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Changes In Youth Executive Function During Trauma-Focused Cognitive Behavioral Therapy: Associations with PTSD Symptom Severity

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CHANGES IN YOUTH EXECUTIVE FUNCTION DURING TRAUMA-FOCUSED COGNITIVE BEHAVIORAL THERAPY: ASSOCIATIONS WITH PTSD SYMPTOM SEVERITY

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ABSTRACT

CHANGES IN YOUTH EXECUTIVE FUNCTION DURING TRAUMA-FOCUSED COGNITIVE BEHAVIORAL THERAPY:

ASSOCIATIONS WITH PTSD SYMPTOM SEVERITY

Amy Hyoeun Lee

Youth with maltreatment and/or interpersonal trauma histories often demonstrate significant executive function difficulties, which may negatively affect self-regulation and represent a transdiagnostic risk factor for trauma-related psychopathology and impaired functioning across domains. Trauma-Focused Cognitive Behavioral Therapy (TF-CBT) is an evidence-based treatment for posttraumatic stress disorder (PTSD) symptoms and other mental health sequelae among maltreated youth; however, the potential impact of impact of TF-CBT on youth executive function difficulties has not been examined despite emerging evidence that executive function may be related to PTSD symptom severity among trauma-exposed youth. The current study sought to evaluate caregiver-reported executive function as a treatment outcome of TF-CBT among youth with interpersonal trauma histories and examine the associations between executive function and PTSD symptom trajectories. Univariate latent growth models, allowing for interindividual heterogeneity in intercepts and slopes, were used to estimate linear trajectories of caregiver-reported executive function difficulties among youth ages 6 to 17 ($N = 278$). Results demonstrated reductions in global and specific executive function difficulties during treatment for both children and adolescents. Bivariate latent growth

models, estimated separately for children and adolescents, were used to examine the associations between executive function and PTSD change. Among children ages 6 to 11, higher initial levels of PTSD symptoms were associated with higher initial levels of difficulties in Attentional Control, $r = .36$, $SD = .15$, 95% CI [.06, .65] and Behavioral Control, $r = .35$, $SD = .17$, 95% CI [-.87, .81]. Among adolescents ages 12 to 17, rates of decrease in overall executive function difficulties were positively associated with rates of PTSD symptom reduction, $r = .59$, $SD = .21$, 95% CI [.11, .90]. Findings highlight caregiver-observed improvements in youth executive function concerns during TF-CBT and suggest that rates of reduction in executive function difficulties and PTSD symptoms are interrelated among adolescents.

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Introduction

Threat-specific child maltreatment (physical and sexual abuse, witnessing domestic violence; McLaughlin & Sheridan, 2016) and exposure to other interpersonal traumas (e.g., peer sexual assault, traumatic bereavement due to interpersonal violence) are associated with wide-ranging negative impact on developmental outcomes (Cicchetti, Hetzel, Rogosch, Handley, & Toth, 2016; Doyle & Cicchetti, 2017; Jaffee 2017; McGuire & Jackson, 2018). Deficits in executive function, a set of higher-order cognitive abilities necessary for deliberate regulation of emotion, thought, and behavior, have been observed among youth with maltreatment histories and may represent a transdiagnostic risk factor for developmental psychopathology and functional impairments across domains (Malarbi, Abu-Rayya, Muscara, & Stargatt, 2017; Op den Kelder, Van den Akker, Geurts, Lindauer, & Overbeek, 2018). Indeed, emerging evidence suggests that executive function difficulties are associated with increased PTSD symptom severity following maltreatment exposure (Hogdon et al., 2018a; Op den Kelder et al., 2017).

Trauma-Focused Cognitive Behavioral Therapy (TF-CBT; Cohen, Mannarino, & Deblinger, 2017) is an evidence-based treatment for youth with trauma-related mental health sequelae including posttraumatic stress disorder (PTSD). No previous investigation has examined, however, whether youth with maltreatment and/or interpersonal trauma histories improve in executive function difficulties following TF-CBT. If these difficulties persist following treatment and PTSD symptom reduction, they may represent an important and additional target of interventions. Thus, the primary aim of the current study was to examine changes in caregiver-reported global executive function and four previously established factors (i.e., Attentional Control, Behavioral

Control, Emotional Control, and Problem Solving) during TF-CBT. We then sought to examine the concurrent associations between executive function changes and PTSD symptom reduction.

Child Maltreatment Sequelae

Child maltreatment, defined as physical, sexual, or emotional abuse, exposure to domestic violence, or neglect, is a prevalent problem with extensive developmental consequences. Approximately 37% of youth in the United States are investigated for maltreatment before age 18 (Kim, Wildeman, Jonson-Reid, and Drake, 2017). Such high rates are problematic because maltreatment is linked with negative outcomes in multiple domains of functioning across development. Maltreated youth are not only likely to experience higher rates of mental health problems including internalizing and externalizing psychopathology and posttraumatic stress disorder (PTSD), but also are at increased risk for poorer physical health trajectories over the lifespan, lower cognitive and academic performance, and social difficulties, relative to nonmaltreated youth. (Cicchetti et al., 2016; Jaffee 2017; McGuire & Jackson, 2018). Emerging research suggests that maltreatment, particularly when chronic, is associated with deficits in executive function, which may negatively impact capacity for self-regulation and confer risk for maladaptive outcomes (Malarbi et al., 2017; Op den Kelder et al., 2018).

PTSD is a salient mental health outcome for threat-specific maltreatment or violence exposures (Hogdon et al., 2018b). For youth exposed to traumatic events, lifetime prevalence for subclinical or full PTSD has been estimated at 13.4%, with interpersonal traumas associated with increased risk for significant PTSD symptoms compared to non-interpersonal traumas (Copeland, Keeler, Angold, & Costello, 2007). Although some remain asymptomatic following maltreatment exposures (Teicher,

Ohashi, & Khan, 2020), in a subset of maltreated youth these symptoms are associated with depression, suicidality, and engagement in risky behaviors (Angelakis, Gillespie, & Panagioti, 2019; Taussig, Harpin, & Maguire, 2014), posing substantial individual, familial, and societal burden.

TF-CBT, a time-limited, skills-based treatment originally designed for youth with sexual abuse histories and their non-offending caregivers, is efficacious in reducing PTSD and additional mental health symptoms among maltreated youth (Cary & McMillen, 2012; Cohen, Deblinger, & Mannarino, 2018; Knutsen, Czajkowski, & Ormhaug, 2018). An independent systematic review of treatments for youth with trauma-related mental health sequelae concluded that TF-CBT is the best-supported treatment to date for childhood trauma (Leenarts, Diehle, Doreleijers, Jansma, & Lindauer, 2013), with more than 20 randomized controlled trials demonstrating its efficacy (see Cohen, Deblinger, & Mannarino, 2018 for a review). Moreover, TF-CBT has been demonstrated to be effective in community settings when compared to treatment as usual (Cohen, Mannarino, & Iyengar, 2011; Jensen et al., 2014). No prior study has examined whether youth executive function difficulties improve following TF-CBT. Given the broad range of negative outcomes associated with maltreatment, there is a need to examine treatment-related changes in transdiagnostic factors that may account for increased vulnerability across domains of functioning. The current study sought to examine one such factor, executive function, and its association with PTSD symptom trajectories, over the course of TF-CBT among youth with threat-specific maltreatment and/or interpersonal trauma histories.

Executive Function as a Transdiagnostic Vulnerability Factor for Maltreated Youth

Executive function is defined as a set of prefrontal cortex-mediated cognitive abilities necessary for deliberate and flexible coordination of thought and behavior (Diamond, 2013). In their seminal study, Miyake and Friedman (2000) found three interrelated but distinguishable components of executive function: inhibitory control, cognitive flexibility, and working memory. Inhibitory control refers to the capacity to resist prepotent or impulsive responses; cognitive flexibility enables shifting of attention and adapting to changing tasks, demands, or environments; and working memory is the capacity to hold and manipulate relevant information for a task at hand. Collectively, these skills are crucial for higher-order abilities of planning, organizing, and executing complex, goal-directed behaviors while managing distractions and effectively solving problems as they arise (Diamond, 2013).

Although researchers have differentiated the use of executive function abilities in more and less emotional contexts (Prencipe et al., 2011; Zelazo & Carlson, 2012), traditional neuropsychological measures of executive function, such as the Dimensional Change Card Sort (Zelazo, 2006) in which children are required to sort shapes based on shifting rules, often lack affective components altogether. In contrast, the use of executive function in everyday situations, such as waiting a turn for a desired toy or organizing college or job applications, typically occurs in affectively or motivationally significant contexts. Investigations of youth executive function in these real-world contexts have been limited, despite the likelihood that they impact key developmental tasks such as academic and social competence (Masten & Cicchetti, 2010).

Chronic exposure to extreme forms of stress in childhood, such as abuse or

violence, is thought to derail developmental processes necessary for promoting children's executive function abilities (National Council on the Developing Child, 2005/2014). Among youth with maltreatment histories, both functional and structural alterations in brain development have been reported including in the prefrontal cortex (Cross, Fani, Powers, & Bradley, 2017; Teicher & Samson, 2016), and a substantial body of literature has demonstrated corresponding deficits in executive function skills (e.g., DePrince, Weinzierl & Combs, 2009; Op den Kelder et al., 2018). A recent meta-analysis synthesized the results of 55 separate studies published between 2001 and 2017, examining associations between childhood trauma and executive function among youth ranging from 3 to 24 years of age at assessment (Op den Kelder et al., 2018). Op den Kelder and colleagues reported small to moderate effect sizes of trauma exposure on each component of executive function (i.e., working memory, cognitive flexibility, and inhibition) and found that chronic trauma histories, relative to exposure to a single traumatic event, were associated with greater executive impairments. An additional meta-analysis by Malarbi and colleagues (2017) also supported the associations between exposure to chronic and interpersonal childhood traumas such as maltreatment and impairments in executive function, independent of the contribution of PTSD symptoms. Although some investigators have suggested that these impairments may represent vulnerabilities that predate onset of maltreatment rather than maltreatment sequelae (Danese, 2020), a recent systematic review of prospective cohort studies concluded that significant associations between various forms of maltreatment and executive function exist, accounting for potential confounders (Yingying, D'Arcy, Shuai, & Xianfei, 2020).

Executive function impairments among maltreated children are readily observed

in clinical practice, with chronic activation of the stress response system during development serving as a putative mechanism (McCrory, De Brito, & Viding, 2010). A child who is chronically physically abused, for instance, experiences repeated activation of the stress response system, strengthening the neural networks responsible for the "fight-or-flight" (i.e., sympathetic nervous system) response. Threatening stimuli activates the amygdala, the region responsible for initiating the body's stress response. The amygdala communicates with the hypothalamus, which increases the production of epinephrine in the body, leading to increased sympathetic nervous system activity that prepares the body for action. Under continued threat, such as in chronic abuse, the hypothalamus also activates the hypothalamic pituitary adrenal (HPA) axis, increasing the production of cortisol to maintain this stress response. Notably, the activation of these *bottom-up* or automatic systems directly inhibits the activation of prefrontal cortex networks implicated in deliberate or *top-down* control (Arnsten, 2009). Thus, the stress response becomes more dominant over time, making it more difficult for the child to down-regulate these responses with executive capacity. Indeed, research has demonstrated trauma-related structural and functional alterations in networks involving the prefrontal cortex, which may lead to underdeveloped executive functions and corresponding deficits in the child's ability to regulate his/her emotions and behavior (De Bellis & Zisk, 2014).

Such children may be emotionally more labile, prone to act impulsively, and have difficulty persevering toward long-term goals. They frequently experience difficulties with learning and social interactions, even in "safe" environments, because the aforementioned alterations are neurobiological. In turn, they experience functional

impairments across domains (i.e., academic, interpersonal, mental health), which can harm development into adulthood (McCrory, Gerin, & Viding, 2017; Silver, 2014). Thus, if executive function difficulties persist following existing interventions targeting symptom reduction for maltreated youth, they may represent an important target of additional interventions (Takacs & Kassai, 2019). Although executive develops rapidly during preschool years, there is evidence of malleability of these abilities through adolescence and even young adulthood (Zelazo & Carlson, 2012), suggesting continued opportunity for intervention.

Informant Ratings of Youth Executive Function

The majority of the aforementioned studies examining associations between maltreatment and executive function have relied on performance-based neuropsychological tests. Although these studies have established a robust link between maltreatment and deficits in executive function (Malarabi et al., 2017; Op den Kelder et al., 2018), performance-based tests of executive function offer limited information about children's everyday use of executive function abilities (Silver, 2014). This methodological consideration has led researchers to recommend the use of informant rating scales in the assessment of executive function abilities (Isquith, Roth, & Gioia, 2013; Silver, 2014; Ten Eycke & Dewey, 2016). Unlike performance-based measures, third party observer rating scales may better reflect children's use of executive function abilities in daily situations, which often occur in motivationally- or emotionally-charged contexts. Because these "hotter" executive functions continue to develop through adolescence with implications for effortful self-regulation (Nigg, 2017) and may not be captured by more traditional neuropsychological tests of executive function, it is

important to consider informant ratings of executive function among maltreated youth.

To date, only two studies have examined informant rated executive function abilities in relation to trauma exposure and PTSD in school-aged children. Hogdon et al. (2018a) examined the role of teacher-reported executive function among youth between 11 and 18 years of age (N = 672) receiving treatment in residential facilities. Their analysis of indirect effects demonstrated that teacher-rated executive function impairments mediated the association between number of caregiver-perpetrated trauma types (i.e., family violence, attachment disruptions) and PTSD symptom severity, but not between non caregiver-perpetrated trauma types and PTSD. Op den Kelder and colleagues (2017) similarly used a meditation model to examine the indirect effects of parent-rated executive function in the relation between trauma exposure and PTSD symptoms among children ages 9 to 17 (N = 119). In this study, trauma exposure was operationalized as a categorical variable with three levels: no trauma, single trauma, and multiple traumas. Notably, the majority of the youth in the multiple trauma group had maltreatment and/or sexual abuse histories, relative to only a small proportion (i.e., < 10%) of the single trauma group. Their results indicated that youth in the multiple trauma group evidenced more caregiver-reported executive function deficits than either of the other groups, and that the deficits in each component (i.e., inhibition, working memory, flexibility) mediated the association between exposure to multiple traumas and PTSD symptom severity.

These studies have provided evidence of informant-rated executive function difficulties among youth with chronic interpersonal trauma histories and suggested that such difficulties, in turn, may be associated with the development and maintenance of

PTSD symptoms. Both of these studies were conducted using cross-sectional data, however, warranting further research to elucidate these associations within a longitudinal and treatment outcome framework. Identification of executive function difficulties among maltreated youth may have the potential to strengthen evidence-based interventions already being offered to target difficulties in non-symptom domains, potentially improving long-term outcomes in addition to mental health trajectories.

TF-CBT and Executive Function

Treatments such as TF-CBT, primarily targeting PTSD and comorbid mental health symptoms, also may improve executive functions among youth with threat-specific maltreatment histories. Zantvoord, Diehle, and Lindauer (2013) demonstrated changes in functional connectivity of the medial prefrontal cortex, a region implicated in executive function, over the course of TF-CBT. Improvements in emotion regulation difficulties, one aspect of executive function related impairments, have been demonstrated during TF-CBT in both children and adolescents (Cisler et al., 2016; Thornback & Muller, 2015). These changes may be due to specific intervention components targeting emotional and behavioral regulation (e.g., affective modulation, parenting skills). Only one treatment outcome study has demonstrated improvements in teacher- and parent-reported executive functions among maltreated youth (McCullough, Gordon-Jones, Last, Vaughn, & Burnell, 2019), highlighting the need to investigate whether similar improvements in caregiver-rated executive function difficulties occur during TF-CBT.

Current Study

Children and adolescents with threat-specific maltreatment and/or interpersonal trauma histories exhibit executive function difficulties relative to those without such

histories (e.g., Cross et al., 2017; DePrince, Weinzierl, & Combs, 2009; Malarbi, et al., 2017), and these difficulties may represent a transdiagnostic risk factor for wide-ranging developmental trauma sequelae (Gould et al., 2012). Informant-rated executive function difficulties have been implicated in the association between maltreatment and increased risk for psychopathology including PTSD symptoms (Hogdon et al. 2018a; op den Kelder et al., 2017), with emerging evidence that deficits may partly account for increased risk for PTSD among traumatized youth. TF-CBT is efficacious in addressing youth PTSD symptoms, and because executive function underlies both emotional and behavioral self-regulation (Nigg, 2017), it may be considered secondary treatment targets in TF-CBT. No prior study has examined treatment-related changes in executive function difficulties among youth with interpersonal trauma histories, or assessed whether such changes are associated with reductions in symptom severity over the course of TF-CBT. Moreover, studies examining executive functions in youth with maltreatment histories have typically relied on behavioral tasks (i.e., standardized measures of executive function abilities administered in non-affective contexts) despite the evidence that third-party observer (e.g., teacher, parent) ratings of executive function abilities may uniquely provide information about behavioral manifestations of youth executive function abilities in everyday situations (Silver, 2014).

To address these gaps in the literature, the current study examined pre-, mid-treatment, and post-treatment executive function and PTSD data from an open trial of TF-CBT for youth with interpersonal trauma histories, including threat-specific maltreatment, to examine the following aims:

Aim 1: to replicate the previously established four-factor model of caregiver-reported executive function among youth with maltreatment histories via confirmatory factor analysis.

Hypothesis 1: Data from the current sample will demonstrate a good fit to the four-factor (i.e., Problem Solving, Attentional Control, Emotional Control, Behavioral Control) model of caregiver-reported executive function.

Aim 2: to examine changes in the four factors of caregiver-reported executive function over the course of TF-CBT.

Hypothesis 2: Treatment will be associated with improvements in overall executive function. Among subscales, effects will be stronger for the Emotional and Behavioral Control, compared to Attentional Control and Problem Solving.

Aim 3: to examine the association between treatment-related changes in caregiver-reported executive function difficulties and changes in PTSD symptom severity over the course of TF-CBT.

Hypothesis 3: Based on the findings of previous cross-sectional studies (Hogdon et al., 2018a; op den Kelder et al., 2017), improvements in overall executive function in will be associated with observed reductions in PTSD symptom severity over the course of TF-CBT. Among subscales, these effects will be stronger for Emotional and Behavioral Control, compared to Attentional Control or Problem Solving.

Method

Power Analysis

Sample sizes required for the models in the current study were estimated using Preacher and Coffman's (2006) online computer software, *Computing Power and Minimum Sample Size for RMSEA*. All calculations were based on $\alpha = .05$, H_o RMSEA = .20, H_1 RMSEA = .05, and power = .80. Estimated minimum sample size for the confirmatory factor analysis (Model 1) was 163, $df = 2$. Estimated minimum sample for the univariate latent growth models was 280, $df = 1$. The parallel process latent growth models had 9 degrees of freedom and an estimated sample size of 54. Some have recommended minimum sample sizes for SEM including $N > 200$ or the ratio of $N:q$ = 10:1 where q represents the number of parameters to be estimated (Lei & Wu, 2007; Kline, 2016). Due to the relatively small sizes of the child and adolescent subsamples, several of these sample size requirements were not met. Thus, Bayesian estimation with non-informative priors was chosen to address potential small sample issues (e.g., non-normal distribution of parameter estimates; Muthén, 2010).

Participants

Participants were drawn from an ongoing effectiveness trial of trauma-specific CBTs for children and adolescents with interpersonal trauma histories and their caregivers. Services were offered in a community clinic in the Northeast region of the United States. Youth and caregivers were enrolled in treatment if they met the following inclusion criteria: 1) endorsement of at least one interpersonal trauma (i.e., physical abuse, witnessing domestic violence, sexual abuse, peer sexual assault, or traumatic bereavement due to interpersonal violence) and 2) a primary caregiver willing to attend

weekly treatment and participate in the remaining assessments. Exclusion criteria for youth included low cognitive ability precluding full participation in components of treatment or acute psychiatric symptoms requiring a higher level of treatment. For the current study, data from children younger than 6 years of age were excluded due to previous research indicating low support for the four-factor structure of the Preschool version of the BASC parent-reported executive function scale (Karr & Garcia-Barrera, 2017). Likewise, due to changes in the executive function scales in the newest edition of the BASC, only those who completed the second edition of the BASC were included in the current study.

In the overall sample (N = 278), youth ranged from 6 to 17 years of age (M = 12.20, SD = 3.36) and were 76% female. The sample was racially and ethnically diverse, with 91% of the youth identifying as non-White minority. The majority of youth (67%) endorsed histories of multiple interpersonal traumas (M = 1.96, SD = .82) and on average displayed clinically significant PTSD symptoms (M = 17.78, SD = 11.65) at pre-treatment. The majority of caregivers participating in the treatment and assessments were biological parents (78%), 85% of whom were mothers. Forty-one percent of caregivers endorsed educational attainment of high school degree or less, and 28% of families endorsed receiving public assistance at the time of the pre-treatment assessment. Seventeen percent of caregivers were monolingual Spanish-speaking. Table 1 summarizes the demographic characteristics of the study participants by child and adolescent subsamples.

Measures

Child and family demographics. Caregivers provided demographic information as part of the pretreatment evaluation. The following variables were included as covariates in the final models: Child Age, Gender, Family Income, and Caregiver Education.

Trauma history. The Kiddie-Schedule for Affective Disorders and Schizophrenia, Present and Lifetime Version (K-SADS-PL; Kaufman, Birmaher, Brent, Rao, & Ryan, 1996) is a semi-structured diagnostic interview designed to assess the lifetime history of psychiatric disorders. A modified version of the screener for traumatic events from the PTSD module of the K-SADS-PL was used to assess history of both interpersonal (e.g., child physical abuse, witnessing domestic violence) and non-interpersonal (e.g., automobile accidents, natural disasters) traumas from youth and caregivers (see Appendix A). For each item, participants indicated "*Yes"* or *"No"* based on whether or not they experienced each trauma type during the child's lifetime. The PTSD module of the K-SADS-PL has demonstrated strong test–retest reliability (κ-coefficient = 0.63) and high inter-rater reliability (Ryan, 1997). In the current study, the total number of interpersonal trauma types was summed and used as a covariate.

Caregiver-rated executive function. The Behavioral Assessment System for Children (BASC-2; Reynolds & Kamphaus, 2004) is a comprehensive measure of youth adaptive functioning and emotional and behavioral symptoms. The Parent Rating Scale (PRS) of the BASC-2 was used exclusively in the current study. Two forms of the BASC-PRS, designed for youth ages 8 to 11 (BASC-PRS Child) and ages 12 to 21 (BASC-PRS Adolescent) were administered to caregivers based on the age of the child

being assessed. Caregivers were instructed to rate statements describing their child as *true* or *false*, or on a 4-point frequency scale (1= *never,* 2 = *sometimes,* 3 = *often,* and 4 = *almost always*) in the past few months or since the last assessment. The BASC-2 PRS is reported to have excellent internal consistency (α = .90 – .96) and high test-retest reliability (r = .89 for the child form; r = .82 for the adolescent form).

The Executive Functioning (EF) Index for the BASC-2 PRS (Appendix B) was empirically derived using existing neuropsychological theories (see Garcia-Barrera, Duggan, Karr, & Reynolds, 2014) and has demonstrated strong psychometric properties among school-aged children (Karr & Garcia-Barrera, 2017) and adolescent samples (Wong, Sakaluk, & Garcia-Barrera, 2018). For the current study, the EF Index for the BASC-2 PRS were computed based on items derived from previous factor analytic studies (Karr & Garcia-Barrera, 2016; Wong, et al., 2018) and consisted of 20 and 25 items on the child and adolescent forms, respectively, comprising four subscales: Attentional Control, Emotional Control, Behavioral Control, and Problem Solving. Total scores were obtained by summing items across all subscales. Internal reliability of the EF Index for the child and adolescent forms were excellent, α = .913 and α = .901, respectively.

PTSD symptom severity. The Child PTSD Symptom Scale (CPSS; Foa, Johnson, Feeny, & Treadwell, 2001; Foa, Asnaani, Zang, Capaldi, & Yeh, 2018) is a self-report measure of PTSD symptom severity in children ages 8 to 18. For the current study, clinical evaluators administered this measure to youth less than 8 years of age if they were able to comprehend the questions. The CPSS-4 (Foa et al., 2001; Appendix C) includes 17 symptom items and yields subscales scores consistent with the three DSM-IV

PTSD symptom clusters (i.e., re-experiencing, avoidance, and hyperarousal). Youth rated the frequency of symptoms experienced in the past two weeks on a 4-point scale ranging from *0 = Not at all or only one time* to *3 = 5 or more times a week/almost always*. The CPSS-4 has excellent internal consistency (α = .87), test-retest reliability (r = .86), and good convergent validity with a semi-structured interview for PTSD (Foa et al., 2001). The CPSS-5 (Foa et al., 2018) is a 20-item revised version corresponding to the DSM-5 criteria for PTSD, which includes the additional symptom cluster of cognition and mood. The CPSS-5 (Appendix D) also has excellent internal consistency (α = .92), good test–retest reliability (r = .90), and good convergent and discriminant validity (Foa et al., 2018). For the CPSS-5, participants rated the frequency with which they experienced each symptom in the past month on a 5-point scale (0 = *not at all*, 1 = *once a week or a little*, 2 = *2 to 3 times a week or somewhat*, 3 = *4-5 times a week or a lot*, and 4 = *6 or more times a week or almost always*). Total severity score was obtained by summing the response for all of the items. Eleven percent of youth in the current study (n = 28) completed the CPSS-5, and the remainder completed CPSS-4. Thus, CPSS-5 scores were converted to match the scaling of the CPSS-4 scores to create a single index of total PTSD symptom severity..

TF-CBT

TF-CBT (Cohen, Mannarino, & Deblinger, 2017) is a time-limited, components-based cognitive behavioral intervention targeting PTSD and comorbid trauma symptoms among youth ages 3 to 18. Doctoral level clinical and school psychology students and postdoctoral fellows served as clinicians under the supervision of staff licensed clinical psychologists. All clinicians were trained in the treatment model by a TF-CBT national trainer and received weekly individual or group supervision to ensure treatment fidelity.

Youth and their non-offending caregivers received weekly individual and/or conjoint sessions with the aim of learning affective and cognitive coping skills, improving parenting skills and the parent-child relationship, processing the traumatic event and related maladaptive cognitions, and gaining mastery of trauma triggers (Cohen, Deblinger, & Mannarino, 2018).

Procedure

The University's Institutional Review Board approved all study procedures on a yearly basis. Referral sources included local schools, community organizations, and other mental health providers in the area. For each referral, the intake coordinator completed phone screening with caregivers to determine initial eligibility. Families deemed eligible were invited for intake (i.e., pretreatment) assessments on site prior to study enrollment. Families ineligible for the study received referrals to other mental health agencies.

Trained doctoral-level research assistants conducted all assessments. During the intake assessment, research assistants first conducted informed consent with caregivers and youth, and obtained assent from youth. Youth and caregivers then separately completed measures administered via interviews, including detailed information about lifetime trauma history, child and caregiver symptoms, family and cultural factors, and child adaptive functioning. Licensed clinical psychologists on staff provided supervision throughout the screening and assessment process to ensure appropriate clinical care. For their participation in the assessments, caregivers were compensated with $20 in cash and youth received a $10 gift card.

Youth and caregivers completed mid-treatment evaluations following completion of the skills-training components of TF-CBT and were paid $10 gift card and $15 in cash,

respectively. Post-treatment evaluations were conducted after the final session, and youth and caregivers received $10 gift cards and $20 cash, respectively. Youth trauma histories and family demographic information were collected only at the pretreatment assessment. Symptom measures (e.g., PTSD) were administered at each time point (i.e., pretreatment, mid-treatment, and post-treatment). Thus, the outcome measures used in the current study were completed at a maximum of three time points.

Data Analytic Plan

Preliminary analyses including descriptive statistics and missing data imputations were conducted using SPSS Version 26. The remaining analyses were conducted in Mplus (Muthén & Muthén, 1998-2017) in a structural equation modeling framework. Due to differences in executive function scales between the child and adolescent forms of the BASC-2 PRS, all models were estimated separately for child and adolescent subsamples. The previously established four-factor model of BASC-EF was replicated via confirmatory factor analysis for each subsample using baseline data. These models included the four subscale scores (i.e., Attentional Control, Behavioral Control, Emotional Control, and Problem Solving) as indicators and a latent variable representing Executive Function (see Figure 1). Global fit statistics (i.e., RMSEA, CFI, TLI, SRMR) and local parameter estimates (i.e., factor loadings) were used to assess model fit.

Next, a series of univariate latent growth curve models were estimated to examine changes in parent-reported executive function from pre-, to mid-, post-treatment. In these models, depicted in Figure 2, means (i.e., intraindividual change) and variances (i.e., interindividual differences in intraindividual change) for the latent intercepts and slopes were estimated for BASC-2-PRS EF total scores and each of the four subscale scores

(i.e., attentional control, emotional control, behavioral control, problem solving). The parameters of interest were the estimated means of latent slopes. Factor loadings for the latent slope and latent intercept were fixed at 0, 1, and 2, and 1, 1, and 1, respectively. Bayes estimation with non-informative priors was used as a computational strategy to approximate full information maximum likelihood estimates. Model fit was evaluated using the Posterior Predictive *p*-value (PPP), with low values (e.g., < .050) indicating poor fit and values near .500 indicating excellent fit (Muthén & Asparouhov, 2012). Potential Scale Reduction factors were examined to ensure these values approached 1 at convergence. .

Finally, bivariate latent growth curve models (i.e., parallel process models; see Figure 3) were estimated to examine the relations between concurrent changes in executive function total and subscale scores and PTSD symptoms during TF-CBT. Latent slopes were regressed on latent intercepts within and between processes, and residual variances and within-time residual covariances were freely estimated. Factor loadings for the latent slope and latent intercept were fixed at 0, 1, and 2, and 1, 1, and 1, respectively, and PPPs were used to evaluate the overall model fit. To facilitate model convergence, maximum likelihood starting values were specified for these models. Parameters of interest in these models were cross-process intercept-slope regression paths and the cross-process covariances between the latent intercepts and between the latent slopes.

Attrition and Missing Data

Among the child participants (*n* = 135), 77 completed treatment, 42 dropped out after attending at least one session, and 16 participants did not initiate treatment after completing the pre-treatment assessment. Among the adolescent participants (*n* = 143),

55 completed treatment, 68 dropped out after attending at least one session, and 20 participants did not initiate treatment after completing the pre-treatment assessment. Of the 135 child participants, 127 completed the BASC-2 PRS at pre-treatment, 78 at mid-treatment, and 67 at post-treatment; eight participants had mid- or post-treatment data only. Of the 143 adolescent participants, 140 completed the BASC-2 PRS at pre-treatment, 71 completed at mid-treatment, and 47 at post-treatment; three participants provided BASC-2 PRS data at mid- and post-treatment only. Only those who attended at least one treatment session (i.e., 119 children and 123 adolescents) were included in the latent growth models.

Due largely to attrition, missing data for BASC-2 PRS EF subscale scores across the three time points ranged from 5.9 to 51.1% for the child subsample and 3.5 to 67.8% for the adolescent subsample. Missing data for CPSS scores across the three time points ranged from 13.3 to 51.1% and 7.0 to 66.4% for child and adolescent samples, respectively. Little's Missing Completely at Random (MCAR; Little, 1988) test suggested that these data were likely missing completely at random, χ^2 (260, N = 135) = 246.68, p = .714, and χ^2 (159, N = 144) = 158.89, p = .532 for the child and adolescent data, respectively. Confirmatory factor models for baseline data used the full information maximum likelihood estimator. All growth models were estimated using the Bayes estimator in Mplus, which is a full information method appropriate for missing data under the MCAR assumption (Asparouhov & Muthén, 2010).

Results

Confirmatory Factor Models of Baseline BASC-2 PRS EF Scale Scores

Table 2 summarizes means and standard deviations of the BASC-2 PRS EF subscale and total scores by child and adolescent samples. At pre-treatment, both subsamples had total scores that were higher than norms provided by prior confirmatory factor analytic studies (Karr & Garcia-Barrera, 2016; Wong, et al., 2018), indicating that the current sample of traumatized youth presenting for treatment displayed greater mean levels of executive function difficulties relative to the normative sample. In the child subsample, the means of each of the pretreatment subscale score were higher than in the normative sample. In the adolescent sample, three of the four pre-treatment subscale scores (i.e., Attentional Control, Behavioral Control, and Problem Solving) were above the normative ranges.

The standardized factor loadings, standard errors, and *p*-values for the final child and adolescent CFA models are summarized in Table 3. The initial child CFA model demonstrated poor overall fit to the data, χ^2 (*df* = 2) = 18.85, *p* = .001, RMSEA = .26, CFI =. 92, TLI = .76, SRMR = .04, with standardized factor loadings of .89, .83, .64, and .59 for Attentional Control, Behavioral Control, Emotional Control, and Problem Solving respectively, all *p*'s < .001. Based on the modification indices, the residual covariance between Behavioral Control and Problem Solving was added to the model. This modified model demonstrated excellent fit, χ^2 (*df* = 1) = .11, *p* = .737, RMSEA = .00, CFI = 1.00, TLI = 1.03, SRMR = .01, with the standardized estimate for the residual covariance between Behavioral Control and Problem Solving estimated at -.99, *SE* = .45, *p* = .029.

The adolescent CFA model demonstrated adequate fit to the data, χ^2 (df = 2) = 8.76, p = .013, RMSEA = .16, CFI =. 97, TLI = .90, SRMR = .04.

Univariate Latent Growth Models Examining EF as Treatment Outcome

Table 4 presents the PPPs, unstandardized estimates, posterior standard deviations, and 95% Credibility Intervals (CIs) of the univariate latent growth models for the child subscale scores. Each of the models demonstrated excellent fit, with PPP at or near .500. The unstandardized estimates of the slope factors means were negative and significant across all subscales, indicating decreases in each of the subscale scores over time. The variance estimates of the intercept and slope factors were significant, indicating inter-individual differences for both parameters. Estimates of the covariance between slope and intercept factors were significant only for the Attentional Control and Behavioral Control subscales, suggesting that greater baseline EF difficulties were associated with steeper rates of decrease in these scores.

Table 5 presents the results of the univariate latent growth models for the adolescent subscale scores. Each model demonstrated adequate fit, with PPP near .500. Similar to the child subscale models, the unstandardized estimates for the slope means were negative and significant, indicating decreases in all subscale scores over time. The variance estimates of the intercept and slope factors were again significant, indicating inter-individual differences in these parameters. Estimates of the covariance parameter between the slope and intercept factors were significant and negative across subscales, demonstrating that greater baseline EF difficulties were associated with steeper rates of decrease in subscale scores during treatment.

The unstandardized model estimated parameters for the total score univariate growth models are presented in Table 6. Both child and adolescent models demonstrated excellent fit, with PPP of .500 and .538 for child and adolescent models, respectively. Unstandardized estimates for the slope factor means were -2.95 and -3.36 for child and adolescent models, respectively, indicating approximately a 3-point decrease on average in total scores between time points. Both intercept and slope factor variance estimates were significant, indicating interindividual differences in these parameters. The estimates of the covariance between the slope and growth factors were negative and significant for both models, indicating that higher baseline scores were associated with larger negative slopes; however, this estimate was significant only for the adolescent model.

Next, the total score models were tested with intercept factors regressed on relevant demographic covariates (i.e., child age, male gender, number of trauma types endorsed, caregiver education ≤ high school, and family receipt of public assistance). All covariates were correlated by Mplus default. Child age was a continuous variable that was mean-centered for each subsample, gender was coded as 0 = male, 1 = female, and caregiver education and public assistance were bivariate variables with 1 reflecting ≤ high school degree and receipt of assistance, and 0 reflecting the reverse. The results of the adjusted models were essentially unchanged from the unadjusted models. Both models demonstrate adequate model fit, PPP = .274 and .562 for the child and adolescent models, respectively. The slope mean estimates were -3.36, *SD* = .48, 95% CI [-4.22, -2.41] for the child model and -3.50, *SD* = .73, 95% CI [-4.98; -2.14] for the adolescent model. In the child model, age (b = -1.33, *SD* = .57), and total trauma types (b = 3.19, *SD*

= 1.36) were significantly associated with the intercept. None of the covariates had significant effects on the intercept factor for the adolescent model.

Parallel Process Latent Growth Models Examining Co-Occurring EF and PTSD Change

PTSD symptom outcomes for the current sample have been reported previously (Ross et al., 2020; Sharma-Patel & Brown, 2016), demonstrating significant reductions in PTSD symptoms from pre- to post-treatment for both children and adolescents. To ensure appropriateness of growth modeling for these data, univariate latent models for PTSD were estimated separately for children and adolescents as a checking step prior to estimating parallel process models. The PTSD models demonstrated adequate fit, with PPP of .167 for children and .444 for adolescents. Unstandardized estimates of the slope factor means were -3.40, *SD* = .64, 95% CI [-4.49, -2.16] and -4.30, *SD* = .81, 95% CI [-5.93, -2.76] for the child and adolescent models, respectively, indicating that scores decreased on average by 3-4 points between assessments. Variance estimates for the intercept and slope factors were significant in both models, suggesting interindividual differences in the baseline PTSD scores and their rates of change over time. The intercept-slope covariance was negative and significant for both models, indicating that higher baseline PTSD scores were associated with larger negative slopes.

Child subscale score models. Table 7 presents the unstandardized estimates, posterior standard deviations, and 95% CI for the parallel process models using child EF subscale scores. All models included the intercept factors regressed on the five demographic covariates and demonstrated adequate fit. Child age had a significant effect on the EF intercept factor for Behavioral Control, b = -48, *SD* = .16 and Emotional

Control, b = -.25, *SD* = .11, and the number of trauma types had a significant effect on the intercept factor for Emotional Control, b = .92, *SD* = .35. There were significant covariances between the intercept factors for the Attentional Control subscale, *r* = .36, *SD* = .15, 95% CI [.06, .65], and the Behavioral Control subscale, *r* = .35, *SD* = .17, 95% CI [-.87, .81]. These suggested that initial levels of PTSD scores were positively associated with initial levels of Attentional Control and Behavioral Control scores. For the Behavioral Control subscale (Figure 3), there was also a significant effect of PTSD intercept on EF slope, b = -.04, *SD* = .02, 95% CI [-.09, .00], such that a 1-unit increase in PTSD intercept was associated with a negative EF slope that was larger in magnitude by a factor of .04. No parameter estimates between the EF and PTSD growth factors for Emotional Control and Problem Solving subscales were significant.

Adolescent subscale score models. Table 8 summarizes the unstandardized estimates, posterior standard deviations, and 95% CIs for the adolescent subscale models. All models again included covariates and demonstrated adequate fit. Among the covariates, only the effect of caregiver education on Behavioral Control intercept was significant, b = -2.17, *SD* = .95. For the Emotional Control and Problem Solving subscales, the covariances between the slope factors were positively associated, *r* = .46, *SD* = .20, 95% CI [.06, .78] and *r* = .50, *SD* = .21, 95% CI [.05, .88] respectively, indicating that rates of reduction in these scores during treatment were positively associated with rates of decrease in PTSD symptoms. Remaining parameter estimates relating EF and PTSD were nonsignificant.

Total score models. Table 9 presents the results of the unadjusted and adjusted total score parallel process models. All models demonstrated adequate fit. In the child

adjusted model, child age, b = -1.39, *SD* = .63, and number of trauma types, b = 3.62, *SD* = 1.39, had significant effects on EF intercept; the effects of covariates on PTSD intercept were nonsignificant. None of the parameter estimates between EF and PTSD growth factors were significant with or without covariates. In the unadjusted adolescent model, none of the estimates between EF and PTSD growth factors were again significant. With the addition of covariates (see Figure 4), there was a positive and significant association between PTSD and EF slopes, *r* = .59, SD = .21, 95% CI [.11, .90]. None of the covariates had significant effects on EF or PTSD intercept factors.

Discussion

The aims of the current study were to evaluate the potential impact of TF-CBT on youth executive function difficulties and to examine whether amelioration of these difficulties were related to trajectories of PTSD symptom reduction during trauma-specific treatment. A set of univariate latent growth models was used to examine linear trajectories of global and specific executive function difficulties among youth enrolled in an effectiveness trial of TF-CBT. Bivariate latent growth models, relating the change processes in executive function and PTSD symptoms, were then estimated to examine the concurrent associations between initial levels and rates of change across these processes. The current study is the first to examine executive function impairments as an outcome for TF-CBT, an evidence-based treatment for youth PTSD and other trauma-related mental health symptoms. Examining global and specific domains of executive function in relation to changes in PTSD symptoms separately among children and adolescents resulted in unique patterns of findings in these subgroups, highlighting the importance of developmental considerations when evaluating treatment-mediated effects.

Executive Function as a Treatment Outcome

The primary hypothesis of the study was that youth enrolled in TF-CBT would demonstrate reduction in their executive function difficulties. The results of the univariate latent growth models indicated that children and adolescents enrolled in this effectiveness trial of TF-CBT demonstrated significant improvements in global executive function and across each of the subscale domains (i.e., Attentional Control, Behavioral Control, Emotional Control, Problem Solving). Thus, the hypothesis that TF-CBT would reduce caregiver-observed executive function concerns among youth with interpersonal trauma

histories was supported, with scores improving to approximately normative ranges at post-treatment. These findings extend the existing literature on the effectiveness of TF-CBT on PTSD and related symptom outcomes among traumatized youth by demonstrating co-occurring improvements in non-symptom domains that are relevant to daily functioning. The current study is the first to demonstrate improvements across multiple executive function domains among both children and adolescents enrolled in TF-CBT, highlighting that an efficacious and cost-effective trauma-specific intervention also may alleviate youth executive function difficulties.

Pre- to post-treatment effect sizes ranged from .24 to .58 for children, representing small to medium effects, and from .54 to .86 for adolescents, representing medium to large effects (Cohen, 1982). The largest effect was seen for Emotional Control among both children and adolescents, consistent with prior studies showing efficacy of TF-CBT in reducing self-reported emotion regulation difficulties among children and adolescents and supporting preliminary work demonstrating this specific executive domain as a potential mechanism of change in TF-CBT for adolescents (Cisler et al., 2016; Thornback & Muller, 2015). Conversely, the smallest effects were seen for Problem Solving, indicating that perhaps this higher-order executive ability may be less sensitive to treatment effects relative to attentional, behavioral, or emotional control. Overall, the effect sizes for executive function obtained in the current study are comparable to within-subject effect sizes for self-reported depression and anxiety aggregated across seventeen outcome trials of TF-CBT (Rubin, Washburn, & Schieszler, 2017), indicating that the effects of TF-CBT on executive function impairments are similar in magnitude to outcomes in secondary (i.e., non-PTSD) symptom domains.

Associations between Executive Function and PTSD during TF-CBT

The hypothesis that executive function difficulties would be associated with PTSD symptom reduction was tested via two pathways: the effect of baseline executive function on PTSD slope, and the covariance between executive function and PTSD slope factors. This hypothesis was partially supported in that, for adolescents, there was a positive association between the rates of change in executive function and PTSD. After accounting for the covariates, the standardized covariance (i.e., correlation) between executive function and PTSD slopes in the adolescent subsample represented a large effect (Cohen, 1988). There was no such association for children, nor were there significant effects of executive function intercepts on PTSD slopes in the adolescent or child subsamples.

Because both slopes were negative, the significant association between PTSD and executive function changes in adolescents indicates that those who decreased more rapidly in executive function difficulties during TF-CBT also tended to decrease more rapidly in PTSD symptoms and vice versa. Although directionality of effects cannot be determined from these data, this finding is consistent with prior studies supporting the contributions of executive function deficits on PTSD among youth with interpersonal trauma histories (Hogdon et al., 2018a; Op den Kelder et al., 2017) and extends the findings of these studies by demonstrating that decreases in executive function concerns and PTSD symptoms co-occur during treatment for adolescents. Thus, executive function concerns may be implicated not only in the development of PTSD symptoms following interpersonal trauma, but treatment effects on executive impairments among adolescents may, in part, facilitate PTSD symptom reduction. The strongest effect was observed for

the Emotional Control subscale, suggesting that perhaps improving emotion regulation abilities are particularly important for PTSD symptom reduction during TF-CBT.

Results did not support the hypothesized pathways between global executive function and PTSD among children ages 6 to 11. This null finding is inconsistent with emerging evidence suggesting that treatment-related changes in executive function may facilitate symptom reduction in non-trauma focused cognitive behavioral therapies (e.g., Godovich et al., 2020). In children with interpersonal trauma histories, however, it is possible that additional factors such as caregiver modeling of effective coping correspond more closely to changes in children's PTSD symptoms than improvements in children's own executive functioning. Among subscale score models, we found significant and positive associations between the intercept factors of Attentional Control and Behavioral Control with PTSD, such that baseline levels of difficulties in these domains were positively associated with initial levels of PTSD symptoms. These associations are in line with prior studies demonstrating that maltreated youth demonstrate decreased attentional control relative to non-maltreated youth, which confers risk for the subsequent development of PTSD symptoms (Gray, Baker, Scerif, & Lau, 2016). Children with Attentional Control impairments may be more prone to re-experiencing and hyperarousal PTSD symptoms due to difficulties disengaging from threatening stimuli, and evidence suggests that maladaptive coping with these trauma symptoms may manifest behaviorally in school-aged children (VanMeter, Handley, & Cicchetti, 2020). Consistent with the notion that these symptoms perhaps represent behavioral manifestation of trauma-related psychopathology at the onset of treatment, higher initial level of PTSD symptoms was associated more rapid reductions in Behavioral Control difficulties. That is, children

presenting with higher PTSD symptoms tended to decrease more rapidly in their behavioral control difficulties during TF-CBT.

The differences in the patterns of findings between children and adolescents highlight important developmental considerations in the examination of executive function-PTSD associations among youth with interpersonal trauma histories. For school-aged children, reductions in executive function difficulties and PTSD symptoms during TF-CBT do not appear to be related processes. However, baseline attentional and behavioral control difficulties were associated with greater PTSD symptom severity, perhaps underscoring preexisting vulnerabilities to PTSD symptoms among children with attentional and/or behavioral difficulties and/or the possibility of PTSD symptoms manifesting behaviorally. Compared to children in this age range who continue to rely on caregivers for self-regulation, adolescents are expected to function in increasingly autonomous ways and thus may be able to apply skills and tools taught in TF-CBT to alter their trauma-related responses, aiding in PTSD symptom reduction. Similarly to our finding, Cisler et al. (2016) found that improvements in self-reported emotion regulation emerged as a mechanism for PTSD reduction among adolescent girls receiving TF-CBT. Although the design of the current study precluded examining the mechanistic effects of executive function change on PTSD symptom trajectories, our findings are consistent with Cisler and colleagues' study and highlight the potential specificity of the role of executive function in PTSD reduction among adolescents. Adolescence is a period of accelerated executive function development relative to middle childhood (Zelazo & Carson, 2012), and simultaneously a developmental stage associated with increased risk of PTSD symptoms (Copeland, Keeler, Angold, & Costello, 2007). Our data reflected

both of these notions, with adolescents demonstrating larger effect sizes in executive function change and greater levels of PTSD symptoms at baseline. Thus, it is possible that treatments such as TF-CBT leverage executive function improvements to reduce PTSD symptoms more effectively for adolescents.

Clinical Implications

The findings of the current study hold important implications for assessment and treatment of youth with interpersonal trauma histories. Knowledge of specific components of executive function deficits, such as inattention and lack of behavioral control, may aid in identifying those most susceptible to PTSD symptoms. Conversely, the presence of significant and wide-ranging executive function impairments in any child or adolescent presenting for psychological treatment should alert clinicians to carefully screen for trauma histories and PTSD symptoms. Our results support the use of caregiver reports (e.g., on the BASC-PRS) for the assessment and outcome monitoring of youth executive functioning. In addition to assessing executive function, the BASC-PRS yields internalizing and externalizing symptom severity and adaptive functioning scales, all of which are important for understanding trauma-related psychopathology. Post-treatment assessment of remaining executive function difficulties will aid in providing additional referrals for interventions to target these areas specifically.

In addition to the concrete (e.g., transportation), perceptual (e.g., stigma) and trauma-specific (e.g., avoidance) treatment barriers for many youth with PTSD (Gopalan et al., 2010), executive function difficulties can impair treatment engagement and participation (e.g. ability to attend to treatment materials in sessions, remembering to engage in home practice of skills, risk-taking behaviors out of sessions). Thus,

assessment of these difficulties at baseline and over the course of treatment is warranted, and if present, therapists will have to modify treatment components. For instance, clinicians may rely more heavily on visual and/or interactive materials during sessions to better engage children with attentional difficulties, request caregiver involvement in home practice of skills, or conduct routine assessment of out-of-session risk-taking behaviors for adolescents. Clinicians can provide education to youth and caregivers at the onset of treatment on the association between childhood trauma exposure and executive function difficulties, framing these concerns as potential trauma sequelae that can be mitigated by TF-CBT. Engaging caregivers in this manner is especially important, given that caregiver reports of child symptoms may be predictive of treatment completion/attrition in trauma-specific therapies (Tebbett, Brown, & Chaplin, 2018). It also will be important for clinicians to consider the temporal relations among executive function, PTSD, and other trauma sequelae, keeping in mind that if significant executive function difficulties preceded trauma onset, treatment may mitigate some but not all of these concerns. In such cases, bolstering TF-CBT components such as parenting skills may be warranted, in addition to consulting with schools and/or recommending concurrent psychiatric referrals.

Limitations and Research Recommendations

The study findings should be interpreted in the context of its limitations. First, our sample consisted of youth with interpersonal trauma histories who presented for treatment and consented to research participation, potentially limiting the generalizability of these findings to a broader sample of maltreated youth. Second, despite providing preliminary support for the efficacy of TF-CBT in ameliorating youth executive function

difficulties, the open trial design of the current study limits causal conclusions about the effects of TF-CBT on executive function. To address these limitations, further examination of the putative effects of TF-CBT on executive function using controlled studies is needed. Specifically, the use of an active control condition (e.g., treatment-as-usual, supportive therapy) can delineate treatment effects on executive function specific to the active components of TF-CBT.

Because the findings support the utility of caregiver-reported executive function measures, future studies can incorporate both informant-rated and performance-based tests of executive function (i.e., multimethod assessment) for a more comprehensive evaluation of treatment effects on executive function. These tests likely will yield related yet unique information about youth executive capacities at baseline and during treatment. Additionally, given the focus of the current study on examining associations between executive function and PTSD, we did not examine additional factors accounting for the interindividual differences in the baseline levels of executive function, which were significant. Further study of these moderating variables may aid targeted identification of traumatized youth most vulnerable to executive function concerns.

Additional limitations concerned the analyses and characteristics of the data. Because each subsample was relatively small, the Bayesian estimator was appropriate for estimating the univariate and bivariate growth models. Bayesian posterior estimates with non-informative priors are expected to approximate maximum likelihood estimates (Muthén & Asparouhov, 2012), but this could not be confirmed due to many models failing to converge when using the maximum likelihood estimator. Additional studies with larger sample sizes will be needed to replicate this study's findings, particularly

using maximum likelihood estimates. Moreover, the available data included only the minimum time points required for estimating linear trajectories, precluding the examination of temporal relations between executive function and PTSD symptoms during treatment. TF-CBT may directly reduce executive function difficulties by equipping youth with strategies for modulating trauma-related responses, which can generalize and aid in broader emotional, behavioral, and cognitive self-regulation. Reduction in PTSD symptoms also may partly account for the improvements in executive function. For instance, in youth with heightened PTSD symptoms, executive control may be allocated to down-regulate heightened hyperarousal symptoms (e.g., physiological responses to trauma triggers, irritability, behavioral impulsivity), and alleviation of these symptoms may indirectly be associated with improved executive function. Additional time points are needed to establish directionality of the executive function-PTSD association, especially among adolescents, and to directly test the hypothesized effects of executive function changes on PTSD symptom reduction. In the effectiveness trial of trauma-specific CBTs from which the study data were drawn, follow-up assessments are routinely offered 3 months post-treatment; however, only a small proportion of youth to date have attended these assessments. Better engagement of youth and caregivers for these follow-up assessments will be crucial for determining the extent to which treatment effects on executive function are sustained following completion of TF-CBT. Likewise, assessment of youth functioning in additional domains impacted by executive function (e.g., academic functioning, social competence) will further demonstrate the utility of informant-rated executive function concerns among children and adolescents with interpersonal trauma histories in future studies.

Table 1

Descriptive Statistics of the Study Sample ($N = 278$)

Variable	Child Sample ($n = 135$)		Adolescent Sample ($n = 143$)	
	M	*SD*	*M*	*SD*
Child age	9.15	1.71	14.97	1.65
Baseline PTSD symptom score[a]	16.66	11.04	20.64	11.90
Number of traumas endorsed	1.86	.76	2.05	.86
	n	%	*n*	%
Referral trauma				
Traumatic bereavement	5	3.7	18	12.6
Witnessing domestic violence	84	62.2	86	60.1
Physical abuse	61	45.2	71	49.7
Sexual abuse	85	63.0	105	73.4
Peer sexual assault	16	11.9	13	9.1
Child gender (male)	42	31.1	25	17.5
Child race/ethnicity				
Hispanic	64	47.4	54	37.8
African American / Black	29	21.5	33	23.1
Multiracial	28	20.7	21	14.7
Caucasian	8	5.9	17	11.9
Guyanese	1	.7	8	5.6
Asian	4	3.0	8	5.6
Unknown	1	.7	2	1.4
Biological parent	112	83.0	105	73.4
Caregiver education ≤ High school	56	41.5	57	39.9
Families receiving public assistance	40	29.6	37	25.9

Note. [a]A total score of 11 indicates clinically significant PTSD symptoms (Child PTSD Symptom Scale; Foa, Treadwell, Johnson, & Feeny, 2001).

Table 2

Descriptive Statistics of BASC-2 PRS Executive Function Subscale and Total Scores

Scale	Number of items	Pre-Treatment		Mid-Treatment		Post-Treatment		Norms[a]	
		M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Child									
Attentional Control	6	9.10	4.26	8.36	4.08	7.24	4.04	6.06	3.84
Behavioral Control	4	4.10	3.01	3.44	2.58	2.58	2.48	2.52	2.24
Emotional Control	4	6.10	2.87	5.21	2.12	4.33	2.33	3.92	2.39
Problem Solving	6	8.18	3.90	8.09	3.87	7.02	3.87	7.39	3.87
Total	20	27.47	11.45	25.08	10.43	21.14	10.91	19.90	10.41
Adolescent									
Attentional Control	6	14.23	3.71	12.73	3.67	11.40	3.54	11-13	
Behavioral Control	8	15.37	4.79	13.28	3.68	12.30	3.48	10-11	
Emotional Control	5	12.29	2.99	11.59	2.74	9.91	2.55	12-14	
Problem Solving	6	15.31	3.79	14.01	3.68	13.15	3.61	13-15	
Total	25	57.29	12.26	51.62	11.47	46.98	11.30	46-52	

Note. BASC-2 PRS = Behavioral Assessment System for Children, second edition, Parent Rating Scales. Child and adolescent executive function scales were computed by summing items rated from 0 to 3 and 1 to 4, respectively.
[a]Karr & Garcia-Barrera (2016); Wong, Sakaluk, & Garcia-Barrera (2018).

Table 3

Standardized Parameter Estimates for One-Factor Confirmatory Models of Baseline BASC-2 PRS Executive Function Scale

Indicator	Child Data (n = 127)			Adolescent Data (n = 140)		
	Estimate	*SE*	*p*	Estimate	*SE*	*p*
Attentional Control	.81	.05	< .001	.95	.04	< .001
Behavioral Control	.92	.04	< .001	.65	.06	< .001
Emotional Control	.64	.06	< .001	.57	.07	< .001
Problem Solving	.72	.07	< .001	.72	.05	< .001

Note. BASC-2 PRS = Behavioral Assessment System for Children, second edition, Parent Rating Scales. The model for Child data included residual covariance between Behavioral Control and Problem Solving, Standardized Estimate = -.99, *SE* = .45, p = .029.

Table 4

Parameter Estimates for Univariate Latent Growth Models: BASC-2 PRS Child Executive Function Subscale Scores

Parameter	Attentional Control			Behavioral Control			Emotional Control			Problem Solving		
	Estimate	*SD*	95% CI	Estimate	*SD*	95% CI	Estimate	*SD*	95% CI	Estimate	*SD*	95% CI
Posterior Predictive *p-value*	.548			.519			.423			.500		
Intercept												
Mean	8.96	.43	8.14, 9.77	4.07	.30	3.48, 4.64	5.95	.27	5.42, 6.46	8.13	.36	7.44, 8.83
Variance	17.20	2.64	12.33, 22.39	7.25	1.40	4.94, 10.64	4.85	1.10	3.01, 7.56	15.13	2.54	11.20, 21.22
Slope												
Mean	-.92	.19	-1.20, -.49	-.73	.14	-1.00, -.43	-.84	.15	-1.14, -.54	-.52	.19	-.91, -.14
Variance	1.34	.47	.52, 2.40	.52	.33	.24, 1.41	.28	.21	.09, .81	1.88	.66	.77, 3.33
Slope WITH Intercept	-2.40	.95	-4.56, -.60	-1.15	.56	-2.36, -.22	-.38	.43	-1.31, .25	-1.53	1.03	-4.04, .17

Note. BASC-2 PRS = Behavioral Assessment System for Children, second edition, Parent Rating Scales.

Table 5

Parameter Estimates for Univariate Latent Growth Models: BASC-2 PRS Adolescent Executive Function Subscale Scores

Parameter	Attentional Control			Behavioral Control			Emotional Control			Problem Solving		
	Estimate	*SD*	95% CI	Estimate	*SD*	95% CI	Estimate	*SD*	95% CI	Estimate	*SD*	95% CI
Posterior Predictive *p-value*	.462			.556			.344			.509		
Intercept												
Mean	14.04	.36	13.37, 14.74	15.22	.44	14.30, 16.08	12.41	.30	11.79, 12.98	15.16	.34	14.46, 15.81
Variance	12.68	2.05	9.45, 17.27	17.51	3.15	12.16, 24.55	7.73	1.49	5.43, 11.33	12.49	2.16	8.71, 16.95
Slope												
Mean	-.88	.26	-1.42, -.42	-1.11	.26	-1.57, -.71	-.99	.20	-1.37, -.58	-.77	.25	-1.27, -.30
Variance	1.91	.90	.71, 4.26	1.57	.82	.39, 3.45	2.05	.63	1.11, 3.40	3.03	.87	1.42, 4.72
Slope WITH Intercept	-2.26	1.01	-4.71, -.66	-3.14	1.41	-6.28, -.72	-2.56	.83	-4.17, -.1.10	-3.24	1.21	-5.65, -.99

Note. BASC-2 PRS = Behavioral Assessment System for Children, second edition, Parent Rating Scales.

Table 6

Parameter Estimates for Univariate Latent Growth Models: BASC-2 PRS Executive Function Total Scores

Parameter	Child			Adolescent		
	Estimate	*SD*	95% CI	Estimate	*SD*	95% CI
Posterior Predictive *p-value*	.500			.538		
Intercept						
Mean	26.91	1.51	24.89, 29.31	56.77	1.23	54.39, 59.17
Variance	123.75	20.76	91.60, 171.97	141.78	6.65	7.20, 33.94
Slope						
Mean	-2.95	.52	-3.95, -1.91	-3.36	.67	-4.74, -2.13
Variance	7.54	3.63	2.10, 15.51	18.66	6.65	7.20, 33.94
Slope WITH Intercept	-12.49	6.61	-28.12, -1.06	-23.37	11.81	-45.05, -.64

Note. BASC-2 PRS = Behavioral Assessment System for Children, second edition, Parent Rating Scales.

Table 7

Parameter Estimates for Parallel Process Models: BASC-2 PRS Child Executive Function Subscale Scores and PTSD

Parameter	BASC-2 PRS Attentional Control			BASC-2 PRS Behavioral Control			BASC-2 PRS Emotional Control			BASC-2 PRS Problem Solving		
	Estimate	*SD*	95% CI	Estimate	*SD*	95% CI	Estimate	*SD*	95% CI	Estimate	*SD*	95% CI
Posterior Predictive *p*-value	.440			.091			.294			.433		
EF Intercept WITH PTSD Intercept	12.25	5.31	1.77, 22.89	7.96	3.92	.25, 15.94	-1.04	3.35	-6.87, 6.14	2.24	4.77	-7.43, 11.76
EF Slope ON												
EF Intercept	-.10	.08	-.22, .10	-.10	.09	-.23, .11	-.15	.08	-.32, .03	-.10	.07	-.21, .04
PTSD Intercept	-.04	.04	-.12, .02	-.04	.02	-.09, .00	-.01	.02	-.05, .03	-.01	.03	-.06, .04
PTSD Slope ON												
PTSD Intercept	-.27	.08	-.43, -.10	-.29	.08	-.46, -.14	-.27	.07	-.41, -.14	-.27	.05	-.35, -.16
EF Intercept	.07	.18	-.32, .39	.10	.28	-.51, .60	.09	.29	-.57, .62	.21	.12	-.02, .45
PTSD Slope WITH EF Slope	-.19	1.00	-2.48, 1.42	.03	.61	-1.21, 1.15	.11	.48	-.83, 1.11	.10	.97	-1.58, 1.99

Note. Unstandardized estimates are presented. All models included intercept factors regressed on child gender, age, number of trauma types, caregiver education, and receipt of public assistance. BASC-2 PRS = Behavioral Assessment System for Children, second edition, Parent Rating Scales. EF = Executive Function. PTSD = Posttraumatic Stress Disorder.

Table 8

Parameter Estimates for Parallel Process Models: BASC-2 PRS Adolescent Executive Function Subscale Scores and PTSD

Parameter	BASC-2 PRS Attentional Control			BASC-2 PRS Behavioral Control			BASC-2 PRS Emotional Control			BASC-2 PRS Problem Solving		
	Estimate	*SD*	95% CI	Estimate	*SD*	95% CI	Estimate	*SD*	95% CI	Estimate	*SD*	95% CI
Posterior Predictive *p*-value	.329			.411			.295			.433		
EF Intercept WITH PTSD Intercept	1.61	5.30	-8.54, 12.25	4.35	6.11	-7.56, 17.10	1.07	4.62	-8.02, 10.47	-7.21	5.51	-18.40, 2.93
EF Slope ON												
EF Slope	-.16	.09	-.31, .02	-.16	.06	-.27, -.02	-.26	.09	-.45, -.08	-.23	.12	-.40, .06
PTSD Intercept	-.02	.03	-.07, .03	-.01	.02	-.07, .02	.00	.03	-.05, .06	.01	.04	-.05, .09
PTSD Slope ON												
PTSD Intercept	-.27	.10	-.43, -.04	-.29	.09	-.43, -.06	-.31	.10	-.50, -.11	-.28	.11	-.45, .00
EF Intercept	.03	.31	-.61, .61	-.02	.26	-.50, .52	.09	.46	-.64, 1.17	.01	.04	-.05, .09
PTSD Slope WITH EF Slope	1.13	1.50	-2.25, 3.71	1.35	1.58	-1.51, 4.61	2.22	1.23	.27, 4.84	3.48	1.69	.32, 7.14

Note. Unstandardized estimates are presented. All models included intercept factors regressed on covariates. BASC-2 PRS = Behavioral Assessment System for Children, second edition, Parent Rating Scales. EF = Executive Function. PTSD = Posttraumatic Stress Disorder.

Table 9

Parameter Estimates for Parallel Process Models: BASC-2 PRS Executive Function Total Scores and PTSD

Parameter	Child Data Unadjusted			Child Data Adjusted			Adolescent Data Unadjusted			Adolescent Data Adjusted		
	Estimate	*SD*	95% CI	Estimate	*SD*	95% CI	Estimate	*SD*	95% CI	Estimate	*SD*	95% CI
Posterior Predictive *p*-value	.380			.304			.410			.384		
EF Intercept WITH PTSD Intercept	26.34	15.89	-4.38, 58.46	22.66	13.50	-2.26, 50.88	-1.63	18.18	-38.43, 32.86	2.10	16.86	-30.48, 34.64
EF Slope ON												
EF Intercept	-.09	.06	-.21, .05	-.10	.06	-.20, .01	-.16	.08	-.31, .01	-.16	.07	-.29, -.01
PTSD Intercept	-.10	.09	-.28, .08	-.10	.08	-.27, .05	.00	.09	-.18, .17	-.02	.07	-.17, .12
PTSD Slope ON												
PTSD Intercept	-.27	.08	-.40, -.09	-.29	.06	-.40, -.17	-.26	.10	-.43, -.05	-.29	.08	-.43, -.09
EF Intercept	.04	.06	-.07, .16	.02	.06	-.08, .14	.03	.08	-.12, .19	.00	.08	-.16, .16
PTSD Slope WITH EF Slope	2.11	2.81	-3.75, 7.17	2.00	2.16	-3.02, 5.81	8.84	5.62	-2.17, 20.30	9.88	4.69	2.25, 21.31

Note. Unstandardized estimates are presented. Adjusted models included both intercept factors regressed on covariates. BASC-2 PRS = Behavioral Assessment System for Children, second edition, Parent Rating Scales. EF = Executive Function. PTSD = Posttraumatic Stress Disorder.

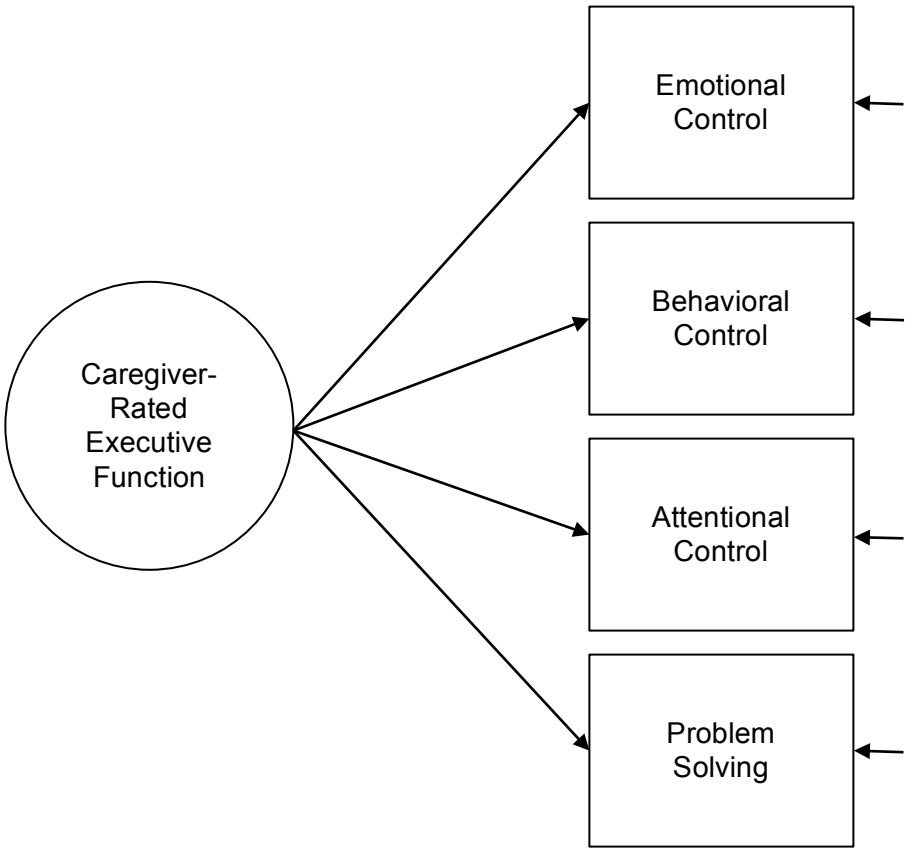

Figure 1. Four-factor model of caregiver-rated BASC-2-PRS Executive Function Scale at pretreatment.

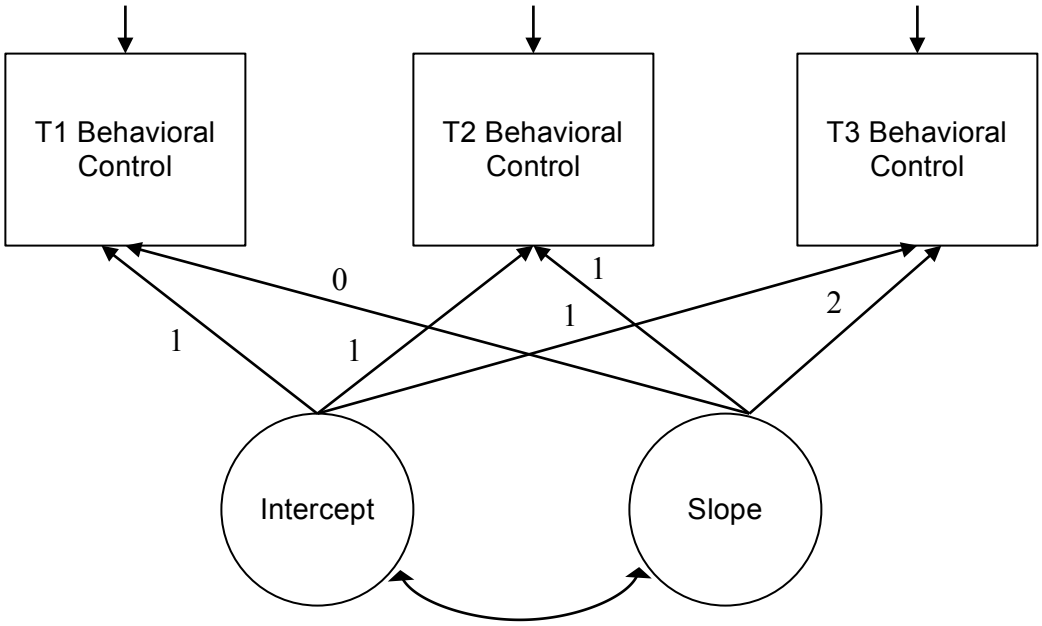

Figure 2. Univariate latent growth curve model depicting trajectories of caregiver-reported BASC-2-PRS EF Behavioral Control subscale scores during TF-CBT. Equivalent models were estimated for Total Score, Emotional Control, Attentional Control, and Problem Solving.

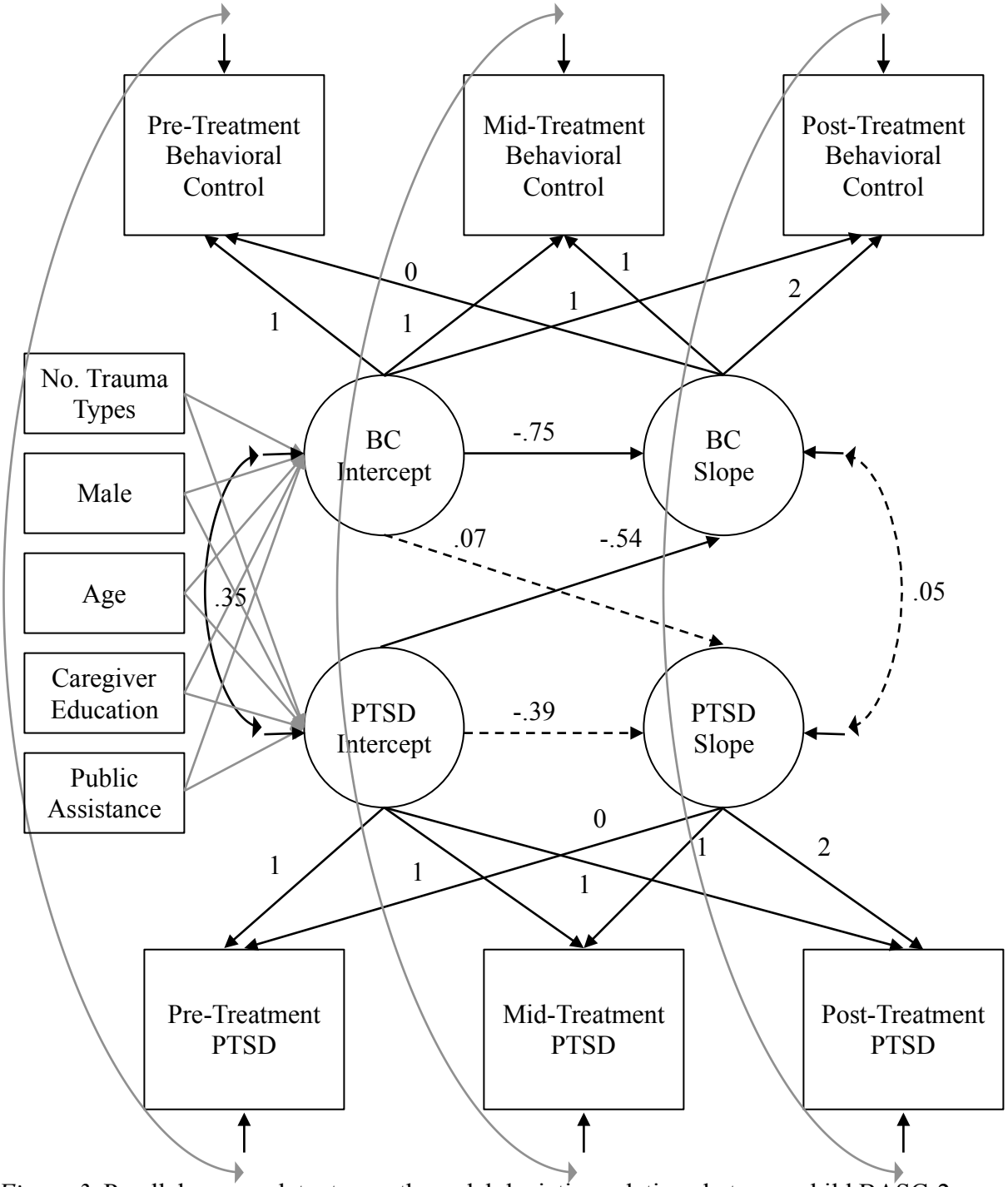

Figure 3. Parallel process latent growth model depicting relations between child BASC-2 PRS EF Behavioral Control subscale and PTSD symptom severity during TF-CBT. Standardized coefficients are shown. Dotted lines indicate nonsignificant paths with 95% CIs containing zeroes. Estimated effects of covariates and within time residual covariances are omitted for clarity. BASC-2 = Behavioral Assessment System for Children, second edition, Parent Rating Scales. BC = Behavioral Control. PTSD = Posttraumatic Stress Disorder. TF-CBT = Trauma-Focused Cognitive Behavioral Therapy.

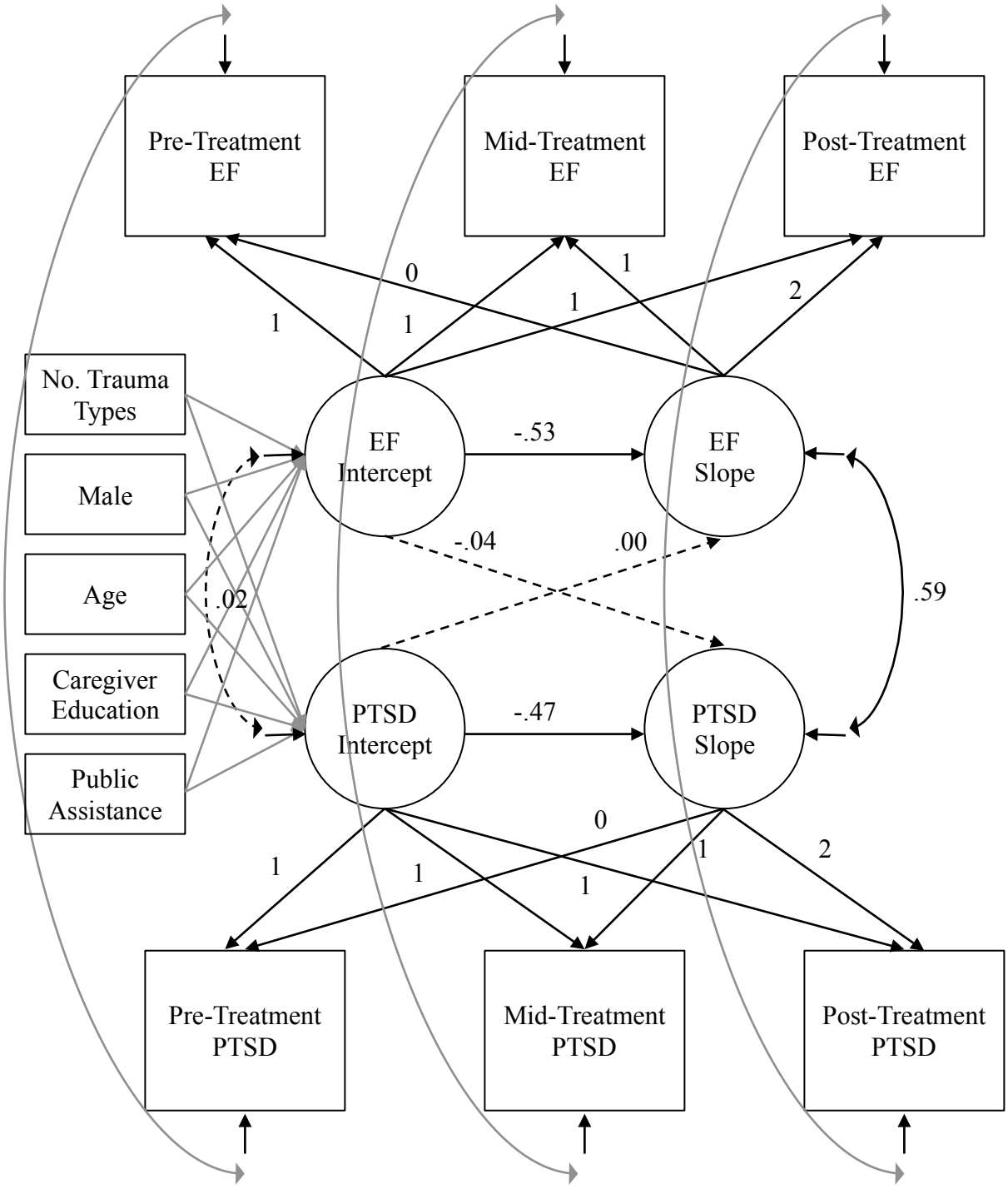

Figure 4. Parallel process latent growth model depicting relations between adolescent BASC-2 PRS EF total scores and PTSD symptom severity during TF-CBT. Standardized coefficients are shown. Dotted lines indicate nonsignificant paths with 95% CIs containing zeroes. Estimated effects of covariates and within time residual covariances are omitted for clarity. BASC-2 = Behavioral Assessment System for Children, second edition, Parent Rating Scales. EF = Executive Function. PTSD = Posttraumatic Stress Disorder. TF-CBT = Trauma-Focused Cognitive Behavioral Therapy.

Appendix A

Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS) Screener for Traumatic Events

Probe: *I am going to ask you about a number of bad things that often happen to children your age, and I want you to tell me if any of these things have ever happened to you. Be sure to tell me if any of these things have ever happened, even if they only happened one time.*

0 = No Information
1 = No
2 = Yes

A. Car Accident: Have you ever been in a bad car accident? Were you hurt? Was anyone else hurt? (Criteria: Significant car accident in which child or other individual in car was injured and required medical intervention.)

B. Other Accident: Have you ever been in any other type of bad accidents? What about a biking accident? Other accidents? What happened? Were you hurt? (Criteria: Significant accident in which child was injured and required medical intervention.)

C. Fire: Were you ever in a serious fire? Did your house or school ever catch on fire? Did you ever start a fire that got out of control? What happened? Were you hurt? (Criteria: Child close to witness to fire that caused significant property damage or moderate to severe injuries.)

D. Witness of a Disaster: Have you ever been in a really bad storm like a tornado or a hurricane? Have you ever been caught in floods with waters that were deep enough to swim in? (Criteria: Child witness to natural disaster that caused significant devastation.)

E. Witness of a Violent Crime: Did you ever see someone rob someone or shoot them? Steal from a store or jump someone? Take someone hostage? What happened? Where were you when this happened? Was anyone hurt? (Criteria: Child close witness to threatening or violent crime.)

F. Victim of a Violent Crime: Did anyone ever mug you or attack you in some other way? What happened? Were you hurt? (Criteria: Child victim of seriously threatening or violent crime.)

G1. Confronted with Traumatic News: Have you ever gotten some really bad news unexpectedly? Like found out someone you loved just died? How did that person die? (Criteria: Learned about sudden, unexpected death of a loved one due to natural causes.)

G2. Confronted with Traumatic News Due to Interpersonal Violence: Have you ever gotten some really bad news unexpectedly? Like found out someone you loved just died?

How did that person die? (Criteria: Learned about sudden, unexpected death of a loved one due to interpersonal violence.)

H. Witness to Domestic Violence/ Child Physical Abuse: Some kids' families have a lot of nasty fights. They call each other bad names, throw things, threaten to do bad things to each other, or sometimes really hurt each other. Have you ever seen your parents and/or siblings and/or
(foster) parent and boyfriend/girlfriend/partner ever get in really bad fights? Tell me about the worst fight you remember them having in front of you? What happened? (Criteria: Child witness to explosive arguments involving threatened or actual harm to parent and/or sibling(s).)

I. Physical Abuse: Tell me about the different ways your parents have disciplined you. When your parents got mad at you, did they ever hit you? Have you ever been hit so that you had bruises or marks on your body, or were you hurt in some way? What happened? (Criteria: Bruises sustained on more than one occasion, or more serious injury sustained.)

J1. Sexual Abuse: Did anyone ever touch you in your private parts when they shouldn't have? What happened? Has someone ever touched you in a way that made you feel bad? Has anyone who shouldn't have ever made you undress, touch you in between the legs, make you get in bed with him/her, or make you play with his privates? (Criteria: Isolated or repeated incidents of genital fondling, oral sex, or vaginal or anal intercourse.)

J2. Peer Sexual Assault: Did anyone else (e.g., peer, teenager, friend) ever touch you in your private parts when they shouldn't have? What happened? Did that person ever touched you in a way that made you feel bad? Has anyone else/that person (e.g., peer, teenager, friend) who shouldn't have ever made you undress, touch you in between the legs, make you get in bed with him/her, or make you play with his privates? (Criteria: Isolated or repeated incidents of genital fondling, oral sex, or vaginal or anal intercourse perpetrated by a child younger than 18.)

K. Other: Is there anything else that happened to you that was really bad, or something else you saw that was really scary, that you want to tell me about? (Criteria: Record incident below.)

Appendix B

Behavioral Assessment System for Children, second edition, Parent Rating Scales (BASC-2-PRS) Executive Function Scale

Subscale	Child	Adolescent
Attentional Control Index	Item 17 Item 9 Item 41 Item 105 Item 73 Item 49	Item 5 Item 35 Item 65 Item 76 Item 106 Item 136
Emotional Control Index	Item 10 Item 90 Item 46 Item 14	Item 64 Item 15 Item 18 Item 61 Item 68 Item 82 Item 86
Behavioral Control Index	Item 116 Item 102 Item 148 Item 56 Item 134 Item 52 Item 38	Item 20 Item 33 Item 45 Item 70 Item 73 Item 75 Item 80 Item 135
Problem Solving Index	Item 4 Item 36 Item 67 Item 113 Item 132 Item 154 Item 39	Item 37 Item 56 Item 77 Item 93 Item 111 Item 127

Appendix C

The Child PTSD Symptom Scale (CPSS-4)

Below is a list of problems kids sometimes have after experiencing an upsetting event. Read each one carefully and indicate the number (0-3) that best describes how often that problem has bothered you IN THE LAST 2 WEEKS.

0 = Not at all or only one time
1 = Once a week or less/once in a while
2 = 2 to 4 times a week/ half the time
3 = 5 or more times a week/almost always

1. Having upsetting thoughts or images about the event that came into your head when you didn't want them to
2. Having bad dreams or nightmares
3. Acting or feeling as if the event was happening again (hearing something or seeing a picture about it and feeling as if I am there again)
4. Feeling upset when you think about or hear about the event (for example, feeling scared, angry, sad, guilty, etc.)
5. Having feelings in your body when you think about or hear about the event (for example, breaking out in a sweat, heart beating fast)
6. Trying not to think about, talk about, or have feelings about the event
7. Trying to avoid activities, people, or places that remind you of the traumatic event
8. Not being able to remember important parts of the upsetting event
9. Having much less interest or not doing things you used to
10. Not feeling close to people around you
11. Not being able to have strong feelings (for example, being unable to cry or unable to feel very happy)
12. Feeling as if your future plans or hopes will not come true (for example, you will not have a job or get married, or have kids)
13. Having trouble falling or staying asleep
14. Feeling irritable or having fits of anger
15. Having trouble concentrating (for example, losing track of a story on television, forgetting what you read, not paying attention in class)
16. Being overly careful (for example, checking to see who is around you and what is around you)
17. Being jumpy or easily startled (for example, when someone walks up behind you)

Indicate YES or NO below if the problems you rated above have gotten in the way with any of the following areas of your life DURING THE PAST 2 WEEKS.

1. Doing your prayers
2. Chores and duties at home
3. Relationships with friends
4. Fun and hobby activities

5. Schoolwork
6. Relationships with your family
7. General happiness with your life

Appendix D

The Child PTSD Symptom Scale (CPSS-5)

Sometimes scary or upsetting things happen to kids. It might be something like a car accident, getting beaten up, living through an earthquake, being robbed, being touched in a way you didn't like, having a parent get hurt or killed, or some other very upsetting event. These questions ask about how you feel about the upsetting thing you wrote down. Read each question carefully. Then indicate the number (0-4) that best describes how often that problem has bothered you IN THE LAST MONTH.

0 = Not at all
1 = Once a week or less/a little
2 = 2 to 3 times a week/somewhat
3 = 4 to 5 times a week/a lot
4 = 6 or more times a week/almost always

1. Having upsetting thoughts or pictures about it that came into your head when you didn't want them to
2. Having bad dreams or nightmares
3. Acting or feeling as if it was happening again (seeing or hearing something and feeling as if you are there again)
4. Feeling upset when you remember what happened (for example, feeling scared, angry, sad, guilty, confused)
5. Having feelings in your body when you remember what happened (for example, sweating, heart beating fast, stomach or head hurting)
6. Trying not to think about it or have feelings about it
7. Trying to stay away from anything that reminds you of what happened (for example, people, places, or conversations about it)
8. Not being able to remember an important part of what happened
9. Having bad thoughts about yourself, other people, or the world (for example, "I can't do anything right", "All people are bad", "The world is a scary place")
10. Thinking that what happened is your fault (for example, "I should have known better", "I shouldn't have done that", "I deserved it")
11. Having strong bad feelings (like fear, anger, guilt, or shame)
12. Having much less interest in doing things you used to do
13. Not feeling close to your friends or family or not wanting to be around them
14. Trouble having good feelings (like happiness or love) or trouble having any feelings at all
15. Getting angry easily (for example, yelling, hitting others, throwing things)
16. Doing things that might hurt yourself (for example, taking drugs, drinking alcohol, running away, cutting yourself)
17. Being very careful or on the lookout for danger (for example, checking to see who is around you and what is around you)
18. Being jumpy or easily scared (for example, when someone walks up behind you, when you hear a loud noise)

19. Having trouble paying attention (for example, losing track of a story on TV, forgetting what you read, unable to pay attention in class)
20. Having trouble falling or staying asleep

Have the problems above been getting in the way of these parts of your life IN THE PAST MONTH? (Yes/No)

1. Fun things you want to do
2. Doing your chores
3. Relationships with your friends
4. Praying
5. Schoolwork
6. Relationships with your family
7. Being happy with your life

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