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Subjective executive function weaknesses are linked to elevated internalizing symptoms among community adolescents

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Abstract

Adolescence is a period of high risk for the emergence of problems with anxiety and depression. Theory and research suggest that executive function deficits accompany internalizing and externalizing problems, although more evidence is required to understand these relationships. This study employed a commonly used rating scale of executive function, the Brief Rating Inventory of Executive Function (BRIEF), and examined relationships with self- and parent-reported internalizing and externalizing problems among a community sample of 299 adolescents. The sample was 56.2% female, with a mean age of 16.22 years old (SD = 2.36 years). Analyses revealed strong associations between poorer self- and parent-reported executive function skills and the severity of anxiety and depression symptoms. Problems with executive function were also associated with externalizing symptoms. These results indicate that subjective ratings of executive function capture important aspects of cognitive problems that are highly relevant to adolescent psychopathology in a transdiagnostic fashion.

Keywords

adolescent; executive function; anxiety; depression; internalizing; externalizing

Introduction

Adolescence is a period of heightened risk for the onset of internalizing disorders. Over the span of adolescence, nearly a third of individuals will meet criteria for an anxiety disorder, and just over 10 percent for a depressive disorder (Merikangas et al., 2010). These conditions are frequently comorbid and are associated with a host of functional consequences, including impaired peer relationships and school performance (Essau, Conradt, & Petermann, 2000; Fröjd et al., 2008). The presence of anxiety and or depression during adolescence also significantly increases the risk for the return of both conditions during adulthood (Pine, Cohen, Gurley, Brook, & Ma, 1998). Further understanding the

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factors that increase risk for anxiety and depression, and how to best assess them, should be a priority for further study.

Extensive meta-analytic evidence suggests that core executive function deficits are implicated across a broad range of psychopathology (Snyder, Miyake, & Hankin, 2015). Executive function (EF) refers to a collection of high-level cognitive processes that allow individuals to control behavior in the pursuit of goals (Friedman et al., 2008). Put plainly, EF is central to nearly every aspect of our daily functioning, allowing us to organize our behavior in a planful manner while also monitoring our performance and responding flexibly to the world around us. Deficits in these abilities are relatively well established for externalizing problems such as attention-deficit hyperactivity disorder (ADHD) (Barkley, 1997; Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005) and antisocial behavior (Morgan & Lilienfeld, 2000; Raine et al., 2005). These findings are not surprising given that these conditions involve symptoms such as concentration deficits, disorganization, and impulsive behaviors. Links between EF and internalizing disorders are less immediately intuitive, though perhaps equally significant.

Influential theories of anxiety (Derakshan & Eysenck, 2009; Eysenck, Derakshan, Santos, & Calvo, 2007) and depression (Gotlib & Joormann, 2010; Levin, Heller, Mohanty, Herrington, & Miller, 2007) have highlighted the relevance of EF deficits. One common feature of anxiety disorders is an excessive attentional vigilance for threat (Cisler & Koster, 2010). It has been proposed that this vigilance may serve to degrade the efficiency of EF (Eysenck et al., 2007). Pessoa (2009) noted that threat processing relies on prefrontal brain circuitry that is shared with EF, thus resources that might normally be prioritized for EF are diverted to processing potentially threatening stimuli. Using laboratory task-based assessments of EF, numerous studies have reported associations between poorer EF and anxiety (Ansari & Derakshan, 2011; Ansari, Derakshan, & Richards, 2008; Caselli, Reiman, Hentz, Osborne, & Alexander, 2004; Ursache & Raver, 2014), although some studies have not found such relationships (Berggren & Derakshan, 2013; McAuley, Chen, Goos, Schachar, & Crosbie, 2010). One meta-analysis of studies examining task-based assessments of EF among youth and adults with major depressive disorder revealed wide-ranging deficits that were not explained by general cognitive slowing (Snyder, 2013). A similar meta-analysis that focused on children and adolescents with depressive disorders identified problems with inhibition of prepotent (automatic but not task appropriate) responses (hereafter *inhibition*), verbal fluency, sustained attention, verbal memory and planning (Wagner, Müller, Helmreich, Huss, & Tadić, 2015).

While EF has been a domain of interest for clinicians and developmental psychopathologists, there has been some concern about the ecological validity of traditional task-based measurements (Barkley & Fischer, 2011; Chaytor & Schmitter-Edgecombe, 2003). Such EF testing typically occurs within a highly structured clinic or laboratory testing, guided by a clinician or research technician in a one-on-one format. This has advantages, in that the tester can choose instruments that target specific domains of EF, and can minimize the influence of possible confounds (e.g., administration inconsistencies, distractors). However, this experimental control may come at the cost of appraising how weaknesses in EF manifest in everyday circumstances. An alternative, or complement, to the

laboratory task-based approach is to employ a questionnaire-based measure of EF. One such measure, the Behavior Rating Inventory of Executive Function (BRIEF; Gioia, Isquith, Guy, & Kenworthy, 2000), was designed to capture the downstream, everyday behavioral and emotional aspects of EF. For example, an item such as, "I get out of my seat at the wrong times," is intended to index an individual's capacity for inhibition of inappropriate behaviors. The BRIEF has received widespread clinical and research use, cited more than 1800 times via a Google Scholar search as of February 2018.

Evidence for convergence between scores on the BRIEF and performance-based EF measures has been mixed. In a review of studies featuring both rating and performance-based measures of EF, the authors found that only 24% of correlations between such measures were significant, with a median value of $r = .18$ for studies using the BRIEF (Toplak, West, & Stanovich, 2013). The authors concluded that rating and performance-based measures of EF capture different information, with performance-based measures assessing processing efficiency, and rating measures capturing the success of goal pursuit. Toplak et al. (2009) found small correlations between performance-based assessments of inhibition, set shifting, working memory, planning and several parent- and teacher-rated BRIEF subscales; however, these associations were not unique to domain (e.g., the working memory performance score correlated not only with BRIEF subscales of working memory, but also with set shifting, inhibition and planning). When included in the same regression model, it was the BRIEF scores that significantly predicted ADHD status, not the performance-based measures. This finding is perhaps not surprising, given that many items on the BRIEF overlap considerably with diagnostic symptoms of ADHD (e.g., "I have a short attention span"). Similarly, in a large longitudinal study of youth with hyperactivity, Barkley et al (2011) found that scores from a self-report measure of EF (Deficits in Executive Function Interview) served as much stronger predictors of ADHD persistence and impairment into adulthood than performance-based measures of inhibition, working memory, nonverbal fluency, or problem solving. Further study of the relationships between rating measures of EF and the broad spectrum of psychopathology among youth may help inform clinical assessment practice.

Relationships between internalizing problems and scores on the BRIEF have received somewhat limited empirical study. Using a sample of children ages 7–12, Geronimi et al. (2016) found that self-reported worry severity was associated with higher BRIEF scores (i.e., worse EF) across all subscales, but that the associations were much stronger among younger versus older children. Another study focused on this shift subscale from the BRIEF, and reported that among children between ages 7–10, lower levels of EF mediated the relationship between fearful temperament and childhood anxiety (Affrunti & Woodruff-Borden, 2015). Similarly, another recent study reported that EF impairment on the BRIEF was associated with depressive symptoms in adolescents, a relationship that was mediated by maladaptive emotion regulation skills (Wante, Mezulis, Beveren, & Braet, 2017). There is a sizeable literature linking deficits on other questionnaire-based measures of EF, such as the Early Adolescent Temperament Questionnaire-Revised (EATQ-R) (Ellis & Rothbart, 2001) and Attentional Control Scale (ACS; Derryberry & Reed, 2002) to internalizing psychopathology. A number of studies have reported that self- and/or parent-reported EF deficits on the EATQ-R or ACS impart risk for internalizing problems during childhood and

adolescence (Muris & Ollendick, 2005; Muris, van der Pennen, Sigmond, & Mayer, 2008; Snyder, Gulley, et al., 2015; van Oort, Greaves-Lord, Ormel, Verhulst, & Huizink, 2011), and strong parent-reported EF has been shown to protect against the development of depression and anxiety in the presence of other risk factors (Gulley, Hankin, & Young, 2016). Recent work has also shown that questionnaire-based measures of poor EF are broadly associated with psychopathology in a transdiagnostic fashion (Caspi et al., 2014; Snyder, Gulley, et al., 2015). While the EATQ-R and ACS are frequently used in temperament and developmental psychopathology research, they each have limitations. First, both are limited in the scope of their content, and do not span the full range of capacities that generally are considered as falling under the umbrella of executive function. Specifically, (as the name implies) the ACS focuses exclusively on focusing and shifting attention; likewise, the EATQ-R focuses on three domains (inhibition, attentional control, and activation control) which are not fully aligned with modern models of EF and do not include key capacities such as working memory, shifting, or planning. Second, the EATQ-R, despite widespread use, has a number of psychometric problems, including often inadequate internal consistency and lack of support for the subscale structure (Snyder, Gulley, et al., 2015). In contrast, the BRIEF, which is more commonly used as a cognitive measure in the context of practical clinical assessment, has broad coverage of multiple EF capacities and has demonstrated strong psychometric properties (Gioia et al., 2000; Gioia, Isquith, Retzlaff, & Espy, 2002). Yet despite these advantages and the frequent use of the BRIEF, its relationships with psychopathology during adolescence are not often examined and are less well understood.

In the current study, we examined links between subjective EF ratings and symptoms of both internalizing and externalizing disorders in a community sample of adolescents. We focused on the BRIEF because it is a widely used measure of EF in clinical contexts, but research using the BRIEF is more common in the domains of ADHD and externalizing disorders. As such, the field presently lacks knowledge on how EF, as measured by the BRIEF, relates to internalizing problems of anxiety and depression in adolescents. We hypothesized that we would find strong associations between weaknesses in EF and anxiety and depression, using self- and parent-report measures of both EF and internalizing symptoms. We also anticipated replicating previously reported associations between BRIEF scores and externalizing symptoms.

Method

Participants

Participants in this study were recruited using three different strategies. First, we recruited individuals participating in a large longitudinal study of psychopathology risk with community children and adolescents (34% of total sample; for more detail, see Hankin et al., 2015). Second, participants were recruited by sending letters to families with a child/adolescent in the home (49% of total sample). Finally, undergraduate students seeking course credits were allowed to participate (17% of the total sample). The current study included 282 adolescents/young adults, ages 12 to 22 years old. The sample was 56.2% female, and 71.2% White, 14.3% multiracial, 5.6% African American, 3.3% American

Indian/Native Alaskan, 2.3% Asian American, with 1.3% selecting “Other” and 2% of participants declining to provide data on race. Eighty percent of the sample identified as non-Hispanic, 19% as Hispanic/Latino, and 1% declined to provide ethnicity data. Eighteen additional participants were excluded from analyses due to a parent-reported learning disability, a possible confound in the assessment of executive function. All parents and adolescent participants 18 years or older provided informed consent, and participants under 18 gave informed assent. We attempted to obtain parent-report data from all participants who were living at home, however we did not pursue such data for those living separately from parents, as we did not feel that parents could be reliable reporters under those circumstances. In total, 222 participants had parent-report data on at least one measure (mean age = 15.36 years old), while 60 did not (mean age = 19.44 years old). Reimbursement was provided to youth and parents for their participation.

Procedure

During a single visit to the laboratory, each participant and a parent completed the BRIEF assessing the participant’s behavior. Prior to the visit, participants went online and completed questionnaires assessing depression (Children’s Depression Inventory; CDI), anxiety (Multidimensional Anxiety Scale for Children; MASC), and hyperactivity/inattention and conduct problems (Strengths and Difficulties Questionnaire; SDQ). At the study visit, participants performed intelligence testing (Wechsler Abbreviated Scale of Intelligence- 2nd Edition; WASI-II), and several experimental procedures (not reported here). All procedures were approved by the institutional review board.

Measures

BRIEF—The BRIEF is a widely used rating scale of executive function that assesses behavior over the past six months. The parent version is composed of 86 items, and the self-report version has 80 items that contribute to eight scales, two composite index scores, and a global summary score. T-scores are generated for each scale, with a mean of 50 and standard deviation of 10, with scores ≥ 65 considered clinically significant. Using a 3-point Likert scale, ranging from 1 “never” to 3 “often,” respondents are asked to indicate how frequently the child or adolescent exhibits problems with certain behaviors that are putatively related to EF. The Behavioral Regulation Index is composed of the Inhibit, Shift, and Emotional Control Scales. The Metacognition Index is composed of the Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor scales (on the self-report version, the Monitor scale is within the Behavioral Regulation Index, and the Metacognition Index includes a Task Completion scale instead). We chose to focus our analyses on the Global Executive Composite score, which represents a combination of the two index scores, as previous work suggests the index scores are highly correlated (Gioia et al., 2002) and that links between EF and psychopathology are broad rather than specific (Caspi et al., 2014; Snyder, 2013; Snyder, Gulley, et al., 2015; Snyder, Miyake, et al., 2015). We examined both self- and parent-report BRIEF scores. Internal consistency was high (α = .971 for self-report, α = .977 for parent-report). Correlations between subscales and the overall Global Executive Composite scale were substantial, ranging from r = .670 – .888 on the self-report BRIEF and r = .664 – .958 on the parent-report measure.

CDI—The CDI (Kovacs, 1992) is a widely used, 27-item measure of depressive symptoms among children and adolescents ages 7 to 17. Each item is rated on a Likert scale (0 to 2). Total scores range from 0 to 54, with higher scores indicating greater severity of depression. In this study, we used the self- and parent-report versions. Both exhibited strong internal consistency (α = .917 for self-report, α = .870 for parent-report). Seventy-five of our participants were age 18 or above, thus they were older than the CDI manual-recommended age limit for this measure. The internal consistency of the self-report CDI for this group was α = .878 and .933 via parent-report. We chose to use the same measure of depressive symptoms across adolescents and young adults rather than use different measures for different age groups, as this allowed us to analyze our data together, maximizing our sample size. Using separate measures would create additional assessment challenges; the CDI was developed to be a youth version of the adult-based Beck Depression Inventory, so its age-based continuity with young adults should not be problematic. Consistent with this view, self-report depression questionnaires have not shown differences in adolescents compared with college students (e.g., Costello, Swendsen, Rose, & Dierker, 2008; Radloff, 1991), and past research has similarly used the CDI with young adults (e.g., Hunt, Burden, Hepper, Stevenson, & Johnston, 2006). This measure has previously been shown to possess adequate internal consistency and test-retest reliability (Smucker, Craighead, Craighead, & Green, 1986) with acceptable criterion validity against a structured interview diagnosis of depression (Timbremont, Braet, & Dreessen, 2004).

MASC—The MASC is a widely used, 39-item self-report measure of anxiety symptom severity among children and adolescents ages 8–19 (March, 1997). Respondents rate how frequently they experience particular symptoms on a Likert scale (0 to 4). In the current study we focused on the summary total score. Internal consistency was α = .806 for self-report, and α = .882 for parent-report. We had 37 participants older than the recommended age cutoff of 19. The self-report MASC was similar internal consistency for these participants (α = .913). Only four of the participants above 19 provided parent-report MASC, thus we did not calculate internal consistency of the scale for this small group. The MASC has well-established validity, internal consistency, and test-retest reliability (March, Parker, Sullivan, Stallings, & Conners, 1997).

SDQ—The SDQ (Goodman, 1997) is a 25-item behavioral screening measure for youth between ages 4–17 years old, with five scale scores generated from five items each: Conduct Problems, Inattention-Hyperactivity, Emotional Symptoms, Peer Problems, and Prosocial behavior. The SDQ features self- and parent-report versions. Our focus was on the Conduct Problems and Inattention-Hyperactivity scales. Internal consistency was α = .672 (parent-report) and α = .531 (self-report) for the Conduct Problems scale and α = .831 (parent-report) and α = .778 (self-report) for the Inattention-Hyperactivity scale. The measure performed similarly for the portion of our sample above 17 years of age (n = 75); the internal consistency of the Conduct Problems scales was α = .631 (parent-report) and α = .593 (self-report) and for the Inattention-Hyperactivity scale was α = .796 (parent-report) and α = .798 (self-report). Internal consistency, cross-informant and test-retest reliability of the SDQ have been shown to be adequate, with scale elevations displaying strong criterion validity against clinical diagnoses (Goodman, 2001).

WASI-II—All participants completed the Vocabulary and Matrix Reasoning subtests from the WASI-II, which allowed for the estimation of IQ. This estimation was calculated based on the WASI-II manual (Wechsler, 2011).

Statistical Analyses

To examine relationships between BRIEF global composite scores and dimensional ratings of anxiety, depression, and externalizing problems, we employed hierarchical linear regression. For each regression model, we first entered a block of three covariates (age, gender, and IQ), followed by the BRIEF Global Executive Composite (GEC) predictor. The dependent variable was either the self- or parent-report MASC total score, CDI total score, SDQ Conduct Problems score, or SDQ Inattention-Hyperactivity score. These models were run separately using both the BRIEF GEC score from the self-report and parent-report measures, thus a total of 16 regressions were performed. To control for type-1 error, Bonferroni correction was used leading to a significance threshold of $p<.003$. Age and IQ were chosen as covariates due to evidence of associations with executive function (Ardila, Pineda, & Rosselli, 2000; Welsh, Pennington, & Groisser, 1991), while gender was chosen because females have significantly higher risk for both depression and anxiety in adolescence (Cohen et al., 1993).

To check for the possibility of multivariate outliers we calculated Mahalanobis distance (Penny, 1996) separately for our two sets of predictors (i.e., the covariates age, gender, and IQ plus either the self- or parent-report BRIEF GEC). The values were compared to the single-tailed chi-square distribution with a degrees of freedom equal to the number of predictors, and values with a probability <.001 were identified as outliers (Tabachnick & Fidell, 2007).

Results

Table 1 contains means, standard deviations, and inter-correlations for all variables. Agreement between parent- and self-report on the BRIEF was moderate, and for outcome variables ranged from moderate to strong.

Internalizing Outcomes

Table 2 contains the results from regression analyses for internalizing variables. Self-report BRIEF GEC was associated with depression via both self- (β= .637, ΔR^2 = .393) and parent-report (β= .496, ΔR^2 = .236), as well as self- (β= .552, ΔR^2 = .295) and parent-report anxiety (β= .379, ΔR^2 = .138). Parent-report BRIEF GEC was associated with self- (β= .313, ΔR^2 = .097) and parent-report depression (β= .512, ΔR^2 = .258), and parent-report anxiety (β= .312, ΔR^2 = .097), although the relationship with self-report anxiety was not statistically significant (β= .151, ΔR^2 = .023).

Because our sample contained 75 participants who exceeded the recommended age range for the CDI and 19 who exceeded the age range for the MASC, we re-ran our analyses without those participants to ensure that our results were not related to atypical use of these measures. Self-report BRIEF GEC was still associated with depression via both self- (β= .635, ΔR^2 = .389) and parent-report (β= .518, ΔR^2 = .258), as well as self- (β= .546,

ΔR^2 = .288) and parent-report anxiety (β= .378, ΔR^2 = .137). Similarly, parent-report BRIEF GEC continued to be associated with self- (β= .323, ΔR^2 = .105) and parent- report depression (β= .523, ΔR^2 = .271), and parent-report anxiety (β= .311, ΔR^2 = .096), and the relationship with self-report anxiety remained below statistical significance (β= .139, ΔR^2 = .019).

Externalizing Outcomes

Table 3 contains regression results for the externalizing variables. Self-report BRIEF GEC was a significant predictor of self-report conduct problems (β=.432, ΔR^2 = .180) and self (β= .560, ΔR^2 = .302) and parent report (β= .422, ΔR^2 = .171) hyperactivity/inattention. It was not a significant predictor of parent-reported conduct problems. Parent-report BRIEF GEC predicted parent- (β= .456, ΔR^2 = .206) and self-report conduct problems (β= .378, ΔR^2 = .141) and parent- (β= .679, ΔR^2 = .456) and self-report (β= .302, ΔR^2 = .090) hyperactivity/inattention.

We also re-ran our analyses excluding those 75 individuals who were 18 or over and thus outside of the recommended age range for the SDQ. Self-report BRIEF GEC remained a significant predictor of self-report conduct problems (β=.463, ΔR^2 = .205) and self- (β= .556, ΔR^2 = .295) and parent-report (β= .432, ΔR^2 = .180) hyperactivity/inattention. It also emerged as a significant predictor of parent-reported conduct problems (β=.212, ΔR^2 = .043). Parent-report BRIEF GEC predicted parent- (β= .481, ΔR^2 = .229) and self-report conduct problems (β= .418, ΔR^2 = .173) and parent- (β= .687, ΔR^2 = .466) and self-report (β= .310, ΔR^2 = .095) hyperactivity/inattention.

Outlier Analyses

Using the multivariate outlier detection method described above, a single participant was identified as having aberrant values. Analyses were re-run without this participant and our findings did not change meaningfully.

Exploratory Subscale Analyses—We elected to use the GEC scores as our predictors for our central analyses. However, because readers may be curious about associations between specific BRIEF subscales and our dependent variables we have included two tables in our supplemental data featuring partial correlations (controlling for age, gender, and IQ) between each of the BRIEF subscales and our internalizing and externalizing outcome scales. These results indicate consistent directionality but some variance in the strength of associations between the subscales and the clinical scales.

Discussion

The current study sought to investigate whether scores on a commonly used rating measure of EF deficits would be associated with internalizing and externalizing problems among a community sample of adolescents. We found evidence that poorer EF skills are strongly related to both depression and anxiety among adolescents. As expected, poorer EF skills were also associated with elevated symptoms of hyperactivity/inattention and conduct problems. Relationships were strongest when the reporter was the same for both the EF and

outcome variables, likely due to shared reporter variance, however cross-informant effects were also substantial. Agreement between self and parent ratings on the BRIEF, and our clinical variables, was in the moderate range.

The BRIEF is a measure with widespread use in the community, often as an element of cognitive and neuropsychological assessment. But the current findings, taken from a large and diverse community sample of adolescents and young adults, indicate that the BRIEF provides a window into emotional as well as cognitive functioning. The BRIEF is often employed in research on ADHD (e.g., Mahone et al., 2002; McCandless & O' Laughlin, 2007; Wehmeier, Schacht, & Barkley, 2010), but has also been used to study EF in conditions ranging from autism (Gilotty, Kenworthy, Sirian, Black, & Wagner, 2002) to traumatic brain injury (Conklin, Salorio, & Slomine, 2008) to spina bifida (Burmeister et al., 2005). Scores on the BRIEF do not align closely with traditional performance-based EF measures (Conklin et al., 2008; McAuley et al., 2010; Toplak et al., 2009, 2013; Vriezen & Pigott, 2002), yet they appear to capture aspects of executive function that are relevant to psychopathology in a transdiagnostic fashion. The current findings extend the literature by indicating that the BRIEF is sensitive to internalizing problems such as anxiety and depression afflicting adolescents in the community. This is consistent with recent work, including previously mentioned studies documenting associations between BRIEF scores and self-reported worry severity (Geronimi et al., 2016), and anxiety (Affrunti & Woodruff-Borden, 2015) among children, and depressive symptoms among adolescents (Wante et al., 2017). The implications of these findings are significant, suggesting that elevations in scores on the BRIEF should alert clinicians to thoroughly screen for internalizing- in addition to externalizing- symptoms in their patients.

As mentioned previously, a parallel literature has examined associations between internalizing symptoms among youth and other questionnaire-based measures of EF (e.g., EATQ-R, ACS), which are commonly referred to as effortful control in the temperament literature. Our findings are compatible with that literature. In terms of associations with the BRIEF, we found medium to large effects for depression and small to large effects for anxiety. These effect sizes are similar to previous papers using the EATQ-R and ACS as correlates of internalizing symptoms in adolescents (Muris et al., 2008; Snyder, Gulley, et al., 2015). Together, these findings support the notion that problems with core executive function skills, are associated with depression and anxiety, and that subjective deficits in EF should alert clinicians to screen carefully for internalizing problems.

It is worth considering why poorer EF skills as measured by the BRIEF would be so strongly associated with anxiety and depression. The BRIEF purportedly captures an individual's ability to employ EF skills in everyday situations, which are often unpredictable and laden with emotion, particularly for youth with psychopathology. In contrast, formal EF tasks are highly structured, with the administrator providing guidelines for the appropriate behavioral responses. As others have concluded, performance-based tasks likely reflect the efficiency of EF under optimized conditions, while rating measures capture success with achieving goals that rely on EF (Toplak et al., 2013). There is evidence that introducing anxiety into the formal testing environment degrades performance on EF tests. For example, one recent study contrasted the effects of induced anxiety or anger on performance on EF tests in healthy

participants. While anger had no palpable effect, anxiety significantly reduced performance on a global EF task (Shields, Moons, Tewell, & Yonelinas, 2016), consistent with prominent theories suggesting that anxiety impairs the efficiency of EF (Eysenck et al., 2007). Rating measures of EF, while subject to known reporter biases, nonetheless offer a way for clinicians to assess how deficits in EF may manifest for a patient as he or she encounters the unpredictability and volatility of everyday life.

This study has several strengths. It focuses on a large, diverse community sample of adolescents. While previous studies of the BRIEF often included only parent- (Affrunti & Woodruff-Borden, 2015; Geronimi et al., 2016) or parent- and teacher-report (Toplak et al., 2009), this study included both parent- and adolescent-report on the BRIEF and on all outcome measures. Another strength of this study is that we controlled for IQ in all analyses, minimizing an important potential confound. There are also limitations of the current study. Foremost, the analyses in this paper do not include direct examination of EF as measured by performance-based EF tasks. Ideally, rating and performance-based EF measures could be used simultaneously to better understand the specificity of relationships between EF and domains of psychopathology. Relatedly, this study relied entirely on questionnaire measures of all predictors and outcomes. To address concerns about shared method variance, it would be helpful for future studies to measure other outcome variables related to internalizing and externalizing problems, such as autonomic markers of emotional response or observational measures of emotion. And finally, this study employed a relatively high-functioning community sample and thus the generalizability to treatment-seeking or high-risk samples needs to be established.

In summary, this study examined whether poorer EF skills, as measured by the BRIEF, were associated with internalizing and externalizing problems in a large community sample of adolescents. Our results suggest that EF weaknesses on the BRIEF are correlated with anxiety and depression as well as hyperactivity-inattention and conduct problems among adolescents. These findings support previous research and theory suggesting that EF problems are highly relevant to both internalizing and externalizing psychopathology. In addition, as the BRIEF is widely used in clinical practice, our findings suggest that elevations on the BRIEF should prompt clinicians to carefully assess for the presence of anxiety and depression among their patients.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

References

Affrunti NW, & Woodruff-Borden J (2015). The associations of executive function and temperament in a model of risk for childhood anxiety. Journal of Child and Family Studies, 24(3), 715–724.

Ansari T, & Derakshan N (2011). The neural correlates of impaired inhibitory control in anxiety. Neuropsychologia, 49(5), 1146–1153. 10.1016/j.neuropsychologia.2011.01.019 [PubMed: 21241717]

Ansari T, Derakshan N, & Richards A (2008). Effects of anxiety on task switching: evidence from the mixed antisaccade task. Cognitive, Affective & Behavioral Neuroscience, 8(3), 229–238. 10.3758/CABN.8.3.229

Ardila A, Pineda D, & Rosselli M (2000). Correlation between intelligence test scores and executive function measures. Archives of Clinical Neuropsychology, 15(1), 31–36. 10.1016/S0887-6177(98)00159-0 [PubMed: 14590565]

Barkley R (1997). Behavioral inhibition, sustained attention, and executive functions: Constructing a unifying theory of ADHD. Psychological Bulletin, 121(1), 65–94. [PubMed: 9000892]

Barkley R, & Fischer M (2011). Predicting impairment in major life activities and occupational functioning in hyperactive children as adults: Self-reported executive function (EF) deficits versus EF tests. Developmental Neuropsychology, 36(2), 137–161. 10.1080/87565641.2010.549877 [PubMed: 21347918]

Berggren N, & Derakshan N (2013). Attentional control deficits in trait anxiety: Why you see them and why you don't. Biological Psychology. 10.1016/j.biopsycho.2012.03.007

Burmeister R, Hannay HJ, Copeland1 K, Fletcher JM, Boudousquie A, & Dennis M (2005). Attention Problems and Executive Functions in Children With Spina Bifida and Hydrocephalus. Child Neuropsychology, 11(3), 265–283. 10.1080/092970490911324 [PubMed: 16036451]

Caselli RJ, Reiman EM, Hentz JG, Osborne D, & Alexander GE (2004). A distinctive interaction between chronic anxiety and problem solving in asymptomatic APOE e4 homozygotes. The Journal of Neuropsychiatry and Clinical Neurosciences, 16(3), 320–329. 10.1176/jnp.16.3.320 [PubMed: 15377739]

Caspi A, Houts RM, Belsky DW, Goldman-Mellor SJ, Harrington H, Israel S, … Moffitt TE (2014). The p Factor: One General Psychopathology Factor in the Structure of Psychiatric Disorders? Clinical Psychological Science, 2(2), 119–137. 10.1177/2167702613497473 [PubMed: 25360393]

Chaytor N, & Schmitter-Edgecombe M (2003). The ecological validity of neuropsychological tests: A review of the literature on everyday cognitive skills. Neuropsychology Review, 13(4), 181–197. 10.1023/B:NERV.0000009483.91468.fb [PubMed: 15000225]

Cisler JM, & Koster EHW (2010). Mechanisms of attentional biases towards threat in anxiety disorders: An integrative review. Clinical Psychology Review, 30(2), 203–216. 10.1016/j.cpr.2009.11.003 [PubMed: 20005616]

Cohen P, Cohen J, Kasen S, Velez CN, Hartmark C, Johnson J, … Streuning EL (1993). An epidemiological study of disorders in late childhood and adolescence--I. Age- and gender-specific prevalence. Journal of Child Psychology and Psychiatry, and Allied Disciplines, 34(6), 851–867.

Conklin HM, Salorio CF, & Slomine BS (2008). Working memory performance following paediatric traumatic brain injury. Brain Injury, 22(11), 847–857. 10.1080/02699050802403565 [PubMed: 18850343]

Costello D, Swendsen J, Rose J, & Dierker L (2008). Risk and protective factors associated with trajectories of depressed mood from adolescence to early adulthood. Journal of Consulting and Clinical Psychology, 76(2), 173–183. 10.1037/0022-006X.76.2.173 [PubMed: 18377115]

Derakshan N, & Eysenck MW (2009). Anxiety, processing efficiency, and cognitive performance: New developments from attentional control theory. European Psychologist, 14(2), 168–176. 10.1027/1016-9040.14.2.168

Derryberry D, & Reed MA (2002). Anxiety-related attentional biases and their regulation by attentional control. Journal of Abnormal Psychology, 111(2), 225–236. 10.1037/0021-843X.111.2.225 [PubMed: 12003445]

Ellis LK, & Rothbart MK (2001). Revision of the Early Adolescent Temperament Questionnaire. Presented at the Society for Research in Child Development, Minneapolis, MN.

Essau CA, Conradt J, & Petermann F (2000). Frequency, comorbidity, and psychosocial impairment of anxiety disorders in German adolescents. Journal of Anxiety Disorders, 14(3), 263–279. 10.1016/S0887-6185(99)00039-0 [PubMed: 10868984]

Eysenck MW, Derakshan N, Santos R, & Calvo MG (2007). Anxiety and cognitive performance: Attentional control theory. Emotion, 7(2), 336–353. 10.1037/1528-3542.7.2.336 [PubMed: 17516812]

Friedman NP, Miyake A, Young SE, DeFries JC, Corley RP, & Hewitt JK (2008). Individual differences in executive functions are almost entirely genetic in origin. Journal of Experimental Psychology: General, 137(2), 201–225. 10.1037/0096-3445.137.2.201 [PubMed: 18473654]

Fröjd SA, Nissinen ES, Pelkonen MUI, Marttunen MJ, Koivisto A-M, & Kaltiala-Heino R (2008). Depression and school performance in middle adolescent boys and girls. Journal of Adolescence, 31(4), 485–498. 10.1016/j.adolescence.2007.08.006 [PubMed: 17949806]

Geronimi EMC, Patterson HL, & Woodruff-Borden J (2016). Relating worry and executive functioning during childhood: the moderating role of age. Child Psychiatry and Human Development, 47(3), 430–439. 10.1007/s10578-015-0577-4 [PubMed: 26268800]

Gilotty L, Kenworthy L, Sirian L, Black DO, & Wagner AE (2002). Adaptive skills and executive function in autism spectrum disorders. Child Neuropsychology : A Journal on Normal and Abnormal Development in Childhood and Adolescence, 8(4), 241–248. 10.1076/chin.8.4.241.13504 [PubMed: 12759821]

Gioia G, Isquith P, Guy S, & Kenworthy L (2000). Behavior rating inventory of executive function. Child Neuropsychology: A Journal on Normal and Abnormal Development in Childhood and Adolescence, 6(3), 235–238. 10.1076/chin.6.3.235.3152 [PubMed: 11419452]

Gioia G, Isquith P, Retzlaff P, & Espy K (2002). Confirmatory factor analysis of the Behavior Rating Inventory of Executive Function (BRIEF) in a clinical sample. Child Neuropsychology: A Journal on Normal and Abnormal Development in Childhood and Adolescence, 8(4), 249–257. 10.1076/chin.8.4.249.13513 [PubMed: 12759822]

Goodman R (1997). The Strengths and Difficulties Questionnaire: A Research Note. Journal of Child Psychology and Psychiatry, 38(5), 581–586. 10.1111/j.1469-7610.1997.tb01545.x [PubMed: 9255702]

Goodman R (2001). Psychometric properties of the strengths and difficulties questionnaire. *Journal of the American Academy of Child &* Adolescent Psychiatry, 40(11), 1337–1345. 10.1097/00004583-200111000-00015

Gotlib IH, & Joormann J (2010). Cognition and depression: Current status and future directions. Annual Review of Clinical Psychology, 6, 285–312. 10.1146/annurev.clinpsy.121208.131305

Gulley L, Hankin B, & Young J (2016). Risk for depression and anxiety in youth: The interaction between negative affectivity, effortful control, and stressors. Journal of Abnormal Child Psychology, 44(2), 207–218. 10.1007/s10802-015-9997-7 [PubMed: 25870113]

Hankin B, Young J, Abela J, Smolen A, Jenness J, Gulley L, … Oppenheimer C (2015). Depression from childhood into late adolescence: Influence of gender, development, genetic susceptibility, and peer stress. Journal of Abnormal Psychology, 124(4), 803–816. 10.1037/abn0000089 [PubMed: 26595469]

Hunt O, Burden D, Hepper P, Stevenson M, & Johnston C (2006). Self-reports of psychosocial functioning among children and young adults with cleft lip and palate. The Cleft Palate-Craniofacial Journal: Official Publication of the American Cleft Palate-Craniofacial Association, 43(5), 598–605. 10.1597/05-080 [PubMed: 16986986]

Kovacs M (1992). Children's Depression Inventory (CDI) manual. Toronto, Ontario, Canada: Multi-Health Systems.

Levin RL, Heller W, Mohanty A, Herrington JD, & Miller GA (2007). Cognitive Deficits in Depression and Functional Specificity of Regional Brain Activity. Cognitive Therapy and Research, 31(2), 211–233. 10.1007/s10608-007-9128-z

Mahone E, Cirino P, Cutting L, Cerrone P, Hagelthorn K, Hiemenz J, … Denckla M (2002). Validity of the behavior rating inventory of executive function in children with ADHD and/or Tourette syndrome. Archives of Clinical Neuropsychology, 17(7), 643–662. 10.1016/S0887-6177(01)00168-8 [PubMed: 14591848]

March J (1997). Multidimensional Anxiety Scale for Children. Tonawnda, NY: Multi-Health Systems.

March J, Parker J, Sullivan K, Stallings P, & Conners C (1997). The Multidimensional Anxiety Scale for Children (MASC): factor structure, reliability, and validity. Journal of the American Academy of Child and Adolescent Psychiatry, 36(4), 554–565. 10.1097/00004583-199704000-00019 [PubMed: 9100431]

McAuley T, Chen S, Goos L, Schachar R, & Crosbie J (2010). Is the behavior rating inventory of executive function more strongly associated with measures of impairment or executive function? Journal of the International Neuropsychological Society: JINS, 16(3), 495–505. 10.1017/S1355617710000093 [PubMed: 20188014]

McCandless S, & O' Laughlin L (2007). The clinical utility of the Behavior Rating Inventory of Executive Function (BRIEF) in the diagnosis of ADHD. Journal of Attention Disorders, 10(4), 381–389. 10.1177/1087054706292115 [PubMed: 17449837]

Merikangas KR, He J-P, Burstein M, Swanson SA, Avenevoli S, Cui L, … Swendsen J (2010). Lifetime prevalence of mental disorders in U.S. adolescents: results from the National Comorbidity Survey Replication--Adolescent Supplement (NCS-A). Journal of the American Academy of Child and Adolescent Psychiatry, 49(10), 980–989. 10.1016/j.jaac.2010.05.017 [PubMed: 20855043]

Morgan AB, & Lilienfeld SO (2000). A meta-analytic review of the relation between antisocial behavior and neuropsychological measures of executive function. Clinical Psychology Review, 20(1), 113–136. 10.1016/S0272-7358(98)00096-8 [PubMed: 10660831]

Muris P, & Ollendick T (2005). The role of temperament in the etiology of child psychopathology. Clinical Child and Family Psychology Review, 8(4), 271–289. 10.1007/s10567-005-8809-y [PubMed: 16362256]

Muris P, van der Pennen E, Sigmond R, & Mayer B (2008). Symptoms of anxiety, depression, and aggression in non-clinical children: relationships with self-report and performance-based measures of attention and effortful control. Child Psychiatry and Human Development, 39(4), 455–467. 10.1007/s10578-008-0101-1 [PubMed: 18446435]

Penny K (1996). Appropriate critical values when testing for a single multivariate outlier by using the Mahalanobis Distance. Journal of the Royal Statistical Society. Series C (Applied Statistics), 45(1), 73–81. 10.2307/2986224

Pessoa L (2009). How do emotion and motivation direct executive control? Trends in Cognitive Sciences, 13(4), 160–166. 10.1016/j.tics.2009.01.006 [PubMed: 19285913]

Pine DS, Cohen P, Gurley D, Brook J, & Ma Y (1998). The Risk for Early-Adulthood Anxiety and Depressive Disorders in Adolescents With Anxiety and Depressive Disorders. Archives of General Psychiatry, 55(1), 56 10.1001/archpsyc.55.1.56 [PubMed: 9435761]

Radloff LS (1991). The use of the Center for Epidemiologic Studies Depression Scale in adolescents and young adults. Journal of Youth and Adolescence, 20(2), 149–166. 10.1007/BF01537606 [PubMed: 24265004]

Raine A, Moffitt TE, Caspi A, Loeber R, Stouthamer-Loeber M, & Lynam D (2005). Neurocognitive impairments in bos on the life-course persistent antisocial path. Journal of Abnormal Psychology, 114(1), 38–49. [PubMed: 15709810]

Shields GS, Moons WG, Tewell CA, & Yonelinas AP (2016). The effect of negative affect on cognition: Anxiety, not anger, impairs executive function. Emotion (Washington, D.C.), 16(6), 792–797. 10.1037/emo0000151

Smucker MR, Craighead WE, Craighead LW, & Green BJ (1986). Normative and reliability data for the children's depression inventory. Journal of Abnormal Child Psychology, 14(1), 25–39. 10.1007/BF00917219 [PubMed: 3950219]

Snyder H (2013). Major depressive disorder is associated with broad impairments on neuropsychological measures of executive function: A meta-analysis and review. Psychological Bulletin, 139(1), 81–132. 10.1037/a0028727 [PubMed: 22642228]

Snyder H, Gulley L, Bijttebier P, Hartman C, Oldehinkel A, Mezulis A, … Hankin B (2015). Adolescent emotionality and effortful control: Core latent constructs and links to psychopathology and functioning. Journal of Personality and Social Psychology, 109(6), 1132–1149. 10.1037/pspp0000047 [PubMed: 26011660]

Snyder H, Miyake A, & Hankin B (2015). Advancing understanding of executive function impairments and psychopathology: bridging the gap between clinical and cognitive approaches. Frontiers in Psychology, 6, 328 10.3389/fpsyg.2015.00328 [PubMed: 25859234]

Tabachnick B, & Fidell L (2007). Using Multivariate Statistics (5th ed.). Boston: Pearson Education.

Timbremont B, Braet C, & Dreessen L (2004). Assessing depression in youth: Relation between the Children's Depression Inventory and a structured Interview. Journal of Clinical Child & Adolescent Psychology, 33(1), 149–157. 10.1207/S15374424JCCP3301_14 [PubMed: 15028549]

Toplak ME, Bucciarelli SM, Jain U, & Tannock R (2009). Executive functions: performance-based measures and the behavior rating inventory of executive function (BRIEF) in adolescents with

attention deficit/hyperactivity disorder (ADHD). Child Neuropsychology, 15(1), 53–72. 10.1080/09297040802070929 [PubMed: 18608232]

Toplak ME, West RF, & Stanovich KE (2013). Practitioner review: do performance-based measures and ratings of executive function assess the same construct? Journal of Child Psychology and Psychiatry, 54(2), 131–143. 10.1111/jcpp.12001 [PubMed: 23057693]

Ursache A, & Raver CC (2014). Trait and state anxiety: Relations to executive functioning in an at risk sample. Cognition & Emotion, 28(5), 845–855. 10.1080/02699931.2013.855173 [PubMed: 24228688]

van Oort FVA, Greaves-Lord K, Ormel J, Verhulst FC, & Huizink AC (2011). Risk indicators of anxiety throughout adolescence: The TRAILS study. Depression and Anxiety, 28(6), 485–494. 10.1002/da.20818 [PubMed: 21509913]

Vriezen ER, & Pigott SE (2002). The relationship between parental report on the BRIEF and performance-based measures of executive function in children with moderate to severe traumatic brain injury. Child Neuropsychology: A Journal on Normal and Abnormal Development in Childhood and Adolescence, 8(4), 296–303. 10.1076/chin.8.4.296.13505 [PubMed: 12759826]

Wagner S, Müller C, Helmreich I, Huss M, & Tadić A (2015). A meta-analysis of cognitive functions in children and adolescents with major depressive disorder. European Child & Adolescent Psychiatry, 24(1), 5–19. 10.1007/s00787-014-0559-2 [PubMed: 24869711]

Wante L, Mezulis A, Beveren M-LV, & Braet C (2017). The mediating effect of adaptive and maladaptive emotion regulation strategies on executive functioning impairment and depressive symptoms among adolescents. Child Neuropsychology, 23(8), 935–953. 10.1080/09297049.2016.1212986 [PubMed: 27535347]

Wechsler D (2011). Manual for the Wechsler Abbreviated Scale of Intelligence- Second Edition (WASI-II) (2nd ed.). San Antonio, TX: Pearson.

Wehmeier PM, Schacht A, & Barkley R (2010). Social and emotional impairment in children and adolescents with ADHD and the impact on quality of life. Journal of Adolescent Health, 46(3), 209–217. 10.1016/j.jadohealth.2009.09.009 [PubMed: 20159496]

Welsh MC, Pennington BF, & Groisser DB (1991). A normative-developmental study of executive function: A window on prefrontal function in children. Developmental Neuropsychology, 7(2), 131–149. 10.1080/87565649109540483

Willcutt EG, Doyle AE, Nigg JT, Faraone SV, & Pennington BF (2005). Validity of the Executive Function Theory of Attention-Deficit/Hyperactivity Disorder: A Meta-Analytic Review. Biological Psychiatry, 57(11), 1336–1346. 10.1016/j.biopsych.2005.02.006 [PubMed: 15950006]

Table 1.

Mean, standard deviation, and inter-correlations between all variables

Variable	*n*	1	2	3	4	5	6	7	8	9	10	11	12
1. Age	298	-											
2. WASI-II	287	.026	-										
3. BRIEF GEC T-Score Self	278	−.104	−.111	-									
4. BRIEF GEC T-Score Parent	212	.041	−.081	.484	-								
5. CDI Self	282	−.016	−.002	.624	.338	-							
6. CDI Parent	220	.152	−.004	.497	.521	.616	-						
7. MASC Self	281	−.087	−.039	.572	.161	.610	.386	-					
8. MASC Parent	219	.208	.053	.399	.288	.412	.522	.486	-				
9. SDQ Self Conduct	281	−.140	−.151	.457	.408	.352	.298	.126	.083	-			
10. SDQ HI Self	281	−.119	−.058	.560	.372	.497	.350	.343	.225	.459	-		
11. SDQ Parent Conduct	221	.025	−.074	.178	.488	.166	.391	.001	.089	.454	.240	-	
12. SDQ HI Parent	221	−.028	−.137	.408	.680	.212	.401	.086	.185	.462	.370	.487	-
Mean		16.22	107.48	50.17	52.79	7.84	5.63	45.74	40.12	1.18	3.57	.98	2.54
SD		2.38	13.91	11.99	10.59	7.41	5.99	16.44	13.8	1.382	2.529	1.35	2.175

Note: WASI-II = Wechsler Abbreviated Scale of Intelligence-Second Edition; BRIEF GEC = Brief Rating Inventory of Executive Function, Global Executive Composite; CDI = Children's Depression Inventory; MASC = Multidimensional Anxiety Scale for Children; SDQ Conduct = Strengths and Difficulties Questionnaire conduct subscale; SDQ HI = Strengths and Difficulties Questionnaire hyperactivity- inattentiveness subscale. Correlations $r \geq |.083|$ are significant at $p < 0.05$.

Table 2

Hierarchical regression analysis predicting internalizing symptoms from self-report and parent-report BRIEF

	CDI Total Self-Report					CDI Total Parent-Report					MASC Total Self-Report					MASC Total Parent-Report				
Variable	**B *(SE)***	**β**	***t***	***p***	**ΔR^2**	**B *(SE)***	**β**	***t***	***p***	**ΔR^2**	**B *(SE)***	**β**	***t***	***p***	**ΔR^2**	**B *(SE)***	**β**	***t***	***p***	**ΔR^2**
Step 1					.025					.039					.072					.084
Gender	2.312 (.893)	.157	2.589	.010		1.123 _(.801)	.096	1.402	.163		8.160 (1.951)	.249	4.182	.000		5.277 (1.842)	.191	2.865	.005	
Age	−.087 (.186)	−.028	−.467	.641		.592 (.236)	.170	2.507	.013		−.703 (.409)	−.102	−1.722	.086		1.641 (.535)	.204	3.067	.002	
IQ	−.005 (.032)	−.010	−.169	.866		.000 (.028)	−.001	−.017	.986		−.059 (.069)	−.050	−.850	.396		.044 (.065)	.045	.671	.503	
Step 2					.393					.236					.295					.138
Gender	1.315 (.695)	.090	1.892	.060		.320 (.705)	.027	.455	.650		6.209 (1.624)	.189	3.822	.000		3.805 (1.719)	.138	2.213	.028	
Age	.103 (.145)	.034	.713	.477		.428 (.206)	.123	2.073	.039		−.326 (.340)	−.047	−.959	.339		1.408 (.496)	.175	2.840	.005	
IQ	.033 (.025)	.063	1.327	.186		.028 (.025)	.067	1.112	.267		.015 (.058)	.013	.256	.798		.087 (.061)	.089	1.436	.152	
BRIEF-SR GEC	.181 (.014)	.637	13.356	.000		.112 (.014)	.496	8.199	.000		.349 (.032)	.552	11.069	.000		.202 (.033)	.379	6.050	.000	
Step 1					.073					.030					.105					.078
Gender	3.587 (1.041)	.233	3.445	.001		1.214 (.829)	.102	1.465	.144		10.185 (2.258)	.300	4.511	.000		5.538 (1.908)	.197	2.902	.004	
Age	.611 (.301)	.137	2.029	.044		.485 (.244)	.138	1.989	.048		1.003 (.658)	.101	1.524	.129		1.535 (.554)	.188	2.772	.006	
IQ	−.008 (.036)	−.015	−.225	.822		−.006 (.029)	−.014	−.205	.838		−.105 (.079)	−.089	−1.337	.183		.027 (.067)	.027	.403	.688	
Step 2					.097					.258					.023					.097
Gender	3.732 (.988)	.242	3.778	.000		1.349 (.712)	.113	1.895	.060		10.337 (2.236)	.305	4.623	.000		5.730 (1.810)	.204	3.165	.002	
Age	.593 (.286)	.133	2.075	.039		.452 (.209)	.129	2.159	.032		.985 (.651)	.099	1.512	.132		1.520 (.525)	.186	2.893	.004	
IQ	.010 (.035)	.018	.275	.783		.017 (.025)	.041	.675	.501		−.086 (.078)	−.073	−1.103	.271		.056 (.064)	.057	.884	.378	
BRIEF-PR GEC	.095 (.019)	.313	4.873	.000		.119 (.014)	.512	8.518	.000		.101 (.044)	.151	2.286	.023		.172 (.036)	.312	4.828	.000	

Note: CDI = Children's Depression Inventory; MASC = Multidimensional Anxiety Scale for Children; BRIEF-PR GEC = Parent report Brief Rating Inventory of Executive Function, Global Executive Composite; BRIEF-SR GEC = Self report Brief Rating Inventory of Executive Function, Global Executive Composite. Sample sizes differed by analysis. For the BRIEF-SR-GEC regressions, they were as follows: CDI Self-Report (n = 269); CDI Parent-report (n = 212); MASC Self-Report (n = 268); MASC Parent-Report (n = 211). For the BRIEF-PR-GEC regressions, they were as follows: CDI Self-Report (n = 208); CDI Parent-report (n = 205); MASC Self-Report (n = 207); MASC Parent-Report (n = 204).

Table 3

Hierarchical regression analysis predicting externalizing symptoms from self-report and parent-report BRIEF

	SDQ SR Inattention-Hyperactivity					SDQ SR Conduct Problems					SDQ PR Inattention-Hyperactivity					SDQ PR Conduct Problems				
	B *(SE)*	β	*t*	*p*	ΔR^2	B *(SE)*	β	*t*	*p*	ΔR^2	B *(SE)*	β	*t*	*p*	ΔR^2	B *(SE)*	β	*t*	*p*	ΔR^2
Step 1					.015					.038					.029					.010
Gender	.066 (.310)	.013	.214	.831		.051 (.169)	.018	.302	.763		−.435 (.291)	−.102	−1.498	.136		−.148 (.185)	−.055	−.802	.424	
Age	−.113 (.065)	−.107	−1.749	.082		−.068 (.035)	−.116	−1.926	.055		.004 (.084)	.003	.050	.960		.027 (.054)	.035	.505	.614	
IQ	−.011 (.011)	−.058	−.947	.345		−.015 (.006)	−.152	−2.514	.013		−.019 (.010)	−.130	−1.897	.059		−.007 (.007)	−.073	−1.054	.293	
Step 2					.302					.180					.171					.030
Gender	−.219 (.260)	−.043	−.842	.400		−.070 (.153)	−.025	−.459	.646		−.676 (.267)	−.159	−2.534	.012		−.211 (.184)	−.079	−1.147	.253	
Age	−.060 (.054)	−.057	−1.111	.267		−.045 (.032)	−.078	−1.419	.157		−.041 (.077)	−.033	−.529	.597		.015 (.053)	.020	.288	.774	
IQ	.003 (.009)	.017	.325	.745		−.009 (.006)	−.094	−1.712	.088		−.011 (.009)	−.074	−1.175	.241		−.005 (.006)	−.049	−.720	.472	
BRIEF-SR GEC	.055 (.005)	.560	10.791	.000		.023 (.003)	.432	7.781	.000		.035 (.005)	.422	6.669	.000		.009 (.004)	.176	2.530	.012	
Step 1					.007					.027					.025					.009
Gender	.323 (.355)	.064	.909	.365		.144 (.179)	.056	.804	.422		−.293 (.292)	−.070	−1.004	.316		−.102 (.188)	−.038	−.544	.587	
Age	−.050 (.103)	−.034	−.485	.628		.056 (.052)	.075	1.087	.278		.044 (.084)	.036	.522	.602		.028 (.054)	.036	.513	.608	
IQ	−.009 (.013)	−.049	−.698	.486		−.013 (.006)	−.142	−2.044	.042		−.019 (.010)	−.133	−1.915	.057		−.007 (.007)	−.074	−1.057	.292	
Step 2					.090					.141					.456					.206
Gender	.372 (.339)	.074	1.096	.274		.175 (.166)	.068	1.058	.291		−.224 (.213)	−.054	−1.050	.295		−.072 (.168)	−.027	−.433	.666	
Age	−.057 (.098)	−.039	−.579	.563		.052 (.048)	.069	1.078	.282		.034 (.062)	.028	.547	.585		.023 (.049)	.030	.484	.629	
IQ	−.003 (.012)	−.015	−.228	.820		−.009 (.006)	−.100	−1.542	.125		−.009 (.007)	−.062	−1.213	.227		−.002 (.006)	−.026	−.419	.676	
BRIEF-PR GEC	.030 (.007)	.302	4.484	.000		.019 (.003)	.378	5.849	.000		.056 (.004)	.679	13.286	.000		.024 (.003)	.456	7.250	.000	

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Note: SDQ-SR= Strengths and Difficulties Questionnaire Self Report; SDQ-PR= Strengths and Difficulties Questionnaire Parent Report; BRIEF-PR GEC = Parent report Brief Rating Inventory of Executive Function, Global Executive Composite; BRIEF-SR GEC = Self report Brief Rating Inventory of Executive Function, Global Executive Composite. Sample sizes differed by analysis. For the BRIEF-SR-GEC regressions, they were as follows: SDQ-SR Inattention-Hyperactivity (n = 268); SDQ-SR Conduct Problems (n = 268); SDQ-PR Inattention-Hyperactivity (n = 213); SDQ-PR Conduct Problems (n = 213). For the BRIEF-PR-GEC regressions, they were as follows: SDQ-SR Inattention-Hyperactivity (n = 207); SDQ-SR Conduct Problems (n = 207); SDQ-PR Inattention-Hyperactivity (n = 206); SDQ-PR Conduct Problems (n = 206).