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Accumulation, Timing, and Duration of Early Childhood Adversity and Behavior Problems at Age 9

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Abstract

Objective: We utilized a life course framework to examine associations between the accumulation, timing, and duration of adverse childhood experiences (ACEs) across early childhood (ages 1 to 5 years) and internalizing and externalizing behavior problems at age 9.

Method: The sample included 1,789 children from the Fragile Families and Child Wellbeing Study, a birth cohort study of children born between 1998 and 2000. Primary caregivers reported on seven ACEs at child ages 1, 3, 5, and 9. We created two summary measures of early childhood ACEs to capture (1) accumulation and (2) timing and duration. We derived indicators of caregiver-reported internalizing and externalizing problems at ages 5 and 9. Logistic regression was used to estimate associations between early childhood ACEs and behavior problems at age 9, sequentially adjusting for socio-demographic covariates, age 9 ACEs, and age 5 behavior problems.

Results: In fully adjusted models, children exposed to 6 ACEs in early childhood faced three times the odds of age 9 behavior problems, compared to children exposed to 0–1 ACE. Intermittent adversity was associated with the greatest increase in odds of age 9 behavior problems, relative to other early childhood timing/duration categories. Categories of high early and high late adversity were also associated with age 9 behavior problems. Chronic adversity was not associated with age 9 behaviors in final models that adjusted for age 5 problems.

Conclusions: These results demonstrate the importance of a developmental perspective for understanding the role of childhood adversity in the etiology of child psychopathology.

Introduction

Extensive research has documented the detrimental impact of exposure to adverse childhood experiences (ACEs) on childrens present and future mental and physical health outcomes (Evans, Li, & Whipple, 2013; Kalmakis & Chandler, 2015). Among the health outcomes that have been studied in relationship to childhood adversity are internalizing behaviors (e.g., depression, anxiety) and externalizing behaviors (e.g., aggression, conduct problems) (Goodman, Lamping, & Ploubidis, 2010). In both cross-sectional and longitudinal studies,

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research on the *accumulation* of ACEs has documented a graded relationship between ACEs and behavior problems in childhood and adolescence (Evans et al., 2013; Fanti & Henrich, 2010; Hunt, Slack, & Berger, 2017; Jimenez, Wade, Lin, Morrow, & Reichman, 2016). Notably, few existing studies on the association between childhood adversity and behavior problems have utilized repeated measures of adversity (Evans et al., 2013), which could result in underestimating ACEs exposure over time. Moreover, very few studies have examined how the developmental *timing* of adversity or *duration* of exposure may contribute to childhood behavior problems. The current study utilized prospective data with repeated measures of adversity to examine how the accumulation of ACEs over the first five years of life are associated with behavior problems at age 9 years, with attention to the timing and duration of exposure.

Childhood Adversity and Behavior Problems

Several longitudinal studies have examined whether children exposed to more ACEs in early childhood face a higher risk of behavior problems in later childhood. In some of these studies, the length of time between measurement of exposures and outcomes has been quite short. One study found associations between adversity measured at age 5 and behavior problems less than a year later (Jimenez et al., 2016). Another measured exposure to adversities by age 2 and child behavior problems at age 3 (Shaw, Vondra, Hommerding, Keenan, & Dunn, 1994). Other research has explored how early adversity relates to behavior problems over a longer period of time. For example, Fanti and Henrich (2010) considered exposure to adversities up to 2 years of age and behavior problem trajectories from ages 2 to 12 years. They found that children exposed to the greatest number of ACEs demonstrated higher odds of internalizing and externalizing problems during at least two time points between ages 2 and 12. While such studies offer evidence of a dose-response relationship between exposure to ACEs in early childhood and subsequent behavior problems, a notable limitation is that few of them have collected or reported on repeated measures of ACEs during early childhood (Evans et al., 2013; McLaughlin, 2016). Consequently, most existing studies do not capture the dynamic nature of adversity.

A recent analysis of data from the Fragile Families and Child Wellbeing Study (FFCWS), the dataset for the present study, considered ACEs at multiple time points (Hunt et al., 2017). In this study, a child was categorized as “exposed” to a particular adversity if it was endorsed at any of those time points. Higher ACEs scores were associated with more age 9 internalizing and externalizing behaviors and a greater likelihood of being diagnosed with attention deficit and hyperactivity disorder (ADHD). Although the use of repeated measures improved the authors ability to capture whether children were *ever* exposed to a set of adversities in early childhood, the study did not attend to the potential importance of exposure at multiple time points (i.e., accumulation of adversity). In addition, the study did not address *when* in early childhood the exposures occurred or *for how long*, leaving unanswered the question of whether timing and duration of ACEs exposure are related to behavioral adjustment in middle childhood.

Life Course Theory and its Application to Early Adversity

Life course theory provides a valuable framework for considering the ways in which cumulative childhood adversity may influence later outcomes (Halfon, Larson, Lu, Tullis, & Russ, 2014). One aspect of adversity to which life course theory attends is the timing of exposure (Fine & Kotelchuck, 2010; Michel & Tyler, 2005). While adverse events can accumulate and impact an individual at any stage of life, early childhood (i.e., 0–5 years) may be especially important because experiences in the early years set the trajectory for childrens subsequent interactions with their environment (Halfon et al., 2014). If the harm from an earlier developmental period is not resolved, developmental tasks associated with later stages may be compromised (Masten & Cicchetti, 2010). In addition to timing, life course theory posits that the duration or length of exposure to adverse experiences also shapes future health and development (Fine & Kotelchuck, 2010). Whereas the experience of stress or hardship at a single time point may have little or no impact on an individuals developmental trajectory, adversity that persists over time may undermine the gradual development of various competencies important for behavioral adjustment, such as emotion regulation (Ackerman, Brown, & Izard, 2004).

Timing of Adversity and its Association with Behavior Problems

Existing studies on the timing of adversity and subsequent behavior problems have produced mixed findings. Some research supports the hypothesis that early childhood is a period of heightened vulnerability to adversity (e.g., Kotch et al., 2008) while other research fails to find a connection between early adversity and later behavior problems (e.g., Thornberry, Ireland, & Smith, 2001). Most of the research investigating the developmental timing of exposure to adversity has focused on single risk factors as opposed to cumulative risk. For example, the effects of poverty on childrens behavior appear to be stronger when they are experienced in the first five years of life compared to later years (Brooks-Gunn & Duncan, 1997; Duncan & Brooks-Gunn, 2000). Similarly, longitudinal studies of child maltreatment have linked earlier age of onset of child maltreatment to more behavior problems in middle childhood (Keiley, Howe, Dodge, Bates, & Petti, 2001; Manly, Kim, Rogosch, & Cicchetti, 2001). The few studies that have investigated timing of exposure to multiple ACEs demonstrate mixed results. For instance, Appleyard and colleagues (2005) measured five adversities at two time points – early childhood (0–5 years) and middle childhood (6–12 years) – among a sample of 171 children. They collected behavioral outcomes at age 16. Compared to children exposed to fewer ACEs in early childhood, children exposed to higher numbers of early ACEs demonstrated more externalizing but not internalizing problems.

Some research suggests that very early childhood (e.g., infancy to 3 years) may be a sensitive period of development during which exposure to adversity is especially harmful to childrens behavioral development. Findings from several studies of maternal depression show that children who are exposed to mothers depression by age 3 are at greater risk for later mental health problems than children who are older at first exposure (Goodman et al., 2011). One hypothesis is that exposure to adverse events such as maternal depression or child maltreatment disrupts the development of secure attachment relationships, which in turn negatively affects behavioral adjustment (Manly et al., 2001). Additionally, children whose own needs have not been adequately met in the first few years of life – whether due to

parental functioning, socioeconomic disadvantage, or for other reasons – may develop little capacity for perspective taking and empathy, both of which are crucial to self-regulation and related skills that promote behavioral health (Manly et al., 2001). Further, evidence from both animal and human studies suggests that adversity very early in life may lead to stress-related changes in brain development and structure that predispose children to depression and other mental health problems later in life (Andersen & Teicher, 2008; De Bellis, 2001). There is a clear need for additional research that assesses the role of timing of exposure to multiple ACEs during early childhood.

Duration of ACEs Exposure in Relation to Behavior Problems

Compared to timing of exposure to adversity, even fewer studies have examined the effects of duration of exposure. A handful of studies, primarily examining single adversities, have found associations between chronic adversity and child behavior problems (Ackerman et al., 2004). Children growing up in chronic poverty, for example, have shown greater risk for externalizing problem behaviors (Dearing, McCartney, & Taylor, 2006; Macmillan, McMorris, & Kruttschnitt, 2004) and higher lifetime risk of depression (Gilman, Kawachi, Fitzmaurice, & Buka, 2002). Manly and colleagues (2001) found that chronic child maltreatment and onset of maltreatment in infancy/toddlerhood or the preschool years was associated with worse behavioral outcomes than maltreatment that occurred during a single developmental period. Similarly, a study by Turney (2011) demonstrated an association between chronic maternal depression (0–5 years) and age 5 behavior problems. In one of the few studies to assess the relationship between duration of multiple adversities and behavior problems, Ackerman and colleagues (2004) did not find an association between exposure to persistent adversity from preschool to 5th grade and behavior problems measured at age 11 years. Instead they found that recent exposure and intermittent exposure to adversity had the strongest associations with behavior problems. Notably, this study was limited by a small sample size (N=110) and it lacked information on adversity prior to preschool. The dearth of research exploring whether chronic exposure to cumulative adversity in early childhood is associated with more behavior problems than exposure at a single or intermittent time points to a significant gap in the ACEs literature.

The Present Study

The present study utilized data from the FFCWS to address two primary research aims. The first was to examine the association between cumulative adversity in early childhood (summing across reports at ages 1, 3, and 5 years) and behavior problem status at age 9. We hypothesized that cumulative adversity in early childhood would demonstrate a graded relationship with age 9 behavior problems, adjusting for age 9 adversity and age 5 behavior problems. Second, we explored how timing and duration of exposure to ACEs in early childhood were associated with age 9 behavior problems. Specifically, we investigated associations between: high early adversity (2 ACEs at age 1 and/or 3 years but not age 5); high late adversity (2 ACEs at ages 3 and 5 years or age 5 only but not at age 1); intermittent high adversity (2 ACEs at ages 1 and 5 years but not at age 3); and chronic high adversity (2 ACEs at ages 1, 3, and 5 years) and internalizing and externalizing problems at age 9. We hypothesized that high early adversity and chronic adversity would be associated with the

highest odds of behavior problems at age 9 after adjusting for age 9 adversity and age 5 behavior problems.

Methods

Data and Sample

We conducted a secondary analysis of data from FFCWS, a longitudinal birth cohort study of 4,898 children born between 1998 and 2000 (Reichman, Teitler, Garfinkel, & McLanahan, 2001). The FFCWS utilized a multistage stratified random sampling design that oversampled non-marital births. Twenty cities were sampled from all U.S. cities with populations greater than 200,000, and within those cities, hospitals were systematically sampled to increase coverage of births to unmarried parents (Reichman et al., 2001). At baseline, the full cohort included 3,711 non-marital births and 1,187 births to married parents (Reichman et al., 2001). Mothers and fathers who gave informed consent were interviewed within 48 hours of the childs birth, typically at the hospital. Both parents were contacted for subsequent phone-based interviews ("core" interviews) when the focal child was approximately age 1 year (Y1), 3 years (Y3), 5 years (Y5), and 9 years (Y9) (Geller, Jaeger, & Pace, 2018). Of the mothers who participated at baseline, response rates at Y1, Y3, Y5, and Y9 were 90%, 88%, 87%, and 76%, respectively. In-home data were also collected from a subset of respondents at Y3 (n = 3,258), Y5 (n = 2,981), and Y9 (n = 3,630) to survey the person the focal child lived with at least half the time (the primary caregiver [PCG], usually the mother). Further details about the original study methodology are available elsewhere (Geller et al., 2018; Reichman et al., 2001).

The present study is based on data collected from mothers at baseline, core interviews at Y1, Y3, Y5, and Y9, and in-home interviews conducted at Y3, Y5, and Y9. Following other FFCWS investigators (e.g., Lee & McLanahan, 2015; Turney, 2012), we restricted the analytic sample to children whose mothers participated in all relevant waves of data collection (core and in-home surveys) and reported living with the child at least half the time (n = 1940). We also excluded 116 children from the two cities in which core surveys were piloted; surveys in these cities were missing information on childrens behavior problems at Y5. Finally, 35 cases were excluded due to incomplete data on the Y9 outcome variables. The analytic sample contained 1,789 children. We conducted multiple imputation using fully conditional specification (FCS) to impute values for missing ACEs. Before imputation, the rate of missing ACEs was less than 5% for all ACEs except Y5 father incarceration (8.5% missing).

A comparison of the analytic sample to the full sample at baseline indicated that a larger proportion of mothers in the analytic sample was Black and a lower proportion was Hispanic (see Table 1). Mothers in the analytic sample had higher levels of education and were less likely to report baseline receipt of public assistance compared to the full baseline sample.

Measures

Adverse childhood experiences (ACEs).—Seven ACEs were assessed at each of the early childhood waves and at Y9: child physical abuse, maternal depression, household

substance use, paternal incarceration, intimate partner violence (IPV), housing instability, and food insecurity.

Child physical abuse.: At Y3, Y5, and Y9, child physical abuse was assessed using items in the Parent-Child Conflict Tactics Scale (CTS) (Straus, Hamby, Finkelhor, Moore, & Runyan, 1998). Following Font and Berger (2015), physical abuse was indicated by the mothers report that she or another caregiver living in the house hit the child with a belt, stick, or other hard object three or more times in the previous year, or shook the child at any time in the previous year. Mothers were not asked to report hitting or shaking by other caregivers at Y9, thus at Y9 we assessed child physical abuse by mothers only. Parent-Child CTS items were not asked at Y1, therefore child physical abuse at Y1 was measured by the mothers response to the question, "In the past month, have you spanked the child because s/he was misbehaving or acting up?" Prior research has shown spanking is highly associated with child physical abuse (Gershoff & Grogan-Taylor, 2016). We created a dichotomous indicator to represent children whose mothers reported spanking 0 to 2 times in the past month compared to those who reported spanking every day, a few times a week, or a few times in the past month.

Maternal depression.: At each wave beginning at Y1, mothers completed the Major Depression Episode subscale of the Composite International Diagnostic Interview–Short Form (CIDI-SF) (Kessler, Andrews, Mroczek, Ustun, & Wittchen, 1998). The questions of the CIDI-SF were designed to correspond to diagnostic criteria from the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (American Psychiatric Association, 1994). Mothers were asked about feelings of depression or being unable to derive pleasure from activities they used to enjoy. Respondents who experienced either of these conditions most of the time, every day, for a 2-week period during the previous year were asked additional questions related to concentration problems, trouble sleeping, feeling tired, changes in weight, thinking about death, and feelings of worthlessness (Kessler et al., 1998). Affirmative responses were summed to construct a score from 0 to 8. Mothers who indicated they were taking medication to treat depression were assigned a score of 8. Each score corresponds to a probability of a depression diagnosis ranging from .0001 to .9083 (Nelson, Kessler, & Mroczek, 2001). Mothers scoring 3 or higher were considered a probable case and were categorized as experiencing depression at that wave.

Household substance use.: To measure household substance use at each wave, mothers responded to questions pertaining to drug and alcohol use in the past 12 months. They were asked, "Was there ever a time when your drinking or being hung over interfered with your work at school, or a job, or at home?" and (in all waves except Y9) "Have you sought help/ been treated for drug/alcohol problem?" Mothers were also asked if they had used marijuana, cocaine or crack, heroin, hallucinogens, amphetamines, or any prescription drugs (e.g., sedatives, pain medications) without a prescription or for longer/in greater quantities than prescribed. Finally, mothers reported if the biological father and/or (if applicable) current live-in partner "had problems such as keeping a job or getting along with family and friends because of alcohol or drug use." Following Jimenez and colleagues (2016), a positive

response to one or more of these questions was categorized as exposure to household substance use.

Paternal incarceration.: Y1 father incarceration was measured by baseline and Y1 reports that the childs biological father was in prison. If the father was in prison at the time of one or both interviews, children were categorized as exposed to paternal incarceration at Y1. At Y3 and Y5, mothers reported whether the father had spent time in prison since the last interview. At Y9, father incarceration was operationalized as father being in jail at the time of the Y9 interview.

IPV.: Previously validated items were used to measure IPV at each wave (Lloyd, 1997; Sweet, Bumpass, & Call, 1988). Mothers were asked to consider how the focal childs biological father (if in relationship with him) or current partner (if applicable) behaves toward them, answering the following questions: 1) “How often does he slap or kick you?” 2) “How often does he hit you with a fist or object that could hurt you?” 3) “How often does he try to make you have sex or do sexual things you dont want to do?” 4) “Have you and the biological father or current partner had a physical fight in front of the child since the last interview?” and 5) “Have you been seriously hurt in a fight with the father or current partner since the last interview?” Following Suglia, Duarte, Chambers, and Boynton-Jarrett (2012), a response of “sometimes” or “often” (rather than “never”) to any of the first three items or an affirmative response to either of the last two items was categorized as an IPV exposure.

Housing instability.: Items from the New York City Social Indicators Survey (Meyers & Garfinkel, 1999) and the Survey of Income and Program Participation (SIPP) (U.S. Department of Commerce, 1998) assessed exposure to housing instability. At each wave, mothers were asked if they had faced any of the following problems in the past 12 months because of lack of money: 1) been evicted from home or apartment; 2) moved in with other people; 3) stayed at a shelter, in a vehicle, or in an abandoned building even for one night; or 4) not paid the full amount of rent or mortgage. Mothers were also asked if they had moved residences more often than once per year since the previous interview. Following Geller and Franklin (2014), affirming one or more of these items was considered exposure to housing instability for that time period.

Food insecurity.: The measure of food insecurity was derived from three SIPP items that asked whether, in the past 12 months, mothers had received free meals, mothers had been hungry but could not afford to buy more food, or their children had been hungry but they could not afford to buy more food. Endorsing one or more of the three items was categorized as exposure to food insecurity (Suglia et al., 2012).

Index of cumulative early adversity.—Dichotomous variables were created for the seven ACEs at Y1, Y3, and Y5. A score of 1 was given for each ACE that was endorsed, such that index scores could range from 0 to 7 at each wave. A cumulative ACEs score was calculated by summing the scores across the three time points, with possible scores ranging from 0 to 21. To examine the gradient effect, this cumulative score was broken into four categories representing total number of ACEs in early childhood (0–1 ACE [reference group]; 2–3; 4–5; 6 ACEs).

Timing and duration of early adversity.—Guided by previous research (Lucio, Hunt, & Bornovalova, 2012; Roberts, Roberts, & Chan, 2009), we dichotomized ACEs index scores at each early childhood wave to represent high adversity (2 ACEs at wave = 1) versus no/low adversity (0–1 ACE at wave = 0). To assess the potential roles of timing and duration of adversity in early childhood, including the potentially heightened vulnerability of children in their first three years (e.g., Goodman et al., 2011; Manley et al., 2001), we adapted the approach used by Suglia and colleagues (2012) to create a 5-level categorical variable: 1) no or low adversity at each wave (<2 ACEs at Y1, Y3, and Y5; reference); 2) high early adversity (2 ACEs in Y1 and/or Y3 but not Y5); 3) high late adversity (2 ACEs in Y3 and Y5 or Y5 only but not Y1); 4) intermittent high adversity (2 ACEs in Y1 and Y5 but not Y3); and 5) chronic high adversity (2 ACEs in Y1, Y3, and Y5).

Index of recent (Y9) adversity.—We controlled for adversities at Y9 in order to examine the independent effects of early adversity. As with the early ACEs index, dichotomous variables for the seven risk factors at Y9 were created and summed to produce an index score ranging between 0 and 7. Scores were divided into four categories (no ACEs [reference group]; 1 ACE; 2 ACEs; 3 ACEs).

Internalizing and externalizing behaviors at Y9.—Internalizing and externalizing behaviors were calculated using sub-scales of the Child Behavior Checklist for children 6 to 18 years old (CBCL/6–18) (Achenbach & Rescorla, 2001). Mothers answered items on the CBCL on a 3-point scale (1 = *not true of this child*, 2 = *sometimes or somewhat true*, 3 = *very or often true*). The internalizing behaviors score is calculated as the sum of three subscales: anxious/depressed (e.g., “Child is too fearful or anxious”), withdrawn/depressed (e.g., “Child is withdrawn, doesnt get involved with others”), and somatic complaints (e.g., “Child has nightmares”). The scale contains a total of 32 items. To measure externalizing behaviors, scores from two subscales are summed: rule breaking (e.g., “Child doesnt seem to feel guilty after misbehaving”) and aggressive behaviors (e.g., “Child is cruel, bullies, or shows meanness to others”). The externalizing behaviors scale consists of 35 items. The CBCL provides normative T-scores for the internalizing and externalizing scales, with T-scores greater than or equal to 64 classified as being in the clinical range, or sufficiently high to warrant professional support (Achenbach & Rescorla, 2001). Dichotomous variables were created to represent internalizing and externalizing behavior problem status (1= clinical range; 0=normal range).

Internalizing and externalizing behavior problems at Y5.—Our final models adjusted for Y5 behavior problems in order to examine change in behavior problem status between ages 5 and 9. We used mothers responses to items on the CBCL (CBCL/4–18) (Achenbach, 1991) at Y5. Scores from the anxious/depressed and withdrawn/depressed subscales were summed to measure internalizing behaviors (22 items). Somatic problems were not measured at Y5. Scores from the rule breaking and aggressive behaviors subscales (30 items) were summed to calculate the externalizing behaviors score. Identical to Y9, scores were dichotomized to represent internalizing and externalizing behavior problem status in the clinical vs. normal range.

Socio-demographic control variables.—Baseline control variables include *child gender, mothers age, mothers race/ethnicity* (non-Hispanic Black, Hispanic, other race, and White non-Hispanic (reference)), *mothers level of education* (< high school, high school, and some college or more (reference)), *marital status at childs birth* (1 = married to childs father; 0 = not married), and *receipt of public assistance*. Public assistance was counted as 1 (versus 0) if the mother reported receiving at least one of the following types of aid in the past year: welfare (cash assistance), food stamps/Supplemental Nutrition Assistance Program (SNAP), Special Supplemental Nutritional Program for Women, Infants, and Children (WIC), or Medicaid. We also created categorical variables to control for consistency of public assistance and of cohabitation between Y1 and Y9. Use of public assistance was categorized as public assistance receipt at all four waves, at two or three waves, and at zero or one wave (reference group). Mothers cohabitation status (living with childs father or a current partner, versus not) was categorized as cohabitating at three or four waves, at two waves, or zero or one wave (reference group). Similar to other researchers analyzing FFCWS data (Carlson, Pilkauskas, Mclanahan, & Brooks-Gunn, 2011; Geller & Franklin, 2014), we controlled for raking variables that were used to create the survey weights (mothers baseline age, race/ethnicity, and education, and parents baseline marital status), rather than apply the survey weights to the analyses.

Analyses

Analyses were conducted using SAS statistical software version 9.4. We conducted descriptive analyses using unweighted variables, including socio-demographics, individual ACEs, variables representing accumulation and timing/duration of ACEs, and clinically-relevant behavior problems at Y5 and Y9.

We ran two series of logistic regression models. Testing hypothesis 1, we regressed Y9 behavioral outcomes on cumulative early ACEs. Model 1 controlled for all socio-demographic characteristics described above. Model 2 further examined the independent effects of early adversity by holding constant ACEs reported at Y9. Model 3 adjusted for the above as well as Y5 behavior problems, allowing us to model the change in behavior problems between Y5 and Y9. To test hypothesis 2, an identical series of models was used to examine odds of Y9 behavioral outcomes in relation to timing and duration of early ACEs. Odds ratios were considered statistically significant if the 95% confidence interval did not include one.

Finally, we conducted supplemental analyses to describe the associations between the accumulation, timing, and duration of early ACEs and Y5 internalizing and externalizing behavior problems, in order to facilitate appropriate interpretation of the models of age 9 outcomes that adjust for Y5 behavior problems.

Results

Descriptive Statistics

The analytic sample contained 927 boys (52%) and 862 girls (48%) (see Table 1). Approximately half the mothers (52%) reported their race/ethnicity as non-Hispanic Black,

followed by 23% identifying as non-Hispanic White and 22% as Hispanic. At baseline, approximately six out of ten women (60%) had a high school education or less and nearly two-thirds (65%) received at least one type of public assistance. Across the four waves, 53% of the sample received public assistance at all time points. Fewer than half of mothers (44%) reported they were cohabiting with the childs father or another partner at three or four waves.

Two-thirds of the sample was exposed to two or more ACEs across the early childhood waves. One out of five children was exposed to six or more ACEs. Regarding timing/duration of ACEs in early childhood, approximately half the sample was categorized as low/no adversity. Twenty percent of the sample was considered exposed to high early adversity, whereas less than 4% of the sample was categorized as experiencing intermittent adversity. Table 2 presents the frequencies of each ACE from Y1 to Y9. More than half the sample (55%) was exposed to at least one ACE at Y1 (see Table 2) while a quarter of the sample was exposed to two or more ACEs, according to mothers reports. In subsequent follow-ups, at least 60% affirmed one or more of seven ACEs, with more than 30% reporting two or more exposures.

Cumulative Early Adversity and Y9 Behavior Problems

Results of logistic regressions examining associations between cumulative adversity across early childhood and behavior problems at Y9 are presented in Table 3. Model 1 showed a dose-response relationship between number of early adversities and odds of behavior problems. Compared to the reference group (0–1 ACE), odds of internalizing problems at Y9 were more than twice as high for children exposed to two or three ACEs (AOR: 2.01; CI: 1.13, 3.57), nearly four times as high for those exposed to four or five ACEs (AOR: 3.59; CI: 1.97, 6.54), and more than five times as high for children with six or more ACE exposures (AOR: 5.41; CI: 3.04, 9.65). Compared to the reference group, children exposed to four or five ACEs in early childhood faced a four-fold increase in odds of externalizing problems at Y9 (AOR: 4.14; CI: 2.25, 7.62) while exposure to six or more ACEs was associated with a nearly six-fold increase (AOR: 5.86; CI: 3.25, 10.55). The addition of recent adversity in Model 2 and Y5 behavior problems in Model 3 attenuated associations between cumulative early adversity and age 9 behavior problems, but they remained significant at $p < .05$. In fully adjusted models, exposure to six or more early ACEs was associated with approximately three times the odds of internalizing problems (AOR: 2.85; CI: 1.51, 5.36) and externalizing problems (AOR: 3.05; CI: 1.60, 5.80).

Multivariate Analyses: Timing and Duration of Early Adversity and Y9 Behaviors

Table 4 shows the results of logistic regressions investigating associations between timing and duration of early childhood adversity and odds of Y9 behavior problems. In Model 1, compared to the reference group of no/low adversity across early childhood, children in all other adversity groups had increased odds of behavior problems. Intermittent high adversity was associated with five times the odds of internalizing problems (AOR: 5.00; CI: 2.29, 10.92) and seven times the odds of externalizing problems (AOR: 7.14; CI: 3.32, 15.38). Chronic high adversity was associated with three and a half times the odds of internalizing problems (AOR: 3.61; CI: 2.05, 6.37) and approximately four times the odds of

externalizing problems (AOR: 4.10; CI: 2.29, 7.34). Exposure to high late adversity also was also associated with four times the odds of externalizing problems compared to no/low adversity (AOR: 4.04; CI: 2.40, 6.78). In Model 2, all early adversity timing and duration variables maintained robust associations with Y9 behavior problems, although associations were attenuated.

In Model 3, intermittent high adversity continued to display the most pronounced associations with internalizing (AOR: 3.39; CI: 1.48, 7.74) and externalizing problems (AOR: 4.11; CI: 1.79, 9.42), although the difference between intermittent adversity and other categories was not significant at $p < .05$. High early and high late adversity were each associated with two to 2.5 times the odds of Y9 behavior problems, adjusting for Y5 behavior problem status. Chronic adversity was no longer associated with Y9 behavior problems at $p < .05$.

Supplemental Analyses

To improve our ability to interpret the results of final models adjusting for Y5 behaviors, we conducted additional logistic regression analyses to examine associations between accumulation and timing/duration of ACEs and Y5 behavior problems (see Appendix 1). As expected, higher levels of cumulative early adversity were associated with increased odds of Y5 behavior problems (see Model 1). Logistic regressions testing associations between timing/duration of early adversity and Y5 outcomes (see Model 2) found that children exposed to chronic high adversity faced the greatest odds of Y5 behavior problems relative to children with no/low ACEs exposure (internalizing AOR: 4.02; 95% CI: 2.45, 6.58); externalizing AOR: 4.62; CI: 2.83, 7.54). Intermittent adversity was associated with Y5 externalizing problems (AOR: 3.18; CI: 1.41, 7.21), but not with internalizing problems (AOR: 2.01; CI: 0.80, 5.02).

Discussion

The goal of the current study was to examine the relationship between accumulation, timing, and duration of early childhood adversity and behavioral outcomes in middle childhood, independent of exposure to recent adversity. We also explored whether duration and timing of exposure across early childhood was associated with later behavior problems.

We hypothesized that (1) cumulative adversity measured at ages 1, 3, and 5 years would demonstrate a dose-response relationship to internalizing and externalizing problems at age 9 and (2) high early adversity and chronic high adversity would be associated with the greatest odds of behavior problems. The data supported our first hypothesis. Exposure to higher levels of adversity in early childhood was associated with greater odds of behavior problems in middle childhood, even after adjusting for recent adversity and prior behavior problems. Current study findings align with and extend previous research linking early childhood adversity with childrens later behavioral adjustment (e.g., Fanti & Henrich, 2010; Hunt et al., 2017; Manly et al., 2001). Although other researchers have used FFCWS data to examine early childhood ACEs and middle childhood behavior problems (Hunt et al., 2017), our study is unique in that it accounted for the accumulation of a set of exposures measured at three separate time points, and for ACEs exposure at age 9. We observed a significant

association between early adversity and age 9 behavior problems, independent of the effects of recent adversity. Further, by including age 5 behavior problems in final analyses, we describe the association between early adversity and change in childrens behavior problems from ages 5 to 9.

The present study also found associations between timing and duration of early adversity and age 9 behavior problems. However, the results did not align with our second hypothesis. Among all timing/duration groups, children exposed to intermittent adversity in early childhood had the highest odds of clinical behavior problems at age 9, although the magnitude of the difference from other categories is not significant at $p < .05$. After adjusting for recent adversity and Y5 behavior problems, intermittent adversity in early childhood was associated with a nearly four-fold increase in odds of internalizing problems and a nearly five-fold increase in odds of externalizing problems at age 9, compared to the no/low-adversity reference group. While chronic adversity in early childhood was associated with Y9 behavior problems in Models 1 and 2, the association was attenuated to non-significance when we adjusted for Y5 behavior problems. These results were surprising in light of research that has found associations between persistent early exposure to adversities (e.g., poverty) and behavior problems (Dearing et al., 2006; Gilman et al., 2002). One possible explanation is that chronic adversity in early childhood is more strongly associated with proximate outcomes (i.e., Y5 behavior problems), such that the association with middle childhood behaviors is mediated by earlier behavior problems. While our study did not include tests for mediation, supplemental analyses showed chronic early adversity was highly associated with odds of Y5 behavior problems. Additional studies are needed to elucidate the different pathways by which chronic adversity may influence behavioral health.

While not hypothesized, the finding that intermittent adversity in early childhood was strongly associated with age 9 behavior problems is consistent with results of other studies that have suggested volatile or unpredictable adversity may be more damaging to childrens adjustment than adversity that is persistent yet predictable (e.g., Dearing, McCartney, & Taylor, 2001). It could be that intermittent adversity is more disruptive to childrens wellbeing over time because it requires regular readjustment to changing circumstances (Ackerman et al., 2004). Volatility and unpredictability of family and environmental circumstances may undermine childrens sense of agency and efficacy, which could compromise the development of impulse control and emotion regulation skills in later childhood (Ackerman et al., 2004). Given that only a small percentage of the analytic sample (3.24%) was categorized as experiencing intermittent high adversity, findings associated with this group should be interpreted with caution. Future research should investigate the relationship between intermittent early childhood adversity and later behavior problems among other samples of children.

Similar to the pattern for intermittent adversity but less marked, final models showed that high early adversity was associated with approximately twice the odds of internalizing problems, and between two and three times the odds of externalizing problems, compared to the reference group (see Table 4). High late adversity conferred nearly the same level of risk as high early adversity. While these findings do not support our hypothesis that the first one to three years of life represent a sensitive period of development for childrens behavioral

health, they align with other research showing that exposure to high adversity in any stage of childhood (i.e., infancy, toddlerhood, preschool years, more proximate) negatively impacts child behavioral outcomes (Ackerman et al., 2004; Flouri & Kallis, 2007; Manly et al., 2001; Schoon et al., 2002).

Limitations and Contributions

This study was subject to several limitations. First, attrition of FFCWS participants and the fact that only a subsample of families took part in all three in-home interviews reduced the sample size considerably. Given that mothers lost to follow-up were less educated and more likely to report baseline receipt of public assistance, the analytic sample may be less disadvantaged than the population FFCWS was designed to represent. Children exposed to the highest levels of adversity may therefore be underrepresented in the sample, limiting the generalizability of the findings. A second limitation was our reliance on a single informant – the mother – for all data. Mothers may have underreported adversities such as child physical abuse, IPV, and substance use. Mothers perceptions of child behavior may also have been affected by their own exposure to stress, their mental health, or other factors that could lead mothers to focus more on negative behaviors or, alternatively, not to notice them (Goodman et al., 2011). Third, FFCWS did not administer a consistent ACEs inventory across time points. Although repeated measures of adversity were collected, some of the measures (e.g., child physical abuse) were not included at every wave. In addition, while we adjusted for marital status at childs birth and for mothers cohabitation status over time, the present study did not include ACEs related to family structure, which may be associated with behavior problems. However, numerous other analyses of the dataset focus on important questions related to the impact of father absence and other family structure dynamics on childrens wellbeing (Carlson et al., 2011; Halpern-Meekin & Turney, 2016; Lee & McLanahan, 2015).

In spite of these limitations, the present study makes several important contributions to the literature on early childhood adversity and later behavior problems. First, we examined ACEs at three time points in early childhood in order to better account for the dynamic nature of adversity and the potential roles of timing and duration of exposure. We also accounted for ACEs reported the same year as outcomes were collected, allowing us to distinguish between contributions of early versus recent adversity. Finally, we added age 5 behavior problems to analyses to examine associations between early adversity and change in behavior problem status between ages 5 and 9. Results demonstrated that it is not only the total amount of adversity that matters for behavior problems in middle childhood. It is also important to consider when the adversity occurred and for how long it persisted, questions that prior studies (e.g., Hunt et al., 2017) have not addressed. As noted above, further research is needed to identify various mechanisms by which the developmental timing and duration of adversity are linked to behavior problems across early and middle childhood (and beyond). Future prospective studies should include repeated and consistent measures of adversity at regular time points across childhood and adolescence. In addition, it may be valuable for future studies to use latent transition analysis or growth curve modeling, which would allow a more detailed examination of the timing and duration of adversity and the interplay of adversity and child behavior problems over time (Jackson, 2015).

Clinical Implications and Conclusions

The prevention of mental and behavioral health problems in middle childhood requires attending to childrens early environment, including the parent or parents ability to meet their familys material needs, family members access to mental and behavioral health care in addition to physical health care, and access to stable and secure housing. Providing more consistent, integrated, and universal supports to families would likely reduce the number of ACEs children are exposed to, as well as reduce the impact of adversity on childrens development (Larkin, Felitti, & Anda, 2014). Interventions such as the Triple P Positive Parenting Program and the Nurse-Family Partnership are potential models for integrating prevention-based programming with access to services that respond to/mitigate the consequences of adversity (Olds, 2006; Prinz, Sanders, Shapiro, Whitaker, & Lutzker, 2009). Evaluations have shown positive results including reduction of child maltreatment and improvements in child behavior (Prinz et al., 2009; Sanders, 2012). Further intervention research is warranted to assess the potential for such models to reduce other adversities in addition to child maltreatment. Given that recent adversity also appears to contribute to risk of behavior problems in middle childhood, interventions that focus on early childhood (such as the Nurse Family Partnership) are necessary but likely not sufficient. Improving the health outcomes of children will require supports that address their unique needs across developmental stages.

In conclusion, this study suggests that reducing or preventing early childhood adversity could substantially reduce the risk of behavior problems in middle childhood. Our findings highlight the importance of attention to accumulation, timing, and duration of childhood adversities for understanding the role of social factors in the etiology of child psychopathology.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1:

Description of analytic sample (n = 1,789) and comparison to the full cohort (N = 4,898)

Study variables	Analytic sample (N = 1,789)	Full baseline sample (N = 4,898)
	Mean (SD[a])	*Mean (SD)*
Mother's age (BL[b])	25.25 (6.00)	25.28 (6.04)
Child gender	*Frequency (%)*	*Frequency (%)*
Female	48.18	47.55
Male	51.82	52.45
Mother's race/ethnicity		
Non-Hispanic Black	51.65[c]	47.49
Hispanic	22.19[d]	27.28
Non-Hispanic White	22.86	21.03
Other	3.30	4.18
Mother's education (BL)		
Less than high school	29.07[d]	34.69
High school	31.30	30.33
Some college or more	39.63[e]	34.98
Marital status (BL)	25.43	24.23
Receipt of public assistance (BL)	65.23[f]	67.97
Receipt of public assistance (Y1-Y9)		
All 4 waves	53.16	
2–3 waves	25.82	
0–1 wave	21.02	
Mother cohabiting[g] (Y1-Y9)		
3–4 waves	43.88	
2 waves	23.76	
0–1 wave	32.36	
Cumulative Early Adversity[h]		
0–1 ACE	32.98	
2–3 ACEs	28.95	
4–5 ACEs	17.89	
≥ 6 ACEs	20.18	
Timing/Duration of Early Adversity[h]		
No or low adversity	49.64	
High early adversity	19.96	
High late adversity	16.88	
Intermittent high adversity	3.24	
Chronic high adversity	10.29	
Internalizing problems, Y5	9.00	

Study variables	Analytic sample (*N* = 1,789)	Full baseline sample (*N* = 4,898)
	Mean (SD[a])	*Mean (SD)*
Externalizing problems Y5	10.12	
Internalizing problems, Y9	8.38	
Externalizing problems, Y9	8.38	

a. SD=standard deviation;

b. BL=baseline;

c. Differs significantly from full baseline sample, $p<.01$;

d. Differs significantly from full baseline sample, $p<.0001$;

e. Differs significantly from full baseline sample, $p<.001$;

f. Differs significantly from full baseline sample, $p<.05$;

g. Mother cohabiting with child's biological father or a current partner;

h. Early adversity = Y1, Y3, and Y5.

Table 2:

Adverse childhood experiences (ACEs) at ages 1, 3, 5, and 9 years (N = 1,789)

	Age 1		Age 3		Age 5		Age 9	
ACEs	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Child physical abuse	229	12.80	399	22.30	489	27.33	381	21.30
Maternal depression	297	16.60	370	20.68	290	16.21	302	16.95
Household substance use	250	13.97	266	14.87	266	14.87	360	20.12
Paternal incarceration	112	6.26	346	19.34	214	11.96	134	7.49
Intimate partner violence	101	5.65	59	3.30	147	8.22	110	6.15
Housing instability	496	27.72	358	20.01	389	21.74	447	24.99
Food insecurity	181	10.12	299	16.71	288	16.10	303	16.94
Total ACEs								
None	813	45.44	678	37.90	687	38.40	693	38.74
1	527	29.46	546	30.52	558	31.19	534	29.85
2	282	15.76	290	16.21	285	15.93	314	17.55
≥ 3	167	9.34	275	15.37	259	14.48	248	13.86

Table 3:

Cumulative early adversity and odds of internalizing and externalizing behavior problems at age 9 (*N*= 1,789)

	Model 1[a] AOR[b] (95% CI[c])		Model 2[a] AOR (95% CI)		Model 3[a] AOR (95% CI)	
Cumulative Early Adversity (Y1-Y5)	Internalizing	Externalizing	Internalizing	Externalizing	Internalizing	Externalizing
0–1 ACE[d, e]						
2–3 ACEs	2.01 (1.13, 3.57)	1.45 (0.77, 2.73)	1.77 (0.98, 3.17)	1.25 (0.66, 2.38)	1.54 (0.85, 2.80)	1.18 (0.62, 2.26)
4–5 ACEs	3.59 (1.97, 6.54)	4.14 (2.25, 7.62)	2.86 (1.54, 5.31)	3.23 (1.72, 6.04)	2.40 (1.28, 4.51)	2.82 (1.49, 5.35)
≥6 ACEs	5.41 (3.04, 9.65)	5.86 (3.25, 10.55)	3.66 (1.97, 6.78)	3.97 (2.12, 7.42)	2.85 (1.51, 5.36)	3.05 (1.60, 5.80)
Recent Adversity (Y9)						
0 ACEs[e]						
1 ACE			1.20 (0.72, 2.01)	1.66 (0.97, 2.85)	1.12 (0.66, 1.90)	1.68 (0.97, 2.90)
2 ACEs			2.26 (1.33, 3.84)	2.25 (1.27, 3.99)	2.21 (1.28, 3.81)	2.26 (1.26, 4.06)
≥3 ACEs			2.43 (1.38, 4.28)	2.75 (1.53, 4.94)	2.10 (1.16, 3.78)	2.79 (1.52, 5.11)
Y5 Behavior Problems						
Internalizing					4.67 (2.99, 7.29)	0.94 (0.55, 1.62)
Externalizing					1.82 (1.10, 3.02)	5.59 (3.55, 8.81)

a. All models adjusted for child gender, maternal race/ethnicity, baseline maternal education, baseline maternal age, baseline marital status of parents, Y1-Y9 consistency of cohabitation status, and Y1-Y9 consistency of public assistance;

b. AOR = adjusted odds ratios;

c. CI = confidence interval;

d. reference group;

e. ACEs = adverse childhood experiences.

Table 4:

Timing and duration of early adversity and odds of internalizing and externalizing behavior problems at age 9 (*N*= 1,789)

	Model 1[a] AOR[b] (95% CI[c])		Model 2[a] AOR (95% CI)		Model 3[a] AOR (95% CI)	
Timing/Duration Adversity (Y1-Y5)	Internalizing	Externalizing	Internalizing	Externalizing	Internalizing	Externalizing
No/low[d]						
High early	2.13 (1.28, 3.56)	2.75 (1.62, 4.67)	1.87 (1.11, 3.16)	2.38 (1.39, 4.09)	1.78 (1.05, 3.03)	2.26 (1.31, 3.91)
High late	2.87 (1.73, 4.77)	4.04 (2.40, 6.78)	2.22 (1.31, 3.77)	3.08 (1.80, 5.27)	1.92 (1.12, 3.31)	2.64 (1.52, 4.48)
Intermittent	5.00 (2.29, 10.92)	7.14 (3.32, 15.38)	3.65 (1.64, 8.13)	5.10 (2.32, 11.21)	3.39 (1.48, 7.74)	4.11 (1.79, 9.42)
Chronic	3.61 (2.05, 6.37)	4.10 (2.29, 7.34)	2.30 (1.25, 4.23)	2.67 (1.44, 4.97)	1.61 (0.84, 3.08)	1.77 (0.92, 3.42)
Recent Adversity (Y9)						
0 ACEs[d, e]						
1 ACE			1.27 (0.76, 2.12)	1.70 (1.00, 2.90)	1.16 (0.68, 1.97)	1.69 (0.98, 2.91)
2 ACEs			2.52 (1.48, 4.27)	2.47 (1.40, 4.37)	2.46 (1.43, 4.23)	2.47 (1.38, 4.42)
≥3 ACEs			2.72 (1.55, 4.80)	3.12 (1.74, 5.58)	2.41 (1.34, 4.34)	3.24 (1.77, 5.93)
Y5 Behavior Problems						
Internalizing					4.87 (3.11, 7.60)	0.99 (0.58, 1.70)
Externalizing					1.89 (1.14, 3.15)	5.96 (3.77, 9.41)

a. All models adjusted for child gender, maternal race/ethnicity, baseline maternal education, baseline maternal age, baseline marital status of parents, Y1-Y9 consistency of cohabitation status, and Y1-Y9 consistency of public assistance;

b. AOR = adjusted odds ratios;

c. CI = confidence interval;

d. reference group;

e. ACEs = adverse childhood experiences.