Research article

Trajectories of post-traumatic stress and externalizing psychopathology among maltreated foster care youth: A parallel process latent growth curve model

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ABSTRACT

Few longitudinal studies have analyzed how violence exposure (e.g. child maltreatment, witnessing community violence) influence both externalizing and Post-Traumatic Stress (PTS) symptoms among children in foster care. Data from three waves of the National Survey of Child and Adolescent Well-Being (1999–2007) (NSCAW; National Data Archive on Child Abuse and Neglect, 2002) were analyzed to investigate the change trajectories of both externalizing and PTS symptomatology among children with a substantiated report of child maltreatment by Child Protective Services (CPS) between October 1999 and December 2000. This study uses data collected at three time points: baseline and approximately 18 (Wave 3) and 36 (Wave 4) months post-baseline. The Child Behavior Checklist (CBCL) scale measured externalizing symptoms and the Post Traumatic Stress Disorder section of a version of the Trauma Symptom Checklist for Children (TSCC) provided the measure of current trauma-related symptoms or distress. Analyses were conducted using a parallel process growth curve model with a sample of $n = 280$ maltreated youth between the ages of 8 and 15 following home removal. Findings revealed that initial levels of externalizing and PTS symptomatology were both significantly and positively related and co-develop over time. Externalizing symptom severity remained in the borderline range during the first two years in out-of-home care. Both direct and indirect forms of interpersonal violence exposure were associated with initial level of externalizing symptom and PTS symptom severity, respectively. Taken together, our results suggest an underlying process that links early violence exposure to the co-development and cumulative impact of PTS on externalizing behavior above and beyond experiences of maltreatment. We conclude by discussing the key points of intervention that result from a more nuanced understanding of the longitudinal relationship between PTS and externalizing symptoms and the effect of complex trauma on growth in these symptoms over time.

1. Introduction

In 2015, almost three quarters of a million children and adolescents had contact with foster care (AFCARS, 2016). Foster youth experience high levels of violence exposure as witnesses, victims or both (Kolko et al., 2010), placing them at an increased risk for developing a range of internalizing and externalizing symptoms including post-traumatic stress, aggression and/or conduct disorder (Burns et al., 2004; Dorsey et al., 2012; Greeson et al., 2011; Harman, Childs, & Kelleher, 2000; Kisiel, Fehrenbach, Small, & Lyons,

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2009; Pecora, Jensen, Romanelli, Jackson, & Ortiz, 2009a; Pilowsky & Wu, 2006; Urquiza, Wirtz, Peterson, & Singer, 1994). While a cross-sectional relationship between violence exposure and externalizing and PTS symptoms in foster care youth has been independently established, a better understanding of the longitudinal interrelationship and co-development of PTS and externalizing symptoms represents an important step in further addressing their unique needs. Using a parallel growth curve model (PGCM), the present study investigated the level and change in PTS and externalizing symptoms among a nationally representative sample of foster care youth (i.e. children and adolescents) in the United States conditional on experiences with violence exposure, as both victims and witnesses.

1.1. Violence exposure among foster care youth

Both direct and indirect forms of violence exposure are DSM-qualifying traumatic experiences (Finkelhor, Turner, Ormrod, & Hamby, 2009). Child maltreatment is direct interpersonal victimization that typically serves as the precipitating event triggering home removal (Harpaz-Rotem, Berkowitz, Marans, Murphy, & Rosenheck, 2008; Greeson et al., 2011). The most commonly recognized domains of child maltreatment that prompt a CPS investigation include physical abuse, sexual abuse, emotional abuse, and neglect (United States Department of Health & Human Services, 2003). Previous research has shown that as many as 85% of foster care youth are emotionally abused and as many as 50% have suffered physical abuse, sexual abuse or neglect from their primary caregiver. In addition to experiences with child maltreatment, children in foster care often experience indirect victimization such as witnessing acts of community-based violence (Oswald, Fegert, & Goldbeck, 2010; Ko et al., 2008; Riebschleger, Day, & Damashek, 2015). Studies of children in foster care report that between 30 and 87% have been a witness to or victim of assaultive, criminal or weapon-related violence during their lifetime (Giaconia et al., 1995; Stein et al., 2001; Copeland, Keeler, Angold, & Costello, 2007) including learning about an unexpected death (51.9%) and witnessing someone being killed or seriously injured (35.9%) (Breslau, Wilcox, Storr, Lucia, & Anthony, 2004).

Previous research has shown that most youth who experience at least one type of maltreatment typically experience at least one additional type (Ney, Fung, & Wickett, 1994; Pears, Kim, & Fisher, 2008; Barboza, 2017). Extant literature refers to recurrent patterns of direct and indirect traumatic experiences early in life as either "complex trauma," "polyvictimization," or "adverse child experiences" (ACEs) (Felitti et al., 1998; van der Kolk, 2005; Ford, Chapman, Mack, & Pearson, 2006; Greeson et al., 2011). Despite different conceptualizations and operational definitions, research within these traditions converges around one fundamental notion: violence exposure among at risk populations is co-occurring, chronic and interferes with healthy development across a range of developmental domains (Cook et al., 2005; Finklehor et al., 2007). A recent study found that 80.3% of foster care youth had experienced at least one DSM-qualifying trauma in their lifetime and almost two-thirds (61.7%) had experienced two or more (Salazar et al., 2013).

1.2. PTS and externalizing symptom prevalence among foster care youth

High levels of trauma exposure, including the frequency and type of violent victimization events in the home, disproportionately impact youth involved with the child welfare system (Dovran, Winje, Arefjord, & Haugland, 2012; Keller, Salazar, & Courtney, 2010; Kolko et al., 2010; McMillen et al., 2005; Riebschleger et al., 2015). Studies of children and adolescents exposed to violence have reported that between 35 and 60% of maltreated foster care youth have heightened PTS (Leslie et al., 2003; Burns et al., 2004; Dovran et al., 2012) and that between 9 and 30% meet lifetime diagnostic criteria for PTSD. In contrast, lifetime prevalence of PTSD among youth in the general population is estimated to be between 0.5–9% (Kolko et al., 2010; Salazar et al., 2014). Studies using behavioral checklists have found that as many as fifty percent of youth aged 11 or older enter foster care with behavioral problems (Pecora, White, Jackson, & Wiggins, 2009b) and as many as 25–50% have significant longer-term behavioral issues including conduct (CD) and aggressive disorder (Burns et al., 2004; Garland et al., 2001; Leslie, Hurlburt, Landsverk, Barth, & Slymen, 2004; McIntyre & Keesler, 1986). The prevalence of externalizing symptoms among the general youth population, however, is significantly lower (3–6%) (Achenbach & Edelbrock 1981; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; Pecora et al., 2009b). PTS and externalizing symptoms are highly co-morbid. Studies have shown that up to 40% of maltreated children meet the criteria for externalizing disorders in addition to PTSD such as conduct or disruptive behavior disorder (Ackerman, Newton, McPherson, Jones, & Dykman, 1998; Copeland et al., 2007). Studies of developmental continuity have shown that about 50% of adults with PTSD have histories of childhood conduct and oppositional defiance disorder and high levels of criminal justice involvement (Van der Kolk, 2005; Koenen, Moffitt, Poulton, Martin, & Caspi, 2007).

Disentangling the effect of violence exposure on heightened PTS and externalizing symptoms is complicated by three key findings. First, only a small subset of individuals with a DSM-qualifying traumatic experience develop PTSD (Copeland et al., 2007; Denton, Frogley, Jackson, John, & Querstret, 2017). Second, PTSD is not the most common diagnosis among trauma exposed foster youth (Rayburn, McWey, & Cui, 2016; van der Kolk, 2005). Instead, many studies have found disorders of adjustment, disruptive behavior, impulse-control, and substance use to be relatively more common among foster care youth (Blumberg et al., 1996; Halfon, Berkowitz, & Klee, 1992; Harman et al., 2000; McMillen et al., 2004; Pilowsky, 1995; Racusin et al., 2005). Finally, as others have noted, given high levels of symptom co-morbidity, existing diagnostic criteria may not capture impairments related to emotional regulation and interpersonal behaviors following complex trauma (Briere & Spinazzola, 2005; Cloitre et al., 2009; Van der Kolk, 2005; Van der Kolk, Roth, Pelcovitz, Sunday, & Spinazzola, 2005).

Developmental Trauma Disorder has been proposed to create conceptual coherence to the manifestations of PTSD symptoms as well as the causal mechanisms undergirding a single traumatic stress diagnosis (Cloitre et al., 2009). Developmental Trauma theorists

argue that trauma results in disturbances or vulnerabilities in self-regulatory capacities that includes not only post-traumatic stress symptoms but also other symptoms reflecting disturbances in affective and interpersonal self-regulatory capacity such as aggression and conduct disorder. Consequently, youth may act in aggressively or impulsively (Kerr, Reinke, & Eddy, 2013; Kofler et al., 2011) to avoid negative feelings associated with abandonment, rejection, or violence exposure (Rovee-Collier, Hayne, & Colombo, 2000). Therefore, the heightened levels of externalizing symptoms characteristic of foster care youth may be manifestations of triggered implicit memories, schemas, and feelings designed to minimize trauma-related characteristics associated with heightened levels of PTS.

The DTD perspective finds empirical support from research showing longitudinal interrelationships between growth in PTS and *internalizing* symptoms over time. O'Donnell, Creamer, and Pattison (2004), for example, found that while PTSD often occurs independently of depression in the short term, PTSD and depression co-occur *and* co-develop over the long term (O'Donnell et al., 2004). More recent research has shown that longitudinal trajectories of PTS and internalizing symptoms in general (Rayburn et al., 2016) and depressive symptoms more specifically (Barboza & Dominguez, 2017) demonstrate significant sub-symptom covariation (Rayburn et al., 2016). Taken together, these studies suggest a complex developmental association between depressive and PTS symptomatology among CPS-involved youth that is rooted in early childhood experiences with complex trauma. The current investigation extends previous work by exploring the interrelationship and co-development between heightened PTS and *externalizing* symptoms among foster care youth who experienced early child maltreatment and have witnessed violence in the home.

1.3. Risk factors for heightened PTS and externalizing symptoms

Research exploring the risk factors for increased symptom complexity and comorbidity across PTS and externalizing symptom domains has focused on factors specific to this population, type of violence exposure, sociocultural risk factors and developmental level or age, that place these youth at greater risk (Deater-Deckard, Dodge, Bates, & Pettit, 1998; Pine & Cohen, 2002). Heightened PTS has been shown to be more characteristic of younger children rather than adolescents due to the former's more limited coping abilities to manage interpersonal and traumatic experiences (Kolko et al., 2010). Childhood exposure to ongoing domestic and community violence as victims, witnesses, or both, has been found in previous work to contribute to heightened levels of both externalizing and PTS symptoms as well as the more stringent diagnoses associated with each (i.e. PTSD, conduct disorders) (Deater-Deckard et al., 1998; Stein et al., 2001). Regarding maltreatment type, neglect has stronger associations to symptoms of withdrawal and depression (Kinard, 2004; Prino & Peyrot, 1994; Widom & Kuhns, 1996) and physical abuse to anger, aggression, acting out and conduct disorder (Fergusson, Boden, & Horwood, 2008; Perfect et al., 2011). Sexually and physically abused children show an increased risk for developing heightened PTS and externalizing symptoms compared to those with no history of abuse (Boney-McCoy & Finkelhor, 1996; Breslau, Davis, Andreski, & Peterson, 1991; Kessler et al., 1995; McCloskey & Walker, 2000). However, research exploring the relative impact of maltreatment type among maltreatment-only samples compared to studies using comparison groups of children with no a history of abuse has yielded conflicting findings (Boney-McCoy & Finkelhor, 1996; Kessler et al., 1995; Petrenko, Friend, Garrido, Taussig, & Culhane, 2012; Pine & Cohen, 2002; Stein et al., 2001). Research conducted on maltreatment-only samples has not found differences between types of abuse and the development of externalizing problems and/or PTSD (English et al., 2005; Knutson, DeGarmo, Koeppl, & Reid, 2005; Lounds, Borkowski, & Whitman, 2006). Therefore, additional studies aimed at disentangling the relative impact maltreatment types is clearly warranted.

1.4. Longitudinal trajectories of PTS and externalizing symptoms

Few studies have explored the longitudinal trajectories of PTS symptoms among youth involved with the child welfare system. The studies that do exist have found that PTS symptoms are highest immediately following home removal but decrease thereafter (Rayburn et al., 2016; Barboza & Dominguez, 2017). As well, only a limited body of research has documented externalizing symptom progression following placement in foster care but the research that does exist is conflicted. One prospective study of 624 foster care youth conducted over a five-year period from birth to age 12 found that behavioral problems worsen as length of time spent in foster care increases (Fanshel, Shinn, & Eugene, 1978). However, more recent longitudinal investigations have demonstrated improvements in behavioral functioning over time (Horwitz, Balestracci, & Simms, 2001; Lee, 2009; McWey, Cui, & Pazdera, 2010; Simmel, Barth, & Brooks, 2007). Thus, the higher than average levels of both PTS and externalizing symptoms compared to the general population coupled with evidence of temporal instability suggests that the observed cross-sectional relationship may extend developmentally. To date, this question has remained largely unexplored, and hence the co-development between these symptoms remains largely unknown.

2. The current study

A central limitation of existing research is the failure to control for the potentially confounding effects of comorbidity (Saigh, Yasik, Oberfield, Halamandaris, & McHugh, 2002) and/or viewing co-morbidity as a cross-sectional phenomenon (Barboza & Dominguez, 2017). Therefore, despite the increasing awareness of the cumulative effects of trauma among at-risk populations, the longitudinal mechanisms underlying the association between complex trauma exposure and PTS and externalizing symptom co-development has remained unclear. As noted above, previous studies reporting heightened levels of PTS and externalizing symptoms among youth entering foster care have, by and large, relied on cross-sectional designs that do not account for the co-development of subdomain indicators.

Our analytic approach was designed to measure multivariate change in PTS and externalizing symptoms over time using parallel process modeling (PPM). The PPM charts trajectories of change or growth processes in two or more variables in parallel making it possible to examine whether the intercept and growth in one is related to the intercept and growth in the other. Based on prior studies, we first hypothesize that a poorer initial level of PTS symptoms contributes to the advancement of more severe externalizing symptoms over time. We further hypothesize that the progression of heightened PTS and externalizing symptoms is affected by witnessing violence in the community or childhood maltreatment. In addition, we explored whether violence exposure results in a greater increase in PTS and depressive symptomatology longitudinally. Importantly, we examined the independent effects of specific traumatic experiences (i.e. child maltreatment type and witnessing community violence) while holding demographic characteristics, socio-economic status and family risk factors constant. We used a parallel latent trajectory model for this investigation which is a powerful method that allows for a simultaneous modeling over time of the differences between and within individuals in both PTS and depressive symptom changes. On the basis of previous research, we expected that (1) PTS and externalizing symptoms would decrease over time; (2) a pattern of co-development over time would emerge between system subdomains (i.e. symptom severity at baseline between both PTS and externalizing symptoms would be highly related) and that changes in one subdomain would predict changes in the other; and (3) that maltreatment type and violence exposure severity would predict PTS and externalizing symptoms severity and growth over time.

3. Methods

3.1. Participants

Data from the National Survey of Children and Adolescent Well-Being (NSCAW; National Data Archive on Child Abuse and Neglect, 2002) were used for this study. The NSCAW sample includes two groups. The first group includes 5501 children between the ages of 1 and 16 years old at Wave 1, who were subjects of child abuse or neglect investigations conducted by CPS from October 1999 to December 2000. The second cohort was comprised of adolescents who had been removed from the home due to maltreatment and were residing in an out-of-home placement at Wave I (long-term foster care (LFTC), n = 727). Researchers obtained active consent to participate from all caregivers and caseworkers and children 7 years and older. Current caregivers were paid $50 for their participation and children were given gift certificates worth $10–$20. Since the scope of this study was specific to youth in foster care, we used data from the second cohort only. Analyses were restricted to children between the ages of 8–15 years who, according to caseworker reports, experienced physical, sexual or emotional abuse, neglect or other forms of abuse (n = 280). Data from wave 2 were excluded from our analyses because data on traumatic symptoms were not collected during this phase of the study. There was only one child who was 16 who was excluded from the study. Our lower age limit was 8 because the measures we used below were only asked of children ages 8 and older.

3.2. Measures

3.2.1. Post-Traumatic stress symptoms (Briere, 1996)
Youth were administered the Post Traumatic Stress Disorder section of a version of the Trauma Symptom Checklist for Children (TSCC) for NSCAW. The PTS subscale is a standardized child-report scale developed to provide a self-report evaluation of current trauma related symptoms or distress in children and adolescents (ages 8–16) who have been exposed to unspecified traumatic events. It consists of a pencil-and-paper assessment consisting of 10 trauma symptoms (e.g., intrusive recollections of traumatic events, sensory re-experiencing and nightmares, dissociative avoidance, fears) presented on a 4-point Likert-type scale (0 = never; 1 = sometimes; 2 = lots of times; 3 = almost all of the time). For example, youth were asked how often they have "bad dreams or nightmares," and how often "scary ideas or pictures just pop into [their] head." The TSCC has been shown to have excellent psychometric properties and to discriminate between abused and control children in previous research (Lanktree & Briere, 1995; Nilsson, Wadsby, & Svedin, 2008; Sadowski & Friedrich, 2000). The TSCC provides norms according to age and gender (T score mean = 50) with scores greater or equal to 65 indicative of clinically significant PTS symptoms consistent with a diagnosis of PTSD (Briere, 1996). Recent research indicates that the TSCC PTS scale correlates with a caretaker report instrument developed to assess trauma-related symptoms in children ages 3–12 (Briere, 2005).

3.2.2. Child behavior checklist (CBCL) (Achenbach, 1991)
The severity of externalizing symptoms was assessed using the CBCL, a standardized psychosocial measure of aggression and rule-breaking behavior that was completed by each child's primary caregiver. The Child Behavior Checklist (CBCL) is a parent-report questionnaire that contains 120 items on behavioral and emotional problems. The externalizing scale comprises aggressive and rule-breaking behavior (e.g., temper tantrums or hot temper, destroys things belonging to others). Responses were scored on a 3-point scale (0, not true to 2, very true or often true). Age- and gender-standardized scores between 60 and 62 are considered borderline and scores of 63 or higher on the CBCL are indicative of clinically significant problem behaviors.

3.2.3. Community violence exposure (Fox & Leavitt, 1995)
Youth provided responses to the severe violence subscale of the Violence Exposure Scale (VEX-R), which assesses whether youth had been exposed to violence in the environment surrounding their home with self-report items and uses cartoons depicting violent and criminal acts (Fox & Leavitt, 1995). Children are shown cards depicting the violent acts and are asked to describe ever saw

someone with whom they lived commit each act, and whether they were the victim of each act. A variable was created representing the number of different types of violence children were the victims of in their homes using the following six items: (1) saw a person steal stuff from another person; (2) saw a person point a knife or a real gun at another person; (3) saw a person stab another person with a knife; (4) saw an adult stab another adult; (5) saw a person arrested; (6) saw an adult beat up another person; and (7) saw a person deal drugs. The scale ranged from 0 to 7 (mean = 1.35, s.d. = 1.5, range = 0–7, Cronbach's α = 0.749).

3.2.4. Child maltreatment

Regarding maltreatment, caseworkers reported the type of maltreatment experienced by the adolescent using a modification of the Maltreatment Classification Scale (Manly, Cicchetti, & Barnett, 1994). In instances where more than one type was reported, caseworkers were asked to indicate the "most serious" form of maltreatment (Rosenthal & Curiel, 2006). Consistent with past classifications, for the purposes of this study the types of maltreatment were categorized into physical abuse, sexual abuse, neglect, and other maltreatment (e.g., abandonment and educational maltreatment).

3.2.5. Demographics

Adolescent gender, age, race and poverty status were included in the model as control variables. Gender was coded as 1 = male and 0 = female; age ranged from 8 to 16; race was coded as white = 1, 0 = non-white; and poverty status was = 1 if the child's foster parents received any of the following benefits: AFDC, TANF, food stamps or housing assistance.

3.3. Data analysis

Parallel process latent growth models were estimated with Mplus version 7.2. (Methuen & Methuen, 1998) First, PTS and externalizing symptoms were investigated separately in order to test how well the hypothesized trajectory shape fits the data. The intervals between slope loadings were rescaled to reflect the intervals between measurement occasions, which were not equally spaced (i.e. we used wave 1, 3 and 4). In the second step, a number of hypothesized relations among PTS and externalizing symptoms were modeled. We examined the covariance structure between initial level and rate of change in both PTS and externalizing symptom factors to understand the co-development of different attributes, capturing the communality in primary growth factors. Directional longitudinal influences were specified between growth parameters of each subdomain. To minimize time specific reporting biases, we included across domain time specific measurement errors to be correlated with each other. We also modeled the correlations between primary growth factors of PTS and externalizing symptoms *within* each subdomain (e.g. a correlation between the initial level and slope of PTS symptoms) and also among primary growth factors *between* different subdomains (e.g. a correlation between the slope of PTS symptoms and the slope of externalizing symptoms). We conducted an examination of the nature of the co-development of PTS and externalizing by testing a variety of different parallel growth models with different directional effects. Once we found the best fitting model, we incorporated the covariate and control variables. The Mplus software uses a full information maximum likelihood estimation under the assumption that the data are missing at random (MAR; Arbuckle, 1996; Little, 1995), which is a widely accepted way of handling missing data (Muthén & Shedden, 1999; Schafer & Graham, 2002). The NSCAW sample design (i.e. a stratified, two-stage sample) and weighting scheme was incorporated into the analyses.

4. Results

4.1. Descriptive statistics

Table 1 presents the means, standard deviations of study variables. Within the subsample, 51.1% of children were male. The average age of children in the subsample at Wave 1 was 11.61 years (*s.d.* = 2.23). Forty-two percent of children identified as Black (non-Hispanic), 35.1% as White (non-Hispanic), 13.4% as Hispanic, and 9.62% were of other races or ethnicities. Caseworkers reported neglect (physical or supervisory) as the most severe type of maltreatment in 50.4% of the cases, followed other types of maltreatment (25.5%) (e.g. abandonment, emotional abuse), physical abuse (12.8%) and sexual abuse (11.3%).

Table 2 presents the zero-order correlations for key variables used in this study. A preliminary view of the descriptive statistics indicated that, on average, both PTS and externalizing symptoms decreased from Wave I to Wave IV. As expected, bivariate correlation coefficients between the PTS and externalizing behavior at the same occasion were highly related and statistically significant at p < 0.05 (r = 0.398 at wave 1, r = 0.267 at wave 2 and r = 0.595 at wave 3). The correlations for the same subdomain at different time points (autocorrelations) ranged between r = 0.452 and r = 0.512 for trauma and r = 0.315 and r = 0.531 for externalizing, and were also statistically significant.

4.2. Dimensional assessments of clinically significant syndromes

Standard cutoffs for both CBCL externalizing (≥63) and CTS PTS (≥65) revealed that 54.5% and 8% of youth demonstrated clinically significant externalizing and PTS symptoms, respectively. At baseline, some children scored in the clinical range for both PTS and externalizing behavior (Fig. 1). Of the 21 youth who met the clinical cutoff for PTS, 13 (62%) also met the cutoff for externalizing behavior (see upper right quadrant of Fig. 3). Further inspection of all waves revealed that average externalizing scores were in the borderline clinical range at both waves 1 and 3 but not at wave 4; nevertheless, externalizing behavior significantly decreased between waves 1 and wave 3 (t = 4.66, p < 0.001) and wave 4 (t = 2.82, p = 0.005). PTS symptoms were statistically

Table 1
Descriptive Statistics of Sample Variables.

	Mean	S.D.	%
PTS1	48.01	10.1	
PTS3	47.38	9.34	
PTS4	46.88	9.47	
EXT1	60.1	12.48	
EXT3	59.43	12.26	
EXT4	58.4	13.2	
AGE	11.61	2.23	
VEX	1.365	1.50	
Male			51.1%
Physical			12.8%
Sexual			11.3%
Phys. Neglect			25.0%
Sup Neglect			25.4%
Other			25.5%
Black			42.2%
White			35.1%
Hispanic			13.4%
Food Stamps			10.5%
TANF			17.8%

Table 2
Correlations among study variables.

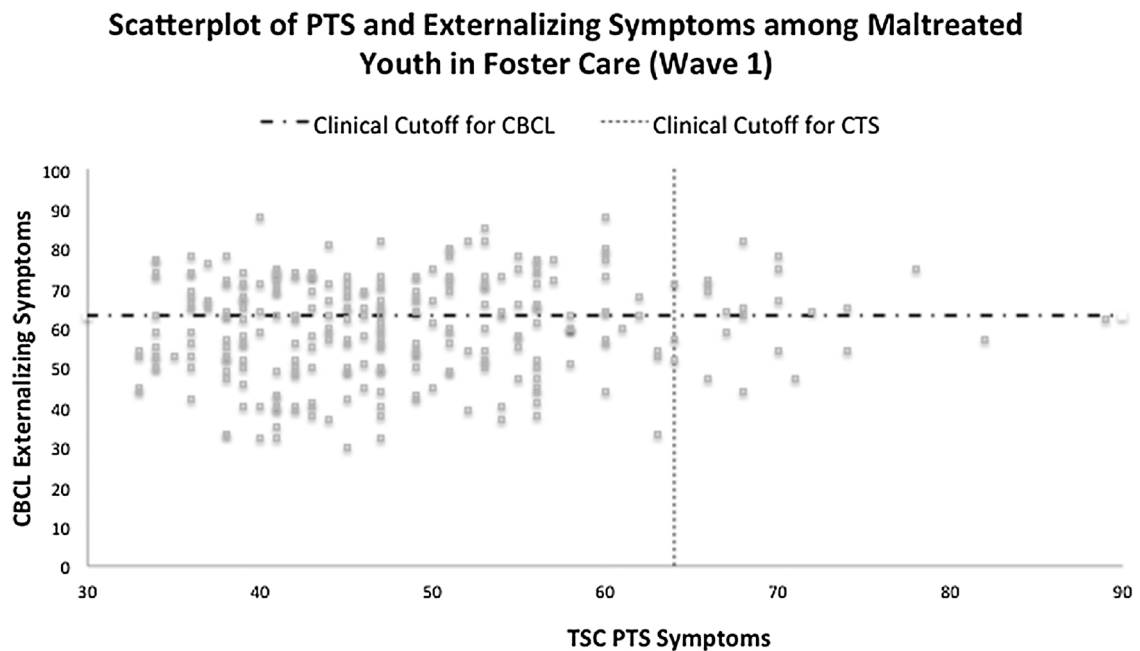| Variables	1	2	3	4	5	6
1. Trauma (W1)	–					
2. Externalizing (W1)	0.398***	–				
3. Trauma (W2)	0.476***	0.111	–			
4. Externalizing (W2)	0.201***	0.489***	0.267***	–		
5. Trauma (W3)	0.452***	0.144*	0.512***	0.214***	–	
6. Externalizing (W3)	0.353***	0.315***	0.369***	0.531***	0.595***	–

Fig. 1. Bivariate Relationship Between PTS and Externalizing Symptoms among Maltreated Foster Care Youth at Wave 1. Clinical Cutoffs were > = 65 for PTS symptoms and > = 63 for Externalizing symptoms. TSC = Trauma checklist; CBCL = child behavior checklist.
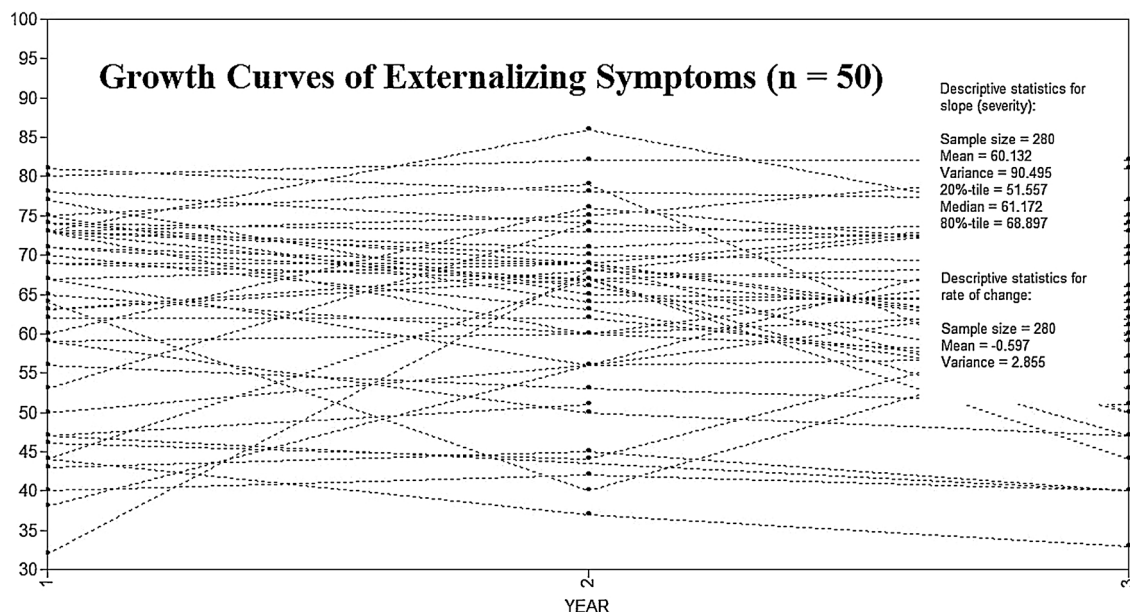
Fig. 2. Individual Growth Curve Trajectories of Externalizing Behavior for a random sample of *n* = 50 youth.

similar at waves 1 and 3 but showed a statistically significant decrease between wave 1 and wave 4 (t = 2.10, p = 0.037). At Wave 4, 44.3% and 6.6% of youth showed clinically relevant externalizing and PTS symptoms, respectively. An examination of the variance in average symptom scores for each wave demonstrated a large amount of variability in both PTS and externalizing score severity as well as the rate of change in externalizing behaviors over time. Fig. 2 shows the externalizing trajectories for a random sample of n = 50 youth over three years.

4.3. Univariate growth curves

Prior to modeling the multivariate (parallel) growth curves, univariate growth curve models were fit to the data in order to explore the development of PTS and externalizing independently. The model fit statistics for each univariate model indicated a good fit to the data (PTS: RMSEA = 0(0.054), CFI/TFI = 1.00/1.25, SRMR = 0; Externalizing = RMSEA = 0(0.031), CFI/TFI = 1.00/1/01, SRMR = 0.01). Results showed that the mean intercept for PTS was positive and statistically significant (intercept = 48.08; p < 0.01) and the mean slope was negative and statistically significant (slope = −0.410; p < 0.05). Regarding externalizing symptoms, the univariate models suggested a similar pattern (mean for intercept: 60.13, p < 0.01; mean for slope: −0.598, p < 0.01). The negative average in slope suggested that both PTS and externalizing symptoms decreased over time. An examination of the variance for the growth parameters of both PTS and externalizing symptoms suggested that there was significant inter-individual variation in both symptom severity and rate of change (Karney & Bradbury, 1995). The significant variation in the intercepts and slopes suggested that enough variability in growth parameters existed to justify further analyses that might explain that variability so we proceeded with a parallel process latent growth model

4.4. Parallel process model

In a PPM, two latent growth models are developed simultaneously and the growth factors are allowed to co-vary. Co-development across domains is expressed when change in one domain simultaneously predicts change in another domain. In the first iteration of the modeling procedure, only non-directional associations were modeled to examine the interrelationships of changes in symptoms. The resulting model indicated an acceptable fit: chi- square = 2.10, p = 0.938, comparative fit index (CFI) = 0.1.00, root mean square error of approximation (RMSEA = 0.001, 90%CI [.00, 0.030]), and SRMR = 0.013. Table 3 presents the results from the PPM with non-directional effects. As shown by the table, the growth parameters (i.e. the means and variances for the intercepts and slopes) for both PTS and externalizing symptoms were statistically significant. As well, the standardized covariances among the primary growth factors were statistically significant, which is evidence for the existence of a parallel process of growth across PTS and externalizing symptoms. More specifically, positive correlations were observed between PTS and externalizing symptom intercepts (r = 0.483, p < 0.001) and slopes values (r = 0.827, p < 0.001). These results demonstrate that PTS symptom scores are strongly associated with externalizing scores, both cross-sectionally and longitudinally.
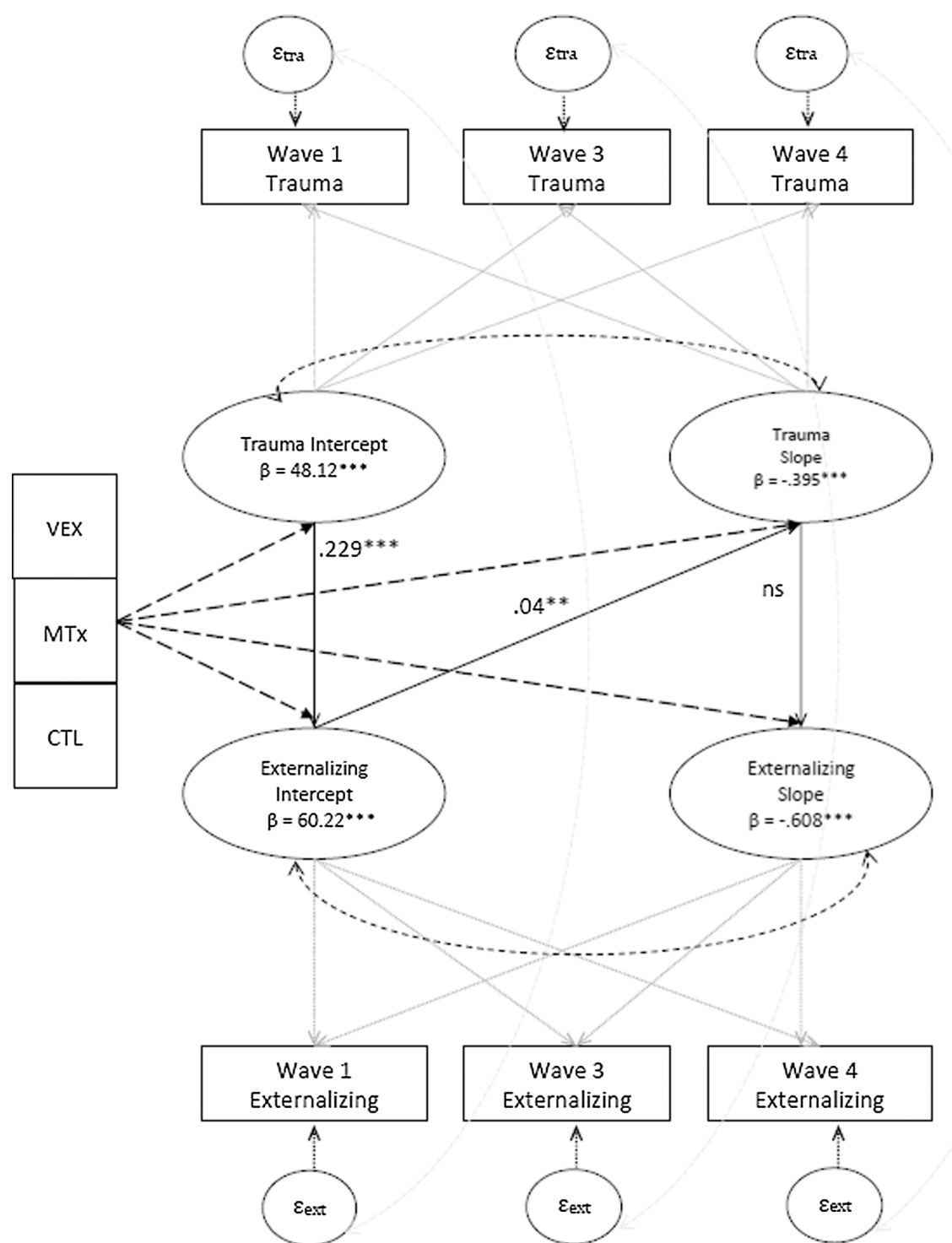
Fig. 3. Parallel Process Model (PPM) with Between-Subdomain Measurement Error Correlations.
Notes: Coefficients of unidirectional interaction effects between externalizing symptoms and time on PTS symptoms are shown as significant values; error terms and between subdomain measurement error correlations are not shown.

4.5. Directional longitudinal influences of co-development

Next, we introduced directional effects between the growth factors of the two subdomains into the model. We tested parallel process models with a cumulative time interaction and reciprocal effects. The best fitting model included path coefficients as

Table 3

Results of the Parallel Process Model (PPM) Using Trauma Symptoms and Externalizing Behavior.

Symptoms	Intercept growth factors (Unstandardized)		Slope growth factors (Unstandardized)	
	Mean	Variance	Mean	Variance
Trauma	48.123***	50.444***	− 0.395**	1.226
Externalizing	60.224***	112.986***	− 0.608**	7.366***

Correlations Between Growth Factors (Standardized)

	Int (trauma)	Int (Ext)	Slope (trauma)	Slope (ext)
Int (trauma)	–			
Int (Ext)	0.483***	–		
Slope(trauma)	− 0.380**	− 0.550**	–	
Slope (ext)	0.059	− 0.470***	0.827***	–

reciprocal direct effects (RMESE = 0, 90%CI[0, 0.054], CFI/TFI = 1.00/1.01, SRMR = 0.041). Upon selecting the final directional effects model, we incorporated covariates to account for the residual variance. Results from the PPM with reciprocal direct effects and covariates are shown in Fig. 3. Consistent with our expectation that this was a high-risk sample, the intercept terms for PTS and externalizing behavior were significantly different from zero. As before, the slopes of both PTS and externalizing symptoms were significantly negative, indicating improvement over time. These intercepts are given in the units of the original raw score on these scales, and thus reflect borderline symptom severity on average for the sample as a whole. Path coefficients suggested that PTS severity was significantly associated with externalizing symptom severity (β = 0.229, $p < 0.05$) and that the intercept of externalizing symptoms significantly predicted the slope of PTS symptoms (β = 0.040, $p < 0.05$). Statistically speaking, this is evidence of an interaction effect between time and PTS symptom severity on the development of externalizing behavior. Substantively, the result shows that PTS symptom severity influences the growth of externalizing symptoms over time. No such interaction was observed between externalizing symptom severity and rate of change in PTS symptoms over time (i.e. the effect was non-significant). No other pathways proved statistically significant.

4.6. Parallel process LGM with reciprocal directional affects and covariates

To investigate the underlying processes associated with the parallel growth trajectories, we incorporated maltreatment type, violence exposure, gender, age, poverty status and race (white versus other) into the model. The results are presented in Table 4. As shown by the table, sexual and physical abuse (versus neglect which included both physical and supervisory) was associated with externalizing symptom severity; in other words, sexually (β = 6.6, $p < 0.001$) and physically (β = 5.5, $p < 0.001$) abused youth had higher levels of externalizing symptoms at baseline compared to neglected youth. On the other hand, increasing levels of violence exposure (β = 1.8, $p < 0.001$) was associated with higher initial levels (i.e. severity) of PTS symptoms at baseline. Being male (β = − 1.0, $p < 0.09$) was moderately associated with slower decreases in externalizing symptoms over time. All of the residual variance in the slope and intercept of externalizing symptoms was explained once these covariates were included in the model but a significant amount of variance in PTS symptoms remained (Table 4).

Table 4

PPM with Reciprocal Directional Effects and Covariates.

	Trauma intercept	Trauma slope	Externalizing intercept	Externalizing slope
Trauma intercept	–	–	0.229**	ns
Trauma slope	–	–	–	ns
Externalizing intercept	–	0.040**	–	–
Externalizing slope	–	–	–	–
Severe Violence Exposure	1.820***	ns	ns	ns
Sexual Abuse	ns	ns	6.611***	ns
Physical Abuse	ns	ns	5.529***	ns
Age (years)	ns	ns	ns	ns
Gender (=male)	ns	ns	ns	− 1.024*
White versus non-White	ns	ns	ns	ns
Residual Variances	0.818***	0.447	0.850***	0.837***
R-squared (Latent Variable)	0.182***	0.553	0.150	0.163

5. Discussion

This study documented the longitudinal relationships between changes in PTS and externalizing symptoms in a nationally representative sample of children who were placed in foster care after their referral to child welfare due to reported maltreatment. The present study modeled PTS and externalizing symptoms as dynamic and co-evolving factors from childhood to early adolescence. We investigated first order growth curves associated with two distinct but comorbid subdomains that previous research has identified as characteristic of youth experiencing complex and ongoing trauma. We examined univariate and multivariate growth curve models and tested several possible directional influences across subdomains. We further examined predictors reflecting violence exposure and child maltreatment history (e.g., physical and sexual abuse) controlling for age, race, poverty status and gender.

Our results have implications for the nosology of PTS and externalizing symptoms (both independently and combined) as well as for identifying effective interventions for youth experiencing complex trauma. The results from this study show that the prevalence of PTSD and heightened PTS symptoms in a non-clinical sample is considerably higher than it is in the general population. In line with previous research, however, the majority of foster children did not develop clinically significant PTS (i.e. PTSD) despite experiencing maltreatment severe enough to warrant removal from the home. Our findings revealed that despite being at risk, only between 6.6%-8% of foster care youth showed evidence of PTSD in the three years following removal from the home. Previous explanations of low PTSD prevalence among traumatized individuals have centered on resilience. One possibility for our low estimate is that youth responses to maltreatment and family disruption were highly variable and hence that most were resilient to these adverse experiences (Dvir, Ford, Hill, & Frazier, 2014). If this were true, however, the question remains why foster care youth demonstrated clinically significant externalizing behavior at levels that are grossly disproportionate compared to the general population? One possibility is that PTS symptoms are masquerading as externalizing behavior. In the present study, there was a high rate of co-morbidity between clinically significant levels of externalizing and PTSD: among the youth who *did* show heightened PTS symptoms (T ≥ 65), 61% also had clinically significant CBCL scores (i.e. ≥63). In addition, however, we found that the symptoms co-develop over time. This indicates that the heightened externalizing and PTS symptoms seen in foster care youth manifests as a complex symptomatology with high rates of comorbidity (Lawrence, Carlson, & Egeland, 2006), which has accompanying implications for successful treatment and accurate diagnosis. Previous research has revealed that PTSD diagnoses may be confused with others due to the presence of factors that also contribute to vulnerability to stress reactions (Koenen, Goodwin, Struening, Hellman, & Guardino, 2003). For example, foster children commonly present for diagnosis and treatment with other nonspecific symptoms including, but not limited to, conduct disorders (e.g., angry outbursts, aggressive behavior) that overlap with different mental disorders and may result in faulty diagnoses (e.g. ADHD) (Oswald et al., 2010).

Building on previous cross-sectional analyses of PTS and externalizing behavior, and in support of our first research hypothesis, the present investigation found that both PTS and externalizing symptoms were highest at baseline, shortly after removal from the home, but had significantly improved by Wave 4 (3 years post-placement). Furthermore, average levels of PTS symptoms declined with length of time spent in out-of-home care. The univariate growth models supported the sample's descriptive features by showing that the average developmental trends in both PTS and externalizing reflected decreases in symptoms across the three-year period. Previous research has suggested that heightened externalizing symptoms seen in children shortly after being removed from the home may be a manifestation of the stress associated with this critical transition. As demonstrated here, subsequent symptom decreases may, in contrast, be due to the stability that out-of-home care offers. Importantly, however, significant variation existed across the period under investigation. The significant means and variances associated with the primary growth factors in each domain suggested the presence of inter-individual differences in intra-individual trends within each subdomain (i.e. PTS and externalizing) that needed further explanation. Consequently, we modeled their co-development with a PPM.

A strength of the present study lies in documenting that changes in externalizing symptoms are significantly associated with changes in PTS symptoms over time even after controlling for the impact of poverty, race, gender, violence exposure and maltreatment type. In this regard, our findings suggest that the progression of PTS and externalizing disorder symptoms following out-of-home placement are best represented in a parallel growth model which assumes that the two disorders are distinct yet highly interrelated, as hypothesized. The parallel process model provided support for a positive association between initial level of PTS symptoms and initial level of externalizing behavior over time. Additionally, the results showed a positive relationship between the intercept of externalizing symptoms and *rate of change* in PTS symptoms. In line with previous studies exploring developmental continuity, we found evidence of an interaction effect between externalizing symptom severity and time in influencing the progression of PTS symptoms (and ultimately perhaps PTSD), but not vice versa. Previous research has shown that juvenile disorders (including conduct disorder) between ages 11 and 15 significantly increase the risk of PTSD following trauma during the same period (independent of childhood maltreatment prior to age 10) (Breslau et al., 2014). We extend this finding by demonstrating the presence of a cumulative effect such that the influence of early externalizing symptoms on PTS change gains strength over time. The finding regarding the interaction between externalizing behavior and time on the development of PTS is consistent with the broader literature suggesting that youth with co-occurring symptoms may be worse off compared to youth with one problem as they develop.

Given that aggressive behaviors are the single most common reason foster parents give for requesting removal of children from placement (Newton, Litrownik, & Landsverk, 2000), our finding that externalizing symptom severity remains high and that severity is an important factor in PTS symptom development represents an important contribution to existing research. The present study suggests a complex and bidirectional relationship between PTS and poor socio-behavioral functioning following trauma. These findings are strong evidence that the higher prevalence of behavior problems among maltreated foster care youth in comparison to both non-maltreated foster care youth and to the general population may be a result of complex trauma. Indeed, many have suggested that the increased symptom complexity (i.e. high comorbidity across several psychopathological domains) is in fact a

psychopathology in and of itself – characteristic of an underlying disorder. The present findings support such a framework that emphasizes the processes undergirding the development of PTS and externalizing psychopathology rather than one that views them as separate or distinct 'co-morbid' diagnostic labels. These findings highlight the importance of continuing to better understand the interrelationship between PTS and externalizing symptoms in a way that facilitates our understanding of co-symptom progression. In this vein, future research should examine the covariance among primary growth factors in each subdomain in order to explore any communality in primary growth factors and/or the existence of a common global factor that captures them both (such as complex trauma or cumulative stress).

Consistent with past research (Garrido, Culhane, Raviv, & Taussig, 2010) increased community violence exposure was positively associated with higher initial levels of PTS symptoms after controlling for type of maltreatment, gender, age, socioeconomic status and race. More specifically, maltreated foster care youth who are exposed to chronically high levels of community-based violence as witnesses are significantly more likely to have heightened PTS symptom severity. On the other hand, consistent with a large body of research documenting the relationship between childhood physical and sexual abuse and externalizing behavior problems in childhood, physical and sexual abuse was associated with externalizing symptom severity. This suggests that maltreatment of commission has more serious consequences for aggressive and rule-breaking behavior than maltreatment by omission. This was not so for PTS symptoms, which implies that neglect may be just as important as a factor as physical and sexual abuse for PTSD onset. Future research should continue to delineate maltreatment type for understanding the processes associated with the interrelated trajectories of PTS and externalizing symptoms.

Despite the contributions this paper makes it is not without limitations. Future research points to the importance of other factors that are associated with psychiatric disorder onset and progression. Future research should explore the influence of family risk factors and placement history on the progression and co-development of comorbid symptoms. As well, due to data limitations, we were unable to extend our findings to other critical periods such as the transition out of foster care. Extended longitudinal investigations of the interrelationships between PTS and externalizing are desperately needed. Moreover, we did not look at specific broadband externalizing symptom subscales which is something we leave for future research. Finally, our analysis focused on the transition into foster care as a developmentally critical period as opposed to something else such as age. While our approach had its benefits (it allowed us to use age as a control variable and to explore symptom progression following a critical transition point), it would be of great interest for researchers to replicate these analyses using developmental age as the time.

In this study, we demonstrated important developmental linkages between PTS and externalizing symptoms during a critical developmental period for the diagnosis and treatment of post-traumatic disorders. Research has shown that only about a third of foster care youth receive any services to address their mental health needs (Leslie et al., 2005). The results of our study support the importance of targeted treatments of externalizing symptoms as meaningful change in this core deficit may lead to related improvements in PTSD, particularly among children who enter out-of-home care with elevated levels of both. The finding of increased symptom severity and multi-symptom profile of elevated PTS symptoms and externalizing problem behavior in our sample of foster care youth strongly suggests the need to improve mental health diagnoses among youth exposed to complex trauma. Dimensional assessments revealed total problem behaviors, specifically externalizing behavior, within the clinical range. Importantly, dimensional assessment not only revealed increased symptom severity in foster care youth, but also a multi-symptom profile of concurrently elevated symptoms associated with the development of PTSD. The multidimensional growth in PTS and externalizing symptoms across the span of three years post-placement argues for a close conceptual relationship that must be further investigated. Mislabeling behavior as externalizing rather than as early signs of PTSD can have devastating consequences, particularly for youth who are frequently exposed to violence (Ford et al., 2006). Our results suggest that foster care youth would benefit from a formal assessment of intensity of multiple forms of violence exposure as a witness regardless of placement setting or maltreatment referral incident type. In turn, any effort designed to minimize their exposure to violence would similarly impede the growth of post-traumatic symptoms. Given the stability of heightened externalizing symptoms (De Bellis & Van Dillen, 2005), continued monitoring of the adjustment of this subgroup also seems warranted to document any associated long-term adverse outcomes including violence perpetration.

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