these scales appeared to best map on to both the temperament and personality traits previously associated with ADHD (e.g., affect, effortful control). All scales displayed adequate internal consistency (α = .75-.93).

Global emotion dysregulation. Emotion dysregulation was observed during the playgroup. Each child was assigned an overall global rating of his or her emotion

dysregulation during each of the five tasks on a 1 (*Low*) -5 (*High*) scale. Emotion dysregulation was defined as "situationally inappropriate and disproportionate emotional response in tone of voice, manner, content, and/or expression." All tasks were double coded by graduate and undergraduate research assistants blinded to each child's diagnostic status. There was sufficient interrater reliability among coders (ICC = .88). The mean of the two coders was used for each task and the overall mean rating of global emotion dysregulation over all five tasks was used in analyses.

Frequency of social behaviors. The frequency of both positive (e.g., prosocial, conversation) and negative (e.g., disruptive, aggressive) behaviors was summed for each child in each task by graduate and undergraduate research assistants. Based on the 30% of the sample that was double coded, interrater reliability was adequate (ICC = .73-.87) with lower reliability for prosocial behaviors (ICC = .66). The current study used the average frequency counts of off task, solitary, prosocial, negative, disruptive, and aggressive behaviors over the five tasks.

Social Outcomes. *Playgroup ratings.* Social outcomes were assessed using the social questions asked to staff and children at the end of the playgroup. Questions were rated on a 1 (*Not at all*) - 4 (*Very much*) scale. The current study used the following four questions: how much peers liked the child, how hard the child made it to finish tasks, how well the child followed rules, and how well the child cooperated. Asher and Dodge (1986) found that using a similar rating scale had convergent validity with peer nominations.

Social skills. Teachers completed 46 items on the Social Skills Improvement System (Gresham & Elliot, 2008b) to rate children's social skills across areas such as

cooperation, engagement, and empathy. Higher scores indicated better social skills. The percentile of the social skills sum score was used with acceptable internal consistency demonstrated ($\alpha = .97$) and previous work indicating satisfactory convergent and discriminant validity (Gresham & Elliott, 2008a).

Global rating of peer rejection. Blind graduate and undergraduate coders rated how much peer rejection each child experienced per task on a scale of 1 (*Low*) – 5 (*High*). Examples of peer rejection were defined as being excluded from activities, receiving negative words/actions, and being ignored when making social overtures. Each child was double coded with the mean between the coders over all five tasks used in analyses. Coders had acceptable interrater reliability (ICC = .85).

Academic outcomes. *Grades.* Teachers reported on children's grades for the two grading periods before and two grading periods after the children participated in the study. Grades were standardized into one system to be commensurate across schools and included the children's grades in language arts, math, science, and social studies. The average overall grade point average (GPA) across all children and available grading periods was used.

Academic Competence Evaluation Scales. Teachers also rated children's academic competence using the Academic Competence Evaluation Scales (DiPerna & Elliott, 1999) in the domains of language arts and mathematics. Previous work found acceptable test-retest stability and convergent validity (DiPerna & Elliott, 1999). These two domains displayed acceptable internal consistency ($\alpha = .97$). Higher scores indicated higher competence in these areas.

Narrative comprehension. *Growing Pains questions*. At the end of the *Growing Pains* episode, children answered 20 open-ended questions about the episode. Questions were explicit, where the answer was shown or said onscreen (e.g., What were the mother and sister carrying when they exited the closet?) or causal, where the child had to tie together character's goals or motivations with story events to answer the question (e.g., Why was the father angry that the son was playing video games?). Causal questions were further split into explicit causal, where the characters explained the connection among actions and responses onscreen, or inferential causal, where the children had to make their own connections to understand the answer. The percentage of explicit causal and inferential causal questions answered correctly were used in the study.

Inferences. Children's recalls of two audiotaped fables and one episode of the family sitcom *Growing Pains* were transcribed and coded for how many explanatory plausible inferences were made during each recall. Explanatory plausible inferences are defined as key information to the story that is not explicitly stated but is necessary to understand the story. For example, one fable says the crowd claps for the strongest man in a competition but does not name who that man is. Therefore, children must determine who the strongest man is based on the contextual information in the story. The average number of explanatory plausible inferences made across both fables and the number of explanatory plausible inferences made in the *Growing Pains* recall were used in analyses. Interrater reliability was adequate (ICC = .77-.79) across raters.

Global coherence. Graduate and undergraduate coders read over children's recalls and rated how well each recall flowed together on a scale of 1 (*Low*) – 4 (*High*). When rating global coherence, coders considered if stories had a clearly stated goal and

resolution, made logical sense, and used transitions. The average global coherence across both fables and the global coherence of the *Growing Pains* recall were used. Interrater reliability was sufficient across raters (ICC = .91-.94).

Analytic Plan

Latent profile analyses. Latent profile analyses using full information maximum likelihood estimation with 2000 random starts were conducted using M*plus* 7 (Muthén & Muthén, 1998-2012). Profiles were evaluated in a stepwise fashion, starting with 1 profile and increasing the number of profiles until fit statistics were maximized (i.e., smaller Bayes Information Criteria [BIC], higher relative entropy; non-significant Lo-Mendell-Rubin likelihood ratio test; Grant et al., 2006; Kline, 2005; Nylund, Asparouhov, & Muthén, 2007) or models would no longer converge. Conceptual profile separability and interpretability were also considered when determining the best number of profiles that fit the data. Variance was freed for ratings of hyperactivity/impulsivity, anxiety, and depression and constrained for ratings of inattention and ODD to aid in model convergence. Due to known cross-informant discrepancies (De Los Reyes & Kazdin, 2005), two LPA were conducted, one based on parent report of ADHD and ODD symptoms and another based on teacher report of ADHD and ODD symptoms.

Profile comparisons. After profiles were identified for both parents and teachers, MANOVAs were conducted in SPSS version 24 to compare profiles on traits, social behaviors, social outcomes, academic outcomes, and narrative comprehension. Significant omnibus tests were further examined using post-hoc comparisons to determine which specific profiles were significantly different from one another. Due to

the multiple comparisons run, significance levels were set at $p < 0.01$. Separate MANOVAs were analyzed for parent and teacher identified profiles.

Network analyses. Graphical Gaussian Models using Least Absolute Shrinkage and Selection Operator were run to create glasso networks (Friedman, Hastie, & Tibshirani, 2008) in R using the package qgraph (Epskamp, Cramer, Waldorp, Schmittmann, & Borsboom, 2012). Glasso networks indicated the correlations among nodes in the network while simultaneously accounting for all other pairwise correlations. Glasso networks also set minimal correlations to zero, thus reducing the number of spurious correlations and presenting a sparser overall network (Bernstein, Heeren, & McNally, 2017). This procedure used the extended Bayesian information criterion model selection to choose the sparsest network (Foygel & Drton, 2011). The Fruchterman-Reingold algorithm, which placed the more strongly connected nodes in the center of the network with less connected nodes at the edge of the network, was used to create a visual representation of the network (Fruchterman & Reingold, 1991). The thickness of the lines connecting nodes (i.e., edges) indicated the magnitude of the correlation, with green representing positive correlations and red representing negative correlations.

Three different measures of centrality (i.e., betweenness, closeness, strength) were used to determine core symptoms using the qgraph package in R (Boccaletti, Latora, Moren, Chavez, & Hwang, 2006; Freeman, 1978; Epskamp et al., 2012). Betweenness indicated how often a node is on the shortest path between two other nodes, suggesting that such a node may have mediated between two other nodes. Strength was the sum of the absolute values of all the edge weights, or partial correlations, a node had with all

other nodes in the network. Closeness indicated the average distance between a node to other nodes in the network (Hofmann et al., 2016).

Once centrality values were identified, case-dropping analyses were conducted to determine the stability of centrality indices by determining how many cases could be dropped to maintain a .7 correlation between the original network centrality value and the case-subset network using the bootnet package in R (Epskamp, Borsboom, & Fried, 2018). Only those indices that had at least a correlation stability coefficient (*CS*-coefficient) greater than .5 were interpreted. The bootnet package was also used to calculate edge weights, or the magnitude of partial correlations between nodes. Edge weights were calculated using bootstrapping with 95% confidence intervals to determine which nodes were most strongly connected (Epskamp et al., 2018).

Clustering coefficients were examined to determine how well neighbors of nodes were connected to one another using the package qgraph. If neighbors of a node were highly connected, then the original node may be seen as redundant as the neighboring nodes would still be connected if the original node was missing (Constantini et al., 2015). Zhang's clustering coefficient was used due to its stability properties in the face of network variations. Small worldness of the network was also examined to see how tightly the network was connected. Networks with a high small worldness, as indicated by values greater than three, would have nodes tightly clustered together, with fewer edges needed to connect one node to another (Constantini et al., 2015). Networks with high clustering or small worlds may indicate a group of particularly connected nodes within the network.

Lastly, the Network Comparison Test was conducted between both parent and teacher networks to determine if networks significantly differed in structure and strength of connections (van Borkulo, 2018). The package NetworkComparisonTest was used in R to calculate if there were significant differences between the global strength and edge weights of the two networks based on 100 permutations of the data.

Table 1

Demographic Information for Overall Sample

	%	*M*	*SD*
Age in years		8.83	0.81
Grade		3.26	0.95
Males	70		
Race			
White	46		
Black	42		
American Indian/Alaskan	<1		
Multiracial	12		
Diagnosis (%)			
ADHD- Inattentive	15		
ADHD-Hyperactive/Impulsive	2		
ADHD-Combined	34		
No diagnosis	49		
Mean symptoms endorsed by parent			
Hyperactive/Impulsive		3.09	3.02
Inattention		3.68	3.29
Oppositional/Defiant		1.29	1.87
Mean symptoms endorsed by teacher			
Hyperactive/Impulsive		2.31	2.89
Inattention		3.03	3.09
Oppositional/Defiant		1.16	2.06
Mean anxiety total score by child		26.59	15.25
Mean depression total T-score by child		54.44	10.31

Note. n = 233, M = mean, SD = standard deviation.

Chapter Three: Results

Latent Profile Analyses

Parent report. Profiles were run for 1-4 profile solutions (see fit statistics in Table 2) with a 5-profile solution unable to replicate the best loglikelihood value. Based on the latent profile analysis of parent reported symptoms of children's inattention, hyperactivity/impulsivity, and oppositional defiant disorder as well as children's report of anxiety and depression, a 3-profile solution best fit the data (BIC = 6624.79, entropy = .90, Lo-Mendell-Rubin Adjusted Likelihood Ratio Test p = .001). These profiles were best described as a Low Overall Symptoms profile, High ADHD/ODD Symptoms profile, and High Inattention Symptoms profile (see Figure 1, anxiety and depression scores were transformed into average ratings to provide comparable scaling to other symptoms). Demographics and symptom ranges based on profiles are shown in Table 3.

The Low Overall Symptoms profile (n = 94) was primarily male (73%), similar to the overall sample, with children primarily identifying as white (55%), then black (37%). The mean age of children in this profile was 8.72 years (SD = 0.80) and the mean grade was 3.19 (SD = 1.00). Most children in this profile had no ADHD diagnosis (93%). Children in this profile had the lowest number of inattention, hyperactivity/impulsivity, ODD, and depression symptoms, significantly lower than the other profiles. Children in this profile also had a significantly lower level of anxiety than the High Inattention Symptoms profile.

The High ADHD/ODD Symptoms profile (n = 42) was primarily male (71%) with children primarily identified as either black (41%) or white (38%). Thus, the gender and racial make-up of this profile was similar to the overall sample. The mean age of

children in this profile was 9.00 years (*SD* = 0.80) and the mean grade was 3.52 (*SD* = 0.92). Most children in this profile were diagnosed with ADHD-combined presentation (74%). Children in this profile had the highest number of inattention, hyperactivity/impulsivity, and ODD symptoms compared to the two other profiles. Children in this profile also had a higher level of depression compared to the Low Overall Symptoms profile.

The High Inattention Symptoms profile (*n* = 96) was primarily male (68%) with most children identifying as either white (41%) or black (47%). The gender and racial make-up of this profile was similar to the overall sample. The mean age of children in this profile was 8.86 years (*SD* = 0.83) and the mean grade was 3.22 (*SD* = 0.90). Most children in this profile were diagnosed with ADHD-combined presentation (49%) and ADHD-inattentive presentation (25%). Children in this profile had higher symptoms of inattention, hyperactivity/impulsivity, and ODD than the Low Overall Symptoms profile but fewer symptoms than the High ADHD/ODD Symptoms profile. Children in this profile had significantly higher levels of anxiety and depression compared to the Low Overall Symptoms profile.

Teacher report. Profiles were run for a 1-4 profile solution (see fit statistics in Table 4) with a 5-profile solution unable to replicate the best loglikelihood value. Based on the latent profile analysis of the number of teacher reported symptoms of children's inattention, hyperactivity/impulsivity, and oppositional defiant disorder as well as children's report of anxiety and depression, a 4-profile solution best fit the data (BIC = 6313.35, entropy = .88). These profiles were best described as Moderate ODD Symptoms, Low Overall Symptoms, High ADHD/ODD Symptoms, and High Inattention

Symptoms (see Figure 2, anxiety and depression scores were transformed into average ratings to provide comparable scaling to other symptoms). Demographics and symptom ranges based on profiles are shown in Table 5.

The Moderate ODD Symptoms profile (n = 11) was primarily male (70%), similar to the overall sample, with children primarily identifying as black (50%). The mean age of children in this profile was 9.00 years (SD = 0.82) and the mean grade was 3.40 (SD = 0.84). Most children in this profile had no ADHD diagnosis (70%). Children in this profile had a higher number of ODD symptoms compared to the Low Overall Symptoms profile and High Inattention Symptoms profile, but not the High ADHD/ODD Symptoms profile.

The Low Overall Symptoms profile (n = 108) was primarily male (69%) with children primarily identifying as white (51%) and black (40%). The gender and racial make-up of this profile was similar to the overall sample. The mean age of children in this profile was 8.83 years (SD = 0.82) and the mean grade was 3.36 (SD = 1.00). Most children in this profile had no ADHD diagnosis (66%). Children in this profile had the lowest number of ODD symptoms compared to all other profiles. Children in this profile also had lower inattention and hyperactivity/impulsivity symptoms compared to the High ADHD/ODD Symptoms and High Inattention Symptoms profiles and lower levels of anxiety and depression compared to the High Inattention Symptoms profile.

The High ADHD/ODD Symptoms profile (n = 26) was primarily male (63%), similar to the overall sample, with children primarily identifying as black (67%). The mean age of children in this profile was 8.90 years (SD = 0.81) and the mean grade was 3.33 (SD = 0.82). Most children in this profile were diagnosed with ADHD-combined

presentation (46%). Children in this profile had the highest number of hyperactivity/impulsivity and ODD symptoms compared to all other profiles. This profile also had more inattention symptoms compared to the Moderate ODD Symptoms and Low Overall Symptoms profile.

The High Inattention Symptoms profile (n = 87) was primarily male (74%), similar to the overall sample, with children primarily identifying as white (49%). The mean age of children in this profile was 8.79 years (SD = 0.82) and the mean grade was 3.09 (SD = 0.92). Most children in this profile had an ADHD-combined presentation diagnosis (53%) and 18% had an ADHD-inattentive presentation diagnosis. Children in this profile had a higher number of inattention symptoms compared to the Moderate ODD Symptoms and Low Overall Symptoms profile. Children in this profile also had a higher number of hyperactivity/impulsivity symptoms and ODD symptoms compared to the Low Overall Symptoms profile as well as higher levels of anxiety and depression.

Profile Comparisons

Parent report. *Characteristics*. Based on MANOVAs looking at profile differences among traits, there were significant differences among profiles on activity level, anger/frustration, assertiveness/dominance, high intensity pleasure, impulsivity, inhibitory control, sadness, and soothability/falling reactivity ($p < .01$) with a marginal difference for fear ($p < .05$; see Table 6). Based on post-hoc comparisons, the High ADHD/ODD Symptoms profile had the highest levels of anger/frustration, assertiveness/dominance, impulsivity, and sadness and the lowest levels of inhibitory control and soothability/falling reactivity compared to the other profiles. The High ADHD/ODD Symptoms profile also had higher levels of activity and high intensity

pleasure compared to the Low Overall Symptoms profile. The High Inattention Symptoms profile had higher levels of anger/frustration, impulsivity, and sadness compared to the Low Overall Symptoms profile, but lower levels compared to the High ADHD/ODD Symptoms profile. Similarly, the High Inattention Symptoms profile had lower inhibitory control and soothability/falling reactivity compared to the Low Overall Symptoms profile but higher levels than the High ADHD/ODD profile. The Low Overall Symptoms profile had the lowest levels of anger/frustration, impulsivity, and sadness with the highest levels of inhibitory control and soothability/falling reactivity compared to the other two profiles.

For social behaviors, there was a significant profile difference in global emotion dysregulation during the playgroup ($p < .01$). Though post-hoc comparisons did not find significant profile differences, the High ADHD/ODD Symptoms had the highest rating of global emotion dysregulation whereas the Low Overall Symptoms profile had the lowest. There were significant profile differences on social behaviors during the playgroup for disruptive behavior ($p < 0.01$) and marginal differences for aggressive behavior ($p < .05$). Though there were no significant post-hoc comparisons, the high ADHD/ODD Symptoms profile displayed the highest frequency of disruptive and aggressive behavior whereas the Low Overall Symptoms profile had the lowest frequency of those behaviors.

Overall, differences in characteristics common to ADHD appeared in a stepwise fashion, with the High ADHD/ODD Symptoms profile demonstrating the highest levels of severe or negative characteristics, then the High Inattention Symptoms profile, with the Low Overall Symptoms profile having the lowest levels of negative characteristics and behaviors. The High ADHD/ODD Symptoms profile appeared to have an emotional

and impulsive temperament, with high levels of both positive (i.e., high intensity pleasure) and negative (i.e., anger/frustration) emotions. Those in this profile were also assertive and difficult to soothe. In terms of social behaviors, the High ADHD/ODD Symptoms profile had the highest numbers for global emotion dysregulation, disruptive behavior, and aggressive behavior whereas the Low Overall Symptoms had the lowest numbers, though post-hoc comparisons were not significant. Overall, those in the comorbid High ADHD/ODD Symptoms profile appeared to have a more difficult temperament compared to the Low Overall Symptoms profile and displayed more negative social behaviors in a playgroup setting.

Outcomes. In terms of social outcomes, there were significant profile differences based on the peer ratings of how well the child followed rules as well as the staff ratings of how much peers liked the child, how hard the child made it for the group to finish tasks, how well the child followed rules, and how well the child cooperated ($p < .01$; see Table 7). Post-hoc comparisons showed that children in the High ADHD/ODD Symptoms profile followed rules less, were less liked, cooperated less, and made tasks harder to finish compared to the Low Overall Symptoms profile. There were significant profile differences on teacher ratings of children's social skills ($p < .001$) where the Low Overall Symptoms profile had significantly higher social skills compared to the High ADHD/ODD Symptoms and High Inattention Symptoms profiles. Lastly, there were significant profile differences on global peer rejection experienced during the playgroup ($p < .01$) with the Low Overall Symptoms profile having lower rates of global peer rejection compared to the High ADHD/ODD Symptoms and High Inattention Symptoms profiles.

For academic outcomes, there were significant profile differences for overall GPA, language arts scores, and mathematics scores ($p < .001$). The Low Overall Symptoms profile had a significantly higher GPA, language arts score, and mathematics score compared to the High Inattention Symptoms profiles.

In terms of narrative comprehension, there was a significant profile difference for the percentage of correct inferential causal questions answered for *Growing Pains* and marginal differences in the percentage of correct explicit causal questions answered for *Growing Pains* and global coherence ratings for fables and *Growing Pains*. The High ADHD/ODD Symptoms profile answered more inferential causal questions correctly than the High Inattention Symptoms profile. There were no significant post-hoc differences for explicit causal questions for *Growing Pains*, though the High ADHD/ODD Symptoms profile also had the highest percentage of questions answered correctly. Post-hoc comparisons were also not significant for global coherence though the High Inattention Symptoms profile had the lowest ratings and the Low Overall Symptoms had the highest global coherence ratings.

Overall, those in the High ADHD/ODD profile had worse social outcomes whereas the High Inattention profile had worse academic outcomes, with marginally worse outcomes in narrative comprehension. After the playgroup, the children in the High ADHD/ODD Symptoms profile were rated as less liked, less cooperative, and an obstacle in finishing tasks. Teachers also thought those in this profile had less social skills. Those in the Low Overall Symptoms profile performed better academically compared to the High Inattention Symptoms profile. Those in the High ADHD/ODD Symptoms profile performed better than other profiles on inferential and causal questions

from *Growing Pains* where those in the High Inattention profile told less coherent recalls of stories. Overall, comorbid ADHD/ODD was related to detrimental social outcomes whereas high inattention symptoms was related to decreased academic and narrative comprehension performance.

Teacher report. *Characteristics.* Based on MANOVAs, there were significant profile differences on impulsivity and inhibitory control ($p < .001$; see Table 8). Those in the High ADHD/ODD Symptoms and High Inattention Symptoms profiles had more impulsivity than the Low Overall Symptoms profile with the High Inattention Symptoms profile having less inhibitory control compared to the Low Overall Symptoms profile.

Regarding social behaviors, there was a significant profile difference on global emotion dysregulation observed during the playgroup ($p < .01$) though post-hoc comparisons were not significant. The High ADHD/ODD Symptoms profile had the highest rating of global emotion dysregulation and the Low Overall Symptoms profile had the lowest rating. There were significant profile differences on social behaviors for off task, negative, and disruptive behavior ($p < .01$) with a marginal difference for aggressive behavior ($p < .05$). Post-hoc comparisons found that the High Inattention Symptoms profile had more negative behaviors than the Low Overall Symptoms profile. There were no other significant post-hoc comparisons, though the High ADHD/ODD Symptoms had the highest frequencies of off task, negative, disruptive, and aggressive behaviors and the Low Overall Symptoms profile had the lowest frequencies of these behaviors.

Similar to parent and child identified profiles, teacher and child identified profiles found differences in characteristics between the High ADHD/ODD Symptoms profile

compared to the Low Overall Symptoms profile. The High ADHD/ODD Symptoms profile was more impulsive and displayed more negative social behaviors compared to the Low Overall Symptoms profile. In particular, the High ADHD/ODD Symptoms profile had the highest ratings for global emotion dysregulation and highest frequencies for off task behavior, disruptive, and aggressive behavior, though post-hoc comparisons were not significant.

Outcomes. Based on profile comparisons, there were significant differences among profiles based on peer ratings of how much peers liked the child, how well the child followed rules, and how well the child cooperated (see Table 9, $p < .001$). There were also significant profile differences for staff ratings of how much peers liked the child, how hard the child made it to finish tasks, how well the child followed rules, and how well the child cooperated ($p < .001$). There was a marginal profile difference for peer ratings of how hard the child made it to finish tasks ($p < .05$). Those in the High Inattention Symptoms profile were liked less as rated by peers and staff compared to the Low Overall Symptoms profile and were less cooperative based on peer ratings. Compared to the Low Overall Symptoms profile, those in the High ADHD/ODD and High Inattention Symptoms profiles made it harder to finish tasks, followed the rules less, and cooperated less based on staff ratings. Peers also rated those in the High ADHD/ODD and High Inattention Symptoms profiles as less likely to follow the rules compared to those in the Low Overall Symptoms profile. There were also significant profile differences on teacher ratings of social skills and coders' ratings of global peer rejection during the playgroup ($p < .01$). Post-hoc comparisons found that those in the Low Overall Symptoms profile had the most social skills as rated by teachers compared

to all other profiles with those in the High Inattention Symptoms profile thought to have more social skills than those in the High ADHD/ODD Symptoms profile. Those in the High Inattention Symptoms profile also were rated as more peer rejected during the playgroup compared to those in the Low Overall Symptoms profile.

For academic outcomes, there were significant profile differences on overall GPA, language arts scores, and mathematics scores ($p < .01$). Those in the High Inattention Symptoms profile had a significantly lower GPA and language arts score compared to those in the Low Overall Symptoms profile. Those in the High Inattention Symptoms and High ADHD/ODD Symptoms profiles had lower mathematics scores compared to those in the Low Overall Symptoms profile.

In terms of narrative comprehension, there were marginal profile differences for the percentage of correct inferential causal questions answered for *Growing Pains,* number of explanatory plausible inferences generated for *Growing Pains* recalls, and global coherence of *Growing Pains* recalls. Though post-hoc comparisons were not significant, those in the High Inattention Symptoms profile had the lowest scores for explicit causal *Growing Pains* questions, inferential causal *Growing Pains* questions, and global coherence of *Growing Pains* recalls.

Overall, the High Inattention Symptoms and High ADHD/ODD Symptoms profiles differed significantly from the Low Overall Symptoms profile on a variety of outcomes. Those in the High Inattention Symptoms and High ADHD/ODD Symptoms profiles were less liked, less cooperative, followed the rules less, made it harder to finish tasks during the playgroup and were thought to have less social skills. Academically, those in the High Inattention Symptoms profile performed worse compared to those in

the Low Overall Symptoms profile. Though post-hoc comparisons were not significant, the High Inattention Symptoms profile also had the lowest narrative comprehension scores. Similar to parent reported profiles, those in the High Inattention and High ADHD/ODD Symptoms profiles appeared to have worse social, academic, and narrative comprehension outcomes compared to those with Low Overall Symptoms with the High ADHD/ODD Symptoms profile more related to social difficulties.

Network Analyses

Parent report. *Characteristics.* The network of inattention, hyperactivity/impulsivity, ODD, anxiety, depression, and traits is shown in Figure 3. Hyperactivity/impulsivity, inattention, ODD, impulsivity, and inhibitory control appeared closely connected. However, depression and anxiety, though strongly related to one another, were distal to the rest of the network. Based on case-dropping analyses, all centrality indices were stable (*CS*-coefficients > .67, see Figure 4). Based on those indices, impulsivity, hyperactivity/impulsivity, and anger appeared core to the network (see Figure 5 for z-scores). When looking at edge weights, strong positive relations were found between activity level and high intensity pleasure, anxiety and depression, and inattention and hyperactivity/impulsivity (see Appendix A). Strong negative edge weights were found for sadness and soothability/falling reactivity, impulsivity and inhibitory control, and anger and soothability/falling reactivity. Lastly, based on Zhang's clustering values, there appeared to be clustering around inhibitory control and fear (see Figure 6 for z-scores), though there were no small worlds in the network (small worldness = 1.09).

The network of inattention, hyperactivity/impulsivity, ODD, anxiety, depression, and social behaviors is shown in Figure 7. Inattention, hyperactivity/impulsivity, and

ODD appeared strongly related to one another with hyperactivity/impulsivity connected to social behaviors. Depression and anxiety were also strongly related to one another, but not to any other nodes in the network. Notably, prosocial behavior was positively related to disruptive and negative behavior. Based on case-dropping analyses, centrality indices of closeness and strength were stable (*CS*-coefficients > .67, see Figure 8). Based on those indices, global emotion dysregulation, hyperactivity/impulsivity, disruptive behavior, and aggressive behavior appeared core to the network (see Figure 9 for z-scores). When looking at edge weights, strong positive relations were found between anxiety and depression and inattention and hyperactivity/impulsivity (see Appendix B). A strong negative edge weight was found for prosocial and solitary behavior. Lastly, based on Zhang's clustering values, there appeared to be clustering around ODD symptoms (see Figure 10 for z-scores) though there were no small worlds in the network (small worldness = 1.38).

Based on the networks of ADHD comorbidities and characteristics, ADHD symptoms and ODD symptoms were strongly related across networks. Hyperactivity/impulsivity appeared core to both trait and social behaviors networks. Additionally, impulsivity and negative emotion appeared core to the trait network whereas negative social behaviors were core to the social behaviors network. Anxiety and depression were strongly related to one another but placed distally in relationship to other nodes in the networks.

Outcomes. The network of inattention, hyperactivity/impulsivity, ODD, anxiety, depression, and social outcomes is shown in Figure 11. Inattention and hyperactivity/impulsivity appeared strongly related to one another with ODD connecting

these nodes to depression and anxiety. Depression and anxiety were also strongly related to one another. Additionally, staff and peer ratings from the playgroup appeared interconnected. Based on case-dropping analyses, the centrality indices closeness and strength were stable (*CS*-coefficient = .60, see Figure 12). Based on those indices, staff and peer ratings of how well children followed rules and staff ratings of how hard a child made it to finish tasks during the playgroup appeared to be core to the network (see Figure 13 for z-scores). When looking at edge weights, strong positive relations were found between inattention and hyperactivity/impulsivity, staff ratings of likeability and cooperation, anxiety and depression, and peer ratings of likeability and cooperation (see Appendix C). A strong negative edge weight was found for staff ratings of rule-following and making tasks hard to finish. Lastly, based on Zhang's clustering values, there appeared to be clustering around ODD symptoms, inattention symptoms, and peer ratings of likeability (see Figure 14 for z-scores) though there were no small worlds in the network (small worldness = 1.09).

The network of inattention, hyperactivity/impulsivity, ODD, anxiety, depression, and academic outcomes is shown in Figure 15. Inattention and hyperactivity/impulsivity appeared strongly related to one another with depression and anxiety strongly related to one another. These two groups appeared connected by ODD. Based on case-dropping analyses, the centrality index strength was stable (*CS*-coefficient = .59, see Figure 16). Based on strength, inattention symptoms and mathematics scores appeared to be core to the network (see Figure 17 for z-scores). When looking at edge weights, strong positive relations were found between anxiety and depression, inattention and hyperactivity/impulsivity, language arts and mathematics, and GPA and mathematics (see

Appendix D). There was also a strong negative relationship between inattention and mathematics. Lastly, based on Zhang's clustering values, there appeared to be clustering around language arts scores, hyperactivity/impulsivity, and ODD (see Figure 18 for z-scores) though there were no small worlds in the network (small worldness = 1.04).

The network of inattention, hyperactivity/impulsivity, ODD, anxiety, depression, and narrative comprehension measures is shown in Figure 19. Inattention, hyperactivity/impulsivity, and ODD appeared strongly related to one another with depression and anxiety strongly related to one another. Based on case-dropping analyses, none of the centrality indices were reliable (*CS*-coefficients < .15, see Figure 20). Therefore, identified central symptoms should be interpreted with caution. Based on centrality indices, the inferential and explicit *Growing Pains* questions and global coherence in fables and *Growing Pains* recalls appeared to be core to the network (see Figure 21 for z-scores). When looking at edge weights, strong positive relations were found between anxiety and depression as well as inattention and hyperactivity/impulsivity (see Appendix E). Lastly, based on Zhang's clustering values, there appeared to be clustering around ODD (see Figure 22 for z-scores) though there were no small worlds in the network (small worldness = 1.04).

Similar to characteristics networks, inattention and hyperactivity/impulsivity were tightly connected across networks. Anxiety and depression symptoms were tightly connected across networks but were placed more distally in the networks. For social outcomes, children's contributions to finishing playgroup tasks and following rules appeared core to the network with likeability strongly tied to cooperation. Mathematics scores appeared core to the academic outcomes network. Due to unstable centrality

indices, there was limited interpretation of the narrative comprehension network. ADHD and ODD symptoms appeared more connected to the social outcomes network whereas inattention symptoms appeared more connected to the academic network. Though there were no small world communities identified in the networks, networks often clustered around ODD symptoms, indicating that many of the nodes connected to ODD were also connected to one another. Such clustering results may indicate that ODD is redundant in the networks, perhaps overlapping with hyperactivity/impulsivity and inattention.

Teacher report. *Characteristics.* The network of inattention, hyperactivity/impulsivity, ODD, anxiety, depression, and trait is shown in Figure 23. Inattention, hyperactivity/impulsivity, and ODD appeared strongly related to one another. Depression and anxiety were also strongly related to one another but placed more distally in the network. Based on case-dropping analyses, only strength was a reliable centrality index (*CS*-coefficient = 0.67, see Figure 24). Based on strength, impulsivity, sadness, soothability/falling reactivity, and hyperactivity/impulsivity appeared to be core to the network (see Figure 25 for z-scores). When looking at edge weights, strong positive relations were found between activity level and high intensity pleasure, anxiety and depression, and ODD and hyperactivity/impulsivity (see Appendix F). There were strong negative relations between impulsivity and inhibitory control as well as sadness and soothability/falling reactivity. Lastly, based on Zhang's clustering values, there appeared to be clustering around fear and anger (see Figure 26 for z-scores) though there were no small worlds in the network (small worldness = 1.28).

The network of inattention, hyperactivity/impulsivity, ODD, anxiety, depression, and social behaviors is shown in Figure 27. Inattention and hyperactivity/impulsivity

appeared strongly related to one another. Depression and anxiety were also strongly related to one another but placed more distally in the network. Social behaviors appeared primarily linked to hyperactivity/impulsivity. Notably, prosocial behavior was positively connected to negative and disruptive behavior. Based on case-dropping analyses, closeness and strength were reliable centrality indices (*CS*-coefficients > 0.59, see Figure 28). Based on those indices, disruptive behavior, aggressive behavior, negative behavior, and hyperactivity/impulsivity appeared to be core to the network (see Figure 29 for z-scores). When looking at edge weights, strong positive relations were found between hyperactivity/impulsivity and ODD symptoms, anxiety and depression symptoms, and inattention and hyperactivity/impulsivity symptoms (see Appendix G). Lastly, based on Zhang's clustering values, there appeared to be clustering around prosocial behaviors, aggressive behaviors, and global emotion dysregulation (see Figure 30 for z-scores) though there were no small worlds in the network (small worldness = 1.14).

Similar to parent and child reported profiles, inattention, hyperactivity/impulsivity and ODD appeared to have strong relations with one another. Anxiety and depression also had strong relations with one another but were placed more distally in the networks. Mirroring parent and child reported profiles, impulsivity, anger, and hyperactivity/impulsivity appeared core to the trait network with strong clustering around negative emotions. Negative social behaviors were key to the social behaviors network, particularly connected to hyperactivity/impulsivity. Overall, ADHD symptoms appeared core to networks with strong relations to negative traits and social behaviors.

Outcomes. The network of inattention, hyperactivity/impulsivity, ODD, anxiety, depression, and social outcomes is shown in Figure 31. Hyperactivity/impulsivity

appeared strongly related to inattention and ODD. Depression and anxiety were strongly related to one another. Teacher reported social skills appeared to bridge between externalizing and internalizing symptoms. Peer and staff ratings appeared interconnected as well. Based on case-dropping analyses, strength was the only reliable centrality index (*CS*-coefficient = 0.60, see Figure 32). Based on strength, peer ratings of rule-following, staff ratings of cooperation, and hyperactivity/impulsivity appeared to be core to the network (see Figure 33 for z-scores). When looking at edge weights, strong positive relations were found between staff ratings of likeability and cooperation, hyperactivity/impulsivity and ODD symptoms, anxiety and depression, and peer ratings of likeability and cooperation (see Appendix H). There were strong negative relations between inattention and teacher ratings of social skills, staff ratings of rule-following and finishing tasks, and ODD and teacher ratings of social skills. Lastly, based on Zhang's clustering values, there appeared to be clustering around peer ratings of likeability, cooperation, and making tasks hard to finish (see Figure 34 for z-scores) though there were no small worlds in the network (small worldness = 1.19).

The network of inattention, hyperactivity/impulsivity, ODD, anxiety, depression, and academics outcomes is shown in Figure 35. Hyperactivity/impulsivity appeared strongly related to inattention and ODD, with inattention connecting these symptoms to academic outcomes. Depression and anxiety were strongly related to one another. Based on case-dropping analyses, strength and closeness were reliable (*CS*-coefficients = 0.67, see Figure 26). Based on those indices, mathematics and inattention appeared to be core to the network (see Figure 37 for z-scores). When looking at edge weights, strong positive relations were found between hyperactivity/impulsivity and ODD symptoms as

well as anxiety and depression symptoms (see Appendix I). There was a strong negative relationship between inattention symptoms and mathematics. Lastly, based on Zhang's clustering values, there appeared to be clustering around language arts and GPA (see Figure 38 for z-scores), though there were no small worlds in the network (small worldness = 1.03).

The network of inattention, hyperactivity/impulsivity, ODD, anxiety, depression, and narrative comprehension outcomes is shown in Figure 39. Hyperactivity/impulsivity appeared strongly related to inattention and ODD, with inattention connecting symptoms to narrative comprehension outcomes. Depression and anxiety were also strongly related to one another, with anxiety related to narrative comprehension outcomes. Based on case-dropping analyses, strength was stable (*CS*-coefficient = 0.52, see Figure 40). Based on strength, global coherence for fables and *Growing Pains* as well as hyperactivity/impulsivity were central to the network (see Figure 41 for z-scores). When looking at edge weights, strong positive relations were found between hyperactivity/impulsivity and ODD symptoms, anxiety and depression symptoms, inattention and hyperactivity/impulsivity, and *Growing Pains* explanatory plausible inferences and global coherence (see Appendix J). Lastly, based on Zhang's clustering values, there appeared to be clustering around ODD (see Figure 42 for z-scores) though there were no small worlds in the network (small worldness = 1.14).

Outcome networks based on teacher and child report were commensurate with networks based on parent and child report. For the social outcomes network, rule-following, cooperation, and hyperactivity/impulsivity were key to the network. Likeability was strongly tied to cooperation. Inattention appeared to link symptoms to

academic outcomes, with inattention and mathematics being core to the network and strongly negatively related. Inattention also seemed to link symptoms to narrative comprehension outcomes with global coherence ratings key to the network. Overall, externalizing and internalizing symptoms separated into two groups and were strongly separated within each group. Hyperactivity/impulsivity appeared more closely related to social outcomes whereas inattention was more closely related to academic outcomes and narrative comprehension.

Network comparison test. Using the Network Comparison Test, there were no differences between parent and teacher reported networks on traits, social behaviors, social outcomes, academic outcomes, or narrative comprehension (S = 0.16 - 1.02, $p > .14$) on strength centrality values. There were also no significant differences between parent and teacher reported networks on social behaviors, social outcomes, and narrative comprehension based on edge weights in the network (M = 0.20 – 0.28, $p > .08$). There were significant differences between parent and teacher reported networks for temperament and academic outcomes (M = 0.27 – 0.30, $p < .04$) for edge weight values. Overall, results suggest that networks did not differ in the strength, or magnitude, of relations in the overall network between parents and teachers; however, there were some differences in the strength of individual relations between nodes in trait and academic outcomes networks.

Table 2

Fit Statistics for Latent Profile Analysis Based on Parent and Child Reported ADHD Comorbidities

Profiles	Bayes Information Criteria	Entropy	Lo-Mendell-Rubin Adjusted Likelihood Ratio Test (*p* value)
1	7074.05	-	-
2	6759.25	0.87	0.34
3	6624.79	0.90	0.001
4	6597.34	0.86	0.79

Note. $n = 233$.

Table 3

Descriptive Statistics for Parent and Child Reported ADHD Comorbidities Profiles

	Profile 1: Low Overall Symptoms (*n* = 94)		Profile 2: High ADHD/ODD Symptoms (*n* = 42)		Profile 3: High Inattention Symptoms (*n* = 96)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Age in years	8.72	0.80	9.00	0.80	8.86	0.83
Grade	3.19	1.00	3.52	0.92	3.22	0.90
Males (%)	73		71		68	
Race (%)						
White	55		38		41	
Black	37		41		47	
American Indian/Alaskan	0		2		0	
Multiracial	8		19		13	
Diagnosis (%)						
ADHD-inattentive	6		12		25	
ADHD-hyperactive/impulsive	0		0		4	
ADHD-combined	1		74		49	
No diagnosis	93		14		22	
Symptoms						
Inattention**	0.70^{a}	2.04	7.23^{b}	2.04	5.03^{c}	2.04
Hyperactivity/impulsivity**	0.43^{a}	0.68	6.50^{b}	2.40	4.20^{c}	2.38
Oppositional defiant disorder**	0.16^{a}	0.90	4.68^{b}	0.90	0.90^{c}	0.90
Anxiety total score*	22.30^{a}	12.67	$26.96^{a,b}$	11.21	30.64^{b}	17.71
Depression total T-score**	50.81^{a}	7.64	55.84^{b}	8.49	57.38^{b}	12.04

Note. *M* = mean, *SD* = standard deviation, *$p < .01$, **$p < .001$, variables that share a superscript letter are not significantly different from one another in the row ($p > .01$).

Table 4

Fit Statistics for Latent Profile Analysis Based on Teacher and Child Reported ADHD Comorbidities

Profiles	Bayes Information Criteria	Entropy	Lo-Mendell-Rubin Adjusted Likelihood Ratio Test (*p* value)
1	6783.92	-	-
2	6435.67	0.83	<0.001
3	6405.69	0.81	0.33
4	6313.35	0.88	*

Note. $n = 233$, *could not be computed.

Table 5

Descriptive Statistics for Teacher and Child Reported ADHD Comorbidities Profiles

	Profile 1: Moderate ODD Symptoms (*n* = 11)		Profile 2: Low Overall Symptoms (*n* = 108)		Profile 3: High ADHD/ODD Symptoms (*n* = 26)		Profile 4: High Inattention Symptoms (*n* = 87)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Age	9.00	0.82	8.83	0.82	8.90	0.81	8.79	0.82
Grade	3.40	0.84	3.36	1.00	3.33	0.82	3.09	0.92
Males (%)	70		69		63		74	
Race (%)								
White	20		51		21		49	
Black	50		40		67		35	
American Indian/Alaskan	0		1		0		0	
Multiracial	30		8		13		15	
Diagnosis (%)								
ADHD-inattentive	10		15		4		18	
ADHD-hyperactive/impulsive	0		1		13		0	
ADHD-combined	20		18		46		53	
No diagnosis	70		66		38		28	
Symptoms								
Inattention**	1.20^{a}	2.25	0.94^{a}	2.25	5.42^{b}	2.25	5.10^{b}	2.25
Hyperactivity/impulsivity**	$1.91^{a,c}$	1.20	0.15^{a}	0.35	6.49^{b}	2.38	3.72^{c}	2.65
Oppositional defiant disorder**	3.07^{a}	0.84	0.07^{b}	0.84	6.49^{c}	0.84	0.76^{d}	0.84
Anxiety total score*	$33.00^{a,b}$	15.73	22.67^{a}	11.16	$27.27^{a,b}$	19.30	30.40^{b}	16.75
Depression total T-score**	$56.66^{a,b}$	6.96	51.38^{a}	6.98	$56.91^{a,b}$	13.17	57.21^{b}	11.92

Table 5 (continued)

Note. *M* = mean, *SD* = standard deviation, *$p < .01$, **$p < .001$, variables that share a superscript letter are not significantly different from one another in the row ($p > .01$).

Table 6

Profile Differences on Characteristics Based on Parent and Child Reported ADHD Comorbidities

	Profile 1: Low Overall Symptoms (n = 94)	Profile 2: High ADHD/ODD Symptoms (n = 42)	Profile 3: High Inattention Symptoms (n = 96)
Temperament			
Activity level*	3.82[a]	4.21[b]	4.11[a,b]
Affiliation	4.04[a]	4.01[a]	4.03[a]
Anger/frustration**	2.59[a]	3.74[b]	3.13[c]
Assertiveness/dominance*	3.55[a]	3.86[b]	3.53[a]
Fear[†]	2.39[a]	2.65[a]	2.65[a]
High intensity pleasure*	3.45[a]	3.85[b]	3.64[a,b]
Impulsivity**	2.52[a]	4.09[b]	3.36[c]
Inhibitory control**	3.62[a]	2.49[b]	2.91[c]
Sadness**	2.35[a]	3.12[b]	2.64[c]
Shyness	2.63[a]	2.63[a]	2.63[a]
Soothability/falling reactivity**	3.89[a]	2.85[b]	3.37[c]
Social behaviors			
Global emotion dysregulation*	1.12[a]	1.40[a]	1.27[a]
Off task	2.07[a]	4.79[a]	3.80[a]
Solitary	7.47[a]	6.71[a]	6.55[a]
Prosocial	14.58[a]	14.33[a]	14.63[a]
Negative	2.85[a]	4.18[a]	3.75[a]
Disruptive*	11.59[a]	16.23[a]	13.50[a]
Aggressive[†]	2.40[a]	4.45[a]	2.57[a]

Note. [†]$p < .05$, *$p < .01$, **$p < .001$, variables that share a superscript letter are not significantly different from one another in the row ($p > .01$).

Table 7

Profile Differences on Outcomes Based on Parent and Child Reported ADHD Comorbidities

	Profile 1: Low Overall Symptoms (n = 94)	Profile 2: High ADHD/ODD Symptoms (n = 42)	Profile 3: High Inattention Symptoms (n = 96)
Social			
How much peers liked child (peer)	3.38[a]	3.21[a]	3.36[a]
How hard child made it to finish (peer)	1.75[a]	1.97[a]	1.81[a]
How of well child followed rules (peer)*	3.52[a]	3.21[b]	3.38[a,b]
How well child cooperated (peer)	3.39[a]	3.24[a]	3.33[a]
How much peers liked child (staff)*	3.10[a]	2.64[b]	2.93[a,b]
How hard child made it to finish (staff)**	1.43[a]	2.21[b]	1.77[b]
How well child followed rules (staff)**	3.48[a]	2.86[b]	3.20[a,b]
How well child cooperated (staff)*	3.25[a]	2.74[b]	2.95[a,b]
Social skills percentile rank (teacher)**	47.87[a]	16.38[b]	25.68[b]
Global peer rejection*	2.38[a]	2.80[b]	2.52[a,b]
Academic			
Overall GPA**	3.26[a]	2.97[a,b]	2.91[b]
Language arts**	36.36[a]	32.79[a,b]	30.19[b]
Mathematics**	26.03[a]	23.11[a,b]	19.16[b]
Narrative comprehension			

Table 7 (continued)

Percentage of correct explicit causal questions (GP)†	50.76[a]	54.21[a]	42.54[a]
Percentage of correct inferential causal questions (GP)*	41.54[a,b]	47.34[a]	32.86[b]
Explanatory plausible inferences (fables)	1.65[a]	1.51[a]	1.50[a]
Explanatory plausible Inferences (GP)	1.77[a]	1.46[a]	1.53[a]
Global coherence (fables)†	2.31[a]	2.05[a]	2.05[a]
Global coherence (GP)†	2.21[a]	2.05[a]	1.80[a]

Note. GPA = grade point average, GP = *Growing Pains*, †$p < .05$, *$p < .01$, **$p < .001$, variables that share a superscript letter are not significantly different from one another in the row ($p > .01$).

Table 8

Profile Differences on Characteristics Based on Teacher and Child Reported ADHD Comorbidities

	Profile 1: Moderate ODD Symptoms	Profile 2: Low Overall Symptoms	Profile 3: High ADHD/ODD Symptoms	Profile 4: High Inattention Symptoms
Temperament				
Activity level	3.86[a]	3.96[a]	4.15[a]	4.06[a]
Affiliation	3.84[a]	4.00[a]	4.05[a]	4.08[a]
Anger/frustration	3.07[a]	2.88[a]	3.25[a]	3.13[a]
Assertiveness/dominance	3.76[a]	3.54[a]	3.68[a]	3.63[a]
Fear	2.30[a]	2.44[a]	2.61[a]	2.69[a]
High intensity pleasure	3.76[a]	3.52[a]	3.71[a]	3.66[a]
Impulsivity**	2.95[a,b]	2.88[b]	3.46[a]	3.45[a]
Inhibitory control**	3.36[a,b]	3.32[a]	3.03[a,b]	2.85[b]
Sadness	2.54[a]	2.57[a]	2.60[a]	2.68[a]
Shyness	2.44[a]	2.75[a]	2.58[a]	2.50[a]
Soothability/falling reactivity	3.48[a]	3.60[a]	3.32[a]	3.38[a]
Social behaviors				
Global emotion dysregulation*	1.22[a]	1.15[a]	1.50[a]	1.27[a]
Off task*	2.68[a]	1.78[a]	6.12[a]	4.54[a]
Solitary	9.44[a]	6.53[a]	5.89[a]	7.53[a]
Prosocial	14.62[a]	13.73[a]	18.90[a]	14.46[a]
Negative**	2.83[a,b]	2.29[a]	6.24[a,b]	4.32[b]
Disruptive*	12.07[a]	11.36[a]	18.13[a]	14.44[a]
Aggressive[†]	2.63[a]	2.01[a]	5.06[a]	3.35[a]

Note. [†]$p < .05$, *$p < .01$, **$p < .001$, variables that share a superscript letter are not significantly different from one another in the row ($p > .01$).

Table 9

Profile Differences on Outcomes Based on Teacher and Child Reported ADHD Comorbidities

	Profile 1: Moderate ODD Symptoms	Profile 2: Low Overall Symptoms	Profile 3: High ADHD/ODD Symptoms	Profile 4: High Inattention Symptoms
Social				
How much peers liked child (peer)**	3.48[a,b]	3.46[a]	3.23[a,b]	3.20[b]
How hard child made it to finish (peer)[†]	1.92[a]	1.70[a]	2.04[a]	1.89[a]
How well child followed rules (peer)**	3.41[a,b]	3.57[b]	3.11[a]	3.27[a]
How well child cooperated (peer)**	03.43[a,b]	3.48[a]	3.20[a,b]	3.18[b]
How much peers liked child (staff)**	3.00[a,b]	3.14[a]	2.73[a,b]	2.75[b]
How hard child made it to finish (staff)**	1.75[a,b]	1.44[a]	2.38[b]	1.88[b]
How well child followed rules (staff)**	3.25[a,b]	3.52[a]	2.73[b]	3.05[b]
How well child cooperated (staff)**	3.00[a,b]	3.28[a]	2.65[b]	2.83[b]

Table 9 (continued)

Social skills percentile rank (teacher)**	12.83[a,c]	52.36[b]	4.50[a]	21.60[c]
Global peer rejection*	2.45[a,b]	2.35[a]	2.62[a,b]	2.71[b]
Academic				
Overall GPA*	3.00[a,b]	3.23[a]	2.83[a,b]	2.89[b]
Language arts*	34.00[a,b]	35.79[a]	28.81[a,b]	30.91[b]
Mathematics*	23.11[a,b]	25.20[b]	19.09[a]	21.21[a]
Narrative comprehension				
Percentage of correct explicit causal questions (GP)	58.57[a]	49.84[a]	46.75[a]	44.62[a]
Percentage of correct inferential causal questions (GP)[†]	52.50[a]	42.71[a]	38.96[a]	32.50[a]
Explanatory plausible inferences (fables)	1.40[a]	1.65[a]	1.35[a]	1.52[a]
Explanatory plausible inferences (GP)[†]	1.10[a]	1.85[a]	1.82[a]	1.31[a]

Global coherence (fables)	2.00[a]	2.25[a]	2.00[a]	2.09[a]
Global coherence (GP)[†]	2.00[a]	2.19[a]	1.96[a]	1.78[a]

Note. GPA = grade point average, GP = *Growing Pains*, [†]$p < 0.05$, *$p < 0.01$, **$p < 0.001$, variables that share a superscript letter are not significantly different from one another in the row ($p > .01$).

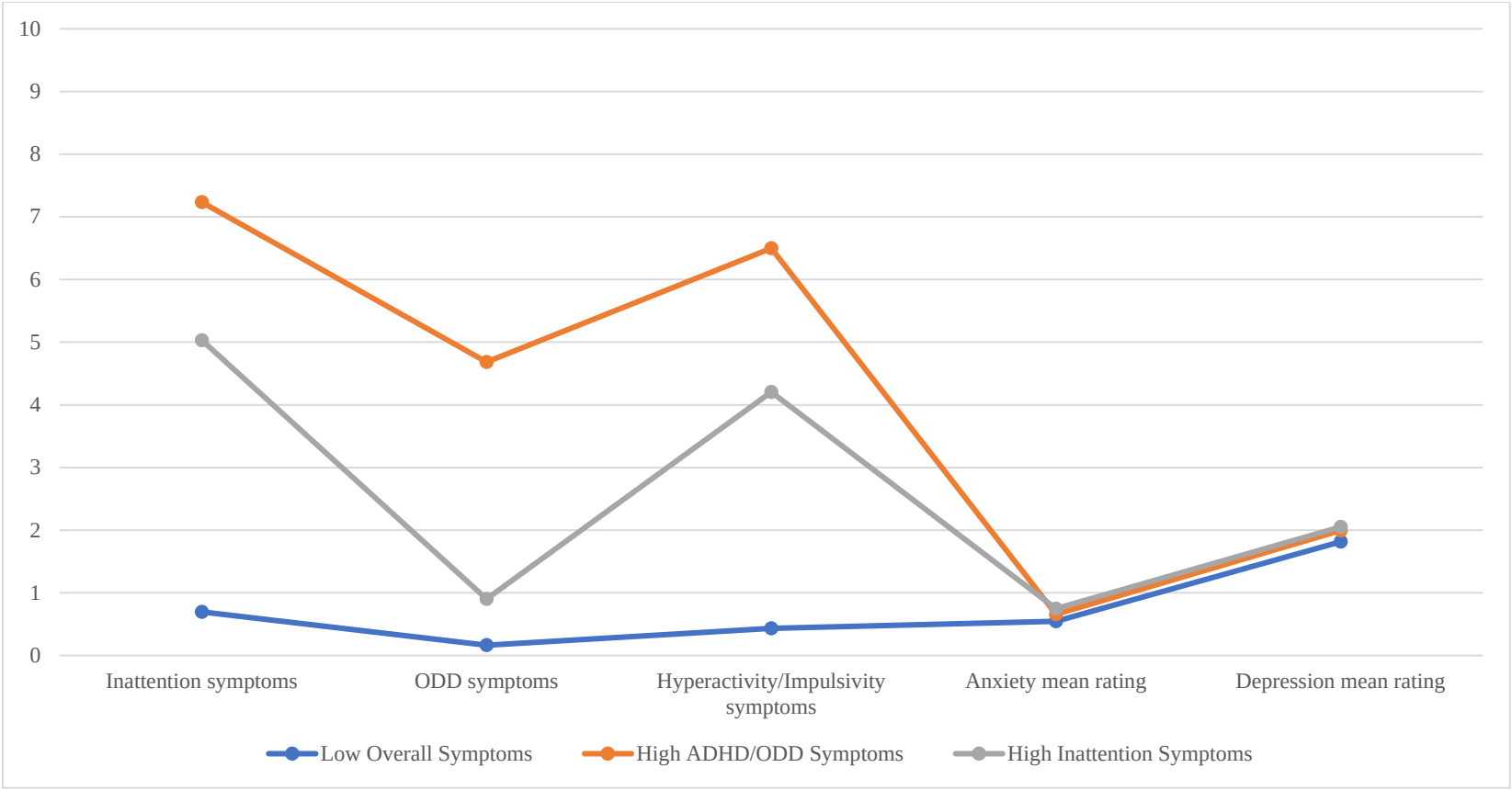


Figure 1. Parent and child reported ADHD comorbidities profiles.

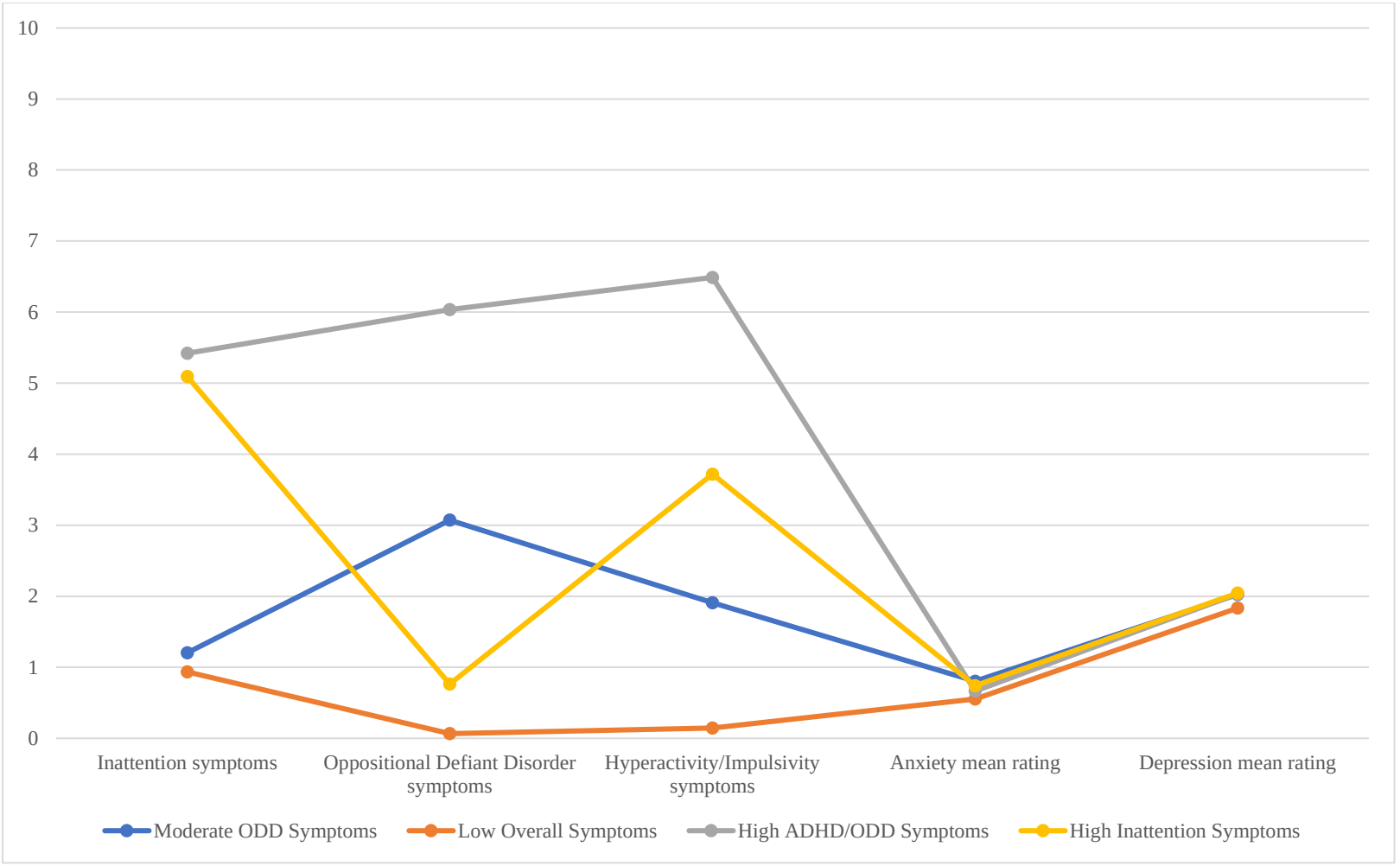


Figure 2. Teacher and child reported ADHD comorbidities profiles.

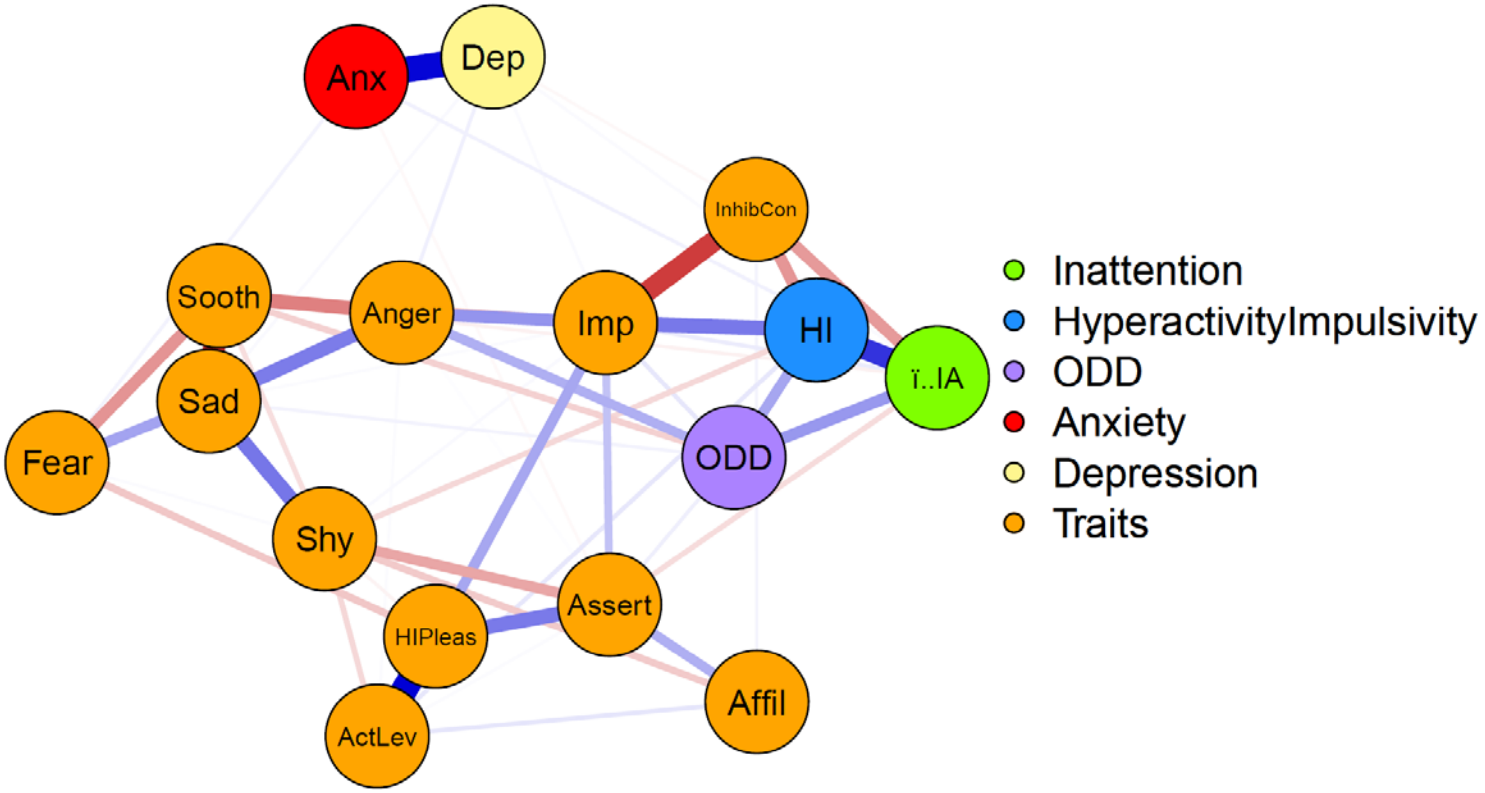


Figure 3. Parent and child reported ADHD comorbidities and trait network. IA = inattention, HI = hyperactivity/impulsivity, ODD = oppositional defiant disorder, Anx = anxiety, Dep = depression, ActLev = activity level, Affil = affiliation, Anger = anger/frustration, Assert = assertiveness/dominance, Fear = fear, HIPleas = high intensity pleasures, Imp = impulsivity, InhibCon = inihibitory control, Sad = sadness, Shy = shyness, Sooth = soothability/falling reactivity.

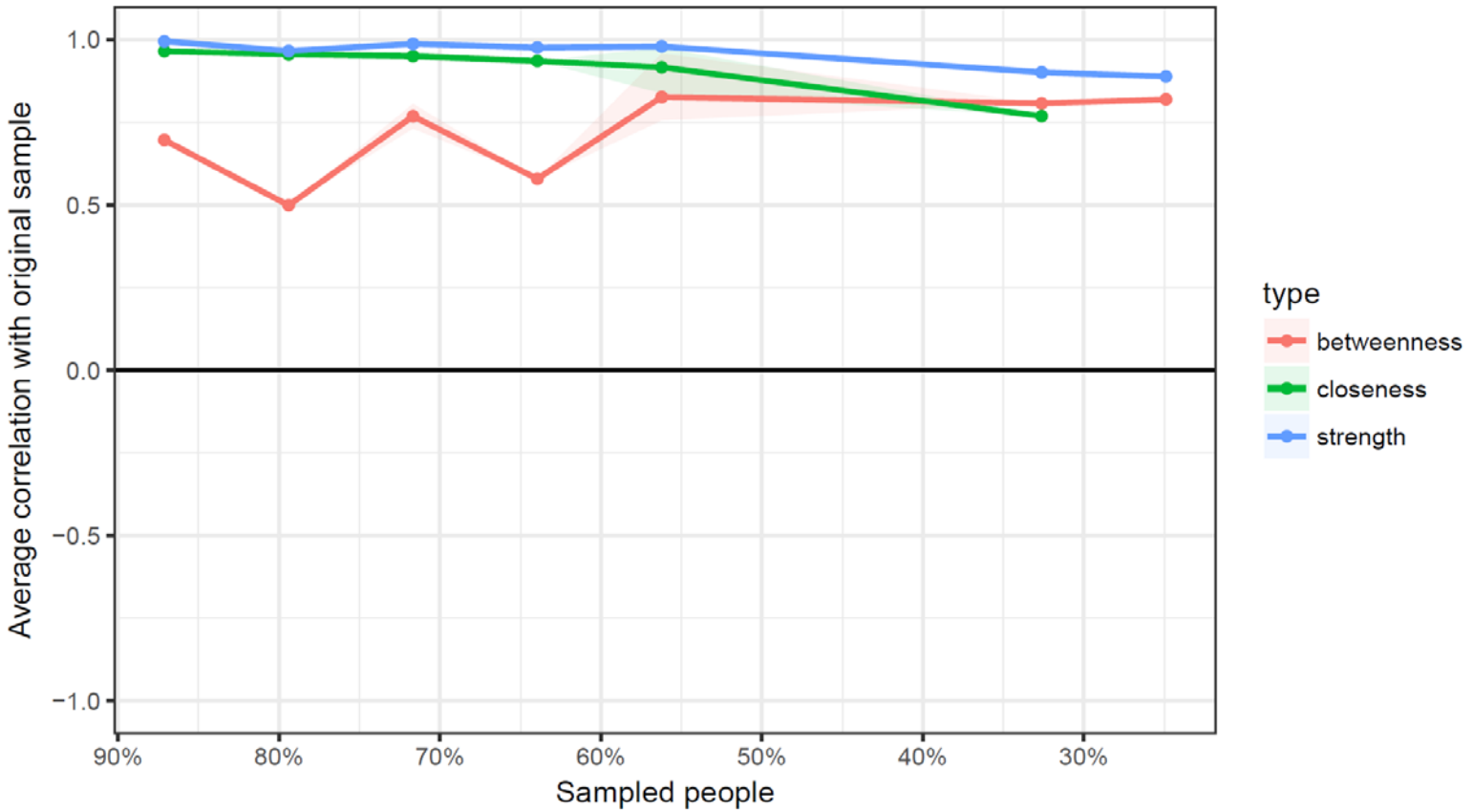


Figure 4. Case-dropping stability for centrality indices of parent and child reported ADHD comorbidities and trait network.

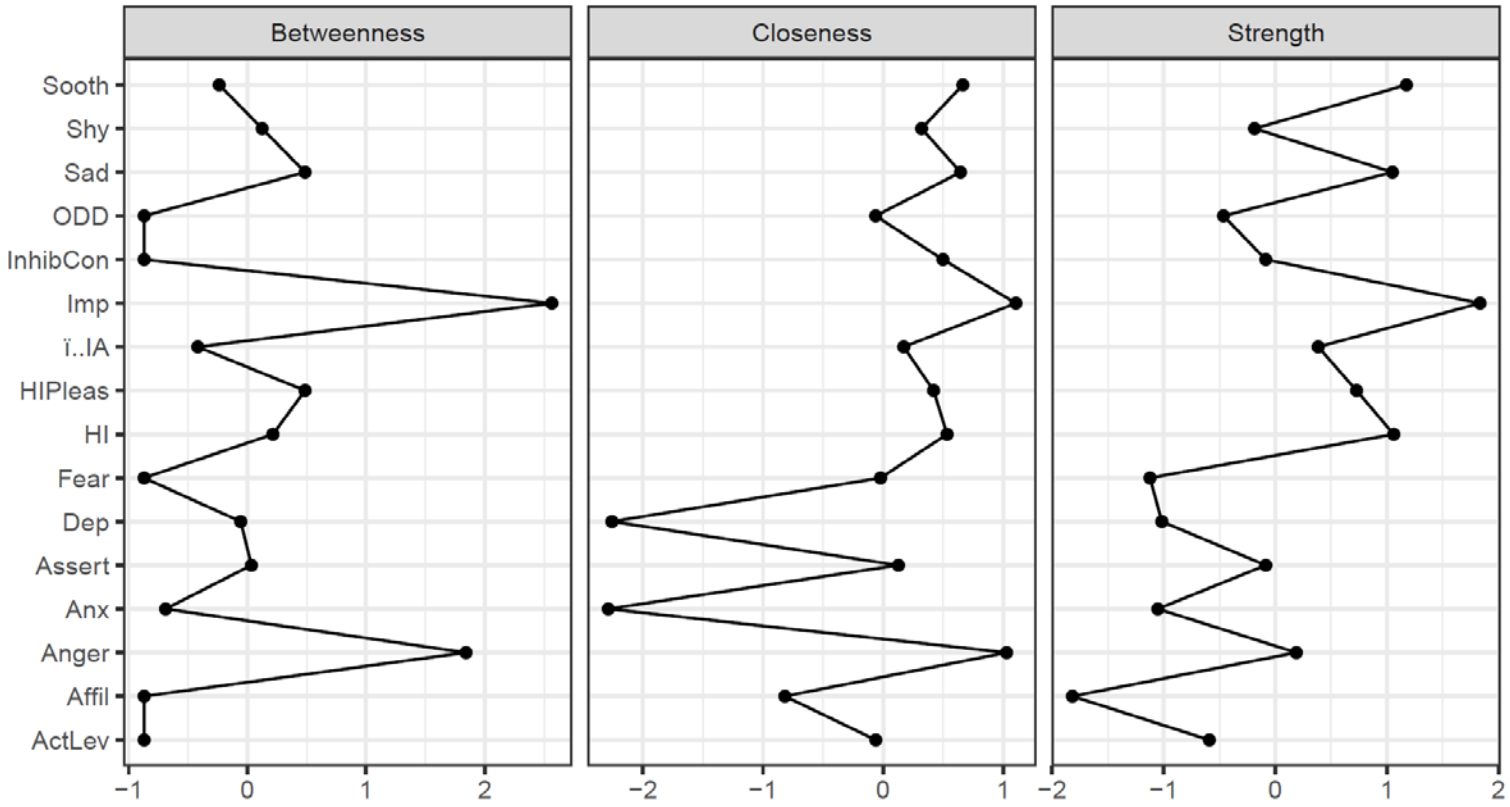


Figure 5. Centrality indices' z-scores for parent and child reported ADHD comorbidities and trait network.

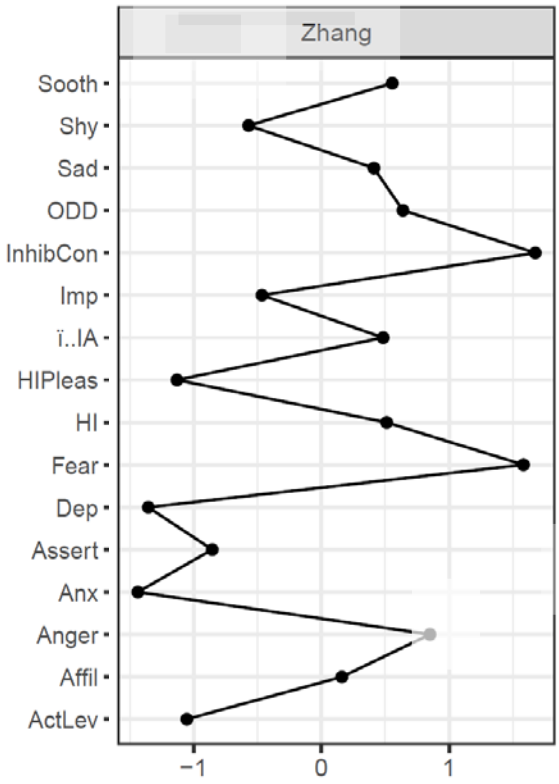


Figure 6. Clustering z-scores for parent and child reported ADHD comorbidities and trait network.

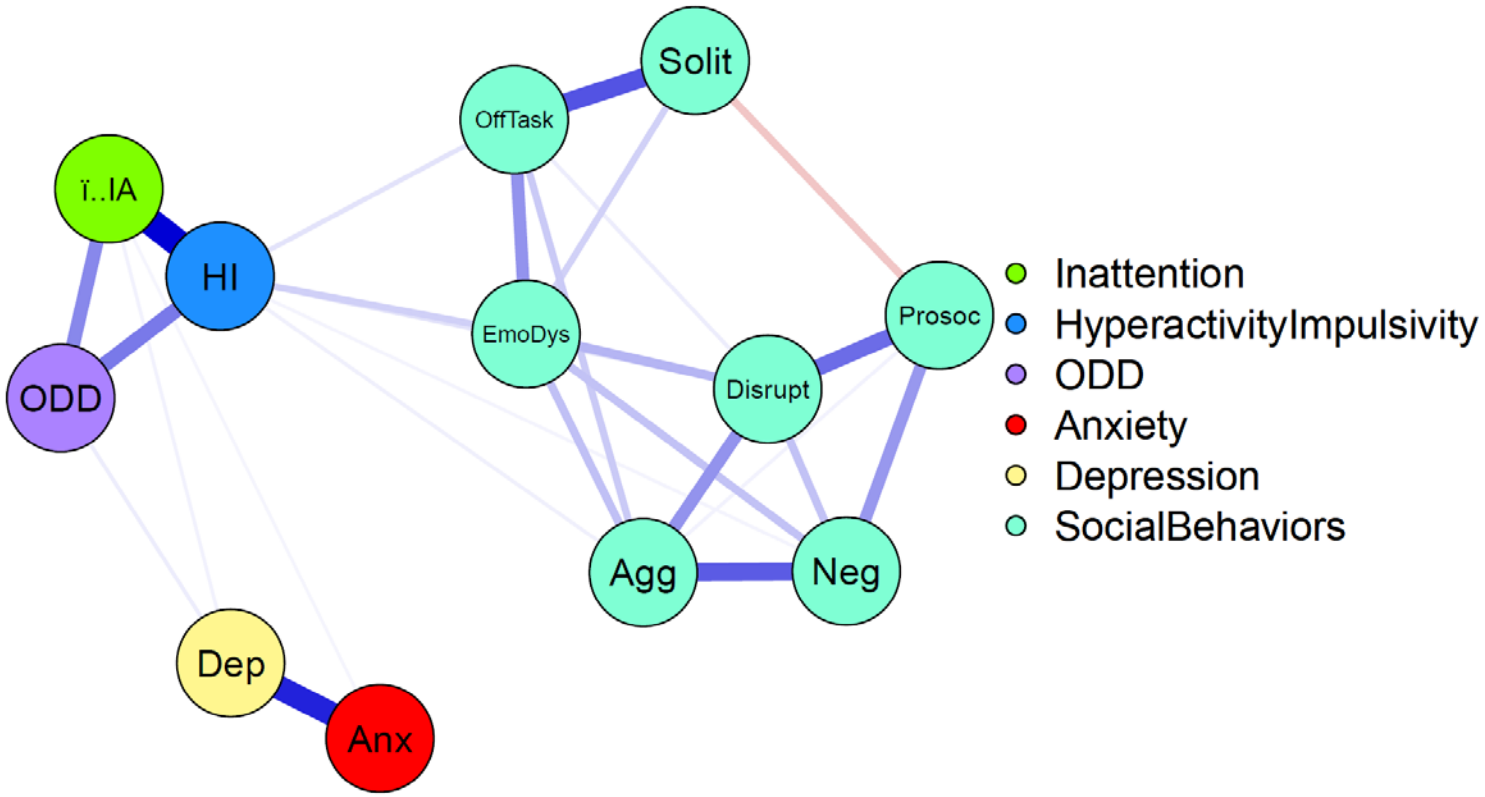


Figure 7. Parent and child reported ADHD comorbidities and social behaviors network. IA = inattention, HI = hyperactivity/impulsivity, ODD = oppositional defiant disorder, Anx = anxiety, Dep = depression, EmoDys = global emotion dysregulation, OfffTask = off task behavior, Solit = solitary behavior, Prosoc = prosocial behavior, Disrupt = disruptive behavior, Neg = negative behavior, Agg = aggressive behavior.

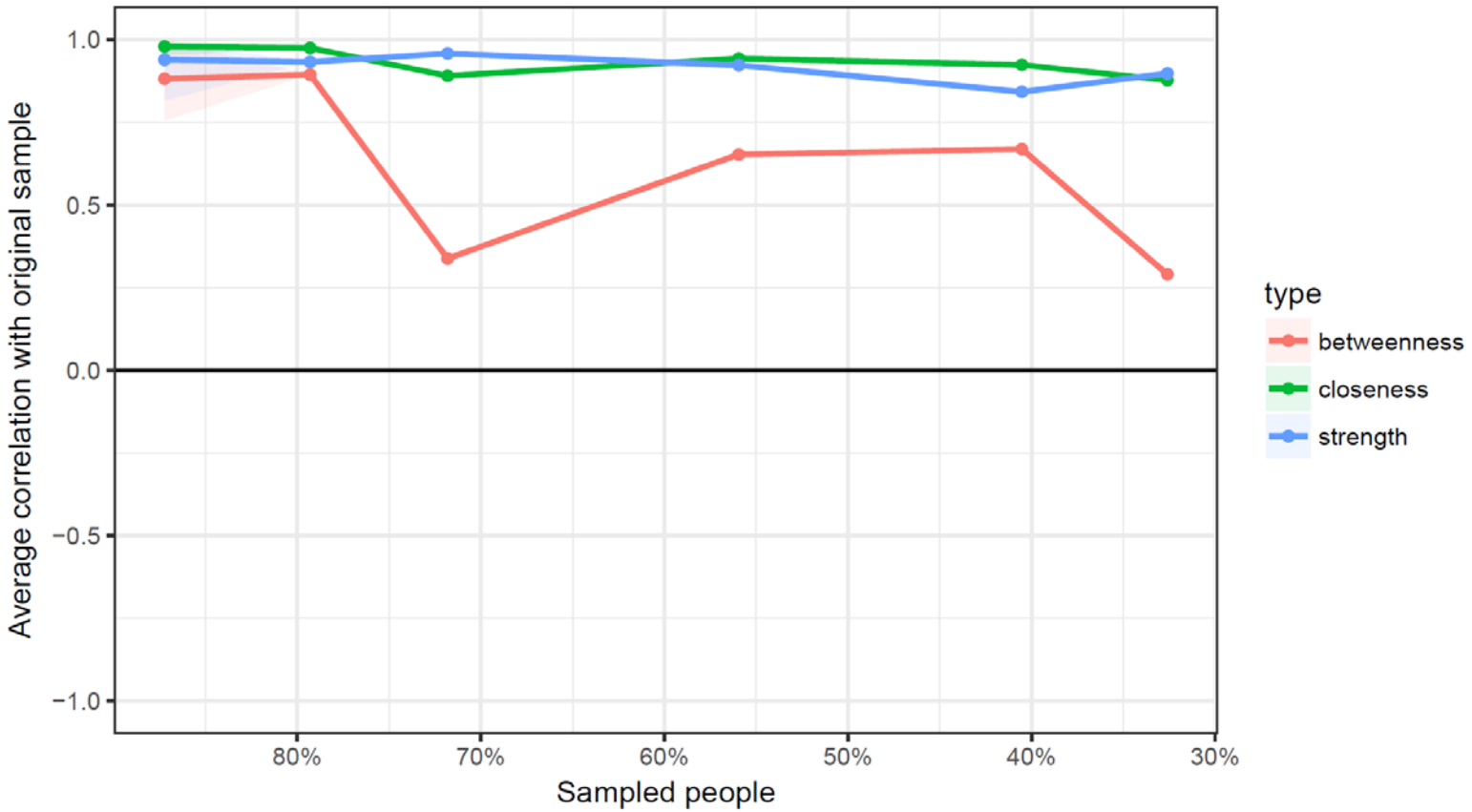


Figure 8. Case-dropping stability for centrality indices of parent and child reported ADHD comorbidities and social behaviors network.

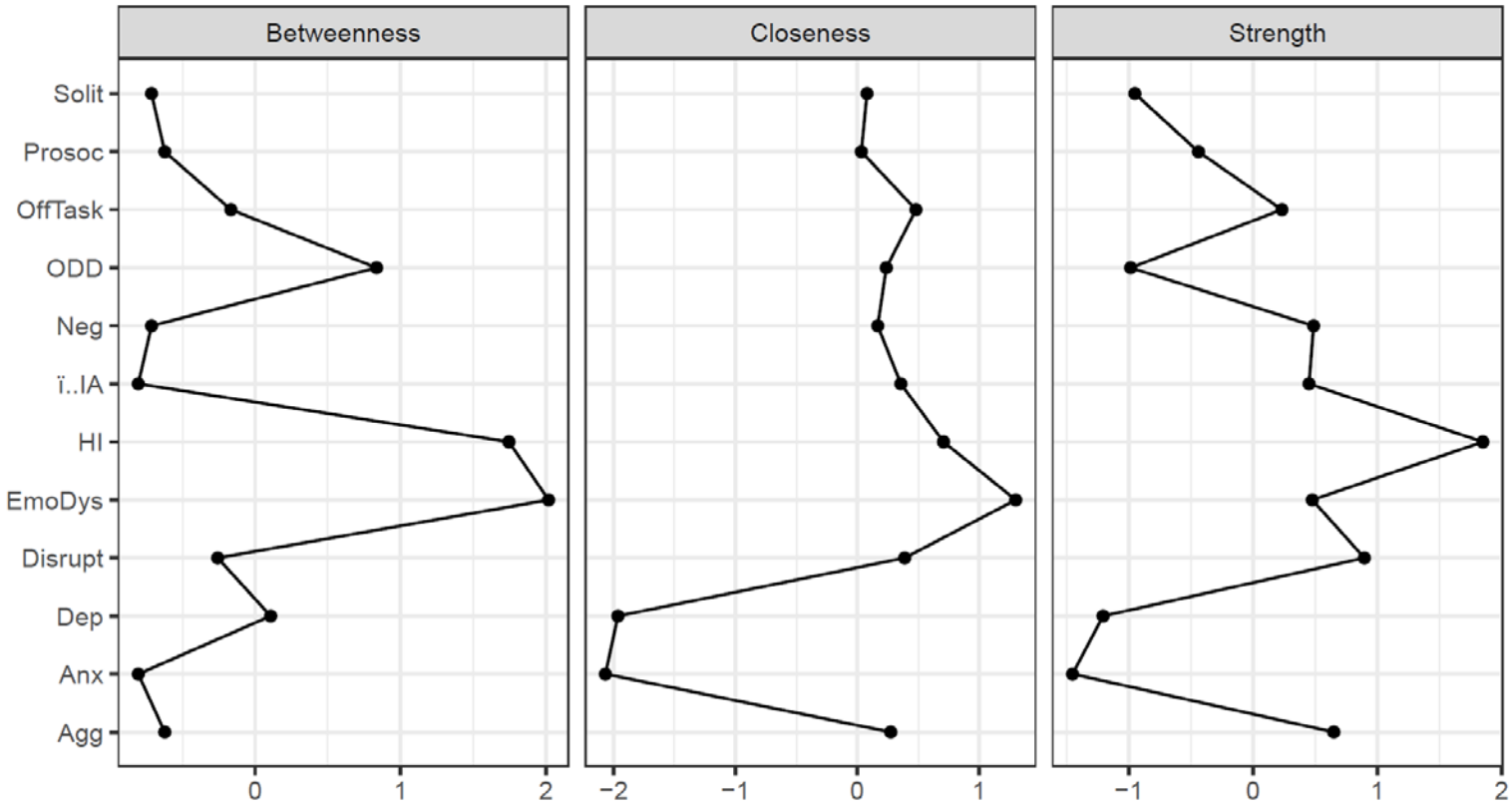


Figure 9. Centrality indices' z-scores for parent and child reported ADHD comorbidities and social behaviors network.

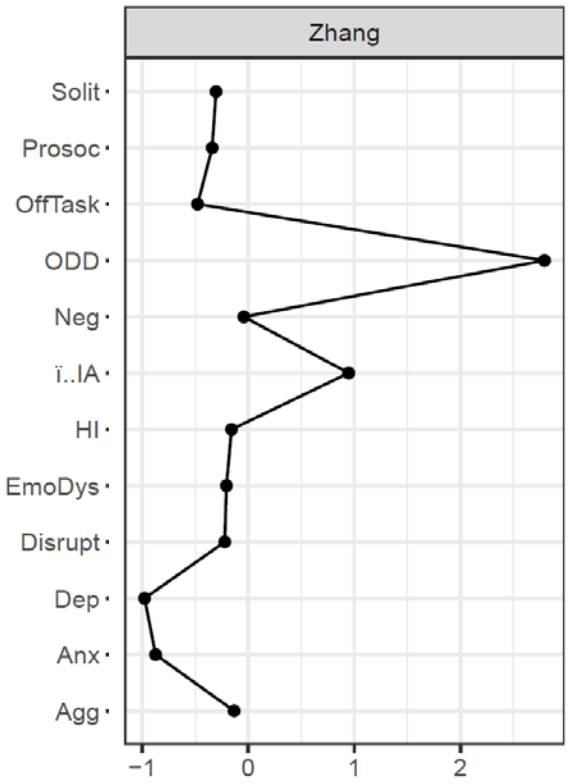


Figure 10. Clustering z-scores for parent and child reported ADHD comorbidities and social behaviors network.

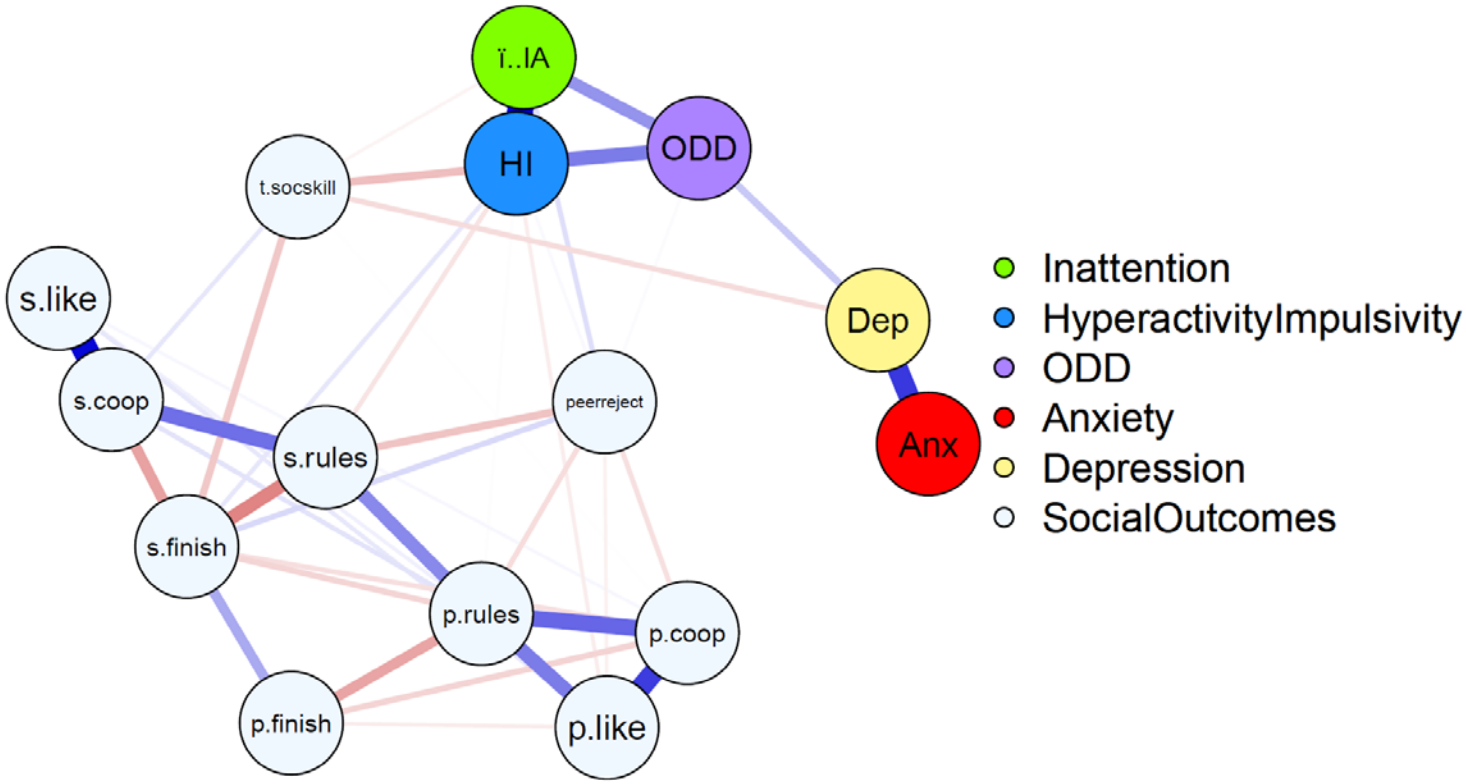


Figure 11. Parent and child reported ADHD comorbidities and social outcomes network. IA = inattention, HI = hyperactivity/impulsivity, ODD = oppositional defiant disorder, Anx = anxiety, Dep = depression, p.rules = peer rating of how well child followed rules, p.finish = peer rating of how hard child made it to finish task, p.like = peer rating of how much peers liked child, p.coop = peer rating of how well child cooperated, s.rules = staff rating of how well child followed rules, s.finish = staff rating of how hard child made it to finish tasks, s.like = staff rating of how much peers like child, s.coop = staff rating of how well child cooperated, t.socskill = teacher ratings of child's social skills, peerreject = global rating of peer rejection.

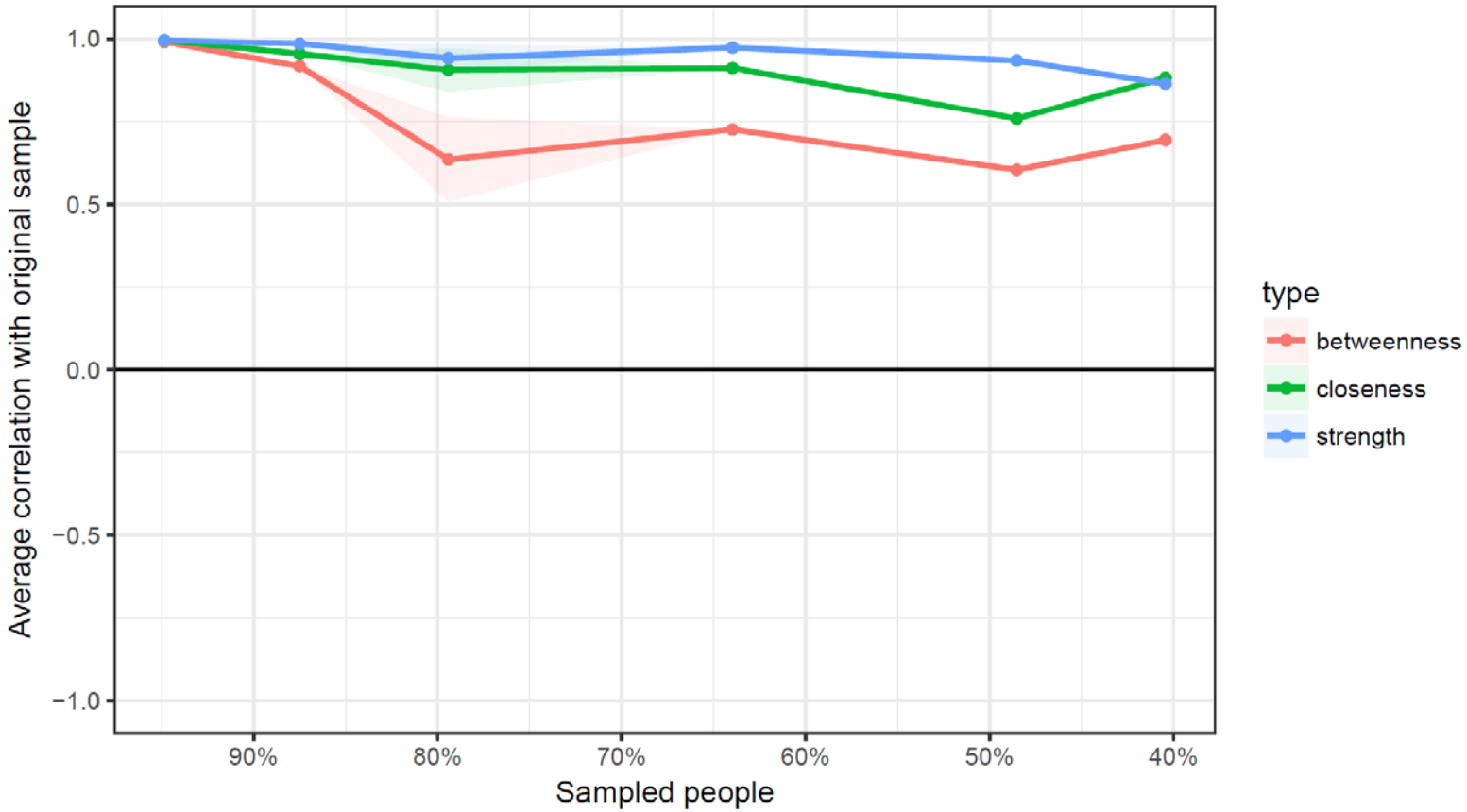


Figure 12. Case-dropping stability for centrality indices of parent and child reported ADHD comorbidities and social outcomes network.

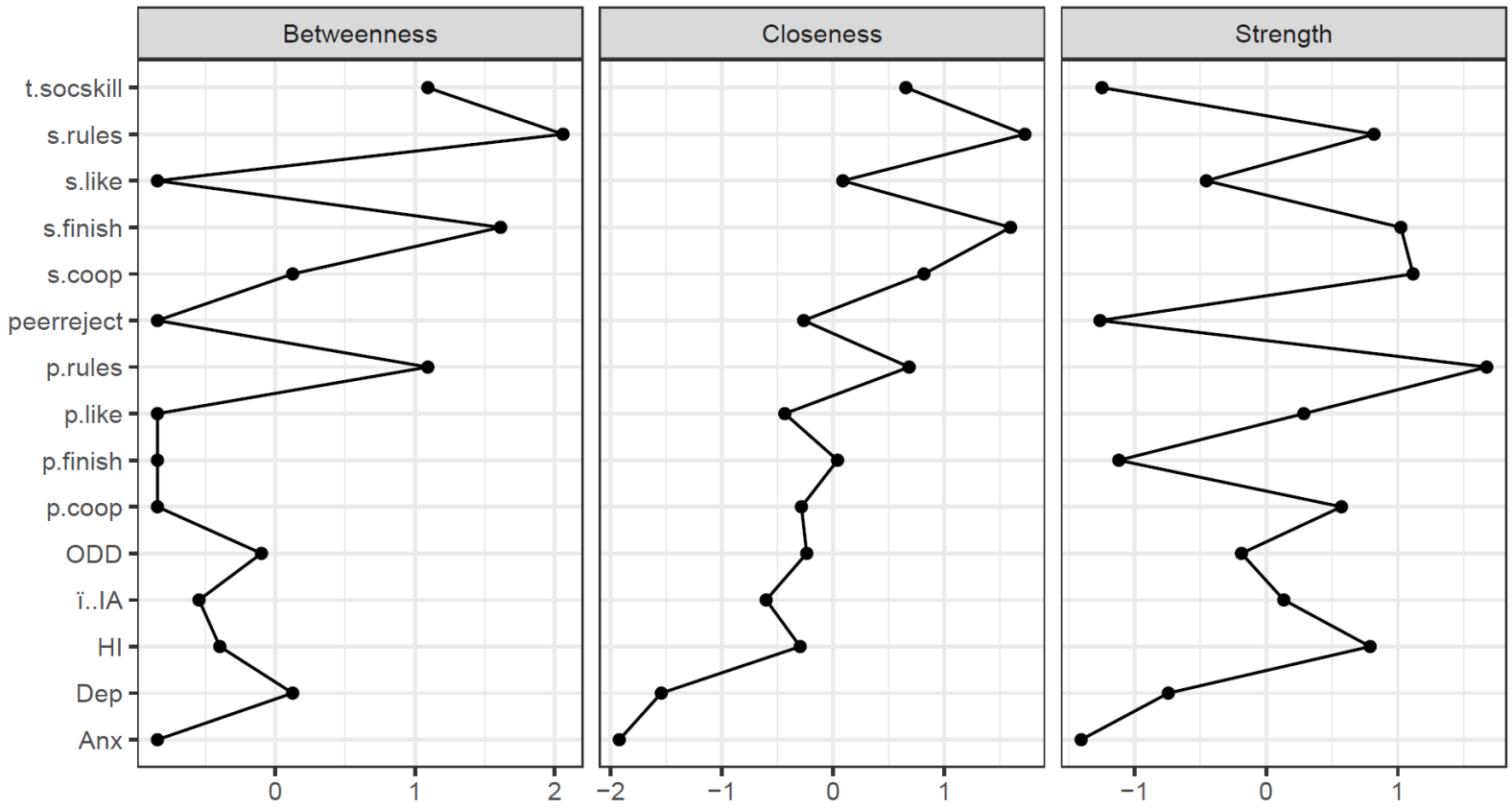


Figure 13. Centrality indices' z-scores for parent and child reported ADHD comorbidities and social outcomes network.

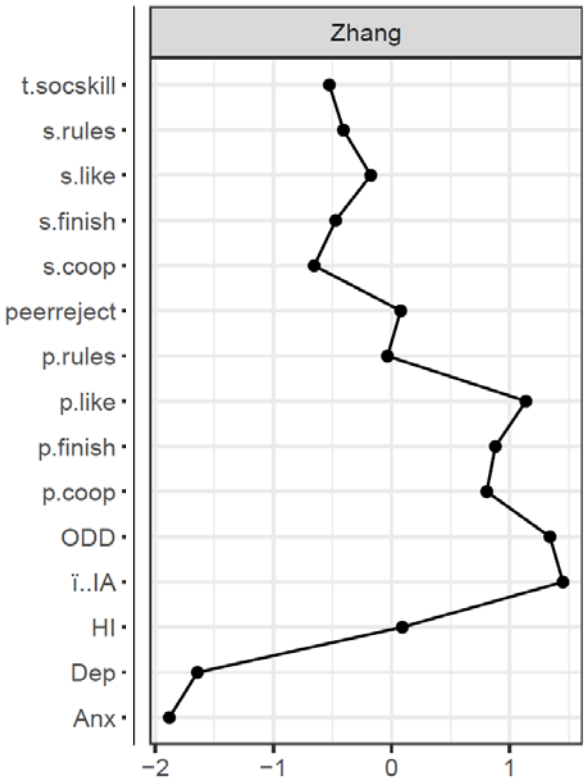


Figure 14. Clustering values z-scores for parent and child reported ADHD comorbidities and social outcomes network.

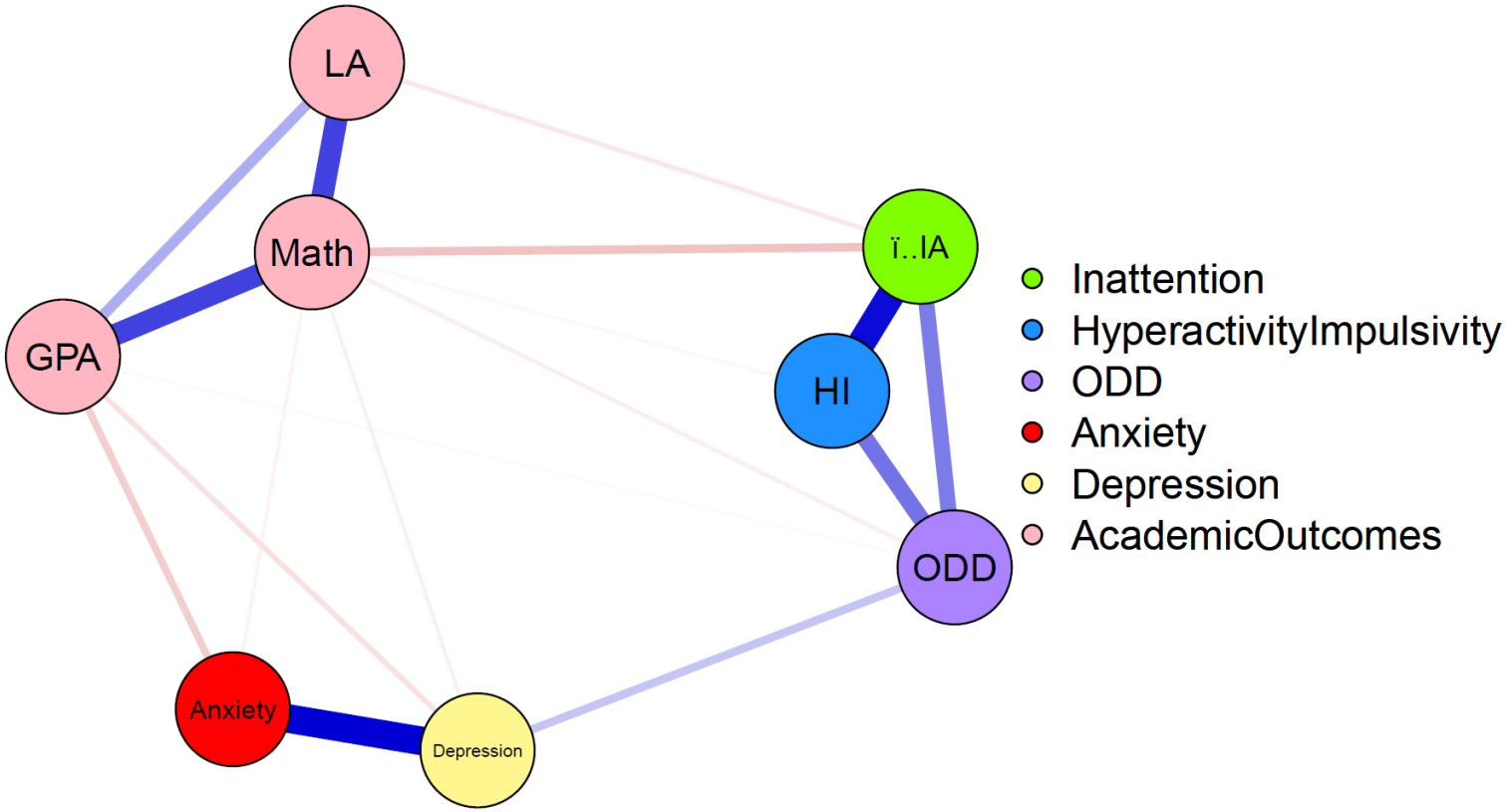


Figure 15. Parent and child reported ADHD comorbidities and academic outcomes network. IA = inattention, HI = hyperactivity/impulsivity, ODD = oppositional defiant disorder, Anx = anxiety, Dep = depression, GPA = overall grade point average, LA = language arts, Math = mathematics.

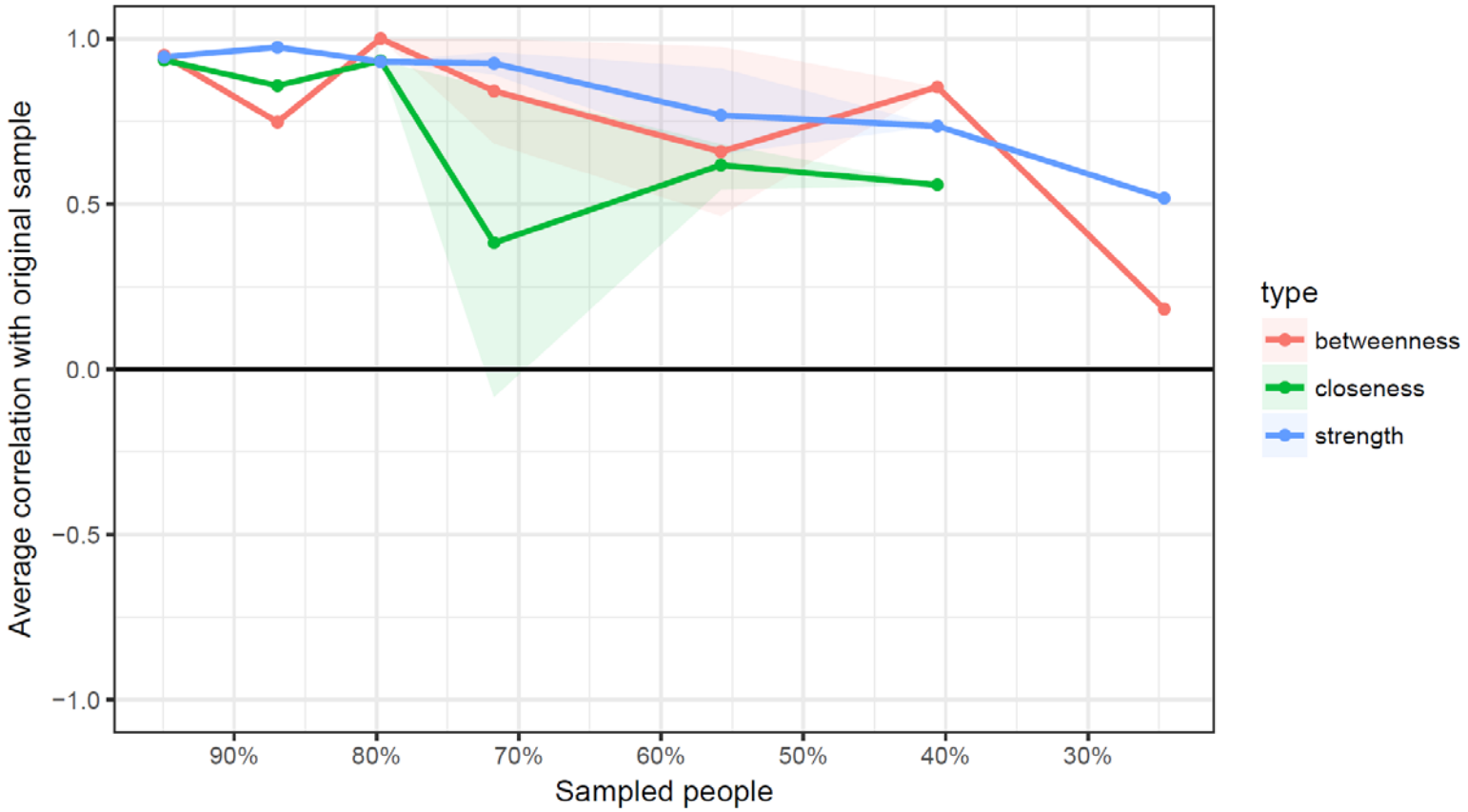


Figure 16. Case-dropping stability for centrality indices of parent and child reported ADHD comorbidities and academic outcomes network.

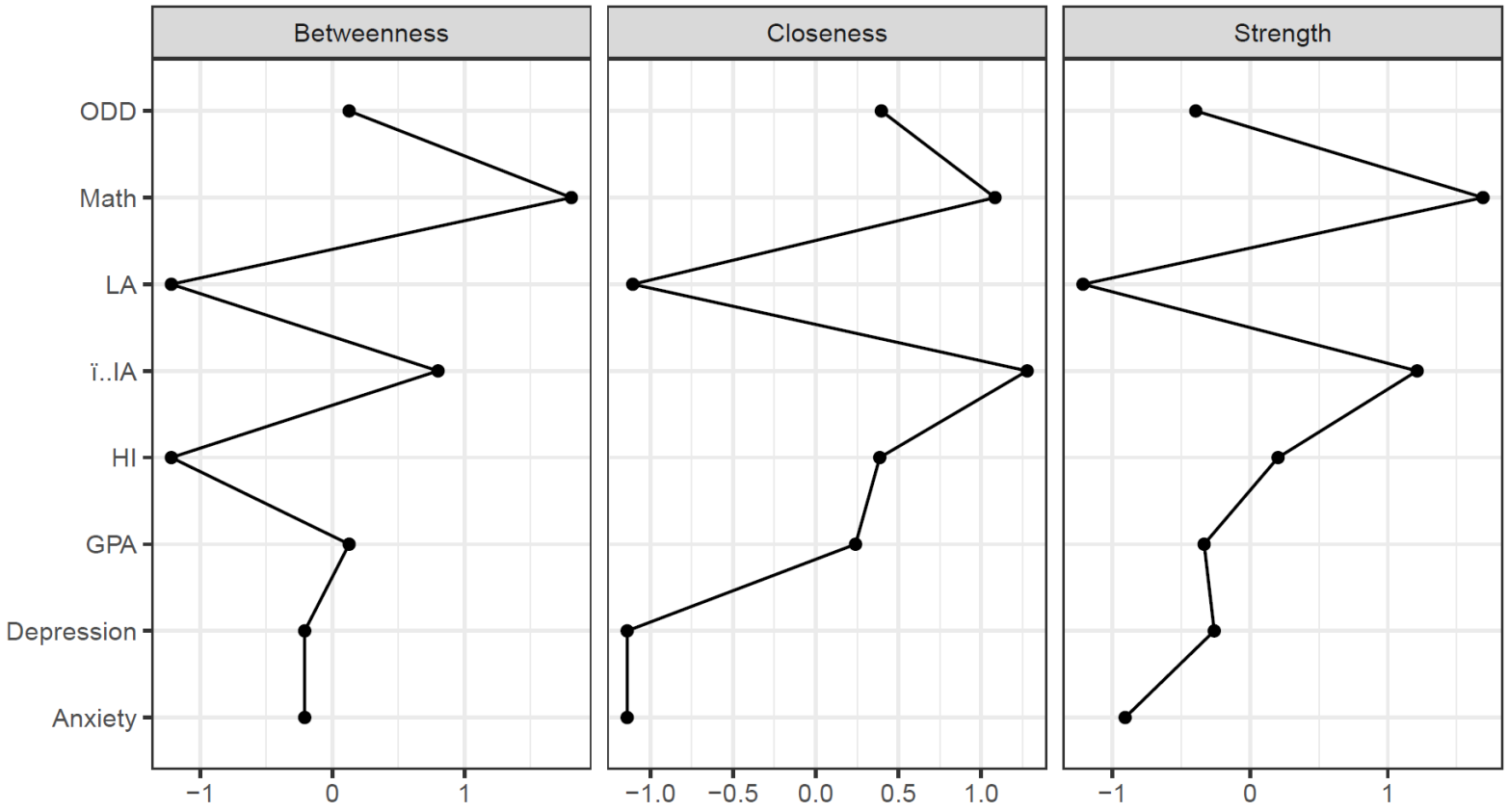


Figure 17. Centrality indices' z-scores for parent and child reported ADHD comorbidities and academic outcomes network.

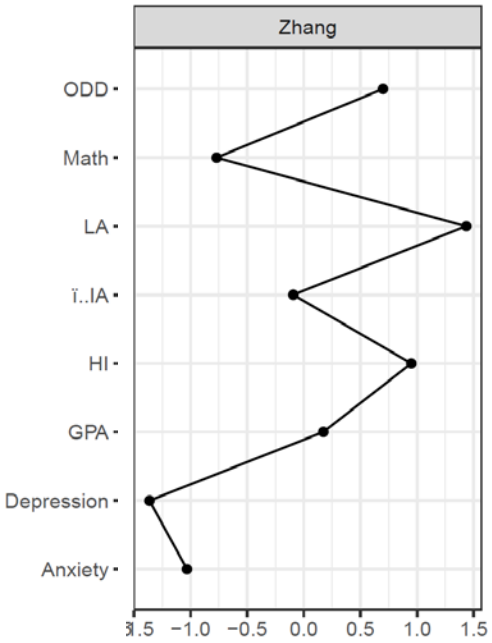


Figure 18. Clustering z-scores for parent and child reported ADHD comorbidities and academic outcome network.

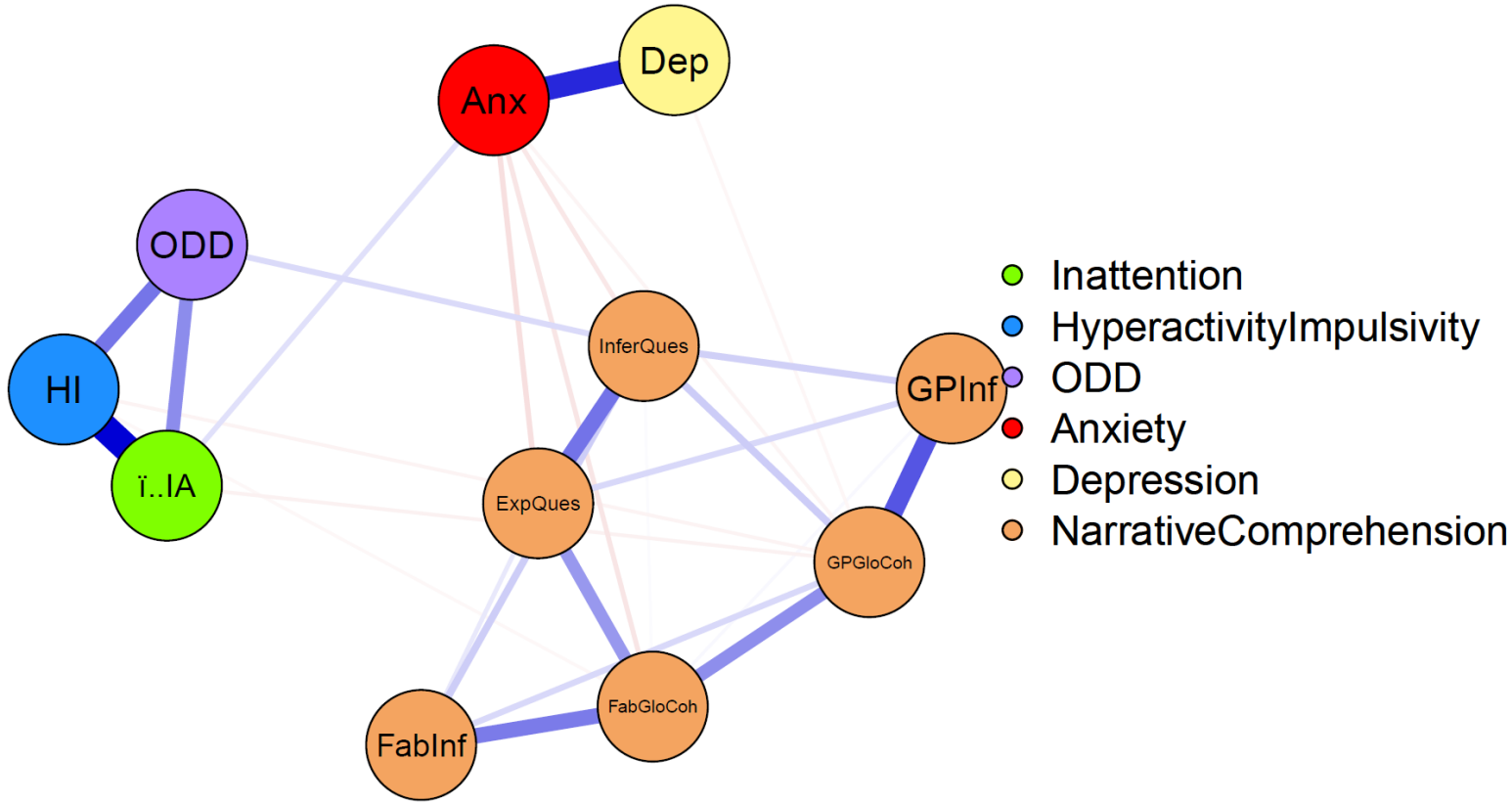


Figure 19. Parent and child reported ADHD comorbidities and narrative comprehension network. IA = inattention, HI = hyperactivity/impulsivity, ODD = oppositional defiant disorder, Anx = anxiety, Dep = depression, ExpQues = *Growing Pains* explicit causal questions, InferQues = *Growing Pains* inferential causal questions, GPInf = *Growing Pains* explanatory plausible inferences, GPGloCoh = *Growing Pains* global coherence, FabInf = fables explanatory plausible inferences, FabGloCoh = fables global coherence.

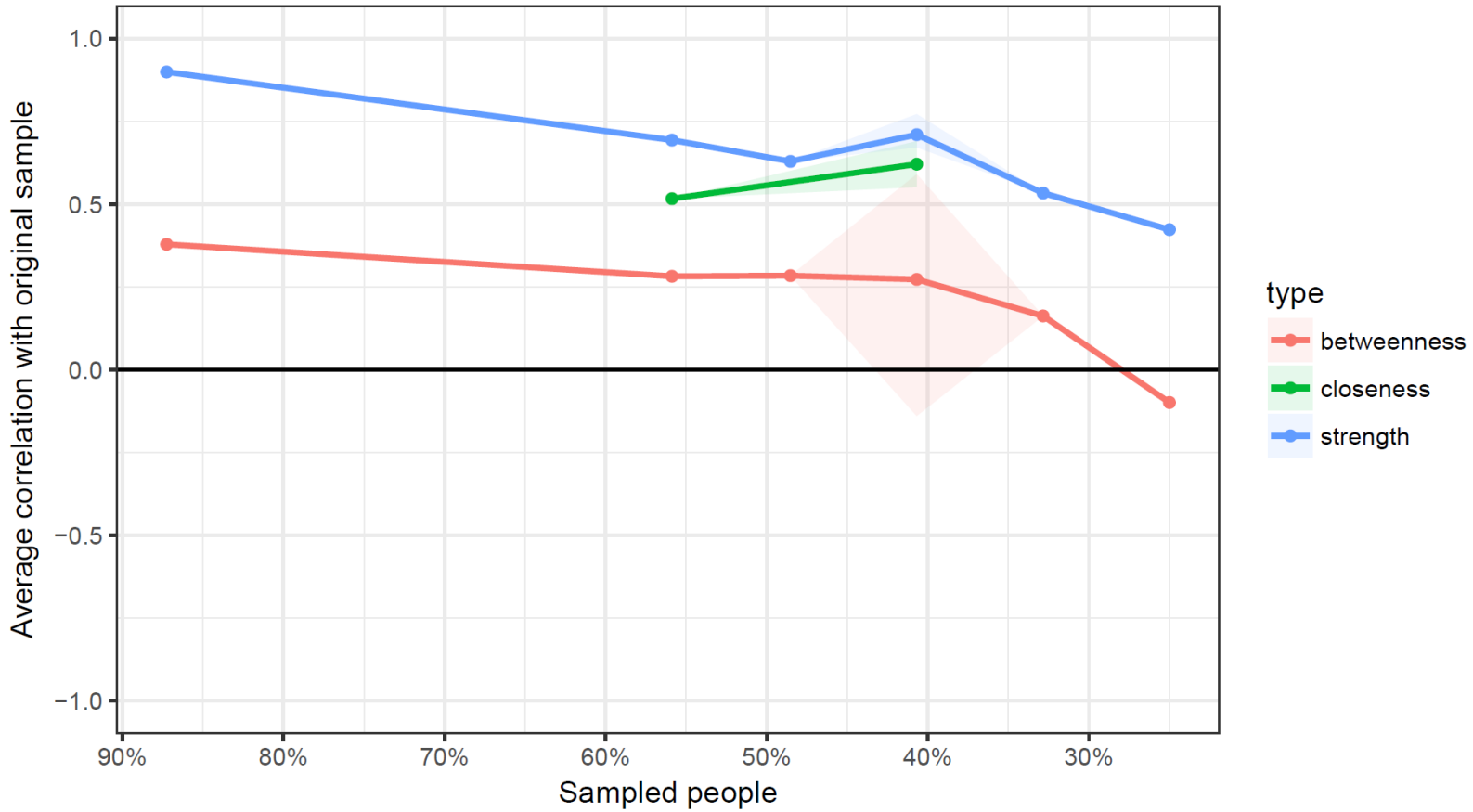


Figure 20. Case-dropping stability for centrality indices of parent and child reported ADHD comorbidities and narrative comprehension network.

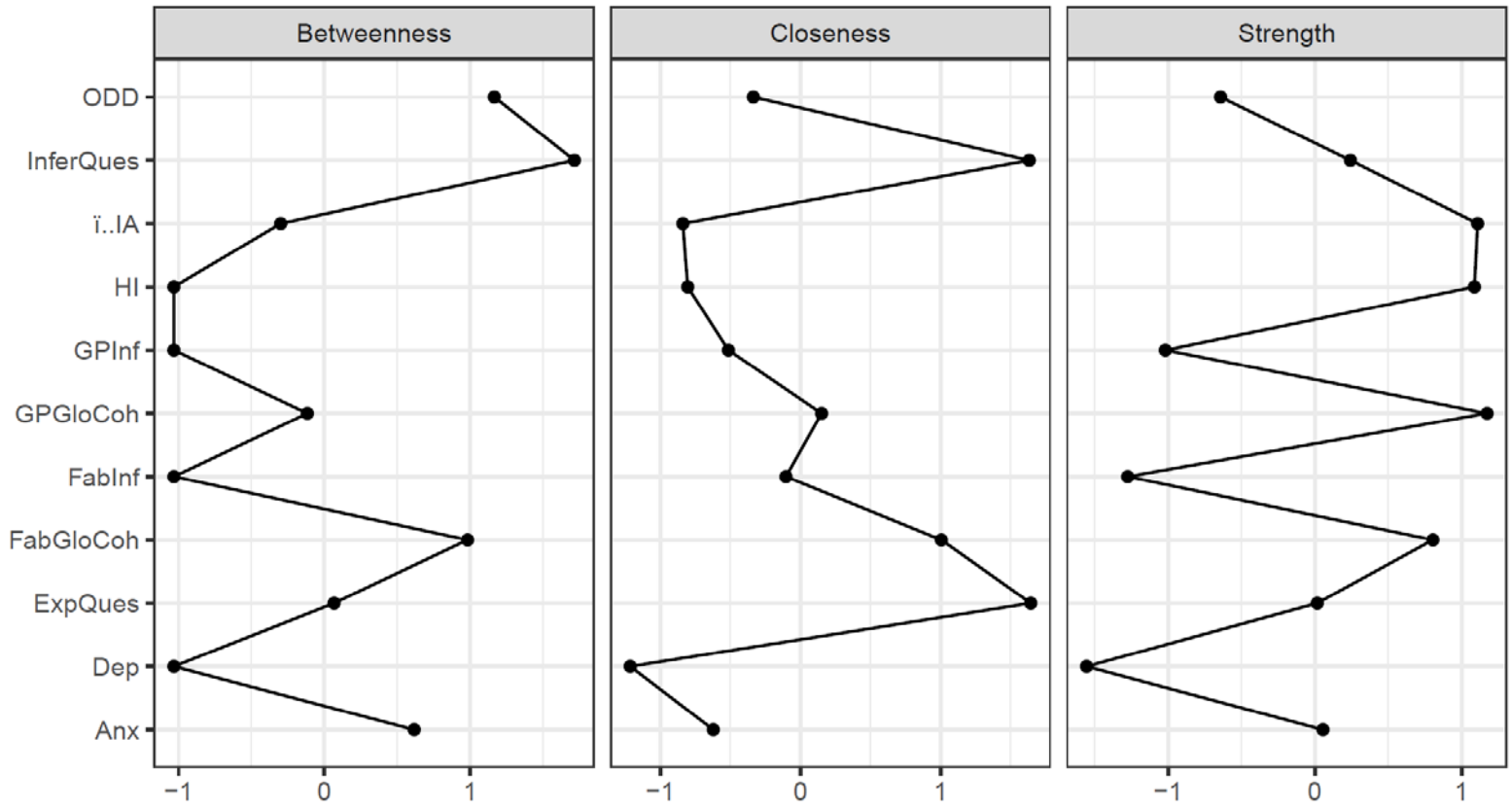


Figure 21. Centrality indices' z-scores for parent and child reported ADHD comorbidities and narrative comprehension network.

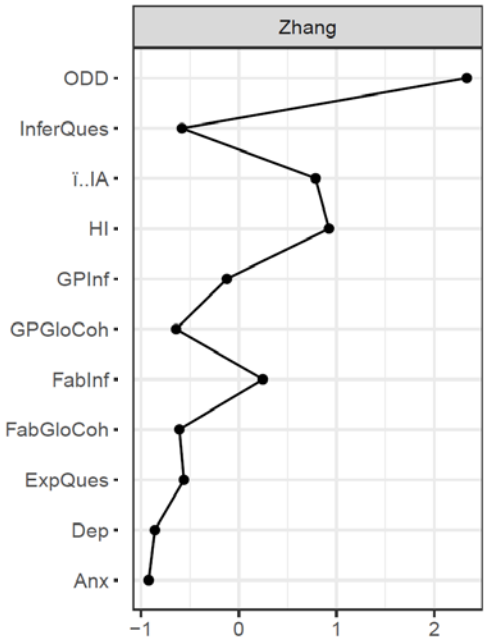


Figure 22. Clustering z-scores for parent and child reported ADHD comorbidities and narrative comprehension network.

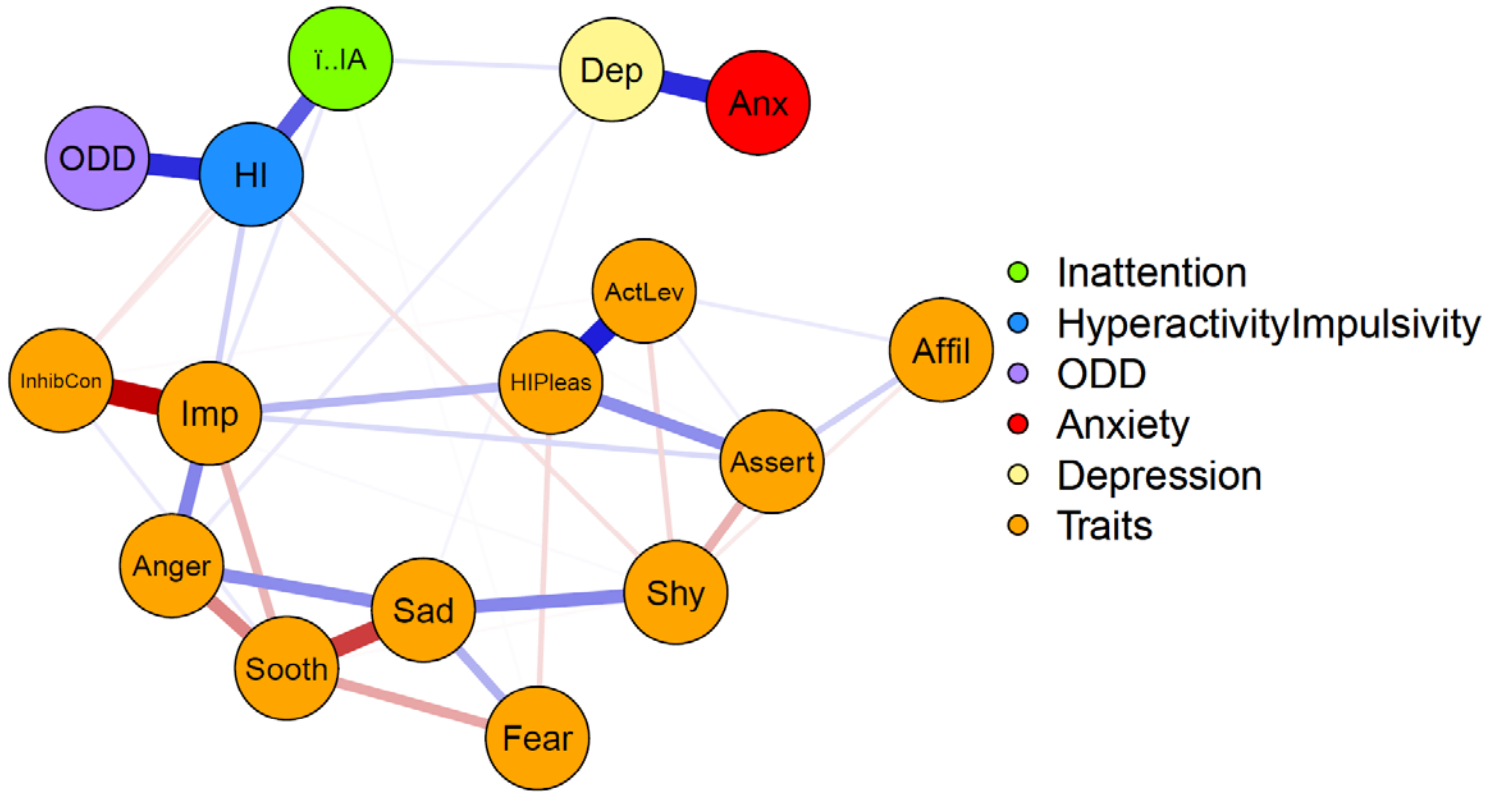


Figure 23. Teacher and child reported ADHD comorbidities and trait network. IA = inattention, HI = hyperactivity/impulsivity, ODD = oppositional defiant disorder, Anx = anxiety, Dep = depression, ActLev = activity level, Affil = affiliation, Anger = anger/frustration, Assert = assertiveness/dominance, Fear = fear, HIPleas = high intensity pleasures, Imp = impulsivity, InhibCon = inihibitory control, Sad = sadness, Shy = shyness, Sooth = soothability/falling reactivity.

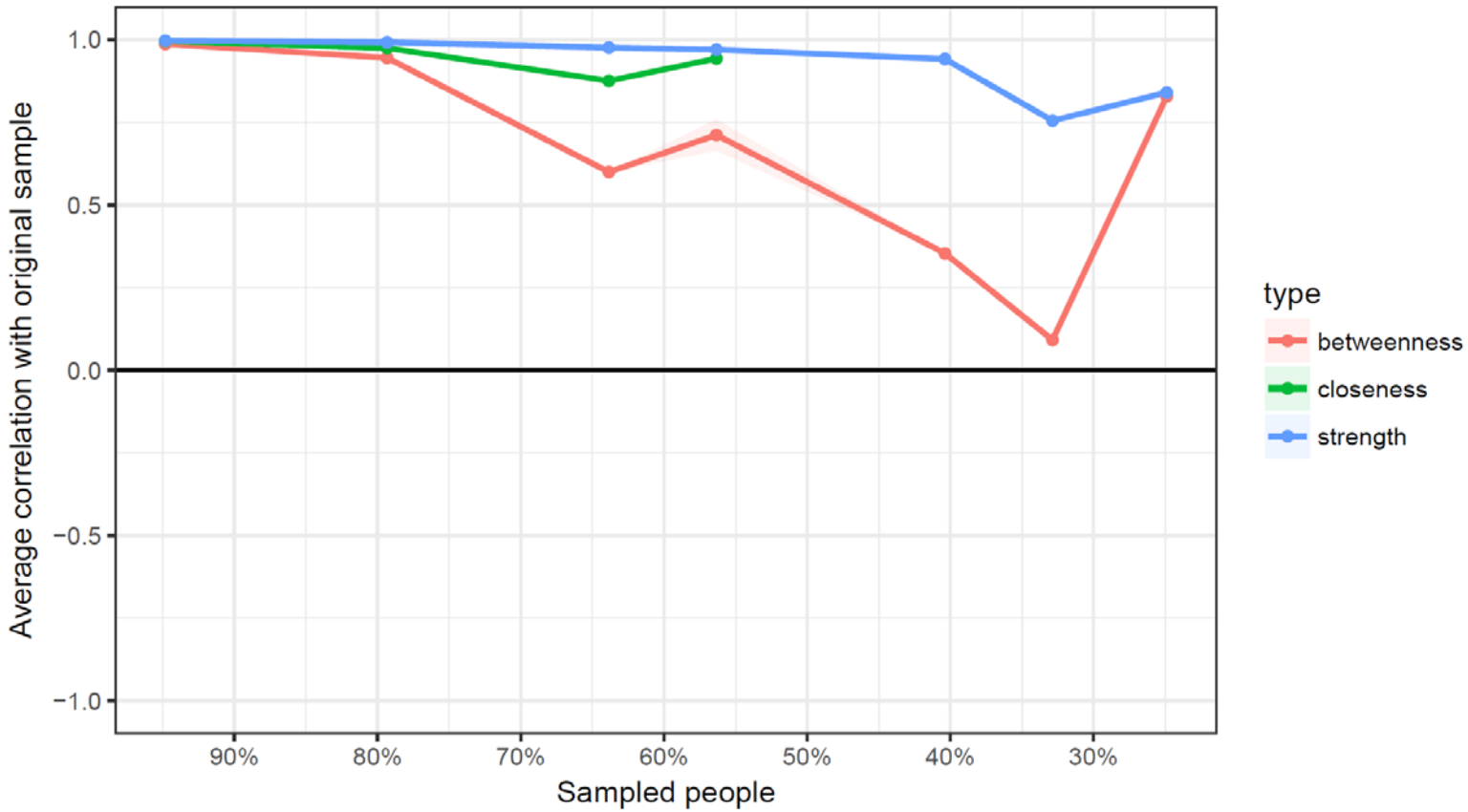


Figure 24. Case-dropping stability for centrality indices of teacher and child reported ADHD comorbidities and trait network.

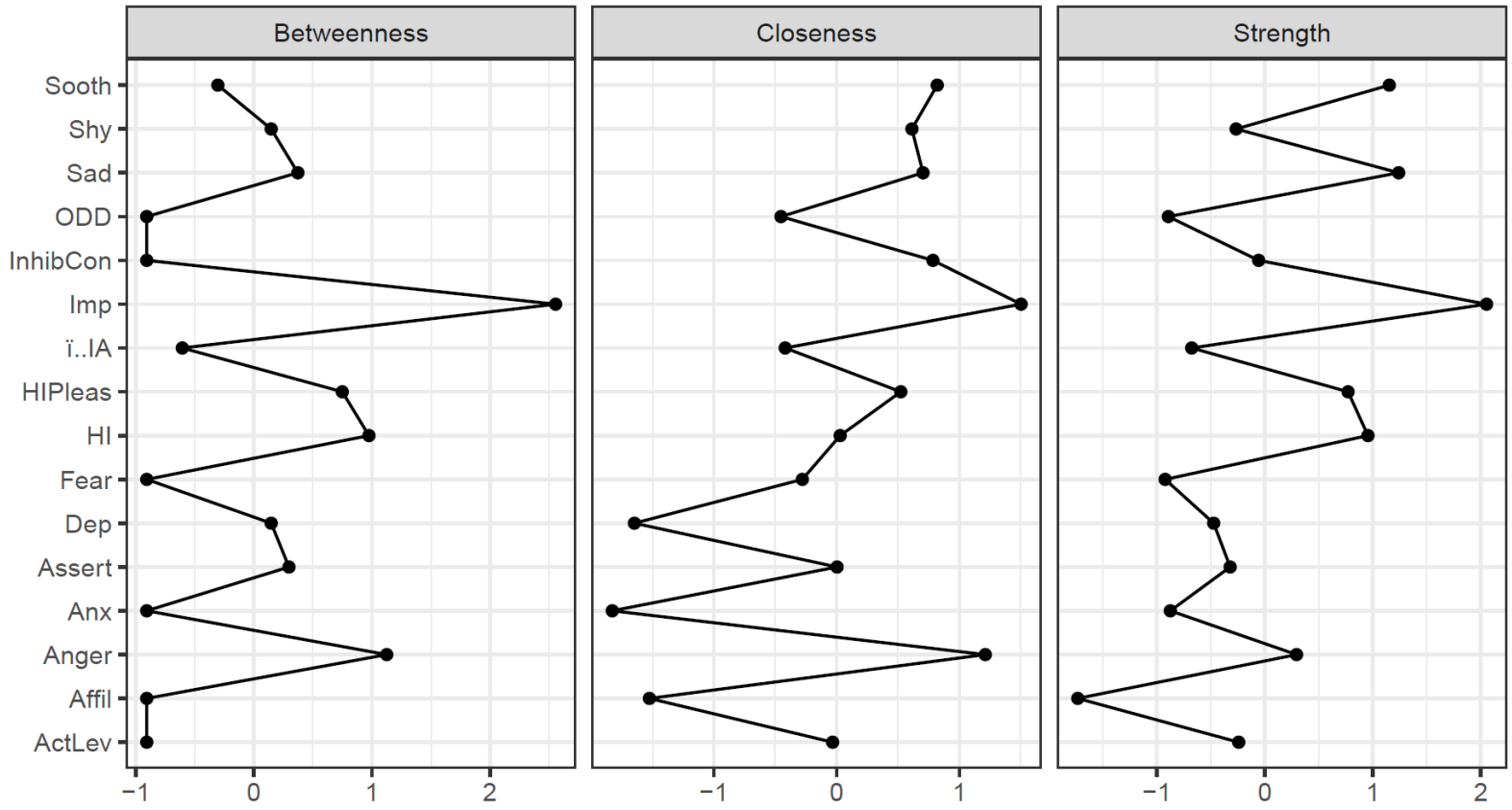


Figure 25. Centrality indices' z-scores for teacher and child reported ADHD comorbidities and trait network.

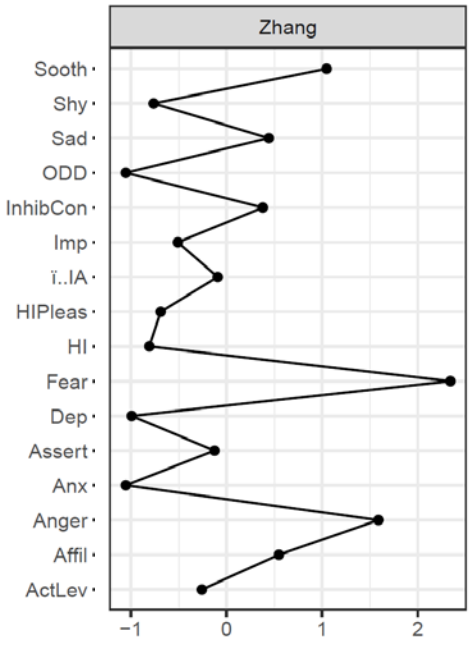


Figure 26. Clustering z-scores for teacher and child reported ADHD comorbidities and trait network.

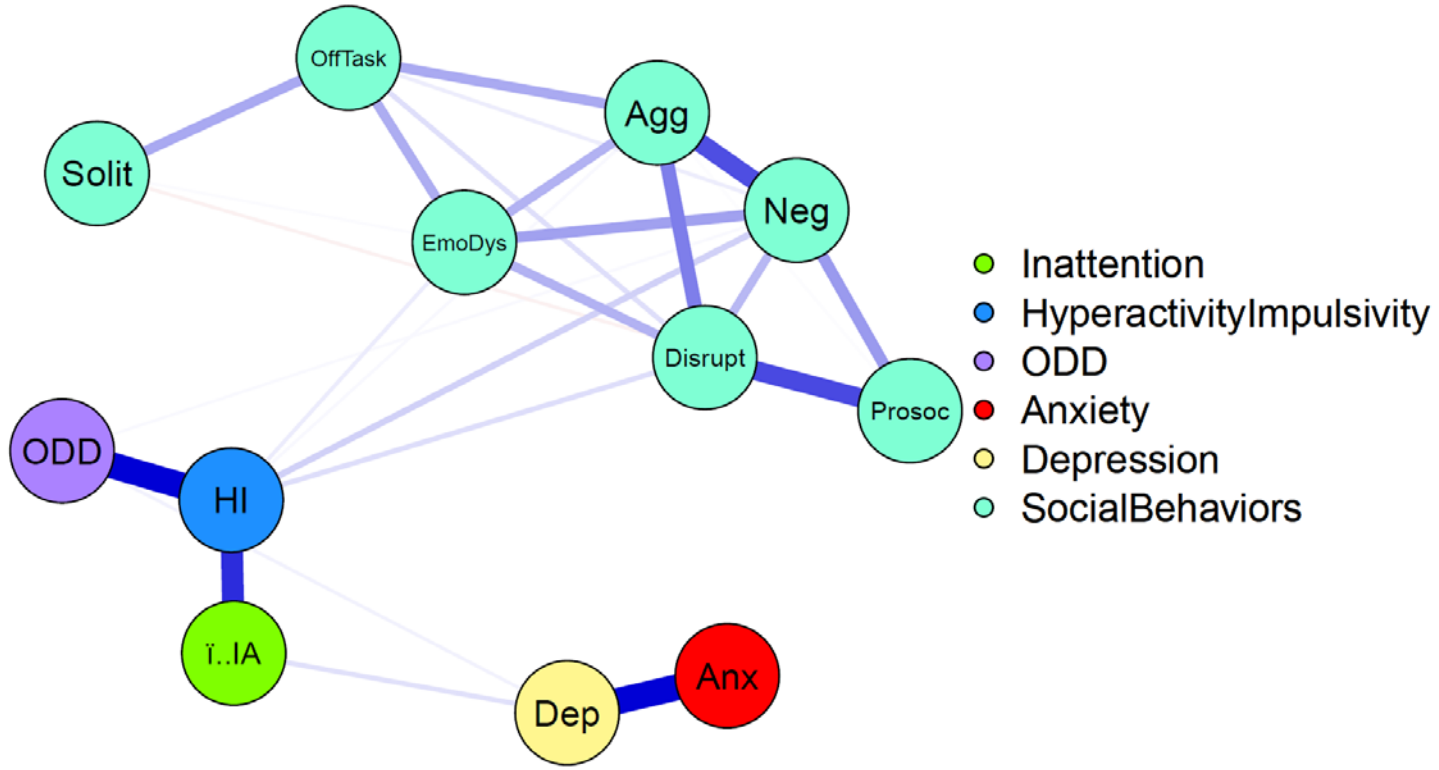


Figure 27. Teacher and child reported ADHD comorbidities and social behaviors network. IA = inattention, HI = hyperactivity/impulsivity, ODD = oppositional defiant disorder, Anx = anxiety, Dep = depression, EmoDys = global emotion dysregulation, OfffTask = off task behavior, Solit = solitary behavior, Prosoc = prosocial behavior, Disrupt = disruptive behavior, Neg = negative behavior, Agg = aggressive behavior.

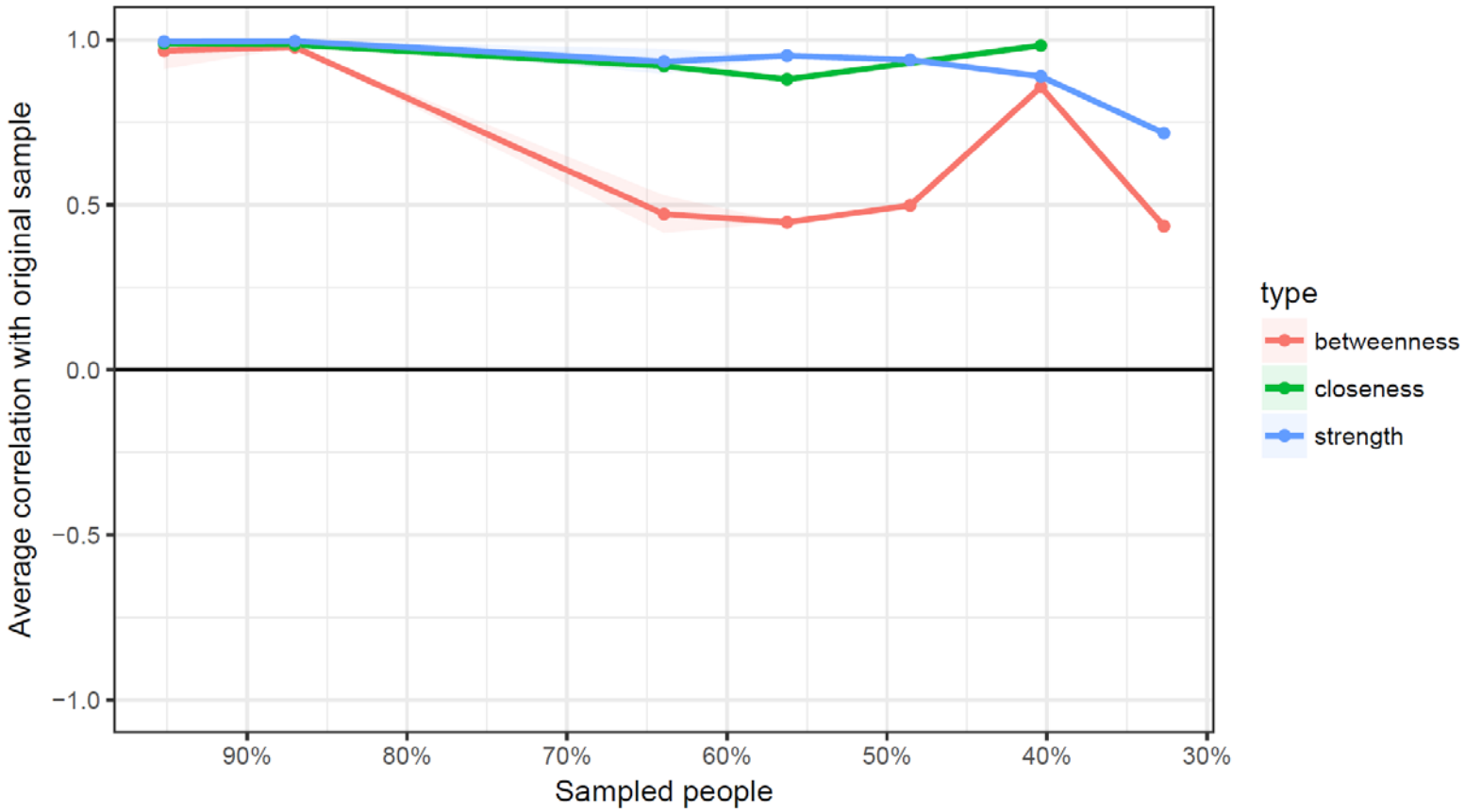


Figure 28. Case-dropping stability for centrality indices of teacher and child reported ADHD comorbidities and social behaviors network.

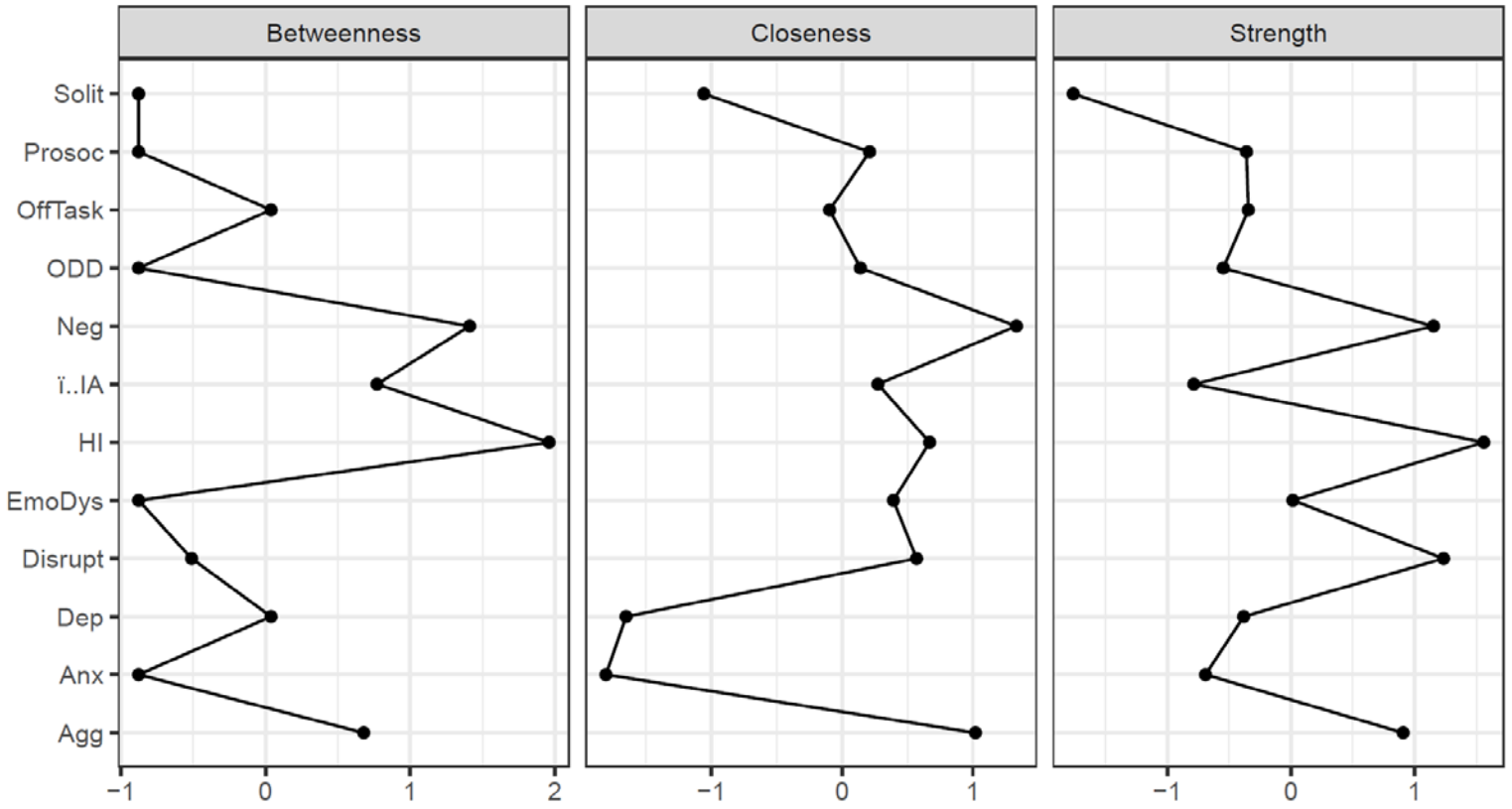


Figure 29. Centrality indices' z-scores for teacher and child reported ADHD comorbidities and social behaviors network.

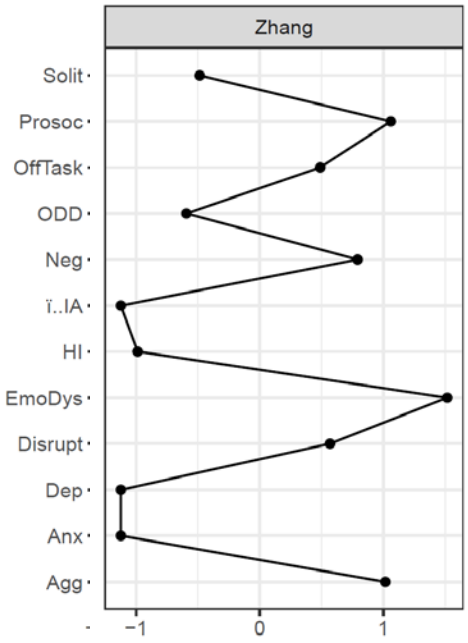


Figure 30. Clustering z-scores for teacher and child reported ADHD comorbidities and social behaviors network.

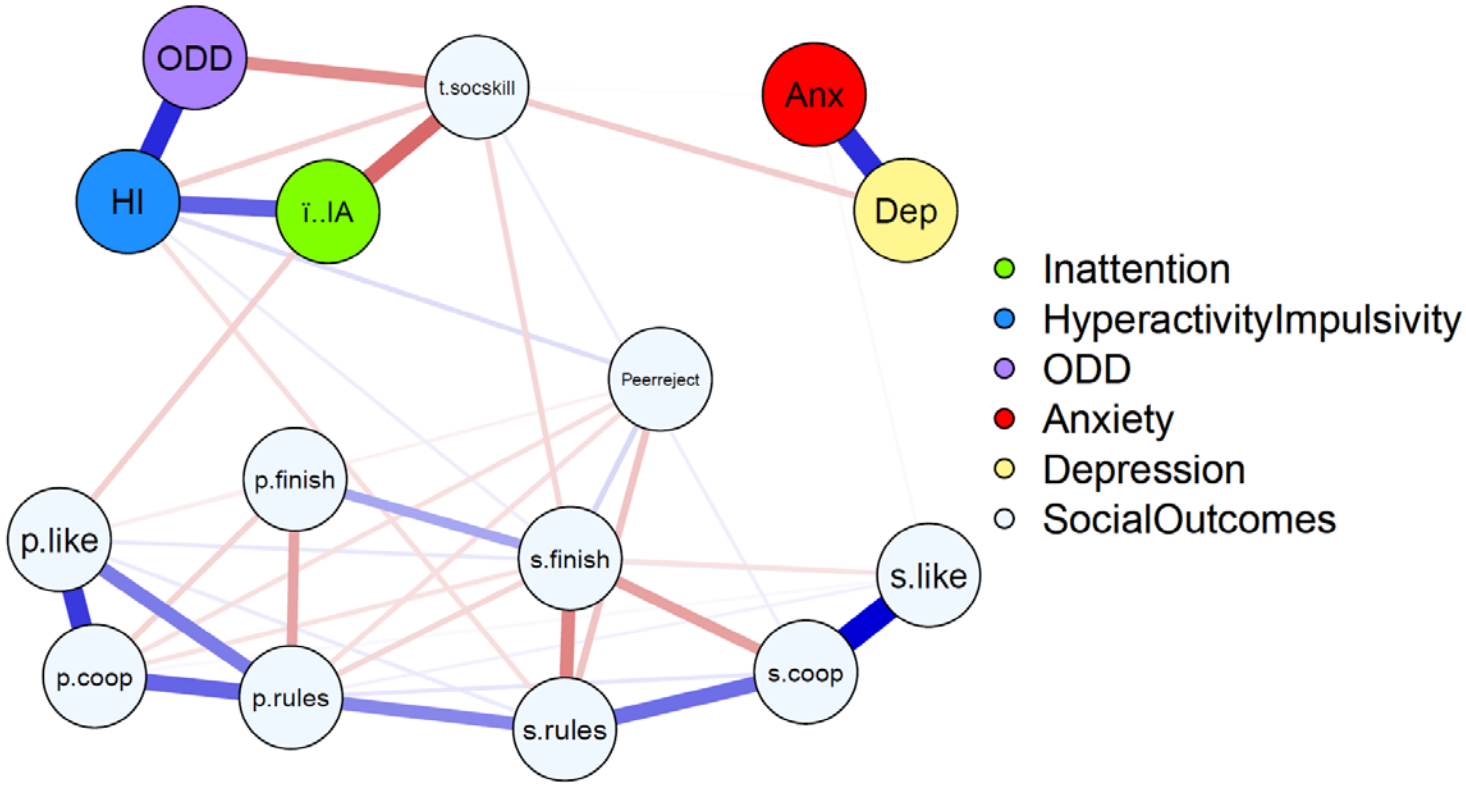


Figure 31. Teacher and child reported ADHD comorbidities and social outcomes network. IA = inattention, HI = hyperactivity/impulsivity, ODD = oppositional defiant disorder, Anx = anxiety, Dep = depression, p.rules = peer rating of how well child followed rules, p.finish = peer rating of how hard child made it to finish task, p.like = peer rating of how much peers liked child, p.coop = peer rating of how well child cooperated, s.rules = staff rating of how well child followed rules, s.finish = staff rating of how hard child made it to finish tasks, s.like = staff rating of how much peers like child, s.coop = staff rating of how well child cooperated, t.socskill = teacher ratings of child's social skills, peerreject = global rating of peer rejection.

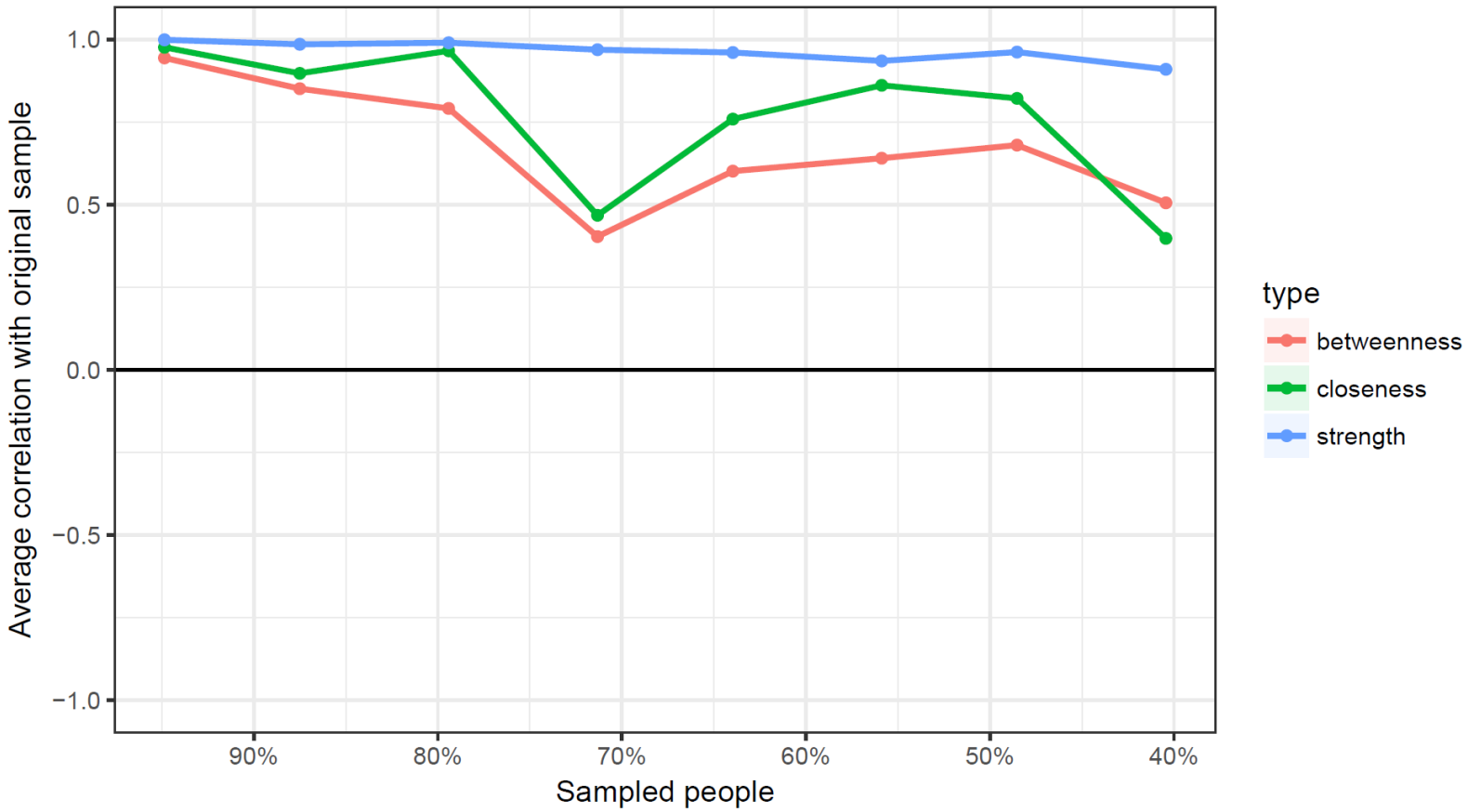


Figure 32. Case-dropping stability for centrality indices of teacher and child reported ADHD comorbidities and social outcomes network.

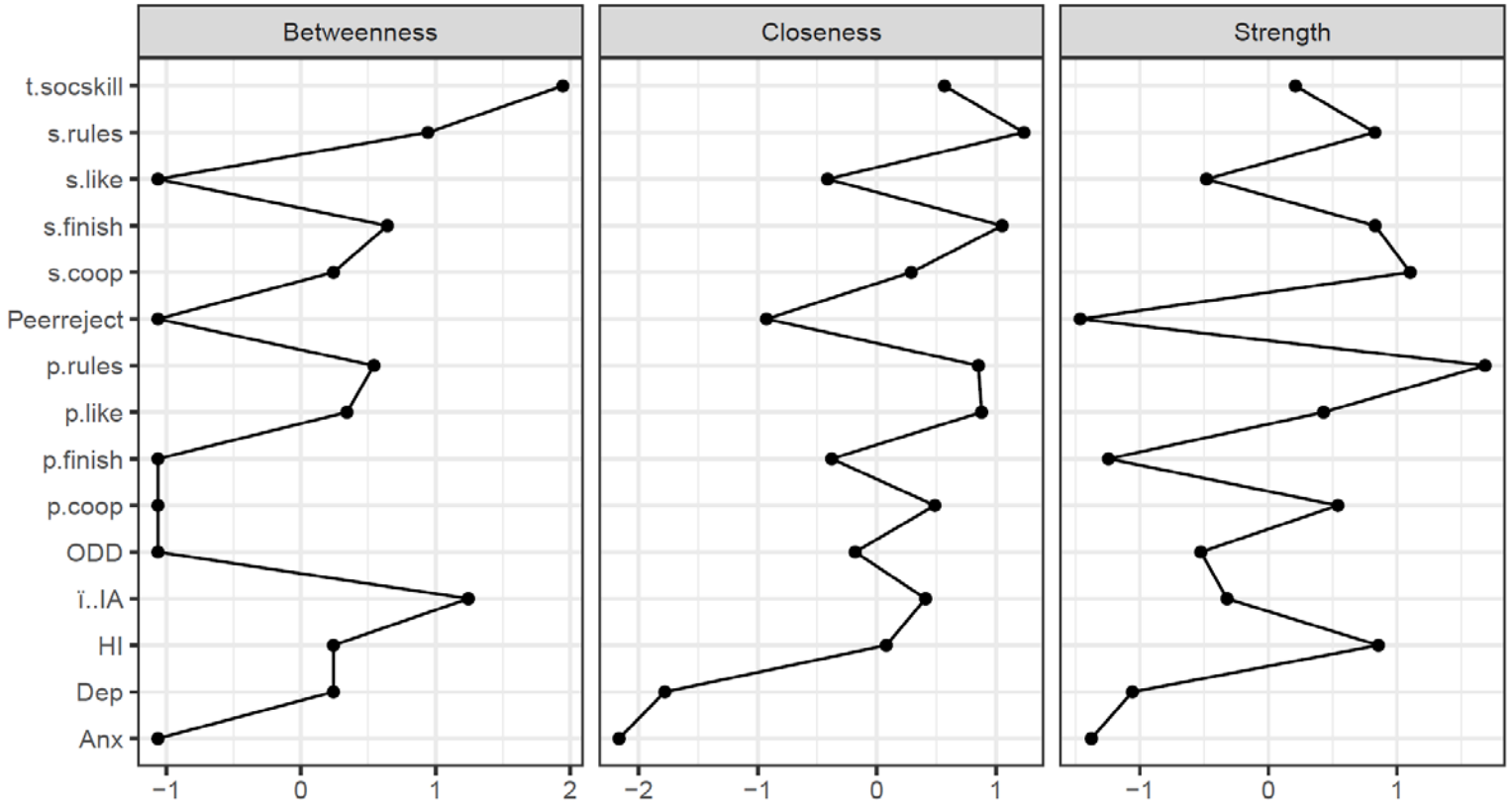


Figure 33. Centrality indices' z-scores for teacher and child reported ADHD comorbidities and social outcomes network.

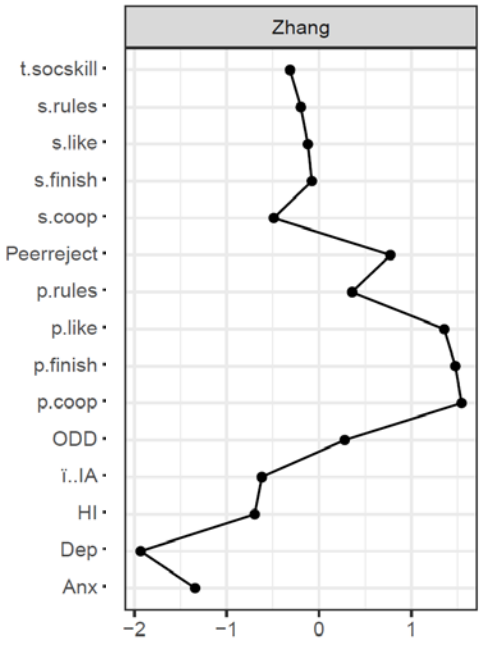


Figure 34. Clustering z-scores for teacher and child reported ADHD comorbidities and social outcomes network.

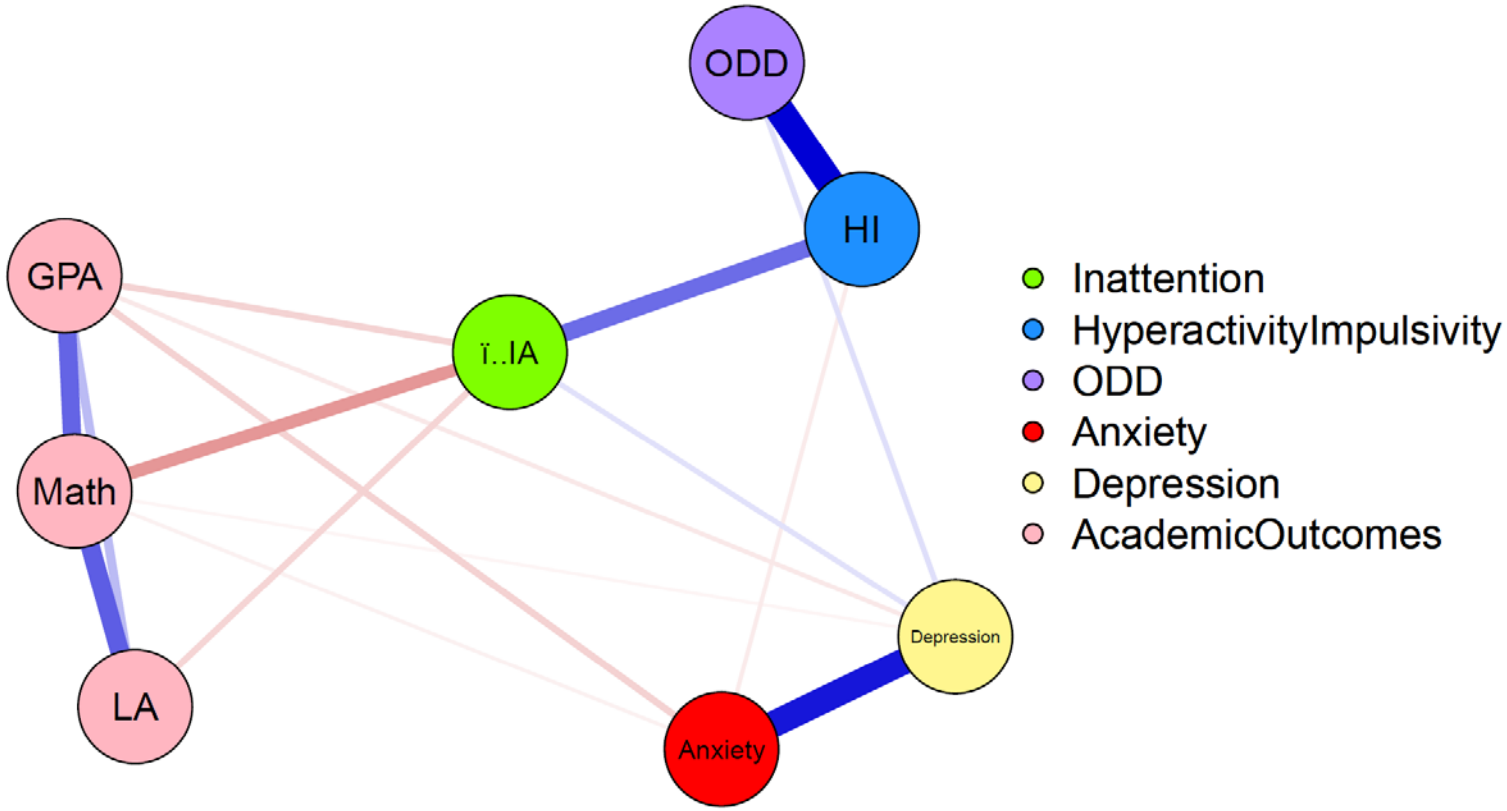


Figure 35. Teacher and child reported ADHD comorbidities and academic outcomes network. IA = inattention, HI = hyperactivity/impulsivity, ODD = oppositional defiant disorder, Anx = anxiety, Dep = depression, GPA = overall grade point average, LA = language arts, Math = mathematics.

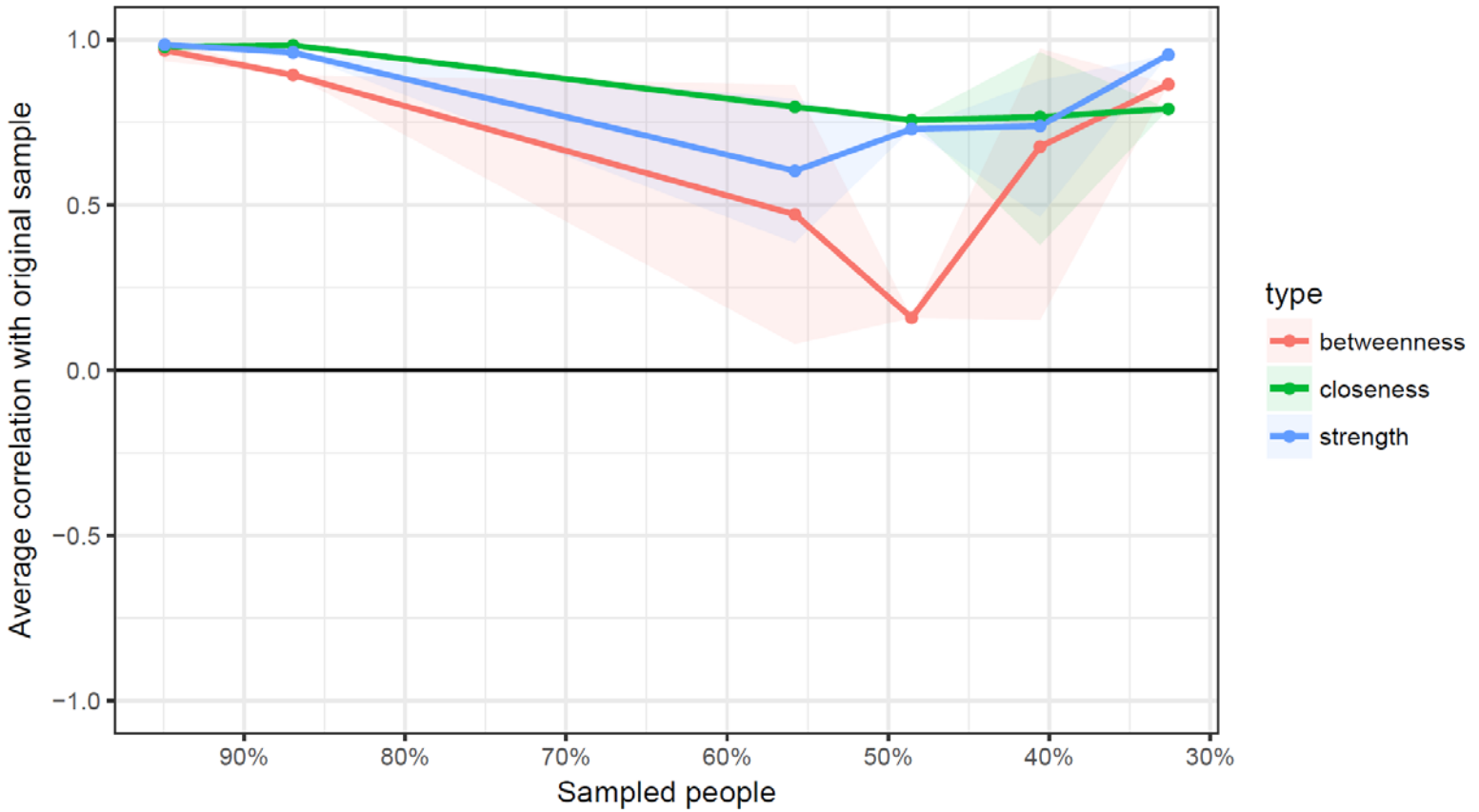


Figure 36. Case-dropping stability for centrality indices of teacher and child reported ADHD comorbidities and academic outcomes network.

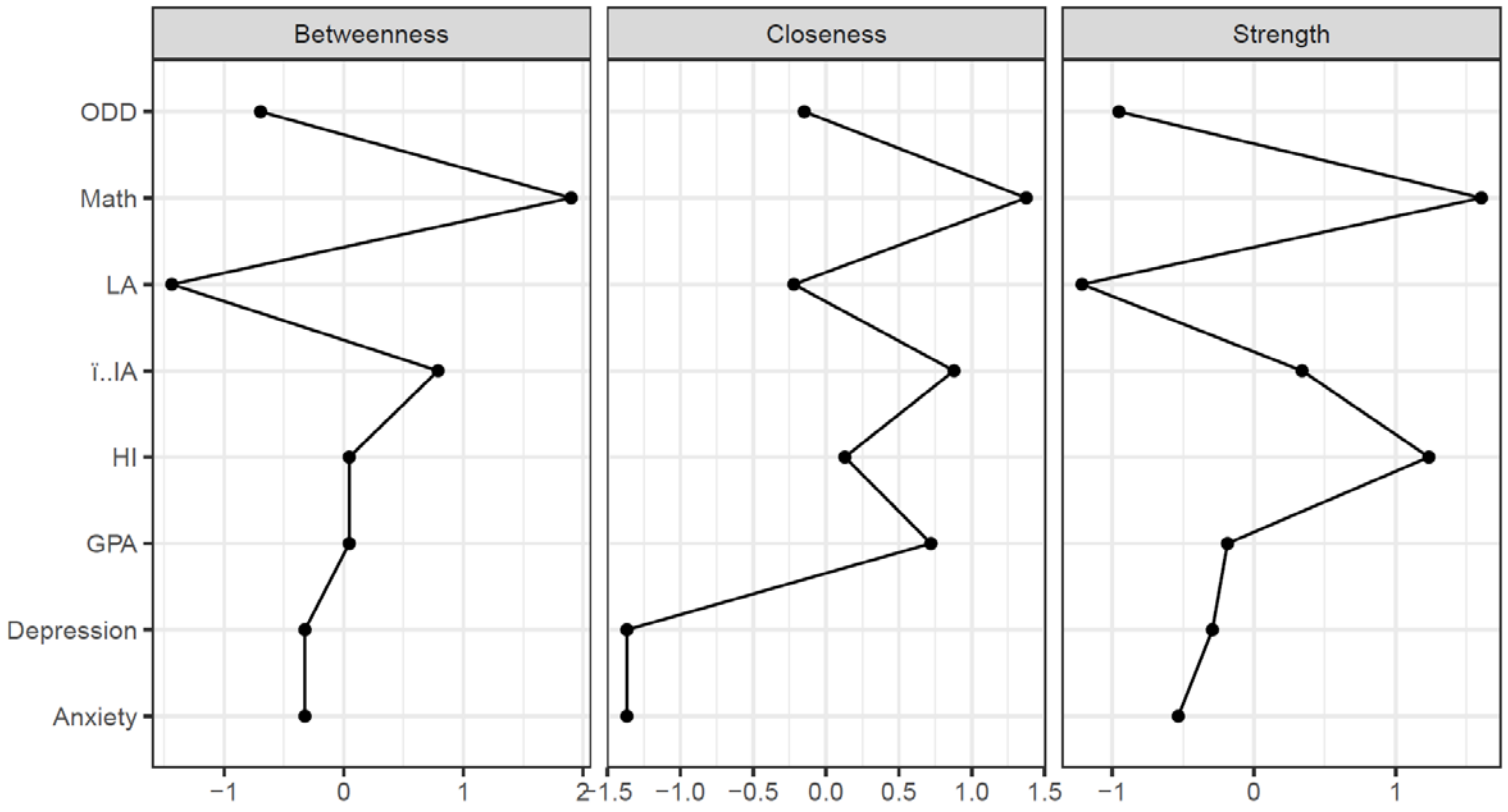


Figure 37. Centrality indices' z-scores for teacher and child reported ADHD comorbidities and academic outcomes network.

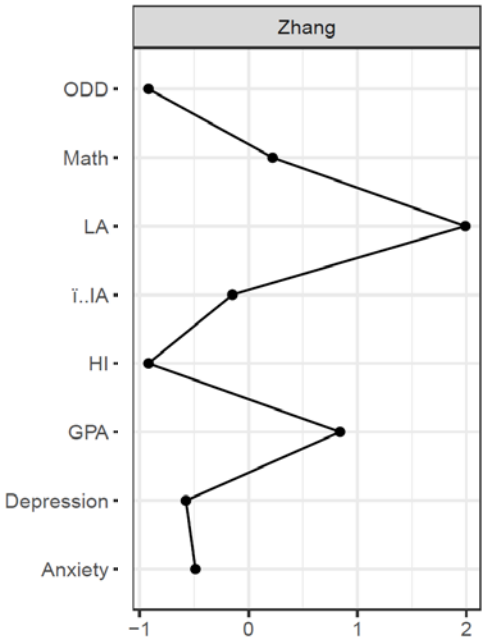


Figure 38. Clustering z-scores for teacher and child reported ADHD comorbidities and academic outcomes network.

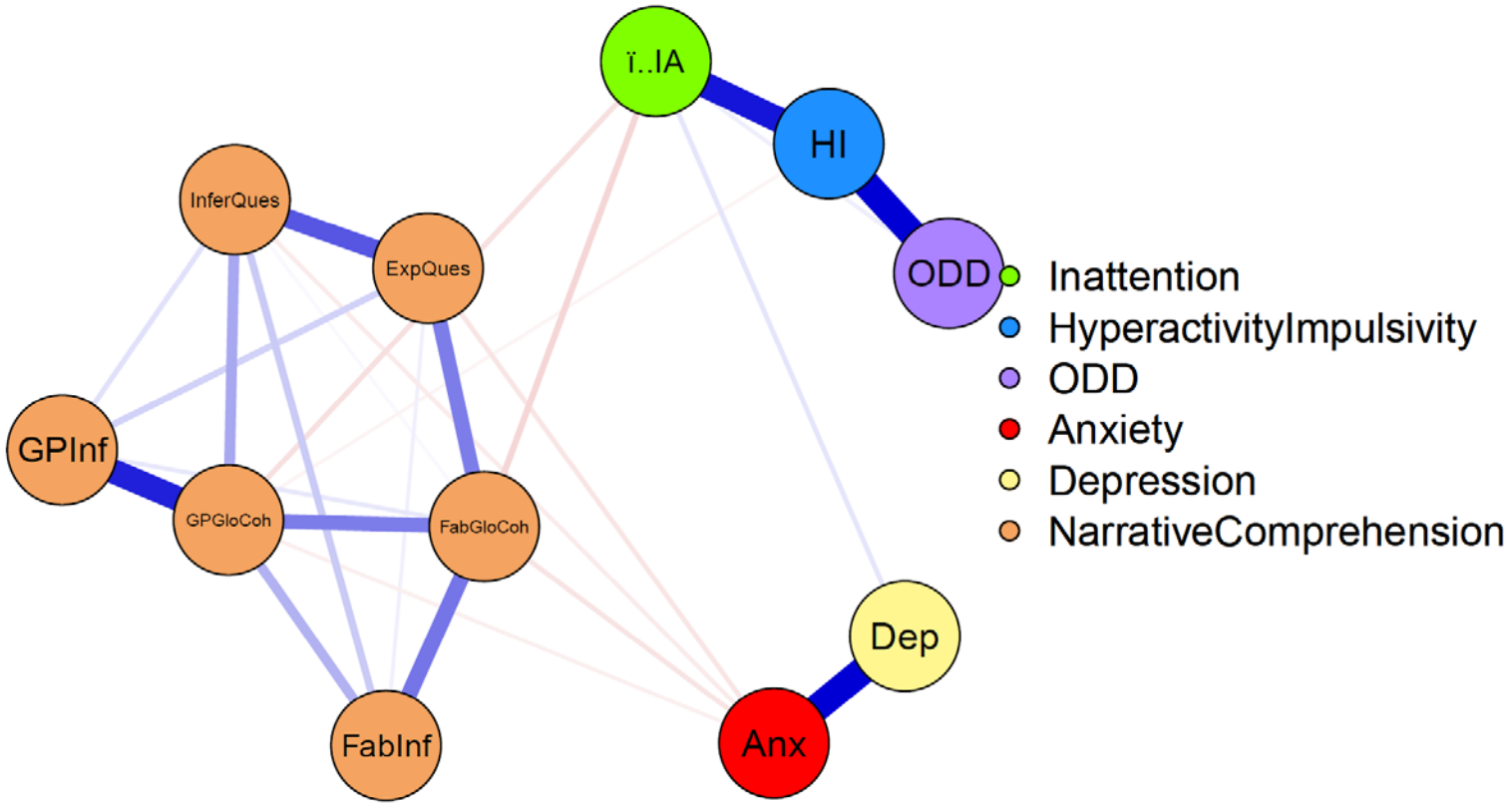


Figure 39. Teacher and child reported ADHD comorbidities and narrative comprehension network. IA = inattention, HI = hyperactivity/impulsivity, ODD = oppositional defiant disorder, Anx = anxiety, Dep = depression, ExpQues = *Growing Pains* explicit causal questions, InferQues = *Growing Pains* inferential causal questions, GPInf = *Growing Pains* explanatory plausible inferences, GPGloCoh = *Growing Pains* global coherence, FabInf = fables explanatory plausible inferences, FabGloCoh = fables global coherence.

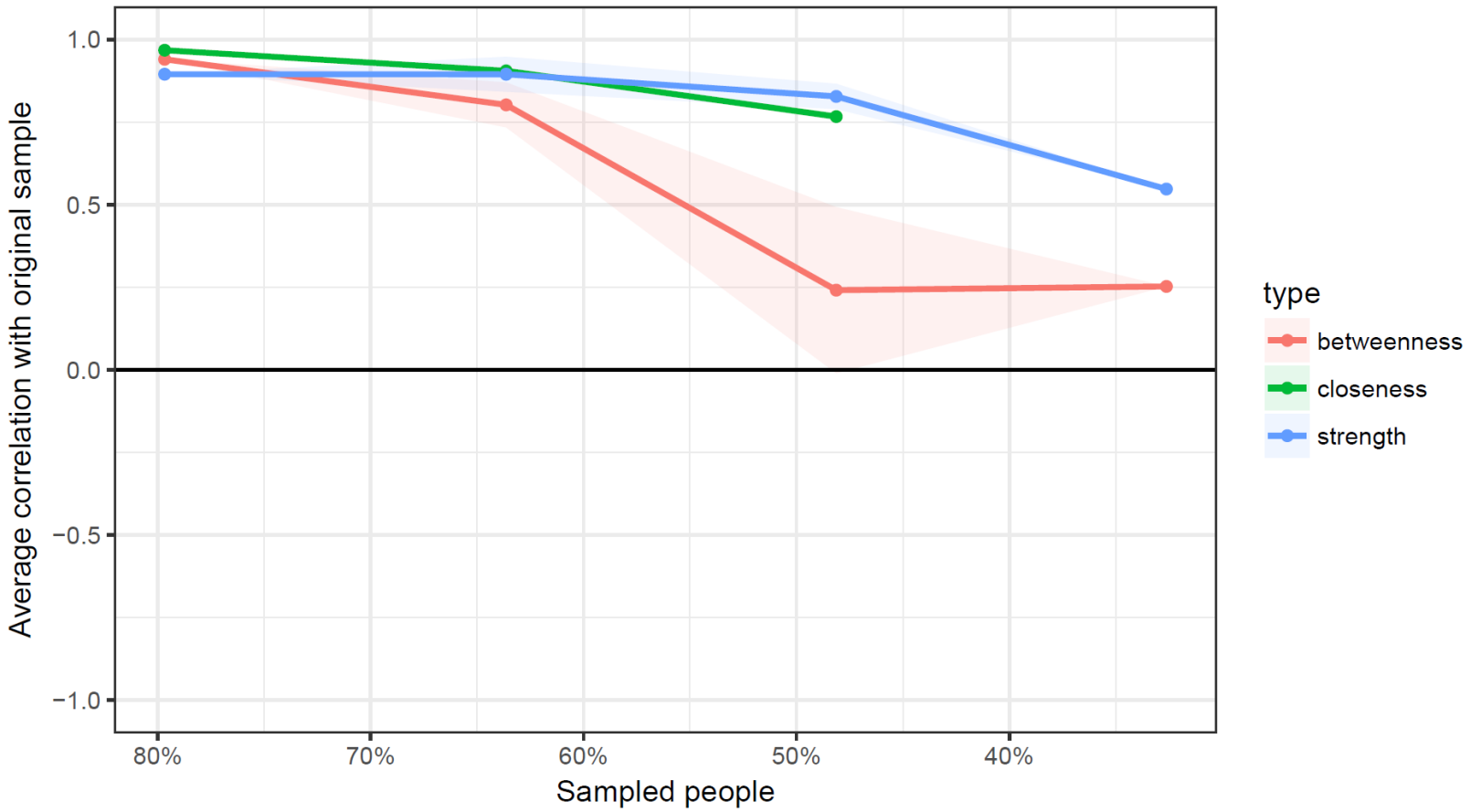


Figure 40. Case-dropping stability for centrality indices of teacher and child reported ADHD comorbidities and narrative comprehension network.

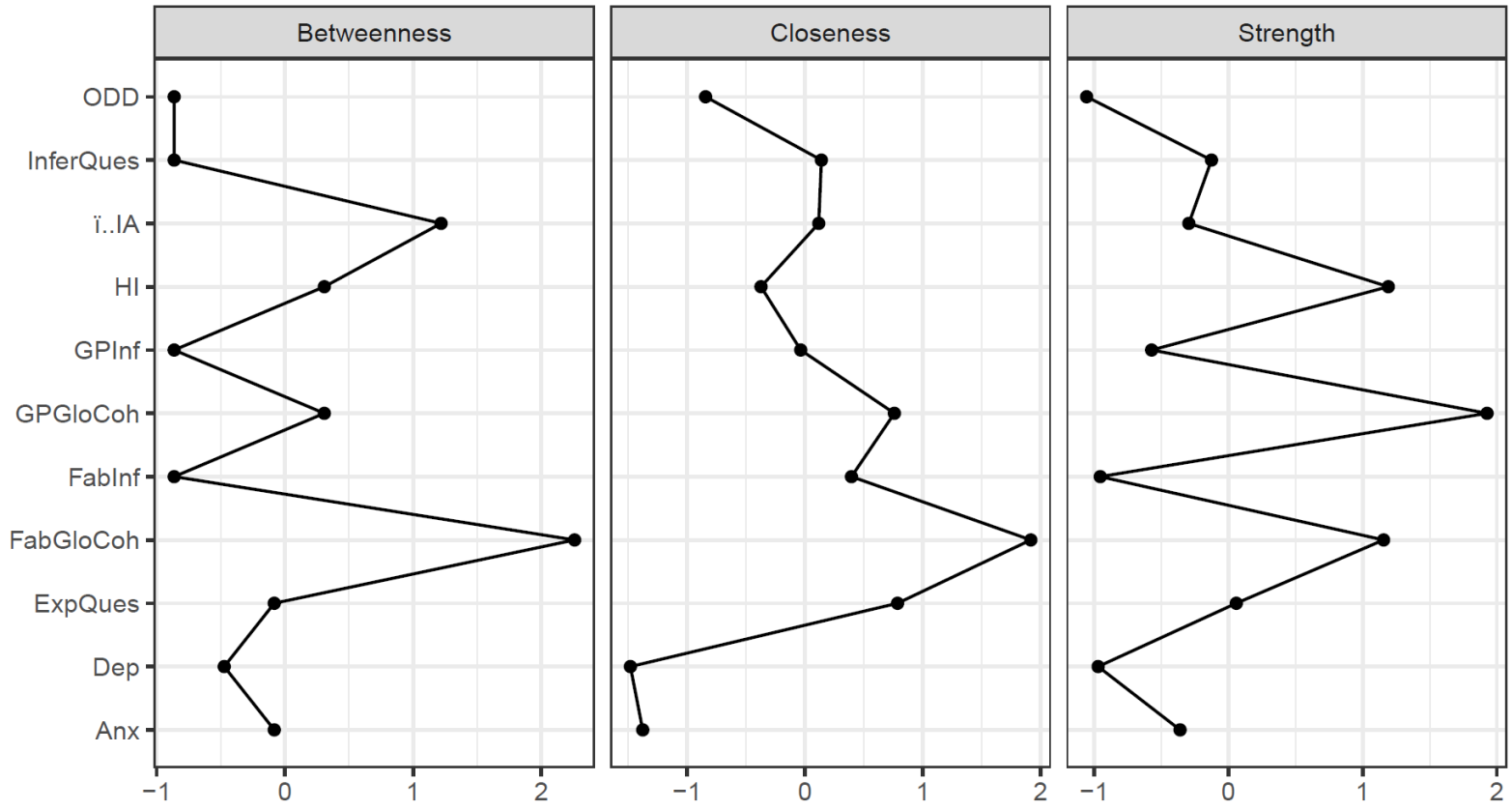


Figure 41. Centrality indices' z-scores for teacher and child reported ADHD comorbidities and narrative comprehension network.

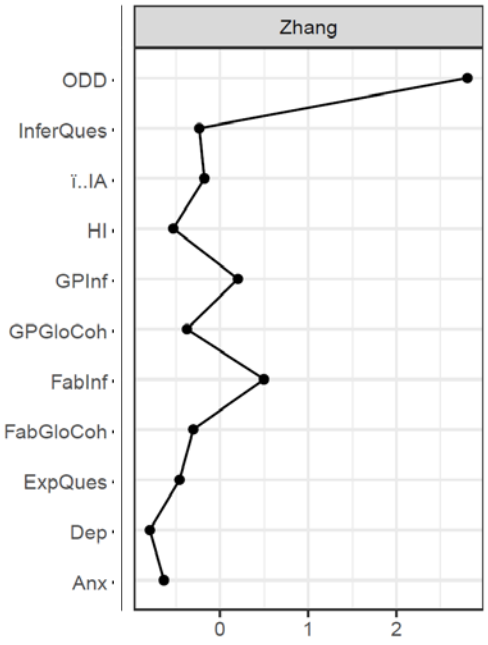


Figure 42. Clustering z-scores for teacher and child reported ADHD comorbidities and narrative comprehension network.

Chapter Four: Discussion

ADHD comorbidities are common, particularly in clinical settings, yet it is unknown how these comorbid presentations may differ from the characteristics and outcomes commonly associated with "pure" ADHD. The current study used data driven approaches to examine ADHD comorbidities and how these comorbidities differed, if at all, with respect to traits, social behaviors, and social, academic, and narrative comprehension outcomes. Latent profile analyses found that a high ADHD/ODD Symptoms profile was present for both parent and teacher reported ADHD and ODD symptoms. Moreover, this profile frequently differed from the Low Overall Symptoms profile by having more impulsive and emotional traits, more negative behaviors displayed during a playgroup setting, and worse social outcomes. There was also evidence that inattention symptoms may be negatively related to academics. For parent and teacher reported profiles, the High Inattention Symptoms profile had worse academic outcomes compared to the Low Overall Symptoms profile. LPA results were mirrored in network analyses results, where impulsivity and negative emotions were core nodes of trait networks and negative social behaviors were core to social behaviors networks. Moreover, hyperactivity/impulsivity was central for trait, social behaviors, and social outcomes networks whereas inattention was central for academic and narrative comprehension outcomes networks.

Overall, results seemed primarily driven by high ADHD/ODD comorbidity. Those in both parent and teacher reported High ADHD/ODD Symptoms profiles frequently differed significantly from those in the Low Overall Symptoms profiles and there were strong relations between ADHD and ODD symptoms across networks.

Moreover, those in the High ADHD/ODD Symptoms profiles displayed the characteristics and social outcomes commonly associated with ADHD by itself (e.g., impulsivity, aggression). The emphasis on externalizing behaviors was also seen in networks, where ADHD and ODD symptoms were strongly connected to one another and the other nodes in the networks, but anxiety and depression were often distally placed in relation to other nodes. Further, anxiety and depression never clustered closely with inattention or hyperactivity/impulsivity symptoms. Results suggest that ODD symptoms perhaps have an exacerbating effect on these existing areas of deficit for those with ADHD (Becker, Luebbe, & Langberg, 2012; Becker, Luebbe, Stoppelbein, et al., 2012), worsening the relations between ADHD and traits, social behaviors, and social outcomes. This theory is supported by the high clustering around ODD symptoms in networks, suggesting that ODD is connected to characteristics or outcomes that its neighboring nodes (i.e., hyperactivity/impulsivity and inattention) are already connected to; thus, ODD comorbidity may not be creating differential relations to characteristics and outcomes, but instead exacerbating existing relations. Another possibility is that since ADHD/ODD is such a common comorbid presentation (Jensen et al., 1997), much of previous work focusing on ADHD is also unknowingly focused on ADHD/ODD comorbidity. Therefore, previously established relations between ADHD and these domains may instead be including the effect of ODD. In contrast, internalizing symptoms did not notably differentiate LPA profiles or appear central to networks. Thus, compared to externalizing symptoms, internalizing symptoms may not have a strong association with characteristics or outcomes associated with ADHD.

The characteristics associated with comorbid ADHD/ODD symptoms align with previous work emphasizing the role of impulsivity, or lack of control, and emotionality. The centrality of negative affect, such as anger/frustration and sadness, corresponds with previous trait work on both ADHD and ODD (Martel et al., 2009; Martel & Nigg, 2006). The high positive emotions associated with this comorbidity, such as high intensity pleasure, match the approach/surgency aspect of hyperactivity/impulsivity (Martel & Nigg, 2006; Martel et al. 2009). Further, the role of emotionality also aligns with the emotion dysregulation shown during the playgroup. There were significant profile differences in emotion dysregulation displayed during the playgroup, with the High ADHD/ODD Symptoms profile having higher ratings of global emotion dysregulation. Additionally, network analysis results highlighted the strong negative relation between soothability/falling reactivity with anger and sadness. Soothability/falling reactivity was also central to trait networks. These results tap into the difficulty children with ADHD/ODD may have in not only experiencing strong emotions but also returning to their baseline emotional state after such outbursts (Bunford et al., 2015).

Similar to previous work on those with comorbid ADHD/ODD (Becker, Luebbe, Stoppelbein, et al., 2012; Harty et al., 2009), those in the High ADHD/ODD Symptoms profile had more negative social behaviors during the playgroup compared to other profiles. However, there were no significant differences in prosocial behaviors displayed, with prosocial behaviors positively related to negative behaviors in the playgroup in network analysis results. Thus, the social difficulties associated with ADHD may not be attributed to a lack of prosocial behavior, but rather the increased accompanying negative

behavior. Overall, these results are commensurate with work on ADHD, ODD, and comorbid ADHD/ODD.

Those with ADHD/ODD also had poorer social outcomes based on parent, staff, and peer reports. Those with this comorbidity were less liked and thought to have less social skills than comparison peers. These difficulties may have been related to their behaviors during the playgroup, where they were perceived as less cooperative and less likely to follow rules, making it harder to finish tasks. Within networks, likeability was negatively related to cooperation and finishing tasks, suggesting that these behaviors may be key for positive peer relations. Thus, similar to social behaviors results, children's negative behaviors appear crucial when considering their social status.

Those with high inattention symptoms had more academic and narrative comprehension difficulties compared to other profiles. These results are unsurprising since narrative comprehension skills parallel essential academic skills, particularly in language arts or reading comprehension. Those in the High Inattention Symptoms profiles also had the highest levels of anxiety and depression compared to other profiles. Based on network analyses, internalizing symptoms appeared to relate to academic and narrative comprehension difficulties. However, networks often had inattention, but not internalizing symptoms, as a core node in the network with inattention and internalizing symptoms not strongly related in networks. Thus, inattention, but not internalizing symptoms, may be driving these deficits. Since this is the first study, to my knowledge, that investigates ADHD/internalizing comorbidity and narrative comprehension, further work and replication is needed. In contrast to trait and social networks, inattention, and

possibly comorbid internalizing, may be the most relevant for academic and narrative comprehension outcomes.

Notably, results were consistent across methods and reporters as well as analytic strategies. Reporters in this study included parents, teachers, children, and blind coders whereas methods included observational coding, grades, and rating scales. Both parent and teacher report of ADHD and ODD symptoms identified similar profiles: Low Overall Symptoms, High ADHD/ODD Symptoms, and High Inattention Symptoms. Moreover, profile comparisons found similar differences among profiles on characteristics and outcomes across both parent and teacher report. This consistency in results across reporters was mirrored when using network analyses; parent and teacher reported networks gave similar results and staff and peer ratings during the playgroup were interconnected. The connectivity and structure of networks between reporters were also comparable with the same traits and behaviors appearing core to networks regardless of reporters. Like profile comparison results, externalizing symptoms were more central to characteristics and social outcomes networks whereas inattention were more central to academic and narrative comprehension networks. Given the difficulty of obtaining multiple informant agreement (De Los Reyes & Kazdin, 2005) and the current replicability controversy largely unaddressed by clinical psychology (Tackett et al., 2017), these consistent results across raters and methods give further strength to the validity of conclusions.

Implications

The results of this study have implications for the assessment and treatment of ADHD comorbidities. ADHD/ODD comorbidity was associated with an impulsive and

emotional temperament, negative social behaviors, and worse social outcomes, suggesting that ADHD assessment must also consider assessment of ODD symptoms as well. Current treatment of ADHD focuses on behavior therapy and parent training to reduce children's negative behaviors by setting limits and rewarding positive behaviors (Evans, Owens, Wymbs, & Ray, 2018). Treatment for ODD similarly focuses on behavior therapy and parent training, such as parent-child interaction therapy (McNeil & Hembree-Kigin, 2010). Thus, treatment may not need to be changed for this comorbidity as it is similar across disorders and targets the needed areas of deficits. Such overlap in treatment may explain why previous research has not found differences in treatment approaches for those with comorbid ADHD/ODD compared to those with ADHD only (Jensen et al., 2001).

Though social skills training has been used for children's social skills difficulties, long-term effects are limited (Evans et al., 2018). Moreover, social skills training often targets improving positive behaviors (e.g. starting conversation, giving compliments), which may not be an issue for those with ADHD. Rather, treatment should focus on reducing negative behavior, such as improving emotion regulation. Indeed, novel interventions focused on emotion regulation or anger reduction have gained empirical support and may be a more effective mechanism for targeting poor peer relations (Rosen, Loren, & Epstein, 2010; Waxmonsky et al., 2016). As emotion regulation is a transdiagnostic characteristic, such a treatment may also have utility across multiple disorders.

In terms of academic and narrative comprehension outcomes, inattention and possibly internalizing symptoms need to be addressed. This finding supports previous

work suggesting that inattention may have a unique relationship with academic difficulties (DuPaul et al., 2004; Hudziak et al., 1998; Milich et al., 2001). Currently, organizational skills training is a well-established treatment for those with ADHD (Evans et al., 2018). This approach, primarily focused on inattention difficulties, is appropriate considering the current study's results. However, this treatment may possibly be augmented by treatment of internalizing difficulties, such as positive coping skills, in line with cognitive-behavioral therapy (Herman et al., 2007). Though cognitive-behavioral therapy is not a traditionally efficacious treatment for ADHD (Bloomquist et al., 1991), it could be a useful adjunct when used with already empirically established treatments, such as organizational skills training.

Overall, based on these results, assessment procedures for those with ADHD should examine comorbid externalizing and possibly internalizing symptoms. However, currently available treatments for ADHD may be sufficient for those with ADHD comorbidities. Specifically, treatment (i.e., behavior therapy, parent training) already overlaps between ADHD and ODD, the comorbidity primarily associated with difficult traits and negative social behaviors and outcomes. Targeted treatment for internalizing symptoms could be addressed through a transdiagnostic approach, such as emotion regulation, or cognitive-behavior skills in conjunction with established ADHD treatment, such as organizational skills training.

Limitations

Though the current study utilized multiple raters and methods to bolster the validity of results, it is not without limitations. The current study was oversampled for those with ADHD symptoms; thus, the lack of associations of internalizing symptoms in

the results may be due to a restricted range of symptoms in the sample. In particular, those using selective serotonin reuptake inhibitors were excluded from the study. Future work could focus on populations oversampled for both externalizing and internalizing symptoms. However, though official diagnoses of anxiety and depression were low, the average sum score on the SCARED was above 25, suggesting that many children were at risk for an anxiety disorder. Therefore, it is also possible that the current study did not investigate the areas where an ADHD/internalizing presentation may show deficits. For example, those with comorbid ADHD/anxiety do not differ from those with ADHD only on ADHD symptom severity and impairment (Jarrett, Wolff, Davis, Coward, Ollendick, 2016), but they do have more working memory deficits, more response inhibition, and slower reaction times to lab tasks (Jarrett et al., 2016; Pliszka, 1989; Schatz & Rostain, 2006). Perhaps if lab tasks of working memory and response inhibition were included in the study, more stark differences for an ADHD/internalizing profile could have been found. Moreover, sluggish cognitive tempo symptoms were not included in the current analyses, but previous work suggests that anxiety and sluggish cognitive tempo may be related (Schatz & Rostain, 2006). Future work can examine how sluggish cognitive tempo symptoms impact ADHD comorbidities, particularly in regard to internalizing symptoms.

Another limitation of the current study is the use of person-centered analyses. Though these approaches allow a more naturalistic representation of the current sample, these approaches are, by definition, sample specific. Thus, these results are specific to this population and the age range covered. Other work suggests that internalizing disorders increase in females as they reach adolescence (Chronis-Tuscano et al., 2010;

Hinshaw et al., 2012). Therefore, profiles may look different for different age groups. Moreover, these analyses are constrained to the measures used in the current study. It is possible if different internalizing measures were used, such as parent or teacher report, internalizing results would have been different. Lastly, though results were consistent across LPA and network analysis results using differing reporters, they still need to be replicated in different samples with varying levels of symptomology using multiple reporters (Fried & Cramer, 2017; Rohde et al., 2001). Replication in larger samples may also provide more power to find profile differences. In the current sample, profile comparison results were often statistically significant, though post-hoc comparisons were not, suggesting that profiles were underpowered to find significant contrasts (Yang, 2006). Replication is also needed since multiple profile and post-hoc comparisons were analyzed. Though a lower value for significance was set to compensate for the number, there is higher possibility of type I error, or false positives, in the current results. Additionally, network analysis of parent and child reported ADHD comorbidities and narrative comprehension had unstable centrality values. Therefore, replication of this network is needed in order to more confidently interpret results.

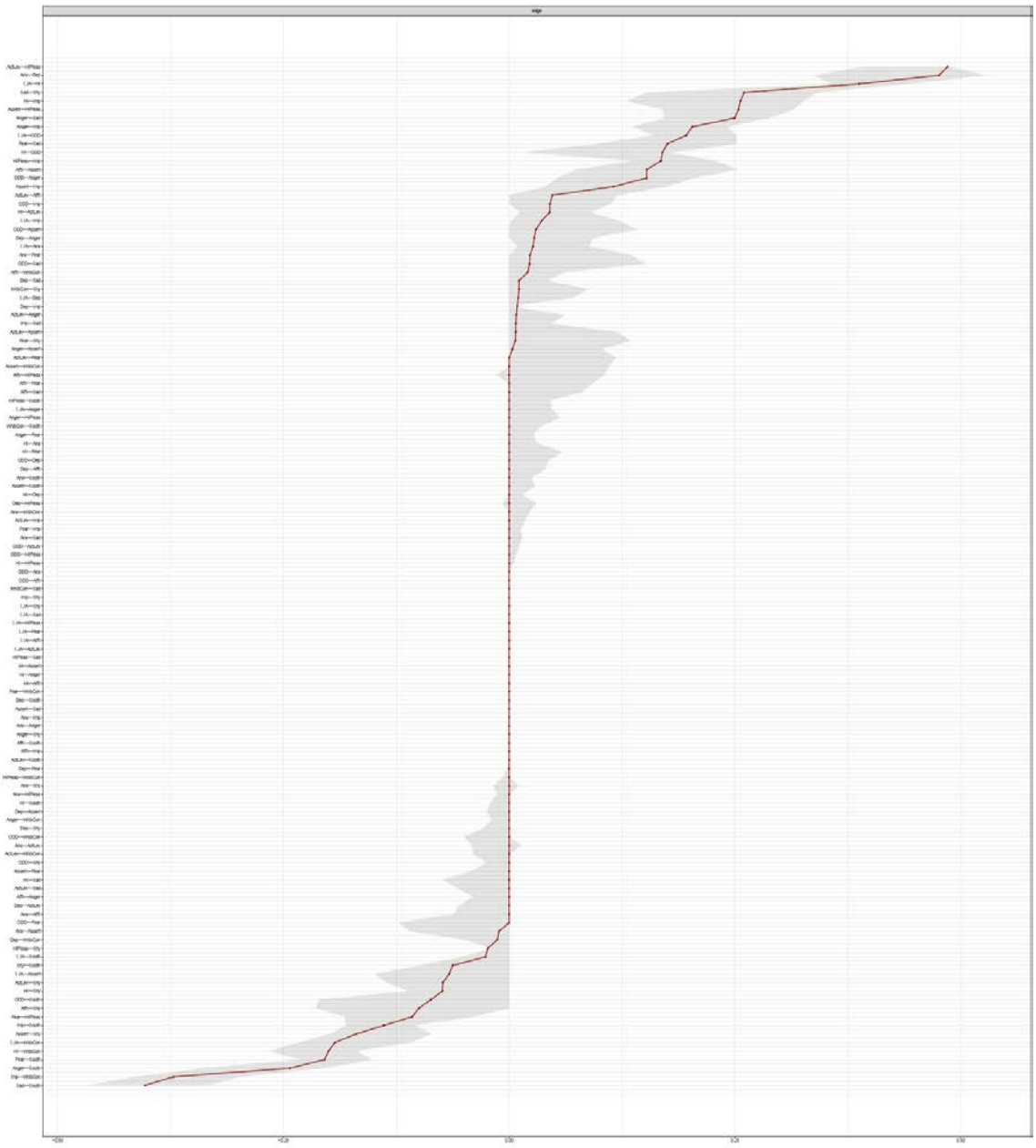
Lastly, the analyses conducted in this study were cross-sectional, preventing causal interpretations of relations. Further, though impact on treatment can be hypothesized, the current study is not equipped to answer treatment questions. Therefore, future work may utilize longitudinal samples and treatment groups to further examine the impact of ADHD comorbidities.

Conclusion

ADHD is a common childhood disorder that is frequently comorbid with ODD, anxiety, and depression. The current study investigated how such comorbidities may influence the common characteristics and outcomes already known to be associated with "pure" ADHD. Latent profile analyses and network analyses highlighted how comorbid High ADHD/ODD Symptoms profiles differed from Low Overall Symptoms profiles on traits, social behaviors, and social outcomes, displaying more negative characteristics (e.g., impulsivity, emotionality) and behaviors (e.g., aggression, emotion dysregulation). These children with comorbid ADHD/ODD were also less liked, less rule-following, and less cooperative during a playgroup setting. Those with high inattention symptoms had more academic and, to an extent, narrative comprehension difficulties. These differential patterns of exacerbating relations have implications for conceptualization of ADHD comorbidities and resulting treatment.

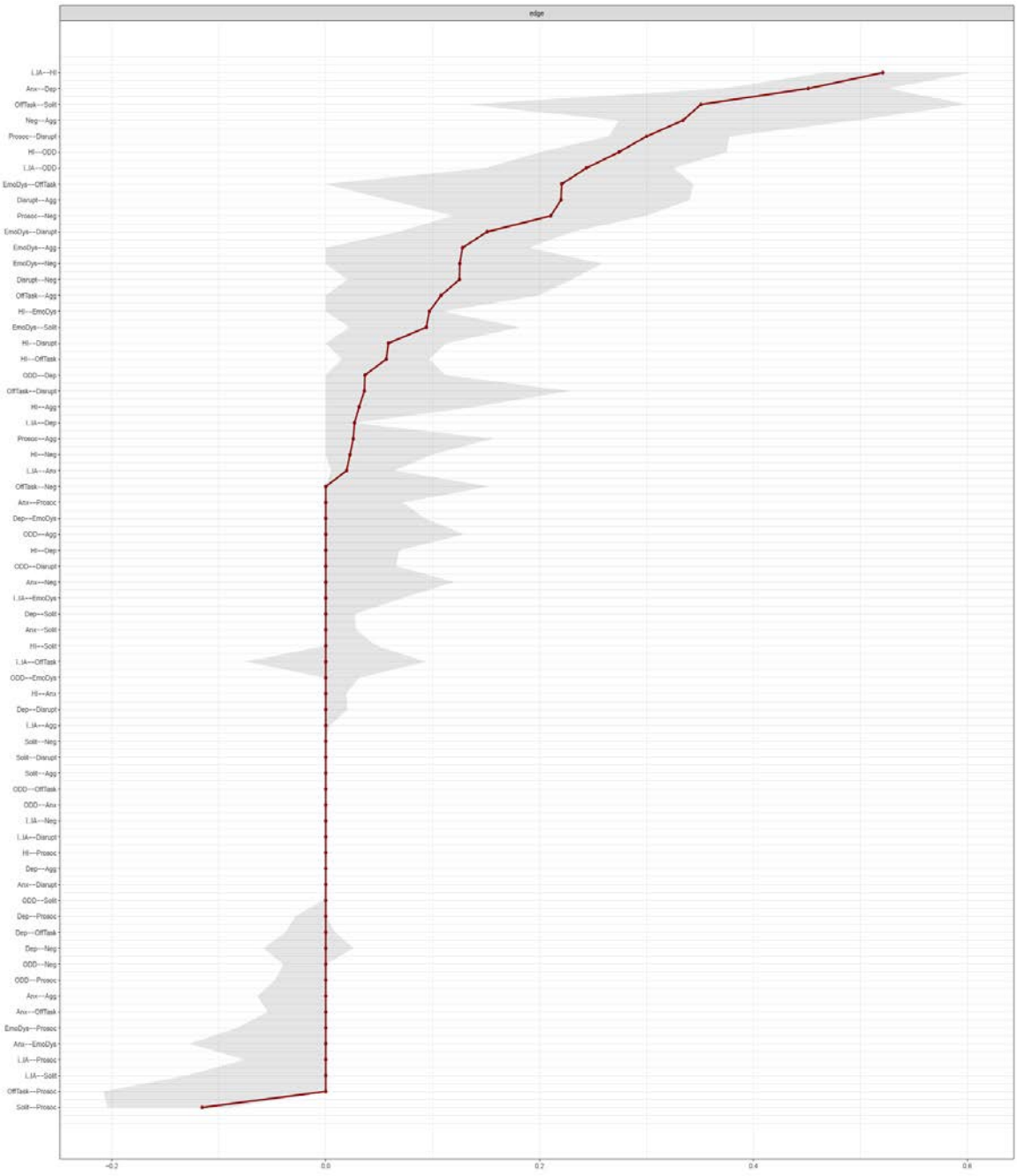
Appendix A

Edge Weights with 95% Confidence Intervals for Parent and Child Reported ADHD Comorbidities and Trait Network



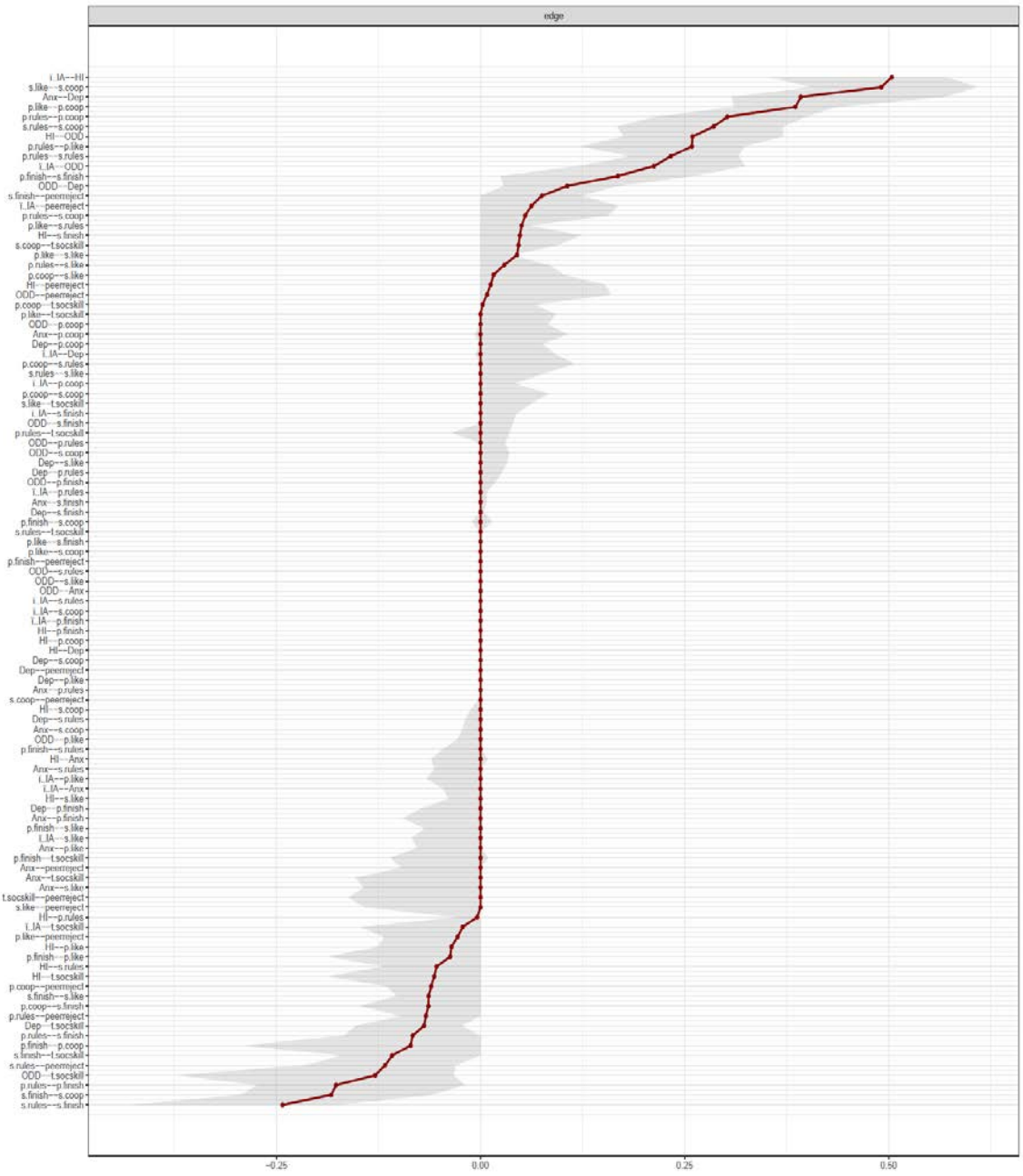
Appendix B

Edge Weights with 95% Confidence Intervals for Parent and Child Reported ADHD Comorbidities and Social Behaviors Network



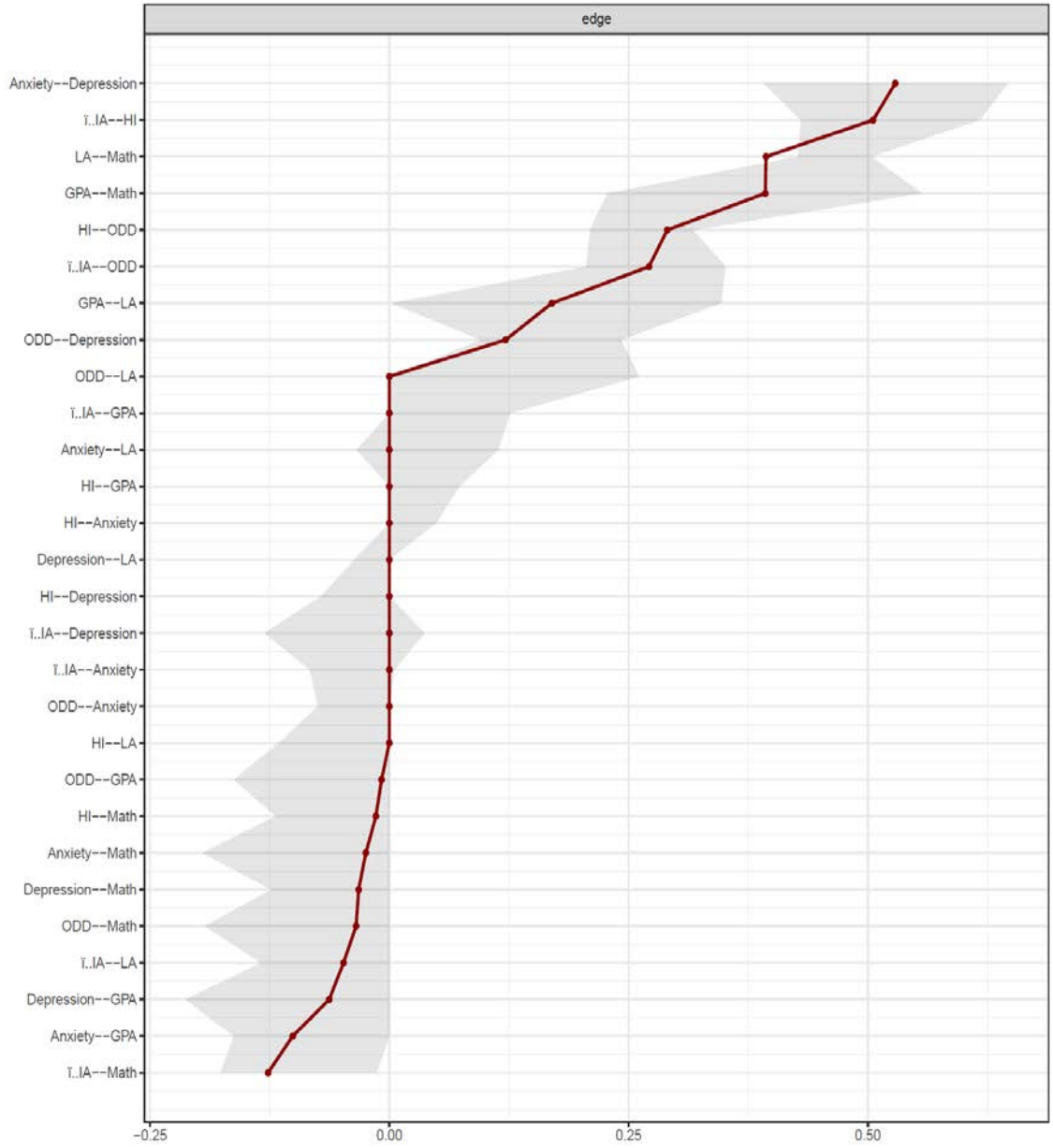
Appendix C

Edge Weights with 95% Confidence Intervals for Parent and Child Reported ADHD Comorbidities and Social Outcomes Network



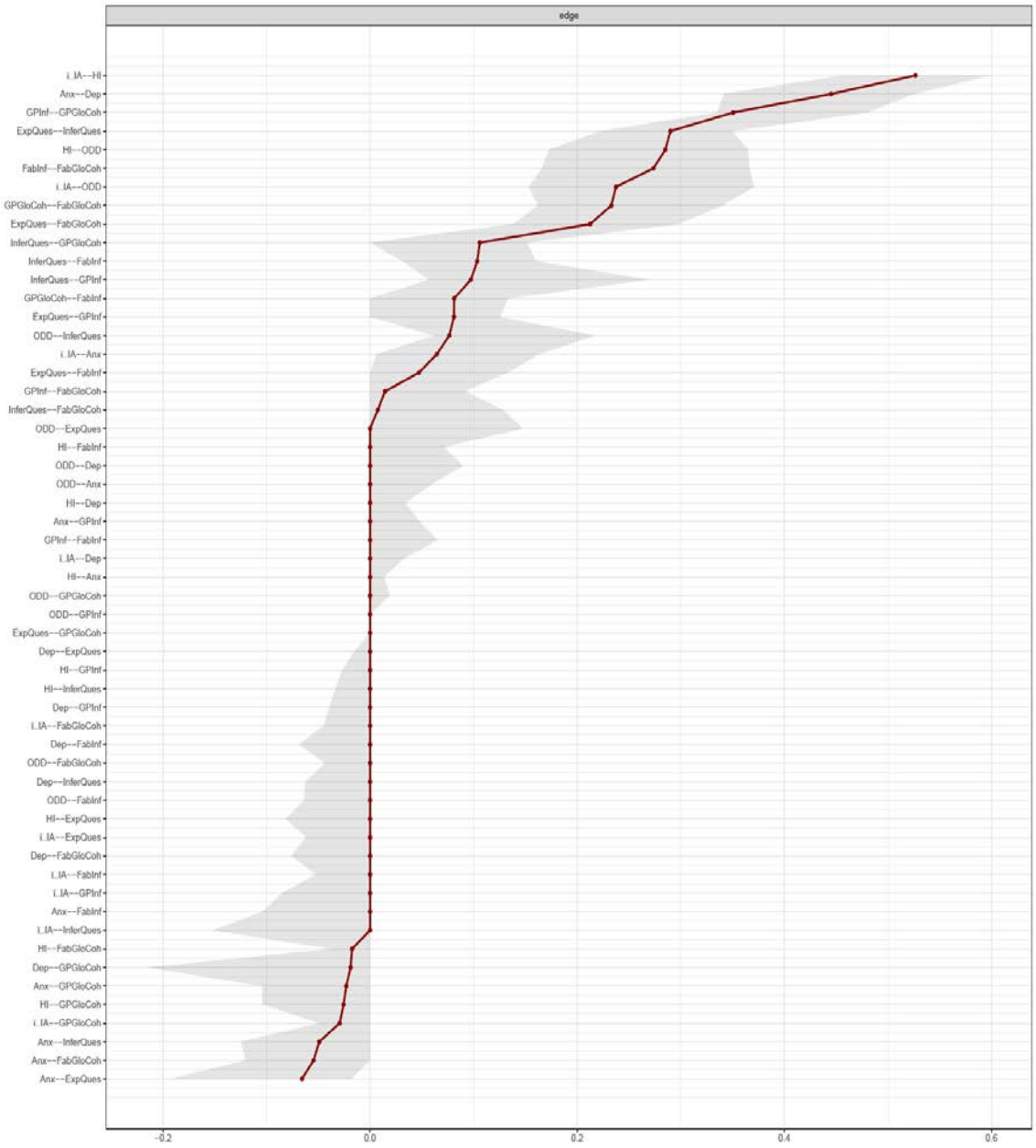
Appendix D

Edge Weights with 95% Confidence Intervals for Parent and Child Reported ADHD Comorbidities and Academic Outcomes Network



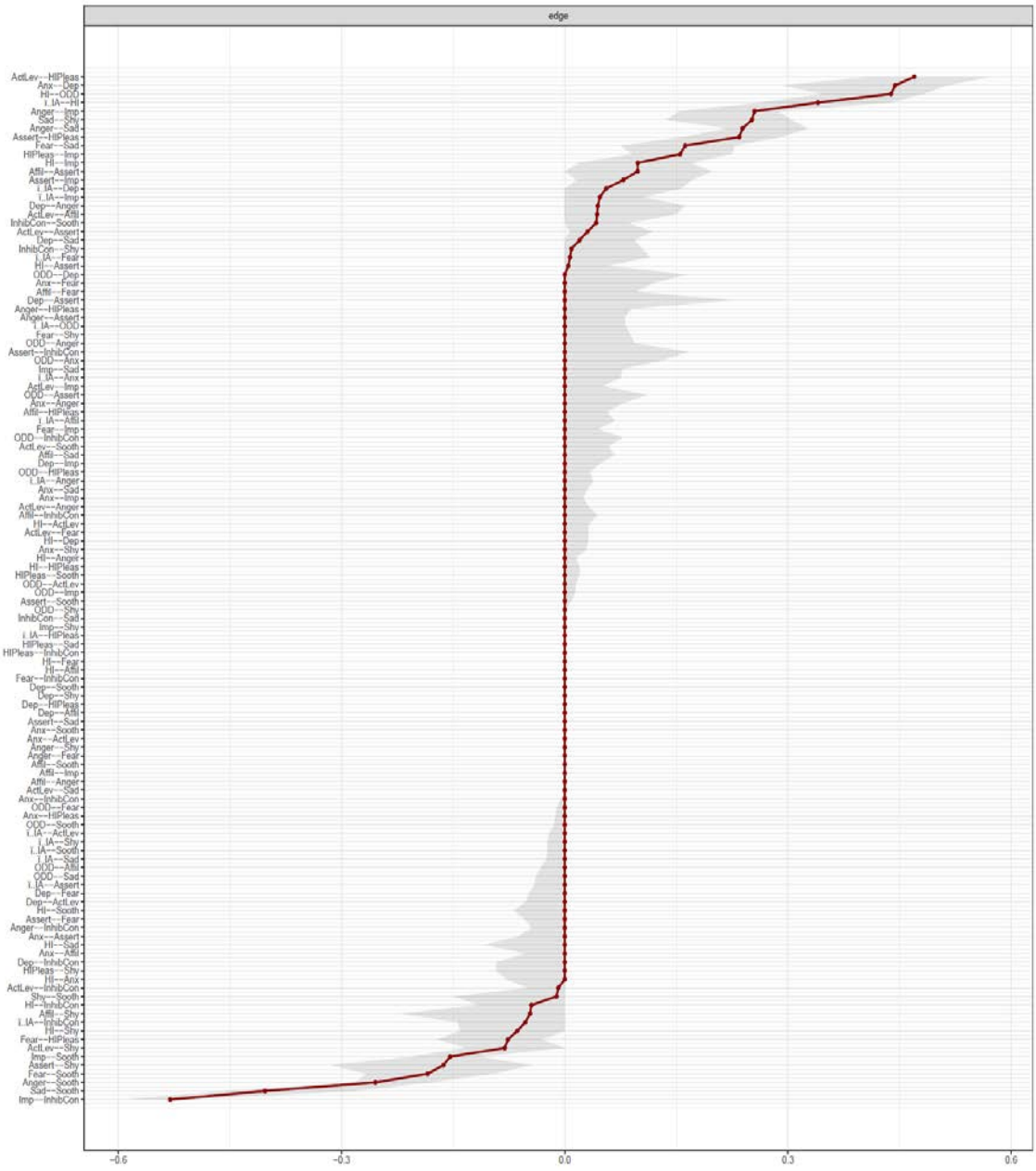
Appendix E

Edge Weights with 95% Confidence Intervals for Parent and Child Reported ADHD Comorbidities and Narrative Comprehension Network



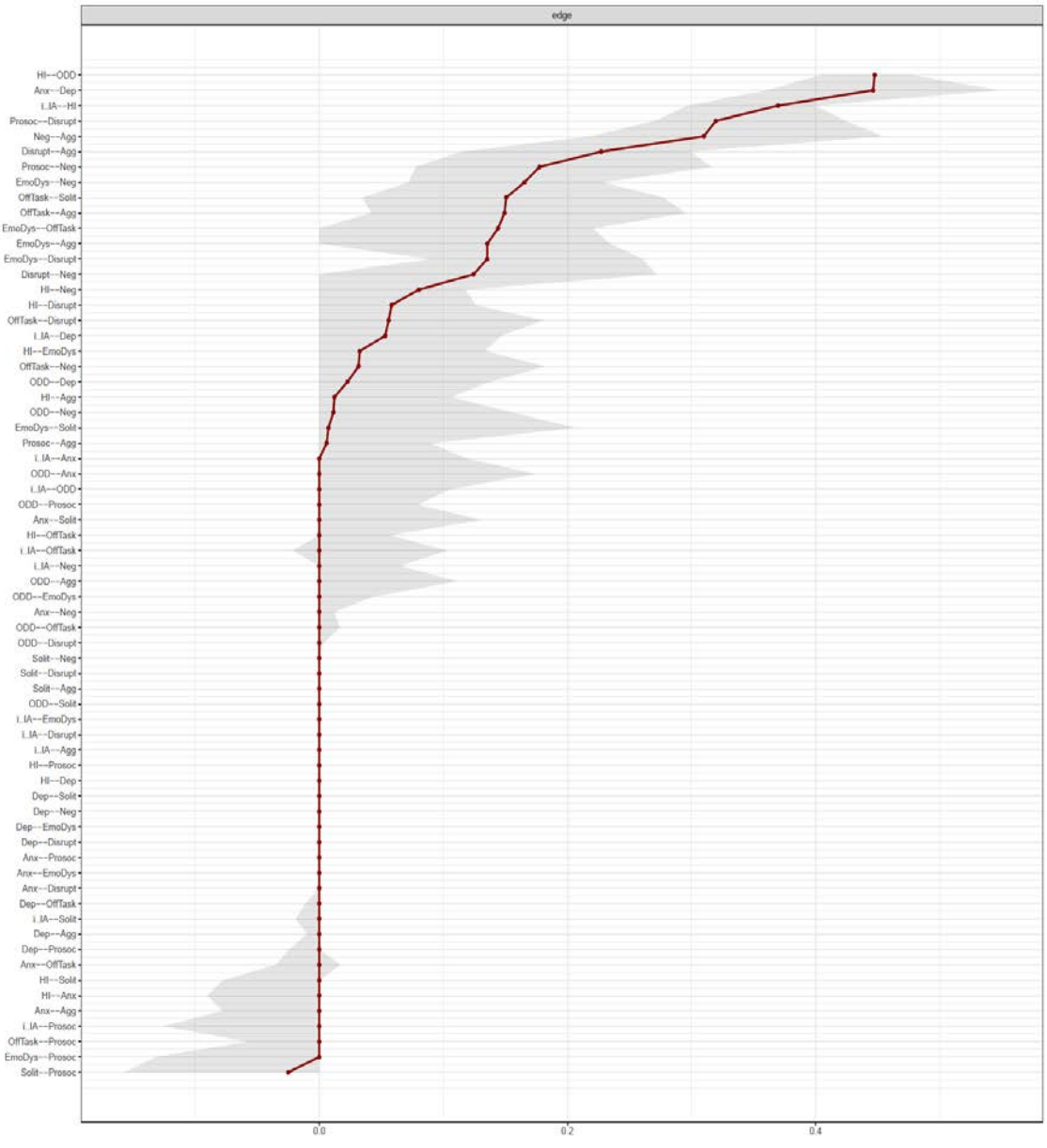
Appendix F

Edge Weights with 95% Confidence Intervals for Teacher and Child Reported ADHD Comorbidities and Trait Network



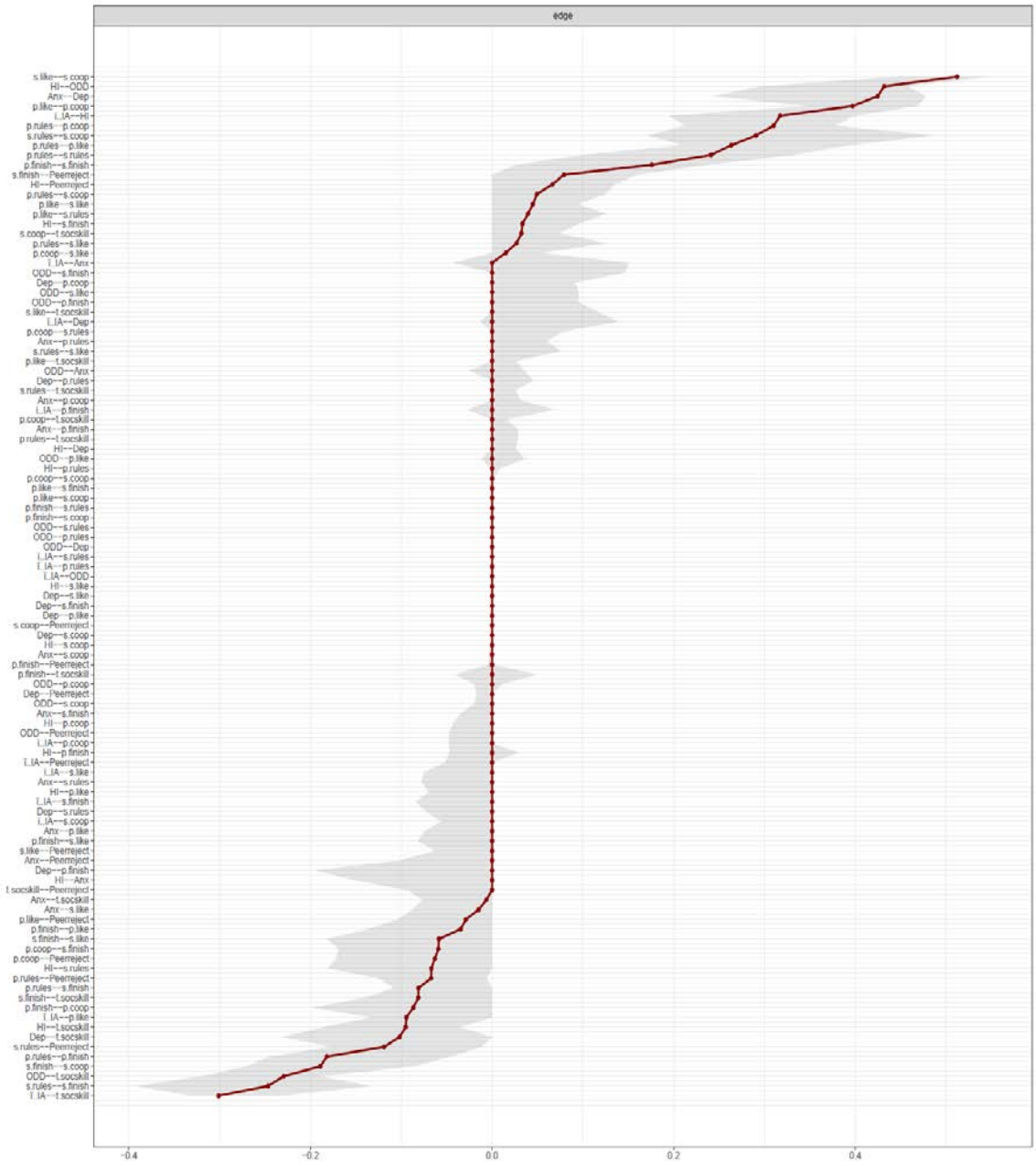
Appendix G

Edge Weights with 95% Confidence Intervals for Teacher and Child Reported ADHD Comorbidities and Social Behaviors Network



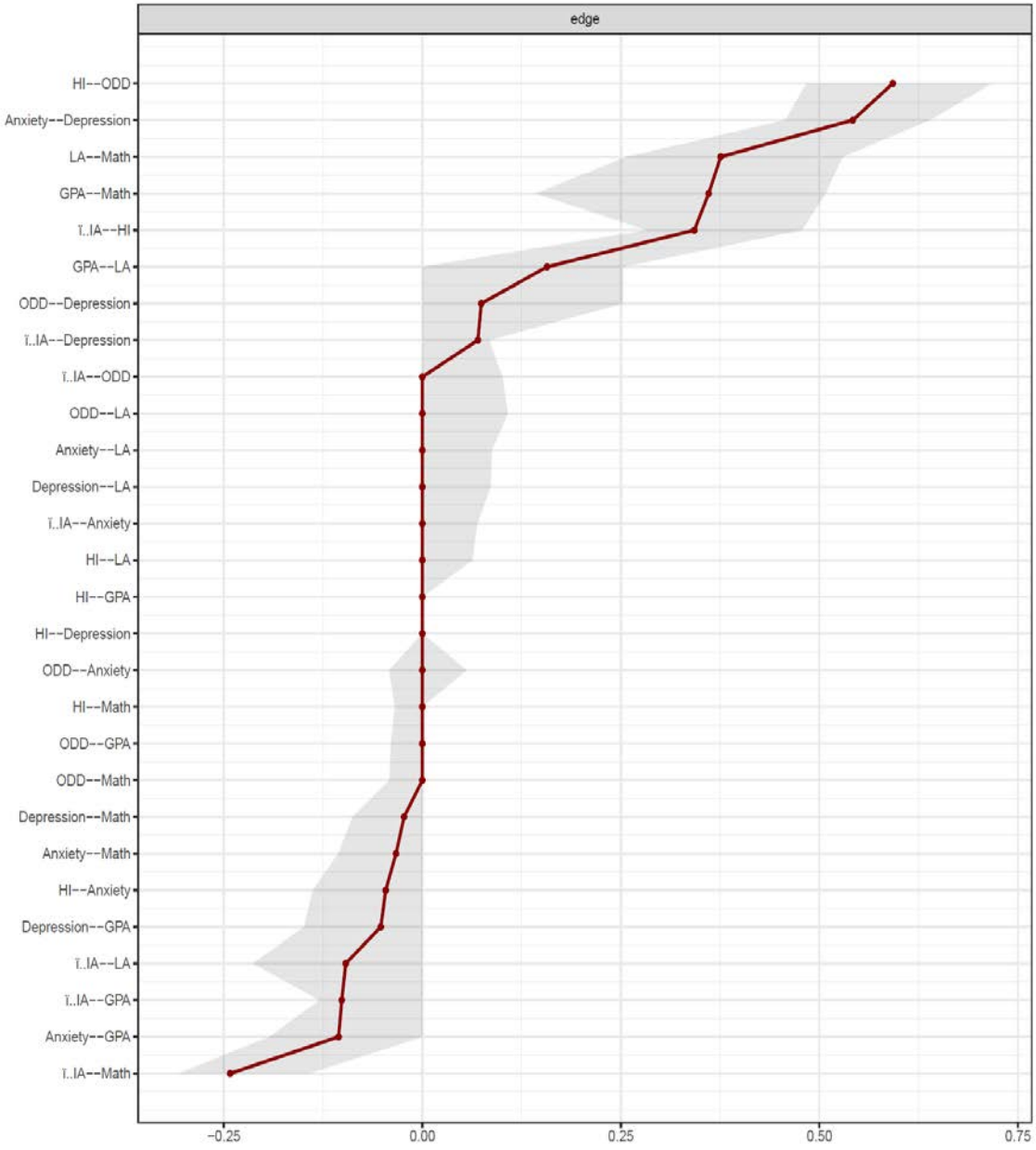
Appendix H

Edge Weights with 95% Confidence Intervals for Teacher and Child Reported ADHD Comorbidities and Social Outcomes Network



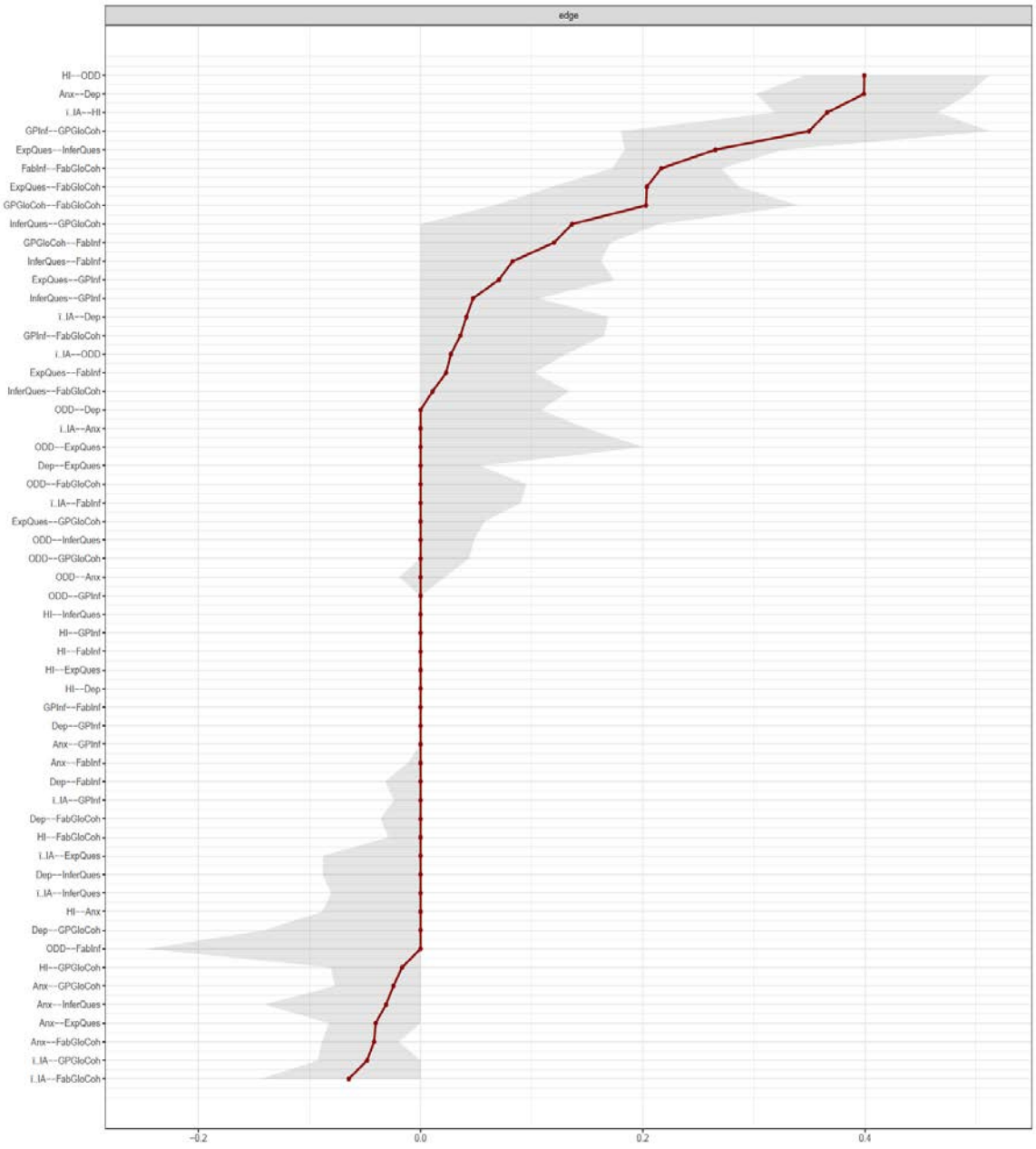
Appendix I

Edge Weights with 95% Confidence Intervals for Teacher and Child Reported ADHD Comorbidities and Academic Outcomes Network



Appendix J

Edge Weights with 95% Confidence Intervals for Teacher and Child Reported ADHD Comorbidities and Narrative Comprehension Network



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Yang, C. (2006). Evaluating latent class analysis models in qualitative phenotype identification. *Computational statistics and data analysis, 50,* 1090-1104.

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EDUCATION

2018-2019	**Predoctoral Psychology Intern** Geisinger Medical Center; Danville, PA
April 2015	**M.S. in Clinical Psychology** University of Kentucky; Lexington, KY Thesis: *Moderated mediation of Attention-Deficit/Hyperactivity Disorder (ADHD) symptoms and peer relations* Chair: Richard Milich, Ph.D. GPA: 4.00/4.00
June 2012	**B.A. in Psychology** Northwestern University; Evanston, IL Minor in Chinese Language and Culture Cum laude Thesis: *Comparison of acculturation and parenting style on behavioral inhibition in European American and Chinese American toddlers* Advisors: Karl S. Rosengren, Ph.D Sarah C. Mangelsdorf, Ph.D. GPA: 3.75/4.00 Study Abroad: Tsinghua University, Beijing, China, Summer 2010

HONORS AND AWARDS

University of Kentucky

2018	**Recipient**, Rachel Steffens Memorial Award
2017	**Recipient,** Jesse G. Harris Jr., Memorial Scholarship Dissertation Award
2017	**Recipient**, Excellent Clinical Performance Award
2016	**Recipient**, Second Place Award Winner for Kentucky Psychological Association Spring Academic Conference Graduate Student Posters
2015	**Recipient,** Society for Prevention Research 2015 Minority Travel Award
2015	**Recipient**, Mixson Outstanding Graduate Student Research Award

Northwestern University

2012	**Recipient**, Asian American Psychological Association Division of Students Undergraduate Research Award
2008–2012	**Recipient,** Dean's List

PUBLICATIONS

Empirical Articles:

Lee, C. A., Milich, R., Lorch, E. P., Flory, K., Owens, J. S., Lamont, A. E., & Evans, S. W. (2018). Forming first impressions of children: The role of ADHD symptoms and emotion dysregulation. *Journal of Child Psychology and Psychiatry, 59,* 556-564. doi: 10.1111/jcpp.12835

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Book Chapters:

Martel, M. M., Goh, P. K., Smith, T. E., & **Lee, C. A.** (2018). Developmental pathways. In M. M. Martel (Ed.), *Disruptive, impulse-control, and conduct disorders: Features, assessment, pathways, and intervention*.