
Dichotic Listening Deficits and the Prediction of Substance Use in Young Boys

[Articles]

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Objective: Prior studies note relationships among verbal deficits, disruptive psychopathology, and substance use. The current study examines the relationship between verbal deficits, assessed through a dichotic listening test, and children's substance use.

Method: A series of 87 young boys was prospectively followed over a 1- to 2-year period. A prior study in these boys noted a cross-sectional relationship between disruptive psychopathology and deficits on a dichotic consonant-vowel listening test. The current study examines the predictive relationship between this language-related deficit at one study wave and substance use assessed during a follow-up study wave.

Results: Reduced right ear accuracy, reflecting a deficit in left hemisphere processing ability, predicted substance use at follow-up. This association was independent of any other predictors, including cognitive or behavioral indices of substance use risk.

Conclusions: A lateralized deficit in verbal processing on a dichotic listening task predicts change in substance use by follow-up. Findings are consistent with other evidence linking early childhood lateralization abnormalities to development of disruptive psychopathology. *J. Am. Acad. Child Adolesc. Psychiatry*, 1999, 38(8):1032-1039.

Key Words: substance use, lateralization, dichotic listening, language processing.

Deficits in verbal skills relate to adolescents' substance use. Relative to matched controls, adolescents who use alcohol and other illicit substances have lower Verbal IQ and have reading deficits (Moss et al., 1994; Tarter et al., 1995a) [23,37]. Sons of alcoholic fathers have poorer Verbal IQ and language skills (Peterson et al., 1992; Sher et al., 1991) [26,36] as do school-age sons of fathers with substance use disorders (Moss et al., 1995) [24]. Thus, verbal skills deficits in young children may predispose to both onset of substance use and substance use disorders.

Such associations are consistent with extensive research on the relationships among verbal skills, disruptive psychopathology, and substance abuse. Disruptive behavior is strongly related to both substance use (e.g., Loeber et al., 1998; Robins and McEvoy, 1990; Windle, 1990) [18,32,44] and poor verbal skills, with the association between disruptive behavior and poor verbal skills arising during childhood (see Moffitt, 1990; Moffitt and Silva, 1988a,b, [20,21,22] for reviews). Three mechanisms might explain the association between verbal skills deficits and disruptive behavior (Pine et al., 1997; Schonfeld et al., 1988) [27,33]. First, disruptive children may begin lagging behind their classmates in academic functioning, predisposing them to verbal deficits. Second, children with lowered verbal skills may show impaired social information processing that in turn contributes to disruptive behavior (e.g., Crick and Dodge, 1994; Dodge et al., 1990; Weiss et al., 1992 [11,13,43]). Finally, the language-disruptive behavior association may result from some antecedent factor causally related to both verbal skills and behavior, such as left brain abnormalities. The first is an unlikely pathway because links between lower verbal skills and disruptive behavior predate school entry (Richman et al., 1982), [31] but there is evidence to support both the second and third mechanisms.

The association between poor verbal skills and disruptive behavior might result from abnormalities in lateralized neural systems that process language (Pine et al., 1997) [27]. Such abnormalities in brain lateralization might also explain connections between substance use and verbal deficits. Hence, deficits in language-related lateralization may confer risk for early substance use. It remains unclear whether substance use is independently associated with both verbal deficits and disruptive psychopathology.

Dichotic listening tests measure lateralization of brain functioning by assessing ability to perceive competing stimuli presented simultaneously to both cerebral hemispheres. Simultaneous presentation of

verbal stimuli to each ear permits assessment of the integrity of brain systems used in language processing. Beginning in early childhood, subjects typically show higher scores on right, as opposed to left, ear measures (Pine et al., 1997), [27] reflecting the left hemisphere's dominance for language ("right ear advantage"). From childhood on (Becker et al., 1993; Hare and McPherson, 1984; Raine et al., 1990), [3,15,30] reduced right ear advantage has been linked to disruptive behavior. While both disruptive behavior and verbal deficits are tied to substance use, to our knowledge, no study has examined the connection between lateralization, assessed by dichotic listening, and substance use at any age.

Because lateralization abnormalities may presage disturbances in both language processing and behavioral adjustment, information regarding lateralization in childhood might help identify youths at high risk for future substance use. Such information may also help elucidate biological processes placing children at risk for substance use disorders, as opposed to processes that are disrupted by use of illicit substances. Longitudinal examination of relationships among brain functioning, behavior problems, and substance use might illustrate the degree to which abnormalities in brain function precede both behavioral and language processing difficulties. The current study examines these issues in the context of a prospective investigation of boys at high risk for developing conduct problems (Wasserman et al., 1996) [41].

METHOD ↗

Subjects ↗

Details of overall study design and sample selection have been described elsewhere (Wasserman et al., 1996) [41]. Briefly, to obtain a sample of youths at high risk for developing future antisocial behavior, New York City court records between November 1991 and October 1993 were screened to identify a sample of 126 younger brothers of adjudicated delinquents. The resulting 109 participating families did not differ from nonparticipants on any measure for which we had data available (i.e., age of delinquent youth, ethnicity, borough in which the crime was committed). All 126 boys received an initial psychiatric, neuropsychological, and language assessment in 1992-1993 (year 1). Five boys, with incomplete or absent neuropsychological assessments, were excluded from analyses relating substance use to neuropsychological functioning; none was tested on the dichotic listening task in year 2.

As described earlier (Wasserman et al., 1996), [41] approximately 15 months later (year 2) 112 boys (89%) received follow-up evaluations (year 2) and all were invited to participate in an assessment of lateralized brain function; 100 (89%) agreed to participate. Six were subsequently excluded because of hearing loss; 7 were excluded because of inability to perform the dichotic task (i.e., inability to read). There were no significant differences on any demographic variable between the 87 boys examined and the 39 without dichotic listening data, except that boys participating in the dichotic test were significantly older than those not participating.

After another 15 months, 105 boys were relocated (year 3) including 76 of the 87 (87%) boys with year 2 dichotic data. Participating boys were 8.6 (SD 1.6) years old at year 1, 9.7 (SD 1.6) years old at year 2, and 11.3 (SD 1.7) years old at year 3. Boys with year 3 data on substance use (n = 105) did not differ systematically from those lost to follow-up. The subset of 76 boys with both dichotic listening and follow-up data did not differ significantly from other boys on any available measure.

Procedures ↗

Home Visit. Families were interviewed at home by bilingual interviewers at years 1, 2, and 3. Parents and children completed various checklists and interviews (see below) regarding child psychiatric and behavioral status and substance use. For certain instruments interviewers read items and marked answers for parents and children with limited reading ability. We designated the child's primary caregiver as the parent informant.

Neuropsychological Assessment. Soon after their first home visit, boys came for a clinic visit and intelligence, academic achievement, and language comprehension were assessed. The test battery included the Wechsler Intelligence Scales for Children (WISC-III) and portions of the Wechsler Individual Achievement Test (WIAT).

Dichotic Listening. Within a few weeks after their year 2 home visit, boys came for a second clinic visit, when the dichotic listening task was administered. An audiometric evaluation excluded 6 boys with either hearing loss >30 dB at 500, 1,000, 2,000, or 4,000 Hz, or between-ear hearing differences >10 dB; 7 boys who were unable to read were also excluded. Remaining boys (n = 87) were tested using a dichotic consonant-vowel identification test (Berlin et al., 1973), [5] played on a tape through balanced headphones. Headphones were calibrated to yield 75 dB SPL outputs from each phone; midway through the test the earphone orientation was reversed to further ensure balanced output. The dichotic test consisted of randomly paired stop consonant-vowels (ba, da, ga, ka, pa, ta). Dichotic pairs consisted of simultaneously presented different syllables to each ear. The 6 consonant-vowel stimuli were paired with each of the others an equal number of times, resulting in 15 trials that were repeated in a second sequence to form 30 trials. These 30 trials were presented a second time with ear presentation reversed. Boys received detailed explanations of the procedures, and 16 monaural practice trials were presented to determine accuracy in each ear.

To record responses, boys were provided with a multiple-choice answer sheet containing a random sequencing of the 6 possible presented syllables. Boys marked the 2 syllables they perceived, guessing when necessary.

The test was administered in a quiet room by an experimenter blind to other data. Fourteen dichotic practice trials were administered, followed by the first set of 30 dichotic test trials. A 5-minute rest was given before the final set of 30 trials was completed.

Measures [↑](#)

Language Lateralization. The dichotic listening test yielded 2 accuracy scores: (1) percent (single) right ear correct (PRC) (number of correct reports of right ear syllable/total syllables presented); and (2) percent (single) left ear correct (PLC) (number of correct reports of left ear syllable/total syllables presented), as indices of left and right hemispheric functioning, respectively.

Disruptive Behavior and Substance Use. Various measures provided information regarding these 2 constructs; the procedure followed for the designation of substance use status is described below, under "Data Analysis."

The Child Behavior Checklist (CBCL) (parent report) (Achenbach, 1991a) [1] obtains information from parent/caretaker on competencies and behavior problems and is validated for children aged 4 to 18 years. Reliability and validity are well documented (Achenbach, 1991a) [1]. We considered here the Externalizing, Aggression, Delinquency, and Attention Problems subscales to index disruptive behavior. A single item ("Uses alcohol or drugs") was included in the composite that designated substance use.

The Youth Self-Report (YSR) (child report) (Achenbach, 1991b) [2] is a companion checklist to parent and teacher versions of the CBCL. The YSR differentiates between referred and nonreferred samples and is intended for use with children older than 11 years. Items on the YSR were read aloud to the boy by the interviewer, who marked responses. Forty-five children younger than 11 years old at year 3 were interviewed in this fashion with the YSR: agreement between self-reported and parent-reported total behavior problems did not differ significantly between the 45 boys younger than 11 years old and the 58 older boys who completed the YSR independently. One item ("I use alcohol or drugs for nonmedical purposes") was included in the substance use composite.

Supplemental antisocial behavior items (parent report) were taken from the Pittsburgh Youth Study Survey (Loeber et al., 1998), [18] which includes a set of 84 items, in parent-reported CBCL-type format, that inquire about a range of overt and covert behavior problems. Two items ("You suspect him/her of drinking" and "You suspect him/her of using drugs") were included in the substance use composite.

The Diagnostic Interview Schedule for Children Version 2.3 (DISC-2.3) (child and parent report) is a general measure of diagnostic status and is the most extensively tested of all the child/adolescent diagnostic interviews (Shaffer et al., 1996), [35] evaluated in both clinical and community samples. The DISC asks about quantity of substance use, age at first use, and impairment, for various licit and illicit substances. It provides diagnoses and symptom counts with "good" test-retest reliability (Jensen et al., 1995) [17]. The child-report version measured substance use and disruptive symptoms (components of oppositional defiant disorder and conduct disorder diagnoses). Test-retest reliability for symptom scales (Shaffer et al., 1996) [35] is acceptable ($\kappa = 0.52$), and concurrent validity is good (Schwab-Stone et al., 1996) [34] between the DISC and a same-day clinician interview.

Neuropsychological Functioning. Two well-standardized tests assessed intelligence and achievement. To measure intelligence we used the WISC-III (Wechsler, 1991), [42] a measure of child intelligence with outstanding reliability for each of the 3 overall scales (Verbal, Performance, Full Scale). In the standardization sample, internal consistency was ≥ 0.89 ; it has excellent validity in predicting future academic performance (Wechsler, 1991) [42].

To measure reading achievement we tested children on the WIAT (Psychological Corporation, 1992) [28]. Standardized on the WISC-III standardization sample, the WIAT has excellent psychometric properties. We used the Basic Reading scale, with stability for the ages tested between 0.93 and 0.95.

Data Analysis [↕](#)

Data were available from 3 years of assessments regarding child- and parent-reported child use of alcohol, amphetamines, marijuana, barbiturates, sedatives, opiates, cocaine, hallucinogens, and inhalants. As noted above, these included 9 items from the CBCL, YSR, and DISC-C (child report) and DISC-P symptom counts for alcohol/marijuana use. No parent reported child use of other drugs on the DISC. Because of low rates of use in the sample, coupled with the use of multiple substances by those children who were users, data were combined into a single dichotomous variable, across informants (parent/child), for each year. This indicated whether a boy had ever used alcohol or any illicit substance as reported in that year (e.g., "year 1 use"). We also combined data from all 3 waves ("ever use") to indicate whether substance use was reported in any assessment year.

There were missing responses on approximately 5% of items used in the substance use measures, primarily interviewer error. For missing data, we constructed substance use measures with available data.

The 2 measures of cognitive functioning provided standardized scores for Full Scale IQ and Reading Achievement. Because these measures were substantially overlapping ($r = 0.62$, $p < .0001$), they were averaged into a single score reflecting cognitive-linguistic ability ("verbal composite").

Univariate data were examined using either independent sample t tests, chi squared tests, or correlations. Pearson correlations were used to compare boys with and without substance use histories (ever use). Multivariate associations were examined by using logistic regression. Predictors of year 3 use were examined while controlling for prior use at either the year 1 or year 2 assessment, thus providing a measure of change in substance use status. Two-tailed tests were used throughout, with $p = .05$.

RESULTS [↕](#)

Sample Characteristics [↕](#)

As described elsewhere, the sample is largely composed of African-American and Hispanic boys living under economic adversity, reflecting the demographics of a New York City court sample. [Table 1](#) shows characteristics for (1) the entire sample, (2) the subset with year 2 dichotic listening data, and (3) the subset with year 2 dichotic data and assessment of year 3 substance use. Groups did not differ significantly in available demographic measures.

	Full Sample (<i>n</i> = 126)	With Dichotic Listening	
		Initial Sample (<i>n</i> = 87)	Year 3 Follow-up (<i>n</i> = 76)
Child's race/ethnicity (%)			
African-American	54.0	56.3	57.9
Hispanic	44.4	42.5	40.8
Other	1.6	1.1	1.3
Child's age (Y1) (mean ± SD)	8.8 ± 1.6	9.0* ± 1.6	8.9 ± 1.7
Parent's education (mean ± SD)	11.0 ± 2.6	11.4 ± 2.4	11.6 ± 2.2
Parent ever worked for pay (%)	87.3	87.4	88.2
Parent currently living with partner (%)	37.3	40.2	40.8
Child living with both biological parents (%)	20.6	24.1	26.3
Full Scale IQ (Y1) (mean ± SD)	85.1 ± 14.0	86.5 ± 14.1	86.4 ± 14.5
Reading Achievement SS (Y1) (mean ± SD)	85.8 ± 14.6	86.7 ± 16.0	87.1 ± 16.0
Verbal composite (Y1) (mean ± SD)	85.5 ± 12.8	86.7 ± 13.6	86.9 ± 13.9
Delinquency (Y1) (mean ± SD)	2.9 ± 3.1	3.0 ± 3.1	3.3 ± 3.2
Percent right correct (Y2) (mean ± SD)	—	57.7 ± 11.7	57.6 ± 11.7
Percent left correct (Y2) (mean ± SD)	—	44.1 ± 10.7	43.8 ± 10.8

Note: Y1 = year 1; Y2 = year 2; SS = standardized score.
* *p* < .05 in *t* test comparing those with and without dichotic listening.

Table 1. Sample Characteristics

Substance Use [↑](#)

Substance use rates increased over the 3 assessment waves. We identified 11, 10, and 19 children (9%, 9%, 18%) with reported substance use in years 1, 2, and 3, respectively. Although there was variability across years in children for whom substance use was reported, users in years 2 and 3 were more likely to have been year 1 users, compared with nonusers (chi squared = 75.6, *df* = 1, *p* = .000 and chi squared = 3.6, *df* = 1, *p* = .06, respectively). At the year 1 and year 3 assessments, users were significantly older than nonusers ($t_{124} = -2.00$, *p* = .048 and $t_{27} = -3.03$, *p* = .003, respectively). At year 2, age of users and nonusers did not differ significantly.

When reported substance use was collapsed across the 3 study years (ever use), 28 (27%) of 105 children with complete data were designated as having ever used substances. Children who had ever used substances (average age = 9.5, *SD* = 1.5 years) were significantly older at intake ($t_{51} = -2.97$, *p* = .004) than nonusers (8.5; *SD* = 1.5 years).

Substance Use, Dichotic Listening Scores, and Cognitive Functioning [↑](#)

Correlations among measures of substance use (ever use), dichotic listening (PRC), and cognitive functioning (verbal composite) were all significant and in the expected direction ([Table 2](#)). Boys with poorer left hemisphere functioning were more likely to use substances and had lower verbal scores. Boys with lower verbal scores were more likely to be substance users. As expected, PLC was not significantly related to other variables.

	Ever Use	Verbal Composite	Percent Right Correct
Verbal composite	-0.20*		
Percent right correct	-0.28**	0.26*	
Percent left correct	0.15	0.20	-0.13

* $p < .05$; ** $p < .01$.

Table 2. Correlations Among Cognitive Functioning, Hemispheric Functioning, and Substance Use

Prediction of Substance Use [↗](#)

The above correlations considered substance use in any assessment year. Hemispheric functioning was assessed only in year 2. To establish the directionality of the substance use/lateralization association, we used logistic regressions to predict year 3 substance use from the dichotic listening scores (year 2) and the verbal composite (year 1), controlling for age (at year 3) and for prior substance use (in either year 1 or 2). In these analyses prior substance use and year 3 age were entered in the first step, PRC was entered in the second, and verbal composite in the third.

In controlling for prior use, our intent was to examine the relative contribution of this variable and of lateralization to substance use. Statistical control for prior use allowed comparing those with stable use and those who changed status between the first 2 assessments and the third. Those who changed status included both individuals who initiated at the third assessment ($n = 9$), and those who had used earlier, but had desisted by the third assessment ($n = 6$). To examine initiation more clearly, we confirmed the results of the analysis predicting year 3 use from age, prior use, and lateralization, by limiting analysis to boys with no prior use; this necessitated dropping 11 boys who had initiated substance use before the year 3 assessment.

The first step (in model 1) was significantly related to year 3 use (Table 3). Although, as noted above, prior substance use is related to later use, this relationship is no longer significant with age in the model: only age contributed significantly to year 3 use. For each year of age at the third assessment, boys showed a 1.76-fold increased risk of year 3 use (odds ratio [OR] = 1.76, 95% confidence interval [CI] = 1.08, 2.88; $p = .02$). Nevertheless, the point estimate for the OR for prior use is still greater than 2.0, although the CI includes 1.00.

	Model 1		Model 2		Model 3		Model 4	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Age (Y3)	1.76*	(1.08–2.88)	2.12**	(1.20–3.73)	2.06*	(1.14–3.71)	2.00*	(1.10–3.60)
Prior substance use	2.76	(0.59–13.06)	3.09	(0.55–17.42)	3.05	(0.53–17.67)	2.40	(0.36–15.87)
Percent right correct ^a			0.28**	(0.11–0.73)	0.30*	(0.11–0.81)	0.34*	(0.12–0.95)
Verbal composite ^b					0.86	(0.37–1.99)	0.98	(0.42–2.46)
Prior delinquency							2.80	(0.58–13.39)
Model $\chi^2_{(df)}$	10.0 ₍₂₎ ***		19.6 ₍₃₎ ***		19.8 ₍₄₎ ***		21.4 ₍₅₎ ***	

Note: OR = odds ratio; CI = confidence interval; Y3 = year 3.
^a In standard deviation units, i.e., 11.7%.
^b In standard deviation units, i.e., 15 points.
* $p < .05$; ** $p = .01$; *** $p = .001$.

Table 3. Logistic Regressions

Controlling for age and prior use, poorer left hemispheric functioning was associated with year 3 use, as seen in model 2 (OR = 0.28, 95% CI = 0.11, 0.73; $p < .01$). A standard deviation decrease in left

hemisphere functioning was associated with a 3.6-fold increase in the odds of year 3 substance use, independent of prior use. When we repeated this analysis only among boys without prior use ($n = 65$), results were unchanged: that is, older boys ($OR = 1.82$, 95% $CI = 1.02, 3.23$; $p = .04$) and those with poorer left hemispheric functioning ($OR = 0.30$, 95% $CI = 0.11, 0.82$; $p = .02$) were significantly more likely to initiate use by year 3.

Results were specific to left hemispheric function: PLC (right hemisphere) was not significantly associated with year 3 use, nor did its addition to any model diminish the effect size for PRC (data not shown).

Model 3 examined effects of cognitive functioning (verbal composite) on the predictive equation. Cognitive functioning did not contribute significantly to year 3 use when the other variables were included, nor did its addition substantially lower the contribution of other variables. Varying entry order, so that the verbal composite was entered before PRC, did not affect these findings.

We previously noted that children with elevated CBCL scores (Attention Problems Aggression, or Delinquency subscales) exhibited significantly lower concurrent PRC scores (Pine et al., 1997) [27]. To investigate whether the lateralization findings might be explained by confounding associations between, on the one hand, substance use and disruptive behavior, and on the other hand, lateralization and disruptive behavior, we repeated our analyses with a fourth step that examined the contribution of prior disruptive behavior to year 3 use (model 4). We created a dichotomous variable indicating whether or not the CBCL Delinquency score was in the clinical range (above the 95th percentile) in either year 1 or 2 ("prior delinquency"). In these analyses, because a single item that appears in the Delinquency (and Externalizing) subscale was also used to designate substance use status, that item was removed from the score for Delinquency and Externalizing before conducting the predictive analyses. While removal of this item obviously lowered scores on both scales, its removal was never sufficient to change the boy's status from clinical (95th percentile) to nonclinical. With the other terms in the model, prior delinquency did not contribute significantly to predicting year 3 use. Its inclusion in the model did not substantially lower the effect size for PRC.

We then repeated these analyses, substituting the component subscales of interest (Prior Attention Problems, Aggression, Externalizing) for prior delinquency. None contributed significantly to year 3 use (data not shown). As with prior delinquency, in no case did the inclusion of these subscales into the model substantially lower the effect size for PRC.

DISCUSSION

Scientific Context

While alternative pathways to substance use surely exist, in the current study, signs of left hemisphere dysfunction on a dichotic listening task predicted substance use among children at risk for psychopathology. This association appeared both when we considered any use of alcohol or illicit substances and when we considered subsequent initiation of substance use.

In the current sample, standardized test scores did not relate significantly to substance use when we controlled for child age. The few other systematic investigations of cognitive functioning in substance-using youths assessed older samples and considered substance use disorders rather than use history (e.g., Moss et al., 1994; Tarter et al., 1995a [23,37]). Of these, a single study that we know of has documented cognitive functioning-substance use associations after control for age (Tarter et al., 1995a), [37] and that study examined only girls.

This investigation extends prior research on associations among verbal deficits, disruptive psychopathology, and substance use. While prior studies found associations among verbal deficits on standardized tests, disruptive psychopathology, and substance use (e.g., Moss et al., 1994; Tarter et al.,

1995b [23,38]), verbal deficits in the current study were assessed by a dichotic listening task as well as by standardized tests. The association between dichotic performance and substance use in the current study remained with control for standardized test scores and prior substance use. This suggests that dichotic listening tests may provide a more sensitive index of the brain processes related to substance use. As the dichotic consonant-vowel task activates relatively specific regions in the left temporal lobe (Davidson and Hugdahl, 1996), [12] these results generate a number of hypotheses on the biological predictors of substance use.

Various mechanisms could explain the association between substance use and verbal deficits. First, while substance use might contribute directly or verbal deficits by disrupting learning, this possibility seems unlikely. Verbal deficits in the current and prior studies predated substance use onset. Second, verbal skills deficits might directly contribute to substance use, if children lacking the verbal skills to navigate through problematic life situations rely on other means. Substance use might be a form of self-medication, intended to compensate for the consequences of an underlying neural defect. Third, verbal skills deficits and substance use disorders might both result from a common underlying deficit in brain functioning that influences a diverse set of behaviors, including substance use, reading, and language-related functions, as well as disruptive psychopathology (Pine et al., 1997) [27]. While the current study is not designed to differentiate among the latter 2 possibilities, prior research provides most support for the third (Brook et al., 1996, 1998) [7,6].

These findings could indicate a role for left temporal structures that mediate language-relevant functions in substance use disorders. While there is relatively little evidence for a direct role of such structures in substance use disorders, brain circuits closely linked to substance use disorders play a major modulatory role in temporal lobe processing. As a result, the current findings could derive through indirect effects of such brain circuits. For example, prefrontal circuits involved in attention regulation influence performance on dichotic listening tasks (Hugdahl, 1995), [16] and deficits in prefrontal function are implicated in impulse control and substance use disorders (London et al., 1996; Pennington and Ozonoff, 1996; Volkow et al., 1996) [19,25,40]. Given the lateralized nature of the dichotic listening abnormality, one might suspect left prefrontal involvement. A deficit in this region has been found in imaging studies on adult impulsivity (Raine et al., 1997) [29] but not in neuropsychological or imaging studies on childhood disruptive disorders (Carter et al., 1995; Castellanos et al., 1996; Epstein et al., 1997) [9,10,14].

Clinical Implications [↗](#)

The current study emphasizes the relationship between verbal skills deficits and various clinical problems. Prior reports from our group and others have emphasized associations with disruptive disorders (Beitchman et al., 1996; Pine et al., 1997) [4,27]. The current report emphasizes associations with substance use. While the relationship between disruptive disorders and substance use is well noted, we found an association between verbal deficits and substance use independent of prior disruptive psychopathology. Hence, clinicians should consider the possibility of substance use disorders among children with language deficits, whether or not they have a history or disruptive behavior. Screens for language-related deficits may help identify children at risk for substance use disorders. Conversely, clinicians should be aware of language deficits in boys with substance use disorders.

Limitations and Conclusions [↗](#)

The current results should be interpreted in light of limitations in the study design. We used a broad indicator of any use of alcohol or illicit substances. However, such an indicator is relevant for research in young children, among whom rates of any substance use are low relative to adolescents. Preadolescent substance use is one of the best predictors of later problems with substance use and dependence. Moreover, despite use of an inexact index, the overall prevalence in the sample and the age-related increases for substance use are both comparable with those in other studies with similar

demographics (e.g., Van Kammen et al., 1991 [39]).

Given that our index of substance use may be less sensitive than other indices, such as those based on toxicology screens, the current study likely underestimates the true strength of the association between verbal skills deficits and substance use, providing only a lower bound estimate. Therefore, it will be important to extend these current findings by studying associations in older cohorts with more specific indicators of substance use problems.

Second, the boys in this study were the brothers of adjudicated delinquents; most were from minority families; and the sample as a whole exhibited relatively high rates of social adversity (Wasserman et al., 1996) [41]. Findings should be extended to samples of girls and children from diverse social backgrounds. Nevertheless, the generalizability of our results is supported by the similarities with results in adolescents and adults from diverse social and ethnic groups (Becker et al., 1993; Hare et al., 1984; Raine et al., 1990) [3,15,30]. Moreover, psychiatrically healthy boys in the current study exhibited dichotic listening results very similar to those in similarly aged normal volunteer children studied in our laboratory (Bruder et al., 1987) [8] and in other laboratories (Berlin et al., 1973) [5].

In summary, considerable research finds an association between deficits in verbal ability and disruptive psychopathology. More recent studies among adolescents suggest that this association also relates to substance use disorders. The current study extends these findings by noting that childhood abnormalities in language-relevant lateralized brain systems predict increased likelihood of initiating substance use at follow-up. Such findings are consistent with a growing body of research linking early childhood lateralization, abnormalities to the development of psychiatric problems.

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