Dimensions of Deprivation and Threat, Psychopathology, and Potential Mediators: A Multi-Year Longitudinal Analysis

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Abstract

Prior research demonstrates a link between exposure to childhood adversity and psychopathology later in development. However, work on mechanisms linking adversity to psychopathology fails to account for specificity in these pathways across different types of adversity. Here, we test a conceptual model that distinguishes deprivation and threat as distinct forms of childhood adversity with different pathways to psychopathology. Deprivation involves an absence of inputs from the environment, such as cognitive and social stimulation, that influence psychopathology by altering cognitive development, such as verbal abilities. Threat includes experiences involving harm or threat of harm that increase risk for psychopathology through disruptions in social-emotional processing. We test the prediction that deprivation, but not threat, increases risk for psychopathology through altered verbal abilities. Data were drawn from the Child Development Project (N=585), which followed children for over a decade. We analyze data from assessment points at age 5, 6, 14, and 17 years. Mothers completed interviews at age 5 and 6 on exposure to threat and deprivation experiences. Youth verbal abilities were assessed at age 14. At age 17, mothers reported on child psychopathology. A path analysis model tested longitudinal paths to internalizing and externalizing problems from experiences of deprivation and threat. Consistent

with predictions, deprivation was associated with risk for externalizing problems via effects on verbal abilities at age 14. Threat was associated longitudinally with both internalizing and externalizing problems, but these effects were not mediated by verbal abilities. Results suggest that unique developmental mechanisms link different forms of adversity with psychopathology.

Over half of children in the United States will experience some form of childhood adversity by the time they reach adulthood (McLaughlin et al., 2012), from maltreatment, community violence, exposure to poverty, or parental death (Finkelhor, Ormrod, Turner, & Hamby, 2005). Child adversity is strongly associated with risk for psychopathology, including both internalizing and externalizing disorders, across the developmental spectrum into adulthood (Green et al., 2010; McLaughlin et al., 2010). Identifying underlying mechanisms that explain the association between childhood adversity and risk for psychopathology is critical for informing targeted preventive interventions. In the current paper, we test a model that compares the relative contributions of deprivation and threat as two forms of childhood adversities with different hypothesized pathways to psychopathology (McLaughlin, Sheridan, & Lambert, 2014; Sheridan & McLaughlin, 2014) in a 12-year longitudinal study. *Threat* includes experiences involving harm or threat of harm, and *deprivation* involves an absence of expected inputs from the environment, such as cognitive and social stimulation.

Adversity Models

The prevailing approach for examining the developmental consequences of adverse childhood experiences is a cumulative risk model (Evans, Li, & Whipple, 2013; Felitti et al., 1998). Cumulative risk models sum the number of adverse experiences without regard to type, chronicity, or severity and use this score to predict outcomes. This approach has demonstrated strong links between number of adversity exposures and developmental outcomes and underscored the importance of preventing exposure to adverse experiences. However, cumulative risk models offer little insight into the developmental mechanisms that explain the links between exposure and outcomes. A recently proposed alternative to the cumulative risk model identifies two dimensions of adverse childhood experiences with mechanisms leading to psychopathology that are at least partially distinct (McLaughlin & Sheridan, 2016; Sheridan & McLaughlin, 2014). This alternative approach, the Dimensional Model of Adversity and Psychopathology (DMAP), argues that it is possible to extract at least two core underlying dimensions—threat and deprivation—that encompass a wide variety of adverse experiences common in childhood. *Threat* involves experiences of harm or threat of harm (e.g., physical abuse), and *deprivation* is the absence of expected inputs from the environment (e.g., an absence of cognitive and social stimulation that occurs in the context of caregiver interactions). These dimensions cut across numerous adverse experiences that share the underlying experience of *threat* or *deprivation* to a varying degree. For example, threat is a core feature of sexual abuse, physical abuse, and community violence exposure; whereas, deprivation is a core feature of neglect, institutionalization, and

the lack of psychosocial stimulation that often occurs in poverty. Although exposures to threat and deprivation frequently co-occur, DMAP argues that the downstream developmental consequences of each dimension are at least partially distinct. In comparison, the cumulative risk approaches ignore features of particular adversity experiences that may influence development differently and thus provide unique information about targetable mechanisms. Importantly, other researchers have also argued for the importance of examining distinct underlying dimensions of childhood adversity (Humphreys & Zeanah, 2015; Johnson, Riis, & Noble, 2016; Manly, Cicchetti, & Barnett, 1994).

DMAP specifies unique emotional, cognitive, and neurobiological pathways linking early dimensions of experience with developmental outcomes. We expect that experiences of threat will alter emotional development to facilitate the rapid identification of potential danger in the environment and magnify emotional responses to those threats (McLaughlin et al., 2014). Specifically, early experiences of violence or risk of violence will alter development of cortical and subcortical circuits involved in fear learning and salience processing to facilitate rapid identification of environmental dangers; ultimately, this contributes to altered emotional processing, attention and memory for emotional stimuli, emotional learning, and emotional reactivity and regulation in response to negative emotional stimuli (McLaughlin & Lambert, 2017; Pollak & Tolley-Schell, 2003). In turn, alterations in each of these areas are associated with increased risk for multiple forms of psychopathology, including internalizing and externalizing problems (see Busso, McLaughlin, & Sheridan, 2016; Gold et al., 2016; McLaughlin & Lambert, 2017 for a review of evidence for these pathways). Here we do not focus on mechanisms underlying the threat pathway, but rather on the deprivation pathway.

DMAP argues that deprivation influences development through different mechanisms. Neglected children are deprived of expected environmental inputs from an early age. Neglectful parents provide inconsistent and irregular care characterized by a reduction in developmental inputs (Bousha & Twentyman, 1984; Gaudin, Polansky, Kilpatrick, & Shilton, 1996; Kauman Kantor et al., 2004). Similarly, children raised in institutions experience caregiving interactions that are infrequent and lack contingent responsiveness to the child's needs (Smyke et al., 2007). Children born into low-SES families typically experience caregiving that is characterized by lack of parental scaffolding behavior (Deater–Deckard, Chen, Wang, & Bell, 2012; Evans, Gonnella, Marcynyszyn, Gentile, & Salpekar, 2005) and well-documented reductions in cognitive and linguistic complexity (Bradley & Corwyn, 2002; Hart & Risley, 1995; Linver, Brooks-Gunn, & Kohen, 2002). These types of caregiving result in reductions in linguistic inputs, cognitive enrichment, and interactions with adults which can be used as scaffolded learning opportunities (Bousha & Twentyman, 1984; Hines, Kantor, & Holt, 2006; Kauman Kantor et al., 2004).

We hypothesize that reductions in complex cognitive and social inputs will result in more limited development of complex cognitive function, including language and executive function. Consistent with this hypothesis, children raised in institutions with dramatically limited caretaker contact in infancy and toddlerhood evidence deficits in language and cognitive ability later in development (Bos, Fox, Zeanah, & Nelson, 2009; Nelson et al., 2007). Similarly, neglect is associated with decreases in executive function and cognitive

function, even controlling for associated abuse (Hildyard & Wolfe, 2002; Sheridan, Peverill, Finn, & McLaughlin, 2017). Finally, an increasingly large body of research has demonstrated that, on average, children raised in low socioeconomic status (SES) environments evidence difficulties in executive function and language abilities relative to their high-SES peers (Britto & Brooks-Gunn, 2001; Brooks-Gunn & Duncan, 1997; Noble, McCandliss, & Farah, 2007; Noble, Norman, & Farah, 2005; Noble, Wolmetz, Ochs, Farah, & McCandliss, 2006). The link between SES and cognitive development has been attributed to less frequent cognitively stimulating experiences and learning opportunities in low-SES relative to high-SES families (Britto & Brooks-Gunn, 2001; Duncan & Brooks-Gunn, 1999).

Pathways to Psychopathology

DMAP posits that the mechanisms linking threat and deprivation with psychopathology are at least partially distinct. Identifying such specificity requires separately measuring each dimension and examining them simultaneously as predictors of proposed developmental mechanisms. DMAP suggests that threat is related to later psychopathology via fear learning, emotional reactivity, and emotion regulation (see McLaughlin & Lambert, 2017; Pollak, Cicchetti, Hornung, & Reed, 2000; Pollak & Tolley-Schell, 2003). As reviewed above, experiences of deprivation are associated with decreased enrichment in inputs and consequently deficits in cognitive and verbal abilities. DMAP predicts that deprivation is associated with later psychopathology due to these effects on cognitive development. Independent evidence points to the importance of complex cognitive function for psychopathology. For example, lower language abilities are associated with clinically significant risk for externalizing psychopathology across both childhood and adolescence (Lonigan et al., 2017; Nigg & Huang-Pollock, 2003; Petersen et al., 2013; Rhee et al., 2016; Yew & O'Kearney, 2015). Evidence from a recent meta-analysis of both cross-sectional and longitudinal studies suggests that individuals with lower language abilities are significantly more likely to evidence externalizing behavior problems than peers with better language abilities (Chow & Wehby, 2016). Lower verbal abilities also predict increased risk for internalizing problems in middle childhood and early adolescence (Bornstein, Hahn, & Suwalsky, 2013; Salmon, O'Kearney, Reese, & Fortune, 2016; Yew & O'Kearney, 2013). Together, available evidence strongly suggests that language ability is associated with risk for psychopathology during development.

Finally, changes in cognitive function mediate associations between profound deprivation (e.g., exposure to institutionalization) and externalizing psychopathology (Tibu et al., 2015), but few studies examine the possibility that this pathway would be reflected in the impact of less severe forms of deprivation (e.g., neglect or poverty) or demonstrated conclusively that these cognitive deficits predate psychopathology onset (as these outcomes are often measured simultaneously). Importantly, prior tests of the effects of deprivation on developmental outcomes have only included proxies of deprivation, such as neglect, institutional rearing, or SES (Busso et al., 2016; Lambert, King, Monahan, & McLaughlin, 2016; Tibu et al., 2015). Studies that include actual observations of the social environment of the child from a young age and outcomes spanning childhood to late adolescence are extremely rare.

Current Study

In this study, we test a core prediction of DMAP: that verbal abilities mediate the relationship between experiences of deprivation in early childhood and psychopathology in late adolescence. We test this prediction in a multi-year longitudinal study of a large sample of youths followed from age 5 to age 17 years. We extend prior work on deprivation by using observational assessments of enrichment and stimulation in the early environment rather than proxy measures of deprivation. We hypothesized that:

1. both deprivation and threat in early childhood would be related to higher internalizing and externalizing psychopathology in late adolescence.

2. the effect of *deprivation* in early childhood on internalizing and externalizing problems in late adolescence would be mediated by verbal abilities in early adolescence, controlling for co-occurring exposure to threat. Further, we hypothesized that verbal abilities in early adolescence would not mediate the association of *threat* in early childhood and externalizing problems in late adolescence, which is theorized to be mediated by altered emotional processing.

3. the mediation pathway from deprivation to lower verbal abilities to internalizing and externalizing problems would remain significant after accounting for previous internalizing and externalizing problems.

Methods

Data for the current study were drawn from the Child Development Project (CDP; see Dodge, Bates, & Pettit, 1990). All procedures for CDP were approved by Duke University Institutional Review Board (#40: "How Chronic Conduct Problems Develop"). Here we analyze data from the ages 5, 6, 14, and 17 assessment points.

Participants

Children and their parents ($N = 585$; 48% female) in the CDP were recruited in 1987 and 1988 in Nashville and Knoxville, Tennessee, and Bloomington, Indiana. Parents were approached during pre-registration for kindergarten, on the first day of class, or by phone or mail. Approximately 75% of parents approached agreed to participate. The resulting sample was drawn from representative schools and matched the demographics from the population at the respective sites. Approximately 82% of individuals identified as white, 17% identified as black, and 2% identified as "other" race. The SES measured by the Hollingshead Four-Fator Index of Social Status (Hollingshead, 1979) included a broad range from 8 to 66 (higher scores = higher SES). Mean SES was 39.53 ($SD = 14.01$). Based on the Hollingshead measure, 9% of families fell in the lowest status category, 17% in the next lowest, 25% in the middle, 32% in the next highest, and 17% in the highest. Additionally, 35.8% of the families lived in single-parent-headed households at the time the study began. These demographic characteristics matched that of the study sites (see Dodge et al., 1990).

Procedures

Parents completed home interviews prior to the child participant's kindergarten year and during the summer after the participant's kindergarten year. Two researchers visited the home to conduct in person interviews. One research assistant interviewed the mother, and the other research assistant interviewed the child. Interviews lasted 90 minutes and included open ended and structured questions about the first five years of the child's life divided into three eras—first 12 months of life, 12 months until 1 year prior to interview, and the past year. The second interview covered the time between age 5 and age 6. Data from these time frames were used to create composite deprivation and threat index described below. Interviewers were trained for 4 weeks to a reliability of .80 or higher; training included reading interview manuals, observing interviews, and conducting interviews with a supervisor. Reliability of actual scores was assessed on 56 randomly selected, audiotaped interviews (9.6% of total) by an independent coder, and agreement was .95. The interviews included questions about the child's development and child-care history, family stressors, parenting behavior, and current child behavior. The parents were also asked about potential physical maltreatment. The interview was strategically designed to maximize disclosures of potential physical harm by framing questions in a way to minimize blame or judgment. Detailed information is available from Dodge, Pettit, and Bates, (1994). Participants were classified as "not physically abused" or "physically abused." Sixty-nine children (12% of sample) were classified as physically abused, which matched rates of physical abuse in the study areas.

During the home visit both child and parent interviewers observed the child's behavior, the home environment, and interactions between child and parent. Each interviewer independently completed a post-visit summary to describe impressions of the mother-child interactions and the environment. The inventory included items from the HOME Scale (Bradley & Caldwell, 1979, 1988). Parents completed paper and pencil measures at baseline. They were brought into a lab when youths were 14 for an in-person assessment and completed paper and pencil measures (via mail or in person) at the age 17 assessment.

Measures

Deprivation—To capture deprivation, we created a composite index of variables drawn from the in-person interviews when participants were ages 5 and 6. We computed a score based on the child and parent interviewers' post-visit impression of the child's environment. Scores were computed from the following items: "are age appropriate toys around," "is there a safe outside play area," "are 8–10 books visible," and "are 2 or more children's books visible." Both the child and the parent interviewer responded with "yes" (coded as 0 reflecting the presence of items) or "no" (coded as 1 reflecting the absence of items). We counted the item as absent in the environment for each question if either the child *or* the parent interviewer reported the item as absent (a score of 1)[1] . We created a sum index score of these 4 items across two years (maximum 8 possible). Higher index scores suggest

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[1]We tested a composition of the deprivation variable where the item was categorized as absent only if both raters agreed. The overall pattern of results was the same, see supplementary material.

environments reflecting deprivation compared to lower scores reflecting more enriched environments.

Threat—We created a composite index variable capturing threat exposures in the first 6 years of the child's life. This variable included observed interactions, coded report of physical abuse, and mother report of harsh physical discipline during in-person interviews. First, during the interviews at age 5 and 6, the child and parent observer recorded whether they witnessed any overt hostility from the mother towards the child *or* whether there were any negative physical actions from mother toward child. We assigned a score of 1 for *each* behavior (Yes) if either the child *or* parent observer recorded these behaviors; a score of 0 (No) was assigned if neither observer recorded these behaviors. Specific procedural details for interviews available in Dodge et al. (1990). Second, participants were previously coded as having experienced physical abuse in the first five years of life based on mothers' baseline interview reports (1 = yes, 0 = no). Please see Dodge et al. (1994) for classification details. Third, at the assessment in the summer following kindergarten, mothers reported on frequency of harsh physical discipline, including grabbing or shaking, spanking with hand, or spanking with object on a scale of 0 (Never), 1 (less than once a month), 2 (about once a month), 3 (about once a week), and 4 (about every day) (see Lansford et al., 2011). We assigned a score of "1" if mothers reported engaging in harsh physical discipline monthly or more frequently and "0" if it was less frequent. The total threat index score (maximum 6 possible) represents observed hostility or negative physical actions across the two in-person interviews (up to 4), presence or absence of physical abuse in the first five years of life (1), and monthly or more frequent harsh physical discipline from age 5 to age 6 (1).

Verbal and visual spatial abilities—At age 14, participants completed the Vocabulary and Block Design subscales of the Wechsler Intelligence Scale for Children-III (Wechsler, 1991). Scaled subscale scores range from 1–19. These subtests are widely use, have strong psychometric properties, and were administered according to standardized procedures. We used Vocabulary subscale scores as a proxy of verbal abilities. This subtest assesses lexical knowledge by asking participants to define specific words that increase in difficulty. We used Block Design subscale scores as a proxy of visual spatial abilities. Block Design asks children to recreate a picture that they are presented with using blocks with specific coloring (red or white) on each side.

Internalizing and externalizing problems—Internalizing and externalizing problems were reported by mothers using the Child Behavior Checklist (CBCL; Achenbach, 1991). The CBCL is a 118-item, psychometrically sound scale that assesses specific child behavior from the parent's perspective. The CBCL provides scores on two dimensions of dysfunction: Internalizing (e.g., anxiety, depression, and withdrawal) and Externalizing (e.g., aggression and impulsivity). Here we examine mother's report of externalizing and internalizing problems when the participant was 17. Additionally, in follow-up analyses we control for internalizing and externalizing problems reported by mother when participants were 5. In one analysis described below, we used the equivalent Youth Self-Report measure of internalizing problems to examine specificity of our findings.

Data Analysis

Data were prepared and descriptive and bivariate correlation analyses were conducted using SPSS Version 24.0. Path analyses were conducted using Mplus Version 7.1 (Muthén & Muthén, 2012) to examine a longitudinal mediation model predicting externalizing and internalizing problems at age 17 (see Figure 1). Model fit was assessed using a variety of indices (Kline, 2011). A Root Mean Square Error of Approximation (RMSEA) under 0.05, a Comparative Fit Index (CFI) over 0.95, and a Standardized Root Mean Square Residual (SRMR) under 0.08 indicate close fitting models (Hu & Bentler, 1999; Kline, 2011). Regression and path coefficients for direct effects are presented as standardized simple effects (z-scores). We report unstandardized beta coefficients and 95% confidence intervals for indirect paths (MacKinnon, 2008). To account for missing data (see Table 1 for rates of missingness), model testing was conducted with a full-information maximum likelihood algorithm (FIML), which uses all observed data points to create parameter estimates and standard errors. When data are missing at random, FIML approaches are unbiased, efficient, and outperform conventional listwise deletion (Enders & Bandalos, 2001).

The primary structural equation model examined the simultaneous effects of deprivation and threat prior to age 6 on externalizing and internalizing problems at age 17 through the indirect effect of verbal abilities at age 14 between the following relationships: deprivation and externalizing problems, threat and externalizing problems, deprivation and internalizing problems, and deprivation and externalizing problems (See Figure 1). These indirect effects were estimated and tested using bias corrected bootstrapping with 10,000 re-samples (Preacher & Hayes, 2008). We specified all hypothesized variables (i.e., deprivation, threat, verbal abilities, internalizing problems, and externalizing problems) in our primary model given the power of structural equation path models to capture simultaneous relationships among variables (Kline, 2015) and prior research and theory regarding the expected role of verbal abilities in the relationship between deprivation and internalizing and externalizing problems. Results are presented with sex and SES as covariates in all models.

To test the robustness of our findings, we examined four alternative models. First, we examined our main model with youth report of internalizing problems instead of parent report of internalizing problems given evidence that adolescents are better able to report on their own internalizing problems (Johnston & Murray, 2003). Second, we tested a model that includes previous internalizing and externalizing problems at age 5 as predictors of internalizing and externalizing problems at age 17. This allows us to examine whether deprivation, threat, and verbal abilities predicted internalizing and externalizing problems above and beyond early childhood externalizing and internalizing problems. Third, we examined a model identical to Model 1 with the addition of race as a predictor of internalizing and externalizing problems. Finally, we tested a model that included both verbal abilities and visual spatial abilities as competing mediators of the relationship between deprivation and threat with internalizing and externalizing problems. This allowed us to investigate whether the effects are specific to verbal abilities or more generalized intelligence.

Results

Descriptive statistics including mean, standard deviation, and percentage missing are presented in Table 1. All variables were normally distributed and within normal limits. Individuals with missing data on the externalizing or internalizing variables did not significantly differ based on baseline deprivation, $t(462) = -1.46$, $p = .14$, threat, $t(493) = -1.03$, $p = .30$, or SES, $t(568) = 0.91$, $p = .36$, scores. Individuals with complete versus incomplete data on deprivation, threat, verbal abilities, externalizing and internalizing did not significantly differ by race, $\chi^2(2) = 4.61$, $p = .10$ or biological sex $\chi^2(1) = 0.96$, $p = .33$. Individuals with incomplete data on any study variable (vs. complete data on all variables) had a lower mean SES, $t(568) = 2.93$, $p = .004$.

Zero-order correlations among study variables are also included in Table 1. In the bivariate analysis, higher scores on the threat index were significantly associated with higher internalizing and externalizing problems at age 17. Higher scores on the deprivation index were significantly associated with higher externalizing problems, but not significantly associated with internalizing problems. Higher deprivation and threat were both significantly associated with lower verbal abilities. Finally, lower verbal abilities were significantly associated with higher externalizing problems and was not significantly associated with internalizing problems.

Path Analysis Model

Model 1—The primary path model is presented in Figure 1. Four individuals only had data on the biological sex variable and were excluded from this analysis[2] . In this model, we estimated the effects of deprivation and threat among participants prior to age 6 on internalizing and externalizing problems at age 17 through verbal abilities at age 14. SES was included as a predictor of externalizing and internalizing problems. Deprivation and threat, SES and verbal abilities, and internalizing and externalizing problems were allowed to covary. Additionally, this model includes biological sex as a predictor of each variable in the model. The overall model fit was excellent, $\chi^2(4) = 6.89$, $p = .14$; CFI = .99; RMSEA = 0.04, 90%CI [0.00, 0.08]; SRMR = 0.02.

As can be seen in Figure 1, greater experiences of deprivation were associated with significantly lower verbal abilities at age 14, $\beta = -0.26$, $p < .001$. Scores on the threat index were not associated with verbal abilities at age 14, $\beta = -0.05$, $p = .31$. Lower verbal abilities were significantly associated with greater externalizing problems, $\beta = -0.16$, $p < .01$, but not internalizing problems, $\beta = -0.01$, $p = .91$. Lower SES was associated with greater externalizing problems, $\beta = -0.14$, $p < .05$, but not internalizing problems, $\beta = -0.02$, $p = .75$.

In Model 1, greater experiences of deprivation before age 6 were not directly associated with increased externalizing, $\beta = 0.01$, $p = .81$, or internalizing, $\beta = 0.01$, p = .89, problems at age 17. However, consistent with the main study hypothesis, the indirect effect of greater deprivation to higher externalizing problems via lower verbal abilities at age 14 was

[2]These individuals were missing on the deprivation and threat indices, vocabulary, and externalizing and internalizing problems.

significant, $\beta = 0.15$, 95% CI [0.04, 0.30]. In contrast, greater experiences of threat before age 6 were directly associated with significantly higher externalizing, $\beta = 0.19$, p < .01, and internalizing, $\beta = 0.18$, $p < .01$, problems at age 17, and the indirect effect from greater threat to higher externalizing problems via lower verbal abilities was non-significant, β =0.07, 95% CI [−0.05, 0.28]. There were no significant indirect effects of deprivation or threat on internalizing problems via verbal abilities, β =0.01, 95% CI [−0.08, 0.10] and β =0.003, 95% CI [−0.05, 0.09], respectively.

Alternative models—We ran four alternative models to test the sensitivity of our main findings. First, we included youth report of internalizing problems at age 17 rather than mothers' report (See Supplemental Figure 1). Overall model fit was excellent, $\chi^2(4) = 6.97$, $p = .13$; CFI = 0.99; RMSEA = 0.04, 90%CI[.00, .08]; SRMR = 0.02. The pattern of results were very similar to Model 1. Greater threat was associated with greater externalizing problems at age 17, $\beta = 0.18$, $p < .01$, but threat was not significantly associated with youth reported internalizing problems at age 17, $\beta = 0.40$, $p = .32$. Deprivation was not directly associated with youth report of internalizing problems, $\beta = 0.03$, $p = .67$, or externalizing problems, $\beta = 0.02$, $p = .75$. As in Model 1, the indirect effects of greater deprivation at age 5 on higher externalizing problems at age 17 through lower verbal abilities was significant, β = 0.15, 95% CI [0.04, 0.30].

Second, we included internalizing and externalizing problems at age 5 as predictors of internalizing and externalizing problems at age 17 (see Supplemental Figure 2). Model fit was acceptable, $\chi^2(10) = 27.53$, $p < .01$; CFI = 0.96; RMSEA = 0.06, 90%CI [0.03, 0.08]; SRMR = 0.03. Including externalizing problems at age 5 as a control did not change our results. The indirect effect of greater deprivation at age 5 on higher externalizing problems at age 17 through lower verbal abilities remained significant after controlling for age 5 externalizing problems, $\beta = 0.17$, 95% CI [0.07, 0.32]. Further, similar to Model 1, greater threat remained significantly associated with higher internalizing problems and higher externalizing problems at age 17, internalizing: $\beta = 0.13$, $p < .05$; externalizing: $\beta = 0.14$, p < .05, and these effects were not mediated by verbal abilities at age 14.

Third, we included race as a predictor of internalizing and externalizing problems at age 17 (See Supplemental Figure 3). Race was allowed to covary with verbal abilities. Model fit was excellent, $\chi^2(5) = 6.94$, $p = .23$; CFI = 0.99; RMSEA = 0.03, 90%CI [0.00, 0.07]; SRMR = 0.02. Including race did not change our results. The indirect effect of greater deprivation at age 5 on higher externalizing problems at age 17 via lower verbal abilities remained significant, $\beta = 0.15$, 95% CI [0.05, 0.31]. Similar to Model 1, higher threat scores were associated with significantly higher internalizing, $\beta = 0.17$, $p < .05$, and externalizing problems, $\beta = 0.18$, $p < .05$. These effects were not mediated by verbal abilities at age 14.

Finally, we included visual spatial abilities as a competing mediator with verbal abilities at age 14 (See Supplemental Figure 4). Model fit was acceptable, $\chi^2(5) = 14.82$, $p < 0.01$; CFI = 0.98; RMSEA = 0.06, 90%CI [0.03, 0.09]; SRMR = 0.03. The overall pattern of results was similar to Model 1. Greater deprivation was associated with lower visual spatial abilities, $\beta = −0.12$, $p < .05$. Greater threat was marginally associated with lower visual spatial abilities, $\beta = −0.05$, $p = .05$. Visual spatial abilities were not associated with

externalizing, $\beta = -0.12$, $p = .18$, or internalizing problems, $\beta = 0.002$, $p = .97$. Further, there were no significant indirect effects between threat or deprivation and internalizing or externalizing problems via visual spatial abilities. However, the indirect relationship between greater deprivation and higher externalizing problems via lower verbal abilities remained significant in this alternative model, $\beta = 0.12$, 95% CI [0.004, 0.28].

Discussion

In the current paper, we tested a model distinguishing between the dimensions of threat and deprivation (McLaughlin & Sheridan, 2016; Sheridan & McLaughlin, 2014) in a longitudinal study spanning 17 years of development. Specifically, we examined whether exposure to deprivation was associated with psychopathology via its effects on verbal abilities. Consistent with our hypotheses, greater deprivation prior to age 6 was associated with increases in externalizing problems at age 17 via decreased verbal abilities at age 14. Experiences of threat before age 6 were directly associated with internalizing and externalizing problems at age 17, but these effects were not mediated by verbal abilities. Our findings suggest that deprivation has unique influence on verbal abilities that confer risk for externalizing psychopathology and highlight the importance of distinguishing between different dimensions of childhood adversity.

Our main hypothesis was supported, demonstrating that experiences of deprivation before age 6 are related to lower verbal abilities at age 14 which then confer risk for externalizing problems at age 17. This means that not having access to a cognitively stimulating environment as indicated by lack of age appropriate books, safe play areas, and appropriate toys significantly predicts reduced verbal abilities by age 14. In turn, these reduced verbal abilities increase risk for externalizing problems, such as aggressive, hyperactive, noncompliant, and under-controlled behaviors in late teenage years even after accounting for externalizing problems in early childhood. Previous research has demonstrated that proxies of deprivation (e.g., low SES, neglect) are associated with lower verbal abilities (e.g., Hackman & Farah, 2009) and that lower verbal abilities are associated with externalizing problems throughout development (e.g., Yew & O'Kearney, 2015). Importantly, this pathway, from deprivation to externalizing psychopathology through verbal abilities was robust to controls for SES and race. This is the first study that has tested these paths together along with a model that simultaneously accounts for prior psychopathology and experiences of threat in a sample of youths followed for over 15 years longitudinally. Together, the models tested in this research study confirm the hypothesis that it is not just cumulative exposure to adversity that predicts outcomes; rather, it is the unique effects of deprivation, independent of threat experiences, on complex cognitive function that increases risk for externalizing problems.

Verbal abilities in early adolescence predicted externalizing problems at age 17 even after accounting for previous externalizing problems (Supplemental Figure 2). These results are consistent with the substantial body of work noting the robust relationship between decreased verbal ability and externalizing behaviors (Chow & Wehby, 2016). We did not find a significant relationship between verbal abilities and internalizing problems in late adolescence. Some evidence suggests that verbal abilities may be more strongly linked with

externalizing problems relative to internalizing problems in children. For example, data from the NICHD Early Child Care Research Network suggest that children with lower cognitive abilities (including verbal abilities) are more likely to be categorized as chronically externalizing compared to internalizing across 10 years of assessment during childhood (Fanti & Henrich, 2010).

Interestingly, the effect of deprivation and verbal abilities was specific to externalizing problems and not internalizing problems. DMAP does not hypothesize that deprivation and threat are each associated with unique psychopathology outcomes. Rather, the model posits different mediators of similar outcomes. Results from the current analyses do not necessarily contradict this assertion; however, future research should seek to replicate these findings, potentially in other existing longitudinal samples.

Threat exposures were related to psychopathology at age 17, but this effect was *not* mediated by verbal abilities at age 14. Consistent with past research, threat experiences were related to increased risk for internalizing and externalizing problems. However, the full paths, through verbal abilities, were not significant. This means that threat has an independent association with each of these outcomes, but threat is not related to externalizing problems through its associations with verbal abilities. These results contribute to an emerging area of research demonstrating that threat affects unique mediators from deprivation, such as emotional development and fear learning (Busso et al., 2016; Everaerd et al., 2016; Lambert et al., 2016; McLaughlin & Lambert, 2017; Sheridan et al., 2017) in addition to well-established social-information processing biases (Dodge et al., 1990). Unfortunately, we did not have access to mediators of threat and psychopathology proposed by the deprivation and threat model, such as neurobiological measures of emotional reactivity and regulation (McLaughlin & Sheridan, 2016; Sheridan & McLaughlin, 2014). It would be beneficial for future work to incorporate mediators of threat exposure and deprivation exposure in longitudinal analyses. Finally, it is noteworthy that threat was not associated with youth self-reported internalizing given some evidence that self-report may be more informative for internalizing (vs. externalizing) problems (Vazire, 2010). Further tests of DMAP will elucidate the effects of differing reporters.

There are several research implications from the current findings. Our study demonstrates the need for longitudinal studies on childhood adversity that separately test dimensions of childhood adversities such as those posited by DMAP. As others have noted (Humphreys & Zeanah, 2015; Johnson et al., 2016; Manly et al., 1994), a more dimensional approach to understanding childhood adversity may provide more explicit targets for intervention and spark future research on mechanisms linking specific types of adversity with outcomes. In contrast, cumulative risk models simply add exposures together. Results from our study demonstrate that such an approach would certainly miss the important and potentially malleable mediator of verbal abilities. Our results also demonstrate the benefits of utilizing statistical techniques that are capable of capturing simultaneous relationships among variables (Kline, 2015). Structural equation modeling represents one such tool that can be expanded further in future research to model the full DMAP with measures of both hypothesized mechanisms. This study was fortunate to have access to observational reports, self-reports, and mother reports of behavior. This type of multi-informant work is of

particular importance for complex problems such as childhood adversity. Work that integrates such assessments with biological data such as neuroimaging may provide even more information about targets for preventive interventions (Sheridan & McLaughlin, 2016).

There are important clinical implications from the current study. Salmon and colleagues (2016) argue that language skills are critical to understanding behavior problems in children as they are necessary for both self-regulation and emotional understanding/knowledge. This argument is consistent with the prevailing idea that language problems early in development have many negative downstream effects. As such, several existing interventions focus on improving verbal communication in families specifically regarding frequency and complexity of language surrounding emotions and feelings. For example, such strategies are a key focus in the Family Check Up (Dishion et al., 2014), the Incredible Years (Webster-Stratton, 2005), and Parent-Child Interaction Therapy (Thomas & Zimmer-Gembeck, 2007). Importantly, these interventions focus on early childhood and specifically on communication surrounding emotional content. Our results generally support the idea that interventions which focus on increasing verbal abilities may have positive downstream buffering effects on externalizing problems, especially among those who have experienced early deprivation. Importantly, much of the existing literature on verbal abilities and externalizing problems is focused on verbal abilities during childhood as opposed to adolescence. While early intervention is typically better (Salmon et al., 2016), it is possible that focusing on cognitive enrichment more generally, even in early adolescence may offset negative outcomes in late adolescence.

This study offers several important strengths, such as the longitudinal research design, simultaneous measurement of key variables, and actual measures of deprivation rather than proxies, but future research would benefit from addressing several imitations in the current study. First, verbal ability as measured by one vocabulary subtest is not an ideal test of mediators proposed by DMAP. Future work with more complex measures of cognitive abilities including executive functioning will provide an in-depth test of DMAP. Second, we did not have access to hypothesized mediators of threat and psychopathology—beyond the well-established social-information biases that have been documented in our own previous papers on this study (Dodge et al., 1990; Dodge, Pettit, Bates, & Valente, 1995). A future study that contains both mediators of deprivation and threat would be of particular interest in determining malleable targets for intervention. Third, we created composite index scores of deprivation from observations of the home environment by family interviewers. Importantly, past research has used proxies of deprivation rather than actual observations of the child-rearing environment. Thus, our study represents an improvement upon past work. However, future work with a combination of observational data in the home as well as self-report data would be beneficial. Similarly, we used observational and self-report data of threat experiences. While this is a strength of the current manuscript, we focus here on threat experiences only in the context of the parent-child relationship. This is likely appropriate for children in the age range we examine, but as children age, it is increasingly likely that environments outside the home will contribute to their development. These environments should also be measured. Fourth, although we think it likely that deprivation influences verbal ability, and although we have longitudinal evidence consistent with that assumption, this study cannot definitively show temporal precedence because we measured verbal

abilities in adolescence and did not measure vocabulary earlier in development, at the same time we measured deprivation. Fifth, our variables display relatively limited variability at the upper ends of the distribution (aside from verbal abilities scores). In other words, we did not have many individuals report extremely high levels of deprivation, threat, or externalizing and internalizing psychopathology. It is possible that study results may be different in more clinically severe samples. Finally, we did not have access to parental IQ or puberty at age 14 and were unable to examine each of their effects on the pathways tested in the model. Previous work has demonstrated that genetic factors link parental verbal abilities and child verbal abilities (Dale, Tosto, Hayiou-Thomas, & Plomin, 2015), and other work suggests that this effect may vary as a function of SES (Harden, Turkheimer, & Loehlin, 2007; Turkheimer, Haley, Waldron, D'Onofrio, & Gottesman, 2003). From our analysis, we were unable to test whether the verbal abilities mediation reflects genetically-based processes, psychological processes, or some combination of factors; however, the data do support a conceptual model that verbal abilities are lower in cases of early deprivation which, in turn, confer risk for externalizing problems in late adolescence.

Despite these limitations, this study offers important evidence that dimensions of adversity have differential mediators in the relationship between exposures and outcomes. In the current paper, we tested a novel model of childhood adversity that suggests that the developmental consequences of childhood adversities are at least partially distinct for experiences of threat and deprivation. Rather than simply lumping adverse experiences together in a cumulative fashion, results from the present study highlight the benefit of exploring mechanisms unique to different exposures. Results from the study provide evidence that early exposure to deprivation relates to decreased verbal abilities in early adolescence and subsequent increased risk for externalizing problems by late adolescence. This suggests specific targets, namely verbal abilities, to reduce the deleterious effects of deprivation on externalizing problems.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

References

Achenbach, TM. Manual for the Child Behavior Checklist/4–18 and 1991 profile. Department of Psychiatry, University of Vermont; Burlington, VT: 1991.

Bornstein MH, Hahn CS, Suwalsky JTD. Language and internalizing and externalizing behavioral adjustment: Developmental pathways from childhood to adolescence. Development and Psychopathology. 2013; 25(3):857–878. https://doi.org/10.1017/S0954579413000217. [PubMed: 23880396]

Bos KJ, Fox N, Zeanah CH, Nelson CA III. Effects of early psychosocial deprivation on the development of memory and executive function. Frontiers in Behavioral Neuroscience. 2009; 3:16. https://doi.org/10.3389/neuro.08.016.2009. [PubMed: 19750200]

Bousha DM, Twentyman CT. Mother–child interactional style in abuse, neglect, and control groups: Naturalistic observations in the home. Journal of Abnormal Psychology. 1984; 93(1):106. [PubMed: 6699267]

Bradley RH, Caldwell BM. Home observation for measurement of the environment: a revision of the preschool scale. American Journal of Mental Deficiency. 1979; 84(3):235–244. [PubMed: 93417]

Bradley RH, Caldwell BM. Using the home inventory to assess the family environment. Pediatric Nursing. 1988; 14(2):97–102. [PubMed: 3353146]

Bradley RH, Corwyn RF. Socioconomic status and child development. Annual Review of Psychology. 2002; 53(1):371–399. https://doi.org/10.1146/annurev.psych.53.100901.135233.

Britto, PR., Brooks-Gunn, J. Provisions of learning experiences in the home and early childhood school readiness are clearly linked; New Directions for Child and Adolescent Development. 2001. p. 1-6.https://doi.org/10.1002/cd.11

Brooks-Gunn J, Duncan GJ. The effects of poverty on children. The Future of Children / Center for the Future of Children, the David and Lucile Packard Foundation. 1997; 7(2):55–71.

Busso, DS., McLaughlin, KA., Sheridan, MA. Dimensions of adversity, physiological reactivity, and externalizing psychopathology in adolescence: deprivation and threat. Psychosomatic Medicine. 2016. Retrieved from https://www.researchgate.net/profile/Daniel_Busso/publication/305382568_Dimensions_of_Adversity_Physiological_Reactivity_and_Externalizing_Psychopathology_in_Adolescence_Deprivation_and_Threat/links/578e91b508aecbca4caad35a.pdf

Chow, JC., Wehby, JH. Associations Between Language and Problem Behavior: a Systematic Review and Correlational Meta-analysis; Educational Psychology Review. 2016. p. 1-22.https://doi.org/10.1007/s10648-016-9385-z

Dale PS, Tosto MG, Hayiou-Thomas ME, Plomin R. Why does parental language input style predict child language development? A twin study of gene–environment correlation. Journal of Communication Disorders. 2015; 57:106–117. https://doi.org/10.1016/j.jcomdis.2015.07.004. [PubMed: 26277213]

Deater–Deckard K, Chen N, Wang Z, Bell MA. Socioeconomic risk moderates the link between household chaos and maternal executive function. Journal of Family Psychology. 2012; 26(3):391–399. https://doi.org/10.1037/a0028331. [PubMed: 22563703]

Dishion TJ, Brennan LM, Shaw DS, McEachern AD, Wilson MN, Jo B. Prevention of Problem Behavior Through Annual Family Check-Ups in Early Childhood: Intervention Effects From Home to Early Elementary School. Journal of Abnormal Child Psychology. 2014; 42(3):343–354. https://doi.org/10.1007/s10802-013-9768-2. [PubMed: 24022677]

Dodge KA, Bates JE, Pettit GS. Mechanisms in the cycle of violence. Science. 1990; 250(4988):1678–1684. [PubMed: 2270481]

Dodge KA, Pettit GS, Bates JE. Effects of physical maltreatment on the development of peer relations. Development and Psychopathology. 1994; 6(01):43–55.

Dodge KA, Pettit GS, Bates JE, Valente E. Social information-processing patterns partially mediate the effect of early physical abuse on later conduct problems. Journal of Abnormal Psychology. 1995; 104(4):632. [PubMed: 8530766]

Duncan, GJ., Brooks-Gunn, J. Consequences of Growing Up Poor. Russell Sage Foundation; 1999.

Enders CK, Bandalos DL. The Relative Performance of Full Information Maximum Likelihood Estimation for Missing Data in Structural Equation Models. Structural Equation Modeling: A Multidisciplinary Journal. 2001; 8(3):430–457. https://doi.org/10.1207/S15328007SEM0803_5.

Evans GW, Gonnella C, Marcynyszyn LA, Gentile L, Salpekar N. The Role of Chaos in Poverty and Children's Socioemotional Adjustment. Psychological Science. 2005; 16(7):560–565. https://doi.org/10.1111/j.0956-7976.2005.01575.x. [PubMed: 16008790]

Evans GW, Li D, Whipple SS. Cumulative risk and child development. Psychological Bulletin. 2013; 139(6):1342–1396. https://doi.org/10.1037/a0031808. [PubMed: 23566018]

Everaerd D, Klumpers F, Zwiers M, Guadalupe T, Franke B, van Oostrom I, … Tendolkar I. Childhood abuse and deprivation are associated with distinct sex-dependent differences in brain morphology. Neuropsychopharmacology. 2016; 41(7):1716–1723. https://doi.org/10.1038/npp.2015.344. [PubMed: 26576924]

Fanti KA, Henrich CC. Trajectories of pure and co-occurring internalizing and externalizing problems from age 2 to age 12: Findings from the National Institute of Child Health and Human Development Study of Early Child Care. Developmental Psychology. 2010; 46(5):1159–1175. https://doi.org/10.1037/a0020659. [PubMed: 20822230]

Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, … Marks JS. Relationship of Childhood Abuse and Household Dysfunction to Many of the Leading Causes of Death in Adults. American Journal of Preventive Medicine. 1998; 14(4):245–258. https://doi.org/10.1016/S0749-3797(98)00017-8. [PubMed: 9635069]

Finkelhor D, Ormrod R, Turner H, Hamby SL. The Victimization of Children and Youth: A Comprehensive, National Survey. Child Maltreatment. 2005; 10(1):5–25. https://doi.org/10.1177/1077559504271287. [PubMed: 15611323]

Gaudin JM, Polansky NA, Kilpatrick AC, Shilton P. Family functioning in neglectful families. Child Abuse & Neglect. 1996; 20(4):363–377. https://doi.org/10.1016/0145-2134(96)00005-1. [PubMed: 8730772]

Gold AL, Sheridan MA, Peverill M, Busso DS, Lambert HK, Alves S, … McLaughlin KA. Childhood abuse and reduced cortical thickness in brain regions involved in emotional processing. Journal of Child Psychology and Psychiatry. 2016; 57(10):1154–1164. https://doi.org/10.1111/jcpp.12630. [PubMed: 27647051]

Hackman DA, Farah MJ. Socioeconomic status and the developing brain. Trends in Cognitive Sciences. 2009; 13(2):65–73. https://doi.org/10.1016/j.tics.2008.11.003. [PubMed: 19135405]

Harden KP, Turkheimer E, Loehlin JC. Genotype by Environment Interaction in Adolescents' Cognitive Aptitude. Behavior Genetics. 2007; 37(2):273–283. https://doi.org/10.1007/s10519-006-9113-4. [PubMed: 16977503]

Hart, B., Risley, T. Meaningful Differences in the Everyday Experience of Young American Childre. Paul H. Brookes Publishing Co; 1995.

Hildyard KL, Wolfe DA. Child neglect: developmental issues and outcomes. Child Abuse & Neglect. 2002; 26(6–7):679–695. [PubMed: 12201162]

Hines DA, Kantor GK, Holt MK. Similarities in siblings' experiences of neglectful parenting behaviors. Child Abuse & Neglect. 2006; 30(6):619–637. https://doi.org/10.1016/j.chiabu.2005.11.008. [PubMed: 16781772]

Hollingshead, W. The Hollingshead four-factor index of socioeconomic status. Yale University; New Haven, CT: 1979. Unpublished Manuscript

Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal. 1999; 6(1):1–55.

Humphreys KL, Zeanah CH. Deviations from the Expectable Environment in Early Childhood and Emerging Psychopathology. Neuropsychopharmacology. 2015; 40(1):154–170. https://doi.org/10.1038/npp.2014.165. [PubMed: 24998622]

Johnson, SB., Riis, JL., Noble, KG. State of the Art Review: Poverty and the Developing Brain. Pediatrics. 2016. peds.2015-3075. https://doi.org/10.1542/peds.2015-3075

Johnston C, Murray C. Incremental Validity in the Psychological Assessment of Children and Adolescents. Psychological Assessment. 2003; 15(4):496–507. https://doi.org/10.1037/1040-3590.15.4.496. [PubMed: 14692845]

Kauman Kantor G, Holt MK, Mebert CJ, Straus MA, Drach KM, Ricci LR, … Brown W. Development and Preliminary Psychometric Properties of the Multidimensional Neglectful Behavior Scale-Child Report. Child Maltreatment. 2004; 9(4):409–428. https://doi.org/10.1177/1077559504269530. [PubMed: 15538039]

Kline, RB. Principles and practice of structural equation modeling. 3. Vol. xvi. New York, NY, US: Guilford Press; 2011.

Kline, RB. Principles and practice of structural equation modeling. Guilford publications; 2015. Retrieved from https://books.google.com/books?hl=en&lr=&id=Q61ECgAAQBAJ&oi=fnd&pg=PP1&dq=kline+structural+equation+modeling&ots=jDnf_vudri&sig=F6Ph7WEAFoe9r4_fWZ7_pYR0Bn8

Lambert HK, King KM, Monahan KC, McLaughlin KA. Differential associations of threat and deprivation with emotion regulation and cognitive control in adolescence. Development and Psychopathology. 2016:1–12.

Lansford JE, Criss MM, Laird RD, Shaw DS, Pettit GS, Bates JE, Dodge KA. Reciprocal relations between parents' physical discipline and children's externalizing behavior during middle childhood and adolescence. Development and Psychopathology. 2011; 23(01):225–238. [PubMed: 21262050]

Linver MR, Brooks-Gunn J, Kohen DE. Family processes as pathways from income to young children's development. Developmental Psychology. 2002; 38(5):719–734. [PubMed: 12220050]

Lonigan, CJ., Spiegel, JA., Goodrich, JM., Morris, BM., Osborne, CM., Lerner, MD., Phillips, BM. Does Preschool Self-Regulation Predict Later Behavior Problems in General or Specific Problem Behaviors?; Journal of Abnormal Child Psychology. 2017. p. 1-12.https://doi.org/10.1007/s10802-016-0260-7

MacKinnon, DP. Introduction to statistical mediation analysis. Routledge Academic; 2008.

Manly JT, Cicchetti D, Barnett D. The impact of subtype, frequency, chronicity, and severity of child maltreatment on social competence and behavior problems. Development and Psychopathology. 1994; 6(1):121–143.

McLaughlin KA, Greif Green J, Gruber MJ, Sampson NA, Zaslavsky AM, Kessler RC. Childhood adversities and first onset of psychiatric disorders in a national sample of US adolescents. Archives of General Psychiatry. 2012; 69(11):1151–1160. https://doi.org/10.1001/archgenpsychiatry. 2011.2277. [PubMed: 23117636]

McLaughlin KA, Lambert HK. Child trauma exposure and psychopathology: mechanisms of risk and resilience. Current Opinion in Psychology. 2017; 14:29–34. https://doi.org/10.1016/j.copsyc. 2016.10.004. [PubMed: 27868085]

McLaughlin KA, Sheridan MA. Beyond Cumulative Risk: A Dimensional Approach to Childhood Adversity. Current Directions in Psychological Science. 2016; 25(4):239–245. https://doi.org/10.1177/0963721416655883. [PubMed: 27773969]

McLaughlin KA, Sheridan MA, Lambert HK. Childhood adversity and neural development: Deprivation and threat as distinct dimensions of early experience. Neuroscience & Biobehavioral Reviews. 2014; 47:578–591. https://doi.org/10.1016/j.neubiorev.2014.10.012. [PubMed: 25454359]

Muthén, LK., Muthén, BO. Mplus User's Guide. 7. Los Angeles, CA: Muthén & Muthén; 2012.

Nelson CA, Zeanah CH, Fox NA, Marshall PJ, Smyke AT, Guthrie D. Cognitive recovery in socially deprived young children: the Bucharest Early Intervention Project. Science (New York, NY). 2007; 318(5858):1937–1940. https://doi.org/10.1126/science.1143921.

Nigg, JT., Huang-Pollock, CL. An early-onset model of the role of executive functions and intelligence in conduct disorder/delinquency. 2003. Retrieved from http://psycnet.apa.org/psycinfo/2003-88137-008

Noble KG, McCandliss BD, Farah MJ. Socioeconomic gradients predict individual differences in neurocognitive abilities. Developmental Science. 2007; 10(4):464–480. https://doi.org/10.1111/j.1467-7687.2007.00600.x. [PubMed: 17552936]

Noble KG, Norman MF, Farah MJ. Neurocognitive correlates of socioeconomic status in kindergarten children. Developmental Science. 2005; 8(1):74–87. https://doi.org/10.1111/j.1467-7687.2005.00394.x. [PubMed: 15647068]

Noble KG, Wolmetz ME, Ochs LG, Farah MJ, McCandliss BD. Brain-behavior relationships in reading acquisition are modulated by socioeconomic factors. Developmental Science. 2006; 9(6):642–654. https://doi.org/10.1111/j.1467-7687.2006.00542.x. [PubMed: 17059461]

Petersen IT, Bates JE, D'Onofrio BM, Coyne CA, Lansford JE, Dodge KA, … Van Hulle CA. Language ability predicts the development of behavior problems in children. Journal of Abnormal Psychology. 2013; 122(2):542–557. https://doi.org/10.1037/a0031963. [PubMed: 23713507]

Pollak SD, Cicchetti D, Hornung K, Reed A. Recognizing emotion in faces: developmental effects of child abuse and neglect. Developmental Psychology. 2000; 36(5):679–688. [PubMed: 10976606]

Pollak SD, Tolley-Schell SA. Selective attention to facial emotion in physically abused children. Journal of Abnormal Psychology. 2003; 112(3):323–338. [PubMed: 12943012]

Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behavior Research Methods. 2008; 40(3):879–891. [PubMed: 18697684]

Rhee SH, Friedman NP, Corley RP, Hewitt JK, Hink LK, … Johnson DP, et al. An examination of the developmental propensity model of conduct problems. Journal of Abnormal Psychology. 2016; 125(4):550. [PubMed: 26653135]

Salmon K, O'Kearney R, Reese E, Fortune CA. The Role of Language Skill in Child Psychopathology: Implications for Intervention in the Early Years. Clinical Child and Family Psychology Review. 2016; 19(4):352–367. https://doi.org/10.1007/s10567-016-0214-1. [PubMed: 27678011]

Sheridan MA, McLaughlin KA. Dimensions of early experience and neural development: deprivation and threat. Trends in Cognitive Sciences. 2014; 18(11):580–585. https://doi.org/10.1016/j.tics.2014.09.001. [PubMed: 25305194]

Sheridan MA, McLaughlin KA. Neurobiological models of the impact of adversity on education. Current Opinion in Behavioral Sciences. 2016; 10:108–113. https://doi.org/10.1016/j.cobeha.2016.05.013. [PubMed: 29046891]

Sheridan MA, Peverill M, Finn AS, McLaughlin KA. Dimensions of childhood adversity have distinct associations with neural systems underlying executive functioning. Development and Psychopathology. 2017 in press.

Smyke AT, Koga SF, Johnson DE, Fox NA, Marshall PJ, Nelson CA. … BEIP Core Group. The caregiving context in institution-reared and family-reared infants and toddlers in Romania. Journal of Child Psychology and Psychiatry, and Allied Disciplines. 2007; 48(2):210–218. https://doi.org/10.1111/j.1469-7610.2006.01694.x.

Thomas R, Zimmer-Gembeck MJ. Behavioral Outcomes of Parent-Child Interaction Therapy and Triple P—Positive Parenting Program: A Review and Meta-Analysis. Journal of Abnormal Child Psychology. 2007; 35(3):475–495. https://doi.org/10.1007/s10802-007-9104-9. [PubMed: 17333363]

Tibu, F., Sheridan, MA., McLaughlin, KA., Nelson, CA., Fox, NA., Zeanah, CH. Disruptions of working memory and inhibition mediate the association between exposure to institutionalization and symptoms of attention deficit hyperactivity disorder; Psychological Medicine. 2015. p. 1-13.https://doi.org/10.1017/S0033291715002020

Turkheimer E, Haley A, Waldron M, D'Onofrio B, Gottesman II. Socioeconomic status modifies heritability of IQ in young children. Psychological Science. 2003; 14(6):623–628. https://doi.org/10.1046/j.0956-7976.2003.psci_1475.x. [PubMed: 14629696]

Vazire S. Who knows what about a person? The self-other knowledge asymmetry (SOKA) model. Journal of Personality and Social Psychology. 2010; 98(2):281–300. https://doi.org/10.1037/a0017908. [PubMed: 20085401]

Webster-Stratton, C. The Incredible Years: A training series for the prevention and treatment of conduct problems in young children. In: Hibbs, Jensen, PS., editors. Psychosocial Treatments for Child and Adolescent Disorders: Empirically Based Strategies for Clinical Practice. Vol. 2. 2005. p. 507-555.

Wechsler, D. WISC-III: Wechsler intelligence scale for children: Manual. Psychological Corporation; 1991.

Yew SGK, O'Kearney R. Emotional and behavioural outcomes later in childhood and adolescence for children with specific language impairments: meta-analyses of controlled prospective studies. Journal of Child Psychology and Psychiatry, and Allied Disciplines. 2013; 54(5):516–524. https://doi.org/10.1111/jcpp.12009.

Yew SGK, O'Kearney R. The role of early language difficulties in the trajectories of conduct problems across childhood. Journal of Abnormal Child Psychology. 2015; 43(8):1515–1527. [PubMed: 26105208]

General Scientific Summary

This study highlights the importance of studying dimensions of childhood adversity to understand increased risk for psychopathology rather than tallying the total number of adverse experiences, regardless of type. In this study, deprivation in early childhood, but not threat, was associated with externalizing psychopathology in late adolescence via lower verbal abilities in early adolescence.
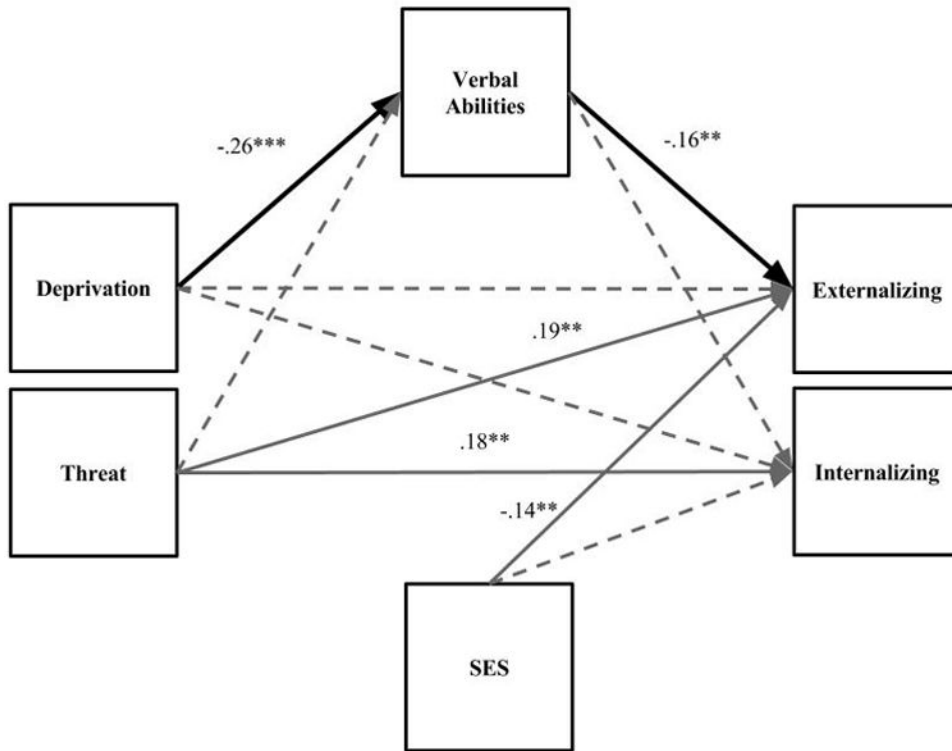
Figure 1.
Path model depicting direct relationships for deprivation, threat, verbal abilities. SES, and externalizing/internalizing problems. The indirect effect of deprivation to externalizing problems via verbal abilities is significant, beta = 0.15. 95% CI [0.04, 0.30]. The indirect effect of threat to externalizing problems via verbal abilities is nonsignificant, beta = 0.07, 95% CI (−0.05, 0.28]. This model adjusts for the covariance of deprivation and threat, socioeconomic status (SES) and verbal abilities, and externalizing and internalizing problems, and controls for sex.

– – – – – – Non-significant path

——————— Significant path

——————— Significant indirect effect

*p < .01

**p < .01

***p < .001

Table 1

Bivariate correlations and descriptive statistics of main study variables

	1.	2.	3.	4.	5.	6.	7.
1. Sex	-						
2. Race	.02	-					
3. Vocabulary	−.08	−.38***	-				
4. Threat	−.03	.05	−.12***	-			
5. Deprivation	−.06	.38***	−.28***	.27***	-		
6. Externalizing Problems	−.01	.15***	−.24***	.22***	.16***	-	
7. Internalizing Problems	.15***	−.02	−.06	.17***	.06	.62***	-
N	585	585	428	495	464	448	446
Mean	-	-	9.83	.63	2.58	8.28	6.72
Standard Deviation	-	-	3.58	.91	2.1	7.72	6.28
Range	-	-	1–19	0–6	0–8	0–43	0–32
Percentage Missing	0%	0%	26.8%	15.4%	20.7%	23.4%	23.8%

Note. Sex, Male = 0, Female = 1; Race, White = 0 (81.5%), Nonwhite = 1 (18.5%).

***
$p < .001$.