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Adolescents With Attention-Deficit/Hyperactivity Disorder: Adverse Behaviors and Comorbidity

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A B S T R A C T

Purpose and Objective: There is growing evidence that adolescents with ADHD develop long-term impairments and adverse outcomes, yet less is known about their adverse behaviors. To quantify rates of mental health comorbidities in adolescents with ADHD and compare the risks of adverse behaviors among adolescents with and without ADHD.
Methods: We performed a cohort analysis of 6,483 youth from the National Comorbidity Survey Adolescent Supplement (NCS-A), a nationally representative in-person structured diagnostic interview of adolescents aged 14–18 years focusing on mental, emotional, and behavioral disorders. Main Outcomes: (1) Percentages with comorbid anxiety, mood, disruptive behavior, and substance use disorders. (2) Strength of associations of ADHD with several adverse behaviors, including suicidal symptoms, aggression, behavior regulation, life events, education, and substance use. Odds ratios were adjusted for age, sex, and race.
Results: Among the sample of 6,483 adolescents, overall, 9.5% met the criteria for ADHD. Most (69.5%) of adolescents with ADHD had at least one comorbid mental health condition. As compared to adolescents without ADHD, those with ADHD were significantly more likely to have had a suicide attempt (aOR 2.9, 95% CI = 1.3–6.6) and to have had perpetrated physical aggression (aOR 2.3, 95% CI = 1.7–3.2). Adolescents with ADHD were also more likely to have been expelled from school or fired from a job (aOR 3.3, 95% CI = 1.7–6.5) and to have had problems related to drinking alcohol (95% CI = 1.2–2.9).
Conclusions: ADHD in adolescents is a complicated disorder with elevated risks for a wide range of adverse behaviors.

IMPLICATIONS AND CONTRIBUTION

By using the results of a nationally-representative face-to-face diagnostic evaluation of 6,483 adolescents, 9.5% met the criteria for ADHD. Those with ADHD were significantly more likely to have comorbid mental health conditions and were at greater risk for adverse behaviors, including suicidal symptoms, emotional dysregulation, employment or educational problems, and legal difficulties.

Attention-Deficit/Hyperactive Disorder (ADHD), which is the most prevalent neurobiological disorder of childhood, is characterized by developmentally inappropriate and impairing patterns of inattention, hyperactivity, and impulsivity [1,2]. ADHD symptoms become evident in school-aged children, are more frequent in boys than girls, and usually persist into adulthood

Conflicts of interest: Drs Sultan, Hacker, and Olfson and Ms Liu report no conflicts to disclose.

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[3,4]. While symptoms of ADHD begin in early childhood, affected youth often develop comorbid mental health conditions, such as depression, anxiety, and substance use [5]. Concurrently, ADHD is associated with a growing number of adverse behaviors that can lead to long-term functional impairments and accumulated disability [6–8].

Adolescence is a period of elevated risk for the development of several mental health disorders. About one-quarter of depression, one-half of substance use, and three-quarters of anxiety disorders begin before the end of adolescence [9]. Individuals with ADHD are at increased risk for many of these conditions, increasing their risk for adverse long-term outcomes [10–15]. Further, recent evidence demonstrates that increasing mental health comorbidity in ADHD generates a more complicated clinical picture with impairments beyond academic function, including increased risk of natural and nonnatural causes of mortality [16,17]. Because evaluation and treatment have the potential to mitigate many of these adverse behaviors [7,18], improving our understanding of the relationship of common mental health comorbidities with adverse behaviors in adolescents with ADHD may help improve the targeting of clinical interventions aimed at prevention of adverse outcomes.

While substantial progress has been made in defining the clinical characteristics of adolescents with ADHD, including associated mental health comorbidities [7,33], most work in this area has been limited to small clinical samples [19,20] and does not examine the effects of comorbidity on adverse outcomes. One exception includes an analysis by Kessler et al. that concluded that several adverse events in adolescents with ADHD were mediated by other disruptive behavior disorders and secondary mood disorders [21]. While these findings were important, the study only examined a select number of adverse events. Examining a wider range of adverse events, including substance use, emotional control, and major life events, will advance our understanding of ADHD's lifetime impairments.

For addressing the knowledge gaps regarding the mental health burden of ADHD in adolescence and the contribution of comorbidity to this burden, this study focused on quantifying lifetime risks of suicidal behavior, aggression, behavioral control, and substance use associated with ADHD the National Comorbidity Survey Adolescent Supplement (NCS-A) a nationally representative fully structured interview of adolescents ages 13–18 years. We hypothesized that as compared to adolescents without ADHD, those with ADHD would have higher lifetime risks of suicidal and aggressive behaviors, poorer sense of behavioral control, and poorer legal, interpersonal, and educational histories and that these risks would be partially accounted for by comorbid anxiety, depressive, and substance use disorders.

Patients and Methods

Data source and study cohort

NCS-A was a nationally representative face-to-face survey of 6,483 adolescents aged 13–18 years, conducted in the continental United States [38]. The design and sampling are described in detail elsewhere. Briefly, the NCS-A was based on face-to-face interviews with adolescents and their parents (or parent surrogates). Parents and adolescents were interviewed separately, and their combined responses were used in determining diagnoses. All interviews were conducted using the Composite International Diagnostic Interview (CIDI) [38].

Sociodemographic characteristics were assessed in the NCS-A, including respondent age, sex, race/ethnicity, and parent income. Approximately half of the sample was male (51.3%), and the mean age was 15.9 (SE = 1.0) years. Non-Hispanic whites comprised 65.5% of the sample, non-Hispanic blacks, 15.1%, and Hispanic adolescents, 14.4%. Anxiety disorders (31.9%) were the most common disorder, followed by behavior (19.6%), mood (14.3%), substance use (11.4%), and eating (2.7%) disorders [38]. The data were weighted to adjust for differential probabilities of selection of respondents within schools and household samples, differential nonresponse, and residual differences between the sample and the U.S. population on the cross-classification of sociodemographic variables.

Measures

Diagnostic assessment. Adolescents were administered the World Health Organization CIDI, a comprehensive, fully structured interview for the assessment of mental disorders based on criteria of ICD-10 and DSM and designed to generate DSM diagnoses [39]. Major classes of disorders included mood disorders (major depression, dysthymia, bipolar disorder), anxiety disorders (generalized anxiety disorder, separation, panic, obsessive-compulsive disorder agoraphobia, social, specific phobia, post-traumatic stress disorder), other behavior disorders (oppositional defiant and conduct disorder), and substance use disorders.

Adverse behaviors. Markers for adverse behaviors were identified throughout the survey to assess specific domains, including lifetime suicidal behaviors (suicidal thoughts, suicidal thoughts with a plan, and suicide attempts), aggression (threats, physical and verbal), self-report of behavior control (ability to stay in calm), educational functioning, and recent life events, substance use (alcohol, cigarettes, and other substances). Complete descriptions of these items are presented in the Appendix.

Analytic procedures

Youth were divided into two mutually exclusive and exhaustive groups: a lifetime ADHD group (n = 617) and a non-ADHD group (n = 5,866). Lifetime ADHD and non-ADHD groups were compared with respect to their general demographic characteristics (age, sex, race/ethnicity, and family income), comorbid mental disorders (mood, anxiety, other disruptive behavior, and substance use), and adverse behaviors (see adverse behaviors). Unadjusted odds ratios were estimated from logistic regression models with ADHD status as the independent variable of interest and each adverse behavior as dependent variables. In a separate set of models, odds ratios were mutually adjusted for age, sex, and race/ethnicity. Our primary interest was evaluating the risk of adverse behaviors among adolescents with and without ADHD. Because comorbid mental disorders may be in the causal developmental pathway from ADHD to these behaviors, we did include this in an additional adjusted analysis [40]. Ninety-five percent confidence intervals (CIs) were estimated by using the Taylor series linearization method implemented in SUDAAN, version 10. Statistical significance was based on two-sided design-based tests evaluated at the .05 level of significance.

Results

Overview

All Odds ratios in primary tables and figures adjust for demographic characteristics (age, sex, and race/ethnicity).

Background characteristics of cohort

Table 1 compares baseline sociodemographic characteristics for youth with and without lifetime ADHD by age group, sex, race/ethnicity, and family income. The ADHD group was significantly more likely than the non-ADHD group to meet the criteria for all four comorbid mental disorder categories. Most of the ADHD sample (69.5%) had at least one comorbid mental disorder.

Lifetime suicidal behaviors

After adjusting for baseline demographic characteristics only, youth with a lifetime history of ADHD had significantly elevated risks for all types of lifetime suicidal behavior. Specifically, the odds of suicidal thoughts (aOR 95% CI 3.1, 2.2–4.3), and suicidal thoughts with a plan (aOR 95% CI 3.2, 2.0–5.0), and suicide attempts 2.9 (aOR 95% CI 2.9,1.3–6.6) were approximately three times greater for ADHD than non-ADHD youth. After adjusting for demographic characteristics, the association between suicidal ideation and ADHD remained significant (Figure 1).

Aggression and emotional control

ADHD was associated with a significantly elevated risk for aggressive behaviors.

Table 1
Comparison of background characteristics of youth with and without lifetime ADHD in NCS-A

Characteristic	ADHD % (N = 617)	Non-ADHD % (N = 5,866)	Chi⁻Sq	*p* value
Age, yr				
13–14	37.4	35.8	.21	.65
15–16	39.7	42.1	.30	.59
17–18	22.9	22.1	.02	.90
Sex				
M	75.3	48.7	45.39	<.0001
F	24.7	51.3	45.39	<.0001
Race/Ethnicity				
Non-Hispanic White	68.8	65.2	.79	.38
Non-Hispanic Black	12.7	15.3	1.78	.19
Hispanic	15.0	14.3	.00	.96
Other	3.6	5.1	2.15	.15
Comorbid Mental Health Disorders				
Any Comorbidity[b]	69.5	40.8	55.30	<.0001
Any Mood disorder	23.2	13.1	8.67	.01
Any Anxiety Disorder	33.3	25.1	5.30	.03
Other Disruptive Behavior Disorder	50.8	11.9	86.37	<.0001
Any Substance Disorder	20.5	10.6	12.89	.00
Family Income[a]				
PIR ≤ 1.5	14.6	14.6	.00	.99
PIR ≤ 3.0	21.9	19.0	1.13	.29
PIR ≤ 6.0	32.0	32.8	.37	.54
PIR ≥ 6.0	32.6	33.6	.14	.71

National Comorbidity Survey Adolescent Supplement (NCS-A).
[a] PIR (Poverty Index Ratio).
[b] Any Mood, Anxiety, Other Disruptive Behavior, or Substance Disorder.

ADHD youth had twice the adjusted odds of a history of anger attacks with loss of control resulting in damage to property (aOR 95% CI 2.3, 1.7–3.2) or physical aggression (aOR 95% CI 2.1, 1.6–2.6) than their non-ADHD peers. However, the risk of anger attacks with threats of harm did not significantly differ between groups. The association between physical aggression with property damage and ADHD persisted following adjustment for potentially confounding demographic characteristics.

Self-assessed behavioral control was significantly poorer for ADHD youth than their non-ADHD peers. The ADHD group also had lower self-reported abilities to keep calm in a crisis, stay out of trouble in potentially troublesome situations, and to control their emotions when situations require it (Table 2).

Recent life events and educational outcomes

Adjusted odds for potentially adverse life events were also significantly elevated for ADHD youth. Past year life events, such as expulsion from a school or job (aOR 95% CI 3.3, 1.7–6.5), problems with police (aOR 95% CI 3.1, 2.2–4.5), and court appearances (aOR 95% CI 2.3, 1.4–3.6), were approximately two to three times more common in ADHD youth. The adjusted odds of serious interpersonal conflict were also significantly elevated. By contrast, odds of romantic break-ups, endings of close friendships, and pregnancies of self or partners did not differ significantly from non-ADHD youth.

Lifetime educational adversities were significantly poorer for ADHD youth. The adjusted odds for suspension from school were approximately four times greater among ADHD than non-ADHD youth. Odds of repeating a grade were more than twice as great and truancy approximately one and half times greater for ADHD youth. A significant association between ADHD and educational outcomes was retained following adjustment for the demographic and other clinical variables (Table 3).

Lifetime substance use

ADHD youth had significantly higher odds of substance use than their non-ADHD peers. Adjusted odds for lifetime alcohol use problems from drinking (aOR 95% CI 1.9, 1.2–2.9), cannabis use (aOR 95% CI 2.2, 1.7–2.9), cocaine use (aOR 95% CI 2.6, 1.1–6.2), and nonprescribed prescription drugs (aOR 95% CI 2.6, 1.5–4.7), were all statistically elevated, ranging from approximately 1.5–2.5 times. By contrast, the adjusted odds of cigarette use and other illicit drugs (heroin, opium, glue LSD, and others) were not significantly elevated (Table 3).

Adjusting for mental health comorbidities

Given the high rate of comorbidity in ADHD, we performed analyses for all behaviors with adjustments for mental health comorbidities, as well as demographic characteristics. In this analysis, the adjusted odds of suicidal thoughts (aOR 95% CI 1.6, 1.1–2.4), history of attacks of anger with loss of control and damage to property (aOR 95% CI 1.5, 1.0–2.0), repeating of a grade (aOR 95% CI 1.5, 1.1–2.2), and suspension from school (aOR 95% CI 2.5, 1.9–3.2), were elevated for youth with ADHD as compared to youth without ADHD (Table 4).

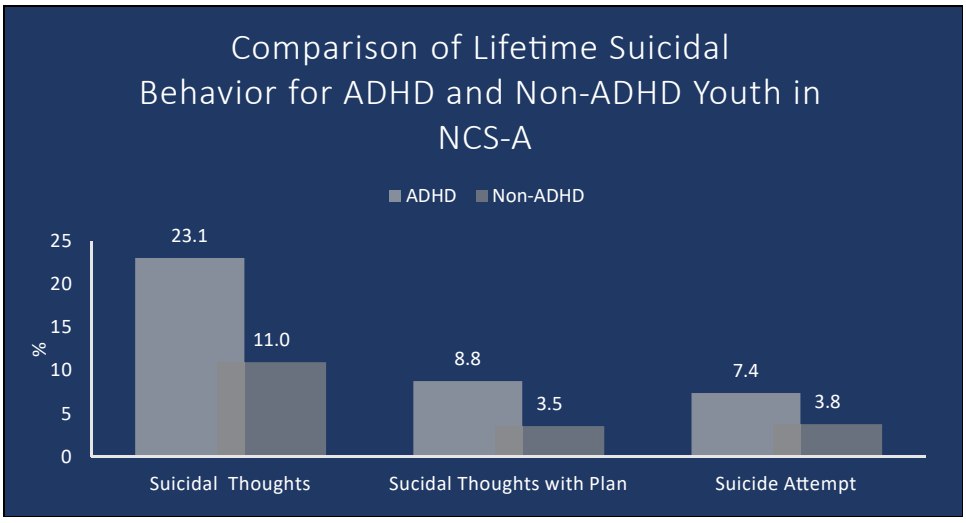

Figure 1. Comparison of Lifetime Suicidal Behavior for ADHD and Non-ADHD Youth in NCS-A. *Unadjusted odds ratios (95% CI) for suicidal thoughts, suicidal thoughts with a plan, and suicide attempts were 2.4 (1.8–3.4), 2.7 (1.7–4.1), and 2.1 (1.0–4.1), respectively. Adjusted (age/sex) odds ratios were 3.1 (2.2–4.3), 3.2 (2.0–5.0), and 2.9 (1.3–6.6), respectively. All pairwise comparisons were significantly different than one another ($p < .05$). National Comorbidity Survey Adolescent Supplement (NCSA).

Discussion

In this large nationally representative sample of youth, ADHD was correlated with a range of adverse behaviors. As compared to their peers, adolescents with ADHD had a higher level of impairment in several important domains. Lifetime risks for suicidal behaviors were approximately three times greater for adolescents with ADHD. These teens were also at risk for aggressive behaviors involving physical aggression or property damage with greater than twice the likelihood than non-ADHD teens. Further, court appearances, problems with the police, and expulsions from a job or school were two to three times as more likely for adolescents with ADHD. Mental health comorbidities were more common among adolescents with ADHD, with approximately three-quarters having a comorbid mood, anxiety, other disruptive, or substance disorder. Comorbidity accounted for much of the increased odds of adverse events.

Approximately one-quarter of adolescents with ADHD reported a history of suicidal ideation, and about seven percent reported a previous attempt. Our findings are consistent with a systematic review that reported elevated rates of suicidal behavior in individuals with ADHD [41]. As the studies in this review include smaller convenience samples, the present study extends and broadens these findings by quantifying the rates of suicidal behavior in adolescents from a large nationally representative sample. While some studies reported this association is largely mediated by comorbidity, overall, disorders associated with severe agitation/anxiety and poor impulse control have been strongly associated with suicidal plans and attempts than depressive disorders among adolescents [42,43]. Previous review articles further support a link between ADHD and death by suicide in adolescents into adulthood and show increasing risk with the severity of ADHD symptoms [41], including the association between ADHD and increased risk for early death by suicide [44]. The association of ADHD with suicidal behaviors is clinically important because past suicidal behavior is known to be a strong predictor of future attempts in adolescents [13,45–49].

Despite prior research [41,44] and our findings, the clinical assessment of suicidal symptoms in adolescents with ADHD is not recommended in current practice parameters, clinical,

Table 2
Comparison of behaviors outcomes for all ADHD and Non-ADHD youth in NCS-A

Lifetime history aggression	ADHD % (N = 617)	Non-ADHD % (N = 5,866)	OR (95% CI)	aOR[a] (95% CI)
History of attacks of anger with loss of control and damage to property	52.3	29.4	2.6 (2.0, 3.6)*	2.3 (1.7, 3.2)*
History of attacks of anger with loss of control and threats to harm others	18.4	18.6	1.0 (.6, 1.5)	1.0 (.6, 1.5)
History of attacks of anger with loss of control and physical aggression to others	57.0	37.5	2.2 (1.7, 2.8)*	2.1 (1.6, 2.6)*
Self-Assessment of Emotional and Behavioral Control[b]	**ADHD Mean (SD) (N = 617)**	**Non-ADHD Mean (SD) (N = 5,866)**	**Unadjusted β (95% CI)**	**Adjusted β[a] (95% CI)**
Ability to keep calm and think of the right thing to do in a crisis	2.9 (.9)	3.0 (.7)	−.2 (−.3, −.1)*	−.2 (−.3, −.1)*
Ability to stay out of trouble in a situation where trouble could happen	2.7 (.9)	3.1 (.8)	−.4 (−.51, −.2)*	−.3 (−.5, −.2)*
Ability to control emotions when situation requires	2.9 (.8)	3.1 (.7)	−.2 (−.3, −.2)*	−.3 (−.3, −.2)*

National Comorbidity Survey Adolescent Supplement (NCSA).
CI = Confidence Interval; OR = Odds Ratio.
[a] Adjusted for age (continuous), sex, and race.
[b] Rating scale, 1 (lowest) to 4 (highest) for Self-Reported Ability.

Table 3
Comparison of life events and substance use for all ADHD and Non-ADHD youth in NCS-A

	ADHD % (N = 617)	Non-ADHD % (N = 5,866)	OR (95% CI)	aOR[a] (95% CI)
Life events				
Romantic break-up	25.0	21.5	1.2 (.8–1.9)	1.5 (.9–2.4)
End of close friendship	16.4	16.9	1.0 (.7–1.4)	1.3 (.9–1.9)
Serious interpersonal conflict	47.0	39.2	1.4 (1.1–1.8)*	1.5 (1.1–2.0)*
Pregnancy of self or partner	2.0	1.3	1.6 (.6–4.5)	1.7 (.6–4.7)
Expulsion from school or job	8.9	2.4	4.0 (2.2–7.1)*	3.3 (1.7–6.5)*
Problems with police	11.0	3.1	3.8 (2.8–5.2)*	3.1 (2.2–4.5)*
Court appearance	10.3	4.4	2.5 (1.6–4.0)*	2.3 (1.4–3.6)*
Repeating of a grade	22.4	10.7	2.4 (1.8–3.3)*	2.3 (1.7–3.1)*
Suspension from school	58.7	25.4	4.2 (3.2–5.4)*	4.1 (3.1–5.4)*
Truancy	35.5	25.7	1.6 (1.2–2.1)*	1.6 (1.2–2.1)*
Lifetime Substance Use				
Problems from Drinking	11.6	6.0	2.1 (1.3–3.2)*	1.9 (1.2–2.9)*
THC or Hashish	36.3	21.2	2.1 (1.7–2.7)*	2.2 (1.7–2.9)*
Cocaine	3.9	1.7	2.4 (1.2–4.8)*	2.6 (1.1–6.2)*
Nonprescribed Prescription Drugs	9.8	4.3	2.5 (1.4–4.2)*	2.6 (1.5–4.7)*
Heroin, opium, glue, LSD or other	5.5	2.9	2.0 (1.1–3.6)*	1.8 (1.0–3.4)

National Comorbidity Survey Adolescent Supplement (NCSA).
CI = Confidence Interval; OR = Odds Ratio.
[a] Adjusted for age (continuous), sex, and race.

teaching, and patient literature [37]. While national suicide prevention guidelines recommend screening for suicide in any individual with a mental disorder, only depression in teens is highlighted for annual visits [50]. These data suggest that the guidelines should be updated to include regular inquiries by pediatricians about suicidal behavior in adolescents with ADHD. As parents are generally unaware of their youth's behavior [51] and inquiries about suicidal behavior do not increase the risk of attempts [29], updating these guidelines may help mitigate risks of suicidal behavior by adolescents. Finally, parents who are aware are more likely to seek specialized mental health treatment for their child [30].

Over half of adolescents with ADHD had a history of aggressive behaviors. This observation extends and quantifies the link between aggression and ADHD in adolescents. Previous work, including an analysis of the Multimodal Treatment of ADHD (MTA) clinical trial cohort, revealed that 54% of young children with a combined subtype of ADHD displayed clinically significant aggression [53–55]. Our work demonstrates that symptoms of aggression may persist into adolescence. Further, aggressiveness among adolescents with ADHD poses risks of persistent behavior problems, encounters with the justice system, deficits in academic achievement, behavioral and disciplinary problems at school, substance experimentation/abuse, and peer rejection than ADHD alone [56]. In about half of patients with ADHD, adequately dosed stimulant medications can be effective in reducing aggression [53–55]. Ongoing severe aggression may require referral to a child and adolescent psychiatrist or more intensive psychosocial intervention such as multisystemic therapy [57].

Impulsivity and emotional dysregulation were also linked to ADHD. In our study, ADHD adolescents described lower self-reported abilities of emotional control. Emotional dysregulation reflects deficits in the ability to regulate one's emotional state in an age-appropriate and socially acceptable manner and is associated with ADHD [58]. This finding is surprising as adolescents with ADHD are generally poor reporters of their own emotion regulation deficits. Awareness of these deficits may contribute to poor self-esteem in adolescents with ADHD as emotional dysregulation [59] is associated with poor peer relationships in youth [56]. Last, the persistence of emotional dysregulation and impulsivity into adulthood may promote accumulated disability, such as impairment in home functioning, social interactions with others, community activities, dating/marital relations, money management, driving, and leisure/recreational activities [59].

Approximately one in 10 adolescents with ADHD had recent problems with the police or court appearances. Legal problems, which have been reported in over one-third of adults with ADHD, may begin in adolescence [60]. The high prevalence of legal problems among adolescents with ADHD suggests that there may be opportunities for earlier intervention in this patient population.

Behavioral problems in school remain a major concern for young people with ADHD. Consistent with previous work showing higher numbers of school absences among ADHD youth [61], adolescents with ADHD were approximately 1.5 times more likely to skip classes. ADHD was also associated with a greater than four times risk for suspension from school. This suggests that ADHD may be a significant contributing factor to school suspension [62]. In addition to medication treatment, a variety of psychosocial interventions exist to assist young people with ADHD in academic domains [63].

After adjusting for mental health comorbidities, the odds ratios for ADHD and many behaviors were reduced. Given that ADHD is a neuro-developmental disorder that is associated with accumulated disability, this finding is not surprising [8]. ADHD begins earlier than most other mental health disorders and is potentially a direct causal factor in the development of other mental health conditions such as anxiety, depression, and substance use [8]. From a clinical perspective, youth receiving community treatment for ADHD, such as in pediatric practices, are very likely to have had these adverse behaviors, although common comorbidities may contribute to this risk.

Our study has several limitations. First, the survey does not provide detailed information on treatment, and as such, we are unable to assess the effects of treatment on the adverse

Table 4
Comparison of all adverse events for all ADHD and Non-ADHD youth in NCS-A

Lifetime history aggression	ADHD % (N = 617)	Non-ADHD % (N = 5,866)	OR (95% CI)	aOR[b] (95% CI)
History of attacks of anger with loss of control and damage to property	52.3	29.4	2.6 (2.0, 3.6)*	1.5 (1.0, 2.0)*
History of attacks of anger with loss of control and threats to harm others	18.4	18.6	1.0 (.6, 1.5)	1.2 (.9, 1.6)
History of attacks of anger with loss of control and physical aggression to others	57.0	37.5	2.2 (1.7, 2.8)*	1.0 (.6, 1.7)

Self-Assessment of Emotional and Behavioral Control[c]	ADHD Mean (SD) (N = 617)	Non-ADHD Mean (SD) (N = 5,866)	Unadjusted β (95% CI)	Adjusted β[a] (95% CI)
Ability to keep calm and think of the right thing to do in a crisis	2.9 (.9)	3.0 (.7)	−.2 (−.3, −.1)*	−.0 (−.2, −.1)
Ability to stay out of trouble in a situation where trouble could happen	2.7 (.9)	3.1 (.8)	−.4 (−.51, −.2)*	−.1 (−.3, −.0)*
Ability to control emotions when situation requires	2.9 (.8)	3.1 (.7)	−.2 (−.3, −.2)*	−.1 (−.2, −.0)

Life Events	ADHD % (N = 617)	Non-ADHD % (N = 5,866)	OR (95% CI)	aOR[b] (95% CI)
Romantic break-up	25.0	21.5	1.2 (.8–1.9)	1.0 (.6–1.6)
End of close friendship	16.4	16.9	1.0 (.7–1.4)	.9 (.6–1.3)
Serious interpersonal conflict	47.0	39.2	1.4 (1.1–1.8)*	.9 (.7–1.2)
Pregnancy of self or partner	2.0	1.3	1.6 (.6–4.5)	.8 (.2–3.1)
Expulsion from school or job	8.9	2.4	4.0 (2.2–7.1)*	1.8 (.9–3.4)
Problems with police	11.0	3.1	3.8 (2.8–5.2)*	1.5 (.9–2.5)
Court appearance	10.3	4.4	2.5 (1.6–4.0)*	1.2 (.7–2.1)
Repeating of a grade	22.4	10.7	2.4 (1.8–3.3)*	1.5 (1.1–2.2)*
Suspension from school	58.7	25.4	4.2 (3.2–5.4)*	2.5 (1.9–3.2)*
Truancy	35.5	25.7	1.6 (1.2–2.1)*	.8 (.6–1.1)*

Lifetime Substance Use	ADHD % (N = 617)	Non-ADHD % (N = 5,866)	OR (95% CI)	aOR[d] (95% CI)
Problems from Drinking	11.6	6.0	2.1 (1.3–3.2)*	.7 (.4–1.3)
THC or Hashish	36.3	21.2	2.1 (1.7–2.7)*	1.0 (.7–1.3)
Cocaine	3.9	1.7	2.4 (1.2–4.8)*	.9 (.4–2.1)
Nonprescribed Prescription Drugs	9.8	4.3	2.5 (1.4–4.2)*	1.2 (.6–2.3)
Heroin, opium, glue, LSD or other	5.5	2.9	2.0 (1.1–3.6)*	.7 (.3–1.5)

Suicidal Behavior	ADHD % (N = 617)	Non-ADHD % (N = 5,866)	OR (95% CI)	aOR[b] (95% CI)
Suicidal Thoughts	23.1	10.1	2.4 (1.8, 3.4)*	1.6 (1.1, 2.4)*
Suicidal Thoughts with a Plan	8.8	3.5	2.6 (1.7, 4.1)	1.4 (.8, 2.5)
Suicide Attempt	7.4	3.8	2.1 (1.0, 4.2)*	.9 (.4, 2.1)

[a] Adjusted for age (continuous), sex and race.
[b] Adjusted for age (continuous), sex, race, and any mood, anxiety, other disruptive behavior, or substance disorder.
[c] Rating scale, 1 (lowest) to 4 (highest) for Self-Reported Ability.
[d] Adjusted for age (continuous), sex, race, and any mood, anxiety, or other disruptive behavior disorder.

behaviors. Second, the adverse behaviors have variable reference periods, and we are unable to temporally order the onset of ADHD and the outcomes, although most ADHD presents before adolescence [64]. For this reason, the results cannot establish causal relationships between ADHD and adverse outcomes. Adverse behaviors are based on single item responses, and therefore, likely have weaker psychometric properties than related scale-based assessments [65,66]. Generalizability may be limited as we were unable to assess potentially important psychosocial factors or family environment, such as parental stressors. Last, while the diagnostic variables have known reliability, the reliability of the adverse behavior variables are not known.

Conclusion

Adolescents with ADHD were found to have had an increased risk of several adverse behaviors previously reported in adults with persistent ADHD. The results offer a broad view of behavioral risks in adolescents with ADHD. Given strong correlations between ADHD and these adverse behaviors and evidence that many continue into adulthood, assessments of ADHD in pediatric primary care settings should include evaluation of these functional domains. Symptom-based evaluations and treatment guidelines do not currently recommend assessment of the range of adverse behaviors common to young people with ADHD [67]. Adolescents with ADHD represent a high-risk group. Screening for these behaviors in adolescents with ADHD can promote appropriate interventions, such as pharmacologic treatment for ADHD and referral to mental health professionals, to help mitigate future adversities and accumulated disability of young people with ADHD [68].

Supplementary Data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jadohealth.2020.09.036.

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References

[1] Xu G, Strathearn L, Liu B, et al. Twenty-year Trends in diagnosed attention-deficit/hyperactivity disorder among US children and adolescents, 1997-2016. JAMA Netw Open 2018;1:e181471.

[2] Group MC. A 14-month randomized clinical trial of treatment strategies for attention-deficit/hyperactivity disorder. Arch Gen Psychiatry 1999;56:1073–86.

[3] Faraone SV, Biederman J, Mick E. The age-dependent decline of attention deficit hyperactivity disorder: A meta-analysis of follow-up studies. Psychol Med 2006;36:159–65.

[4] Srebnicki T, Kolakowski A, Wolanczyk T. Adolescent outcome of child ADHD in primary care setting: Stability of diagnosis. J Atten Disord 2013;17:655–9.

[5] Jensen PS, Hinshaw SP, Kraemer HC, et al. ADHD comorbidity findings from the MTA study: Comparing comorbid Subgroups. J Am Acad Child Adolesc Psychiatry 2001;40:147–58.

[6] Fleming M, Fitton CA, Steiner MFC, et al. Educational and health outcomes of children treated for attention-deficit/hyperactivity disorder. JAMA Pediatr 2017;171:e170691.

[7] Harpin V, Mazzone L, Raynaud JP, et al. Long-term outcomes of ADHD: A systematic review of self-esteem and social function. J Atten Disord 2016;20:295–305.

[8] Franke B, Michelini G, Asherson P, et al. Live fast, die young? A review on the developmental trajectories of ADHD across the lifespan. Eur Neuropsychopharmacol 2018;28:1059–88.

[9] Kessler RC, Berglund P, Demler O, et al. Lifetime prevalence and age-of-onset Distributions of. Arch Gen Psychiatry 2005;62:593–602.

[10] Kessler RC, Adler L, Barkley R, et al. The prevalence and correlates of adult ADHD in the United States: Results from the national comorbidity survey replication. Am J Psychiatry 2010;163:716–23.

[11] Rokeach A, Wiener J. The romantic relationships of adolescents with ADHD. J Atten Disord 2018;22:35–45.

[12] Frazier TW, Youngstrom EA, Glutting JJ, Watkins MW. ADHD and achievement: meta-analysis of the child, adolescent, and adult literatures and a concomitant study with college students. J Learn Disabil 2007;40:49–65.

[13] Goldston DB, Daniel SS, Reboussin DM, et al. Suicide attempts among formerly hospitalized adolescents: A prospective naturalistic study of risk during the first 5 years alter discharge. J Am Acad Child Adolesc Psychiatry 1999;38:660–71.

[14] Pingault J-B, Tremblay RE, Vitaro F, et al. Childhood trajectories of inattention and hyperactivity and prediction of educational attainment in early adulthood: A 16-year longitudinal population-based study. Am J Psychiatry 2011;168:1164–70.

[15] Klein RG, Mannuzza S, Olazagasti MAR, et al. Clinical and functional outcome of childhood attention-deficit/hyperactivity disorder 33 years later. Arch Gen Psychiatry 2012;69:1295–303.

[16] Sun S, Kuja-Halkola R, Faraone SV, et al. Association of psychiatric comorbidity with the risk of premature death among children and adults with attention-deficit/hyperactivity Disorder. JAMA Psychiatry 2019;76:1141–9.

[17] Chen VC-H, Chan H-L, Wu S-I, et al. Attention-Deficit/hyperactivity disorder and mortality risk in TaiwanAttention-deficit/hyperactivity disorder and mortality risk in TaiwanAttention-deficit/hyperactivity disorder and mortality risk in Taiwan. JAMA Netw Open 2019;2:e198714.

[18] Mikolajczyk R, Horn J, Schmedt N, et al. Injury prevention by medication among children with attention-deficit/hyperactivity disorder: A Case-only StudyInjury prevention in children with ADHDInjury prevention in children with ADHD. JAMA Pediatr 2015;169:391–5.

[19] Pelham WEJ, Fabiano GA, Waxmonsky JG, et al. Treatment Sequencing for childhood ADHD: A Multiple-Randomization study of Adaptive medication and behavioral interventions. J Clin Child Adolesc Psychol 2016;45:396–415.

[20] Luo SX, Wall M, Covey L, et al. Exploring longitudinal course and treatment-baseline severity interactions in secondary outcomes of smoking cessation treatment in individuals with attention-deficit hyperactivity disorder. Am J Drug Alcohol Abuse 2018;44:653–9.

[21] Jangmo A, Stålhandske A, Chang Z, et al. Attention-Deficit/hyperactivity disorder, school performance, and effect of medication. J Am Acad Child Adolesc Psychiatry 2019;58:423–32.

[22] Marcus SC, Durkin M. Stimulant adherence and academic performance in urban youth with attention-deficit/hyperactivity disorder. J Am Acad Child Adolesc Psychiatry 2011;50:480–9.

[23] Powers RL, Marks DJ, Miller CJ, et al. Stimulant treatment in children with attention-deficit/hyperactivity disorder moderates adolescent academic outcome. J Child Adolesc Psychopharmacol 2008;18:449–59.

[24] Scheffler RM, Brown TT, Fulton BD, et al. Positive association between attention-deficit/hyperactivity disorder medication use and academic achievement during elementary school. Pediatrics 2009;123:1273–9.

[25] Lu Y, Sjolander A, Cederlof M, et al. Association between medication Use and performance on higher education Entrance tests in individuals with attention-deficit/hyperactivity disorder. JAMA psychiatry 2017;74:815–22.

[26] Shaw M, Hodgkins P, Caci H, et al. A systematic review and analysis of long-term outcomes in attention deficit hyperactivity disorder: Effects of treatment and non-treatment. BMC Med 2012;10:99.

[27] Stein REK, Horwitz SMC, Storfer-Isser A, et al. Do pediatricians Think they are responsible for Identification and management of child mental health problems? Results of the AAP periodic survey. Ambul Pediatr 2008;8:11–7.

[28] Southammakosane C, Schmitz K. Pediatric Psychopharmacology for treatment of ADHD, depression, and anxiety. Pediatrics 2015;136:351–9.

[29] Olfson M, King M, Schoenbaum M. Stimulant treatment of young people in the United States. J Child Adolesc Psychopharmacol 2016;26:520–6.

[30] Sultan RS, Correll CU, Schoenbaum M, et al. National patterns of commonly prescribed Psychotropic medications to young people. J Child Adolesc Psychopharmacol 2018;28:158–65.

[31] Fremont WP, Nastasi R, Newman N. Comfort level of pediatricians and family medicine physicians diagnosing and treating child and adolescent psychiatric disorders. Int J Psychiatry Med 2008;38:153–68.

[32] Wissow LS, Zafar W, Fothergill K, et al. Using vignettes to assess contributions to the work of addressing child mental health problems in primary care. BMC Health Serv Res 2016;15:1–10.

[33] Elkins IJ, Saunders GRB, Malone SM, et al. Associations between childhood ADHD, gender, and adolescent alcohol and marijuana involvement: A causally informative design. Drug Alcohol Depend 2018;184:33–41.

[34] Ebeling H, Hurtig T, Rodriguez A, et al. Comorbidity of disruptive behavioral disorders and attention-deficit hyperactivity disorder—Indicator of severity in problematic behavior? AU - Nordström, Tanja. Nord J Psychiatry 2013;67:240–8.

[35] Becker SP, ed. ADHD in Adolescents Development, Assessment, and Treatment. Guilford Press; 2020.

[36] Pliszka S. Practice parameter for the assessment and treatment of children and adolescents with attention-deficit/hyperactivity disorder. J Am Acad Child Adolesc Psychiatry 2007;46:894–921.

[37] Wolraich M, Brown L, Brown RT, et al. Adhd: Clinical practice guideline for the diagnosis, evaluation, and treatment of attention-deficit/hyperactivity disorder in children and adolescents. Pediatrics 2011;128:1007–22.

[38] Merikangas K, Avenevoli S, Costello J, et al. National comorbidity survey replication adolescent supplement (NCS-A): I. Background and measures. J Am Acad Child Adolesc Psychiatry 2009;48:367–9.

[39] Kessler RC, Üstün BB. The World mental health (WMH) survey Initiative version of the World health Organization (WHO) Composite International diagnostic interview (CIDI). Int J Methods Psychiatr Res 2004;13:93–121.

[40] Kessler RC, Adler LA, Berglund P, et al. The effects of temporally secondary co-morbid mental disorders on the associations of DSM-IV ADHD with adverse outcomes in the US National Comorbidity Survey Replication Adolescent Supplement (NCS-A). Psychol Med 2014;44:1779–92.

[41] Balazs J, Kereszteny A. Attention-deficit/hyperactivity disorder and suicide: A systematic review. World J Psychiatry 2017;7:44.

[42] Nock MK, Hwang I, Sampson NA, Kessler RC. Mental disorders, comorbidity and suicidal behavior: Results from the national comorbidity survey replication. Mol Psychiatry 2010;15:868–76.

[43] Nock MK, Green JG, Hwang I, et al. Prevalence, correlates, and treatment of lifetime suicidal behavior among adolescents: Results from the national comorbidity survey replication adolescent supplement. JAMA Psychiatry 2013;70:300–10.

[44] Barbaresi WJ, Colligan RC, Weaver AL, et al. Mortality, ADHD, and psychosocial adversity in adults with childhood ADHD: A prospective study. Pediatrics 2013;131:637–44.

[45] Wichstrøm L. Predictors of adolescent suicide attempts: A nationally representative longitudinal study of Norwegian adolescents. J Am Acad Child Adolesc Psychiatry 2000;39:603–10.

[46] Pfeffer CR, Klerman GL, Hurt SW, et al. Suicidal children Grow up: Rates and psychosocial risk factors for suicide attempts during follow-up. J Am Acad Child Adolesc Psychiatry 1993;32:106–13.

[47] Hultén A, Jiang GX, Wasserman D, et al. Repetition of attempted suicide among teenagers in Europe: Frequency, timing and risk factors. Eur Child Adolesc Psychiatry 2001;10:161–9.

[48] Lewinsohn PM, Rohde P, Seeley JR. Psychosocial risk factors for future adolescent suicide attempts. J Consult Clin Psychol 1994;62:297–305.

[49] Miranda R, Shaffer D. Understanding the suicidal moment in adolescence. Ann N Y Acad Sci 2013;1304:14–21.

[50] Prevention NAA for S. Recommended standard care for people with suicide risk: Making health care suicide Safe. Available at: https://theactionalliance.org/sites/default/files/action_alliance_recommended_standard_care_final.pdf.

[51] Mojtabai R, Olfson M. Parental Detection of youth's self-harm behavior. Suicide Life-threatening Behav 2008;38:60–73.

[52] Gould MS, Marrocco FA, Kleinman M, et al. Evaluating iatrogenic risk of youth suicide screening programs: A randomized controlled trial. JAMA 2005;293:1635–43.
[53] Jensen PS, Youngstrom EA, Steiner H, et al. Consensus report on impulsive aggression as a symptom across diagnostic categories in child psychiatry: Implications for medication studies. J Am Acad Child Adolesc Psychiatry 2007;46:309–22.
[54] Blader JC, Pliszka SR, Kafantaris V, et al. Prevalence and treatment outcomes of persistent Negative mood among children with attention-deficit/hyperactivity disorder and aggressive behavior. J Child Adolesc Psychopharmacol 2016;26:164–73.
[55] Blader JC, Pliszka SR, Jensen PS, et al. Stimulant-responsive and stimulant-Refractory aggressive behavior among children with ADHD. Pediatrics 2010;126:e796–806.
[56] Saylor KE, Amann BH. Impulsive aggression as a comorbidity of attention-deficit/hyperactivity disorder in children and adolescents. J Child Adolesc Psychopharmacol 2016;26:19–25.
[57] Henggeler SW, Schaeffer CM. Multisystemic Therapy(®): Clinical Overview, outcomes, and Implementation research. Fam Process 2016;55:514–28.
[58] Barkley RA, Fischer M. The unique contribution of emotional impulsiveness to impairment in major life activities in hyperactive children as adults. J Am Acad Child Adolesc Psychiatry 2010;49:503–13.
[59] Barkley RA, Fischer M. The unique contribution of emotional impulsiveness to impairment in major life activities in hyperactive children as adults. J Am Acad Child Adolesc Psychiatry 2010;49:503–13.
[60] Biederman J, Faraone SV, Spencer TJ, et al. Functional impairments in adults with self-reports of diagnosed ADHD: A controlled study of 1001 adults in the community. J Clin Psychiatry 2006;67:524–40.
[61] Kent KM, Pelham WE, Molina BSG, et al. The academic experience of male high school students with ADHD. J Abnorm Child Psychol 2011;39:451–62.
[62] Martin AJ. The role of ADHD in academic adversity: Disentangling ADHD effects from other personal and contextual factors. Sch Psychol Q 2014;29:395–408.
[63] Evans SW, Schultz BK, Sadler JM. Safety and efficacy of psychosocial interventions used to treat children with attention-deficit/hyperactivity disorder. [References]. Psychiatr Ann 2008;38:58–65.
[64] Kessler RC, Amminger GP, Aguilar-Gaxiola S, et al. Age of onset of mental disorders: A review of recent literature. Curr Opin Psychiatry 2007;20:359–64.
[65] Cochrane-Brink KA, Lofchy JS, Sakinofsky I. Clinical rating scales in suicide risk assessment. Gen Hosp Psychiatry 2000;22:445–51.
[66] Innamorati M, Pompili M, Serafini G, et al. Psychometric properties of the suicidal history self-rating screening scale. Arch Suicide Res Off J Int Acad Suicide Res 2011;15:87–92.
[67] Kollins SH. Moving beyond symptom Remission to Optimize long-term treatment of attention-deficit/hyperactivity DisorderOptimizing long-term treatment of attention-deficit/hyperactivity DisorderOptimizing long-term treatment of attention-deficit/hyperactivity disorder. JAMA Pediatr 2018;172:901–2.
[68] Hechtman L, Swanson JM, Sibley MH, et al. Functional adult outcomes 16 Years after childhood diagnosis of attention-deficit/hyperactivity disorder: MTA results. J Am Acad Child Adolesc Psychiatry 2016;55:945–952.e2.