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Pathways to self-harmful behaviors in young adult females with and without ADHD:
A longitudinal examination of risk and mediating factors

By

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A dissertation submitted in partial satisfaction of the

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Committee in Charge:

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Abstract

Pathways to self-harmful behaviors in young adult females with and without ADHD:
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Professor Stephen P. Hinshaw, Chair

Accumulating evidence suggests that rates of suicide attempt and non-suicidal self-injury ([NSSI]; e.g., cutting, burning) peak in adolescence and early adulthood. Females and those with psychiatric symptoms/diagnoses appear to be at particular risk. Recent findings reported by Hinshaw and colleagues (in press) revealed that young adult women with childhood ADHD diagnoses ($n = 140$) reported higher rates of suicide attempts and NSSI than non-diagnosed, comparison women ($n = 88$). The current study aimed to expand on these preliminary findings in order to more thoroughly understand the pattern of suicide attempts and NSSI in this all-female sample. ADHD subtype differences and effects of diagnostic persistence (versus transient and non-diagnosed classifications) on self-harmful behaviors were explored. Crucially, possible mediating effects of impulsivity and comorbid psychopathology, ascertained in early/mid-adolescence, were investigated. Results indicated that young adult women with a childhood diagnosis of ADHD-Combined type (ADHD-C) and those with a persistent ADHD diagnosis (e.g., in childhood and young adulthood) were at highest risk for suicide attempts as well as the most varied and severe forms of NSSI. Mechanism analyses indicated unique pathways from childhood ADHD status to self-harmful behaviors in young adulthood. First, a lab-based measure of impulsivity, along with comorbid externalizing symptoms, emerged as simultaneous, partial mediators of the ADHD-NSSI linkage. Second, internalizing symptoms emerged as a partial mediator of the ADHD-suicide attempt linkage. Results underscore the elevated risk for self-harmful behaviors among young women with ADHD. Limitations, future directions, and implications for prevention and intervention efforts are discussed.

For several decades, prospective research has revealed long-lasting impairments for boys with attention-deficit/hyperactivity disorder (ADHD) into adolescence and adulthood (for a review, see Barkley, Murphy, & Fischer, 2008). Yet far less is known about adolescent and adult outcomes among girls with ADHD. Accumulating evidence suggests that they are also at increased risk for persistent ADHD symptoms, comorbid internalizing disorders, delinquency, lower academic achievement, as well as troubled relationships with family, peers, and romantic partners (Babinski et al., 2011; Biederman et al., 2010; Blachman & Hinshaw, 2002; Hinshaw, Owens, Sami, & Fargeon, 2006; Hinshaw et al., in press; Manuzza & Klein, 2000; Zalecki & Hinshaw, 2004). Yet there is surprisingly little research on the associations between ADHD and self-harmful behaviors, defined herein as (a) behaviors that reflect an attempt to die (i.e., suicide attempts) or (b) behaviors that reflect a deliberate and direct destruction of one's body tissue without reported suicidal intent (i.e., non suicidal self-injury [NSSI]). Self-harmful behaviors are a significant health concern among clinical and community samples of adolescents and young adults. Thus, the focus of the present investigation is (a) a careful analysis of the prospective, longitudinal links of childhood ADHD with young adult suicidal behavior and NSSI and (b) potential risk factors and mediators of this important association, including impulsivity, psychiatric comorbidity, and diagnostic persistence of ADHD symptoms over time.

In the following literature review, I present an overview of NSSI and suicide attempts in adolescence; (b) issues of classification and terminology; (c) theoretical rationale as to why young adult girls with ADHD may be at-risk particular for NSSI and suicide attempts, (d) existing research in this population; and (e) aims and hypotheses for the current study.

Overview of Suicide Attempts and NSSI in Adolescence/Young Adulthood

Rates of suicide attempts in adolescence and the early years of adulthood are distressingly high, posing a significant burden along with major public health costs. Suicide is the third leading cause of death among 15 to 24 year olds, the second leading cause of death among college students, and accounts for 12% of all deaths annually in this age group (Centers for Disease Control and Prevention [CDC], 2006). In 2007, the CDC reported that 6.9% of students in grades 9-12 reported making at least one suicide attempt in the previous 12 months (9.3% of females; 4.6% of males). In a key epidemiological paper that synthesized worldwide age trends in suicide and suicidal behavior, Nock and colleagues (2008) found escalating rates of suicide attempts in adolescence and into the early 20's.

Compared to the extensive literature on suicide in this age group, a burgeoning interest in NSSI has developed only recently, promoted by either an increased awareness of this distressing behavior pattern, the apparently skyrocketing prevalence in this age group, or both (Olfson et al., 2005). Indeed, contemporary rates of NSSI among community-based samples of adolescents (15%-25%; Ross & Heath, 2002; Whitlock, Eckenrode, & Silverman, 2006) and clinically-referred samples (21%-61%; Darce, 1990; DiClemente, Ponton & Hartley, 1991) are significantly greater than rates of NSSI among community-based samples of adults (1-4%; Klonsky, Oltmanns, & Turkheimer, 2003) or clinically-referred adult samples (21%; Briere & Gil, 1998).

Both forms of self-harmful behaviors (i.e., suicide attempts and NSSI) are complex, diagnostically heterogeneous, and overdetermined (Prinstein, 2008). The strikingly high rates of these behaviors in adolescence and young adulthood have led some to speculate that this developmental stage represents a particularly vulnerable period marked by high levels of emotional distress, increased risk-taking behaviors, and heightened interpersonal stress, escalating risk for self-harm (Brausch & Gutierrez, 2010; Goldston et al., 2009; Lloyd-

Richardson, 2008; Nock, 2009). This risk may be particularly high for individuals with increased emotionality and decreased inhibitions related to the presence of certain psychiatric diagnoses (e.g., mood and impulse-control problems, alcohol/substance use, psychosis, personality disorders, and multiple concurrent psychiatric diagnoses). Although past research on sex differences in suicide attempts and NSSI have yielded mixed results, adolescence and early adulthood may be an exceptionally vulnerable time period for girls to engage in these behaviors (Guerry & Prinstein, 2010; Ross & Heath, 2002).

Classification and Terminology

There is considerable debate about the terminology used to describe self-harmful behaviors. Many different terms have been used across investigations (e.g., parasuicide, deliberate self-harm, self-inflicted injury), fragmenting and slowing research in this area. Prinstein (2008) defined NSSI as self-harmful behaviors that are widely considered to be socially unacceptable (versus piercing and tattooing) and lacking suicidal intent, whereas suicide attempts involve an explicit desire to die. Still, this distinction is based on the assumption that suicide intent is a dichotomized variable that is either present or absent, whereas many individuals may be uncertain about their intentions when engaging in such behaviors (Rodham, Hawton, & Evans, 2004).

Indeed, NSSI and suicide attempts often co-occur, either concurrently or sequentially. Approximately 50-75% of adolescents with a history of NSSI make a suicide attempt at some point (Joiner, 2005; Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006). Yet there may also be differences among adolescents who engage in varying levels of self-harmful behavior. Brausch and Gutierrez (2010) found that adolescents engaging in NSSI with at least one suicide attempt (a) reported a longer history of NSSI, (b) used more varied methods of NSSI, (c) had less perceived parental support, (d) lower self-esteem, and (e) were likely to meet criteria for major depressive disorder (MDD) and/or an externalizing disorder (e.g., conduct disorder [CD]) compared to adolescents engaging in NSSI alone.

Theoretical Rationale

There are two key theoretical reasons to believe that young adult girls with ADHD may be at unique risk for NSSI and suicide attempts. First, there is substantive evidence that impulsivity (a cardinal symptom of ADHD) is a common risk factor and correlate of suicidal behavior and NSSI (for a review, see Gvion & Apter, 2011). Impulsivity is a key component of the diagnostic criteria for individuals with ADHD, particularly those with ADHD-C, which requires at least six of nine total symptoms of hyperactivity (comprising six symptoms) and/or impulsivity (comprising three symptoms) in addition to six of nine inattention symptoms (American Psychiatric Association, 2000). Particularly salient aspects of impulsivity that distinguish ADHD are features of increased urgency (e.g., tendency to act impulsively when experiencing negative affect), lack of premeditation (e.g., failure to reflect on consequences of an act before engaging in that act), and lack of perseverance on task completion (Miller, Derefinko, Lynam, Milich, & Fillmore, 2010). Individuals with ADHD also demonstrate poorer performance than non-diagnosed comparison groups on laboratory-based inhibitory control tasks (Hinshaw et al., 2002; Lijffijt, Kenemans, Verbaten, & van Engeland, 2005; O'Brien, Dowell, Mostofsky, Denckla, & Mahone, 2010). Moreover, there is evidence that the impulsivity characterizing ADHD uniquely contributes to other co-morbid problems, such as pathological eating behaviors (Mikami & Hinshaw, 2008), antisocial behavior (Colledge & Blair, 2001; Mathias et al., 2007), and higher quantities of alcohol consumption (Weafer, Milich & Fillmore, 2011). Finally, Miller and Hinshaw (2010) found that impulsive responding in childhood, as

defined by commission errors on the Continuous Performance Task (CPT), predicted low teacher-rated and peer-rated social preference in adolescence, for girls both with and without ADHD, a finding that underscores the potential importance of inhibitory control regardless of psychiatric diagnosis. Deficits in this area may render a child, and particularly one with ADHD, more vulnerable to self-harmful behaviors through direct and indirect (e.g., social rejection) pathways.

In terms of comorbidity, internalizing problems (e.g., depression, anxiety) have been shown to be prospectively and concurrently associated with suicide attempts and NSSI (Brausch & Gutierrez, 2010; Goldston et al., 2009; Gould et al., 1998; Guerry & Prinstein, 2010; Hilt, Cha, & Nolen-Hoeksema, 2008; Lloyd-Richardson, 2008). Furthermore, girls are at particular risk for internalizing symptoms beginning in adolescence (Hankin et al., 1998; Twenge & Nolen-Hoeksema, 2002). Yet, there is accumulating evidence that the combination of an externalizing disorder, such as CD, and an internalizing disorder, such as MDD, is uniquely associated with suicide attempts and NSSI, over and above other individual and comorbid diagnostic profiles (Goldston et al., 2009; Kovacs, Goldston, & Gatsonis, 1993). Nock and colleagues (2006) found that more than half of a sample of adolescents admitted to a psychiatric inpatient unit with a recent history of NSSI met dual criteria for an internalizing and an externalizing disorder. Because girls with ADHD are far more likely than non-diagnosed peers to maintain or develop internalizing and/or externalizing disorders in adolescence (Biederman et al., 2008; Biederman et al., 2010; Hinshaw, 2002; Hinshaw et al., 2006; Hinshaw et al., in press), the risk of suicide attempts and NSSI may be amplified in this population.

Existing Research

Despite the vast research literature on ADHD, there is extremely limited information regarding suicide attempts, and no studies examining NSSI in this population. Some reports have examined the correlation between ADHD and suicidality (i.e., ideation and/or attempts) when mediated by comorbid conditions, such as CD and MDD (Biederman et al., 2008; James, Lai & Dahl, 2004), indicating that ADHD appears to increase the risk of suicidality by increasing the severity of these comorbid conditions. In terms of actual suicide attempts, Barkley and colleagues (2008) found that severity of childhood hyperactivity and number of CD symptoms in adolescence emerged as marginally significant mediators of suicide attempts among young adults with ADHD. A longitudinal study in a predominantly male sample reported that children with the ADHD-C subtype or the ADHD-HI (predominately hyperactive-impulsive) subtype, but not the ADHD-I (predominantly inattentive) subtype, were at greater risk for adolescent suicide attempts than a comparison sample (Chronis-Tuscano et al., 2010). The authors reported that CD symptoms at ages 4 to 6 years uniquely predicted future suicide attempts among children with any ADHD diagnosis, signaling that early impulsivity and comorbid psychopathology may facilitate prediction of suicide attempts. Crucially, Chronis-Tuscano and colleagues (2010) found a significant effect of sex, such that girls with childhood-diagnosed ADHD ($n = 18$) were at greater risk for depression and suicide attempt in adolescence than the far larger subsample of boys with ADHD. However, conclusions are limited based on the limited number of females and small representation of the ADHD-I subtype.

Most recently, Hinshaw and colleagues (in press) presented findings from the young adult follow-up (*Mean age = 19.6, Median age = 20*) of a 10-year longitudinal study of girls with and without ADHD. Despite considerable changes in diagnostic subgroup status over time, women with a childhood-diagnosis of ADHD (Wave 1) had significantly more psychiatric symptoms and functional impairments in young adulthood (Wave 3) than the comparison group,

despite stringent control of potential confounding factors (e.g., age, IQ, demographics, comorbidities, medication status). Most striking were markedly high self-reports of NSSI behavior and suicide attempts among young women with ADHD. Specifically, young women with a childhood-diagnosis of ADHD-C had significantly higher reports of NSSI behavior in young adulthood (51%) than the comparison group (19%, with the ADHD-I group intermediate, at 29%) *and* higher rates of suicide attempts (22%) than those with childhood diagnosed ADHD-I (8%) or the comparisons (6%), who did not differ significantly. These descriptive findings bear far closer examination.

Current Study

The current study expands upon recent findings of elevated NSSI and suicide attempts among young women with ADHD. This rich, longitudinal dataset allows for a more detailed investigation of three key aims that extend findings reported by Hinshaw and colleagues (in press). First, I examine ADHD-comparison differences in the frequency, variety and severity of NSSI behaviors, over and above the findings of Hinshaw et al. (in press) on frequency alone. I predict that young women with childhood-diagnosed ADHD-C will report engaging in the most frequent, varied, and severe forms of NSSI followed by the childhood-diagnosed ADHD-I group and the comparison group, respectively.

My second aim is to examine whether persistent ADHD diagnosis across development (e.g., from childhood through young adulthood), compared to a group with transient ADHD diagnosis and a group never diagnosed with ADHD, confers the highest risk for suicide attempts and NSSI in young adulthood. Barkley and colleagues (2002, 2008) have cautioned that there are various ways to measure ADHD persistence (e.g., diagnostic, symptomatic, or DSM-IV ratings of functional impairment). However, Biederman and colleagues (2010) found that *any* definition of ADHD persistence was associated with more psychiatric co-morbidity and functional impairment than any form of remitted ADHD. I predict that young women with persistent ADHD diagnoses will have more reported suicide attempts as well as higher frequency, wider variety, and more severe NSSI than young women with transient ADHD or the comparison group. I also predict that those with transient ADHD diagnoses will report more suicide attempts plus higher frequency, wider variety, and more severe forms of NSSI than the comparison group.

Third, it will be essential to determine whether self-harmful behaviors are *specific* to childhood ADHD status or whether other factors co-occurring with ADHD across development help to explain these grave outcomes. The longitudinal nature of this study allows for an examination of many important potential pathways between childhood ADHD diagnosis (Wave 1), candidate mediators in adolescence (Wave 2), and reports of NSSI severity and suicide attempts in young adulthood (Wave 3). In the interest of conceptual focus and optimal measurement in the current database, I focus on psychological factors (e.g., impulsivity, internalizing and externalizing psychopathology) rather than familial (e.g., parent mental health, family conflict, quality of parent-child interactions) or environmental factors (e.g., stressful life events, peer influences). I also focus specifically on pathways to NSSI severity, as it represents the most clinically interpretable data about these behaviors. I examine the three candidate mediators individually and build more complex, multiple mediation models in instances with two or more significant mediators.

Method

Participants

The initial recruitment process involved a multi-gated screening and diagnostic procedure to recruit a sample of girls, ages 6-12 years (Wave 1: $M = 9.1$ years, $SD = 1.7$) comprising a

carefully diagnosed ADHD group and a comparison sample of girls matched on age and ethnicity (see Hinshaw, 2002, for details). Both groups were recruited through schools, pediatricians, and mental health centers as well as, in some cases, direct advertisement. Preliminary rating criteria on parent and teacher scales were set with somewhat low, sex-specific thresholds for ADHD symptoms to prevent premature exclusion of eligible girls. Final inclusion criteria for the clinical group required ADHD participants to meet full criteria for ADHD through the Diagnostic Interview Schedule for Children (4th ed., DISC-IV; Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000). Common comorbidities were permitted (e.g., major depressive disorder [MDD], anxiety disorders, learning disorders, oppositional defiant disorder [ODD], and conduct disorder [CD]). Comparison girls could not meet criteria for ADHD on parent ratings, teacher ratings, or structured interview criteria. Exclusion criteria for all girls included evidence of psychosis or overt neurological disorder, mental retardation, pervasive developmental disorder, lack of English spoken at home, or any medical problems that prevented participation in the summer camp.

The summer camps were not designed to be therapeutic but rather constituted enrichment programs provided free of charge, allowing inclusion of a diverse sample. The ethnic heterogeneity of the San Francisco Bay Area and wide range of referral sources yielded a sample from diverse socioeconomic and ethnic backgrounds (53% White, 27% African-American, 11% Latina, 9% Asian-American). The average family income was \$50,000 to \$60,000, with 13.6% receiving public assistance. On average, mothers had completed “some college” on our ordinal scale. There were no ADHD versus comparison group differences on level of maternal education, family income, child race, or child age.

At the 5-year adolescent follow-up (Wave 2), participants were re-contacted and invited to participate in comprehensive assessments of adolescent functioning. The project completed evaluations on 209 of the 228 participants (92% retention), who ranged from 11.3-18.2 years of age ($M = 14.2$ years, $SD = 1.7$). Reasons for nonparticipation in the follow-up included loss of the family in tracking efforts ($n = 4$), refusal to participate ($n = 5$), and scheduling difficulty, despite contact ($n = 10$). Comparison of the retained sample versus those lost to attrition on a wide range of baseline variables yielded only two significant differences between the groups: (1) single-parent vs. dual-parent status (53% of the girls lost to attrition versus 28% of the retained sample were from single-parent homes); and (2) teacher-reported internalizing scores (girls lost to attrition had slightly higher internalizing behavior scores than the retained sample).

At the most recent, 10-year young adult follow-up (Wave 3), assessments were completed on 216 of the 228 participants (95% retention from Wave 1), who ranged from 17 to 24 years ($M = 19.6$, $Md = 20$). The 10-year follow-up sample is similarly representative of the baseline sample. The increased retention rate over Wave 2 was aided by use of social media (e.g., Facebook) to locate hard-to-track participants. To evaluate the representativeness of the 10-year sample, baseline measures for the 12 participants lost to the 10-year follow-up were contrasted with the retained sample. From 23 total analyses, five significant differences were found. Specifically, the non-retained sample had lower family incomes, lower Full-Scale IQ (FSIQ) scores, and higher baseline rates of teacher-rated ADHD, externalizing, and internalizing symptoms. Thus, the non-retained subgroup was more socioeconomically disadvantaged and had higher teacher ratings of cognitive and behavioral impairment, but across 18 other contrasts ranging from demographics, core ADHD symptoms, parent-report of comorbid symptoms, and functional impairments, the 10-year follow-up sample was largely representative of the total sample.

Measures

At each wave, highly trained B.A.-level research assistants and doctoral students in clinical psychology performed assessments. Staff members changed at each wave of data collection. Staff members during Wave 2 and Wave 3 were not informed of participants' baseline (Wave 1) diagnostic status. Although responses to questions at follow-up assessments could suggest the presence of ADHD (e.g., queries about use of stimulant medication), many data are objective (e.g., academic testing; computerized structured interviews) and diagnostic status changed for some girls at each follow-up (Hinshaw et al., 2006). Thus, it is unlikely that data were biased by the breaking of blinds.

Independent variable: Childhood (Wave 1) ADHD diagnosis

A multi-method, multi-informant process was used to determine ADHD diagnosis at baseline. The Diagnostic Interview Schedule for Children—4th edition (DISC-IV; Shaffer et al., 2000) is a well-validated, highly structured diagnostic interview that provides symptom counts and psychiatric diagnoses for the major disorders in the Diagnostic and Statistical Manual of Mental Disorders (4th ed., DSM-IV, American Psychological Association, 1994). At Wave 1, parents completed the DISC-IV at baseline to assess the girls' psychiatric symptoms prior to participation in the camps. Girls assessed as having ADHD met full criteria for ADHD (either inattentive [ADHD/I] or combined [ADHD/C] subtype) on the DISC-IV, requiring at least six inattentive symptoms for ADHD/I or at least 6 inattentive and 6 hyperactive-impulsive symptoms for ADHD/C. Comparison girls had to have an absence of a DISC-IV diagnosis of ADHD. Diagnostic procedures were based largely on the DISC-IV but also included Swanson, Nolan, and Pelham Rating Scale - 4th edition (SNAP-IV) ratings (Swanson, 1992), a widely used adult informant rating scale of ADHD symptoms. Each of the 18 DSM-IV ADHD symptoms was considered present if endorsed on the DISC-IV or if the mother or teacher rated it as a 2 (*pretty much*) or 3 (*very much*) on the SNAP-IV. The SNAP-IV was administered to girls' parents and teachers at baseline, prior to participation in the camps. For a complete description of the ADHD and comparison criteria, see Hinshaw (2002); Hinshaw et al. (in press).

Independent variable: Persistence or remission of ADHD diagnosis from Wave 1 to Wave 3

A dummy variable was created to reflect remission or persistence of ADHD diagnosis from Wave 1 to Wave 3. Wave 1 diagnosis was established via the guidelines described above. However, at Wave 3, I used youth report on the SNAP-IV (instead of parent and teacher) plus both parent *and* youth report from the DISC-IV to establish the presence of ADHD. Young women in the comparison group who did not meet ADHD criteria at Wave 1 or Wave 3 were coded as 0. Young women who met ADHD criteria at Wave 1 *or* Wave 3 only were coded as 1 (i.e., transient ADHD). Finally, young women who met ADHD criteria at Wave 1 *and* Wave 3 were coded as 2 (i.e., persistent ADHD).

Wave 3 criterion variables

Nonsuicidal self injury (NSSI). All young women responded to the Self-Injury Questionnaire (SIQ), an interviewer-administered questionnaire based on a modification of Claes, Vandereycken and Vertommen's (2001) SIQ. Validity and reliability data of the SIQ within samples of individuals with eating disorders is available (Vanderlinden and Vandereycken, 1997). Participants were asked whether, in the past year, they deliberately injured themselves (e.g., "cut, scratch, or poke skin with pins or other sharp objects until you bleed/scar on purpose," "cut words, shapes or initials into your skin," "constantly pick at scabs until they scar," "burn yourself on purpose," "hit yourself so hard or so frequently on purpose to the point of bruising," and "pull or play with your hair so much that it comes out."). When a particular

behavior was endorsed respondents were also asked about frequency (1 = only once; 6 = a couple times a day).

Three NSSI scores were used in this study: (1) a NSSI variety score (0 to 6 scale) based on the total number of methods tried; (2) a NSSI frequency score, which is an average frequency score across the 6 items; and (3) a NSSI severity score (0 to 3 scale). The NSSI severity score was informed by a lethality continuum based on degree of potential tissue damage postulated by Skegg (2005) and confirmed by factor analysis. I created a 4-point, ordinal NSSI severity score in which the ‘highest’ level of severity endorsed on the SIQ was used as each participant’s NSSI severity score. A score of 0 represents the non-endorsement of any NSSI behaviors; 1 represents participants who only endorsed either or both of the low severity NSSI methods: “constantly pick at scabs until they scar” and “pull or play with your hair so much that it comes out”; 2 represents participants who endorsed one or several of the three mild to moderate severity NSSI methods: “cut, scratch, or poke skin with pins or other sharp objects until you bleed/scar on purpose,” “cut words, shapes or initials into your skin,” and “hit yourself so hard or so frequently on purpose to the point of bruising”; and 3 represents participants who endorsed the highest level of severity on this scale, namely the “burn yourself on purpose” item. Of the 11 young women who endorsed burning, all of them also endorsed trying between 2-5 other lower severity NSSI methods.

Number of suicide attempts. Suicide attempts were queried via the Barkley Suicide Questionnaire and the Family Information Packet (FIP). The Barkley Suicide Questionnaire (Barkley, 2006) is a brief, self-report questionnaire with three yes/no items: (e.g., “Have you ever considered suicide?” “Have you ever attempted suicide?” and “Have you ever been hospitalized for an attempt?”). A positive endorsement to any of these questions is followed up with a frequency question (e.g., “How many times?”). I analyzed the dichotomous suicide attempts item. The FIP was completed prior to the assessment by the girls’ primary caregiver (sometimes with assistance by the young adult herself) and checked by the interviewer during the assessment, in review with the family, for completeness. The FIP inquired about several domains of the girl’s life and functioning (e.g., education, medical, employment) during the five years between Wave 2 and Wave 3, including suicide attempts. In the single case where the FIP reported an attempt but the Barkley scale did not, the individual was counted as positive for attempted suicide.

Wave 2 hypothesized mediators

Swanson, Nolan, and Pelham Rating Scale – 4th edition (SNAP-IV; Swanson, 1992). The SNAP is an informant-report checklist of the nine DSM-IV items for inattention, the six items for hyperactivity, and the three items for impulsivity, with each scored on a 0 (*not at all*) to 3 (*very much*) metric. The SNAP-IV is used extensively in ADHD treatment and assessment research (e.g., MTA Cooperative Group, 1999). It has good internal consistency and test-retest reliability. Mean parent and teacher scores for the three impulsivity items were used or individual scores if only one informant report was available, employing the “or” rule (Piacentini, Cohen & Cohen, 1992).

Conners’ Continuous Performance Task (CPT; Conners 1995). The CPT is a 14-minute computerized visual task for which participants are asked to press the spacebar when a target letter appears on the screen (all letters except ‘X’), and not press the spacebar when they see the letter ‘X’. Within each of the six trials letter stimuli are displayed for 250 milliseconds with a variable interstimulus interval of 1, 2, or 4 seconds. Failing to inhibit the bar-pressing response to the letter “X” is considered an error of commission. The percentage of commission errors is a commonly used measure of behavioral impulsivity (Janis & Nock, 2009; McGee, Clark, &

Symons, 2000) and prior research in our lab has shown that girls with ADHD exhibit higher percentages of commission errors with effect sizes in the medium range (Hinshaw et al., 2002; Hinshaw et al., 2007). This variable will be reverse-scored such that higher scores equate to better (i.e., less impulsive) performance.

Cancel Underline Task (CUL). The CUL is a modified version of the Underlining Task (Rourke and Orr, 1977). It measures inhibitory control and rapid, accurate visual discrimination. Participants were asked to underline targets (shape or consonant sequences) and cancel out nontargets (ratio of 1:5). Scores are derived from correct minus incorrect responses (Nigg, Hinshaw, Carte & Treuting, 1998). Previous research has shown differences between ADHD and comparison individuals on this measure, with those with ADHD making more errors (Carte, Nigg & Hinshaw, 1996; Hinshaw et al., 2002; Hinshaw et al., 2007; Nigg et al., 1998). CUL-shapes and CUL-consonant scores were analyzed separately.

Internalizing symptoms. A composite measure was created using the Internalizing broadband factor from the Child Behavior Checklist and Teacher Report Form (CBCL, TRF; Achenbach 1991a; Achenbach, 1991b), as well as the total score from the Children's Depression Inventory (CDI; Kovacs, 1992). Multiple reports were combined according to the "or" rule (Piancentini et al., 1992), or used individually when only one informant was available. All instruments have excellent validity, test-retest reliability, and internal consistency. Correlations among the three scales were small to moderate ($r = .27-.36$). To facilitate interpretation, all component measures were z-scored before calculating the composite scores.

Externalizing symptoms. A composite measure was created using the Externalizing broadband factor from the CBCL and TRF. Multiple reports were combined or used individually when only one informant was available, employing the "or" rule (Piancentini et al., 1992). The subscales were moderately correlated ($r = .52$) and z-scored before calculating the composite scores.

Covariates

Five variables were included as covariates in our analyses. First, girls' Full Scale IQ at Wave 1 as indexed by the Wechsler Intelligence Scale for Children, third edition (WISC-III; Wechsler, 1991). The WISC-III is a psychometrically sound and widely-used test of intelligence. Test-retest reliabilities are high for the Full Scale IQ (.94-.96; Kaufman, 1994). Second, a composite of parent report of family income and maternal education at Wave 1 was used to indicate socioeconomic status (SES). Third, I included the presence versus absence of stimulant medications as well as the presence versus absence of SSRIs/antidepressants during the year preceding the Wave 3 follow-up interview. Finally, girls' reported race and age at the Wave 3 follow-up were included as covariates.

Data Analytic Plan

Statistical analyses were performed using SPSS for Mac (Version 19; SPSS, 2010). First, one-way analyses of variance (ANOVA) were used to assess group differences between ADHD subtypes and the comparison group, diagnosed at Wave 1, with respect to the Wave 3 NSSI variables: (1) NSSI frequency; (2) NSSI variety; and (3) NSSI lethality, as well as reports of suicide attempt. I then used analyses of covariance (ANCOVAs) to address the potential effects of covariates. Finally, I used planned Tukey post-hoc comparisons to examine pairwise differences between subgroups (ADHD-C, ADHD-I, and comparison).

Second, parallel one-way analyses of variance (ANOVA) were used to assess group differences between young women with a persistent ADHD diagnosis, young women with a transient ADHD diagnosis, and a lifetime comparison group with respect to the Wave 3 NSSI

variables: (1) NSSI frequency; (2) NSSI variety; and (3) NSSI severity, as well as reports of suicide attempt. I then used analyses of covariance (ANCOVAs) to address the potential effects of covariates. Finally, I used planned Tukey post-hoc comparisons to examine pairwise differences between diagnostic subgroups (persistent ADHD, transient ADHD, and lifetime comparison).

Third, regarding mediational analyses, I used a bootstrap procedure to investigate the effects of single and multiple mediators on the ADHD-NSSI and ADHD-suicide attempt links (Preacher & Hayes, 2008; Shrout & Bolger, 2002). In the bootstrap procedure, a new sample (N=228) was created by randomly sampling observations from the original data with replacement. Next, a point estimate of the mediated effect (a-prime x b-prime) was determined for this sample. This procedure was repeated 10,000 times, and all point estimates were aggregated to arrive at an overall estimate of the effect. Finally, 95 % bias-corrected and accelerated confidence intervals were formed based upon the distribution of these effects, and statistical significance was determined if this interval did not contain 0 (see Preacher & Hayes, 2008; Shrout & Bolger, 2002). All models included the covariates presented above, which functioned as statistical controls of the mediator and outcome variable. Finally, separate analyses were conducted using ordinary least squares (OLS) regression to ensure that the pathway from the predictor to the mediator and mediator to outcome were in the hypothesized direction.

Results

Predicting self-harm from Wave 1 ADHD status

Table 1 presents mean values of NSSI frequency, NSSI variety, NSSI severity, and percentage of young women who reported at least one suicide attempt for the two childhood-diagnosed ADHD subtypes (i.e., ADHD-C and ADHD-I) and the comparison group. The omnibus one-way ANOVA showed a pattern of significant differences across the ADHD and comparison groups. All findings remained after controlling for key covariates of age, IQ, family income, maternal education, as well as stimulant or SSRI/antidepressant treatment during the year preceding the follow-up interview. Tukey post-hoc comparisons revealed that young women with childhood-diagnosed ADHD-C used a wider variety of methods and engaged in more severe NSSI than those in the comparison and ADHD-I groups, who did not differ. Effect sizes (Cohen's *d*) were small on the NSSI variety variable and medium to large on the NSSI severity variable. Young women with childhood-diagnosed ADHD-C reported more frequent NSSI than comparison girls (with a large effect size), but the two ADHD subtypes did not significantly differ.

Table 2 provides additional descriptive information about the four levels of NSSI severity by Wave 1 subgroup status. The majority of the comparison group and those diagnosed with Wave 1 ADHD-I diagnoses did not report any NSSI (79% and 71%, respectively). Strikingly, more than half (55%) of the young women with a Wave 1 ADHD-C diagnosis engaged in some form of self-harm, with 11% of them endorsing the most severe NSSI on the SIQ (i.e., burning), compared to 0% and 5% in the comparison and ADHD-I groups, respectively.

With respect to reported suicide attempts, findings were consistent with Hinshaw and colleagues (in press). Young women with childhood-diagnosed ADHD-C had a higher rate of suicide attempts (22%) than those with childhood-diagnosed ADHD-I (8%) or the comparisons (6%), which did not differ significantly. Odds ratios for the ADHD-C vs. ADHD-I and comparison groups were 3.5 and 4.5, respectively. These findings remained significant after controlling for all key covariates.

Prediction of self-harm from diagnostic persistence of ADHD over time

Table 3 presents group differences for the three NSSI variables and reports of suicide attempts in young women from the three subgroups (e.g., persistent ADHD, transient ADHD, lifetime comparison group). Young women with persistent ADHD had significantly higher reports of NSSI frequency, variety, and severity relative to the transient ADHD and lifetime comparison groups, who did not significantly differ on any variable. The persistent ADHD group had significantly higher reports of suicide attempts relative to the lifetime comparison group, but did not differ from the transient ADHD group. Effect sizes (Cohen's *d*) ranged from small to medium for the NSSI frequency variable and medium to large for the NSSI variety and NSSI severity variables. These findings remained after controlling for key covariates, with the exception of NSSI severity, which lost significance in the ANCOVA. Each covariate was considered individually to discern what accounted for the loss of significance. The analyses revealed that treatment with stimulant medication or SSRI/antidepressant in the past year contributed to the lack of group differences.

Table 4 provides more descriptive information about the four levels of NSSI severity by diagnostic persistence. The majority of young women in the lifetime comparison and transient ADHD group did not report any NSSI (81% and 70%, respectively). However, 58% of the young women with a persistent ADHD diagnosis did report some form of NSSI with 42% of women reporting moderate (i.e., cutting, hitting self) to severe (i.e., burning) self-harm methods.

In terms of suicide attempts, the persistent ADHD group had a higher rate of suicide attempts (22%) than the lifetime comparison group (4%), but did not significantly differ from the transient ADHD group (13%). Odds ratio for the persistent ADHD group versus the lifetime comparison group was 6.7. These findings remained after controlling for key covariates.

Mediational analyses

There was a significant positive relation between Wave 1 ADHD status and Wave 3 NSSI severity scores, $b = .28$, standard error [SE] = .13, $t(195) = 4.12$, $p < .001$, $R^2 = .08$. Bootstrapping analyses were used to examine whether Wave 2 candidate mediators of impulsivity (e.g., 1 adult-informant and 3 lab-based measures), or Wave 2 internalizing symptoms (e.g., 1 multi-informant composite) or Wave 2 externalizing symptoms (e.g., 1 multi-informant composite) mediated the relation between Wave 1 ADHD status and Wave 3 NSSI severity scores. Candidate mediators were entered into separate models before combining significant mediators into more complex models. The association between variables in each pathway was tested (i.e., between Wave 1 ADHD status and the candidate mediator and the candidate mediator and Wave 3 NSSI severity scores). A total of six mediation models were examined with the following candidate mediators: (1) SNAP – impulsivity subscale; (2) CPT – commission errors percentage; (3) CUL – shape scores; (4) CUL – consonant scores; (5) internalizing symptoms composite; and (6) externalizing symptoms composite.

ADHD-NSSI severity link. Results indicate that Wave 2 CUL – consonant scores was a significant partial mediator of the relation between Wave 1 ADHD status and Wave 3 NSSI severity scores, indirect effect [IE] = .11, SE = .05, $CI_{95} = .03 - .25$. Importantly, given concerns about demands on phonological awareness skills associated with the CUL-consonant task (McGee, Clark & Symons, 2000), this finding remained after controlling for childhood (Wave 1) reading disorder status (defined as presence vs. absence of Wechsler Individual Achievement Test reading score < 85; see Hinshaw, 2002). Wave 2 externalizing symptoms was also a significant partial mediator of the relation between Wave 1 ADHD status and W3 NSSI severity scores, IE = .19, SE = .09, $CI_{95} = .02 - .38$. None of the other candidate mediators were significant. The total effects for these two significant models are presented in Figure 1.

Wave 2 CUL–consonant scores and Wave 2 externalizing symptom scores were then entered simultaneously into the model. Results indicated that both variables significantly mediated the relation between Wave 1 ADHD status and W3 NSSI severity scores, $IE = .29$, $SE = .11$, $CI_{95} = .10 - .51$. The total effects of this complex model are presented in Figure 2. The model fits were compared using an F-test to determine whether the two-mediator model explained more variance than either of the single-mediator models. First, I compared the two-mediator model (e.g., Wave 2 CUL – consonant scores + Wave 2 externalizing symptom scores) to the one-mediator model containing only Wave 2 CUL-consonant scores. The two–mediator model accounted for significantly more variance among NSSI severity scores than the single-mediator model, $F\text{-ratio} = 5.14$, $F(1, 175) = 3.84$, $p < .05$. The two-mediator model also accounted for significantly more variance among NSSI severity scores than the one-mediator model containing only Wave 2 externalizing symptoms scores, $F\text{-ratio} = 7.801$, $F(1, 175) = 3.84$, $p < .05$. In sum, higher errors scores on Wave 2 CUL – consonant test, which represents a lab-based measure of impulsivity, and greater Wave 2 externalizing symptoms, were simultaneous partial mediators of the ADHD-NSSI severity link.

ADHD-suicide attempt link. There was a significant positive relation between Wave 1 ADHD status and Wave 3 suicide attempts, $b = .28$, standard error [SE] = .13, $t(195) = 4.12$, $p < .001$, $R^2 = .08$. Bootstrapping analyses were used to examine whether any of the six Wave 2 mediators previously described (i.e., 4 measures of impulsivity, 1 measure of externalizing symptoms, 1 measure of internalizing symptoms) mediated the relation between Wave 1 ADHD status and Wave 3 NSSI suicide attempts. Results indicate that Wave 2 internalizing symptoms was a significant partial mediator of the relation between Wave 1 ADHD status and Wave 3 suicide attempts, indirect effect [IE] = .11, $SE = .05$, $CI_{95} = .03 - .25$. None of the other candidate mediators was significant. The total effects of this model are presented in Figure 3.

Discussion

In this examination of NSSI and suicide attempts, I aimed to expand on preliminary findings reported by Hinshaw and colleagues (in press) regarding elevated NSSI and suicide attempts among young women with childhood-diagnosed ADHD, relative to comparison peers. I examined NSSI frequency, number of NSSI methods tried, and NSSI severity. I also investigated associations of NSSI severity and suicide attempts with ADHD diagnostic persistence across childhood through young adulthood. I aimed to better elucidate the links between ADHD and self-harming behaviors by examining two theoretically driven candidate mediators: comorbid psychopathology and impulsivity.

Key findings are as follows: (1) Young women with childhood-diagnosed ADHD-C engaged in the most severe forms of NSSI, and experimented with the widest variety of methods, relative to the childhood-diagnosed ADHD-I and comparison groups. Both ADHD subtypes engaged in more frequent NSSI than the comparison group, but did not significantly differ from each other. Findings regarding suicide attempts were consistent with those of Hinshaw and colleagues (in press), such that young women with childhood-diagnosed ADHD-C had a higher rate of suicide attempts than the ADHD-I and comparison groups, who did not differ significantly. All of these findings survived stringent statistical control of IQ, Wave 1 demographics, and medication status during the preceding year. (2) Young women with a persistent ADHD diagnosis (i.e., Wave 1 and Wave 3) reported greater NSSI frequency, used a wider variety of NSSI methods, and engaged in more severe NSSI than those with transient ADHD (i.e., Wave 1 *or* Wave 3) and the comparison group, who did not differ significantly. Young women with persistent ADHD also had a higher rate of suicide attempts than the lifetime

comparison group, but did not significantly differ from the transient ADHD group. Most of these findings survived statistical control of key covariates, with the exception of NSSI severity. Stimulant or SSRI/antidepressant medication treatment in the past year appeared to contribute to the loss of group differences for this variable. (3) Adolescent-assessed externalizing symptoms and a lab-based measure of impulsivity during adolescence emerged as significant partial mediators of the ADHD-NSSI severity link, but internalizing symptoms emerged as a significant partial mediator of the ADHD-suicide attempt link.

As predicted, young women with childhood-diagnosed ADHD-C used a wider variety of NSSI methods and engaged in more severe NSSI behavior than those with childhood-diagnosed ADHD-I and the comparison group. Notably, 11% of the ADHD-C group reported self-burning behavior, compared to 5% and 0% in the ADHD-I and comparison groups, respectively. Suicide attempts were 3.5 to 4.5 times higher in the ADHD-C group than in the ADHD-I and comparison groups, respectively. These ADHD-C versus ADHD-I subtype differences in self-harming behavior in this all-female sample are unusual because, historically, few ADHD subtype differences have emerged for nearly all criterion (Hinshaw, 2002; Hinshaw et al., 2002, Hinshaw et al., 2006; Hinshaw et al., 2007, Hinshaw et al., in press). However, our patterns of findings are consistent with those reported by Chronis-Tuscano and colleagues (2010) who found that children, and particularly girls, with ADHD-C (and ADHD-HI), but not ADHD-I, were at increased risk for adolescent suicide 5 to 13-years post-baseline. Taken together, these data suggest that there may be something related to the higher levels of hyperactive-impulsive symptoms in the ADHD-C subtype that places these children (particularly girls), at high risk for self-harming behaviors. Nearly a quarter of young women in the ADHD-I and comparison group reported engaging in low-to-moderate forms of NSSI, which is consistent with previously reported rates in clinical and community samples (Darche, 1990; DiClemente et al., 1991; Ross & Heath, 2002; Whitlock et al., 2006).

Diagnostic persistence of ADHD across childhood and young adulthood appears to be associated with the most dangerous pattern of self-harming behaviors, relative to transient ADHD and the lifetime comparison group. This finding is consistent with Cicchetti and Rogosch's (2002) suggestion of a cascading chain of difficulties across development that places individuals with persistent ADHD-related impairments at risk for increased stress and difficulty through adolescence and into adulthood. It has been suggested that girls with ADHD experience a higher rate of diagnostic persistence than males (Hinshaw, 2006; Mick et al., 2011) and may thus be at even greater risk for these dangerous outcomes than males with ADHD.

This study was novel in conducting mediation analyses to understand the pathways between childhood (Wave 1) ADHD status and young adult (Wave 3) reports of NSSI severity or suicide attempt. Results indicated that adolescent (Wave 2) externalizing symptoms and a lab-based measure of impulsivity (i.e., CUL-consonant), also assessed during Wave 2, partially mediated the relation between childhood (Wave 1) ADHD status and young adult (Wave 3) NSSI severity scores. A different pathway was found for the ADHD-suicide attempt link such that only adolescent (Wave 2) internalizing symptoms partially mediated this association. It was somewhat surprising that different psychological symptoms (i.e., internalizing versus externalizing) mediated the ADHD-NSSI severity and ADHD-suicide attempt pathways, given their moderate correlation in this sample ($r = .56$) as well as recent evidence suggesting that *concurrent* externalizing and internalizing diagnoses are more strongly associated with suicide attempts and NSSI than either diagnosis alone (Goldston et al., 2009; Nock et al., 2006).

However, one possibility is that significant mediation of concurrent internalizing and externalizing symptoms were undetectable due to sample size limitations.¹

The pattern of findings regarding the mediating role of impulsivity was unexpected. First, none of the impulsivity measures mediated the ADHD-suicide attempt linkage. Only one lab-based measure of impulsivity emerged as a significant partial mediator of the ADHD-NSSI severity link, versus other lab-based measures (i.e., CPT, CUL-shapes) or informant report (i.e., SNAP). Previous research has shown that individuals who engage in NSSI endorsed higher levels of impulsivity on self-report measures relative to non-NSSI clinical and comparison samples, but did not differ on behavioral measures of impulsivity (McCloskey, Look, Chen, Pajoumand & Berman, 2012). Our findings suggest otherwise. It may be that the CUL-consonant task taps a particular aspect of impulsivity more associated with NSSI (e.g., response inhibition). Also, the CUL-consonant task requires scanning multiple letters in a sequence versus one shape at a time, so it may be sufficiently more effortful than the CUL-shapes task and more sensitive to detecting impulsivity. Previous research has shown medium-sized differences between ADHD and comparison individuals on this measure, with those with ADHD performing worse (Hinshaw, Carte, Sami, Treuting & Zupan, 2002; Hinshaw et al., 2007). There may also be inherent weaknesses in the other lab-based measures of impulsivity. Indeed, recent criticism suggests that such lab-based measures of executive function are often not sufficiently ecologically valid (Barkley, 2012). For example, several studies have shown that correlations between CPT commission scores and impulsivity symptoms are low to moderate and are associated with all three ADHD symptom domains (e.g., inattention, hyperactivity and impulsivity; Barkley, 1991; Epstein et al., 2003). Finally, the three impulsivity items on the SNAP, which map directly onto the three impulsivity items in the DSM-IV criteria for ADHD, do not adequately cover this broad, multidimensional construct.

In contrast to previous research, the present findings suggest that there may be unique pathways to self-harmful behaviors, at least in this all-female sample. Although NSSI severity and suicide attempts were moderately correlated ($r = .51$), some young women endorsed both NSSI and suicide attempts, whereas others endorsed only one or the other. Rather than attempting to identify common mediators for such complex and over-determined behaviors, future research may benefit from adopting a person-centered approach to examine mediating pathways for clusters of young women with distinct self-harm profiles.

The present findings should be viewed in the context of limitations, many of which provide important launching points for future research efforts. To start, replication and expansion of these findings is critical. Second, it is unclear whether these findings generalize to males with ADHD. The self-harming profiles and key mediating factors in young adult men with ADHD are yet unknown. Examination of all-male samples will inform our understanding of possible sex differences and aid in targeted treatment development.

In terms of associations between ADHD persistence and self-harming behaviors, only diagnostic persistence at Wave 1 and Wave 3 was considered. I lacked adequate power to investigate persistence of both subtypes (i.e., ADHD-C, ADHD-I) individually. Also, future

¹For the ADHD-NSSI severity linkage, a sample size of 445 would be required to detect a significant mediated effect with a power of .8 (Fritz & MacKinnon, 2007). Thus, power issues preclude a definitive statement of whether internalizing symptoms may indeed be an additional mediator of the ADHD-NSSI severity link.

research efforts may consider analyzing other definitions of persistence. To this point, previous research by Barkley and colleagues (2002, 2008) found that the prognosis of ADHD largely depends on what definition of persistence (or remission) is used (e.g., diagnostic, symptomatic, persistence of functional impairment). Indeed, even subsyndromal forms of ADHD are associated with significant impairment (Faraone et al. 2006, 2007).

Restrictions in measurement options also limited analytic options and explanatory scope. For example, the SIQ covered a somewhat narrow range of NSSI behaviors. There is great need to use assessment instruments that provide a more comprehensive understanding of self-harming behaviors. One possible measurement option is the Self-Injurious Thoughts and Behaviors Interview (SITBI) developed by Nock, Holmberg, Photos, and Michel (2007), a structured interview which more comprehensively assesses the presence, frequency, severity, functions, precipitants, characteristics, and future likelihood for five behaviors: (1) suicidal ideation; (2) suicide plans; (3) suicide gesture; (4) suicide attempt; and (5) NSSI.

Similarly, future investigations would benefit from a broader assessment of impulsivity in this population, including self-report questionnaires, lab-based performance tests, as well as personality measures. One such personality-based measure is the UPPS impulsive behavior scale developed by Whiteside and Lynam (2001), which assesses four distinct facets of personality associated with impulsive behavior: (1) urgency; (2) lack of perseverance; (3) lack of premeditation; and (4) sensation seeking.

Importantly, there are many other known risk factors for self-harming behaviors that may provide more explanatory information about the ADHD-NSSI severity and ADHD-suicide attempt linkages. Potential factors for future inquiry might include family history of suicidal and NSSI behavior, stressful life events such as family and romantic conflicts, legal and disciplinary problems, chronic occupational stress, unemployment, and child maltreatment (for a review, see Nock et al., 2008). In particular, peer victimization may be a particularly salient risk factor for females with ADHD, who have been found to have elevated rates of both overt and relational peer victimization relative to comparison peers (Blachman, 2005; Cardoos & Hinshaw, 2011; Hinshaw, 2002; Wiener & Mak, 2009). There are multiple lines of research suggesting that overt and relational peer victimization is associated with long-term maladjustment in children and adolescents across multiple domains (Cullerton-Sen & Crick, 2005; Hodges & Perry, 1999, Lad & Lad, 2001). Adolescent girls who experience peer victimization appear to be at particular risk for negative outcomes, including NSSI and suicide attempts. (Hawker & Boulton, 2000; Hilt et al., 2008; Klomek, Marrocco, Kleinman, Schonfeld & Gould, 2008).

At the same time, it will be useful to explore protective factors that may decrease the probability of NSSI and suicide attempts in young women with ADHD. To date, no such studies have been conducted in ADHD samples. There is correlational evidence to suggest that religious beliefs, religious practice, and spirituality are associated with decreased probability of suicide attempts. In addition, perceptions of social and family support and connectedness are also associated with lower rates of suicidal behavior (Nock et al., 2008). Clearly this is an area worthy of further inquiry.

Overall, what do these findings tell us about the risk of NSSI and suicide attempts among young women with ADHD and what are the implications for clinical prevention and intervention? First, females with childhood diagnoses of both ADHD subtypes are at elevated risk for NSSI and suicide attempts in young adulthood, relative to comparison peers. In particular, young adult women with a childhood diagnosis of ADHD-C and those with a persistent ADHD diagnosis (of either subtype) in childhood through young adulthood appear to

be at highest risk. Second, as predicted, comorbid psychopathology mediates the association of childhood ADHD diagnosis and self-harming behaviors in young adulthood. Specifically, internalizing symptoms were more causally related to suicide attempts, while externalizing symptoms were more causally related to NSSI. Impulsivity, as measured by a lab-based task of response inhibition, also showed a causal relation with NSSI. These findings underscore the importance of thorough and frequent monitoring of self-harmful behaviors among girls with ADHD, and particularly those with the ADHD-C subtype and persistent diagnostic profiles. In addition, medication and/or skill building to reduce high levels of impulsivity as well as treatment of comorbid symptoms may help to reduce risk. It is my hope that this investigation and findings herein can advance efforts regarding the assessment and treatment of self-harmful behavior in young women with ADHD and provides the groundwork for important research and clinical directions.

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Table 1

Wave 3 Non-Suicidal Self-Harm and Suicide Attempts by Wave 1 ADHD Diagnostic Status

Dependent variable (DV)	Comparison		ADHD-I		ADHD-C		p^a	ES ^b and post-hoc			Covariates p^c
	<i>N</i>	<i>M</i> (SD)	<i>N</i>	<i>M</i> (SD)	<i>N</i>	<i>M</i> (SD)		0-1	0-2	1-2	
NSSI Frequency	78	0.9 (1.8)	38	2.0 (4.1)	80	3.5 (4.9)	.000	.35, ns	.71***	.33, ns	.029
NSSI Variety	79	0.3 (0.7)	38	0.6 (1.2)	81	1.1 (1.4)	.000	.28, ns	.35***	.20*	.022
NSSI Severity	79	.33 (.67)	38	.47 (.86)	81	1.1 (1.1)	.000	.20, ns	.85***	.64**	.014
Suicide Attempts	85	6.0%	39	7.0%	85	22.0%	.004	1.3, ns	4.5**	3.5*	.004

Note. ADHD = Attention-Deficit/Hyperactivity Disorder; ADHD-I = Attention-Deficit/Hyperactivity Disorder – Inattentive Type; ADHD-C = Attention-Deficit/Hyperactivity Disorder – Combined Type; 0 = Comparison; 1 = ADHD-I; 2 = ADHD-C; NSSI = Non-suicidal self-harm.

^aSignificance: ANOVA. ^b Effect size is Cohen's *d*, reflecting subgroup contrasts. ^c Significance: ANCOVA.

Table 2

Severity of Wave 3 Non-Suicidal Self-Injury By Wave 1 Subgroup Status

Subgroup		No NSSI	Low	Moderate	Severe
Comparison	Count	62	8	9	0
	% within subgroup	79%	10%	11%	0%
ADHD-I	Count	27	6	3	2
	% within subgroup	71%	16%	8%	5%
ADHD-C	Count	36	12	24	9
	% within subgroup	44%	15%	30%	11%

Note. ADHD = Attention-Deficit/Hyperactivity Disorder; ADHD-I = Attention-Deficit/Hyperactivity Disorder – Inattentive Type; ADHD-C = Attention-Deficit/Hyperactivity Disorder – Combined Type; 0 = Comparison; 1 = ADHD-I; 2 = ADHD-C; NSSI = Non-suicidal self-harm.

Table 3

Wave 3 Non-Suicidal Self-Harm and Suicide Attempts by Diagnostic Persistence

Dependent variable (DV)	No ADHD (W1/W3)		Transient ADHD (W1 or W3)		Persistent ADHD (W1 and W3)		p^a	ES ^b and post-hoc			Covariates p^c
	<i>N</i>	<i>M</i> (SD)	<i>N</i>	<i>M</i> (SD)	<i>N</i>	<i>M</i> (SD)		c-t	c-p	t-p	
NSSI Frequency	67	0.8 (1.7)	60	1.4 (2.5)	69	4.3 (5.4)	.000	.28, ns	.40***	.32***	.008
NSSI Variety	68	0.3 (0.6)	60	0.5 (0.9)	70	1.3 (1.5)	.000	.27, ns	.88***	.66***	.016
NSSI Severity	68	0.3 (0.7)	60	0.5 (0.9)	70	1.1 (1.1)	.000	.25, ns	.87***	.60***	.075
Suicide Attempts	73	4.0%	63	13%	72	22.0%	.005	3.4, ns	6.7**	2.0, ns	.012

Note. ADHD = Attention-Deficit/Hyperactivity Disorder; W1 = Wave 1; W3 = Wave 3; NSSI = Non-suicidal self-harm; c = lifetime comparison group; t = transient ADHD; p = persistent ADHD.

^aSignificance: ANOVA. ^b Effect size is Cohen's *d*, reflecting subgroup contrasts. ^c Significance: ANCOVA.

Table 4

Severity of Wave 3 Non-Suicidal Self-Injury By Diagnostic Persistence

Status		No NSSI	Low	Moderate	Severe
Lifetime Comparison	Count	62	8	9	0
	% within subgroup	79%	10%	11%	0%
Transient ADHD (W1 or W3)	Count	27	6	3	2
	% within subgroup	71%	16%	8%	5%
Persistent ADHD (W1 and W3)	Count	36	12	24	9
	% within subgroup	44%	15%	30%	11%

Note. ADHD = Attention-Deficit/Hyperactivity Disorder; W1 = Wave 1; W3 = Wave 3; NSSI = Non-suicidal self-harm.

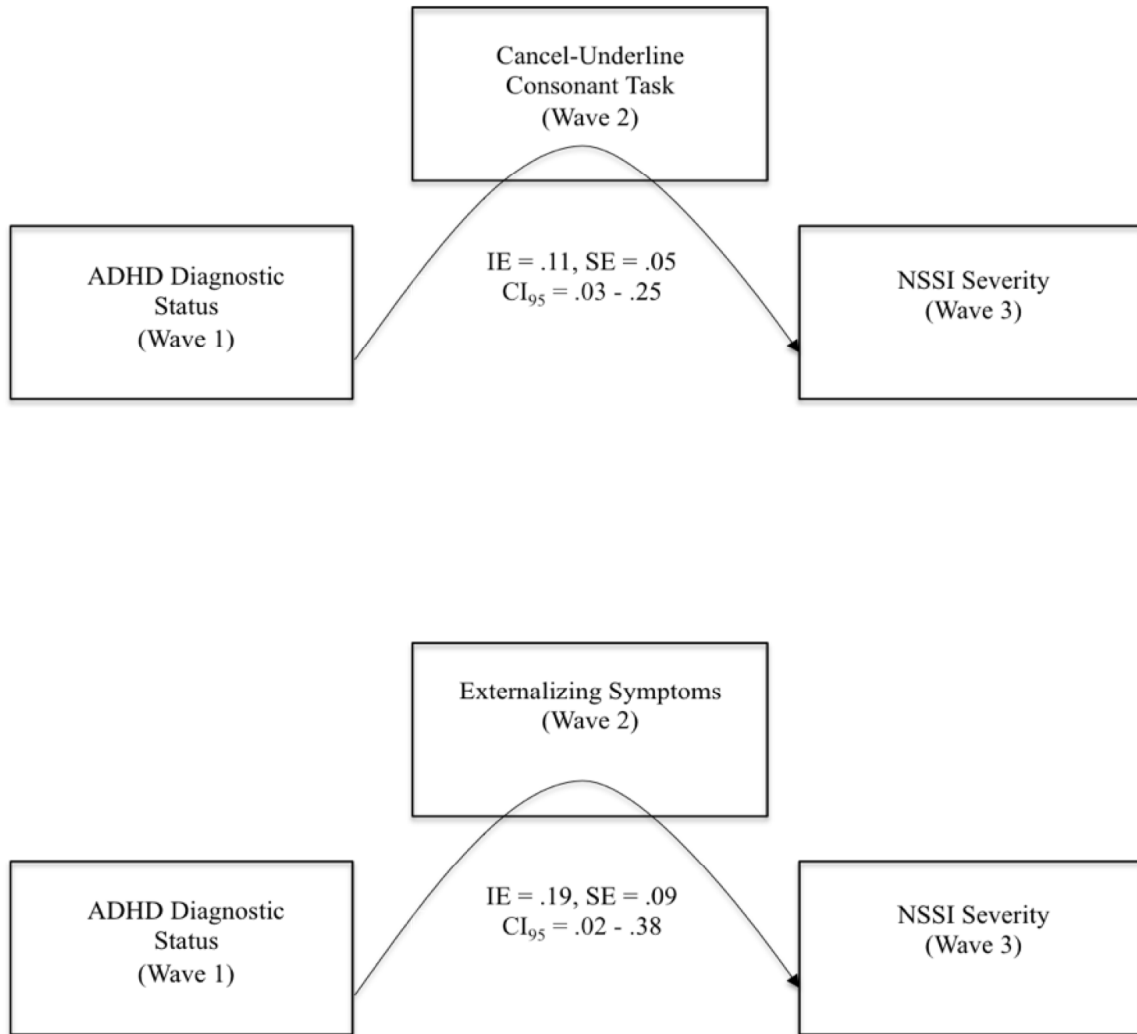


Figure 1. (top panel) The relation between Wave 1 ADHD diagnostic status and Wave 3 NSSI severity scores partially mediated by the Wave 2 Cancel Underline Consonant task. (bottom panel) The relation between Wave 1 ADHD diagnostic status and Wave 3 NSSI severity scores partially mediated by Wave 2 externalizing symptoms. (both panels) Data represents indirect effect and standard errors using 10,000 bootstrap samples to obtain bias-corrected and accelerated ninety-five percent confidence intervals.

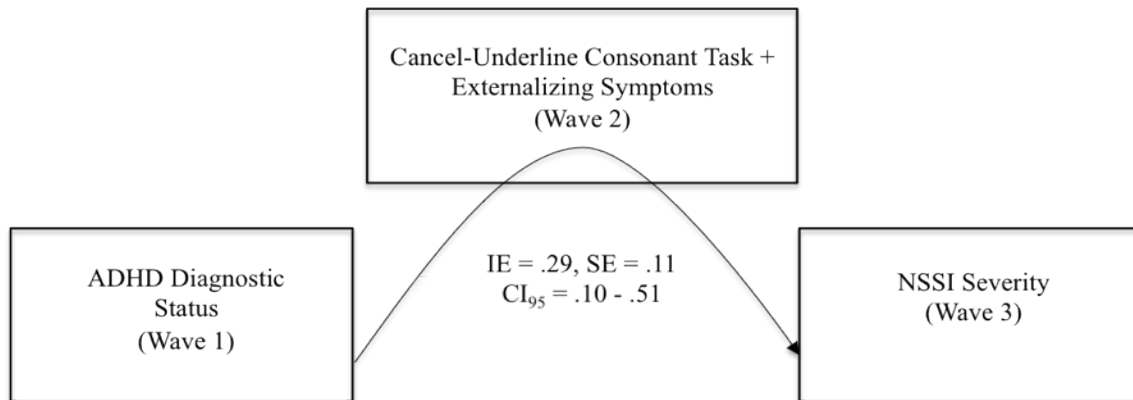


Figure 2. The relation between Wave 1 ADHD diagnostic status and Wave 3 NSSI severity scores mediated by the Wave 2 Cancel Underline Consonant task and Wave 2 externalizing symptoms. Data represents indirect effect and standard errors using 10,000 bootstrap samples to obtain bias-corrected and accelerated ninety-five percent confidence intervals.

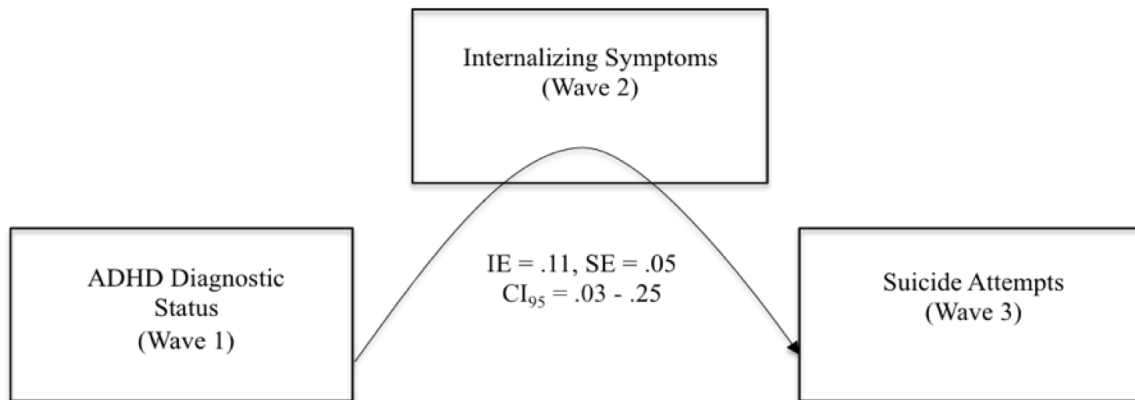


Figure 3. The relation between Wave 1 ADHD diagnostic status and Wave 3 suicide attempts mediated by Wave 2 internalizing symptoms. Data represents indirect effect and standard errors using 10,000 bootstrap samples to obtain bias-corrected and accelerated ninety-five percent confidence intervals.