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School-based intervention for adolescents with attention-deficit/hyperactivity disorder: Effects on academic functioning

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ABSTRACT

Multi-component training interventions such as the Challenging Horizons Program (CHP) improve organization skills and academic functioning of middle school students with attention-deficit/hyperactivity disorder (ADHD); however, few studies have investigated treatment for high school students. We explored the extent to which CHP adapted for high school would improve proximal (e.g., organization skills, homework performance) and distal (e.g., report card grades) academic outcomes through 6-month follow-up relative to a community care (CC) condition. Participants included 186 adolescents who were randomly assigned to CHP ($n = 92$; 80% male; M age = 15.0; $SD = 0.8$) or CC ($n = 94$; 78% male; M age = 15.1; $SD = 0.9$) with CHP delivered over one school year. Parent, teacher, and self-report ratings of organization skills and academic performance, report card grades, and achievement tests were collected across multiple occasions. Intent-to-treat analyses using hierarchical linear modeling revealed significant improvements of small to medium magnitude (d range = 0.32 to 0.58) for parent-rated organization skills, homework performance, and academic functioning at 6-month follow-up. CHP effect on grades was small, but associated with a less steep decline than that found for CC. No statistically significant effects on teacher or self-report ratings were obtained. CHP appears efficacious for ameliorating organization skills and homework performance deficits exhibited by high school students with ADHD and can protect against decline in report card grades experienced by these students. CHP may require supplementation with academic skills instruction for some students and may need implementation beyond one school year to produce durable effects.

Adolescents with attention-deficit/hyperactivity disorder (ADHD) experience significant functional impairment in multiple areas, chief among these being compromised academic performance and achievement (Raggi & Chronis, 2006). Specifically, high school students with ADHD frequently obtain lower grades and achievement test scores relative to typically developing classmates (Kuriyan et al., 2013) and demonstrate poor homework assignment completion, study habits, and note-taking behaviors (Evans et al., 2001; Kent et al., 2011). In the absence of treatment, grades for secondary school students with ADHD typically decline over the school year (e.g., Evans et al., 2016) presumably because expectations for independence and complexity of academic subject matter increase. ADHD also is associated with higher rates of school tardiness, absenteeism, and ultimately an increased likelihood of dropping out of school (Murray et al., 2014). These deficits in academic functioning and school performance represent significant costs to individuals

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with ADHD and society (Pelham III et al., 2020).

As they progress from elementary to secondary school settings, youth with ADHD typically experience increased difficulties with executive functioning skills, including behavioral self-regulation, effortful planning, decision-making, and engaging in goal-directed behavior (Miller et al., 2012). Executive functioning deficits impact students' ability to stay on-task, retain instruction, organize materials, regulate classroom behavior, and accurately remember information on tests (Gerst et al., 2017). Thus, adolescents with ADHD often experience difficulties tracking and completing homework assignments, organizing their materials in school lockers and book bags, studying effectively for tests, and obtaining passing grades on exams (Evans et al., 2020; Langberg et al., 2016). In addition, parents of adolescents with ADHD show varying levels of involvement in students' school activities and their support (or lack thereof) of students' organizational and time management skills may address deficits in student academic functioning (Sibley, Campez, et al., 2016). Thus, interventions that provide direct training in proximal targets of organization skills and homework completion appear necessary to improve distal outcomes by preventing the typical decrement in academic grades over time and possibly promoting achievement gains, particularly if training involves the key mechanisms of guided practice and corrective feedback delivered over an extended time period.

1. Intervention for Adolescents with ADHD

Although psychotropic medication, chiefly central nervous system stimulants, has been found to improve ADHD symptoms and related behaviors in adolescents with ADHD (e.g., Evans et al., 2001; Pelham et al., 2017), pharmacotherapy typically has limited effects on teen academic functioning. Although stimulant medication may reduce the frequency and severity of ADHD symptoms and increase engagement with learning activities, pharmacotherapy does not teach skills that have not been taught previously or have not been taught in an effective manner (DuPaul & Stoner, 2013). Alternatively, training intervention programs that include organization training and study skills strategies with adolescents, coupled with parenting interventions that guide how parents can best support their teen in homework completion and time management can have protective effects on the academic functioning of adolescents with ADHD (Evans et al., 2018; Raggi & Chronis, 2006). The Homework, Organization, and Planning Skills (HOPS) intervention is a short-term (16-week) school-based program that involves both students and parents to improve executive functions (i.e., homework, organization, planning skills) in middle-school children with ADHD. HOPS is associated with decreased organization difficulties, homework problems, and academic impairment (Langberg et al., 2012). Supporting Teens' Autonomy Daily (STAND) is a clinic-based family treatment program that targets adolescent organization, time management, and planning skills by increasing parent monitoring and contingency management skills for young adolescents with ADHD (Sibley, Graziano, et al., 2016). STAND is associated with high levels of parent-teen treatment engagement and significant improvements in parent-rated organization skills and homework behavior, with some effects (e.g., improved organization and planning skills) maintained at 6-month follow-up. (Sibley, Graziano, et al., 2016).

The Challenging Horizons Program (CHP; Evans et al., 2016) is a year-long multi-component intervention program for middle-school students with ADHD that is comprised of training focused on organization skills, homework management, and interpersonal skills. CHP has demonstrated positive effects on academic skills and behaviors. Intent-to-treat analyses indicate that participation in CHP is associated with moderate effect size improvements in parent-rated organization and time-management skills, homework problems, and ADHD symptoms of inattention, along with small improvements in overall academic functioning and grade point average (GPA; Evans et al., 2016). One factor that makes CHP unique from other interventions is evidence that it may prevent the typical decrement in academic grades experienced by students with ADHD over the course of a school year. Additionally, the gains observed in student GPAs continued to improve in the year following receipt of the intervention, suggesting that a year-long training program may improve proximal and distal academic outcomes that are maintained into a subsequent school year.

To date, few studies have evaluated the efficacy of school-based interventions to support academic success of high school students. Several psychosocial treatment programs have been examined for this age group (e.g., Antshel et al., 2012; Boyer et al., 2015; Kern et al., 2021; Sibley et al., 2020; Sibley, Olson, et al., 2016; Sprich et al., 2016); however, none of these studies showed significant group by time interaction effects on impairment related to ADHD symptoms nor did they directly address student academic functioning in a school-based context. Although the effects of HOPS and STAND on academic and homework functioning have been established, prior studies of those programs have primarily focused on young adolescents with ADHD attending middle school. Furthermore, STAND is a clinic-based intervention implemented across 10 sessions and HOPS is a school-based program implemented over 16 sessions (i.e., less than one academic semester). School-based interventions implemented for a sustained period of time (i.e., one school year) at the point of performance are likely necessary because high school students (a) are more likely to receive mental health interventions in schools than in clinic settings due to variations in access and affordability (Green et al., 2013), (b) are expected to manage school assignments and responsibilities more independently than middle school students, and (c) must develop self-regulation skills predictive of educational success, job attainment, and transition to adulthood. In addition, high school students are generally expected to show greater skill in independent problem-solving and also are influenced by their peers to a greater degree relative to younger adolescents. Thus, high school students with ADHD likely need ongoing support in problem-solving, interpersonal relationships, and development of autonomy in academic work.

To address this gap, the impact of CHP on proximal (i.e., organizational skills and assignment completion) and distal (i.e., report card grades) indices of academic functioning was evaluated in a pilot sample of 36 high school students with ADHD (M age = 15.4 years, $SD = 1.0$) who were randomly assigned to receive CHP ($n = 24$) or community care ($n = 12$) over the course of one school year (Evans, Schultz, & DeMars, 2014). Intent-to-treat analyses revealed that, relative to controls, CHP students showed moderate improvements in parent ratings of inattention (Cohen's $d = 0.49$), academic impairment ($d = 0.41$), and family functioning ($d = 0.80$). Effects on grades in core subject areas were mixed and mostly not statistically significant. Follow-up dosage analyses indicated that

students were likely to exhibit reliable change in academic performance if they received about 50 CHP coaching sessions (approximately 22 min per session) over the course of the year. Based on these pilot findings, in the current study CHP was modified to include a greater frequency of coaching sessions to increase treatment dosage given the impact of the latter on academic functioning. In addition, we added a treatment component in which teens were guided through monthly problem-solving sessions to enhance their ability to self-monitor indicators of risk for negative school outcomes (e.g., low grades, low assignment completion, frequent absences) and generate and evaluate possible solutions to identified problems, because these skills are important in early adult functioning.

2. Purpose of study

Multi-component interventions for middle school students with ADHD have been found to enhance academic functioning; however, few studies have examined school-based treatment for high school students with the disorder, particularly in the context of a large sample randomized trial. Also, given the long-term benefits of CHP for middle school students, we focused analyses on benefits 6–8 months after treatment ended (i.e., a subsequent school year). The emphasis on long-term maintenance of treatment benefits is consistent with the goals of stakeholders who are looking for gains to persist over time (Evans, Owens, et al., 2014). Thus, the purpose of this study was to examine the effects on academic performance of CHP relative to typical community care (CC) in a large sample of high school students with ADHD, separate from those who participated in the earlier CHP pilot trial. Using an intent-to-treat research design, our primary aim was to determine the extent to which CHP improved proximal (i.e., organization skills, homework performance) and distal (e.g., student report card grades) academic outcomes over the course of one school year relative to CC conditions and whether gains maintained into the following school year. Given positive findings associated with CHP in middle (Evans et al., 2016) and high (Evans, Schultz, & DeMars, 2014) school, it was hypothesized that CHP would lead to significant improvements of small to medium magnitude (relative to CC) in organization, homework, academic grades, and achievement test performance that would be maintained into the following school year.

Table 1
Baseline demographics by treatment condition.

Demographics	Group				*p*
	CHP (*N* = 92)		CC (*N* = 94)		
	n	%	*n*	%	
Boys	74	80%	73	78%	0.642
Grade					0.564
9	45	49%	43	46%	
10	33	36%	31	33%	
11	14	15%	20	21%	
Race					0.246
African American	16	17%	11	12%	
White	65	71%	73	87%	
Asian	1	1%	1	1%	
Other	7	8%	2	2%	
Ethnicity Hispanic	11	12%	8	9%	0.416
ADHD Medication Usage	33	36%	36	38%	0.548
ADHD-C	45	49%	48	51%	0.584
Current IEP or 504 plan	52	57%	65	69%	0.075
Current IEP	37	40%	41	44%	0.736
Current 504	21	23%	30	32%	0.338
Generalized Anxiety Disorder	30	33%	22	23%	0.162
Major Depressive Disorder	10	11%	12	13%	0.689
Social Anxiety Disorder	7	8%	6	6%	0.743
Oppositional Defiant Disorder	46	50%	45	48%	0.772
Conduct Disorder	7	8%	9	10%	0.633
	M	SD	M	SD	
Child Age	15.0	0.8	15.1	0.9	0.253
Household income	4.9	1.9	5.5	1.9	0.041*
Parental Education	4.5	1.6	4.7	1.5	0.728
Child FSIQ	98.8	13.5	96.1	13.7	0.165
Reading Achievement	91.7	11.6	91.3	11.5	0.824
Math Achievement	89.5	14.8	84.0	16.0	0.017*
Writing Achievement	97.2	10.4	93.7	12.3	0.035*

Note. CHP = Challenging Horizons Program. CC = Community Care. ADHD-C = ADHD Combined Presentation. IEP = Individualized Education Plan. FSIQ = Full Scale IQ. Household income = 1, up to $10,000; 2, $10,001-14,999; 3, $15,000-24,999; 4, $25,000-49,999; 5, $50,000-74,999; 6, $75,000-99,999; 7, $100,000-149,999; 8, $150,000-199,999; 9, $200,000 or more. Parental Education = 1, Less than 9th grade; 2, Partial high school; 3, High school diploma; 4, Partial college (no degree); 5, Associate degree; 6, Bachelor's degree; 7, Master's/doctoral degree.

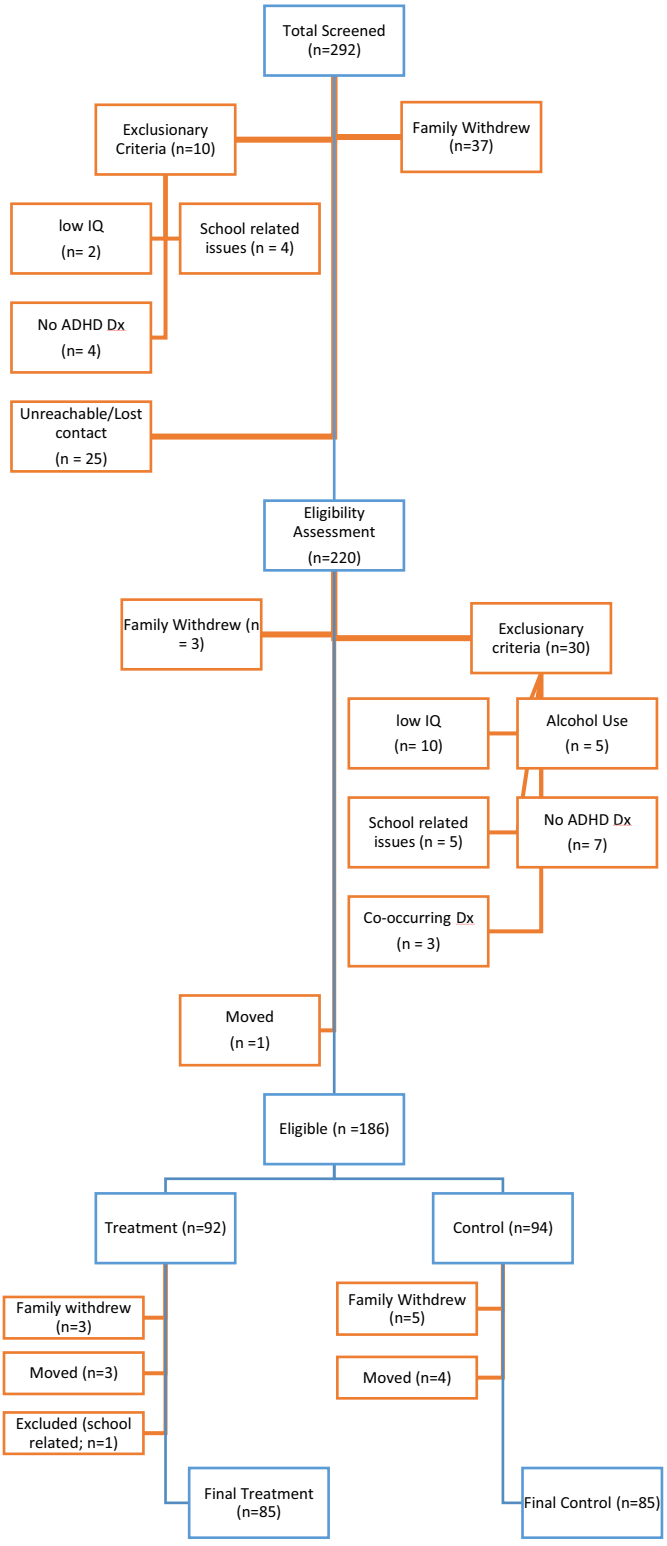

Fig. 1. Participant flow chart.

3. Method

3.1. Participants

Participants were 186 students in Grades 9–11 recruited over two consecutive years (2015–2016) from four public high schools in Ohio and three consecutive years (2015–2017) from six public high schools in Pennsylvania. Schools were located in rural, suburban, and urban communities. Table 1 presents participant demographic information for each study condition. The demographic profile of the sample is closely aligned with the US Census (2020) and closely matches that of the local communities in which the schools were located. Recruitment was conducted through study announcement letters to all families attending participating schools, direct referral from school staff, and fliers posted in each school. Primary caregivers (hereafter "parents") who responded were screened by telephone for the likelihood of eligibility (i.e., parent reported that adolescent had a prior diagnosis of ADHD or the adolescent exhibited 4 of 9 symptoms of inattention as *often* or *very often* and the adolescent attended school at least four days a week on average). Eligible families were scheduled for an evaluation. School administrators and research boards at each university approved all procedures and all participants completed the informed consent process; parents signed active consent and adolescents signed assent statements.

The eligibility evaluation included psychological testing (intelligence and academic achievement testing), diagnostic interview with the parent and adolescent, and rating scales completed by the parent, adolescent, and teachers. Eligible families were scheduled for an evaluation that determined whether they met criteria for inclusion in the study that required that adolescents (a) attend one of the 10 participating schools and were in general education settings for at least half of the day, (b) met diagnostic criteria for at least one presentation of ADHD based on the Parent-Children's Interview for Psychiatric Syndromes (P-ChIPS; Weller et al., 2000; symptoms were considered present if endorsed on the P-ChIPS or on the parent or teacher ratings on the ADHD Rating Scale-5 [ARS-5; DuPaul et al., 2016] and six symptoms of inattention or hyperactivity/impulsivity needed to be endorsed), (c) demonstrated an IQ of 75 or above on the Wechsler Abbreviated Scale of Intelligence – Second Edition (WASI-II; Wechsler, 2011), (d) did not meet a cutoff score on the Substance Abuse Subtle Screening Inventory (SASSI; Miller & Lazowski, 2001) that indicated a high probability of a substance use disorder, and (e) did not meet diagnostic criteria for bipolar disorder, psychosis, or obsessive-compulsive disorder. Eligibility and diagnostic decisions were reviewed by doctoral level psychologists at the participant's site and 20% of eligibility and diagnostic decisions were randomly selected to be reviewed at both sites with greater than 90% agreement obtained. At baseline, groups did not differ with respect to ADHD presentation, comorbid diagnoses, WASI IQ, or SASSI scores, but families of adolescents in the CC condition reported higher income than CHP families and CHP students obtained higher math and writing achievement test scores than CC students (see Table 1). Fig. 1 presents the number of participants excluded and included at each stage of assessing eligibility.

CHP coaches were clinicians (100% female) (a) completing graduate training in clinical or school psychology or (b) held graduate degrees in school counseling. All coaches received training prior to beginning the program and received 60 min of individual supervision from a licensed psychologist (the primary investigators) weekly.

3.2. Intervention and assessment procedures

Eligible participants were stratified based on gender and medication status and were randomly assigned (within school) to either the CHP or CC condition. Between 12 and 18 students per school participated in the study with a relatively equivalent distribution of students across schools. Siblings (4 pairs, 1 triad) were assigned together such that they would be in the same condition. All measures (except the achievement test which was given at eligibility and post-treatment assessment) were administered on at least three occasions including pre-treatment (i.e., eligibility or baseline), post-treatment, and 6-month follow-up. Rating scales were completed online using REDCap (Harris et al., 2009) with the exception of the School Functioning Scale, which teachers and students completed by hand. Parents and teachers were not masked to student treatment group assignment. Families were compensated $100 for the eligibility assessment and $50 for completing rating scales at each additional time point. Core subject teachers were paid $5–15 per participating student for completing rating scales based on the number of scales to be completed at a given time point.

3.2.1. CHP treatment group

CHP was adapted for high school students to include twice weekly individual in-school coaching sessions throughout the school year, at least monthly collaborative problem-solving between the teen and coach, and additions to content of parent sessions (e.g., sleep hygiene). Students met with their coaches individually for 15–20 min twice per week throughout the academic year, typically during homeroom, lunch, study hall, or an elective class. Individual sessions included organization, problem solving, study skills, and interpersonal skills training (i.e., follow-up on self-monitoring of progress toward interpersonal goals set during interpersonal skills group sessions). Ten, 90-min evening group sessions at their school (five in the fall, five in the winter/spring) were offered separately for adolescents and parents.

The organization intervention occurred during each individual session. During initial sessions, students and coaches worked collaboratively to develop a system of organizing the student's binders or folders and tracking assignments in a daily planner or electronic calendar. Subsequent sessions included a binder and daily planner check in which the student's adherence to the system was recorded and then the student practiced addressing disorganization (e.g., put assignments in the correct folders, update planner). Coaches praised students for following through on assignment tracking and binder organization, but no additional motivational contingencies were used. After meeting objective criteria for organization (e.g., at least 80% planner completion for two consecutive weeks), adolescents independently completed organization and planner checks under supervision by coaches.

Each month, coaches checked with students and school records regarding six areas of risk including tardiness, absenteeism, in-

school disciplinary actions, out-of-school suspension, failing classes, and missing assignments. If students met a predetermined threshold for risk (e.g., 80% or fewer assignments turned in on time), then the student and coach had a problem-solving discussion. The goal was to teach students skills in self-monitoring and in the development and evaluation of a solution to the relevant problem (i.e., problem-solving skills). The process included (a) defining the problem, (b) setting a goal, (c) brainstorming ways to achieve that goal, (d) selecting one or more of these solutions, (e) determining how to know if the plan is working, (f) setting a date to start implementation, and (g) setting a date to review the success of the plan. During a subsequent session, the coach and student reviewed the results of the plan relative to stated goals and determined if they should continue the plan or make changes.

For students who were not performing well on tests and quizzes, coaches provided study skills intervention. Coaches reviewed test-taking strategies regarding different styles of test questions (e.g., planning an outline for an essay question). Students were tested on these strategies to demonstrate mastery and then practice the skills on practice tests. Students also learned strategies for using flashcards and class notes effectively to prepare for tests.

Parents were invited to attend a 10-session group wherein they received psychoeducation on ADHD and common difficulties faced by teenagers (e.g., poor sleep hygiene). Five sessions occurred during the fall semester and five sessions occurred in the spring semester. Parents worked with project staff to develop a homework management plan that determined the timing and duration of nightly homework completion. Home-based contingencies (e.g., access to preferred activities) could be included in homework management plans. Parents could also work with project staff to develop other behavioral contracts with their students. Adolescents were invited to attend interpersonal skills group (ISG) sessions concurrent with parent groups wherein students learned and practiced how to set personal goals for successful peer interactions (for details about interpersonal skills groups and social outcomes, see Evans et al., 2021).

Percentages of students who received medication and IEP/504 school services are reported in Table 1. In addition, during the treatment year, some CHP participants received individual (18.5%) or group (5.4%) counseling in school, individual or group counseling outside of school (19.6%), parent counseling (16.3%), and family therapy (9.8%).

3.2.2. Community care (CC)

Participants who were randomized to the CC condition were given a list of available resources in their community, including locally available providers of child and family psychosocial and pharmacological interventions. Participants in both CC and CHP were informed that they could continue with any services they were receiving as well as seek additional services. Data regarding receipt of in-school and outside services were periodically collected. Percentages of students who received medication and IEP/504 school services are reported in Table 1. In addition, during the treatment year, some CC participants received individual or group counseling (48%), parent counseling (9.6%), and family therapy (12%).

3.3. Intervention integrity

Prior to the start of the trial, coaches attended a 2.5-day training to learn and role play procedures for each treatment component. Following training, coaches practiced each session until proficiency was reached, as observed by site supervisors. All coaching sessions were audio recorded and coaches were given feedback about adherence and competence in weekly supervision sessions. If there were concerns, a plan was developed to rectify the behavior in the next session.

To assess adherence, 27% of individual and 30% of parenting group sessions were randomly selected and coded by research assistants at each site. In addition, 25% of coded individual sessions and 26% of coding parent group sessions were randomly selected and double coded to assess inter-rater reliability within site. To assess for cross-site consistency in coding, at least 5% of coded audio files were randomly selected and coded by research assistants at both sites (6% of individual sessions; 16% of parenting groups).

3.3.1. Individual sessions

A coaching adherence checklist was created for each component within an individual session (e.g., binder check, problem solving discussion) and a percentage adherence score was created for each component. Because components occurred (and were coded) with different frequencies, we computed a weighted average for adherence. The weighted average adherence across all coaches and components was 92.94%. Average adherence for each component ranged from 25% to 100%, with adherence falling at or above 75% for 9 of 12 components (all academic and homework components except flash cards). Across components, the weighted average percent agreement for double-coded components was 92.98% (range across components: 76%–100%). For cross-site coded components, the weighted average percent agreement was 73.48% (range: 50%–85%).

3.3.2. ISG and parenting groups

An adherence checklist was created for each parent session and a percentage adherence score was calculated for each session coded. Average adherence across all coaches and sessions was 78% (range across sessions: 75%–82%). Across sessions, average percent agreement for double-coded sessions was 89% (range: 78%–100%). For cross-site coded sessions, average percent agreement was 87% (range: 82%–92%).

An adherence checklist was created for the process of coaches discussing student and coach ratings of student ISG goals during group sessions and giving feedback to students on these goals. A percentage adherence score was created for each feedback session coded. Across all feedback sessions, average adherence was 92% (range: 52%–100%). Average percentage agreement for double-coded sessions was 91% (range: 83%–100%). For cross-site coded sessions, average percentage agreement was 84% (range: 78%–94%).

3.4. Session attendance

The average number of individual school-based sessions attended was 40.3 (*SD* = 15.9, ranging from 0 to 69, median = 45). The average amount of total time spent in individual sessions was 637.7 min (*SD* = 328.7, ranging from 0 to 1523, median = 612). Thus, on average, students attended one session per week through the school year (i.e., about 50% of intended sessions) with each session averaging approximately 15 min. In most instances, missed sessions occurred due to student absences, school closings due to weather (e.g., snow days), and, in six cases, withdrawal from treatment. The average number of parent group sessions attended was 4.3 (*SD* = 3.8, ranging from 0 to 10, median = 4) and the average number of interpersonal skills groups attended was 3.1 (*SD* = 3.3, ranging from 0 to 10, median = 2). Two students out of the 92 assigned to CHP did not attend any sessions and six participants withdrew from treatment during the academic year.

3.5. Outcome measures

3.5.1. Children's organizational skill scale (COSS)

The COSS is a parent-completed rating scale measuring organization skills (58 items) comprised of three subscales including Task Planning, Organizing Actions, and Memory and Materials Management (Abikoff & Gallagher, 2008). The COSS is specifically designed to measure organization skills and has adequate psychometric properties overall with internal consistency ranging from 0.70 to 0.98 and two and four-week test-retest reliability coefficients from 0.88 to 0.99 (Abikoff & Gallagher). Internal consistency for the current sample was α = 0.76 (Organizing Actions), α = 0.82 (Task Planning), α = 0.86 (Memory and Materials Management), and α = 0.96 (Total). Lower scores indicate *better* organization skills.

3.5.2. Homework problems checklist (HPC)

The HPC is a parent report scale measuring students' homework preparation and completion. The HPC has 20 items measuring the frequency of typical problem behaviors related to homework completion (Anesko et al., 1987). Parents respond regarding the frequency of each item on a 4-point Likert scale (0 = *never*, 1 = *at times*, 2 = *often*, 3 = *very often*). The HPC has strong internal consistency (0.90–0.92; Anesko et al.). The HPC has two factors including Completion (i.e., problem behaviors during homework) and Materials Management (i.e., problems bringing assignments home and returning homework to school). Internal consistency estimates for HPC scores in the current sample were α = 0.91 (Management), α = 0.92 (Completion), and α = 0.96 (Total). Lower scores indicate *better* homework performance.

3.5.3. Adolescent academic problems checklist (AAPC)

The AAPC is a 24-item parent-report rating scale measuring middle and high school students' common academic problems (Sibley et al., 2014). The AAPC measures frequency of each item on a 4-point Likert scale (0 = *not at all,* 1 = *just a little,* 2 = *pretty much,* 3 = *very much*). In addition to a total score, there are Academic and Behavior subscales. In their development and validation study, Sibley et al. (2014) reported strong internal reliability for parent scores (0.92) and internal consistency was α = 0.95 for AAPC-Academic in the current sample. Lower scores indicate *fewer* academic problems.

3.5.4. Classroom performance survey (CPS)

The CPS (Brady et al., 2012) is a 20-item, teacher rating scale that assesses students' classroom behaviors and areas of strength and weakness. Responses are scored on a 5-point Likert scale (1 = *Always,* 5 = *Never*). The CPS includes Academic and Social subscales. Research indicates that the CPS demonstrates strong reliability and has demonstrated adequate validity in a sample of young adolescents with ADHD (Brady et al.). Internal consistency (i.e., coefficient alpha) for CPS Academic in the current sample was 0.92. Mean scores across core academic subject teachers (i.e., English, mathematics, science, social studies) during the treatment year were included in analyses with higher scores representing *better* functioning.

3.5.5. School functioning scale (SFS)

Teachers and students completed the SFS, a 9-item measure designed to efficiently obtain teacher perceptions of indicators of high school student performance across academic, behavior, and social functioning, as well as student perceptions of their own functioning in said areas (DuPaul et al., 2019). Teachers from each of the students' four core academic classes were sent the SFS each month during the year of treatment. Students completed the SFS for each of their four core classes monthly. Exploratory and confirmatory factor analyses support a general factor and three-factor structure consisting of academic, behavior, and social factors and provided support for convergent validity and internal consistency (DuPaul et al., 2019). Internal consistency reliabilities were α = 0.78 and α = 0.70 for teacher and adolescent academic ratings, respectively. We examined mean SFS academic ratings for students and teachers (i.e., of the four core academic classes) at each of eight assessment occasions during the treatment year, with higher scores indicating better academic performance.

3.5.6. Grade point average (GPA)

GPA was calculated as an average of the grades earned for each course, with an A = 4, B = 3, C = 2, D = 1 and an F = 0, and possible scores ranging from 0.00 to 4.00. Mean GPA was calculated as an average across the four core content areas (e.g., English, Mathematics, Science, and Social Studies) during each quarterly marking period of the intervention and post-intervention year, and a single cumulative GPA was calculated for the pre-intervention year. GPA data were collected directly from official student academic

transcripts.

3.5.7. School tardiness

The total number of occasions of student tardiness to school in a given school year was derived from school records. Tardiness data were available for three school years including the year preceding treatment, the treatment year, and the follow-up year.

3.5.8. Woodcock johnson achievement test IV (WJ-IV)

The WJ-IV is a standardized measure of academic achievement for which we administered six subtests: Letter-Word Identification, Applied Problems, Spelling, Passage Comprehension, Calculation, and Writing Samples to derive Reading, Mathematics, and Writing composite scores (Mather & Wendling, 2015). Median reliability coefficients are excellent for Reading ($\alpha = 0.95$), Mathematics ($\alpha = 0.96$), and Writing ($\alpha = 0.92$; McGrew et al., 2014). There are three available forms (Forms A, B, C) that provide alternate and equivalent tests to facilitate re-testing. Participants were randomized to different forms for eligibility and post-treatment evaluations. Analyses were conducted with eligibility (pre-treatment) and post-treatment reading, mathematics, and written expression composite standard scores.

3.6. Data analyses

Two-level hierarchical linear modeling (HLM; Raudenbush & Bryk, 2002) was used as the primary data analytic method to determine whether outcomes improved over time, and whether the CHP and CC groups differed in their time trajectories. HLM was deemed appropriate for our nested data (i.e., repeated measures within students) and presence of non-complete data across the time of assessments. All the HLM analyses, including time at level one (i.e., within-subjects level) and condition group at level two (i.e., between-subjects level), were conducted with SAS PROC MIXED, using full information maximal likelihood (FIML).

Depending on the assessment time frame for each outcome measure (e.g., three occasions for school tardiness, four occasions for AAPC, COSS, CPS, and HPC, and up to 8 or 9 occasions for Grades, SFS teacher and student ratings), we iteratively tried a series of HLMs, starting with random intercept and random linear trend and then testing random quadratic trend for measures assessed on four or more occasions. Random cubic trends were tested for Grades and SFS scores. For curvilinear trends, random effects terms, if non-significant ($p > .05$), were removed, leaving fixed effects in the model. If the fixed effects were also non-significant, the curvilinear trend was removed. To identify the model that best fit the data for each outcome, we compared the Bayesian Information Criterion (BIC) and deviance (−2 log likelihood) among the nested models given their degrees of freedom (*df*). For post-treatment WJ-IV

Table 2
Means and standard deviations of parent-reported measures across assessment occasions by group.

Parent Measures	Baseline		Mid-Year		Post-Treatment		6-mo FU	
	CHP	CC	CHP	CC	CHP	CC	CHP	CC
AAPC-Tot**	34.03	35.07	–	–	29.34	35.08	24.85	33.11
	(10.55)	(11.51)	–	–	(14.38)	(13.76)	(14.98)	(16.23)
AAPCAca***	30.36	30.66	–	–	25.61	31.38	22.14	29.53
	(9.48)	(9.02)	–	–	(12.11)	(11.53)	(13.05)	(13.34)
AAPC-Beh	3.66	4.41	–	–	3.73	3.69	2.71	3.68
	(2.64)	(3.58)	–	–	(3.12)	(3.14)	(2.70)	(3.68)
COSS-TP*	14.90	14.84	13.68	13.91	12.95	14.38	11.91	13.51
	(3.53)	(3.90)	(3.55)	(3.97)	(4.00)	(4.12)	(4.23)	(3.74)
COSS-OA***	34.03	33.77	32.74	33.94	31.43	33.37	30.91	34.17
	(3.85)	(3.92)	(4.01)	(3.71)	(5.88)	(5.37)	(6.37)	(4.62)
COSS-MM**	22.38	22.16	19.69	21.29	19.67	21.11	17.66	20.48
	(4.85)	(5.41)	(4.84)	(5.82)	(5.22)	(5.84)	(4.69)	(6.08)
COSS-Tot***	160.61	158.39	148.59	154.90	143.74	153.78	136.22	151.48
	(21.06)	(24.66)	(22.44)	(25.98)	(24.90)	(27.11)	(28.52)	(27.05)
HPC-Tot**	51.92	51.36	47.68	48.32	46.49	49.88	41.09	47.3492
	(12.00)	(12.46)	(13.26)	(12.44)	(14.73)	(13.59)	(14.84)	(13.88)
HPC-Comp**	33.57	33.07	30.47	30.84	29.72	31.69	26.03	26.03
	(7.66)	(7.73)	(8.09)	(7.81)	(9.19)	(8.71)	(9.59)	(8.91)
HPC-Man**	16.42	16.46	15.37	15.88	14.93	16.55	13.46	15.65
	(5.20)	(5.24)	(5.60)	(5.18)	(5.84)	(5.65)	(5.33)	(5.49)

Note. CHP = Challenging Horizons Program. CC = Community Care. 6-mo FU = 6-month Follow-Up. AAPC-Tot = Adolescent Academic Problems Checklist Total. AAPC-Aca = Adolescent Academic Problems Checklist Academic subscale. AAPC-Beh = Adolescent Academic Problems Checklist Behavior subscale. COSS-TP = Children's Organization Skills Scale Task Planning. COSS-OA = Children's Organization Skills Scale Organizing Actions. COSS-MM = Children's Organization Skills Scale Memory and Management. COSS-Tot = Children's Organization Skills Scale Total. HPC-Tot = Homework Problems Checklist Total. HPC-Comp = Homework Problems Checklist Completion. HPC-Man = Homework Problems Checklist Management. CPS-Aca = Classroom Performance Survey Academic. CPS-Soc = Classroom Performance Survey Social. SFS-T-Aca = School Functioning Scale (Teacher) Academic. SFS-A-Aca = School Functioning Scale (Adolescent) Academic. WJ-Reading = Woodcock Johnson Achievement Test Reading score. WJ-Math = Woodcock Johnson Achievement Test Mathematics score. WJ-Writ = Woodcock Johnson Achievement Test Writing score. WJ-Ach – Woodcock Johnson Achievement Test Basic Achievement score. *Group by Time interaction $p < .05$. **Group by Time interaction $p < .01$. ***Group by Time interaction $p < .001$.

Table 3
Means and standard deviations of teacher-reported measures across assessment occasions by group.

Teacher Measures	Baseline		3 Months		Mid-Year		5 Months		6 Months		7 Months		Post-Treatment		6-mo FU	
	CHP	CC	CHP	CC	CHP	CC	CHP	CC	CHP	CC	CHP	CC	CHP	CC	CHP	CC
CPS-Aca	21.59	23.44	–	–	22.71	23.81	–	–	–	–	–	–	23.81	23.92	23.13	24.75
	(7.60)	(8.10)	–	–	(7.13)	(8.42)	–	–	–	–	–	–	(8.52)	(8.54)	(7.32)	(9.203)
CPS-Soc	8.97	9.73	–	–	9.52	10.00	–	–	–	–	–	–	9.80	10.05	9.52	10.38
	(3.28)	(3.58)	–	–	(3.29)	(3.53)	–	–	–	–	–	–	(3.81)	(3.51)	(2.80)	(3.122)
SFS-T-Aca	14.80	14.64	14.68	14.63	14.61	13.64	14.74	13.91	14.76	13.71	15.22	13.96	14.01	13.38	–	–
	(3.02)	(2.90)	(2.99)	(3.41)	(2.85)	(3.79)	(2.65)	(3.76)	(2.95)	(3.43)	(3.15)	(3.65)	(3.58)	(3.82)	–	–

Note. CHP = Challenging Horizons Program. CC = Community Care. 6-mo FU = 6-month Follow-Up. AAPC-Tot = Adolescent Academic Problems Checklist Total. AAPC-Aca = Adolescent Academic Problems Checklist Academic subscale. AAPC-Beh = Adolescent Academic Problems Checklist Behavior subscale. COSS-TP = Children's Organization Skills Scale Task Planning. COSS-OA = Children's Organization Skills Scale Organizing Actions. COSS-MM = Children's Organization Skills Scale Memory and Management. COSS-Tot = Children's Organization Skills Scale Total. HPC-Tot = Homework Problems Checklist Total. HPC-Comp = Homework Problems Checklist Completion. HPC-Man = Homework Problems Checklist Management. CPS-Aca = Classroom Performance Survey Academic. CPS-Soc = Classroom Performance Survey Social. SFS-T-Aca = School Functioning Scale (Teacher) Academic. SFS-A-Aca = School Functioning Scale (Adolescent) Academic. WJ-Reading = Woodcock Johnson Achievement Test Reading score. WJ-Math = Woodcock Johnson Achievement Test Mathematics score. WJ-Writ = Woodcock Johnson Achievement Test Writing score. WJ-Ach – Woodcock Johnson Achievement Test Basic Achievement score.

reading, math, and writing scores, analyses of covariance (ANCOVAs) were conducted in SPSS to examine whether the two condition groups differed significantly at post-treatment, adjusting for pre-treatment.

Because the two groups differed with respect to family income, WJ-IV math, and WJ-IV writing at pre-treatment, we reran all HLMs by including these three variables as level-two covariates, both at the intercept and for their interaction with the linear time trend, to adjust their potential relationship with each student academic outcome. Other than for GPA, inclusion of covariates did not alter substantive findings regarding Group main effects or Group by Time interactions, thus results are reported and discussed based on HLMs without these covariates. Similarly, the ANCOVAs for post-treatment WJ-IV Reading, Math, and Writing scores were rerun for each subject area, using family income as an additional covariate. However, there was no difference in substantive findings and we report results for ANCOVAs without income.

We assessed whether there were baseline differences across the two geographic sites in terms of demographic characteristics (i.e., gender, race, ethnicity, grade, and parent income) and parent report of student ADHD symptoms for the participating students. The only statistically significant differences were for parent income and ethnicity. As previously reported, we already controlled for parent income with no impact on obtained findings (except for GPA). We did not control for ethnicity given the relatively low percentage of students from Latinx backgrounds ($n = 19$ in sample of 186 participants) included in the study.

4. Results

Means and standard deviations associated with outcome measures across assessment occasions are provided in Table 2 (parent report), Table 3 (teacher report), Table 4 (adolescent report), and Table 5 (report card grades).

4.1. AAPC total and subscale scores

At 6-month follow-up, students in the CHP condition obtained significantly lower parent-rated AAPC Total and Academic subscale scores relative to those in the CC condition ($p < .01$; Cohen's $d = -0.53$ [Total], -0.55 [Academic]). There was no significant linear effect of Time for the CC group Total ($b = -0.64$, $p = .25$) or Academic ($b = -0.38$, $p = .43$) scores; however, Group by Time interactions were significant for Total ($p < .01$) and Academic ($p < .001$) scores (see Supplementary Table 1). Consistent with hypotheses, students in the CHP condition showed significantly steeper negative slopes in Total and Academic scores (i.e., greater improvement) relative to those in the CC group (see Fig. 2, top panel).

4.2. COSS total and subscale scores

Parent-rated COSS Total and subscale scores for students in the CHP group were significantly lower (i.e., better organization skills) at 6-month follow-up relative students in the CC group ($p < .05$; Cohen's d range $= -0.40$ [Task Planning] to -0.58 [Organizes Actions]). There was a statistically significant negative linear slope for the CC group Total ($b = -2.40$, $p < .05$), Materials Management ($b = -0.61$, $p < .01$), and Task Planning ($b = -0.36$, $p < .05$) scores, but not for Organizes Actions ($b = 0.06$, $p = .76$) (see Supplementary Tables 2a-d). Consistent with hypotheses, the Group by Time interaction effect was significant for COSS Total and subscale scores with students in the CHP group showing steeper negative slopes (i.e., more improvement over time) than those in the CC condition (see Fig. 2, middle panel).

Table 4
Means and standard deviations of adolescent-reported measures across assessment occasions by group.

Adolescent Measures	Eligibility		Baseline		3 Months		Mid-Year		5 Months		6 Months		7 Months		Post-Treatment		6-mo FU	
	CHP	CC	CHP	CC	CHP	CC	CHP	CC	CHP	CC	CHP	CC	CHP	CC	CHP	CC	CHP	CC
SFS-A-Aca	–	–	16.93 (1.86)	16.68 (2.04)	16.86 (2.13)	17.02 (1.73)	17.26 (1.89)	16.87 (2.12)	17.28 (2.06)	16.85 (2.08)	17.43 (2.07)	16.73 (2.21)	17.54 (1.74)	16.81 (1.93)	17.58 (1.76)	16.86 (2.02)	17.22 (2.02)	17.17 (2.11)
WJ-Reading	91.72 (11.61)	91.34 (11.46)	–	–	–	–	–	–	–	–	–	–	–	–	93.33 (10.42)	90.45 (11.59)	–	–
WJ-Math	89.49 (14.83)	84.02 (15.97)	–	–	–	–	–	–	–	–	–	–	–	–	87.78 (13.28)	85.82 (16.58)	–	–
WJ-Writ	97.21 (10.38)	93.66 (12.28)	–	–	–	–	–	–	–	–	–	–	–	–	96.72 (10.43)	95.19 (11.95)	–	–
WJ-Ach	95.34 (12.12)	91.94 (12.92)	–	–	–	–	–	–	–	–	–	–	–	–	94.83 (11.43)	92.89 (12.69)	–	–

Note. CHP = Challenging Horizons Program. CC = Community Care. 6-mo FU = 6-month Follow-Up. AAPC-Tot = Adolescent Academic Problems Checklist Total. AAPC-Aca = Adolescent Academic Problems Checklist Academic subscale. AAPC-Beh = Adolescent Academic Problems Checklist Behavior subscale. COSS-TP = Children's Organization Skills Scale Task Planning. COSS-OA = Children's Organization Skills Scale Organizing Actions. COSS-MM = Children's Organization Skills Scale Memory and Management. COSS-Tot = Children's Organization Skills Scale Total. HPC-Tot = Homework Problems Checklist Total. HPC-Comp = Homework Problems Checklist Completion. HPC-Man = Homework Problems Checklist Management. CPS-Aca = Classroom Performance Survey Academic. CPS-Soc = Classroom Performance Survey Social. SFS-T-Aca = School Functioning Scale (Teacher) Academic. SFS-A-Aca = School Functioning Scale (Adolescent) Academic. WJ-Reading = Woodcock Johnson Achievement Test Reading score. WJ-Math = Woodcock Johnson Achievement Test Mathematics score. WJ-Writ = Woodcock Johnson Achievement Test Writing score. WJ-Ach – Woodcock Johnson Achievement Test Basic Achievement score.

4.3. HPC total and subscale scores

At 6-month follow-up, students in the CHP group obtained significantly lower (i.e., better) parent-rated HPC total and subscale scores than those in the CC group ($p < .05$; Cohen's d range = −0.40 [Management] to −0.44 [Total]). There was a significant negative linear slope for the CC group HPC Completion ($b = -0.74$, $p < .05$), but not for Total ($b = -0.91$, $p = .10$) or Management ($b = -0.15$, $p = .48$) scores (see Supplementary Tables 3a-c). Consistent with hypotheses, the Group by Time interaction was significant for HPC Total and subscale scores with students in the CHP condition exhibiting significantly steeper negative slopes (i.e., greater improvement in homework performance) relative to students in the CC condition (see Fig. 2, bottom panel).

4.4. Teacher and student ratings

HLM analysis using a random intercept and fixed linear trend model showed no significant group difference in teacher-rated CPS Academic scores at follow-up. A significant Time effect with positive linear trend was found ($b = 0.63$, $p < .05$) with scores improving over time. The Group by Time interaction was not significant ($p = .63$; see Supplementary Table 4). No statistically significant Group, Time, or Group by Time interaction effects were found for teacher or adolescent SFS ratings (see Fig. 3 and Supplementary Tables 5a & 5b).

4.5. Report card grades

Changes in mean report card grades for core academic subjects were determined for each group across nine assessment phases, including pre-treatment school year cumulative grade, four quarterly marking periods (MPs) for the treatment year, and four quarterly MPs for the post-treatment follow-up year (see Fig. 4). Adjusting for family income, WJ-IV Math, and WJ-IV Writing, the random cubic HLM model shows that Groups did not differ significantly at intercept (i.e., last MP in the post-treatment follow-up year; $p = .39$; Cohen's $d = 0.06$). The linear slope for the CC group was negative ($b = -0.19$, $p = .08$), whereas the CHP group had a slightly *positive*

Table 5
Means and standard deviations of core subject grades across marking periods by group.

	Challenging Horizons		Community Care		Cohen's *d*
	M	*SD*	*M*	*SD*	
Pre-Treatment Year	2.09	0.86	2.06	0.94	0.03
Treatment Year Quarter 1	2.39	0.84	2.25	0.88	0.16
Treatment Year Quarter 2	2.22	0.93	2.00	0.95	0.23
Treatment Year Quarter 3	2.26	0.96	1.86	0.99	0.41
Treatment Year Quarter 4	2.12	0.94	1.91	1.04	0.21
Follow-Up Year Quarter 1	2.44	0.86	2.39	0.98	0.05
Follow-Up Year Quarter 2	2.08	0.98	2.12	1.05	–0.04
Follow-Up Year Quarter 3	2.06	1.02	2.08	1.02	–0.02
Follow-Up Year Quarter 4	2.16	1.05	2.10	1.04	0.06

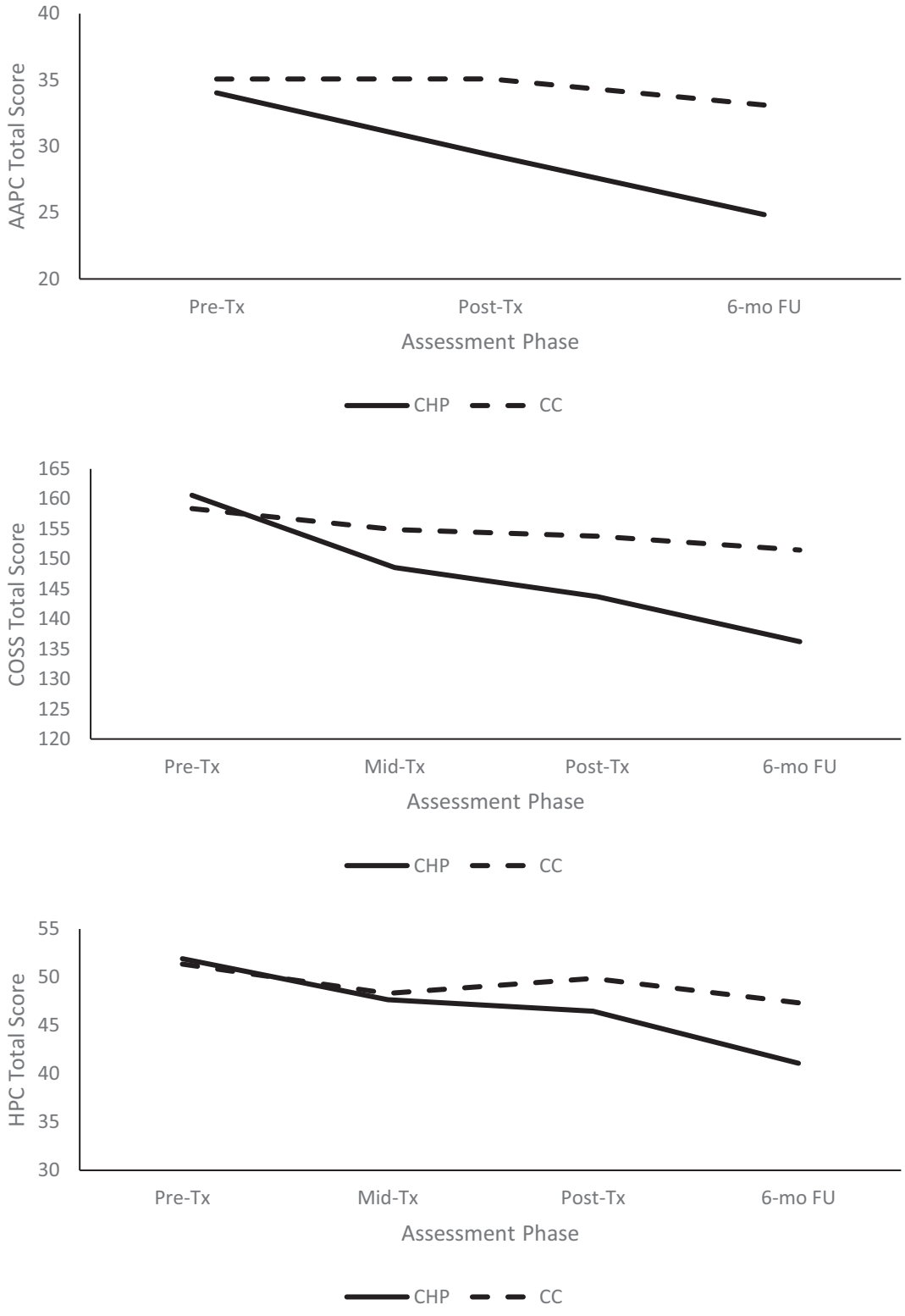

Fig. 2. AAPC, COSS, HPC ratings across assessment occasions by group.
Note. AAPC = Adolescent Academic Problems Checklist; COSS = Children's Organizational Skills Scale; HPC = Homework Problems Checklist. CHP = Challenging Horizons Program. CC = Community Care. Lower scores indicate better functioning.

linear slope; however, the difference from the control group ($b = 0.20$ for the group difference) did not reach the threshold for a statistically significant Group by Time interaction ($p = .08$). Alternatively, Group by Time interactions were significant for quadratic ($p = .024$) and cubic ($p = .012$) trends (see Supplementary Table 6). CHP students showed positive quadratic and cubic trends, accelerating their overall positive linear trend over time. By contrast, the negative curvilinear trends for CC students accelerated over time (i.e., additional downturns beyond negative linear slope). Across the nine assessment points, between-group Cohen's *d* effect sizes ranged from −0.04 (Follow-up second MP) to 0.41 (treatment year third MP) with CHP students obtaining a cumulative GPA during the treatment year that was 0.29 *SD* units better than CC students.

4.6. School tardiness

Controlling for three covariates (i.e., pre-treatment income, mathematics achievement, writing achievement), there was no

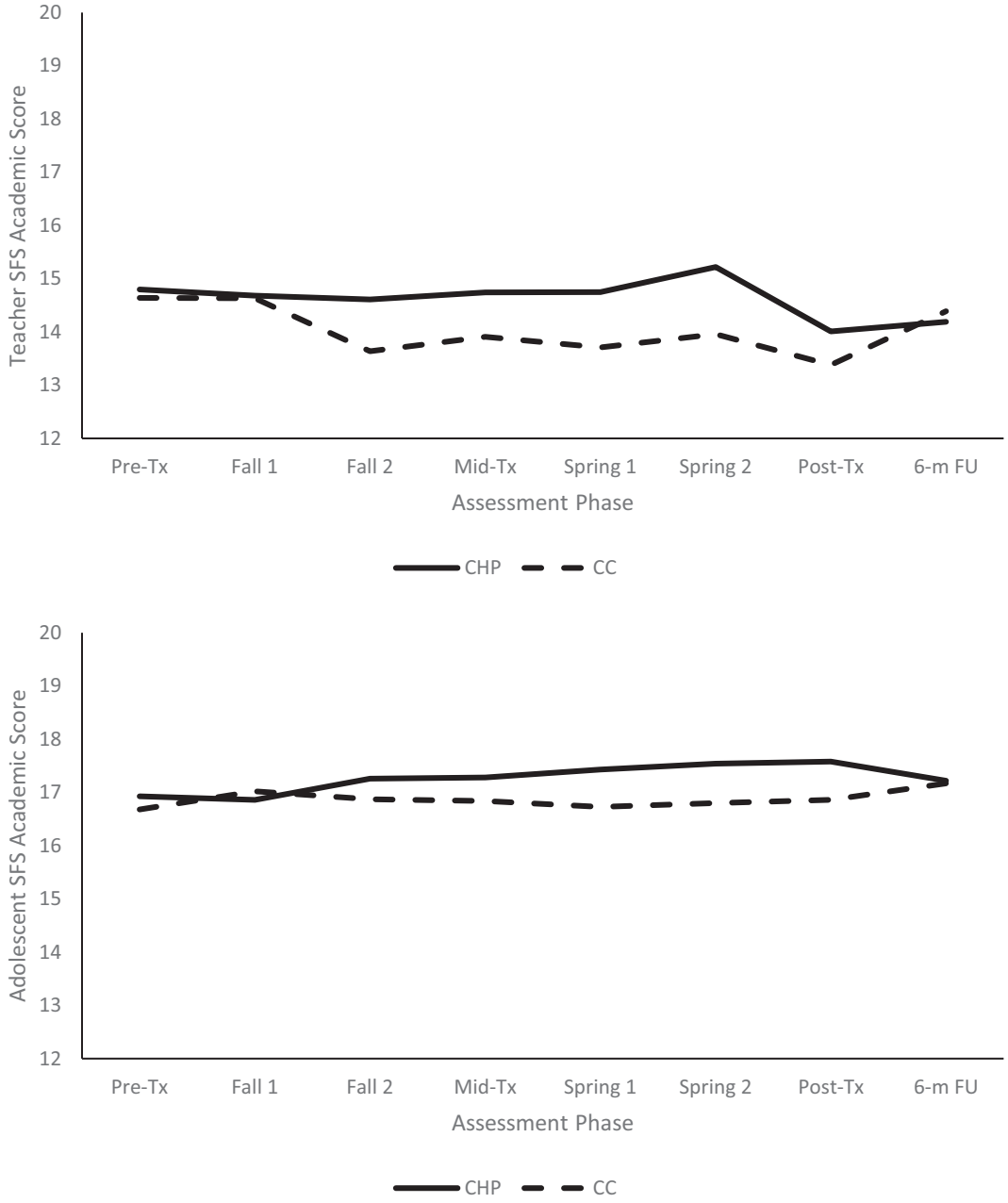

Fig. 3. . SFS-Teacher (top) and Adolescent (bottom) Scores Across Assessment Occasions by Group.
Note. SFS = School Functioning Scale. Higher scores indicate better functioning. CHP = Challenging Horizons Program. CC = Community Care.

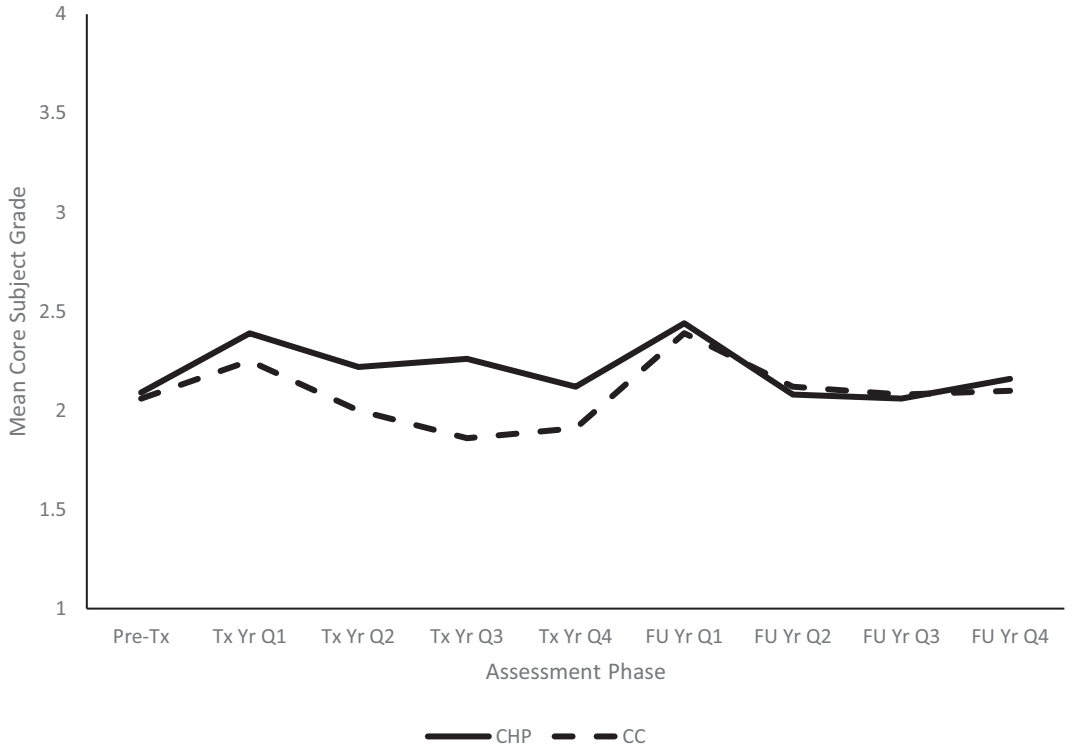

Fig. 4. Core subject area mean report card grade across assessment occasions by group.
Note. Core subject areas including mathematics, English, science, and social studies. CHP = Challenging Horizons Program. CC = Community Care.

Table 6
Means and standard deviations for school tardiness frequency by group across school years.

	Challenging Horizons		Community Care		Cohen's *d*
	M	*SD*	*M*	*SD*	
Pre-Treatment Year	1.92	2.88	1.90	3.55	0.01
Treatment Year	1.72	2.61	1.98	3.34	–0.09
Follow-Up Year	2.12	3.99	2.64	4.11	–0.13

statistically significant Group ($p = .75$) or Time ($p = .96$) effect for school tardiness data (see Supplementary Table 7). Although students in the CHP condition showed a decline in tardiness frequency during the treatment year (see Table 6), the Group by Time interaction was not statistically significant ($p = .24$).

4.7. Woodcock-Johnson achievement test

After controlling for pre-treatment WJ-IV Reading score, students in the CHP condition obtained significantly higher post-treatment WJ-IV reading scores than did students in the CC group ($p < .05$, Cohen's $d = 0.37$). However, the opposite result (i.e., CC students higher than CHP students) was obtained for WJ-IV Math ($p < .05$, Cohen's $d = -0.34$) and no group differences were found for WJ-IV Writing ($p = .46$, Cohen's $d = -0.18$).

5. Discussion

As hypothesized, CHP, as compared to CC conditions, led to significant improvements that (a) were medium in magnitude, (b) represented faster improvements over time, and (c) were maintained into the following school year in parent-rated organization skills, parent-rated homework performance, and, to some extent, grades. The impact on proximal treatment targets of parent-rated organization skills and homework is consistent with post-treatment findings for middle school students with ADHD who received CHP-After School program (Evans et al., 2016), HOPS (Langberg et al., 2012), and STAND (Sibley, Graziano, et al., 2016). Moreover, the range of CHP effect sizes at 6-month follow-up for organization skills (*d*s range from −0.32 to −0.58) and homework performance (*d*s range from −0.40 to −0.44) ratings were nearly identical to those obtained for middle school students in the Evans et al. (2016) study. It

should be noted that CHP and CC groups were equivalent in terms of percentage of adolescents receiving medication for ADHD, special education services, or educational accommodations (see Table 1). Thus, CHP effects were beyond those associated with typical school-based treatment or accommodations.

Although CHP effects on the distal outcome of report card grades were small, the impact may be clinically meaningful in that CHP appears to lead to less steep decline in grades found with CC (i.e., based on significant quadratic and cubic trend outcomes) and the pattern of effects during the treatment year is similar to that found in CHP for middle school students with ADHD (Evans et al., 2016). Protective effects on GPA were more substantial than those found in intent-to-treat analyses of a pilot trial of CHP in high school (Evans, Schultz, & DeMars, 2014), perhaps due to the modified treatment protocol and students receiving a greater number of treatment sessions in the current study ($M = 40.3$ vs. $M = 26.8$ in Evans, Schultz, & DeMars, 2014). In contrast to CHP middle school findings, the protective effect of CHP on decline in grades did not maintain into the following school year. Thus, sustained partial or full implementation of treatment may be necessary across school years for high school students who have more advanced academic material to master and greater responsibility for independent work relative to middle school students. Longer-term implementation would sustain contact with the presumed mechanisms of action (e.g., guided practice with specific feedback, accountability to maintain mastered skill) for training interventions. Also, the mixed impact of CHP on the distal outcome of achievement test scores could indicate that more direct intervention (e.g., more intensive remedial academic instruction) is necessary to make changes in academic skills. Specifically, CHP intervention targeting organization skills and homework performance may need to be supplemented with direct evidence-based academic support, particularly in math given the low scores obtained by students in both groups in this subject area.

There were no statistically significant CHP effects on teacher or adolescent ratings of academic and classroom performance; however, the pattern of scores appears to show some separation between CHP and CC over the course of the treatment year. Teacher and adolescent rating trajectories (see Fig. 3) appear similar to report card grade trajectories (see Fig. 4) with some separation between CHP and CC during the treatment year followed by convergence in the follow-up school year. Nevertheless, group differences were relatively small in magnitude (SFS rating post-treatment $d = 0.17$, 0.38 for teachers and adolescents, respectively). A possible reason for these small, nonsignificant effects is that ratings were averaged across multiple teachers and multiple subject areas (in the case of self-report) to derive a mean score for analyses. Average ratings may attenuate findings because treatment response could vary across classrooms due to differences in student performance (Dirks et al., 2012) and differential teacher standards, perceptions, and expectations (Evans et al., 2016).

5.1. Limitations

Findings from this study should be interpreted in the context of several methodological limitations. First, although intent-to-treat analyses represent a methodological strength, findings could underestimate CHP effects that may be associated with completion of a critical percentage of treatment sessions (Schultz et al., 2017) and/or dosage (Evans, Schultz, & DeMars, 2014). Thus, additional analyses are needed to assess CHP effects for students who received an adequate dosage of treatment in order to obtain a more precise estimate of the impact of CHP on academic functioning. A second related concern is that treatment could be interrupted by school vacations and weather as these are inherent challenges to school-based service delivery. These interruptions may have deleteriously impacted the consistency of CHP treatment delivery; however, such interruptions are part of the typical school experience and thus CHP outcomes were examined under "real world" conditions. Third, participants were recruited from two geographic locations which may limit external validity of our findings; however, the racial and ethnic diversity of the sample was representative of the local communities and was similar to the population distribution in the United States. Also, income and parent education levels were similar to or slightly lower than the national average. Thus, results should be generalizable to the population of high school students with ADHD. Fourth, due to limited cell size for girls and non-White participants, we weren't able to evaluate whether treatment outcomes varied by student gender, race, or ethnicity. Although this may limit generalizing our findings across subgroups, no prior studies examining psychosocial treatment of ADHD have found differential effects based on gender, race, or ethnicity. Finally, parent ratings were not masked to group assignment and could be subject to some degree of bias as has been articulated in one meta-analysis (Sonuga-Barke et al., 2013). However, parent perspectives are critically important in documenting treatment effects given their role in overseeing the development of adolescents' homework and organization skills.

5.2. Implications for practice and research

Our findings add to the growing literature supporting the use of training interventions for adolescents with ADHD (Barbaresi et al., 2020; Wolraich et al., 2019) and extend the findings to high school students, as this represents the first large randomized clinical trial of school-based psychosocial treatment to this population. The CHP protocol (i.e., brief individual coaching sessions plus after-school ISG and parenting groups) could be used by school-based mental health professionals to enhance the organizational skills and homework performance of high school students with ADHD. Relative to other possible school-based interventions (e.g., individual or group counseling), this model of CHP is less time-intensive (i.e., one or two 15-min sessions per week plus up to 10 after-school ISG and parent group meetings) and may be feasible for implementation by school practitioners (e.g., as evidenced by the procedures in the HOPS trial; Langberg et al., 2018). This intervention should precede use of commonly implemented educational accommodations (e.g., reduced workload, extra time on tests) as the latter have limited efficacy and potential negative side-effects in relation to interventions (Harrison et al., 2020) and skill building is of primary importance in the context of a life course model for ADHD services (Evans et al., 2014). CHP may need to be supplemented by evidence-based academic support focused on class content especially for students who

continue to underachieve despite improvements in organization skills and assignment completion. Motivational interventions (e.g., behavior contracting, motivational interviewing) may also be helpful for some students as is the case for younger students with ADHD (DuPaul et al., 2012; Sibley, Graziano, et al., 2016). To maintain gains in academic performance, continued CHP implementation or periodic booster CHP sessions may be necessary in subsequent school years.

To further explicate the impact of CHP on high school student academic functioning, with this data set we will continue to examine whether (a) students who completed a majority of scheduled coaching sessions showed greater improvement than non-completers, (b) treatment effects vary across academic subject areas, and (c) demographic, familial, clinical (e.g., symptoms of comorbid disorders), or treatment-related (e.g., therapeutic alliance) variables predict outcome. Future investigations should design and evaluate the specific contributions of each CHP component (i.e., individual coaching, parenting groups, ISG), methods to promote maintenance of treatment gains across school years, assess whether adjunctive interventions (e.g., academic tutoring, motivational strategies) could enhance CHP effects, and conduct dissemination trials to evaluate the effectiveness of CHP when implemented by high school mental health professionals.

6. Conclusions

School-based training interventions such as CHP provide repeated practice in organization, planning, and problem-solving skills along with frequent, specific practice and feedback that lead to improvements in academic enablers (i.e., assignment tracking, organization of materials, homework completion) and may prevent declines in academic performance typically exhibited by high school students with ADHD. In particular, because high school GPA is associated with highly salient educational outcomes (e.g., graduation, college admission), effective intervention during this developmental period is critically important. CHP coaching sessions can be relatively brief and delivered at various points during the school day; thus, sustained intervention across extended periods of time is feasible for school mental health professionals. Further examination of CHP is warranted as part of a comprehensive approach to treating the significant impairment associated with ADHD in adolescents.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jsp.2021.07.001.

References

Abikoff, H., & Gallagher, R. (2008). Assessment and remediation of organizational skills deficits in children with ADHD. In K. McBurnett, & L. Pfiffner (Eds.), *Attention deficit hyperactivity disorder: Concepts, controversies and new directions* (pp. 137–152). LLC: Taylor & Francis Group.

Anesko, K. M., Schoiock, G., Ramirez, R., & Levine, F. M. (1987). The homework problem checklist: Assessing children's homework difficulties. *Behavioral Assessment, 9*, 179–185.

Antshel, K. M., Faraone, S. V., & Gordon, M. (2012). Cognitive behavioral treatment outcomes in adolescent ADHD. *Focus, 10*(3), 334–345.

Barbaresi, W. J., Campbell, L., Diekroger, E. A., Froehlich, T. E., Liu, Y. H., O'Malley, E., … Chan, E. (2020). Society for Developmental and Behavioral Pediatrics clinical practice guideline for the assessment and treatment of children and adolescents with complex attention-deficit/hyperactivity disorder. *Journal of Developmental and Behavioral Pediatrics, 41*, S1–S23.

Boyer, B. E., Geurts, H. M., Prins, P. J., & Van der Oord, S. (2015). Two novel CBTs for adolescents with ADHD: The value of planning skills. *European Child & Adolescent Psychiatry, 24*(9), 1075–1090.

Brady, C. E., Evans, S. W., Berlin, K. S., Bunford, N., & Kern, L. (2012). Evaluating school impairment with adolescents using the classroom performance survey. *School Psychology Review, 41*(4), 429–446.

Dirks, M. A., De Los Reyes, A., Briggs-Gowan, M., Celia, D., & Wakschlag, L. S. (2012). Annual research review: Embracing not erasing contextual variability in children's behavior—Theory and utility in the selection and use of methods and informants in developmental psychopathology. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 53*, 558–574.

DuPaul, G. J., Eckert, T. L., & Vilardo, B. (2012). The effects of school-based interventions for attention-deficit hyperactivity disorder: A meta-analysis. *School Psychology Review, 41*, 387–412.

DuPaul, G. J., Evans, S. W., Allan, D., Puzino, K., Xiang, J., Cooper, J., & Owens, J. S. (2019). High school teacher ratings of academic, social, and behavioral difficulties: Factor structure and normative data for the school functioning scale. *School Psychology, 34*, 479–491.

DuPaul, G. J., Power, T. J., Anastopoulos, A. D., & Reid, R. (2016). *ADHD rating Scale-5 for children and adolescents: Checklists, norms, and clinical interpretation*. Guilford Publications.

DuPaul, G. J., & Stoner, G. (2013). *ADHD in the schools: Assessment and intervention strategies* (3rd ed.) (Guilford).

Evans, S. W., DuPaul, G. J., Benson, K., Owens, J. S., Fu, Q., Cleminshaw, C., Kipperman, K., & Margherio, S. (2021). *Social functioning outcomes of a high school based treatment program for adolescents with ADHD* (manuscript under review).

Evans, S. W., Langberg, J. M., Schultz, B. K., Vaughn, A., Altaye, M., Marshall, S. A., … Zoromski, A. K. (2016). Evaluation of a school-based treatment program for young adolescents with ADHD. *Journal of Consulting and Clinical Psychology, 84*, 15–30.

Evans, S. W., Owens, J. S., Mautone, J., DuPaul, G. J., & Power, T. J. (2014). Toward a comprehensive, life course model of care for youth with ADHD. In M. Weist, N. Lever, C. Bradshaw, & J. Owens (Eds.), *Handbook of school mental health* (2nd ed., pp. 413–426). Springer.

Evans, S. W., Owens, J. S., Wymbs, B. T., & Ray, R. R. (2018). Evidence-based psychosocial treatments for children and adolescents with attention-deficit/hyperactivity disorder. *Journal of Clinical Child and Adolescent Psychology, 47*, 157–198.
Evans, S. W., Pelham, W. E., Smith, B. H., Bukstein, O., Gnagy, E. M., Greiner, A. R., Altenderfer, L., & Baron-Myak, C. (2001). Dose–response effects of methylphenidate on ecologically valid measures of academic performance and classroom behavior in adolescents with ADHD. *Experimental and Clinical Psychopharmacology, 9*(2), 163–175.
Evans, S. W., Schultz, B. K., & DeMars, C. E. (2014). High school-based treatment for adolescents with attention-deficit/hyperactivity disorder: Results from a pilot study examining outcomes and dosage. *School Psychology Review, 43*, 185–202.
Evans, S. W., Van der Oord, S., & Rogers, E. E. (2020). Academic functioning and interventions for adolescents with ADHD. In S. P. Becker (Ed.), *ADHD in adolescents: Development, assessment, and treatment (pp. 148–169)* (Guilford).
Gerst, E. H., Cirino, P. T., Fletcher, J. M., & Yoshida, H. (2017). Cognitive and behavioral rating measures of executive function as predictors of academic outcomes in children. *Child Neuropsychology, 23*, 381–407.
Green, J. G., McLaughlin, K. A., Alegria, M., Costello, E. J., Gruber, M. J., Hoagwood, K., Leaf, P. J., Olin, S., Sampson, N. A., & Kessler, R. C. (2013). School mental health resources and adolescent mental health service use. *Journal of the American Academy of Child and Adolescent Psychiatry, 52*, 501–510.
Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009). Research electronic data capture (REDCap)—A metadata driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics, 42*, 377–381.
Harrison, J., Evans, S. W., Baran, A., Khondker, F., Press, K., Noel, D., Wasserman, S., Belmonte, C., & Mohlmann, M. (2020). Comparison of accommodations and interventions for youth with ADHD: A randomized controlled trial. *Journal of School Psychology, 80*, 15–36.
Kent, K. M., Pelham, W. E., Molina, B. S., Sibley, M. H., Waschbusch, D. A., Yu, J., … Karch, K. M. (2011). The academic experience of male high school students with ADHD. *Journal of Abnormal Child Psychology, 39*(3), 451–462.
Kern, L., Evans, S. W., Lewis, T. J., State, T. M., Mehta, P. D., Weist, M. D., Wills, H. P., & Gage, N. A. (2021). Evaluation of a comprehensive assessment-based intervention for secondary students with social, emotional, and behavioral problems. *Journal of Emotional and Behavioral Disorders, 29*(1), 44–55.
Kuriyan, A. B., Pelham, W. E., Molina, B. S., Waschbusch, D. A., Gnagy, E. M., Sibley, M. H., … Kent, K. M. (2013). Young adult educational and vocational outcomes of children diagnosed with ADHD. *Journal of Abnormal Child Psychology, 41*(1), 27–41.
Langberg, J. M., Dvorsky, M. R., Molitor, S. J., Bourchtein, E., Eddy, L. D., Smith, Z., Schultz, B. K., & Evans, S. W. (2016). Longitudinal evaluation of the importance of homework assignment completion for the academic performance of middle school students with ADHD. *Journal of School Psychology, 55*, 27–38.
Langberg, J. M., Dvorsky, M. R., Molitor, S. J., Bourchtein, E., Eddy, L. D., Smith, Z. R., Oddo, L. E., & Eadeh, H. M. (2018). Overcoming the research-to-practice gap: A randomized trial with two brief homework and organization interventions for students with ADHD as implemented by school mental health providers. *Journal of Consulting and Clinical Psychology, 86*, 39–55.
Langberg, J. M., Epstein, J. N., Becker, S. P., Girio-Herrera, E., & Vaughn, A. J. (2012). Evaluation of the homework, organization, and planning skills (HOPS) intervention for middle school students with ADHD as implemented by school mental health providers. *School Psychology Review, 41*, 342–364.
Mather, N., & Wendling, B. J. (2015). *Essentials of WJ IV tests of achievement.* John Wiley & Sons.
Miller, F. G., & Lazowski, L. E. (2001). *The adolescent SASSI-2 manual: Identifying substance use disorders*. SASSI Institute.
Miller, M., Nevado-Montenegro, A. J., & Hinshaw, S. P. (2012). Childhood executive function continues to predict outcomes in young adult females with and without childhood-diagnosed ADHD. *Journal of Abnormal Child Psychology, 40*, 657–668.
Murray, D. W., Molina, B. S., Glew, K., Houck, P., Greiner, A., Fong, D., … Abikoff, H. B. (2014). Prevalence and characteristics of school services for high school students with attention-deficit/hyperactivity disorder. *School Mental Health, 6*(4), 264–278.
Pelham, W. E., III, Page, T. F., Altszuler, A. R., Gnagy, E. M., Molina, B. S. G., & Pelham, W. E., Jr. (2020). The long-term financial outcome of children diagnosed with ADHD. *Journal of Consulting and Clinical Psychology, 88*, 160–171.
Pelham, W. E., Smith, B. H., Evans, S. W., Bukstein, O., Gnagy, E. M., Greiner, A. R., & Sibley, M. H. (2017). The effectiveness of short-and long-acting stimulant medications for adolescents with ADHD in a naturalistic secondary school setting. *Journal of Attention Disorders, 21*(1), 40–45.
Raggi, V. L., & Chronis, A. M. (2006). Interventions to address the academic impairment of children and adolescents with ADHD. *Clinical Child and Family Psychology Review, 9*(2), 85–111.
Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Sage Publications.
Schultz, B. K., Evans, S. W., Langberg, J. M., & Schoemann, A. M. (2017). Outcomes for adolescents who comply with long-term psychosocial treatment for ADHD. *Journal of Consulting and Clinical Psychology, 85*, 250–261.
Sibley, M. H., Altszuler, A. R., Morrow, A. S., & Merrill, B. M. (2014). Mapping the academic problem behaviors of adolescents with ADHD. *School Psychology Quarterly, 29*, 422–437.
Sibley, M. H., Campez, M., Perez, A., Morrow, A. S., Merrill, B. M., Altszuler, A. R., Coxe, S., & Yeguez, C. E. (2016). Parent management of organization, time management, and planning deficits among adolescents with ADHD. *Journal of Psychopathology and Behavioral Assessment, 38*, 216–228.
Sibley, M. H., Graziano, P. A., Kuriyan, A. B., Coxe, S., Pelham, W. E., Rodriguez, L., Sanchez, F., Derefinko, K., Helseth, S., & Ward, A. (2016). Parent-teen behavior therapy+ motivational interviewing for adolescents with ADHD. *Journal of Consulting and Clinical Psychology, 84*(8), 699–712.
Sibley, M. H., Morley, C., Rodriguez, L., Coxe, S. J., Evans, S. W., Morsink, S., & Torres, F. (2020). A peer-delivered intervention for high school students with impairing ADHD symptoms. *School Psychology Review, 49*, 275–290.
Sibley, M. H., Olson, S., Morley, C., Campez, M., & Pelham, W. E., Jr. (2016). A school consultation intervention for adolescents with ADHD: Barriers and implementation strategies. *Child and Adolescent Mental Health, 21*(4), 183–191.
Sonuga-Barke, E. J. S., Brandeis, D., Cortese, S., Daley, D., Ferrin, M., Holtmann, M., Stevenson, J., Danckaerts, M., van der Oord, S., Dopfner, M., Dittmann, R. W., Simonoff, E., Zuddas, A., Banaschewski, T., Buitelaar, J., Coghill, D., Hollis, C., Konofal, E., Lecendreux, M., … European ADHD Guidelines Group. (2013). Nonpharmacological interventions for ADHD: Systematic review and meta-analyses of randomized controlled trials of dietary and psychological treatments. *The American Journal of Psychiatry, 170*, 275–289.
Sprich, S. E., Safren, S. A., Finkelstein, D., Remmert, J. E., & Hammerness, P. (2016). A randomized controlled trial of cognitive behavioral therapy for ADHD in medication-treated adolescents. *Journal of Child Psychology and Psychiatry, 57*(11), 1218–1226.
Wechsler, D. (2011). *Wechsler Abbreviated Scale of Intelligence–Second Edition (WASI-II)* (NCS Pearson).
Weller, E. B., Weller, R. A., Fristad, M. A., Rooney, M. T., & Schecter, J. (2000). Children's interview for psychiatric syndromes (ChIPS). *Journal of the American Academy of Child & Adolescent Psychiatry, 39*(1), 76–84.
Wolraich, M. L., Hagan, J. F., Allan, C., Chan, E., Davison, D., Earls, M., … Zurhellen, W. (2019). Clinical practice guideline for the diagnosis, evaluation, and treatment of attention-deficit/hyperactivity disorder in children and adolescents. *Pediatrics, 144*, Article e20192528.