

PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

Receptive Language and Educational Attainment for Sexually Abused Females

Jennie G. Noll, Chad E. Shenk, Michele T. Yeh, Juye Ji, Frank W. Putnam and
Penelope K. Trickett

Pediatrics 2010;126:e615-e622; originally published online Aug 9, 2010;
DOI: 10.1542/peds.2010-0496

The online version of this article, along with updated information and services, is
located on the World Wide Web at:

<http://www.pediatrics.org/cgi/content/full/126/3/e615>

PEDIATRICS is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. PEDIATRICS is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2010 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 0031-4005. Online ISSN: 1098-4275.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™



Receptive Language and Educational Attainment for Sexually Abused Females

AUTHORS: Jennie G. Noll, PhD,^{a,b,c} Chad E. Shenk, PhD,^{a,b} Michele T. Yeh, PhD,^d Juye Ji, MSW,^e Frank W. Putnam, MD,^{a,f} and Penelope K. Trickett, PhD^g

^aDepartment of Pediatrics, ^bDivision of Behavioral Medicine and Clinical Psychology, ^cDivision of Epidemiology and Biostatistics, and ^dMayerson Center for Safe and Healthy Children, Cincinnati Children's Hospital Medical Center, University of Cincinnati College of Medicine, Cincinnati, Ohio; ^eDepartment of Psychiatry and Behavioral Neuroscience, University of Chicago, Chicago, Illinois; ^fCollege of Human Ecology, Syracuse University, Syracuse, New York; and ^gSchool of Social Work, University of Southern California, Los Angeles, California

KEY WORDS

childhood abuse, cognitive development, educational attainment

ABBREVIATIONS

SES—socioeconomic status

PPVT-R—Peabody Picture Vocabulary Test—Revised

HLM—hierarchical linear modeling

GLM—general linear modeling

Dr Noll analyzed the data.

www.pediatrics.org/cgi/doi/10.1542/peds.2010-0496

doi:10.1542/peds.2010-0496

Accepted for publication May 18, 2010

Address correspondence to Jennie G. Noll, PhD, Cincinnati Children's Hospital Medical Center, Division of Behavioral Medicine and Clinical Psychology, 3333 Brunet Ave, MLC 3015, Cincinnati, OH 45229-3039. E-mail: jennie.noll@cchmc.org

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2010 by the American Academy of Pediatrics

FINANCIAL DISCLOSURE: *The authors have indicated they have no financial relationships relevant to this article to disclose.*



WHAT'S KNOWN ON THIS SUBJECT: Through a number of possible mechanisms, childhood sexual abuse may significantly impair long-term cognitive functioning and educational attainment. Identifying deficits in growth trajectories and points of impairment throughout development could help identify critical periods and avenues of intervention for victims.



WHAT THIS STUDY ADDS: Developmental trajectories of receptive language acquisition revealed significant deficits beginning in midadolescence and lower overall educational attainment for females exposed to childhood sexual abuse. Findings will aid intervention efforts designed to enhance the well-being and quality of life for victims.

abstract

OBJECTIVES: The objective of this study was to test whether the experience of childhood sexual abuse is associated with long-term receptive language acquisition and educational attainment deficits for females.

METHODS: Females with substantiated familial childhood sexual abuse ($n = 84$) and a nonabused comparison group ($n = 102$) were followed prospectively for 18 years. Receptive language ability was assessed at 6 time points across distinct stages of development, including childhood, adolescence, and young adulthood. Rates of high school graduation and total educational attainment were assessed during young adulthood.

RESULTS: Hierarchical linear modeling revealed that receptive language did not differ between the groups at the initial assessment point in childhood; however, a significant group by time interaction was observed across development with abused females (1) acquiring receptive language at a significantly slower rate throughout development and (2) achieving a lower overall maximum level of proficiency. Significant differences in receptive language scores emerged as early as midadolescence. In addition, abused females reported significantly lower rates of high school graduation and lower overall educational attainment when compared with their nonabused peers.

CONCLUSIONS: Exposure to childhood sexual abuse may be a significant risk factor for cognitive performance and achievement deficits for victims. These findings have particular public health relevance given the high prevalence of sexual abuse and that poor cognitive functioning and low levels of educational attainment can contribute to continued adversity throughout the life course. Early intervention may assist victims in improving cognitive functioning, altering deleterious trajectories, and promoting greater life successes. *Pediatrics* 2010;126:e615–e622

Childhood maltreatment, including physical and sexual abuse as well as child neglect, is highly prevalent, with recent estimates reporting >750 000 documented cases annually in the United States.¹ The link between maltreatment and deleterious psychological and social functioning is fairly well-established.² Many maltreatment-associated sequelae have implications for learning and academic performance, including high levels of depression, anxiety, dissociative tendencies, behavior problems, and negative affect, which can interfere with students' motivation to learn and disrupt their ability to concentrate and attend.³ Moreover, maltreatment often co-occurs with other types of adversities, such as poverty and family disruption, which can have implications for the level of acculturation and educational investment within the home environment. Because school performance and environmental enrichment are closely tied to learning, one might expect that maltreated children would exhibit cognitive deficits in areas such as vocabulary acquisition and receptive language skills, which are thought to be largely environmentally based.⁴ There is increasing speculation that maltreatment itself can result in cognitive deficits through its effect on the developing brain.⁵ There are several plausible explanations for this effect on the brain. Perhaps most obvious is how brain development might be impaired as the result of traumatic brain injury in cases of physical abuse. Altered brain development is also associated with malnutrition or the withholding of adequate medical care in instances of child neglect. Less obvious is the notion of chronic stress, which often is associated with severe maltreatment.⁶ For example, many cases of childhood sexual abuse involve persistent safety and boundary violations, are initiated at young ages,

and can span several years.⁷ Such conditions are arguably some of most stressful that a child can endure. Stress stimulates neurologic responses across both sympathetic and endocrine systems, and there is considerable evidence that maltreated children have high catecholamine⁸ and cortisol activity,⁹ indicating possible dysregulation in these neuroendocrine systems. High levels of glucocorticoids such as cortisol can act on brain structures, such as the hippocampus and amygdala, to disrupt learning and memory¹⁰ and lead to adverse brain development through accelerated loss of neurons,¹¹ delays in myelination,¹² abnormalities in developmental pruning,¹³ inhibition of neurogenesis,¹⁴ and decreased brain growth factors.¹⁵

The extent to which these environmental and/or physiologic impairments might be operating in the lives of maltreatment victims could have important implications for long-term cognitive development, global cognitive functioning, academic achievement, educational attainment, and overall quality of life. Although precise mechanisms have yet to garner consistent empirical support, tangible neuropsychological outcomes for maltreatment victims have been reported in the past few decades. One review revealed that childhood stressors and maltreatment were associated with reductions in multiple brain structures and functions,¹⁶ including reduced corpus callosum¹⁷ and hippocampal volumes,¹⁸ and attenuated development of the amygdala.¹⁹ Another comprehensive review²⁰ found that 49 of 65 studies reported a relationship between child maltreatment and relatively poor cognitive performance. In particular, maltreated children displayed lower verbal abilities and receptive language acquisition relative to nonabused children.^{21–24}

Because early cognitive ability is highly predictive of subsequent academic problems in later adolescence and adulthood²⁵ and maltreated children are likely to underachieve academically or require special education assistance,²⁰ it is especially important to examine the developmental trajectories of cognitive abilities in maltreated children. Such trajectories might aid in articulating (1) the long-term effects of severe childhood adversity; (2) points in development when children are most vulnerable to the effects of maltreatment or when deficits might begin to manifest in observable discrepancies; and (3) implications for other potential life-course disruptions, such as academic underachievement, that might be closely tied to cognitive challenges across development.

To date, most empirical evidence supporting the relationship between maltreatment and cognitive functioning derives from cross-sectional designs. The few prospective studies of maltreatment victims were limited to follow-ups spanning only a few years^{26,27} or using limited numbers of assessment points.²⁸ There also are many retrospective studies in which maltreatment status was derived from self-reported recall that could not be substantiated. These design limitations preclude strong inferences and make it difficult to rule out the possibility that cognitive deficits predated the abuse. This study was designed with several methodologic advances in mind. First, the design was prospective and longitudinal in that abuse was substantiated and cognitive ability was assessed on several subsequent occasions across development at 6 time points during 18 years; hence, the study is the first of its kind to report on developmental trajectories of receptive language acquisition, including both starting points (intercepts) and rates and shapes of change over time.

This will aid inferences regarding (1) whether cognitive deficits might have preceded the abuse experience and (2) the point in development when deficits might first be observable. Second, the study contrasts these trajectories to those observed in a group of non-abused females who were comparable on a host of key demographic, family, and environmental variables. Third, the focus was on a single type of childhood maltreatment, namely substantiated sexual abuse by a family member, affording an opportunity to homogenize the sample as opposed to using a wide array of maltreatment types and severities, which has plagued much of the extant literature. The following hypotheses were tested: In comparison with their demographically similar nonabused peers, sexually abused females would be more likely to (1) manifest lower overall receptive language abilities throughout development and (2) manifest lower high school graduation rates and lower educational attainment by adulthood.

METHODS

Participants

Sexually abused females ($n = 84$) who were willing to participate in this study were referred by child protective services agencies in the Washington, DC, metropolitan area. Eligibility criteria were (1) age 6 to 16 years; (2) participation within 6 months of disclosure; (3) substantiated sexual abuse including genital contact and/or penetration; (4) perpetration by a family member (eg, parent, grandparent, older sibling, uncle); and (5) participation of a non-abusing caregiver (usually the biological mother). Child protective services records indicated that the median age at abuse onset was 7.8 years, the median duration was 24 months, 70% experienced vaginal and/or anal penetration, and 60% of perpetrators were the primary father figure (biological

fathers, step fathers, or mother's live-in boyfriends). These abuse characteristics were similar to comparable information reported in the 1988 National Incidence Study (NIS-2).²⁹

Comparison females ($n = 102$) were recruited via advertisements in newspapers and posters in welfare, child care, and community facilities in the same neighborhoods in which the abused participants lived. Comparison families contacted study personnel and were screened for eligibility, which included having no previous contact with protective services agencies and being demographically similar to a same-aged abused female. Comparison and abused females were similar in terms of residing zip codes, racial/ethnic group, age, predislosure socioeconomic status (SES), family constellation (1- or 2-parent households), and other nonsexual traumatic events. At some point after entry into the study, 13 comparison females revealed some form of sexual abuse and were dropped from the study, resulting in a comparison sample of 89.

Forty-six percent of the sample was of minority status, including 43% black, 2% Hispanic, and 1% Asian. The sample ranged from low to middle SES with mean Hollingshead³⁰ scores of ~ 36 (defined as "blue collar," or working class). As can be seen in Table 1, there were no statistical differences across groups regarding mean SES or percentage of minority (ie, white versus all minority categories).

Study Design

The impetus for this study was to observe the long-term consequences of childhood sexual abuse as well as make discrete cross-sectional comparisons within distinct developmental periods. To do so, this study used a cross-sequential design. A cross-sequential design is 1 that allows for the recruiting of individuals who rep-

resent a cross-section of development although following this cross-section longitudinally (Table 1). This design permits analyses of both static, cross-sectional within-time effects and dynamic, repeated-measures within-person effects. As illustrated in Table 1, the study began in 1987 (time 1), when participants were a mean age of 11 years. Five follow-up assessments were conducted (times 2 through 6) throughout adolescence and into adulthood. More than 96% of the sample was retained for the follow-up assessments (abused: 82; comparison: 84). The study received approval from the university institutional review board and a Federal Certificate of Confidentiality. Child assent and parental consent were obtained at each assessment for all participants who were younger than 18 years. When participants were aged ≥ 18 years, they provided their own consent.

Measures

Receptive Language

The Peabody Picture Vocabulary Test–Revised (PPVT-R),³¹ a measure of receptive language, was administered at times 1 through 6 via alternating parallel versions. The PPVT-R is a picture-prompted vocabulary test whereby participants are shown an array of pictures and are prompted to identify the picture that best represents the target vocabulary word. The test is graduated such that simpler pictures are presented earlier with progressing difficulty until a ceiling is reached. Raw scores were obtained and used in subsequent statistical analyses. Higher raw scores indicate that more vocabulary words were correctly identified. The PPVT-R was selected because it is a reliable indicator of vocabulary acquisition (or crystallized ability), is widely used, and shows strong convergent validity with Wechsler full-scale IQ scores.³¹

TABLE 1 Summary Statistics and Sample Sizes for Analyses

Parameter	Total (N = 173)	Abused (n = 84)	Comparison (n = 89)
Minority, % ^a	46	39	51
SES ^b			
Mean ± SD	36 ± 12	35 ± 14	37 ± 11
Range	11–44	10–47	12–43
Age at assessment (dates)			
Time 1 (1987–1989)			
Mean ± SD	11 ± 3	11 ± 3	11 ± 3
Range	6–16	6–16	6–16
Time 2 (1988–1991)			
Mean ± SD	12 ± 3	12 ± 3	12 ± 3
Range	7–18	7–17	7–18
Time 3 (1990–1992)			
Mean ± SD	13 ± 3	13 ± 3	13 ± 3
Range	8–20	8–18	8–20
Time 4 (1996–1998)			
Mean ± SD	18 ± 4	19 ± 4	18 ± 3
Range	11–25	11–25	11–23
Time 5 (1999–2001)			
Mean ± SD	20 ± 3	21 ± 3	20 ± 3
Range	13–26	13–26	13–26
Time 6 (2004–2006)			
Mean ± SD	24 ± 3	25 ± 4	24 ± 3
Range	18–30	18–30	18–30
No. per developmental period			
Childhood (age 6–10)	63	32	31
Young/midadolescence (age 11–14)	113	54	59
Mid/late adolescence (age 15–18)	106	52	54
Young adulthood (age 19–25)	145	65	80
Adulthood (age 26–30)	62	27	35
No. returning for follow-up (time 4, 5, and/or 6) used in growth curve analyses (96%)	166	82	84
% with all 6 time points	48	42	52
% with only 5 time points	22	34	12
% with only 4 time points	11	13	9
% with only 3 time points	16	9	23
% with only 2 time points	3	2	4

^a Defined as black (90%), Hispanic (9%), and Asian (1%).

^b Defined via Hollingshead ratings.³⁰

Educational Attainment

At the final assessment (time 6), participants indicated their highest level of education attained in the following manner: 1 = eighth grade or less; 2 = some high school; 3 = graduated high school; 4 = some college; 5 = college graduate; 6 = some postgraduate school; or 7 = postgraduate degree. High school graduate was defined as “1” equaling a score of ≥ 3 and “0” equaling a score of < 3 .

Statistical Analysis

Hierarchical linear modeling (HLM) via SAS PROC MIXED was used to esti-

mate average growth trajectories across development on the basis of raw PPVT-R scores arrayed from ages 6 to 30. The degree to which group membership (abused = 1; comparison = 0) could account for individual variation in parameter estimates (ie, intercept, slope) was then evaluated. An advantage of HLM is that maximum likelihood estimation methods can accommodate missing data, thereby allowing the analyst to make use of all available data so that any participant with multiple time points (or ages) can be included in the analysis of the entire

trajectory. Using Bayes’s estimation, individuals with more data are given more weight in the calculation, a procedure preferred to using list-wise or pairwise deletion in analysis in which portions of the developmental curve are represented by differing individuals or any given portion of the curve is only sparingly represented.³² Restricted maximum likelihood estimation with an estimated degrees of freedom procedure³³ was used to arrive at valid parameter estimates under the assumption of ignorable missing data. Although not necessarily contiguous, 70% of participants had at least 5 data points for the HLM growth analysis (see Table 1). Both linear and quadratic trends of PPVT-R scores throughout development were estimated.

For identification of specific points in development when deficits might begin to manifest in observable discrepancies, general linear modeling (GLM) was used via SAS PROC GLM to test for significant group main effects in PPVT-R scores at distinct developmental periods: childhood (ages 6–10), young/midadolescence (ages 11–14), mid/late-adolescence (ages 15–18), young-adulthood (ages 19–25), and adulthood (ages 26–30). Because it is possible that participants might be assessed more than once during any given developmental period, PPVT-R scores that were assessed during that developmental period were averaged. GLM analyses were also tested for the educational attainment variable as well as a variable created to describe whether participants graduated from high school. Because of the study design, not every participant was assessed at every developmental stage; hence, the sample size fluctuates slightly for each comparison (see Table 1).

RESULTS

Results demonstrate that despite starting with similar abilities (intercept), abused females, on average, acquired receptive language skills at a significantly slower rate (linear effect) during development than did comparison females. Moreover, receptive language skills peaked at lower levels (quadratic effect) in development for abused females than for comparison females. Unconditional (level 1) HLM results revealed a significant overall omnibus χ^2 ($\chi^2_{2} = 526.79$, $P < .0001$), with the linear slope coefficient significantly different from 0 ($t_{1,244} = 10.00$, $P < .0001$) and the quadratic coefficient significantly different from 0 ($t_{1,245} = -4.62$, $P < .001$). These results suggest that the entire sample, on average, showed a linear positive trend of PPVT-R vocabulary acquisition across development from childhood to adulthood but that this trend leveled off in the early 20s. Figure 1 depicts HLM results for raw PPVT-R trajectories by group with age arrayed on the x-axis spanning ages 6 to 30. These conditional (level 2) HLM results showed that there was not a significant group by intercept effect ($t_{1,207} = 0.04$, $P = .96$), indicating that abused and comparison females did not differ with respect to raw PPVT-R scores at intercept (age 6). Results did reveal, however, a group by linear time interaction, ($t_{1,243} = 2.68$, $P = .008$) and a group by quadratic time interaction, ($t_{1,254} = -2.41$, $P = .01$).

Results of the GLM presented in Table 2 demonstrate that abused females, on average, scored significantly lower than comparison females on the PPVT-R beginning in midadolescence and continued to be lower through the final adulthood assessment. Table 2 also shows that a greater percentage of comparison females graduated high school, and, on average, the comparison group reported attaining some

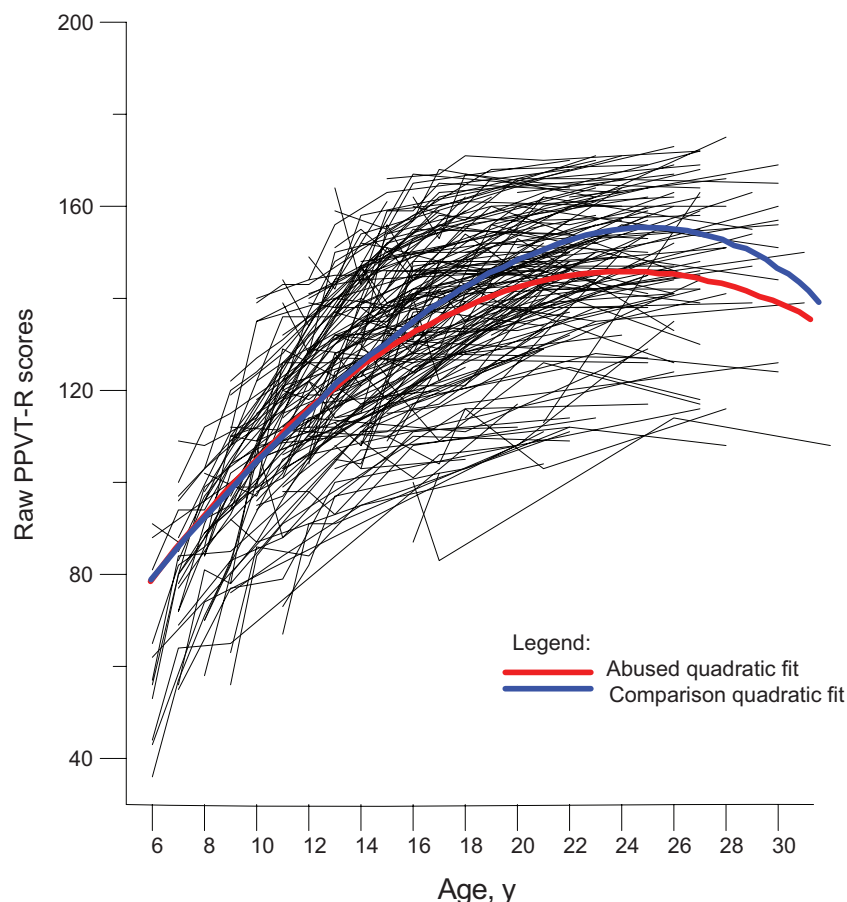


FIGURE 1

Individual raw score receptive language trajectories and group \times quadratic effect demonstrating slower acquisition and lower peak performance across development for sexually abused females. No differences were observed between groups at intercept.

college education, whereas the abused group reported graduating high school as their highest achievement.

DISCUSSION

Although the detrimental effects of childhood sexual abuse have been shown across psychosocial, physical, and behavioral health domains, this study demonstrates that sexually abused females (1) acquired receptive language abilities at a slower pace and performed at lower peaks than their nonabused peers, (2) differed from their nonabused peers in receptive language abilities by midadolescence, and (3) had lower rates of high school graduation and educational attainment by young adulthood. It is notable that there were significant differences

between groups neither at the first assessment point nor at the intercept of the growth trajectory model. This lack of initial difference, combined with the use of a demographically similar comparison group, enhances our ability to assert with relatively strong inference that the deficits observed across development are in large part attributable to the experience of childhood sexual abuse.

As the larger literature suggests, multiple plausible mechanisms could affect cognitive development and educational attainment of maltreated children. For instance, poorer cognitive functioning may be explained by the direct impact of child maltreatment on brain functioning and neuro-

TABLE 2 Abused Versus Comparison Differences in Receptive Language Scores and Educational Attainment

Parameter	Total	Abused	Comparison	F _{df} ^a
Raw vocabulary scores, mean ± SD ^b				
Childhood (ages 6–10)	93.70 ± 19.34	95.68 ± 19.99	91.66 ± 18.73	0.31 _{1,62}
Young/midadolescence (ages 11–14)	123.24 ± 17.31	120.19 ± 17.79	126.06 ± 16.52	6.09 _{1,112}
Mid/late adolescence (ages 15–18)	134.65 ± 19.68	130.97 ± 22.47	138.20 ± 15.97	9.38 _{1,105} ^c
Young adulthood (ages 19–25)	145.06 ± 17.79	142.27 ± 20.55	147.33 ± 14.94	7.68 _{1,144} ^c
Adulthood (ages 26–30)	147.16 ± 18.52	140.85 ± 21.44	152.03 ± 14.42	7.59 _{1,61} ^c
% Graduated high school ^d	89.49	84.44	94.55	8.63 _{1,143} ^c
Educational attainment, mean ± SD ^{d,e}	3.87 ± 1.13	3.63 ± 1.20	4.07 ± 1.04	7.56 _{1,143} ^c

df indicates degrees of freedom.

^a F values correspond to individual GLM tests of group differences for each dependent variable via SAS PROC GLM. Alpha corrections were imposed to control type 1 error for multiple comparisons ($P < .007$).

^b Averaged over ages spanning developmental period.

^c $P < .007$.

^d Marginal means reported with age at final assessment (time 6) covaried.

^e 1 = Eighth grade or less; 2 = some high school; 3 = graduated high school; 4 = some college; 5 = college graduate; 6 = some postgraduate school; and 7 = postgraduate degree.

psychological systems. Indeed, childhood is a critical period when rapid and dramatic maturation of the brain occurs and thus any assault, such as the chronic stress associated with childhood sexual abuse, during this critical period has the potential to disrupt permanently neuropsychological development for victims.³⁴ Childhood abuse often co-occurs with other forms of impoverishment, such as economic disadvantage, family dysfunction, and low parental education, and it is quite possible that cognitive abilities that are tied to these environmental factors might be particularly susceptible to delays in maltreated children. Typical features of the abusive environment, such as poor parenting³⁵ and poor quality of stimulation provided by a caregiver,³⁶ may play a significant role in the delayed cognitive development of maltreated children. The importance of these environmental features cannot be understated or ruled out as relevant correlates of cognitive deficits.

There are several limitations that should be taken into account when interpreting these data. First, we cannot parse out the exact mechanisms that are responsible for adverse cognitive development or low educational attainment in this study. We cannot

speak directly to the brain maldevelopment hypothesis because we did not assess the sample for functional or structural changes. Similarly, our data cannot speak directly to the extent of environmental influences because childhood sexual abuse is so often associated with other and often multiple types of adversities; however, we were able to effect experimental control over some of these factors by studying a demographically similar comparison sample, which suggests that the difference between our abused and non-abused groups is tied to the experience of sexual abuse (and its associated elements) and not merely family constellation, SES, or minority status. Second, we studied a limited set of cognitive abilities and cannot generalize to abilities that we did not measure, such as novel reasoning or memory. Third, we cannot generalize to the development of males. Finally, it should be noted that other studies have shown associations between alternative forms of abuse and adversity (eg, physical abuse, child neglect) and poor cognitive functioning. Although this study suggests that sexual abuse may be a particularly salient and important risk factor for these developmental outcomes, we recognize that various types of abuse and adversity

often co-occur,³⁷ and it is quite difficult to parse out the unique effects of 1 type versus another. As such, we are not asserting that sexual abuse per se impinges on cognitive development; rather, we are simply suggesting a plausible link between the various consequences that are associated with severe childhood abuse and the subsequent cognitive deficits.

CONCLUSIONS

Pediatricians should be aware that optimal cognitive development could be adversely affected by histories of maltreatment. The importance of environmental factors with respect to care and enrichment provided by biological or foster parents should be underscored when promoting healthy growth trajectories for child victims. Enrollment in after-school and cultural enrichment programs can significantly improve the educational attainment of any child but may be especially important for children who have been exposed to maltreatment. In addition, efforts should be made to reduce the chronic stress that is associated with maltreated families, and pediatricians can play an important role. This could take the form of coordination of psychosocial services aimed at intervening on the individual psychological consequences of maltreatment. This could also entail in-home interventions aimed at promoting overall family health and safety by addressing the precipitants of abuse and reducing overall family conflict. No matter the intervention focus, results from this study suggest that efforts should be implemented early in development, perhaps even before declines that may not be noticeable until later in life. Such intervention may have far-reaching benefits over the course of life and may likely include enhances in education goals and opportunities for victims of abuse.

ACKNOWLEDGMENTS

This research was supported by federal and foundation research National Institutes of Health grants R01MH048330 (Drs Trickett and Putnam), K02MH01284 (Dr Trickett),

REFERENCES

- Gaudiosi JA. *Child Maltreatment 2007*. Washington, DC: Department of Health and Human Services, Administration on Children, Youth and Families; 2009
- Kendall-Tackett KA, Williams LM, Finkelhor D. Impact of sexual abuse on children: a review and synthesis of recent empirical studies. *Psychol Bull*. 1993;113(1):164–180
- Trickett PK, McBride-Chang C, Putnam FW. The classroom performance and behavior of sexually-abused females. *Dev Psychopathol*. 1994;6:183–194
- Cattell RB, Horn JL. A check on the theory of fluid and crystallized intelligence with description of new subtest designs. *Journal of Educational Measurement*. 1978;15(3):139–164
- Teicher MH, Andersen SL, Polcari A, Anderson CM, Navalta CP. Developmental neurobiology of childhood stress and trauma. *Psychiatr Clin North Am*. 2002;25(2):397–426, vii–viii
- De Bellis MD. Psychobiology of neglect. *Child Maltreat*. 2005;10(2):150–172
- Trickett PK, Noll JG, Reiffman A, Putnam FW. Variants of intrafamilial sexual abuse experience: implications for short- and long-term development. *Dev Psychopathol*. 2001;13(4):1001–1019
- Carrion VG, Weems CF, Ray RD, Glaser B, Hessel D, Reiss AL. Diurnal salivary cortisol in pediatric post-traumatic stress disorder. *Biol Psychiatry*. 2002;51(7):575–582
- De Bellis MD, Lefter L, Trickett PK, Putnam FW. Urinary catecholamine excretion in sexually abuse girls. *J Am Acad Child Adolesc Psychiatry*. 1994;33(3):320–327
- Lupien S, Sharma S, Nair NP, et al. Glucocorticoids and human brain aging [published correction appears in *Nat Neurosci*. 1998;1(4):329]. *Nat Neurosci*. 1998;1(1):69–73
- Sapolsky RM, Romero LM, Munck AU. How do glucocorticoids influence stress responses? Integrating permissive, suppressive, stimulatory, and preparative actions. *Endocr Rev*. 2000;21(1):55–89
- Dunlop SA, Archer MA, Quinlivan JA, Beazley LD, Newnham JP. Repeated prenatal corticosteroids delay myelination in the ovine central nervous system. *J Matern Fetal Med*. 1997;6(6):309–313
- Todd RD. Neural development is regulated by classical neuro-transmitters: dopamine D2 receptor stimulation enhances neurite outgrowth. *Biol Psychiatry*. 1992;31(8):794–807
- Gould E, Tanapat P, McEwen BS, Flugge G, Fuchs E. Proliferation of granule cell precursors in the dentate gyrus of adult monkeys is diminished by stress. *Proc Natl Acad Sci USA*. 1998;95(6):3168–3171
- Smith MA, Makino S, Kvetnansky R, Post RM. Effects of stress on neurotrophic factor expression in the rat brain. *Ann NY Acad Sci*. 1995;771:234–239
- Teicher MH, Andersena SL, Polcarib A, Andersona CM, Navaltae CP, Kima DM. The neurobiological consequences of early stress and childhood maltreatment. *Neurosci Biobehav Rev*. 2003;27(1–2):33–44
- Teicher MH, Dumont NL, Ito Y, Vaituzis C, Giedd JN, Andersen SL. Childhood neglect is associated with reduced corpus callosum area. *Biol Psychiatry*. 2004;56(2):80–85
- Carrion VG, Weems CF, Reiss AL. Stress predicts brain changes in children: a pilot longitudinal study on youth stress, posttraumatic stress disorder, and the hippocampus. *Pediatrics*. 2007;119(3):509–516
- Driessen M, Herrmann J, Stahl K, et al. Magnetic resonance imaging volumes of the hippocampus and the amygdala in women with borderline personality disorder and early traumatization. *Arch Gen Psychiatry*. 2000;57(12):1115–1122
- Veltman MW, Browne KD. Three decades of child maltreatment research: implications for the school years. *Trauma Violence Abuse*. 2001;2(3):215–239
- Allen RE, Oliver JM. The effects of child maltreatment on language development. *Child Abuse Negl*. 1982;6(3):299–305
- Culp RE, Watkins RV, Lawrence H, Letts D, Kelly DJ, Rice ML. Maltreated children's language and speech development: abused neglected and abused and neglected. *First Language*. 1991;11(33):377–389
- Fox L, Long SH, Langlois A. Patterns of language comprehension deficit in abused and neglected children. *J Speech Hearing Dis*. 1988;53(3):239–244
- McFadyen RG, Kitson WJ. Language comprehension and expression among adolescents who have experienced childhood physical abuse. *J Child Psychol Psychiatry*. 1996;37(5):551–662
- Young AR, Beitchman JH, Johnson C, et al. Young adult academic outcomes in a longitudinal sample of early identified language impaired and control children. *J Child Psychol Psychiatry*. 2002;43(5):635–645
- Calam R, Horne L, Glasgow D, Cox A. Psychological disturbance and child sexual abuse: a follow-up study. *Child Abuse Negl*. 1998;22(9):901–913
- Cohen J, Mannarino AP. A treatment study for sexually abused preschool children: outcome during a one-year follow-up. *J Am Acad Child Adolesc Psychiatry*. 1997;36(9):1228–1235
- Perez CM, Widom GS. Childhood victimization and long-term intellectual and academic outcomes. *Child Abuse Negl*. 1994;18(8):617–633
- National Clearinghouse on Child Abuse and Neglect. *Second Study of National Incidence and Prevalence of Child Abuse and Neglect*. Washington, DC: US Department of Health and Human Services; 1988
- Hollingshead AB. *Four Factor Index of Social Status*. New Haven, CT: Yale University; 1975
- Dunn L, Dunn L. *Manual for the Peabody Picture Vocabulary Test—Revised Manual for Forms L and M*. Circle Pines, MN: American Guidance Service, Inc; 1981
- Collins LM, Schafer JL, Kam CM. A comparison of inclusive and restrictive strategies in modern missing data procedures. *Psychol Methods*. 2001;6(4):330–351
- Kenward MG, Roger JH. Small sample inference for fixed effects from restricted maximum likelihood. *Biometrics*. 1997;53(3):983–997
- Watts-English T, Fortson BL, Gibler N, Hooper SR, De Bellis MD. The psychobiology of maltreatment in childhood. *Journal of Social Issues*. 2006;63(4):717–736
- van Bakel HJ, Riksen-Walraven JM. Par-

- enting and development of one-year olds: links with parental, contextual and child characteristics. *Child Dev.* 2002;73(1): 256–273
36. Puckering C, Pickles A, Skuse D, Heptinstall E, Dowdney L, Zur-Szpiro S. Mother-child interaction and the cognitive and behavioral development of four-year-old children with poor growth. *J Child Psychol Psychiatry.* 1995;36(4):573–595
37. Thornberry TP, Ireland TO, Smith CA. The importance of timing: the varying impact of childhood adolescent maltreatment on multiple problem outcomes. *Dev Psychopathol.* 2001;13(4):957–979

Receptive Language and Educational Attainment for Sexually Abused Females

Jennie G. Noll, Chad E. Shenk, Michele T. Yeh, Juye Ji, Frank W. Putnam and
Penelope K. Trickett

Pediatrics 2010;126:e615-e622; originally published online Aug 9, 2010;

DOI: 10.1542/peds.2010-0496

Updated Information & Services

including high-resolution figures, can be found at:
<http://www.pediatrics.org/cgi/content/full/126/3/e615>

References

This article cites 33 articles, 7 of which you can access for free
at:
<http://www.pediatrics.org/cgi/content/full/126/3/e615#BIBL>

Subspecialty Collections

This article, along with others on similar topics, appears in the
following collection(s):

Office Practice

http://www.pediatrics.org/cgi/collection/office_practice

Permissions & Licensing

Information about reproducing this article in parts (figures,
tables) or in its entirety can be found online at:
<http://www.pediatrics.org/misc/Permissions.shtml>

Reprints

Information about ordering reprints can be found online:
<http://www.pediatrics.org/misc/reprints.shtml>

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

