HHS Public Access

Author manuscript

J Clin Child Adolesc Psychol. Author manuscript; available in PMC 2022 March 01.

Published in final edited form as:

J Clin Child Adolesc Psychol. 2021 ; 50(2): 267–280. doi:10.1080/15374416.2019.1678165.

Sluggish Cognitive Tempo and ADHD Symptoms in a Nationally Representative Sample of U.S. Children: Differentiation using Categorical and Dimensional Approaches

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Abstract

A nationally representative sample of U.S. children was used to determine the empirical and clinical differentiation of sluggish cognitive tempo (SCT) and attention-deficit/hyperactivity disorder (ADHD) symptoms using both categorical and dimensional approaches. Mothers of children (N = 2,056, $M \pm SD_{age}$ = 8.49±2.15 years, 49.3% girls) completed measures of SCT, ADHD, oppositional defiant disorder (ODD), anxiety, depression, sleep difficulties, daily life executive functioning, conflicted shyness, friendship difficulties, and social and academic impairment. Scores greater than the top 5% on SCT and ADHD measures were used to create SCT-only (n = 53, 2.58%), ADHD-only (n = 93, 4.52%), SCT+ADHD (n = 49, 2.38%), and comparison (n = 1,861, 90.52%) groups. Fifty-two percent of the SCT group did not qualify for the ADHD group, whereas 65% of the ADHD group did not qualify for the SCT group. The SCT-only group had higher levels of anxiety, depression, conflicted shyness, and sleep difficulties than the ADHD-only group. In contrast, the ADHD-only group had greater executive functioning deficits and higher ODD than the SCT-only group. SCT-only and ADHD-only groups showed similar levels of friendship, social, and academic impairment. Similar findings emerged when using structural regression analyses to determine the unique clinical correlates of SCT and ADHD dimensions. This is only the second study to examine the distinction of clinically-elevated SCT from ADHD in a national sample of children and extends previous findings to a broader array of functional outcomes. Normative information on the SCT scale also provides a validated rating scale to advance research and clinical care.

Keywords

ADHD; attention-deficit/hyperactivity disorder; comorbidity; depression; diagnosis; prevalence; sluggish cognitive tempo; functional impairment

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Growing evidence supports the differentiation of sluggish cognitive tempo (SCT) and attention-deficit/hyperactivity disorder (ADHD). SCT symptoms, which include excessive daydreaming, slowed behavior/thinking, staring into space, fogginess, and mental confusion, are distinct from both ADHD inattentive (ADHD-IN) and hyperactive-impulsive (ADHD-HI) symptoms (Becker, Leopold, et al., 2016). There is also evidence that SCT symptoms are largely heritable (Moruzzi, Rijsdijk, & Battaglia, 2014), trait-like starting in early childhood (Burns, Becker, Geiser, Leopold, & Willcutt, 2019), and prospectively associated with poorer functioning in adolescence (Becker, Burns, Leopold, Olson, & Willcutt, 2018). Further, SCT symptoms are associated with functional outcomes including poorer academic functioning, internalizing symptoms, and social difficulties (Becker, Leopold, et al., 2016).

Despite the growing research supporting the internal and external validity of SCT, only two studies have used large samples to examine whether children with clinical elevations in SCT-only, ADHD-only, and SCT+ADHD symptoms can be meaningfully identified. In particular, it is important to determine whether and at what prevalence rate there are children who display clinically-elevated SCT symptoms but without elevated ADHD symptoms. Further, if such groups can be identified, it is then necessary to evaluate whether these groups differ across domains of functioning.

Using parent ratings in a nationally representative sample of 1,800 U.S. children and adolescents, Barkley (2013) found that 59% of children meeting criteria for clinical SCT also had clinically elevated ADHD; conversely, 39% of children meeting criteria for clinical ADHD also had clinically elevated SCT.[1] More recently, Servera and colleagues (Servera, Sáez, Burns, & Becker, 2018) examined the distinction and overlap of elevated SCT and ADHD symptoms across mother, father, and teacher ratings in a school-based sample of 2,142 Spanish children. Largely consistent with Barkley's (2013) findings, Servera et al. (2018) found that, across informants, 44–54% of the elevated SCT group met criteria for elevated ADHD, whereas 27–35% of the elevated ADHD group met criteria for elevated SCT. Servera et al. (2018) further found that 28–46% of the children with elevated SCT symptoms did *not* meet criteria for either elevated ADHD *or* depression.[2]

These studies also found that children with SCT-only generally had greater internalizing symptoms, community-leisure impairment, and conflicted shyness compared to children with ADHD-only (Barkley, 2013; Servera et al., 2018). In contrast, children with ADHD-only had greater oppositional defiant disorder (ODD) symptoms and daily life executive functioning (EF) deficits than children with SCT-only (Barkley, 2013; Servera et al., 2018). In addition, Barkley (2013) used regression analyses to demonstrate that dimensional ADHD symptoms were more consistently associated than SCT symptoms with daily life EF deficits. However, the Barkley (2013) study did not examine internalizing and externalizing

[1]Barkley (2013) used a symptom count procedure (six or more ADHD-IN symptoms [percentile > 93.1] and six or more ADHD-HI symptoms [percentile > 95.2]) to define the clinical range on ADHD-IN and ADHD-HI. For SCT symptoms, Barkley (2013) selected a number of SCT symptoms that identified a similar percentage of the sample as for the ADHD-IN and HI dimensions (percentile > 95.2 for SCT). Impairment was not used to define the groups because impairment was an outcome measure.

[2]Servera et al. (2018) used the criterion of greater than the top 5% to define the clinical range for SCT, ADHD-IN, and ADHD-HI symptom dimensions, though similar findings were found when using a symptom count procedure. Impairment was again not used to define the groups because impairment was an outcome measure. The symptom count and greater than top 5% procedures yielded similar findings across Barkley (2013) and Servera (2018).

symptoms or conflicted shyness, whereas the Servera et al. (2018) study did not examine daily life EF. We sought to replicate these two previous studies by including all these domains and to extend these findings to additional domains of friendship and sleep difficulties. We also sought to determine if a dimensional approach (i.e., unique relative external correlates of SCT, ADHD-IN, and ADHD-HI factors) would replicate the findings from the clinical groups approach.

Objectives and Hypotheses

The seven objectives were to determine the (1) convergent and discriminant validity of SCT, ADHD-IN, and ADHD-HI symptoms, (2) independence of clinically-elevated SCT and ADHD groups, (3) external correlates of SCT-only, ADHD-only, and SCT+ADHD groups relative to each other and a comparison group, (4) independence of the clinically-elevated SCT group from clinically-elevated depression and from *both* clinically-elevated ADHD and depression groups, (5) demographic characteristics of groups, (6) *common and unique* external correlates of SCT, ADHD-IN, and ADHD-HI factors (a dimensional regression analysis as a follow-up to the categorical clinical groups analyses), and (7) establishment of normative data on the SCT rating scale. We now note the hypotheses:

1. **Convergent and discriminant validity of SCT and ADHD-IN symptoms.** SCT symptoms were expected to demonstrate substantial loadings on the SCT factor and loadings close to zero on the ADHD-IN and ADHD-HI factors with similar results for the ADHD-IN and ADHD-HI symptoms (high loadings on their respective factors and low loadings on the other two factors). Such results would establish convergent and discriminant validity of the symptom sets.

2. **Creation and independence of clinically-elevated SCT and ADHD symptom groups.** Objective two involved two sequential aspects. The first determined if clinical elevations (greater than the top 5%) on SCT, ADHD-IN, and ADHD-HI dimensions would identify SCT-only, ADHD-only, and SCT+ADHD groups. The second was to determine the independence of SCT and ADHD groups. It was expected that approximately 50% of the SCT group would be independent of the ADHD group whereas approximately 65% of the ADHD group would be independent of the SCT group (Barkley, 2013; Servera et al., 2018). The greater than the top 5% criterion was used to be consistent with the earlier study (Servera et al., 2018).

3. **Common and unique external correlates of SCT and ADHD groups.** A range of functional outcomes were used to replicate and extend previous studies examining the clinical differentiation of clinically-elevated SCT-only, ADHD-only, and SCT+ADHD groups (Barkley, 2013; Servera et al., 2018). We now note our predictions for these outcomes.

   Comparison vs. clinical groups. The SCT-only, ADHD-only, and SCT+ADHD groups were expected to have poorer functioning than the comparison group for all outcomes except one (the ADHD-only and comparison groups would not differ on conflicted shyness; Servera et al., 2018).

Psychopathology symptoms. The ADHD-only and SCT+ADHD groups should have higher ODD than the SCT-only group, whereas the SCT-only and SCT +ADHD groups should have higher anxiety and depression than the ADHD-only group (Barkley, 2013; Servera et al., 2018).

Sleep difficulties. The SCT-only and SCT+ADHD groups were expected to have more sleep difficulties than the ADHD-only group (Becker, Garner, & Byars, 2016).

Social impairment and academic impairment. The SCT-only, ADHD-only, and SCT+ADHD groups were expected to show similar levels of social and academic impairment. The SCT-only and SCT+ADHD groups, while not differing in conflicted shyness, should be higher in conflicted shyness than the ADHD-only group (Servera et al., 2018). Given the absence of research examining SCT and friendship, no hypothesis was made here.

Daily life EF. Increasing deficits in EF were expected across the SCT-only, ADHD-only, and SCT+ADHD groups for self-organization, self-restraint, self-motivation, and emotional regulation. The ADHD-only and SCT+ADHD groups, while not significantly differing, were expected to show greater deficits in time management than the SCT-only group (Barkley, 2013).

4. **Independence of SCT group from ADHD and depression groups.** Scores greater than the top 5% on the depression measure were used to create a depression group. Approximately 60% of the SCT group were expected *not* to be in the depression group with approximately 30% of the SCT group *not* being in the ADHD *or* depression groups (Servera et al., 2018).

5. **Demographic characteristics of SCT and ADHD groups.** The ADHD-only group was expected to contain significantly more boys than the comparison and SCT-only groups (Barkley, 2013; Servera et al., 2018). The four groups were also compared on children's age, race (White vs. other), ethnicity (Hispanic vs. non-Hispanic), and family structure (one parent vs. two parents) as well mothers' education and income. No predictions were made here.

6. **Unique associations of SCT, ADHD-IN, and ADHD-HI factors with other symptom and impairment factors.** SCT's unique relative associations with anxiety, depression, conflicted shyness, and sleep difficulties were expected to be larger than the unique relative associations for ADHD-IN and ADHD-HI (Sáez, Servera, Becker, & Burns, 2018). In contrast, ADHD-IN's and ADHD-HI's unique relative associations with ODD and daily life EF were expected to be larger than the unique relative associations for SCT (Barkley, 2013). Finally, SCT and ADHD-IN were expected to have similar unique relative associations with friendship difficulties, number of friends, and social impairment. Such results from the structural regression analysis would replicate the results from the clinical-groups analyses.

7. **Normative Data on SCT.** Providing norms for the SCT module of the Child and Adolescent Behavior Inventory (CABI), a frequently used parent-report

measures of SCT, is important for advancing research and clinical care. Our final objective was to provide such norms for clinicians and researchers.

Methods

Participants and Procedures

Qualtrics (www.qualtrics.com) leveraged partnerships with online panels to obtain a sample of mothers of kindergarten through sixth grade U.S. children whose characteristics were nationally representative of the latest U.S. census information. The goal was to obtain a sample of 2,100 children (300 per grade). Once a mother was identified as meeting the criteria for the study, the mother was presented with the informed consent form. A total of 62 mothers declined the invitation to participate in the study. Two questions were then used to improve the quality of the answers. The first question—*Do you commit to thoughtfully provide your best answers to each question in this survey?*—required a positive answer to move forward with the survey (i.e., *I will provide my best answers*). A positive answer was not provided by 82 mothers. The second question was an attention check question (i.e., *Please select "sometimes" for this question*). A failure to select "sometimes" resulted in the elimination of the mother. The attention check item was failed by 240 mothers with the final number of mothers being 2,056. Table 1 shows the characteristics of children ($M \pm SD_{age}$ = 8.49 ± 2.15 years) and mothers. The university's Institutional Review Board determined the research protocol was exempt from IRB review. The research protocol was then approved by the university's Department of Psychology.

Measures

Child and Adolescent Behavior Inventory (CABI) (Burns et al., 2015)

The CABI measures SCT (15 symptoms), DSM-5 ADHD-IN (nine symptoms), DSM-5 ADHD-HI (nine symptoms), DSM-5 ODD (eight symptoms), anxiety (six symptoms) depression (six symptoms), social impairment (six items: quality of interactions with parents, other adults, siblings, peers, visiting others homes, and community activities), friendship difficulties (five items: left out of activities by peers, teased by peers, difficulty making friends, difficulty keeping friends, and number of friends), and academic impairment (five items: quality of homework, reading skills, arithmetic skills, writing skills, and global academic skills). Bernad, Servera, Becker, and Burns (2016, Table 1) lists the anxiety and depression symptoms.

Symptoms were rated with 6-point anchors for the past month (0 = *almost never [never or about once per month], 1 = seldom [about once per week], 2 = sometimes [several times per week], 3 = often [about once per day], 4 = very often [several times per day],* and 5 = *almost always [many times per day]*. Social and academic impairment items were rated with 7-point anchors (0 = *severe difficulty*, 1 = *moderate difficulty*, 2 = *slight difficulty*, 3 = *average performance* [*average interactions*] *for grade level*, 4 = *slightly above average*, 5 = *moderately above average*, and 6 = *excellent performance* [*excellent interactions*] *for grade level*). Social and academic items were reverse keyed, so higher scores indicate more impairment. The four friendship difficulty items were rated with 5-point anchors (0 = *not at*

all, 1 = *seldom*, 2 = *sometimes*, 3 = *often*, 4 = *very often*). A single item assessed number of friends (0 = *no friends*, 1 = *1 friend*, 2 = *2 friends*, 3 = *3 friends*, 4 = *4 friends*, 5 = *5 or more friends*).

Earlier studies support the factor structure, reliability (internal consistency, test-retest, inter-rater), and validity of CABI scores (Becker, Burns, Schmitt, Epstein, & Tamm, 2019; Burns, Becker, Servera, Bernad, & García-Banda, 2017; Lee, Burns, & Becker, 2018; Sáez et al., 2018). The friendship difficulties scale and number of friends' item were new to this study. Cronbach's alpha (α) for SCT, anxiety, depression, ADHD-IN, ADHD-HI, ODD, social impairment, friendship difficulties, and academic impairment scores were .94, .86, .92, .96, .94, .95, .92, .90, and .93 for this study, respectively.

Barkley Deficits in Executive Functioning Scale—Child and Adolescent Short Form (BDEFS-CA SF) (Barkley, 2012a)

This scale assesses daily life EF in five areas: (1) time management (α = .90), (2) self-organization and problem-solving (α = .91), (3) self-restraint (α = .92), (4) self-motivation (α = .89), and (5) emotion regulation (α = .94). The 20 items were rated with 4-point anchors for the past 6-months (0 = *never or rarely*, 1 = *sometimes*, 2 = *often*, and 3 = *very often*). Higher scores represent greater deficits. Within our sample, the primary loadings of each item on its own scale was substantial with the cross-loadings close to zero. The five-factor model with our sample also resulted in a close fit, CFI = .997, SRMR = .009. The correlations among the five EF factors ranged from .62 (self-organization with emotion regulation) to .76 (time management to self-motivation), thus there was good to reasonable discrimination among the five daily EF factors within our sample. The manual provides psychometric information on the long version of the measure (Barkley, 2012a).

Child Social Preference Scale (CSPS) (Coplan, Prakash, O'Neil, & Armer, 2004)

The CSPS measures conflicted shyness with seven items (e.g., "My child will turn down social initiations from other children because he/she is shy") with the items rated with 5-anchors (0 = *not at all*, 1 = *seldom*, 2 = *sometimes*, 3 = *often*, 4 = *very often*, α = .88) (Coplan et al., 2004 for positive psychometric properties).

Children's Sleep Scale (CSS) (Becker & Burns, 2018)

The CSS was developed for this study with items modeled after other frequently-used measures of sleep problems (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989; Owens, Spirito, & McGuinn, 2000). Five items were used to measure sleep difficulties (*Goes to bed at the same time each night*, *Falls asleep within 20 minutes of going to bed*, *Wakes up more than once during the night*, *Has trouble getting out of bed in the morning*, and *Has trouble staying awake during the day* [e.g., *while watching TV or riding in the car*]) and one item assessing overall sleep quality (*How would you describe your child's overall sleep quality*?). Ratings were for the past month (sleep difficulties items: *0 = never*, *1 = rarely* [*once per week or less in the last month*], *2 = sometimes* [*2–3 times per week*], *3 = often* [*4–5 times per week*], and *4 = very often* [*6–7 times per week*]; and sleep quality item: *0 = very bad, 1 = pretty bad, 2 = fair, 3 = pretty good, and 4 = very good*). Higher scores represent greater sleep difficulties (α = .68, slightly lower than ideal).

Analytic Strategy

Factor and structural regression analyses used the Mplus software (version 8.1). Here the items were treated as categorical indicators (robust weighted least squares estimator). The ANOVA and chi-square analyses for the group comparisons used the Stata statistical software (version 14).

Results

Missing Information

Completion rate was greater than .998 for items with most completion rates being 1.00. For the group comparisons, if a scale had missing information, then the average of the other items was used for the scale score. This procedure allowed the inclusion of all 2,056 children. For factor and structural regression analyses, the WLSMV estimator uses a pairwise approach to missing information. Supplemental Table S1 shows the description information for the measures.

Convergent and Discriminant Validity of SCT, ADHD-IN, and ADHD-HI Symptoms

An a priori three-factor model with cross-loadings was applied to SCT, ADHD-IN, and ADHD-HI symptoms (exploratory confirmatory factor analysis with target rotation; Asparouhov & Muthén, 2009). This model yielded a close fit, χ^2 (432) = 6858, $p < .001$, CFI = .951, and SRMR = .031. Only two of the 528 standardized residuals in the residual matrix were larger than .10 (.138 and .151) with these results indicating no major localized ill-fit.

For SCT symptoms, mean loadings were .75 (*SD* = .10), .06 (*SD* = .06), and .03 (*SD* = .04) on the SCT, ADHD-IN, and ADHD-HI factors, respectively. For ADHD-IN symptoms, mean loadings were .76 (*SD* = .07), .02 (*SD* = .18), and .10 (*SD* = .09) on the ADHD-IN, SCT, and ADHD-HI factors, respectively. Finally, for ADHD-HI symptoms, mean loadings were .75 (*SD* = .09), .10 (*SD* = .07), and −.01 (*SD* = .17) on the ADHD-IN, ADHD-HI, and SCT factors, respectively. The symptoms thus showed convergent and discriminant validity. Supplemental Table S2 shows the individual symptom loadings. The correlation of SCT factor with the ADHD-IN and ADHD-HI factors was .73 (*SE* = .01) and .49 (*SE* = .02), respectively, with the ADHD-IN with ADHD-HI factor correlation being .67 (*SE* = .02).

Creation and Independence of SCT and ADHD groups

Creation of the groups—Scores greater than the top 5% on SCT (score ≥ 2.73, *n* = 102, 4.96%), ADHD-IN (score ≥ 4.22, *n* = 97, 4.72%), and ADHD-HI (score ≥ 4.11, *n* = 94, 4.57%) distributions defined the clinical range (possible score range 0 to 5). Cut scores for SCT, ADHD-IN, and ADHD-HI were 2.05, 2.16, and 2.17 standard deviations above their respective means. *Clinical scores were thus greater than two standard deviations above the means.*

The SCT-only group (*n* = 53, 2.58%) had scores greater than the top 5% on SCT but not greater than the top 5% on ADHD-IN *or* ADHD-HI. The ADHD-only group (*n* = 93, 4.52%) had scores greater than the top 5% on ADHD-IN *or* ADHD-HI but not greater than the top

5% on SCT. The SCT+ADHD group (n = 49, 2.38%) had scores greater than the top 5% on SCT *and* greater than the top 5% on ADHD-IN *or* ADHD-HI. The comparison group (n = 1,861, 90.52%) consisted of all other children (scores not greater than the top 5% on SCT, ADHD-IN, or ADHD-HI). A total of 142 children (6.9%) met our criteria for ADHD (34% inattentive presentation, 32% hyperactive/impulsive presentation, and 34% combined presentation) and 102 children (4.96%) met our criterion for SCT.[3]

Independence of the groups—Of 102 children in the SCT group, 49 (48%) were also in the ADHD group. For these 49 children, 18 (37%) qualified for the ADHD-IN presentation (> top 5% of IN dimension), 5 (10%) qualified for the ADHD-HI presentation (> top 5% of HI dimension), and 26 (53%) qualified for the ADHD-combined presentation (> top 5% for IN *and* HI dimensions). Of the 142 children in the ADHD group, 49 (35%) were also in the SCT group. To summarize, 52% of the SCT group did *not* qualify for the ADHD group, whereas 65% of the ADHD group did *not* qualify for the SCT group.[4]

SCT, ADHD-IN, and ADHD-HI means for groups—Table 2 shows SCT, ADHD-IN, and ADHD-HI means for the comparison, SCT-only, ADHD-only, and SCT+ADHD groups. *These means reflect the group creation procedures.* First, the comparison group had significantly (per-comparison $p_a < .008$ for the six comparisons per measure, Bonferroni correction) lower SCT, ADHD-IN, and ADHD-HI scores than the SCT-only, ADHD-only, and SCT+ADHD groups. Second, the SCT-only and SCT+ADHD groups, while not differing significantly on SCT, both were significantly higher on SCT than the ADHD-only group. Third, the ADHD-only and SCT+ADHD groups, while not differing significantly on ADHD-HI, both had significantly higher ADHD-HI scores than the SCT-only group. Fourth, the SCT+ADHD group had significantly higher ADHD-IN scores than the ADHD-only and SCT-only groups with the ADHD-only group having significantly higher ADHD-IN scores than the SCT-only group.

Common and Unique External Correlates for the SCT and ADHD Groups—Table 3 shows the correlates associated with group membership. A per-comparison alpha of $p_a < .008$ was used for the six subsequent tests per measure (Bonferroni correction) subsequent to a significant F value ($p < .001$).

Externalizing behaviors—The three clinical groups were significantly higher in ODD than the comparison group. In addition, the ADHD-only and SCT+ADHD groups were significantly higher in ODD than the SCT-only group with the SCT+ADHD group also being significantly higher in ODD than the ADHD-only group.

Internalizing behaviors—The three clinical groups had significantly higher anxiety and depression than the comparison group. The SCT+ADHD group had significantly higher

[3]The current study used the same criterion (greater than top 5%) to form the groups as Servera et al. (2018) to allow a direct comparison with the results with the Spanish children. The current study also used Barkley's (2013) symptom count procedure to create the groups in a secondary analysis. The symptom count procedure yielded the same results as the greater than top 5% procedure reported in this paper.

[4]The sample was not large enough to perform the analyses on all eight possible groups—(1) comparison (n = 1,861), (2) SCT-only (n = 53), (3) IN-only (n = 30), (4) HI-only (n = 40), (5) IN & HI (n = 23), (6) SCT & IN (n = 18), (7) SCT & HI (n = 5), and (8) SCT, IN, & HI (n = 26).

anxiety and depression than the SCT-only and ADHD-only groups with the SCT-only group also having significantly higher anxiety and depression than the ADHD-only group.

Sleep difficulties—The three clinical groups had significantly more sleep difficulties than the comparison group. Although the SCT+ADHD and SCT-only groups did not differ significantly, both had significantly greater sleep difficulties than the ADHD-only group.

Social difficulties—The SCT-only and SCT+ADHD groups were significantly higher in conflicted shyness than the comparison group (the ADHD-only and comparison groups did not differ significantly on conflicted shyness). Although the SCT-only and SCT+ADHD groups did not differ, both were significantly higher on conflicted shyness than the ADHD-only group. All three clinical groups had significantly more friendship difficulties, fewer friends, and greater social impairment than the comparison group. For friendship difficulties, the SCT+ADHD and ADHD-only groups, while not differing significantly, were both significantly higher on friendship difficulties than the SCT-only group. Finally, the three clinical groups had significantly higher levels of social impairment and fewer friends than the comparison group with the three clinical groups not differing significantly.

Academic impairment—The three clinical groups were significantly higher in academic impairment than the comparison group with the three clinical groups not differing significantly.

EF deficits—The three clinical groups were significantly higher than the comparison group on the five EF deficits measures. The ADHD-only and SCT+ADHD groups were significantly higher in deficits in time management and self-restraint than the SCT-only group but did not differ significantly from each other. For self-motivation and emotion regulation, the SCT+ADHD group showed significantly higher deficits than the ADHD-only and SCT-only groups with the ADHD-only group being significantly higher than the SCT-only group. For self-organization and problem-solving, the SCT+ADHD group showed significantly higher deficits than the SCT-only and ADHD-only groups with the SCT-only and ADHD-only group not differing significantly from each other.[5]

Independence of the SCT Group from ADHD and Depression Groups—The percentage of children with scores greater than the top 5% on the depression measure was 2.10%, 34.96%, 11.83%, and 51.02% for the comparison, SCT-only, ADHD-only, and SCT +ADHD groups, respectively. For the SCT-only group, 65.04% did not thus qualify for the depression group while 34.31% did not qualify for either the clinically-elevated ADHD *or* depression groups.

[5]Supplemental Table S3 examines the differences on the external correlates for the comparison (n = 1,861), SCT-only (n = 53), IN-only (n = 30), and HI-only (n = 40) groups, thus allowing a comparison of SCT-only and IN-only groups. SCT-only group had significantly (p < .05) *higher* scores on depression, sleep difficulties, and shyness than the IN-only group whereas the SCT-only group had significantly (p < .05) *lower* scores than the IN-only group on ODD as well as time management, self-restraint, and self-motivation deficits in daily EF. These findings indicate group differences in these domains reported in the main text were not due to creating an ADHD group based on elevations in ADHD-IN and/or ADHD-HI.

Sex Differences across SCT and ADHD Groups—Group membership varied significantly as a function of children's sex, χ^2 (3) = 11.24, p = .01, comparison group: 50% boys, SCT-only group: 50% boys, SCT+ADHD group: 61% boys, and ADHD-only group: 66% boys. The ADHD-only group had significantly more boys than the SCT-only and comparison groups.

Demographic Characteristics of SCT and ADHD Groups—The four groups did not differ significantly (ps > .001) on children's age, race (White vs. other), and ethnicity (Hispanic vs. non-Hispanic) as well as family structure (two parents vs. one parent), family income, mother's age, and mother's education.

Diagnoses Associated with SCT and ADHD Groups—Mothers indicated if their child had received a professional diagnosis from a list of mental and developmental disorders. Only Attention Deficit Disorder (ADD)/ADHD (13.33%), oppositional defiant disorder (ODD)/conduct disorder (CD) (2.53%), anxiety disorders (6.47%), depressive disorders (2.24%), autism/autism spectrum disorders (4.67%), reading disorder (2.24%), and language delay (3.75%) had occurrences greater than 2.00%. The other disorders had rates too low for analysis (bipolar disorder 0.68%; sleep disorders 1.02%; math disorder: 1.07%; spelling disorder: 0.88%; writing disorder: 1.12; intellectual disability: 1.02%).

Supplemental Table S4 shows the variation of the ADD/ADHD, ODD/CD, anxiety, depressive, autism, reading, and language delay disorders as a function of group membership. The overall χ^2 evaluation was significant (ps < .001) for the ADD/ADHD, ODD/CD, anxiety, depressive, and autism disorders. The SCT-only group had significantly fewer ODD/CD diagnoses than the ADHD-only group and did not differ from the comparison group. The SCT-only and ADHD-only groups also differed in the expected manner on ADD/ADHD, anxiety, and depression disorders yet none of these comparisons were significant. Supplemental Table S4 shows all the non-significant and significant differences. These findings should be considered tentative due to the small number of cases in the three clinical groups.

Unique Relative Associations of SCT, ADHD-IN, and ADHD-HI Factors with Other Symptom and Impairment Factors

Supplemental Table S5 shows the first order correlations of the SCT, ADHD-IN, and ADHD-HI factors with the other symptom and impairment factors. Of greater interest, Table 4 shows the partial standardized regression coefficients for the unique relative associations of SCT, ADHD-IN, and ADHD-HI factors with the other symptom and impairment factors. The significant level for the coefficients was set at p < .001 given the large size of the sample.

Externalizing symptom factor—Higher scores on SCT, ADHD-IN, and ADHD-HI were uniquely associated with significantly higher scores on ODD (β = .07, SE = .02, β = .33, SE = .02, and β = .48, SE = .02, respectively). However, compared to SCT, the unique relative relationships were five to seven times larger for ADHD-IN and ADHD-HI, respectively.

Internalizing symptom factors—Higher scores on SCT, ADHD-IN, and ADHD-HI were uniquely associated with significantly higher scores on anxiety (β = .53, SE = .03, β = .14, SE = .03, and β = .16, SE = .02, respectively). Higher scores on SCT and ADHD-IN were uniquely associated with significantly higher scores on depression (β = .58, SE = .03, and β = .23, SE = .03, respectively), whereas ADHD-HI was not (β = .02, SE = .03). SCT had a larger unique relative association than ADHD-IN and ADHD-HI with anxiety and depression.

Sleep difficulties factor—Higher scores on SCT were uniquely associated with significantly higher levels of sleep difficulties (β = .42, SE = .03) whereas ADHD-IN and ADHD-HI did not have significant unique associations (β = .12, SE = .04, and β = .02, SE = .03, respectively).

Social impairment factors—Higher scores on SCT were uniquely associated with significantly higher scores on conflicted shyness (β = .43, SE = .03) whereas ADHD-IN and ADHD-HI did not have a significant unique association with conflicted shyness (β = .08, SE = .04, and β = −.09, SE = .03). SCT's unique relative association with conflicted shyness was approximately five times larger than ADHD-IN and ADHD-HI.

Higher scores on SCT and ADHD-IN were uniquely associated with significantly higher levels of friendship difficulties (β = .33, SE = .03 and β = .27, SE = .03, respectively), fewer friends (β = −.14, SE = .03 and β = −.21, SE = .04, respectively), and social impairment (β = .13, SE = .03, and β = .34, SE = .03, respectively). ADHD-HI did not have a significant unique relationship with friendship difficulties (β = −.09, SE = .03), number of friends (β = .00, SE = .03), or social impairment (β = .06, SE = .03).

Daily life EF deficits—Higher scores on ADHD-IN were uniquely associated with significantly greater deficits in time management (β = .75, SE = .03), self-organization and problem solving (β = .32, SE = .03), self-restraint (β = .40, SE = .03), self-motivation (β = .73, SE = .03), and emotion regulation (β = .38, SE = .03) with ADHD-HI uniquely associated with significantly greater deficits in self-organization and problem solving (β = .12, SE = .03), self-restraint (β = .43, SE = .03), and emotion regulation (β = .29, SE = .02). SCT, in contrast, only had a significant unique association with higher deficits in self-organization and problem solving (β = .43, SE = .03) and emotion regulation (β = .11, SE = .03). SCT thus had much smaller unique relative associations than ADHD-IN and ADHD-HI with EF deficits, especially ADHD-IN, with the one exception that SCT and ADHD-IN had similar unique relative associations with self-organization and problem-solving deficits.

Academic impairment factor—Higher scores on ADHD-IN were uniquely associated with significantly higher levels of academic impairment (β = .59, SE = .03) whereas SCT and ADHD-HI did not have a significant unique association (β = .03, SE = .03 and β = −.05, SE = .03, respectively)[6]

[6]All the structural regression analyses were repeated controlling for the association of child's sex, age, race (White vs. other), ethnicity (Hispanic vs. other) along with family structure (one parent vs. two parents), family income, mother's age and education with the three predictors (SCT, ADHD-IN, and ADHD-HI) and all the outcomes. All the significant and non-significant unique effects in

Supplemental Analyses

Invariance of SCT, ADHD-IN, and ADHD-HI symptoms across boys and girls

An a priori three-factor model with cross-loadings resulted in a close fit with no decrement in fit indices when constraints were imposed on like symptom loadings and thresholds across boys and girls, baseline model: χ^2 (864) = 6693, $p < .001$, CFI = .956, and SRMR = .032; constrained model: χ^2 (1083) = 4521, $p < .001$, CFI = .974, and SRMR = .033. Boys and girls did not differ significantly on the SCT factor mean ($d = .01$, $SE = .05$, $p > .10$). Although boys had significant higher ADHD-IN and ADHD-HI factor means than girls, the effect sizes were small ($d = .23$, $SE = .05$, $p < .001$; $d = .20$, $SE = .05$, $p < .001$, respectively).

Relationships of SCT, ADHD-IN, and ADHD-HI factors with child and mother demographic variables

Supplemental Table S6 shows the correlations of the SCT, ADHD-IN, and ADHD-HI factors with child's race (White vs. other), ethnicity (Hispanic vs. non-Hispanic), age, and family structure (two parents vs. one parent) as well as mother's age, education, and income. These *d* values or the correlations were either non-significant or, if significant, reflected trivial or small effects.

Normative Information for the SCT Measure

The mean total score for SCT was 14.61 ($SD = 12.81$, range = 0–75). Boys and girls did not differ significantly (boys: $M = 14.82$, $SD = 13.10$, $n = 1{,}042$, range = 0–75; girls: $M = 14.40$, $SD = 12.62$, $n = 1{,}014$, range = 0–75; $t(2054) = 0.74$, $p = .46$, $d = .03$). The correlation of children's age with SCT was .09 ($p = .009$) for boys and .10 ($p = .002$) for girls. Table 5 shows the normative information for the total sample given boys and girls did not differ on SCT and there was only a small association between age and SCT.

Discussion

The study replicates and extends research on SCT in several important ways. First, this is only the second study to use a nationally representative sample of U.S. children, making it unlikely that findings are due to demographic, geographic, or ascertainment biases. Second, this study provides compelling replication of two studies (Barkley, 2013; Servera et al., 2018) that also aimed to identify children with elevated SCT and ADHD symptoms, both in isolation and co-occurrence. The replication provided in this study is especially important given the importance of replicating findings across multiple samples when determining the nature of psychopathology and broader concerns about replicability in psychology. Third, the study extends findings from these two previous studies by comparing the clinical groups across a larger number of functional outcomes, including internalizing symptoms, academic and social impairment, daily life EF, friendship, and sleep. Fourth, the dimensional analyses

Table 4 remained the same with one exception, the ADHD-HI unique association with friendship difficulties changed from non-significant ($p > .001$) to significant ($p < .001$).

yielded findings consistent with the clinical-groups findings. Fifth, this study provides normative data for the parent CABI SCT module, a frequently-used measure of SCT.

Prevalence Rates and Independence of Clinically-Elevated SCT and ADHD Symptoms

As in studies in U.S. (Barkley, 2013) and Spain (Servera et al., 2018), children can be identified who have clinically-elevated ADHD *or* SCT symptoms, as well as children clinically-elevated on both. Our prevalence rate of an SCT-only group (2.58%) was remarkably consistent with both Barkley (2013; 2.3%) and Servera et al. (2018; 2.30% to 2.80%). In addition, our rate of a co-occurring SCT+ADHD group (2.38%) was generally in line with the previous studies (3.33%, Barkley, 2013; and 2.09–2.67%, Servera et al., 2018). Our prevalence rate of an ADHD-only group (4.52%) was also similar to earlier studies (5.28%, Barkley, 2013; and 4.97–5.74%, Servera et al., 2018). Even with different countries, different age ranges, slightly different measures of SCT, and different group creation procedures, the three studies yielded highly similar prevalence rates.

Additional studies need to examine whether these groups (SCT-only, ADHD-only, SCT +ADHD) demonstrate stability or, akin to ADHD presentations, may emerge at certain developmental points but lack consistency over time. Finding a *stable* SCT-only group would provide particularly compelling evidence for SCT as a clinically identifiable syndrome and possible diagnosis separate from ADHD (Becker & Willcutt, 2019). In any event, findings across the three studies indicate that approximately 2.5% of children have elevated SCT symptoms without elevated ADHD symptoms, and that elevated SCT *and* ADHD symptoms occur in another 2–3%.

Unique and Similar Clinical Correlates in Children with Clinically-Elevated SCT or ADHD Symptoms

Children with clinically-elevated SCT or ADHD symptoms have distinct patterns of correlates. Particularly novel is our examination of friendship which was not examined in the previous studies. Children with ADHD have fewer friends and poorer-quality friendships than children without ADHD (Mikami, 2010), and we found no differences in the number of friends between children in SCT-only, ADHD-only, and SCT+ADHD groups as well as no differences in friendship difficulties for SCT-only and ADHD-only, though all three groups had fewer friends and more friendship difficulties than comparison children. In addition, children in SCT+ADHD group had more friendship difficulties than children with either SCT-only or ADHD-only groups. Although either aggressive or withdrawn behaviors may cause friendship difficulties, findings from previous studies indicate that children with ADHD who have co-occurring SCT symptoms display *less* aggression and greater withdrawal (Carlson & Mann, 2002; Marshall, Evans, Eiraldi, Becker, & Power, 2014). Consistent with these findings, children in the SCT-only and SCT+ADHD groups had greater conflicted shyness than comparison children or ADHD-only children.

SCT and ADHD symptom groups also differed in expected ways in their co-occurring externalizing and internalizing symptoms (Barkley, 2013; Servera et al., 2018). Children with ADHD had greater ODD symptoms than children with SCT, and children with SCT had greater anxiety and depressive symptoms than children with ADHD-only. Given these

findings, social skills training and cognitive-behavioral treatment may be beneficial for children with SCT despite lacking compelling support for children with ADHD (Becker, Garner, Tamm, Antonini, & Epstein, 2019). Studies have also found atomoxetine to be effective for youth with ADHD who have co-occurring internalizing symptoms (Bangs et al., 2007; Geller et al., 2007; Kratochvil et al., 2005) and to reduce SCT symptoms in adolescents with ADHD (McBurnett et al., 2017; Wietecha et al., 2013).

Another novel contribution was the inclusion of sleep difficulties. Children with SCT, with or without ADHD, had more sleep difficulties than children with ADHD-only, who in turn had more sleep difficulties than comparison children. In addition, only the SCT dimension had a unique relationship with sleep difficulties in the regression analyses. Previous studies have found only SCT symptoms (Becker, Garner, et al., 2016; Markovich-Pilon, Corkum, & Joyce, 2017), only ADHD symptoms (Lee, Burns, & Becker, 2017), or both SCT and ADHD symptoms (Becker, Luebbe, & Langberg, 2014; Becker, Pfiffner, Stein, Burns, & McBurnett, 2016; Langberg et al., 2017) to be uniquely associated with poorer sleep and increased daytime sleepiness. Our findings add to this mixed literature by demonstrating children with SCT to have more sleep problems than children with ADHD-only, with no differences in sleep difficulties between children with SCT-only and SCT+ADHD.

Finally, children with ADHD, with or without SCT, had greater daily life EF deficits than children with SCT-only across all EF domains with the exception of the self-organization and problem-solving domain. These findings are consistent with Barkley's (2013) study that also found ADHD more strongly related than SCT to daily life EF deficits, though the strongest association of SCT with EF deficits in his study was also with the self-organization and problem-solving subscale. Self-organization and problem-solving EF deficits were also associated with SCT in adults (Barkley, 2012b; Becker, Burns, Garner, et al., 2018; Jarrett, Rapport, Rondon, & Becker, 2017), suggesting that this domain of daily life EF may be most consistently impaired in individuals with SCT. In addition, there is evidence that SCT symptoms are related to executive dysfunction characterized by overly-slow working memory systems and overly-fast inhibition systems, with findings robust to control of IQ (Kofler et al., 2019). Nevertheless, additional studies are needed that examine both daily life and task-based EF, with particular attention to how findings vary across these different methods and whether ADHD status or cognitive ability moderates the relation between SCT and EF.

It was also encouraging that the findings from the dimensional approach were very consistent with the findings from the clinical groups approach. In other words, the unique relative associations of the SCT, ADHD-IN, and ADHD-HI factors with the external correlate factors yielded similar conclusions. One strength of the study was the similar results across the categorical and dimensional procedures, thus yielding stronger support for the external validity of SCT.

What is the Nature of SCT?

The current study builds upon a foundation of studies aiming to better understand the SCT construct. As studies accumulate, it is important to use descriptive findings to build conceptual models of SCT. The clearest findings in the current study demonstrate SCT –

whether defined categorically or dimensionally – to be associated with depression, anxiety, conflicted shyness, and sleep problems. Accordingly, our findings join a growing body of research indicating that SCT likely fits within the internalizing spectrum of psychopathology and yet, given its strong association with ADHD inattention specifically, may be important for understanding heterotypic co-occurrence between internalizing and externalizing spectra (Becker & Willcutt, 2019). Empirical findings further suggest that default mode network connectivity (Camprodon-Rosanas et al., 2019) and physiological under arousal (Yung, Lai, Chan, Ng, & Chan, 2019) may be involved in the pathophysiology of SCT, in addition to temperament and personality domains linked to punishment sensitivity and negative affect (Becker et al., 2013; Becker, Schmitt, et al., 2018). Longitudinal studies that incorporate multiple levels of analysis (e.g., behavior, physiology) are needed to understand the developmental interplay of SCT and internalizing psychopathology over time, as well as whether SCT is a buffer against subsequent externalizing psychopathology. Studies using multiple timepoints will be especially well-suited to examine mechanisms that may account for longitudinal associations.

Normative SCT Data

The study provides the first normative data for the parent SCT measure. The CABI SCT scale is a frequently-used measure but has until now lacked normative data, and inquiries regarding norms from clinicians and researchers were in part the impetus for our study. We hope the normative information from the current sample will help advance research across independent investigative teams and inform clinical care for children. For example, a recent trial of children with ADHD found that those who had co-occurring SCT symptoms were more likely to be non-responders or have a poorer response to methylphenidate (Froehlich et al., 2018). As noted above, another trial found that atomoxetine effectively reduces SCT symptoms (McBurnett et al., 2017; Wietecha et al., 2013). These findings, if replicated, have important implications for the assessment and treatment of children with ADHD. This is but one example of how identifying children with clinically-elevated SCT based on normative data could be used to advance both research and clinical care.

Limitations and Future Directions

Several limitations merit consideration. First, the study was cross-sectional, and such precludes inferences about directionality. Although few in number, longitudinal studies using continuous measure of SCT indicate that SCT is a stable trait (Burns et al., 2019; Preszler et al., 2019) and predicts later internalizing symptoms, social impairment and withdrawal, and reading difficulties (Becker, Burns, Leopold, et al., 2018; Becker, Webb, & Dvorsky, 2019; Bernad et al., 2016). Other studies, however, are needed to prospectively examine the longitudinal outcomes of children with clinically-elevated SCT. Second, this study relied solely on maternal ratings of adjustment, and other studies can build upon this work by incorporating multiple informants and diverse methods such as academic and neurocognitive testing, actigraphy and polysomnography, and neurophysiology and neuroimaging. Third, it is important to acknowledge that our groups were based on clinically-elevated symptoms as opposed to formal diagnosis. Relatedly, like Barkley (2013), functional impairment was not considered as a criterion for our clinically-elevated symptom

groups since impairment was instead examined as a clinical outcome of interest. We cannot presume that our findings will generalize to children diagnosed with ADHD using full DSM criteria, and it is likewise important to acknowledge that SCT is not currently a formal, recognized diagnosis (see Barkley, 2014; Becker & Willcutt, 2019; and Servera et al., 2018) for a discussion of the diagnostic status of SCT). Fourth, although the age range of our sample is not a limitation per se, there is a need for studies examining the clinical presentation and correlates of SCT in adolescence.

Conclusions

Our findings join a growing body of work supporting the statistical and clinical differentiation of SCT from ADHD symptoms. The current study used a nationally representative sample and examined the broadest array of outcomes yet to show that children with clinically elevated SCT symptoms have a unique profile of adjustment that is especially characterized by increased anxiety and depressive symptoms, sleep difficulties, and conflicted shyness. In contrast, children with clinically-elevated ADHD symptoms (with or without SCT) display more ODD symptoms and have greater daily life EF deficits than children with SCT-only. Similar results were found when using a dimensional approach, bolstering confidence in the study findings. Future studies are needed across other units of analysis to further differentiate SCT and ADHD, and there is a growing need for prevention and intervention research that directly targets SCT and associated impairments.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

Stephen Becker is supported by award number K23MH108603 from the National Institute of Mental Health (NIMH). The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIMH.

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Table 1

Characteristics (Percentages) of Children and Mothers

Children	%	Mothers	%
Sex			
Male	50.68	Education	
Female	49.32	Less than high school	2.53
		High school/GED	20.82
Grade		Some college	20.96
Kindergarten	15.32	2 years college	14.06
First	14.06	4-year degree	23.25
Second	14.11	Master's degree	7.73
Third	14.11	Professional/doctoral degree	1.65
Fourth	14.35		
Fifth	13.76	Mothers' Relationship Status	
Sixth	14.30	Married	66.68
		Divorced	7.30
Race		Cohabiting	11.48
American Indian/Alaskan Native	1.02	Separated	2.09
Asian	5.50	Single	12.45
Black/African American	10.85		
Native Hawaiian/Pacific Islander	0.29	Family Income	
White	72.08	Up to $19,999	11.77
Biracial/Multiracial	10.26	$20,000 to $39,999	22.52
		$40,000 to $59,999	22.57
Ethnicity		$60,000 to $79,999	15.81
Hispanic/Latino	16.80	$80,000 to $99,999	11.38
Non-Hispanic/Latino	83.20	$100,000 to $119,999	6.71
		$120,000 to $139,999	3.75
		$140,000 or higher	5.30
		Missing	0.19

Note. $N = 2,056$.

Table 2

ADHD and SCT Symptom Means for Comparison (n=1,861),SCT (n=53),ADHD (n=93),and SCT+ADHD (n=49) Groups

	1. Comparison		2. SCT		3. ADHD		4. SCT+ADHD				
Measure	***M***	***SE***	***M***	***SE***	***M***	***SE***	***M***	***SE***	***F***	**Contrasts**	***Eta*^{2}**
ADHD-IN	1.21^{a}	0.02	3.05^{b}	0.13	4.00^{c}	0.09	4.54^{d}	0.06	442 *	1 < 2 < 3 < 4	.39
ADHD-HI	1.20^{a}	0.02	2.29^{b}	0.15	3.98^{c}	0.11	3.97^{c}	0.16	344 *	1 < 2 < 3, 4	.33
SCT	0.82^{a}	0.02	3.18^{b}	0.06	1.64^{c}	0.07	3.43^{b}	0.08	504 *	1 < 3 < 2, 4	.42

Note. Row means with different superscripts differ significantly at $p < .008$ to maintain a $p < .05$ for the six-comparisons (Bonferroni correction). ADHD=attention-deficit/hyperactivity disorder. IN=inattention; HI=hyperactivity/impulsivity, SCT=sluggish cognitive tempo.

* $p<.001$.

Table 3

External Correlate Differences between Comparison (n=1,861), SCT (n=53), ADHD (n=93), and SCT+ADHD (n=49) Groups

External Correlates	1. Comparison		2. SCT		3. ADHD		4. SCT+ADHD				
	M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*F*	Contrasts	Eta^2
Psychopathology Symptoms											
Oppositional defiant disorder	1.10^a	0.02	2.15^b	0.18	3.32^c	0.14	3.91^d	0.14	244*	1 < 2 < 3 < 4	.26
Anxiety	0.78^a	0.02	2.07^b	0.18	1.70^c	0.12	3.01^d	0.17	176*	1 < 3 < 2 < 4	.20
Depression	0.45^a	0.02	1.58^b	0.18	1.09^c	0.11	2.61^d	0.21	196	1 < 3 < 2 < 4	.22
Sleep											
Sleep Difficulties	1.05^a	0.01	1.66^b	0.10	1.28^c	0.07	1.88^b	0.10	49*	1 < 3 < 2, 4	.07
Social Functioning											
Conflicted Shyness	1.18^a	0.02	1.93^b	0.10	1.39^a	0.10	2.29^b	0.14	41*	1, 3 < 2, 4	.06
Friendship difficulties	0.80^a	0.02	1.87^b	0.14	1.73^b	0.12	2.37^c	0.15	103*	1 < 2, 3 < 4	.13
Number of friends	3.07^a	0.03	2.09^b	0.20	2.24^b	0.16	2.00^b	0.19	26*	1 >2, 3,4	.04
Social impairment	2.10^a	0.03	2.97^b	0.19	3.08^b	0.14	3.38^b	0.22	37*	1 <2, 3,4	.05
Academics											
Academic impairment	2.15^a	0.03	3.23^b	0.19	3.54^b	0.15	3.74^b	0.26	50	1 <2, 3,4	.07
Daily Life Executive Functioning											
Time management	1.08^a	0.02	1.99^b	0.10	2.38^c	0.07	2.73^c	0.07	162	1 < 2 < 3, 4	.19
Self-organization	0.62^a	0.02	1.88^b	0.11	1.64^b	0.08	2.56^c	0.09	219*	1 < 2, 3 < 4	.24
Self-restraint	0.90^a	0.02	1.73^b	0.12	2.45^c	0.07	2.58^c	0.07	190	1 < 2 < 3, 4	.22
Self-motivation	0.82^a	0.02	1.68^b	0.11	2.03^c	0.08	2.52^d	0.10	162	1 < 2 < 3 < 4	.19
Emotion regulation	0.83^a	0.02	1.65^b	0.13	2.05^c	0.10	2.46^d	0.09	123	1 < 2 < 3 < 4	.15

Note. Higher scores indicate greater impairment/poorer functioning with the exception of number of friends. Row means with different superscripts differ significantly at $p < .008$ to maintain a $p < .05$ for the six-comparisons (Bonferroni correction). ADHD = attention-deficit/hyperactivity disorder. SCT=sluggish cognitive tempo.

*$p<.001$.

J Clin Child Adolesc Psychol. Author manuscript; available in PMC 2022 March 01.

Table 4

Partial Standardized Regression Coefficients for the Associations of SCT, ADHD-IN, and ADHD-HI Factors with Symptom and Impairment Factors

	SCT		ADHD-IN		ADHD-HI		
External Correlates	***β***	***SE***	***β***	***SE***	***β***	***SE***	***R^2(SE)>***
ODD	.07*	.02	.33*	.02	.48*	.02	.62 (.02)
Anxiety	.53*	.03	.14*	.03	.16*	.03	.53 (.02)
Depression	.58*	.03	.23*	.03	.02ns	.03	.59 (.02)
Sleep difficulties	.42*	.03	.12ns	.04	.02ns	.03	.27 (.02)
Conflicted Shyness	.43*	.03	.08ns	.04	−.09ns	.03	.20 (.02)
Friendship difficulties	.33*	.03	.27*	.03	.09ns	.03	.38 (.02)
Number of friends[2]	−.14*	.03	−.21*	.04	.00ns	.03	.11 (.01)
Social impairment	.13*	.03	.34*	.03	.06ns	.03	.22 (.02)
Time management	.01ns	.02	.75*	.03	.07ns	.02	.65 (.02)
Self-organization	.43*	.03	.32*	.03	.12*	.02	.60 (.02)
Self-restraint	.06ns	.02	.40*	.03	.43*	.02	.61 (.02)
Self-motivation	.06ns	.03	.73*	.03	.04ns	.02	.62 (.02)
Emotion regulation	.11*	.03	.38*	.03	.29*	.03	.46 (.02)
Academic impairment	.03ns	.03	.59*	.03	−.05ns	.03	.34 (.02)

Note. N = 2056. SCT = sluggish cognitive tempo; ADHD = attention-deficit/hyperactivity disorder; IN = inattention; HI = hyperactivity/impulsivity; ODD = oppositional defiant disorder; ns = non-significant ($p > .001$).

[1]Number of friends was a single item. All other external correlates were latent variables defined by manifest variables.

*$p < .001$.

Table 5

Normative Information on Sluggish Cognitive Tempo (SCT) Scale

Total SCT Score	Cumulative Percentage	T-Score
55 to 75	99+	82 to 97
46 to 54	98	74 to 80
45	97.2	73.6
44	96.7	72.8
43	96.4	72.0
42	96.0	71.3
41	95.5	70.5
40	95.0	69.7
39	94.6	68.9
38	93.8	68.2
37	93.0	67.8
36	92.3	66.6
35	91.8	65.8
34	91.0	65.5
33	90.6	64.3
32	89.6	63.5
31	88.9	62.7
30	87.7	62.0
29	86.4	61.2
28	85.2	60.4
27	84.4	59.6
26	83.4	58.8
25	82.1	58.1
24	80.9	57.3
23	79.2	56.5
22	77.2	55.7
21	76.6	55.0

Total SCT Score	Cumulative Percentage	T-Score
20	73.9	54.2
19	71.6	53.4
18	69.9	52.6
17	67.8	51.9
16	65.4	51.1
15	62.7	50.3
14	59.4	49.5
13	56.9	48.7
12	53.9	48.0
11	51.5	47.2
10	47.9	46.4
9	44.5	45.6
8	40.6	44.9
7	36.6	44.5
6	32.6	43.1
5	28.1	42.8
4	23.7	41.7
3	19.5	41.1
2	14.9	40.2
1	10.4	39.4
0	6.8	38.7

Note. *N*=2,056. SCT mean was 14.61 (*SD*=12.88). A score of 41 or higher defined the clinical range on SCT.