Research paper

A network analysis of psychopathology in young Black children: Implications for predicting outcomes in adolescence

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\textbf{ABSTRACT}

\textbf{Objective:} Network analysis may identify specific symptoms involved in the maintenance and development of psychopathology. This approach, however, has not been applied to the study of young Black children, a population facing unique challenges and developmental risks. It is also unclear whether network analysis identifies early symptoms in Black children that are linked to their longer-term difficulties and strengths in adolescence.

\textbf{Methods:} We conducted a network analysis of emotional and behavioral difficulties in 1238 Black (non-Hispanic) children from the age-3 assessment in the Future of Families and Child Wellbeing Study (47 % female). We also explored whether early childhood symptoms predict subsequent caregiver-reported internalizing and externalizing problems, and youth-reported social competencies and extracurricular and community involvement, at the age-15 assessment.

\textbf{Results:} We identified specific symptoms of externalizing and emotional reactivity as central in the network. Symptoms of emotional reactivity were also involved in comorbidity, bridging different communities of symptoms. Using elastic net models, we identified specific central and bridge symptoms, but also peripheral network symptoms, that contributed uniquely to the prediction of internalizing and externalizing problems in adolescence. Early childhood symptoms were less predictive of positive outcomes in adolescence.

\textbf{Conclusions:} This study identified central and bridge symptoms in young Black children, an underrepresented population in network analysis research. Some of these central and bridge symptoms, but also peripheral network symptoms, may be useful targets in early interventions to prevent long-term difficulties. Conversely, network approaches to understanding early psychopathology may have less utility for predicting Black children’s subsequent strengths in adolescence.

1. Introduction

Network analysis has been used to visualize the structure of relations among symptoms in a range of disorders and populations (e.g., Muliarkey et al., 2019; Rouquette et al., 2018; Russell et al., 2017). In addition, this approach holds promise for identifying specific symptoms that are implicated in the development and maintenance of psychopathology (McNally, 2016). Intervening to reduce the severity of such symptoms may decrease the strength of other symptoms. Despite the growing interest in network analysis and increasing recognition of its clinical potential, this approach has not been applied to the study of young African American, or Black, children. To extend network analysis to this population, we drew on a subset of participants from the Future of Families and Child Wellbeing Study (FFCWS), a population-based cohort that was oversampled for non-marital births. We analyzed the network structure of emotional and behavioral difficulties in preschool-age Black children in this sample and examined whether network analysis can identify early symptoms that forecast risk for both the subsequent development of psychopathology and attenuated psychosocial strengths or competencies in adolescence.
Network analysis conceptualizes mental health difficulties as arising from relations among symptoms (Borsboom, 2017). From this perspective, psychopathology is a complex organization of symptoms that can be represented by a set of nodes (i.e., individual symptoms) and their interconnections, or edges (i.e., relations between symptoms). Activation of symptoms that are central within the network (i.e., highly connected with other symptoms) may lead to spreading activation to other symptoms across the network (Borsboom et al., 2011). Conversely, activation of more peripheral symptoms that share fewer connections is less likely to activate other symptoms. Network analysis also conceptualizes comorbidity as the outcome of relations among symptoms of multiple disorders; these connecting pathways are termed bridge symptoms (Cramer et al., 2010). Measures of centrality and bridge symptoms offer clinically useful insights; identifying central and bridge symptoms may facilitate the early identification both of vulnerable children and of targets for intervention (Mullarkey et al., 2019; Rouquette et al., 2018).

Despite its increasing use and significant promise (Bansal et al., 2020; Martel et al., 2016; Rouquette et al., 2018), network analysis has not yet been used to elucidate the structure of emotional and behavioral problems in Black preschool-age children, nor have researchers examined whether central and bridge symptoms predict future psychosocial outcomes in this population. This is a significant gap in the literature as it is unclear whether findings from network analyses studies generalize to Black children in the United States, who face unique challenges, including being disproportionately affected by socioeconomic disadvantage (Hodgkinson et al., 2017) and being at increased risk for experiencing bias and discrimination (Gilliam et al., 2016). These conditions and experiences can have profound implications for both well-being and the development of socioemotional and cognitive skills (Coker et al., 2009; Merz et al., 2019; Priest et al., 2013; Reiss, 2013). It is important to recognize, however, that the majority of Black youth exhibit competencies in domains that have been implicated in mental health (Gaylord-Harden et al., 2018), such as social skills and extracurricular and community involvement (Caplan et al., 1992; Fredricks and Eccles, 2010). Considering within-group variability may inform early identification and targeted treatment efforts for Black children who are at risk for developing psychopathology and/or fewer psychosocial strengths.

The current study examined the network structure of emotional and behavioral problems in preschool-age Black (non-Hispanic) children from predominantly low-income backgrounds. We conducted network analysis to identify which symptoms are most central for activating other symptoms within the network, and which are the strongest bridge symptoms and pathways that connect different communities of symptoms. In addition, we used elastic net regression to test whether central and bridge symptoms in early childhood predict the subsequent development of both psychopathology and psychosocial strengths in adolescence.

2. Methods

2.1. Participants

The Future of Families and Child Wellbeing Study (FFCWS) is a longitudinal birth cohort study with a sample of 4898 children born in large US cities between 1998 and 2000. Nonmarital births were oversampled to facilitate the inclusion of low-income families. Both parents were interviewed in the hospital shortly after birth, which marked the start of data collection for the core study. Follow-up interviews were conducted at multiple waves. Detailed methodology is available in Reichman et al. (2001) and at https://fragilefamilies.princeton.edu/documentation. Our network analysis focused on symptoms, reported by primary caregivers of Black (non-Hispanic) children, at the age-3 assessment. We conducted elastic net regression for Black children for whom data were also available for internalizing and externalizing problems and positive developmental outcomes at the age-15 assessment. All FFCWS participants (or their parents) provided informed consent and all procedures were approved by the affiliated human subjects review board.

We used both parents’ self-reported race and ethnicity to determine whether a child was non-Hispanic Black. We did not include mixed race/ethnicity children in our analysis due to the small sample sizes of those groups. Our final sample was composed of 1238 Black children (i.e., both parents reported being non-Hispanic Black; 47.2% female) who had complete Child Behavior Checklist data at the age-3 assessment (see below). We used the mean value of mother and father incomes to estimate family income; we considered only one parent’s income if the other parent’s income was not reported. The mean annual household income in our sample was $28,498 (SD = $26,722).

2.2. Emotional and behavioral difficulties at preschool-age

At the age-3 assessment, primary caregivers completed the Child Behavior Checklist (CBCL) for ages 1.5 to 5 (Achenbach and Rescorla, 2000). The CBCL is a widely used measure that allows researchers and clinicians to assess emotional and behavioral problems in children. Primary caregivers provided responses to each CBCL item on a scale from 0 to 2, with 0 indicating “Not True,” 1 indicating “Sometimes True,” and 2 indicating “Very True or Often True.” We focused on 39 CBCL items that comprise the Emotional Reactivity (4 items), Aggressive (19 items), Withdrawn (8 items), and Anxious/Depressed (8 items) subscales. In Table 1 we present the assigned labels and relevant communities/subscales for each of these 39 CBCL items. We did not analyze the 6 items from the Attention Deficit/Hyperactivity Problems subscale in FFCWS both because some of these items overlapped with items in the Aggressive subscale, and because this is a DSM-oriented scale, whereas the other subscales are syndrome scales.

2.3. Psychosocial outcomes in adolescence

To assess negative and positive psychosocial outcomes at the age-15 assessment, we analyzed caregivers’ reports of their adolescents’ internalizing and externalizing problems, and the adolescents’ self-reports of their social skills and extracurricular/community involvement.

Primary caregivers used the CBCL to report on their adolescents’ internalizing and externalizing problems. Internalizing problems were computed as the average of responses to items on the Anxious/Depressed (6 items) and Withdrawn (2 items) subscales. Externalizing problems were computed as the average score of responses to items on the Aggressive (11 items) and Delinquent Behaviors (9 items) subscales. In FFCWS, caregivers rated their adolescents’ behavior from 1 (Not true) to 3 (Often true). To be consistent with the age-3 scoring, we recoded these ratings to range from 0 to 2 prior to computing mean internalizing and externalizing scores. There were 1089 Black children with CBCL data at both the age-3 and age-15 assessments.

Youths’ self-reported social competencies were assessed using items from modified versions of the Social Skills Rating System (SSRS; Gresham and Elliott, 1990) and the Adaptive Social Behavior Inventory (ASBI; Hogan et al., 1992). We summed responses to 9 SSRS items (e.g., “I make friends easily,” “I start conversations rather than waiting for others to talk first”) and 3 ASBI items (e.g., “I understand others’ feelings like when they are happy, sad, or mad,” “I try to comfort others when they are upset”). In FFCWS, adolescents were asked to report how true they think each statement is for them on a scale from 1 to 3, with 1 indicating “not true,” 2 indicating “sometimes true,” and 3 indicating “often true.” As recommended by the FFCS, these items were recoded to range from 0 to 2 prior to creating sum scores. There were 1056 Black children with both CBCL data at the age-3 assessment and social competencies data at the age-15 assessment.

Adolescents self-reported their extracurricular and community involvement since the beginning of the school year or in the previous school year. We computed the average of participants’ responses to six.
items that were based on measures from the National Longitudinal Study of Adolescents Health Wave 3 (Add Health), and the Panel Study of Income Dynamics Child Development Supplement. Frequency of involvement was rated on a scale from 0 ("Never") to 4 ("several times a week"). There were 1057 Black children with both CBCL data at the age-3 assessment and extracurricular and community involvement data at the age-15 assessment.

3.2.3 Statistical analysis

All analyses were conducted in R version 4.1.3 (R Core Team, 2022). Our first aim focuses on the network structure at the age-3 assessment, including examining how different symptoms cluster together in Black children, determining which symptoms were connected most strongly to other symptoms (i.e., most central), and elucidating which symptoms include examining how different symptoms cluster together in Black children, determining which symptoms were connected most strongly to other symptoms (i.e., most central), and elucidating which symptoms included symptoms that are part of other communities), which was used to identify symptoms that bridge different clusters of emotional and behavioral difficulties.

Our second aim was to evaluate whether early childhood difficulties, particularly those identified as central or bridge symptoms in our network analysis, predicted psychosocial outcomes in adolescence. We conducted elastic net regression using the glmnet package (Friedman et al., 2010). We tested four elastic net models that used the 39 CBCL items at the age-3 assessment as predictors of internalizing problems, externalizing problems, social competencies, and extracurricular and community involvement at the age-15 assessment. The elastic net approach is useful for selecting predictors that are highly correlated provided that they minimize error (Zou and Hastie, 2005). Model complexity is penalized using a lambda value to shrink the coefficients of correlated predictors towards each other. We used a full elastic net penalty (α = 0.50). We used leave-one-out cross-validation to identify the lambda values for each model that minimized mean squared error, yielding sparse models with non-zero coefficients for only the most important predictors of each outcome. To complement the elastic net coefficients, we conducted follow-up zero-order correlations between predictors at the age-3 assessment selected by elastic net models and psychosocial outcomes at the age-15 assessment.

3. Results

3.1. Emotional and behavioral symptoms network in early childhood

The network of symptoms is presented in Fig. 1. Visual inspection suggests a dense network with many connections among symptoms, but with subscale items tending to cluster together, particularly items from the aggressive and withdrawal subscales. The network parameter estimates were stable (edge stability coefficient = 0.59; strength centrality stability coefficient = 0.67). Fig. 2 presents the node centrality indices (strength, betweenness, closeness) for each symptom. Most of the highly central symptoms were from the aggressive and emotional reactivity subscales, whereas symptoms that were part of the anxious/depressed and withdrawn subscales were more peripheral in the network. Based on strength centrality, the top eight central symptoms (i.e., those with the highest peaks in Fig. 3) were temper tantrums or hot temper, angry moods, sudden changes in mood or feelings, can’t stand waiting; wants everything now, demands must be met immediately, uncooperative, and other children.

The model was then visualized using a network analysis plot. The layout of the plotted network was determined using the Fruchterman-Reingold (F-R) algorithm, which enhances comprehension by placing strongly connected nodes in the center of the network and moving weakly connected nodes to the perimeter. Nodes are represented by circles and edges are represented by their connecting lines. The darkness and thickness of edges indicate the magnitude of the association between two nodes, whereas the color of edges indicates whether the association is positive or negative.

Node strength (the sum of weighted number and strength of connections of a node) was estimated as the main measure of symptom centrality. Other centrality indices that were calculated were betweenness (importance of a node in the average path between other node pairs) and closeness (node’s relations to other nodes through examination of indirect connections). We used the R package bootnet to determine the stability of edge weights and the stability of strength centrality, using 1000 nonparametric subset bootstraps. In addition, we calculated bridge strength (the sum of absolute values for paths connecting a node to symptoms that are part of other communities), which was used to identify symptoms that bridge different clusters of emotional and behavioral difficulties.

Methodology is appropriate for networks based on ordinal variables and produces a sparse network by removing edges that are likely spurious. The model was then visualized using a network analysis plot. The layout of the plot was determined using the Fruchterman-Reingold (F-R) algorithm, which enhances comprehension by placing strongly connected nodes in the center of the network and moving weakly connected nodes to the perimeter. Nodes are represented by circles and edges are represented by their connecting lines. The darkness and thickness of edges indicate the magnitude of the association between two nodes, whereas the color of edges indicates whether the association is positive or negative.
anxious/depressed, and aggressive subscales were conceptualized as separate communities. Fig. 3 presents the bridge strength of all the nodes and helps identify the key bridge symptoms for this network. The strongest four bridge symptoms were all from the emotional reactivity community: sudden changes in mood or feelings; whining; sulks a lot; and is disturbed by changes in routine. The other highly ranked bridge symptoms were part of the anxious/depressed (e.g., looks unhappy without good reason, too fearful or anxious) and withdrawn communities (e.g., withdrawn; doesn’t get involved with others, doesn’t answer when people talk to him/her). We computed a partial correlation matrix to find the strongest inter-symptom associations involving top bridge symptoms. The top bridge symptom – sudden changes in moods or feelings – had the strongest connections with the stubborn, sullen, or irritable (r = 0.20) and angry moods (r = 0.19) symptoms from the aggressive community. These connections may be particularly strong bridge pathways between different communities of symptoms.

3.2. Predicting psychosocial outcomes in adolescence

3.2.1. Internalizing problems

Table 2 presents the results of the elastic net models using CBCL symptoms in early childhood as predictors of internalizing and externalizing problems in adolescence. The elastic net model identified 15 CBCL symptoms that helped to minimize error in predicting future internalizing problems. All of these symptoms were positively and significantly associated with internalizing problems. Two of the childhood symptoms that contributed uniquely to predicting internalizing problems in adolescence were also identified as highly central in the network analysis: “Child has temper tantrums or hot temper” from the Aggressive subscale and “Child has sudden changes in mood or feelings” from the Emotional Reactivity subscale were the first and third ranked symptoms, respectively, based on strength centrality. It is noteworthy that the “sudden changes in mood” item was also the top-ranked symptom in terms of bridge strength. In addition, the item “child is disturbed by any change in routine” from the Emotional Reactivity subscale emerged as both a unique predictor of future internalizing problems in the elastic net model and a top bridge symptom in the network analysis (ranked 4th). Most of the unique predictors of internalizing were middle- or bottom-ranked symptoms in terms of centrality and bridge strength. Collectively, the childhood symptoms selected by the elastic net model accounted for 9% of the variance in internalizing problems in adolescence.

3.2.2. Externalizing problems

The elastic net model predicting externalizing problems in adolescence selected 13 CBCL items from the age-3 assessment, all of which were positively and significantly associated with externalizing problems. The central and bridge symptoms that were identified as significant predictors of internalizing problems were also selected as predictors of externalizing problems (temper tantrums, changes in mood, and disturbed by change in routine). Angry mood was identified as an additional predictor of externalizing problems and was highly central in the network analysis (ranked second in terms of strength centrality). Many of the other predictors of externalizing problems were the same items that were selected as predictors in the internalizing problems model. Collectively, childhood symptoms selected by the elastic net model accounted for 13% of the variance in externalizing problems in adolescence.

3.2.3. Positive social outcomes

Table 3 presents the results of the elastic net models using CBCL symptoms in childhood as predictors of social competencies and
extracurricular and community involvement in adolescence. The elastic net model predicting social competencies selected 12 symptoms as unique predictors. However, four of these symptoms were not significantly correlated with social competencies; we do not interpret these symptoms as meaningful predictors. Of the remaining eight predictors, the most central symptom that was selected by elastic net regression was ‘can’t stand waiting, wants everything now’ from the Aggressive subscale (ranked fourth in strength centrality). The “whining behaviors” symptom, which is part of the emotional reactivity subscale and was selected as a predictor of social competencies, was ranked second in bridge strength in the network analysis. Collectively, childhood symptoms selected by the elastic net model accounted for 3 % of the variance in social competences adolescence.

Finally, the elastic net model predicting extracurricular and community involvement in adolescence selected 4 symptoms as predictors. As was the case with the elastic net model predicting externalizing problems, the highly central symptom of angry moods (ranked second in terms of strength centrality) from the aggressive subscale was selected as a predictor of less extracurricular and community involvement. Two other predictors that were selected from the aggressive subscale were screaming (ranked ninth in strength centrality) and physically attacking people (ranked 20th in strength centrality). Being unhappy, sad, or depressed (ranked last in strength centrality) from the anxious/depressed subscale was also selected as a predictor of extracurricular and community involvement, although the direction of this association was positive. The childhood symptoms selected by the elastic net model accounted for 2 % of the variance in extracurricular and community involvement in adolescence.

3.3. Sensitivity analyses

Regarding the network analysis, it is noteworthy that the number of nodes is unbalanced across communities. For example, the aggressive subscale includes twice as many items as the withdrawn and anxious/depressed subscales. To test whether the relatively high number of aggressive nodes artificially inflated their strength centrality, we conducted a network analysis that included the top eight aggressive symptoms in terms of strength centrality instead of the full subscale (18 items). This network yielded similar results as our original network, with most of the top central symptoms remaining the same (see Supplement).

It is possible that the elastic net models distributed predictive importance among symptoms that were more central in the network. This could have led the model to select some highly central symptoms over others. To test this possibility, we repeated our predictive models using a stronger ridge regularization penalty, which would be expected to include more correlated features as important predictors. These results are presented in the Supplement. Briefly, these models yielded results similar to those that we obtained in our original elastic net model. Thus, item centrality does not appear to undermine the predictive utility of symptoms.

4. Discussion

This study is the first to use network analysis to elucidate the structure of relations among emotional and behavioral difficulties in preschool-age Black children from predominantly low-income families,
and to explore the role of early central and bridge symptoms in predicting psychosocial problems and competencies in adolescence. Our analyses identified specific externalizing and emotional reactivity symptoms that are central to a psychopathology network in early childhood, and that may be particularly important for bridging different kinds of emotional and behavioral difficulties. Consistent with the perspective that central and bridge symptoms are involved in the maintenance and development of psychopathology (Rouquette et al., 2018; Smith et al., 2019), we observed that some of the central and bridge symptoms were also selected in elastic net models as predictors of internalizing and externalizing problems in adolescence. Importantly, however, peripheral symptoms in the network also contributed uniquely to the prediction of future problems. Further, symptoms in early childhood explained relatively little variance in participants' psychosocial strengths in adolescence, assessed by social competencies and extracurricular and community involvement. Taken together, our findings highlight specific symptoms in young Black children that may contribute to other difficulties and comorbidities in early childhood and that may be involved in processes leading to difficulties in mental health in adolescence. Targeted assessment, intervention, and prevention efforts may benefit by focusing on the emotional and behavioral difficulties identified in our network and elastic net analyses.

Most network analyses in developmental psychopathology have focused on school-age children and adolescents (Kim et al., 2021; Mullarkey et al., 2019; Rouquette et al., 2018; Russell et al., 2017); in contrast, the current study provides novel insights concerning the structure of emotional and behavioral difficulties in preschool-age Black children. We found that proneness to anger, temper tantrums, sudden changes in mood, and needing demands met immediately were among the most central symptoms in the network. Thus, struggling with anger, irritability, and impatience appear to be significant difficulties that activate other symptoms. From a network perspective, reducing these high-centrality symptoms should have the benefit of initiating reductions in other emotional and behavioral difficulties (McNally, 2016; Mullarkey et al., 2019; Russell et al., 2017).

We found that the top bridge symptoms in the network were emotional reactivity difficulties, including sudden changes in mood or feelings, being disturbed by changes in routine, and proneness to whining and sulking. These bridge symptoms may constitute pathways between internalizing and externalizing problems in young Black children. Our findings build on research suggesting that children's problems with emotion reactivity and dysregulation are associated with risk for comorbidities (Dvir et al., 2014) and may serve as a transdiagnostic mechanism underlying the development of general psychopathology (Weissman et al, 2019). In addition, we found that sudden changes in mood and feelings, the top-ranked bridge symptom, had the strongest relations with the central symptoms of proneness to anger and being stubborn, sullen, or irritable. Bidirectional influences between these symptoms could be particularly important for the emergence of co-morbid difficulties in early childhood and beyond. Indeed, we found that proneness to sudden changes in mood and feelings was an important prospective predictor of internalizing and externalizing problems in adolescence. For Black children from high-risk family backgrounds, assessments that capture information about sudden changes in mood/feelings could support efforts to prevent the development of psychopathology and comorbidities in childhood and adolescence. Our findings are consistent with prior findings that bridge symptoms predict future anxiety disorders (Rouquette et al., 2018) and, further, extend this work by examining the predictive value of bridge (and highly central) symptoms in preschool-age Black children.

It is worth noting that we found considerable overlap in the preschool-age symptoms that were associated with internalizing and externalizing problems in adolescence. Researchers have documented that internalizing and externalizing problems in adolescents are...
moderately correlated, suggesting that these symptoms frequently co-occur (Buthmann et al., 2022; Liu et al., 2017) and that comorbidities may be driven by a more general psychopathology factor (Caspi et al., 2014; Laceulle et al., 2015). From this perspective, it is perhaps unsurprising that adolescent internalizing and externalizing problems in adolescence are predicted by similar preschool-age symptoms. The present findings provide further support for the perspective that central and bridge symptoms (but also some peripheral symptoms) are involved in the development of psychopathology in adolescence (McNally, 2016), which is often characterized by high comorbidity.

In addition to studying risk for psychopathology, it is important to consider the development of strengths and competencies that promote well-being (Coll et al., 1996; Gaylord-Harden et al., 2018). We found that symptoms explained less variance in psychosocial strengths than

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<td>&lt;0.001</td>
</tr>
<tr>
<td>A_Belon</td>
<td>13</td>
<td>22</td>
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<td>34</td>
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<td>0.26</td>
<td>0.20, 0.31</td>
<td>&lt;0.001</td>
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<tr>
<td>A_Hits</td>
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<tr>
<td>A_Alla</td>
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<td>23</td>
<td>33</td>
<td>39</td>
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<td>0.20</td>
<td>0.15, 0.26</td>
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</tr>
<tr>
<td>A_Defi</td>
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<td>17</td>
<td>21</td>
<td>33</td>
<td>0.03</td>
<td>0.20</td>
<td>0.14, 0.26</td>
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<tr>
<td>A_Figh</td>
<td>28</td>
<td>29</td>
<td>35</td>
<td>38</td>
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<td>0.26</td>
<td>0.21, 0.32</td>
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<tr>
<td>EM_Rout</td>
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<td>4</td>
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<td>0.09, 0.21</td>
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<td>A_Atten</td>
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<td>20</td>
<td>17</td>
<td>20</td>
<td>0.03</td>
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<td>0.09, 0.21</td>
<td>&lt;0.001</td>
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<tr>
<td>W_Youn</td>
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<td>0.06, 0.18</td>
<td>&lt;0.001</td>
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they did in indicators of psychopathology in adolescence. It is possible
that in Black children, early emotional and behavioral difficulties do not
portend future development in positive domains. We should note,
however, that the stronger predictive utility of early symptoms for
future difficulties may be due, at least in part, to the fact that the same
measures and reporters were used at the age-3 and the age-15 assess-
ments; indeed, 16 CBCL items were repeated across the two assessments.
Thus, it is important that future work replicate and extend our findings
to other measures of psychosocial problems and strengths.

Although we identified specific central and bridge symptoms as longitudinal predictors of psychosocial outcomes, peripheral symptoms
from the social withdrawal and anxious/depressed communities of
symptoms also appeared to be important predictors. Specifically, acting
too young for one’s age (ranked 38th in strength centrality) significantly
predicted subsequent internalizing and externalizing problems. Clinging
to adults or being too dependent (ranked 30th in strength centrality) and
being nervous, high-strung, or tense (ranked 25th in strength centrality)
predicted subsequent internalizing, but not externalizing, problems. Clinging
appear to be influential in the development and maintenance of psy-
chopathology in Black children. One explanation is informed by
research suggesting that adults who regularly interact with children,
such as teachers, often have racial bias in how they perceive and respond
to Black children’s negative emotions, especially anger (Halberstadt
et al., 2022; Thomas et al., 2009). Black parents often encourage their
children to suppress anger-related emotions and behaviors to protect
them against such bias and discrimination (Dunbar et al., 2017). From
this perspective, the expression of some emotions and behaviors in Black
children may have unique adverse social consequences, increasing risk
for psychopathology across childhood and adolescence (Simons et al.,
2002; Smith-Bynum et al., 2014). Future research that assesses trans-
actional processes of discrimination and Black children’s emotions and
behaviors should test this possibility more directly. One implication of
our findings is that clinical interventions for young Black children may
benefit from targeting emotions and behaviors that are also commonly
the focus of emotion and racial socialization in Black families.

We should note five limitations of the current study. First, the sample
size of 1238 Black preschool-age children may be small for estimating a
network of 39 variables, although it is worth noting that our sample and
network size is comparable to prior studies (Rouquette et al., 2018), and
our network estimates appeared to be stable based on bootstrapping
procedures. As a related point, we did not explore potential moderators
in our analyses, such as child sex and family income. Future research with
larger samples is needed to compare network and predictive features
across different groups of children. Second, we limited our network
analysis to the age-3 assessment in FFCSW. Although the CBCL was
administered at subsequent waves, the versions of the measure and
items administered were not consistent across assessments, preventing
us from investigating changes in network structure and features over
time. Longitudinal examinations of networks will also be important for

**Table 3**

<table>
<thead>
<tr>
<th>Predicting social competencies</th>
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<tr>
<td>EM_Sulk</td>
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<tr>
<td>EM_Whin</td>
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<tr>
<td>W_Acti</td>
</tr>
<tr>
<td>A_Frus</td>
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<td>A_Atna</td>
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<td>AN_Nerv</td>
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<td>AN_Feel</td>
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<td>W_Ansr</td>
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<td>A_Aten</td>
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<table>
<thead>
<tr>
<th>Predicting extracurricular and community involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable (Node name)</td>
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<tr>
<td>A_Scre</td>
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<td>A_Atna</td>
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<td>AN_Sad</td>
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</tbody>
</table>
understanding the directions of effects among symptoms over time (McNally, 2021). Third, we conducted our primary analyses with children whose parents both reported being non-Hispanic Black. It is also worth noting that the FFCCWS study oversampled for children born out of wedlock, contributing to high levels of socioeconomic disadvantage within the sample. Thus, our findings may not generalize to Black children growing up in other racial/ethnic, family, and socioeconomic contexts. Individual differences in contextual factors, such as parent and family characteristics, play a role in the development of symptoms of psychopathology (Giamnouli, 2018; Harold and Sellers, 2018). Integrating these contextual factors into symptom networks is a promising approach for understanding which ‘symptom’ factors are most central to the development and maintenance of psychopathology (Zhang et al., 2023). Fourth, we used caregiver reports on the CBCL to assess psychological symptoms in both childhood and adolescence, and youth reports on positive outcomes in adolescence. As we noted above, overlap in the measures, reporters, and constructs may have led childhood symptoms to be stronger predictors of difficulties than of strengths in adolescence. Finally, the FFCCWS sample included children born between 1998 and 2000; it is unclear whether the network and elastic net models will replicate using data from more recent cohorts.

Despite these limitations, the current study advances our understanding of the network structure of symptoms in young Black children. Specific externalizing and emotional reactivity symptoms appear to be central to emotional and behavioral difficulties; further, emotional reactivity symptoms may play a particularly important role in early comorbidity. Although some central and bridge symptoms during the preschool years predicted future internalizing and externalizing problems in adolescence, many peripheral symptoms also contributed to these predictions. The dense nature of the network structure may explain the wide selection of central, bridge, and peripheral symptoms as predictors of future psychopathology; young Black children growing up in at-risk contexts may have several paths to spreading activation among symptoms reflecting emotional and behavioral difficulties. Consequently, the set of early childhood predictors of adolescent psychopathology may extend beyond those symptoms that are highly central or involved in bridging different communities of symptoms. Conversely, network approaches to understanding early psychopathology may be less useful for predicting the development of positive psychosocial outcomes in Black adolescents. Our study serves as a call for investigators to conduct within-group network analyses of psychopathology and psychosocial strengths in Black and other racial/ethnic minority children.

CRediT authorship contribution statement

Mahnoor Hyat: Conceptualization, Formal analysis, Methodology, Visualization, Writing – original draft. Jonas G. Miller: Conceptualization, Formal analysis, Methodology, Supervision, Visualization, Writing – original draft. Ian H. Gotlib: Conceptualization, Funding acquisition, Writing – review & editing.

Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jad.2024.01.071.

References


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