Validation of an electronic self-administered version of the Dimensional Inventory of Stress and Trauma Across the Lifespan (DISTAL) in a large sample of young adults

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Acknowledgments: This work was supported by the National Science Foundation (NSF) CAREER Award (BCS-2145372), Jacobs Foundation Early Career Research Fellowship, The Society for Clinical Child and Adolescent Psychology (Division 53 of the American Psychological Association) Richard "Dick" Abidin Early Career Award and Grant, and National Institutes of Health (NIH) Director's Early Independence Award (DP5OD021370) to D.G.G.; and a NSF Graduate Research Fellowship Program (GRFP) award (NSF DGE-1752134), The Society for Clinical Child and Adolescent Psychology (Division 53 of the American Psychological Association) Donald Routh Dissertation Grant, the American Psychological Foundation Elizabeth Munsterberg Koppitz Child Psychology Graduate Fellowship, a Dissertation Funding Award from the Society for Research in Child Development, a Dissertation Research Award from the American Psychological Association, an American Dissertation Fellowship from the American Association of University Women (AAUW), and a Scholar Award granted by the International Chapter of the Philanthropic Educational Organization (P.E.O. Foundation) to E.M.C. Funding sources had no role in this work beyond financial support. The authors gratefully acknowledge individuals who facilitated data collection via the REDCap and MTurk platforms, including Samuel Haller, Christine James, Sui Tsang, and Theresa DeLuca.

Author note: The data that support the findings of this study are not publicly available due to privacy restrictions; study materials and analysis code are available upon request to the corresponding author. The authors declare no conflicts of interest. The study's design, hypotheses, and analytical plan were pre-registered (see https://osf.io/nzm9h?view_only=db87ea0d51d44c98ab728f76a9de0b57).

Abstract

Recent advances in dimensional assessment of traumatic stress have initiated research examining correlates of exposure to specific features of stress. However, existing tools require intensive, in-person, clinician administration to generate rich phenotypic data required for such analyses. These approaches are time-consuming, costly, and substantially restrict the degree to which assessment tools can be disseminated in large-scale studies, constraining refinement of existing dimensional models of early adversity. Here, we present an electronic adaptation of the Dimensional Inventory of Stress and Trauma Across the Lifespan (DISTAL), called the DISTAL-Electronic (DISTAL-E), present descriptive statistics drawn from a large sample of N = 500 young adult participants who completed the novel measure, and provide information about its psychometric properties. Results suggest that the DISTAL-E adequately assesses the following dimensional indices of traumatic stress exposure: type, chronicity, age of onset, severity, proximity, caregiver involvement, controllability, predictability, betrayal, threat, and deprivation, and that it has excellent content and convergent validity and good test-retest reliability over a 7-11 day period. Though the development of the DISTAL-E facilitates the broad assessment of dimensions of stress exposure in large-scale datasets and has the potential to increase access to stress-related research to a wider group of participants who may not be able to access clinical research in traditional, in-person, clinic-based settings, generalizability of results of the present study may be constrained by the fact that study participants were primarily White, educated, and with adequate income.

Keywords: adversity, traumatic stress, multidimensional assessment of adversity, electronic assessment, online assessment

Clinical impact statement

The development of the Dimensional Inventory of Stress and Trauma Across the Lifespan-Electronic (DISTAL-E) allows for broader assessment of exposure to specific features of stress. The DISTAL-E is a validated tool for practitioners to thoroughly assess an individual's dimensional exposure to a range of traumatic stressors and the online format facilitates greater access to such assessment among diverse populations across varied clinical settings. This new wave of assessment is likely to improve understanding of the ways in which specific dimensions of stress confer risk or resilience for mental health and neurobiological sequelae of stress exposure.

Introduction

Exposure to traumatic stress is a ubiquitous experience that has far-reaching effects on mental health across the lifespan (McFarlane, 2010). An estimated seventy percent of adults report having experienced at least one traumatic event that satisfies criterion A of the Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5) definition of posttraumatic stress disorder (PTSD; American Psychiatric Association, 2013; Kessler et al., 2017). Extant research—which has predominantly taken a categorical approach to classifying exposure to traumatic stress—has revealed consistent patterns of association between exposure to traumatic stress and alterations in neurobiology (see VanTieghem & Tottenham, 2017 for a review), as well as vulnerability for development of cognitive, social, physical, and mental health problems (e.g., Boyce, 2007; Shonkoff et al., 2012).

Exposure to traumatic stress, however, does not have homogeneous effects on all individuals, which is likely driven by heterogeneity in traumatic stress exposure and the developmental stage at which an individual is exposed to a given traumatic stressor (Cohodes et

al., 2021; Gee & Casey, 2015). In light of this heterogeneity in the psychobiological sequelae of stress exposure, researchers have further embraced dimensional approaches to studying the impact of traumatic stress, with a focus on parsing experiential, environmental, and temporal features of stress that may moderate the association between exposure to traumatic stress and psychobiological features of interest (e.g., Herzog et al., 2020). Theoretical models have proposed that the developmental timing of traumatic stressors—as well as whether or not a traumatic stressor is characterized by specific features such as threat, deprivation, caregiver involvement, predictability, and controllability—may moderate the association between traumatic stress exposure and clinical and neurodevelopmental outcomes (e.g., Cohodes et al., 2021; Gee & Casey, 2015; Glynn & Baram, 2019; Manly et al., 2001; McLaughlin & Sheridan, 2016; Teicher et al., 2016).

Although the prominence of such theoretical approaches is increasing, testing key predictions from these theories and further refining them has been restricted by limitations of available assessment tools to assess dimensions of traumatic stress exposure in sufficient detail. In order to test and, ultimately, expand upon, existing dimensional theoretical models, assessment tools designed to measure lifetime exposure to traumatic stress must query exposure to specific dimensions of traumatic stress—as well as the developmental stage at which they occurred. The tools most frequently used to retrospectively assess exposure to traumatic stress, either in development or across the lifespan (e.g., ACEs-based questionnaires), facilitate only a cumulative-based approach to quantifying exposure to traumatic stress across the lifespan. Several measures extend this approach in that they systematically assess several dimensions of exposure such as type and severity (e.g., Childhood Trauma Questionnaire [CTQ]; Bernstein et al., 1997) or type, severity, and developmental timing of exposure (e.g., UCLA Posttraumatic

Stress Disorder Reaction Index [UCLA PTSD RI]; Steinberg et al., 2004), or further assess presence of specific dimensions of exposure such as perceptions of controllability (e.g., Dimensions of Stressful Events Rating Scale [DOSE]; Spilsbury et al., 2008).

The development of the Dimensional Inventory of Stress and Trauma Across the Lifespan (Cohodes et al., 2023), a novel adaptation of the UCLA PTSD RI (Steinberg et al., 2004), represents a major advancement in measurement of retrospectively reported exposure to key dimensions of stress exposure that have been theorized to contribute to heterogeneity in behavioral and neurodevelopmental outcomes following exposure to trauma. This clinician-administered interview comprehensively assesses an individual's exposure to multiple features of traumatic stress, namely the timing, severity (of both an individual's exposure and reaction), type, persons involved in the exposure, controllability, predictability, presence of threat, presence of deprivation, proximity, perception of betrayal, and perception of discrimination during exposure to traumatic stress at each age of an individual's life to date. The DISTAL yields a rich phenotypic profile that has the potential to facilitate investigations of the complex interplay of features of stress in predicting both clinical and neurobiological outcomes. Recent validation efforts suggest that this novel instrument captures variability in the degree to which individuals were exposed to each of the aforementioned dimensions of stress exposure, and that the DISTAL has good content validity, established via associations between the DISTAL and other established measures of exposure to traumatic stressors (Cohodes et al., 2023).

The development and validation of the DISTAL reflects important progress in the dimensional assessment of exposure to traumatic stress across the lifespan and can facilitate a wave of empirical inquiry that further elucidates the ways in which exposure to traumatic stressors characterized by specific features may affect the developing brain and mental health.

Despite the utility of this tool, administration of the DISTAL—like similar tools—requires intensive resources at the level of data collection both in terms of participant burden, interview time, and required skill level of the clinical interviewer. The intensive nature of administration of clinical interviews like the DISTAL substantially restricts the degree to which these types of phenotypic approaches can be applied in large-scale studies (e.g., Hoffman et al., 2019) that may be most likely to yield shifts in understanding of the psychobiological sequelae of stress exposure.

The benefits of using electronic data capture-based methods to assess clinical symptomatology have been well-documented and include reduction in participant as well as administrative burden, utilization of skip patterns, branching logic, and embedded data quality checks, minimization of error introduced in data entry from paper forms to databases, data that are reliably date- and time-stamped via electronic capture, and minimization of missing data due to the possibility of implementing required fields (see Muehlhausen et al., 2015). In addition, recent commentary in the field of clinical assessment has highlighted that minoritized populations may face structural barriers to accessing traditional clinical research settings (Adams & Miller, 2022); electronic capture and dissemination of clinical assessments via online platforms is likely to afford increased access to such tools, with the potential for increased representation among participants in clinical psychological science.

As electronic data capture has become increasingly common across clinical fields including clinical psychology (Alfonsson et al., 2014), several studies have examined concordance between data generated by clinician-administered interviews and computer-based surveys of clinical measures (Alfonsson et al., 2014; see van Ballegooijen et al., 2016 for a review), and, specifically, assessments of exposure to traumatic stress (Read et al., 2009). These

studies suggest high rates of concordance between data generated by clinical interviews and computer-based surveys of traumatic history and point to internet-based studies as a vehicle for reliable, efficient assessment in a more diverse population.

The numerous benefits of electronic self-administration of a dimensional assessment tool such as the DISTAL motivated the development of the Dimensional Inventory of Stress and Trauma Across the Lifespan-Electronic (DISTAL-E). Like the DISTAL, the DISTAL-E was designed to thoroughly and retrospectively assess the timing, severity (of exposure and reaction), type, persons involved, controllability, predictability, threat, deprivation, proximity, betrayal, and discrimination inherent in an individual's exposure to adversity. This novel measure facilitates the broad assessment of dimensions of stress exposure in large-scale datasets, which has the potential to greatly enhance understanding of the ways in which specific features of stress may impact both short- and long-term psychological sequelae of exposure to stress. As it has been suggested that psychometric validity should be re-established when adapting clinician-administered tools to online (self-report) formats (Coons et al., 2009), here, we present initial descriptive statistics and examine evidence for content and convergent validity, as well as test-retest reliability, of the Dimensional Inventory of Stress and Trauma Across the Lifespan-Electronic (DISTAL-E) using data from a large sample of adults collected via distribution of an electronic survey via Amazon Mechanical Turk ($N = 500$).

We hypothesized that severity of exposure to childhood adversity (at both a broad level and within a given type of exposure [e.g., physical abuse]), as assessed by the DISTAL-E, would be significantly positively associated with severity of exposure to childhood adversity assessed by the CTQ. We further hypothesized that a higher number of exposures to adversity across the lifespan—and a greater degree of exposure to each novel dimension of interest—would be

significantly positively associated with trauma-related symptomatology, as assessed by the Trauma Symptoms Checklist-40 (TSC-40). With regard to test-retest reliability, we hypothesized that patterns of responding to the DISTAL-E—both in terms of endorsement of screener questions and module-specific questions—would not differ significantly across the two administrations.

Method

Pre-registration

Study hypotheses, detailed methods and procedures, and an initial data analysis plan (including exclusion criteria and data-stopping rules) for the present study were pre-registered using the Open Science Framework repository (osf.io); full pre-registration (anonymized for review) is available here.

Participants

Test participants

For the test portion of the study, participants with approval ratings over 90% ($N = 856$ unique participants) were recruited in response to an Amazon TurkPrime (Litman et al., 2017) posting advertising a study titled "Life Experiences Survey" for individuals between the ages of 18 and 30 years of age living in the United States. Following data quality checking, $N = 484$ participants were included in the final sample for analyses related to content and convergent validity (see Supplemental Materials [SM] for detailed description of participant exclusion and Table 1 [SM] for participant demographics).

Retest participants

For the retest portion of the study, a subset of the original $N = 856$ participants who successfully completed the initial survey were recruited to complete the retest portion of the

study after 1 week (n = 90). Following data quality checking, N = 48 subjects were included in the final sample for test-retest analyses (see SM for a detailed description of selection of retest participants, participant exclusion, and Table 1 [SM] for participant demographics).

Procedure

All consent and assessment procedures were approved by the Institutional Review Board at [masked for review]. All study procedures were executed via distribution of a REDCap survey (Harris et al., 2009) on Amazon TurkPrime (managed via the Amazon CloudResearch platform). Participants provided informed consent prior to completing a series of questionnaires including the validation target (electronic version of the DISTAL; DISTAL-E), and were thanked, debriefed, and compensated $20 for completion of test procedures and $15 for completion of retest procedures. Attention checks (e.g., "I have been paying attention") were embedded in each questionnaire that comprised the overall battery. See SM for a detailed description of methodological approaches to maintenance of data quality.

In addition to the newly developed electronic version of the Dimensional Inventory of Stress and Trauma Across the Lifespan (DISTAL; Cohodes et al., 2023; DISTAL-E), participants also completed measures of demographic information and trauma-related symptomatology (TSC-40), as well as an additional measure assessing exposure to traumatic stress in childhood as a target of convergent validity (CTQ). In order to assess test-retest reliability of the validation target (DISTAL-E), one week following the initial survey completion, an invitation to complete a retest survey (comprised of solely the validation target) was sent to a subset of participants who successfully completed all study procedures.

Materials

Demographics

Participants were asked to report on their age, sex assigned at birth, gender identity, race/ethnicity, level of education, annual household income, and marital status.

Dimensional Inventory of Stress and Trauma Across the Lifespan-Electronic (DISTAL-E)

The Dimensional Inventory of Stress and Trauma Across the Lifespan-Electronic (DISTAL-E) is an electronic, self-administered adaptation of the Dimensional Inventory of Stress and Trauma Across the Lifespan (DISTAL; Cohodes et al., 2023). Like the clinical interview-based version of the measure, the structure of the DISTAL-E is broadly based on the structure of the UCLA PTSD RI (Pynoos & Steinberg, 2017; Steinberg et al., 2004). The DISTAL-E contains two subsections: a broad screener for potential exposure to multiple types of adversity at three levels of exposure (directly experiencing, witnessing, and learning about the event happening to a close person) and event-specific modules that query additional details about each event endorsed. Participants reported on their exposure to 24 distinct types of adversity events (e.g., serious accidental injury, physical abuse, caregiver separation).

Screening items for exposure to each type of adversity listed above were written to capture exposure to a particular type of adversity at the three levels of exposure of interest (i.e., directly experiencing, witnessing, and learning about the event happening to a close person; at least three screener questions were included for each type of event). See SM for a detailed description of screener questions.

For each type of event that was endorsed in the screening portion of the survey, participants were then asked to report on the cumulative list of ages at which they experienced a particular type of adversity (0-30, or 0 through the current age of participant, if current age less than 30). Following this comprehensive reporting of the list of ages at which a participant was exposed to a particular type of adversity, for each age of exposure that an individual endorsed,

specific features of the exposure at a given age were queried (e.g., all dimensional queries were at the level of adversity type at a given age; e.g., serious accidental injury at age 5). All event-specific module questions were adapted from the DISTAL (see Cohodes et al., 2023, for details on drafting of specific module-level questions). The following factors were queried: *level of exposure* (i.e., whether exposure to a particular type of aversity at a given age was at the level of direct experience, witnessing, or learning about the event happening to a close person); *chronicity* (i.e., number of days and months, respectively during which an individual was exposed to a particular type of adversity at a given age), *severity* (i.e., severity of event [average and worst severity of exposure to a particular type of aversity at a given age] and severity of reaction [average and worst severity of reaction to exposure to a particular type of adversity at a given age]), *person involvement, discrimination, threat, deprivation, control, predictability, physical proximity,* and *betrayal* (i.e., generalized exposure to betrayal, in addition to *caregiver betrayal, personal betrayal, and systemic betrayal*). Specific prompts for each module-specific dimension queried, as well as a detailed description of quality assurance features embedded within the survey, are provided in the SM.

Measures included to assess content and convergent validity

A detailed description of measures included to facilitate examination of content and convergent validity (i.e., CTQ; TSC-40) is provided in the SM.

Analytic strategy

Derivation of dimensions of interest

Consistent with prior dimension derivation from the clinical interview-based DISTAL (Cohodes et al., 2023), based on participants' endorsements of screener questions, the number of distinct types of adversity to which an individual was exposed were summed as an index of ***type*** of

adversity exposure. Three separate metrics of ***chronicity,*** the number of ages, months, and days, respectively, that an individual was exposed to any type of adversity, were summed. The ***age of onset*** of an individual's exposure to adversity was calculated by identifying the earliest age at which a participant reported exposure to any type of adversity. Averages of ***average event severity, worst event severity, average reaction severity,*** and ***worst reaction severity***, respectively, were computed by averaging these specific scores across all completed modules. ***Physical proximity*** was calculated by summing the number of events during which an individual was either close enough to sense (e.g., hear, see, smell) specific aspects of a given event or during which they reported being in the same house or room as the person to whom this event occurred (including themselves). ***Caregiver involvement*** was operationalized as the number of exposures during which a caregiver was involved as a perpetrator and/or affected caregiver. The number of events characterized by ***threat***, ***deprivation***, ***controllability, predictability, betrayal (generalized betrayal, caregiver betrayal, personal betrayal,*** and ***systemic betrayal),*** and ***discrimination*** were summed to create indices reflecting prevalence of these elements of exposure in an individual's history of exposure to adversity.

Treatment of missingness

Given that the focus of the present study was to present descriptive statistics and initial content and convergent validity of the DISTAL-E, as described above, we limited the sample for the present study to a sample of participants who provided a full traumatic stress history (i.e., all events were fully characterized), with the exception of the temporal granularity of exposures (i.e., information regarding the number of days and number of months during which a participant was exposed to a given stressor). Missingness at the level of temporal granularity of exposure was allowed due to that fact that participants declined to answer these questions at a relatively

high frequency, relative to questions assessing all other dimensions of experience (see Discussion). As such, sums related to the number of days and number of months during which an individual was exposed were based upon available (non-missing) data.

Assessment of content and convergent validity

Among participants who completed both the DISTAL-E and CTQ (n = 484), additional DISTAL-E indices were calculated to facilitate assessment of content validity via associations between the DISTAL-E and the CTQ (Bernstein et al., 1994), an established measure of childhood exposure to abuse and neglect. Pearson correlations were calculated to examine relations between DISTAL-E subscales and CTQ subscale and total scores. The following DISTAL-E subscale scores were created to mirror CTQ subscale scores: severity of sexual abuse exposure in childhood; severity of physical abuse exposure in childhood; severity of emotional abuse exposure in childhood; severity of neglect exposure in childhood[1]; and severity of abuse and neglect exposure in childhood (a composite severity rating of all aforementioned adversity categories). Note, in order to parallel the assessment of exposure to adversity via the CTQ, only exposures to adversity that participants reported directly experiencing on the DISTAL-E were considered in creation of DISTAL-E subscale scores (i.e., exposures that participants witnessed or learned about were not included).

A Pearson correlation was calculated to examine the relation between total number of lifetime traumatic exposures, as assessed by the DISTAL-E, and a theoretically relevant construct to establish convergent validity with trauma-related symptomatology (assessed via the TSC-40; Elliott & Briere, 1992) among participants who completed both the DISTAL-E and additional validation targets (TSC-40 and CTQ; n = 484). To assess the utility of examining

[1]Due to the fact that the DISTAL-E does not query emotional and physical neglect separately, distinct emotional and physical neglect subscale scores were not created.

isolated dimensions of exposure (assessed by the DISTAL-E), a Pearson correlation was calculated to examine the relation between each dimension of interest (i.e., number of ages of exposure, number of events characterized by predictability) and trauma-related symptomatology.

Assessment of test-retest reliability

In order to assess test-retest reliability, among participants who provided complete data for both the test and retest studies (n = 48), responses to both screener questions and responses to module-related questions were compared across the two administrations. Specifically, responses to the following questions were compared across the two administrations: total number of lifetime traumatic exposures, chronicity (the number of ages during which an individual was exposed to an adverse event), and number of distinct types of adversity to which an individual was exposed (type). Test-retest reliability was calculated using Pearson r coefficients between each scale score at baseline test and the follow-up retest surveys (n = 48). Reliability coefficients ≥ .70 were considered acceptable, ≥ .80 were considered good, and ≥ .90 considered excellent (Groth-Marnat, 2009).

Results

Descriptive statistics for all dimensions of interest

Descriptive statistics for all dimensions of interest are presented in Table 2 (SM). Participants reported experiencing an average of 12.18 exposures to adversity events across their lifetime to date (*SD* = 9.25; *range* = 0-59), and an average exposure to 7.34 distinct types of events (e.g., sexual abuse, serious accidental injury; *SD* = 4.06; *range* = 0-22). Participants reported directly experiencing an average of 5.96 adversity events (*SD* = 6.67; *range* = 0-47), witnessing an average of 3.64 adversity events (*SD* = 4.09; *range* = 0-30), and learning about an average of 3.90 adversity events (*SD* = 3.57; *range* = 0-21). Participants reported experiencing

adversity at, on average, 7.57 distinct ages (*SD* = 4.22; *range* = 0-22), for an average of 934.52 days across their lifetime (*SD* = 1,827.60; *range* = 0-20,665), and for an average of 46.60 months across their lifetime (*SD* = 67.07; *range* = 0-652). The average onset of exposure to adversity—across all adversity types queried—was 8.41 years of age (*SD* = 4.78; *range* = 0-26). The average event severity of all events reported across participants' lifetimes to date was 3.94 (*SD* = 1.74; *range* = 0-8), and the average worst event severity of all events was 4.81 (*SD* = 1.72; *range* = 0-8). The average reaction severity of all events was 4.11 (*SD* = 1.78; *range* = 0-8), and the average worst reaction severity was 4.95 (*SD* = 1.75; *range* = 0-8).

Participants reported direct physical proximity to an average of 8.33 exposures to adversity (*SD* = 8.25; *range* = 0-8). Participants reported exposure to an average of 2.14 exposures (*SD* = 4.63; *range* = 0-39) that involved a caregiver in a perpetrating role. Participants reported exposure to an average of 2.87 events (*SD* = 5.02; *range* = 0-45) that they perceived to be characterized by controllability, an average of 3.06 events (*SD* = 5.19; *range* = 0-50) that they perceived to be characterized by predictability, an average of 3.50 events (*SD* = 5.98; *range* = 0-43) that they perceived to be characterized by betrayal, an average of 1.89 events (*SD* = 4.41; *range* = 0-40) that they perceived to be characterized by caregiver betrayal, an average of 2.04 events (*SD* = 4.23; *range* = 0-39) that they perceived to be characterized by systemic betrayal, an average of 0.86 events (*SD* = 2.61; *range* = 0-30) that they perceived to be characterized by personal betrayal, and an average of 1.13 events (*SD* = 2.38; *range*; 0-26) that they perceived to be characterized by discrimination. The average number of events that participants perceived to be characterized by threat was 4.47 (*SD* = 6.01; *range* = 0-43), and the average number of events that they perceived to be characterized by deprivation was 3.07 (*SD* = 6.03; *range* = 0-47).

Preliminary evidence of content and convergent validity of selected DISTAL subscales and test-retest reliability

Correlations between DISTAL-E subscales (i.e., severity of sexual abuse exposure in childhood; severity of physical abuse exposure in childhood; severity of emotional abuse exposure in childhood; severity of neglect exposure in childhood; and severity of abuse and neglect exposure in childhood [a composite severity rating of all aforementioned adversity categories]) and CTQ subscales (i.e., severity of sexual abuse in childhood, severity of physical abuse in childhood, severity of emotional abuse in childhood, severity of emotional neglect in childhood, severity of physical neglect in childhood) and total score were broadly in line with our expectations, thus supporting the convergent validity of the DISTAL-E (see Table 3 [SM] for full correlation matrix). In addition, consistent with hypotheses, total number of lifetime exposures to adversity was significantly positively associated with trauma-related symptomatology, $r(482) = .42$, $p < .01$ (see Table 4 [SM]). As is also depicted in Table 4 (SM), all specific dimensions of traumatic stress exposure derived from the DISTAL-E were significantly positively correlated with trauma-related symptomatology. Test-retest reliability indicated generally acceptable stability, with test-retest coefficients at .86, .84, and .85 for number of lifetime exposures to adversity, number of distinct types of adversity, and number of distinct ages of exposure to adversity, respectively.

Discussion

Following the recent validation of the Dimensional Interview of Stress and Trauma Across the Lifespan (DISTAL; Cohodes et al., 2023), here we present descriptive and psychometric information for an electronic adaptation of this novel tool, the Dimensional Interview of Stress and Trauma Across the Lifespan-Electronic (DISTAL-E). The present

validation study is based on a sample of young adult participants who completed both the DISTAL-E (validation target) and a battery of questionnaires designed to assess content and convergent validity, as well as test-retest reliability. Results suggest that the DISTAL-E adequately assesses the following dimensional indices of traumatic stress exposure: type, chronicity, age of onset, severity, proximity, caregiver involvement, controllability, predictability, betrayal, threat, and deprivation. Psychometric analyses also demonstrate excellent content and convergent validity via assessment of associations between the DISTAL-E subscales and well-established indices of childhood trauma exposure and trauma-related symptomatology, respectively, as well as good test-retest reliability over a 7-11 day period.

Despite considerable interest in applying dimensional models of traumatic stress exposure to better understand the psychobiological sequalae of exposure to early life adversity (Cohodes et al., 2021; McLaughlin et al., 2021; McLaughlin & Sheridan, 2016), advances in this area of the field of stress research have been substantially constrained by a dearth of assessment tools that specifically query the presence of specific features of traumatic stress exposure at each age of an individual's life. As has been increasingly critiqued, research to date has either utilized a categorical approach to examining the impacts of exposure to traumatic stress (i.e., grouping individuals into stress-exposed and non-stress exposed categories) or has relied on researcher-driven definitions and assignments to conditions reflecting exposure to particular features of adversity (e.g., determining that a child has been exposed to deprivation based on report of environmental attributes rather than participant report [Pollak & Smith, 2021]). Expanding upon the recent validation of the DISTAL, the DISTAL-E enables larger-scale application of dimensional assessment tools to query exposure to specific dimensions of interest, which has the potential to usher a novel body of empirical research on the impacts of exposure to adversity.

As previously described, here we analyzed data from participants who fully reported on all dimensional features of their traumatic stress exposures—in other words, we constrained the present sample to participants who provided full dimensional accounts of their lifetime traumatic stress histories and excluded participants who declined to report on the presence or absence of the specific features of interest. Due to the fact that a substantial proportion of participants opted to decline to provide detailed information about the fine-grained chronicity of their exposure to traumatic events (i.e., at the level of reporting on the number of days and months to which they were exposed to a particular type of event in a given year), we included participants in the final validation sample reported here even if they declined to report on these two features. As this validation effort represents the first translation of the DISTAL into an electronic format that has the potential to be widely disseminated, it should be noted that the method of assessing chronicity of exposure—at the level of days and months of exposure—should be revamped in future validation studies. We suspect that participants opted to "decline to answer" the number of days and months to which they were exposed to a specific stressor as these questions may be challenging to recall (e.g., it may be difficult to precisely report on the number of days to which one was exposed to a chronic stressor at a specific young age). In future data collection efforts, these questions should be revised so that they are appropriately gated and/or participants should be encouraged to provide an estimation of the number of days and months during which they were exposed to a given stressor (potentially, participants should be offered categorical responses rather than being prompted to provide a specific number of months and days, as this may be more feasible to ascertain). More broadly, we opted to filter the dataset to include only participants who had fully characterized traumatic exposures for the purposes of this validation study, but we note that the inclusion of participants with partially characterized events (i.e.,

participants who declined to answer one or more details about one or more traumatic events) is at the researcher's discretion and is likely to be a determination that is project-specific.

As has been previously noted (Cohodes et al., 2023), the specific dimensions of interest presented here are only a representative portion of the numerous variables of interest that could be derived from the phenotypic data generated by the DISTAL-E; the creation of specific indices of interest is researcher- and research question-specific. We highlight that, here, we provide descriptive statistics for dimensions in isolation. However, it is likely that researchers will be increasingly interested in using this highly detailed data to generate dimensions that reflect interactions between specific features of stress. These approaches are likely to require complex multivariate and data-driven approaches (e.g., machine learning-based approaches) that will afford analysis of age- and developmental time period-specific analyses (e.g., Herzog et al., 2020; Nikolaidis et al., 2022; Sicorello et al., 2021). In this vein, depending on the specific research question of interest, we encourage researchers to modify the current "template" of the DISTAL-E in order to facilitate assessment of varied additional dimensions of interest that may be pertinent to a diverse array of research questions.

The format of the DISTAL-E presented here is reflective of several methodological choices reflecting the need to balance potential richness of phenotypic data and participant burden. We opted to query individuals' exposure to specific features of adversity at a given age (e.g., the specific features of physical abuse experienced at age 5) due to our commitment to assessing developmental stage as a critical backdrop for all other features of exposure (in line with recent recommendations stemming from a systematic review of sensitive periods of stress exposure, see Schaefer et al., 2022). Depending on the granularity of exposure to specific dimensions that is of interest to a particular research group, the DISTAL-E could be easily

modified to examine exposure to each dimension at an even finer level (e.g., at the level of specific events within a given year—in other words, looking at each exposure to each type of event in isolation across the life course). In order to limit the scope of assessments of event type, we also chose to only assess exposure to event types that had the potential to be considered criterion A traumatic stressors (Friedman, 2013). While this is likely to be relevant to other research groups studying traumatic stress, the DISTAL-E could be easily modified to assess exposure to a range of more normative stressors (e.g., divorce, unemployment). The DISTAL-E accommodates assessment of multiplicity of exposure in that it assesses exposure to all types of events that a specific exposure could possibly entail (i.e., if an individual's exposure to one isolated traumatic event comprises exposure to multiple types of exposure—e.g., serious accidental injury and separation from a caregiver due to hospitalization—exposure to both of these event types is queried in full). Finally, the DISTAL-E, like the DISTAL, utilizes retrospective reports, exclusively; future studies should employ prospective, longitudinal designs to assess the impact of exposure to dimensions of interest, particularly given the potential limitations of retrospective reports in this sphere (Baldwin et al., 2019). Broadly, we encourage researchers to flexibly adapt the DISTAL-E to optimally assess traumatic stress exposure in a manner consistent with the goals of a specific research project.

Several studies on the presence of clinical symptomatology in MTurk samples, relative to the general population, are helpful in interpreting the degree to which results of the present validation study can and should be generalized to a broader population (Arditte et al., 2016; Shapiro et al., 2013). Generally, results of these studies suggest that levels of trauma exposure among MTurk workers are consistent with levels of trauma exposure among college students (Bernat et al., 1998; Shapiro et al., 2013), and that levels of clinical symptomatology appear to

match or exceed the general population (Shapiro et al., 2013), with more substantial elevations noted in specific domains of functioning, such as social anxiety and depression in one study (Arditte et al., 2016). Of primary importance, MTurk workers have reported more comfort reporting on mental health-related symptoms in an anonymized, online setting, relative to an in-person clinical interview (Shapiro et al., 2013), which may indicate that participants' report of trauma exposure in the present study may be more comprehensive relative to studies relying on interview-based data collection.

More broadly, we note that the development of an electronic tool to assess retrospective reports of exposure to specific dimensions of adversity—that can be easily collected online—has the potential to greatly increase access to stress research among individuals who may not be able to access in-person research opportunities (e.g., due to living in rural areas, not having financial means to participate in studies during work hours, etc.). Though barriers still remain (e.g., access to reliable internet, time to complete studies; Roubinov et al., 2020), recruitment of large, online samples via such platforms to study the impact of exposure to features of stress exposure is likely to greatly increase the socioeconomic diversity of participants recruited for stress research.

In conclusion, here we present validation evidence for the Dimensional Inventory of Stress and Trauma Across the Lifespan—Electronic (DISTAL-E), an adaptation of the Dimensional Inventory of Stress and Trauma Across the Lifespan (DISTAL; Cohodes et al., 2023), an electronic tool designed to assess adults' retrospective report of their exposure to a range of specific dimensions of interest across the life course. Given the burgeoning interest in the impact of exposure to specific dimensions of traumatic stress across the lifespan on both neural and behavioral functioning, utilization of the DISTAL-E has the potential to yield valuable insights about the role of exposure to specific elements of stress.

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