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# Validation of the UCLA PTSD Reaction Index for *DSM-5*: A Developmentally Informed Assessment Tool for Youth

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**Objective:** To describe the test construction procedure and evaluate the internal consistency, criterion-referenced validity, and diagnostic accuracy of the Child/Adolescent Self-Report Version of the UCLA PTSD Reaction Index for *DSM-5* (RI-5) across 2 independent samples.

**Method:** Study 1 examined the clarity, developmental appropriateness, acceptability of individual RI-5 items, and internal consistency and criterion-referenced validity of the full test. The study 1 sample included 486 youth recruited from 2 major US cities who completed the RI-5 and a measure of depression. Study 2 evaluated the reliability and diagnostic accuracy of the RI-5 in 41 treatment-seeking youth who completed the RI-5 and a “gold standard” structured diagnostic interview, the Clinician-Administered PTSD Scale for *DSM-5*—Child/Adolescent Version.

**Results:** RI-5 total scale scores showed excellent internal consistency in the 2 samples. Study 1 provided evidence of criterion-referenced validity, in that total scale scores correlated positively with depressive symptoms. Study 2 provided evidence of diagnostic accuracy (including discriminant-groups validity). RI-5 total scores discriminated youth with from youth without PTSD as benchmarked against the structured diagnostic interview. Further, receiver operating characteristic analyses using a total score of 35 provided excellent diagnostic classification accuracy (area under the curve 0.94).

**Conclusion:** The developmental appropriateness and diagnostic accuracy of the RI-5 support its utility for clinical assessment, case conceptualization, and treatment planning in different child-serving systems, including schools, juvenile justice, child welfare, and mental health.

**Key words:** posttraumatic stress disorder, assessment, psychometrics

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**E**xposure to potentially traumatic events is common among children and adolescents, with some studies reporting that approximately two-thirds of youth experience or witness at least 1 type of trauma.<sup>1-3</sup> Trauma exposure increases the risk for disruptions in developmental tasks of childhood and adolescence,<sup>3</sup> risk-taking behaviors in adolescence,<sup>4</sup> and mental illness in later life.<sup>5,6</sup> Trauma exposure also is the primary etiologic risk factor for posttraumatic stress disorder (PTSD). A recent meta-analysis found that 15.9% of children and adolescents exposed to a potentially traumatic event met diagnostic criteria for lifetime PTSD.<sup>7</sup>

The widespread prevalence of trauma exposure and associated risk for PTSD underscores the need for reliable and valid measures for youth. The UCLA PTSD Reaction Index for *DSM-IV* (PTSD-RI) is one of the most widely used tools to assess posttraumatic stress reactions and predict PTSD diagnostic status in trauma-exposed children and

adolescents.<sup>8-11</sup> The *DSM-5* calls for a developmentally appropriate measure of PTSD that incorporates *DSM-5*-related modifications and exhibits sound psychometric properties, including reliability, validity, and utility.<sup>12</sup>

## *DSM-5* PTSD

*DSM-5* PTSD diagnostic criteria have undergone changes since the *DSM-IV-TR*.<sup>13</sup> PTSD is now classified as a trauma- and stressor-related disorder rather than an anxiety disorder. This shift emphasizes external environmental exposure (Criterion A) as the hallmark of the disorder. *DSM-5* also clearly delineates the distinction between traumatic events and other stressors by providing explicit examples. For PTSD symptoms, criteria were reclassified as re-experiencing (Criterion B), avoidance (Criterion C), negative alterations in cognitions and mood (Criterion D), and arousal (Criterion E). *DSM-5* also added dissociative and preschool subtypes. The dissociative subtype denotes

persistent or recurrent symptoms of derealization or depersonalization, and the preschool subtype is applied to children 6 years and younger.

### Existing Measures of DSM-5 PTSD

Although different self-report scales<sup>14,15</sup> and structured interviews<sup>16,18</sup> reflecting the new *DSM-5* PTSD criteria have been developed for use with adults, measures for youth have lagged behind. The Clinician-Administered PTSD Scale for *DSM-5*–Child/Adolescent Version (CAPS-CA-5),<sup>17</sup> a developmentally modified version of the Clinician-Administered PTSD Scale for *DSM-5* (CAPS-5),<sup>18</sup> is considered the “gold standard” semistructured interview for generating accurate diagnoses of PTSD. However, this semistructured interview requires extensive training for raters and is time consuming to administer and score. Thus, there is a need for efficient and developmentally informed child/adolescent *DSM-5* PTSD measures that are suitable for making a thorough assessment of trauma exposure, PTSD symptoms, associated distress, and functional and behavioral impairment.

Few studies have been published on the psychometric properties of rating scales for child *DSM-5* PTSD. Those validation studies that do exist focus on the Child and Adolescent Trauma Screen (CATS)<sup>19</sup> and the Child PTSD Symptom Scale for *DSM-5* (CPSS-5).<sup>20</sup> The CATS assesses trauma exposure using a 15-item checklist, past-month PTSD symptom frequency using 20 items, and impairment in psychosocial functioning using 5 dichotomous items. The psychometric properties of the CATS have been examined in English, German, and Norwegian versions. Across languages, the self-report and caregiver-report versions exhibited good to excellent reliability in the form of internal consistency. Convergent validity was demonstrated by medium to strong correlations with measures of depression and anxiety, and evidence of divergent validity was demonstrated by low to medium inverse correlations with measures of externalizing symptoms. The factor structure also was supported in self-report and caregiver-report versions.

The CPSS-5 assesses past-month child PTSD symptom severity and diagnosis, and it is available in a semistructured interview and a self-report version.<sup>20</sup> The CPSS-5 assesses history of trauma in an open-ended format to identify an index trauma. The frequency of PTSD symptoms is assessed by 20 items, and 7 items assess frequency of daily functional impairment. Research on the reliability of the PTSD symptom items has shown excellent total internal consistencies and good to excellent test-retest reliability. Convergent validity has been demonstrated between scores in the interview and self-report versions, as has diagnostic agreement between these versions. Discriminant validity

was indicated by lower correlations with depression and anxiety measures than correlations between the 2 versions of the CPSS-5. Receiver operating characteristic (ROC) analyses yielded a cutoff score on the CPSS-5 self-report version for identifying probable PTSD diagnosis; however, the CPSS-5 interview version was used as the criterion to determine PTSD diagnosis, inflating their cutoff estimate owing to shared method variance.<sup>21</sup>

Although the CATS and the CPSS-5 contribute to the literature on *DSM-5* PTSD scales for youth, more research is warranted on rating scales for *DSM-5* PTSD. For example, it is unclear how the items (comprising either measure) were generated and/or evaluated from a developmental perspective. Moreover, the validation of *DSM-5* PTSD scales for youth against an independent gold standard (eg, a semistructured interview) is needed to ascertain validity and clinical utility, especially when the goal is to derive cutoff scores to identify trauma-exposed youth at risk of PTSD.

### Toward a Developmentally Informed Measure of Childhood PTSD

The PTSD-RI demonstrated excellent internal consistency across age groups (7–18 years), sex, and ethnicity (American Indian/Alaska Native, black/African American, white, and Hispanic/Latino)<sup>8,22,23</sup> and high test-retest reliability.<sup>24</sup> The measure also showed good factorial and convergent validity with the Trauma Symptom Checklist Posttraumatic Stress Subscale.<sup>23</sup> Outside the United States, the PTSD-RI has been found to have good or better internal consistency in Chile and Zambia.<sup>25,26</sup> The PTSD-RI also demonstrated concurrent and discriminant-groups validity.<sup>26</sup> More recently, the Japanese translation of the Child/Adolescent Self-Report Version of the UCLA PTSD Reaction Index for *DSM-5* (RI-5) was found to exhibit good internal consistency and convergent validity with another measure of PTSD, and a 4-factor model implied by the *DSM-5* diagnostic criteria provided adequate fit to the data.<sup>27</sup>

Building on its *DSM-IV* predecessor, the RI-5 was developed to reflect *DSM-5* PTSD criteria and account for developmentally linked variations in how specific PTSD symptoms manifest. The following changes were included. First, reflecting the *DSM-5*'s greater emphasis on precipitating traumatic events, the RI-5 contains an expanded trauma history section listing more trauma types and specific details regarding each type. Second, for each traumatic event, respondents report on whether they were a victim, witness, or learned about the trauma. Third, the symptom scale was modified to accommodate negative alterations in cognitions and mood symptoms. Fourth, better attention to functional impairment is provided by including questions assessing the extent to which symptoms caused clinically

significant distress and impairment in behavior and functioning. Fifth, items assessing dissociative subtype were added. Sixth, drawing on focus groups and expert opinion (discussed below), each RI-5 item was worded to reflect age-related manifestations of specific *DSM-5* symptom criteria.

### Study Aims and Hypotheses

We used a 2-study design to pursue 2 primary aims. The 2 primary aims were to apply best-practice test construction procedures in creating an updated, developmentally informed measure of *DSM-5* PTSD (the RI-5)<sup>28</sup> and then to evaluate its reliability and validity. Study 1 focused on evaluating the clarity, developmental appropriateness, and acceptability of test items and refining items as needed through qualitative feedback from a panel of 20 content experts. Study 1 also examined internal consistency and criterion-referenced validity of the RI-5 by examining bivariate correlations between RI-5 scores and a depression measure in a sample of trauma-exposed youth. Study 1 a priori hypotheses were that RI-5 items would show evidence of high internal consistency (hypothesis 1) and criterion-referenced validity, such that RI-5 criterion category and total scale scores would positively correlate with a measure of depression as research suggests (hypothesis 2).<sup>29</sup>

Using a separate sample of treatment-seeking youth, study 2 focused on replicating the findings of study 1 by re-evaluating the RI-5's internal consistency. Study 2 also examined the diagnostic accuracy of the RI-5 in relation to a gold standard benchmark and identifying a clinical cutoff score for accurately identifying youth at high risk for meeting criteria for *DSM-5* PTSD. Study 2 a priori hypotheses were that RI-5 items would show evidence of high internal consistency (hypothesis 3) and diagnostic accuracy (including discriminant-groups validity and classification accuracy) as benchmarked against a gold standard structured clinical interview (hypothesis 4).

## METHOD

### Study 1

**Participants.** Study 1 participants included 486 children (54% girls) 7 to 18 years old (mean 13.32 years, standard deviation [SD] 2.90). Of these, 43% identified as black, 37% identified as Caucasian, 7% identified as mixed/biracial, 3% identified as other, and 10% did not identify their race/ethnicity.

**Procedure.** Study 1 participants were recruited through a large practice research network consisting of school-based health clinics, grief support centers, community clinics, and academic medical center settings, all of which provide support to children and adolescents who have experienced a traumatic

event. The network uses a shared battery of common assessment tools to create a data repository with the goal of validating trauma- and bereavement-informed assessment tools across diverse populations. Participating youth agreed to contribute their anonymous de-identified data to the shared data repository. This study received institutional review board approval from the Baylor College of Medicine (Houston, TX).

**Measures: Child/Adolescent Self-Report Version of the RI-5.** The RI-5 is a clinician-administered assessment in which the child/adolescent (7–18 years old) is interviewed. It includes 6 sections: Trauma History Profile, Trauma Details, PTSD Symptom Scale, Frequency Rating Sheet, Distress and Impairment in Functioning, and the Reaction Index Score Sheet. The Trauma History Profile section assesses exposure to 19 different types of traumatic events (eg, serious accidental injury, sexual abuse, bereavement) and type of exposure (ie, victim, witness, learned about). For each traumatic experience endorsed, the Trauma Details section gathers trauma-specific details and the ages at which these occurred. The Trauma History Profile can be completed with information furnished by the child/adolescent, parent/caregiver, and other informants.

The PTSD Symptom Scale and the Frequency Rating Sheet are used to rate the number of days in the past month that the child/adolescent experienced each PTSD symptom. The RI-5 uses a calendar rating sheet to assist in the determination of the number of days in the past month that a symptom occurred (0 = none [no days]; 1 = little [2 days during past month]; 2 = some [1–2 days a week]; 3 = much [2–3 days a week]; and 4 = most [almost every day]).

The Distress and Impairment in Functioning section is used to rate whether the symptoms cause clinically significant distress and problems in relationships at home, in school, with peers, and in development. The Reaction Index Score Sheet provides a method for calculating whether *DSM-5* criteria for PTSD and dissociative subtype are met. Scoring procedures tabulate RI-5 category subscale scores (ie, Criterion B, C, D, and E categories) and a total scale score.

**Short Mood and Feelings Questionnaire.** The 13-item Short Mood and Feelings Questionnaire (SMFQ) Child Version assesses depressive symptoms in children and adolescents.<sup>30</sup> Because items are based on *DSM-III* depression criteria, the SMFQ is not used as a diagnostic measure. Children rate whether each item reflects their feelings and behavior on a 3-point scale (“not true,” “sometimes,” “true”) during the previous 2 weeks. The SMFQ has produced a unidimensional factor structure in child samples.<sup>31</sup> In epidemiologic samples, SMFQ scores have converged with scores on other measures of child depression, distinguished children who are depressed from controls, and

exhibited good internal consistency ( $\alpha = .85$ ).<sup>30</sup> In this study, the SMFQ internal consistency was good ( $\alpha = .89$ ).<sup>32</sup>

**Data Analytic Plan.** We used Cronbach  $\alpha$  values to evaluate the internal consistency of each RI-5 criterion category and its total scale score and bivariate correlations to evaluate the criterion-referenced validity of all continuous RI-5 scores and the SMFQ total score.

## Study 2

**Participants.** Study 2 participants included 41 children (59% girls) 7 to 17 years old (mean 12.44 years, SD 2.99). Of these, 39% identified as black, 27% identified as Caucasian, 20% identified as Latino, and 15% identified as mixed/biracial.

**Procedure.** Participants were recruited through an outpatient clinic housed in a large academic medical center that provides evidence-based assessment and intervention services to youth 7 to 17 years of age who have experienced potentially traumatic events, including high rates of bereavement. Clinic procedures involve administering a standardized assessment protocol, including the RI-5, to all children and adolescents presenting at the clinic. For study 2, participants were administered an additional semi-structured clinical interview, the CAPS-CA-5,<sup>16</sup> and compensated for their time. Of the 41 youth approached about the study (on a rolling basis as they presented to the clinic), all families consented/assented to participate (100% response rate).

**Measures: Demographics.** Demographic information, including sex, age, and race/ethnicity, was obtained through in-person interviews with caregivers.

**RI-5 (See Study 1): Clinician-Administered PTSD Scale for DSM-5-Child/Adolescent Version.** The CAPS-CA-5 is a 30-item clinician-administered semistructured interview designed to assess *DSM-5* PTSD diagnostic criteria for youth at least 7 years old.<sup>17</sup> This measure is a developmentally modified version of the CAPS-5<sup>18</sup> and includes age-appropriate items and picture response options. The validation of the CAPS-CA-5 is currently underway according to communication with its authors. The child self-reported Trauma History Profile section of the RI-5 was used to identify the index traumatic event. Similar to the CAPS-5, the CAPS-CA-5 assesses each of the 20 *DSM-5* PTSD symptoms. For each symptom, standardized questions and probes are provided that are designed to target the onset and duration of symptoms, subjective distress, impact of symptoms on social functioning, impairment in development, overall response validity, overall

PTSD severity, and specifications for the dissociative subtype. The assessor integrates information about frequency and intensity of an item into a single severity rating. CAPS-CA-5 symptom cluster severity scores are calculated by summing individual item severity scores for symptoms corresponding to a given *DSM-5* cluster. A symptom cluster score also can be calculated for dissociation by summing the 2 corresponding dissociative items. PTSD diagnostic status is determined by dichotomizing each symptom as “present” or “absent” and then applying the *DSM-5* diagnostic rule (symptom present if the corresponding item severity score is  $\geq 2$ , “moderate/threshold”). *DSM-5* PTSD diagnostic rules require at least 1 Criterion B symptom, at least 1 Criterion C symptom, at least 2 Criterion D symptoms, and at least 2 Criterion E symptoms persist for longer than 1 month and produce clinically significant distress or functional impairment.

The clinic director trained 2 clinicians (1 master’s-level and 1 doctoral-level) to administer and score the CAPS-CA-5. All participants’ interviews were videotaped, and 38% were double coded and randomly selected at intermittent points throughout the study to evaluate inter-rater reliability. The team used intraclass correlation coefficients to assess inter-rater reliability between coders for continuous ratings and  $\kappa$  statistics to evaluate inter-rater reliability between coders for diagnostic and subtype status. Intraclass correlation coefficients for all symptom cluster scores were very good (range 0.80–1.0),<sup>34</sup> and all  $\kappa$  coefficients for diagnostic and subtype status were 1.0. Any between-rater discrepancies were discussed with the clinic director to reach consensus.

**Data Analytic Plan.** Internal consistencies of each RI-5 category and the total scale score were measured with Cronbach  $\alpha$  values. Discriminant-groups validity was evaluated by independent-group *t* tests contrasting total number of trauma types, RI-5 criterion category scores, and total scales scores between youth who met and those who did not meet full PTSD diagnostic criteria according to the CAPS-CA-5.

Diagnostic accuracy was examined by ROC analyses.<sup>21,35</sup> ROC analyses estimate the diagnostic accuracy of a measure by comparing it with an index test (eg, diagnostic interview), producing thresholds that maximize a measure’s sensitivity and/or specificity. ROC analyses were used to evaluate the RI-5’s compromise between diagnostic sensitivity and specificity.<sup>21</sup> The RI-5’s total number of trauma types reported, Criterion B category score, Criterion C category score, Criterion D category score, Criterion E category score, dissociative subtype score, and total scale score served as input, and the CAPS-CA-5 served as the index test criterion determining the presence versus absence

of PTSD. The probability of accurately classifying children with PTSD was estimated with the area under the curve (AUC) coefficient, which is tested against the null hypothesis of chance performance (ie, 0.50). Benchmarks used to gauge AUCs included at least 0.9 (“excellent”), at least 0.80 (“good”), at least 0.70 (“fair”), and less than 0.70 (“poor”).<sup>36</sup>

To inform the clinical utility of the RI-5, a single diagnostic likelihood ratio (DLR; ie, sensitivity divided by the false alarm rate) was estimated based on the RI-5 total scale score that maximized sensitivity and specificity as indicated by ROC analyses.<sup>37</sup> A DLR is a data-driven diagnostic efficiency statistic that provides information about the change in the odds associated with a particular test score. Because this estimate is tied to the base rate, a DLR was computed for the study 2 sample base rate (32%) to provide a more conservative estimate for an outpatient clinic setting (one that does not necessarily specialize in treating trauma-exposed youth) with the lower base rate of 15%.<sup>38</sup> Posterior probabilities for these base rates were computed using an online calculator.<sup>21</sup> DLRs less than 1.0 lower the odds of a PTSD diagnosis; those near 1.0 indicate no change; those of 2 to 5 represent a moderate increase; those of 5 to 10 represent a large increase; and those greater than 10 represent often clinically decisive odds changes.<sup>37</sup>

## RESULTS

### Study 1

**Test Item Clarity and Developmental Appropriateness.** As part of study 1, candidate RI-5 items were developed with the assistance of clinicians and researchers with expertise in assessing childhood traumatic stress with the aim of developing age-appropriate items that correspond with *DSM-5* PTSD symptom criteria. Step 1 involved generating candidate RI-5 items, which included items taken verbatim from the *DSM-IV* version, reworded items from the *DSM-IV* version, and new items designed to capture new *DSM-5* PTSD symptoms, including the dissociative subtype. For the developmental appropriateness of the measure, items were intentionally worded such that school-age youth would understand their meaning. However, older youth and adolescents in the sample also were accepting of the item wording, resulting in a measure that spans a wide age range without compromising the acceptability or feasibility of its administration. Step 2 involved having 20 clinicians field-test each items’ performance with patients from their current workload. They were instructed to administer each candidate question and evaluate how well the question was understood by asking patients to indicate whether the items made sense to them, identify items that were confusing, suggest alternative

wording, and provide examples for each symptom question. Then, focus groups were held with the clinicians to obtain their feedback on developmental appropriateness and item wording. As a result, several item wordings were altered to enhance their comprehensibility, especially if the *DSM-5* PTSD criterion offered multiple alternatives, such as “significant increased frequency of negative emotional states (eg, fear, guilt, sadness, shame, confusion).” Some item wordings were changed to incorporate age-appropriate terminology. For example, 1 question in the Trauma History Profile asked youth whether anyone had touched their “private sexual body parts.” Youth feedback suggested the need for revising the wording to “private parts.” As a second example, deaths of any kind (eliminating the word “violent”) were listed as a potential index trauma based on clinician observations and empirical evidence that even nonviolent deaths can result in childhood PTSD.<sup>33</sup>

**Descriptive Statistics.** Table 1 presents descriptive statistics for the sample. On average, participants reported exposure to 3.64 different types of potentially traumatic events (SD 2.30). Approximately 81% reported experiencing the death of a close person; 52% witnessed or heard about the violent death/serious injury of a loved one/friend; 36% witnessed someone being beaten up, shot, or killed; 27% witnessed domestic violence; 25% experienced “other traumas”; 23% experienced school/neighborhood violence; 22% experienced painful/scary medical treatments; 21% experienced domestic violence; 20% saw a

**TABLE 1** Study 1: Descriptive Statistics for Demographic and UCLA PTSD Reaction Index for *DSM-5* (RI-5) Variables of Interest

Variable	n	Mean	SD	Range
Girls	264	—	—	—
Age (y)	486	13.32	2.90	
Ethnicity				
European American	179	—	—	—
African American	211	—	—	—
Mixed/biracial	32	—	—	—
Other	16	—	—	—
RI-5				
Total traumas reported	486	3.64	2.30	1–13
Criterion B category score	476	6.25	5.52	0–20
Criterion C category score	476	2.97	2.58	0–8
Criterion D category score	478	9.04	6.95	0–28
Criterion E category score	478	8.69	5.73	0–23
Dissociative subtype score	466	2.00	2.50	0–8
Total scale score	478	26.92	18.37	0–76

Note: N = 486.



dead body; 20% experienced a serious accident; 15% experienced a natural disaster; 13% experienced sexual molestation; 6% experienced rape; and 3% experienced war/political violence.

**Hypothesis 1: Internal Consistency.** Internal consistencies of the RI-5 categories, with the exception of Criterion C category ( $\alpha = .67$ ), were within acceptable to good ranges ( $\alpha = .76-.89$ ; Table 2).<sup>32</sup> Internal consistency of the RI-5 total scale score was excellent ( $\alpha = .94$ ).

**Hypothesis 2: Criterion-Referenced Validity.** Bivariate correlations among all RI-5 category scores, total scale score, and SMFQ total scores were examined for evidence of criterion-reference validity. Total number of trauma types ( $r = 0.35$ ), all RI-5 category scores (ie, Criterion B category, 0.56; Criterion C category, 0.48; Criterion D category, 0.70; Criterion E category, 0.50), and RI-5 total scale scores ( $r = 0.68$ ) correlated positively with SMFQ total scores.

**Study 2**

**Descriptive Statistics.** Table 3 presents demographic information by diagnostic classification and results of independent-groups *t* tests. Youth meeting PTSD criteria were significantly older.

Overall, participants reported an average of 4.02 traumas (SD 2.30). Approximately, 93% reported experiencing the death of a close person; 71% witnessed or heard about the violent death/serious injury of a loved one or friend; 37% experienced a natural disaster; 37% witnessed domestic violence; 32% experienced domestic violence; 27% saw a dead body; 24% witnessed someone being beaten up, shot, or killed; 20% experienced a serious accident; 20% experienced school/neighborhood violence; 17% experienced painful/scary medical treatments; 12% experienced sexual molestation; 10% experienced “other traumas”; 7% experienced rape; and 2% experienced war/political violence.

**Hypothesis 3: Internal Consistencies.** Consistent with study 1, Cronbach  $\alpha$  values for the RI-5 categories, with the

exception of Criterion C category ( $\alpha = .69$ ), were within the good to excellent ranges ( $\alpha = .81-.95$ ; Table 2).<sup>32</sup> Internal consistency of the RI-5 total scale score was excellent ( $\alpha = .96$ ).

**Hypothesis 4: Discriminant-Groups Validity, Diagnostic Accuracy, and Clinical Utility.** Independent-groups *t* tests showed that youth who met full PTSD diagnostic criteria had significantly higher RI-5 scores across all criterion categories and total scale scores than youth who did not meet full diagnostic criteria (Table 3).

Table 4 presents AUC statistics and corresponding Cohen *d* scores. All RI-5 categories discriminated between PTSD diagnostic statuses significantly better than chance. Total number of trauma types reported and the dissociative subtype continuous score demonstrated “fair” performance, Criterion C category demonstrated “good” performance, and the remaining indicators demonstrated “excellent” performance.<sup>36</sup>

For clinical utility, an RI-5 total scale score of 35 showed the best diagnostic accuracy, demonstrating high sensitivity (1.00) and specificity (0.86). This threshold score produced a DLR of 6.99, representing a large increase in the odds of a PTSD diagnosis. This can be clinically interpreted by transforming the likelihood of having a PTSD diagnosis in a site (prior probability; eg, 32% base rate in study 2 or 15% base rate in a general outpatient clinic<sup>37</sup>) to the percentage of chance of having PTSD given a RI-5 total scale score of 35 (posterior probability; eg, a 76% in a sample resembling study 2 and a posterior probability of 55% in a sample resembling a general outpatient clinic setting). Participants were significantly more likely to have a PTSD diagnosis with an increased RI-5 total scale score.

**DISCUSSION**

The RI-5, a child self-report measure designed to assess DSM-5 PTSD criteria in youth 7 to 18 years old, was developed using best-practice test construction procedures to enhance test validity, developmental sensitivity, and clinical utility.<sup>28,39</sup> Content experts helped to ensure that candidate test items were clear, comprehensible, and developmentally appropriate for school-age children and adolescents alike. Information gathered from focus groups with clinicians also was used to support the clarity, developmental appropriateness, and acceptability of the items. Consistent with hypotheses 1 and 3, across the 2 studies the RI-5 criterion categories showed good internal consistency (with the exception of Criterion C category), and the total scale showed excellent reliability. Criterion C category is composed of 2 items, which likely contributes to its lower rate of reliability. This finding is consistent with other studies assessing the internal consistency of Criterion C category in US

**TABLE 2** Internal Consistencies<sup>a</sup> of UCLA PTSD Reaction Index for DSM-5 (RI-5) Categories and Total Scale Score

RI-5	Study 1	Study 2
Criterion B category	0.86	0.85
Criterion C category	0.67	0.69
Criterion D category	0.89	0.92
Criterion E category	0.76	0.81
Dissociative subtype score	0.87	0.95
Total scale score	0.94	0.96

Note: *n* = 390–469.  
<sup>a</sup>As measured by Cronbach  $\alpha$ .

**TABLE 3** Study 2: Descriptive Statistics for Clinical and Demographic Variables and Tests of Association with Posttraumatic Stress Disorder (PTSD) Status

Variable	PTSD (n = 13)	No PTSD (n = 28)	Test Statistic	p	Effect Size (Cohen d)
Age (y), mean (SD)	13.85 (3.11)	11.46 (2.89)	$t_{39} = 2.40$	.02*	0.77
Girls, n (%)	9.0 (69)	15.0 (54)	$\chi^2_1 = 0.90$	.34	
Ethnicity			$\chi^2_3 = 3.17$	.37	
European American	4	7			
African American	7	9			
Latino	1	7			
Mixed/biracial	1	5			
RI-5, mean (SD)					
Total traumas reported	5.54 (2.44)	3.39 (1.91)	$t_{39} = 3.19$	.003***	1.02
Criterion B category score	14.46 (4.50)	5.18 (4.23)	$t_{39} = 6.41$	<.001***	2.05
Criterion C category score	6.31 (1.49)	2.79 (2.57)	$t_{36.80} = 5.51$	<.001***	1.82
Criterion D category score	17.62 (5.84)	6.61 (5.84)	$t_{39} = 5.62$	<.001***	1.80
Criterion E category score	15.38 (4.48)	5.61 (4.59)	$t_{39} = 6.39$	<.001***	2.05
Dissociative subtype score	3.62 (2.93)	1.71 (2.65)	$t_{39} = 2.07$	.05	0.66
Total scale score	53.92 (13.11)	20.18 (14.94)	$t_{39} = 6.98$	<.001***	2.24

Note: n = 41. RI-5 = UCLA PTSD Reaction Index for DSM-5.

\*p < .05; \*\*p < .01; \*\*\*p < .001.

samples.<sup>19,20</sup> Descriptively, when we applied other metrics (eg, item-total correlations), the reliability of Criterion C category became acceptable (sample 1,  $r = 0.51$ ; sample 2,  $r = 0.55$ ).<sup>40</sup> Consistent with hypothesis 2, the RI-5 exhibited criterion-referenced validity in study 1, in that all subscales and the total scale score correlated significantly with a measure of depression.<sup>29</sup> Consistent with hypothesis 4, the RI-5 showed evidence of discriminant-groups validity in study 2, in that youth who met full PTSD diagnostic criteria as gauged by a semistructured clinical interview had significantly higher RI-5 criterion category scores and total scale scores than youth who did not. Moreover, ROC analyses identified a total scale score cutoff score of 35 that showed excellent diagnostic accuracy.<sup>37</sup>

The construction of a developmentally informed child self-report measure of DSM-5 PTSD that exhibits good internal consistency, criterion-referenced validity, and diagnostic accuracy in predicting PTSD carries important implications for a range of child-service settings, including schools, juvenile justice, child welfare, and community health and mental health clinics. Given evidence on the high prevalence of trauma and traumatic bereavement among US students,<sup>1</sup> associated rates of PTSD,<sup>7</sup> and the potential interference of trauma and PTSD with learning,<sup>41</sup> school districts can benefit from adopting developmentally informed, psychometrically sound, and efficient tools with which to evaluate PTSD. For example, the RI-5 can be used to conduct school- and district-level situation analysis

**TABLE 4** Study 2: Area Under the Curve (AUC) Coefficients From Receiver Operating Characteristic Analyses

Index Test vs. RI-5	AUC	SE	p	95% CI		Effect Size (Cohen d)
				Lower	Upper	
Total number of traumas	0.78	0.08	.005**	0.62	0.93	1.09
Criterion B category score	0.92	0.04	<.001***	0.84	1.00	1.99
Criterion C category score	0.87	0.06	<.001***	0.76	0.98	1.59
Criterion D category score	0.90	0.05	<.001***	0.81	0.99	1.81
Criterion E category score	0.94	0.04	<.001***	0.86	1.00	2.20
Dissociative subtype score	0.72	0.09	.03*	0.55	0.89	0.82
Total scale score	0.94	0.03	<.001***	0.88	1.00	2.20

Note: RI-5 = UCLA PTSD Reaction Index for DSM-5; SE = standard error.

\*p < .05; \*\*p < .01; \*\*\*p < .001.



(estimating prevalence rates of specific trauma types), needs assessment (estimating prevalence rates of PTSD among students), and strategic planning (on how to meet identified needs using school-based interventions).<sup>42</sup> The RI-5 also can guide case formulation and treatment planning by using individualized test profiles to tailor intervention according to youths' trauma history, trauma-specific details, and symptom profile.

Study strengths include adherence to best-practice test construction procedures including expert raters, focus groups, and iterative item refinement; a 2-study design that permitted replication; and use of 2 methods (discriminant-groups validity testing and ROC analyses) to evaluate diagnostic accuracy. Further, this study used a clinical sample whose histories of repeated trauma exposure more closely resemble "real-life" professional practice conditions than the single-incident trauma-exposed youth sample used to validate its *DSM-IV* predecessor.<sup>24</sup>

Study limitations include the use of a single external criterion variable (depression) to evaluate criterion-referenced validity in study 1 and cross-sectional designs in studies 1 and 2 that preclude causal inference and tests of predictive validity. Further, although racially and ethnically diverse, the 2 study samples were recruited largely from 2 large urban cities in which youth encounter high levels of bereavement (81% in study 1 and 93% in study 2), often under violent circumstances. This limits study generalizability to trauma-exposed youth who are not bereaved or who live in regions with less violence. In addition, these 2 studies evaluated only a limited set of different types of validity, underscoring the need for ongoing evaluation of the RI-5's test-retest reliability, predictive validity, factorial validity/internal structure, and factorial invariance across different populations. Future research can incorporate a broader array of criterion variables, including measures of anxiety, maladaptive grief reactions, behavioral disturbances, and positive youth development to more rigorously evaluate validity.<sup>4</sup> Given the high rates of bereavement in our sample and in the general population<sup>43</sup> and the risk of conceptually and diagnostically conflating posttraumatic stress and grief reactions through the use of such labels as "childhood traumatic grief,"<sup>44</sup> future

studies with traumatically bereaved youth that examine the prevalence of PTSD and maladaptive grief (eg, persistent complex bereavement disorder)<sup>45</sup> and their interplay could be especially informative.<sup>44</sup>

In conclusion, the present study provides evidence to support the internal consistency, criterion-referenced validity, and diagnostic accuracy of the RI-5. This developmentally informed assessment tool allows researchers and clinicians to assess trauma-exposed children and adolescents (7–18 years of age) with regard to traumatic life events and *DSM-5* diagnostic criteria for PTSD, including a clinical cutoff score.

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## REFERENCES

- McChesney GC, Adamson G, Shevlin M. A latent class analysis of trauma based on a nationally representative sample of US adolescents. *Soc Psychiatry Psychiatr Epidemiol*. 2015;50:1207-1217.
- Finkelhor D, Turner H, Ormrod R, Hamby SL. Violence, abuse, and crime exposure in a national sample of children and youth. *Pediatrics*. 2009;124:1411-1423.
- Copeland WE, Keeler G, Angold A, Costello EJ. Traumatic events and posttraumatic stress in childhood. *Arch Gen Psychiatry*. 2007;64:577-584.
- Wenar C, Kerig P. *Developmental Psychopathology: From Infancy Through Adolescence*. 6th ed. New York: McGraw-Hill; 2015.
- Mueser KT, Taub J. Trauma and PTSD among adolescents with severe emotional disorders involved in multiple service systems. *Psychiatr Serv*. 2008;59:627-634.
- Kaplow JB, Widom CS. Age of onset of child maltreatment predicts long-term mental health outcomes. *J Abnorm Psychol*. 2007;116:176-187.
- Alisic E, Zalta AK, van Wesel F, et al. Rates of post-traumatic stress disorder in trauma-exposed children and adolescents: meta-analysis. *Br J Psychiatry*. 2014;204:335-340.
- Steinberg AM, Brymer MJ, Decker KB, Pynoos RS. The University of California at Los Angeles post-traumatic stress disorder reaction index. *Curr Psychiatry Rep*. 2004;6:96-100.

9. Steinberg A, Brymer M. UCLA PTSD reaction index. In: Reyes G, Elhai JD, Ford JD, eds. *The Encyclopedia of Psychological Trauma*. Hoboken, NJ: Joh Wiley & Sons; 2008:673-674.
10. Hawkins SS, Radcliffe J. Current measures of PTSD for children and adolescents. *J Pediatr Psychol*. 2006;31:420-430.
11. Ohan JL, Myers K, Collett BR. Ten-year review of rating scales. IV: Scales assessing trauma and its effects. *J Am Acad Child Adolesc Psychiatry*. 2002;41:1401-1422.
12. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 5th ed. Washington, DC: American Psychiatric Association; 2013.
13. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 4th ed, text reved. Washington, DC: American Psychiatric Association; 2000.
14. Blevins CA, Weathers FW, Davis MT, Witte TK, Domino JL. The Posttraumatic Stress Disorder Checklist for *DSM-5* (PCL-5): development and initial psychometric evaluation. *J Trauma Stress*. 2015;28:489-498.
15. Foa EB, McLean CP, Zang Y, *et al.* Psychometric properties of the Posttraumatic Diagnostic Scale for *DSM-5* (PDS-5). *Psychol Assess*. 2016;28:1166-1171.
16. Foa EB, McLean CP, Zang Y, *et al.* Psychometric properties of the Posttraumatic Stress Disorder Symptom Scale Interview for *DSM-5* (PSSI-5). *Psychol Assess*. 2016;28:1159-1165.
17. Pynoos RS, Weathers FW, Steinberg AM *et al.* Clinician-Administered PTSD Scale for *DSM-5*—Child/Adolescent Version. National Center for PTSD. <https://www.ptsd.va.gov/professional/assessment/child/caps-ca.asp>. Updated March 9, 2017. Accessed April 5, 2018.
18. Weathers FW, Bovin MJ, Lee DJ, *et al.* The Clinician-Administered PTSD Scale for *DSM-5* (CAPS-5): development and initial psychometric evaluation in military veterans. *Psychol Assess*. 2018;30:383-395.
19. Sachser C, Berliner L, Holt T, *et al.* International development and psychometric properties of the Child and Adolescent Trauma Screen (CATS). *J Affect Disord*. 2017; 210:189-195.
20. Foa EB, Asnaani A, Zang Y, Capaldi S, Yeh R. Psychometrics of the Child PTSD Symptom Scale for *DSM-5* for trauma-exposed children and adolescents. *J Clin Child Adolesc Psychol*. 2018;47:38-46.
21. Youngstrom EA. A primer on receiver operating characteristic analysis and diagnostic efficiency statistics for pediatric psychology: we are ready to ROC. *J Pediatr Psychol*. 2014;39:204-221.
22. Elhai JD, Layne CM, Steinberg AM, *et al.* Psychometric properties of the UCLA PTSD Reaction Index. Part II: Investigating factor structure findings in a national clinic-referred youth sample. *J Trauma Stress*. 2013;26:10-18.
23. Steinberg AM, Brymer MJ, Kim S, *et al.* Psychometric properties of the UCLA PTSD Reaction Index: Part I. *J Trauma Stress*. 2013;26:1-9.
24. Rodriguez N, Steinberg AS, Saltzman WS, Pynoos RS. PTSD index: psychometric analyses of the adolescent version. Presented at the 17th Annual Meeting of the International Society for Traumatic Stress Studies; New Orleans, LA; December 2001.
25. Garfin DR, Silver RC, Gil-Rivas V, *et al.* Children's reactions to the 2010 Chilean earthquake: the role of trauma exposure, family context, and school-based mental health programming. *Psychol Trauma*. 2014;6:563-573.
26. Murray LK, Bass J, Chomba E, *et al.* Validation of the UCLA child post-traumatic stress disorder-reaction index in Zambia. *Int J Ment Health Syst*. 2011;5: 24-24.
27. Takada S, Kameoka S, Okuyama M, *et al.* Feasibility and psychometric properties of the UCLA PTSD reaction index for *DSM-5* in Japanese youth: a multi-site study. *Asian J Psychiatr*. 2018;33:93-98.
28. DeVellis RF. *Scale Development: Theory and Applications*. Vol 26. 3rd ed. Thousand Oaks, CA: Sage Publications; 2012.
29. Cornelis MC, Nugent NR, Amstadter AB, Koenen KC. Genetics of post-traumatic stress disorder: review and recommendations for genome-wide association studies. *Curr Psychiatry Rep*. 2010;12:313-326.
30. Angold A, Costello EJ, Messer SC, Pickles A. Development of a short questionnaire for use in epidemiological studies of depression in children and adolescents. *Int J Methods Psychiatr Res*. 1995;5:237-249.
31. Messer SC, Angold A, Costello EJ, *et al.* Development of a short questionnaire for use in epidemiological studies of depression in children and adolescents: factor composition and structure across development. *Int J Methods Psychiatr Res*. 1995;5:251-262.
32. George D, Mallery P. *SPSS for Windows Step by Step: A Simple Guide and Reference*. 4th ed. Needham Heights, MA: Allyn & Bacon; 2003.
33. Kaplow JB, Howell KH, Layne CM. Do circumstances of the death matter? Identifying socioenvironmental risks for grief-related psychopathology in bereaved youth: do circumstances of the death matter? *J Trauma Stress*. 2014;27:42-49.
34. Gwet KL. *Handbook of Inter-Rater Reliability: The Definitive Guide to Measuring the Extent of Agreement Among Raters*. 3rd ed. Gaithersburg, MD: Advances Analytics; 2012.
35. Kraemer HC. *Evaluating Medical Tests: Objective and Quantitative Guidelines*. Newbury Park, CA: Sage Publications; 1992.
36. Swets JA. Measuring the accuracy of diagnostic systems. *Science*. 1988;240:1285-1293.
37. Straus SE, Tetroe JM, Graham ID. Knowledge translation is the use of knowledge in health care decision making. *J Clin Epidemiol*. 2011;64:6-10.
38. Gabbay V, Oatis MD, Silva RR, Hirsch G. Epidemiological aspects of PTSD in children and adolescents. In: Silva R, ed. *Posttraumatic Stress Disorders in Children and Adolescents: Handbook*. 1st ed. New York: WW Norton & Co; 2004:1-17.
39. Haynes SN, Smith GT, Hunsley JD, Smith G. *Scientific Foundations of Clinical Assessment*. Florence: Routledge; 2014;2011.
40. Nunnally JC, Bernstein IH. *The assessment of reliability*. 3rd ed., *Psychometric Theory*. 1st ed. New York: McGraw-Hill; 1994:248-292.
41. Saigh PA, Yasik AE, Oberfield RA, Halamandaris PV, Bremner JD. The intellectual performance of traumatized children and adolescents with or without posttraumatic stress disorder. *J Abnorm Psychol*. 2006;115:332-340.
42. Saltzman W, Layne C, Pynoos R, Olafson E, Kaplow J, Boat B. *Trauma and Grief Component Therapy for Adolescents: A Modular Approach to Treating Traumatized and Bereaved Youth*. Cambridge: Cambridge University Press; 2017.
43. Oosterhoff B, Kaplow JB, Layne CM. Links between bereavement due to sudden death and academic functioning: results from a nationally representative sample of adolescents. *Sch Psychol Q*. 2018;33:372-380.
44. Layne CM, Kaplow JB, Oosterhoff B, Hill RM, S. Pynoos R. The interplay between posttraumatic stress and grief reactions in traumatically bereaved adolescents: when trauma, bereavement, and adolescence converge. *Adolesc Psychiatry*. 2018;7:266-285.
45. Kaplow JB, Layne CM, Oosterhoff B, *et al.* Validation of the Persistent Complex Bereavement Disorder (PCBD) Checklist: a developmentally-informed assessment tool for bereaved youth. *J Trauma Stress*. 2018;31:244-254.