


Toward an empirically based Developmental Trauma Disorder diagnosis and semi-structured interview for children: The DTD field trial replication

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Abstract

Objective: Developmental trauma disorder (DTD) is a childhood psychiatric syndrome designed to include sequelae of trauma exposure not fully captured by PTSD. This study aimed to determine whether the assessment of DTD with an independent sample of children in mental health treatment will replicate results from an initial validation study.

Methods: The DTD semi-structured interview (DTD-SI) was administered to a convenience sample in six sites in the United States (N = 271 children in mental health care, 8–18 years old, 47% female, 41% Black or Latinx) with measures of trauma history, DSM-IV PTSD, probable DSM-IV psychiatric diagnoses, emotion regulation/dysregulation, internalizing/externalizing problems, and quality of life. Confirmatory factor (CFA) and item response theory (IRT) analyses tested DTD's structure and DTD-SI's information value. Bivariate and multivariate analyses tested DTD's criterion and convergent validity.

Results: A three-factor solution (i.e., emotion/somatic, attentional/behavioral, and self/relational dysregulation) best fit the data (CFI = 0.91; TLI = 0.89; BIC = 357.17; RMSEA = 0.06; SRMR = 0.05). DTD-SI items were informative across race/ethnicity, gender, and age with three exceptions. Emotion dysregulation was the most informative item at low levels of DTD severity. Non-suicidal self-injury was rare but discriminative in identifying children with high levels of DTD severity. Results supported the criterion and convergent validity of the DTD construct.

Conclusion: This replication provides empirical support for DTD as a construct and potential psychiatric syndrome, and the DTD-SI's validity as a clinical research tool.

KEYWORDS

traumatic stress, children, assessment, diagnosis, psychometrics

1 | INTRODUCTION

Children who experience severe threat and deprivation are at risk for internalizing (e.g., anxiety and depression), externalizing (e.g., aggression and delinquency), somatic (e.g., unexplained pain and illness), neurodevelopmental (e.g., attentional and learning), and dyscontrol (e.g., mania and psychosis) disorders as well as post-traumatic stress disorder (PTSD).^{1,2} Existing categorical psychiatric diagnoses offer only partial accounts of complex posttraumatic sequelae in children and adolescents.^{3,4} To address this dilemma, developmental trauma disorder (DTD) was developed, to “see anew something that has been there before them all along”⁵ (p. 295).

DTD was formulated to assess trauma-related symptoms traditionally assigned to psychiatric diagnoses other than PTSD. Both *ICD-11* CPTSD (by adding symptoms in the three Disturbances of Self Organization [DSO] domains) and *DSM-5* PTSD increased the heterogeneity of PTSD diagnosis from prior versions (e.g., *DSM-IV*), and DTD represents a logical extension consistent with research showing that post-traumatic sequelae include symptoms that span several transdiagnostic spectra.^{1,6,7} DTD involves a complex combination of both symptoms (e.g., alexithymia, somatization, reactive aggression, and self-harm) and traits (e.g., intolerance of negative affect; preoccupation with or avoidance of threat; deficit-based self-perception; callousness or empathic over-involvement), consistent with transdiagnostic psychopathology models.⁸ Although conceptualized as a categorical psychiatric syndrome, DTD adopts a hybrid approach aligned with a transdiagnostic framework. Based on evidence that trauma-related symptoms span the fear, thought disorder, and internalizing/distress transdiagnostic spectra,⁶ DTD’s three dysregulation domains include symptoms from each of those spectra. Additionally, DTD includes externalizing (antagonistic, disinhibited) spectra symptoms related to childhood victimization,¹ which PTSD omits.⁶

DTD extends current PTSD conceptualizations by including symptoms that are not assessed in *DSM-5* PTSD (i.e., somatic dysregulation and impaired self-protection) or *ICD-11* CPTSD (i.e., betrayal schemas, self-soothing, impaired empathy, and alexithymia). Emotion dysregulation is integral to DTD because it is a core sequelae childhood exposure to threat and deprivation^{1,9} and a central feature in transdiagnostic networks of psychopathology.¹⁰ Emotion dysregulation is not explicitly included in *DSM-5* PTSD, but is prominent in *ICD-11* CPTSD. DTD includes somatic forms of emotion dysregulation that are absent from CPTSD owing to their network centrality with traumatized children.¹¹ Also, *DSM-5* PTSD and *ICD-11* CPTSD omit an important form of emotion dysregulation, alexithymia.¹²

Significant Outcomes

- Developmental trauma disorder’s validity and potential utility as a unifying diagnosis for traumatized children distinct from PTSD was supported in this replication study.
- The structured interview for developmental trauma disorder was shown to provide a psychometrically robust assessment for psychiatric research and clinical practice.
- Emotion dysregulation was the most informative structured interview item at low levels of DTD severity. Non-suicidal self-injury was rare but strongly discriminative in identifying children with high levels of DTD severity.

Significant Limitations

- Study participants were a convenience sample of children in mental health treatment.
- Participants were solely from the United States, although from several regions and both rural and urban communities with diverse ethnocultural backgrounds.
- Validation data were obtained only from a subset of participants.

In the relational dysregulation domain, both *DSM-5* PTSD and *ICD-11* CPTSD assess only detachment and withdrawal. DTD incorporates a broader range of relational problems consistent with transdiagnostic formulations⁸: separation anxiety (i.e., attachment insecurity/disorganization¹³—DTD symptom D2) and intimacy avoidance (i.e., expectancy of betrayal¹⁴—DTD symptom D3). In the behavioral dysregulation domain, reactive aggression (symptom D4)¹⁵ and maladaptive self-soothing (symptom C3) and self-injury (symptom C4)¹⁶ are included in DTD (unlike *ICD-11* CPTSD) based on an association with childhood victimization⁹ and because they represent antagonistic and disinhibited externalizing problems, respectively, in the transdiagnostic HiTOP (the Hierarchical Taxonomy of Psychopathology) paradigm that has been proposed as a dimensional alternative to categorical conceptualizations of psychopathology.⁸ In the attentional domain, DTD extends the *DSM-5* and *ICD-11* PTSD constructs of hypervigilance by explicitly assessing inattention to danger as well as preoccupation with threat (DTD symptom C1), based on transdiagnostic research demonstrating that anxious children exhibit attention bias away from as well as toward threat.¹⁷

A final consideration in defining DTD was the role of dissociation, which is an optional sub-type (but not a core symptom) in *DSM-5 PTSD*¹⁸ and is excluded from both *ICD-11 CPTSD*¹⁹ and transdiagnostic formulations (except somatoform conversion in *ICD-11*).⁸ In DTD, dissociation is an emotion dysregulation symptom based on evidence that dissociation mediates relationships between cumulative trauma and internalizing and externalizing disorders among sexually abused children²⁰ and is a risk for suicide attempts in traumatized children.²¹

DTD symptoms were identified in an international survey of clinicians²²⁻²⁶ as relevant for children with multiple psychiatric disorders^{27,28} in order to facilitate targeted trauma-focused treatment. DTD was designed to identify specific symptoms of trauma-related dysregulation that otherwise would lead to psychiatric treatments but, unless PTSD also was diagnosed, would not lead clinicians to provide trauma-focused treatment. Based on a literature review⁷ and results of the survey study, a semi-structured interview (DTD-SI) was developed to assess the three biopsychosocial domains of dysregulation (i.e., affective/physiological [Criterion B], cognitive/behavioral [Criterion C], and relational/self [Criterion D]; see Table 1) that have been shown across multiple research studies to be sequelae of childhood traumatization.⁷

An initial field trial study was conducted and provided support for the DTD-SI's psychometric integrity²⁹ and DTD's syndromal validity. Specifically, the initial field trial's results confirmed the DTD-SI's item-level temporal and inter-rater reliability, informativeness, and absence (with one exception) of demographic bias, and (b) DTD construct factor structure, unidimensionality, and convergent and discriminant validity. The hypothesized three domains of dysregulation (affective/physiological, cognitive/behavioral, and relational/self) provided the best fitted structural model in a confirmatory factor analysis. Additionally, as hypothesized, *independent of the effects of PTSD*, DTD was shown to be associated with past victimization (i.e., community or family violence) and attachment disruption (i.e., impaired caregivers),³⁰ as well as with probable diagnoses of internalizing (i.e., separation anxiety and panic) and externalizing (i.e., oppositional defiant and conduct) disorders.³¹

1.1 | Aims of the current study

Given the importance of replication in science and psychiatric research, the current study was designed as an independent replication of the initial DTD field trial results. It was hypothesized that (1) the three-factor DTD

TABLE 1 Developmental trauma disorder (DTD) symptom criteria.

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|--|
| Criterion B (current emotion or somatic dysregulation, 4 items; 3 required for DTD) |
| B1: Emotion dysregulation |
| B2: Somatic dysregulation |
| B3: Impaired access to emotion or somatic feelings |
| B4: Impaired verbal mediation of emotion or somatic feelings |
| Criterion C (current attentional or behavioral dysregulation, 5 items; 2 required for DTD) |
| C1: Attention bias toward or away from threat |
| C2: Impaired self-protection |
| C3: Maladaptive self-soothing |
| C4: Non-suicidal self-injury |
| C5: Impaired ability to initiate or sustain goal-directed behavior |
| Criterion D (current relational- or self-dysregulation, 6 items; 2 required for DTD) |
| D1: Self-loathing or self-viewed as irreparably damaged and defective |
| D2: Attachment insecurity and disorganization |
| D3: Betrayal-based relational schemas |
| D4: Reactive verbal or physical aggression |
| D5: Impaired psychological boundaries |
| D6: Impaired interpersonal empathy |

hierarchical structure will be replicated, (2) DTD-SI items will be informative across race/ ethnicity, gender, and age, and (3) DTD criterion and convergent validity will be supported.

2 | MATERIALS AND METHODS

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human subjects/patients were approved by the University of Connecticut Health Center Institutional Review Board. Written consent was obtained by a parent or guardian for each child, and assent was obtained from all child participants.

2.1 | Sample and procedure

A convenience sample of 271 children in mental health treatment (ages 8–18 years old, $M = 12.1$, $SD = 2.9$; 47%

female; 53% White non-Hispanic, 31% Black or biracial, 10% Latinx; 6% Asian American or other) was recruited between October 2014 and November 2016 in six U.S. urban, suburban, and rural communities. Parent/guardian consent and child assent were obtained following an Institutional Review Board-approved protocol. Interviews were conducted with 152 parent-child dyads, 113 parents alone, and alone with six adolescents. One-third lived with both birth parents, one-third in step/foster/adoptive families, and one-third in out-of-home placements. Foster/adoptive parents were required to be knowledgeable of their child's full life history and to be the primary caregiver for a continuous period of sufficient length to complete all measures.

All children met criteria for at least one probable psychiatric diagnosis other than PTSD (Median = 4), including major depression ($N = 168$; 62%); generalized anxiety disorder ($N = 157$; 58%); ADHD ($N = 144$; 53%); oppositional defiant disorder, ODD ($N = 135$; 50%); separation anxiety disorder ($N = 121$; 45%); conduct disorder ($N = 65$; 24%); phobia ($N = 64$; 24%); bipolar disorder ($N = 41$; 15%); obsessive compulsive disorder ($N = 27$; 10%), psychotic disorder ($N = 26$; 10%), and eating disorder ($N = 15$; 6%).

Interviewers ($N = 25$) were trained with simulated expert interviews. Interviewers independently rated videotaped interviews until achieving >80% agreement with expert ratings, and conducted and rated role-play interviews until achieving >90% agreement with experts' reviews. Interviewers' first two study interview tapes were reviewed by an expert with >90% agreement required for calibration. A randomly selected set of 31 interviews with a parent/guardian only and 15 with a child was independently rated for reliability.

2.2 | Measures

2.2.1 | Developmental Trauma Disorder Semi-Structured Interview

The DTD-SI assesses 15 items in 30–45 minutes (13). In the current sample, inter-rater agreement of DTD-SI items was $M = 93.0\%$ for child interviews and 93.5% for parent interviews (Table 1). DTD cases ($N = 74$, 27%) were identified with the algorithm validated in the first DTD field trial²⁹: criterion B (≥ 3 of 4 symptoms); criteria C and D (≥ 2 of 5 or 6 symptoms, respectively). Alternative algorithms were tested with more conservative (≥ 3 symptoms) C or D criteria (i.e., DTD332 or DTD323), or a more liberal B criterion and conservative C and D criteria (i.e., DTD233).

2.2.2 | Traumatic experiences screening instrument

This semi-structured interview assesses lifetime history of eight types of non-interpersonal trauma and 13 types of traumatic interpersonal victimization (Table 2). Traumatic experiences screening instrument (TESI) items have demonstrated retest reliability (Kappa [K] = 0.50–0.70) and criterion and predictive validity.³² Inter-rater agreement for trauma types was $M = 97.7\%$ for child and 97.4% for parent/guardian-only interviews.

2.2.3 | Kiddie schedule for affective disorders and schizophrenia, present/lifetime version

This interview assesses *DSM-IV* child psychiatric disorders with child and parent versions.³³ The full PTSD module was used. Other disorders (Table 2) were identified as probable using KSADS screening questions. Inter-rater agreement for KSADS PTSD items was $M = 85.7\%$ for child interviews and 89.4% for parent/guardian-only interviews. Inter-rater agreement for probable KSADS diagnoses was $M = 88.8\%$ with children, and 89.6% with parents. An internally consistent ($\alpha = 0.79$) impairment index was calculated based on family, school, and peer functioning: 95% ($N = 258$) of participants were impaired in 1+ domain; 84% ($N = 228$) were impaired in all domains.

2.2.4 | Parent ratings

The *Child Behavior Checklist* (CBCL) dysregulation score was calculated as a sum of the anxiety/depression, attention problems, and aggression CBCL sub-scale T-scores.³⁴ Parents also rated their child's emotion-related capacities: (1) awareness/expression on the 14-item reliable ($\alpha = 0.94$) and validated *Children's Alexithymia Measure* (CAM)³⁵; and (2) dysregulation (10 items, $\alpha = .82$) and (3) adaptive regulation (14 items, $\alpha = .91$) on the reliable and validated *Children's Emotion Regulation Checklist* (ERC).³⁶ Parent ratings were obtained for $N = 81$ –89 cases.

2.2.5 | Child self-report measures

Children completed a 5-item version of the reliable ($\alpha = .73$) and cross-culturally validated Emotion Regulation Questionnaire.³⁷ Children also rated the reliable ($\alpha = 0.85$) and validated 15-item Pediatric Quality

TABLE 2 Descriptive statistics.

| Child and Parent Report Measures | N | Range | M[SD] |
|--|----------|----------|---------------|
| Child Emotion Regulation Questionnaire | 70 | 6–26 | 12.76[4.42] |
| Pediatric Quality of Life Questionnaire | 68 | 42–70 | 58.12[7.44] |
| Child Alexithymia Measure | 89 | 0–42 | 12.49[9.61] |
| Emotion Regulation Checklist Negative Scale | 93 | 14–42 | 24.31[8.01] |
| Emotion Regulation Checklist Adaptive Scale | 93 | 16–40 | 28.63[5.86] |
| Child Behavior Checklist Internalizing T-score | 82 | 33–81 | 56.89 [12.78] |
| Child Behavior Checklist Externalizing T-score | 82 | 33–82 | 54.48 [12.99] |
| Child Behavior Checklist Dysregulation T-score | 82 | 50–84 | 58.79 [9.15] |
| DSM-IV Probable Psychiatric Diagnoses | N | % | |
| Posttraumatic Stress Disorder | 107 | 39.5 | |
| Depression | 168 | 62 | |
| Bipolar Disorder | 41 | 15 | |
| Psychotic Disorder | 26 | 9.5 | |
| Panic Disorder | 28 | 10 | |
| Separation Anxiety Disorder | 121 | 44.5 | |
| Phobia | 64 | 23.5 | |
| Obsessive Compulsive Disorder | 27 | 10 | |
| Attention Deficit Disorder | 144 | 53 | |
| Oppositional defiant disorder | 136 | 50 | |
| Conduct disorder | 65 | 24 | |
| Eating Disorder | 15 | 5.5 | |
| Trauma History | N | % | |
| Non-Interpersonal Trauma | 153 | 56.5 | |
| Traumatic Loss | 171 | 63 | |
| Traumatic Separation from Caregiver | 109 | 40 | |
| Traumatic Caregiver Impairment | 154 | 57 | |
| Traumatic Neglect | 39 | 14.5 | |
| Traumatic Emotional Abuse | 53 | 19.5 | |
| Interpersonal Violence | 132 | 48.5 | |
| Family Violence | 88 | 32.5 | |
| Community Violence | 49 | 18 | |
| Sexual Trauma | 56 | 20.5 | |

of Life Enjoyment and Satisfaction Questionnaire (PQ-LES-Q³⁸). Owing to logistical limitations, child self-ratings were obtained only from a subset of participants

($N = 68$ – 70). However, these children did not differ demographically or diagnostically from the remaining sample.

2.3 | Statistical analyses

SAS 9.4 was used for all analyses in this project/study. There were no missing data on any study measure completed by participants. Confirmatory factor analysis was conducted ($N = 271$) with estimations using the CALIS procedure to test the hypothesized 3-factor DTD symptom structure (affect dysregulation: DTD-SI B1-B4; attention/behavioral dysregulation: DTD-SI C1-C5; self/relational dysregulation: DTD-SI D1-6) versus a 1-factor solution or a 4-factor hybrid solution modeled on the ICD-11 Complex PTSD diagnosis.¹⁹ The hybrid model was designed to be the closest approximation to the CPTSD domains that was possible using the 15 DTD symptoms. The hybrid factors were formed by grouping DTD symptoms consistent with the DSO domains of affect dysregulation (B1-B4 and C3-C4), impaired relationships (D2-D6), and altered self-perceptions (C2, D2), and a fourth factor composed of DTD symptoms that are not similar to DSO symptoms but are similar to the ITQ's PTSD avoidance and hypervigilance symptoms (C5 and C1, respectively). A 10-point lower BIC between non-nested models identified the statistically superior model with 150:1 odds.³⁹

Item response theory (IRT) analyses⁴⁰ considered two models: a 2-parameter logistic model and an unconstrained single-slope Rasch model.⁴¹ Differential item functioning (DIF) was assessed for age, race, and gender using Lord's chi-squared test.⁴² IRT model fitting was carried out with the *ltm* package and DIF model fitting was done with the *difR* package⁴³ in the statistical software R.

Criterion validity was tested with (1) *t*-tests comparing DTD cases versus non-cases on number of types of traumatic events and victimization traumas specifically; (2) linear regressions predicting impairment and psychiatric morbidity with the validated algorithm for DTD versus three alternative algorithms, controlling for PTSD diagnosis, KSADS diagnosis count, poly-victimization, and demographics. Convergent validity was tested with analyses of variance comparing DTD sub-groups on parent and child self-report measures.

3 | RESULTS

Descriptive statistics are summarized in Table 2. Most ($N = 259$; 95.5%) participants endorsed at least one past traumatic event (median = 4 trauma types [$M(SD) = 4.79$ (2.26)]). One in six (17%, $N = 47$) met criteria for

poly-victimization (i.e., ≥ 5 of 8 types of interpersonal trauma). One in four ($N = 74$, 27%) met DTD symptom criteria, and 39% ($N = 107$) met criteria for PTSD. One in five children met criteria for PTSD but not DTD ($N = 57$, 21%), one in 11 for DTD but not PTSD ($N = 24$, 9%), and 18% met criteria for both PTSD and DTD ($N = 50$).

A three-factor solution best fit the CFA, with the highest CFI and TLI and lowest BIC and χ^2 , and RMSEA and SRMR at or below optimal levels (Table 3). Item loadings supported the proposed DTD structure. Each DTD criterion was internally consistent when scored as a count of items endorsed (criterion B $\alpha = 0.70$, criterion C $\alpha = 0.60$, criterion D $\alpha = 0.73$). Inter-item correlations of criterion scores were significant (criterion B: $r = 0.29$ – 0.46 , $p < 0.0001$; criterion C: $r = 0.20$ – 0.33 , $p < 0.001$; criterion D: $r = 0.27$ – 0.41 , $p < 0.0001$), except for non-suicidal self-injury (C4) with attention dysregulation (C1) and impaired self-protection (C2) ($r = 0.09$, 0.12 , $p > 0.05$).

IRT item information function (IIF) confirmed: (1) the unidimensionality of the DTD construct with modified parallel analysis⁴⁴ and scree plot analysis (Figure S1), (2) that DTD-SI items were informative (maximum peak information $>20\%$ of that of the maximally informative item, except C4 = 19%), and (3) that items were unbiased in relation to race/ethnicity, to gender (with one exception, B2 somatic dysregulation was endorsed

for 47% of boys versus 33% of girls, $p < 0.05$), and age (with two exceptions, impaired boundaries [D5] was endorsed by 48% of children versus 32% of teenagers, and impaired empathy [D6] was endorsed by 41% of teenagers versus 22% of children, $p < 0.01$). Item characteristic curves (ICC) and item information curves (IIC) (Figure 1) indicated that DTD-SI items discriminate individual differences at all DTD severity levels. Item B1 (emotion dysregulation) was most informative and most discriminating at low levels of DTD severity (i.e., maximal IIC height at 0.5 standard deviations below average DTD severity). Item C4 (self-harm) was least informative but was informative at high levels of DTD severity (i.e., maximal IIC height at two standard deviations above average severity). Items C2 (impaired self-protection), C3 (maladaptive self-soothing), D4 (reactive aggression), and D6 (impaired empathy) also were most informative at moderately high levels of DTD severity (i.e., maximal height at one to 1.5 standard deviations above average).

Compared with children not meeting criteria for DTD, children classified as DTD cases experienced more types of traumatic events ($M[SD] = 7.3[3.2]$ vs. $M[SD] = 5.1[3.4]$, respectively, $t[269] = 4.981$, $p < .001$) and interpersonal victimization ($M[SD] = 3.4[2.5]$ vs. $M[SD] = 2.0[2.1]$, respectively, $t[269] = 4.694$, $p < .001$). The validated DTD

TABLE 3 Confirmatory factor analyses (CFA) of DTD-Structured Interview symptom items.

| | χ^2 | CFI | TLI | BIC | RMSEA [95% CI] | SRMR |
|--|-----------|------|----------|----------|------------------|------|
| 1-Factor | 198.81 | 0.88 | 0.87 | 366.87 | 0.07 [0.05–0.08] | 0.06 |
| 3-Factor | 172.30 | 0.91 | 0.89 | 357.17 | 0.06 [0.05–0.07] | 0.05 |
| Hybrid | 179.56 | 0.90 | 0.87 | 381.23 | 0.06 [0.05–0.07] | 0.05 |
| Item | N/% | | Factor 1 | Factor 2 | Factor 3 | |
| B1 (Emotion Dysregulation) | 181 (67%) | | 0.71 | | | |
| B2 (Somatic Dysregulation) | 109 (40%) | | 0.65 | | | |
| B3 (Psychoform/Somatoform Dissociation) | 68 (25%) | | 0.47 | | | |
| B4 (Alexithymia/Somatization) | 105 (39%) | | 0.59 | | | |
| C1 (Attention/Cognitive Dysregulation) | 156 (58%) | | | 0.53 | | |
| C2 (Impaired Self-Protection) | 67 (25%) | | | 0.56 | | |
| C3 (Maladaptive Self-Soothing) | 70 (26%) | | | 0.46 | | |
| C4 (Non-Suicidal Self Injury) | 35 (13%) | | | 0.31 | | |
| C5 (Impaired Goal-Directed Behavior) | 137 (51%) | | | 0.50 | | |
| D1 (Self/Identity Fundamentally Damaged) | 98 (36%) | | | | 0.53 | |
| D2 (Attachment Disorganization) | 110 (41%) | | | | 0.48 | |
| D3 (Betrayal Relational Schemas) | 94 (35%) | | | | 0.59 | |
| D4 (Reactive Aggression) | 80 (30%) | | | | 0.67 | |
| D5 (Impaired Psychosocial Boundaries) | 110 (41%) | | | | 0.52 | |
| D6 (Impaired Empathy) | 83 (31%) | | | | 0.55 | |

Abbreviations: BIC, Bayesian information criterion; CFI, comparative fit index; CI, confidence interval; DTD, developmental trauma disorder; RMSEA, root mean square error of approximation; SRMR, standardized RMR; TLI, Tucker–Lewis index.

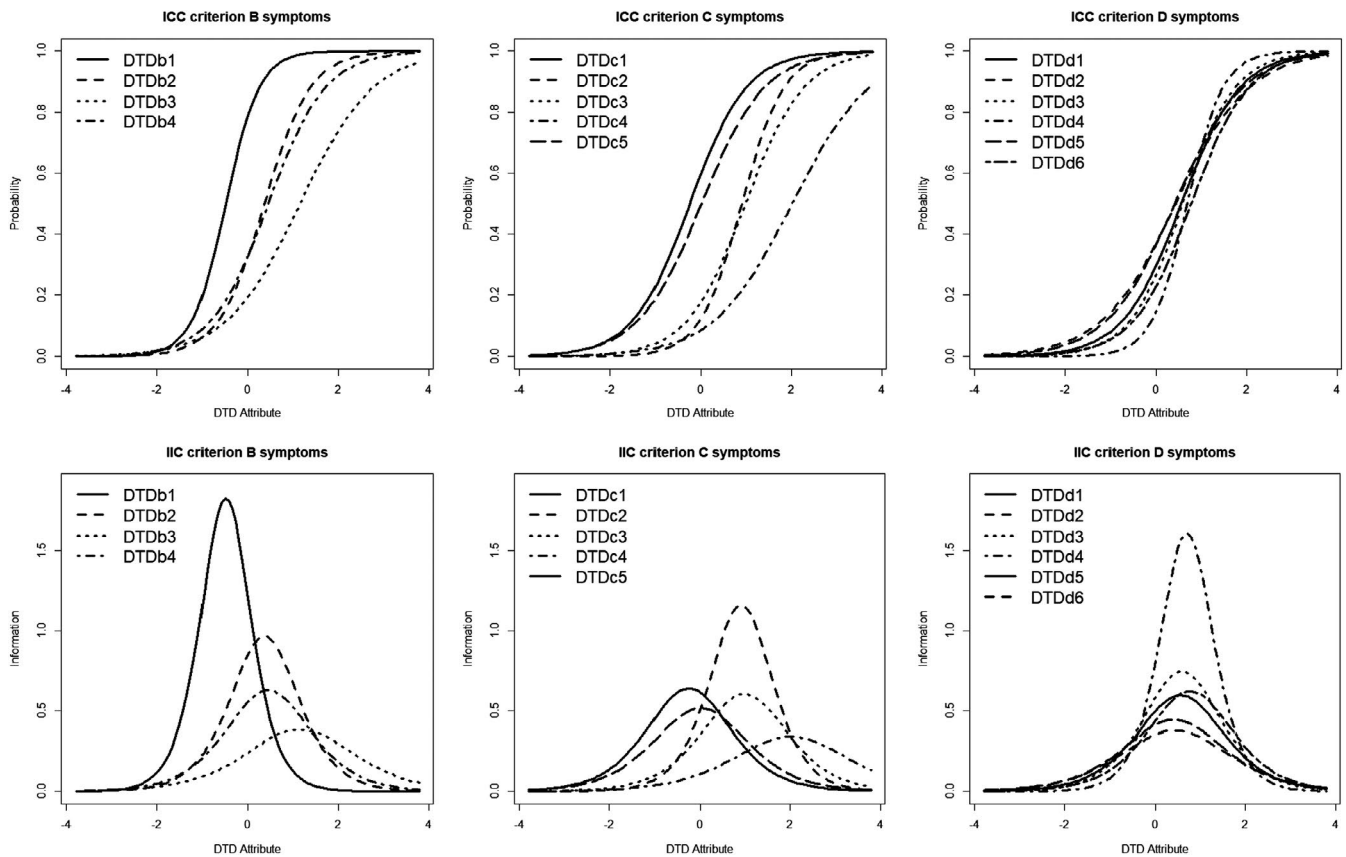


FIGURE 1 Item characteristic curves (ICC) (upper panels) and item information curves (IIC) (lower panels) for symptoms of developmental trauma disorder (DTD): ICC: ^acriterion B symptoms—left-hand panel; ^bcriterion C symptoms—middle panel; ^ccriterion D symptoms—right-hand panel. IIC: ^dcriterion B symptoms—left-hand panel; ^ecriterion C symptoms—middle panel; ^fcriterion D symptoms—right-hand panel. Location parameters from the 2-PL IRM are shown in the ICC as the point at which the curve crosses 0.5, representing the location where individuals have a 0.5 probability of responding “Yes.” The slope and breadth of the ICC curve for each item represents the rate at which the probability of “Yes” on that item changes with increasing severity of DTD.

algorithm predicted impairment after controlling for demographics and other algorithms (Table 4).

Children classified as DTD also had worse parent-rated emotion and behavior dysregulation and alexithymia, lower adaptive regulation, and twice as many probable psychiatric disorder diagnoses as children who met only criterion A or who met no DTD criteria (Table 4). Parent-rated internalizing and externalizing problems and child-rated emotion dysregulation were worse for the DTD group than the non-DTD group, although children who met only DTD criterion A did not differ from the DTD or non-DTD groups (Table 5). One finding contrary to study hypotheses was that there was no difference by DTD status in children’s self-reported quality of life (Table 4).

4 | DISCUSSION

Study findings replicate results from the prior DTD field trial²⁹: DTD is a hierarchical clinical construct with three dimensional domains of dysregulation and

heterogeneous and generally informative symptoms predictive of impairment and distinct from PTSD. DTD-SI items were informative across race/ethnicity, age, and gender with few exceptions. Interestingly, boys more often experienced somatic dysregulation than girls, which is the opposite of prior findings⁴⁵ but is consistent with evidence that severely traumatized boys experience alexithymia⁴⁶ and may indirectly express distress via somatic dysregulation.⁴⁷ Regarding age invariance, impaired boundaries were more common among children than teens, perhaps because of traumatized children’s tendency to become enmeshed or conflictual relationships.⁴⁸ Adolescents were more likely than younger children to have impaired empathy, consistent with evidence that teens with psychiatric problems often have empathy deficits.^{49,50} Thus, while DTD symptoms are applicable for both boys and girls and from early middle childhood through adolescence, there are expectable gender and age differences that should be taken into account when using DTD as a framework for mental health assessment and treatment planning.

TABLE 4 Stepwise multiple-predictor linear regression with the KSADS 3-item impairment index.

| Step | Independent variables | Beta | SE | B | t | p |
|---|-----------------------|--------------|--------------|--------------|--------------|--------------|
| 1 | Age | 0.081 | 0.027 | 0.184 | 3.020 | 0.003 |
| | Gender | 0.227 | 0.153 | 0.091 | 1.487 | 0.138 |
| | Race/Ethnicity | 0.031 | 0.158 | 0.012 | 0.196 | 0.845 |
| Adjusted R ² = 0.03, F Change = 3.95 p = 0.009 | | | | | | |
| 2 | Age | 0.072 | 0.025 | 0.184 | 3.020 | 0.003 |
| | Gender | 0.239 | 0.142 | 0.095 | 1.689 | 0.092 |
| | Race/Ethnicity | 0.035 | 0.147 | 0.013 | 0.237 | 0.813 |
| | DTD233 | 0.572 | 0.284 | 0.183 | 2.017 | 0.045 |
| | DTD323 | 0.273 | 0.250 | 0.091 | 1.093 | 0.276 |
| | DTD332 | 0.507 | 0.317 | 0.156 | 1.603 | 0.110 |
| Adjusted R ² = 0.175, F Change = 40.38 p = 0.000 | | | | | | |
| 3 | Age | 0.063 | 0.024 | 0.143 | 2.584 | 0.010 |
| | Gender | 0.280 | 0.138 | 0.112 | 2.024 | 0.044 |
| | Race/Ethnicity | 0.038 | 0.144 | 0.015 | 0.266 | 0.790 |
| | DTD233 | 0.410 | 0.280 | 0.131 | 1.467 | 0.144 |
| | DTD323 | 0.309 | 0.287 | 0.103 | 1.076 | 0.283 |
| | DTD332 | 0.332 | 0.312 | 0.099 | 1.032 | 0.303 |
| | Validated DTD | 0.934 | 0.243 | 0.183 | 2.017 | 0.000 |
| Adjusted R ² = 0.215, F Change = 14.73 p = 0.000 | | | | | | |

Statistically significant ($p < 0.05$) associations shown in **bold font**.

Abbreviations: DTD, developmental trauma disorder = three B, two C and two D symptoms; DTD3-2-3, three B, two C, and three D symptoms; DTD3-3-2 = three B, three C, and two D symptoms; DTD2-3-3, two B, three C, and three D symptoms.

Differences in the degree to which the DTD-SI items are informative at different levels of symptomatic severity also should be considered in clinical and research applications of DTD. Only one DTD symptom was highly informative for children with low overall levels of DTD symptoms, but that symptom—B1, emotion dysregulation—was the most informative overall compared with all of the other DTD symptoms. Emotion dysregulation thus may represent a core foundational symptom of DTD, but it is not likely to be sufficient alone to identify children with DTD because it often occurs in the absence of other DTD symptoms. Other symptoms that are less informative overall but especially informative at high levels of total DTD symptomatology—notably self-harm and maladaptive self-soothing—are important to consider in assessment and as targets for safety as well as therapeutic intervention with highly traumatized children. Further, symptoms that typically lead to the diagnosis of disruptive behavior disorders and identifying youths as at risk for delinquency (i.e., reactive aggression and impaired empathy) were highly informative overall and especially at relatively high levels of overall DTD symptomatology. That finding highlights the importance of identifying youths whose externalizing symptoms

represent attempts to cope with traumatic past (or current) circumstances and developing trauma-focused approaches to treatment that address traumatic stress reactions and behavior problems.⁵¹

Study findings also demonstrate that, although DTD and PTSD often co-occur, there appears to be a substantial sub-group of children in mental health treatment who have only one of the two syndromes. Specifically, almost one in three children in the study sample met criteria only for DTD (9%) or for PTSD (21%). As a result, one in eleven children in this sample of mental health treatment recipients, who represented more than one-third of the children who met criteria for DTD, did not qualify for a diagnosis of PTSD and therefore would not be considered in need of, or eligible for, trauma-focused treatment in many healthcare settings and systems. Thus, in the absence of a diagnosis for DTD, one in eleven children in mental health treatment who have clinically significant trauma-related impairment may be deprived of the opportunity to receive potentially essential trauma-focused treatment. Including DTD as a diagnostic option also might actually reduce the burden of providing intensive services for all trauma-affected children, because the more than one in five children who met criteria for PTSD but not for DTD

TABLE 5 Convergent validity analyses.

| | | N | Mean | SD | SE | 95% CI | F | p |
|--|--------------------------|----------|-------------|-----------|-----------|-----------------|----------|----------|
| Parent Rated Child Dysregulation | No DTD ^a | 50 | 22.5800 | 7.54332 | 1.06679 | 20.4362–24.7238 | 9.25 | 0.000 |
| | Criterion A ^a | 24 | 22.9583 | 6.18890 | 1.26330 | 20.3450–25.5717 | | |
| | DTD ^b | 15 | 31.6667 | 8.45718 | 2.18363 | 26.9832–36.3501 | | |
| | Total | 89 | 24.2135 | 8.03044 | .85123 | 22.5219–25.9051 | | |
| Parent Rated Child Adaptive Regulation | No DTD ^a | 48 | 30.0208 | 6.12803 | .88450 | 28.2414–31.8002 | 5.69 | 0.005 |
| | Criterion A ^b | 24 | 28.9167 | 4.86261 | .99258 | 26.8634–30.9700 | | |
| | DTD ^b | 14 | 24.3571 | 4.21731 | 1.12712 | 21.9221–26.7921 | | |
| | Total | 86 | 28.7907 | 5.82917 | .62858 | 27.5409–30.0405 | | |
| Child Self Report Emotion Dysregulation | No DTD ^a | 36 | 8.0833 | 2.96045 | .49341 | 7.0817–9.0850 | 5.08 | 0.009 |
| | Criterion A | 17 | 10.0588 | 3.89664 | .94507 | 8.0554–12.0623 | | |
| | DTD ^b | 17 | 11.5294 | 5.11270 | 1.24001 | 8.9007–14.1581 | | |
| | Total | 70 | 9.4000 | 4.01952 | .48042 | 8.4416–10.3584 | | |
| Parent Rated Child Alexithymia | No DTD ^a | 47 | 11.0213 | 9.53139 | 1.39030 | 8.2228–13.8198 | 4.17 | 0.019 |
| | Criterion A ^a | 20 | 10.0000 | 8.62676 | 1.92900 | 5.9626–14.0374 | | |
| | DTD ^b | 14 | 18.6429 | 10.1875 | 2.72273 | 12.7608–24.5250 | | |
| | Total | 81 | 12.0864 | 9.80076 | 1.08897 | 9.9193–14.2535 | | |
| Child Self Report Pediatric Quality of Life | No DTD | 33 | 63.2424 | 7.34860 | 1.27923 | 60.6367–65.8481 | 0.51 | 0.605 |
| | Criterion A | 15 | 62.9333 | 7.17602 | 1.85284 | 58.9594–66.9073 | | |
| | DTD | 16 | 61.0000 | 7.89937 | 1.97484 | 56.7907–65.2093 | | |
| | Total | 64 | 62.6094 | 7.39072 | .92384 | 60.7632–64.4555 | | |
| N Psychiatric Diagnoses (except PTSD) | No DTD ^a | 122 | 2.8115 | 2.32248 | .21027 | 2.3952–3.2278 | 43.65 | 0.000 |
| | Criterion A ^a | 85 | 3.2000 | 2.21359 | .24010 | 2.7225–3.6775 | | |
| | DTD ^b | 64 | 5.8906 | 1.94461 | .24308 | 5.4049–6.3764 | | |
| | Total | 271 | 3.6605 | 2.52892 | .15362 | 3.3581–3.9630 | | |
| CBCL | No DTD ^a | 44 | 53.4091 | 14.0307 | 2.11616 | 49.1414–57.6767 | 5.26 | 0.007 |
| Internalizing T | Criterion A | 23 | 56.6957 | 9.63627 | 2.00930 | 52.5285–60.8627 | | |
| | DTD ^b | 15 | 65.2000 | 9.12767 | 2.3.5675 | 60.1453–70.2547 | | |
| | Total | 82 | 56.4878 | 12.7483 | 1.41179 | 53.6788–59.2968 | | |
| CBCL | No DTD ^a | 44 | 50.7273 | 13.3266 | 2.00906 | 46.6756–54.7789 | 6.07 | 0.004 |
| Externalizing T | Criterion A | 23 | 55.1304 | 10.5714 | 2.20429 | 50.5590–59.7019 | | |
| | DTD ^b | 15 | 63.4000 | 11.1791 | 2.88642 | 57.2092–69.5908 | | |
| | Total | 82 | 54.2805 | 12.9884 | 1.43433 | 51.4266–57.1343 | | |
| CBCL | No DTD ^a | 44 | 57.5909 | 9.19298 | 1.38589 | 54.7960–60.3858 | 5.64 | 0.005 |
| Dysregulation T | Criterion A ^a | 23 | 56.6182 | 5.64029 | 1.17608 | 54.2421–59.1202 | | |
| | DTD ^b | 15 | 65.5333 | 10.7000 | 2.76271 | 59.6079–71.4589 | | |
| | Total | 82 | 58.7896 | 9.15190 | 1.01066 | 56.7777–60.7995 | | |

Note: Superscripts (a,b) denote groups with significantly different scores.

Abbreviations: CBCL, child behavior checklist; SD, standard deviation; SE, standard error; T, T-score.

could be safely and ethically provided with relatively brief evidence-based approaches to trauma-focused therapy based on the careful rule out of more complex DTD symptoms and impairments. These potential implications of including DTD as a childhood psychiatric diagnosis warrant both clinical research and testing in clinical practice and health services research.

Study limitations include the convenience sample with most data provided by parents. Foster/adoptive parents also may not have known their child's trauma history as fully as biological parents, but all adult caregivers had resided with the child for several months (and typically many years). Questionnaire data were obtained from a sub-sample, and convergent validity data may have been

inflated when the same individual completed both the interviews and questionnaires. Although the findings provide an independent replication of the initial DTD field trial's structure and item content, additional adaptation and testing of the DTD-SI items and structure is warranted because of the modest levels of internal consistency for the DTD symptom criterion scores (especially for criterion C, i.e., $\alpha = .60$) and the finding that several items had factor loadings less than .55 (especially items C3 and C4, with loadings of .46 and .31, respectively). The assessment of PTSD using the *DSM-IV* criteria rather than more recent *DSM-5* or *ICD-11* criteria also is a limitation.

In conclusion, this independent replication supported DTD's validity and potential utility as a unifying diagnosis for traumatized children with heterogeneous symptoms that span multiple transdiagnostic spectra. Overall, study findings point to the value of DTD as a trauma-related diagnosis that brings together heterogeneous symptoms based on the overarching theme of posttraumatic dysregulation. DTD therefore could expand the scope trauma-focused assessment and treatment for children diagnosed with multiple comorbidity⁵²—including many who otherwise may not receive trauma-focused treatment because of not meeting criteria for PTSD.

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CONFLICT OF INTEREST

Bessel van der Kolk and Joseph Spinazzola report no conflicts of interest. Julian Ford is a consultant to Advanced Trauma Solutions Professionals, Inc., the sole licensed distributor of the TARGET model copyrighted by the University of Connecticut.

AUTHOR CONTRIBUTIONS

Julian Ford, Joseph Spinazzola, and Bessel van der Kolk formulated the research questions and designed the study, Julian Ford and Joseph Spinazzola carried out the study, Grace Chan analyzed the data, Julian Ford wrote the article with contributions from the other three co-authors.

PEER REVIEW

The peer review history for this article is available at <https://publons.com/publon/10.1111/acps.13424>.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author, [author initials], upon reasonable request.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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