Published in final edited form as:
J Fam Psychol. 2013 December ; 27(6): 937–944. doi:10.1037/a0034592.

Intimate Partner Violence and Children's Memory

Hanna C. Gustafsson,
The University of North Carolina at Chapel Hill

Jennifer L. Coffman,
The University of North Carolina at Chapel Hill

Latonya S. Harris,
University of California Cooperative Extension

Hillary A. Langley,
The University of North Carolina at Chapel Hill

Peter A. Ornstein, and
The University of North Carolina at Chapel Hill

Martha J. Cox
The University of North Carolina at Chapel Hill

Abstract

The current study was designed to examine the relation between intimate partner violence (IPV) and children's memory and drew from a socioeconomically and racially diverse sample of children living in and around a midsized southeastern city (n = 140). Mother-reported IPV when the children were 30 months old was a significant predictor of children's short-term, working, and deliberate memory at 60 months of age, even after controlling for the children's sex and race, the families' income-to-needs ratio, the children's expressive vocabulary, and maternal harsh-intrusive parenting behaviors. These findings add to the limited extant literature that finds linkages between IPV and children's cognitive functioning and suggest that living in households in which physical violence is perpetrated among intimate partners may have a negative effect on multiple domains of children's memory development.

Keywords

intimate partner violence; short-term memory; working memory; deliberate memory; maternal parenting behaviors

A significant body of literature suggests associations between intimate partner violence (IPV) and maladaptive outcomes for children of all ages (Kitzmann, Gaylord, Holt, &

Correspondence concerning this article should be addressed to: Hanna C. Gustafsson, Center for Developmental Science, 100 E. Franklin Street, Suite 200, The University of North Carolina at Chapel Hill, Chapel Hill, NC 27599-8115. hgustaf@email.unc.edu. Hanna C. Gustafsson and Jennifer L. Coffman, Department of Psychology, The University of North Carolina at Chapel Hill; Latonya S. Harris, Youth, Families, and Communities Statewide Program, University of California Cooperative Extension; Hillary A. Langley, Peter A. Ornstein, and Martha J. Cox, Department of Psychology, The University of North Carolina at Chapel Hill.

Kenny, 2003; Wolfe, Cooks, Lee, McIntyre-Smith, & Jaffe, 2003). According to Emotional Security Theory (EST; Davies & Cummings, 1994), witnessing violence is distressing and dysregulating for children, and repeated exposure to interparental conflict undermines their sense of safety and security in the family. In turn, the chronic security concerns triggered by IPV can interfere with children's ability to cope effectively with the stresses and challenges of everyday life, including their ability to acquire age-appropriate skills in various domains. Despite evidence that children's cognitive development is among the domains linked with IPV (e.g., Graham-Bermann, Howell, Miller, Kwek, & Lilly, 2010; Huth-Bocks, Levendosky, & Semel, 2001; Koenen, Moffitt, Caspi, Taylor, & Purcell, 2003), little research to date has investigated the effect that a physically violent home environment may have on the development of children's memory skills. Given the integral role that memory abilities play in the development of various later competencies (Bull, Espy, & Wiebe, 2008; Sabol & Pianta, 2012), it is important to investigate factors, such as IPV, that may be negatively associated with its development.

Memory in Preschool-Aged Children

Over the preschool years, there are significant age-related changes in the development of multiple aspects of children's memory performance, including short-term memory, working memory, and the use of deliberate strategies for remembering information (Ornstein, Baker-Ward, & Naus, 1988; Schneider & Bjorklund, 1998). Research has demonstrated that with increases in age children become more skilled in spontaneously generating strategies for the storage or retrieval of information and more efficient in the use of these techniques in different contexts. Moreover, these early basic mnemonic skills have been shown to be important for children's later functioning and school success (Bull et al., 2008; Ornstein, Coffman, & Grammer, 2009; Sabol & Pianta, 2012). Acquiring facility with these memory skills before entering kindergarten may be particularly important for children's long-term success because being able to store, recall, and apply information is crucial for meeting the demands of formal schooling. As such, the current study focused on the memory of children when they were 60 months old as they were transitioning to kindergarten.

Despite a rich literature describing changes in children's performance over time, relatively little is known about the development of these skills and about the contextual or family-level factors that may influence children's memory development during the early years (Ornstein & Haden, 2001). Although research has suggested associations between characteristics of the home context—such as the nature of parental conversational style (Fivush, Haden & Reese, 2006; Reese, Haden, & Fivush, 1993) or exposure to maltreatment or traumatic events (Eisen & Goodman, 1998; Howe, Toth, & Cicchetti, 2006)—and children's autobiographic memory, little is known about the influence of IPV specifically.

IPV and Memory

Despite limited attention having been paid to the mnemonic consequences of IPV, there are several hints in the literature that suggest that IPV may compromise the development of children's memory. For example, research guided by EST points to several ways in which IPV may undermine children's performance on memory tasks.

More specifically, children's concerns about their safety and security in the family have been shown to interfere with their attentional skills (Davies, Woitach, Winter, & Cummings, 2008; Towe-Goodman et al., 2011). In turn, problems with attention regulation have implications for memory, not only because attending to relevant stimuli is essential for encoding pertinent information but also because being able to effectively focus and shift attention is important for working memory performance. Also guided by EST, IPV has been linked with children's emotional reactivity and self-regulatory skills (Gustafsson, Cox, Blair, & the Family Life Project Key Investigators, 2012; Thompson & Calkins, 1996), such that children exposed to IPV seem to be more emotionally reactive and less likely to regulate their emotions in an adaptive manner than those who have not witnessed IPV. Moreover, children who are focused on regulating their emotions—perhaps by engaging in constant self-monitoring of their emotional state or by focusing on possible cues of impending conflict in their environment—may do so at the expense of the key cognitive operations of encoding, storing, and retrieving information. In addition, a child's self-regulatory skills may have implications for his or her ability to inhibit irrelevant information during recall. Thus, difficulties in regulating attention and emotional reactivity have clear implications for remembering. Indeed, children's memory is thought to be particularly sensitive to the negative effect of dyregulated attention and arousal (e.g., Jouriles, McDonald, Slep, Heyman, & Garrido, 2008). Given this view of influences of attention, arousal, and self-regulation on remembering, it may be particularly important to investigate the extent to which IPV and children's memory are linked above and beyond other dimensions of cognition.

Research that has been conducted with maltreated children may also give insight into possible relations between IPV and children's memory. Although most of the work concerning relations between maltreatment status and children's memory has been focused on memory for traumatic events, a few researchers have linked maltreatment and general memory skills. For example, DePrince, Weinzierl, and Combs (2009) found that school-age children exposed to familial trauma (a classification of trauma that included witnessing domestic violence) showed poorer working memory performance relative to children exposed to nonfamilial trauma or to those who did not experience trauma. These results are complemented by findings indicating impaired working memory and short-term memory among adults who reported childhood trauma (Bremner et al., 1995; El-Hage, Gaillard, Isingrini, & Belzung, 2006). Although these studies support the proposed association between IPV and children's memory, most of the participants were referred to a clinical setting because of maltreatment that they had experienced, a fact that likely reflects the severity and extreme nature of the trauma to which they had been exposed. Therefore, it remains unclear to what extent these findings might extend to samples of children in community-based samples, in which the experiences may be less extreme.

In what we believe is the only study specifically linking IPV and children's memory, Jouriles, Brown et al. (2008) recruited a sample of 4- to 5-year-old children from social service agencies, domestic violence shelters, preschools, and libraries. These researchers found that higher levels of IPV were associated with lower levels of concurrent explicit memory as measured by the visual reception and receptive language scales of the Mullen Scales for Early Learning (Mullen, 1995) and the memory for faces subtest from the NEPSY

(Korkman, Kirk, & Kemp, 1998). Although this study adds substantially to the field's understanding of the relation between IPV and memory, further investigation of this relation is warranted for several reasons. First, although the findings suggest a linkage between IPV and explicit memory, it remains unclear if IPV is also associated with other aspects of memory, including short-term and working memory capacity, as well as the deliberate use of strategies for remembering. Second, IPV and explicit memory were linked concurrently in the Jouriles, Brown et al. (2008) study; thus, no information could be provided regarding the longitudinal associations between these variables. Finally, although the sample used by these authors included some families who were from the general community, it also included families who were receiving services from agencies or shelters, a fact that implies that at least part of the sample was clinical in nature. Therefore, it remains unclear how IPV and remembering may be associated in purely community-based samples.

The Current Study

This study was designed to address each of these three concerns with a community-based longitudinal sample and multiple measures of memory performance so as to explore associations among IPV and children's short-term, working, and deliberate memory. Given that children under the age of 5 years have been shown to be more likely than older children to be living in homes characterized by IPV (Fantuzzo, Boruch, Beriama, Atkins, & Marcus, 1997), we focused on IPV occurring over the toddler years and children's memory as they transitioned to school. More specifically, we examined the following questions: (a) Is IPV that is reported when children are 30 months old associated with their short-term, working, and deliberate memory performance when they are 60 months old? (b) Can this effect be observed above and beyond the influence of several child- and family-level covariates? We hypothesized that IPV would be negatively correlated with children's memory skills at school entry even when controlling for several family (income-to-needs ratio, maternal harsh-intrusive parenting) and child (race, gender, and expressive vocabulary) factors.

Given the demonstrated associations between IPV and children's cognitive skills, we used expressive vocabulary as a proxy control measure of general cognitive ability. Moreover, building upon suggestions that IPV and child-directed aggression often co-occur (Jouriles, McDonald et al., 2008; Knickerbocker, Heyman, Slep, Jouriles, & McDonald, 2007), we also controlled for maternal harsh-intrusive parenting behaviors. In this manner, we were able to account for the possibility that parental hostility, rather than the violent climate of the home, was responsible for any observed relations between IPV and children's memory performance. Further, although we acknowledge that the parenting of men in physically violent intimate relationships is also compromised by IPV (Holden & Barker, 2004), in the current study we focused on maternal parenting behaviors for two major reasons: (a) past research demonstrates that mothers tend to spend more time caring for their children relative to fathers, particularly during the early years (Pleck & Masciadrelli, 2004), and (b) maternal care-giving during early childhood has been shown to be uniquely and particularly important for children's later development (Maccoby, 2000; Verhoeven, Junger, Van Aken, Deković & Van Aken, 2007); therefore, disturbances in maternal parenting during this time may be particularly detrimental for children's long-term functioning.

Method

Participants

Participants in this study were a subsample of the Durham Child Health and Development Study (DCHDS), a longitudinal study of 206 socioeconomically and racially diverse families living in and around a midsized southeastern city. Families with healthy, full-term infants were recruited via fliers and postings at birth and parenting classes and through phone contact via birth records during the first 3 months of the child's life.

Interested mothers participated in a brief screening interview to determine eligibility. Eligible families were those in which the mother indicated that (a) the child was born full term, healthy, and without significant birth complications; (b) the child was not one of a multiple birth; (c) the child was either African American or European American; (d) she was at least 18 years old; (e) she was fluent in English; and (f) the family had no plans to move out of the catchment area during the 3 subsequent years. Participants were selected in accordance with a stratified sampling plan designed to reflect the demographic diversity of Durham, North Carolina. Recruitment procedures were designed to yield approximately equal numbers of European-American and African-American families sampled from low- and middle-income groups. Of the families deemed eligible, approximately 87% enrolled in the study.

The subsample only included families in which the target child's mother had a romantic partner at the 30-month time point (n = 145). Although all children enrolled in the DCHDS were full-term, healthy infants, five of them were identified as having a developmental delay by the 60-month assessment. These five children were not included in the current analyses, yielding a final sample of 140 families. In this subsample, 53% of the children were female, 52% were African American (48% were European American), and the median household income when the child was 60 months old was $83,000 ($M$ = $94,089, SD = $65,740, range: $6,240–400,000). In most cases, the mother's partner was the target child's biological father (n = 122; 87.14%) and lived in the home with the child (n = 123, 87.86%). This subsample did not differ significantly from the complete sample on any of these variables. It is important to note that 15% (n = 21) of the mothers in this subsample reported that they or their partners had perpetrated at least one physically violent act in the previous year. This figure is consistent with those found by the National Family Violence Survey, which reported that 10–12% of couples experienced at least one instance of IPV in the previous year (Straus & Gelles, 1990).

Thirty-five (24%) of the 145 families who met criteria for inclusion in the current study were unavailable for assessment at the 60-month assessment time point. Although the mothers who did not participate in this assessment, on average, had completed significantly fewer years of education than those who did participate in this visit, these two groups of mothers did not differ on any of the variables included in the current study. It is important to note that the mothers who participated in the 60-month assessment time point did not differ from those who did not participate in this visit on the amount of IPV that they reported when their children were 30 months old. The current study's treatment of this missing data is described in further detail under *Analytic Strategy*.

Procedure

Data used in the current study came from a series of laboratory visits when the target child was 30, 36, and 60 months old. At each of these time points, parents completed questionnaires, reported on family demographic information, and participated in parent–child interactions that were videotaped for later coding. In addition, children were administered a battery of assessments that were also videotaped for later coding. All procedures were approved by the Institutional Review Board at the University of North Carolina at Chapel Hill.

Measures

Intimate partner physical violence—IPV was assessed using the Conflict Tactics Scale–Couple Form R (CTS-R; Straus & Gelles, 1990), a 19-item self-report measure completed by each mother when her child was 30 months old. Each of these items lists a possible response to a question regarding marital conflict; respondents were asked to rate on a 7-point Likert-type scale (0 = *never*, 1 = *once*, 2 = *twice*, 3 = *3–5 times*, 4 = *6–10 times*, 5 = *11–20 times*, 6 = *<20 times*) how often in the past 12 months they engaged in specific behavior in response to an argument. They were also asked to rate how often in the past 12 months their partner engaged in each behavior. The 9-item physical violence subscale of this measure (which is computed by taking the mean of these items) was used in this study. An example item reads "[How often in the past 12 months have you/your partner] kicked, bit, or hit him/her/you with a fist?" Fifteen percent of the mothers in our subsample reported that they or their partners had perpetrated at least one physically violent act in the previous year. In most of these cases (i.e., 55% of the physically violent couples), the mothers reported that they and their partners had perpetrated an act of physical violence, a fact that is consistent with previous work with community samples suggesting that physical violence in community samples is commonly mutual (Archer, 2000; Caetano, Vaeth, & Ramisetty-Mikler, 2008). As such, each mother's report of her own IPV and her partner's IPV were summed to create a score that represents the total amount of physical violence experienced in the household (α = .84).

Short-term memory—Short-term memory was assessed using the Digit Span task (McCarthy, 1972) when the child was 60 months old. Following standardized assessment procedures, two forward span trials were administered. On each trial, strings of numbers of increasing length were presented, with the child's task being that of repeating the numbers in sequence. The child's span was measured as the length of the longest forward string of digits (out of the two administered trials) that could be produced without error.

Working memory—Working memory was also assessed using the Digit Span task (McCarthy, 1972) when the child was 60 months old. Two backward span trials were administered. On each trial, strings of numbers of increasing length were presented, with the child's task being that of stating the numbers in reverse order. The child's span was measured as the length of the longest backward string of digits (out of the two administered trials) that could be produced without error.

Deliberate memory—Children also completed the Object Memory Task (Baker-Ward, Ornstein, & Holden, 1984) at the 60-month assessment. In this task, children were provided with 15 familiar objects (e.g., plastic toy animals or vehicles or household items such as a mirror or brush) and instructed to do anything during a 2-min study period that they thought would help them to remember the materials. After the study period, the objects were hidden with a cloth, and recall was requested. To characterize the simple strategies used by the children while trying to remember the objects, their behavior during the 2-min study period was videotaped for later coding and analysis of behaviors typically elicited by instructions to remember as opposed to instructions to play (Baker-Ward, 1985; Baker-Ward et al., 1984).

During coding, the 2-min study period was divided into 24 5-s intervals. For each interval, coders noted the presence or absence of nonverbal behaviors (e.g., visual examination, manipulation, playing, pointing) in addition to the frequency of verbal behaviors (e.g., naming, association, object talk, onomatopoeia). Further description of these behaviors can be found in previously published reports that have used this coding scheme (e.g., Baker-Ward et al., 1984). In addition, the coders judged whether each interval was predominantly deliberate or nondeliberate on the basis of the amount of time that was devoted to deliberate or nondeliberate behaviors within the interval. The total number of these intervals (out of 24) that were judged to be predominantly deliberate in nature was used as our measure of deliberate memory.

To establish reliability in the coding of these behaviors, two coders independently scored 25% of the records. κ values were calculated separately for the nonverbal and verbal coding sections of each file; in addition, percentage agreement was calculated for the overall deliberate versus nondeliberate judgment for the 24 intervals. Coders were required to obtain κ values of at least .70 for the nonverbal and verbal sections and at least 80% agreement on the deliberate versus nondeliberate distinction for each file. The nonverbal κ values ranged from .74 to 1.00 with an average of .95, the verbal κ values ranged from .70 to 1.00 with an average of .93, and the percentage agreement scores ranged from 88% to 100% with an average of 97%.

Maternal harsh-intrusive parenting behaviors—Maternal parenting behaviors were assessed during a parent–child interaction when the target child was 36 months old. During this activity, mothers and children completed a puzzle task in which they were presented with three developmentally appropriate puzzles of increasing difficulty. Parents were told that this was a task for the child to complete, but that they could provide any assistance that they deemed necessary. All interactions lasted 10 min and were videotaped for later coding by two coders who were blind to other information about the families. For each of seven global rating scales (Sensitivity/Supportive Presence, Detachment/Disengagement, Intrusiveness, Stimulation of Cognitive Development, Positive Regard, Negative Regard, and Animation; see Cox & Crnic, 2002) adapted from those used by the National Institute of Child Health and Human Development Study of Early Child Care (National Institute of Child Health and Human Development Early Child Care Research Network, 1999), coders rated parenting behaviors on a 7-point scale (1 = *not at all characteristic* and 7 = *very characteristic*). Informed by an exploratory factor analysis with an oblique rotation (i.e., promax), the seven individual scales were combined to obtain overall measures of sensitive

parenting (the mean of Sensitivity, Stimulation, Positive Regard, Animation, and reverse-scored Detachment) and harsh-intrusive parenting (the mean of Intrusiveness and Negative Regard). Only the harsh-intrusive parenting score was used in the current study.

The first component of the harsh-intrusive parenting measure was derived from the Intrusiveness scale. A parent who was given a score of 7 on Intrusiveness was one who consistently displayed behaviors that showed a lack of respect for the child as an individual. These mothers frequently interfered with their children's needs, desires, and interests and denied almost all of their attempts at autonomy, often persisting with their own personal desires or agendas in the face of their children's strong defensive behaviors (e.g., crying, withdrawing, verbalizing that they would like them to stop). Example behaviors include physically manipulating the child's hands or body, denying the child the opportunity to select the puzzle pieces to use or the opportunity to try to interact with or complete the task themselves, and verbally directing the child at a pace and in a context that was not appropriate to his or her cues.

The second component of the harsh-intrusive measure was derived from the negative regard scale that captured the amount of negative and hostile maternal behaviors being directed toward the target child during the activity. Example behaviors include expressing disapproval through irritated or harsh comments and/or vocal tone, tense facial muscles or posture meant to communicate a threat or disapproval, threatening or punishing the child without explanation, and calling the child unflattering names. In our sample, a parent assigned a 7 on this scale typically displayed harsh, disapproving comments and behaviors consistently throughout the task while also exhibiting more severe forms of hostility, such as threatening or striking the child.

Two coders underwent training until acceptable reliability as assessed with an intraclass correlation of greater than .80 was achieved and maintained for each coder on each of the seven scales. Once the two coders demonstrated that they could reliably score the training videos, these coders began formal coding of the videos included in the current study. To assess reliability after formal coding had begun, both coders coded a random selection of 33% of interactions. Coders met biweekly to reconcile scoring discrepancies; the final scores that they arrived at by consensus were used in all analyses. Inter-rater reliability for the harsh-intrusive parenting composite was .89.

Expressive vocabulary—The child's expressive vocabulary was assessed at the 60-month assessment time point using the Expressive Vocabulary Test (EVT; Williams, 1997), a well-validated and highly reliable standardized language measure designed to assess expressive vocabulary and word retrieval for the English language. This test measures expressive vocabulary knowledge with two types of items: labeling and synonyms. For the labeling items, the research assistant points to a picture or part of the body and asks a question, and the child is asked to respond with a one-word answer that is a noun, verb, or adjective. For the synonym items, the research assistant presents a picture and a stimulus word, and the child is asked to respond with a one-word answer that is a noun, verb, adjective, or adverb. A basal score for this measure is achieved when the child correctly answers five consecutive items whereas a ceiling is achieved when the child obtains five

consecutive errors. Raw expressive vocabulary scores were calculated by subtracting the total number of items that the child answered incorrectly from the value of the highest item number that the child answered correctly.

Demographic covariates—At each time point, mothers reported information on various household demographic variables, including the total household income from all possible sources, the number of individuals living in the home, and the race of the target child (0 = *African American*, 1 = *European American*). Income-to-needs ratios were calculated at each assessment by dividing the total household income from all possible sources by the federally determined poverty threshold for the number of people living in the household for that year. Income-to-needs ratios above 1.0 indicate that a family is able to provide for basic needs whereas values below 1.0 indicate that it is not able to do so. The 60-month assessment was used in the current analyses. These demographic variables, in addition to the sex of the child (0 = *female*, 1 = *male*), were used as control variables during model parameterization.

Analytic Strategy

A path model was parameterized using the Mplus 6.0 software package (Muthén & Muthén, 1998–2010) using the robust maximum likelihood estimator. This estimator accommodates non-normal data by adjusting standard errors using the Huber–White sandwich estimator. As mentioned above, 35 families were missing data on one or more study indicators. Rather than eliminating these observations when testing our research questions, we conducted all analyses using full information maximum likelihood (FIML; Arbuckle, 1996), a missing data technique that uses all available information to produce estimates that have been shown to be unbiased and more efficient than those produced via other methods of handling data that are missing at random (e.g., listwise deletion, pairwise deletion; Allison, 2003). To strengthen our confidence in the robustness of our findings, we repeated all analyses without these 35 observations included. Both methods of handling these missing data yielded the same pattern of results. Thus, we present the results from the models in which FIML was used, given its demonstrated strengths.

Model parameterization proceeded as follows. First, each of the three 60-month outcome variables (i.e., short-term, working, and deliberate memory) was regressed on 30-month intimate partner physical violence measure. Paths were also estimated from each of the covariates (i.e., the family's income-to-needs ratio, the child's race and sex, the child's expressive vocabulary, and maternal harsh-intrusive parenting behaviors) to each of the three outcome variables. A correlation between the digit span forward and digit span backward tasks was estimated to account for the common method of administration.

Results

Descriptive Statistics

Descriptive statistics and bivariate correlations among study variables are presented in Table 1. Associations among variables were largely as expected, such that higher levels of IPV at 30 months were associated with lower scores on the various measures of memory when the child was 60 months old. The association between 30-month IPV and our measure of

deliberate memory (number of intervals out of 24 in which a deliberate strategy was used) was the only nonsignificant correlation among the focal variables, but the association was in the expected direction ($r = -.13$).

Path Model

Results from the path model are displayed in Figure 1, in which all presented results are standardized and all depicted paths are significant. Inspection of the figure indicates that even after controlling for the children's gender and race, the family's income-to-needs ratio, the child's expressive vocabulary, and maternal harsh-intrusive parenting behaviors, IPV measured when the children were 30 months old predicted their short-term ($\beta = -.46$, $p < .01$), working ($\beta = -.17$, $p < .05$), and deliberate ($\beta = -.15$, $p < .05$) memory when they were 60 months of age such that IPV predicted lower memory scores. Only two paths from any of the covariates to the memory measures were significant: the path from the race of the children to their short-term memory scores ($\beta = .18$, $p < .05$; such that European-American children on average had higher digit span forward scores relative to African-American children) and the path from the children's expressive vocabulary to their working memory scores ($\beta = .31$, $p < .01$; such that higher expressive vocabulary scores were associated with longer backward digit spans). This model fit the data well, $\chi^2(1, N = 140) = .36$, $p = .55$ comparative fit index = 1.00, Tucker-Lewis index = 1.12, root mean square error of approximation = .00, and accounted for 32% of the variance in forward digit span scores, 27% of the variance in backward digit span scores, and 4% of the variance in the number of intervals in which the child used a deliberate strategy during the object memory task.

Discussion

Using data from a socioeconomically and racially diverse community sample of families living in and around a midsized southeastern city, the current study enabled us to investigate the relation between IPV and children's memory at school entry. Consistent with expectations, IPV measured when the children were 30 months of age predicted short-term, working, and deliberate memory performance at 60 months even after controlling for the children's sex and race, the family's income-to-needs ratio, and the child's expressive vocabulary. This effect was also above and beyond the influence of maternal harsh-intrusive parenting behaviors, suggesting that the violent climate of the parents' relationship had an independent association with children's memory skills. These findings add to the limited extant literature linking IPV and children's cognitive functioning and suggest that living in households in which there is physical violence perpetrated between parents may have a negative effect on multiple dimensions of children's memory development. These findings also suggest that researchers who design interventions that are aimed at helping children exposed to IPV may want to assess or target children's memory skills, including deficits in their short-term and working memory performance and their use of deliberate memory strategies.

Previous research points to several potential mechanisms that could help to explain these linkages between IPV and various aspects of memory functioning, although it must be noted that we were unable to test these proposed mechanisms in this study. For example, exposure

to IPV has been associated with symptoms of hyperarousal (Graham-Bermann & Levendosky, 1998), symptoms that may have implications for children's performance on memory tasks similar to those discussed above with reference to self-regulatory skills (i.e., difficulties attending to memory-relevant stimuli, difficulties inhibiting irrelevant information during recall). Moreover, although Jouriles, Brown et al. (2008) did not find evidence that hyperarousal symptoms mediate the association between IPV and explicit memory performance, it is possible that more general difficulties regulating emotion play a role in this association. Alternatively, several authors have suggested that chronic exposure to stressors such as IPV may have a negative effect on brain structures, including the hippocampus (e.g., Howe et al., 2006); that is, repeated exposure to IPV may result in chronically elevated levels of stress hormones, which have the potential to damage the hippocampus, thereby affecting children's memory. This proposition is supported by animal models that have shown that chronic stress is related to the atrophy of neurons in the hippocampus (Bremner & Vermetten, 2001; McEwen, 2006). Future research should investigate these, and other, potential explanatory mechanisms that may underlie the relation between IPV and children's memory.

The current study adds to the extant literature in a number of ways. For example, this is the first study to our knowledge to establish a relation between IPV and multiple dimensions of children's memory using data from a community-based sample of young children. This represents a contribution not only because research linking IPV and children's memory is sparse, but also because young children remain an understudied population in the IPV literature, despite research that suggests that children under the age of five are more likely to be exposed to IPV than older children (Fantuzzo et al., 1997). The longitudinal design of our study allowed us to investigate the long-term impact of IPV and also permitted us to rule out alternative characterizations of the association between these variables. That is, the temporal ordering of our measurement of IPV and memory allowed us to rule out the possibility that children's memory when they were 60 months of age contributed to physical violence among their parents several years earlier (given that this is theoretically implausible), thereby eliminating this alternative interpretation of our data. Another strength of this study stems from our ability to use rich observational data of both children's memory strategies and maternal parenting behaviors.

Despite its contributions, this investigation also had several limitations. For example, although the model that we tested proposed a directionality of effect (based on the temporal ordering of our measurement of IPV and children's memory), this is nonetheless correlational research and should be treated as such. Although it is difficult to think of a scenario in which a child's memory skills would elicit violent behavior among parents, the analyses used in this study did not eliminate this possibility explicitly. Although manipulating these variables to make causal claims about the nature of the association between IPV and children's memory would be difficult and unethical, future research may want to use methods or research designs that would give further insight into the directionality of this relation, perhaps by examining memory at even earlier ages or investigating changes in memory over time.

Also limiting is the fact that IPV was assessed using maternal report. Although mothers may inaccurately or intentionally under-report IPV (Jouriles, McDonald, Norwood, & Ezell, 2001), women have been shown to be more accurate reporters of verbal and physical aggression than men (Stets & Straus, 1989; Straus & Sweet, 1992), making maternal report a reasonable method of assessing IPV in the current study. However, future research should make use of data from multiple informants. Also concerning is the fact that although we measured the total amount of IPV to which each mother was exposed, we did not measure how much of the IPV the child witnessed. Although past research suggests that most children living in violent homes directly witness IPV (Fantuzzo & Fusco, 2007), future research should investigate whether these relations vary based on the amount of IPV to which the child was exposed. Also, the focus of the current study was on violence occurring within the family; thus, we were not able to investigate or control for children's exposure to violence occurring in contexts outside of the home. Therefore, in future research investigators may want to explore the link between violence occurring outside of the home (e.g., community violence or violence occurring in schools) and children's memory as well as the ways in which these other types of violence may moderate the associations examined in the current study.

Summary and Conclusions

Building on previous research that demonstrates that IPV is associated with children's emerging cognition, these results provide additional evidence that living in households characterized by IPV may undermine children's ability to acquire cognitive skills that are foundational for later learning. The current study focused on investigating linkages between IPV occurring early in the child's life and his or her short-term memory, working memory, and deliberate strategy use at school entry. Results indicate that, even after controlling for several child- and family level variables, IPV occurring early in the child's life was negatively associated with each of these dimensions of memory development at school entry. These findings suggest that clinicians who design intervention programs that are aimed at helping children who are living in physically violent homes should target not only children's behavioral and emotional problems but also potential deficits in the development of memory and other basic cognitive skills.

Acknowledgments

This study was supported by the National Science Foundation through a Children's Research Initiative grant (BCS-0126475) and an Integrative Research Activities for Developmental Science grant (BCS-0720660) as well as by a postdoctoral fellowship provided by the National Institute of Child Health and Human Development (T32-HD07376).

References

Allison PD. Missing data techniques for structural equation modeling. Journal of Abnormal Psychology. 2003; 112:545–557.10.1037/0021-843X.112.4.545 [PubMed: 14674868]

Arbuckle, JL. Full information estimation in the presence of incomplete data. In: Marcoulides, GA.; Schumacker, RE., editors. Advanced structural equation modeling. Mahwah, NJ: Erlbaum; 1996. p. 243-277.

Archer J. Sex differences in aggression between heterosexual partners: A meta-analytic review. Psychological Bulletin. 2000; 126:651–680.10.1037/0033-2909.126.5.651 [PubMed: 10989615]

Baker-Ward, L. Unpublished doctoral dissertation. University of North Carolina; Chapel Hill: 1985. An exploration of memorization in kindergarten children.

Baker-Ward L, Ornstein PA, Holden DJ. The expression of memorization in early childhood. Journal of Experimental Child Psychology. 1984; 37:555–575.10.1016/0022-0965(84)90076-6 [PubMed: 6747548]

Bremner JD, Randall P, Scott TM, Capelli S, Delaney R, McCarthy G, Charney DS. Deficits in short-term memory in adult survivors of childhood abuse. Psychiatry Research. 1995; 59:97–107.10.1016/0165-1781(95)02800-5 [PubMed: 8771224]

Bremner JD, Vermetten E. Stress and development: Behavioral and biological consequences. Development and Psychopathology. 2001; 13:473–489.10.1017/S0954579401003042 [PubMed: 11523844]

Bull R, Espy K, Wiebe SA. Short-term memory, working memory, and executive functioning in preschoolers: Longitudinal predictors of mathematical achievement at age 7 years. Developmental Neuropsychology. 2008; 33:205–228.10.1080/87565640801982312 [PubMed: 18473197]

Caetano R, Vaeth PAC, Ramisetty-Mikler S. Intimate partner violence victim and perpetrator characteristics among couples in the United States. Journal of Family Violence. 2008; 23:507–518.10.1007/s10896-008-9178-3

Cox, MJ.; Crnic, K. Unpublished manuscript. University of North Carolina; Chapel Hill: 2002. Qualitative ratings for parent–child interaction at 3–12 months of age.

Davies PT, Cummings EM. Marital conflict and child adjustment: An emotional security hypothesis. Psychological Bulletin. 1994; 116:387–411.10.1037/0033-2909.116.3.387 [PubMed: 7809306]

Davies PT, Woitach M, Winter M, Cummings EM. Children's insecure representations of the interparental relationship and their school adjustment: The mediating role of attention difficulties. Child Development. 2008; 79:1570–1582.10.1111/j.1467-8624.2008.01206.x [PubMed: 18826543]

DePrince AP, Weinzierl KM, Combs MD. Executive function performance and trauma exposure in a community sample of children. Child Abuse & Neglect. 2009; 33:353–361.10.1016/j.chiabu.2008.08.002 [PubMed: 19477515]

Eisen ML, Goodman GS. Trauma, memory, and suggestibility in children. Development and Psychopathology. 1998; 10:717–738.10.1017/S0954579498001837 [PubMed: 9886223]

El-Hage W, Gaillard P, Isingrini M, Belzung C. Trauma-related deficits in working memory. Cognitive Neuropsychiatry. 2006; 11:33–46.10.1080/13546800444000164 [PubMed: 16537232]

Fantuzzo J, Boruch R, Beriama A, Atkins M, Marcus S. Domestic physical violence and children: Prevalence and risk in five major cities. Journal of the American Academy of Child & Adolescent Psychiatry. 1997; 36:116–122.10.1097/00004583-199701000-00025 [PubMed: 9000789]

Fantuzzo J, Fusco R. Children's direct exposure to types of domestic violence crime: A population-based investigation. Journal of Family Violence. 2007; 22:543–552.10.1007/s10896-007-9105-z

Fivush R, Haden CA, Reese E. Elaborating on elaborations: The role of maternal reminiscing style in cognitive and socioemotional development. Child Development. 2006; 77:1568–1588.10.1111/j.1467-8624.2006.00960.x [PubMed: 17107447]

Graham-Bermann SA, Howell KH, Miller LE, Kwek J, Lilly MM. Traumatic events and maternal educations as predictors of verbal ability for preschool children exposed to intimate partner violence (IPV). Journal of Family Violence. 2010; 25:383–392.10.1007/s10896-009-9299-3

Graham-Bermann SA, Levendosky AA. Traumatic stress symptoms in children of battered women. Journal of Interpersonal Violence. 1998; 13:111–128.10.1177/088626098013001007

Gustafsson HC, Cox MJ, Blair C. the Family Life Project Key Investigators. Maternal parenting as a mediator of the relationship between intimate partner violence and effortful control. Journal of Family Psychology. 2012; 26:115–123.10.1037/a0026283 [PubMed: 22142253]

Holden, GW.; Barker, T. Fathers in violent homes. In: Lamb, ME., editor. The role of the father in child development. New York, NY: Wiley; 2004. p. 417-445.

Howe, ML.; Toth, SL.; Cicchetti, D. Memory and developmental psychopathology. In: Cicchetti, D.; Cohen, D., editors. Developmental Psychopathology (2nd Edition): Developmental Neuroscience. Vol. 2. New York, NY: Wiley; 2006. p. 759-769.

Huth-Bocks AC, Levendosky AA, Semel MA. The direct and indirect effects of domestic violence on young children's intellectual functioning. Journal of Family Violence. 2001; 16:269–290.10.1023/A:1011138332712

Jouriles EN, Brown AS, McDonald R, Rosenfield D, Leahy MM, Silver C. Intimate partner violence and preschoolers' explicit memory functioning. Journal of Family Psychology. 2008; 22:420–428.10.1037/0893-3200.22.3.420 [PubMed: 18540770]

Jouriles EN, McDonald E, Slep AMS, Heyman RE, Garrido E. Child abuse in the context of domestic violence: Prevalence, explanations, and practice implications. Violence and Victims. 2008; 23:221–235.10.1891/0886-6708.23.2.221 [PubMed: 18624091]

Jouriles, EN.; McDonald, R.; Norwood, WD.; Ezell, E. Issues and controversies in documenting the prevalence of children's exposure to domestic physical violence. In: Graham-Bermann, SA.; Edleson, JL., editors. Domestic physical violence in the lives of children: The future of research, intervention, and social policy. Washington, DC: American Psychological Association; 2001. p. 12-34.

Kitzmann KM, Gaylord NK, Holt AR, Kenny ED. Child witnesses to domestic physical violence: A meta-analytic review. Journal of Consulting and Clinical Psychology. 2003; 71:339–352.10.1037/0022-006X.71.2.339 [PubMed: 12699028]

Knickerbocker L, Heyman RE, Slep AMS, Jouriles EN, McDonald R. Co-occurrence of child and partner maltreatment: Definitions, prevalence, theory, and implications for assessment. European Psychologist. 2007; 12:36–44.10.1027/1016-9040.12.1.36

Koenen KC, Moffitt TE, Caspi A, Taylor A, Purcell S. Domestic violence is associated with environmental suppression of IQ in young children. Development and Psychopathology. 2003; 15:297–311.10.1017/S0954579403000166 [PubMed: 12931829]

Korkman, M.; Kirk, U.; Kemp, S. NEPSY: A developmental neuropsychological assessment. San Antonio, TX: Psychological Corporation; 1998.

Maccoby EE. Parenting and its effects on children: On reading and misreading behavior genetics. Annual Review of Psychology. 2000; 51:1–27.10.1146/annurev.psych.51.1.1

McCarthy, DA. Manual for the McCarthy scales of children's abilities. New York, NY: Psychological Corporation; 1972.

McEwen BS. Protective and damaging effects of stress mediators: Central role of the brain. Dialogues in Clinical Neuroscience. 2006; 8:367–381. [PubMed: 17290796]

Mullen, EM. Mullen scales of early learning. Circle Pines, MN: American Guidance Service; 1995.

Muthén, LK.; Muthén, BO. Mplus user's guide. 6. Los Angeles, CA: Muthén & Muthén; 1998–2010.

National Institute of Child Health and Human Development Early Child Care Research Network. Child care and mother–child interaction in the first 3 years of life. Developmental Psychology. 1999; 35:1399–1413.10.1037/0012-1649.35.6.1399 [PubMed: 10563730]

Ornstein, PA.; Baker-Ward, L.; Naus, MJ. The development of mnemonic skill. In: Weinert, FE.; Perlmutter, M., editors. Memory development: Universal changes and individual differences. Hillsdale, NJ: Erlbaum; 1988. p. 31-49.

Ornstein, PA.; Coffman, JL.; Grammer, JK. Learning to remember. In: Barbarin, OA.; Wasik, B., editors. Handbook of child development and early education: Research to practice. New York, NY: Guilford Press; 2009. p. 103-122.

Ornstein PA, Haden CA. Memory development or the development of memory? Current Directions in Psychological Science. 2001; 10:202–205.10.1111/1467-8721.00149

Pleck, JH.; Masciadrelli, BP. Paternal involvement by U.S. residential fathers: Levels, sources, and consequences. In: Lamb, ME., editor. The role of the father in child development. 4. New York, NY: Wiley; 2004. p. 222-271.

Reese E, Haden CA, Fivush R. Mother-child conversations about the past: Relationships of style and memory over time. Cognitive Development. 1993; 8:403–430.10.1016/S0885-2014(05)80002-4

Sabol TJ, Pianta RC. Patterns of school readiness forecast achievement and socioemotional development at the end of elementary school. Child Development. 2012; 83:282–299.10.1111/j.1467-8624.2011.01678.x [PubMed: 22103310]

Schneider, W.; Bjorklund, DF. Memory. In: Damon, W.; Kuhn, D.; Siegler, R., editors. Handbook of child psychology, cognition, perception, and language. 5. Vol. 2. New York, NY: Wiley; 1998. p. 467-521.

Stets J, Straus M. The marriage license as a hitting license: A comparison of assaults in dating, cohabiting, and married couples. Journal of Family Violence. 1989; 4:161–180.10.1007/BF01006627

Straus, MA.; Gelles, RJ. Physical violence in American families: Risk factors and adaptations to physical violence in 8,145 families. New Brunswick, NJ: Transaction; 1990.

Straus M, Sweet S. Verbal/symbolic aggression in couples: Incidence rates and relationships to personal characteristics. Journal of Marriage and the Family. 1992; 54:346–357.10.2307/353066

Thompson RA, Calkins SD. The double-edged sword: Emotion regulation in high risk children. Development and Psychopathology. 1996; 8:163–182.10.1017/S0954579400007021

Towe-Goodman NR, Stifter CA, Coccia MA, Cox MJ. the Family Life Project Key Investigators. Interparental aggression, attention skills, and early childhood behavior problems. Development and Psychopathology. 2011; 23:563–576.10.1017/S0954579411000216 [PubMed: 23786696]

Verhoeven M, Junger M, Van Aken C, Deković M, Van Aken MAG. Parenting during toddlerhood: Contributions of parental, contextual, and child characteristics. Journal of Family Issues. 2007; 28:1663–1691.10.1177/0192513X07302098

Williams, KT. Expressive Vocabulary Test. Circle Pines, MN: American Guidance Service; 1997.

Wolfe DA, Cooks CV, Lee V, McIntyre-Smith A, Jaffe PG. The effects of children's exposure to domestic violence: A meta-analysis and critique. Clinical Child and Family Psychology Review. 2003; 6:171–187.10.1023/A:1024910416164 [PubMed: 14620578]

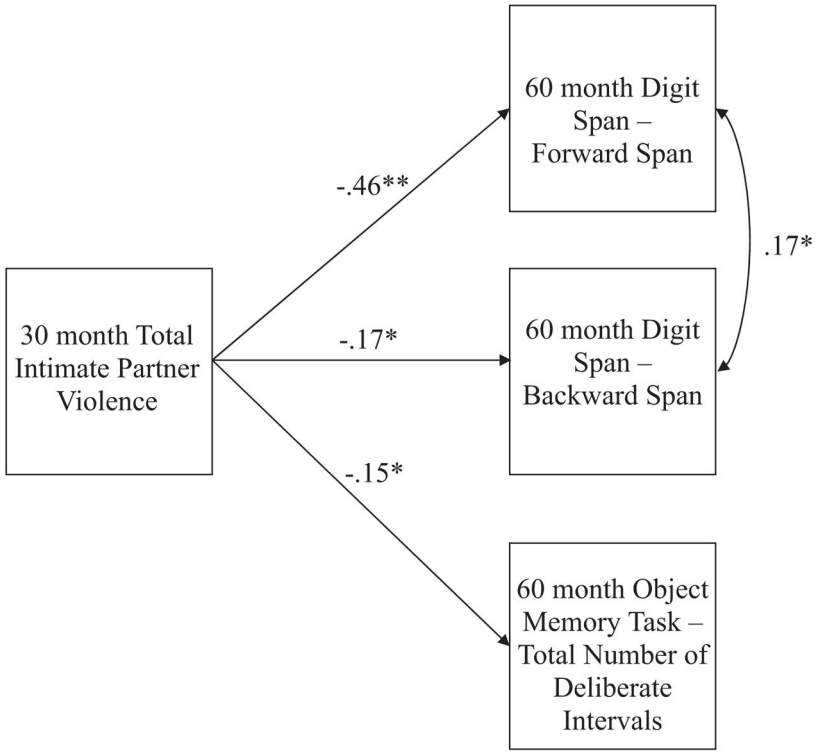

Figure 1. Final model relating IPV and short-term, working, and deliberate memory

Note: χ^2 (1, N = 140) = .36, p = .55 CFI = 1.00, TLI = 1.12, RMSEA = .00. All presented results are standardized. *p < .05, **p < .01

Table 1

Descriptive Statistics and Bivariate Correlations Among Study Variables (N = 140)

Variable	1	2	3	4	5	6	7	8	9
1. Total 30-min IPV	—								
2. 60-min digit span forward	−.55	—							
3. 60-min digit span backward	−.32	.34**	—						
4. 60-min object memory task	−.13	−.09	−.11	—					
5. 36-min harsh-intrusive parenting	−.22**	−.18	−.37**	.08	—				
6. Income-to-needs ratio	−.13	.12	.26**	.01	−.48**	—			
7. Child sex[a]	−.07	−.15	−.06	−.05	.07	.10	—		
8. Child race[b]	−.14	.23*	.28**	.01	−.39**	.34**	.10	—	
9. Child expressive vocabulary	−.31**	.35**	.47**	−.09	−.49**	.33**	−.16	.35**	—
Mean (*SD*)	.10 (.43)	4.77 (.88)	2.46 (1.05)	17.84 (4.98)	2.40 (1.20)	3.84 (2.95)	—	—	60.45 (11.42)
Range	0–4.44	1–7	0–4	2–24	1–7	.04–16.86	—	—	37–84

[a] 0 = female, 1 = male.

[b] 0 = African American, 1 = European American.

* $p < .05$.

** $p < .01$.