

Comorbidity of developmental trauma disorder (DTD) and post-traumatic stress disorder: findings from the DTD field trial

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ABSTRACT

Background: Developmental trauma disorder (DTD) has been proposed to describe the biopsychosocial sequelae of exposure to interpersonal victimization in childhood that extend beyond the symptoms of post-traumatic stress disorder (PTSD).

Objective: To characterize the psychopathology comorbid with DTD and to determine whether this comorbidity is distinct from, and extends beyond, comorbidities of PTSD.

Method: DTD was assessed by structured interview, and probable Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) psychiatric disorders were identified with screening modules on the Kiddie Schedule for Affective Disorders and Schizophrenia, Present/Lifetime version (K-SADS-PL), in a multi-site sample of 236 children (7–18 years old; 50% female) referred by paediatric or mental health providers.

Results: DTD ($N = 80$, 34%) and PTSD ($N = 69$, 29%) were highly comorbid and shared several DSM-IV internalizing disorder and DSM, 5th Edition (DSM-5) dysregulation disorder comorbidities. However, DTD, but not PTSD, was associated with comorbid panic disorder and disruptive behaviour disorders. On a multivariate basis including all probable DSM-IV disorders and DSM-5 dysregulation disorders, DTD was associated with separation anxiety disorder and attention deficit hyperactivity disorder after controlling for PTSD, while PTSD was associated with major depression and generalized anxiety disorder after controlling for DTD.

Conclusions: DTD's comorbidities overlap with but extend beyond those of PTSD to include panic, separation anxiety, and disruptive behaviour disorders. DTD warrants further investigation as a potential diagnosis or a complex variant of PTSD in children, similar to the adult symptoms of disturbances of self-organization in the proposed International Classification of Diseases, 11th revision (ICD-11) complex post-traumatic stress disorder subtype.

Comorbilidad del Trastorno Traumático del Desarrollo (DTD en sus siglas en inglés) y Trastorno de Estrés Traumático: Los Hallazgos desde el Ensayo de Campo del DTD

Antecedentes: El Trastorno Traumático del Desarrollo ha sido propuesto para describir las secuelas psicosociales de la exposición a la victimización interpersonal en la infancia que se extiende más allá de los síntomas del trastorno de estrés postraumático (TEPT).

Objetivo: Caracterizar la comorbilidad psicopatológica con el DTD y determinar si esta comorbilidad es diferente de, y se extiende más allá, de las comorbilidades del TEPT.

Método: El DTD fue evaluado por medio de una entrevista estructurada, y probables trastornos psiquiátricos bajo el DSM-IV fueron identificados con los módulos de tamizaje KSADS-PL (en sus siglas en inglés), en una muestra 236 niños (de edades entre 7 y 18 años de edad; 50% mujeres) provenientes de múltiples sitios y que fueron referidos por proveedores pediátricos y de salud mental.

Resultados: El DTD ($N=80$, 34%) y el TEPT ($N = 69$, 29%) fueron altamente comórbidos y compartieron comorbilidades con el trastorno internalizado del DSM-IV y el trastorno de desregulación del DSM-5. Sin embargo, el DTD, pero no el TEPT, se asoció a comorbilidad con trastorno de pánico y trastornos de la conducta disruptiva. Sobre una base multivariada incluyendo todos los probables trastornos del DSM-IV y los trastornos de desregulación del DSM-5, el DTD se asoció con el trastorno de ansiedad por separación y con el trastorno de déficit atencional con hiperactividad luego de controlar el TEPT, mientras que el TEPT se asoció con la depresión mayor y el trastorno de ansiedad generalizada luego de controlar el DTD.

Conclusiones: Las comorbilidades del DTD se superponen con, pero se entienden más allá del TEPT para así incluir pánico, ansiedad de separación, y los trastornos de la conducta disruptiva. El DTD garantiza las investigaciones futuras como un potencial diagnóstico o una variante compleja del TEPT en niños, similar a los síntomas adultos de las perturbaciones en la auto-organización en el subtipo del TEPT Complejo propuesto del CIE-11.

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关键词

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HIGHLIGHTS

- Developmental trauma disorder (DTD) is a proposed complex post-traumatic stress disorder (PTSD) syndrome for children.
- Comorbidities that are unique to DTD or not associated with PTSD include panic, separation anxiety, and disruptive behaviour disorders.
- DTD may provide a new way to understand and treat traumatized children that is consistent with adult complex PTSD (CPTSD).

发展创伤障碍和创伤后应激障碍的共病：DTD现场试验的结果

背景：发展性创伤障碍（DTD）已被提议用于描述儿童时期接触人际受害的生物心理社会后遗症，这种后遗症超出了创伤后应激障碍（PTSD）的症状。

目的：描述DTD合并症的精神病理学特征，并确定它们是否区别并超过创伤后应激障碍的合并症。

方法：由儿科医生或心理医生转诊的236名儿童（7-18岁；50%女性）组成一个多区域的样本，通过结构化访谈评估DTD，并通过KSADS-PL筛查模块鉴定他们可能的DSM-IV精神疾病。

结果：DTD（N = 80，34%）和PTSD（N = 69，29%）高度共病，并且同时共病几种DSM-IV内化障碍和DSM-5失调障碍合并症。然而，DTD与共病惊恐障碍和破坏行为障碍有关，PTSD没有。在包括所有可能的DSM-IV障碍和DSM-5失调障碍的多变量分析中，在控制创伤后应激障碍后，DTD与分离焦虑症和注意力缺陷多动障碍相关；而在控制DTD后，PTSD与重度抑郁症和广泛性焦虑症相关。

结论：DTD的合并症与创伤后应激障碍的合并症重叠并超出其范围，包括惊恐障碍，分离焦虑和破坏性行为障碍。DTD值得进一步考查，作为儿童创伤后应激障碍的潜在诊断或复杂变异，类似于拟议的ICD-11 CPTSD亚型中自我组织紊乱的成人症状。

Abbreviations: ADHD, attention-deficit hyperactivity disorder; CD, conduct disorder; CPTSD, complex post-traumatic stress disorder; DSM, Diagnostic and Statistical Manual of Mental Disorders; DTD, developmental trauma disorder; DTD-SI, Developmental Trauma Disorder Semi-structured Interview; ICD, International Classification of Diseases; K-SADS-PL, Kiddie Schedule for Affective Disorders/Schizophrenia, Present/Lifetime version; ODD, oppositional defiant disorder; PTSD, post-traumatic stress disorder; SUD, substance use disorder; TESI, Traumatic Events Screening Inventory.

1. Introduction

A recent meta-analysis of data from 96 countries concluded that at least 50% of all children in Asia, Africa, and North America had experienced violence in the past year, which translates to more than 1 billion children globally who are victimized by violence (Hillis et al., 2017). Approximately two in every three children and adolescents in the USA have experienced violence or other forms of victimization (Finkelhor, Turner, Shattuck, & Hamby, 2015). Those samples were assessed for multiple types of violence or victimization ranging in severity from relatively mild (e.g. a fight with a same-age peer resulting in no physical injury) to severe (e.g. poly-victimization involving family and community violence and sexual abuse or exploitation). Although children may be adversely impacted by any form of victimization, subgroups who have the most severe cumulative exposure are at highest risk of significant negative biopsychosocial outcomes (Dierkhising, Branson, Ford, Grasso, & Lee, 2018).

Research consistently documents a strong association between exposure to childhood victimization and psychopathology (D'Andrea, Ford, Stolbach, Spinazzola, & van der Kolk, 2012; Norman et al., 2012; Teicher & Samson, 2013), accounting for an estimated 45% of the population attributable risk for childhood-onset psychiatric disorders including depression, anxiety, suicide attempts, psychosis, substance use disorders (SUDs), dysregulation disorders, and personality disorders (Green et al., 2010), as well as poorer treatment response (Nanni, Uher, & Danese, 2012; Ruf et al., 2010; Shenk, Dorn, Kolko, Rausch, & Insana, 2014). The economic toll of

childhood fatal and non-fatal maltreatment in the USA in 2008 was estimated by the Centers for Disease Control to be \$124 billion (Fang, Brown, Florence, & Mercy, 2012).

Traumatically victimized children are at risk not only for post-traumatic stress disorder (PTSD), but also for multiple internalizing and externalizing psychiatric disorders (Briggs-Gowan et al., 2010; Copeland, Keeler, Angold, & Costello, 2007). A substantial subgroup (approximately 25%) of children receiving outpatient mental healthcare report multiple types of potentially traumatic victimization and receive multiple psychiatric diagnoses (Ford, Wasser, & Connor, 2011; Kretschmar, Tossone, Butcher, & Flannery, 2017). Exposure to interpersonal violence is uniquely associated with externalizing behaviour problems in both community and clinical populations, and may also account for the relationship between non-interpersonal trauma and psychiatric morbidity with internalizing psychopathology (Briggs-Gowan et al., 2010; Ford, Gagnon, Connor, & Pearson, 2011b). Youths with psychiatric diagnoses also are at subsequent risk for multiple forms of trauma exposure and victimization (Cuevas, Finkelhor, Ormrod, & Turner, 2009; McLaughlin et al., 2013). Moreover, the number and complexity of symptoms and diagnoses in childhood increase significantly if multiple forms of traumatic victimization have occurred, i.e. chronically poly-victimized (Terr's type II) versus single type/incident trauma exposure (Terr's type I) (Terr, 1991; Finkelhor, Ormrod, & Turner, 2007; Ford, Elhai, Connor, & Frueh, 2010; Gustafsson, Nilsson, & Svedin, 2009; Holt, Finkelhor, & Kantor, 2007). Further, when primary caregiving relationships are disrupted as a result

of caregiver impairment or multiple out-of-home placements (Fischer, Dolitzsch, Schmeck, Fegert, & Schmid, 2016; Ford, Connor, & Hawke, 2009), as many as 30–50% of these children are poly-victims and receive multiple psychiatric diagnoses, yet few (< 5%) are identified with PTSD by clinical or research diagnostic criteria. Thus, the combination of interpersonal victimization and disrupted primary caregiving is associated with complex paediatric psychiatric morbidity (D'Andrea et al., 2012).

Children who receive multiple diagnoses as a result of complex emotional and behavioural problems often are refractory to focal treatment regimens and receive costly and fragmented multiple-component treatment regimens (Comer, Olfson, & Mojtabai, 2010; Grella & Joshi, 2003; Lau & Weisz, 2003; Mojtabai & Olfson, 2010; Mueser & Taub, 2008; Saldana et al., 2014). Poly-pharmacological and/or poly-psychotherapeutic treatment is at best only partially and temporarily effective with chronic and severe psychiatric disorders (Grella & Joshi, 2003; Holtmann et al., 2011; Jacobs et al., 2008; Jucksch et al., 2011) and may lead to severe adverse reactions (Barbui et al., 2007; Luo, Cappelleri, & Frush, 2007; Schorr, Loonen, Brouwers, & Taxis, 2008). Treatment targeted to address trauma-related symptoms could provide a complementary or alternative approach for poly-victimized and poly-diagnosed children and adolescents (D'Andrea et al., 2012). Targeted therapies are emerging for these children and adolescents (Ford & Courtois, 2013) and show promise in observational studies (Dorsey et al., 2017; Harvey & Taylor, 2010) and preliminary efficacy trials (Ford, Grasso, Levine, & Tennen, 2018; Ford, Steinberg, Hawke, Levine, & Zhang, 2012; Lowell, Carter, Godoy, Paulicin, & Briggs-Gowan, 2011; Murray et al., 2015; Pfeiffer, Sachser, Rohlmann, & Goldbeck, 2018; Ruf et al., 2010; Spinhoven, Slee, Garnefski, & Arensman, 2009). However, these studies use a wide variety of clinical criteria and assessment measures to identify participants and monitor outcome, making it difficult to compare the findings and make progress towards evidence-based treatments. Establishing a single integrative set of clinical criteria that can be operationalized by a validated assessment protocol could greatly enhance this research, and that is the goal of the present study.

The empirically guided refinements and elaboration of the criteria for PTSD in adults (Weathers, 2017) and young children (Scheeringa, Myers, Putnam, & Zeanah, 2012) in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) provide a potential framework for addressing complex biopsychosocial sequelae that were not previously included in the PTSD diagnosis. However, evidence supporting the establishment of a complex subtype of PTSD in adults (Brewin et al., 2017) and

children (Sachser, Keller, & Goldbeck, 2017) suggests that a parallel complex subtype may be warranted to fully assess the complex sequelae of poly-victimization in childhood and adolescence. Many poly-victimized children do not meet criteria for PTSD despite having severe internalizing and externalizing problems (D'Andrea et al., 2012). The absence of a focal clinical/conceptual framework and comprehensive yet efficient assessment measures to characterize the complex sequelae of traumatic victimization in children has limited the development and testing of targeted therapies for poly-victimized children and adolescents (Ford, 2015).

Therefore, based on a review of the research on the childhood sequelae of severe and chronic exposure to interpersonal violence and impaired primary caregivers (D'Andrea et al., 2012), developmental trauma disorder (DTD) was formulated (van der Kolk, 2005). Consistent with the results of an international survey of clinicians (Ford et al., 2013), DTD was operationalized as 15 symptoms in three biopsychosocial domains: (1) emotion and somatic; (2) cognition and behaviour; and (2) self and relationships. This structure parallels that proposed for adults in the complex post-traumatic stress disorder (CPTSD) symptom domains of 'disturbances of self-organization', which identify problems of emotion regulation, cognitive distortions, and behavioural and interpersonal problems that are distinct from the symptoms of traditional [Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV)] PTSD (Karatzias et al., 2017; Murphy, Elklit, Dokkedahl, & Shevlin, 2016; Shevlin et al., 2017, 2018).

The present study extends initial findings from a field trial with children in mental health or paediatric treatment that evaluated the psychometrics of a structured interview for DTD (Ford, Spinazzola, van der Kolk, & Grasso, 2018) and demonstrated that DTD and PTSD share many trauma antecedents but also each have distinct unique trauma history profiles (Spinazzola, van der Kolk, & Ford, 2018). The key question addressed here is whether DTD and PTSD have distinct patterns of psychiatric comorbidity. If DTD can be shown to have psychiatric comorbidities different from or independent of PTSD's comorbidities, DTD may have incremental clinical utility by identifying psychiatrically impaired children who do not meet criteria for PTSD but could benefit from trauma-focused treatment. On the other hand, if DTD has no unique psychiatric comorbidities independent from those associated with PTSD, this would suggest that PTSD is sufficient as a means of identifying psychiatrically impaired children who are traumatized, including poly-victims. That also would be consistent with a view that DTD is reducible to PTSD plus psychiatric comorbidities, as has been proposed

for adult complex trauma survivors (De Jongh et al., 2016; Resick et al., 2012).

2. Method

2.1. Participants and procedure

A convenience sample of families of 236 children age 7–18 years ($M = 12.1$, $SD = 3.0$; 50% female) from varied ethnocultural backgrounds (51% white non-Hispanic, 30% black, 16% Latino/Hispanic; 3% Asian American) was recruited by announcing the study to mental health, social work, and paediatric practitioners and agencies at sites in three geographical regions in the USA (Northeast, Mid-Atlantic, South, and Midwest), which represented a mix of urban, suburban, and rural communities. Parent/guardian consent and youth assent were obtained with a protocol approved by the [University of Connecticut Health Center] institutional review board (IRB) and the local site IRB or institutional research review authority. Interviewers received training on administering all measures and were required to demonstrate calibration with master raters prior to conducting study interviews. Interviews were conducted with either the parent alone (53%), or the child alone (only for 10–17-year-olds; 8%), or the parent and child together (39%); in the last case, each index trauma event or symptom was considered present if endorsed by either respondent.

Participating children were receiving psychiatric care from a psychologist, psychiatrist, psychiatric social worker, or counsellor in an outpatient setting ($N = 189$, 80%) or residential treatment ($N = 23$, 10%), or were recruited in community sites or by paediatric healthcare professionals ($N = 24$, 10%). The providers invited the parent and child to participate in ‘a research study on children’s life experiences and socio-emotional adjustment.’ A majority of participating children (78%) were not living with both birth parents; instead, they were living in a step-family (30%), foster or adoptive family (19%), or a residential facility (29%). Almost all (91%) reported at least one type of past trauma/adversity: traumatic separation of loss (73%), mentally ill primary caregiver (48%), family violence (47%), severe neglect (43%), emotional abuse (28%), family member arrested (25%), sexual trauma (21%), witnessing community violence (17%), and non-interpersonal traumas (e.g. severe accident, illness, or disaster, 61%) Ford, Spinazzola, & van der Kolk, 2018.

Interviewers at all sites received training with a simulated demonstration interview conducted by expert assessors for each study interview protocol (see below). Interviewers then independently rated videotaped interviews with > 80% agreement with

expert ratings required before progressing to a third preparation phase of conducting and scoring a role-play videotaped complete assessment interview. A cross-site assessment supervisor independently scored the taped role-play interviews, with > 80% agreement on all measures required before the interviewer was qualified to conduct study interviews. The first two complete study interviews by each interviewer were taped and reviewed independently by master assessors, and additional externally reviewed interviews were required if < 80% agreement was achieved between the interviewer and master assessor. After these initial calibration interviews, randomly selected study interviews (i.e. 5% of all interviews) were independently rated by a master assessor to measure inter-rater reliability across the full set of study interviews at University of Connecticut Health Center.

2.2. Measures

2.2.1. Developmental Trauma Disorder Semi-structured Interview (DTD-SI)

Previously reported analyses with the current sample have demonstrated the internal consistency and inter-rater reliability, and structural, convergent, and construct validity of the 15-symptom DTD-SI version 10.0 (Ford et al., 2018) (Table 1). Additional analyses showed that DTD and PTSD were both associated with physical assault/abuse, family violence, emotional abuse, neglect, and impaired caregivers, but after accounting for the effects of PTSD, DTD was uniquely associated with exposure to interpersonal (family or community) violence and impaired primary caregivers (Spinazzola et al., 2018). Criterion A for developmental trauma exposure therefore required a history of exposure to traumatic violence and impaired primary caregiver(s). Based on analyses of symptom counts optimally related to psychosocial impairment (Ford, Spinazzola, et al., 2018), DTD required three (of four possible) Criterion B (affect and physiological dysregulation) symptoms, two (of five possible) Criterion C (cognitive and behavioural dysregulation) symptoms, and two (of six possible) Criterion D (self and relational dysregulation in the past month with clinically significant psychosocial impairment).

2.2.2. Traumatic Events Screening Inventory (TESI)

The TESI is a semi-structured interview (<https://www.ptsd.va.gov/professional/assessment/child/tesi.asp>) that assesses 23 behaviourally anchored types of stressors. Items were added to the TESI to assess unexpected death of or suicide attempt/non-suicidal self-injury by someone close, a primary caregiver impaired by psychiatric disorder or substance use, emotional abuse, and neglect. Items are scored dichotomously and combined into composite categories: non-interpersonal

Table 1. Developmental trauma disorder (DTD) criteria.

- Criterion A: lifetime contemporaneous exposure to both types of developmental trauma
 - A1: interpersonal victimization: victim of or witness to physical or sexual assault or abuse, or witness to domestic/adult intimate partner violence;
 - A2: primary caregiver attachment disruption: prolonged separation from or neglect or verbal/emotional abuse by a primary caregiver.
- Criterion B (current emotion or somatic dysregulation, 4 items; 3 required for DTD)
 - B1: Emotion dysregulation (either B1.a. extreme negative affect states; or B1.b. impaired recovery from negative affect states)
 - B2: Somatic dysregulation (either B2.a. aversion to touch; or B2.b. aversion to sounds; or B2.c. somatic distress/illness that cannot be medically explained/resolved)
 - B3: Impaired access to emotion or somatic feelings (either B3.a. absence of emotion; or B3.b. physical anaesthesia that cannot be medically explained/resolved)
 - B4: Impaired Emotion or Somatic Verbal Mediation/Expression (either B4.a. alexithymia; or B4.b. impaired ability to recognize/express somatic feelings/states)
- Criterion C (current attentional or behavioural dysregulation, 5 items; 2 required for DTD)
 - C1: Attention bias towards or away from threat (either C1.a. threat-related rumination; or C1.b. hyper- or hypo-vigilance to actual or potential danger)
 - C2: Impaired self-protection (either C2.a. extreme risk-taking or recklessness; or, C2.b. intentional provocation of conflict or violence)
 - C3: Maladaptive self-soothing
 - C4: Non-suicidal self-injury
 - C5: Impaired ability to initiate or sustain goal-directed behaviour
- Criterion D (current relational- or self-dysregulation, 6 items; 2 required for DTD)
 - D1: Self-loathing, including self viewed as irreparably damaged and defective
 - D2: Attachment insecurity and disorganization (either D2.a. parentified over-protection of caregivers; or D2.b. difficulty tolerating reunion following separation from primary caregiver(s))
 - D3: Betrayal-based relational schemas (either D3.a. expectation of betrayal; or D3.b. oppositional-defiance based on expectation of coercion or exploitation)
 - D4: Reactive verbal or physical aggression (including proactive instrumental aggression that is motivated primarily by preventing/responding to harm/injury)
 - D5: Impaired psychological boundaries (either D5.a. promiscuous enmeshment; or D5.b. craving for reassurance)
 - D6: Impaired interpersonal empathy (either D6.a. lacks empathy for, or intolerant of, others' distress; or D6.b. excessive responsiveness to the distress of others)

trauma (i.e. severe accidents, illnesses, or disasters witnessed or directly experienced; animal attacks); four types of interpersonal trauma (i.e. physical abuse or assault; sexual abuse or assault; family violence; community violence), and four types of primary attachment adversity (i.e. traumatic loss due to death of or prolonged separation from primary caregiver(s) or other primary support relationships; primary caregiver(s) impaired by behavioural health problems; emotional abuse; severe neglect). TESI items have shown evidence of retest reliability and criterion/predictive validity with similar-age youths (Daviss et al., 2000, 2000). Twenty TESI items represent six composite types of traumatic stressors that qualify for Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision (DSM-IV-TR) (American Psychiatric Association, 2000) PTSD Criterion A1 (actual or threatened death or serious injury, or violation of bodily integrity). Three other TESI items refer to types of victimization or adversity (emotional abuse, neglect, primary caregiver impaired by mental illness) that do not meet Criterion A1 but were included to represent a full range of types of victimization assessed in prior studies of poly-victimization. TESI items were coded as having occurred only if the respondent met Criterion A2 (i.e. subjective reaction of intense fear, helplessness, or horror) on a follow-up probe to endorse events. Inter-rater agreement was acceptable for each of the nine TESI composite scores ($\kappa = .67-1.00$).

2.2.3. Kiddie Schedule for Affective Disorders and Schizophrenia, Present/Lifetime version (K-SADS/PL)

The K-SADS/PL is a validated (Jarbin, Andersson, Rastam, & Ivarsson, 2017) semi-structured clinical research interview that assesses DSM-IV child psychiatric disorders with separate versions for child self-report and parent report (Kaufman et al., 1997). PTSD symptoms and diagnoses were ascertained using the K-SADS module for PTSD. The index child's other internalizing and externalizing disorders were identified as probable versus absent using K-SADS screening questions for: major depressive disorder, bipolar disorder, psychotic disorder, panic disorder, generalized separation anxiety disorder, phobia, eating disorder, SUD, attention-deficit hyperactivity disorder (ADHD), oppositional-defiant disorder (ODD), and conduct disorder (CD). Inter-rater reliability was acceptable for PTSD diagnosis ($\kappa = 1.00$) and for K-SADS positive screens for each DSM-IV psychiatric disorder ($\kappa = .78-1.00$, $Mdn = .87$).

2.2.4. DSM-5 regulatory disorders

DSM-5 diagnostic criteria for the following disorders were rated by interviewers (on checklists created using the exact symptom definitions in the DSM-5 for each disorder) on a subset of 67% ($N = 155$) participants: disinhibited social engagement disorder ($N = 7$; 4.5% of this subsample), disruptive mood dysregulation disorder ($N = 11$, 7%), non-suicidal self-injury ($N = 9$, 6%), and reactive attachment

disorder ($N = 8$, 5%). Overall, 27 (15%) of this subsample met criteria for at least one DSM-5 regulatory disorder. Inter-rater reliability for the presence of a DSM-5 regulatory disorder was $\kappa = 1.00$.

2.3. Statistical analyses

Descriptive statistics were used to characterize the sample and key study variables, followed by bivariate cross-tabulation analyses with odds ratios (ORs) and 95% confidence intervals (CIs) to examine unadjusted associations of age, gender, ethnicity, and family status with DTD, PTSD, and the trauma history variables. Unadjusted ORs and 95% CIs were calculated for DTD and PTSD with each K-SADS diagnosis. Multivariate logistic regression analyses then were used to test the simultaneous associations of all K-SADS DSM-IV diagnoses with DTD and PTSD, adjusting for the effects of the other disorder (i.e. controlling for PTSD in analyses with DTD as outcome, and controlling for DTD in analyses with PTSD as outcome).

3. Results

3.1. Descriptive statistics for DTD and K-SADS and DSM-5 diagnoses

Approximately one in three participants met criteria for DTD, and slightly fewer than one in three met criteria for PTSD. One in five participants met criteria for DTD but not PTSD ($N = 47$, 20%), one in eight met criteria for PTSD but not DTD ($N = 30$, 13%), and one in six met criteria for both DTD and PTSD ($N = 39$, 16.5%). Age, gender, ethnicity, and whether the child lived with both birth parents were unrelated to the likelihood of either DTD or PTSD.

Participants screened positive on average for more than three diagnoses other than PTSD ($M = 3.70$, $SD = 2.66$; range = 0–7): ADHD ($N = 139$, 59%), major depression ($N = 131$, 55%), ODD ($N = 113$, 48%), generalized anxiety disorder ($N = 113$, 48%), separation anxiety disorder ($N = 95$, 40%), CD ($N = 72$, 30.5%), phobia ($N = 49$, 21%), bipolar disorder ($N = 43$, 18%), psychosis ($N = 37$, 16%), panic disorder ($N = 23$, 10%), eating disorder ($N = 20$, 8.5%), and SUD ($N = 13$, 6%). One in eight ($N = 28$, 12%) met criteria for at least one DSM-5 regulatory disorder.

Psychiatric diagnoses were largely unrelated to age (preteen vs adolescent), gender, ethnicity (black/Hispanic vs white), or whether the child was living with both birth parents. Exceptions included (see Supplemental Table): depression, panic disorder, and phobias were more likely among adolescents than children, while SUDs were more likely for adolescents; generalized anxiety disorder and eating disorders were more likely among girls than boys;

and children not living with both birth parents were more likely to have probable diagnoses of depression, ADHD, and CD (a similar pattern was marginally significant, $p < .08$, for separation anxiety disorder, phobias, and ODD).

3.2. Relationship of DTD and PTSD with K-SADS probable diagnoses

Children meeting criteria for DTD were approximately two to four times more likely than others to screen positive for every DSM-IV psychiatric disorder assessed except for eating disorders and SUD, and to meet criteria for at least one DSM-5 dysregulation disorder (i.e. non-suicidal self-injury, disruptive mood dysregulation disorder, disinhibited social engagement disorder, reactive attachment disorder) (Table 2). Similarly, PTSD was related to psychotic, affective, and anxiety disorders, and was associated with meeting criteria for at least one DSM-5 dysregulation disorder. However, unlike DTD, PTSD was unrelated to all externalizing disorders (i.e. ADHD, ODD, CD) and to panic disorder (Table 2).

3.3. Multivariate relationship of DTD and PTSD to K-SADS diagnoses

In a multivariate logistic regression analysis (Table 3), when DSM-IV psychiatric disorders (including PTSD) and DSM-5 dysregulation disorder were entered simultaneously into a regression analysis, children with DTD were more likely than other participants to meet criteria for separation anxiety disorder and ADHD [$\chi^2(12) = 46.26$, \log likelihood = 193.23, Nagelkerke $R^2 = .31$]. By contrast, when all DSM-IV psychiatric disorders, a DSM-5 dysregulation disorder, and DTD were entered simultaneously into a regression analysis (Table 3),

Table 2. Unadjusted relationship of developmental trauma disorder (DTD) and post-traumatic stress disorder (PTSD) with probable psychiatric diagnoses.

Comorbid diagnosis	DTD	PTSD
	OR (95% CI)	OR (95% CI)
Major depression	3.30 (1.86–5.87)	3.08 (1.66–5.71)
Bipolar disorder	2.67 (1.36–5.23)	2.56 (1.29–5.05)
Psychosis	3.55 (1.71–7.35)	3.15 (1.53–6.46)
Panic disorder	3.75 (1.52–5.43)	2.01 (0.83–4.83)
Separation anxiety disorder	3.81 (2.18–6.65)	2.37 (1.34–4.19)
Phobia	1.94 (1.02–3.66)	3.03 (1.58–5.82)
Eating disorder	1.32 (0.29–6.04)	1.85 (0.40–8.50)
Substance use disorder	1.53 (0.50–4.72)	1.55 (0.49–4.93)
Generalized anxiety disorder	3.30 (1.89–5.75)	2.79 (1.55–5.02)
ADHD	3.48 (1.92–6.30)	1.33 (0.75–1.38)
Oppositional defiant disorder	3.30 (1.89–5.75)	1.50 (0.86–2.64)
Conduct disorder	2.94 (1.66–5.22)	1.74 (0.96–3.15)
DSM-5 dysregulation disorder	2.65 (1.08–6.54)	3.35 (1.33–8.41)

ADHD, attention-deficit hyperactivity disorder; DSM-5, Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition; OR, odds ratio; CI, confidence interval.

$p < .05$ indicated in bold.

Table 3. Multivariate logistic regression analyses.

	β	SE	Wald <i>F</i>	df	<i>p</i>	OR	95% CI	
							Lower	Upper
Outcome variable: PTSD								
DTD	.892	.351	6.457	1	.011	2.441	1.226	4.858
Major depression	.733	.372	3.884	1	.049	2.082	1.004	4.318
Bipolar disorder	.314	.432	0.531	1	.466	1.422	0.618	3.192
Psychosis	.540	.435	1.341	1	.247	1.730	0.732	4.091
Panic disorder	-.315	.540	0.340	1	.560	1.776	0.616	5.124
Separation anxiety disorder	-.057	.376	0.023	1	.880	2.132	1.071	4.246
Phobia	.679	.412	3.015	1	.351	0.681	0.916	4.242
Generalized anxiety disorder	.908	.382	5.645	1	.018	2.479	1.172	5.243
ADHD	-.508	.377	1.601	1	.074	2.116	0.274	1.322
Oppositional defiant disorder	-.144	.367	0.127	1	.228	1.555	0.393	1.909
Conduct disorder	-.121	.373	0.092	1	.547	1.252	0.406	1.935
DSM-5 dysregulation disorder	.644	.465	1.918	1	.281	1.905	0.765	4.470
Outcome variable: DTD								
PTSD	.888	.350	6.442	1	.01	2.430	1.224	4.825
Major depression	.235	.361	0.421	1	.515	1.265	0.624	2.555
Bipolar disorder	.352	.425	0.687	1	.407	1.422	0.618	3.270
Psychosis	.548	.439	1.560	1	.212	1.730	0.732	4.091
Panic disorder	.574	.541	1.130	1	.288	1.776	0.616	5.124
Separation anxiety disorder	.757	.351	4.643	1	.031	2.132	1.071	4.246
Phobia	-.385	.412	0.871	1	.351	0.681	0.303	1.527
Generalized anxiety disorder	.209	.365	0.329	1	.566	1.233	0.603	2.519
ADHD	.750	.377	3.950	1	.047	2.116	1.010	4.433
Oppositional defiant disorder	.442	.367	1.451	1	.228	1.555	0.758	3.190
Conduct disorder	.225	.373	0.363	1	.547	1.252	0.603	2.600
DSM-5 dysregulation disorder	.509	.472	1.160	1	.281	1.653	0.659	4.195

All disorders other than post-traumatic stress disorder (PTSD) and developmental trauma disorder (DTD) are probable diagnoses based on Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS) screeners.

ADHD, attention deficit hyperactivity disorder; DSM-5, Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition; OR, odds ratio; CI, confidence interval.

p < .05 indicated in bold.

children with PTSD were more likely than other participants to meet criteria for generalized anxiety disorder and major depression [$\chi^2(12) = 40.01$, log likelihood = 181.32, Nagelkerke $R^2 = .28$]. Thus, although DTD and PTSD were interrelated independently of the effects of other DSM-IV or DSM-5 comorbidities, each disorder had a unique pair of primary psychiatric comorbidities: DTD comorbidity uniquely involved separation anxiety and ADHD, while PTSD comorbidity uniquely involved anxiety and affective symptoms.

4. Discussion

The study findings provide support for the study hypothesis that the proposed DTD syndrome is associated with pervasive psychiatric comorbidities that are distinct from those for PTSD. This finding suggests that, contrary to the position of sceptics who question the complex PTSD framework for adult trauma survivors (De Jongh et al., 2016; Resick et al., 2012), DTD does not seem to be reducible to a combination of PTSD plus psychiatric comorbidities. Instead, the study results suggest that DTD may co-occur with other psychiatric disorders in a subset of cases in which PTSD is not present. DTD thus cannot be explained simply as a variant of PTSD or any other disorder, and may complicate the symptoms and impairment of some children who are diagnosed

with psychiatric disorders but not recognized as trauma survivors owing to not meeting criteria for PTSD. Implications of these findings for research and practice will be discussed. The findings converge with those of an international survey of child-serving clinicians (Ford et al., 2013) to indicate that DTD may have clinical utility as a parsimonious integrative diagnostic framework that, in addition to PTSD, can inform clinical formulation and treatment planning for traumatically poly-victimized (Spinazzola et al., 2018) children and adolescents. Although comorbidity is common for most psychiatric disorders, what is unique about the current study's findings is that they show that DTD has comorbidities that cannot be accounted for by the comorbidities of PTSD. DTD thus potentially could enable clinicians to identify children and adolescents who could benefit from trauma-focused treatment who would be overlooked if only PTSD was considered as a basis for recommending that treatment. If those youths do not respond positively to evidence-based treatment for the comorbid diagnoses owing, at least in part, to untreated traumatic stress symptoms, this could add to the economic and social costs of their disorders as well as adversely impacting their health and quality of life. Research therefore is warranted to test whether identifying and treating DTD can enhance the psychosocial outcomes and reduce the costs of treatment for DTD's comorbid psychiatric disorders.

The psychiatric comorbidities associated with DTD but not PTSD – ADHD and separation anxiety disorder in multivariate analyses; ODD, CD, and panic disorder in bivariate analyses – suggest that DTD may play a role in the symptoms of a subgroup of children and adolescents who present with either externalizing or internalizing psychopathology. By contrast, PTSD was comorbid with two internalizing disorders independent of the effects of DTD: generalized anxiety disorder and major depressive disorder. Thus, although DTD and PTSD have comorbidities in common, their association with other psychiatric disorders is sufficiently distinct to indicate that DTD may offer an added approach to identifying poly-traumatized psychiatrically impaired children who might be missed if only PTSD is used as the basis for assessing the sequelae of trauma exposure. Whether DTD is better conceptualized and operationalized as a complex subtype of PTSD [as is proposed for the International Classification of Diseases, 11th revision (ICD-11) adult CPTSD subtype] (Brewin et al., 2017) or as a separate traumatic stress disorder apart from PTSD (as originally proposed for adult CPTSD) (Ford, 2017) was not addressed in this study and remains to be determined by future research.

The study findings may, however, shed light on the fundamental question of whether DTD can be justified as a distinct psychiatric syndrome. One argument against DTD is that its symptoms overlap with, and therefore may be explained by the presence of, other psychiatric disorders (Schmid, Petermann, & Fegert, 2013). Despite the evidence of comorbidity in the current study, DTD occurred with no psychiatric comorbidity for a subset of children and adolescents. DTD was particularly likely to co-occur only with a subset of the childhood psychiatric disorders studied (i.e. separation anxiety disorder, bipolar disorder, ADHD, ODD, CD, panic disorder), and contained symptoms not included in any of those disorders. Thus, although DTD had several psychiatric comorbidities, the study results indicate that DTD was not entirely reducible to any other disorder or combination of disorders. Instead, DTD identified subgroups in each of these psychiatric diagnostic cohorts who may warrant trauma-focused treatment in addition to treatment for their identified psychiatric disorder(s).

However, it is important to note that trauma-focused treatment may be beneficial with clients who have a history of exposure to traumatic stressors and do not meet criteria for PTSD but are experiencing emotional or behavioural symptoms that may be related to or exacerbated by their trauma history (Ford, 2018). Trauma exposure is a well-documented antecedent of many childhood psychiatric disorders (D'Andrea et al., 2012), so it is important not to overlook the potential impact of trauma history in

conducting assessment and providing treatment with children and adolescents who are identified with disorders other than PTSD or DTD. Although the current study focused on comparing the likelihood of different forms of psychiatric comorbidity among youths who did versus those who did not meet full criteria for DTD, youths who do not meet those full diagnostic criteria may have symptoms of DTD that could warrant trauma-focused treatment. The study findings therefore should not be assumed to imply that trauma-focused assessment and treatment are indicated only if full DTD co-occurs with other psychiatric disorders. Indeed, a potential clinical implication of the study findings, which warrants empirical testing in future research, is that the provision of evidence-based trauma-focused treatment designed to address clinically identified DTD symptoms (Ford, Blaustein, Habib, & Kagan, 2013) may enhance the outcome of other evidence-based treatments for children and adolescents who have developmental trauma histories and other psychiatric disorders.

An additional related criticism of both PTSD and DTD is that these syndromes' purported trauma-based aetiology oversimplifies the complex biopsychosocial origins of psychopathology (Schmid et al., 2013). Specifically, the putative symptoms of PTSD or DTD may occur in the absence of any trauma history, or, in the case of DTD, as sequelae of traumatic stressors that do not include interpersonal victimization and impaired caregivers. Prior analyses with this data set showed that symptoms qualifying for a diagnosis of DTD were unlikely to occur in the absence of a history of traumatic exposure to family and community violence or impaired caregivers, and most likely to occur when both had occurred, independent of the presence of PTSD (Spinazzola et al., 2018). This does not prove causal aetiology, but instead suggests that a history of the hypothesized pattern of victimization plus disrupted primary caregiver bonding may place children at risk for symptoms constituting DTD.

The comorbidity findings reported here further demonstrate that the traumatic antecedents and symptoms proposed to constitute DTD are associated with a pattern of comorbidity that involves internalizing and externalizing disorders for which exposure to traumatic stressors is not generally considered an aetiological factor (D'Andrea et al., 2012). These findings neither presuppose that, nor test whether, this profile of traumatic antecedents is the cause of DTD and its distinct psychiatric comorbidities. Instead, the comorbidity findings indicate that children with externalizing disorders or internalizing (panic/separation anxiety) disorders may benefit from a thorough assessment of trauma history and of DTD symptoms to identify a potential subgroup who are experiencing clinically significant trauma-related symptoms and

who might benefit from trauma-focused treatment yet otherwise may be overlooked. This would in no way rule out other aetiological factors for those disorders, nor would it contraindicate the provision of evidence-based treatment for the 'primary' psychiatric disorder. Instead, identifying children who meet criteria for DTD in addition to other psychiatric disorders would open the door to trauma-focused treatment for that subgroup, in the context of a multi-syndrome and multi-disciplinary treatment plan (Schmid et al., 2013).

Study findings regarding the comorbidities of DTD that are either not shared by PTSD or independent of their relationship to PTSD are consistent with extensive prior research. With regard to the externalizing disorder comorbidities of DTD (ADHD, ODD, CD), externalizing behaviour problems have been linked empirically to cumulative exposure to violence (Alvarez-Lister, Pereda, Abad, & Guilera, 2014; Briggs-Gowan et al., 2010; Cudmore, Cuevas, & Sabina, 2015; du Plessis, Kaminer, Hardy, & Benjamin, 2015; Ford et al., 2010, 2011; Greger, Myhre, Lydersen, & Jozefiak, 2015; Horan & Widom, 2015; Shen, 2009; Turner, Shattuck, Finkelhor, & Hamby, 2015), including childhood maltreatment (Boden, Fergusson, & Horwood, 2010; Ford, Gagnon, Connor, & Pearson, 2011a; Ford et al., 1999; Greger et al., 2015; Horan & Widom, 2015; Lewis et al., 2015; Shen, 2009; Simmel, Brooks, Barth, & Hinshaw, 2001), family violence (Briggs-Gowan et al., 2010; Ford et al., 2011a, 1999; Lewis et al., 2015; Shen, 2009), community violence (Borofsky, Kellerman, Baucom, Oliver, & Margolin, 2013; Briggs-Gowan et al., 2010; Cecil, Viding, Barker, Guiney, & McCrory, 2014; Ford et al., 2011a; Ford, Hartman, Hawke, & Chapman, 2008; Ford et al., 1999; Javdani, Abdul-Adil, Suarez, Nichols, & Farmer, 2014; Lambert, Boyd, Cammack, & Ialongo, 2012; Lewis et al., 2015), and maladaptive parenting (Briggs-Gowan et al., 2010; Horan & Widom, 2015; Logan-Greene & Semanchin Jones, 2015; Maguire et al., 2015; Moffitt et al., 2008). With regard to internalizing disorders, victimization is associated with separation anxiety disorder (Battaglia, Ogliari, D'Amato, & Kinkead, 2014; Silove et al., 2015) and panic disorder (Battaglia et al., 2014; Ural, Belli, Akbudak, & Tabo, 2015) (Liu, Sareen, Bolton, & Wang, 2015). Thus, for the subgroup of children with these disorders who have experienced victimization and impaired primary caregivers, but do not meet criteria for PTSD, DTD may provide a framework for targeting trauma-focused treatment.

4.1. Limitations

Study limitations should be considered when interpreting the results. The convenience sample is not representative of community populations of children,

with an over-representation of children with extensive trauma histories in mental health treatment. Therefore, comorbidity profiles documented here cannot be assumed to apply to other populations, and research is needed with samples that are representative of a range of clinical and community populations to more definitively determine the comorbidities of DTD.

Assessment of psychiatric diagnoses, while conducted with a well-validated and widely used semi-structured interview measure, used the full diagnostic module only for PTSD and positive screen findings for all other DSM-IV diagnoses. The resultant estimates of diagnostic occurrence and comorbidity are likely to have good sensitivity but may be inflated (i.e. reduced specificity) owing to instances in which children were positive for a probable diagnosis despite not meeting full diagnostic criteria. The K-SADS screening items were found to correctly identify more than 85% of childhood cases of depression (Lauth et al., 2010) and ADHD (Rucklidge, 2008), but as many as one in four positive screens did not meet full diagnostic criteria. Replication of the current findings with full diagnostic ascertainment of comorbidities is an important future direction. DSM-5 dysregulation disorder assessment required assessors to apply the criteria without the benefit of a semi-structured interview protocol, although they were assessed using the exact DSM-5 diagnostic criteria. The traumatic victimization variable was assessed by retrospective self-report in a cross-sectional design without the prospective longitudinal data necessary to establish the timing and sequence of symptoms/impairment and victimization (Schmid et al., 2013) or external corroboration, although a widely used and well-validated trauma history interview was utilized. Replication is therefore needed with similar and different populations, trauma histories that are externally corroborated, and validated diagnoses.

4.2. Conclusion

DTD warrants further study as a developmentally sensitive extension of PTSD for poly-victimized and poly-diagnosed children, paralleling the adult disturbances in self-organization proposed for CPTSD in the ICD-11. DTD's comorbidities that are distinct from those of PTSD suggest that subgroups of children diagnosed with externalizing and internalizing disorders who do not meet criteria for PTSD nevertheless may warrant assessment and treatment for trauma-related symptoms that extend beyond PTSD. With further research, DTD may offer an integrative clinical framework for assessing and treating poly-traumatized children that is aimed at enhancing cognitive, behavioural, relational, and arousal/affective

self-regulation, consistent with the conclusion by Appleyard and colleagues that: in ‘comprehensive prevention and early intervention efforts with high-risk children, ... every risk factor we can reduce matters’ (Appleyard, Egeland, van Dulmen, & Sroufe, 2005, p. 235).

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