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Girls with Childhood ADHD as Adults: Cross-Domain Outcomes by Diagnostic Persistence

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Abstract

Objective—To ascertain adult outcomes in ten domains reflecting symptomatology (internalizing, externalizing, self-injury, substance use), attainment (education, employment), and impairment (health, social, driving, overall) as a function of both childhood diagnosis of ADHD and persistence of ADHD symptoms across time.

Method—We prospectively followed 140 grade-school-aged girls with rigorously diagnosed childhood ADHD and 88 age- and ethnicity-matched comparison girls for 16 years. Outcome measures were obtained via self- and parent-report questionnaires, interviews, and objective tests.

Results—Childhood ADHD, whether it remitted or persisted, was a pernicious risk factor for a limited number of poor outcomes, including low educational attainment, unplanned pregnancy, body mass index, and clinician-rated impairment. Childhood ADHD that persisted over time, whether completely or partially, was associated with a number of additional detrimental outcomes in the externalizing, internalizing, self-injury, occupational, social, and overall impairment domains. Finally, in this all-female sample, ADHD was not associated with objective measures of employment, substance use, or driving outcomes.

Conclusions—We discuss the considerable impairments accruing from both childhood-limited and adult-persisting ADHD, with major implications for the health and well-being of females with this neurodevelopmental disorder.

Keywords

ADHD; adult outcome; prospective; female

In the latter decades of the last century, a number of long-term prospective investigations of children with attention-deficit/hyperactivity disorder (ADHD) were initiated. Those children are now grown up, and reports of their adult outcomes show above-normative symptoms and impairments in most measured domains (Babinski et al., 2011a; Barkley, Fischer, Smallish, & Fletcher, 2004, 2006; Biederman et al., 2006; Biederman et al., 2010a; Hechtman et al., 2016; Klein et al., 2012; Kuriyan et al., 2013). The typical male:female ratio in these studies was around 9:1, with the exception of the all-male Klein et al. (2012) initial Biederman samples (Biederman et al., 2006) and the subsequent all-female Biederman sample (Biederman et al. 2010a). In short, what is known about the long-term outcomes of children with ADHD applies primarily to males, most of whom presented with hyperactivity and impulsivity.

Given normative gender differences in developmental outcomes, such as high rates of internalizing problems (Hinshaw, 2009; Leadbeater, Kuperminc, Blatt, & Herzog, 1999) and self-injury (Breslin & Shoenleber, 2015, especially in clinical populations) among girls, and high rates of externalizing and antisocial behavior among boys (Hicks et al., 2007; Leadbeater et al., 1999; Moffitt, Caspi, Rutter, & Silva, 2001), the findings to date may not fully generalize to females with ADHD. Hence, our primary objective is to extend our previous prospective examinations of outcomes (Hinshaw, Owens, Sami, & Fargeon, 2006; Hinshaw et al., 2012) among a large, diverse sample of girls with and without childhood ADHD, initially diagnosed with both the combined and inattentive types, who were followed prospectively and comprehensively, with high retention, for 16 years.

Most investigations thus far have focused on circumscribed adult outcome domains, such as educational and occupational attainment (e.g., Kuriyan et al., 2013), or psychiatric diagnoses (e.g., Biederman et al. 2006, 2010a). However, Hechtman et al. (2016), Barkley et al. (2006), and Klein et al. (2012) have taken a more comprehensive approach, having each examined adult outcomes across several core domains. Following, and parallel to Hinshaw et al. (2012), we examine clinically interpretable outcomes across ten domains, including internalizing problems, externalizing problems, substance use, self-injury, educational achievement, employment, health problems, social functioning, driving behavior, and overall impairment. We also examine persistence of ADHD from childhood to adulthood. Our intention is to provide, in a single investigation, a comprehensive picture of psychiatric status and functional impairments during adulthood in this unique sample - a strategy preferable, we believe, to presenting isolated publications concerning single domains of functioning.

Overall, we expect that girls with childhood ADHD will have worse (and often sizably so) outcomes than matched comparison girls in each domain. First, regarding externalizing psychopathology, childhood ADHD is typically associated with increased risk for such conditions (conduct [CD] or oppositional defiant disorder [ODD], or antisocial personality), as well as for adult antisocial and criminal behavior (Biederman et al., 2010a; Hinshaw et al., 2012; Klein et al., 2012; Mannuzza et al., 1998; Satterfield & Schell, 1997). Yet some previous findings do not survive covariation of key baseline characteristics (e.g., earlier antisocial behavior, Biederman et al., 2006) or adjustment for multiple comparisons (Hechtman et al., 2016). In other reports, such outcomes are mediated by adolescent antisocial behavior or substance use (Mannuzza, Klein, & Moulton, 2008). Regarding moderation by sex, although girls in general are less likely to exhibit externalizing behavior than boys, when girls with ADHD are compared to girls without ADHD, their risk of developing externalizing problems is equal to or even greater than boys with ADHD (Gaub & Carlson, 1997; Biederman et al. 2006, 2010a).

Yet linkages between childhood ADHD and adult internalizing problems are not as firmly established. Although some investigators report a longitudinal association (Fisher, Barkley, Smallish, & Fletcher, 2002), many others have failed to find a link (Babinski et al., 2011a; Hechtman et al., 2016; Klein et al., 2012; Mannuzza et al., 1998). Others report predictive associations that fail to survive key covariates (Biederman et al., 2006; Hinshaw et al., 2012). Nevertheless, we expect to find a prospective link between childhood ADHD and

adult internalizing problems because the salience of internalizing problems as a developmental outcome among females (Hinshaw, 2009) may be exacerbated by ADHD.

The literature regarding risk for adult substance use problems posed by childhood ADHD is mixed (see Owens, Cardoos, & Hinshaw, 2015). Support for the association between childhood ADHD and adult alcohol use is typically not documented (Babinski et al., 2011a; Hechtman et al., 2016; Hinshaw et al., 2012; Klein et al., 2012), yet it is not non-existent (Charach, Yeung, Climans, & Lillie, 2011). Some evidence does suggest increased use of illicit drugs during adulthood for those with childhood diagnoses of ADHD (Lee et al., 2011; Mannuzza et al., 1998), but other investigations have failed to find robust associations (Babinski et al., 2011a; Biederman et al., 2010a; Hechtman et al., 2016; Hinshaw et al., 2012). Sex does not reliably moderate any longitudinal, predictive associations, but tests of moderation by sex are typically underpowered. CD may mediate or moderate risk (Barkley et al., 2004; Nigg, 2013).

Next, self-harm has not been widely investigated among children with ADHD, but in the present sample, Hinshaw et al. (2012) reported greatly increased risk for self-injury and suicide attempts among girls with ADHD-Combined type (but not ADHD-Inattentive type). Furthermore, Chronis-Tuscano et al. (2010) reported increased risk for attempting suicide through 18 years among girls with early ADHD. Poor response inhibition, comorbid psychopathology, and adolescent peer problems (Meza, Owens, & Hinshaw, 2016; Swanson, Owens, & Hinshaw, 2014) help explain why girls with ADHD are at increased risk for self-harm.

As for the area of attainment, spanning education and employment, it is clear that educational outcomes are compromised by a childhood ADHD diagnosis. Young adults with childhood ADHD complete fewer years of education, perform more poorly on achievement tests, and show more academic impairment than those without ADHD (Barkley et al., 2006; Babinski et al., 2011a; Hechtman et al., 2016; Hinshaw et al., 2012; Klein et al., 2012; Kuriyan et al., 2013; Mannuzza et al., 1997). Similarly, childhood ADHD is a risk factor for employment problems, including fewer hours worked, more conflict at work, lower work quality, employment rates, occupational rank, and salaries (Babinski et al., 2011a; Barkley & Fischer, 2011; Barkley et al., 2006; Brook, Brook, Zhang, Seltzer, & Finch, 2013; Fletcher, 2014; Klein et al., 2012; Kuriyan et al., 2013; Mannuzza et al., 1997), although deficits are not evidenced on every employment measure, especially those that are self-reported. It is unknown whether women with childhood ADHD display the same employment problems as men, but the small-sample investigation of Babinski et al. (2011b) provides suggestive evidence along this line.

From largely cross-sectional studies, that ADHD appears to be associated with certain dimensions of poor physical health, but it is not yet known to what extent associations are due to ADHD specifically versus co-occurring characteristics (Nigg, 2013). For example, Nigg et al. (2016) and Cortese et al. (2016) show ADHD to be associated with obesity, at least among adults. Korczak, Lipman, Morrison, Duku, and Szatmari (2014) demonstrated a longitudinal relation between childhood ADHD and adult body mass index, but this link was accounted for by comorbid conduct problems. Sleep problems are common among children

with ADHD (Barkley, 2015; Nigg, 2013) and may also be independently associated with ADHD among adults (Surman et al., 2009). Finally, childhood ADHD poses risk for early parenthood and more pregnancies (Barkley et al., 2006; Flory, Molina, Pelham, Gnagy, & Smith, 2006) and for overall poor health during adulthood (Brook et al., 2013).

In the social arena, adult outcomes of childhood ADHD vary by informant and measure. Fisher and Barkley (2006) found fewer closer friends, trouble keeping friends, and poorer relationship quality during adulthood among previously hyperactive boys versus comparisons. Klein et al. (2012) reported more divorces by age 41 among men with childhood ADHD. On five of seven measures, parents reported that their adult daughters had problems with family and friends, yet the daughters themselves self-reported relationship problems on only two of 10 measures, one of which was conflict with their mothers (Babinski et al., 2011a). Overall, evidence is mixed in this domain, and sex differences have mostly not been addressed.

Regarding driving behavior, Fischer, Barkley, Smallish, and Fletcher (2007) reported that children with ADHD perform more poorly on almost every measure of driving behavior, including traffic citations, damage during crashes, license suspensions, impulsive errors, and slowed reaction times. Similarly, Olazagasti et al. (2013) reported more at-fault accidents and accidents involving injury among their participants with childhood ADHD. In the present all-female sample, Hinshaw et al. (2012) did not find statistically significant differences in self-reported driving offenses at young-adult follow-up, but significant differences did emerge based on parent report.

Finally, in terms of overall impairment, parents of boys with ADHD reported them to be more impaired during adulthood than comparison boys in all 10 domains assessed (Barkley & Fischer, 2011). Similarly, Klein et al. (2012) found that boys with ADHD followed into adulthood showed deficits on 11 of 12 measures of functioning. In parallel, Hinshaw et al. (2012), investigating the present sample, found girls with childhood ADHD to be much more impaired overall as young adults than girls without ADHD.

If adult outcomes are typically worse for girls with childhood ADHD versus those without, it is imperative to understand whether such risk can be specifically attributed to ADHD. Indeed, in some cases positive associations between childhood ADHD and poor adult outcome dissipate with covariation of potential confounds. Biederman et al. (2006) showed that risk conferred by childhood ADHD for adult antisocial and anxiety disorders was no longer evident once baseline demographics and comorbidities were covaried; in addition, differential adult rates of addictive disorders among those with and without ADHD did not survive covariation of baseline comorbidities (Biederman et al., 2010a). Barkley et al. (2004) and Fischer, Barkley, Smallish, and Fletcher (2002) showed that elevated rates of adult substance use and other psychiatric disorders among boys with hyperactivity were explained by earlier CD. Thus, we analyze a comprehensive set of covariates to enhance arguments for specificity of predictions from childhood ADHD to adult problems. Moreover, still unresolved is whether predictive associations with later impairment are related to childhood ADHD per se or to ADHD that has persisted across development. The few relevant studies suggest that persistent ADHD is the culprit (Agnew-Blais et al., 2016; Barkley & Fisher,

2011; Biederman, Petty, Evans, Small, & Faraone, 2010b; Breyer, Lee,Winters, August, & Realmuto, 2014; Hechtman et al., 2016; Swanson et al., 2014). Yet in some domains, including cognitive, educational, and occupational functioning, even childhood-limited ADHD is associated with negative outcomes (Biederman et al., 2009, 2010b; Hechtman et al., 2016).

In sum, we first investigate which long-term outcomes, across a comprehensive set of domains, are associated with childhood ADHD among females. We hypothesize worse adult functioning in all domains among girls with childhood ADHD versus girls without. Second, we examine whether the persistence of childhood ADHD predicts worse outcomes than childhood-limited ADHD. In most domains we expect ADHD persistence into adulthood to be associated with worse outcomes than childhood-limited ADHD, but in educational and employment domains even childhood-limited ADHD may be negatively associated with adult attainment.

Method

Overview of Procedures

We initially recruited girls aged 6–12 years from San Francisco East Bay schools, mental health centers, and pediatric practices, and through advertisements to participate in research summer camp programs in 1997, 1998, and 1999. These enrichment (i.e., non-therapeutic) programs were designed with emphasis on ecologically valid measures. After extensive diagnostic assessments, 140 girls with ADHD and 88 age- and ethnicity-matched comparison girls were selected and participated in the summer camps (Wave 1 or W1; Hinshaw, 2002). Five years later (Wave 2 or W2; Hinshaw et al., 2006) and 10 years later (Wave 3 or W3; Hinshaw et al., 2012) participants and their parents were invited to two half-day, clinic-based assessments during which assessors, unaware of diagnostic status, conducted interviews, and administered questionnaires and neuropsychological testing. At Wave 4 (W4), 16 years later, we invited participants for a single half- to full-day, clinic-based assessment for which they were compensated $400. With participant consent, parents were contacted and asked to complete questionnaires and compensated $50. When necessary, we performed telephone interviews or home visits.

Participants

At W1, preliminary parent and teacher rating-scale criteria were intentionally set with low, sex-specific thresholds, in order to prevent premature exclusion of potentially eligible girls. Final study eligibility was contingent on meeting full criteria for ADHD via the parent-administered Diagnostic Interview Schedule for Children, 4th ed. (DISC-IV; Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000). Common comorbidities were allowed. Comparison girls, screened to match the ADHD sample on age and ethnicity, could not meet diagnostic criteria for ADHD via either adult ratings or structured interview criteria. A small number of comparison participants (3.4%) met criteria for internalizing disorders (anxiety/depression) or for disruptive behavior disorders (6.8%). Exclusion criteria for both groups were intellectual disability, pervasive developmental disorders, psychosis or overt neurological disorder, English not spoken in the home, and serious medical problems.

At W1, the mean age was 9.6 years ($SD = 1.7$). The sample was ethnically diverse (53% White, 27% African-American, 11% Latina, 9% Asian-American). Retention of participants was 91.6% at W2 and 94.7% at W3. For the most recent follow-up (W4), we obtained at least some data from 211 of the 228 original participants (92.6%) The age range was 21.6 to 29.8 years ($M = 25.6$; $SD = 1.8$).

To evaluate the representativeness of the retained sample, we compared the 17 participants lost to W4 follow-up with the 211 retained on seven demographic, ten clinical, and three cognitive measures from W1. Nine W1 characteristics differed significantly between those lost versus retained: family income ($p = .002$, $d = .80$); maternal education ($p < .001$, $d = .88$), single parent status ($p = .001$, odds ratio = 5.0), teacher-reported inattention ($p < .001$, $d = .76$), hyperactivity/impulsivity ($p < .001$, $d = .68$), externalizing problems ($p < .001$, $d = .76$), and internalizing problems ($p < .001$, $d = .62$), and full-scale IQ ($p < .001$, $d = .91$). The remaining 11 W1 characteristics were not associated with retention at W4 (age, race, adoption status, receipt of public assistance, ADHD diagnostic status, reading and math achievement, and maternal report of inattention, hyperactivity/impulsivity, externalizing problems, internalizing problems, and overall impairment). Thus, the non-retained subgroup showed some demographic disadvantage, lower IQs, and greater problematic behavior according to teachers but not parents.

Measures

Psychopathology and harmful behaviors

ADHD diagnoses: At W1, girls eligible for the ADHD group met full diagnostic criteria according to parent report on the DISC-IV (Shaffer et al., 2000), a well-validated, highly-structured diagnostic interview regarding the major disorders in the *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed. (DSM-IV; American Psychiatric Association, 2000). At W3, the DISC-IV and the Swanson, Nolan, and Pelham Rating Scale, 4th edition (SNAP-IV, Swanson, 1992) were administered separately to parents and to participants. The SNAP-IV is a dimensionalized checklist of the 18 DSM-IV ADHD items, with each scored on a 0 ("not at all") to 3 ("very much") metric. It has been used extensively in ADHD assessment and treatment research (e.g., MTA Cooperative Group, 1999). Each of the 18 DSM-IV ADHD symptoms was considered present if endorsed on the parent or participant DISC-IV or rated by the parent or participant as a 2 (pretty much) or 3 (very much) on the SNAP-IV. Girls with at least six inattentive symptoms, four of which were endorsed on the DISC-IV, or at least six hyperactive-impulsive symptoms, four of which were endorsed on the DISC-IV, were considered positive for ADHD. We prioritized the DISC because of the greater specificity of questions with respect to time frame than is available from rating scales. At W4, diagnostic status was determined by combining parent- and participant self-report on the SNAP-IV. As recommended by Sibley et al. (2016) for optimizing diagnostic accuracy, we used an "or" algorithm to determine symptom presence and a norm-based cutoff of either four inattentive or four hyperactive-impulsive symptoms to establish a positive ADHD diagnosis at W4.

Internalizing and Externalizing problems: We used T scores from the Adult Behavior Checklist and Adult Self-Report (ABCL and ASR; Achenbach & Rescorla, 2003) to assess

internalizing and externalizing symptoms at W4. All ABCL (parent-completed) and ASR (participant-completed) scales have good to excellent reliability and validity (Achenbach & Rescorla, 2003).

Depression: Depressive symptomatology was self-reported using the Beck Depression Inventory-II (BDI-II; Beck, Steer, Ball, & Ranieri, 1996). Its psychometric properties are excellent. Depressive diagnoses were determined using the mood disorders module of the Structured Clinical Interview, non-patient edition for DSM-IV-TR (SCID; First, Spitzer, Gibbon, & Williams, 2002). Ample evidence attesting to the reliability and validity of the SCID can be found at www.scid4.org.

Substance use: The Substance Use Questionnaire (SUQ; Molina & Pelham, 2003) is a structured interview adapted from existing measures, including the Health Interview Questionnaire (Jessor, Donovan, & Costa, 1989) and the National Institute on Drug Abuse's National Household Survey of Drug Abuse. The SUQ includes questions regarding current and past quantity and frequency of drug, alcohol, and cigarette use. Kappas for 2-week test-retest reliability for "ever trying" one of five substances averaged .84, ranging from .70 (cigarettes) to .91 (marijuana). We computed three variables: (a) alcohol use severity, by standardizing and averaging past year frequency (on an 11-point scale from "never" to "several times per day") and typical amount consumed (on a 13-point scale from "none" to "25 drinks or more"), (b) frequency of marijuana use in the past year on 11-point scale from "never" to "several times per day", and (c) severity of illicit drug use (excluding marijuana), by standardizing and averaging the number of different substances used in the past year, out of 10 (inhalants, heroin, LSD, cocaine, misused prescription medication, amphetamines, downers, narcotic, stay-awake pills, and other non-medical drugs) with the average frequencies with which these drugs were used on 11-point scales from "never" to "several times per day."

Self-injury: We assessed non-suicidal self-injury and suicide attempts since W3 using the Self-Injurious Thoughts and Behaviors Interview (SITBI, Nock, Holmberg, Photos, & Michel, 2007). Nock et al. (2007) demonstrated that the SITBI has strong interrater and test-retest reliability, as well as concurrent validity with other measures of suicidality and self-injury. We assessed non-suicidal self-injury and suicide attempts prior to W3 using two measures previously administered at W3 (see Hinshaw et al., 2012): the Self-Injury Questionnaire (Claes, Vandereycken, & Vertommen, 2001) and the Barkley Suicide Questionnaire (Barkley, 2006). From the responses at W3 and W4 we created two dichotomous variables: (a) a non-suicidal self-injury variable indicating whether a participant had ever injured herself on purpose, and (b) a suicide attempt variable indicating whether the participant had ever attempted suicide.

Impairments and attainments

Self, parent, and clinician ratings: Impairment ratings in the educational, employment, social, and overall domains were obtained from parent, participant, and clinician report on the Longitudinal Interval Follow Up – Range of Impaired Functioning Tool (Life-RIFT, Leon, Solomon, Mueller, & Keller, 1999). The Life-RIFT assesses impairment on 1- (no

impairment) to 5-point (severe impairment) scales in multiple domains. Evidence regarding reliability and validity in multiple populations was provided by Leon et al. (1999; 2000). We adapted the measure slightly by asking respondents to complete it twice: once to reflect how the participant was faring when at her best since her last visit with us, and once to reflect how she was doing when she was at her worst. We then averaged the best and worst scores in each domain so that our dependent variables captured average level of impairment across early adulthood, rather than impairment at a particular point in time. Clinicians also completed the Global Assessment of Functioning scale from the DSM-IV twice (at the participant's best and worst), and these scores were also averaged.

Academic achievement: We administered the Word Reading and Math Reasoning subtests of the Wechsler Individual Achievement Test, 2nd Version (WIAT-II; Wechsler, 2001). The WIAT-II is a psychometrically sound, widely used test.

Health: Body mass index (BMI) was calculated using a standard formula employing height and weight measurements taken during the laboratory visit. Overall sleep quality, on a 1 to 5 scale, was derived from self-report on the Pittsburgh Sleep Quality Index (Buysee, Reynolds, Monk, Berman, & Kupfer, 1989), which assesses sleep quality and disturbances over a one-month interval. Buysse et al. (1989), as well as Carpenter and Andrykowski (1998), have demonstrated the reliability and validity of this measure in multiple populations.

Social Relationships: The Satisfaction subscale from the Dyadic Adjustment Scale (DAS, Spanier, 1976) was used to assess self-reported romantic relationship quality. DAS reliability and validity is summarized by Cohen (1985). The Satisfaction subscale has 10 six-point items, with a Cronbach's alpha of .82 in our sample. Friendship problems were assessed using our project-derived Social Relationships Interview, which is based on conceptual models of friendships and social/dating relationships. We standardized and averaged responses to two questions scored on scales of 1 to 4: (a) My best friend and I have fun together, share secrets with each other, take care of each other, admire each other, help each other figure things out, and care about each other (reversed), and (b) My best friend and I get mad at each other, argue with each other, criticize each other, put each other down, annoy each other, and nag each other. Of the women seen at W4, 85% reported having a best friend. For the other 15%, these items were not completed.

Driving Behavior: We employed the self-report Driving Behavior Questionnaire (DBQ), based on Barkley, Murphy, and Kwansik's (1996) questionnaire, which assesses illegal driving behavior, accidents, and traffic violations, as opposed to minor driving errors and attentional lapses. We created an illegal driving score ranging from 0 to 2, which reflected whether the participant had ever had a permit or license revoked or suspended, and whether she had ever driven illegally (e.g., underage, without a license, in violation of permit rules). We also analyzed the number of accidents and traffic citations.

Other measures: The remaining dependent measures (incarcerated/arrested since W3, highest educational degree, years of education, receipt of public assistance, current employment status, hours worked per week, current monthly earnings, problems at work, unplanned pregnancies, overall health, and history of psychiatric hospitalizations) were all

obtained using a project-derived structured interview. Years of education was calculated using a series of detailed questions regarding post-high school coursework. One academic year of full-time schooling in a degree or credential program resulting in successful progression to the next year of schooling (or graduation) counted as one year of post-high school education. For the (many) girls who repeatedly started and stopped their post-high school educational endeavors, passing eight classes counted as one year of post-high school education. Questions about problems at work were modeled on questions described in Barkley et al. (2008). We totaled responses to six questions about current and past problematic behavior or performance, quitting due to hostility or disagreement with a supervisor, being fired, problems getting along with co-workers, and ever being reprimanded because of poor performance (Cronbach's alpha = .60). Overall health was ascertained using self-report on a 5-point scale from very poor to excellent.

Covariates: Family socioeconomic status (SES) was measured by standardizing and averaging mother's level of education on a 6-point scale (from 1 = less than 8th grade to 6 = advanced or professional degree) and family yearly income on a 9-point scale (from 1 = less than $10,000 to 9 = $75,000 or more). Child Full-Scale IQ was obtained from the Wechsler Intelligence Scale for Children, 3rd ed. (Wechsler, 1991). Comorbid diagnoses (CD/ODD, depressive/anxiety disorders not including specific phobia) were obtained from parent-report on the DISC-IV. We also used the following W4 variables as covariates: age, stimulant medication use between W3 and W4, student status (not a student, part-time student, or full-time student), parent status (whether or not the participant was caring for their young children at home), earnings type (pre- or post-tax), and months with a valid driver's license.

Data Analytic Plan

All statistical analyses were performed with SPSS for Windows, Version 23 (SPSS, Inc. 2015). Our data analytic procedure is similar to that from our previous articles at W1 (Hinshaw, 2002), W2 (Hinshaw et al., 2006), and W3 (Hinshaw et al., 2012), in which we examined clinically interpretable outcomes measure-by-measure. We categorized our 43 W4 outcomes into 10 domains: Internalizing Problems, Externalizing Problems, Substance Use, Self-Injury, Educational Achievement, Employment, Health Problems, Social Impairment, Driving Problems, and Overall Impairment. However, herein we feature persistence of ADHD diagnostic status over time as our independent variable, departing from our previous emphasis on ADHD subtype (inattentive versus combined), for three reasons: One, our previous reports revealed extremely few outcome differences by subtype (Hinshaw et al., 2006, 2012), with a key exception involving self-harm (Hinshaw et al., 2012); two, because subtypes (now termed "presentations" in DSM-5) are not stable (Todd et al., 2008; Willcutt et al., 2012), classifying girls according to subtype becomes problematic and counterfactual in multi-phase longitudinal studies; and three, with our lengthened follow-up interval, the role of diagnostic persistence has become more relevant.

Preliminary analyses included examination of missing data and outliers. Next we computed 35 ANOVAs and eight chi-squared tests regarding the 43 W4 dependent measures by ADHD status and persistence. Our objective was to thoroughly examine adult outcome in a large set of relevant domains employing multiple methods and informants. In order to reduce Type I

error, we chose .001 as the p value required for an omnibus test to be considered statistically significant. Furthermore, we computed Tukey post-hoc comparison tests only when the initial F or X^2 was associated with a p value < .001 and used a false discovery rate correction (Benjamini-Hochberg, 1995) within domain. We always computed effect sizes, regardless of the significance level of the omnibus test or post-hoc comparison, but we only interpret pairwise comparisons that survived our multiple controls for Type I error. We also assessed the overall magnitude of the group differences using averaged effect sizes within domain. To do so, we converted odds ratios for dichotomous outcome measures to Cohen's ds according to computations in Borenstein, Hedges, Higgins, and Rothstein (2009).

Additionally, we followed statistically significant ($p < .001$) ANOVAs and chi-squared tests with ANCOVAs and logistic regressions, respectively, using the sets of covariates described above to make reasonable inferences that statistically significant associations were attributable specifically to ADHD diagnostic status and persistence. In every ANCOVA and logistic regression we adjusted for W1 family SES, child IQ, age at W4, and stimulant medication use between W3 and W4. For all outcomes except for those in the externalizing domain we additionally covaried comorbid CD/ODD or at W1. For all outcomes except for those in the internalizing domain we covaried comorbid anxiety and depressive disorders at W1. For outcomes in the employment domain we also included student status and parent status as covariates.

Results

Preliminary Analyses

Missing data rates ranged from 7.9% to 12.7% ($M = 9.6\%$) for most self-reported variables, from 15.8% to 17.1% ($M = 16.7\%$) for most parent-reported variables, and from 0% to 9.6% ($M = 4.3\%$) for covariates. Some questions did not apply to all participants (i.e., some were not in romantic relationships or did not drive), so the missing data rates for the 11 variables derived from these questions were somewhat higher ($M = 20.5\%$; range 10.1% to 42.5%). As noted above, a number of baseline characteristics were significantly associated with the presence or absence of data at W4. Because data did not appear to be missing at random, and because most variables showed relatively low rates of missing data, we did not impute missing values.

Dependent measures at W4 were examined for values lying beyond three standard deviations from the mean. Four variables (monthly earnings, hours worked per week, substance se severity, and alcohol use severity) each had one outlier; traffic citations had two outliers. These values were changed to a value 3.1 standard deviations from the mean (or 3.2 for the furthest outlying citation variable).

For the key independent variable, we created ADHD persistence groups as follows: First, we termed as Desisters those girls who met criteria for ADHD at W1 but not at W3 and not at W4 ($n = 32$; 26.0% of girls with ADHD and valid data at W3 and W4). These girls had an average of 1.00 inattentive symptom (range 0 to 3) and 1.25 hyperactive/impulsive symptoms (range 0 to 3) at W4. Second, we termed those who met criteria for ADHD at W1 and at W3 *or* W4 Partials, i.e., partially desisting or partially persisting ($n = 38$; 30.9% of

girls with ADHD and valid data at W3 and W4). Finally, we termed girls who met criteria for ADHD at all three time points Persisters ($n = 53$; 43.1% of girls with ADHD and valid data at W3 and W4). Note that 57.1% ($n = 72$) of the 126 girls diagnosed with childhood ADHD at W1 who were followed-up at W4 met criteria for ADHD at W4. Girls who had missing diagnostic status information at W3 or W4 ($n = 17$) were not included in these analyses.

Omnibus Tests

As can be seen in Table 1a, the 35 ANOVAs and eight chi-squared tests yielded statistically significant ($p < .001$) differences across ADHD groups for 29 measures: ASR Internalizing, ABCL Internalizing, BDI total, SCID mood diagnosis, ASR Externalizing, ABCL Externalizing, suicide attempts, any non-suicidal self-injury, highest educational degree earned, years of education, WIAT Math, WIAT Reading, clinician-, parent-, and self-reported educational functioning, problems at work, clinician-, parent-, and self-reported functioning at work, BMI, unplanned pregnancies, poor overall health, clinician-, parent-, and self-reported social impairment, clinician-, parent-, and self-reported overall impairment, and psychiatric hospitalizations. After adjustment for a stringent set of covariates (described in the Data Analytic Plan), each one of these differences remained significant at the .05 level or below, except for WIAT Math ($p = .069$) and self-reported social impairment ($p = .171$).

Differences were considered statistically non-significant for the following variables: incarcerated/arrested ($p = .174$), SUQ alcohol use severity ($p = .682$), SUQ marijuana use frequency ($p = .860$), SUQ other illicit drugs severity ($p = .247$), currently employed ($p = .125$), receiving public assistance ($p = .012$), current salary ($p = .023$), current hours worked per week ($p = .098$), poor sleep quality ($p = .031$), dissatisfaction with current romantic relationship ($p = .932$), problems with best friend ($p = .008$), DBQ illegal driving ($p = .089$), DBQ accidents ($p = .093$), and DBQ citations ($p = .978$).

Pairwise Comparisons

For the 29 outcome variables with statistically significant group differences, we computed post-hoc Tukey tests among all pairwise comparisons and applied a correction for the false discovery rate (Benjamini & Hochberg, 1995) within domain. The pairwise comparisons that survived these controls for Type I error are noted in Table 1b with asterisks. To place emphasis on the size of the effects, rather than on null-hypothesis significance testing (as recommended by Cumming, 2012), we do not report the p value for each contrast. However, please note that we interpret only those contrasts that survived our multiple controls for Type I error.

Psychopathology: Within the internalizing domain, Persisters showed significantly higher levels and rates of Internalizing problems than every other group on every measure (versus Comparisons ds .77 to 1.41, versus Desisters ds = .92 to 1.47, versus Partials ds = .57 to .84). Additionally, Partials showed higher levels of parent-rated Internalizing problems than the Comparisons ($d = .58$) and higher rates of mood diagnoses than Desisters (odds ratio = 5.1).

Within the externalizing domain there were no differences for incarceration/arrest since W3. However, Peristers showed higher levels of parent- and self-reported Externalizing problems than each of the other three groups (versus Comparisons ds .92 and 1.53, versus Desisters ds = .85 and 1.02, and versus Partials ds = .58 and .60). Additionally, Desisters (d = .50) and Partials (d = .95) showed higher levels of parent-reported (but not self-reported) Externalizing problems than Comparisons.

In the self-injury domain, Partials (odds ratios of 2.9 and 5.0) and Persisters (odds ratios of 5.8 and 6.0) showed significantly higher rates than Comparisons. Peristers also showed significantly higher rates of non-suicidal self-injury than Desisters (odds ratio = 6.1). Two odds ratios for suicide attempts were very large (Partials versus Desisters, 9.0, and Persisters versus Desisters, 10.6) but were not statistically significant because of small cell sizes. Substance abuse outcomes yielded no statistically significant differences, regardless of childhood ADHD or ADHD persistence.

Average differences across measures within the psychopathology domains are also presented in Table 1b in the rows containing effect size means. There were no overall differences in adult psychopathology between Comparisons and Desisters. Partials showed somewhat higher mean levels of Internalizing and Externalizing problems and self-injury than Comparisons (M ds were .26, .54, and .74), and Persisters showed much higher levels of these problems than Comparisons (M ds were .96, 1.05, and .98).

Among girls with childhood ADHD, the patterns for Internalizing and Externalizing problems were similar, with small differences between Desisters and Partials (M ds .44 and .19), medium to large differences between Desisters and Peristers (M ds = 1.14 and .69), and medium differences between Partials and Persisters (M ds = .51 and .71). For self-injury, both Partials and Persisters showed a large difference relative to the Desisters (M ds .91 and 1.15). Average substance use differences among all groups were very small (.01 to -.13).

Attainments: For every objective measure (highest degree earned, years of education, WIAT Math, and WIAT Reading) and for clinician-rated functioning, Comparisons significantly outperformed each group with childhood ADHD (versus Desisters: ds = .59 to 1.18, versus Partials: ds = .69 to 1.14, and versus Persisters: ds = .85 to 1.38), with no statistically significant differences on these measures among the three groups with childhood ADHD. Parent- and self-report of functioning also showed that comparisons significantly outperformed Partials (ds = .79 and .93) and Persisters (ds = .83 and 1.35), but not Desisters (ds = .20 and .30). Parent- and self-report of functioning also showed no differences among the three childhood ADHD groups, except that Desisters outperformed Persisters (d = 1.05) according to parents.

In the employment domain there were no statistically significant differences among any groups on objective measures (currently employed, receiving public assistance, current salary, hours worked per week). Persisters showed significantly more problems at work than each of the three other groups (ds = .69 to .94). Reports of functioning varied according to informant. Clinicians reported each ADHD group to be functioning significantly less well than the Comparisons (ds = .56 to 1.34), and they reported Persisters to be significantly

worse off than Desisters (d = .66) and Partials (d = .76). According to parents, Comparisons and Desisters functioned equally well (d = .10), and Comparisons functioned significantly better than both Partials (d = .72) and Persisters (d = 1.51). Among girls with ADHD, Desisters functioned significantly better than Partials (d = .61) and Persisters (d = 1.40), and Partials functioned significantly better than Persisters (d = .79). According to self-report, employment functioning was essentially equivalent across groups, with the exception that Comparisons reported significantly better functioning at work than girls with persistent ADHD (d = .68).

Average differences across measures within the attainment domains are also presented in Table 1b in the rows containing effect size means. Each group with childhood ADHD showed a medium to large overall deficit in educational achievement relative to Comparisons (M ds = −.69, −.84, and −1.06), with small differences among groups of girls with childhood ADHD, regardless of diagnostic persistence (M ds = −.15, −.37, and −.22). Overall, employment outcomes among Comparisons were slightly better than Desisters (M d = −.23) and Partials (M d = −.36), but much better than Peristers (M d = −.83). Among girls with childhood ADHD, the overall difference between Desisters and Partials was very small (M d = −.12), but Desisters fared somewhat better than Persisters (M d = −.59), as did Partials (M d = −.47).

Impairments: In the health problems domain, there were no differences for sleep quality and only one for poor health, with Persisters reporting significantly worse overall health than Comparisons (d = .61). Comparisons had significantly lower BMIs than Partials (d = .80) and Persisters (d = .56). Comparisons also had far lower rates of unplanned pregnancies (10.6%) relative to Desisters (48.4%), Partials (40.5%), and Persisters (39.2%), with odds ratios of 5.4 to 7.9. There were no differences among ADHD groups for BMI or unplanned pregnancies.

In the social impairment domain, there were no statistically significant differences on self-reports of romantic relationship dissatisfaction or best-friend problems, except that Comparisons reported significantly better relations with best friends than Persisters (d = .65). According to clinicians (d = .68) and self-report (d = .73), the only statistically significant difference in social functioning occurred between Comparisons and Persisters. However, according to parents, Partials were more socially impaired than Comparisons (d = .72), and Persisters were more impaired than Comparisons (d = 1.40), Desisters (d = 1.07), and Partials (d = .68).

In the overall impairment domain, Comparisons were mostly equivalent to Desisters, except for clinician-rated functioning (d = .57). Partials and Persisters were significantly worse off than Comparisons on each of the four measures (ds versus Partials = .55 to .82; ds versus Persisters = .97 to 1.51). Among the girls with childhood ADHD, Desisters were mostly equivalent to Partials, except for parent-reported overall impairment (d = .67), but Persisters showed worse overall functioning than Desisters on all measures (ds = .79 to 1.36). Additionally, Persisters showed worse functioning than Partials according to parents and clinicians (ds = .68 and .67). There were no statistically significant differences, regardless of childhood ADHD status or persistence, for driving outcomes.

Average pairwise differences across measures within the impairment domains are also presented in Table 1b in the rows containing effect size means. Each group of girls with childhood ADHD showed problems in the health domain relative to Comparisons (M ds = .49, .59, and .66), with small differences among girls with ADHD, regardless of diagnostic persistence (M ds = .11, .17, and .07). Average effect sizes in the social domain were small, with the exception that Persisters showed worse outcomes, on average, than Comparisons (M d = .71) and Desisters (M d = .47). In the overall impairment domain, Desisters were statistically equivalent to Comparisons (M d = .15), but Partials and Persisters were not (M ds of .68 and 1.21, respectively). Among girls with childhood ADHD, Persisters were much more impaired, overall, than Desisters (M d = 1.05), with Partials intermediate (M d of .51 versus Desisters, and M d of .53 versus Persisters). For the driving measures, there were no sizable differences among any groups, regardless of childhood ADHD status or persistence (absolute M ds = .00 to .27).

Discussion

Overall, girls with ADHD whose symptoms persisted beyond childhood experienced sizable detrimental outcomes by their mid-20s on most key measures in almost every domain, including internalizing problems, externalizing problems, self-injury, educational achievement, occupational attainment, health problems, social impairment, and overall impairment. These findings survived covariation of potential confounds, including childhood comorbidities. Furthermore, over two-thirds (74%) of the girls with childhood ADHD showed symptom-based diagnostic persistence beyond childhood, signifying that the majority of girls with childhood ADHD in our sample were at risk for these detrimental adult outcomes. At the same time, the much smaller group of girls (26%) with childhood-limited ADHD was not at risk for poor outcome in the majority of domains. Their outcomes in the domains of psychopathology, occupational attainment, social impairment, and overall impairment (with the exception of clinician rating of overall impairment) were highly comparable to those of comparison girls without childhood ADHD. However, in the educational achievement domain and for two key outcomes in the health domain (unplanned pregnancy and body mass index), childhood ADHD posed substantial risk for detrimental outcomes, even when it was not persistent. Finally, in this all-female sample, ADHD was not associated with objective measures of employment, substance use, or driving outcomes at our 16-year follow-up.

These findings are consistent with the majority of previous reports showing childhood ADHD to be a risk factor for externalizing psychopathology, self-injury, and overall impairment (Barkley & Fischer, 2011; Biederman et al., 2010a; Chronis-Tuscano et al., 2011; Klein et al., 2012; Hinshaw et al., 2012, Satterfield & Schell, 1997). Most investigators have not tested these adult outcomes as a function of ADHD persistence, but when they have (e.g., Agnew-Blais et al., 2016; Hechtman et al., 2016; Swanson et al., 2014), their findings are consistent with ours in suggesting that persistent ADHD, rather than childhood-limited ADHD, is responsible. Similarly, our findings of poorer educational outcomes are highly consistent with previous work (Barkley et al., 2006; Babinski et al., 2011a; Hinshaw et al., 2012; Klein et al., 2012; Kuriyan et al., 2013; Mannuzza et al., 1997), some of which also considers the effect of ADHD persistence (Biederman et al., 2009 and

2010b; Hechtman et al., 2016). That is, childhood ADHD, regardless of its persistence across adolescence and the early-adult years, is consistently found to portend educational impairment. Our interpretation is that early problems with inattention and hyperactivity/impulsivity interfere with classroom learning, yielding lasting effects. Even if ADHD symptoms remit, rebound or catch-up appears unlikely because later school-based learning requires successful early learning.

Regarding internalizing problems, our findings do depart from the typically negative findings in the mostly-male literature (Babinski et al., 2011a; Biederman et al., 2006; Hechtman et al., 2016; Klein et al., 2012; Mannuzza et al., 1998). Perhaps related to our all-female sample, many of whom initially presented with the inattentive type of ADHD, we found statistically significant and often very large associations between childhood ADHD and adult internalizing outcomes, but only when ADHD persisted beyond childhood. The mechanisms by which ADHD contributes to adult internalizing (and externalizing) problems among women are likely to be varied, but they appear to involve behavioral dysregulation and academic failure (Owens & Hinshaw, 2016).

The large effects of even childhood-limited ADHD on adult body mass index and unplanned pregnancy are consistent with other reports (Barkley et al., 2008; Cortese, Comencini, Vincenzi, Speranza, & Angriman, 2013), but explanations are speculative at this point. Depression may mediate weight gain among girls with ADHD (Schrodek, Ahmad, & Hinshaw, 2011). It also seems likely that hyperactivity/impulsivity, especially in girls (van Egmond-Frohlich, Weghuber, & de Zwaan, 2012), or executive dysfunction (Cortese et al., 2013; Nigg, 2013) mediate the ADHD-obesity link. It is also plausible that executive dysfunction interferes with the planning required to avoid unplanned pregnancies.

In the substance use and driving domains, outcomes were not related to ADHD, whether persistent or not. Within the substance use domain, the effect sizes were very small and our comparison sample actually showed slightly higher (though not significantly different) rates of substance use than girls with childhood ADHD. Our findings depart from some previous reports (Charach, Yeung, Climans, & Lillie, 2011, Lee et al., 2011; Mannuzza et al., 1998), including those who have considered ADHD persistence (Hechtman et al., 2012), but robust associations between childhood ADHD and adult substance use are not typically demonstrated among females (Babinski et al., 2011a; Biederman et al., 2010a; Hinshaw et al., 2012). On the other hand, our finding of no association between ADHD (either childhood status or persistence) and illegal driving behavior, although consistent with our previous self-report findings (Hinshaw et al., 2012), diverges from most previous results (Fischer et al., 2007; Olazagasti et al., 2013). Note, however, that we did not examine specific attentional lapses and/or impulsive errors while driving.

Consistent with previous findings (Babinski et al., 2011a; Barkley & Fischer, 2011; Barkley et al., 2006; Brook et al., 2013; Fletcher, 2014; Klein et al., 2012; Kuriyan et al., 2013; Mannuzza et al., 1997), adult outcomes in the occupational domain varied by informant, with parents and clinicians more likely to report differences based on ADHD status and persistence than the participants themselves. However, unlike previous investigations, we did not find statistically significant differences on objective measures such as weekly hours

worked or current salary, despite some moderate-sized effects. It appears that our all-female sample, on average, found gainful employment but their work may suffered from low productivity or quality, as evidenced by parent and clinician ratings of impairment, and increased problems at work when ADHD persisted beyond childhood. When girls with ADHD do evidence poor occupational outcomes, it may be due to (a) direct effects of deficits in organizational skills, attention, impulse- and self-control (Barkley, 2015) or (b) indirect effects of low educational attainment or other mental health problems (Fletcher, 2014; Klein et al., 2012; Kuiyan et al., 2013).

Finally, social domain findings were related to both informant and ADHD persistence effects. ADHD beyond childhood was associated with certain relationship problems, with parents reporting greater impairments than clinicians or the participants themselves. This finding is consistent with the only other report of adult social relationships among girls with childhood ADHD (Babinski et al., 2011a). Although much evidence attests to the association between childhood ADHD and problematic peer relationships (McQuade & Hoza, 2015), once symptoms remit there may be fewer long-term developmental effect for girls, at least on dyadic relationships among adults.

Clinical Implications

Clinical implications pertain to what can be said about prognosis and long-term course when a school-aged girl is diagnosed with ADHD. A minority of girls with ADHD "grow out of" the diagnosis and are likely spared some of the more problematic adult outcomes (e.g., serious psychopathology), but these girls are still significant risk for educational under-attainment, as well as adult obesity and unplanned pregnancy. Thus, early and intensive educational interventions should be a cornerstone of treatment plans for children with ADHD. Interventions aimed to prevent weight gain and to encourage family planning may also be extremely important; however, we need to better understand the mechanisms responsible for these health-related outcomes before making intelligent recommendations. It is also important for clinicians and parents to understand that despite instances of remission, childhood ADHD is prone to persist beyond childhood, significantly raising the likelihood of problematic outcomes in many areas. Effective and ongoing treatment appears necessary to halt the continuance of ADHD and divert girls with early diagnoses from serious negative outcomes, especially high levels of anxiety and depression, increased risk for self-injury, and educational underachievement.

Limitations

Despite our attempt to create a comprehensive picture of adult outcome among girls with and without ADHD, we necessarily had to overlook certain important outcomes. For example, we examined experiences and impairments in close relationships, but not social skills. We tested substance use severity (excluding nicotine) but not disorders. Furthermore, our findings are preliminary in the sense that meaningful understanding will be achieved only when we examine mediators and moderators of the (many) significant findings, as we plan for subsequent papers. In addition, sampling procedures influence generalizability of findings. Ours was not an exclusively clinic-referred sample, nor was it nationally representative. Instead, findings can be generalized to a population of urban and suburban

community-referred girls of various ethnicities, ranging widely in family income levels, but not to representative, population-level samples.

Conclusion

In most domains, the risks incurred by childhood ADHD for negative adult outcomes depend on its persistence. Girls with childhood-limited ADHD showed substantial educational impairments, as well as elevated body mass index and much greater likelihood of at least one unplanned pregnancy, compared to girls without childhood ADHD, but did not show major social or psychiatric impairments as adults. On the other hand, among those girls whose childhood ADHD partially or completely persisted into adulthood, additional significant risks appeared in many domains (internalizing, externalizing, self-injury, occupational attainment, social problems, and overall impairment), underscoring the growing literature showing childhood ADHD to be a serious neuropsychological disorder, particularly when its symptoms persist.

Acknowledgments

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Public health implications

(1) Although a minority of girls no longer meet symptom criteria for ADHD in adulthood, they still show substantial educational underachievement over time, as well as increased body mass index and much greater likelihood of at least one unplanned pregnancy. (2) Among girls, childhood ADHD that persists into adulthood is associated with these educational and health problems (increased body mass index and unplanned pregnancy) as well as substantially increased risk for internalizing problems (e.g., anxiety and depression), externalizing problems (e.g., aggression and defiance), self-injury, and occupational impairment. (3) On average, however, girls with childhood ADHD are not at increased risk for later substance use problems, at least in the present sample.

Table 1a

W4 outcomes across groups defined by ADHD status and persistence

W4 Dependent Measure	Comparisons n = 85 M (SD)	Desisters n = 32 M (SD)	Partial n = 38 M (SD)	Persisters n = 53 M (SD)	df	F or X^2	p^a	p with covariates[c]
Internalizing Problems								
ASR Internalizing, 6 mos.	56.0 (12.4)	51.8 (9.6)	57.9 (9.8)	65.4 (11.7)	3,200	10.89	<.001	<.001
ABCL Internalizing, 6 mos.	45.7 (10.8)	50.2 (11.4)	53.6 (9.8)	64.7 (12.4)	3,183	30.46	<.001	<.001
BDI Total – 2 weeks	6.3 (8.0)	6.1 (6.6)	6.8 (6.2)	13.8 (9.0)	3,201	11.72	<.001	<.001
SCID Mood Dx, since W3	34.1%	12.9%	42.1%	67.9%	3,204	27.67	<.001	.001
Externalizing Problems								
ASR Externalizing, 6 mos.	52.1 (11.1)	53.0 (8.6)	55.7 (8.9)	62.5 (11.4)	3,200	10.97	<.001	<.001
ABCL Externalizing, 6 mos.	46.2 (7.9)	51.8 (7.9)	56.8 (8.2)	63.2 (10.2)	3,183	42.14	<.001	<.001
Incarcerated/Arrested, since W3	5.9%	12.9%	10.5%	18.0%	3,201	4.98	.174	na
Substance Use								
SUQ Alcohol use severity	19.0 (11.7)	18.3 (15.8)	15.9 (11.4)	17.0 (18.7)	3,201	0.50	.682	na
SUQ Marijuana freq, past yr.	2.9 (3.8)	3.2 (4.0)	3.4 (4.2)	3.5 (4.4)	3,201	0.25	.860	na
SUQ Other illicit sev, past yr.	.14 (1.0)	–.18 (0.8)	–.12 (0.7)	–.05 (0.9)	3,201	1.39	.247	na
Self-Injury								
Suicide Attempts - ever	6.1%	3.4%	23.7%	27.5%	3,197	17.01	.001	.004
Any NSSI - ever	24.4%	24.1%	47.2%	66.0%	3,190	25.96	<.001	.001
Educational Achievement								
Highest Degree Earned	3.2 (1.4)	2.3 (1.3)	2.1 (1.5)	1.7 (1.1)	3,201	16.23	<.001	<.001
Years of Education	15.5 (1.6)	14.3 (1.6)	13.9 (1.8)	13.6 (1.6)	3,201	18.00	<.001	<.001
WIAT Math	101.9 (15.8)	81.5 (18.0)	88.7 (14.1)	84.5 (19.1)	3,198	17.89	<.001	.069
WIAT Reading	105.3 (8.4)	88.5 (19.1)	95.5 (12.6)	92.3 (14.2)	3,200	18.90	<.001	.002
Functioning since W3, clinician	3.2 (0.9)	2.2 (1.0)	1.8 (1.0)	1.5 (1.0)	3,176	34.25	<.001	<.001
Functioning since W3, parent	3.3 (0.9)	2.9 (1.2)	2.0 (1.4)	1.5 (1.2)	3,135	20.12	<.001	<.001
Functioning since W3, self	2.9 (0.8)	2.7 (1.0)	2.2 (1.0)	2.2 (0.9)	3,171	9.77	<.001	.001
Employment								

W4 Dependent Measure	Comparisons n = 85 M (SD)	Desisters n = 32 M (SD)	Partial n = 38 M (SD)	Persisters n = 53 M (SD)	df	F or X²	pᵃ	p with covariatesᶜ
Currently Employed	77.6%	80.6%	73.7%	60.8%	3,201	5.74	.125	na
Public Assistance	14.1%	32.3%	23.7%	38.0%	3,201	10.90	.012	na
Current Salary (month)	2087 (1896)	1603 (1556)	1575 (1702)	1167 (1420)	3,199	3.35	.023	na
Current Hours Worked (week)	27.8 (19.1)	27.4 (18.6)	23.7 (19.4)	19.6 (20.0)	3,201	2.13	.098	na
Problems at Work	1.0 (1.4)	1.4 (1.6)	1.7 (1.6)	2.6 (2.1)	3,196	7.82	<.001	.003
Functioning since W3, clinician	3.2 (0.8)	2.4 (1.0)	2.5 (0.9)	1.7 (1.1)	3,198	26.09	<.001	<.001
Functioning since W3, parent	3.5 (0.7)	3.4 (0.6)	2.7 (0.9)	1.9 (0.9)	3,172	31.93	<.001	<.001
Functioning since W3, self	3.1 (0.6)	3.1 (0.6)	2.9 (0.7)	2.6 (0.9)	3,194	5.38	.001	.008
Health Problems								
Body Mass Index, current	24.9 (5.4)	30.0 (7.9)	32.5 (12.5)	30.2 (11.2)	3,201	9.13	<.001	.011
Unplanned Pregnancy, ever	10.6%	48.4%	40.5%	39.2%	3,201	24.67	<.001	.021
Poor Sleep Quality, past month	1.9 (0.8)	2.0 (0.8)	2.1 (0.6)	2.3 (0.7)	3,198	3.03	.031	na
Poor Overall Health, current	0.1 (0.7)	0.2 (0.7)	0.5 (0.9)	0.6 (0.9)	3,198	4.34	<.001	.012
Social Impairment								
DAS – Dissatisfaction, current	–.02 (0.5)	.03 (.48)	–.05 (.45)	.04 (.83)	3,126	0.15	.932	na
SRI – Friend problems, current	–.22 (0.5)	.11 (0.8)	.07 (0.7)	.27 (1.0)	3,169	4.33	.008	na
Impairment since W3, clinician	1.9 (0.9)	2.0 (0.7)	2.4 (1.1)	2.6 (1.0)	3,199	7.19	<.001	.011
Impairment since W3, parent	1.5 (0.7)	1.9 (0.8)	2.3 (1.0)	3.0 (1.0)	3,184	29.24	<.001	<.001
Impairment since W3, self	1.8 (0.7)	1.9 (0.6)	2.1 (0.8)	2.3 (0.8)	3,199	6.06	.001	.171
Driving								
DBQ Illegal, ever	0.4 (0.6)	0.5 (0.7)	0.3 (0.5)	0.7 (0.8)	3,198	2.23	.089	na
DBQ Accidents, ever	0.9 (1.0)	1.3 (1.5)	1.1 (1.1)	1.4 (1.4)	3,197	2.22	.093ᵇ	na
DBQ Citations, ever	2.6 (3.5)	2.7 (4.6)	2.3 (3.5)	2.4 (4.3)	3,194	0.07	.978	na
Overall								
Functioning since W3, clinician	73.6 (11.6)	66.4 (9.4)	64.9 (10.6)	56.5 (9.6)	3,201	27.82	<.001	<.001
Impairment since W3, parent	1.8 (0.6)	1.9 (0.6)	2.5 (0.6)	3.1 (0.8)	3,185	25.34	<.001	<.001
Impairment since W3, self	2.0 (0.5)	2.1 (0.5)	2.3 (0.5)	2.6 (0.5)	3,199	12.84	<.001	<.001
Psych Hospitalization ever	9.0%	6.7%	24.3%	38.5%	3,194	21.28	<.001	.004

Notes. ASR = Adult Self Report; ABCL = Adult Behavior Checklist; BDI = Beck Depression Inventory; SCID = Structured Clinical Interview for DSM; SUQ = Substance Use Questionnaire; NSSI = Non-suicidal self-injury; WIAT = Wechsler Individual Achievement Test; DAS = Dyadic Adjustment Scale; SRI = Social Relationships Interview; DBQ = Driving Behavior Questionnaire; GAF = Global Assessment of Functioning. SES was measured by standardizing and averaging mother's level of education on a 6-point scale (from 1 = less than 8th grade to 6 = advanced or professional degree) and family yearly income on a 9-point scale (from 1 = less than $10,000 to 9 = $75,000 or more).

[a] F test when outcomes continuous and variances equal; Welch test used in 13 instances in which variances were unequal. X^2 when dependent measure is dichotomous.

[b] When months with license is controlled, $p = .005$

[c] Covariates always included: child IQ, W1 SES, W1 comorbid CD/ODD, W1 comorbid anxiety/depression, age at W4, stimulant medication status between W3 and W4. Covariate exceptions: outcomes in internalizing domain did not include W1 comorbid anxiety/depression; outcomes in externalizing domain did not include W1 CD/ODD; outcomes in employment domain also included student status, parent status.

Table 1b

Effect sizes[a] and post-hoc contrasts[b] across groups defined by ADHD status and persistence

W4 Dependent Measure	Comparisons vs. Desisters	Comparisons vs. Partial	Comparisons vs. Persisters	Desisters vs. Partial	Desisters vs. Persisters	Partial vs. Persisters
Internalizing Problems						
ASR Internalizing, 6 mos.	−0.35	0.16	0.77*	0.50	1.11*	0.61*
ABCL Internalizing, 6 mos.	0.33	0.58*	1.41*	0.25	1.07*	0.83*
BDI Total – 2 weeks	−0.02	0.05	0.90*	0.08	0.92*	0.84*
SCID Mood Dx, since W3	0.3 (−.66)[c]	1.5 (.22)	4.1 (.78)	5.1* (.90)	14.3* (1.47)	2.8* (.57)
Effect size mean	−0.18	0.25	0.97	0.43	1.14	0.71
Externalizing Problems						
ASR Externalizing, 6 mos.	0.08	0.32	0.92*	0.24	0.85*	0.60*
ABCL Externalizing, 6 mos.	0.50*	0.95*	1.53*	0.45	1.02*	0.58*
Incarcerated/Arrested, since W3	2.4 (.48)	1.9 (.35)	3.5 (.69)	0.8 (−.12)	1.5 (.22)	1.8 (.32)
Effect size mean	0.35	0.54	1.05	0.19	0.70	0.50
Substance Use						
SUQ Alcohol use severity	−0.05	−0.22	−0.14	−0.17	−0.08	0.08
SUQ Marijuana freq, past yr.	0.07	0.12	0.14	0.06	0.07	0.01
SUQ Other illicit, past yr.	−0.36	−0.29	−0.21	0.07	0.15	0.08
Effect size mean	−0.11	−0.13	−0.07	0.01	0.05	0.06
Self-Injury						
Suicide Attempts - ever	0.6 (−.28)	5.0* (.89)	5.8* (.97)	9.0 (1.21)	10.6 (1.30)	1.2 (.10)
Any NSSI - ever	1.0 (.00)	2.9* (.59)	6.0* (.99)	3.0 (.61)	6.1* (1.00)	2.1 (.41)
Effect size mean	−0.14	0.74	0.98	0.91	1.15	0.26
Educational Achievement						
Highest Degree Earned	−0.59*	−0.76*	−1.02*	−0.16	−0.43	−0.26
Years of Education	−0.67*	−0.88*	−1.05*	−0.21	−0.38	−0.17
WIAT Math	−1.09*	−0.71*	−0.93*	0.39	0.16	−0.23
WIAT Reading	−1.18*	−0.69*	−0.85*	0.49	0.33	−0.16
Functioning since W3, clinician	−0.82*	−1.14*	−1.38*	−0.33	−0.56	−0.23

W4 Dependent Measure	Comparisons vs. Desisters	Comparisons vs. Partial	Comparisons vs. Persisters	Desisters vs. Partial	Desisters vs. Persisters	Partial vs. Persisters
Functioning since W3, parent	−0.30	−0.93*	−1.35*	−0.63	−1.05*	−0.42
Functioning since W3, self	−0.21	−0.79*	−0.83*	−0.59	−0.63	−0.04
Effect size mean	−0.69	−0.84	−1.06	−0.15	−0.37	−0.22
Employment						
Currently Employed	1.2 (0.10)	0.8 (−0.12)	0.4 (−0.51)	0.6 (−0.28)	0.4 (−0.51)	0.6 (−0.28)
Public Assistance - reversed	0.4 (−0.58)	0.5 (−0.37)	0.3 (−0.73)	1.5 (0.22)	0.8 (−0.14)	0.5 (−0.36)
Current Salary (month)	−0.28	−0.30	−0.53	0.02	−0.25	−0.24
Current Hours Worked (week)	−0.02	−0.21	−0.42	−0.19	−0.40	−0.22
Problems at Work - reversed	−0.26	−0.26	−0.94*	−0.00	−0.69*	−0.69*
Functioning since W3, clinician	−0.68*	−0.58*	−1.34*	0.11	−0.66*	−0.76*
Functioning since W3, parent	−0.10	−0.72*	−1.51*	−0.61*	−1.40*	−0.79*
Functioning since W3, self	−0.05	−0.29	−0.68*	−0.23	−0.63	−0.39
Effect size mean	−0.23	−0.36	−0.83	−0.12	−0.59	−0.47
Health Problems						
Body Mass Index, current	0.55	0.80*	0.56*	0.26	0.01	−0.24
Unplanned Pregnancy, ever	7.9* (1.14)	5.4* (.93)	5.4* (.93)	0.7 (−.20)	0.7 (−.20)	1.0 (.00)
Poor Sleep Quality, past month	0.17	0.23	0.53	0.06	0.36	0.30
Poor Overall Health, current	0.09	0.40	0.61*	0.31	0.52	0.21
Effect size mean	0.49	0.59	0.66	0.11	0.17	0.07
Social Impairment						
DAS – Dissatisfaction, current	0.09	−0.04	0.10	−0.13	0.01	0.14
SRI – Friend problems, current	0.44	0.38	0.65*	−0.05	0.21	0.27
Impairment since W3, clinician	0.17	0.54	0.73*	0.37	0.56	0.19
Impairment since W3, parent	0.33	0.72*	1.40*	0.39	1.07*	0.68*
Impairment since W3, self	0.18	0.50	0.68*	0.32	0.51	0.19
Effect size mean	0.24	0.42	0.71	0.18	0.47	0.29
Driving Problems						
DBQ Illegal, ever	0.14	−0.07	0.44	−0.21	0.29	0.50
DBQ Accidents, ever	0.37	0.13	0.43	−0.24	0.07	0.30

W4 Dependent Measure	Comparisons vs. Desisters	Comparisons vs. Partial	Comparisons vs. Persisters	Desisters vs. Partial	Desisters vs. Persisters	Partial vs. Persisters
DBQ Citations, ever	0.02	−0.07	−0.05	−0.09	−0.06	0.02
Effect size mean	.18	−0.00	0.27	−0.18	0.10	0.27
Overall						
Impairment since W3, clinician[d]	0.57*	0.69*	1.36*	0.12	0.79*	0.67*
Impairment since W3, parent	0.15	0.82*	1.51*	0.67*	1.36*	0.68*
Impairment since W3, self	0.13	0.55*	0.97*	0.42	0.85*	0.43
Psych Hospitalization, ever	0.7 (−.27)	3.3* (.66)	6.3* (1.01)	4.5 (.83)	8.8* (1.20)	1.9 (.35)
Effect size mean	0.15	0.68	1.21	0.51	1.05	0.53

Notes. Comparisons, $n = 87$; Desisters, $n = 32$, Partials, $n = 37$; Persisters, $n = 53$. ASR = Adult Self Report; ABCL = Adult Behavior Checklist; BDI = Beck Depression Inventory; SCID = Structured Clinical Interview for DSM; SUQ = Substance Use Questionnaire; NSSI = Non-suicidal self-injury; WIAT = Wechsler Individual Achievement Test; DAS = Dyadic Adjustment Scale; SRI = Social Relationships Interview; DBQ = Driving Behavior Questionnaire; GAF = Global Assessment of Functioning.

[a] Cohen's *d* for continuous variables and odds ratios for dichotomous variables.

[b] Only when the omnibus test was $p < .001$ were post-hoc pairwise comparisons computed. Within-domain False Discovery Rate (Benjamini & Hochberg, 1995) applied to these pairwise comparisons.

[c] In parenthesis are odds ratios converted to *d*s according to Bornstein et al. (2009).

[d] reversed.