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Gretchen Shoemaker March 13, 2022

Delineating Childhood Adversity: Examining the Unique Effects of Threat, Deprivation, and Unpredictability on Social, Emotional, and Cognitive Processes

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An abstract of
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of Emory University in partial fulfillment
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Bachelor of Arts with Honors

Psychology

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Abstract

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The link between childhood adversity and poor outcomes is well established, but less is known about the mechanisms that underlie these associations and whether they are specific to different types of adversity exposures. The current study utilized a dimensions of adversity approach that distinguishes adversity experiences along dimensions of threat, deprivation, and unpredictability and examined whether these dimensions have distinct effects on social, emotional, and cognitive risk processes. Results were compared to the prevailing cumulative-risk approach using a total adversity sum score. Participants (*n*=562, mean age = 18.4) were drawn from a large study of youth at risk for serious mental illness (NAPLS-3). Measures of childhood adversity, working memory performance, emotional expression and experience, social anhedonia and social functioning were completed at the baseline visit. Results revealed dimension-specific association between threat and deprivation and social functioning as well as an association between cumulative adversity exposure and working memory. These findings underscore the importance of both dimension-specific and cumulative impacts of childhood adversity exposures on important social and cognitive risk pathways. A clearer understanding of the specific impact childhood adversity exposures have on risk mechanisms is critical to improving our prevention and treatment efforts

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Introduction

The past decade of psychological research has broadened our understanding of childhood adversity and the widespread psychobiological consequences of these experiences. Evidence from population based epidemiological studies show that children who experience childhood adversity are more likely to perform poorly in school, have social difficulties, and develop psychological disorders and chronic diseases (McGinnis et al., 2022; McGrath et al., 2017; Felitti et al., 1998). Nearly 60% of U.S adolescents report exposure to at least one form of adversity which puts them at risk of deleterious emotional, cognitive, and social outcomes (McLaughlin et al., 2012; Teicher et al., 2003). Exposure to childhood adversity explains more than 30% of mental disorders in the U.S. population emphasizing the significance of these experiences in our rising prevalence of mental health diagnoses (Green et al., 2010). While it is well-established that childhood adversity is associated with poor outcomes, less is known about the mechanisms underlying these associations and whether these mechanisms are specific to different types of adversity experiences.

Dimensionality of Adverse Childhood Experiences

Childhood adversity refers to a wide range of negative childhood experiences including, but not limited to, abuse, neglect, domestic violence, parent psychopathology, poverty and exploitation (Felitti et al., 1998). There is strong evidence that childhood adversity increases vulnerability to chronic mental and physical conditions in adulthood, as well as poor occupational and social functioning (Huh et al., 2017; Kessler et al., 2010; Masson et al., 2015; McLaughlin et al., 2012). Until recently, childhood adversity has been treated as a unitary

construct and examined primarily using a "cumulative risk" approach, which sums the number of adversities experienced to create a total risk score (Evans et al., 2013). This approach emphasizes *number* – rather than *type* or *severity* - of adverse experiences and assumes a strong dose-response relationship between the number of adverse exposures and outcomes. The cumulative-risk approach has been widely used and supported by a number of studies (e.g., Kraemer et al. 2005; Sameroff, 2006; Sameroff, Seifer, & McDonough, 2004; Chapman, Witfield, Felitti, Dube, Edwards, & Anda, 2004; Thurner, Finklehor & Ormrod, 2006). However, there are a number of challenges that arise with the cumulative-risk approach that may limit our ability to delineate the impact of adversity exposures. Notably, the cumulative-risk approach implicitly assumes different experiences uniformly impact outcomes. A child who has experienced physical abuse and sexual abuse should be impacted in the same way as a child who has experienced poverty and neglect, as both have a risk score of 2. The cumulative-risk model also treats different adverse experiences as equal and interchangeable, suggesting that the *nature* of the experience is not related to its impact. However, evidence from developmental neuroscience and principles of experience-dependent plasticity suggest the nature, not just the number, of experiences matter (McLaughlin et al., 2012; Sheridan & McLaughlin, 2014). Growing evidence suggests that environmental inputs shape the developing brain and calibrate a range of social, emotional, and cognitive systems to meet the demands of the environment (Hong et al., 2021; Bronfenbrenner & Evans, 2000; Callaghan & Tottenham, 2016). Moreover, the type of environmental input can result in distinct developmental differences. For example, exposure to violence in the home has been linked to exaggerated amygdala response (McCrory et al., 2011), which is likely due the increased demands for hyper-vigilance and threat detection required to survive in a violent

environment. Similarly, poor caregiving environments are associated with accelerated development of corticolimbic circuitry (Gee, 2016), which may result from extended activation of the stress response system due to a lack of consistent safety cues. These findings suggest that adversity experiences may lead to distinct changes based on the nature of the experience and should be investigated separately.

In response to concerns about the cumulative-risk approach, McLaughlin and colleagues proposed the Dimensional Model of Adversity and Psychopathology (DMAP), which categorizes adversity exposures based on whether they reflect t*hreat*—experiences involving harm or threat of harm (e.g., abuse), or *deprivation*—experiences involving an absence of expected inputs from the environment (e.g., neglect) (McLaughlin & Sheridan, 2016). Drawing on principles of experience-dependent plasticity, the DMAP model hypothesizes that threat and deprivation constitute important yet different dimensions of adversity experiences that will have distinct effects on at least some biological, learning, and cognitive systems. Rather than counting the total number of childhood adversities, this approach assesses the frequency and severity of threat and deprivation experiences separately and examines them simultaneously in predicting outcomes (McLaughlin & Sheridan, 2016). This dimensional approach allows us to investigate whether these dimensions of adversity have unique impacts on risk mechanisms that might be missed in cumulative-risk approaches that rely on a single sum score. Recent studies provide support for the DMAP model and have delineated unique effects of threat and deprivation across a range of risk mechanisms including executive functioning (Sheridan, Perverill, Finn, & McLaughlin, 2017), emotion processing (Lambert, Kin, Monahan, & McLaughlin, 2017), reward processing (Dennison et al., 2019), physiological reactivity (Busso et al., 2017), and stress

perception (LoPilato et al., 2019). These findings suggest that conceptualizing childhood adversity along dimensions of threat and deprivation can identify specific associations that may be missed in cumulative-risk models.

Threat

Threat is characterized by the *presence* of harmful physical or psychological inputs. Examples of threat include sexual or physical abuse, psychological bullying, and domestic violence. Prior work has found that the experience of threat impacts development of the cortico-limbic circuits that underly fear learning and processing (McCrory et al., 2011). Threat experiences have also been associated with blunted sympathetic and HPA-axis reactivity (Busso et al., 2017) as well as heightened activation of the amygdala (Marusak et al., 2015; McCrory et al., 2011). Behavioral studies are consistent with these neurobiological findings and have found deficits in emotional perception, reactivity, and regulation in children exposed to violence (Heleniak et al., 2016; Pollak & Tolley-Schell, 2003). These findings suggest that threat may have specific effects on emotional processing and reactivity.

Deprivation

In contrast to threat, deprivation is characterized by the *absence* of expected cognitive, social, and emotional environmental inputs. Examples of deprivation include emotional neglect, poverty, caregiver absence, and institutionalization. While threat experiences may specifically disrupt emotion regulation and processing, deprivation experiences are hypothesized to disrupt high-order cognitive processes (McLaughlin et al. 2014; Lambert et al., 2017). Childhood

poverty - which is thought to encompass reduced linguistic, sensory, cognitive, and social stimulation - has been associated with poor working memory in adulthood across several studies (Bos et al., 2009; Noble et al., 2005; Evans & Schamberg, 2009; McLaughlin et al., 2014). In prior work using the DMAP model, deprivation, but not threat, was specifically associated with poor cognitive control specifically impacting inhibition and working memory (Lambert et al., 2017). Moreover, the deprivation of expected cognitive stimulation has demonstrated long term deficits in complex cognitive function and associative learning (McLaughlin et al., 2017). These findings suggest deprivation may be uniquely associated with poorer cognitive performance, particularly in the areas of working memory and inhibition.

Unpredictability

Although the DMAP addresses the dimensions of threat and deprivation exposure, it does not currently capture contextual characteristics related to unpredictability. Environmental unpredictability, which denotes a lack of social, emotional, and physical stability, is a core element underlying multiple forms of childhood adversity (Liu & Fisher, 2022). Research has shown that unpredictable rather than merely harsh environments uniquely predict behavior (Simpson et al., 2012). Evolutionarily, developmental exposures to environmental harshness and unpredictability result in a fast life-history strategy consisting of early reproduction and shortened lifespan (Ellis et al., 2009). Furthermore, environmental unpredictability uniquely predicts life history development in adolescence as well as longitudinal effects into young adulthood (Brumbach et al., 2009). Evidence from both animal and human models indicate that environmental unpredictability influences a range of behavioral, social, and physiological

processes (Chen & Baram, 2016; Soltani & Izquierdo, 2019; Peters et al., 2017). For example, greater cocaine self-administration and increased exploratory behavior was observed at a higher rate in episodically stressed rodents compared to chronically stressed rodents indicating that unpredictable stress has a unique effect on behavior (Miczek et al., 2011). Animal models have also shown that a lack of predictable maternal inputs are associated with early maturation of the corticolimbic circuitry (Gee & Cohodes, 2021). In the context of human development, lack of predictable and contingent caregiver input has been found to alter children's perceptions of the environment increasing feelings of uncertainty and vulnerability (Harms et al., 2018). Exposure to greater unpredictability in childhood predicted more externalizing behaviors in adolescents (Doom et al., 2016) with greater engagement in risk taking behavior and decreased academic performance (Chang et al., 2019; Ellis et al., 2012). Neurobiological analyses have shown that unpredictable care patterns disrupt maturation of cognitive and emotional brain circuits (Glynn & Baram, 2019; Baram et al., 2012). Additional behavioral studies found that unpredictability experience in early childhood predicted increased aggression and decreased prosociality (Dickerson et al., 2019; Belsky et al., 2012; Simpson et al., 2012). Moreover, exposure to predictable environments predicts greater social satisfaction and better psychological adjustment (Coe et al., 2017; Fiese et al., 2002). These findings suggest that unpredictability is another important dimension of childhood adversity to consider.

Current Study

Cumulative-risk approaches to studying childhood adversity limit our ability to identify whether different types of adversity have distinct effects on the processes that underlie risk for poor

outcomes. Identifying dimensions that cut across multiple types of adversity (i.e., threat, deprivation, and unpredictability) may be a more effective strategy for delineating the impact of childhood adversity and identifying relevant risk mechanisms. An important next step in understanding the impact of childhood adversity is extending the DMAP model to include a dimension of unpredictability and to examine dimension-specific associations with risk mechanisms that may underlie the range of poor psychobiological outcomes observed in the literature. The aims of the current study are to 1.) test a dimensions of adversity model that distinguishes adversity along dimensions of threat, deprivation, and unpredictability to determine whether these dimensions have differential impacts on social, emotional, and cognitive processes, and 2.) compare results from the dimensions of adversity approach to prevailing cumulative-risk models. To test these models, measures of childhood adversity, social functioning, emotional functioning, and cognitive performance (i.e., working memory, vigilance) were obtained from a large sample of youth at risk for serious mental illness. Based on the current literature we predict that threat will be uniquely associated with poorer emotional functioning, and deprivation will be uniquely associated with poorer cognitive performance. We predict that both threat and deprivation will be associated with poor social outcomes given that these dimensions both impact processes relevant to social functioning. No a priori hypotheses are made about the differential effects of unpredictability, given that paucity of work on this proposed dimension within the DMAP framework. Finally, we predict that the cumulative-risk approach will obscure the specificity of the associations revealed using the dimensions of adversity approach.

Methods

Sample

The sample included 562 individuals between 12-30 years of age (mean=18.4, SD=4.1). All participants were recruited as part of the North American Prodrome Longitudinal Study (NAPLS-3). Participants were included in the current study if measures of childhood adversity exposure, family history, prodromal symptoms, global social functioning, structured assessment of violence in youth, premorbid adjustment, and neurocognition were collected at the baseline visit. Of the 562 participants, 486 (86.5%) met clinical-high risk (CHR) criteria for serious mental illness; 76 (13.5%) did not meet the criteria for CHR status. All analyses were conducted combining across the groups in order to include variation in exposure to adversity, ethnicity, and. psychopathology.

Measures

Threat Exposure**.** Threat was operationalized to denote the presence of experiences that represent a threat to one's physical or psychological integrity (McLaughlin et al., 2014: Table 1). Specific types of threat exposures were assessed using the Documentation of Trauma Form, a semi-structured interview that retrospectively assesses six types of negative childhood experiences before the age of 16. Participants were asked whether they had experienced the following: psychological abuse (e.g., “unjustified punishment” “being sworn at”), physical abuse (e.g., “being kicked or punched”), psychological bullying (e.g. “taunted or sworn at by peers”), physical bullying (“physical assaulted at school”), and sexual abuse (e.g., “touched sexually against will”, “sexual contact against will”). Responses were rated categorically based reported

on occurrence (0 = has not occurred, 1 = has occurred). Exposure to domestic violence was determined using the Structured Assessment of Violence Risk in Youth (SAVRY; Borum 2006) a clinician-administered instrument designed to measure historical, social, contextual factors associated with violence risk. Scores of 2 ("witnessed occasional physical aggression and/or serious violence in the home") or 3 ("witnessed chronic physical aggression and/or serious violence in the home") on the Violence in the Home item were used to indicate exposure. The six criteria were used to create a composite threat score for each individual. The threat composite score ranged from 0 (no endorsement of threat exposures) to 6 (endorsement of all threat exposures) and was used in all statistical analyses to capture variation in threat exposures.

Deprivation Exposure. Deprivation was operationalized to denote absence of expected social, caregiving, and cognitive inputs and complexity (McLaughlin et al., 2014). In the current study, deprivation items included indices of childhood poverty, emotional neglect, lack of social support, and restricted peer relationships (Table 1). Poverty was determined by the ratio of income to family members as compared to the US census 2014 poverty line for a family of that size (US Census Bureau). A value of <1 indicated that a family lived below the poverty line. Neglect was assessed via the Documentation of Trauma Form described above. Responses were rated categorically based reported on occurrence (0 = has not occurred, 1 = has occurred). Restricted peer relationships were determined using the social subscales of The Premorbid Adjustment Scale (PAS; Cannon-Spoor et al., 1982), a widely used semi-structured interview designed to retrospectively assess social and academic functioning across development. Interviewers rated participants on a 0-6 scale for peer relationships during childhood. Scores falling between 4-6 were used to indicate restricted peer relationships. Finally, a lack of social

support was determined from the Social Support item on the Structured Assessment of Violence Risk in Youth (SAVRY; Borum, 2006) A score of 3 on the Social Support item indicates "few or no sources of emotional support and guidance". A deprivation composite score was created by summing items of childhood poverty, neglect, restricted peer relations, and lack of social support. The deprivation composite score ranged from 0 (no endorsement of deprivation exposures) to 4 (endorsement of all deprivation exposures) and was used in all statistical analyses to capture variation in deprivation exposures.

Unpredictability Exposure**.** Unpredictability was operationalized to denote a lack of social, emotional, and physical stability. In the current study, environmental unpredictability items included early caregiver disruption, unpredictable social support, and community disorganization (Table 1). Caregiver disruption was assessed with the Structured Assessment of Violence Risk in Youth (SAVRY) described above. Scores of 2 ("some discontinuity of care during childhood") or 3 ("significant discontinuity of care during childhood") on the Caregiver Disruption item were used to indicate the presence of caregiving instability. Unpredictable social support was determined from the lack of personal/social support item on the SAVRY with scores of 2 ("inconsistent or unreliable emotional support and guidance") indicating unpredictable support. Community instability was determined from the Community Disorganization item on the SAVRY with scores of 3 ("significant crime poverty, and/or violence in community") indicating instability in the surrounding physical environment. An unpredictability composite score was created by summing items of caregiver disruption, unpredictable social support, and community disorganization. The unpredictability composite score ranged from 0 (no endorsement of

unpredictability exposures) to 3 (endorsement of all unpredictability exposures) and was used in all statistical analyses to capture variation in unpredictability exposures.

Emotional Processes. In the current study, emotional processes related to the expression and experience of emotions were outcomes of interest. These emotional processes were measured using the Structured Interview for Prodromal Symptoms (SIPS), a semi-structured, clinician-administered interview used to evaluate prodromal symptoms of psychosis in clinical-high risk populations (SIPS; Miller et al., 1999). "Decreased expression of emotion" (N3) consists of flat, constricted emotional response, lack of conversational spontaneity, and poor rapport. "Decreased Experience of Emotions and Self" (N4) consists of feeling less strong emotions, difficulty distinguishing emotions, and a feeling of disconnection from the self. Both items were scored on a severity scale of 0-6. Scores falling between 3-6 indicate impairment in these domains.

Cognitive Processes. Based on prior work, working memory and vigilance were selected as our cognitive processes of interest. These cognitive processes were evaluated using the Auditory Continuous Performance Task (ACPT; Tinius, 2003), a compilation of four auditory vigilance tests designed to measure the cognitive functions of working memory and interference control. The ACPT focuses on vigilance and working memory (WM) under different load conditions. Individuals receive three total scores (criteria) that are calculated from percent of hits and reaction time. The QA score evaluates vigilance, the QA3 score evaluates working memory, and the QAINT score evaluates working memory with interference. All three scores were investigated individually in our analyses.

Social Processes. Our social processes of interest were social anhedonia and social functioning. These measures give a sense of an individual's interest as well as their ability to

function effectively in social relationships. Social anhedonia was assessed with the Structure Interview for Prodromal Symptoms (SIPS) and current social functioning on the Global Functioning: Social Scale (GF:S; Auther & C. W. Smith, 2006). Social anhedonia (N1) - which consists of disinterest in social activities, lack of close friends, and a preference for spending time alone - was scored on a severity scale of 0-6. Scores falling between 3-6 indicate moderate (3) to extreme (6) social anhedonia. Current social and interpersonal functioning were scored from 0-10 by a clinician on the Global Functioning: Social Scale (GF:S). A score of 0 indicates extreme social isolation, while a 10 indicates superior social functioning.

Data Analyses

A series of multivariate linear regressions were used to examine the associations of childhood adversity dimensions (threat, deprivation, unpredictability) with emotional, cognitive, and social processes. We estimated a series of models for each specific adversity dimension while controlling for the others for each outcome of interest (e.g. deprivation and unpredictability were controlled for in models examining the effect of threat on social processes). In addition, we estimated a cumulative-risk model (sum score of all adversity dimensions) for each outcome so we could compare the dimensional and cumulative-risk approaches. Preliminary analyses showed no significant effects of age or sex on any of the outcome variables and were not controlled for in subsequent analyses. Both unstandardized and standardized betas are presented in the results and tables; standardized betas appear in parentheses. Statistical significance level set at .05.

Results

Childhood adversity characteristics

Demographic and adversity characteristics are shown in Table 2. Across the entire sample, 473 (84.2%) endorsed at least one type of adversity. Co-occurring adversities were common, with 333 (59.3%) individuals reporting two or more adversity exposures. There were significant sex differences in threat (F=3.65, p<.01), deprivation (F=2.72, p<.01), and total adversity (F=3.81, p<.01). There were no significant age differences in types of adversity exposure.

Zero-order correlations between the adversity measures and social, emotional, and cognitive processes are shown in Table 4. Threat (r=-.16, p<.01), deprivation (r=-.18, p<.01), and unpredictability (r=-.12, p<.01) were negatively correlated with social functioning. Total adversity was negatively correlated with social functioning (r=-.23, p<.01) and working memory (r=-.09, p<.05). Moderate correlations were observed between threat and deprivation (r=.40, p<.01), threat and unpredictability (r=.20, p<.01), and deprivation and unpredictability (r=.12, p<.01) which is consistent with the literature on the co-occurrence rates among different types of adversity. However, these modest correlations also suggest a degree of independence of the three adversity dimensions.

Dimensions of adversity models

We first tested the association between threat and social, emotional, and cognitive processes, controlling for deprivation and unpredictability (see Table 5). Contrary to our hypothesis, threat was not associated with expression of emotion (β=.00(.00), p=.99) or experience of emotion (β=-.04(-.04), p=.42). However, threat was associated with worse social functioning (β=-.17(-.16),

p<.01). Threat was not associated with social anhedonia (β=.04(.03), p=.52), vigilance (β=.37(.06), p=.20), working memory (β=-.67(-.07), p=.17), or working memory with interference (β=.57(.05), p=.28).

Next, we tested the association between deprivation and social, emotional, and cognitive processes, controlling for threat and unpredictability (see Table 5). Contrary to our hypothesis, deprivation was not associated with any of the cognitive processes: vigilance (β=-.81(-.06), p=.19), working memory (β=-.57(-.03), p=.58), or working memory with interference (β=-.15(-.06), p=.20) However, deprivation was associated with worse social functioning (β=-.27(-.11), p<.05). Deprivation was not associated with social anhedonia (β=-.04(-.02), p=.74), expression of emotion (β=.09(.05), p=.35), or experience of emotion (β=.16(.07), p=.15).

We then tested the association between unpredictability and social, emotional, and cognitive processes, controlling for threat and deprivation. Unpredictability was not associated with any processes: social anhedonia (β=-.11(-.03), p=.47), social functioning (β=-.06(-.02), p=.63), expression of emotion (β=.-.13(-.05), p=.27), experience of emotion (β=.10(.03), p=.50), vigilance (β=.96(.06), p=.22), working memory (β=-.97(-.03), p=.45), and working memory with interference (β=1.31(.04), p=35).

Cumulative-risk model

Finally, we estimated a cumulative-risk model using a total sum score of all adversity exposures. Total adversity was associated with worse social functioning (β=-.18(-.23), p<.01), and working memory (β=-.68(-.09), p<.05). Total adversity was not associated and social anhedonia (β=.00(.00), p=.94), expression of emotion (β=.01(.01), p=.87), experience of emotion

(β=-.02(.02), p=.60), vigilance (β=.19(.04), p=.33), and working memory with interference (β=.22(.03), p=.53).

Discussion

The current study sought to 1.) test a model that distinguishes adversity along dimensions of threat, deprivation, and unpredictability to determine whether these dimensions have differential impacts on social, emotional, and cognitive processes, and 2.) compare these results to prevailing cumulative-risk models. We analyzed the associations of threat, deprivation, and unpredictability on emotional, social, and cognitive processes both independently and cumulatively. Although we did not find dimension-specific associations in the emotional or cognitive domains, we found that both threat and deprivation were uniquely associated with current social functioning. In the total cumulative risk model, we found that total adversity was also associated with current social functioning, as well as working memory. This pattern of findings provides evidence for both dimension-specific and cumulative effects on the sequalae following exposure to childhood adversity.

Social Functioning

We found that threat, deprivation, total adversity, were associated with poorer social functioning. The independent associations of both threat and deprivation on social functioning suggest unique contributions from each dimension. The presence of harmful social inputs that characterize threat exposures and the absence of supportive social inputs that characterize deprivation may similarly impair social functioning but through different pathways. Early

experiences of threat, particularly those that are interpersonal in nature (e.g., physical abuse, sexual abuse, psychological abuse, bullying), may lead individuals to be more fearful or cautious of social relationships and/or more vulnerable to social anxiety (Huh et al., 2017, 2014; Meng et al., 2021). Experiencing trauma in childhood may provide negative social learning experiences and feelings of rejection which impair ability to form secure attachments (van Marle et al., 2009). On the other hand, deprivation of important social inputs from caregivers and peers during childhood may result in less developed social skills & positive relationship experiences, which are critical scaffolds to adult social functioning (Evans & Kim, 2007; Noble et al., 2005). Although we did not assess psychopathology in this study, both deprivation and threat experiences are associated with internalizing symptoms in adulthood, which are known to compromise social functioning (e.g., depressed mood, anxiety; Beauchaine et al., 2013; Henry et al., 2021). In sum, both types of experiences are likely to impact on social functioning via both unique and shared pathways.

Cognitive Functioning

We also found that total adversity was associated with poorer working memory. Contrary to our hypothesis, there were no deprivation-specific associations with cognitive processes. These findings suggest that the impact of childhood adversity on working memory may have a dose-response relationship and that different experiences may operate via a shared pathway. There is a large body of research that has found working memory to be impacted by early adversity (Bos et al., 2009; Evans & Schamberg, 2009; Masson et al., 2015; Hanson et al., 2012; Noble et al., 2005). Meta analyses have confirmed that those who reported exposure to early life stress

performed more poorly on working memory tasks than those who had not experienced early life stress, and that these effects persist into adulthood (Goodman et al., 2019; Masson et al., 2015). Although speculative, both stress and neurodevelopmental mechanisms could underlie this association. Elevated stress in childhood has been shown to negatively impact working memory in adulthood (Lupien et al., 2007; Evans & Schamberg, 2009). We know adversity alters the HPA system and, thus, these stress-system changes may lead to working memory deficits observed (Gould et al., 2012). It is also possible that childhood adversity disrupts the neurodevelopment of brain regions that support working memory. Consistent with this, early life adversity has been linked to volumetric reductions of both the hippocampus (Barch et al., 2019; Lajud & Torner, 2015) and prefrontal cortex (Hanson et al., 2012) in adults, both of which are critical to supporting working memory. While the nature of experiences (e.g. threat vs. deprivation) may exert differential effects on some risk mechanisms, there are likely to be shared effects on others. This speaks to importance of assessing both dimensional and cumulative models simultaneously.

Emotional Functioning

We did not find any dimension-specific or cumulative associations with emotional functioning. We had predicted that threat would be associated with emotional functioning given prior work using the DMAP framework, which pointed to threat-specific associations with impaired emotion processing (Thompson et al., 2014; Lambert et al., 2017). It is possible that threat is related to other aspects of emotional functioning not captured by the items used in this study. The SIPs N3 (“Expression of Emotion”) and N4 (“Experience of Emotions and Self”)

items used to measure emotional functioning in this study place an emphasis on *decreased* emotional experiencing and feeling more disconnected/less strong emotions. However, threat may actually be associated with *increased* emotional experiencing, reactivity, and hypervigilance – which are not captured in the current studies measures.

Unpredictability

Finally, we did not find unpredictability-specific associations for any of the social, cognitive, or emotional processes. Our lack of findings may have resulted from our limited ability to measure unpredictability in the current sample. We were only able to isolate 3 items that mapped onto this dimension within the available NAPLS-3 measures. Including comprehensive measures of childhood unpredictability in future studies will allow us to better understand the impact of this adversity dimension. For example, the Questionnaire of Unpredictability in Childhood (QUIC; Glynn et al., 2019) is a new promising self-report survey that evaluates predictability of childhood environment by assessing a range of items related to parental predictability and involvement, physical environment as well as safety and security in day-to-day life.

Limitations

There are several limitations to the current study that should be noted. First, due to the nature of the NAPLS 3 data set, our deprivation and unpredictability measures were limited. Compared to previous studies which utilized an earlier cohort of NAPLS subjects (NAPLS-2: LoPilato et al. 2019) this sample had less deprivation exposures. Additionally, our measure of unpredictability

was particularly limited given the constraints of current measures. The limitations of our deprivation and unpredictability measures required the creation of composite variables from a variety of questionnaire items, versus the threat composite which was drawn from primarily one measure. In relying on completion of multiple measures to create composite scores, we run into missing data that contributed to the lower numbers of reported deprivation and unpredictability exposure as compared to threat.

Second, our adversity measures were categorical and did not include information about frequency, intensity, or timing of specific exposures which are likely relevant to the impact of adversity exposure. Experts hypothesize that the detrimental psychobiological effects of childhood adversity may be more heavily influenced by timing rather than adversity type. For example, there is a growing body of evidence that demonstrates a sensitive period to caregiver cues when corticolimbic circuits are developing (Callaghan & Tottenham, 2016; Gee, 2016). To that effect, there is compelling evidence that children who experience adversity earlier in development see more deleterious behavioral and neurodevelopmental outcomes (Cohodes et al., 2021; Nelson et al., 2007; Manly et al., 2001).

Finally, our study assessed self-reported childhood adversity and processes concurrently and, thus, cannot provide evidence of cause-and-effect relationship. Although we are speculating that adversity exposure directly impacts behavioral and psychological outcomes, our results are correlational and cannot determine causation.

Future Directions

Given the expansive, deleterious nature of childhood adversity, further research on the impacts specific diversity dimensions have on risk mechanisms is needed. Future studies would benefit from a standardized operational definition as well as a comprehensive clinical measure of unpredictability. While we did not find evidence of unpredictability-specific associations in our study, a growing literature supports continued investigation of this dimension. Experts in the field predict that the effects of the COVID-19 pandemic may be valuable in studying the mechanisms of unpredictability and, in turn, improving a conceptual understanding of this dimension of adversity (Liu & Fisher, 2022).

In addition to a lack of standardized measures of unpredictability, the field is missing insight on the biological mechanisms underpinning unpredictable adversity. Emerging evidence has shown that unpredictability may impact human corticolimbic neural circuitry (Callaghan & Tottenham, 2016; Gee & Cohodes, 2021), physiological stress response (Brown et al., 2021), and immune functioning (Robles, 2021). Although these early findings are promising, more studies are needed to understand the neurobiological underpinnings of unpredictability.

Future research of dimensions of adversity should also examine interactions among dimensions. For example, the negative impacts of threat exposure may be heightened only in the context of high deprivation exposure. When children have appropriate and supportive social inputs (i.e., lower deprivation) they may be buffered from the deleterious effects of threat.

Conclusion

Our results add to a growing body of literature that demonstrates both dimension-specific and cumulative impacts of childhood adversity exposures on important social and cognitive risk

pathways. Continuing to expand and test both DMAP and cumulative models will help delineate which effects are dimension-specific and which are cumulative. Comparing these models will ultimately help us determine which risk pathways are shared versus distinct. A clearer understanding of the specific impact childhood adversity exposures have on risk mechanisms is critical to improving our prevention and treatment efforts. The ability to identify who is most at risk for negative outcomes and what specific processes are impacted as a function of exposure history will lead to more personalized and effective interventions.

References

Auther, A., & C. W. Smith. (2006). Global functioning: Social scale (GF: social). *Glen Oaks, NY: Zucker-Hillside Hospital*.

Baram, T. Z., Davis, E. P., Obenaus, A., Sandman, C. A., Small, S. L., Solodkin, A., & Stern, H. (2012). Fragmentation and Unpredictability of Early-Life Experience in Mental Disorders. *American Journal of Psychiatry*, *169*(9), 907–915. https://doi.org/10.1176/appi.ajp.2012.11091347

Barch, D. M., Harms, M. P., Tillman, R., Hawkey, E., & Luby, J. L. (2019). Early Childhood Depression, Emotion Regulation, Episodic Memory and Hippocampal Development. *Journal of Abnormal Psychology*, *128*(1), 81–95. https://doi.org/10.1037/abn0000392

Beauchaine, T. P., Gatzke-Kopp, L., Neuhaus, E., Chipman, J., Reid, M. J., & Webster-Stratton, C. (2013). Sympathetic- and Parasympathetic-linked Cardiac Function and Prediction of Externalizing Behavior, Emotion Regulation, and Prosocial Behavior among Preschoolers Treated for ADHD. *Journal of Consulting and Clinical Psychology*, *81*(3), 481–493. https://doi.org/10.1037/a0032302

Belsky, J., Schlomer, G. L., & Ellis, B. J. (2012). Beyond cumulative risk: Distinguishing harshness and unpredictability as determinants of parenting and early life history strategy. *Developmental Psychology*, *48*(3), 662–673. https://doi.org/10.1037/a0024454

Borum, R. (2006). *Manual for the Structured Assessment of Violence Risk in Youth (SAVRY)*.

Bos, K. J., Fox, N., Zeanah, C. H., & Nelson Iii, C. A. (2009). Effects of early psychosocial deprivation on the development of memory and executive function. *Frontiers in Behavioral Neuroscience*, *3*, 16. https://doi.org/10.3389/neuro.08.016.2009

Bronfenbrenner, U., & Evans, G. W. (2000). Developmental Science in the 21st Century: Emerging Questions, Theoretical Models, Research Designs and Empirical Findings. *Social Development*, *9*(1), 115–125. https://doi.org/10.1111/1467-9507.00114

Brown, E. D., Holochwost, S. J., Laurenceau, J.-P., Garnett, M. L., & Anderson, K. E. (2021). Deconstructing Cumulative Risk: Poverty and Aspects of Instability Relate Uniquely to Young Children's Basal Cortisol. *Child Development*, *92*(3), 1067–1082. https://doi.org/10.1111/cdev.13512

Brumbach, B. H., Figueredo, A. J., & Ellis, B. J. (2009). Effects of Harsh and Unpredictable Environments in Adolescence on Development of Life History Strategies. *Human Nature*, *20*(1), 25–51. https://doi.org/10.1007/s12110-009-9059-3

Busso, D. S., McLaughlin, K. A., & Sheridan, M. A. (2017). Dimensions of Adversity, Physiological Reactivity, and Externalizing Psychopathology in Adolescence: Deprivation and Threat. *Psychosomatic Medicine*, *79*(2), 162–171. https://doi.org/10.1097/PSY.0000000000000369

Callaghan, B. L., & Tottenham, N. (2016). The Neuro-Environmental Loop of Plasticity: A Cross-Species Analysis of Parental Effects on Emotion Circuitry Development Following Typical and Adverse Caregiving. *Neuropsychopharmacology*, *41*(1), 163–176. https://doi.org/10.1038/npp.2015.204

Cannon-Spoor, H. E., Potkin, S. G., & Wyatt, R. J. (1982). Measurement of premorbid adjustment in chronic schizophrenia. *Schizophrenia Bulletin*, *8*(3), 470–484. https://doi.org/10.1093/schbul/8.3.470

Chang, L., Lu, H. J., Lansford, J. E., Skinner, A. T., Bornstein, M. H., Steinberg, L., Dodge, K. A., Chen, B. B., Tian, Q., Bacchini, D., Deater-Deckard, K., Pastorelli, C., Alampay, L. P., Sorbring, E., Al-Hassan, S. M., Oburu, P., Malone, P. S., Di Giunta, L., Tirado, L. M. U., & Tapanya, S. (2019). Environmental harshness and unpredictability, life history, and social and academic behavior of adolescents in nine countries. *Developmental Psychology*, *55*(4), 890–903. https://doi.org/10.1037/dev0000655

Chen, Y., & Baram, T. Z. (2016). Toward Understanding How Early-Life Stress Reprograms Cognitive and Emotional Brain Networks. *Neuropsychopharmacology*, *41*(1), 197–206. https://doi.org/10.1038/npp.2015.181

Coe, J. L., Davies, P. T., & Sturge-Apple, M. L. (2017). The Multivariate Roles of Family Instability and Interparental Conflict in Predicting Children's Representations of Insecurity in the Family System and Early School Adjustment Problems. *Journal of Abnormal Child Psychology*, *45*(2), 211–224. https://doi.org/10.1007/s10802-016-0164-6

Cohodes, E. M., Kitt, E. R., Baskin-Sommers, A., & Gee, D. G. (2021). Influences of early-life stress on frontolimbic circuitry: Harnessing a dimensional approach to elucidate the effects of heterogeneity in stress exposure. *Developmental Psychobiology*, *63*(2), 153–172. https://doi.org/10.1002/dev.21969

Dickerson, K. L., Milojevich, H. M., & Quas, J. A. (2019). Early Environmental Unpredictability: Implications for Youth's Perceptions and Social Functioning. *Journal of Youth and Adolescence*, *48*(9), 1754–1764. https://doi.org/10.1007/s10964-019-01052-9

Doom, J. R., Vanzomeren-Dohm, A. A., & Simpson, J. A. (2016). Early unpredictability predicts increased adolescent externalizing behaviors and substance use: A life history perspective. *Development and Psychopathology*, *28*(4pt2), 1505–1516. https://doi.org/10.1017/S0954579415001169

Ellis, B. J., Del Giudice, M., Dishion, T. J., Figueredo, A. J., Gray, P., Griskevicius, V., Hawley, P. H., Jacobs, W. J., James, J., Volk, A. A., & Wilson, D. S. (2012). The evolutionary basis of risky adolescent behavior: Implications for science, policy, and practice. *Developmental Psychology*, *48*(3), 598–623. https://doi.org/10.1037/a0026220

Ellis, B. J., Figueredo, A. J., Brumbach, B. H., & Schlomer, G. L. (2009). Fundamental Dimensions of Environmental Risk: The Impact of Harsh versus Unpredictable Environments on the Evolution and Development of Life History Strategies. *Human Nature (Hawthorne, N.Y.)*, *20*(2), 204–268. https://doi.org/10.1007/s12110-009-9063-7

Evans, G. W., & Kim, P. (2007). Childhood poverty and health: Cumulative risk exposure and stress dysregulation. *Psychological Science*, *18*(11), 953–957. https://doi.org/10.1111/j.1467-9280.2007.02008.x

Evans, G. W., Li, D., & Whipple, S. S. (2013). Cumulative risk and child development. *Psychological Bulletin*, *139*(6), 1342–1396. https://doi.org/10.1037/a0031808

Evans, G. W., & Schamberg, M. A. (2009). Childhood poverty, chronic stress, and adult working memory. *Proceedings of the National Academy of Sciences of the United States of America*, *106*(16), 6545–6549. https://doi.org/10.1073/pnas.0811910106

Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., Koss, M. P., & Marks, J. S. (1998). Relationship of childhood abuse and household dysfunction

to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. *American Journal of Preventive Medicine*, *14*(4), 245–258. https://doi.org/10.1016/s0749-3797(98)00017-8

Fiese, B. H., Tomcho, T. J., Douglas, M., Josephs, K., Poltrock, S., & Baker, T. (2002). A review of 50 years of research on naturally occurring family routines and rituals: Cause for celebration? *Journal of Family Psychology: JFP: Journal of the Division of Family Psychology of the American Psychological Association (Division 43)*, *16*(4), 381–390. https://doi.org/10.1037//0893-3200.16.4.381

Gee, D. G. (2016). Sensitive Periods of Emotion Regulation: Influences of Parental Care on Frontoamygdala Circuitry and Plasticity. *New Directions for Child and Adolescent Development*, *2016*(153), 87–110. https://doi.org/10.1002/cad.20166

Gee, D. G., & Cohodes, E. M. (2021). Caregiving Influences on Development: A Sensitive Period for Biological Embedding of Predictability and Safety Cues. *Current Directions in Psychological Science*, *30*(5), 376–383. https://doi.org/10.1177/09637214211015673

Glynn, L. M., & Baram, T. Z. (2019). The influence of unpredictable, fragmented parental signals on the developing brain. *Frontiers in Neuroendocrinology*, *53*, 100736. https://doi.org/10.1016/j.yfrne.2019.01.002

Goodman, J. B., Freeman, E. E., & Chalmers, K. A. (2019). The relationship between early life stress and working memory in adulthood: A systematic review and meta-analysis. *Memory*, *27*(6), 868–880. https://doi.org/10.1080/09658211.2018.1561897

Gould, F., Clarke, J., Heim, C., Harvey, P. D., Majer, M., & Nemeroff, C. B. (2012). The Effects of Child Abuse and Neglect on Cognitive Functioning in Adulthood. *Journal of Psychiatric Research*, *46*(4), 500–506. https://doi.org/10.1016/j.jpsychires.2012.01.005

Green, J. G., McLaughlin, K. A., Berglund, P. A., Gruber, M. J., Sampson, N. A., Zaslavsky, A. M., & Kessler, R. C. (2010). Childhood adversities and adult psychiatric disorders in the national comorbidity survey replication I: Associations with first onset of DSM-IV disorders. *Archives of General Psychiatry*, *67*(2), 113–123. https://doi.org/10.1001/archgenpsychiatry.2009.186

Hanson, J. L., Chung, M. K., Avants, B. B., Rudolph, K. D., Shirtcliff, E. A., Gee, J. C., Davidson, R. J., & Pollak, S. D. (2012). Structural Variations in Prefrontal Cortex Mediate the Relationship between Early Childhood Stress and Spatial Working Memory. *Journal of Neuroscience*, *32*(23), 7917–7925. https://doi.org/10.1523/JNEUROSCI.0307-12.2012

Harms, M. B., Shannon Bowen, K. E., Hanson, J. L., & Pollak, S. D. (2018). Instrumental learning and cognitive flexibility processes are impaired in children exposed to early life stress. *Developmental Science*, *21*(4), e12596. https://doi.org/10.1111/desc.12596

Heleniak, C., Jenness, J. L., Stoep, A. V., McCauley, E., & McLaughlin, K. A. (2016). Childhood Maltreatment Exposure and Disruptions in Emotion Regulation: A Transdiagnostic Pathway to Adolescent Internalizing and Externalizing Psychopathology. *Cognitive Therapy and Research*, *40*(3), 394–415. https://doi.org/10.1007/s10608-015-9735-z

Henry, L. M., Gracey, K., Shaffer, A., Ebert, J., Kuhn, T., Watson, K. H., Gruhn, M., Vreeland, A., Siciliano, R., Dickey, L., Lawson, V., Broll, C., Cole, D. A., & Compas, B. E. (2021). Comparison of Three Models of Adverse Childhood Experiences: Associations With Child and Adolescent Internalizing and Externalizing Symptoms. *Journal of Abnormal Psychology*, *130*(1), 9–25. https://doi.org/10.1037/abn0000644

Hong, S.-J., Sisk, L. M., Caballero, C., Mekhanik, A., Roy, A. K., Milham, M. P., & Gee, D. G. (2021). Decomposing complex links between the childhood environment and brain structure in school-aged youth. *Developmental Cognitive Neuroscience*, *48*, 100919. https://doi.org/10.1016/j.dcn.2021.100919

Huh, H. J., Kim, K. H., Lee, H.-K., & Chae, J.-H. (2017). The relationship between childhood trauma and the severity of adulthood depression and anxiety symptoms in a clinical sample: The mediating role of cognitive emotion regulation strategies. *Journal of Affective Disorders*, *213*, 44–50. https://doi.org/10.1016/j.jad.2017.02.009

Huh, H. J., Kim, S.-Y., Yu, J. J., & Chae, J.-H. (2014). Childhood trauma and adult interpersonal relationship problems in patients with depression and anxiety disorders. *Annals of General Psychiatry*, *13*(1), 26. https://doi.org/10.1186/s12991-014-0026-y

Kessler, R. C., McLaughlin, K. A., Green, J. G., Gruber, M. J., Sampson, N. A., Zaslavsky, A. M., Aguilar-Gaxiola, S., Alhamzawi, A. O., Alonso, J., Angermeyer, M., Benjet, C., Bromet, E., Chatterji, S., de Girolamo, G., Demyttenaere, K., Fayyad, J., Florescu, S., Gal, G., Gureje, O., … Williams, D. R. (2010). Childhood adversities and adult psychopathology in the WHO World Mental Health Surveys. *The British Journal of*

Psychiatry: The Journal of Mental Science, *197*(5), 378–385. https://doi.org/10.1192/bjp.bp.110.080499

Lajud, N., & Torner, L. (2015). Early life stress and hippocampal neurogenesis in the neonate: Sexual dimorphism, long term consequences and possible mediators. *Frontiers in Molecular Neuroscience*, *8*, 3. https://doi.org/10.3389/fnmol.2015.00003

Lambert, H. K., King, kevin M., Monahan, kathryn C., & Mclaughlin, K. A. (2017). Differential associations of threat and deprivation with emotion regulation and cognitive control in adolescence. *Development and Psychopathology*, *29*(3), 929–940. https://doi.org/10.1017/S0954579416000584

Liu, S., & Fisher, P. A. (2022). Early experience unpredictability in child development as a model for understanding the impact of the COVID-19 pandemic: A translational neuroscience perspective. *Developmental Cognitive Neuroscience*, *54*, 101091. https://doi.org/10.1016/j.dcn.2022.101091

LoPilato, A. M., Goines, K., Addington, J., Bearden, C. E., Cadenhead, K. S., Cannon, T. D., Cornblatt, B. A., Mathalon, D. H., McGlashan, T. H., Seidman, L., Perkins, D. O., Tsuang, M. T., Woods, S. W., & Walker, E. F. (2019). Impact of childhood adversity on corticolimbic volumes in youth at clinical high-risk for psychosis. *Schizophrenia Research*, *213*, 48–55. https://doi.org/10.1016/j.schres.2019.01.048

Lupien, S. J., Maheu, F., Tu, M., Fiocco, A., & Schramek, T. E. (2007). The effects of stress and stress hormones on human cognition: Implications for the field of brain and cognition. *Brain and Cognition*, *65*(3), 209–237. https://doi.org/10.1016/j.bandc.2007.02.007

Manly, J. T., Kim, J. E., Rogosch, F. A., & Cicchetti, D. (2001). Dimensions of child maltreatment and children's adjustment: Contributions of developmental timing and subtype. *Development and Psychopathology*, *13*(4), 759–782.

Marusak, H. A., Martin, K. R., Etkin, A., & Thomason, M. E. (2015). Childhood Trauma Exposure Disrupts the Automatic Regulation of Emotional Processing. *Neuropsychopharmacology*, *40*(5), 1250–1258. https://doi.org/10.1038/npp.2014.311

Masson, M., Bussières, E.-L., East-Richard, C., R-Mercier, A., & Cellard, C. (2015). Neuropsychological Profile of Children, Adolescents and Adults Experiencing Maltreatment: A Meta-analysis. *The Clinical Neuropsychologist*, *29*(5), 573–594. https://doi.org/10.1080/13854046.2015.1061057

McCrory, E. J., De Brito, S. A., Sebastian, C. L., Mechelli, A., Bird, G., Kelly, P. A., & Viding, E. (2011). Heightened neural reactivity to threat in child victims of family violence. *Current Biology: CB*, *21*(23), R947-948. https://doi.org/10.1016/j.cub.2011.10.015

McGinnis, E. W., Sheridan, M., & Copeland, W. E. (2022). Impact of dimensions of early adversity on adult health and functioning: A 2-decade, longitudinal study. *Development and Psychopathology*, 1–12. https://doi.org/10.1017/S095457942100167X

McGrath, J. J., Saha, S., Lim, C. C. W., Aguilar-Gaxiola, S., Alonso, J., Andrade, L. H., Bromet, E. J., Bruffaerts, R., Caldas de Almeida, J. M., Cardoso, G., de Girolamo, G., Fayyad, J., Florescu, S., Gureje, O., Haro, J. M., Kawakami, N., Koenen, K. C., Kovess-Masfety, V., Lee, S., … Kessler, R. C. (2017). Trauma and psychotic experiences: Transnational data from the World Mental Health Survey. *The British Journal of Psychiatry*, *211*(6), 373–380. https://doi.org/10.1192/bjp.bp.117.205955

McLaughlin, K. A., Green, J. G., Gruber, M. J., Sampson, N. A., Zaslavsky, A. M., & Kessler, R. C. (2012). Childhood adversities and first onset of psychiatric disorders in a national sample of adolescents. *Archives of General Psychiatry*, *69*(11), 1151–1160. https://doi.org/10.1001/archgenpsychiatry.2011.2277

McLaughlin, K. A., & Sheridan, M. A. (2016). Beyond Cumulative Risk: A Dimensional Approach to Childhood Adversity. *Current Directions in Psychological Science*, *25*(4), 239–245. https://doi.org/10.1177/0963721416655883

McLaughlin, K. A., Sheridan, M. A., & Lambert, H. K. (2014). Childhood adversity and neural development: Deprivation and threat as distinct dimensions of early experience. *Neuroscience & Biobehavioral Reviews*, *47*, 578–591. https://doi.org/10.1016/j.neubiorev.2014.10.012

McLaughlin, K. A., Sheridan, M. A., & Nelson, C. A. (2017). Neglect as a Violation of Species-Expectant Experience: Neurodevelopmental Consequences. *Biological Psychiatry*, *82*(7), 462–471. https://doi.org/10.1016/j.biopsych.2017.02.1096

Meng, T., He, Y., Zhang, Q., Yu, F., Zhao, L., Zhang, S., Chen, Z., Wang, S., Gong, J., & Liu, J. (2021). Analysis of features of social anxiety and exploring the relationship between childhood major adverse experiences and social anxiety in early adulthood among Chinese college students. *Journal of Affective Disorders*, *292*, 614–622. https://doi.org/10.1016/j.jad.2021.05.105

Miczek, K. A., Nikulina, E. M., Shimamoto, A., & Covington, H. E. (2011). Escalated or Suppressed Cocaine Reward, Tegmental BDNF, and Accumbal Dopamine Caused by

Episodic versus Continuous Social Stress in Rats. *The Journal of Neuroscience*, *31*(27), 9848–9857. https://doi.org/10.1523/JNEUROSCI.0637-11.2011

Miller, T., Mcglashan, T., Rosen, J., Cadenhead, K., Cannon, T., Ventura, J., Mcfarlane, W., Perkins, D., Pearlson, G., & Woods, S. (1999). Prodromal Assessment With the Structured Interview for Prodromal Syndromes and the Scale of Prodromal Symptoms: Predictive Validity, Interrater Reliability, and Training to Reliability. *Schizophrenia Bulletin*, *29*, 703–715. https://doi.org/10.1093/oxfordjournals.schbul.a007040

Nelson, C. A., Zeanah, C. H., Fox, N. A., Marshall, P. J., Smyke, A. T., & Guthrie, D. (2007). Cognitive recovery in socially deprived young children: The Bucharest Early Intervention Project. *Science (New York, N.Y.)*, *318*(5858), 1937–1940. https://doi.org/10.1126/science.1143921

Noble, K. G., Norman, M. F., & Farah, M. J. (2005). Neurocognitive correlates of socioeconomic status in kindergarten children. *Developmental Science*, *8*(1), 74–87. https://doi.org/10.1111/j.1467-7687.2005.00394.x

Peters, A., McEwen, B. S., & Friston, K. (2017). Uncertainty and stress: Why it causes diseases and how it is mastered by the brain. *Progress in Neurobiology*, *156*, 164–188. https://doi.org/10.1016/j.pneurobio.2017.05.004

Pollak, S. D., & Tolley-Schell, S. A. (2003). Selective attention to facial emotion in physically abused children. *Journal of Abnormal Psychology*, *112*(3), 323–338. https://doi.org/10.1037/0021-843X.112.3.323

Robles, T. F. (2021). Annual Research Review: Social relationships and the immune system during development. *Journal of Child Psychology and Psychiatry*, *62*(5), 539–559. https://doi.org/10.1111/jcpp.13350

Sheridan, M. A., & McLaughlin, K. A. (2014). Dimensions of early experience and neural development: Deprivation and threat. *Trends in Cognitive Sciences*, *18*(11), 580–585. https://doi.org/10.1016/j.tics.2014.09.001

Simpson, J. A., Griskevicius, V., Kuo, S. I.-C., Sung, S., & Collins, W. A. (2012). Evolution, stress, and sensitive periods: The influence of unpredictability in early versus late childhood on sex and risky behavior. *Developmental Psychology*, *48*(3), 674–686. https://doi.org/10.1037/a0027293

Soltani, A., & Izquierdo, A. (2019). Adaptive learning under expected and unexpected uncertainty. *Nature Reviews Neuroscience*, *20*(10), 635–644. https://doi.org/10.1038/s41583-019-0180-y

Teicher, M. H., Andersen, S. L., Polcari, A., Anderson, C. M., Navalta, C. P., & Kim, D. M. (2003). The neurobiological consequences of early stress and childhood maltreatment. *Neuroscience & Biobehavioral Reviews*, *27*(1), 33–44. https://doi.org/10.1016/S0149-7634(03)00007-1

Thompson, K. L., Hannan, S. M., & Miron, L. R. (2014). Fight, flight, and freeze: Threat sensitivity and emotion dysregulation in survivors of chronic childhood maltreatment. *Personality and Individual Differences*, *69*, 28–32. https://doi.org/10.1016/j.paid.2014.05.005

Tinius, T. P. (2003). The Integrated Visual and Auditory Continuous Performance Test as a neuropsychological measure. *Archives of Clinical Neuropsychology*, *18*(5), 439–454. https://doi.org/10.1016/S0887-6177(02)00144-0

van Marle, H. J. F., Hermans, E. J., Qin, S., & Fernández, G. (2009). From specificity to sensitivity: How acute stress affects amygdala processing of biologically salient stimuli. *Biological Psychiatry*, *66*(7), 649–655. https://doi.org/10.1016/j.biopsych.2009.05.014

Tables

Table 1. Proposed Dimensions of Adversity

Dimension	*Operational Definition*	*Items*
Adversity Variables		
Threat	Presence of harmful inputs; Experiences that denote harm or threat of harm	Childhood psychological bullying[a] Childhood physical bullying[a] Childhood psychological abuse[a] Childhood physical abuse[a] Childhood sexual abuse[a] Childhood exposure to domestic violence [b]
Deprivation	Absence of expected inputs; Absence of cognitive and social experiences	Childhood emotional neglect[a] Childhood poverty[c] Childhood restricted peer relationships[d] Childhood lack of social support[b]
Environmental Unpredictability	Presence of unpredictable inputs	Early caregiver disruption[b] Inconsistent social support[b] Community disorganization[b]
Outcome Variables		
Emotional Functioning		Expression of Emotions[e] Experience of Emotions[e]
Social Functioning		Social Anhedonia[e] Social Functioning[f]
Cognitive Functioning		Vigilance[g] Working Memory[g] Working Memory - Interference[g]

[a] Documentation of Trauma Interview; [b] SAVRY; [c] Demographics; [d] PAS; [e] SIPs; [f] GFS; [g] ACPT

Table 2. Sample characteristics (*n*=562)

Age, years (mean ± *SD)*	18.40 ± 4.14
Sex, n(%)	
Male	300 (53.4%)
Female	262 (46.6%)
Race, n(%)	
First Nations	11 (2.0%)
East Asian	40 (7.1%)
Southeast Asian	12 (2.1%)
South Asian	15 (2.7%)
Black	60 (10.7%)
Central/South American	33 (5.9%)
West/Central Asian and Middle Eastern	6 (1.1%)
White	315 (56.0%)
Native Hawaiian or Pacific Islander	2 (0.4%)
Interracial	68 (12.1%)
Subject Type, n(%)	
CHR	486 (86.5%)
Control	76 (13.5%)
Threat Exposure, n(%)	
Psychological bullying	438 (54.3%)
Physical bullying	208 (25.8%)
Psychological abuse	202 (25.0%)
Physical abuse	143 (17.7%)
Sexual abuse	93 (11.5%)
Domestic violence exposure	155 (19.2%)
Deprivation Exposure, n(%)	
Poverty	99 (12.3%)
Emotional Neglect	249 (30.9%)
Restricted peer relationships	46 (5.7%)
Lack of social support	51 (6.3%)
Unpredictability Exposure, n(%)	
Early caregiver disruption	118 (14.6%)
Unpredictable social support	140 (17.4%)
Community disorganization	21 (2.6%)
Threat Only Exposure	119 (31.7%)
Deprivation Only Exposure	40 (10.7%)
Unpredictability Only Exposure	38 (10.1%)
Threat, Deprivation, & Unpredictability Exposure	89 (23.7%)
No Adversity Exposure	89 (23.7%)

Table 3. Descriptive Statistics of Study Variables (*n*=562)

Variable	*Mean*	*SD*	*Range*
Adversity Dimensions			
Threat	1.54	1.50	0-6
Deprivation	0.59	0.69	0-3
Unpredictability	0.34	0.53	0-3
Total Adversity	2.47	2.08	0-11
Social Processes			
Social Anhedonia	2.15	1.73	0-6
Social Functioning	6.73	1.63	0-8
Emotional Processes			
Expression of Emotion	1.28	1.43	0-5
Experience of Emotions	1.88	1.67	0-6
Cognitive Processes			
Vigilance	94.97	9.06	0-100
Working Memory	81.54	15.21	0-100
Working Memory - Interference	77.31	16.43	0-100

Table 4. Zero-order Correlations Between Adversity Dimensions and Social, Emotional, and Cognitive Outcomes

	1	2	3	4	5	6	7	8	9	10	11
1. Threat	--	--	--	--	--	--	--	--	--	--	--
2. Deprivation	0.40**	--	--	--	--	--	--	--	--	--	--
3. Unpredictability	0.20**	0.12**	--	--	--	--	--	--	--	--	--
4. Total Adversity	0.92**	0.65**	0.47**	--	--	--	--	--	--	--	--
5. Social Anhedonia	-0.02	-0.01	-0.04	0.00	--	--	--	--	--	--	--
6. Social Functioning	-0.16**	-0.18**	-0.12**	-0.23**	-0.02	--	--	--	--	--	--
7. Expression of emotion	-0.04	0.04	-0.04	0.01	.50**	0.04	--	--	--	--	--
8. Experience of Emotion	-0.03	0.05	0.01	0.02	0.38**	0.03	0.47**	--	--	--	--
9. Vigilance	0.05	-0.03	0.05	0.04	0.03	0.05	0.02	0.03	--	--	--
10. Working Memory	-0.06	-0.05	-0.04	-0.09*	-0.02	.14**	0.003	0.00	.49**	--	--
11. Working Memory - Interference	0.00	-0.03	0.00	0.03	-0.07	.13**	-0.05	-0.04	.44**	.43**	--

* p <.05 ** p<.01

Table 5. Dimensions of Adversity and Total Adversity Models: Associations Between Adversity Dimensions and Social, Emotional, and Cognitive Outcomes

	Social Processes				Emotional Processes				Cognitive Processes					
	Social Anhedonia		Social Functioning		Expression of Emotion		Experience of Emotion		Vigilance		WM		WM - Interference	
Adversity Measure	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE
Dimensional Model														
Threat	.03 (.03)	.06	-.17** (-.16)	.05	.001 (.00)	.05	-.04 (-.04)	.05	.37 (.06)	.29	-.67 (-.07)	.49	.57 (.05)	.53
Deprivation	-.04 (-.02)	.12	-.27* (-.12)	.11	.09 (.04)	.10	.16 (.07)	.11	-.81 (-.06)	.62	-.57 (-.03)	1.04	-.14 (-.06)	1.12
Unpredictability	-.11 (-.03)	.15	-.06 (-.02)	.13	-.13 (-.05)	.12	.10 (.03)	.14	.96 (.06)	.77	-.97 (-.03)	1.30	1.31 (.04)	1.40
Total Adversity Model														
Total Adversity	.00 (.00)	.04	-.18** (-.23**)	.03	.01 (.01)	(.03)	.02 (.02)	.03	.19 (.04)	.19	-.68* (-.09*)	.32	.22 (.03)	.35

Note. Standardized β are presented in parentheses. WM = Working Memory. * p <.05 ** p<.01