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Brief Report: Language Ability and School Functioning of Youth Perinatally Infected With HIV

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ABSTRACT

Introduction: The purpose of this article is to describe the language ability and school functioning of early adolescents with perinatal HIV/AIDS.

Method: Participants included 43 youths, 9-15 years, and their primary caregivers. Youths completed the Peabody Picture Vocabulary Test (PPVT) and the Reading Subtest of the Wide Range Achievement Test (WRAT3) and were interviewed regarding their future educational aspirations and parental supervision and involvement with homework. Caregivers were interviewed regarding the child's school achievement, parental supervision and monitoring, and educational aspirations for their child.

Results: Fifty-four percent of youths scored below average (<25th percentile) on the PPVT, and 29% scored below the 10th percentile; 40% scored below average (<25th percentile) on the WRAT3, and 24% scored below the 10th percentile. Scores were associated with parental monitoring and educational aspirations.

Discussion: Youths performed poorly on tests of verbal and reading ability, although their scores were not dissimilar to those of other samples of inner-city youths. Future research should attempt to isolate the impact of HIV disease on intellectual and school functioning of HIV+ youths. *J Pediatr Health Care.* (2009) 23, 158-164.

Key words: Perinatal HIV infection, verbal ability, reading ability

With the advent of antiretroviral treatment (ART), children living with perinatal HIV/AIDS are reaching adolescence in large numbers. By 2006, in New York City (NYC), more than 60% of children living with perinatal HIV/AIDS were older than 13 years (NYC Department of Health and Mental Hygiene [DOHMI], 2006). They are primarily poor ethnic minorities living in impoverished, inner-city communities with a large number of risk factors for poor cognitive functioning (e.g., exposure to substances in utero, attendance at schools in "poor performance districts," co-morbid behavioral problems, and inconsistent school atten-

dance because of poor health or health care appointments). Clinical reports indicate that older school-aged perinatally infected children present with significant learning problems affecting their ability to perform in school, achieve developmental milestones, and function independently (Martin et al., 2006). Poor educational achievement, including poor development of reading and verbal skills, might place this cohort at risk for difficulty in understanding their illness and its treatment, adhering to potentially complex medication regimens, and making decisions about sexual and/or drug risk behaviors, as has been found in HIV-positive (HIV+) adults and other populations of adolescents (Halpern, Joyner, Udry, & Suchindran, 2000; Hinkin et al., 2002; Wagner, 2002).

From the beginning of the epidemic, there have been consistent findings of significant neurologic, developmental, cognitive, and language deficits in HIV-infected infants and younger children (Belman et al., 1996; Coplan et al., 1998; Epstein et al., 1988; Mellins, Levenson, Zawadzki, Kairam, & Weston, 1994). Unfortunately, less is known about these children as they age. In general, the severity of neurologic and neuropsychologic compromise increases with the severity of HIV-related illness (Jeremy et al., 2005; Pulsifer & Aylward, 2000). Prior to the advent of ART, two relatively distinct neurodevelopmental patterns were described in largely untreated HIV-infected infants and children: progressive encephalopathy, characterized by the loss of developmental milestones, declining IQ scores, and increasing difficulties with language, attention, concentration, and memory; and static encephalopathy, characterized by nonprogressive deficits in cognitive, motor, and/or language function, likely attributable to prenatal drug exposure, prematurity, low birth weight, and heritable or environmentally mediated impair-

ment rather than the disease itself (Brouwers, Belman, & Epstein, 1991; Epstein, Sharer, & Goudsmit, 1988; Mellins et al., 1994). Before the development of ART, HIV-related encephalopathy was a common sequela of HIV infection in children, reported in 35% to 50% of children with pediatric AIDS (Cooper et al., 1998; Lobato, Caldwell, Ng, & Oxtoby, 1995; Rigardetto et al., 1999). Since the advent of ART, the rate of HIV encephalopathy has declined markedly, yet with some residual neurologic, cognitive, and academic difficulties (Chiriboga, Fleishman, Champoin, Gaye-Robinson, & Abrams, 2005; Jeremy et al., 2005; Manisha et al., 2005).

To date, few if any research studies of perinatally infected older children and adolescents have documented their level of

but that lower CD4 percentages were associated with lower overall cognitive functioning (Shaw, 2007). Information about cognitive functioning of these youths would be useful to clinical providers as well as for educational and vocational planning.

Given that perinatally HIV-infected youths were not expected to live to adolescence, parental expectations as well as their own expectations regarding school achievement may be low. Although adolescence marks the time when children become more independent from parents and rely more on peer groups, they continue to rely on their parents for guidance. Parental involvement and supervision are critical for children's academic functioning and have been associated with positive

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cognitive functioning and/or educational attainment as they approach adolescence or factors that might be associated with that functioning. One study by Martin and colleagues (2006) found that children and adolescents (6-16 years, mean = 11 years) with HIV infection being treated with ART typically score at the low end of the average range on a composite measure of cognitive functioning, and children with computed tomography scan abnormalities are at risk for poorer cognitive functioning than are those without scan abnormalities. One recent dissertation that looked at overall cognitive functioning of HIV+ and HIV negative (HIV-) youth (mean age = 10.2 years) found that HIV+ youths who were healthier performed similarly to HIV- youth,

school adjustment and better grades for children, particularly in language achievement (e.g., Gutman, Sameroff, & Eccles, 2002; Klein & Forehand, 2000). Among a sample of perinatally HIV-infected youths ages 9 to 15 years, the goals of this brief report are to (a) describe levels of verbal ability, reading ability, and school achievement, and (b) examine child and family factors (e.g., health status, parental supervision, and monitoring) that might predict those skills. We hypothesize that (a) these youths will score poorly when compared with the general population, (b) youths with greater disease progression will have lower scores, and (c) family factors, such as parental involvement and interest in school functioning, will be associated with better scores.

METHODS

Participants and Procedures

In a pilot study for a larger, longitudinal project examining a range of psychosocial and behavioral functioning variables (Mellins, Brackis-Cott, Dolezal, & Abrams, 2006), 43 early adolescents perinatally infected with HIV/AIDS and their primary caregivers were recruited in 2004 from a comprehensive pediatric HIV care and research program in NYC. Inclusion criteria for youth were (a) perinatal infection with HIV, (b) ages 9 to 16 years, (c) English speaking, and (d) having a legal guardian who could provide informed consent. Caregivers had to be English or Spanish speaking. Both youths who had and had not been formally told of their HIV status were included.

To determine eligibility, a list of all eligible families was created by the medical director ($n = 63$). Each caregiver was approached by a medical provider during the child's monthly medical appointment. The project was presented and verbal consent to be contacted by the research team was requested. A member of the research team then contacted the family to further explain the study and confirm eligibility and interest. Of the 63 eligible dyads, 48 were enrolled; 13 refused to participate because of time constraints, family stressors, or lack of interest, and two dyads agreed to participate but were never available to be interviewed. New York State HIV confidentiality laws preclude any data collection on families who refused participation.

Caregivers and children signed consent/assent forms and were interviewed simultaneously and separately at two time points, 1 to 3 months apart (to reduce interview burden). Each interview lasted from 1 to 2 hours and was conducted at the youth's medical clinic (79%), research offices (15%), or the families' homes (5%), depending on participant preference. Par-

ticipants were compensated \$25 for each interview and reimbursed for travel expenses. This study received Institutional Review Board approval and was compliant with the Health Insurance Portability and Accountability Act of 1996. Among the 48 dyads enrolled who received the first interview, four were not able to complete the two study interviews within the 3-month period, and one child (2%) was too distressed to complete the interview. Thus, the final sample size was 43.

Assessments

Child verbal ability and reading skills. The Peabody Picture Vocabulary Test (PPVT-III) is a widely used test of verbal ability (Dunn & Dunn, 1997). The examiner reads each word aloud; the

the day, family routines, caregiver's knowledge of the child's friends, amount of time the caregiver and youth spend together, etc. The Pittsburgh Youth Study is a longitudinal study of a community sample of inner-city boys documenting the development of antisocial and delinquent behavior from childhood to early adulthood. The scale is based on a literature review of family factors related to delinquency (Loeber & Stouthamer-Loeber, 1986), on Moos' Family Environment Scale (Moos & Moos, 1975), and on Skinner, Steinhauer, and Santa-Barbara's (1983) Family Assessment Measure. Descriptions of the psychometrics have been published elsewhere supporting the use of this measure (Loeber et al., 2000). Caregiver and youth versions of this measure are not comparable.

...our sample of perinatally HIV-infected youths scored poorly on measures of language functioning. . .

child chooses which of four pictures best illustrates the word. The Reading Subtest of the Wide Range Achievement Test (WRAT3; Wilkinson, 1993) is a widely used measure of reading skills, focusing on recognizing and naming letters and pronouncing printed words. Excellent psychometric properties, including reliability and validity, have been established for both measures (Dunn & Dunn; Wilkinson).

Maternal-child supervision and involvement. The Supervision and Involvement (S&I) Scale from the Pittsburgh Youth Study (Loeber, Stouthamer-Loeber, Van Kammen, & Farrington, 1991) was administered to caregivers and youths and consists of 37 items assessing the caregiver's knowledge of where the child is at all points in

We used the communication, supervision, and monitoring scales from the caregiver responses only for this article.

Future goals and school motivation. Questions from the Monitoring the Future survey (Johnston, Bachman, & O'Malley, 1993) were used to assess the youths' future goals in the areas of school and vocational aspirations as well as the caregivers' goals for their children. In addition, caregivers and youths were asked to report on level of parental supervision over homework and amount of communication about homework. Monitoring the Future is an ongoing study of the behaviors, attitudes, and values of American secondary school students, college students, and young adults and has been administered annually since 1975.

Adequate psychometric properties have been established for this measure (Johnston, O'Malley, Bachman, & Schulenberg, 2007).

Demographics. Items included the child's age, sex, ethnic identity, the child's relationship to the caregiver (biologic vs. adoptive), household income, education and work status of the caregiver, and single-parent status of the caregiver. Caregivers also reported on whether the child was in special or regular education classes and whether the child had ever skipped a grade, been held back, been suspended, or been expelled.

Child health status. CD4+ number (cells/m³), HIV ribonucleic acid viral load (copies/mL) values, and Centers for Disease Control and Prevention (CDC) classification for the closest date to the research interview were obtained through medical record abstraction.

Data analyses. Post hoc, secondary analyses were conducted on youths' verbal ability, reading ability, and school achievement. SPSS was used to generate descriptive statistics. Regression analyses were used to assess the associations between WRAT3/PPVT scores and various predictor variables. Individual models were tested for each predictor variable separately. We also ran these analyses on dichotomized outcome variables (WRAT3 <25th percentile vs. ≥25th percentile, PPVT <25th percentile vs. ≥25th percentile). The pattern of significant associations was comparable with analyses using continuous scores (data not shown). Some variables from the Monitoring the Future survey had little to no variability and thus were deemed inappropriate for inclusion in statistical analyses and only used for descriptive purposes.

RESULTS

Table 1 describes the demographic characteristics of the youths and their caregivers. Table

2 describes school-related difficulties for these youths.

Verbal and Reading Ability

The mean PPVT score was 84.65 (SD = 16.66). Scores ranged from the 1st to the 87th percentile (mean = 24th percentile); 54% scored below average (<25th percentile), and 29% scored below the 10th percentile. The mean WRAT3 score was 91.72 (SD = 18.25). Scores ranged from below the 1st to the 95th percentile (mean = 38th percentile); 40% of the sample scored below average (<25th percentile), and 24% scored below the 10th percentile.

Caregiver-child Educational Involvement

The majority of caregivers reported that it was very important

65% of the youths reported talking with their caregivers about school in the past month.

Associations with Verbal and Reading Ability

Increased parental monitoring of the child (the parental monitoring subscale of the S&I scale) was associated with better PPVT scores ($b = 14.3$, $SE = 5.8$, $P = .018$) and better WRAT3 reading subscores ($b = 24.4$, $SE = 8.6$, $P = .007$). Better WRAT3 reading subscores also were associated with the greater level of importance parents placed on going to college ($b = 16.3$, $SE = 7.3$, $P = .032$). Neither the PPVT or WRAT3 subscores were related to CD4+ number, viral load, CDC classification, child relationship to caregiver, whether

The etiology may likely be multifactorial, including the realities of living in impoverished neighborhoods with under-resourced schools and the immediate stressors of daily living.

that their child graduate from high school (95%), attend college (84%), graduate from college (88%), and get a job (93%). Similarly, the majority of youths believed that they definitely would graduate from high school (74%), go to college (74%), graduate from college (74%), and get a job (61%). Both caregivers and youths reported high levels of parental supervision over homework. All of the caregivers reported that they either ask if homework is done or ask to review it; 86% of youths said that their caregivers ask if homework is done and 70% ask to review it. Both caregivers and youths reported good communication about school. All of the caregivers reported talking with their children about school in the past month;

the caregiver was a single parent, caregiver employment, caregiver education, income, or child or caregiver ethnic identity.

DISCUSSION

Although caregivers and youths reported high educational aspirations and levels of parental supervision over homework, our sample of perinatally HIV-infected youths scored poorly on measures of language functioning: 29% scored below the 10th percentile on the PPVT and 24% scored below the 10th percentile on the WRAT3. Large numbers of youths were academically retained and placed in special education classes.

As hypothesized, performance by this cohort of early adolescents was below age expectations. How-

TABLE 1. Characteristics of 43 HIV-infected youth and their primary caregivers*

Child variables	n (%)	Caregiver variables	n (%)
Race		Relationship to child	
African American	35 (81)	Biological parent	10 (24)
Hispanic or other	8 (19)	Adoptive parent	32 (76)
Age (y)		HIV infected	10 (23)
9-10	12 (28)		
11-12	15 (35)		
13-14	10 (23)		
15	6 (14)		
Female sex	20 (46)	Race	
		African American	35 (81)
		Hispanic	6 (14)
Education (current grade)		Age (y)	22-74 (mean=52)
3rd-4th	9 (21)		
5th-6th	15 (35)		
7th-8th	11 (25)		
9th-10th	8 (19)		
		Female sex	39 (91)
		Education	
		<high school	4 (10)
		10th-12th grade	25 (61)
		>high school	12 (29)
		Currently unemployed	34 (79)
		Single parent	34 (81)

*Numbers do not always sum to 43 because of missing data.

TABLE 2. School-related characteristics for 43 HIV-infected youth

School-related characteristics	n (%)
Currently in school (yes)	42 (98)
Ever held back in school (yes)	15 (35)
Ever suspended from school (yes)	10 (23)
Type of class child currently attends	
Regular education	29 (67)
Special education	9 (21)
Resource room or transitional class	5 (12)
Ever attended special education class (yes)	21 (49)
Reason for special education placement (n = 21)	
Reading problems	12 (57)
Math problems	8 (38)
Attention problems	7 (33)
Discipline problems	7 (33)

ever, performance was similar to that in previous studies of urban African American uninfected children (Luster & McAdoo, 1994), prenatally drug exposed children (Goldschmidt, Richardson, Cornelius, & Day, 2004), and impoverished inner-city chronically ill adolescents (Silver, Bauman, Coupey, Doctors, & Boeck, 1990), suggesting that poor language functioning may not necessarily be attributed to HIV infection. Rather, the etiology may likely be multifactorial, including the realities of living in

impoverished neighborhoods with under-resourced schools and the immediate stressors of daily living.

Despite comparable achievement profiles between our sample and youths of similar demographic backgrounds, the implications of being placed in a remedial educational setting or being functionally illiterate becomes an additional stigmatizing attribute for youths with HIV. The stressors of living with a chronic stigmatized illness coupled with a sense of educational failure place youths with

HIV at further risk for behavioral and health problems. For example, poor language skills may limit youths' ability to understand their illness and compromise their ability to adhere to challenging medication regimens (Hinkin et al., 2002; Wagner, 2002). Furthermore, better skills may operate as a protective factor against early sexual activity during adolescence, and lower intelligence may be a risk factor (Halpern et al., 2000).

Contrary to our second hypothesis, language delays were not as-

sociated with disease severity. Martin and colleagues (2006) also found viral load to be unrelated to cognitive test scores, although they found that CD4+ counts greater than or equal to 500 was associated with lower scores on subtests measuring processing speed. The authors speculate that the lack of association with viral load might be due to the fact that viral load values can be more variable and fluctuate with changes in adherence (Haubrich et al., 1999; Van Dyke et al., 2002). Further research should continue to examine the relationship between markers of disease severity and cognitive functioning.

Although many clinics providing medical care to perinatally HIV-infected youths grapple with these issues, it has been unclear how best to facilitate interventions to increase opportunities for these youths to acquire requisite skills for adult independent living, in part because of limited research. As this population ages, studies examining the association of cognitive and language skills and risk versus health-promoting behaviors will be needed. Interventions to address the learning gap among perinatally infected youths may need to consider multiple risk factors at the individual, familial, and environmental level. Psychosocial interventions for HIV+ children and adolescents commonly focus on behavioral and adjustment difficulties that compromise their medical treatment. However, it may be important to broaden the scope of these psychosocial services to include specialized evaluations and interventions that help youths and their parents identify effective learning strategies or navigate educational systems. Given that high levels of parental supervision and monitoring was associated with better language functioning, strategic family-based interventions that promote structured, stimulating home environments and facilitate caregiver-child interactions also may

Interventions to address the learning gap among perinatally infected youths may need to consider multiple risk factors at the individual, familial, and environmental level.

be helpful in HIV-specialized programs for youths. In the 2001 study by Coscia and colleagues of impoverished HIV-infected children, for example, stimulating and supportive home settings buffered the negative effects of poverty on cognitive functioning.

In conclusion, although our sample of youths with perinatal HIV infection performed poorly on tests of verbal and reading ability,

backgrounds of HIV-exposed children, both in the United States and internationally, the effects of HIV infection on cognitive functioning, in the absence of disease progression, often are difficult to disentangle from other background characteristics that also are known to affect neuropsychological outcomes. Notwithstanding these limitations, this study highlights poor verbal and reading ability among

As this population ages, studies examining the association of cognitive and language skills and risk versus health-promoting behaviors will be needed.

they were not dissimilar to other samples of inner-city youths. However, the findings are limited to a small convenience sample of HIV+ early adolescents receiving medical care from an urban medical center. The cross-sectional study design and small sampling does not allow us to determine the temporal sequence of events. Longitudinal follow-up studies with this cohort are needed to clarify whether family management practices continue to influence children's cognitive and achievement functioning over time. Future research should focus on isolating the impact of HIV disease on intellectual and school functioning of HIV-infected youths by including a comparison group with similar socioeconomic status and other risk factors. Because of the high-risk

youths with perinatal HIV and highlights the importance of educational and family-based interventions that address this emerging need, regardless of its etiology.

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