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ORIGINAL PAPER

Predictors of Response and Mechanisms of Change in an Organizational Skills Intervention for Students with ADHD

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Abstract The purpose of the study was to evaluate predictors of response and mechanisms of change for the Homework, Organization, and Planning Skills (HOPS) intervention for middle school students with Attention-Deficit/Hyperactivity Disorder (ADHD). Twenty-three middle school students with ADHD (grades 6–8) received the HOPS intervention implemented by school mental health providers and made significant improvements in parent-rated materials organization and planning skills, impairment due to organizational skills problems, and homework problems. Predictors of response examined included demographic and child characteristics, such as gender, ethnicity, intelligence, ADHD and ODD symptom severity, and ADHD medication use. Mechanisms of change examined included the therapeutic alliance and adoption of the organization and planning skills taught during the HOPS intervention. Participant implementation of the HOPS binder materials organization system and the therapeutic alliance as rated by the student significantly predicted post-intervention outcomes after controlling for pre-intervention severity. Adoption of the binder materials organization system predicted parent-rated improvements in organization, planning, and homework problems above and beyond the impact of the therapeutic alliance. These findings demonstrate the importance of teaching students with ADHD to use a structured binder organization system for organizing and filing homework and classwork materials and for transferring work to and from school.

Keywords Attention-Deficit/Hyperactivity Disorder · Predictors · Mechanisms of change · Organization · Time-management · Intervention · School mental health

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Introduction

Attention-Deficit/Hyperactivity Disorder (ADHD) is a common neurobehavioral disorder with prevalence rates estimated at 5–8 % (Barkley 2006). As defined by the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV; American Psychiatric Association [APA] 2000), a core behavioral characteristic of an ADHD diagnosis is difficulty with organization of time and materials. Specifically, the inattentive symptom criteria in the *DSM-IV* stipulate that children with ADHD "often" do not follow through on instructions and fail to finish activities, have difficulty organizing tasks and activities, lose things necessary for tasks and activities, and are forgetful in daily activities (APA 2000). It has been suggested that these behaviors stem from an underlying deficit in executive functions, such as behavioral inhibition, self-regulation, and working memory (Barkley 2006).

Regardless of the cause, it is clear that difficulties with organization of materials and time are positively associated with functional impairment in youth with ADHD and particularly, with impairment in school. In the school setting, problems with organization manifest as lost or misplaced homework assignments, disorganized bookbag, locker, and binder systems for managing materials, and

problems in adequately planning to complete homework assignments or study for tests (Booster et al. 2012; DuPaul and Stoner 2003; Evans et al. 2005; Langberg et al. 2008). Difficulties with organization of materials and time have been shown to predict grade point average (GPA) above and beyond the impact of child intelligence (Langberg et al. 2011a). Further, difficulties with organization of homework materials in elementary school have been shown to predict GPA in high school, above and beyond intelligence and lifetime service utilization (Langberg et al. 2011b). Given these associations, organization of materials and time are clearly important targets for intervention.

A number of psychosocial interventions have been developed that target the organizational skills of youth with ADHD. Organizational skills interventions have been developed for clinic and school settings and for use with elementary (Abikoff and Gallagher 2008a; Abikoff et al. 2012; Pfiffner et al. 2007, 2011) and middle school (Evans et al. 2009; Gureasko-Moore et al. 2007; Langberg et al. 2008b) aged youth. These interventions differ across a number of areas, including focus (e.g., targets organizational skills specifically or is multi-modal), structure (e.g., number and length of intervention sessions), and delivery (e.g., individual versus group and therapist versus school mental health provider). A commonality across these interventions is that they are all routed in behavioral theory and utilize contingency management to shape and encourage particular behaviors to occur more often. Specifically, in most organizational skills interventions, external reinforcement of some kind is provided when youth engage in productive materials organization and planning behaviors.

Organizational skills interventions also typically use other behavior therapeutic techniques, such as modeling and rehearsal to teach materials organization and planning skills. For example, through modeling and rehearsal, youth learn to implement a specific binder and bookbag system for transferring homework materials to and from school, record assignments consistently and accurately in a planner, plan ahead for the completion of long-term projects and tests, and balance extracurricular activities and school responsibilities. Parents and/or school staff are involved in these interventions to varying degrees, and their primary role is to monitor skills implementation to ensure that improvements generalize beyond the intervention period (see Langberg et al. 2008a for a review).

To date, interventions specific to organizational skills have been evaluated using case studies (Gureasko-Moore et al. 2006, 2007), open trials (Langberg et al. 2011c; Pfiffner et al. 2011), and randomized controlled trials (Abikoff et al. 2012; Langberg et al. 2008b; in press; Pfiffner et al. 2007). These interventions consistently produce moderate to large improvements in parent- and/or teacher-rated materials organization and planning skills. Further, it appears that these gains are maintained over time, beyond the period of active intervention implementation. In addition, there is some evidence that organizational skills interventions produce improvements in more distal outcomes, such as functional impairment (e.g., family conflict or life interference due to organizational skills problems) and school grades (Abikoff et al. 2012; Langberg et al. 2008b, in press; Pfiffner et al. 2007).

Given accumulating evidence that organizational skills interventions are efficacious, an important next step is to begin examining factors that predict how youth will respond to these interventions. This type of knowledge is critical to allow clinicians to make informed decisions about where to devote resources (i.e., which students are likely to benefit and under what conditions). There is evidence that youth with ADHD respond differently to organizational skills interventions, with some quickly adopting and implementing skills and others being slow to respond (Evans et al. 2009). However, no research has been completed examining predictors of organizational skills intervention response.

A number of factors have consistently shown to predict psychosocial intervention response in general or to be associated with academic outcomes such as grades and achievement scores, and these data can be used to guide organizational skills prediction research. Demographic and child factors, such as ethnicity, symptom severity, ADHD medication use, and intelligence have been shown to be associated with academic outcomes both cross-sectionally and longitudinally (DuPaul et al. 2004; Langberg et al. 2011a, b) and therefore, may be important in predicting response to interventions that target academic functioning. For example, in samples of children with ADHD, intelligence is highly positively correlated with standardized achievement scores and ADHD symptom ratings are negatively correlated with grades and achievement scores (Langberg et al. 2011b). Further, in the Multimodal Treatment of ADHD (MTA) study, baseline parent-rated ADHD symptom severity moderated improvements in homework performance such that children with high baseline severity (top quartile of the sample) made large significant improvements in homework problems but between treatment group differences were absent (i.e. the interventions were all equally effective; Langberg et al. 2010).

It is also particularly important to examine potential mechanisms of change to determine which aspects of the intervention are most strongly related to outcomes. For example, most organizational skills interventions teach students specific systems for binder and bookbag organization as well as skills for efficiently managing time and planning ahead. However, nothing is known about which of these skills is most important in producing improvements.

This type of information is useful as it may serve to streamline or make interventions more efficient. It is also important to consider the role of the therapeutic alliance/relationship as a mechanism of change. Broadly defined, the term therapeutic alliance refers not only to the bond between the therapist and client, but also to the therapist and client's ability to work together collaboratively and to agree upon treatment goals (Martin et al. 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., Hogue et al. 2006; Horvath and Luborsky 1993; Martin et al. 2000).

Accordingly, the purpose of this paper is to examine predictors of response to an organizational skills intervention and to identify mechanisms of change. The organizational skills intervention examined in this paper is the Homework, Organization, and Planning Skills (HOPS) intervention (Langberg 2011). The impact of the HOPS intervention was recently evaluated using a randomized controlled trial design (Langberg et al. in press). In this study, 47 middle school students with ADHD were randomly assigned to receive the HOPS intervention or to a treatment-as-usual comparison condition. Without ongoing consultation from research staff, school mental health (SMH) providers implemented the intervention during the school day. Parents indicated that students receiving the organizational intervention made significant improvements in materials organization, planning skills, impairment due to organizational skills problems, and homework management and completion behaviors (Langberg et al. in press).

In the current paper, predictors of improvement in each of these areas are examined for the intervention group participants. Predictors examined in this study include demographic and child characteristics (e.g., gender, intelligence, ADHD symptom severity). In addition, the therapeutic alliance from both the student and clinician perspective and participant adoption of the HOPS organization and time-management skills are examined as potential mechanisms of change. Only intervention group participants are examined in this study because there are no data available for the comparison group for the main variables of interest (e.g., therapeutic alliance and organization and time-management skills adoption). Given the large literature highlighting the importance of the therapeutic alliance in therapeutic outcomes (see Martin et al. 2000 for a meta-analytic review), a primary goal of this study was to determine whether participant adoption of any of the HOPS skills (e.g., use of structured bookbag and binder systems and use of a planner) would predict outcomes above and beyond the impact of the therapeutic alliance. Previous cross-sectional research has demonstrated that materials management behaviors are strongly associated with school grades (Langberg et al. 2011a), which are highly important to parents. Accordingly, we predicted that adoption of the binder and bookbag organization systems would be the strongest predictors of parent-rated outcomes and would predict above and beyond the impact of the therapeutic alliance.

Method

Participants

Intervention participants ($N = 23$) were middle school students in grades 6–8, with an age range of 11–14 (see Table 1 for additional demographic information). Seventeen SMH providers (including seven school psychologists and ten school counselors) from five school districts and

Table 1 Participant demographics

Demographic variable	*M* (*SD*)
WISC estimated IQ	98.5 (14.7)
WIAT-III	
Reading	95.3 (11.5)
Math	96.1 (18.3)
Spelling	97.1 (14.9)
	% (*n*)
Male	73.9 (17)
Minority	21.7 (5)
Comorbid diagnoses[a]	
ODD	39.1 (9)
Anxiety	4.3 (1)
Mood	0.0 (0)
Highest level of parent education	
High school	17.4 (4)
Some college	8.7 (2)
Associates degree	17.4 (4)
Bachelor's degree	30.4 (7)
Master's degree	17.4 (4)
Family income	
<$25,000	8.7 (2)
$25,000–75,000	47.8 (11)
>$75,000	43.5 (10)
ADHD medication	
Medicated	69.6 (16)

Total $N = 23$. *ADHD* attention-deficit/hyperactivity disorder, *IEP* individualized education plan; *ODD* oppositional defiant disorder, *WIAT-III* Wechsler Individual Achievement Test, Third Edition, *WISC* Wechsler Intelligence Scale for Children

[a] Comorbid diagnoses established based on parent-report on the Diagnostic Interview Schedule for Children (DISC); anxiety counted as present if social phobia, separation anxiety, or generalized anxiety criteria were met on the DISC

twelve distinct schools were recruited to participate in this study to implement the HOPS intervention. The school districts involved in the study were diverse, with urban, suburban and rural school districts represented. The three urban schools in this study each had a >90 % minority student body with >85 % of students receiving free or reduced lunch. All of the SMH providers who participated were female and Caucasian. The SMH providers were diverse in terms of age ($M = 39$; $SD = 12.7$; *Range* = 27–66), educational background ($N = 7$ Ed.S; $N = 7$ M.A.; $N = 3$ M. Ed.), and years of service ($M = 10.1$; $SD = 7.8$; *Range* = 1–26).

Flyers were developed stating that students in grades 6–8 with attention problems and academic difficulties and/or students with a diagnosis of ADHD were eligible to participate in the study. These flyers were mailed home to families of students identified by SMH providers and teachers. Parents who called study staff to express interest in participation were scheduled for an inclusion/exclusion evaluation if their child met the phone screen criteria (≥4 of 9 symptoms of inattention endorsed over phone *or* a previous diagnosis of ADHD). To be included in the study, students had to meet *DSM-IV* criteria for a diagnosis of ADHD—Inattentive Type or Combined Type and have an estimated full scale IQ > 75. Diagnosis was determined using a combination of a structured interview administered to the parent, the Diagnostic Interview Schedule for Children-IV (DISC-IV; Shaffer et al. 2000), and teacher ratings on a DSM-based scale, the Vanderbilt ADHD Teacher Rating Scale (VATRS; Wolraich et al. 1998). The VATRS was mailed to the core class teacher that each participant's parent/guardian stated knew their child the best. To be eligible for participation, students had to meet criteria for ADHD on the DISC-IV and have at least four symptoms in one domain endorsed as "often" or "very often" on the VATRS. Full scale IQ was estimated using the block design, vocabulary, digit span, and coding subtests from the Wechsler Intelligence Scale for Children-4th Edition (WISC IV; Wechsler 2003). Participant inclusion/exclusion evaluations were conducted in a mental health clinic setting and the DISC and WISC were administered by trained and supervised post-bachelors level research assistants. Of the 57 participants that met the phone screen criteria, 47 met full inclusion/exclusion criteria and were enrolled in the study. For additional details on the sample and recruitment procedures, see Langberg et al. (in press).

Procedure

SMH providers received the HOPS intervention manual (Langberg 2011) and began implementing the HOPS intervention with children assigned to the intervention group at the beginning of the school year. Outcome measures were collected approximately 3 weeks into the school year (i.e. pre) and immediately following the completion of the intervention period (i.e. post). The first author met individually with each of the SMH providers for 1 h prior to intervention implementation. Half of this meeting was spent reviewing study procedures (e.g. when outcome measures for the study would be administered and how treatment fidelity observations would be scheduled). During the second half of this meeting, the first author described when each particular HOPS skill would be introduced (e.g., organization versus time management) and demonstrated how to complete the progress monitoring checklists provided in the HOPS manual. The first author and research staff did not provide any further training or ongoing consultation. The HOPS intervention delivered in this study was an individual (i.e., 1:1), 16-session intervention, delivered during the school day, with each session designed to last no longer than 20 min. Initial sessions occurred twice weekly and then moved to once-a-week for the last six sessions. Three main skills areas were covered: school materials organization, homework recording and management, and planning/time-management.

For materials organization, the SMH provider taught the student a specific system of bookbag and binder organization. For homework recording and management, the SMH provider taught the student how to accurately and consistently record homework assignments, projects, and tests in a planner and to obtain teacher initials indicating that what was recorded was accurate (or that "no homework" was written when appropriate). In the planning/time-management portion of the program, SMH providers taught students how to break projects and studying for tests down into small, manageable pieces, and how to plan for the timely completion of each piece. Participants were also taught how to plan out after school activities using an evening schedule to balance extracurricular activities and school responsibilities.

At each HOPS session, the student's materials (e.g., binder, bookbag, and planner) were visually inspected by the SMH provider. Students received points for each criterion they met on the skills tracking checklists (e.g., no loose papers in bookbag = 1 point). In later sessions, the SMH providers also completed a checklist containing operationalized definitions of time-management, and the student earned points for effectively planning and studying for tests and projects (e.g., recorded a test in the planner = 1 point; designated a time to study for the test = 1 point). These points accumulated and students traded in the points for gift card rewards (for further detail, see Langberg et al. in press).

Treatment Fidelity

There were three separate processes for evaluating SMH provider fidelity to the intervention procedures. First,

HOPS intervention component checklists were developed that listed the specific topics to be covered by the SMH provider during each intervention session. Study staff observed a randomly selected HOPS session for each SMH provider and completed the components checklist to evaluate SMH providers' fidelity to intervention procedures. Second, during the session observations study staff also completed the organizational skills checklist independent of the SMH provider. Agreement between the study staff checklists and the SMH provider checklists was examined. Third, all SMH provider-completed checklists were photocopied at the end of the intervention. This allowed study staff to evaluate SMH providers' fidelity to completing the checklists to monitor and reward progress with organizational skills at all intervention sessions.

Outcome Measures

Homework Problems Checklist (HPC)

Homework completion and homework materials management behaviors were assessed using the 20-item parent-completed HPC (Anesko et al. 1987). For each item, parents rate the frequency of a specific homework problem on a 4-point Likert scale (0 = *never*, 1 = *at times*, 2 = *often*, 3 = *very often*). Higher scores on the measure indicate more severe problems. The measure has demonstrated excellent internal consistency in previous studies, with alpha coefficients ranging from .90 to .92 and corrected item-total correlations ranging from .31 to .72 (Anesko et al. 1987). Factor analyses indicate that the HPC has two distinct factors (Langberg et al. 2010a; Power et al. 2006) measuring homework completion behaviors (HPC Factor I) and homework materials management behaviors (HPC Factor II). These factors are consistent across general education and clinical samples. Example items from Factor I (Homework Completion) include: a) Must be reminded to sit down and start homework; b) Daydreams during homework; c) Doesn't complete work unless someone does it with him/her; and d) Takes an unusually long time to complete homework. Example items from Factor II (Homework Materials Management) include: a) Fails to bring home assignments and materials; b) Forgets to bring assignments back to class; and c) Doesn't know exactly what has been assigned. In the present study, scores on the HPC were internally consistent (Factor I $\alpha = .87$, Factor II $\alpha = .88$).

Children's Organizational Skills Scale (COSS)

The parent-reported COSS (Abikoff and Gallagher 2008b) was used as a measure of organization, planning and time-management skills. The COSS yields three subscale scores that have been validated through factor analysis: Task Planning, Organized Actions, and Memory and Materials Management. Items on the Task Planning subscale relate to children's proficiency with planning out the steps needed to complete tasks in order to meet deadlines. Items on the Organized Actions subscale relate to children's use of tools (e.g., planners and calendars) and strategies (e.g., lists) to accomplish tasks. Items in the Memory and Materials Management subscale relate to whether children lose items and how well they manage their materials (e.g., bookbags, binders, and supplies). The items from these subscales can be combined to generate a COSS Total Score. There are also two additional subscales, Life Interference and Family Conflict, which assess for the presence of functional impairment due to organizational skills problems. Scoring the COSS generates raw scores for each subscale which were used in the analyses. Higher raw scores are associated with more problems with organization and time-management skills. The raw scores can be turned into *T*-scores with scores > 60 indicating a clinically significant problem. *T*-scores between 60 and 69 are considered elevated (more problems than typical) and scores >70 are considered to be very elevated (many more concerns than typical). The parent-reported COSS score has evidenced high test–retest reliabilities across the three COSS subscales (.94–.99; Abikoff and Gallagher 2008b). Scores on the COSS subscales were internally consistent in the present study (αs = .74–93).

Predictor Measures

ADHD/ODD Symptom Severity

The Vanderbilt ADHD Diagnostic Parent Rating Scale (VADPRS) is a parent-report scale with good internal consistency, factor structure, and concurrent validity for the assessment of ADHD (Wolraich et al. 2003). The VADPRS includes the 18 *DSM-IV* ADHD symptoms rated on a 4-point scale that indicates how frequently each ADHD symptom occurs (0 = *never*, 1 = *occasionally*, 2 = *often*, 3 = *very often*). In addition, the VADPRS includes the eight oppositional defiant disorder (ODD) items that correspond to the *DSM-IV* symptoms. The VADPRS ADHD Total Score (sum of 18 ADHD items; $\alpha = .94$) and ODD Total Score (sum of 8 ODD items; $\alpha = .89$), as rated by parents at baseline, were examined as predictors in the current study.

Demographic/Child Characteristics

As described above, full scale IQ was estimated using a four subscale combination from the *WISC-IV* (Wechsler 2003) shown to correlate highly with the full *WISC-IV*

administration (Sattler and Dumont 2004). Academic achievement was assessed using the *Wechsler Individual Achievement Test, Third Edition* (WIAT-III; Wechsler 2009). In addition, baseline demographic variables previously shown to be associated with academic achievement were included. These variables included child age, ethnicity, sex, and ADHD medication status. Parents reported children's ADHD medication use on the Services Use in Children and Adolescents–Parent Interview (SCA–PI; Jensen et al. 1994). The SCAPI is a structured interview that was administered at baseline during the face–to–face assessments.

Mechanism of Change Measures

Organizational Skills

The Organizational Skills Checklist has been utilized in a number of studies with adolescents with ADHD (e.g., Evans et al. 2005b, 2009; Langberg et al. 2008b). This checklist consists of operationalized criteria for binder (7 criteria) and bookbag (4 criteria) organization. Example items include: (1) There are no loose papers in the bookbag; and (2) All papers in the binder are filed in the appropriate class section. SMH providers completed the organizational skills checklist at the beginning of every HOPS session and record either "Yes" or "No" to indicate whether participants met each criterion. A percentage was then calculated separately for binder and bookbag for each HOPS session (e.g., 4 out of 7 binder criteria met = 57 %). The average percentages of criteria met for binder and bookbag across all of the HOPS sessions were calculated and examined as predictor variables.

Homework Recording

All participants were taught to record homework assignments in a planner prior to the end of each class period. Participants were also taught to have their teachers initial the planner, indicating that the homework assignment was recorded accurately and in sufficient detail. Participants were taught to have each of their core class teachers initial the planner on all school days, regardless of whether or not they had homework (i.e., the teacher initialed one time each day to indicate that the homework recorded was correct or that the student wrote "no homework" when appropriate). At each intervention session for the duration of the intervention, SMH providers recorded the number of teacher initials received over the number of initials expected. The number of initials expected was typically four (i.e., the four core classes) and the number received was determined by examining the student's planner (e.g., two initials received out of four expected = 50 %). The percentage of teacher initials received/expected, averaged across the entire HOPS intervention, was calculated and is examined as a predictor variable in the analyses.

Time Management

Per the HOPS manual, introduction to time management skills did not occur until session 7. Beginning with session 7, SMH providers completed a time management checklist at all intervention sessions. The time management checklist contains six operationalized criteria related to planning and studying for upcoming tests, four criteria related to planning for the completion of long-term projects, and three criteria related to planning out activities after school. Example criteria include: (1) student recorded an upcoming test or quiz in the planner at least one day in advance and listed in specific terms the material that the test will cover (e.g., page numbers); (2) student recorded an upcoming test in the planner and designated a time to study for the test and an amount of study time; and (3) student completed an evening schedule planning out all after school activities, including designating when homework and extracurricular activities would be completed. The SMH provider examined the student's planner and recorded how many of these criteria were met at each HOPS session. The average number of time management criteria met across all HOPS intervention sessions (from session 7 forward) was calculated and examined as a predictor variable.

Therapeutic Alliance

The short version of the Working Alliance Inventory (WAI-Short; Tracey and Kokotovic 1989) was used to measure SMH provider-student therapeutic alliance. It consists of 12 items on a 7-point Likert scale with three subscales mapping directly onto important aspects of the therapeutic alliance (i.e., agreement on tasks, agreement on goals, and bond) and a total score (sum of three subscales). The WAI has consistently been reported as highly reliable (.84–.92) and possessing adequate convergent validity with other alliance measures (Hanson et al. 2002). In this study, the SMH provider and the student independently completed the WAI at the end of the intervention period. Both the SMH provider's ($\alpha = .95$) and student's ratings ($\alpha = .79$) were examined as predictor variables.

Analytical Approach

A three-tiered analytical approach was used to address the research questions. First, correlation analyses were conducted to examine which child characteristic, working alliance, and intervention mechanism variables were significantly associated with post-intervention Total COSS,

Total COSS Impairment, and Total HPC. Child characteristic predictors considered included demographic (i.e., age, sex, race), academic (i.e., IQ, academic achievement), and mental health (i.e., ADHD symptom severity, ODD symptom severity, ADHD medication use) variables collected at baseline. Working alliance (i.e., youth-reported alliance, SMH provider-reported alliance) and intervention components (i.e., bookbag organization, binder organization, time management, and teacher initials) were considered as potential mechanisms of change. Using Spearman's rank correlations to account for any non-normal distributions given our sample size, variables correlated with a post-intervention variable at $p < .15$ were retained for subsequent analyses. Consistent with previous research (e.g., Schreurs et al. 2011), a p value of .15 was used in order to avoid eliminating potentially important variables prematurely.

Second, regression analyses were conducted to examine whether any of the variables retained from the first set of analyses remained significantly associated with post-intervention outcome scores after controlling for pre-intervention severity on the outcome measures of interest (e.g., does working alliance predict post-intervention Total COSS after controlling for pre-intervention Total COSS). In these and all subsequent analyses, a p value cutoff of .05 was used. In addition to predicting the total score for each measure in this second set of analyses (e.g., Total COSS), we also examined measure subscales (e.g., COSS Task Planning, COSS Organized Actions, COSS Materials and Memory Management) in separate regression models in order to evaluate whether distinct associations emerged across the subscale domains and the overarching organization, organization-related impairment, and homework scales.

Finally, hierarchical regression analyses were conducted to examine whether any significant intervention mechanism variables from the preceding analyses remained significant (on Step 3) when controlling for both pre-intervention severity of the outcome measure (entered on Step 1) as well as working alliance scores that were initially correlated with post-intervention scores (entered on Step 2). Again, equivalent models were run for the total score and measure subscale variables.

Results

Correlation Analyses

As shown in Table 2, few child characteristics were significantly correlated with post-intervention outcome scores. ADHD Total Symptoms were significantly positively associated with post-intervention Total COSS and Total COSS Impairment. Also, WIAT Reading was significantly positively associated with Total COSS. In terms of mechanisms of change variables, Youth WAI (but not SMH Provider WAI) was significantly negatively associated with all three outcome scores at post-intervention (i.e., Total COSS, Total COSS Impairment, Total HPC); therefore, SMH provider working alliance is not considered further. Binder Organization was also significantly negatively associated with all three outcome scores at post-intervention. Finally, Teacher Initials were significantly positively associated with Total COSS Impairment.

Regression Analyses

Next, regression models were conducted to examine which of the significantly correlated variables remained significantly associated with post-intervention outcome scores after controlling for baseline severity on the respective COSS organization, COSS impairment, and HPC domains. First, COSS organization variables were examined, including the Total COSS scale and the Organized Actions, Task Planning, and Memory and Materials Management subscales. Binder Organization remained significantly associated with post-intervention Total COSS ($t = -2.62$, $p = .02$), Organized Actions ($t = -2.90$, $p = .01$), Task Planning ($t = -2.90$, $p = .01$), and Memory and Materials Management ($t = -2.48$, $p = .02$) scores when controlling for baseline severity on these dimensions. Youth WAI remained significantly associated with post-intervention Task Planning ($t = -2.54$, $p = .02$) and Memory and Materials Management ($t = -3.69$, $p = .002$) dimensions, but not with Total COSS or Organized Actions ($ps > .05$). Neither WIAT Reading nor baseline ADHD symptom severity significantly predicted post-intervention COSS organization scores when controlling for pre-intervention COSS organization severity (all $ps > .05$) and are therefore not considered further.

The COSS impairment dimensions were examined next, including the COSS Total Impairment scale and the Life Interference and Family Conflict subscales. After controlling for pre-intervention COSS impairment severity, Teacher Initials was a significantly positive predictor of post-intervention Total COSS Impairment ($t = 3.48$, $p = .003$), Life Interference ($t = 3.02$, $p = .008$), and Family Conflict ($t = 3.17$, $p = .006$) scores. Binder Organization was a significant predictor of post-intervention Life Interference ($t = -2.30$, $p = .03$), but not COSS Total Impairment ($p > .05$). Baseline ADHD symptom severity did not significantly predict post-intervention COSS impairment scores when controlling for pre-intervention COSS impairment severity (all $ps > .05$) and is therefore not considered further. In addition, Youth WAI did not significantly predict post-intervention COSS impairment when controlling for pre-intervention COSS impairment (all $ps > .05$).

Table 2 Descriptive statistics and correlations of child characteristic, working alliance, and intervention mechanism variables with post-intervention outcome scores

Variable	*M* (*SD*)	Correlations		
		Total COSS	Total COSS impairment	Total HPC
Child characteristics				
Age[a]	–	−.02	−.13	.12
Sex[b]	–	.01	−.16	.06
Ethnicity[c]	–	.11	−.02	.08
ADHD medication use[d]	–	.05	.10	.08
WISC IQ	98.48 (14.65)	.13	.002	.21
WIAT reading	95.26 (11.46)	**.34**‡	.24	.13
WIAT spelling	97.13 (14.90)	.24	.30	.16
WIAT math	96.13 (18.26)	.30	.24	.17
ADHD symptoms	31.05 (9.43)	**.51***	**.38**†	.32
ODD symptoms	11.00 (6.83)	−.01	−.10	.16
Working alliance				
Youth WAI	62.76 (7.72)	**−.63****	**−.66****	**−.55***
SMH Provider WAI	57.90 (11.06)	.08	.17	−.08
Intervention mechanisms				
Bookbag organization[e]	3.23 (0.62)	−.28	−.28	−.30
Binder organization[e]	5.59 (0.81)	**−.49***	**−.50***	**−.64****
Time management[e]	1.56 (1.20)	−.08	.09	.28
Teacher initials[e]	0.59 (0.26)	.32	**.50***	.10

ADHD attention-deficit/hyperactivity disorder, *COSS* Children's Organizational Skills Scales, *HPC* homework problems checklist, *ODD* oppositional defiant disorder, *SMH* school mental health, *WAI* Working Alliance Inventory, *WIAT* Wechsler Individual Achievement Test, *WISC* Wechsler Intelligence Scale for Children

Bold values indicate variables were correlated with post-intervention outcome scores at $p < .15$ and were therefore retained for subsequent analyses (see text)

‡ $p < .15$, † $p < .10$, * $p < .05$, ** $p < .01$

[a] Age is calculated in years

[b] For sex, boys = 0, girls = 1

[c] For ethnicity, non-Caucasian = 0, Caucasian = 1

[d] For ADHD medication use, no medication use = 0, medication use = 1

[e] Average score on intervention adoption across treatment period

After controlling for pre-intervention HPC severity on the Total HPC scale and Factor I and Factor II subscales, Binder Organization significantly predicted post-intervention Total HPC ($t = -2.39$, $p = .03$) and Factor II ($t = -3.20$, $p = .005$) scores, but not Factor I ($t = -1.28$, $p = .21$). Youth WAI significantly predicted post-intervention Total HPC ($t = -2.12$, $p = .049$), but neither Factor I nor Factor II subscales ($ps > .05$).

Intervention Mechanisms and Youth-Reported Working Alliance

Finally, given the importance of examining intervention mechanisms in tandem with working alliance, hierarchical regression analyses were conducted to examine whether the intervention mechanisms that significantly predicted post-intervention scores after controlling for pre-intervention scores remained significant above and beyond Youth WAI. As summarized in Table 3, Binder Organization remained significantly associated with three of the four COSS organization scores (i.e., Total COSS, Organized Actions, Task Planning) such that higher binder organization scores negatively predicted COSS organization scores post-intervention. Table 4 shows that Teacher Initials remained significantly positively associated with all three COSS impairment scores (i.e., Total COSS Impairment, Life Interference, Family Conflict) and Binder Organization did not. Finally, Table 5 shows that Binder Organization remained significantly associated with two of the three HPC scores (i.e., Total HPC, Factor II) such that higher binder organization scores negatively predicted these homework problem scores post-intervention. Across all ten models, Youth WAI remained significantly associated with only Memory and Materials Management such that higher youth-reported working

Table 3 Multiple regression models examining intervention mechanisms and youth alliance in predicting post-intervention COSS organization after controlling for pre-intervention severity

	R^2	ΔR^2	ΔF	β	t	R^2	ΔR^2	ΔF	β	t
	COSS organized actions					COSS task planning				
Step 1 model summary	.06	–	1.11			.22	–	4.82*		
Baseline severity				.25	1.06				.47	2.20*
Step 2 model summary	.12	.05	0.98			.43	.21	5.89*		
Baseline severity				.23	0.99				.55	2.89*
Youth WAI				−.23	−0.99				−.47	−2.43*
Step 3 model summary	.44	.32	8.57*			.60	.17	6.31*		
Baseline severity				.17	0.87				.41	2.32*
Youth WAI				−.06	−0.31				−.31	−1.72
Binder organization				−.60	−2.93*				−.46	−2.51*
	COSS memory and materials management					COSS total				
Step 1 model summary	.36	–	9.73**			.28	–	6.73*		
Baseline severity				.60	3.12**				.53	2.59*
Step 2 model summary	.64	.28	12.62**			.43	.14	3.99†		
Baseline severity				.57	3.82**				.47	2.47*
Youth WAI				−.53	−3.55**				−.38	−2.09†
Step 3 Model summary	.71	.07	3.48†			.57	.14	4.93*		
Baseline severity				.46	3.01**				.34	1.84†
Youth WAI				−.45	−3.10**				−.28	−1.58
Binder organization				−.30	−1.87†				−.42	−2.22*

COSS Children's Organizational Skills Scales, *WAI* Working Alliance Inventory

† $p < .10$, * $p < .05$, ** $p < .01$

alliance negatively predicted Memory and Materials Management scores post-intervention (see Table 3).

Discussion

Considerable evidence has accumulated supporting the efficacy of organizational skills interventions for children and adolescents with ADHD (Abikoff et al. 2012; Evans et al. 2009; Pfiffner et al. 2007; Langberg et al. 2008b, in press). However, no published research to date has examined predictors of response to organizational skills intervention or mechanisms of change. Most organizational skills interventions are multi-faceted, and information about key mechanisms of change is important as it may pave the way for dismantling research and the development of more efficient interventions. This study examined predictors of response and mechanisms of change in a sample of 23 middle school students with ADHD who received the HOPS intervention. Participants' implementation of the HOPS binder organization system to manage school materials and their ratings of the therapeutic relationship (i.e., the working alliance with the SMH provider) consistently predicted improvements on parent ratings of organization and time-management skills, impairment due to organization, and homework problems. Importantly, implementation of the binder organization system predicted parent-rated improvement above and beyond the impact of the therapeutic alliance.

These findings are consistent with prior work demonstrating the importance of materials organization skills in the middle school setting. Specifically, parent ratings of materials organization have been shown to predict GPA both in cross-sectional and longitudinal samples above and beyond the impact of intelligence (Langberg et al. 2011a, b). Given the association between materials organization and GPA, and the importance of school grades to parents, it is not surprising that adoption of the binder organization system was most strongly associated with parent ratings. The purpose of the binder organization system is to prevent problems with misplacing, losing, and forgetting items that are frequently exhibited by students with ADHD. Specifically, the binder organization system taught in HOPS provides students with a structured way of storing and filing homework and classwork, and a system for transferring materials to and from school. A structured binder organization system is likely particularly important in the middle school setting where students are required to

Table 4 Multiple regression models examining intervention mechanisms and youth alliance in predicting post-intervention COSS impairment after controlling for pre-intervention severity

	R^2	ΔR^2	ΔF	β	t	R^2	ΔR^2	ΔF	β	t
	COSS life interference					COSS family conflict				
Step 1 model summary	.46	–	12.66**			.23	–	4.54†		
Baseline severity				.68	3.56**				.48	2.13†
Step 2 model summary	.58	.12	3.90†			.33	.10	1.98		
Baseline severity				.59	3.26**				.50	2.29*
Youth WAI				−.36	−1.97†				−.31	−1.41
Step 3 model summary	.77	.19	5.01*			.65	.32	5.41*		
Baseline severity				.54	3.55**				.48	2.34*
Youth WAI				−.20	−1.32				−.12	−0.61
Binder organization				−.27	−1.74				−.20	−0.96
Teacher initials				.36	2.49*				.54	2.99*
	COSS total impairment									
Step 1 model summary	.38	–	9.35**							
Baseline severity				.62	3.06**					
Step 2 model summary	.51	.13								
Baseline severity			3.61†	.59	3.12**					
Youth WAI				−.36	−1.90†					
Step 3 model summary	.76	.25	6.20*							
Baseline severity				.57	3.46**					
Youth WAI				−.19	−1.24					
Binder organization				−.18	−1.07					
Teacher initials				.48	3.19**					

COSS Children's Organizational Skills Scales, *WAI* Working Alliance Inventory

† $p < .10$, * $p < .05$, ** $p < .01$

manage materials for at least four separate core class subjects.

The current findings are also consistent with the broader literature on psychosocial intervention in showing that the therapeutic alliance is a critical facilitator of therapeutic change. This finding highlights the importance of the SMH provider student relationship and controlling for non-specific therapeutic effects in psychosocial intervention research. It is noteworthy that student perception of the therapeutic alliance was a strong predictor of improvement whereas SMH provider assessment of the alliance was not. As shown in Table 2, the SMH provider ratings of alliance did not even correlate with parent-rated outcomes independent of the other predictor variables.

The WAI used to assess alliance in this study largely evaluates the extent to which the student and SMH provider agree on the goals of treatment (i.e., improved organizational skills) and the tasks set forth to accomplish those goals (e.g., implementation of a binder organization system). One possible explanation for the discrepancy in ratings on the WAI is that if the adolescent does not agree with the goals of treatment they may be unlikely to articulate this, and instead, may passively work against the SMH provider. This suggests that specifically querying the adolescent about their view of the treatment goals and targets and perhaps use of motivational interviewing, might be a useful additions to organizational skills intervention protocols. Alternatively, it is possible that SMH providers are prone to provide overly positive alliance ratings even in the face of student resistance or relational barriers, whereas students may be less susceptible to these types of rating biases.

Perhaps the most important finding from this study was that the adoption of the binder materials organization system predicted improvement above and beyond the therapeutic alliance. This finding lends credence to the results of the randomized trial with HOPS (Langberg et al. in press) which utilized a waitlist comparison group and, therefore, did not control for non-specific therapeutic effects. The only other intervention component associated with outcomes was receipt of teacher initials, which was positively associated with parent-rated life interference and family conflict due to organizational skills issues. This finding is contrary to expectations as it suggests that the more teacher initials participants received, the higher the level of conflict

Table 5 Multiple regression models examining intervention mechanisms and youth alliance in predicting post-intervention homework problems after controlling for pre-intervention severity

	R^2	ΔR^2	ΔF	β	t	R^2	ΔR^2	ΔF	β	t
	HPC Factor I					HPC Factor II				
Step 1 model summary	.60	–	25.90***			.50	–	17.01**		
Baseline severity				.78	5.09***				.71	4.13**
Step 2 model summary	.67	.07	3.35†			.63	.13	5.40*		
Baseline severity				.75	5.18***				.64	4.11**
Youth WAI				−.26	−1.83†				−.36	−2.33*
Step 3 model summary	.70	.03	1.30			.79	.16	11.14**		
Baseline severity				.62	3.47**				.36	2.48*
Youth WAI				−.22	−1.45				−.27	−2.12†
Binder organization				−.21	−1.14				−.50	−3.34**
	HPC total									
Step 1 model summary	.56	–	21.32***							
Baseline severity				.75	4.62***					
Step 2 model summary	.65	.10	4.44†							
Baseline severity				.69	4.65***					
Youth WAI				−.32	−2.11†					
Step 3 model summary	.74	.09	5.38*							
Baseline severity				.44	2.59*					
Youth WAI				−.24	−1.73					
Binder organization				−.41	−2.32*					

HPC Homework Problems Checklist, *WAI* Working Alliance Inventory

† $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

and interference. However, this finding makes sense clinically, as receipt of teacher initials means that parents are fully aware of what homework assignments the adolescent needs to complete each day, which likely leads to conflict and battles over when and how assignments will be completed. The HOPS intervention does not include intervention components that are designed to teach parents how to manage conflicts during homework completion time. Interventions that more directly target homework completion time have been developed (Power et al. 2001, 2012), and future research with HOPS could evaluate the impact of adding some of these strategies to the protocol in order to reduce parent-adolescent conflict.

Demographic and child characteristics exhibited almost no significant correlations with outcomes (see Table 2). In addition, ADHD medication use was not significantly correlated with outcomes. These findings are encouraging given that the sample included in this study was relatively diverse and included young adolescents with a range of intellectual abilities and comorbid conditions (see Table 1). In summary, it appears that a broad range of young adolescents with ADHD can benefit from organizational skills interventions. An important area for future research is to examine the degree to which organization interventions such as HOPS are effective for students who do not have ADHD, but experience organization-related academic impairments.

Limitations

Perhaps the most important limitation to note with this study is the small sample size and the fact that predictors were examined within the intervention group only. Specifically, given that the sample included only 23 adolescents with ADHD, the study may not have had sufficient power to detect smaller predictor effects, and findings regarding predictors may not generalize to other populations or to other organizational skills intervention protocols. Further, key measures of interest such as adoption of the binder organizational skills system and working alliance were only collected for the intervention group, precluding examination of predictors in comparison to the waitlist group or formal tests of statistical mediation. Nevertheless, given that this is the first study of predictors of response to organizational skills intervention, these results may serve to guide additional research in this area.

Another limitation is that this study only examined predictors of response to parent-rated outcomes. Participants did not demonstrate significant improvements

according to teacher ratings in the present study (Langberg et al. in press) and therefore, predictors of teacher-rated response were not examined. Given the oft-cited lack of agreement between parent and teacher ratings of behavior (Achenbach et al. 1987), and that parent/teacher agreement is often poorest in middle school settings (Evans et al. 2005), it is likely that predictors of teacher-rated response will differ from what was found in this study. An additional limitation is that students and SMH providers rated the therapeutic alliance at the end of the intervention period. As such, it is possible that ratings of alliance were confounded with treatment response (Martin et al. 2000).

Conclusions

Important questions remain regarding predictors of response to organizational skills interventions and moderators and mediators of response. Larger samples are needed to address these types of questions. Knowledge related to the types of students most likely to benefit from intervention and the mechanisms through which improvement occurs will greatly increase schools ability to utilize organizational skills interventions effectively. It is also critically important that organizational skills intervention approaches be evaluated against active intervention conditions that are similar to what is typically delivered in schools. For example, students who receive organizational skills intervention could be compared to students who receive homework support or homework tutoring. Schools frequently provide homework support services, for example through after school programming. It may be that this type of service is sufficient for some children but that for others, an organizational skills intervention approach is needed.

Studies are also needed to further identify mechanisms of change in organizational skills interventions. This study found that implementation of a structured binder organization system predicted improvement, whereas the other skills that were taught (e.g., time management and planning) did not. Future dismantling research could examine whether simply teaching students to implement a binder organization system is sufficient intervention to produce change. However, it is likely that each intervention components interacts with, and supports, each other. Use of the binder organization system may have been most highly correlated with outcomes because it is a more tangible intervention component that is easily observable. For example, parents and teacher may be less attune to noticing more covert behavior changes such as the student recording homework assignments more accurately or with sufficient detail in a planner. In addition, given the significant impact of the therapeutic alliance as rated from the student perspective, future research with organizational skills interventions should seek to harness and improve upon this relationship, potentially by utilizing engagement and motivational interviewing techniques.

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