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Direct and Indirect Effects of Child Abuse and Environmental Stress: A Lifecourse Perspective on Adversity and Depressive Symptoms

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Abstract

There is a great deal of evidence about the mental health implications of physical child abuse and environmental stressors, or hardships that people experience at the household and neighborhood level (e.g., neighborhood violence; economic hardship, substance abuse, or conflict among family members). Yet, studies often focus on either abuse or environmental stress, not both, or else examine abuse and environmental stressors as a combined set of experiences. Less is known, therefore, about how child abuse and environmental stress might work as either distinct or inter-related risks to diminish mental health over time. In this longitudinal study, we used path analyses to examine the cumulative effects of physical child abuse and environmental stressors on adult depressive symptoms among a sample of children followed into adulthood (N = 356). The goal was to assess whether chronic physical child abuse remains an independent predictor of adult outcomes once we accounted for the cumulative effects of household and neighborhood stressors across the lifecourse. Cumulative measures of physical child abuse and environmental stress each independently predicted a higher likelihood of adult depressive symptoms ($\beta = .122$, $p < .01$ and $\beta = .283$, $p < .001$, respectively). After accounting for adolescent depressive symptoms, only cumulative environmental stressors independently predicted depressive symptoms ($\beta = .202$, $p < .001$). Tests of the indirect effect of cumulative environmental stress on the relationship between cumulative

physical abuse and adult depressive symptoms were marginally statistically significant.

Results add to literature that examines child abuse, adversity, and lifecourse perspectives on health.

In investigating the independent and joint contributions of chronic child abuse and repeated stress, findings from this study demonstrate the cumulative effects that each risk factor has on mental health across the lifecourse. Results underscore the need for simultaneous investigation of abuse and stress, and for prevention initiatives that both address the risks and effects of child abuse within individuals and that support the well-being of neighborhoods and families.

Introduction

Depression is a leading cause of morbidity and mortality in adults, and by 2030 is expected to be the primary contributor to the global burden of disease (Ferrari et al., 2013; Lepine & Briley, 2011; World Health Organization, 2008). Depression not only lessens one's quality of life, it also increases risks for suicide and serious health problems, including cardiovascular disease (Ferrari et al., 2013; Lepine & Briley, 2011; World Health Organization [WHO], 2008).

Physical child abuse is a well-established risk factor for depression in youth and adults (Duncan, Saunders, Kilpatrick, Hanson, & Resnick, 1996; Norman, et al., 2012). One systematic review found that adults who had experienced physical child abuse were at a significantly higher risk for depressive disorders when compared to those who had not experienced abuse (OR= 1.54; 95% CI 1.16-2.04) (Norman, et al., 2012). Studies also point to the connections between depression and environmental stressors, or stressors that are not direct manifestations of violence against oneself as with abuse, but rather represent ongoing challenges within one's neighborhood (e.g., crime) or household (e.g., family problems with substance abuse, financial problems, marital discord, or mental illness) (Goosby, 2013; Hazel et al. 2008; Herrenkohl et al. 2009; Kim, 2008; Morales & Guerra, 2006; Mossakowski, 2009; Olstad et al. 2001; Raposa et al. 2014).

The effects of both abuse and environmental stressors on development and well-being are most evident when people experience these hardships over multiple timepoints (DeBellis et al., 2014; English et al. 2005; Hammen, 2005; Jaffee & Maikovich-Fong, 2011; Lupien et al. 2009). Evidence about the long-term effects of chronic stress are

supported by theoretical notions about how stress becomes “toxic” as it is experienced repeatedly (Shonkoff et al. 2012). According to one perspective, repeated stress impairs the brain’s ability to effectively regulate stimuli. Biological responses to occasional, moderate levels of stress are sometimes adaptive, resulting in allostasis, or equilibrium. However, when high levels of stress are experienced over extended periods of time (e.g., years), physiological responses can become maladaptive, as the main response system within the brain, the limbic-hypothalamic-pituitary-adrenal axis, no longer functions as it should (De Bellis & Zisk, 2014; Heim et al. 2008). A dysregulation of stress hormones leads to changes in mood, behavior, and immune response, which places an individual at-risk for the onset of physical and mental health disorders (De Bellis & Zisk, 2014; Heim et al. 2000; McEwen, 2000, 2007; Miller et al. 2008; Odgers & Jaffee, 2013; Shonkoff et al. 2012).

The Adverse Childhood Experiences (ACE) study, one of the largest investigations into the cumulative effects of early adversity on later well-being, is perhaps the best known study providing evidence about how cumulative stress increases the risks for outcomes like depression (Centers for Disease Control and Prevention [CDC], 2014; Felitti, et al. 1998; Turner & Butler, 2003). In an early paper from the ACEs study, Felitti, et al. (1998) found that, while one ACE predicted an odds for depression of 1.5, two ACEs raised the odds to 2.4, and four or more ACEs resulted in an even higher odds of 4.6. Studies that focus on adverse childhood experiences highlight not only the effects of cumulative adversity, but also how stressors like child abuse, neighborhood discord, and family problems with relationships, substance abuse, or police tend to co-occur (Felitti, et al., 1998; Horan & Widom, 2014). In one study, 86% of those

who had experienced physical abuse in childhood also experienced another kind of ACE (e.g., substance abuse, mental illness, or imprisonment among members of their household) (Felitti, et al., 1998). Similarly, Horan and Widom's (2014) prospective study of 908 individuals found that child abuse and neglect significantly correlated with multiple other stressors within the household, such as substance abuse, arrest, or economic stress.

There are advantages of a cumulative index of adversity that combines the stressor of child abuse (psychological, physical, and sexual) alongside other household stressors (e.g., familial substance abuse, mental illness, or criminal behavior), including the ability of such measures to help establish a dose-response relationship between stressors and a variety of poor outcomes. Yet, because these types of studies primarily focus on how more experiences predict worse outcomes, the summative measures used in ACE studies (and other studies with a similar design with regards to measuring accumulated adversities) also have disadvantages. Aggregate indices assume overlapping experiences of environmental stressors and physical abuse result in simple additive effects, such that depression and other disorders are more likely when an individual is exposed to an increasing number of stressors, regardless of the nature or severity of the stressor or how stressors might correlate and work together to affect outcomes (Evans, 2013; McLaughlin, 2010; Schilling, Aseltine, & Gore, 2008).

There is evidence that child abuse and environmental stressors such as neighborhood conflict, or family mental illness and substance abuse are conceptually separable and independently predictive of mental health and behavioral outcomes (Finkelhor, Shattuck, Turner, & Hamby, 2013; Fletcher, 2009; Herrenkohl & Herrenkohl,

2007; Horan & Widom, 2015; Springer et al. 2007). Yet, summative indices leave relatively unexplored the question of how strongly child abuse remains an independent predictor of later outcomes once we've accounted for other stressors within the neighborhood or household environment. For example, Horan and Widom (2014) found that child abuse and neglect had a significant independent effect on adult anxiety and depression, over and above the effect of the childhood environmental stressors contained in a cumulative risk index they had constructed, which included items such as household financial difficulties, substance abuse, and problems with police. Similarly, Springer, et al. (2007) found that childhood physical abuse had significant independent effects on depression net of the effects of environmental stressors in childhood (e.g., income and four measures of parental problems, including issues with drinking, the marital relationship, as well as violence between or separation of the parents). While the studies referenced here are limited in that they do not examine the re-occurrence of environmental stress throughout the life course, their results nonetheless point to the importance of parceling out abuse to examine it apart from the types of stress that occur within people's environmental contexts. Determining the risks of poor outcomes attributable to the stress of abuse versus the stress that occurs within one's environment to determine what (if any) unique effects we might see of one or the other will help expand the base of knowledge upon which we can build future research and interventions (Nurius, Logan-Greene, & Green, 2012; Schilling, Aseltine, & Gore, 2008).

Furthermore, the risks of child abuse and environmental stressors might operate in tandem to reduce adult psychosocial functioning, with one risk serving to either mediate or moderate the effects of the other. Given, for instance, what is known about the

detrimental role of child abuse and stress, one might expect that the effects of child abuse on later health might depend, at least in part, on the level of stress one encounters within their daily lives. Yet, only a very limited number of studies have used moderation to examine the hypothesis that the long-term effects of child abuse depends on how much environmental stress people encounter, and these had mixed results. One cross-sectional study found that the presence of current life stressors (e.g., difficulties with finances or relationships) nearly doubled the effects of child abuse on health problems in adulthood (Cromer & Sachs-Ericsson, 2006). By contrast, Horan and Widom (2014) found that the relationship between childhood abuse and later mental health symptoms did not depend on the values of their cumulative childhood risk index.

The rare study that tested stressful life events as both a moderator and a mediator of child emotional abuse (a cross-sectional study of 208 undergraduate students) found that stressful life events (measured with a 53-item scale of hassles in the past week) mediated, but did not moderate, the effect of child emotional abuse on depression (Uhrlass & Gibb, 2007). In line with this finding, there is more evidence that child abuse is mediated by environmental stress in the prediction of adult depression. For example, Kessler and Magee (1994) found that chronic interpersonal stress significantly mediated the effects of childhood violence on recurrence of depression in adulthood (Kessler & Magee, 1994). In another study, Vranceanu et al. (2007) found that stressors in the household mediated the relationship between a woman's exposure to childhood maltreatment and her later risk of depression in adulthood.

In sum, while the basic associations of physical abuse and environmental stressors with depression are relatively well documented in cross-sectional studies, there has been

very little comparative, prospective research that helps to establish which is the more salient predictor of adult depression. There is also little research that examines if the accumulation of environmental stress throughout the lifecourse might mediate or moderate the effects of child abuse on later outcomes, further limiting understanding of potentially important developmental pathways leading to depression. Questions therefore remain as to how long-term effects of physical child abuse and cumulative environmental stress independently and together relate to later depression. The goal of the current study is, therefore, to examine measures of cumulative physical child abuse collected at two timepoints in childhood alongside measures of cumulative environmental stressors collected in childhood, adolescence, and adulthood to establish how each predicts depressive symptoms in adults. Analyses investigate: (1) the main effects of cumulative physical abuse and cumulative environmental stress on adult depressive symptoms; (2) whether cumulative environmental stressors moderate the effect of cumulative physical abuse on adult depressive symptoms; and (3) whether cumulative environmental stressors mediate the effect of cumulative physical child abuse on adult depressive symptoms.

Methods

Sample

Data are from the Lehigh Longitudinal Study (Herrenkohl et al. 2013). The study began in 1976 with 457 children ages 18 months to 6 years of age. Data were subsequently collected when children were in elementary school (average age was 8 years), adolescence (average age was 18 years), and adulthood (average age was 36 years). Study procedures were approved by the Human Subjects Division at the

University of Washington and the Office of Research and Sponsored Programs at Lehigh University.

Children and their parents were recruited from child welfare programs, Head Start centers, and childcare programs in a 2-county (urban/suburban and rural) area of Pennsylvania. The children were in one of several group settings (e.g., day care, Head Start, programs for handicapped children, Home Start programs, nursery school programs). Attention was given to group composition on the basis of child gender and age. The sample was also arranged to reflect diversity in the socioeconomic status (SES) of participating families.

The original study sample (N = 457) was 54% male and 80.7% (n = 369) White, 11.2% (n = 51) more than one race, 5.3% (n = 24) Black or African American, 1.3% (n = 6) American Indian/Alaska Native, 1.3% (n = 6) unknown, and 0.2% (n = 1) Native Hawaiian or Other Pacific Islander. 86% of the families were from two-parent households. 63% of families in the mid-1970s earned below \$700 per month (about 60% of the sample would be considered poor according to the income-to-needs ratio and poverty threshold set by the United States Census Bureau in 1976 (n.d.)).

Approximately 91% of the original 457 child participants were reassessed in adolescence (n = 416). Tests of differential attrition in the adolescent wave of the study showed the percentage lost to attrition varied somewhat across groups: child welfare abuse (13.9%), child welfare neglect (10.5%), Head Start (7.1%), day care (4.7%), and middle-income nursery (8.1%), although these percentages overall did not differ significantly ($\chi^2 > .05$). Tests of selective attrition found no significant differences in

childhood SES, physically abusive discipline used by parents, or childhood exposure to domestic violence for attriters versus nonattriters.

In the fourth wave of (adult) data collection (average age = 36; n = 357), the sample remained gender balanced: 171 (47.9%) females and 186 (52.1%) males. While more of the original child welfare abuse group was lost to attrition, analyses have shown no significant group differences in gender, age, childhood SES, or observer ratings of neglect or parent-reported physically abusive discipline.

Measures

Cumulative physical child abuse. To create the variable for cumulative physical abuse, a first step was to score the data to reflect the presence or absence of physical abuse assessed over two consecutive waves of the study. We used a scale from the preschool and school-age waves that one caregiver (usually the mother) responded to yes/no questions about whether or not any of three potential caregivers (mother, father, other) used nine practices of severe physical abuse (e.g., biting or slapping a child in such a way that it bruised; burning a child; hitting a child with a stick or paddle, or a strap, rope, or belt). Previous analysis of this dataset have found that maternal reports of abuse had a high predictive validity (Tajima, Herrenkohl, Huang, & Whitney, 2004). During the preschool wave of data collection, the respondent (again, mostly mothers) reported on the previous 3 months, and in the school-age wave of the study, they reported on practices in the past year. Since the respondent was reported on disciplining practices used by three potential people (again, mother, father, other), for each of the two time periods, a child's score for physical abuse for each timepoint could range from 0 to 27.

To create an index of physical abuse so that we could examine our hypotheses, which focused on chronicity of severe physical abuse, we needed to create a new variable to reflect the number of timepoints (0, 1, or 2) that high rates of severe physical abuse was experienced. This involved first creating dichotomous variables from the continuous, timepoint specific variables so that we could represent in a yes/no manner if frequent, severe physical abuse occurred at each timepoint (Evans, Li, & Whipple, 2013). Following the suggestions of Farrington and Loeber (2000), who documented the advantageous use of dichotomization and the usefulness of a 25%/75% split, we recoded each indicator variable of severe physical abuse for each wave to differentiate individuals in the top 25% of the score distribution (i.e., those with frequently occurring abuse) from those in the lower 75% (those with less frequently occurring abuse). The newly dichotomized variables were then summed to create a count of the number of timepoints in which participants frequently experienced severe physical abuse. Scores on this measure ranged from 0 to 2, where 0 represents the absence of frequent, severe physical abuse at both waves; 1, the presence of frequent, severe physical abuse at a single wave; and 2, the presence of frequent, severe physical abuse at both the preschool and schoolage waves. 8.3% of our sample experienced severe physical abuse at both timepoints; 33% at only one timepoint; and 58.6% at neither timepoint.

Cumulative environmental stress. To create a cumulative stress variable that represented the number of timepoints in which people experienced high environmental stress across multiple domains we followed a similar procedure. We used stress indices from the school-age wave (items were reported by mother) and from the adolescent and adult waves (items were self-report). We did not use the stress index from the preschool

wave because of measurement differences. To ensure that our indicators and overall measure conformed to conceptually meaningful constructs, we modeled the construction of this measure after Felitti et al.'s analysis of adverse experiences in childhood (Felitti et al. 1998). We determined six domains of stress that were similar at all three time points (school-age [T2], adolescence [T3], and adulthood [T4]): neighborhood crime, economic stress (unemployment or an increase in bill collectors), family conflict/separation, household substance abuse, emotional/mental problems in household, and household trouble with police/incarceration. For a few of the domains, multiple items indicated the particular stressor (for instance, family economic stress at each time point could be signaled by either unemployment or bill collectors or foreclosure of mortgage or loan); thus, for domains that had more than one indicator, participants scored a 1 if they responded affirmatively to any of the items within that domain (Felitti et al. 1998). From these six domains, we created time-point specific cumulative stress scores; at each time point participants could have a score of between 0 to 6, representing the number of domains of stress they experienced at that time point.

Next, we dichotomized the time-point specific cumulative environmental stress scores into high (those in the top 25th percentile) and low (those in the bottom 75th percentile) frequency of stress (again, following the suggestions of Farrington & Loeber, 2000). Finally, we added the dichotomous scores to create a count of how many periods of high stress were experienced – 0 (no timepoint), 1 (one timepoint), 2 (two timepoints), or 3 (three timepoints). Dichotomous stress scores were highly correlated ($p < .001$) between adjacent timepoints (school age and teen $r = .212$; teen and adult $r = .345$), but school age and adult scores were not significantly correlated. The dichotomous stress

scores were all highly correlated ($p < .001$) with the final score of cumulative stress (school age $r = .648$; adolescent $r = .733$; adult $r = .686$).

Depressive symptoms. Data from the Beck Depression Inventory (BDI) (Beck et al. 1988) were collected at two time points – in adolescence and in adulthood. It is a 21-item scale including items such as sadness, discouragement about the future, feeling like a failure, disappointed in self, crying more than usual, loss of interest in other people, and sleep and appetite problems. Respondents answered using a scale of 0 to 3, with higher scores on a possible range from 0 to 63 indicating more depressive symptoms.

Cronbach's alpha for adult depressive symptoms was .91, and in adolescence it was .83.

Covariates. Gender and socio-economic status (SES) were included as covariates (Batten et al. 2004; Dunn, 2012; Fletcher, 2009; Gilbert et al. 2009). Gender was coded 0 = female, 1 = male. SES, a continuous composite variable consisting of parents' occupational status, educational level, family income, and total rooms in the family's home, was meaningfully distinct from our measure of environmental stress. Due to strong relationships between depressive symptoms in adolescence and adulthood (Kendler et al. 2002), adolescent depressive symptoms was used as a covariate in our second model.

Analyses

Data were analyzed using MPlus, Version 7 (Muthén & Muthén, 1998-2012). Regression analysis was used to examine the first two hypotheses: (1) that cumulative physical abuse and cumulative stress would each independently predict adult depressive symptoms, and (2) that cumulative stress would moderate the relationship between cumulative physical abuse and adult depressive symptoms. In the test for moderation, mean-centered variables were used to create the interaction term (Frazier et al. 2004).

Variables were entered into a regression equation in the following order: the independent variable (cumulative physical abuse in childhood), the moderator (cumulative environmental stress), and the interaction term (cumulative severe physical abuse in childhood x cumulative environmental stress) (Frazier et al. 2004). The first model tested the influence of cumulative physical abuse and cumulative environmental stress, using the covariates of gender and SES. The second model simultaneously tested the influence of cumulative physical abuse, cumulative environmental stress, and the interaction between repeated cumulative physical abuse and cumulative environmental stress on adult depressive symptoms, using gender, SES, and adolescent depressive symptoms as covariates.

To test our third hypothesis, that cumulative environmental stress mediates the relationship between cumulative physical abuse and adult depressive symptoms, we ran path analyses. The initial model provided a follow-up test for the direct effects of cumulative physical abuse and cumulative environmental stress on adult depressive symptoms, and also examined whether cumulative environmental stress mediated the relationship between cumulative physical abuse and adult depressive symptoms. In a subsequent model, adolescent depressive symptoms was added to the model to account for the stability of depressive symptoms over time (Kendler et al. 2002) and the coefficients for other variables re-estimated. To account for skewed data and nesting of children within families within both models, we used the MLR (maximum likelihood estimation with robust standard errors) estimator with the `type = complex` command in Mplus (Muthén & Muthén, 1998-2012; Schafer & Graham, 2002). Statistical significance

of the indirect effect was tested using the bias-corrected bootstrapping method in MPlus (MacKinnon et al. 2007; Muthén & Muthén, 1998-2012).

Results

Means, standard deviations, and correlations for our study variables are shown in Table 1. Scores on adult depressive symptoms ranged from 0 to 52, with a mean of 9.76. Most (59.5%) of our adult sample had not experienced severe physical abuse at any time point; 32.7% experienced severe physical abuse at one time point; and 7.8% experienced severe physical abuse at two time points. Nearly 34% of the adult sample did not experience high environmental stress at any time point; 34.2% experienced high environmental stress at one time point; 22.2% at two time points; and 9.6% at three time points.

Results from the regression analyses (Table 2) showed that, after controlling for gender, SES, and depressive symptoms in adolescence, cumulative physical abuse in childhood and cumulative environmental stress each independently predicted adult depression ($\beta = .084$, $p < .05$; $\beta = .202$, $p < .001$, respectively). The interaction term was not statistically significant, indicating that cumulative environmental stress did not moderate the effect of cumulative severe physical abuse in childhood on adult depressive symptoms.

To address the question of whether cumulative environmental stress mediates the effect of cumulative physical abuse on adult depressive symptoms, path analyses were conducted. The two-path models (the initial model and the more stringent model that added adolescent depressive symptoms) both had all possible paths estimated and, therefore, were just identified (i.e., $\chi^2 = 0.000$, $df = 0$). In the initial model (Figure 1),

cumulative physical child abuse predicted cumulative environmental stress ($\beta = .094$, $p < .05$) and both predicted adult depressive symptoms ($\beta = .122$, $p < .01$ and $\beta = .283$, $p < .001$, respectively). A test of the indirect effect of cumulative environmental stress on the relationship between cumulative physical abuse and depressive symptoms in adulthood was marginally statistically significant ($\beta = 0.027$, $p = .068$) 95% CI [-.001, .055]; 90% CI [.003, .050]. Variables in the model explained 14% of the variance in adult depressive symptoms ($r^2 = .14$; $p < .001$).

In the subsequent model (Figure 2), adolescent depressive symptoms was the strongest predictor of adult depressive symptoms ($\beta = .350$, $p < .001$). Cumulative environmental stress remained a statistically significant independent predictor of adult depressive symptoms ($\beta = .202$, $p < .001$), and significantly predicted adolescent depressive symptoms ($\beta = .256$, $p < .001$). The effect of cumulative physical abuse in childhood on adult depressive symptoms was reduced in this model, although it remained marginally significant ($\beta = .084$, $p = .066$). A test of the indirect effect of cumulative environmental stress on the relationship between cumulative physical abuse and depressive symptoms in adulthood was marginally statistically significant ($\beta = 0.019$, $p = .083$) 95% CI [-.002, .040]; 90% CI [.001, .036]. Variables explained 24% of the variance in adult depressive symptoms ($r^2 = .240$; $p < .001$).

Discussion

In this study, we tested three hypotheses: (1) that cumulative physical abuse and cumulative environmental stress would predict adult depressive symptoms and that repeated environmental stress would (2) moderate or (3) mediate the effect of cumulative physical abuse on adult depressive symptoms. Overall, results from this study

demonstrate the lasting impacts of physical child abuse and environmental stress over the lifecourse. Our findings therefore add some important dimensions to knowledge about the relationships between chronic experiences of adversity and adult depression. We discuss each set of results below, reflecting back to the literature and indicating some potential areas for future research. This is followed by a discussion of the limitations of this study. We end with a short exploration of the implications of our findings for practice, especially with regards to interventions aimed at promoting well-being through addressing the wide-scale conditions within people's living environments that undergird well-being.

Results supported the first research hypothesis; both cumulative environmental stress and cumulative physical child abuse independently predicted more depressive symptoms in adulthood. In each path model, cumulative environmental stress was a stronger predictor of later depressive symptoms than cumulative severe physical child abuse. When the continuity of depressive symptoms over time was modeled, only cumulative stress predicted a change in depressive symptoms from adolescence to adulthood, likely due to the high stability of depressive symptoms across timepoints (Kendler et al. 2002).

Our second hypothesis was that cumulative environmental stress, that is environmental stress within one's neighborhood or household that is experienced at more than one timepoint across the lifecourse, would moderate the effect of chronic physical abuse on adult depressive symptoms. Tests of moderation did not support the second hypothesis; in our regression models, cumulative stress did not moderate the relationship between cumulative physical abuse and adult depressive symptoms. This is surprising,

given that it was expected that the mental health effects of child abuse would be intensified for those who repeatedly experience environmental stress, although our results echo those from one study that found that environmental stress acted to mediate, not moderate, the effects of early abuse on depressive symptoms (Uhrlass & Gibb, 2007).

Our third hypothesis was that cumulative environmental stress acts as a mediator to account in full or part for the relationship between cumulative abuse and later depressive symptoms (Uhrlass & Gibb, 2007; Vranceanu et al. 2007). We found a marginally significant mediation effect for environmental stress in our first model. While only marginally significant, these findings, taken alongside the body of literature on the topic, might indicate that environmental stress could be part of a progressive sequela whereby adversity promotes an increased propensity for, and/or a heightened psychological sensitivity to, later stressful experiences that generate depression (Hammen, 2005; Kendler et al. 2004; Liu & Alloy, 2010; Monroe & Harkness, 2005; Post, 1992). In this way, results of this study contribute to developing theories about adversity and depression. Our findings also suggest many more questions about the temporal and causal chains related to adversity and depressive symptoms, pointing to the need for continued exploration about the connections between abuse, stress, and mental health. Further research is needed, however, as indirect effects were only marginally significant in this study.

Limitations of this study include challenges regarding the timing of some of our variables. The temporal overlap of the hypothesized mediator (cumulative environmental stress) with the independent variable (cumulative physical child abuse) and the outcome of the study (depressive symptoms in adulthood) is an important limitation. Ideally,

studies would assess adversities across developmental periods that are distinct from the outcome. This would, however, require even longer-term data (which we do not yet have available) to push the outcome back. We could have summarized chronicity over fewer waves, using only school age and adolescent stress, but that would have truncated the risk period and given us a less complete picture of chronicity. Given the importance of the topic at hand and the need for scholarship that examines the long-term effects of abuse and environmental stressors (McEwen, 2000; Shonkoff et al. 2012), this study was designed to optimize the benefits of the data available. It also should be noted that in our first path model, the effects of cumulative severe physical abuse in childhood predicted a higher level of adult depressive symptoms, even after accounting for the effects of stress throughout the life course, indicating that even with the issue of proximity, the measure from childhood retains some predictive power. Another limitation is that while analyses captured environmental stress within the domains of family, neighborhood, and economic well-being, the measure did not capture the full range of stressors (e.g., social stress or stress due to chronic medical conditions). Finally, it should be understood that this study is based on a non-representative sample and findings may therefore not be generalizable.

Above, we noted several implications for future research, based on the results of this study. It is also important to note that this study focused on the effects of cumulative abuse and cumulative environmental stress, rather than the effects of abuse or stress at particular time points. Future research might focus more on the mental health effects of experiencing these adversities at specific developmental junctures (Andersen & Teicher, 2008; Lupien et al. 2009; St. Clair, 2014). Additional analyses might consider, for instance, if moderation or mediation effects might be seen with measures obtained at

conceptually meaningful age-related intervals. Furthermore, while we studied physical abuse, other forms of abuse in childhood also have been shown to be significantly related to poorer mental health (Batten et al. 2004; Herrenkohl et al. 2013; Gibb et al. 2001). Childhood violence exposure also often entails exposure to multiple forms of victimization (Finkehor et al. 2007). Given this, future analyses should also focus on exploring the long-term effects of repeated environmental stress and (singular and combined) exposure to neglect, sexual abuse, and emotional abuse.

These limitations and potential areas for future research notwithstanding, by focusing on the mental health effects of experiencing abuse and environmental stressors at more than one timepoint, our findings contribute to literature about the health consequences of the accumulation of stress over time (McEwen, 2000; Shonkoff et al. 2012). In line with other research, our findings about the relative impact of child abuse across the lifecourse point to the need to prevent and mitigate the lasting effects of child abuse, while also underscoring that the long-term effects of abuse are not necessarily a foregone conclusion, but may well be affected by the level of environmental stressors that one encounters throughout their life (Hammen et al. 2000; Harkness et al. 2006; Kaufman & Charney, 2001; Kendler et al. 2004; Shapero, 2014). Our results also suggest how cumulative environmental stress may affect mental health, both directly and through mediating the effects of severe physical abuse in childhood (though our findings about mediation should be interpreted with caution since this finding was only marginally statistically significant). Our findings about the important role of environmental stress as it accumulates across the lifecourse therefore point to the importance of interventions aimed at modifiable environmental risk factors, providing yet more evidence of the value

of broad-based interventions and social justice initiatives that support the financial, emotional, and physical well-being of neighborhoods and families (Armstrong et al. 2005; Bronfenbrenner, 1986; Goosby, 2013; Jin et al. 1995; Johnson et al. 2009; Matheson et al. 2006; Mossakowski, 2009; Saxena, Jané Llopis, & Hosman, 2006).

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Table 1. *Correlations, means, and SD for study variables*

	Cumulative physical abuse	Cumulative Stress	Adolescent depression	Adult depression
Cumulative physical abuse	1	.128 (p=.006)	.135 (p=.006)	.170 (p=.001)
Cumulative Stress		1	.358 (p=.000)	.349 (p=.000)
Adolescent depression			1	.456 (p=.000)
Adult depression				1
Mean	.497	.978	10.649	9.756
SD	.646	.929	7.991	9.292

Table 2. *Regression of Cumulative Severe Physical Abuse and Cumulative Stress on BDI*

Variable	B (standardized)	S.E.	<i>p</i> -value
Regression model without interaction term			
Adolescent depression	.350	.057	.000
Cumulative severe physical abuse	.084	.046	.066
Cumulative stress	.202	.048	.000
SES	.068	.049	.169
Gender	-.008	.044	.864
Regression model with interaction term			
Adolescent depression	.351	.057	.000
Cumulative severe physical abuse	.077	.043	.073
Cumulative stress	.201	.048	.000
Cumulative severe physical abuse X Cumulative stress	.032	.037	.381
SES	.069	.049	.157
Gender	-.008	.044	.849