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Childhood Maltreatment and Conduct Disorder: Independent Predictors of Adolescent Substance Use Disorders in Youth with ADHD

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Attention-deficit/hyperactivity disorder (ADHD) is one of the most frequently diagnosed childhood psychiatric disorders with prevalence rates in school-aged children ranging from 5–10% (Scahill & Schwab-Stone, 2000). Longitudinal studies have consistently shown childhood ADHD to be a significant contributing factor to poor outcome in adolescence and adulthood (Barkley, Fischer, Edelbrock, & Smallish, 1990; Fischer, Barkley, Edelbrock, & Smallish, 1990; Hechtman & Weiss, 1986; Mannuzza, Klein, Konig, & Giampino, 1989; Mannuzza, Klein, Bessler, Malloy, & LaPadula, 1993). Negative outcomes often associated with childhood ADHD include heightened risk for adolescent psychopathology (Gittelman, Mannuzza, Shenker, & Bonagura, 1985; Satterfield & Schell, 1997; Barkley, Fischer, Smallish, & Fletcher, 2004; Hechtman, Weiss, Perlman, & Amsel, 1984), antisocial behavior, problems with employment, driving, and sexual relationships (Barkley, Guevremont, Anastopoulos, Dupaul, & Shelton, 1993; Barkley, Fischer, Smallish, & Fletcher, 2006) as well as substance use disorders (Barkley et al., 2004; Biederman, Monuteaux, Mick, Spencer, Wilens, Silva et al., 2006; Mannuzza & Klein, 2000). Factors that contribute to negative outcomes in this

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population include high rates of psychiatric comorbidity such as oppositional defiant disorder (ODD), conduct disorder (CD), and a variety of mood and anxiety disorders (Biederman, Newcorn, & Sprich, 1991; Fischer & Barkley, 2003; Jensen, Martin, & Cantwell, 1997). In addition, there are many psychosocial and environmental factors such as family substance abuse history and low socioeconomic status which potentially contribute to poor outcome in this population.

Among the negative outcomes often associated with ADHD, substance use disorders (SUDs) are particularly problematic (Mannuzza et al., 1993; Mannuzza, Klein, Bessler, Malloy, & LaPadula, 1998; Biederman, Wilens, Mick, Faraone, & Spencer, 1998; King, Iacono, & McGue, 2004). Prevalence rates of adolescent and adult SUDs among individuals diagnosed with ADHD range between 30–43% (Fischer, Barkley, Smallish, & Fletcher, 2002), a more than two-fold increase over the 8–15% reported in the general population (Olfson, Shea, Feder, Fuentes, Nomura, Gomeroff, 2000; Thomas, Waxmonsky, Gabow, Flanders-McGinnis, Socherman, Rost, 2005). Investigations into potential risk factors for later substance abuse in children with ADHD have yielded mixed results. Some researchers have highlighted the role of early conduct problems and externalizing symptoms (Armstrong & Costello, 2002; Brook, Whiteman, Cohen, Shapiro, & Balka, 1995; Disney, Elkins, McGue, & Iacono, 1999). Others have reported that severity of childhood ADHD symptoms predicts substance abuse over and above that accounted for by childhood antisocial symptoms (Molina & Pelham, 2003). Still others have emphasized the role of the persistence of ADHD, CD and antisocial symptoms into adolescence (Gittelman et al., 1985; Mannuzza et al., 1991; Mannuzza et al., 2000). It seems likely that several factors play a contributory role in SUD outcomes, and, while these studies clearly indicate a role for ADHD and comorbid externalizing disorders in the emergence of adolescent SUD, the extent to which other factors play a role has received considerably less study.

Individuals with histories of childhood maltreatment are also at heightened risk for developing SUDs in adolescence and adulthood (Moran, Vuchinich, & Hall, 2004; Liebschutz et al., 2002; Wall & Kohl, 2007). Rates of maltreatment in samples of individuals with drug and alcohol abuse disorders are reported as high as 77–84% while rates of childhood maltreatment in the general population range between 25–40% (Cohen & Densen-Gerber, 1982; Triffleman, Marmar, Delucchi, & Ronfeldt, 1995). Although children diagnosed with ADHD are known to be at increased risk for maltreatment due to externalizing behaviors and dysfunctional peer and parental relations (Briscoe-Smith & Hinshaw, 2006; Ford, Racusin, Daviss, Ellis, Thomas, Rogers et al., 1999), the relationship between maltreatment and SUDs is relatively unstudied in this population. Given that consistent links have been established between childhood maltreatment and SUDs as well as between externalizing disorders and SUDs (Appleyard, Egeland, Van Dulmen, & Sroufe, 2005; Biederman et al., 1998; Mannuzza et al., 1998), it seems logical to examine how these factors influence youth with ADHD who are known to be at heightened risk for both of these conditions.

To our knowledge, no study has examined the contributory role of childhood maltreatment in the development of later SUDs among individuals diagnosed with ADHD in childhood. Because of prior research indicating that children with ADHD are at heightened risk for maltreatment (Appleyard et al., 2005; Ford et al., 1999), as well as later substance use disorders (Biederman et al., 1998; Mannuzza et al., 1998), this is an important area of study. The major aim of the present study was to investigate the relationship between childhood maltreatment and later SUDs in a longitudinal sample of adolescents diagnosed with ADHD in childhood. Further, does maltreatment proffer added risk over other known contributory factors such as early CD (Gittelman et al., 1985; Barkley et al., 1990; Hechtman et al., 1986), parental alcohol and drug use (Biederman, Faraone, Monuteaux, & Feighner, 2000; Johnson, Leonard, & Jacob, 1989; Prescott, Aggen, & Kendler, 1999; Chassin, Curran, Hussong, & Colder, 1996; Clark,

Cornelius, Kirisci, & Tarter, 2005), and lower socio-economic status (SES)(Duncan, Duncan, Hops, & Alpert, 1997)? We hypothesized that a history of childhood maltreatment would increase the likelihood of a SUD in adolescence, and that this risk would be above and beyond that accounted for by other comorbid psychiatric disorders, parental substance use and lower SES.

Method

Participants

The study sample consisted of 86 adolescents (75 males) who represent a sub-sample derived at follow-up from a longitudinal study of adolescents diagnosed with ADHD at baseline during childhood ($N = 169$). The baseline childhood sample were all clinically referred for behavioral difficulties by schools, physicians, or mental health providers as part of a study focusing on the biology of ADHD and other disruptive behavior disorders. The childhood sample as a whole was rated as having significant behavior problems by both parents and teachers, and all participants were diagnosed with ADHD. Children were between the ages of 7–11 years, with a mean (SD) age of 8.99 (1.30) years at the time of initial evaluation. The present adolescent sample ($n = 86$) were those who participated in the follow-up assessment, approximately 10 years later. The follow-up participants ranged in age between 16–21 years, with a mean (SD) age of 18.21 (1.33) years. The follow-up sample was ethnically diverse, comprised of 22.1% African American, 26.7% Caucasian, 32.6% Latino, and 18.6% of mixed or other ethnicity. The participants were generally of lower to lower-middle socioeconomic status (Mean socioeconomic prestige = 44.03; $SD = 17.40$) on a measure of socioeconomic prestige (Nakao & Treas, 1994; see follow-up evaluation section for description of measure), although a wide distribution of socio-economic prestige was represented (Range: 20–96). The sample was almost exclusively urban, and all participants were English speaking. Individuals with a diagnosis of schizophrenia, pervasive developmental disorder, Tourette's syndrome, or a Full Scale IQ below 70 were excluded from entry into the initial childhood study.

The original group was not recruited for a longitudinal study and was comprised of a highly diverse and mobile inner-city population who were difficult to locate. As such, we did not anticipate re-evaluation of the complete sample. Of the 169 childhood subjects, 112 families (66.3%) were located. Among those located, 86 (76.8%) completed the follow-up re-evaluation, 18 refused participation, seven were incarcerated, and one individual was deceased. The group that was lost to follow-up ($n = 83$) did not differ significantly in age at child evaluation, parent or teacher ratings of behavior, or in their rates of ODD, CD, mood or anxiety disorders as assessed during childhood (all $p > .05$) from those followed ($n = 86$). The two groups did differ significantly on childhood FSIQ, with those followed having a significantly higher scores than those lost to follow-up (94.0 vs. 89.3; $t(159) = 2.0, p = .05$). Overall, those included in the follow-up appear to be representative of the original childhood sample.

This study was approved by the Institutional Review Boards of the Mount Sinai School of Medicine and Queens College, City University of New York. Participants over the age of 18 signed their own statement of informed consent for participation in the study. When participants were under the age of 18, parents signed written statements of informed consent for their own and their child's participation. Assent was obtained from all participants younger than 18. Participants were compensated for their time and travel expenses.

Baseline Psychiatric Evaluation

The childhood diagnosis of ADHD, CD, ODD, anxiety and mood disorders was based on information obtained from parents and teachers. Parents were interviewed regarding their child's diagnosis using either the Diagnostic Interview Schedule for Children (DISC) version

2.1 (Shaffer, Fisher, Piacentini, Schwab-Stone, Wicks, 1989), which incorporates diagnostic criteria from Diagnostic and Statistical Manual - Third Edition –Revised (DSM-III-R; American Psychiatric Association, 1987), or the DISC version 2.3 (Shaffer, Fisher, Dulcan, Davies, Piacentini, Schwab-Stone et al., 1996), which reflects criteria from DSM-IV (American Psychiatric Association, 1994), depending on their date of entry into the study. Parents and teachers also rated the severity of various disruptive behaviors using the Child Behavior Checklist (CBCL; Achenbach, 1991) and the IOWA Conners Teacher Questionnaire (IOWA; Loney & Milich, 1982), respectively. Although diagnoses for those recruited before 1994 were made on the basis of DSM-III-R criteria, virtually all participants would likely have met DSM-IV criteria for ADHD, Combined Type. To examine differences due to differing criteria for ADHD between the DSM-III-R and DSM-IV, we reviewed all ADHD symptom data from the two groups. The groups did not differ with regard to parent or teacher ratings, or in rates of comorbidity (all $p > .05$). Table 1 shows childhood characteristics of the sample.

Parent History Assessment at Baseline

The family history of each proband was assessed for symptomatology of substance use problems using a semi-structured interview (Halperin, Schulz, Mckay, Sharma, & Newcorn, 2003) administered to either the child's mother alone, both parents, or another relative with whom the child lived. Initially, each respondent completed a genogram diagramming the child's first- and second-degree relatives. The genogram was then used as a guide while the interviewer systematically asked about the past and present substance use patterns of each family member. When a positive report of substance use was elicited, additional probes were used to determine whether the use was abusive, represented a persistent pattern of behavior, or caused functional impairment for the individual. Since the family history interview examined both past and present disturbances, the reported rates of symptomatology in relatives reflect lifetime prevalence. Problematic substance use was operationally defined as use to a level where a problem was experienced by the individual either at home or at work. This study focused exclusively on parental history of problematic substance use. Parents were not formally diagnosed with a substance use disorder.

Follow-up Evaluation

Childhood Maltreatment was assessed using the Childhood Trauma Questionnaire (CTQ). The CTQ (Bernstein, Fink, Handelsman, Foote, Lovejoy, Wenzel et al., 1994) is a 28-item self-report measure that screens adults and adolescents for histories of childhood abuse and neglect. Subjects rate statements about childhood trauma according to frequency on a 5-point Likert scale as 'never true', 'rarely true', 'sometimes true', 'often true', and 'very often true'. Minimization and denial of abuse and neglect are rated on a three-item scale which is incorporated in the questionnaire to detect false-negative trauma reports. Item scores are transferred to clinical scales for five types of maltreatment: Emotional Abuse, Physical Abuse, Sexual Abuse, Emotional Neglect, and Physical Neglect, with each type of maltreatment represented by five items. The Emotional Abuse items assess the extent to which the child was verbally demeaned or degraded (e.g., "People in my family said hurtful or insulting things to me"). The Physical Abuse items determine the degree of physical assault(s) the child has endured (e.g., "I was punished with a belt, a board, a cord, or some other hard object"). The Emotional Neglect items estimate the level at which the child's emotional needs were met (e.g., "My family was a source of strength and support" [reverse scored]). The Physical Neglect items assess if the child's physical needs were met (e.g., "I didn't have enough to eat"). Finally, the Sexual Abuse items assess if the child was coerced into sexual scenarios (e.g., "Someone tried to touch me in a sexual way, or tried to make me touch them"). The CTQ produces both dimensional and categorical levels for each form of maltreatment to which cutoff scores are used to classify individuals as abused or not abused. The CTQ is a brief, reliable and valid means of retrospectively assessing childhood maltreatment with test-retest reliability

coefficients over four months ranging from .79 to .86, and internal consistency reliability coefficients ranging from .66 to .92 across samples (Bernstein, Ahluvalia, Pogge, & Handelsman, 1997; Bernstein, Stein, Newcomb, Walker, Pogge, Ahluvalia et al., 2003). For the purposes of this study, individuals were categorized as maltreated if they met criteria for one or more sub-types of maltreatment using the cut scores provide in the CTQ manual. A dichotomous variable of maltreated/not-maltreated was used in all analyses.

Socioeconomic status was assessed using a measure of socioeconomic prestige developed at the National Opinion Research Center (Nakao & Treas 1994). This measure approaches the issue of measuring socioeconomic status by ranking the relative prestige of the individual's occupation. Although this approach has been used in sociological and economics research, it has not been widely used in health research. Occupational prestige scaling is a process whereby occupations are ranked on a scale from 1 to 100 for its perceived prestige. The rankings are derived from surveys that ask respondents to attach a ranking to the occupation. Thousands of occupations are classified and the rankings are updated periodically. Information about parental occupation was obtained from parents during the follow-up assessment.

Adolescent substance use was assessed using several measures. Initially, the Rutgers Alcohol and Drug Use Questionnaire (Labouvie, Bates, & Pandina, 1997) was used to systematically evaluate the subject's overall drug and alcohol use. The RADQ assesses current and past use of cigarettes, alcohol, marijuana, cocaine, and other prescription and non-prescription drugs. Respondents were asked to report the frequency and amount of drug and alcohol use in the past three years. Secondly, the substance abuse supplemental module of the Kiddie-SADS-Present Lifetime Version (K-SADS-PL; Kaufman, Ryan, Rao, Brent, & Brimaher, 1996) was used to interview adolescents and parents separately about subject's substance use. The K-SADS is a semi-structured diagnostic interview designed to ascertain current and lifetime psychopathology including SUDs. It contains algorithms to generate categorical diagnoses of substance use based on the criteria that have been established in the DSM-IV. Interviewing was conducted by trained clinicians, and interviews were carried out separately with adolescents and their parents as informants. Responses were combined across raters by item; if either informant or the clinician indicated that the item caused significant distress or impairment, the symptom was judged to be present. Although the K-SADS was designed for use with children and adolescents up to the age of 19 years, this measure has been used by other research groups to assess the psychiatric status of young adults up to the age of 21 years (Biederman, Faraone, Milberger, Guite, Mick, Chen et al., 1996; Faraone, Biederman, Mennin, Gershon, & Tsuang, 1996). Finally, a urine toxicology screen (Varian Inc., Lake Forest, CA.) was collected from each subject on the day of evaluation, analyzed for the presence of marijuana, cocaine, amphetamines and opiates, and used to corroborate subject report, although this could not be used to determine the proband's diagnostic status. In addition, to facilitate honest responding and to maintain strict measures of confidentiality, we obtained a certificate of confidentiality from the National Institute of Health. Information gathered from all sources was used in conjunction to inform the clinician on the individual subject's drug and alcohol habits and guided the clinician to probing for the specific criteria needed to make a diagnosis of drug of alcohol abuse and/or dependence in accordance with the criteria set forth in the DSM-IV. Additionally, before a final SUD diagnosis was rendered, two independent teams of evaluators reviewed all pertinent clinical information provided during the course of the follow-up evaluation. Evaluator ratings were completed independently and final diagnosis was dependent upon evaluator agreement. A diagnosis of substance abuse or dependence for alcohol and drugs in accordance with DSM-IV criteria was formulated using parent and adolescent responses from the K-SADS along with information obtained from the RADQ. Measures of abuse and dependence were collapsed to create a dichotomous variable of *substance abuse/dependence* versus *no substance abuse/dependence*.

Statistical Procedures

To examine group differences on several possible risk factors, we separated the sample into two groups; adolescents with a SUD, and adolescents without a SUD. Chi-square analyses were used to determine group differences on dichotomous measures and Student's *t*-test were used to determine differences between groups on continuous variables. To determine the relative contributions of childhood maltreatment and other risk factors to the development of SUD in adolescence, binary logistic forward (Wald) regressions were used to determine if the individual risk factors (i.e., childhood maltreatment, childhood CD, parental substance use problems) had unique contributions to substance abuse/dependence outcomes. Socioeconomic status was entered into the first step of the regression analysis as a control variable. Dichotomous variables for childhood maltreatment, childhood CD, and parental substance use problems were entered on the second step, and served as independent predictor variables. To explore the possibility that maltreatment increases risk for adolescent SUD primarily in those with either parental substance use problems or childhood CD, these interaction terms were entered on the third step. All variables were centered using *z*-scores (Aiken & West, 1991) before creating the multiplicative interaction terms and running the regression analysis. Dichotomously coded substance abuse/dependence served as the dependent measure. All data analyses were completed using the SPSS 11.5 statistical software program for PC (SPSS Inc., 2002).

Results

Of the 86 participants, six individuals were detected as underreporting by the minimization and denial scales of the CTQ and excluded from further analyses. Of the remaining 80 participants (71 males), 34 (42.5%) were diagnosed with a SUD at follow-up. Fifty-seven participants (71.3%) met criteria for at least one type of maltreatment. Adolescents diagnosed with SUDs were significantly more likely than those without a diagnosis to report histories of childhood maltreatment (91.2% vs. 56.5%; $\chi^2 = 11.46, p = .001$). Of those adolescents who reported a history of childhood maltreatment, 31 (55.4%) met criteria for a SUD while only three (13.0%) of those with no history of childhood maltreatment met SUD criteria.

Forty-one (51.3%) adolescents had at least one parent who was identified as having a history of problematic substance use. Adolescents diagnosed with SUDs had significantly higher rates of parental substance use problems as compared to those without a SUD diagnosis (67.6% vs. 39.1%; $\chi^2 = 6.36, p = .01$). Among those adolescents who had a parent with problematic substance use, 23 (56.1%) met criteria for a SUD while 11 (28.2%) of those who did not have a parental history of problematic substance use met SUD criteria.

At baseline, 23 (28.8%) of the children were diagnosed with CD. Adolescents diagnosed with SUDs had significantly higher rates of childhood CD as compared to those without a SUD diagnosis (47.1% vs. 15.2%; $\chi^2 = 9.68, p = .002$). Among those adolescents with a childhood diagnosis of CD, 16 (69.6%) met criteria for a SUD while 18 (31.6%) of those who did not have a childhood diagnosis of CD met SUD criteria. The SUD group came from significantly lower socioeconomic backgrounds when compared to the non SUD groups 39.2 (13.9) vs. 47.9 (19.7); $t(78) = 2.21, p = .03$. Group comparisons are summarized in Table 2.

As expected, parental substance use problems, low SES, childhood CD, and maltreatment were not unrelated. Although correlations were modest, problematic parental substance use was significantly associated with childhood CD ($r = .234, p < .05$) and lower SES ($r = -.283, p < .05$), but not maltreatment ($r = .024, p > .10$). In addition, the presence of childhood CD was associated with increased likelihood for maltreatment ($r = .226, p < .05$); SES was not associated with maltreatment or childhood CD (both $p > .10$). To assess the possible threat of multicollinearity on the accuracy of the regression estimates, we examined the variance

inflation factor and tolerance measures of the predictor variables and found them to be below accepted cutoff values (Cohen, Cohen, West, & Aiken, 2002).

Do Maltreatment, Conduct Disorder and Parental Substance Abuse Independently Predict Adolescent Substance Use Disorders?

Results from the logistic regression analysis revealed that two of the three risk factors were significantly associated with the emergence of adolescent SUDs after controlling for other variables in the equation. Childhood maltreatment (Wald = 7.56, $p = .006$), and childhood CD (Wald = 4.88, $p = .027$) were independently related to adolescent SUDs after controlling for SES. Despite a notable trend, parental substance use problems (Wald = $p < .07$) was not independently associated with adolescent SUDs. The interaction between childhood maltreatment and parental substance use problems also showed a notable trend ($p = .06$) such that among those with parental with substance use problems, maltreatment had a greater impact upon the probability of SUDs in the offspring (see Table 3). The interaction between childhood maltreatment and childhood CD was not significant. In terms of the relative influence of the risk factors on adolescent SUDs, a history of childhood maltreatment emerged with the strongest association over childhood CD and parental substance use problems.

To determine whether our findings were affected by the sex of the participants, the logistic regression was re-run using only males ($n = 71$). All significant results remained virtually identical to those from the full sample; the impact of both Maltreatment and CD marginally increased (from $p = .006$ to $p = .004$ and $p = .027$ to $p = .015$, respectively). Analyses using only female participants could not be conducted due to their small number in the sample ($n = 9$).

Discussion

The major aim of this study was to investigate the association between childhood maltreatment and the development of SUDs among adolescents diagnosed with ADHD in childhood. We sought to elucidate whether maltreatment predicted SUDs above and beyond other commonly associated risk factors such as childhood CD and parental substance use problems. As hypothesized, our results identified a robust relationship between childhood maltreatment and later SUDs in this group. Our data indicate that childhood maltreatment independently contributed to SUD outcome over and above the variance accounted for by the other variables in the model. Strikingly, childhood maltreatment was a better predictor than childhood CD and parental substance use problems, two traditionally potent predictors of adolescent substance use (Armstrong et al., 2002; Brook et al., 1995; Disney et al., 1999; Prescott & Kendler, 1999).

Overall, our findings are consistent with the extant child abuse literature demonstrating that children with histories of maltreatment have elevated rates of SUDs in adolescence (Liebschutz et al., 2002; Moran et al., 2004; Ondersma, 2007; Wall et al., 2007). Notably, within our sample of adolescents with a history of childhood ADHD, those who were maltreated had elevated rates of SUDs (55.4%), while those with ADHD but no maltreatment had rates consistent with those reported in the general population (13.0%). This suggests that childhood maltreatment may play an important role in SUD outcome, and that ADHD itself, in the absence of maltreatment and/or comorbid CD, may not increase risk for later SUD.

Although consistent links have been shown between parent's substance abuse and substance abuse problems in their offspring (Biederman et al., 2000; Johnson et al., 1989; Chassin et al., 1996; Clark et al., 2005; Prescott et al., 1999), it is likely that this familial transmission is accounted for by a combination of genetic and environmental factors. Parents with SUDs have been reported to be more likely to maltreat their children (Ammerman, Kolko, Kirisci,

Blackson, & Dawes, 1999). Thus it would seem reasonable to hypothesize that those youth at increased risk due to parental substance use would be differentially more vulnerable to the negative impact of maltreatment. In support of this hypothesis we identified a statistical trend for the interaction effect between parental substance use problems and childhood maltreatment.

As previously noted, children with behavior problems, such as CD, are at increased risk for developing SUDs in adolescence (Mannuzza, Klein, Abikoff, & Moulton, 2004). Interestingly, we found that childhood maltreatment was inter-correlated with childhood CD. Albeit logical to suppose that those youth at increased risk of SUDs due to early CD would be more susceptible to the influence of childhood maltreatment, we did not find an interaction effect between childhood CD and childhood maltreatment in this sample.

The results of this study should be interpreted in the context of several limitations. First, identification of childhood maltreatment was based solely on retrospective reports from each participant. Although considerable data support the reliability and validity of the CTQ (Bernstein et al., 1997; Bernstein et al., 2003; Fink, Bernstein, Handelsman, Foote, & Lovejoy, 1995; Scher, Stein, Asmundson, McCreary, & Forde, 2001), self-report measures are susceptible to a variety of biases including social desirability, mood at time of report, and memory limitations (Babor, Brown, & DelBoca, 1990). Nevertheless, had maltreatment been assessed during childhood, there would be increased likelihood for false negatives due to parental under-reporting as well as the possibility of the childhood maltreatment occurring subsequent to our childhood evaluation, which occurred nearly ten years ago for most of the adolescents. In addition, the classification of problematic parental substance use as determined during the baseline evaluation was developed to cast a broad net to encompass a wide range of impairing substance use behaviors, but the parents were not formally diagnosed with a SUD. Nevertheless, increased error in our assessment of maltreatment and/or problematic parent substance use would decrease the likelihood of finding associations with adolescent SUDs. Yet, significant associations clearly emerged. Increasing the adequacy of these measures would likely make the findings more robust. Furthermore, there was a ten year time span between baseline and follow-up assessments and it is possible that some parents would have developed substance use disorders during this time. Unfortunately we did not employ a measure at follow-up to supplement the baseline data. Finally, as in many studies of ADHD, the low rate of female participants in our sample limits the generalizability of these results as it relates to girls diagnosed with ADHD in childhood.

This study was designed to elucidate pathways leading to later SUDs in children with ADHD. While data have consistently indicated that comorbid CD and parental substance abuse account for a substantial proportion of the variance associated with later SUDs in this population, findings have been mixed as to whether ADHD alone poses increase risk for later SUD. Our findings indicate that a third, independent factor, childhood maltreatment, must be considered. This finding is not surprising given the fact that maltreatment has been linked to adolescent SUDs in other populations. However, it has been completely overlooked in longitudinal research in ADHD examining SUD outcomes, despite the fact that these children are at increased risk for maltreatment (Briscoe-Smith & Hinshaw, 2006). Our data suggest that children with ADHD who did not have childhood CD and were not maltreated are at no greater risk for later SUDs than children from the general population. Thus, ADHD alone does not appear to be an independent risk factor for later SUD.

Implications for Research, Policy, and Practice

These findings have important implications with regard to substance abuse outcomes and emphasize the utility of assessing childhood maltreatment in ADHD populations. Maltreatment has been largely ignored in the investigation of SUDs in this population, and as previously noted, children with behavior disorders, such as ADHD, are at elevated risk for maltreatment

(Appleyard et al., 2005) and later SUDs (Mannuzza et al., 1993; Mannuzza et al., 1998; Biederman et al., 1998). As such, clinicians providing services to individuals with ADHD should be aware of the implications of co-occurring maltreatment and the risks associated therein. Accordingly, the assessment and diagnostic process of ADHD referrals should include screening for possible childhood maltreatment, as this would help to identify ADHD youth with enhanced vulnerability for later SUDs.

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Table 1

Characteristics of the Childhood Sample

	Total (N=86)
CBCL Externalizing	68.8 (11.4)*
CBCL Internalizing	64.7 (11.9)*
ODD	48.8%
CD	26.7%
Anxiety Disorder	29.1%
Mood Disorder	9.3%
Parental Substance Use Problems	51.3%
Childhood Maltreatment**	71.3%

* Note. Mean (SD),

** assessed at follow-up

Table 2

Group Differences on Various Risk Factors

	No SUD (<i>n</i> =46)	SUD (<i>n</i> =34)	χ^2/t	<i>p</i>
Age ^{<i>b</i>}	18.0 (1.36) [*]	18.4 (1.29) [*]	1.29	.72
SES ^{<i>b</i>}	47.9 (19.7) [*]	39.2 (13.9) [*]	-2.21	.03
CBCL Externalizing ^{<i>a</i>}	67.7 (11.0) [*]	67.2 (9.6) [*]	-0.24	.82
CBCL Internalizing ^{<i>a</i>}	62.8 (11.0) [*]	62.1 (11.8) [*]	-0.20	.84
ODD ^{<i>a</i>}	54.3 %	41.2 %	1.36	.24
CD ^{<i>a</i>}	15.2 %	47.1 %	9.68	.002
Anxiety disorder ^{<i>a</i>}	34.8 %	23.5 %	1.18	.28
Mood disorder ^{<i>a</i>}	6.5 %	11.8 %	0.67	.41
Parental Substance Use Problems ^{<i>a</i>}	39.1%	67.6%	6.36	.01
Childhood Maltreatment ^{<i>b</i>}	56.5%	91.2%	11.46	.001

* Note. Mean (SD),

^{*a*} assessed at baseline,

^{*b*} assessed at follow-up

Binary Logistic Forward (Wald) Regression Examining Childhood Maltreatment, CD, Parental Substance Use, Maltreatment * Parental Substance Use Problems, and Maltreatment * CD as Predictors of Adolescent SUDs

Table 3

Variable	β	SE	Wald	p	OR	CI (95%)
SES (control variable)	.030	.017	3.02	.082	1.03	0.99–1.07
Maltreatment	1.99	.723	7.56	.006	7.30	1.77–31.14
Conduct Disorder	1.26	.567	4.88	.027	3.52	1.15–10.73
Parental Substance Use Problems	1.19	.645	3.38	.066	3.28	0.93–11.60
Maltreatment * Parental Substance Use Problems	1.13	.595	3.58	.060	3.08	0.96–9.88
Maltreatment * CD	-2.37	1.74	1.85	.173	.093	.003–2.84

Note. β = regression coefficient; SE = standard error; Wald = z-score; p = probability value for Wald; OR = odds ratio expressed as % increase in odds: $100(e^{\beta} - 1)$; CI = 95% confidence interval for the odds ratio. The above models included 3 variables; Maltreatment, CD, Parental Substance Use Problems, using the forward (Wald) stepwise method, and 2 interaction terms; Maltreatment by Parental Substance Use Problems and Maltreatment by CD. Parental Substance Use Problems did not reach statistical significance on any step. The interaction terms were not significant. SES was entered as a control variable in the equation.