Toward an Empirically Based Developmental Trauma Disorder Diagnosis for Children:

Factor Structure, Item Characteristics, Reliability, and Validity of the Developmental Trauma Disorder Semi-Structured Interview

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ABSTRACT

Objective: Developmental trauma disorder (DTD) is an integrative syndrome for assessing the biopsychosocial sequelae of early life traumatization and attachment disruption. The psychometrics of a DTD Semi-Structured Interview (DTD-SI) and the validity and structure of the DTD construct were tested.

Methods: The DTD-SI was administered by research clinicians at 5 sites between September 2011 and August 2013 to a convenience sample of 236 children ages 7–17 years (50% female, 47% black or Latino/Hispanic, 91% with trauma histories) and/or a parent, recruited in pediatric or mental health services. Validity data were obtained from structured interviews for traumatic stressor and attachment disruption history (Traumatic Events Screening Instrument), *DSM-IV* disorders (Kiddie Schedule for Affective Disorders and Schizophrenia, Present/Lifetime Version), and potential alternative *DSM-5* disorders; parent ratings on the Child Behavior Checklist; and child self-report on measures of emotion dysregulation and quality of life.

Results: Statistical analyses confirmed (*a*) the DTD-SI's item-level temporal and interrater reliability, informativeness, and absence (with 1 exception) of demographic bias and (*b*) DTD construct factor structure, unidimensionality, and convergent and discriminant validity.

Conclusions: The DTD-SI yielded reliable, structurally meaningful, and valid item- and criterion-level data for the proposed DTD syndrome. Further clinical and scientific investigation of the clinical utility of DTD as a childhood psychiatric syndrome and diagnosis is warranted.

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Children who experience potentially traumatic victimization (eg, maltreatment, family or community violence) are at risk for developing biopsychosocial and developmental problems that include, but extend beyond, posttraumatic stress disorder (PTSD).[1–4] These children tend to be polydiagnosed in childhood[5,6] and adolescence[7] and subsequently as adults.[8] However, trauma-focused treatments designed to remediate developmental deficits in self-regulation and relational security have demonstrated benefit with victimized children.[9]

Therefore, a developmentally adapted complex traumatic stress syndrome for children, developmental trauma disorder (DTD), has been proposed to guide assessment and treatment with victimized children.[1,10] DTD was designed to differ from PTSD in content but parallel PTSD in structure, with a gateway criterion A representing stressor exposure followed by 3 symptom domains (criteria B, C, and D). DTD criterion A requires exposure to both interpersonal trauma (eg, maltreatment, family or community violence) and disruptions in the child's development of attachment bonds with primary caregivers—a combination that has been shown to interfere with children's mastery of stage-salient developmental tasks, including emotion regulation, attentional focusing, behavioral self-control, autonomy, socialization, and learning.[1] DTD's proposed symptom criteria B (affective/physiological dysregulation), C (cognitive/behavioral dysregulation), and D (self/relational dysregulation) parallel but differ from those proposed for adult complex PTSD.[11] The proposed DTD stressor criterion and symptom criteria are described in Table 1.

An international survey of child-serving mental health and pediatric professionals was conducted[12] as a first test of DTD's incremental clinical utility,[13] with survey ratings paralleling those from prior clinical utility surveys.[14–16] Respondents evaluated the proposed DTD stressor and symptom criteria as feasible, unique, and value-added[17]—more parsimonious and accurate than other psychiatric diagnoses for characterizing treatment-refractory problems. Based on these findings, the present study investigated the reliability and validity of a new semistructured DTD clinical research interview (the DTD-SI) with a sample of children representing a range of ages, ethnocultural backgrounds, trauma histories, and psychiatric morbidity.

METHODS

Sample and Procedure

A convenience sample of families of 236 children ages 7–18 years (mean = 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 between September

Clinical Points

- Children who experience traumatic victimization and disrupted primary attachment relationships often receive multiple psychiatric diagnoses and are difficult to treat.
- Developmental trauma disorder provides a clinical framework for classification and treatment of complexly traumatized children.
- The Developmental Trauma Disorder Semi-Structured Interview is a psychometrically validated protocol for assessing the symptoms of complexly traumatized children.

2011 and August 2013 at sites in 3 geographical regions in the United States (Northeast, Mid-Atlantic, South, Midwest) that represented a mix of urban, suburban, and rural communities. Parent/guardian consent and child assent were obtained with a protocol approved by a (blinded) institutional review board. Interviews were conducted with the child alone if requested by youths 14 years or older (n = 18), with 93 parent-child dyads conjointly, and with 125 parents alone. Most children were in outpatient psychiatric (n = 189, 80%) or residential (n = 23, 10%) treatment; 10% were referred by a pediatrician (n = 24). Most participants (78%) were not living with both birth parents but were living in a stepfamily (30%), foster or adoptive family (19%), or residential facility (29%). Interviews were conducted with the parent and child together (n = 93; 39%; ages 7–12 years old, child mean age = 10.4, SD = 2.6), the parent alone (n = 125; 53%; child mean age = 12.9, SD = 2.6), or the child alone (n = 18; 8%; child mean age = 15.2, SD = 1.8).

Interviewers viewed simulated demonstration interviews conducted by expert assessors, then independently rated videotaped interviews until they achieved > 80% agreement with expert ratings, then conducted videotaped role-play interviews with > 90% agreement required by an independent expert's review and had their first 2 study interview tapes reviewed by an independent expert, with > 90% agreement required to be considered calibrated. A randomly selected 15% of the remaining interviews that included a parent (N = 13; 5 with the parent alone, and 8 with the parent and child together) and half of all interviews with a child alone (n = 9) were independently reviewed by an interviewer supervisor in order to ensure interrater reliability across the full set of study interviews. In total, interviews by 15 interviewers were re-rated.

Measures

Developmental Trauma Disorder Semi-Structured Interview. DTD-SI items were initially designed by experts from the National Child Traumatic Stress Network. After iterative review/revisions, DTD-SI version 10.0[18] was used in this study, representing 3 DTD symptom criteria sets (B, C, D): emotion/somatic, attentional/behavioral, and interpersonal/self-dysregulation (Table 1). Each symptom was assessed with an overview descriptive statement followed by optional probe questions. DTD criterion A was assessed by the TESI (see below).

Table 1. Proposed 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 anesthesia 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 behavioral dysregulation, 5 items; 2 required for DTD)
- C1: Attention bias toward 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: Nonsuicidal 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, including self-viewed as irreparably damaged and defective
- D2: Attachment insecurity and disorganization (either D2.a. parentified overprotection 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 D.5a. 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)

Traumatic Experiences Screening Instrument. This semistructured interview assesses 8 types of non-victimization adversity (accidents, illnesses, losses) and 13 types of interpersonal victimization. Traumatic Experiences Screening Instrument (TESI) items have shown evidence of retest reliability over a 2–4 month period (κ = 0.50–0.70) and criterion and predictive validity in psychiatric and pediatric samples.[19,20] Interrater reliability for TESI composite scores in the current sample was κ = 0.67–1.00, median = 0.81 (see Table 2).

Kiddie Schedule for Affective Disorders and Schizophrenia, Present/Lifetime Version. This semistructured interview assesses *DSM-IV* child psychiatric disorders with child and parent versions.[21] PTSD symptoms and diagnoses were ascertained using the Kiddie Schedule

for Affective Disorders and Schizophrenia, Present/Lifetime Version (K-SADS) module for PTSD. The child's other internalizing and externalizing disorders were identified as probable vs absent using K-SADS screening questions for major depressive disorder, bipolar disorder, psychotic disorder, obsessive-compulsive disorder, panic disorder, social phobia, agoraphobia, generalized anxiety disorder, phobias, eating disorder, attention-deficit/hyperactivity disorder, oppositional defiant disorder, and conduct disorder. Interrater reliability was acceptable for PTSD diagnosis (κ = 1.00) and for K-SADS positive screens for each *DSM-IV* psychiatric disorder (κ = 0.78–1.00, median = 0.87). An internally consistent (α = .85) psychosocial impairment index was calculated with 8 K-SADS items for family, school, and peer functioning and emotional distress or behavioral avoidance.

Potential alternative* DSM-5 *disorders. Interviewers queried parent respondents using checklists with *DSM-5* criteria to identify 4 disorders with core symptoms that closely parallel the proposed DTD symptoms. Potential *DSM-5* diagnostic alternatives to DTD included 1 revised disorder (reactive attachment disorder; n = 8, 5% prevalence in the current sample), 2 new disorders (disinhibited social engagement disorder; n = 7, 4.5%; disruptive mood dysregulation disorder, n = 11, 7%), and 1 condition for further study (nonsuicidal self-injury, n = 9, 6%). Interrater reliability for the presence of these *DSM-5* disorders was κ = 1.00.

Parent ratings. The Child Behavior Checklist (CBCL)[22] is a 118-item parent/adult informant rating measure that assesses 8 factor analytically derived, internally consistent, and validated internalizing and externalizing dimensions (α = .84 and .87, respectively in this sample). A dysregulation score (α = .78) was calculated as a sum of the anxiety/depression, attention problems, and aggression CBCL subscale *t* scores.[23] Parents also rated their child's emotion-related capacities: (1) awareness/expression on the 14-item reliable (α = .94) and validated Children's Alexithymia Measure[24]; and (2) dysregulation (10 items, α = .84) and (3) adaptive regulation (14 items, α = .87) on the reliable and validated Children's Emotion Regulation Checklist.[25,26] The CBCL could not be completed when only the child was interviewed (n = 18) and due to time limitations of the interview in 78 other cases.

Child self-report measures. Children self-rated their emotion regulation abilities using a 5-item abbreviated version of the reliable (α = .64) and cross-culturally validated Emotion Regulation Questionnaire.[27] Child self-efficacy and optimism were assessed with the 6-item reliable (α = .78) and validated Children's Hope Scale.[28] Children rated their quality of life with the reliable (α = .86) and validated 13-item Pediatric Quality of Life Enjoyment and Satisfaction Questionnaire.[29] Child self-ratings were not obtained when only the parent could be interviewed (n = 125) and due to time limitations on interviews that precluded administration of 1 or more of the questionnaires with 37 children.

Statistical Analyses

Confirmatory factor analysis was conducted to test the hypothesized 3-factor DTD symptom structure versus a 1-factor solution or a 4-factor hybrid solution modeled on the *DSM-5* PTSD 4 symptom domains. For these analyses, a 10-point or greater difference in Bayesian information criterion (BIC) between non-nested models was used to indicate that the model with the smaller BIC was statistically superior with 150:1 odds.[30] Multivariate linear regression analyses were used to identify the DTD symptom criteria that best predicted psychosocial impairment. DTD-SI convergent validity was tested with analyses of variance and child and parent ratings as dependent variables and a 3-level independent variable: (*a*) meets full criteria for DTD, (*b*) meets DTD exposure criterion A but not DTD symptom criteria, or (*c*) meets neither DTD exposure nor symptom criteria. Discriminant validity was tested with univariate and multivariate logistic regression analyses with the presence of any of the 4 alternative *DSM-5* disorders as the independent variable. Item response theory (IRT) analysis was done to test DTD-SI item characteristics in relation to the underlying DTD dimension,[31] considering 2 models (a 2-parameter logistic model and an unconstrained single-slope Rasch model[32]) and likelihood ratio tests. Differential item functioning (DIF) assessed whether items functioned differently between dichotomized demographic groups (age, race, and gender). Lord's χ^2 method was used to determine differential item function.[33] IRT model fitting was carried out with the ltm package and DIF model fitting was carried out with the difR package[34] in the statistical software R.[35]

RESULTS

Descriptive Statistics

One in 9 (n = 26; 11%) children had no psychiatric diagnosis, 14% (n = 33) screened positive for 1 psychiatric disorder, and 75% met criteria or screened positive for 2 or more (up to 10) psychiatric disorders (Table 2). Participants had a median of 3 psychiatric disorders. Almost all (91%) participants endorsed at least 1 traumatic event, with a median of 4.0 past types of traumatic events (mean [SD] = 4.8 [3.3]). A majority (58%) met the DTD exposure criterion.

DTD-SI Item and Diagnostic Reliability and Factor Structure

Interrater reliability was good (κ > 0.70) to excellent (κ = 0.88–1.00) for all DTD-SI items with 1 exception (Table 2), the rarely endorsed nonsuicidal self-injury item (κ = 0.64). Interrater reliability coefficients for the DTD syndrome and the presence of DTD symptom criteria B, C, and D were, respectively, κ = 1.00, 0.86, 0.71, and 0.71.

A 3-factor solution (versus 1-factor or a hybrid 4-factor modeled on the *DSM-5* 4-factor PTSD conceptualization) produced the best fit in the confirmatory factor analysis (Table 3). The 3-factor solution had a lower BIC than either alternative solution, a difference just below the conventional threshold of 10 points, and a higher Tucker-Lewis index

Table 2. Descriptive Statistics for Study Variables

Variable	N	Range	Mean	SD
Child and parent report measures				
Child Emotion Regulation Questionnaire	74	5–21	11.24	3.99
Children's Hope Scale	80	11–36	24.81	5.98
Pediatric Quality of Life Enjoyment and Satisfaction Questionnaire	80	26–65	13.33	10.48
Children's Alexithymia Measure	157	0–42	51.95	8.29
Emotion Regulation Checklist Negative Scale		14–43	24.67	7.28
Emotion Regulation Checklist Adaptive Scale		13–38	27.12	6.46
CBCL Internalizing *t* score	140	33–91	59.89	12.25
CBCL Externalizing *t* score	140	33–86	59.38	11.96
CBCL Dysregulation *t* score sum	140	150–270	185.21	25.93
DSM-IV psychiatric diagnoses			%	κ
Posttraumatic stress disorder	236	0–1	29%	1.00
Depression	236	0–1	55%	0.78
Bipolar disorder	236	0–1	18%	1.00
Psychotic disorder	236	0–1	16%	0.84
Panic disorder	236	0–1	10%	0.87
Separation anxiety disorder	236	0–1	40%	0.90
Phobia	236	0–1	21%	0.90
Generalized anxiety disorder	236	0–1	48%	1.00
Attention-deficit/hyperactivity disorder	236	0–1	59%	0.81
Oppositional defiant disorder	236	0–1	48%	0.85
Conduct disorder	236	0–1	31%	0.79
Obsessive-compulsive disorder	236	0–1	10%	0.86
Eating disorder	236	0–1	3%	1.00
Addictive disorder	236	0–1	6%	1.00
Trauma history composite variables				
Noninterpersonal trauma	230	0–1	61%	0.84
Physical violence	229	0–1	59%	0.81
Family violence	229	0–1	47%	0.79
Sexual trauma	229	0–1	21%	0.92
Community violence	229	0–1	17%	0.73
Traumatic neglect	229	0–1	24%	0.86
Traumatic emotional abuse	229	0–1	21%	0.67
Traumatic separation from caregiver	229	0–1	45%	0.80
Traumatic loss	229	0–1	33%	0.74
Impaired caregiver	236	0–1	50%	0.81
Poly-victimization (≥5 types of victimization)	229	0–1	16%	1.00
DTD Structured Interview items				
DTDb1	236	0–1	65%	0.75
DTDb2	236	0–1	60%	0.86
DTDb3	236	0–1	40%	0.88
DTDb4	236	0–1	54%	0.88
DTDc1	236	0–1	55%	0.88
DTDc2	236	0–1	34%	1.00
DTDc3	236	0–1	36%	1.00
DTDc4	236	0–1	15%	0.64
DTDc5	236	0–1	57%	0.85
DTDd1	236	0–1	46%	1.00
DTDd2	236	0–1	45%	0.71
DTDd3	236	0–1	44%	1.00
DTDd4	236	0–1	38%	0.86
DTDd5	236	0–1	50%	0.87
DTDd6	236	0–1	46%	0.87

Abbreviations: CBCL = Child Behavior Checklist, DTD = developmental trauma disorder.

(TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) than the hybrid solution. Although the 1-factor solution had a higher comparative fit index than the 3-factor solution, they were equivalent on TLI, RMSEA, and SRMR, and the 3-factor solution had a lower χ^2 than the 1-factor solution. Thus, while the 1-factor solution warrants further consideration (consistent with item analysis results indicating a unidimensional construct, see below), overall it appeared that the 3-factor solution best fit the data.

Table 3. Confirmatory Factor Analyses of DTD-Structured Interview Symptom Items

	χ^2	CFI	TLI	BIC	RMSEA	SRMR
1-Factor	147.07*	0.93	0.91	4,404.62	0.05 [0.04, 0.07]	0.05
3-Factor	145.79*	0.92	0.91	4,395.52	0.05 [0.04, 0.07]	0.05
Hybrid	149.16*	0.92	0.90	4,404.35	0.06 [0.04, 0.07]	0.08

*$P < .001$.

Abbreviations: BIC = Bayesian information criterion, CFI = comparative fit index, DTD = developmental trauma disorder, RMSEA = root mean square error of approximation, SRMR = standardized root mean square residual, TLI = Tucker-Lewis index.

Each factor's items, when scored as a simple count variable, comprised a scale that demonstrated moderate internal consistency (criterion B $\alpha = 67$, criterion C $\alpha = 61$, criterion D $\alpha = 72$). Interitem correlations for each factor-based scale also were of moderate strength and statistically significant (criterion B: $r = 0.24–0.42$, $P < .001$; criterion C: $r = 0.20–0.34$, $P < .01$; criterion D: $r = 0.23–0.39$, $P < .001$) with 2 exceptions: the criterion C nonsuicidal self-injury symptom was uncorrelated with criterion C symptoms for insufficient self-protection and difficulty with completing goal-directed behavior ($r = 0.07–0.08$, $P > .20$)

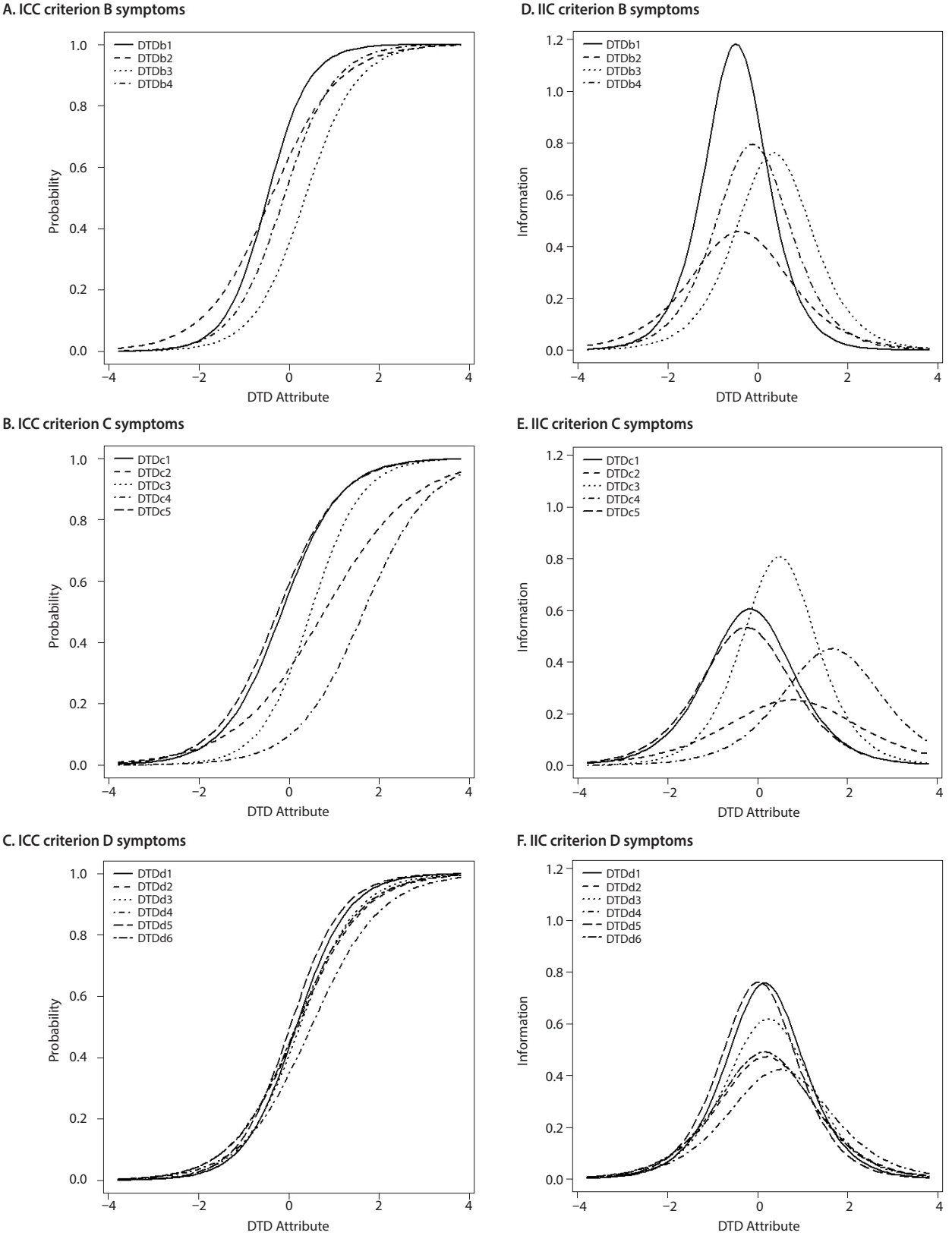
DTD-SI Item Response Theory Analyses

IRT item information function (IIF) analyses (Figure 1) using a 2-parameter logistic item response model (2-PL IRM) confirmed (1) the unidimensionality of the DTD construct with modified parallel analysis[36] and scree plot analysis and (2) that all items were informative (maximum peak information > 20% of that of the maximally informative item) and (with 2 exceptions) unbiased in relation to demographics.[37] Results from the 2-PL IRM, showing item characteristic curves and associated item information curves (IIC) (Figure 1), indicate that DTD-SI items discriminate individual differences across a spectrum of DTD severity. Criterion B item 1 was the most informative item for discriminating children scoring low on DTD severity (ie, maximal IIF height). All criteria B, C, and D items have maximum IIC information measure peaks no less than 20% of the IIC peak for the most informative item. DIF analyses on race (white vs nonwhite), gender, and age (pre-teen vs teenager) (Supplementary Figure 1) showed no differential functioning by DTD items by gender or race. Two items (DTDc5 and DTDd5) performed differently for children versus teens.

Empirical Evaluation of Alternative Algorithms for Classifying DTD Cases

Provisional DTD cases (N = 86, 36%) were identified using a conservative threshold for the hypothesized primary DTD component, criterion B emotion dysregulation symptoms (≥3 of 4 possible), and a less restrictive threshold for criterion C cognitive/behavioral and criterion D interpersonal/self-dysregulation (≥2 of 5 or 6 possible,

Figure 1. Item Characteristic Curves (ICC) and Item Information Curves (IIC) for Symptoms of Developmental Trauma Disorder (DTD)[a]



[a]Location parameters from the 2-parameter logistic item response model 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.

Table 4. Number of DTD Symptoms Endorsed by Children Based on Their DTD Status

DTD Status[a]	Mean	SD	*df*	*t*	*P*
Positive for provisional DTD	11.01	1.96	234	17.72	<.001
Negative for provisional DTD	4.73	3.08			
Positive for DTD323 classification	11.30	1.74	234	18.08	<.001
Negative for DTD323 classification	4.45	3.27			

[a]DTD323 = at least 3 criterion B, 2 criterion C, and 3 criterion D symptoms of DTD; provisional DTD = at least 3 criterion B, 2 criterion C, and 2 criterion D symptoms of DTD.
Abbreviation: DTD = developmental trauma disorder.

Table 5. Stepwise Multivariate Linear Regression With the K-SADS 8-Item Impairment Index[a]

Step	Independent Variables[b]	β	SE	*B*	*t*	*P*
1	**DTDalt323**	**2.100**	**0.266**	**0.482**	**7.896**	**.000**
2	DTDalt323	0.333	0.800	0.077	0.417	.677
	DTD	**1.828**	**0.782**	**0.429**	**2.338**	**.020**
3	DTDalt323	–0.475	0.724	–0.109	–0.655	.513
	DTD	**1.798**	**0.700**	**0.422**	**2.569**	**.011**
	PTSD diagnosis	**1.844**	**0.256**	**0.435**	**7.208**	**.000**
	Poly-victimization	0.087	0.304	0.016	0.287	.775
4	DTDalt323	–0.471	0.729	–0.108	–0.645	.519
	DTD	**1.782**	**0.702**	**0.419**	**2.538**	**.012**
	PTSD diagnosis	**1.795**	**0.257**	**0.423**	**6.989**	**.000**
	Poly-victimization	0.109	0.306	0.020	0.357	.721
	Gender	0.029	0.217	0.007	0.131	.896
	Age (dichotomous)	0.401	0.216	0.101	1.856	.065
	White versus nonwhite	–0.127	0.215	–0.032	–0.591	.555

[a]Statistically significant (*P* < .05) associations shown in boldface.
[b]DTD = hypothesized developmental trauma disorder classification algorithm requiring 3 B, 2 C, and 2 D symptoms; DTDalt323 = alternative DTD classification algorithm requiring 3 B, 2 C, and 3 D symptoms.
Abbreviations: K-SADS = Kiddie Schedule for Affective Disorders and Schizophrenia, Present/Lifetime Version; PTSD = posttraumatic stress disorder.

respectively). These cut-points resulted in a minimum total DTD symptom count (ie, ≥ 7) that was above the sample median (median = 6.5).

Compared to children not meeting these DTD criteria, children classified as DTD cases had experienced 50% more types of potentially traumatic events (mean = 6.3 [3.5] vs mean = 4.0 [3.3], respectively; $t_{228} = 5.00$, $P < .001$) and twice as many types of interpersonal victimization (mean = 3.4 [2.4] vs mean = 1.9 [2.1], respectively; $t_{228} = 4.88$, $P < .001$).

Alternative classification algorithms were tested based on a more liberal B criterion (≥ 2 symptoms), or more conservative C/D criteria (≥ 3 symptoms). The DTD233 algorithm included both of these changes. Two other alternative algorithms retained the conservative B criterion (≥ 3 symptoms) but increased the threshold for either the C (DTD332) or D criteria (DTD323). The alternative algorithms reduced estimated DTD prevalence from N = 86 (36% of the sample) to N = 80 for DTD323 (34%), N = 68 for DTD233 (29%), and N = 63 for DTD 332 (27%).

All of the DTD classification algorithms were associated with DTD symptom burden in linear regression analyses controlling for *DSM-IV* diagnostic morbidity, *DSM-5* alternative disorders, PTSD diagnosis, poly-victimization, and demographics (standardized *B* values = 0.54–0.60, $P < .001$). DTD233 and DTD332 were not included in further analyses due to not accounting for significant variance in psychosocial impairment in multivariate linear regression analyses.

The provisional DTD and DTD323 algorithms accounted for significant variance in psychosocial impairment (R^2 change = 0.19 for each) in multivariate regression analyses. All cases based on those algorithms had impairment in at least 1 psychosocial domain and met the DTD exposure criterion A. Cases identified based on either the provisional DTD or DTD323 algorithms also reported more than twice as many DTD symptoms as non-cases (Table 4).

Finally, a stepwise multivariate regression was conducted with the K-SADS impairment index as the dependent variable and independent variables entered in the following steps: (1) DTD323 classification only; (2) DTD323 and provisional DTD; (3) DTD323, provisional DTD, and PTSD; and (4) DTD323, provisional DTD, PTSD, poly-victimization, and demographics (Table 5). Although DTD323 accounted for significant variance in the first step, in all subsequent steps in which the provisional DTD classification was entered DTD323 was nonsignificant and the provisional DTD classification was significant. In the final step, both the provisional DTD classification and the PTSD diagnosis were significantly associated with impairment (Table 4).

DTD Convergent Validity

Convergent validity of the DTD algorithm was supported by analyses of variance showing significant differences between the subgroups defined by DTD status on all measures except child self-rated adaptive emotion regulation (Table 6). Compared to children who did not have lifetime adversities meeting DTD criterion A, DTD cases had lower levels of child self-reported hope and quality of life and higher levels of child self-reported negative emotion regulation, parent-reported dysregulation, internalizing symptoms, externalizing problems, and alexithymia, as well as more extensive psychiatric morbidity (ie, number of psychiatric diagnoses). On a more stringent test of convergent validity, compared to children who met DTD criterion A but not the DTD symptom criteria, DTD cases did not differ on child self-reported measures but had higher levels of parent-reported dysregulation, internalizing symptoms, externalizing problems, and alexithymia, as well as more extensive psychiatric morbidity.

DTD Discriminant Validity

DTD was unrelated to the presence of a *DSM-5* alternative disorder on an unadjusted basis (OR = 1.74; 95% CI, 0.76–3.60). On the other hand, PTSD was associated with the presence of at least 1 *DSM-5* alternative disorder on both an unadjusted (OR = 3.72; 95% CI, 1.60–8.62) and a multivariate (OR = 3.34; 95% CI, 1.36–8.20) basis. In the multivariate logistic regression, DTD was nonsignificant; age was the only significant covariate (OR = 2.80; 95% CI, 1.117–6.74). Thus, only PTSD, but not DTD, was strongly

Table 6. Developmental Trauma Disorder Convergent Validity Analyses[a]

Dependent Variables	Independent Variables	n	Mean	SD	SE	95% CI Lower	95% CI Upper
Child Hope Scale	No DTD criterion A[A]	15	28.47	4.39	1.13	26.04	30.90
	DTD criterion A/No DTD	45	24.87	5.82	0.87	23.12	26.61
	DTD[B]	20	21.95	6.09	1.36	19.10	24.80
	Total	80	24.81	5.98	0.67	23.48	26.14
Child Alexithymia Measure	No DTD criterion A[A]	19	4.42	4.29	0.98	2.36	6.49
	DTD criterion A/No DTD[B]	78	12.55	9.36	1.06	10.44	14.66
	DTD[C]	60	17.45	9.93	1.28	14.89	20.02
	Total	157	13.44	9.96	0.79	11.87	15.01
Emotion Regulation Checklist Negativity	No DTD criterion A[A]	15	20.33	5.12	1.32	17.50	23.17
	DTD criterion A/No DTD	38	24.62	6.99	1.13	22.32	26.91
	DTD[B]	21	27.86	7.75	1.69	24.33	31.39
	Total	74	24.67	7.28	0.845	22.98	26.36
Emotion Regulation Checklist Adaptive	No DTD criterion A	15	27.40	9.33	2.41	22.23	32.57
	DTD criterion A/No DTD	38	27.63	5.30	0.86	25.89	29.37
	DTD	21	26.00	6.14	1.34	23.21	28.79
	Total	74	27.12	6.46	0.75	25.62	28.62
Pediatric Quality of Life	No DTD criterion A[A]	16	57.56	5.40	1.35	54.68	60.44
	DTD criterion A/No DTD[B]	43	52.07	6.90	1.05	49.95	54.19
	DTD[B]	21	51.43	8.89	1.94	47.38	55.48
	Total	80	53.00	7.50	0.84	51.33	54.67
CBCL Dysregulation	No DTD criterion A[A]	21	14.81	13.08	2.85	8.85	20.76
	DTD criterion A/No DTD[A]	68	19.66	10.94	1.33	17.01	22.31
	DTD[B]	51	33.49	15.78	2.21	29.05	37.93
	Total	140	23.97	15.07	1.27	21.45	26.49
CBCL Externalizing *t* score	No DTD criterion A[A]	21	49.90	10.80	2.36	44.99	54.82
	DTD criterion A/No DTD[B]	68	57.99	11.18	1.36	55.28	60.69
	DTD[C]	51	66.53	10.54	1.48	63.56	69.49
	Total	140	59.89	12.25	1.04	57.84	61.93
CBCL Internalizing *t* score	No DTD criterion A[A]	21	54.38	13.65	2.98	48.17	60.59
	DTD criterion A/No DTD[A]	68	56.13	10.21	1.24	53.66	58.60
	DTD[B]	51	65.76	10.81	1.51	62.72	68.81
	Total	140	59.38	11.96	1.01	57.38	61.38
No. of K-SADS diagnoses	No DTD criterion A[A]	38	1.97	2.26	0.37	1.23	2.72
	DTD criterion A/No DTD[A]	112	3.13	2.25	0.21	2.71	3.54
	DTD[B]	86	5.34	2.52	0.27	4.80	5.88
	Total	236	3.75	2.66		3.40	4.09
Summary Statistics							
			Sum of Squares	*df*		*F*	*p*
Child Hope Scale	Between groups		364.30	2		5.693	.005
	Within groups		2,463.88	77			
	Total		2,828.198	79			
Child Alexithymia Measure	Between groups		2,571.899	2		15.348	.000
	Within groups		12,902.778	154			
	Total		15,474.68	156			
Emotion Regulation Checklist Negativity	Between groups		495.52	2		5.211	.008
	Within groups		3,375.62	71			
	Total		3,871.14	73			
Emotion Regulation Checklist Adaptive	Between groups		37.46	2		.441	.645
	Within groups		3,012.44	71			
	Total		3,049.91	73			
Pediatric Quality of Life	Between groups		422.13	2		4.043	.021
	Within groups		4,019.87	77			
	Total		4,442.00	79			
CBCL Dysregulation	Between groups		7,646.68	2		21.911	.000
	Within groups		23,905.20	137			
	Total		31,551.89	139			
CBCL Externalizing *t* score	Between groups		4,588.67	2		19.322	.000
	Within groups		16,267.50	137			
	Total		20,856.17	139			
CBCL Internalizing *t* score	Between groups		3,321.00	2		13.744	.000
	Within groups		16,551.94	137			
	Total		19,872.94	139			
No. of K-SADS diagnoses	Between groups		380.30	2		34.440	.000
	Within groups		1,286.45	233			
	Total		1,666.75	235			

[a]Superscripted letters denote groups with significantly different scores on the measure.
Abbreviations: CBCL = Child Behavior Checklist, CI = confidence interval, K-SADS diagnoses = psychiatric diagnoses based on the Kiddie Schedule for Affective Disorders and Schizophrenia Present/Lifetime.

associated with the *DSM-5* alternative disorders, suggesting that DTD is distinct from alternative *DSM-5* disorders.

DISCUSSION

Study results support the DTD-SI's reliability, construct (ie, factor analytic) validity, informativeness on an item-level basis, and convergent and discriminant validity. DTD was associated with psychosocial impairment independent of the effects of PTSD, poly-victimization, and demographics. DTD also was discriminable from alternative *DSM-5* diagnoses that include some symptoms that closely parallel some DTD symptoms, whereas PTSD actually showed evidence of co-occurrence with those alternative *DSM-5* diagnoses. Although the adult complex PTSD construct has been criticized as duplicative,[38] study findings replicate and extend results of an international survey of child/family-serving clinicians who viewed DTD as related to *but distinct from* PTSD and both Axis I and Axis II *DSM*-IV psychiatric disorders.[12] DTD therefore warrants further consideration as a distinct diagnostic syndrome that could enhance the assessment and treatment of victimized children.[1,39]

Consistent with the survey's findings,[12] all children who met DTD symptom criteria had histories of interpersonal victimization and attachment disruption. Children who met the DTD symptom criteria also had experienced twice as many types of interpersonal victimization as other children, consistent with an association of DTD with poly-victimization. In addition, independent of the effects of both PTSD and poly-victimization, meeting both the DTD exposure and symptom criteria was associated with psychosocial impairment. Thus, the proposed trauma antecedents of DTD are supported, and the symptoms of DTD account for psychosocial impairment over and above the effects of both poly-victimization and PTSD. Although both poly-victimization[2,3,40] and PTSD[41,42] are important to assess clinically with dysregulated children and adolescents, the study findings suggest that attachment disruption[43–45] and DTD symptoms also should be considered clinically in assessing the full range of childhood adversities and their sequelae symptoms. Further research is needed to establish whether DTD is related to types of childhood adversities that are distinct from the antecedents of PTSD.[1]

Study results also supported the hypothesized symptom structure of DTD, with 3 interrelated but phenomenologically and empirically distinct domains of dysregulation: emotion/physiological, cognitive/behavioral, and interpersonal/self-identity.[1] Additionally, each item in the DTD-SI was psychometrically informative in relation to overall DTD symptomatology. While requiring replication with both clinical and community/school or pediatric health care populations of children and adolescents, the findings support the conceptual and clinical integrity of DTD and its constituent symptoms. Interestingly, PTSD symptoms in the *DSM*-5 now include several symptoms similar to DTD symptoms (eg, pervasive negative emotions; preoccupation with blame; self-harm; reckless or aggressive behavior). However, DTD did not co-occur with *DSM-5* diagnoses that included those symptoms, while the *DSM-IV* PTSD syndrome did show evidence of co-occurrence with those *DSM-5* diagnoses. This suggests that DTD as an integrated syndrome may enable clinicians to identify features of biopsychosocial dysregulation that are not tapped by PTSD or by alternative *DSM-5* diagnoses.[12] Although the evidence of DTD's discriminant validity in relation to both PTSD and alternative *DSM-5* diagnoses is encouraging, whether DTD is sufficiently distinguishable from, and has incremental clinical utility beyond that of, those disorders to warrant a separate diagnosis requires further research.

Study limitations should be considered when interpreting the results. The sample was of convenience, primarily including children in psychiatric treatment with histories of exposure to traumatic stressors (ie, approximately 90%, in contrast to community prevalence estimates of 25%–70%[41,46,47]). Although several areas of the United States and both urban/suburban and rural areas were represented, the sample was not geographically dispersed across the United States.

The perspective of both the child and parent was included in a subset of cases, but most of the data were collected from either the child or parent but not both. Parent-child concordance on structured interviews of psychiatric symptoms tends to be weak, with each individual having unique information and perspectives such that combining data from both respondents tends to be optimal.[48–50] Convergent validity was supported in relation to questionnaires completed by parents, but only partially for child self-report; the latter finding may be an artifact of reporter bias but also suggests a need for further testing of the DTD-SI with youths alone, which was possible in only a small number of cases (7.5% of the sample) in this study. Discriminant validity was tested with data from unvalidated checklists because validated structured interviews for *DSM-5* dysregulation disorders were not available at the time of the study. Replication with these methodological concerns addressed is needed to further test the clinical utility of DTD.

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Potential conflicts of interest: **Dr Ford** is co-owner of Advanced Trauma Solutions, Inc, the sole licensed distributor of the TARGET model copyrighted by the University of Connecticut. Other authors (**Drs Spinazzola**, **van der Kolk**, and **Grasso**), and named contributors (Drs Lynch and Pynoos), report no conflicts of interest.

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Supplementary material: Available at PSYCHIATRIST.COM.

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Supplementary Material

Article Title: Toward an Empirically Based Developmental Trauma Disorder Diagnosis for Children: Factor Structure, Item Characteristics, Reliability, and Validity of the Developmental Trauma Disorder Semi-Structured Interview

Author(s): Julian D. Ford, PhD; Joseph Spinazzola, PhD; Bessel van der Kolk, MD; and Damion J. Grasso, PhD

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List of Supplementary Material for the article

1. **Figure 1** Item Response Theory Results

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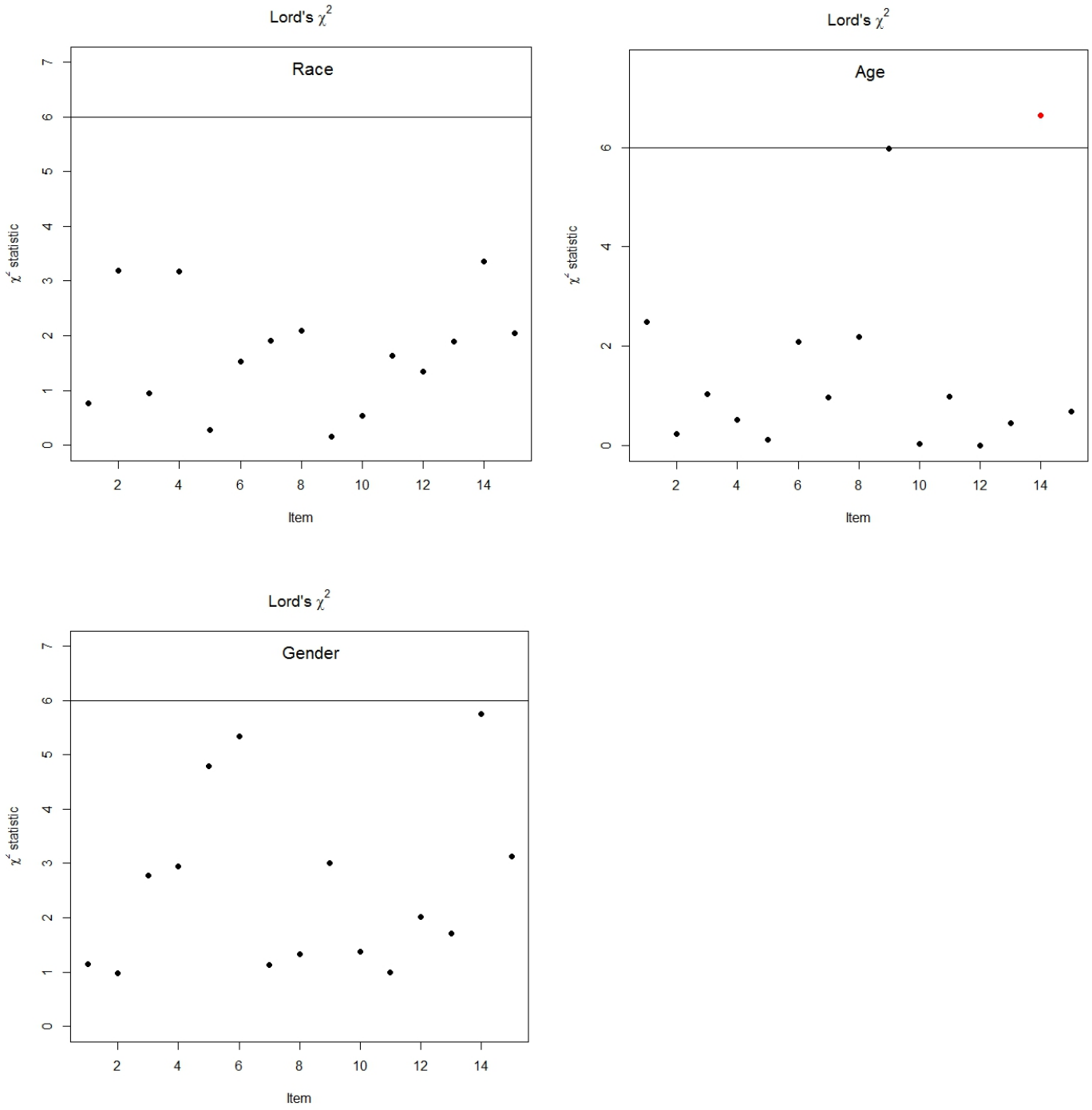
Supplementary Figure 1. Item Response Theory Results



Lord's chi-squared test statistic values for DIF shown for each Developmental Trauma Disorder Semi-structured Interview (DTD-SI) item. Values above the reference line are $p < 0.05$. Results are shown in panels labeled: [a]Race, [b]Age, [c]Gender. The one DTD-SI item with a chi-squared value $p < 0.05$ is shown in red font in the Age analyses panel: DTDd5 (DTD-SI item d5, impaired psychological boundaries).