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# Trajectories and Predictors of Response to the Challenging Horizons Program for Adolescents With ADHD

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**The Challenging Horizons After School Program is one of the only psychosocial interventions developed specifically for adolescents with attention-deficit/hyperactivity disorder (ADHD) that has demonstrated efficacy in multiple randomized controlled trials. To date, however, all research with the intervention has evaluated outcomes at the group level, and it is unclear whether all adolescents respond similarly, or if the intervention is particularly well suited for certain adolescents with ADHD. This type of information is needed to guide stakeholders in making informed choices as part of dissemination and implementation efforts. The purpose of this study was to evaluate trajectories of response to intervention for a large sample of middle-school age adolescents with ADHD (grades 6–8) who received the after-school intervention ($N$ = 112). An additional goal of the study was to evaluate potential predictors of response trajectories, focusing on determining what factors best distinguished between intervention responders and nonresponders. Latent trajectory analyses consistently revealed four or five distinct classes. Depending on the outcome, between 16% and 46% of participants made large improvements, moving into the normal range of functioning, and between 26% and 65% of participants made small or negligible improvements. Multivariate predictor analyses revealed that a strong counselor/adolescent working alliance rated from the adolescent perspective and lower levels**

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**of parenting stress and parent-adolescent conflict consistently predicted an increased likelihood of intervention response. Implications of these findings for disseminating the after school intervention and for further intervention development are discussed.**

*Keywords:* ADHD; intervention; predictors; latent trajectories; working alliance

Attention-Deficit/Hyperactivity Disorder (ADHD) is a Chronic Mental Health condition that persists into adolescence in the majority of cases (Copeland et al., 2013). During adolescence the expectations placed upon youth begin to shift and increase. In particular, adolescents are increasingly expected to regulate their own behavior and to complete tasks autonomously. At school, adolescents are expected to independently organize, manage, and plan for the completion of homework assignments for four or five classes. At home, parents begin to ask adolescents to take on more household responsibilities (e.g., wake up on own or keep room clean) and to manage time more autonomously (e.g., when to study for a test; Eccles & Harold, 1996). These contextual changes are problematic for adolescents with ADHD who often struggle with goal setting and self-regulation of behavior, especially when tasks are protracted and task completion is not associated with immediate reward (Marco et al., 2009; Toplak, Jain, & Tannock, 2005). As such, ADHD-related impairments can worsen in adolescence as a function of rising environmental demands. Further, parent–child conflict often increases when adolescents with ADHD fail to meet their parents' expectations (Harpin, 2005). Given the scope of developmental changes that occur from childhood to adolescence, it is not surprising that interventions that are effective during childhood do not exhibit lasting effects into adolescence (Molina et al., 2009). Accordingly, researchers are increasingly focusing on interventions that specifically target the skills and impairments unique to adolescents with ADHD.

The Challenging Horizons Program–After School version (CHP-AS) was designed specifically for middle school age adolescents with ADHD and has been evaluated through several small open trials, including three independent investigative teams. In addition, a large randomized trial of the CHP-AS was recently completed (Evans et al., 2015; $N = 324$) comparing the CHP-AS to less intensive model of the CHP, the mentoring model (CHP-M), and to a community care (CC) condition. In this trial, adolescents with ADHD in the CHP-AS made significant improvements in organization and time-management skills, homework problems, and overall academic progress that were sustained to a 6-month follow-up. Improvements were significant relative to both the CC condition and to CHP-M (Evans et al., 2015).

Given the accumulation of data supporting the efficacy of the CHP-AS, efforts to inform schools about the CHP-AS and to provide them with intervention materials (i.e., dissemination; Glasgow et al., 2012) are under way. As often occurs with community-based dissemination efforts, stakeholders are concerned with how best to use limited intervention resources and ask questions such as, "What is a typical response to this intervention (i.e., what can we expect if we put resources towards this?)" or "What types of students are most likely to benefit from participation in the CHP (i.e., where should we focus resources?)." Unfortunately, there has been no research addressing these questions, so it is unclear if there are characteristics of students or intervention implementation processes that are associated with optimal benefit from the CHP. If a group of students can be identified that clearly responds well to the CHP-AS, this would allow schools to effectively target resources towards those students. In addition, it is important to understand whether intervention process variables such as the counselor/student working alliance and intervention dose impact outcomes. If factors associated with intervention implementation (i.e., schools adopting CHP-AS strategies and integrating them into existing curriculum; Glasgow et al., 2012) significantly impact response to intervention, those factors could be emphasized in training educators to implement the CHP-AS. To achieve this goal, it is vital to evaluate participants' response trajectories as well as predictors of these trajectories.

Similar analyses have proven useful for identifying predictors of treatment response for multiple mental health conditions (e.g., anxiety, Ginsburg et al., 2011; conduct problems, Beauchaine et al., 2005). This is because predictor analyses that collapse all individuals who receive treatment into a single group may miss important patterns and potentially lead to inaccurate conclusions. That is, different response trajectories can be associated with unique predictors, and the impact of these predictors may be masked when all participants are collapsed together irrespective of treatment response. For example, in looking at response to treatment for posttraumatic stress disorder (PTSD), Stein et al. (2012) identified separate responder and nonresponder classes and found that several clinically relevant factors predicted treatment response. In contrast, prior research looking at

predictors across all participants with PTSD had been mixed or failed to identify predictors (van Minnen, Arntz, & Keijsers, 2002). In addition, trajectory analyses often lead to clinically relevant information that overall group analyses mask, including the possibility of uncovering a subgroup of children who get worse with treatment (e.g., Warren et al., 2010). Although no latent trajectory or predictor research with the CHP-AS has been conducted to date, research on predictors of treatment response from other ADHD intervention trials with children can be used to formulate hypotheses.

### Predictors of Treatment Response

A wealth of information on predictors of treatment response for younger children with ADHD comes from the Multimodal Treatment of ADHD Study (MTA; MTA Cooperative Group, 1999). These findings have previously been summarized (Hinshaw, 2007; Murray et al., 2008; see van der Oord & Daley, 2015 for a recent comprehensive review) and will only be reviewed briefly here. Swanson et al. (2007) used latent trajectory analyses to evaluate response to the MTA interventions 3 years post-baseline. Across interventions, three classes were identified, with 34% of the sample making a small initial improvement and continued gradual improvement, 52% making a large initial improvement that was maintained, and 14% making an initial large improvement followed by deterioration of functioning. Factors such as ADHD severity and psychiatric comorbidity predicted class membership. Indeed, the severity of the child's ADHD at baseline and associated comorbid conditions has been shown to predict response to treatment across multiple studies using data from the MTA. In particular, children with comorbid anxiety had an improved response to behavioral treatment, responding equally well as participants in the medication condition. It appears that children with ADHD and comorbid anxiety may have a greater desire to please adults/authority figures and may therefore be motivated to implement the recommended behavioral strategies and skills (March et al., 2000). In contrast, children with comorbid ODD had poorer outcomes than children with ADHD alone (Murray et al., 2008). Further, given that severity of ADHD symptoms is associated with treatment response, use of ADHD medication may be an important predictor to consider. Specifically, adolescents on medication may have less severe symptom profiles at the start of treatment and/or be better able to benefit from behavioral strategies. Taken together, these findings suggest that ADHD medication use and symptoms of ADHD, ODD, and anxiety may be important predictors of trajectories for young adolescents with ADHD.

Attendance to treatment (i.e., dose of treatment received) was also found to be an important predictor of response in the MTA study (Hinshaw, 2007), and this finding has been replicated in other psychosocial intervention research (e.g., Clarke et al., 2015). One obvious reason for this is that the skills taught through intervention are unlikely to be learned and rehearsed sufficiently with inconsistent intervention attendance. Another reason for this finding may be that without consistent attendance, a strong therapist-child working alliance is unlikely to form. Broadly defined, the term working alliance refers not only to the bond between the therapist and client, but also to the therapist and client's ability to work collaboratively and to agree upon treatment goals (Martin, Graske, & Davis, 2000). Given these relational and motivational factors, it is not surprising that alliance has been shown to account for a significant portion of the variance in therapeutic improvement (e.g., McLeod, 2011; Shirk, Karver, & Brown, 2011). For example, Langberg et al. (2013) evaluated predictors of response to a school-based organizational skills intervention in 23 adolescents with ADHD and found that working alliance as rated by the student was an important predictor of outcomes but working alliance as rated by the school mental health provider did not predict outcomes.

Finally, factors related to participants' parents/guardians and broad family factors have repeatedly been shown to predict response to treatment for younger children with ADHD (e.g., Hoza et al., 2000). Two factors may be particularly relevant for an intervention such as the CHP-AS. First, high levels of parent stress are common in families of adolescents with ADHD (Harpin, 2005) and may impede parents' ability to effectively monitor skills implementation or to positively reinforce skills use. Second, parent-adolescent conflict often increases during the period of adolescence as parents begin to expect adolescents with ADHD to complete school activities autonomously, but they often fail to do so. High parent–child conflict may make it difficult for parents to effectively assist the adolescent with skills implementation and may reduce the likelihood that adolescents are motivated to use the skills at home. Although there are certainly a host of additional factors that could be considered, the factors reviewed above have the most theoretical relevance for a skills-based intervention such as CHP-AS.

The purpose of the present study was first and foremost to identify different trajectories of treatment response to the CHP-AS. We are only aware of one prior study with adolescents with ADHD that evaluated trajectories of response. Specifically, in a sample of 49 middle school students with ADHD,

Evans et al. (2009) reported that there were three different trajectories of response; "immediate responder," "slow-but-steady," and "honeymoon." However, these trajectories were identified visually rather than statistically, the CHP-AS includes many other intervention components, and predictors of response were not evaluated in the Evans et al. study. The present study builds upon this prior work by evaluating trajectories of response using latent growth curve analyses in a larger sample of middle school age adolescents who received the CHP-AS for a full school year. A secondary goal of this study is to evaluate whether participant/family characteristics (i.e., ADHD, ODD, anxiety, gender, anxiety, parent stress, parent-adolescent conflict, sex, medication use) and/or intervention process variables (i.e., working alliance, intervention dose) predict the trajectory classes.

The present study was focused on determining which factors distinguished those adolescents who exhibited a large response to the CHP-AS, moving well into the normal range of functioning, from those who made small or negligible improvements. Given the importance of working alliance from the student perspective in the Langberg et al. (2013) study, we hypothesized that higher working alliance would predict a positive response to intervention. Further, given that CHP-AS is a behavioral skills-training intervention, we predicted that adolescents with higher attendance (defined as number of ASP activities received) and with comorbid anxiety would be more likely to respond positively to intervention. We also believed that parent/family level factors would contribute significantly to the trajectory of response because many of the skills adolescents were taught (e.g., homework management and organizational skills) would be more likely to be utilized if they were reinforced at home. This may be less likely to occur in families with high stress and conflict. In terms of outcomes, the present study focuses on the academic domain, because adolescents with ADHD frequently exhibit clinically significant academic impairment (DuPaul & Langberg, 2014) and academic outcomes are typically very salient to parents and school-based stakeholders. Specifically, this study evaluates trajectories of response for each of the parent-rated primary academic outcomes collected in the randomized controlled trial (Evans et al., 2015).

## Method

The present multisite study was conducted in nine urban, suburban, and rural middle schools. In a three-group parallel design, stratified for site and medication status at baseline, participants were randomly assigned within middle school to either (a) CHP-AS, (b) CHP-M, or (c) CC. Site institutional review boards approved the study and all participants completed informed consent/assent procedures. Recruitment was conducted through three primary methods: study announcement letters were mailed to the parents of all students attending the middle school, school staff directly informed parents of some students about the opportunity to participate, and fliers were posted in each school.

### PARTICIPANTS

Participants were 326 students in sixth through eighth grades recruited in three cohorts over three successive academic years. Only participants randomly assigned to the CHP-AS ($n$ = 112) are included in the present study. All participants were in middle school ($M_{age}$ = 12.1 at baseline). The sample was 70% male and self-identified as 74% White, 14% Biracial, 7% African American, 3% Hispanic and 5% other. A wide range of family incomes ($M$ = 56,000; $SD$ = 45,000) and parental education levels ($M$ = 14 years of school; $SD$ = 2.2) were represented.

Primary caregivers (hereafter "parents") who contacted the investigators in response to recruitment activities completed an eligibility screening. Those meeting the screening criteria were scheduled for an evaluation to determine eligibility. Criteria for inclusion in the study required that adolescents met full DSM-IV-TR diagnostic criteria for either ADHD–Predominantly Inattentive Type or ADHD Combined Type ADHD based on the Parent Children's Interview for Psychiatric Syndromes (P-ChIPS; Weller, Weller, Fristad, Rooney, & Schecter, 2000) and did not meet diagnostic criteria for a pervasive developmental disorder, bipolar disorder, psychosis, or obsessive–compulsive disorder. Each participant's comprehensive assessment data were reviewed by two doctoral-level psychologists to determine eligibility and diagnosis. Using DSM-IV criteria, 55% of the participants met criteria for ODD or CD, 27% met criteria for an anxiety disorder, and 13% met criteria for a depressive disorder (see Evans et al., 2015, for a more detailed description of recruitment activities and of participant demographic characteristics).

### DESCRIPTION OF THE CHP-AS

The CHP-AS occurred two days per week for 2 hours and 15 minutes per day beginning in September and continuing through May. Between 6 and 10 students were assigned to attend the program at each school. The intervention focuses on teaching academic skills that are particularly relevant following the transition to middle school when students have multiple classes/teachers and an

increased workload. Specifically, materials organization and homework management and recording skills are some of the primary intervention targets. Each after-school program day was composed of five daily activities including a meeting between the participant and a designated staff member (Primary Counselor Time), a group intervention targeting social impairment (Interpersonal Skills Group; ISG), recreation/game time (Recreation Time), an education/study skills group (Education Group), and an individual education time for homework completion (Individual Education Time). The CHP-AS was staffed by undergraduate students (referred to as primary counselors [PC]) and a site-supervisor (advanced graduate student/post-doctoral fellow).

Participants were randomly assigned to a PC with no more than two students assigned to one PC. PCs focused on developing a therapeutic relationship, managing progress on the level system, coordinating interventions, and regularly communicating with the students' teachers. PCs helped participants develop a system for organizing their binders, bookbags, and lockers according to a list of organization criteria in the CHP manual. During the academic year PCs checked their belongings to monitor continuous adherence to the checklists. PCs also checked students' planners/agendas to track the accuracy of homework/assignment recording (see Evans et al., 2015, for a more detailed description of intervention procedures).

### FIDELITY TO INTERVENTION PROCEDURES

An 18-item adherence form was created to assess implementation of core treatment components (0 = *not implemented as intended*, 1 = *fully implemented as intended*). A team of independent observers were trained to assess adherence during live observations of the CHP-AS. For the purpose of assessing treatment adherence, 24.32% ($n$ = 81) of all program sessions were randomly selected to be observed and analyzed. Across all observed sessions, treatment adherence was high, as 85.06% of the program components were implemented as intended. Thirty percent of the observed sessions were double-coded with interobserver agreement calculated and discrepancies discussed. In total, the average interobserver agreement was 95.32%.

### OUTCOME MEASURES

All participants were assessed six times across the study: initial assessment (spring of pretreatment year, T1), four equally spaced occasions during the intervention year (T2, T3, T4, and T5 [posttreatment]), and 6 months after treatment ended (T6, follow-up; approximately halfway through the subsequent school year). The academic outcome measures are listed below.

*Children's Organizational Skills Scale (COSS; Abikoff & Gallagher, 2009)*

The COSS is a parent-completed rating scale assessing organization, time management, and planning difficulties. The parent version is composed of 58 items each with a 4-point rating scale (1 = *Hardly ever or never*; 2 = *Sometimes*; 3 = *Much of the time*; 4 = *Just about all of the time*). The COSS has demonstrated good discriminative validity and sensitivity to treatment effects in previous studies of youth with ADHD (e.g., Abikoff et al., 2013, Langberg et al., 2012; Pfiffner et al., 2014). In contrast to the other outcome measures, the COSS was only collected at four time points during the study, T1, T3 (mid-intervention year), T5, and T6. *T*-scores for all three subscale scores (Materials Management [α = .82], Organized Actions [α = .64[1]], and Task Planning [α = .81]) were included in the analyses.

*Homework Problems Checklist (HPC; Anesko, Schoiock, Ramirez, & Levine, 1987)*

The HPC is 20-item parent completed rating scale assessing performance on homework. It includes a factor related to *inattention and avoidance of homework* (Factor 1; α = .91) and another related to *poor productivity and nonadherence with homework rules* (Factor 2; α = .88). Concurrent validity was supported by examining correlations between the HPC and other parent and teacher ratings of related behavior (Power et al., 2006). Both HPC factors were included as outcomes.

*Impairment Rating Scale (IRS; Fabiano et al., 2006)*

The IRS is a 7-item rating scale assessing broad areas of impairment. Items are scored on a 7-point scale ranging from *No Problem, Definitely does not need to treatment or special services* to *Extreme problem, Definitely needs treatment or special services*. Past research supports good test–retest reliability, convergent/discriminant validity, and internal consistency (Fabiano et al., 2006). Parent ratings of the participants' impairment on academic progress using a 7-point scale described above was included as an outcome in the present study.

### PARTICIPANT/FAMILY CHARACTERISTIC PREDICTOR VARIABLES

*Stress Index for Parents of Adolescents (SIPA; Sheras, Abidin, & Konold, 1998)*

The SIPA is a 112-item parent-completed rating scale that measures parental stress across multiple

[1] One item on this factor appears to have compromised its internal consistency. Item 50 asks parents to rate whether other children do not like to work on projects with their child due to disorganization. It is possible that parents of young adolescents do not know this. Without this item α = .82. Analyses were re-run after removing Item 50, and results were unchanged.

domains and produces an overall composite score (total stress) and subscale scores. Ninety items are rated on a 5-point scale from *Strongly Disagree* to *Strongly Agree*. The Total Parenting Stress raw score was used in these analyses (α = .82). Normative data collected with the SIPA found high internal consistency for the Total Parenting Stress score (.97) and strong test–retest reliability (.93).

*Conflict Behavior Questionnaire (CBQ; Prinz, Foster, Kent & O'Leary, 1979)*
A 20-item true/false version of the CBQ (Prinz et al., 1979) was developed by Robin (Robin & Foster, 1989) that correlated with the full measure (44 items; .96). This scale has been widely used in adolescent intervention research and found to have excellent internal consistency (.90), adequate test–retest reliability (.57 – .82 for parents appraisals of teens), and evidence of validity in distinguishing distressed from nondistressed families (Robin & Foster, 1989). In this study the primary caregiver completed the scale rating the target adolescent (α = .90).

*Disruptive Behavior Disorders Rating Scale (DBD; Pelham, Evans, Gnagy, & Greenslade, 1992)*
The DBD is a 45-item DSM-based parent-rated checklist for symptoms of ADHD and ODD on a Likert scale (*not at all*, *just a little*, *pretty much*, *very much*). Van Eck, Finney, and Evans (2010) documented the reliability of the measure and confirmed the factor structure in a sample of young adolescents. The ADHD and ODD symptom dimensions were evaluated as predictors in the current study (αs = .89 and .90, respectively).

*Multidimensional Anxiety Scale for Children (MASC; March et al., 1997)*
The MASC is a 39-item self-report measure of anxiety symptoms in youth across four domains: physical symptoms (12 items), harm avoidance, social anxiety, and separation. Item responses range from 0 (*never true about me*) to 3 (*often true about me*). Internal consistency for the subscales is adequate and concurrent, convergent, and divergent validity has been established (Baldwin & Dadds, 2007; March, 1997). In the present study, the total *T*-score (α = .90) was examined as a predictor variable.

*Medication Use*
Participants' use of ADHD medication was documented at baseline and tracked by asking parents at each assessment point for information about their child's service use. If parents reported that their child took medication, they were asked how many days per week the child took medication and when changes were made. Similar to the methodology used in the MTA Study (MTA Cooperative Group, 1999), these data were used to create a variable indicating the percent of days the child was taking medication in between each of the assessment occasions. This variable was examined as a predictor in the analyses.

### INTERVENTION PROCESS PREDICTOR VARIABLES

*Working Alliance*
The short version of the Working Alliance Inventory (WAI-Short; Tracey & Kokotovic, 1989) was used to measure the student-counselor working alliance. It consists of 12 items on a 7-point Likert scale (1 = *never*, 4 = *sometimes*, and 7 = *always*) with three subscales mapping directly onto important aspects of the working alliance (i.e., agreement on tasks, agreement on goals, and bond) and a total score (sum of three subscales). The items were slightly modified to make them relevant to the current study and clear to the adolescent. Mainly, this involved removing the word "therapy" and making change statements relate specially to school performance (i.e., the target of the intervention). For example, the item "The counselor and I agree about the things I will need to do in therapy to help improve my situation" was modified to read "The counselor and I agree about the things I will need to do to improve my school performance." The WAI has consistently been reported as highly reliable (.84–.92) and possessing adequate convergent validity with other alliance measures (Hanson, Curry, & Bandalos, 2002). In this study, the counselor and the student independently completed the WAI halfway through the second semester of the school year, or one third of the way through the intervention and school year. Both the PC's (α = .95) and student's ratings (α = .80) were examined as predictor variables.

*Attendance*
Participant attendance to the ASP sessions was tracked on an ongoing basis. In some cases, participants would attend part of an after-school program day rather than the full day. This occurred most frequently when a participant was on a sports team, in which case after-school time was split between the CHP and practice. As such, ASP attendance was also tracked on a more nuanced level; number of CHP activities completed each day. As described above, there were five primary activities delivered each day. The percentage of activities attended averaged over the course of the year was used as a predictor in the analyses.

### ANALYTIC PLAN

We used group-based trajectory analyses to identify subgroups of treatment response trajectory. Group-based trajectory analyses assume that the

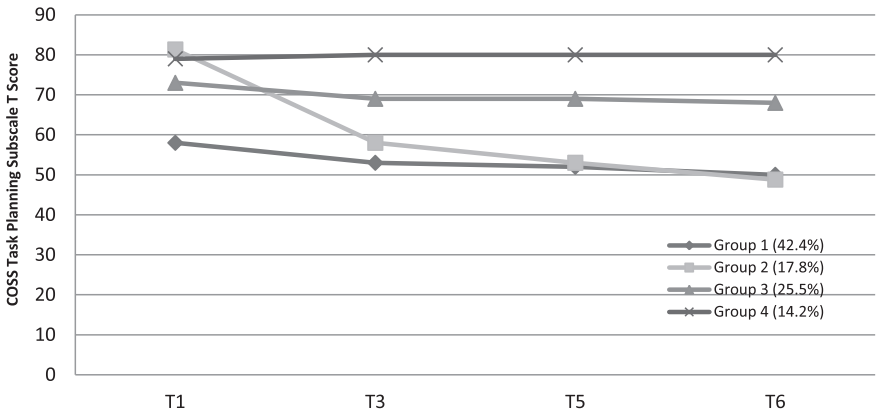


FIGURE 1 Latent Trajectories for the COSS Task Planning Subscale. Children's Organizational Skills Scale (COSS) Task Planning Subscale trajectories of response from baseline (T1) to 6-month follow-up (T6). Higher scores on Y- axis indicate more impairment and scores below 60 are within normal range.

whole population is composed of different groups that each have a distinct trajectory of a given outcome over time and identify groups of individuals that follow a similar trajectory. Specifically, mixture models analyses were used where the probability of group membership is modeled with a generalized logit model and a censored normal model to model the conditional distribution of outcome given a group membership. The group based trajectory analyses were conducted using SAS PROC Traj (Jones & Nagin, 2007), and the parameters of the model were estimated using maximum likelihood estimation. Clustering and trajectory models were evaluated separately for each outcome measure and the number of groups was chosen based on the Bayesian Information Criterion (BIC) criteria (Nagin, 2005). As described by Jones, Nagin, and Roeder (2001), traditionally the BIC is the log-likelihood evaluated at the maximum likelihood estimate less one-half the number of parameters in the model times the log of the sample size and it is used as a model selection tool. However, this tends to favor more parsimonious models than likelihood ratio tests when used for model selection. Fraley and Raftery (1998) provide the use of Bayes factors in model based clustering. The Bayes factor gives the posterior odds that the alternative hypothesis is correct equals one-half. Hence we used the BIC log Bayes factor approximation, $2\log_e(\text{Bayes factor}) \approx 2(\Delta\,\text{BIC})$ where $\Delta\,\text{BIC}$ is the BIC of the alternative (more complex) model less the BIC of the null (simpler) model. The log form of the Bayes factor is interpreted as the degree of evidence favoring the alternative model.

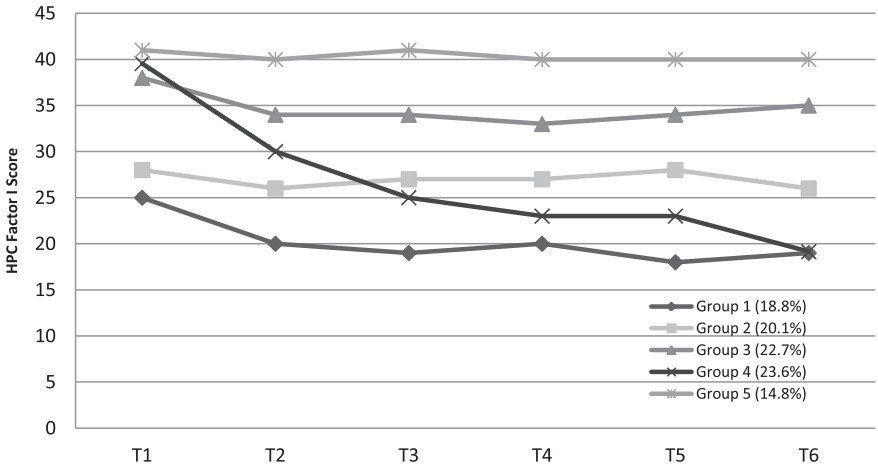


FIGURE 2 Latent Trajectories for Homework Problems Checklist Factor I. Homework Problems Checklist (HPC) Factor I trajectories of response from baseline (T1) to 6-month follow-up (T6). Higher scores on Y- axis indicate more impairment.

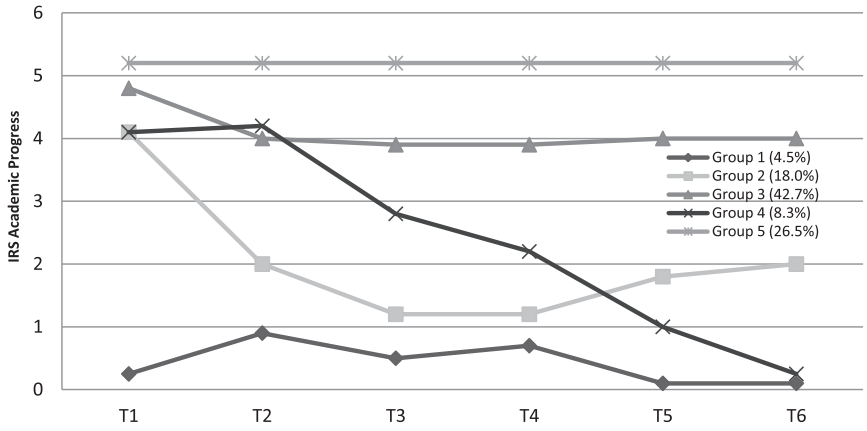


**FIGURE 3** Latent Trajectories for Impairment Rating Scale Academic Progress. Impairment Rating Scale (IRS) academic progress trajectories of response from baseline (T1) to 6-month follow-up (T6). Higher scores on Y- axis indicate more impairment and score below 3 is within the normal range.

For the predictor analyses, the treatment trajectories identified as specified above were dichotomized, with a focus on identifying groups that made small or negligible effect size improvements and groups that made large effect size improvements. These groups were readily apparent from calculation of Cohen's *d* and visual inspection of the trajectories (see Figures 1–3). In addition, we ensured that the groups selected did not differ significantly on baseline severity. If two or more groups were found that did not differ at baseline (i.e., pretreatment) *and* had similar response trajectories (e.g., both falling in the small/negligible range), they were collapsed into a single group for predictor analyses in order to prevent group sizes from becoming so small that they lost clinical utility (e.g., Figure 1, groups 3 and 4). Trajectories of participants that started in the normal range of functioning and ended in the normal range of functioning were not of interest and were not considered further (e.g., Figure 3, group 1).We subsequently fit logistic regression models to evaluate the ability of the identified predictor variables to distinguish between the group that made small/negligible improvements and group that made large improvements. The SAS PROC Genmod procedure was used to fit the model while at the same time accounting the clustering effect of students within schools via the general estimating equation approach.

Correlations between each predictor and outcome variable were calculated. Predictors that were correlated with outcomes at $p < .10$ were retained and entered simultaneously into the multivariate regression models. Consistent with other longitudinal studies of youth with ADHD (e.g., Massetti et al., 2008), the liberal $p < .10$ cutoff was selected to ensure that potentially important predictor variables were not excluded from the model. Because we were interested in determining if predictors varied as a function of the academic outcome being evaluated, seven multivariate models were tested. We chose this statistical strategy because we wanted to identify the most parsimonious set of variables that predict outcomes. The alternative is to start with a base model and to add variables to the base model to determine if additional variance is explained. However, this approach assumes that certain variables (e.g., ADHD symptoms) should be in the base model. There has been almost no research on predictors of intervention for adolescents with ADHD (as opposed to children), which makes such a priori decisions both difficult and premature. Accordingly, we treated all variables equally and allowed the data (correlations) to determine which variables to include in the regression models. To assess for the potential presence of multicollinearity between the predictor variables, we calculated a variance inflation factor (VIF) for each model.

## Results

### LATENT TRAJECTORIES OF TREATMENT RESPONSE

The results of the latent trajectory analyses were graphed so that treatment response by subgroup could be examined visually. Four or five separate groups were identified for all outcomes and patterns were similar across outcomes. As exemplars, the Task Planning subscale of the COSS is displayed in Figure 1, HPC Factor I in Figure 2, and IRS Academic Impairment in Figure 3. No VIF values were above 10 (values >10 are typically considered problematic) and no tolerance values were below 0.10, indicating that multicollinearity was not an issue.

*Organization*

For the Task Planning subscale of the COSS (see Figure 1), four separate trajectories were identified. Three groups of participants had scores well into the clinical range (scores above 60) at baseline and one group (44% of the sample) was in the normal range at baseline and stayed in the normal range throughout the study and was therefore not considered further. Eighteen percent of participants made large and significant improvements on this subscale, with average scores of 81.33 (*SD* = 6.89) at baseline and average scores well into the normal range of functioning at the 6-month follow-up assessment 48.8 (*SD* = 5.82), an effect size of Cohen's *d* = 5.11. For the predictor analyses presented below, this group of participants was compared to the combination of the two groups of participants who started in the clinically impaired range 73.8 (*SD* = 8.28) but did not make such dramatic improvements (*M* at follow-up =69.47 [*SD* = 9.12]; *d* = .50).

Analyses for the COSS Memory and Materials Management subscale identified five distinct trajectories. Two of these groups (58%) started with minimal impairment and ended with minimal impairment (scores in the 50–60 range at baseline and follow-up) and are thus not considered further. Three groups were rated as highly impaired at baseline (scores in the 75–80 range) and one of these groups made large and significant improvements with intervention (16% of sample), moving from an average score at baseline of 77.94 (*SD* = 5.66) to an average score at follow-up of 49.25 (*SD* = 5.45), an effect size of *d* = 5.16. The other two groups that started in the clinical range did not improve or made small improvements (combined *d* = .36). For the predictor analyses, the responders group was compared to the combination of the two nonresponders groups (26% of sample).

Finally, the latent trajectory analyses with the COSS Organized Action subscale revealed four distinct groups with two (35%) making significant improvements and two (65%) making small improvements. Accordingly, for the predictor analyses, the two responder groups were combined (combined *d* = 1.38) and contrasted with the combination of the two small response groups (combined *d* = .31).

*Homework Problems*

The profile identified for Factor I of the HPC (see Figure 2) mirrored the profile for the COSS Memory and Materials Management subscale. Specifically, five trajectories were identified with three of the five groups having baseline scores showing significant impairment (means for all three groups ~40). One of these groups (23% of the sample) made very large improvements (*d* = 5.07) with the CHP-AS intervention, with scores dropping from 39.56 (*SD* = 3.5) at baseline to 19.15 (*SD* = 4.54) at the 6-month follow-up. Accordingly, for the predictor analyses, this responders group was compared to the combination of the two groups that started with similar impairment but that made smaller, but still substantial in this case, improvements (combined baseline *M* = 39.4; combined follow-up *M* = 35.03; 36% of the sample; *d* = .85).

For Factor II on the HPC, four distinct trajectories were identified. One group (28% of the sample) exhibited minimal to no impairment on Factor II at baseline or throughout the study period and was thus not considered further. In contrast, and as reflected in the intent-to-treat (ITT) analyses where effect sizes were large for this factor, 45% of the sample made large and significant improvements and were classified as responders. This group went from an average score of 17.5 (*SD* = 3.25) at baseline to a score of 11.14 (*SD* = 3.03) at the 6-month follow-up (*d* = 2.02). Two groups had baseline scores in the impaired range at baseline similar to the responders' baseline scores (combined *M* = 19.77) but made negligible improvements (combined *M* = 19.27 at follow-up; 27% of the sample). Accordingly, the two groups that made a negligible response (*d* = .13) were combined and compared to responders for predictors analyses.

*Academic Impairment*

The latent trajectory analyses for IRS academic impairment identified five groups. As shown in Figure 3, four of the groups had mean baseline scores between 4 and 5.5, suggesting that they started the intervention with significant academic impairment. Two of those groups made considerable improvement during the study period but had different trajectories. The first group (18% of the sample) made rapid improvements into the normal range of functioning and then leveled off or increased slightly in impairment from postintervention to the follow-up period. The second group was small (8%) and did not show as rapid an improvement as the first group but made steady, remarkable improvement during and after the intervention, moving from a mean score of 4.0 to a mean score near 0. The other two groups that started in the impaired range either made small improvements (average 1 point improvement) but stayed in the clinical range (43% of sample) or made no improvement at all (26% of sample). Accordingly, for the predictor analyses, the two groups that made improvements into the normal

range were combined and compared to the two groups that stayed in the clinical range throughout the study period.

### PREDICTORS OF TREATMENT RESPONSE TRAJECTORY

#### *Organization*

For the COSS Task Planning subscale self-reported symptoms of anxiety, adolescent-rated working alliance, and parent-adolescent conflict were bivariately associated with the latent trajectories and included in the multivariate model. In the multivariate model, only adolescent-report of the working alliance was marginally significance ($z = 1.83$; $p = .07$) and was in the expected direction with higher alliance associated with greater likelihood of being in the responder group.

For the COSS Organized Action subscale, sex, baseline hyperactive/impulsive, ODD, and anxiety symptoms, adolescent- and counselor-rated working alliance, parent-adolescent conflict and parent stress were all associated with the trajectories of interest and were included in the multivariate model. When included together in the multivariate model, sex ($z = -2.28$; $p = .02$), anxiety ($z = 2.7$; $p = .007$), adolescent-rated working alliance ($z = 2.15$; $p = .03$), and parent-adolescent conflict ($z = -2.08$; $p = .04$) were all statistically significant. Consistent with hypotheses, higher self-reported anxiety, stronger working alliance, and lower parent-adolescent conflict were associated with a significantly greater likelihood of being in the responder group. The sex coefficient was negative, indicating that girls had a greater likelihood of being in the responder group than boys.

Finally, for the COSS Memory and Materials Management subscale, sex, ADHD medication use, counselor- and adolescent-rated working alliance, and parent-adolescent conflict and parenting stress were bivariately associated with the trajectories. In the multivariate model, sex ($z = -2.26$; $p = .02$) and ADHD medication use ($z = 2.95$; $p = .003$) were both significant. Girls again had an increased likelihood of being a responder when compared to boys, as was ADHD medication use.

#### *Homework Problems*

For Factor I of the HPC, sex, ADHD medication use, ODD symptoms, intervention dose/attendance (number of ASP activities completed), adolescent-rated working alliance, and parent-adolescent conflict and parenting stress were bivariately associated with the trajectories. In the multivariate model, sex ($z = 3.49$; $p = .0005$), number of ASP activities ($z = 3.32$; $p = .0009$), and parent-adolescent conflict ($z = -2.12$; $p = .03$) were all significant and adolescent-rated working alliance was marginally significance ($z = 1.86$; $p = .06$). All predictors were operating in the expected direction with a higher number of ASP activities completed associated with an increased likelihood of being the in responder group as was lower conflict. However, the effect of sex differed in that girls were more likely than boys to be in the nonresponder group.

For HPC Factor II, only number of ASP activities completed, adolescent-rated working alliance, and parent-rated stress were significant at the bivariate level. In the multivariate model, parent-rated stress was a significant predictor ($z = -1.98$; $p = .047$) and number of ASP activities completed was a marginally significant predictor ($z = 1.83$; $p = .067$). Higher parent stress was associated with a decreased likelihood of responding to treatment and completion of a higher number of ASP activities was associated with an increased likelihood of being a responder.

#### *Academic Impairment*

Sex, ADHD medication use, baseline symptoms of inattention, number of ASP activities completed, adolescent-rated working alliance, and parent-adolescent conflict and parent stress were all significantly associated with IRS academic impairment trajectories at the bivariate level. In the multivariate model only sex ($z = 2.31$; $p = .02$) and adolescent-rated working alliance ($z = 2.02$; $p = .04$) were statistically significant predictors. As with previous outcomes, a higher working alliance was associated with a significantly increased likelihood of being a responder. Similar to the HPC Factor I results, girls were more likely to be nonresponders.

## Discussion

This study evaluated trajectories of response to intervention in a sample of 112 middle school age adolescents with ADHD who received the CHP-AS. In addition, predictors of response were evaluated with a focus on determining what factors distinguished participants who made large and significant improvements from those participants who made only small or negligible improvements. The latent growth analyses consistently revealed four or five distinct response trajectories. Depending on the outcome, between 16% and 46% of the sample fell into a group classified as responders. Participants in this group made large and substantial improvements, moving in multiple domains from having significant impairment in the clinical range prior to intervention to being well within the normal range post-intervention (e.g., see Figures 1–3 for examples; *d*s range from 1.38 – 5.16). Groups of participants were also identified who did not respond as well to the CHP-AS, with between 26% and 65% of participants classified

as nonresponders across outcomes examined. These participants were not "nonresponders" in the traditional sense because they did make small to moderate effect size improvements on some outcomes (*d*s range from 0.13 to 0.85) but did not move into the normal range postintervention.

The significant variability in response to the CHP-AS provided the opportunity to conduct predictor analyses comparing those participants who made large and clinically meaningful improvements to those who did not. The most consistent single predictor of response was adolescent-rated working alliance, with stronger alliance significantly associated with being a treatment responder for four of the six outcomes examined. However, when considered together as family-related factors, high parent-adolescent conflict or parent stress also predicted nonresponse in four out of six outcomes. These findings are discussed in more detail below.

### WHAT IS A TYPICAL RESPONSE TO THE CHP-AS INTERVENTION?

The trajectory analyses revealed multiple findings that could be useful to stakeholders considering implementing the CHP-AS. When disseminating information about an intervention, it is important to be realistic when discussing potential intervention effects with stakeholders. These data suggest that a minority of adolescents with ADHD who receive the CHP-AS will exhibit *normalized* academic functioning as a result of participation. The percentage of adolescents rated as functioning in the normal range at the 6-month follow-up varied as a function of the outcome. Across all outcomes, the average percentage of participants placed in the group that made large and significant improvements into the normal range was 28%. The highest percentage of adolescents moved into the normal range according to parent-rated homework materials management problems (45% of participants). This is consistent with the emphasis the CHP-AS places on teaching adolescents with ADHD how to accurately record assignments and to successfully transfer materials between home and school. It is also interesting to note that for each outcome there was a group of students who started and ended in the nonimpaired range. For some outcomes (e.g., COSS Task Planning) this percentage was substantial (42.4%). This is also important information for stakeholders because if the students also lacked impairment in other areas, it could be viewed as a poor use of resources to include these students in the CHP-AS. However, it is important to note that one of the benefits of the CHP-AS has been the prevention of decline across an academic year as multiple studies have reported substantial declines in performance for students in a control condition over the course of the acadmic year (e.g., Evans et al., 2015). Thus, maintaining performance in the normal range or near the normal range may represent meaningful prevention for some of the participants.

It is also important for stakeholders to know that there are groups of students who will make small or negligible improvements with the CHP-AS. For each outcome, there were one or two groups of students who started in the highly impaired range and remained impaired following the intervention. Unfortunately, this was not an insignificant number of students. As shown in Figures 1 – 3, 39% of the sample was classified as nonresponders for Task Planning, 35% for HPC Factor I, and more than half the sample (69%) for IRS Academic Progress. In many ways, these differences between outcomes are consistent with expectations as the Task Planning and HPC Factor I measures ask about specific behaviors targeted in the CHP-AS, whereas the IRS is asking parents to rate academic functioning in the broadest sense and may therefore be less sensitive to change. Nevertheless, these are either adolescents who should not be treated using the CHP-AS or who will need a higher dose of intervention. Alternatively, if factors could be identified that predicted nonresponse, then the CHP-AS intervention could be systematically improved to target those factors.

### CHARACTERISTICS OF ADOLESCENTS AND FAMILIES MOST LIKELY TO BENEFIT FROM THE CHP-AS

In turning to our findings from the predictor analyses, consistent with hypotheses, parent-level factors (parent-adolescent conflict and parent stress) were bivariately associated with almost all outcomes and reached or were marginally significant in five of the eight logistic regression models. This is an important finding as the CHP-AS is an adolescent focused training intervention and only minimally involves parents. The focus on the adolescent is by design, as in many of the schools requiring parent involvement would significantly limit the number of adolescents who could participate. However, many of the skills taught to the adolescents with ADHD (e.g., homework recording, materials organization, and study strategies) would likely be implemented more successfully if parent support were provided. For example, parents might praise or reinforce in other ways use of the skills being taught in the CHP-AS. It may be that those families with high parent-adolescent conflict or high parent stress are unable to effectively encourage use of the CHP-AS skills and

so generalization and improvement in outcomes is less likely to occur. Again, there are multiple potential implications of this finding, including the possibility that families could be screened to determine which adolescents are most likely to benefit from the CHP-AS (i.e., low on parent-adolescent conflict). It may be that families with high parent-adolescent conflict and parent stress need a family-focused intervention approach (e.g., Sibley et al., 2013) in addition to or rather than an adolescent focused intervention. However, as discussed above, many parents are reluctant to engage in treatment. Another possibility would be to increase the emphasis on parent involvement for the CHP-AS intervention. For example, interested parents could be taught how to praise and reinforce skills and how to avoid conflict surrounding homework.

Additional participant characteristics predicted outcomes less consistently, including internalizing symptoms, ADHD medication use, and sex. Given the inconsistency with which these variables predicted outcomes, these findings will only be discussed briefly. It is unclear why girls would respond worse than boys to the CHP-AS interventions on the COSS outcomes, but better on the HPC Factor I and IRS academic progress outcomes. Given these differential findings, more research is needed before making recommendations regarding participation based on sex. Although it is interesting that ADHD medication use was associated with an increased likelihood of responding for the COSS Memory and Materials Management subscale, medication use was not associated with the other five outcomes. This is consistent with the vast majority of prior ADHD psychosocial intervention research which has not found evidence that medication use facilitates uptake of, or response to, behavioral strategies. Similarly, symptoms of anxiety were only significant in one of the multivariate models. Finally, it is interesting to note that ADHD and ODD symptoms were not significant in any of the final models, suggesting that the presence of overt externalizing behaviors does not preclude adolescents from responding to the CHP-AS.

### THE IMPORTANCE OF INTERVENTION PROCESS VARIABLES

Intervention process variables evaluated in this study included working alliance as rated by the counselor and student and intervention dose, defined as the number of CHP activities completed. Number of activities completed was significant in the model for HPC Factor I ($p = .0009$) and marginally significant in the model for HPC Factor II ($p = .067$). This finding is logical as homework management and completion behaviors are the main focus of the CHP-AS intervention and those adolescents who consistently attended the CHP would have received more assistance completing and managing homework assignments, thereby reducing the parent burden typically associated with homework. It is interesting that the number of activities completed did not predict any other outcomes, and this suggests that a shorter version of the CHP-AS may be sufficient for some targets. Alternatively, this finding may simply reflect the fact that intervention attendance does not necessarily imply intervention engagement. That is, it is possible that participants attended the after-school program because they were required to do so, but did not fully engage in learning and applying the intervention strategies.

The other intervention process variable measured in this study was working alliance. As hypothesized, a stronger working alliance was associated with being a responder for four of the seven outcomes. Consistent with past research in the area (Langberg et al., 2013), only adolescent-rated working alliance was a significant predictor and counselor-rated working alliance was not significant in any of the final models. This finding suggests that although counselor ratings of working alliance are not necessarily inaccurate, they may be irrelevant in relation to facilitating student response. Indeed, in the present sample, counselor- and adolescent-rated working alliance were only moderately correlated ($r = .48$). Interestingly, meta-analyses are mixed on whether client ratings are more predictive of outcomes than clinician ratings (McLeod, 2011; Shirk et al., 2011), and recent findings suggest that the most important piece may actually be the degree to which the clinician and client agree about how the alliance changes over time (Fjermestad et al., 2015). Regardless, the impact of the working alliance is well-established (e.g., McLeod, 2011; Shirk et al., 2011), and it accounts for a small but significant portion of the variance in treatment outcome for children (McLeod, 2011). Despite this, the importance of a working alliance is sometimes overlooked in favor of focusing on specific intervention components, intervention delivery methods, and the behaviors being targeted. The working alliance is particularly important to consider in school-based intervention research where some providers may not receive extensive training in core clinical competencies often used to establish an alliance. The alliance items on the WAI focus on students believing that they agree with the counselor on goals and work together to achieve them and also whether the student believes that the PC likes, appreciates, and respects the student. Educators

Table 1
Means, Standard Deviations, and Bivariate Correlations of Study Variables

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Sex | – | .04 | .11 | .09 | .06 | .05 | .12 | −.03 | .09 | −.01 | .05 | ***.34*** | ***.35*** | ***.45*** | .01 | ***−.27*** | −.09 |
| 2. ADHD-I | | – | ***.56*** | ***.48*** | −.05 | *.24* | ***.25*** | .14 | −.20 | −.11 | −.01 | ***.35*** | .14 | ***.49*** | ***.50*** | ***.42*** | ***.39*** |
| 3. ADHD-HI | | | – | ***.61*** | .06 | ***.32*** | ***.41*** | ***.25*** | ***−.30*** | ***−.27*** | .01 | *.24* | .16 | ***.40*** | *.23* | ***.27*** | .19 |
| 4. ODD | | | | – | .01 | ***.64*** | ***.70*** | .10 | ***−.36*** | ***−.34*** | −.13 | .14 | ***.26*** | ***.28*** | ***.24*** | *.24* | .02 |
| 5. Anxiety | | | | | – | .06 | .13 | *.22* | .02 | −.07 | .07 | .18 | .10 | .15 | −.05 | −.07 | .01 |
| 6. Stress | | | | | | – | ***.76*** | .11 | ***−.31*** | *−.22* | −.07 | *.21* | ***.34*** | ***.36*** | *.22* | ***.29*** | .06 |
| 7. Conflict | | | | | | | – | .03 | *−.24* | ***−.29*** | −.06 | *.19* | ***.32*** | ***.30*** | *.20* | .15 | −.05 |
| 8. ADHD Med Use | | | | | | | | – | *−.25* | −.08 | .12 | −.02 | .04 | .12 | −.16 | −.03 | −.05 |
| 9. Child WAI | | | | | | | | | – | ***.48*** | ***.40*** | .03 | −.12 | −.16 | .05 | −.14 | −.01 |
| 10. Counselor WAI | | | | | | | | | | – | *.20* | −.04 | −.10 | −.16 | .10 | −.02 | .04 |
| 11. Attendance | | | | | | | | | | | – | −.04 | −.11 | .03 | −.07 | −.12 | −.15 |
| 12. Task Planning | | | | | | | | | | | | – | ***.41*** | ***.68*** | ***.57*** | ***.37*** | ***.27*** |
| 13. Organ. Actions | | | | | | | | | | | | | – | ***.51*** | *.19* | ***.25*** | .19 |
| 14. Material Manage | | | | | | | | | | | | | | – | ***.29*** | ***.35*** | *.22* |
| 15. HPC Factor I | | | | | | | | | | | | | | | – | ***.63*** | ***.34*** |
| 16. HPC Factor II | | | | | | | | | | | | | | | | – | ***.50*** |
| 17. IRS Academic | | | | | | | | | | | | | | | | | – |
| *Mean* | 70% | 19.39 | 12.32 | 10.32 | 49.63 | 220.9 | 8.59 | 42% | 47.66 | 53.01 | 149.1 | 67.74 | 62.39 | 67.44 | 34.47 | 16.47 | 4.58 |
| *SD* | | 5.38 | 6.79 | 6.02 | 12.23 | 43.07 | 5.16 | | 11.72 | 13.64 | 91.19 | 12.45 | 5.41 | 11.85 | 7.66 | 4.71 | 1.77 |

*Note.* Values in italics represent associations significant at the $p < .05$ level; Values in bold italics represent associations at the $p < .01$ level; Sex = 70% male; ADHD Medication Use = 42% taking ADHD medications; I = inattention symptoms; HI = hyperactive/impulsive symptoms; WAI = Working Alliance Inventory; Attendance = number of after school activities attended during the year; HPC = Homework Problems Checklist; IRS = Impairment Rating Scale.

implementing the CHP-AS could be taught specific techniques that can increase the likelihood that students perceive these aspects of alliance. It is also interesting to note that the working alliance was negatively correlated with symptoms of ADHD and ODD (see Table 1), suggesting that less symptomatic adolescents reported a stronger working alliance. Although the correlation is small, indicating that there are many other factors involved, it does suggest that counselors may have been having a difficult time establishing a strong alliance in the presence of more severe behavior problems.

### LIMITATIONS

Perhaps the most notable limitations are associated with the predictor analyses. A host of variables could predict response to psychosocial interventions for youth with ADHD, and only a handful were considered in this study. We emphasized more easily addressable and malleable predictors in this study as they could lead to intervention modifications and additions. Additional variables that could be evaluated in future research include, but are not limited to, parent psychopathology, intelligence, and achievement. It is also important to note that all of the outcome variables explored in this study were based on parent ratings. This is a limitation because parents may have had expectancy effects associated with the intervention and because of the potential for shared method variance accounting for some of the predictor findings. Although the reliance on parent ratings is certainly a limitation, a significant proportion of the sample was rated by parents as making minimal improvement, suggesting that expectancy effects were not driving effects. Further, we included multiple predictor variables that were rated by the child or by counselors or that were not ratings (e.g., medication use) and so shared method variance would not apply in those situations. The rationale for focusing on parent ratings is that middle school teachers often do not have the opportunity to observe the behaviors/outcomes assessed in this study and, accordingly, assessment of change over time is complicated by the fact that teachers may report baseline functioning in the normal range (Evans et al., 2005; see ITT outcomes paper for a detailed discussion of this topic, Evans et al., 2015). Another limitation is that we used a data-driven approach to determine which predictor variables to include in the multiple regression models. This is because there was insufficient power to include all variables in every model and we did not have a strong theoretical rationale for which predictors might be most important. Finally, some of the benefit of CHP-AS may be the prevention of declines in performance that are common for adolescents with ADHD over the school year, and the approach used in this study did not consider the value of a prevention benefit.

### CONCLUSIONS

Across outcomes, approximately 20% to 25% of participants made large improvements into the normal range of functioning after 1 year of ASP intervention. The CHP intervention appears to be most effective at improving homework and materials management behaviors as responders made large effect size gains on those measures and larger proportions of adolescents fell into the responders groups (e.g., 45% responders for HPC Factor II). Across measures, another 20% of participants on average started in the normal range of functioning and ended in the normal range of functioning. Further research is needed to determine to what extent this maintenance is successful prevention or unnecessary intervention. Finally, approximately 50% of the adolescents with ADHD who received the intervention made negligible to moderate improvements. Based upon the findings of the predictor analyses, it appears that the intervention may need to more explicitly target and engage parents, as those families with high parent-adolescent conflict and parent stress did not do well with the intervention. Further, in disseminating the CHP, school mental health providers will need to be trained in techniques for establishing a strong working alliance. Overall, this study highlights the utility of trajectory approaches in treatment outcome work, as there was clearly great variability in response to the CHP and these analyses provided more clinically rich information in comparison to the overall group analyses.

### Conflict of Interest Statement

The authors declare that there are no conflicts of interest.

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