Title

Empirical Inquiry into the Multidimensional Adversity: Implications for Families Affected by Housing Instability

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Empirical Inquiry into the Multidimensional Adversity:
Implications for Families Affected by Housing Instability

By

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DISSERTATION

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Dedication

Given the immense support I have received as an international student over many years of my undergraduate and graduate academic journey, I would like to dedicate this work to those who have made this research possible, - whose kindness, dedication, care, and support carried me through some challenging times and added meaning and joy to life triumphs:

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Acknowledgements and Permissions

Study I of this dissertation includes a published manuscript, which I am reproducing herein as the first author with the permission of the Journal of the Developmental Psychopathology, holding the publishing rights, and the approval of Dr. Amanda Guyer, the Chair for the Department of Human Ecology, as well as the publication co-authors and the Dissertation Committee.

Abstract

Complex contexts of adversity such as family poverty and homelessness have been linked to multiple adverse, yet heterogenous risk profiles. Traditionally, high-risk environments have been examined through the framework of cumulative risk, which has been useful in exploring associations between risk factors and child and family outcomes. Methodologically, however, this approach lacks sensitivity to disentangle nuanced relationships between proximal experiences of various aspects of adversity and distal developmental and functional outcomes. These limitations underscore insufficiencies in currently existing typologies and risk assessment tools, translating to practical barriers to serving these underprivileged communities.

The current dissertation seeks to explore alternative theoretical frameworks concerned with dimensional conceptualization of adversity. More specifically, Studies I and II draw on the Fragile Families and Child Wellbeing Study (FFCW) longitudinal data to test empirically a) the feasibility of dimensional decomposition of high-risk contexts of adversity; b) the effects of early life dimensional adversity on subsequent child development; and c) comparison of the ecological fit and predictive performance of cumulative risk and dimensional adversity models.

Study I presents a case for integration of the two well-established dimensional frameworks into a three-dimensional parsimonious model of threat, deprivation, and unpredictability, modeled on the total sample of FFCW (N = 3253). Study I findings were consistent with theory, as children exposed to threat at three years of age showed more aggressive behaviors at age five; whereas exposure to deprivation at age three related to physical health problems and cognitive deficits at age five, and exposure to unpredictability at age three predicted risky behaviors and sexual risk-taking at age 15.

Study II expands on Study I by applying the three-dimensional framework to a subset of

FFCW multigenerational and doubled-up families (N = 2422), based on the literature review, which identified this precariously housed population as the most heterogenous subgroup in terms of child and family outcomes and participation in services. Furthermore, dimensional modeling of adversity based on indicators of precarious housing was compared to the cumulative risk modeling, with the focus on the ecological fit and predictive performance the competing models.

Results indicated that the three-dimensional model yielded a considerably better fit to the data than did the cumulative-risk model. In terms of developmental predictions, the two competing models showed similar effects magnitude and directionality, whereas dimensional approach also showed promise in terms of predictive specificity. In line with Study I findings, Study II demonstrated robust associations between early exposure to threat and prospective aggressive behavior; early experiences of deprivation and unpredictability and downstream cognitive deficits, and to some degree, a link between exposure to unpredictability in early childhood and risky behavior and sexual risk-taking in adolescence.

Taken together, these findings lend credibility to the utility of the three-dimensional integrative framework of adversity in application to complex developmental contexts, such as family poverty and precarious housing, with implications relevant to the field of developmental science and public health.

Empirical Inquiry into the Multidimensional Adversity: Implications for Families Affected by Housing Instability

Family homelessness is a known risk factor for child development, and as such, has been at the forefront of research and policy in the last decade (Bassuk et al., 2020; Bassuk et al., 2015; Masten et al., 2015; Wilson & Squires, 2014). Yet, current literature reflects high heterogeneity in outcomes in families and children affected by homelessness (Bassuk & Beardslee, 2014; Miller et al., 2015; Park et al., 2011). The task of eradicating family homelessness is directly tied to our ability to isolate homogenous population clusters that may be characterized by patterns of events leading to similar environmental conditions, which may be further predictive of specific outcomes in terms of child development, parent-child relationships, and family stability. A functional conceptualization should be generalizable across a variety of individual circumstances, and, at the same time, sensitive to variations in context (Knopf, 2013; Rog et al., 2007).

Historically, this task has been approached through examination of risk factors, which have been inspected individually, grouped by commonalities (Bonin et al., 2009; Nooe & Patterson, 2010), or examined under the cumulative risk models (Cutuli & Herbers, 2014; Labella et al., 2016; Marcal, 2016). This approach yielded a narrow understanding of homelessness as living on the streets or in emergency shelters, and typologically defined as transitional, episodic, and chronic (Danseco & Holden, 1998; Culhane et al., 2007; McAllister et al., 2010; McAllister et al., 2011; Rabinovitch et al., 2016). However, this typology showed limited functionality when applied to homeless families (Bassuk, 2007; Culhane et al., 2007). Unlike homeless adults, families are more likely to experience a greater range of housing instability surrounding homelessness (Bassuk et al., 2020). This fact was reflected in newer typologies, which aimed to capture various contexts of precarious housing as part of complex experiences of family homelessness (Busch-Geertsema et

al., 2016; Grant et al., 2013; Pavlakis, 2018). While this approach deepened our understanding of housing instability prevalent in family homelessness, it offered limited functionality in regard to more complex characteristics, such as nontraditional familial systems, variation in housing contexts across various geographies, historical misclassification of displaced families, and evolving landscape of family homelessness giving rise to new contexts of homelessness.

Such constantly evolving complexity of contexts and characteristics surrounding family homelessness prompted calls for multidimensional approaches to defining and typologizing this phenomenon (Rog et al, 2007). At present, this approach is represented by the European Classification of Homelessness (ETHOS), defining homelessness as exclusion from legal, social, and physical dimensions, which are thought to overlap (Edgar & Meert, 2005). While ETHOS represents a shift from categorical and unidimensional understanding of homelessness, its utility is hindered by practical limitations associated with lack of empirical validation and wide scope.

In recent years, the contexts of high adversity have been dissected dimensionally, which has been primarily studied in the context of childhood poverty (Belsky et al., 2012; Kuhlman et al., 2018; McLaighlin et al., 2015; McLaighlin & Sheridan, 2016; Sumner et al., 2019; Walker et al., 2017). Although this approach was found promising in terms of predictive specificity (Ackerman et al., 2004; Labella et al., 2019; McLaughlin & Lambert, 2017), it has not been applied to gain systematic knowledge on family homelessness. Given the intersection of family homelessness and poverty, it stands to reason to extend multidimensional approaches to adversity to research on family homelessness. The current investigation aims to address this gap.

Study I will focus on identifying dimensional continuums that may adequately capture a variety of developmental contexts. The proposed prototypical dimensions will be extracted using a nationally representative sample of children who have participated with their families in the

Fragile Families and Child Wellbeing (FFCW) Study. To test the ecological validity of the resulting theoretical model, we will evaluate model fit in two samples based on data collected when children were three years old, and then use it to predict prospective child cognitive, behavioral, and health outcomes, measured when children were five and 15 years old.

Study II will apply the theoretical structure derived and validated in Study I to the contexts of precarious housing and homelessness. We are particularly interested in ecological fit and predictive potential of modeling adversity in residential contexts by comparing performance of dimensional models and models based on cumulative risk. This task will be approached using data from the *FFCW Study*, wherein dimensional adversity was measured when children were three years of age and cognitive and behavioral outcomes were captured at five and 15 years of age.

Collectively, we argue that adopting a multidimensional approach to precarious housing would allow for a more nuanced understanding of conditions that foreshadow family homelessness, barriers to stable housing, and specificities of developmental trajectories, psychopathology, relational health, and family functioning in children and families at risk of or affected by housing instability. Recommendations for future studies and implications of implementing this approach in clinical practice and policymaking will be discussed.

Study I

Testing the Empirical Integration of Threat-Deprivation and Harshness-Unpredictability Dimensional Models of Adversity

Abstract

Recent dimensional models of adversity informed by a neurobiological deficit framework highlights threat and deprivation as core dimensions, whereas models informed by an evolutionary, adaptational and functional framework calls attention to harshness and unpredictability. This report seeks to evaluate an integrative model of threat, deprivation, and unpredictability, drawing on the Fragile Families Study. Confirmatory factor analysis of presumed multiple indicators of each construct reveals an adequate three-factor structure of adversity. Theory-based targeted predictions of the developmental sequelae of each dimension also received empirical support, with deprivation linked to health problems and cognitive ability; threat linked to aggression; and unpredictability to substance use and sexual risk-taking. These findings lend credibility to utility of the three-dimensional integrative framework of adversity. It could thus inform development of dimensional measures of risk assessment and exploration of multidimensional adversity profiles, sensitive to individual differences in lived experiences, supporting patient-centered, strength-based approaches to services.

Testing the Empirical Integration of Threat-Deprivation and Harshness-Unpredictability Dimensional Models of Adversity

Understanding early life adversity is critical to mitigating its well-documented negative effects on the development of children (Cicchetti, 2016; Dunn, Nishimi, Gomez, Powers, & Bradley, 2018; Lupien, McEwen, Gunnar, & Heim, 2009; McLaughlin, Conron, Koenen, & Gilman, 2010; Wilson, Hurtt, Shaw, Dishion, & Gardner, 2009; Yoshikawa, Aber, & Beardslee, 2012). Traditionally, adversity has often been treated categorically (i.e., present/absent), with risk factors assumed to exert additive effects, such that exposure to more risks undermines normative development more than exposure to fewer risks (Appleyard, Egeland, van Dulmen, & Sroufe, 2005; Cicchetti, 2010; Hostinar & Gunnar, 2013; Masten, Fiat, Labella, & Strack, 2015). This widely utilized approach to studying effects of early life adversity is known as *cumulative-risk* (Evans & Whipple, 2013)—or, more recently, ACES (Adverse Childhood Experiences; Danese & McEwen, 2012; Felitti et al., 1998).

While these approaches to conceptualizing adversity and investigating its effects have proven useful in predicting variation in diverse features of development (e.g., neurobiology, cognition, problem behavior; Evans & Whipple, 2013; Nusslock & Miller, 2016; Pechtel & Pizzagalli, 2011; Repetti, Robles, & Reynolds, 2011; Sturge-Apple, Skibo, Rogosch, Ignjatovic, & Heinzelman, 2011; Taylor, Way, & Seeman, 2011), it is ever more appreciated that these paradigms are limited (Widaman, in press). Conceptually, these deficit-oriented models regard exposure to any adversity as potentially undermining the well-being of children (i.e., Daskalakis, Bagot, Parker, Vinkers, & de Kloet, 2013), when the Darwinian process of natural selection may have shaped human development to respond in strategic and beneficial ways (Belsky, Steinberg & Draper, 1991). Methodologically, various risk factors are typically assigned equal weight,

thereby failing to recognize that some may be more influential than others (e.g., see Ettekal, Eiden, Nickerson, & Schuetze, 2019). More importantly, the categorical parameterization of adversity in these frameworks has little capacity to account for the timing, intensity and/or duration (i.e., severity) of early-life experiences and exposures presumed to harm the developing child (McLaughlin & Sheridan, 2016).

In recent years, alternative dimensional models have emerged in an effort to address these—and other—limitations. Dimensional models of adversity are based on the view that different individual risk conditions share underlying characteristics that can—and should—be measured continuously (Ellis, Figueredo, Brumbach, & Schlomer, 2009; McLaughlin & Sheridan, 2016; McLaughlin, Sheridan, & Lambert, 2014; Sheridan & McLaughlin, 2014). In so doing, they allow for treating different risks similarly, while capturing the severity gradient of risk. Central to the dimensional approach is the presumption that while some adverse exposures may have broad, across-the-board developmental effects, as more or less presumed by cumulative-risk and ACE frameworks, most exert more particular, targeted and specific effects (Kuhlman, Chiang, Horn, & Bower, 2018; McLaughlin et al., 2014; McLaughlin, Sheridan, Humphreys, Belsky, & Ellis, 2020).

The current report aims to integrate and expand two separate dimensional models—the neurobiological threat-deprivation framework and the evolutionary-adaptive harshness-unpredictability one—within a single three-dimensional model of adversity. To evaluate the utility of joining these independently developed models we draw on data from the *Fragile Families and Child Wellbeing Study* (*FFCW;* Reichman, Teitler, Garfinkel, & McLanahan, 2001). More specifically, we first evaluate the fit of a three-dimensional model and then test hypotheses linking each dimension with the particular aspects of development they are

hypothesized to influence (e.g., cognition, risk taking). Before doing so, we (a) review the two foundational dimensional models in order to highlight conceptual similarities—and differences—that serve as the basis for their integration; (b) discuss briefly the conceptual and operational definitions of the adversity dimensions under consideration; and then (c) provide the conceptual and empirical foundations for the dimension-outcome predictions that will be tested.

Dimensional Models of Adversity

The dimensional models of adversity on which this report is based—and builds—can be distinguished in terms of their scholarly foundations. McLaughlin and associates' (2014) *threat-deprivation model* is neurobiologically based (McLaughlin et al., 2014), whereas Ellis and associates' (2009) harshness-unpredictability one is grounded in evolutionary-developmental thinking. More specifically, the former framework is focused on understanding of brain mechanisms linking adversity exposures involving threat and deprivation with different psychological and behavioral phenotypes, including psychopathology (McLaughlin et al., 2014; Sheridan & McLaughlin, 2014). The evolutionary-developmental (evo-devo) framework, in contrast, is based on the "why" of development rather than founded on the mechanistic concern for the "how" of development: Why does development operate the way it does? It calls attention to experiences of harshness and unpredictability, as well as energetic resources (Ellis et al., 2009), though the latter is only of secondary consideration in this report.

Unlike cumulative-risk, ACES and other deficit-oriented approaches that exclude consideration of any developmental advantages that may be associated with exposure to adversity, both aforementioned dimensional frameworks call attention to developmental adaptation. Critically, though, they differ in how adaptation is conceptualized. *The threat-deprivation model* regards effects of these adverse conditions as fostering self-preservation and

strategic coping in the immediate environment (Kundakovic & Champagne, 2015; McLaughlin & Lambert, 2017; McLaughlin et al., 2015), while recognizing that longer-term consequences may include maladaptation, compromised development and even diagnosable psychiatric disorders. It derives from a neurobiological analysis of experience-driven plasticity (McLaughlin et al., 2014; Sheridan & McLaughlin, 2014). The central tenet of this model is that different dimensions of adversity will exert distinctive influence on neural development and, thereby, phenotypic functioning.

The evolutionary-developmental model, related as it is to life history theory (Del Giudice, Gangestad, & Kaplan, 2016), is based on a Darwinian view of adaptation. That is, the consequences of adversity often, even if not always, constitute a strategic response to morbidity and mortality risks that, over the course of human history, have fostered reproductive success, that is, the passing on of genes to future generations, the ultimate goal of all living things. Thus, responses to adversity do not represent compromised, dysfunctional, dysregulated, or disordered development, even when they involve making the best of a bad situation and result in forms of thinking, feeling and behaving that are not socially desirable in modern society (Belsky et al., 1991; Belsky & Pluess, 2013; Ellis & Del Giudice, 2019). More specifically, forces that increase morbidity and mortality risks—stemming from not just the immediate environment, but the broader one as well (e.g., neighborhood, society)—promote a fast rather than slow life history strategy—because such a developmental trajectory is presumed to have increased the likelihood of survival to reproductive age and, thereby, the passing on of genes to the next generation in human ancestral history (Ellis et al., 2009; Del Giudice, 2020; Del Giudice et al., 2016).

Indeed, even if this is no longer the case in the modern world, the presumption is that the developmental machinery for inducing fast-life history phenotypes—including advantage taking,

discounting of the future, and accelerated sexual development, leading to more promiscuous mating, high fertility and limited parental investment—remains operative (Belsky, 2019; Belsky et al., 1991; Brumbach, Figueredo, & Ellis, 2009; Ellis, 2004). This is all in contrast to slow life histories which involve quite the opposite developmental trajectories, ones presumed to be induced by safe, secure and supportive early-life experiences and exposures (Ellis et al., 2009). Notably, neither manner of developing in response to developmental conditions is considered inherently better or worse than the other. Both are strategic alternatives assumed to fit the developing organism to the present and probabilistic future environment in the service of reproductive success (Belsky, 2007; Belsky, Schlomer, & Ellis, 2012; Ellis et al., 2009).

Important to appreciate is that the *slow* life history may also be induced by conditions of resource scarcity, that is, deprivation (Ellis, Sheridan, Belsky, & McLaughlin, in press). When energetic resources (e.g., nutrition) are limited, the developing organism privileges survival and maintenance rather than development, according to life history theory. This should result in slower growth, smaller body size, later sexual maturation and constrained reproductive potential (Ellis et al., 2009). Related to the threat-deprivation model is the fact that conservation of energetic resources may come at a cost of neurobiological complexity and maintenance of physical fitness (Ellis et al., in press).

This brief summary of the dimensional models of adversity which are the focus of the research presented herein highlights significant conceptual differences between the two, including differential emphasis on the immediate vs. the broader and future environment, psychological adaptation vs. reproductive adaptation, and the how vs. the why of development. At the same time, it reveals no evidence of irrevocable contradictions that would preclude their integration. (For more extensive discussion of the models and this point, see Ellis et al., in press).

Model Dimensions

Having delineated major postulates of the dimensional models of adversity that are the focus of this report, attention is now turned to the specific dimensions highlighted by each of these models—to lay the groundwork for the specific predictions that are central to this empirical report.

The Threat-Deprivation Model

Deprivation is broadly understood as developmentally insufficient expected species- and age-typical environmental complexity, with the primary emphasis on the lack (or presence) of cognitive and social-relational stimulation. As such, deprivation has been assessed on a continuum, ranging in severity from lack of cognitive and psychosocial stimulation to the extent of environmental enrichment. Consequently, a few widely used indicators of the lower end of the deprivation-enrichment continuum include neglect, institutional rearing and caregiver emotional unavailability, whereas the higher end of that continuum may be exemplified by parental scaffolding and psychosocial stimulation, among other factors such as adequate linguistic input (Colich, Rosen, Williams, & McLaughlin, 2020; Drury et al., 2012; Lambert, King, Monahan, & McLaughlin, 2017; McLaughlin et al., 2014, 2015; McLaughlin, Sheridan, & Nelson, 2017; Miller et al., 2018; Miller, Machlin, McLaughlin, & Sheridan, 2021).

Threat is conceptualized as any aversive exposure that physically or psychologically harms or poses risk of harm to an individual or someone close to them. Therefore, threat is indexed by traumatic or violent events linked to serious injury or threat to life. Examples include experiencing or witnessing physical, sexual, or emotional abuse, as well as violence in the home, in childcare, in the classroom or in the peer group or the community (Colich et al., 2020; Lambert et al., 2017; McCoy, Raver, & Sharkey, 2015; McLaughlin et al., 2014, 2015; Miller et

al., 2018, 2021; Sumner, Colich, Uddin, Armstrong, & McLaughlin, 2019).

The Harshness-Unpredictability Model

Environmental harshness represents external conditions associated with increased risk of morbidity and mortality, which may be conveyed via cues of resource scarcity, conspecific violence and population-level epidemiological indicators of risk to safety and survival that evolution has sensitized the developing individual to detect (e.g., crime rate; Brumbach et al., 2009; Ellis et al., 2009). To this extent, dimensions of deprivation and threat identified under *the harshness-unpredictability framework* map on to the conceptually broader components of environmental harshness (Ellis et al., 2021, in press). Indeed, whereas in the threat-deprivation view, poor caregiving quality and/or absence of a caregiver largely accounts for the absence of experience-expectant environmental input, the harshness-unpredictability framework considers the critical role of material resources, such as nutrition, shelter, and basic safety, in terms of survival and eventual reproductive success (Ellis & Del Giudice, 2019; Ellis et al., 2009). Thus, material deprivation reflecting harshness can be indexed by measures of economic insufficiency, such as low income-to-needs ratio, food insecurity, receipt of public assistance or neighborhood deprivation (Belsky et al., 2012; Dennison & Swisher, 2019; Mededović & Bulut, 2019; Nettle, 2010; Sturge-Apple et al., 2016).

Similarly, environmental cues of threat within the harshness-unpredictability framework extend beyond proximal experiences of violence recognized by the threat-deprivation model, to more distal contextual cues, as noted above. From the Darwinian adaptational viewpoint, the threat component of harshness has been operationalized as family dysfunction (i.e., harsh parenting, interparental conflict), thereby acknowledging the unique role that families play in conveying to children—but not necessarily consciously—what the future will be like, based on

their own lived experiences in childhood and adulthood (Belsky, 2019; Belsky et al., 1991, 2012; Brumbach et al., 2009). At the same time, it incorporates broader indicators of epidemiological environmental quality as markers of increased morbidity and/or mortality, such as population-wide indicators of health, life expectancy, and crime rates (Brumbach et al., 2009; Ellis et al., 2009; Ellis et al., this issue).

Environmental unpredictability reflects the stochastic component of sensory input in the environment associated with elevated risk of morbidity and mortality (Belsky et al., 2012; Ellis et al., 2009; Kuhlman et al., 2018). In other words, the continuum of unpredictability may be captured by experiences characterized by high entropy rate and low autocorrelation (i.e., see Davis et al., 2017; Young, Frankenhuis, & Ellis, 2020). At the household level, unpredictability is commonly operationalized as parental transitions (e.g., changes in the family structure or marital status), changes in employment or economic status, residential mobility, as well as general lack of family routines, inconsistent parenting, parental relational instability, and household chaos (Baram et al., 2012; Davis et al., 2017; Glynn et al., 2019; Hartman, Sung, Simpson, Schlomer, & Belsky, 2018; Sturge-Apple, Davies, Cicchetti, Hentges, & Coe, 2017). Fluctuating family income has also been considered an index of unpredictability (Li & Belsky, in press). Broader environmental conditions pointing to unpredictability include chaotic neighborhoods and change in societal economic conditions, among others (Coley, Lynch, & Kull, 2015; Ross & McDuff, 2008; Young et al., 2020).

Developmental Correlates of Dimensional Adversity

Both dimensional models of adversity have stimulated theory-testing research linking specific dimensions with particular developmental outcomes. Here we focus on developmental phenotypes that serve as outcomes for the empirical work we report: cognitive ability, physical

health, aggressive behavior and risk-taking.

Cognitive ability has been linked to socio-cognitive deprivation within the threat-deprivation model (e.g., Sheridan, Peverill, & McLaughlin, 2017) and the broader resource scarcity component of environmental harshness within the life history approach (e.g., Nettle, 2010). The threat-deprivation literature elucidates neurobiological pathways by which socio-cognitive deprivation shapes the neural architecture of the brain—the how of development—via the over-pruning of synaptic connections and the underlying thinning in frontoparietal, default and visual network areas of the prefrontal cortex (McLaughlin et al., 2014, 2015; Sheridan & McLaughlin, 2014). These effects on the brain lead to deficits in cognitive control and executive functioning, such as working memory, cognitive flexibility and cognitive inhibition, which collectively can manifest as cognitive and language delays and developmental disabilities (Lambert et al., 2017; McLaughlin & Lambert, 2017; Miller et al., 2018; Rosen et al., 2020). Considered within the evolutionary-developmental perspective, cognitive outcomes may be a marker of low embodied capital, shaping development of a slow life history (see Ellis et al., in press), rather than as evidence of dysfunction or disorder (see Ellis et al., in press).

Physical health is another feature of development commonly associated with early exposure to deprivation. Turning to the "how" of development, physiological indicators of poor health have been linked to nutritional deficits, as well as hyper- and hypo-physiological stress responsivity, depending on the duration, intensity and developmental timing of deprivation experiences (Chen, Matthews, & Boyce, 2002; Cutuli et al., 2014; Shankar, Chung, & Frank, 2017; Yoshikawa et al., 2012). Although the threat-deprivation model does not explicitly address effects of deprivation on physical health, it subsumes earlier neurobiological models, such as allostatic load, which elucidate mechanisms by which early life adversity, including material

deprivation, undermine physical health (McLaughlin & Sheridan, 2016). From the threat-deprivation standpoint, then, compromised health may be viewed as a cost associated with adaptive changes induced by exposure to adversity (Mclaughlin et al., 2020).

From the evo-devo perspective, exaggerated immune responsivity may be an adaptation to conditions of elevated environmental morbidity (McDade, 2003), with limited allocation of resources for physical health maintenance representing an adaptive trade-off (Hill, Boehm, & Prokosch, 2016; Jasienska, Bribiescas, Furberg, Helle, & Núñez-de la Mora, 2017; Mededović & Bulut, 2019; Urlacher et al., 2018; Walker et al., 2006). Aligned with the slow life history trajectory, this trade-off involves redistribution of resource allocation from growth to maintenance, with the goal of improving the odds of surviving and eventually reproducing.

Aggressive behavior is linked to exposure to heightened threat and harshness. From the evolutionary standpoint, aggressive, destructive, or oppositional behavior, accounting for 17-33% of childhood psychopathology (Danielson et al., 2021), may be conceived as functional in harsh environmental conditions, such as in use of violence in self-defense (i.e., see Belsky et al., 1991, 2012; Ellis et al., 2009; McLaughlin et al., 2014; Sheridan & McLaughlin, 2014). Given that hypervigilance to threat may be protective in contexts characterized by violence, whereas aggressive behavior may be critical to asserting dominance needed to secure access to energetic resources and reproductive partners, externalizing behavior is considered a marker of *fast* life history (Belsky, 2019; Belsky et al., 1991, 2012; Del Giudice, 2020; Ellis et al., 2009; Suor, Sturge-Apple, Davies, & Cicchetti, 2017). Neurobiological mechanisms supporting increased sensitivity to real or perceived threat in areas of attention, memory and emotional processing of environmental stimuli under conditions of threat encountered early in life are well-described by the threat-deprivation model and related biopsychosocial perspectives, again reflective of the

how of development (Humphreys & Zeanah, 2015; Machlin, Miller, Snyder, McCoy et al., 2015; McLaughlin, & Sheridan, 2019; McLaughlin et al., 2015, 2017; Miller et al., 2021; Sheridan et al., 2017).

More specifically, exposure to threat cues is hypothesized to trigger changes in amygdala-prefrontal cortex connectivity and cortical thinning in the ventromedial area of the prefrontal cortex. Restructuring of emotional learning networks implicated in fear learning and appraisal of environmental cues increases propensity to interpret neutral or ambiguous stimuli as threatening (Briggs-Gowan et al., 2015; Lambert et al., 2017; McLaughlin et al., 2014; Miller et al., 2018). In turn, hypervigilance to perceived cues of threat, coupled with exaggerated physiological reactivity to stress and deficits in emotion regulation, are common correlates of behavioral problems, as highlighted in the threat-deprivation model (Jenness et al., 2021; Lambert et al., 2017; McLaughlin et al., 2014, 2017; Miller et al., 2018, 2021; Sheridan et al., 2017).

Risk-taking behavior, such as youth substance use and the early onset of sexual behavior, often with multiple partners, is presumed to reflect a *fast* life history and derive from early exposure to threat, harshness and unpredictability (Belsky et al., 1991; Brumbach et al., 2009; Doom, Vanzomeren-Dohm, & Simpson, 2016; Ellis et al., 2009; Hartman et al., 2018; Simpson, Griskevicius, Kuo, Sung, & Collins, 2012). Among possible mechanisms are cellular inflammation and up-regulation of the *Hypothalamic -Pituitary-Adrenal (HPA)*-axis, linked to disrupted caregiving (Drury et al., 2014; Kuhlman et al., 2018; Sturge-Apple et al., 2017). In turn, inflammation and elevated HPA axis reactivity mediates the relationship between exposure to early life unpredictability and difficulties with emotion regulation and impulsivity, delay of gratification and long-term planning, with the downstream consequence of behavioral problems,

such as substance use (Gassen et al., 2019; Sturge-Apple et al., 2017). Similarly, cellular indices of accelerated biological development (e.g., epigenetic clock, telomere erosion) are related to parental conflict, unemployment, family instability, parental substance problems, and neighborhood disorder (Coimbra, Carvalho, Moretti, Mello, & Belangero, 2017; Price, Kao, Burgers, Carpenter, & Tyrka, 2013). These epigenetic and chromosomal markers of biological aging are associated with earlier pubertal timing and sexual risk-taking, such as early sexual debut and multiple sexual partners (Belsky & Shalev, 2016; Belsky, Steinberg, Houts, & Halpern-Felsher, 2010). Accordingly, exposure to unpredictability is thought to favor the *fast* life history, characterized by prioritization of immediate gratification over long-term planning and an emphasis on mating over parental investment, all at the cost of physical or mental tenacity (Belsky et al., 2012; Brumbach et al., 2009; Ellis et al., 2009; Simpson et al., 2012).

In sum, *the threat-deprivation* and *harshness-unpredictability* frameworks are very much aligned when it comes to predicting developmental sequelae of exposure to harshness/threat, harshness/deprivation and unpredictability, as well as in the selection of many indicators of their adversity dimensions. Based on these commonalities, this report focuses on a parsimonious, three-dimensional model of adversity represented by threat-harshness, deprivation and unpredictability (Ellis et al., in press).

Current Study

On the basis of the work reviewed, we draw on the *Fragile Families and Child Wellbeing (FFCW) Study* to measure threat-harshness, unpredictability and deprivation in order to test specific predictions linking these exposures with particular developmental outcomes. Toward this end, we emphasize the following conceptual points that inform selection of indicators of each construct. First, each of the integrated dimensions are represented by proximal indicators

(e.g., spanking) and more distal ones (e.g., neighborhood violence; environmental toxins). Second, threat and harshness are clearly overlapping even if not one and the same, though for purposes of this report the focus will be on overlap, resulting in reliance on terminology of threat-harshness throughout the remainder of this report. Third, all dimensions are conceptualized in bipolar terms (i.e., from "positive" to "negative", rather than from none to "negative"). Thus, for example, in order to represent the positive pole, deprivation will include sensitive-supportive care; threat-harshness will include parental warmth; and unpredictability consistency of caregiving and relational stability of parents.

With regard to predictions, we exclusively test the following dimension-specific exposure-outcome hypotheses following the creation of latent constructs representing each dimension: (1) greater deprivation will predict more developmental delays and physical health problems; (2) greater threat-harshness will predict more aggressive behavior; and (3) greater unpredictability will predict more risk-taking behavior, above and beyond the effects associated with aggression levels measured at an earlier timepoint. Adversity exposures were measured at around age 3 and hypothesized sequelae when children were 5 and 15 years of age.

Method

Data Sources and Characteristics

Empirical data for this investigation comes from *the Fragile Families and Child Wellbeing (FFCW) Study*, an ongoing longitudinal survey that follows a birth cohort of 5,000 children born between 1998 and 2000 across 20 U.S. cities sampled from medium sized urban, metropolitan, and large metropolitan areas (Reichman et al., 2001). The *FFCW Study* participants were selected via stratified, multistage random sampling from cities with populations over 200,000, grouped by political and labor market conditions. By design, unmarried mothers

were oversampled, such that for each three children born to unwed mothers there was one child born to a married couple.

The *FFCW Study* is comprised of three components, the *Primary Caregiver (PCG) Core Study*, consisting of Mother and Father and/or Caregiver Surveys; the *In-Home Study*, which included caregiver surveys, standardized tests administered by the interviewers to children and interviewer observations of focal families' homes, parenting behavior and parent-child relationship; and the *Child Care Centers* and *Teachers' Study*, which surveyed participating families' childcare providers and teachers. For the present report, the data come from the first two study components. Additionally, of the currently available six waves of data collection, spanning from pregnancy to when the child was 15 years old, the present study relied on the Wave 3 data to index dimensions of threat, deprivation, and unpredictability, collected when target children were around 3 years of age. Data on children's physical, cognitive and behavioral development was sourced from Wave 4 when children were around 5 years old and Wave 6 when they were around 15 years of age.

Study Sample

The total sample consisted of 3,253 children and their caregivers. Target child's gender was evenly split, with 51% boys and 49% girls. By age 15, 18% of children identified as White, 49% as Black, 25% as Hispanic or Latino, and 8% as Other or Mixed ethnicities. In terms of yearly household income, when children were 3 years of age, 28% of families earned $15,000 or less per year; another 27% earned less than $30,000, 28% between $30,000 and $60,000, and the remaining 17% more than $60,000. The majority of children were eutrophic (92% within normal range for weight and height); only 7% were identified as malnourished, underweight or stunted, and less than 1% as obese. Maternal age at childbirth varied, with 24% of mothers being under

19, 38% between 20 and 24, 32% between 25 and 34, and 6% 35 or older. The majority of mothers were U.S. born (87%); 59% graduated from high school and/or attained higher education.

Measures

The *a priori* choice of indicators to index dimensions of threat, deprivation, and unpredictability—used as early-life predictors of later development—was theoretically based on ideas outlined in the introduction and/or prior empirical research. Indicators of each dimension are detailed below. Overall, the indicators used for this empirical investigation represented a mix of standardized assessments in their original, abridged, or adopted versions, as well as continuous scale and binary yes/no items (used to create sum scores) from the *FFCW Primary Caregiver (PCG) Core Study*.

Predictors

All predictor indicators were measured around three years of age.

Threat-Harshness. To capture this dimension, we relied on 13 indicators. Of these, four pertained to parenting behavior (spanking; physical abuse; psychological abuse; warmth/acceptance of child by parent); four to the interparental relationship (domestic violence; physical assault; psychological aggression; supportive relationship between parents); three to neighborhood characteristics (neighborhood violence; neighborhood safety; parent victim of neighborhood violence); and two to environmental risk of morbidity (parental health; exposure to environmental toxins).

Deprivation. Seventeen indicators were used to index deprivation. Of these, three reflected financial security of the household (income; assets; monthly rent or mortgage), six financial insecurity (financial hardship; length of welfare use; food insecurity; insufficient

utilities; financial uncertainty; receipt of free meals by children and/or adults in household), three insufficient caregiving (parental depression; child neglect; number of hours child watches television), two engaged caregiving or scaffolding (stimulating home environment; parental interaction/stimulation), and three as broader familial and extra-familial relational resources (parental relationship quality; availability of family/friends instrumental support; parental community involvement).

Unpredictability. Finally, to index unpredictability we used 12 indicators: four aimed to capture household composition changes (parental relationship status; change in parental relationships or living arrangements; number of serious relationships since child's birth; household composition reflective of relational ties and number of families living in the home); three changes in domicile and related areas of life (residential instability; unreliable transportation; regularity of child support payments); two of stability of child's living arrangements (how often child sees parent; who child lives with); and three indicative of irregular caregiving behavior (parental substance use interfering with work; coparenting issues-lack of agreement on parenting; coparenting issues-lack of trust in prudent parenting between child's caregivers).

Outcomes

Dependent developmental constructs were assessed in a variety of ways, including parent report, standardized testing, and interviewer observations. All outcome indicators were measured when children were five years old, with the exception of those related to risk behavior, which were assessed at age 15.

Child Physical Health was indexed by two indicators reflecting child's general health and asthma diagnosis. The general health was measured by a single item on a scale from *1*

(excellent) to *5 (poor)*. The asthma diagnosis was a sum score of three yes/no variables indicating whether a child was ever diagnosed with asthma.

Child Cognitive Ability was indexed by two indicators, the *Peabody Vocabulary Test Third Edition* (*PPVT-III*; Dunn & Dunn, 1997) standardized Z-score, and the *Woodcock Johnson Letter-Word Identification Test* (*W-J Test 22*; Woodcock, Mather, McGrew, & Wendling, 2001) Passage Comprehension and Applied Problems standardized score. For both measures, higher scores represented higher cognitive ability.

Child Aggressive Behavior was assessed by means of the parent form of the CBCL 4—18 (Achenbach, 1991) subscales of *aggressive* and *delinquent* behavior. The aggressive subscale score was a sum of 18 items (Cronbach's a = .74) and the delinquent subscale score was a sum of nine items (Cronbach's a = .56), all on a scale from *0 (not true)* to *2 (very true)*.

Youth Risky Behavior was based on three items. The first two asked about age at first sexual intercourse and the number of sexual partners. The third was a sum score of three yes/no items that whether youth tried smoking, drinking, and/or other illicit drugs. All items were self-reported by youth.

Analytical Plan

Analyses proceeded in three steps: 1) selection of indicators; 2) evaluation of the three-factorial measurement model; and 3) testing predictions linking specific adversity dimensions with specific developmental outcomes.

Selection of Indicators. Before proceeding with this first step, data were examined for missingness and normality; scales were scored using the *User's Guides for the FFCW Study Public Data* (https://fragilefamilies.princeton.edu/sites/fragilefamilies); and intercorrelations of the resulting composite scores and individual indicator variables were examined. For each

indicator pair that correlated at .85 or greater, one was removed to minimize redundancy (Bergqvist, Tossavainen, & Johansson, 2020). An exploratory factor analysis was used to identify and drop indicators loading on more than one factor with .20 or less difference in factor loadings (Hair, Black, Babin, Anderson, & Tatham, 2006). The final selection consisted of 13 potential indicators of threat-harshness, 17 indicators of deprivation, and 12 indicators of unpredictability. Detailed information on indicators used in this study can be provided on request.

Three-Factorial Measurement Model. In the next analytic step, indicator variables selected in the previous step were entered into a Confirmatory Factor Analysis (CFA) in which the 3 latent factors were allowed to covary. To meet the minimum level of factor loadings for interpretation of factor structure, all indicators with a standardized loading at or below .30 were dropped (Hair et al., 2006). The resulting factorial structure yielded, at age 3 years, five indicators of threat-harshness, six indicators of deprivation, and nine indicators of unpredictability. To test factor structure, the total sample (N = 3,253) was split into two independent subsamples (n = 1,671/1,582). The three-factorial measurement model was fit to the first subsample data, then cross-validated by running a multisample CFA with the second subsample data (Immekus & Ingle, 2017). Results of these analyses informed the basis of the adversity-predictor constructs in the next phase of analysis.

Predictive Model. The final analytic step involved two sub-steps. First, a measurement model of four latent outcome factors via a CFA, then specified a predictive model by adding predictive paths from the three latent predictor factors to the four latent outcome factors, using Structural Equation Modeling (SEM). The measurement model of *latent outcome factors* was specified as follows: the latent factors of child physical health, cognitive ability, and aggression

were each indexed by two indicators each, all measured at age 5 years; the latent risk-taking factor was indexed by three indicators, all measured at age 15 years. For each of the three latent factors measured at age 5, indicator factor loadings were constrained to equality.

In the second sub-step, theory-driven predictive paths based on the strongest hypothesized relations between each predictor and each outcome were tested by means of Structural Equation Modeling (SEM). Thus, aggression was regressed on threat-harshness; cognitive ability and physical health on deprivation; and risk-taking on unpredictability, accounting for aggression at age 5 years. The latent predictor factors of threat-harshness, deprivation and unpredictability were allowed to covary, as were the latent outcomes of aggression, cognitive ability and physical health.

Analyses were carried out in R 4.1.0., package *lavaan* (Rosseel, 2012), using Maximum Likelihood estimation. All models were examined based on the Chi-square statistic, as well as robust CFI and RMSEA indices. The latter was considered more important when evaluating model fit, given the sensitivity of the Chi-square statistic to large sample sizes. Parameter estimates are reported in standardized form.

Results

The Three-Factorial Measurement Model Testing

The three-factorial measurement model of threat-harshness, deprivation, and unpredictability depicted in *Figure 1* showed acceptable fit, considering its *a priori* specification, model complexity and large sample size (Fabrigar, MacCallum, Wegener, & Strahan, 1999; Kim, H., Ku, Kim, J., Park, Y. J., & Park, Y. B., 2016; Schumacker & Lomax, 2016). Robust fit indices for the model fit to the first sub-sample were as follows: $\chi^2(135) = 663.00$, $p < .001$, CFI = .87, RMSEA = .054, 90% CI [.050, .058]. The final model featured 4 indicators of threat-

harshness, 7 indicators of deprivation, and 7 of unpredictability. All indicator loadings were significant at *a*-level of .001 or below (see Table 1).

To test for latent-factor invariance, a series of Chi-square difference tests were used to evaluate measurement equivalence between the two randomly created subsamples. When testing for *configural invariance*, results of the multigroup CFA demonstrated comparable fit between the two groups, with the second subsample $\chi^2(135) = 744.83$, $p < .001$, CFI = .85, RMSEA = .059, 90% CI [.055, .063]. *Weak invariance*, when the factor loadings between the two samples were constrained to equality, similarly held, χ^2_{diff} (15) = 10.49, $p = .662$. Likewise, no significant differences emerged between the two subsamples when evaluating *strong invariance*, with factor loadings and intercepts constrained to equality, χ^2_{diff} (30) = 30.20, $p = .465$; or factor loadings, intercepts, and covariances all held equal, χ^2_{diff} (33) = 31.83, $p = .526$. Finally, evidence proved consistent with *strict invariance,* when factor loadings, intercepts, covariances, and residuals proved equal, with a χ^2_{diff} (51) = 38.64, $p = .898$. The measurement equivalence of the three-factorial model observed between two independent subsamples generated by randomly splitting the full-sample data sample supports the three-factorial structure of the integrative dimensional model, at least in this high-risk sample.

Before proceeding to testing the predictive model linking adversity dimension with developmental outcomes, we evaluated factor loadings and model fit for the latent outcome measurement model. A CFA model fitted to the whole sample demonstrated good fit, $\chi^2(24) = 92.33$, $p < .001$, CFI = .99, RMSEA = .031, 90% CI [.025, .038]. Figure 2 and Table 1 show that all indicator loadings were significant at *a*-level of .001 or below.

Testing Predictive Model

The predictive model in which latent constructs representing specified child outcomes

measured at ages 5 and 15 years were regressed on latent constructs representing distinct dimensions of adversity measured at age 3 years. The model showed acceptable fit in the total sample, $\chi^2(318) = 2096.80$, $p < .001$, CFI = .89, RMSEA = .044, 90% CI [.043, .046]. Figure 3 demonstrates that all specified predictive paths were significant at *a*-level of .001 or below, with small-to-medium effect sizes in the expected direction. Thus, greater exposure to deprivation at age 3 predicted, at age 5, more physical health problems, $b = 0.50$, $p = .000$, and lower cognitive functioning, $b = -0.45$, $p = .000$. At the same time, children who experienced more threat-harshness at age 3 exhibited more aggressive behavior by 5 years of age, $b = 0.43$, $p = .000$. Finally, as expected, children exposed to more unpredictable environmental conditions at age 3 were more likely to use substances, showed earlier engagement in sexual activity, and had more sexual partners by age 15, $b = 0.17$, $p = .000$, after accounting for aggression at age 5, which independently predicted higher likelihood of substance use and sexual risk-taking at 15, $b = 0.10$, $p = .000$. Additionally, as is also depicted in Figure 3, children's physical health problems related to lower cognitive functioning, $b = -0.15$, $p = .023$.

Discussion

Given the emergence of recent dimensional models of childhood adversity, this study sought to empirically integrate the mechanistic threat-deprivation and the evolutionary harshness-unpredictability frameworks within a parsimonious threat-deprivation-unpredictability model, drawing on longitudinal data from the well-known *FFCW Study*. We endeavored to achieve this goal in two ways: (a) by proposing and evaluating a measurement model comprised of three separate, even if related dimensions of adversity and (b) by testing the fit of a theory- and evidence-derived predictive model linking each of the three dimensions with particular developmental phenotypes they were each hypothesized to most influence. Each goal is

discussed in turn.

Three-Dimensional Measurement Model of Childhood Adversity

We hypothesized that multiple indicators of all three aforementioned adversity dimensions would fit a hypothesized measurement model with threat-harshness based on safety indicators (or lack thereof), deprivation on indicators of available resources and unpredictability on indicators of contextual instability. The task of operationalizing dimensions of adversity as latent constructs proved somewhat novel, as only one previous investigation has adopted this approach. It, too, relied on the *FFCW Study* to generate dimensions of threat and deprivation (Miller et al., 2021), while using many fewer indicators. We were unaware of this work as we conducted that reported herein.

Indicator assignment to the three latent constructs of adversity was based on both foundational models on which the present work is based. Where appropriate, both proximate indicators (e.g., unpredictability: coparenting issues) and distal (e.g., threat-harshness: neighborhood violence; exposure to environmental toxins) variables were included. Nevertheless, the decision-making process was challenging. For example, although various research groups relied on socioeconomic variables (e.g., maternal education, household income) as indices of deprivation experiences given the presumption that they reflect exposure to stimulating environments (e.g., Machlin et al., 2019; Sheridan et al., 2017, Suor et al., 2017, etc.), concerns have been raised about this practice. This is because dimensions of threat and deprivation may be difficult to disentangle in the context of poverty (Colich et al., 2019; Sumner et al., 2019). Issues also arose with regard to what indicators should be considered to reflect, where possible, the bipolarity of each continuum. For example, we chose to include maternal warmth and perceptions of neighborhood safety to reflect the positive pole of the threat-safety

continuum, whereas indicators of psychological aggression and neighborhood violence were chosen to reflect the negative pole of the same continuum.

Whatever the apparent merits of our decision making regarding what indicators went with which of the three dimensions—and we think that open-minded scholars could have honest disagreements on this score—what seems particularly important is that the hypothesized measurement model received empirical support. Recall, in fact, that this proved true even when the sample was randomly split in half. Thus, the three-dimensional model was twice confirmed. To be clear, however, this should not be read to imply that an alternative model based on a somewhat different array of indicators for each dimension would not fit the data.

It was not surprising that the dimensions themselves proved related to one another. Recall that levels of deprivation, threat-harshness and unpredictability were positively associated with each other, consistent with results of other investigators (Dong et al., 2004; Green et al., 2010; McLaughlin et al., 2020). Despite this, there would seem to be reasons to wonder whether there could be ecological niches in which the positive associations detected herein among the three latent adversity constructs might prove to be weaker—or even stronger. It could be of interest to see if this would be the case in contexts other than the USA and Western nations more generally.

Testing Adversity Predictions

The second goal of the study was to evaluate the predictive validity of the three-dimensional model by treating latent constructs reflecting each adversity dimension as specific predictors of select latent child-development outcome constructs. Recall that the specific predictor-outcome associations evaluated herein were informed by both foundational dimensional models on which this study was based. Given that exposure to deprivation presupposes limited availability of material resources and cognitive stimulation, known to affect

executive functioning (e.g., Rosen et al., 2019), it was hypothesized and confirmed that greater deprivation experienced in early childhood would forecast more limited cognitive capacity at the cusp of middle childhood. While investigation of the specific neurophysiological or other mechanisms mediating such an effect was beyond the scope of this investigation, our result is in line with the notion that the limited complexity of social and cognitive input constrains development of brain architecture (Sheridan et al., 2017). The result is also in line with life history theory, in that under conditions of material deprivation, particularly, limited nutrients, growth is traded off for maintenance and thus survival for reproduction, thereby favoring lower complexity of bodily systems (Ellis et al., 2009). The two foundational dimensional frameworks converge here in that brain development carries high energetic costs, particularly in early childhood (Kuzawa et al., 2014; Ellis et al, in press). Also empirically confirmed was the prediction that greater deprivation would prove related to poorer physical health. Once again, the trade-off between growth and maintenance and thus between current survival and future reproduction help to explain this finding (Mell, Safra, Algan, Baumard, & Chevallier, 2018; Urlacher et al., 2018).

Because a *fast* life history is presumed to be favored in—and induced by—environmental contexts high on threat-harshness, the expectation was that such exposure would predict high levels of aggression/externalizing problems, which it did. And, interestingly, this prediction is not just in line with evolutionary analysis (Ellis et al., 2009, in press). And this is because the threat-deprivation literature underscores links between violence exposure and neurophysiological adaptive response characterized by hypervigilance to threat and reduced self-control (Jenness et al., 2021; McLaughlin et al., 2014). Of course, for reasons other than those just outlined, developmental scholars have long linked family violence with heightened aggression (Dodge,

Bates & Petit, 1990).

Considering the origins and character of a *fast* life history, in which conditions of environmental uncertainty are thought to preferentially support development geared toward earlier sexual maturation and increased fertility, exposure to early life unpredictability predicted, as hypothesized, sexual risk-taking (i.e., earlier age at first intercourse, more sexual partners by age 15), as well as other risky behaviors (i.e., substance use). Importantly, these predictions held even after accounting for earlier levels of externalizing behavior, a known mediator in the developmental cascades between early life stress, self-regulation, and later life risk-taking (e.g., Dishion & Snyder, 2016; Zucker, Heitzerg, & Nigg, 2011). They are also consistent with other research inspired by evolutionary-developmental thinking because, as here, a fast life history is characterized by a limited capacity to delay gratification and the proclivity to value present rewards over future ones, among other psychological and behavioral tendencies that privilege mating over parental investment (Belsky et al., 2012; Brumbach et al., 2009; Simpson et al., 2012). But because life history thinking stipulates that this trade off proves strategic only when energetic resources are sufficient to promote growth and do not have to be husbanded in the service of survival (Ellis et al., 2009), there is reason to wonder whether the three adversity dimensions investigated in the current research would interact when it comes to predicting the phenotypes found herein to be associated with unpredictability. Addressing such possibilities was beyond the scope of the current work but certainly merits attention in future research.

Conclusion and Limitations

The work presented herein contributes to the field of developmental science by advancing and empirically testing—and finding support for—an integrative multidimensional model of adversity based on two reasonably well-established dimensional frameworks (Ellis et al., this

issue). Whatever the real strengths of the current inquiry—including the effort to integrate empirically two separately developed dimensional frameworks, reliance on multiple indicators of adversity constructs and developmental outcomes, confirmatory evaluation of a measurement model, and the formal testing of a predictive model reliant on latent constructs of predictors and outcomes—it is not without limitations. To begin with, while it is not surprising that the high-risk *FFCW* sample had a large amount of missing data, often due to family attrition, this situation created many computational difficulties. While we regard decisions made in coping with this situation reasonable, it is indisputable that others might have handled data limitations differently; and this could have resulted in somewhat different findings. In light of this, it is critical to assert that we did not analyze the data in multiple ways, after exploring alternative decisions, until we arrived at results consistent with expectations. Nonetheless, it is important to validate the three-factorial CFA model with new data in future research.

Another limitation is that the three-dimensional measurement model of adversity was based on select indicators collected at one point in time, when the children were three years of age. Only future work can determine whether a model based on similar data collected at other ages would fit as well as our data did. Next, there is the issue of cohort effects, given that adversity was measured between 2001 and 2003. As there are grounds for believing that since that time the ecological landscape has changed even within the same communities and for families like those that are the focus herein—due to the Great Recession and COVID, to cite but two obvious reasons—we cannot be sure how replicable the measurement model we tested will prove to be. Changing family policies also matter in this regard, including, for example, the McKinney-Vento Act of 2001 (No, C. L. B., 2002; Act of 2001, Pub. L. No. 107-110, § 115. *Stat*, 1425), Medicaid expansion (aka Obamacare; The Patient Protection and Affordable

Care Act of 2010, P.L. §§ 111–148), and Families First Prevention Services Act of 2018 (Bipartisan Budget Act of 2018, H.R. § 1892, 115th Congress. 2017–2018), to name a few particularly relevant to people of color and other underserved communities that were oversampled in the *FFCW Study*.

Despite these real limits, we believe that our effort has advanced the developmental-science ball down the field. While we did not seek to incorporate brain measurements in order to fully integrate the mechanistic "how" of development championed by threat-deprivation investigators (McLaughlin et al., 2014; McLaughlin & Sheridan, 2014) with the "why" of development championed by evo-devo ones (Ellis et al., 2009), we believe we have succeeded in other ways of advancing the integration of these two generative frameworks. Much more empirical integration is called for, but it is clear that there exist many opportunities to pursue this worthy scholarly goal.

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Table 1. Indices of threat, deprivation, unpredictability, and latent child development outcome factor loadings, based on total sample (N = 3253) data.

Latent Construct Indicators	**Standardized Estimate**	**Standard Error**
Threat (T3)		
Child experienced psychological abuse by parent/partner [a]	0.34**	0.01
Interparental physical violence [a]	0.50**	0.01
Neighborhood violence [a]	0.43**	0.01
Neighborhood safety [a]	-0.35**	0.01
Deprivation (T3)		
Physical/emotional neglect	0.33**	0.02
Parental depression	0.40**	0.03
Stimulating environment in the home	-0.37**	0.02
Parent/partner has access to instrumental support	-0.59**	0.02
Housing insufficiency-no utilities	0.44**	0.03
Food insecurity/hunger	0.54**	0.03
Financial uncertainty	0.32**	0.03
Unpredictability (T3)		
Residential instability	0.30**	0.02
Parent/partner's change in relational/live-in status	0.69**	0.02
Instability in father's payment of child support	0.77**	0.02
Reliable transportation	-0.56**	0.02
Coparenting issues – lack of agreement on parenting	0.65**	0.02
Stability of child's living arrangements (who child lives with)	-0.88**	0.02
Household composition	0.50**	0.02
Covariances		
Threat ◄► Unpredictability	0.57**	0.03
Threat ◄► Deprivation	0.74**	0.03
Deprivation ◄► Unpredictability	0.48**	0.02
Child physical health problems (T4)		
Child's general health status [c]	0.55**	0.01
Child's asthma diagnosis [c]	0.53**	0.01
Child's cognitive ability (T4)		
Child's PPVT score [d]	0.69**	0.02
Child's WWJS score [d]	0.68**	0.02
Child's aggression (T4)		
Child's aggressive behavior [e]	0.80**	0.02
Child's destructive behavior [e]	0.78**	0.02

Youth's risk-taking behaviors (T6)		
Youth's substance use	0.42**	0.02
Youth's age at first sexual intercourse	-0.98**	0.05
Number of sexual partners reported by youth	0.99**	0.02
Covariances		
Physical health problems ↔ Cognitive ability	-0.26**	0.05
Physical health problems ↔ Aggressive behavior	0.18**	0.03
Physical health problems ↔ Risk-taking behavior	0.08*	0.03
Cognitive ability ↔ Aggressive behavior	-0.18**	0.03
Cognitive ability ↔ Risk-taking behavior	-0.12**	0.03
Aggressive behavior ↔ Risk-taking behavior	0.13**	0.03

Note. All factor loadings were significant at α = 0.001 level. $^{*}p < .05$; $^{**}p < .01$; superscripts indicate equality constraints. Abbreviations: T3 = Time 3 (target child's age - 3); T4 = Time 4 (target child's age - 9); T6 = Time 6 (target child's age - 15). PPVT = Child's Peabody Picture Vocabulary Test; WJSS = Child's Woodcock Johnson Passage Comprehension and Applied Problems.

Figure 1. Robust fit indices for the integrative 3-factorial measurement model fit to *sample 1* (*n* = 1971): $\chi^2(135) = 663.00$, $p = .000$, CFI = 0.87, RMSEA = .054 [.050; .058]; and *sample 2* (*n* = 1582): $\chi^2(135) = 744.83$, $p = .000$, CFI = 0.85, RMSEA = .059 [.055; .063]. Coefficients are reported in standardized form; $^{**}p < .001$. Abbreviations: T3 = Time 3 (target child's age 3); X1 … X3… X5 = placeholder for 5 indicators of threat; Y1…Y6…Y9 = placeholder for 9 indicators of unpredictability; Z1…Z3…Z6 = placeholder for 6 indicators of deprivation; *bb* = a range of standardized loading coefficients for indicators of each of the three latent factors.

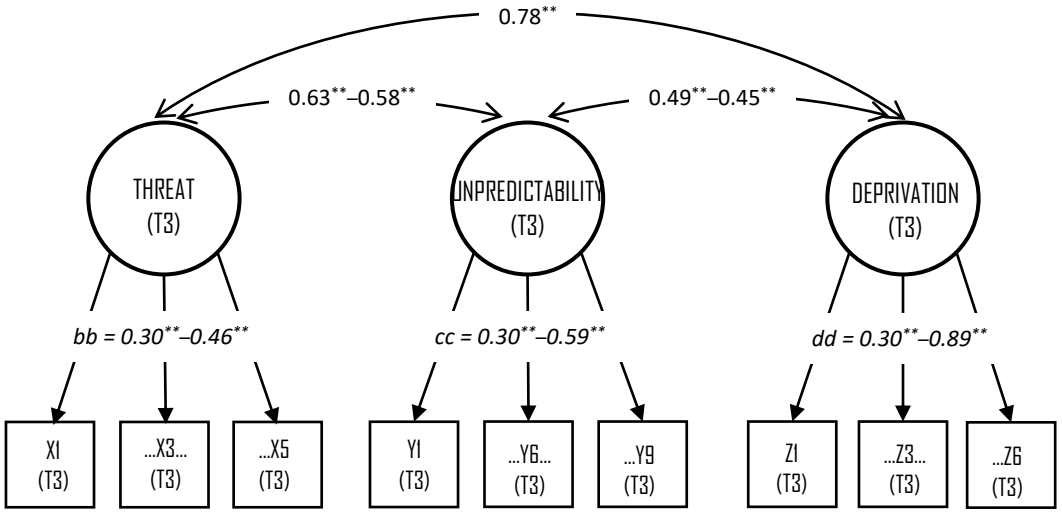


Figure 2. Robust fit indices for the multifactorial latent outcome measurement model, fitted to the whole sample (N = 3253): $\chi^2(24) = 92.33$, $p = .000$, CFI = 0.99, RMSEA = .031 [.025; .038]. Indicators of each latent factor at T4 are held equal. Coefficients are reported in standardized form; $^{*}p < .05$, $^{**}p < .001$. Abbreviations: T3 = Time 3 (target child's age 3), T4 = Time 4 (target child's age 9), T6 = Time 6 (target child's age 15); PPVT = Child's Peabody Picture Vocabulary Test; WJSS = Child's Woodcock Johnson Passage Comprehension and Applied Problems.

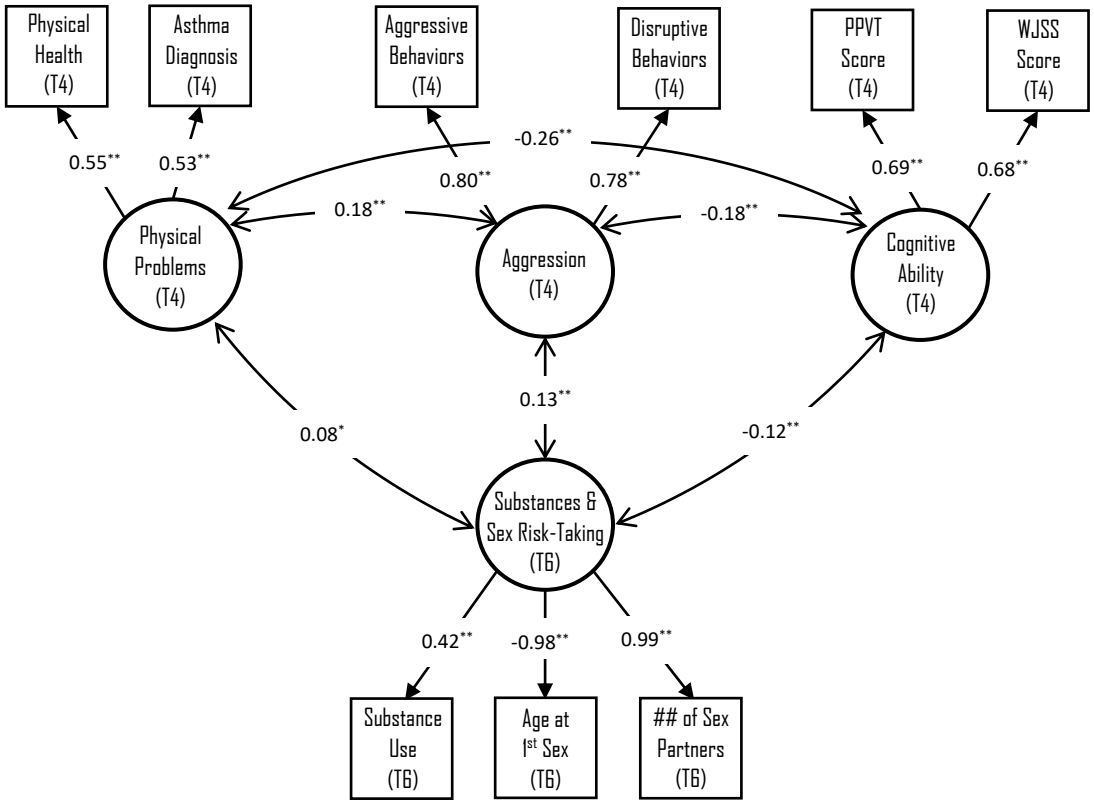
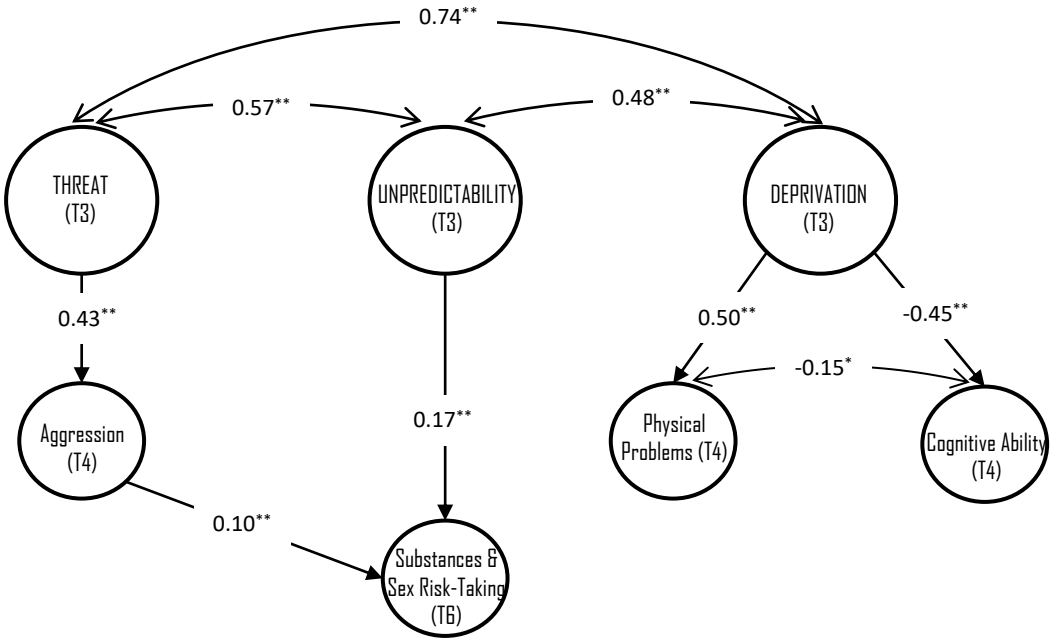


Figure 3. Robust indices for the 3-factorial predictive model fit to the whole sample (N = 3253): $\chi^2(318) = 2096.80$, $p = .000$, CFI = 0.89, RMSEA = .044 [.043; .046]. Non-significant covariances are not shown. Coefficients are reported in standardized form; $^{*}p < .05$; $^{**}p < .001$. Abbreviations: T3 = Time 3 (target child's age 3), T4 = Time 4 (target child's age 9), T6 = Time 6 (target child's age 15).



Study II

Testing the Ecological Fit and Predictive Performance of Dimensional vs. Cumulative Risk Models of Precarious Housing

Abstract

Housing instability presents a serious public health issue as a correlate of poverty and homelessness, yet the cumulative risk lens largely shaping existing research and policy does not sufficiently address high heterogeneity in child and family outcomes. Consequently, this study explores the utility of an alternative theoretical framework of dimensional adversity. To compare performance of the cumulative-risk and the dimensional adversity approaches, 12 precarious housing indicators were used to specify two predictive models, fit to a sample of Fragile Families and Child Wellbeing Study families living in multigenerational or doubled-up households (N = 2422). Confirmatory Factor Analysis revealed a considerable improvement in fit indices from the single cumulative risk factor to the three interrelated factors of threat, deprivation, and unpredictability. The two models were comparable in the magnitudes and directionality of the robust associations between adversity, measured at age three, and child cognitive ability and aggressive behavior, measured at age five, as well as risk-taking behavior at age 15. At the same time, the multidimensional model showed promise in terms of predictive specificity, evidenced by the emerged links between deprivation and cognitive deficits, threat and aggressive behavior, and unpredictability and risk-taking, pointing to dimension-specific developmental pathways. Results indicate that the multidimensional approach to adversity may be a viable alternative to the well-established cumulative risk model, particularly in complex contexts of adversity such as poverty and family homelessness.

Testing the Ecological Fit and Predictive Performance of Dimensional vs. Cumulative Risk Models of Precarious Housing

Increasing housing instability presents a significant concern as the main precursor to family homelessness (Cunninghman, Harwood, & Hall, 2010; Pavlakis, 2018). And yet, the 10-year *Plan to End Family Homelessness by 2020*, put forth by the *Federal Interagency Council on Homelessness* in 2009, have not been achieved (Bassuk, Hart, & Donovan, 2020). In fact, family homelessness represents the fastest growing segment of displaced populations, shifting from situational, short-lived episodes of sheltered stays toward prolonged and even chronic unsheltered exposures (Rahman, Turner, & Elbedour, 2015; Zlotnick, 2009). According to *the National Center on Family Homelessness*, 2.5 million (or one in 30) U.S. children are homeless on any given year, and these numbers are likely underestimated due to differences in definitions and polling methods adopted by various agencies (Bassuk et al., 2020). Nearly a half of homeless men and over two-thirds of homeless women report to be parents of underage children, but only 7% reside with their fathers and 20–65% with their mothers (Zlotnick, 2009). Homeless parents without children are treated as single adults, neglecting their trauma of separation and child loss, and disqualifying them from scarce family-oriented services critical to reunification (Paquette & Bassuk, 2009; Shinn, Rog, & Culhane, 2005).

Social disparities disproportionately affect ethnic minorities, as 40–90% of families of color experience infringement of fundamental human rights, such as parenthood, or ability to meet basic needs (Cutuli, Wiik, Herbers, Gunnar, & Masten, 2010; David, Gelberg, & Suchman, 2012; Herbers & Cutuli, 2014; Narayan, 2017; Shinn et al., 2005). Ethnic minorities endorse more negative lifetime events, such as community violence and family separations, including a greater likelihood of having their children removed into protective custody and lower reunification rates

(Wamser-Nanney, Cherry, Campbell, & Trombetta, 2018; Womack, Taraban, Shaw, Wilson, & Dishion, 2019; Zlotnick, 2009). Due to systemic inequalities, families of color are overrepresented among the households affected by poverty, residential mobility, and homelessness, bearing the brunt of the volatile residential market (Anderson, Leventhal, Newman, & Dupéré, 2014; Cowan, 2014). The scope of the problem is aggravated by the well-established negative effects of precarious housing on child and family functioning. Despite high heterogeneity in outcomes, lack of residential security is generally associated with cognitive, regulatory, and social deficits amounting to higher rates of psychopathology, developmental delays, and learning disabilities (Bassuk, Richard, & Tsertsvadze, 2015; Cutuli et al., 2010; Gewirtz, Hart-Shegos, & Medhanie, 2008; Herbers & Cutuli, 2014; Labella, Narayan, & Masten, 2016; McGuire-Schwartz, Small, Parker, Kim, & McKay, 2015; Murphy, 2011; Narayan, Herbers, Plowman, Gewirtz, & Masten, 2012; Park, Fertig, & Allison, 2011).

This brief overview underscores the need for a strategic bilateral social response comprised of the prevention arm, tasked with identification, need prioritization, and service engagement of high-risk families, and the intervention arm, delivering services aimed at support and residential stabilization of families and minimization of negative developmental consequences of residential instability in children (see Rog, Holupka, & Patton, 2007).

Barriers to addressing housing instability and homelessness

The social efforts to assist precariously housed and homeless families are impeded by lack of agreement on the fundamentals of the very concept of homelessness in relation to poverty and precarious residential contexts. First issue concerns determination of whether homelessness should be treated as a distinct type of adversity or the apex of the poverty continuum. Second, it requires conceptual consolidation of various contexts of precarious housing as a progression of residential

instability culminating in homelessness or as its precursors and outcomes, best illustrated by *the Ecological Model of Homelessness* (Nooe & Patterson, 2010). The extent of overlap in experiences of economic poverty and precarious housing and the dual role of the housing risk gradient preceding and following homeless episodes exemplify key issues in conceptualizing homelessness and disentangling it from high-risk contexts of poverty (Rog et al., 2007).

Conceptual challenges in defining and typologizing housing instability and homelessness impede efforts to identify households most in need of residential stabilization. This task is further compounded by practical difficulties in serving hard-to-reach populations. For instance, doubled up (i.e., sharing one residence) families may fail to self-identify as homeless due to temporary nature of their living arrangements and lack of awareness about residential and supportive services that may be available to them (Bassuk et al., 2020; Fantuzzo, LeBoeuf, Chen, Rouse, & Culhane, 2012; Pavlakis, 2018). Families residing in shelters may decline services to avoid public scrutiny or to prevent separation from children or other family members (David et al., 2012; Pavlakis, 2018; Shinn et al., 2005; Shinn, 2010). Unsheltered families are particularly disenfranchised, as many share a history of stigmatization and negative interactions with service providers leading them to distrust authorities (Pavlakis, 2018). Moreover, households lacking access to stable housing are largely represented by families of color, who are hesitant to seek help despite greater symptom severity, citing systemic inequalities and lack of cultural sensitivity in social welfare and healthcare practices (Bassuk, DeCandia, Tsertsvadze, & Richard, 2014; Cutuli et al., 2010; Park et al., 2011).

In this light, the current study seeks to address some of the challenges associated with defining, typologizing, and serving families at risk of residential instability by exploring the utility of a novel dimensional approach. To tackle this task, we will compare ecological fit and predictive

performance of two models, conceptually juxtaposing the established cumulative risk perspective with a newly emergent three-dimensional framework, which decomposes environmental cues of adversity into dimensions of threat, deprivation, and unpredictability (Ellis, Sheridan, Belsky, & McLaughlin, 2022). We start by highlighting the role of cumulative risk perspective in shaping operational concepts of housing instability and homelessness and its relation to present-day risk assessment and decision-making tools used for service-matching and prioritization. Next, we discuss conceptual and practical limitations rendered by this approach, segueing to dimensional understanding of adversity and its applicability to contexts of residential instability. We close with the summary of common cognitive and behavioral outcomes associated with precarious housing, attending to theoretical inferences of causality predicated on dimensional view of adversity.

The Legacy of Cumulative Risk Approach to Housing Instability and Homelessness

The cumulative risk perspective is widely used in poverty research and clinical practice. Sometimes referred to as *the deficit model*, it views functional deficits and developmental psychopathology as a byproduct of the cumulative burden of stress associated with a lifetime exposure to adverse events (Evans & Whipple, 2013; Repetti, Robles, & Reynolds, 2011). Consequently, adversity is decomposed into discrete (present/absent) risk factors, thought to exert additive effects on development, as demonstrated by well-established cumulative risk models such as *Adverse Childhood Experiences* (Danese & McEwen, 2012; Felitti et al., 1998).

Conceptual understanding of homelessness was initially shaped by its narrow definition of shelter stays and unsheltered contexts, which aligned with the notion of poverty-related negative life events. As cumulative risk paradigm assumes equal weight distribution among risk factors (Ettekal, Eiden, Nickerson, & Schuetze, 2019), these studies generally found that poverty stressors, such as adverse events, parental distress, mental illness, and other indicators of chronic risk were

the strongest predictors of negative child outcomes (Howard, Cartwright, & Barajas, 2009; Masten et al., 2014; Masten, Fiat, Labella, & Strack, 2015). Researchers concluded that the risk of psychopathology did not differ for homeless and poor housed children with similar histories of poverty-related adversity, supporting the view of homelessness as one of many negative life events associated with poverty (Grant, Gracy, Goldsmith, Shapiro, & Redlener, 2013; Howard et al., 2009).

This position affirmed shared experiences of economic hardship central to poverty and homelessness but overlooked the gradient in severity evidenced by lower income and income diversity (Lee et al. 2010; Masten et al., 2015; Shinn et al., 2005) and greater food insecurity and hunger reported by homeless families (Grant et al., 2013; Greder, Peng, Doudna, & Sarver, 2017; Narayan, 2015). It also failed to account for stressors specific to shelter contexts, such as loss of friendships, changes in parent-child relationships, and altered threat perception (Cowan, 2014; Herbers et al., 2011). Follow-up studies designed to address these concerns confirmed negative impact of homelessness above and beyond the effects of poverty, in support of the dual concept of homelessness as a unique stressor and the extreme point of poverty (Cowan, 2014; Herbers et al., 2011). However, no consensus was reached on the endurance of cognitive and behavioral impairments following exit from homelessness, bringing the question of heterogeneity in individual differences, subjective experiences, and objective circumstances around housing instability and homelessness to the forefront of research agenda (Rog et al., 2007).

Typologies of homelessness developed to investigate heterogeneity associated with housing instability may be theoretically or methodologically differentiated into three approaches that fall under the umbrella of cumulative risk. The first group, represented by ***risks/outcomes-oriented typologies,*** sought to explore factors relevant to poverty and shelter stays and identify

meaningful clusters differentiated by odds of entering or exiting homeless shelters (Bonin, Fournier, & Blais, 2009; Knopf, 2013). Studies exemplifying this approach relied on clustering of sociodemographic risks (i.e., economic hardship, trauma history, physical or relational health); outcomes (i.e., precarious housing, substance use); or a mix of both (i.e., family composition, parenting stress, child conduct problems, negative life events). The resulting categories of *getting-by*, *at-risk*, and *resilient* were proposed as a measure of risk assessment (Danesco & Holden, 1998). Although cluster-based typologies offered limited clinical functionality, the focus on precursors of shelter stays parlayed into investigation of timing related to shelter utilization.

The second approach mapped out patterns of frequency and duration of shelter stays, producing ***temporal-oriented typologies*** based on three isolated clusters denoting *transitional*, *episodic*, and *chronic* types of homelessness (Kuhn & Culhane, 1998), which were later replicated (Brown, Cummings, Lyons, Carrión, & Watson, 2018; Rabinovitch, Pauly, & Zhao, 2016) and expanded (McAllister, Kuan, & Lennon, 2010; McAllister, Lennon, & Kuang, 2011). This typology informed definition of *homelessness* adopted by the *U.S. Department of Housing & Urban Development* as spending a night in *unsheltered* (i.e., streets, cars, uninhabitable structures) or *sheltered* (i.e., homeless shelter) contexts (U.S. HUD, 2019). Applicability of this typology to homeless families has been questioned due to limited empirical support (Culhane, Metraux, Park, Schretzman, & Valente, 2007) and ecological validity, given similarities in psychosocial profiles, needs, and barriers of homeless and poor housed families in contrast to single homeless men (Bassuk, 2007; Shinn et al., 2005). This criticism contributed to the updated definition of homelessness which expanded criteria to residential contexts relevant to children, youth, and families (U.S. HUD, 2019), reflecting conceptual pivot toward the broader spectrum of precarious housing.

The third approach considered patterns of residential instability as a characteristic rather than a risk or an outcome of homelessness. Therefore, ***spatial-oriented classifications*** aimed to typologize residential contexts to reflect a gradual progression in severity of housing instability, proportionate to the exhaustion of family resources to the point of homelessness. Increasing residential harshness may be exemplified as downward mobility from *doubled-up* or *housing-first* accommodations to *motels* and *shelters*, and finally, sleeping in the streets, cars, and other types of *unsheltered homelessness* (Pavlakis, 2018). Reflecting the view of homelessness as a type of precarious housing, the *U.S. Department of Education (DOE)* began to identify students living in temporary or insufficient housing as *homeless and highly mobile,* following the 2001 reauthorization of the *McKinney-Vento Education for Homeless Children and Youth Program* (Aratani, 2009; Miller, 2011; Wilson & Squires, 2014).

Limitations of the cumulative risk approach relate to a) the deficit-based interpretation of stress-related changes in functioning as suboptimal or non-normative, rather than adaptive; b) the view of adversity as a sum of discrete (i.e., single events); which are c) equally weighted; and d) categorically coded (i.e., based on yes/no indicators). These assumptions of cumulative risk place constraints on the ecological validity of present-day typologies, since categorical dissection of complex residential contexts cannot account for individual differences, subjective experiences, or historical and socio-cultural context, summarized next (Rog et al., 2007).

First, there is an issue of *historic precedence,* which explains but does not necessarily justify irregularities in distinguishing between homeless and displaced populations. Involuntary (i.e., incarceration, out of home placement, inpatient treatment) or partially voluntary (i.e., dormitory, army barracks) displacement came to denote social, rather than residential contexts like homelessness (Aratani, 2009; Grant et al., 2013; Narayan, 2015; Narayan, Sapienza, Monn,

Lingras, & Masten, 2015, Narayan, 2017; O'Sullivan, 2019; Zlotnick, 2009). In contrast, voluntary displacement may be equated to homelessness by default (i.e., domestic shelter; refugee camp, halfway/transitional housing, doubled-up) or under very limited circumstances (i.e., street-dwelling, homeless shelter), regardless of similarities in sociodemographic histories and psychosocial profiles of these populations (Grant et al., 2013; Rabiah-Mohammed, Oudshoorn, & Forchuk, 2019).

Second, progression of residential instability linked to mobility, exhaustion of social resources, and family breakup may explain a shift in social structure toward complex, *non-traditional familial systems* and *extended social networks*, largely comprised of unrelated, geographically separated members (Anderson et al., 2014; Casey, Shlafer, & Masten, 2015; Marcal, 2016; Paquette & Bassuk, 2009; Wildeman, 2014; Womack et al., 2019). At the same time, growing economic volatility broadened the spectrum of risk associated with residential uncertainty, from young single mothers of color with limited education and multiple children to older households with fewer children and two parents, employed or in college (Miller, 2011; Shinn et al., 2005; Zlotnick, 2009).

Third, residential market trends and sharing economy shape the *evolving landscape of homelessness*, marked by longer, more frequent, under increasingly unsheltered episodes, particularly in *urban regions* with high cost of living (Lee, 2016). Despite greater access to residential programs (i.e., shelters, transitional housing), the overcrowding indices continue to grow, as more families live doubled-up or turn to alternative housing solutions, like motorhomes and boats (Bloom, 2018; Long, 2018; Matier, 2019). Economic insecurity remains a primary reason for temporary living arrangements, although a growing segment of highly mobile families reports non-economic motivation, such as employment proximity, geographic preference, and

concerns about consumerism and ecological "footprint" (Bloom, 2018; Hansen, 2017). In *rural geographies,* lacking residential services, families rely on support of local close-knit communities, evidenced by a greater share of multigenerational households living in substandard conditions (Pavlakis, 2018; Wilson, Hurtt, Shaw, Dishion, & Gardner, 2009).

Practical challenges in research and policymaking informed by the cumulative risk perspective are well-documented, ranging from unreliable prevalence estimates due to inconsistent and narrowly defined parameters of homelessness, to a persistent issue of high intra-class heterogeneity, which renders present-day typologies ineffective in long-term predictions of child and family outcomes (Bassuk et al., 2020; Rog et al., 2007). Predictive specificity is essential for development of risk assessment protocols tasked with matching families to preventive services and targeted therapeutic intervention programs.

Current decision-making tools assign risk probabilities by comparing a global sum score of risks endorsed by individual families against predetermined cutoffs, representing hierarchical risk profiles. To compensate for limited sensitivity associated with the cumulative risk approach, present-day risk assessment tools rely on extensive questionnaires, such as *the Family Service Prioritization Decision Assistance Tool (F–SPDAT).* These measures require considerable time commitment and risk secondary traumatization due to the breadth and depth of questions targeting severity of precarious housing and homelessness, cumulative risk exposure, and projected and documented deficits in child and family functioning. However, the burden on providers and participants is difficult to justify, given limited empirical evidence of ecological validity, test-retest reliability, and safeguards against bias in risk assessment measures used to match families to services and determine eligibility for residential and supportive programs (Aubry, Nelson, & Tsemberis, 2015; Brown et al., 2018; Farrell, Dibble, Randall, & Britner, 2017).

In sum, development of a functional typology of residential contexts requires exploration of alternative theoretical models, capable of transcending categorical constraints of cumulative risk. In this light, an emergent view of adversity as a dimensional construct rather than a sum of categorically defined stressors presents a viable option.

Dimensional Approach to Residential Instability and Family Homelessness

The idea of dimensionality capitalizes on the premise that complex contexts of adversity may be decomposed into patterns of qualitatively similar experiences rather than a collection of individual risk exposures. The first attempt to conceptualize homelessness as a multidimensional construct predated emergence of formal models of dimensional adversity.

Multidimensional typology of homelessness known as ETHOS, defined *home* as the intersection of *legal domain* (i.e., possession of legal title or exclusive housing rights), *physical domain* (i.e., access to a dwelling), and *social domain* (access to privacy and personal space for social relations; see Edgar & Meert, 2005). Exclusion from all three domains represents literal *homelessness*, whereas exclusion from any two domains refers to *housing exclusion.* The intersecting domains determine the type of housing exclusion: 1) legally secure but inadequate housing; 2) legally insecure and inadequate housing; 3) legally secure but inadequate housing with social isolation; 4) legally insecure but adequate housing, and 5) legally secure and adequate housing with social isolation (Amore, Baker, & Howden-Chapman, 2011; Edgar & Meert, 2005). Given the wide scope and impracticality of data collection, the ETHOS classification did not receive empirical validation, limiting functionality. Nonetheless, it represents a significant shift from categorically derived typologies based on cumulative risk toward patterns of risk exposures.

From this vantage point, economic hardship manifested as lack of personal space, shut off utility services, visible housing decay and other insufficiencies endemic to insecure or unsheltered

housing contexts may be consolidated under a dimension of *resource scarcity* (Miller, 2011; Wilson et al., 2009). Equally pervasive to precarious housing are patterns of *instability*, which may take form of household chaos, family structure fluidity, and other types of *household instability* (Marcal, 2016; Shinn et al., 2005), as well as *residential* and *school mobility* (Anderson et al., 2014; Cowan, 2014; Womack et al., 2009). Finally, homeless and highly mobile populations share high lifetime *exposure to violence* (Cutuli et al., 2010; Haskett, Armstrong, & Tisdale, 2016; McGuire-Schwartz et al., 2015). These commonalities, repeatedly highlighted in studies on family homelessness, line up with the broader theoretical framework of dimensional adversity.

Multidimensional Models of Adversity

Generally, *dimensional models of adversity* view environmental contexts as intersecting continuums of risk, where individual risk exposures share underlying characteristics that exert predictable effects on development (Ellis, Figueredo, Brumbach, & Schlomer, 2009; McLaughlin & Sheridan, 2016; McLaughlin, Sheridan, & Lambert, 2014; Sheridan & McLaughlin, 2014). This approach is best represented by models of threat-deprivation and harshness-unpredictability, which have been recently integrated into an evolutionary-developmental three-dimensional framework of *threat-harshness* (further referenced as *threat*), *deprivation-harshness* (referenced as *deprivation*), and *unpredictability* (Ellis et al., 2022). In contrast to the deficit-oriented cumulative risk approach, focused on deviations from "optimal" or "normative" functioning (Daskalakis, Bagot, Parker, Vinkers, & de Kloet, 2013), the concept of dimensionality spans from negative to positive poles of experiential continuum shaping development (Ellis et al., 2022). Developmental adaptation is guided by environmental cues, tied to ancestral experiences of threat, deprivation, and unpredictability, differing in ecological proximity (i.e., individual, relational, or contextual) and intensity (Ellis et al., 2022).

Threat-Harshness (i.e., Threat) may be understood as environmental conditions that communicate real or perceived threat of harm, such as history of physical injury, maltreatment, family and community violence and perceived neighborhood safety (McLaughlin et al., 2014; Miller et al., 2018), as well as broader indicators of morbidity and mortality, such as regional crime indicators, and environmental hazards (Brumbach, Figueredo, & Ellis, 2009; Ellis et al., 2009; Ellis et al., 2022). Health risks associated with living in resource-poor settings include exposure to lead, mold, structural hazards, exposed wiring, and other indicators of inadequate or decrepit housing (Aratani, 2009; David et al., 2012; Grant et al., 2013; Volk, 2014). Children may find residential instability particularly threatening, as novel environments command a heightened attention to ambiguous or conflictual situations. About 15% of children entering homeless shelters report witnessing arguments, and 20–30% feel threatened, worry about robbery, and overall safety (Haskett et al., 2016; Mohammad, Shapiro, Wainwright, & Carter, 2014; Narayan, 2015).

Deprivation-Harshness (i.e., Deprivation) broadly denotes lack or insufficiency of required environmental inputs or resources needed to meet basic (in evolutionary terms) physiological and socio-cognitive needs (Ellis et al., 2022). Consequently, dimensional indicators may reflect conditions of material (i.e., unemployment, hunger) deprivation (Ellis & Del Giudice, 2019; Ellis et al., 2009) and socio-cognitive (lack of cognitive stimulation, nurturance) deprivation (McLaughlin et al., 2014; McLaughlin, Sheridan, & Nelson, 2017). Homeless and highly mobile families experience physical deprivation related to food and shelter to a greater degree than their poor housed counterparts. Precariously housed families are more likely to live doubled up, in shelters, or transitional housing, have significantly lower income, experience extreme hunger, and report lower quality of home environment. In contrast, poor housed families report milder

forms of food insecurity, comparatively higher and more diversified income, and more stable housing, marked by structural decay, overcrowding, unreliable utility services, and other insufficiencies (Cunninghman et al., 2010; Grant et al., 2013; Greder et al., 2017; Kasting & Artz, 2005; Lee et al. 2010; Masten et al., 2015; Narayan, 2015; Park, Ostler, & Fertig, 2015; Shinn et al., 2005).

Unpredictability relates to disruption, fragmentation, or aberration of patterns of environmental cues that indicate change in ecological context (Belsky, Schlomer, & Ellis, 2012; Ellis et al., 2009; Ellis et al., 2022). Historically, unpredictability has been indexed by changes in household composition, income and employment volatility, inconsistent caregiving and household chaos, and residential instability and mobility (Belsky et al., 2012; Brumbach et al., 2009; Ellis et al., 2022; Hartman, Sung, Simpson, Schlomer, & Belsky, 2018; Kuhlman, Chiang, Horn, & Bower, 2018; Li & Belsky, 2022; Sturge-Apple, Davies, Cicchetti, Hentges, & Coe, 2017). Sharing a living space is often fraught with conflict, relational turmoil, and household chaos, accounting for the doubled-up status of 80% of families the night prior to entering a shelter (Cunninghman et al., 2010; Miller, 2011; Pavlakis, 2018). Although for some families, shelters may provide structure and access to resources, they are generally considered to represent the high end of the environmental volatility due to short family stays, lack of personal space, and limited access to resources (Miller, 2011; Pavlakis, 2018).

As the prevalence of housing instability declines from 65-76% for doubled-up contexts, to 14-20% emergency shelters, 7% motels, and 3% unsheltered contexts, environmental volatility marked by residential and school mobility show proportional increases (Cunninghman et al., 2010; Masten et al., 2015; Pavlakis, 2018; Womack et al.,

2019; Zio-Guest & McKenna, 2009). Poor households, particularly families of color, move twice as much as non-poor, and predominantly for negative reasons, such as loss of employment or family breakup (Anderson et al., 2014; Womack et al., 2019). Homeless children living in shelters average three moves a year, missing 5–15 days of school each time (Cunningham et al., 2010; Murphy, 2011). Irregular school attendance affects 45% of sheltered children, whereas 12% stop attending altogether, even if a move to a shelter is not accompanied by changing schools (Cowan, 2014; Miller, 2011; Perlman & Fantuzzo, 2010). However, residential mobility typically correlates with school changes, nationwide experienced at least once by 41% of elementary-age students and 2–3 times by over 30% of students, with 5–9% citing homelessness as the main reason (Cunningham et al., 2010; Fantuzzo et al., 2012).

The Role of Dimensional Adversity in Child Development

In contrast to the cumulative risk approach, which views adversity-related disruptions in functioning as deficits, dimensional understanding of adversity considers undesirable developmental outcomes in terms of adaptive trade-offs that serve to maximize evolutionary benefits in a given ecological context (Del Giudice, 2020; Ellis et al., 2009). Empirical evidence of neurobiological and physiological mechanisms linking exposure to adversity to developmental outcomes and appreciation of their adaptive value across the lifespan, corroborated in the evolutionary-developmental literature, led to an integration of adversity dimensions under the *threat, deprivation, unpredictability model* (Ellis et al., 2022; Usacheva, Choe, Liu, Timmer, & Belsky, 2022).

Life history theory consolidates known adaptive responses to dimensional cues of adversity into two developmental strategies that evolved to promote survival and reproduction

(Del Giudice, Gangestad, & Kaplan, 2016). *Slow life histories* are organized around a longer lifespan, presumed in safe, resource-abundant, and stable environments. Slower growth and sexual maturation accommodate fulfilment of developmental potential in areas of cognitive complexity, self-regulation, and health maintenance, linked to greater intelligence, delayed gratification, and social skills. These internal resources support more stable romantic partnerships, fewer children, and greater parental investment, contributing to the competitive edge of offspring (Ellis et al., 2009; Del Giudice, 2020; Del Giudice et al., 2016).

In contrast, *fast life histories* offer an adaptive advantage in more dangerous, resource-poor, and volatile contexts, conducive to phenotypical expressions of aggression, hypervigilance, and reactivity. A shorter lifespan is offset with faster growth and sexual maturation at the expense of health, cognitive, and regulatory abilities, whereas a greater reproductive effort in childbearing is balanced with lower parental investment (Belsky, Steinberg, & Draper, 1991; Belsky & Pluess, 2013; Ellis & Del Giudice, 2019). However, nutritional scarcity may slow the rate of development, consistent with slow life histories (Ellis et al., 2009; Ellis et al., 2022).

In sum, *dimensional models* carry the assumption of specific, targeted developmental outcomes of complex adversity, which extend beyond broad, multisystemic effects implied by the *cumulative risk* approach (Kuhlman et al., 2018; McLaughlin et al., 2014; McLaughlin, Sheridan, Humphreys, Belsky, & Ellis, 2020).

The Effects of Precarious Housing on Child Developmental Outcomes

Severity of housing instability has been positively associated with prevalence of psychopathology, developmental delays, learning disabilities, and difficulties with self-regulation and social skills (Bassuk et al., 2015; Cutuli et al., 2010; Gewirtz et al., 2008; Herbers & Cutuli, 2014; Labella et al., 2016; Murphy, 2011; Narayan et al., 2012; Park et al., 2011).

Cognitive deficits are 2–4 times higher in children living in precarious housing contexts than the national norm, manifesting as early as 18 months of age and amounting to a three times greater likelihood of developmental delays (14%) and learning disabilities (54%) by the time a child turns three (Cutuli et al., 2010; David et al., 2012; Gewirtz et al., 2008; Haskett et al., 2016; Murphy, 2011; Park et al., 2011; Volk, 2014). It may be attributed to nutritional deficits (Ellis et al., 2022), as well as lack of stimulating environment, restricted play, limited peer interactions, and fewer academic supports available to children living in emergency shelters, doubled-up, and other contexts of housing insecurity (Anderson et al., 2014; Cowan, 2014; David et al., 2012; Haskett et al., 2016; Masten et al., 2015; Miller, Kahle, Lopez, & Hastings, 2015; Pavlakis, 2018; Volk, 2014). Socio-cognitive deprivation has been linked to thinning in the areas of the prefrontal cortex responsible for problem-solving, memory, language acquisition, communication, and early critical thinking skills (Lambert, King, Monahan, & McLaughlin, 2017; McLaughlin et al., 2014; Sheridan & McLaughlin, 2014; Sumner, Colich, Uddin, Armstrong, & McLaughlin, 2019). Although shelter mothers interacting with their children showed more warmth than negativity and ranked higher on cognitive stimulation than their low-income housed peers (Howard et al., 2009; Labella et al., 2016, Narayan, Sapienza, Monn, Lingras, & Masten, 2015), only a third reported being aware of their child's emotional and academic needs (Anderson et al., 2014; Miller, 2011), suggesting that parenting stress may undermine compensatory scaffolding behavior in contexts of housing instability.

Aggressive behavior exhibited by 15–40% of homeless and highly mobile children represents five times the national average and a two-fold increase compared to low-income housed children, with externalizing symptoms persisting despite higher use of services associated with entering shelters or transitional housing (Bassuk et al., 2015; Gewirtz et al., 2008; Gilroy,

McFarlane, Maddoux, & Sullivan, 2016; Herbers & Cutuli, 2014; Labella et al., 2016; Lee et al., 2010; Marcal, 2016; Masten et al., 2015; McFarlane, Symes, Binder, Maddoux, & Paulson, 2014; Mohammad et al., 2014; Murphy, 2011; Narayan et al., 2012; Narayan, 2015; Park, 2012). From the evolutionary-developmental perspective, aggressive phenotypical profiles associated with fast life histories carry adaptive advantages in high-risk contexts (Belsky et al., 1991, 2012; Ellis et al., 2009; Ellis et al., 2022).

Indeed, over 90% of children in shelters share a history of violence across multiple contexts. For instance, physical abuse is documented for 7% of highly mobile children and even higher estimated rates, increasing from 11% in transitional housing to 20% for doubled-up and 15-30% shelter children (Perlman & Fantuzzo, 2010; Mohammad et al., 2014; Gewirtz et al., 2008; Park et al., 2015). Moreover, despite lower risk of physical abuse associated with more stable housing contexts, parental psychological aggression, affecting 30% of children, continues to increase (Perlman & Fantuzzo, 2010; Park et al., 2015). Additionally, over 80% of children cite domestic violence as the primary reason for displacement; 30-50% report school or neighborhood violence; and 25% witness assault with a gun or a knife or have a documented serious injury in the past year (Coker et al., 2009; Cowan, 2014; Haskett et al., 2016; Perlman & Fantuzzo, 2010; Mohammad et al., 2014).

Exposure to threat triggers changes in the prefrontal cortex involved in appraisal of environmental cues and fear learning, simultaneously increasing sensitivity of stress response systems, tied to hypervigilance, reactivity, and impulsivity (Briggs-Gowan et al., 2015; Lambert et al., 2017; McLaughlin et al., 2014; Miller et al., 2018). Socio-cognitive deficits in emotion-regulation and coping strategies, coupled with aggression-related socialization compound the effects of altered neuro-physiological architecture (Lambert et al., 2017; Mededovic & Bulut,

2019; Sturge-Apple, Suor, Davies, Cicchetti, Skibo, & Rogosch, 2016; Squires & Lathrop, 2019; Waller et al., 2019). Cumulatively, these adaptive changes first manifest as tantrums and acting out in response to parental harshness and with age translate to overtly aggressive behavior (Labella et al., 2016; McGuire-Schwartz et al., 2015; Marra, McCarthy, Lin, Ford, Rodis, & Frisman, 2009; McFarlane et al., 2014; Mohammad et al., 2014).

Risk-taking behavior indexed by illicit substance use and sexual risk-taking, i.e., earlier onset of sexual activity, unprotected intercourse, and multiple sexual partners, represents a more distal outcome associated with fast life histories (Belsky & Shalev, 2016; Belsky, Steinberg, Houts, & Halpern-Felsher, 2010; Gassen et al., 2019; Sturge-Apple et al., 2017). To optimize odds of survival and reproduction in volatile environments, the processes of epigenetic aging and altered stress responsivity facilitate earlier sexual maturation and greater mating effort, whereas higher reward sensitivity, impulsivity, and lower capacity for emotion regulation and delayed gratification translate to social and behavioral challenges such as substance use, rule-breaking behavior, and criminality (Belsky et al., 2012; Brumbach et al., 2009; Ellis et al., 2009; Simpson, Griskevicius, Kuo, Sung, & Collins, 2012).

The degree of these phenotypic expressions is proportional to the severity of household volatility and residential mobility (Belsky & Shalev, 2016; Belsky et al., 2010; Ellis et al., 2022; Coimbra, Carvalho, Moretti, Mello, & Belangero, 2017; Price, Kao, Burgers, Carpenter, & Tyrka, 2013). Whereas 46% of low-income children lose contact with fathers following a family breakup, 25-80% of homeless and highly mobile children may be separated from one or both caregivers due to involvement of child protective services, domestic violence, voluntary surrender, incarceration, inpatient treatment, or death (Anderson et al., 2014; Casey et al., 2015; Cowan, 2014; David et al., 2012; Haskett et al., 2016; Marcal, 2016; Paquette & Bassuk, 2009;

Shinn et al., 2005; Wildeman, 2014; Zlotnick, 2009). Changes in family structure and living arrangements exacerbate household chaos and interpersonal conflict. Over 50% of shelter children report worse parent-child relationship and more household duties, 70% miss friends, and 40% stop seeing extended family due to shelter rules (Cowan, 2014; Masten et al., 2015; Pavlakis, 2018; Womack et al., 2019). Disruptions in peer networks are particularly detrimental to youth (Anderson et al., 2014; Moore, 2013), as evidenced by continued substance use and rule-breaking behavior despite upward mobility afforded through participation in the *Moving to Opportunity (MTO)* experiment (David et al., 2012; Jackson, Langille, Lyons, Hughes, Martin, & Winstanley, 2009). The MTO experiment offered randomly selected families to receive vouchers to move out of high-poverty neighborhoods (for more information, visit https://nber.org).

Current Study

To juxtapose efficiency of predictive modeling based on cumulative risk and dimensional adversity, we will evaluate how the ecological fit related to precarious housing contexts and predictive performance related to child cognitive and behavioral outcomes compare between the unifactorial cumulative risk model and the three-factorial dimensional adversity model. Based on the fundamental properties of the two competing frameworks and empirical data related to housing contexts and child outcomes, we make the following predictions:

(H1) For the unifactorial model, higher cumulative risk will predict 1a) greater aggressive behavior; 1b) lower cognitive ability; and 1c) higher risk-taking.

(H2) For the multifactorial model, 2a) higher exposure to threat, but not deprivation or unpredictability, will predict more aggressive behavior; 2b) higher levels of deprivation, but not threat or unpredictability, will predict lower cognitive ability; and 2c) greater unpredictability, but not deprivation or threat, will predict more risk-taking.

Method

Data Collection

The data on doubled-up families was sourced between 1998 and 2000 a part of *the Fragile Families and Child Wellbeing (FFCW) Study.* The study followed a birth cohort of 5,000 children and their caregivers, selected via multistage random sampling from 20 metropolitan U.S. cities stratified by political and labor market conditions (Reichman, Teitler, Garfinkel, & McLanahan, 2001). The *FFCW Study* collected data on children, their mothers, fathers, caregivers, childcare providers, and teachers, from child's birth, and when children were *1, 3, 5, 9,* and *15* years of age. The study had three components; the *Primary Caregiver (PCG) Core Study* relied on caregiver surveys; the *In-Home Study* complemented caregiver surveys with standardized tests and home and behavior observations; and the *Child Care Centers* and *Teachers' Study* employed surveys and observations.

Study Sample

Current study sample was restricted to 2422 families who reported living in doubled-up or multigenerational households when their children (52% boys) were 3 years old. Mothers (81.7% U.S.-born) were equally split between those who did not have a high school diploma (27.4%), those who did (27.3%), and those who attended college (30.3%), with only 15% college graduates. Maternal age at childbirth mostly fell in the range of 19-34 years (80.7%), with the remainder split between younger (9.3%) and older participants (10%). Most focal families (89.5%) shared household with adult relatives, close to 1% with adult non-relatives, and 9.7% with adult relatives and non-relatives (see *Table 1*). Over half of these families (53.1%) reported yearly income of less than $15,000, 14.6% less than $30,000, 11.8% less than $45,000, and the remaining 20.5% between $45,000 and $99,000. At age 15, 22.1% of youth identified as White,

42.5% as Black, 27.3% as Hispanic/Latino, and 8% as other or mixed ethnicities.

Measures

The data for the present study were collected during the 3^{d}, 9^{th}, and 15^{th} years of children's lives from the *PCG Core Study* surveys and the *In-Home Study* observations.

Predictors

Latent constructs of cumulative risk, threat, deprivation, and unpredictability were indexed by items related to housing characteristics and contexts, selected from standardized assessments, interviewer observations, self-reports, and demographic data of the *FFCW PCG Core Study* and the *In-Home Study* components, measured when children were three years old. *A priori* indicator selection was based on theoretical and empirical evidence reviewed above. A detailed information on all indicator variables is available in supporting documentation.

The latent threat-harshness dimension was indexed by four indicators: parent being a victim of neighborhood crime, parent witnessing neighborhood crime, perceived neighborhood safety, and perceived neighborhood cohesion.

The latent deprivation dimension was similarly captured with four indicators: decayed housing interior, decayed housing exterior, condition of the neighborhood block, and overcrowding.

The latent unpredictability dimension was, again, comprised of four indicators: residential mobility, residential instability, household composition, and security of household occupancy.

The latent cumulative risk factor was created as an alternative approach to dimensional adversity, and as such, was indexed by all 12 indicator variables described above.

Outcomes

Developmental outcomes were similarly constructed as latent factors, with indicator items gathered from parental and youth reports, standardized testing, and interviewer observations reported as part of the *FFCW Primary Caregiver (PCG) Core Study* and the *In-Home Study* components. Child cognitive capacity and aggressive behavior were assessed when children were five years old, whereas youth risky behavior was measured at age 15.

The latent child cognitive ability factor was based on two items, where higher scores represent higher cognitive ability. The first is the *Woodcock Johnson Letter-Word Identification Test* (*W-J Test 22*; Woodcock, Mather, McGrew, & Wendling, 2001) Passage Comprehension and Applied Problems standardized score, and the second is the *Peabody Vocabulary Test Third Edition* (*PPVT-III*; Dunn & Dunn, 1997) standardized z-score.

The latent child aggressive behavior factor was defined via a sum score of 18 items from the *aggressive* behavior subscale (Cronbach's $a = 0.74$) and nine items from the *delinquent* behavior subscale (Cronbach's $a = 0.56$) of the parent form of the CBCL 4—18 (Achenbach, 1991). The items ranged on a scale from *0 (not true)* to *2 (very true).*

The latent youth risky behavior factor was indexed by three youth-reported items, two of which related to sexual risk-taking (age at first sexual intercourse and the number of sexual partners) and one to non-sexual risky behavior. The latter was constructed as a sum score of three items indicating whether youth ever tried tobacco, alcohol, or illicit drugs.

Analytical Plan

To model and evaluate performance of the cumulative risk and dimensional adversity approaches, we planned to use the same set of theory-informed indicators of precarious housing. First, we would utilize all 12 indicators to index a single latent factor of cumulative risk. Next, we would use the same group of indicators to specify an alternative, three-factor model, where

each latent factor would be defined by a set of four, dimension-specific, indicators. Finally, we would fit the two latent factor models, equivalent in indicators but non-nested in structure, to the same data sample, to allow for cross-model comparisons of fit indices and factor loadings.

Next, both measurement models would be extended by adding predictive paths from all latent predictors to the three latent outcomes, representing child cognitive ability and aggressive behavior at age five and youth risky behavior at age 15. Finally, fitting the two competing predictive models to the same data sample would allow us to compare and contrast the two model solutions on the following parameters: 1) model fit indices; 2) regression coefficient sizes; and 3) predictive specificity (i.e., detection of theoretically hypothesized discriminant links between individual dimensions of adversity and specific developmental outcomes). Analyses used Structural Equation Modeling (SEM) with Maximum Likelihood estimation in R 4.1.0., package *lavaan* (Rosseel, 2012).

Results

Testing Competing Measurement Models (Latent Predictors)

The 12 indicators of precarious housing, measured when children were 3 years of age, were first used to specify a unifactorial model, representing cumulative risk approach, and then re-specified into a multifactorial model, to reflect covarying dimensions of threat, deprivation, and unpredictability. Next, the respective one-factor and the three-factor model solutions, yielded by fitting both models to the FFCW data gathered from 2422 doubled-up or multigenerational household families were reviewed.

Cross-Model Comparisons of Factor Loadings

All indicators loaded significantly ($p < .001$) on the latent factor of risk under the unifactorial model, as well as the covaried factors of threat, deprivation, and unpredictability

under the multifactorial model. Standardized loadings showed significant cross-model overlap in estimate magnitude and directionality, ranging between 0.20 and 0.78 for 10 out of 12 indicators of latent cumulative risk factor (*Figure 1*) and between 0.22 and 0.80 for all 12 indicators of latent dimensional adversity factors, positively and moderately (0.32-0.56) correlated (*Figure 2*). Judging against the minimum threshold of 0.20 required for discrimination and interpretability of the proposed factor structure (Hair, Black, Babin, Anderson, & Tatham, 2006), the cumulative risk model is at a slight disadvantage, as two of its factor loadings (0.16 and 0.19) fall short of meeting this requirement.

Cross-Model Comparisons of Fit Indices

In terms of the goodness of fit, multifactorial dimensional model appears to outperform the unifactorial risk model, as the latter shows poor fit across a range of robustly estimated fit indices: $\chi^2(54) = 911.45$, $p < .001$, CFI = .64, TLI = .57, RMSEA = .087, 90% CI [.082, .092], AIC = 56503.33, BIC = 56597.48. In comparison, examination of the multifactorial model output suggests acceptable overall model fit with some inconsistencies in performance of individual fit indices: $\chi^2(51) = 449.62$, $p < .001$, CFI = .84, TLI = .79, RMSEA = .061, 90% CI [.056, .066], AIC = 55976.99, BIC = 56078.98. Given the non-nested structure of the two models, we approached the task of model selection based on descriptive comparisons of model fit indices and selection criteria. Specifically, compared to the dimensional model, the cumulative risk model showed higher divergence from the "perfect" model (ΔRMSEA = .026) and lower divergence from the baseline (i.e., "worse possible fit") model (ΔCFI = .19; ΔTLI = .22). Consequently, the chi-square estimate for the cumulative risk model was almost double the value of the dimensional model ($\Delta\chi^2 = 461.83$). The emerging trend favoring multifactorial model structure in our sample was further supported the lower AIC (ΔAIC = 526.34) and BIC

(ΔBIC = 518.5) values, pointing to higher efficiency (Burnham & Anderson, 2002; Claeskens & Hjort, 2008) as well as consistency (Yang, 2005) of the dimensional adversity model, compared to the model of cumulative risk.

Testing the Measurement Model (Latent Outcomes)

Following establishment of the latent constructs of cumulative risk under the unidimensional model and latent factors of threat, deprivation, and unpredictability under the multidimensional model, these latent constructs were tested as predictors of prospective child outcomes. Consequently, three latent factors were constructed; the indicators of child aggressive behavior and cognitive ability were measured at age 5, whereas the indicators for the latent factor of risky behaviors, including sexual risk-taking, were measured at age 15. Based on 2422 cases, the model showed good fit: $\chi^2(11) = 23.53$, $p = .013$, CFI = .99, TLI = .99, RMSEA = .022, 90% CI [.010, .034]. All indicators loaded onto the respective latent factors significantly ($p < .001$), with loadings in the range of 0.44-0.99.

Testing Competing Predictive Models (Latent Predictors → Latent Outcomes)

To test predictive efficiency of the two competing models, the three latent outcome factors of child aggressive behavior, cognitive ability, and risky behavior were first regressed on the cumulative risk factor under the unifactorial model and then on each of the three latent factors of dimensional adversity under the multifactorial model. Results are presented below.

Cross-Model Comparisons of Fit Indices

Both predictive models showed improvement in model fit over respective measurement models. Based on robust goodness-of-fit estimates, the unifactorial predictive model demonstrated acceptable fit: $\chi^2(146) = 1145.17$, $p < .001$, CFI = .84, TLI = 0.81; RMSEA = .056, 90% CI [.053, .059], AIC = 82321.54, BIC = 82486.30. In turn, examination of fit indices of the

multifactorial predictive model suggests good fit to the data: $\chi^2(137) = 639.31$, $p < .001$, CFI = .92, TLI = 0.90; RMSEA = .041, 90% CI [.038, .044], AIC = 81771.27, BIC = 81959.56. The follow-up descriptive comparisons highlight notable improvement in absolute fit (ΔRMSEA = .015), incremental fit (ΔCFI = .083; ΔTLI = .09), and chi-square value ($\Delta\chi^2 = 505.86$) of the dimensional predictive model of its cumulative risk competitor. These differences are in line with improvements in AIC (ΔAIC = 550.27) and BIC (ΔBIC = 526.74) criteria, indicative of better efficiency and higher consistency when the data is interpreted based on a dimensional, rather than cumulative risk-based statistical modeling.

Cross-Model Predictive Comparisons

As was expected, both statistical models demonstrated predictive potential in regard to all three developmental outcomes of interest. As hypothesized under the unifactorial predictive model, higher exposure to cumulative risk observed when children were three years old predicted more aggressive behaviors, $b = 0.24$, $p < .001$, and lower cognitive functioning, $b = -0.39$, $p < .001$, around age 5, as well as more risk-taking behaviors, $b = 0.17$, $p < .001$, at age 15. No significant associations emerged between the three latent outcome constructs (*Figure 4*).

Under the multifactorial predictive model, proximally measured dimensional types of adversity also predicted distally measured child outcomes, with the magnitude of effect sizes similar to the cumulative risk model estimates. Moreover, we observed some evidence of predictive specificity. As expected, children who have experienced more threatening conditions when they were three years old showed more aggressive behavior when they were five years of age, $b = 0.25$, $p < .001$. Importantly, higher levels of both, deprivation and unpredictability were predictive of lower cognitive ability at age five, with respective estimates of $b = -0.22$, $p < .001$ and $b = -0.31$, $p < .001$, but not aggressive behavior at that age, with equal path estimates of $b =$

0.02, $p > .05$. Additionally, higher levels of unpredictability at age three were marginally predictive of substance use and sexual risk-taking behavior at age 15, $b = 0.10$, $p = .051$. Moreover, threat significantly ($p < .001$) and positively covaried with unpredictability ($b = 0.55$) and deprivation ($b = 0.53$), which in turn covaried with unpredictability ($b = 0.32$), whereas none of the latent child outcome factors appeared to covary (*Figure 5*).

Discussion

The study was conceived as an attempt to tackle complexity of the progressively more severe and prolonged forms of residential instability and subsequent negative effects on children and families. The current approach to risk assessment, which determines linkage to services, is based on the cumulative risk approach and existing, categorically defined typologies of homelessness. Earlier studies point to high intra-class heterogeneity in personal characteristics, physical and relational contexts, and subsequently, families' needs, which presents a significant challenge for development of strategies that could effectively prevent or slow a shift along the continuum of residential instability toward homelessness. In search for solutions, the current investigation sought to explore potential benefits of adapting emergent dimensional approach to adversity to the science of intervention, particularly in the context of residential instability.

The pivot from cumulative risk to dimensional adversity was informed by two properties of the latter framework. The first regards conceptualization of environmental contexts as expressions of the intersecting continuums of safety-threat, resource abundance-deprivation, and stability-unpredictability, which lends nuance as a potential benefit that could be applied to ranking families' needs (i.e., by designing multidimensional assessments as compared to assessments based on categories of cumulative risk with arbitrary cutoffs to create hierarchical risk classes). The second pertains to a degree of purported specificity, wherein dimensional

types of adversity represented by intrafamilial dynamics and housing contexts, among others, carry predictable implications, from caregivers' health to parenting to developmental trajectories in children. In this regard, we sought to compare predictive performance of two models, where one represents the cumulative risk approach and the other dimensional approach to adversity.

Comparing Performance of Cumulative Risk vs Dimensional Adversity Models

To examine the differences between the cumulative risk and the dimensional adversity approaches in real world data, we selected twelve housing-related indicators of risk from the *FFCW Study* sample restricted to multigenerational and doubled-up families. The cumulative nature of the traditional approach to adversity informed our choice to index latent risk factor based on all twelve selected indicators. At the same time, operationalization of the latent factors of threat, deprivation, and unpredictability posed some challenges, given the paucity of empirical studies due to the novelty of the task of modeling dimensional adversity. Therefore, *a priory* assignment of indicators as indices of each dimensional factor were based on the recently proposed parsimonious framework that integrated the foundational threat-deprivation and harshness-unpredictability models (Ellis et al., 2022) and two relevant empirical studies, which relied on the *FFCW Study* data to construct adversity dimensions (Miller, Machlin, McLaughlin, & Sheridan, 2021; Usacheva et al., 2022).

Examining cross-model consistency between structural differences and model fit

The degree to which the hypothesized structure of the cumulative risk model, compared to the dimensional adversity model, fit the *FFCW Study* data relied on evaluation of standard goodness-of-fit indices, such as CFI, TLI, and RMSEA for each model, as well as comparing the AIC and BIC criteria of model selection used with non-nested models fit to the same data. Based on descriptive comparisons, the hypothesized unifactorial structure representing cumulative risk

approach appeared to offer a worse solution to explaining our data than the hypothesized multifactorial structure reflecting dimensional approach to adversity, with the chi-square estimate for the cumulative risk model at almost double the value of the dimensional model. The cumulative risk model RMSEA showed higher divergence from the "perfect" model, whereas CFI and TLI indices also pointed to lower divergence from the baseline (i.e., "worse possible fit") model. The emerging trend favoring dimensional model structure was further supported by pronounced differences in AIC and BIC selection criteria between the two models, supporting higher efficiency and consistency, favoring selection of the multidimensional model of adversity.

Cross-model examination of predictive potential

To evaluate differences in predictive performance of models based on the cumulative risk and dimensional views of adversity, we examined prospective relationships between childhood aggression, cognitive capacity, and adolescent risky behaviors, including sexual risk-taking, and cumulative risk on the one hand, and threat, deprivation, and unpredictability, on the other. First, given the well-established connection between greater exposure to adverse or stressful events and a broad range of negative child outcomes, we hypothesized that the cumulative risk factor measured when children were three years old would predict child aggression and cognitive ability by five years of age and youth risky behaviors by 15 years of age. Indeed, we observed that in our data, greater risk moderately predicted lower cognitive ability and to a lesser degree, aggressive and risky behaviors.

Next, informed by the life history theory postulates, we considered the role of the environmental cues of threat and unpredictability in developmental adaptations consistent with the fast life history trajectory. In particular, developmental mechanisms of adaptive change identified under the threat-deprivation and harshness-unpredictability models link exposure to threat to

deficits in self-regulation underlying greater aggression, impulsivity, and reactivity, whereas exposure to unpredictability relates to greater sexual risk-taking and lower family planning behavior (Belsky, 2019; Ellis & Del Giudice, 2019). Congruent with this line of reasoning, environmental cues of the threat-safety continuum predicted higher level of aggression in our sample, whereas cues of unpredictability-stability and deprivation-resource abundance dimensions did not relate to aggression but did predict lower cognitive ability, supporting our first hypothesis.

The same theoretical models, supported by previous empirical findings suggest that deficits in cognitive functioning represent developmental adaptation to environmental deprivation and may be conceptualized as a marker of slow life histories, whereas conditions of unpredictability are primarily related to developmental adaptations associated with early sexual maturation and risk-taking behavior, characteristic of fast life histories (Belsky, 2019; Ellis et al., 2009). Consequently, our second hypothesis forecast deprivation as the sole predictor of cognitive ability, whereas the third hypothesis presumed that unpredictability would stand as the single predictor of risk-taking. Both were partially supported. Contextual unpredictability experienced by children at 3 years of age emerged as the sole, albeit marginal predictor of risk-taking behavior at 15 years of age. It is plausible that the strength and significance of this association waned over the 12-year period between the two data points.

As hypothesized, deprivation manifested in lower cognitive ability, although contrary to our expectation, not as a sole predictor. The moderate negative effects exerted by deprivation were similar in magnitude to the effects of unpredictability. Given that *FFCW Study* oversampled for single mothers at a 3:1 ratio (Reichman et al., 2001), it is conceivable that higher levels of instability in household structure overlapped with greater levels of deprivation in these single-income households in our sample. This assumption is supported by our model

estimates, showing a moderate correlation between deprivation and unpredictability, as well as existing empirical evidence elucidating a negative dose-response relationship between residential mobility and academic outcomes (Miller, 2011; Murphy, 2011).

Among known mediators between frequency and severity of housing instability and truancy, low school attendance, and poor academic performance are overcrowding, food insecurity, household chaos, and lack of personal space (Fantuzzo et al., 2012; Miller, 2011; Moore, 2013; Pavlakis, 2018). For example, lack of family routines and higher household chaos were found to correlate with lower inhibitory control and delayed gratification (Martin, Razza, & Brooks-Gunn, 2012), as well as lower general intelligence quotient (Deater-Deckard et al., 2009; Petrill, Pike, Price, & Plomin, 2004). Earlier and more prolonged periods of residential volatility predicted increase challenges in social and task engagement by 40% (Miller, 2011; Moore, 2013; Fantuzzo, LeBoeuf, Brumley, & Perlman, 2013; Pavlakis, 2018). At the same time, high rates of change in childcare/school and subsequent suspensions and expulsions persist across precarious housing contexts, affecting roughly 6% of preschoolers and over 50% of adolescents transitioning from shelters to supportive housing (Gewirtz et al., 2008; Lee et al., 2010).

Conclusion and Limitations

All in all, regardless of the theoretical approach (i.e., the *cumulative risk* view or the *threat, deprivation, unpredictability* view), both models predicted child aggressive behavior, cognitive ability, and youth risk-taking behavior in multigenerational and doubled-up families in our sample. However, the dimensional model demonstrated a considerably better fit to the data as well as potential for higher sensitivity in predicting developmental outcomes of adversity, compared to the cumulative risk model. Moreover, we saw some evidence of specificity in associations between dimensions of adversity and child developmental outcomes, set forth by the multidimensional

developmental model reviewed earlier (Ellis et al., 2022; McLaughlin et al., 2014; Usacheva et al., 2022). Our findings support those reported in a recent publication which similarly sought to compare performance of the models of cumulative risk and dimensional adversity. The study found no differences in the magnitude of predictive estimates between the single cumulative risk factor and the four latent factors of dimensional adversity (threat, deprivation, unpredictability, and loss). At the same time, dimensional model demonstrated prospective differential impact of dimensional adversity, wherein deprivation was linked to child's cognitive functioning and threat to emotional functioning, among other outcomes (McGinnis, Sheridan, & Copeland, 2022).

Nonetheless, the results of our study should be interpreted with caution, given the relative novelty of the adopted theoretical perspective and, as an implication, the lack of empirical studies supporting our core assumptions, and the variation in the number of adversity dimensions and the indicators used to index these dimensions among the few existing studies relevant to this theoretical and methodological approach (e.g., McGinnis et al., 2022; Miller et al., 2021; Usacheva et al., 2022). Our hope is that future investigations based on different samples and broader/stronger dimensional indicators will be able to ascertain whether our present findings are best explained by the specificity of our sample and selection of indicators, or whether a more nuanced theoretical picture would need to be explored.

Implications

The study findings carry theoretical and practical significance. From the theoretical angle, it is noteworthy that a limited selection of indicators related to housing instability generally supported dimensional predictions based on earlier studies, featuring a well-rounded selection of indicators (McGinnis et al., 2022; Miller et al., 2021; Usacheva et al., 2022). Notably, the latent construct of deprivation predictive of cognitive functioning was captured via material rather than

socio-cognitive indicators. Although it could be reasoned that both types of denominators reflect the broader dimension of deprivation--resource abundance, they are thought to operate via different developmental pathways (Ellis et al., 2022). Moreover, it is important to acknowledge the paucity of empirical studies firmly establishing material and socio-cognitive deprivation as proximally different cues of the same underlying dimension.

As far as practical applicability, our work may serve as the stepping stone toward a global shift from intervention approach, aimed to support families with the highest burden of cumulative risk, toward targeted prevention. In contrast to functional challenges associated with overly broad risk criteria set by the multidimensional ETHOS classification, the current three-dimensional developmental framework offers greater sensitivity to subjective experiences of families. Individual histories may be collected via dimensional measures of risk assessment, which would enable construction of multidimensional risk profiles and nuanced predictive modeling to inform targeted service design and delivery.

Dimensional risk assessment measures may depict three lines, reflecting lifetime experiences of environmental conditions of threat–safety, deprivation–resource abundance, and unpredictability–stability. Using red ink, clients may circle timeline segments corresponding to negative subjective experiences of each dimension, and blue ink for positive experiences. To communicate significance of these conditions, clients may be asked to shade these circles, where no shading may denote no effect, striped shading stand for mild effect, and solid shading indicate profound effect. Compared to extensive questionnaires like F-SPDAT (available from https://cceh.org/wp-content/uploads/2016/07/F-SPDAT-v2.0-Family-Manual.pdf), a prototypical dimensional measure depicted in *Figure 6* may be more efficient. The initial screener, therefore, would probe for information on the type, duration, and intensity of negative and positive

dimensional experiences, their intersectionality and developmental timing. It may be further supplemented with dimension-specific measures on a case-by-case basis, to decrease the burden on participants and service providers.

As a decision-making tool, dimensional measures may be developed to account for the role of dimensional environmental cues in shaping long-term developmental trajectories. Of particular significance is empirical evidence suggesting that conditions of relative safety, stability, and adequate access to resource act as prerequisites for development of socially desirable phenotypic characteristics of slow life histories, including greater self-regulation, intelligence, physical, emotional, and relational health, and high-quality parenting (Ellis et al., 2022). In this light, dimensional dissection of personal histories would allow providers to identify and address sources of environmental cues that promote socially undesirable fast life histories. To illustrate this point, a doubled-up family living in a high-conflict, chaotic household may benefit from supportive housing to attenuate threat and unpredictability, whereas a close-knit multigenerational family experiencing food insecurity may need a referred to a nutritional program to decrease deprivation.

In complex cases, such as custody disputes or concerns regarding child's welfare, a dimensional cost-benefit analysis may be useful in determining whether the child's best interests would be better served by awarding custody to one of the caregivers, removing the child from home, or providing the family with supportive services. This process may take into account that exposure to deprivation is generally associated with fewer behavioral problems than exposure to unpredictability (Ellis et al., 2022). It may also consider that low energetic resources linked to extreme nutritional deprivation prohibit selection of a life history trajectory (Ellis et al., 2009; Ellis et al., 2022). It may weigh in on the difference between an inherently threatening experience of

separation from a primary caregiver in early childhood versus in adolescence when it would likely reflect unpredictability or deprivation.

To improve services, various program components may be evaluated from the position of the environmental cues they communicate to service recipients. For instance, provider-client communication infrastructure may relay unpredictability if it lacks consistency and transparency. Moreover, a dimensional approach is inherently strength-based, as it recognizes adaptive advantages of various phenotypical profiles. With the focus on patient-centered care, providers may consider that aside from constraining cognitive functioning, physical deprivation may improve memory and creative problem-solving, which may be used in psychotherapy and case planning (Ellis, Bianchi, Griskevicius, & Frankenhuis, 2017).

In sum, the limited state of empirical knowledge on the hierarchy, intersectionality, and other aspects of a dimensional developmental experiences bars any meaningful interpretation of dimensional histories in precariously housed families. Nonetheless, rapid scientific progress in this direction may bring the potential benefits of dimensional approach related to risk assessment, service-matching, and decision-making, within reach in the near future.

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Table 1. Covariances and factor loadings for the indices of cumulative risk and latent child development outcomes based on the unifactorial predictive model.

Latent Construct Indicators	**Standardized Estimate**	**Standard Error**
Cumulative Risk (T3)		
Parent was victim of neighborhood violence	0.20**	0.02
Parents witnessed neighborhood violence	0.47**	0.03
Neighborhood safety	0.56**	0.04
Neighborhood social control	0.39**	0.04
House interior in decay	0.43**	0.07
House exterior in decay	0.67**	0.07
Conditions of surrounding block	0.76**	0.07
Proportion of people to rooms in the household	0.37**	0.02
Security of occupancy	0.45**	0.03
Residential mobility	0.17**	0.03
Number and type of families in the household	0.19**	0.03
Residential instability	0.26**	0.03
Child's cognitive ability (T4)		
Child's PPVT score	0.95**	0.08
Child's WWJS score	0.48**	0.04
Child's aggression (T4)		
Child's aggressive behavior	0.70**	0.06
Child's destructive behavior	0.84**	0.07
Youth's risk-taking behaviors (T6)		
Youth's substance use	0.44**	0.03
Youth's age at first sexual intercourse	-0.99**	0.03
Number of sexual partners reported by youth	0.94**	0.04
Covariances		
Cognitive ability ↔ Aggressive behavior	-0.06	0.04
Cognitive ability ↔ Risk-taking behavior	-0.03	0.04
Aggressive behavior ↔ Risk-taking behavior	0.05	0.04

Note. All factor loadings were significant at $\alpha = 0.001$ level (**$p < .01$). Abbreviations: T3 = Time 3 (target child's age - 3); T4 = Time 4 (target child's age - 9); T6 = Time 6 (target child's age - 15). PPVT = Child's Peabody Picture Vocabulary Test; WJSS = Child's Woodcock Johnson Passage Comprehension and Applied Problems.

Table 2. Covariances and factor loadings of indices of threat, deprivation, unpredictability, and latent child development outcomes based on the multifactorial predictive model.

Latent Construct Indicators	**Standardized Estimate**	**S. E.**
Threat (T3)		
Parent was victim of neighborhood violence	0.24**	0.02
Parents witnessed neighborhood violence	0.49**	0.03
Neighborhood safety	0.74**	0.04
Neighborhood social control	0.51**	0.03
Deprivation (T3)		
House interior in decay	0.51**	0.06
House exterior in decay	0.79**	0.05
Conditions of surrounding block	0.81**	0.04
Proportion of people to rooms in the household	0.32**	0.03
Unpredictability (T3)		
Security of occupancy	0.65**	0.02
Residential mobility	0.34**	0.02
Number and type of families in the household	0.21**	0.02
Residential instability	0.36**	0.02
Covariances		
Threat ◄► Unpredictability	0.55**	0.05
Threat ◄► Deprivation	0.53**	0.04
Deprivation ◄► Unpredictability	0.32**	0.05
Child's cognitive ability (T4)		
Child's PPVT score	0.93**	0.08
Child's WWJS score	0.49**	0.04
Child's aggression (T4)		
Child's aggressive behavior	0.75**	0.06
Child's destructive behavior	0.79**	0.07
Youth's risk-taking behaviors (T6)		
Youth's substance use	0.44**	0.03
Youth's age at first sexual intercourse	-0.99**	0.03
Number of sexual partners reported by youth	0.94**	0.04
Covariances		
Cognitive ability ◄► Aggressive behavior	-0.08	0.04
Cognitive ability ◄► Risk-taking behavior	-0.02	0.04
Aggressive behavior ◄► Risk-taking behavior	0.05	0.04

Note. All factor loadings were significant at $\alpha = 0.001$ level (**$p < .01$). Abbreviations: S.E. = Standard Error; T3 = Time 3 (target child's age - 3); T4 = Time 4 (target child's age - 9); T6 = Time 6 (target child's age - 15). PPVT = Child's Peabody Picture Vocabulary Test; WJSS = Child's Woodcock Johnson Passage Comprehension and Applied Problems.

Figure 1. The unifactorial, cumulative risk measurement model. Robust fit indices (N = 2422): $\chi^2(54) = 911.45$, $p < .001$, CFI = 0.64, TLI = 0.57, RMSEA = .087 [.082; .092]; AIC = 56,503.33, BIC = 56,597.48. Coefficients are reported in standardized form; $^{**}p < .001$. Abbreviations: T3 = Time 3 (target child's age 3).

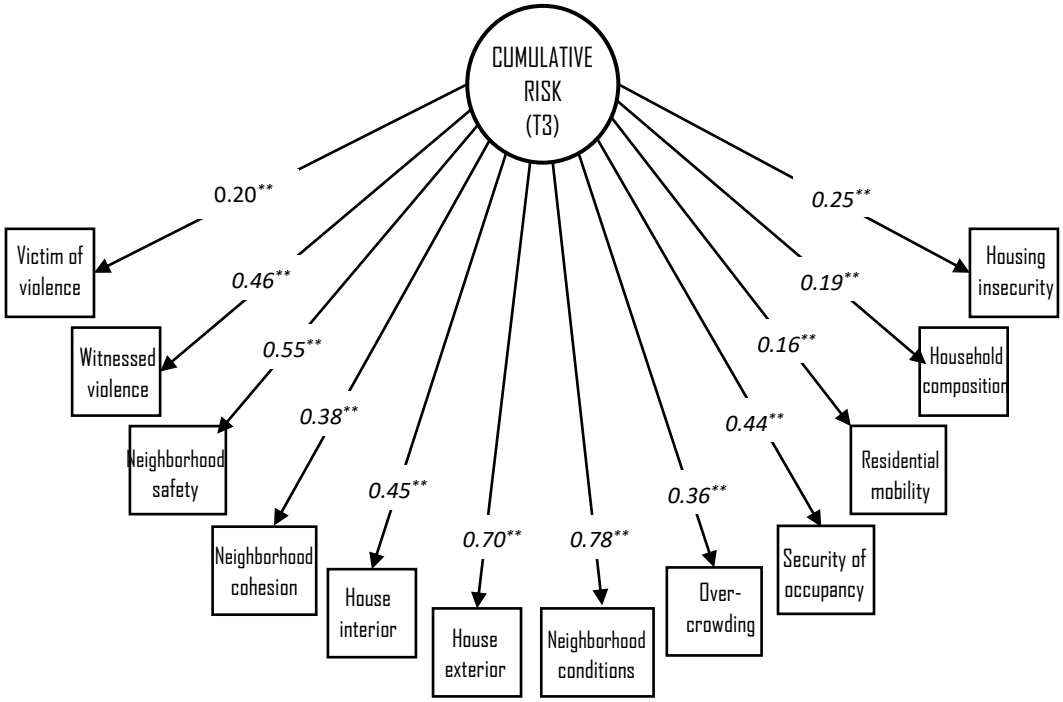

Figure 2. The multifactorial, dimensional adversity measurement model. Robust fit indices (N = 2422): $\chi^2(51) = 449.62$, $p < .001$, CFI = 0.84, TLI = 0.79, RMSEA = .061 [.056; .066]; AIC = 55,976.99, BIC = 56,078.98. Coefficients are reported in standardized form; $^{**}p < .001$. Abbreviations: T3 = Time 3 (target child's age 3).

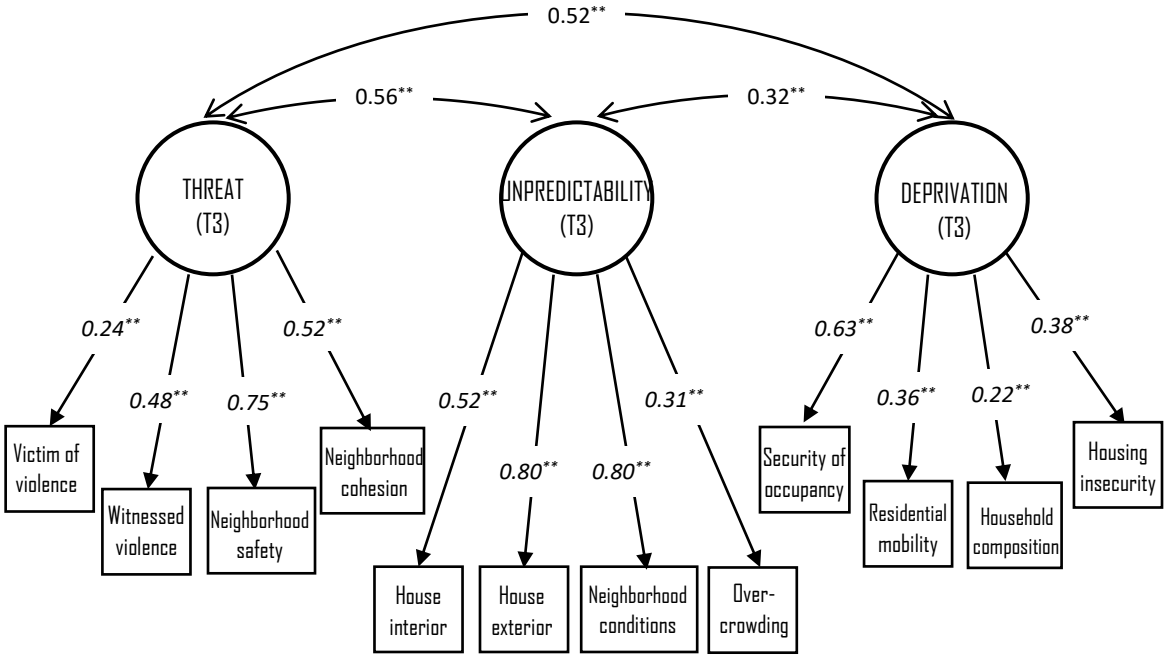

Figure 3. The multifactorial latent outcome measurement model. Robust fit indices (N = 2422): $\chi^2(11) = 23.53$, $p > .05$, CFI = 0.99, TLI = 0.99, RMSEA = .022 [.010; .034]; Coefficients are reported in standardized form; $^{**}p < .001$. Abbreviations: T3 = Time 3 (target child's age 3); T4 = Time 4 (target child's age 9), T6 = Time 6 (target child's age 15); PPVT = Child's Peabody Picture Vocabulary Test; WJSS = Child's Woodcock Johnson Passage Comprehension and Applied Problems.

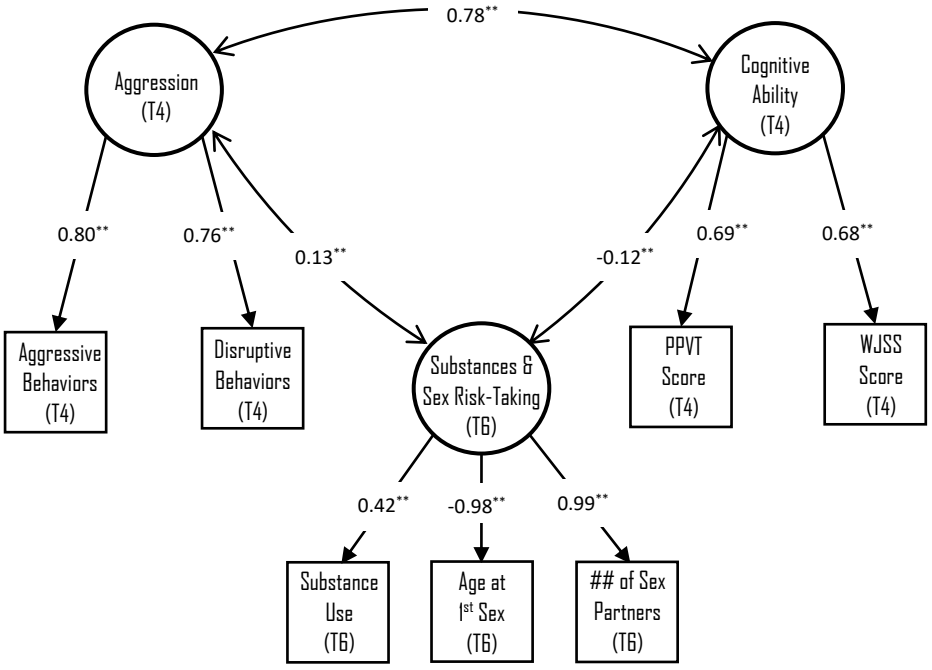

Figure 4. The unifactorial, cumulative risk predictive model. Robust fit indices (N = 2422): $\chi^2(146) = 1145.17$, $p < .001$, CFI = 0.84, TLI = 0.81, RMSEA = .056 [.053; .059]; AIC = 82,321.54, BIC = 82,486.30. Non-significant covariances are not shown. Coefficients are reported in standardized form; $^{**}p < .001$. Abbreviations: T3 = Time 3 (target child's age 3); T4 = Time 4 (target child's age 9), T6 = Time 6 (target child's age 15).

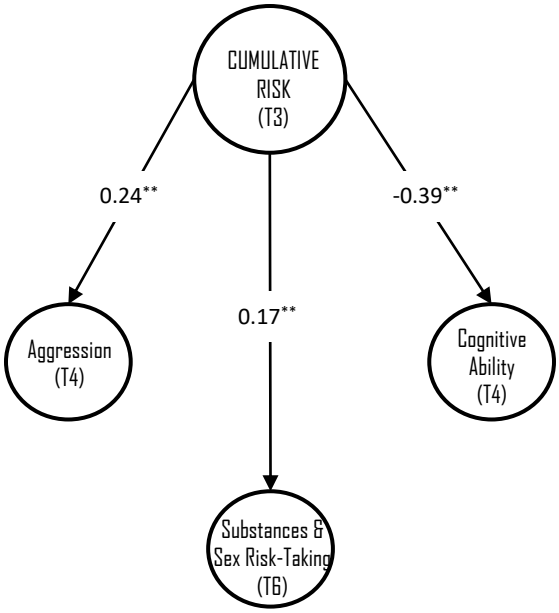

Figure 5. The multifactorial, dimensional adversity predictive model. The unifactorial, cumulative risk predictive model. Robust fit indices (N = 2422): $\chi^2(137) = 639.31$, $p < .001$, CFI = 0.92, TLI = 0.90, RMSEA = .041 [.038; .044]; AIC = 81,771.27, BIC = 81,959.56. Non-significant covariances are not shown. Coefficients are reported in standardized form; $^{**}p < .001$. Abbreviations: T3 = Time 3 (target child's age 3); T4 = Time 4 (target child's age 9), T6 = Time 6 (target child's age 15).

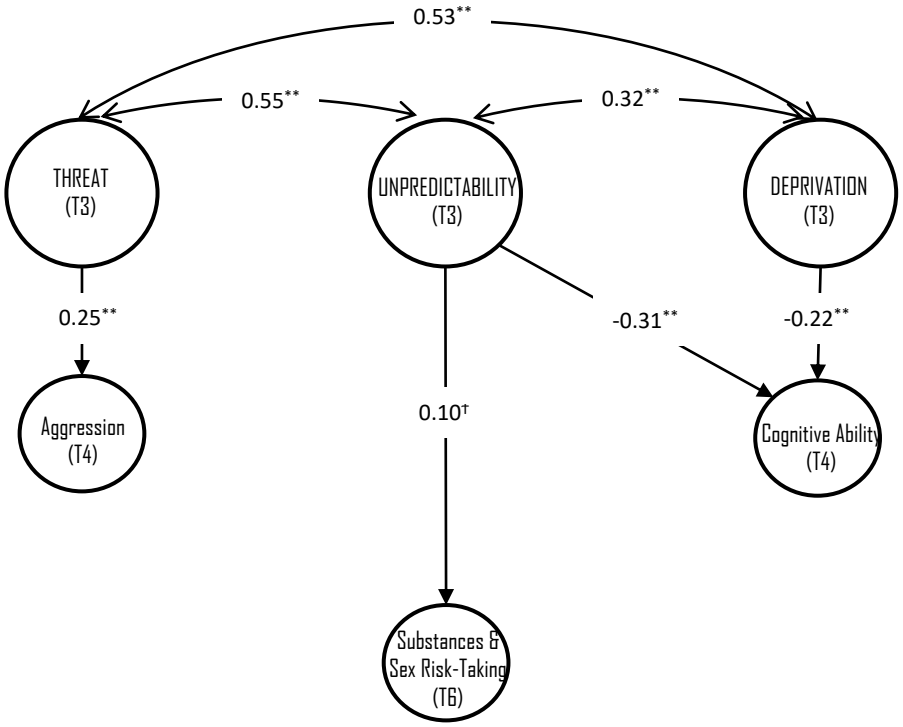

Figure 6. A prototypical risk assessment measure based on dimensional approach to adversity.