Available online at www.sciencedirect.com

ScienceDirect

Behavior Therapy xxx (2021) xxx–xxx

Behavior Therapy

www.elsevier.com/locate/bt

Patterns of Parental Adherence and the Association to Child and Parenting Outcomes Following a Multicomponent School-Home Intervention for Youth With ADHD

Melissa R. Dvorsky
Children's National Hospital
The George Washington University School of Medicine and Health Sciences
University of California, San Francisco

Lauren M. Friedman
Arizona State University
University of California, San Francisco

Madeline Spiess
University of California, San Francisco

Linda J. Pfiffner
University of California, San Francisco

The goal of the present study was to evaluate the role of parent adherence in the Collaborative Life Skills (CLS) program, a multicomponent school-home intervention, for predicting child and parenting outcomes. A sample of 129 children (63% male; *M* age = 8.22, *SD* = 1.10; grades 2–5) with attention-deficit/hyperactivity disorder (ADHD) and their parents participated in CLS, which included 10 weekly behavioral parent training group sessions. Each week, parents provided information on their CLS skill use between sessions (at home) as part of the intervention. Outcome measures included parent and teacher ratings of child behavior and parenting at post-intervention and 6 months follow-up. Growth mixture models examining weekly parent skill use trajectories throughout the intervention significantly predicted parent- and teacher-reported outcomes including parent-rated child behavior, teacher-rated academic competence, and positive parenting behaviors. Fifty-two percent of parents displayed moderate skill use throughout the intervention, whereas the remaining parents had either low (20%) or high (28%) initial levels of use but demonstrated high skill utilization by the middle of the intervention. Results highlight the importance of examining

This study made use of data collected from the Collaborative Life Skills program. The Collaborative Life Skills program was funded by the Institute of Education Sciences, U.S. Department of Education, through two grants: R324A120358 and R324A080041 to University of California, San Francisco. Melissa Dvorsky is supported by a grant (K23MH122839) from the National Institute of Mental Health. This research is also partially supported by T32MH018261 from the National Institute of Mental Health. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health, the Institute or the U.S. Department of Education. We would like to thank the families, teachers, and school mental health providers who made this research possible.

Address correspondence to Melissa R. Dvorsky, 6th Floor Main, Children's National Research Institute/Center for Translational Research, Division of Psychology and Behavioral Health, 111 Michigan Ave NW, Children's National, Washington, DC 20010. MDvorsky@childrensnational.org

Please cite this article as: Dvorsky, Friedman, Spiess et al., Patterns of Parental Adherence and the Association to Child and Parenting Outcomes Following a Multicomponent School-Home Intervention for Youth With ADHDBehavior Therapy, https://doi.org/10.1016/j.beth.2020.09.007

individual differences in parents between session strategy use for behavioral parent training interventions targeting child and parenting outcomes.

Keywords: attention-deficit/hyperactivity disorder; adherence; treatment outcomes; skill use; between session practice

Behavioral treatments targeting parenting practices or behavioral parent training (BPT) programs are well-established for improving acute ADHD symptoms and impairment for youth with ADHD (Evans et al., 2018; Pfiffner et al., 2020). Despite being one of the most widely used treatments and demonstrating efficacy when examined at the group level, between 40–60% of parents of youth with ADHD are estimated to have difficulty fully engaging in treatment (Chacko et al., 2016; Chacko et al., 2012). Adherence challenges are particularly problematic when BPTs are implemented in school and community settings, where families frequently experience stressors that interfere with adherence (Haine-Schlagel & Walsh, 2015). As a result, the majority of youth and their families struggle long-term, even if they have received treatment, given the chronic nature of ADHD (Molina et al., 2009).

BPT interventions focus directly on parents (includes primary caretakers) as the primary intervention target, making parents' adherence a key mechanism by which BPT reduces child externalizing behaviors and ADHD-related impairment (Chacko et al., 2012; Ros et al., 2017). Parents are taught specific strategies to manage their child's behavior and asked to actively practice these skills in daily life contexts (Pfiffner et al., 2020). The success of BPT hinges on parents' frequent and consistent in vivo implementation of learned parenting skills. As such, parent engagement during BPT is a central predictor of treatment-related improvements in children's ADHD and behavior problems (Chacko et al., 2016; Clarke et al., 2015).

Parent treatment engagement comprises both in-session (e.g., attendance, participation) and out-of-session components (e.g., completing between-session practice; Becker et al., 2015; Lindsey et al., 2019). To date, studies on parent engagement in BPT have largely focused on parent attendance, with higher rates of attendance being associated with improved outcomes for children with ADHD and other externalizing behavior problems (e.g., Becker et al., 2015; Chacko et al., 2016). Although necessary, attendance is not sufficient for treatment success; parents' between-session strategy use is needed to maximize treatment outcomes (Lindsey et al., 2019). In BPT, parent adherence refers to the degree to which parents comply with treatment by utilizing recommended parenting skills *in vivo* (i.e., between sessions) to influence children's behavior (Chacko et al., 2016). When BPT is implemented in the context of multicomponent behavioral interventions with both home and school components, parent adherence is essential for generalizing treatment gains across settings (Clarke et al., 2015; Lindsey et al., 2019).

Attention to parent adherence in children's mental health treatment has increased in recent years (Becker et al., 2015; Lindsey et al., 2019) owing to the growing emphasis on moving efficacious treatments into community settings, improving quality of care, and promoting sustained positive outcomes. Across behavioral/cognitive-behavioral treatments (CBT) for youth with either internalizing or externalizing problems, parents' between-session strategy use is a fundamental skill-building process that encourages practice of skills in various situations where challenges arise (Haine-Schlagel & Walsh, 2015). Meta-analyses of parent adherence in CBT have found ample support for parents' between-session strategy use predicting greater improvements in child behavior (e.g., Kazantzis et al., 2016).

Although parent adherence is fundamental to the success of BPT, only a few studies have examined the role of parents' between-session strategy use in the context of ADHD and other externalizing behavior problems (Clarke et al., 2015; Rooney et al., 2018; Villodas, et al., 2014). Parent adherence has been associated with improvements in child and parenting outcomes for youth with oppositional and conduct problems. In one evaluation of BPT for youth with conduct problems (ages 3 to 10), parent homework completion mediated changes in conduct problems from baseline to posttreatment (Kling et al., 2010), such that reductions in behavior were driven by parents completing more homework practices. Parents' between-session strategy use has also been associated with increased positive and supportive parenting practices, and decreases in children's externalizing behavior, even after accounting for attendance (Ros et al., 2017).

The few studies examining parental adherence to BPT specifically for youth with ADHD also suggest the importance of parents' between-session practice. In one study of the Family-School Success program, a multicomponent school-based intervention for children with ADHD which includes BPT, parents completed weekly written reports of their between-session practice (Clarke et al.,

Please cite this article as: Dvorsky, Friedman, Spiess et al., Patterns of Parental Adherence and the Association to Child and Parenting Outcomes Following a Multicomponent School-Home Intervention for Youth With ADHDBehavior Therapy, https://doi.org/10.1016/j.beth.2020.09.007

2015). After accounting for attendance, an aggregate score of parents' between-session adherence significantly predicted improvements in positive parenting as well as child's attention during homework completion and homework productivity. In the open trial of the Collaborative Life Skills program (CLS; Pfiffner et al., 2013), a multicomponent school-based intervention for youth with ADHD ($N = 57$), investigators found higher mean clinician ratings of parent adherence (i.e., session participation and homework completion) predicted improvements in symptoms of ADHD, ODD, and social skills (Villodas et al., 2014). Rooney et al. (2018) evaluated parent adherence in a multicomponent clinic-based intervention, the Child Life and Attention Skills program (CLAS), which includes BPT adapted for youth with ADHD Predominantly Inattentive Presentation, a child skills group, and classroom intervention, relative to BPT alone. Utilizing a composite of parent and clinician ratings of parent adherence aggregated across sessions, Rooney et al. (2018) found parent adherence predicted improvement in child outcomes for the single-component, BPT treatment. In a recent study of BPT plus medication for youth with ADHD and co-occurring ODD or CD and severe physical aggression, parent engagement (i.e., therapists ratings of parents' knowledge and participation during sessions and homework completion) was associated with improved parent-rated ADHD and ODD symptoms (Joseph et al., 2019).

Only one study has demonstrated an association between parent adherence and teacher-rated treatment outcomes for youth with ADHD. Villodas et al. (2014) found higher parent-rated between-session strategy use was associated with lower teacher-rated ODD symptom severity at posttreatment. Further, despite parenting practices being a primary target of BPT, only one study has examined the impact of parent adherence on posttreatment parenting outcomes (e.g., positive parenting behaviors, parental monitoring; Clarke et al., 2015).

Critically, the impact of parental adherence in BPT has been examined at the group level; thus, it is unclear to what extent intra-individual differences in parent engagement are present across sessions and impact treatment outcome. Additionally, all prior studies of parent adherence in BPT for ADHD or externalizing problems have evaluated adherence as an overall percentage or aggregate score, averaged across sessions during treatment (e.g., Clarke et al., 2015; Rooney et al., 2018; Villodas et al., 2014). This approach fails to address the possibility that parents vary their use of strategies (between families and across treatment weeks) and this variability in patterns of adherence may significantly impact both immediate and long-term treatment outcomes. Examining patterns or trajectories of parent may identify (a) subgroups that require additional support to more fully engage in BPT, (b) precise supports likely to produce maximal engagement, and (c) critical periods in treatment when supports may have the most potent effects.

There is some evidence of heterogeneity in the initial degree and consistency to which parents adhere to BPT. Clarke et al. (2015) found parent adherence during the first half of treatment was more predictive of improved parenting and child outcomes (i.e., inattention to schoolwork, productivity, teacher-rated ADHD/ODD) relative to adherence at the end of treatment. In contrast, Rooney et al. (2018) demonstrated late adherence predicted improved child outcomes, whereas early adherence predicted improved parenting outcomes. One possible explanation for these discrepant findings may lie in the timing of session content presentation. It is possible certain parenting skills drive certain treatment outcomes, such that patterns regarding early vs. late adherence may reflect whether specific parenting skills are introduced earlier vs. later in the program. However, given the moderate sample sizes, the authors were restricted to examining adherence at the group level and modeling time as early or late adherence (i.e., arbitrarily split at the mid-intervention point). To date, no study has examined patterns of parent adherence during treatment or how patterns predict treatment outcomes.

Current Study

The present study focused on examining trajectories of between-session strategy use among parents participating in the CLS intervention for children with ADHD. Important baseline child (i.e., sex, ADHD medication status) and family characteristics (i.e., single parent status, parent education level), as well as parental attendance at treatment sessions, were also examined as predictors of trajectories of parental strategy use. Based on evidence demonstrating single parents and parents with lower levels of education are more likely to disengage or drop out of BPT (Chacko et al., 2016; Chronis-Tuscano et al., 2017), we hypothesized these characteristics would be associated with reduced treatment adherence. Consistent with prior literature supporting the role of attendance on parent BPT strategy use (e.g., Clarke et al., 2015; Chacko et al., 2016; Rooney et al., 2018; Villodas et al., 2014), we also hypothesized

Please cite this article as: Dvorsky, Friedman, Spiess et al., Patterns of Parental Adherence and the Association to Child and Parenting Outcomes Following a Multicomponent School-Home Intervention for Youth With ADHDBehavior Therapy, https://doi.org/10.1016/j.beth.2020.09.007

parent attendance to BPT would be associated with trajectories of higher adherence. Finally, consistent with past research (e.g., Owens et al., 2018), we predicted ADHD-medication use and child sex would not be associated with parent adherence or post-intervention outcomes.

A secondary aim was to examine how weekly trajectories of parent adherence during treatment differentially predicted treatment outcomes. Additionally, this study evaluated how strategy use after treatment ended was associated with the maintenance of treatment outcomes at 6-month follow-up. For the secondary aim and follow-up analyses, we used outcome variables previously demonstrated significant treatment response to CLS (Pfiffner et al., 2013, 2016) including: parent- and teacher-rated ADHD and ODD symptom severity, organization problems, teacher-rated academic competence, and parent-rated positive parenting, involvement, and inconsistent parenting. We hypothesized that those with more positive treatment adherence patterns would be associated with greater improvements in child behavior and parenting practices from pre- to posttreatment. We also hypothesized families with the least parent adherence would display poorer treatment outcomes. Since prior studies report mixed findings depending on the outcome, informant, or measure of adherence examined, we did not make hypotheses regarding specific child or parenting outcomes across parent and teacher informants.

Method

PARTICIPANTS AND PROCEDURES

The present study uses data from two separate school-based investigations of CLS: (a) randomized controlled trial investigating the efficacy of CLS relative to a waitlist control (Pfiffner et al., 2016) and (b) an open trial of CLS ($N = 57$; Pfiffner et al., 2013) for a combined sample of $N = 129$. As youth in both original samples significantly improved compared to their baseline levels on the outcomes of interest in the this study (Pfiffner et al., 2016, 2013) and previously reported mean levels of parent adherence were similar across both studies (Villodas et al., 2014), adherence trajectories were not predicted to differ by subsample, although all analyses control for this sampling. Participants were 129 children (M age = 8.22 years, 27% girls) in 2nd–5th grade general education classrooms at 22 schools in a large northern California urban public-school district who received the CLS intervention. Approximately six students participated per school. The intervention was implemented in staggered (fall and winter) cohorts of two schools each over the intervention period with: 5 cohorts (10 schools) in the open trial of CLS (Pfiffner et al., 2013) and 6 cohorts (12 schools) in the randomized trial of CLS (Pfiffner et al., 2016).

All procedures were approved by the university and school district institutional review board committees. Written consent (parents, teachers) and assent (children) was obtained prior to study enrollment. Study procedures, including full description of the CLS intervention, recruitment procedures, and sample characteristics are described extensively in detail elsewhere (Pfiffner et al., 2016, 2013). Children were referred by school staff for ADHD symptoms and related social and/or academic problems. Eligibility criteria included (a) elevated ADHD symptoms (i.e., ≥ 6 inattention symptoms and/or ≥ 6 hyperactivity/impulsivity symptoms endorsed by the parent or teacher on the Child Symptom Inventory (CSI; Gadow & Sprafkin, 1997), (b) presence of impairment in multiple domains/settings (i.e., as evidenced by parent and teacher ratings ≥ 3 on the Impairment Rating Scale (IRS; Fabiano et al., 2006), (c) Full-Scale IQ ≥ 80, and (d) both a caregiver and a primary classroom teacher who were able to participate in the study. Consistent with baseline symptom severity and impairment reported in prior studies (Pfiffner et al., 2013, 2016), in the combined sample for the present study, baseline ADHD symptom severity (ranging from 0-3; $M = 1.73$ [teacher-rated], $M = 1.82$ [parent-rated]) and baseline ratings of overall impairment on the IRS (Fabiano et al., 2006) were elevated ($M = 4.42$ [parent-rated], $M = 4.62$ [teacher-rated]). Approximately 48% of the sample (distributed similarly across the schools/cohorts) also met symptom count criteria for oppositional-defiant disorder (ODD), by having four or more symptoms endorsed as *often* or *very often* per parent or teacher report on the CSI. Children taking medication (11.6%) were eligible to participate if their medication regimen was stable. Multi-informant measures were collected at baseline, posttreatment, and 6-month follow-up during the next academic year.

CLS is a 12-week collaborative school-home intervention delivered by school-based mental health providers (SMHPs) that integrates simultaneous delivery of three empirically supported, manual-based treatments: (1) behavioral parent training, (2) child social and life skills training, and (3) teacher consultation and implementation of daily behavior report cards in the classroom. All treatment components were delivered by SMHPs at the child's school in close collaboration

Please cite this article as: Dvorsky, Friedman, Spiess et al., Patterns of Parental Adherence and the Association to Child and Parenting Outcomes Following a Multicomponent School-Home Intervention for Youth With ADHDBehavior Therapy, https://doi.org/10.1016/j.beth.2020.09.007

with teachers and parents. Parents participated in a 10 weekly behavioral parent training group and implemented parenting skills at home (see Table S1 for BPT session topics). As part of the larger program, teachers also implemented daily behavior report cards in the classroom tracking 2–3 target behaviors (e.g., following directions, prosocial behaviors), which were reinforced daily at home by parents and weekly at the child group by SMHPs. All SMHPs were master's-level social workers or counselors who volunteered to implement the study interventions as part of their work responsibilities. SMHPs attended an initial 8-hour training and then weekly group training sessions led by doctoral-level clinician trainers. Results of an open trial (Pfiffner et al., 2013) and separate RCT (Pfiffner et al., 2016) supported CLS as feasible and acceptable intervention with high implementation fidelity. CLS demonstrated marked decreases in parent-and teacher-rated ADHD symptoms, oppositional behavior, organization, and academic impairment, compared with usual services (Pfiffner et al., 2016).

MEASURES

Parent Adherence

During Weeks 2 to 10 of the BPT sessions, parents reported the number of days they used the BPT strategies learned during the previous session on a 5-point scale from 1 (*no days*) to 5 (*everyday*). After the intervention, parents completed a post-strategy use questionnaire in which they rated how often they used the various BPT strategies learned in group (e.g., attending, response cost) on a scale ranging from 1 (*not at all*) to 5 (*very often/every day*). On average, parents reported using the strategies they learned in BPT during the previous week (mean rating 3.5) and at the end of CLS (mean rating of 3.6) more than half of the time.

ADHD and ODD Symptoms

Parents and teachers completed the ADHD (18-items) and ODD (8-items) scales on the Child Symptom Inventory (CSI; Gadow & Sprafkin, 1997). Items correspond to DSM-IV symptoms and are rated from 0 (*never*) to 3 (*very often*). The CSI has normative data and acceptable test-retest reliability and predictive validity for ADHD and ODD (Gadow & Sprafkin, 1997). Parent and teacher versions of the ADHD total severity score (α = .89–.93) and the ODD total severity score (α = .85–.94) were used in the present study.

Organizational Skills

Parents and teachers completed the Children's Organizational Skills Scale (COSS; Abikoff & Gallagher, 2009), which assesses organizational skills problems pertinent to academic functioning. Items are rated on a 4-point scale from *hardly ever/never* to *just about all the time* (higher scores indicate greater organizational impairment). The COSS parent and teacher versions have excellent internal consistency (αs = .97–.98) and test–retest reliability (*r*s = .94–.99) and evidence of structural, convergent, and discriminant validity. In the present study, parent and teacher ratings on the COSS total *T* score were used (α = .90–.94).

Academic Competence

The Academic Competence standard (sex-specific) scale on the teacher version of the Social Skills Improvement System (Gresham & Elliot, 2008) was used to measure academic functioning. This scale measures reading and math performance, academic motivation, and general cognitive functioning. Each item is rated on a 5-point scale relative to students in the same class (lowest 10% to highest 10%). This scale has high internal consistency (α = .97) and test-retest reliability (*r* = .93) and evidence of convergent and discriminant validity.

Parenting Practices

Parents completed the Alabama Parenting Questionnaire (APQ; Essau et al., 2006), a 42-item measure assessing positive and negative parenting practices rated from 1 (*never*) to 5 (*always*). Summary scores are created for five parenting practices (i.e., Involvement, Positive Parenting, Inconsistent Discipline, Poor Monitoring, and Corporal Punishment). The APQ has demonstrated good internal consistency and construct validity (Essau et al., 2006) and converges well with direct observations of parenting (Hawes & Dadds, 2006). In the present study, the Parent Involvement (α = .79–.90), Positive Parenting (α = .76–.91), and Inconsistent Discipline (α = .77–.87) scales were used to assess parenting outcomes.

Covariates

Cohort, sample (i.e., open trial or randomized trial), child sex, and ADHD medication status at baseline were examined as covariates. Parent BPT attendance, baseline family demographic characteristics including single-parent status and parent education level, were examined as predictors of adherence. Parent attendance was recorded by the clinician at each session and was calculated as a percentage of total possible sessions attended (*M* = 79.4%).

ANALYTIC STRATEGY

Data from participants who received the CLS intervention from the open trial (*N* = 57) and

Please cite this article as: Dvorsky, Friedman, Spiess et al., Patterns of Parental Adherence and the Association to Child and Parenting Outcomes Following a Multicomponent School-Home Intervention for Youth With ADHDBehavior Therapy, https://doi.org/10.1016/j.beth.2020.09.007

RCT ($N = 72$) were collapsed and analyzed together to maximize sample size.[1] The first question tested whether differential trajectories of between-session strategy use were exhibited by latent subpopulations of parents across the intervention. We also examined whether covariates predicted trajectories of between-session strategy use. The second question assessed whether these differential classifications of change in strategy use were associated with post-intervention outcomes. The third question tested whether strategy use at post-intervention was associated with maintenance outcomes at six-month follow-up. All models were estimated in *Mplus Version 8.3* (Muthén & Muthén, 1998–2019). Full-information maximum likelihood accommodated missing data (i.e., included all available data for each child).

To address the first two questions, growth mixture modeling (GMM) was used. GMM attempts to capture sample heterogeneity by examining multiple latent subpopulations that differ in model parameters (intercepts and slopes) and allowing variability around these parameters within each class (Muthén & Muthén, 2000). Of note, GMMs do not necessarily assume growth exists; rather, latent classes may exhibit positive slopes, negative slopes, or no change over time. A visual inspection of individual trajectories indicated a high level of variability between individuals, as well as a high number of nonlinear trajectories of strategy use. Specifically, some trajectories of strategy use exhibited periods of rapid acceleration (i.e., initial acquisition) followed by deceleration. To account for the rapid increases that occurred for many across the first few sessions, we used a freed loading growth model, where the first time point was fixed to 0 and last time point was fixed to 1, with all intermediate time points freely estimated. As such, the estimated factor loadings for the intermediate time points represent the total change observed between the first and last time point (McArdle, 2009).

Muthén and colleagues (e.g., Lubke & Muthén, 2007; Muthén & Muthén, 2000) emphasize that to support interpretation, it is important to consider not only the growth trajectories but also covariates and distal outcomes (i.e., predictive validity). Consistent with recent studies using GMM to examine heterogeneity (e.g., Breaux et al., 2019; Dvorsky et al., 2019), we performed these analyses in three steps. First, we evaluated an unconditional GMM with classes K (in which $K = 1, 2, 3, 4$). Following best practice (Muthén & Muthén, 2000), a combination of empirical (i.e., [sample size adjusted] Bayesian Information Criterion [BIC], Akaike Information Criteria [AIC], Lo-Mendell-Rubin [LMR] adjusted likelihood ratio test for K-1 classes, bootstrapped parametric likelihood ratio test [BLRT], statistical significance of parameter estimates for intercepts and slopes) and substantive (i.e., proportion assigned to each class) criteria were used to determine the optimal number of classes. Second, we evaluated a conditional GMM model involving key predictors of class membership (i.e., parent attendance, single parent status, parent education, child sex, ADHD medication status, and cohort/sample). Third, we examined a conditional GMM involving posttreatment outcomes at post and follow-up using the auxiliary function in Mplus and Vermunt's (2010) three-step procedure. Models controlled for pretreatment (baseline) score for the respective outcome measure and significant covariates. This approach involved regressing treatment outcome variables, one at a time, onto an indicator that represents an individual's most likely GMM class membership (i.e., trajectory that most closely approximated their data). This procedure minimizes potential bias in predictive models by using information about classification probabilities, obtained from the standard output of the unconditional GMM to represent the measurement error associated with forcing individuals into a particular GMM class. To provide an estimate of effect size for any significant predictors and outcomes of class membership, Cohen's d was calculated based on model estimated means and standard errors for each class.

Finally, we examined whether parent strategy use at post-intervention predicted child behaviors and parenting practices at 6-month follow-up. A series of regression analyses examined post-strategy use predicting each of the child and parenting follow-up outcomes. Models controlled for pretreatment score for the respective outcome measure, cohort/sample, and parent attendance.

[1] Using procedures described by Miyazaki and Raudenbush (2000), we first tested whether or not it was justified to converge separate samples in a common growth model. Using a multi-group growth model in *Mplus*, we tested the assumption of invariance of growth parameters across the samples by constraining growth parameters to be equal. Chi-square dierence tests revealed the fit of a model with equality constraints did not significantly dier from a model a freely estimated model, $\Delta\chi^2(5) = 9.98$, $p = .08$. We also tested for sample eects on the trajectory of adherence by estimating a conditional growth curve model in which the growth factors were regressed on sample. Sample did not significantly predict any of the growth factors ($ps > 0.05$). Together, we concluded that there were no systematic sample eects in the level and shape of the parent strategy use trajectory which supports modeling a converged trajectory collapsing data across samples in subsequent analyses.

Please cite this article as: Dvorsky, Friedman, Spiess et al., Patterns of Parental Adherence and the Association to Child and Parenting Outcomes Following a Multicomponent School-Home Intervention for Youth With ADHDBehavior Therapy, https://doi.org/10.1016/j.beth.2020.09.007

Sandwich variance estimators were used to adjust standard errors to account for students within schools. Multicollinearity was tested using collinearity diagnostics (i.e., variation inflation factors and tolerance levels). Standardized regression weights are presented as a measure of effect size.

Results

TRAJECTORIES OF PARENT ADHERENCE DURING TREATMENT

A series of unconditional GMMs were estimated that differed solely in the number of assumed classes (1–4). Each model assumed a freed functional form of change with variation in intercepts and slopes across all classes. Inspection of the BIC and AIC favored a three-class solution (BIC = 1,750.07; AIC = 1,678.93) and the bootstrapped parametric likelihood ratio test (BLRT) test statistic was significant for the three-class ($p < .001$) but not four-class ($p = .67$) solution, favoring the three-class solution. Collectively, these results indicated a three-class solution was optimal for modeling parent between-session strategy use (Table S2). The three-class solution adequately discriminated between classes with class probabilities ranging from .86 to .94. To investigate the stability of this three-class solution, we reestimated the model with different starting values for the growth parameters. The solution proved robust for different starting values, suggesting that the optimization was not achieved through identification of a local maximum. Trajectories for the three-class model are displayed in Fig. 1. Two classes made increasing improvements in parent strategy use: (1) a "high-increasing" class (27.5%) that started with high adherence that increased slightly ($\mu_{slope} = .38$, $p = .04$), and (2) a "low/high-rapid increasing" class (20.3%) that demonstrated rapid increases during the first 4 weeks which then decelerated ($\mu_{slope} = .81$, $p < .001$); and 3) a "low/moderate-stable" class that remained stable (52.2%) throughout the intervention period ($\mu_{slope} = .18$, $p = .41$).

PREDICTORS OF PARENT ADHERENCE TRAJECTORIES

After class enumeration, we examined the associations between key covariates (i.e., parent attendance, single parent status, parent education, child sex, ADHD medication status, and cohort/sample) by estimating their effects in a conditional GMM. The conditional model resulted in improved model fit (BIC = 1,530.45; AIC = 1,472.70) and, importantly, no substantive changes in the model classes occurred after the covariates were included, demonstrating model stability. In support of the validity of the distinction between the three classes, child sex and ADHD medication status did not significantly differ across the trajectories of adherence ($ps > .05$). Contrary to expectations, baseline family characteristics including single parent status and parent education level did not significantly predict class membership ($ps > .05$). For model parsimony, these nonsignificant covariates were trimmed from subsequent models. Parent attendance significantly predicted adherence trajectory classes such that the high-increasing ($M = 86.7\%$, $SE = 2.36$; $b = 4.19$, $p = .04$, $d = .49$) and low/high-rapid increasing ($M = 90.0\%$, $SE = 2.56$; $b = 5.04$, $p = .02$, $d = .62$) classes had significantly higher attendance rates than those in the low/moderate-stable ($M = 75.2\%$, $SE = 3.33$) adherence class. Given the study design, we also examined cohort and sample as covariates in the conditional model, which did not significantly differ across the latent classes ($ps > .05$), further strengthening our approach to collapse across samples/cohorts.

TRAJECTORIES OF PARENT ADHERENCE PREDICTING INTERVENTION OUTCOMES

Means and associations between the three trajectory classes and post-intervention outcomes are reported in Table 1. Class membership significantly predicted teacher-rated academic competence at post-intervention, such that individuals in the high-increasing ($M = 96.21$, $SE = 2.26$; $\chi^2 = 7.46$, $p = .006$, $d = .46$) and low/high-rapid increasing ($M = 96.09$, $SE = 2.68$, $\chi^2 = 6.52$, $p = .01$, $d = .44$) classes had significantly higher teacher-rated academic competence than those in the low/moderate-stable ($M = 86.64$, $SE = 2.93$) adherence class, controlling for baseline teacher-rated academic competence and relevant covariates. Class membership also significantly predicted parent-rated ADHD symptoms, with the high-increasing class (ADHD: $M = 17.95$, $SE = 1.52$; $\chi^2 = 9.97$, $p < .001$, $d = .53$) and low/high-rapid increasing class ($M = 18.55$, $SE = 1.37$; $\chi^2 = 9.43$, $p < .001$, $d = .49$) displaying significantly less ADHD symptom severity than individuals in the low/moderate-stable class ($M = 27.92$, $SE = 2.72$), controlling for baseline parent-rated ADHD and relevant covariates. Class membership similarly predicted parent-rated ODD, with those in the high-increasing class ($M = 5.59$, $SE = .78$; $\chi^2 = 8.22$, $p = .004$, $d = .49$) and low/high-rapid increasing class ($M = 6.40$, $SE = .68$; $\chi^2 = 6.17$, $p = .009$, $d = .39$) displaying significantly fewer ODD symptoms than the low/moderate-stable

Please cite this article as: Dvorsky, Friedman, Spiess et al., Patterns of Parental Adherence and the Association to Child and Parenting Outcomes Following a Multicomponent School-Home Intervention for Youth With ADHDBehavior Therapy, https://doi.org/10.1016/j.beth.2020.09.007

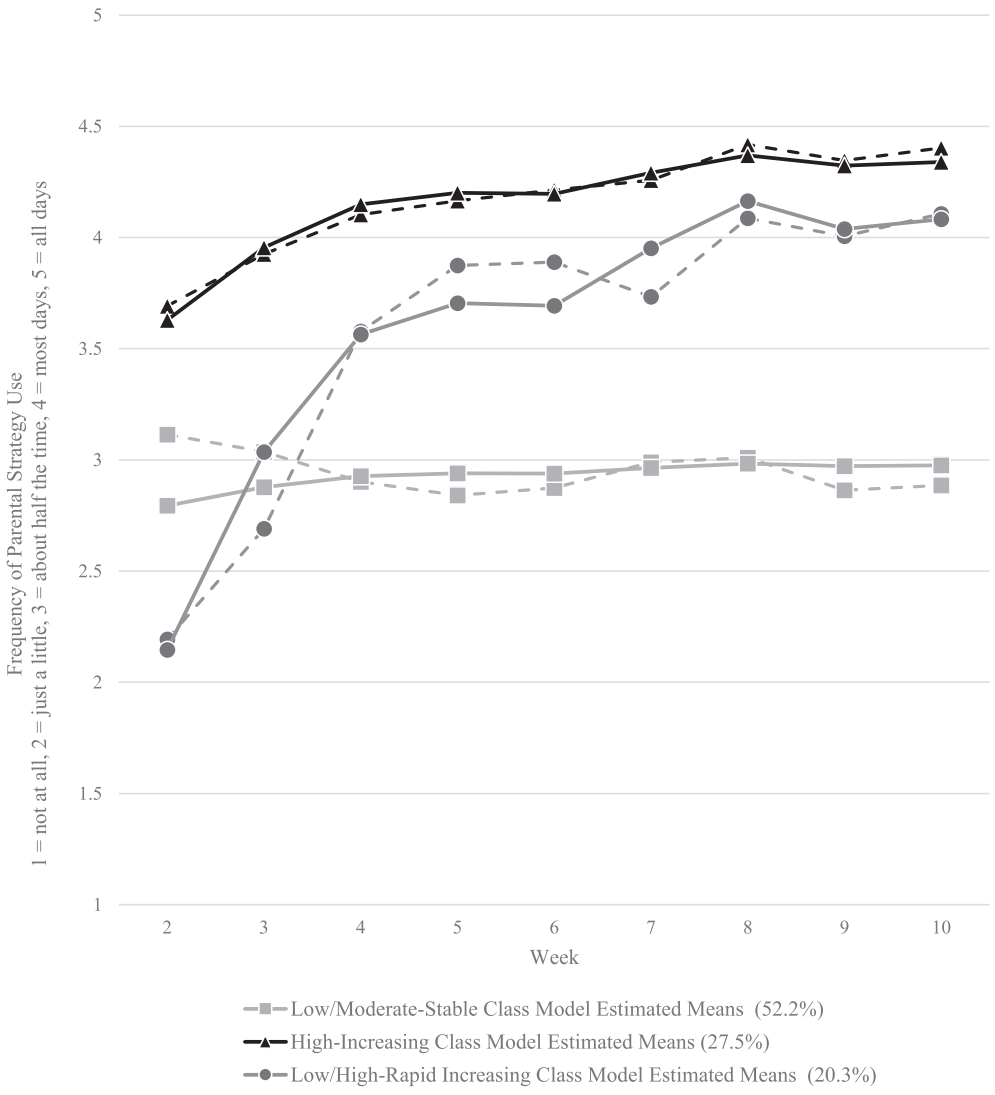

FIG. 1. Trajectories for the Three-Class Growth Mixture Model of Parent Adherence over the 10 Weeks of Intervention. *Note.* Sample means and model estimated means are plotted for each latent class and the percentage of the total sample represented in each trajectory class (20.3–52.2%) is also presented.

(M = 10.02, SE = 1.29) adherence class, controlling for baseline parent-rated ODD. Participants in the two increasing classes demonstrated similar levels of child post-intervention outcomes (ADHD, ODD, academic competence). Class membership also significantly predicted parent involvement at post-intervention, such that those in the high-increasing class displayed significantly greater involvement (M = 43.24, SE = 1.10) than individuals in the low/high-rapid increasing (M = 39.56, SE = .99; χ^2 = 6.05, p = .014, d = .45) and low/moderate-stable (M = 38.76, SE = 1.11; χ^2 = 6.78, p = .007, d = .56) adherence classes, controlling for baseline parent involvement and relevant covariates. Class membership similarly predicted positive parenting, such that those in the high-increasing class displayed significantly more positive parenting (M = 27.74, SE = .62) than individuals in the low/high-rapid increasing (M = 25.80, SE = .64; χ^2 = 4.71 p = .03, d = .54) and low/moderate-stable (M = 25.56, SE = .65; χ^2 = 5.37, p = .02, d = .63) adherence classes, controlling for baseline parent involvement and relevant covariates. The high-increasing class (M = 12.68, SE = .90; χ^2 = 6.41, p = .009, d = .52) and low/high-rapid increasing class (M = 12.80, SE = .91; χ^2 = 5.49, p = .019, d = .51) also displayed significantly less inconsistent parenting than the low/moderate-stable class (M = 16.36, SE = .95), controlling for baseline inconsistent parenting and relevant covariates. Class membership did not significantly predict parent or

Please cite this article as: Dvorsky, Friedman, Spiess et al., Patterns of Parental Adherence and the Association to Child and Parenting Outcomes Following a Multicomponent School-Home Intervention for Youth With ADHDBehavior Therapy, https://doi.org/10.1016/j.beth.2020.09.007

Please cite this article as: Dvorsky, Friedman, Spiess et al., Patterns of Parental Adherence and the Association to Child and Parenting Outcomes Following a Multicomponent School-Home Intervention for Youth With ADHDBehavior Therapy, https://doi.org/10.1016/j.beth.2020.09.007

Table 1
Post treatment Outcomes by Parent Adherence Trajectory Class Membership

	Class specification means			Wald χ2 tests of mean equality		
	(1) High-Increasing *M* (SE)	(2) Low/High-Rapid Increasing *M* (SE)	(3) Low/Moderate Stable *M* (SE)	High-Increasing vs. Low/High-Rapid Increasing	High-Increasing vs. Stable	Low/High-Rapid Increasing vs. Stable
Post Treatment Outcomes						
PR ADHD	17.95 (1.52)	18.55 (1.37)	27.92 (2.72)	07	**9.97*** **	**9.43*** **
TR ADHD	17.95 (1.66)	20.04 (2.79)	20.68 (1.48)	.64	1.83	.04
PR ODD	5.59 (.78)	6.40 (.68)	10.02 (1.29)	.48	**8.22** **	**6.17** **
TR ODD	3.83 (.80)	4.54 (.69)	4.95 (1.34)	.35	.47	.08
TR Academic Competence	96.21 (2.26)	96.09 (2.68)	86.64 (2.93)	.02	**7.46** **	**6.52** **
PR Organization Problems	54.96 (1.38)	54.21 (2.19)	56.92 (1.57)	.08	.81	.82
TR Organization Problems	59.39 (2.93)	57.24 (1.97)	62.05 (2.09)	.36	.25	1.93^{+}
PR Parent Involvement	43.24 (1.10)	39.56 (.99)	38.76 (1.11)	**6.05** **	**6.78** **	.25
PR Positive Parenting	27.74 (.62)	25.80 (.64)	25.56 (.65)	**4.71***	**5.37** **	.05
PR Inconsistent Parenting	12.68 (.90)	12.80 (.91)	16.36 (.95)	.01	**6.41** **	**5.49***
Follow-up Treatment Outcomes						
PR ADHD	17.85 (1.65)	17.20 (1.53)	20.63 (1.93)	.08	1.93	1.94
TR ADHD	23.52 (2.50)	19.35 (2.03)	26.27 (2.11)	1.54	.49	2.46^{+}
PR ODD	5.21 (1.78)	4.75 (1.04)	7.95 (1.11)	.50	**4.10***	**6.20** **
TR ODD	4.69 (1.03)	4.54 (.86)	6.44 (1.62)	.39	.98	1.56
TR Academic Competence	89.09 (2.65)	92.60 (3.09)	88.27 (4.44)	.71	.02	.50
PR Organization Problems	57.11 (1.15)	54.88 (1.27)	58.51 (1.26)	1.66	.31	2.14^{+}
TR Organization Problems	63.48 (1.76)	59.85 (1.97)	63.95 (1.92)	1.92	.09	1.97^{+}
PR Parent Involvement	41.99 (.92)	41.32 (1.04)	36.78 (1.43)	.08	**6.90** **	**8.03** **
PR Positive Parenting	27.06 (.59)	24.55 (.88)	24.67 (.94)	**4.63***	**4.11***	.02
PR Inconsistent Parenting	13.21 (1.48)	12.45 (.76)	16.33 (1.14)	1.75	**6.02***	**6.72** **

Note. PR = parent rated. TR = teacher rated. ADHD = attention-deficit/hyperactivity disorder symptom severity. ODD = oppositional defiant disorder symptom severity. Wald = multivariate Wald $\chi^2(1)$ and represents differences in the likelihood of having higher (or lower) levels on each out of the treatment outcomes controlling for baseline levels of each respective outcome, parent attendance, and cohort/sample. $^{+}p < .10$. $^{*}p < .05$. ** $p < .01$. *** $p < .001$.

teacher-rated organization or teacher-rated ADHD/ODD at post-intervention.

We also explored the associations between the three trajectory classes and intervention outcomes at the six-month follow-up assessment, controlling for baseline levels of each respective outcome, parent attendance, and cohort/sample (Table 1). Similar to findings at post-intervention, at follow-up, class membership significantly predicted parent-rated ODD, such that individuals in the high-increasing ($M = 5.21$, $SE = 1.78$; $\chi^2 = 4.10$, $p = .04$, $d = .29$) and low/high-rapid increasing ($M = 4.75$, $SE = .64$; $\chi^2 = 6.20$, $p = .01$, $d = .39$) adherence classes demonstrated significantly less parent-rated ODD than those in the low/moderate stable ($M = 7.95$, $SE = 1.11$) adherence class. Class membership also predicted parent involvement at follow-up, such that individuals in the high-increasing ($M = 41.99$, $SE = .92$; $\chi^2 = 6.90$, $p = .009$, $d = .44$) and low/high-rapid increasing ($M = 41.32$, $SE = 1.04$; $\chi^2 = 8.03$, $p = .006$, $d = .52$) adherence classes displayed significantly more involvement than participants in the low/-moderate stable ($M = 36.78$, $SE = 1.43$) adherence class. Class membership similarly predicted inconsistent parenting at follow-up, such that individuals in the high-increasing ($M = 13.21$, $SE = 1.48$; $\chi^2 = 6.02$, $p = .02$, $d = .34$) and low/high-rapid increasing ($M = 12.45$, $SE = .76$; $\chi^2 = 6.72$, $p = .01$, $d = .47$) adherence classes displayed significantly less inconsistent parenting than participants in the low/moderate stable ($M = 16.33$, $SE = 1.14$) adherence class. Class membership significantly predicted positive parenting at follow-up, with the high-increasing ($M = 27.06$, $SE = .59$) adherence class displaying significantly more positive parenting at follow-up than the low/high-rapid increasing ($M = 24.55$, $SE = .88$; $\chi^2 = 4.63$, $p = .03$, $d = .65$) and low/moderate-stable ($M = 24.67$, $SE = .94$; $\chi^2 = 4.11$, $p = .04$, $d = .36$) classes. The classes did not differ across parent or teacher-rated organization, ADHD severity, or teacher-rated ODD or academic competence at follow-up.

POST-STRATEGY USE PREDICTING FOLLOW-UP OUTCOMES

Finally, we examined parents' strategy use at post-treatment as a predictor of follow-up child and parenting outcomes. Multicollinearity between predictors/covariates was not demonstrated with variance inflation factors much less than 10 (between 1 and 5) and tolerance above .20 (Bowerman & O'Connell, 1990). Controlling for the baseline score for the respective outcome, parents' overall strategy use at post significantly predicted parent-rated ODD ($\beta = -.22$, $SE = .07$, $p = .001$), teacher-rated ODD ($\beta = -.15$, $SE = .06$, $p = .02$), parent-rated organization ($\beta = -.19$, $SE = .08$, $p = .02$), teacher-rated academic competence ($\beta = -.21$, $SE = .10$, $p = .04$), parent involvement ($\beta = .20$, $SE = .08$, $p = .01$), positive parenting ($\beta = .18$, $SE = .08$, $p = .04$), and inconsistent parenting ($\beta = -.21$, $SE = .09$, $p = .02$) at follow-up. Parent post-strategy use was unrelated to ADHD severity (parent-rated: $\beta = -.13$, $SE = .08$, $p = .12$; teacher-rated: $\beta = .05$, $SE = .07$, $p = .49$) and teacher-rated organization ($\beta = .02$, $SE = .09$, $p = .85$). Parent attendance, cohort, and sample were not associated with any follow-up outcomes ($ps > .05$).

Discussion

This is the first study to empirically examine the heterogeneity in parent adherence to behavioral treatment for children with ADHD. This study evaluated the role of varying trajectories of parent engagement for differentially predicting parent- and teacher-rated measures of intervention response. Interestingly, although there was significant variability across families, most parents demonstrated at least moderate adherence to BPT skills throughout the intervention. Approximately half of families reported using the parenting skills "about half the time," which was stable throughout the intervention (52.2%); whereas the remaining families increased their strategy use during the intervention period, especially in the first 4 to 5 weeks, to "most days" or more. Some families demonstrated substantial improvement in between-session BPT skills utilization by the 4th week (20.3%) and another set of families were highly adherent from the start of the intervention and increased even more across the treatment weeks (27.5%). Importantly, as hypothesized the two adherence trajectories in which adherence increased during treatment (i.e., high-increasing and low/high-rapidly increasing), were positively associated with parent- and teacher-rated child outcomes, as well as positive parenting. These results highlight the importance of individual differences in engagement and change in parent between-session strategy use during BPT.

Interestingly, child and family characteristics (i.e., single parent status, parent education level, child sex, medication status) did not significantly differentiate between the trajectories of adherence. This finding is in contrast to our hypothesis and prior work demonstrating family sociodemographic factors, especially single-parent status, are associated with treatment engagement

Please cite this article as: Dvorsky, Friedman, Spiess et al., Patterns of Parental Adherence and the Association to Child and Parenting Outcomes Following a Multicomponent School-Home Intervention for Youth With ADHDBehavior Therapy, https://doi.org/10.1016/j.beth.2020.09.007

(Haine-Schlagel & Walsh, 2015) and may moderate treatment response among youth with ADHD (e.g., Green et al., 2020; Rieppi et al., 2002). This may be because the BPT program was delivered in schools, during times convenient for families (e.g., before school, after dropoff), potentially reducing the impact of certain barriers to parent engagement often observed in clinic-based interventions. Conversely, parent attendance was significantly higher among families in both of the two increasing adherence trajectories relative to those in the low/moderate-stable trajectory of adherence. Yet attendance did not significantly predict child and family post-intervention or follow-up outcomes in subsequent models. The limited role of attendance for predicting intervention response confirms prior research indicating attendance is not sufficient for treatment success and between-session skills use is essential for improved outcomes (Clarke et al., 2015; Rooney et al., 2018).

In addition to extending previous work (Rooney et al., 2018; Villodas et al., 2014) by demonstrating that parental adherence predicts both child and parenting outcomes, this study adds novel information about the impact of trajectories of parental adherence throughout the intervention period. Results of the GMMs revealed that families whose parents used strategies at increasing rates and at least "most days" by mid-intervention experienced significantly greater reductions in parent-rated ADHD (*d*s = .49–.53) and ODD (*d*s = .39–.49) symptom severity, increases in teacher-rated academic functioning (*d*s = .44–.46), and improved parenting practices (*d*s = .51–.52) relative to those with stable and low/moderate adherence (used strategies "about half the time") during treatment. Interestingly, the low/moderate-stable adherence trajectory improved significantly less on parent-rated ADHD and ODD and teacher-rated academic outcomes relative to both the low/high-rapidly increasing and high-increasing adherence trajectories; whereas there were no significant distinctions in level of response between the low/high and high adherence trajectories of adherence for any child outcomes. This finding suggests that continued growth in strategy use and practice on at least "most days" is optimal for predicting positive child behavior and academic outcomes.

Our findings suggest that parent adherence within the first four to five sessions is particularly critical for predicting immediate and sustained treatment outcomes. One explanation for this finding may be due to the order of BPT content. That is, similar to traditional BPT programs, the BPT component in CLS starts with positive reinforcement strategies (e.g., praise, rewards, quality time/attending) in order to establish a positive foundation before introducing negative consequences. High adherence by Week 4 or 5 is particularly critical for predicting who benefits most from treatment, and this finding is consistent with prior studies showing that initial treatment engagement is especially critical for posttreatment outcomes (Chacko et al., 2012; Clarke et al., 2015). Since positive BPT strategies were covered in the first few sessions, parents who displayed high adherence at the outset of treatment may have been more successful using positive BPT strategies (e.g., praise, rewards, positive attention), which in turn may explain the greater improvement on positive parenting outcomes at posttreatment. If parent strategy use is monitored closely during treatment, providers implementing BPT could identify optimal responders from suboptimal responders early on in treatment. This can be used to troubleshoot relevant barriers or tailor strategies to facilitate engagement and optimize treatment gains.

Notably, effect sizes for trajectory differences in treatment outcomes were largest at home (parent ratings) relative to school (teacher ratings). One explanation for this finding is perhaps child behaviors at home (e.g., following a morning routine, completing chores) are more sensitive to changes in parent adherence to BPT in a multicomponent school-home intervention. Child outcomes from intervention in the school setting may be more strongly associated with teacher adherence to other components of the CLS intervention relative to parent adherence to BPT. However, we did find parents with increasing between-session strategy use throughout treatment were more likely to experience significant improvements in teacher-rated academic competence at post-intervention. Parents' posttreatment strategy use was also associated with improved teacher-rated academic competence at follow-up. These findings may be an indicator of parent's level of involvement with their child's academic behaviors at home (e.g., monitoring homework, facilitating a homework routine). Such involvement may be more directly related to improved academic competence at school than other teacher-rated child behavior outcomes.

Further, moderate to high and increasing levels of parents' strategy use during treatment significantly predicted greater reductions in parent-rated, but not teacher-rated, oppositional behavior at post and follow-up. These findings are consistent with a recent examination of BPT adherence in a family-school intervention for children with

Please cite this article as: Dvorsky, Friedman, Spiess et al., Patterns of Parental Adherence and the Association to Child and Parenting Outcomes Following a Multicomponent School-Home Intervention for Youth With ADHDBehavior Therapy, https://doi.org/10.1016/j.beth.2020.09.007

ADHD. Specifically, Clarke et al. (2015) similarly demonstrated parent adherence predicted improvements in teacher-rated academic performance as well as in parent- but not teacher-rated ADHD/ODD severity. However, this finding is in contrast to prior work (Villodas et al., 2014) suggesting that parents' overall strategy use is associated with teacher-rated oppositional behavior at posttreatment. It is possible that our failure to replicate this finding is a result of the overall low prevalence of teacher-rated ODD behaviors in the current sample. Teacher ratings of ODD severity (*M*s = 4.91 – 6.49, *SD*s = 4.44 – 5.72) were low at all timepoints and significantly lower than parent ratings (*M*s = 6.45–10.05, *SD*s = 3.61–5.87). Another explanation for the discrepant findings may be due to differences in the measurement of parental adherence. Prior studies have examined parent adherence as an aggregate sum collapsed across all sessions (e.g., Clarke et al., 2015; Rooney et al., 2018; Villodas et al., 2014), rather than evaluating parents' strategy use at multiple time points. Whereas an aggregated approach assumes similar levels of adherence across all sessions and individuals, the present study explored patterns of change in adherence throughout BPT for predicting child and parenting outcomes. Further, assessing the frequency of strategy use, the present analyses captured greater variability in changes in adherence throughout treatment as opposed to a dichotomous assessment of whether or not homework was completed, which has been commonly used in prior studies (e.g., Chacko et al., 2016).

Interestingly, trajectories of strategy use during treatment were not differentially associated with parent- or teacher-rated organization at post or follow-up assessment periods. Prior examinations of parent adherence to BPT for children with ADHD have also failed to find significant association between adherence and organizational skills outcomes (Clarke et al., 2015; Rooney et al., 2018). One explanation for the lack of association between weekly parent adherence and child organization skills is that in the CLS program, as in other BPT programs, the majority of parenting strategies focus on behavioral targets rather than on organizational skills per se. However, it is important to note that in our randomized trial (Pfiffner et al., 2016), the CLS intervention yielded sizable improvements in parent- and teacher-rated organizational skills relative to usual services, and in this study, parent strategy use at the end of treatment predicted reduced organizational problems at follow-up. Therefore, while parent adherence may contribute to long-term improvements in organization, it is quite possible that the teacher and child treatment components of CLS (which incorporated organizational skills training features) were more critical for immediate outcomes than parent adherence trajectories during treatment per se.

In contrast to effects on outcomes immediately following treatment, parents' between-session adherence failed to differentially predict sustained improvements in parent-rated ADHD symptoms and teacher-rated academic competence at 6-month follow-up. Conversely, high and increasing levels of adherence during treatment was associated with greater improvements in parent-rated ODD and parenting behaviors at follow-up. Interestingly, when comparing trajectories of strategy use it appears that parent adherence during the last few weeks of BPT is especially critical for predicting maintenance of treatment outcomes, which is consistent with our findings that parent adherence at the end of treatment was important for maintaining improvements in child outcomes and parenting behaviors. Specifically, parents' posttreatment adherence predicted maintenance of gains at 6-month follow-up across all parenting measures, parent- and teacher-rated ODD, parent-rated organization, and teacher-rated academic competence. Relative to patterns of change in between-session strategy use during treatment, parents' strategy use at posttreatment was a stronger predictor of sustained improvements in parent- and teacher-rated child outcomes at follow-up.

Interpretation of these differences is complicated by the possibility that strategy use may be confounded by the current severity of children's symptoms and impairments, an observed attenuated response to treatment, or a failure to make gains during the course of treatment. While this does not threaten our findings, it strongly suggests that BPT skill use following intervention is a requisite and critically important component for long-term improvements. Our findings also support the need for examining adherence in closer proximity to outcomes, as well as supporting greater adherence after treatment ends. For instance, it is possible that use of more proximal indices of treatment response, such as weekly assessments of child behavior targets, may be more closely associated with between-session strategy use. Future research is needed to understand how patterns of change in child behavior during treatment are associated with parallel patterns of parental strategy use both during treatment and maintenance periods.

Overall, our findings suggest that augmentations to promote adherence and reduce barriers to BPT skill usage, particularly during the maintenance

Please cite this article as: Dvorsky, Friedman, Spiess et al., Patterns of Parental Adherence and the Association to Child and Parenting Outcomes Following a Multicomponent School-Home Intervention for Youth With ADHDBehavior Therapy, https://doi.org/10.1016/j.beth.2020.09.007

period, are needed. That is, barriers to adherence are compounded following cessation of treatment, as clinician expertise, support from other parent-group members, and prompting/social reinforcement of skill use from providers is withdrawn. Recent work suggests that promoting active skill use after treatment (e.g., via booster sessions, technology augmentations) results in maintained gains across several parent and child outcome domains at 12-months follow-up (DuPaul et al., 2013; Lindhiem et al., 2015). Given (a) the precipitous decline in treatment gains often associated with treatment cessation and (b) this study's findings that increasing between-session skill use predicts improved treatment outcomes, adherence promoting mechanisms and tools are sorely needed. For example, personalized approaches and ongoing support via novel digital health tools is a growing area of research that can be harnessed to improve parent adherence.

LIMITATIONS AND FUTURE DIRECTIONS

The methodological and practical implications of the current findings should be considered within the context of study's limitations. The primary limitation of this study is that the measure of parent strategy use is comprised of a self-report measure completed by parents at each session. While this is consistent with prior studies of parent engagement in BPT (Ros et al., 2017; Stokes et al., 2016), this measure is limited by reporting bias and does not necessarily assess the *quality* of parenting skills implementation. It is important for future work to include multimethod assessments of parent engagement, including ecological momentary assessments (e.g., daily diary of child behavior and in vivo skills used to manage), naturalistic observation (e.g., video/audio recordings), and/or coding of homework practice products (e.g., coding the quality of home routine plan; Clarke et al., 2015). It is also important to recognize that the appropriate frequency of strategy use is likely to differ depending on the BPT strategy. For example, praise and positive reinforcement strategies could (and should) be used on a daily basis, whereas some strategies (e.g., response cost) may not need to be used as frequently. Future research should explore both the frequency and appropriateness of various BPT strategies given the context and child behaviors (e.g., see Lindhiem et al., 2020). In addition, our sample size may have limited the number of trajectory classes we were able to examine given small class membership. It is possible that other trajectories of adherence also exist that were not captured in the present data. Further, we were not able to assess trajectories of strategy use after post-intervention (during the follow-up period). It is important to continue to examine facilitators of sustained strategy use during this follow-up period and the implications for sustained parent skills use for long-term child and family outcomes. Relatedly, feasible methods for assessing and monitoring parent skills utilization after treatment has ended are also needed.

Future research should examine whether these trajectories hold in other cultural contexts, such as in other geographic areas, among different racial and ethnic groups, among different family structures, and other socioeconomic stratums. The present sample may not be representative of children presenting to clinic settings or those taking medication for ADHD at higher rates. Of note, there is evidence of regional variations in medication use for ADHD (e.g., Visser et al., 2014), with lower rates in the region where this study was collected relative to other areas of the country. Given the two present samples used medication infrequently (11.6%), it is possible that concurrent medication use or medication-first treatment may undermine parent engagement in BPT intervention (e.g., Coles et al., 2020) or substantially impact the degree of improvement in child symptoms or functional impairment.

It is also important for future research to examine the role of additional barriers and facilitators (e.g., parental ADHD, parenting stress) for predicting trajectories of strategy use. Future efforts should explore how these associations impact the process of sustained strategy use and positive child and parenting outcomes in response to treatment. Further, the present study did not evaluate other child-level factors such as social emotional functioning, which may predict treatment response in behavioral interventions for youth with ADHD (Dvorsky & Langberg, 2016; Dvorsky et al., 2016). Further, because none of the examined child/family characteristics significantly predicted parents between-session strategy use, except for parental session attendance, increased efforts to identify mechanisms that promote parent adherence and in vivo skills implementation are warranted. For example, in the present study, there were in-session opportunities for parents to role-play and practice BPT skills, as well as to complete specific home-activity planning using guided handouts and activities (e.g., creating a home-rewards system, selecting activities and scheduling time to practice attending) to promote parents' ability to successfully implement BPT skills at home. It is important for future work to evaluate the role of increased in-session practice and other

Please cite this article as: Dvorsky, Friedman, Spiess et al., Patterns of Parental Adherence and the Association to Child and Parenting Outcomes Following a Multicomponent School-Home Intervention for Youth With ADHDBehavior Therapy, https://doi.org/10.1016/j.beth.2020.09.007

between-session techniques (e.g., text reminders, brief between-session check-in phone calls), as well as potential family-level mechanisms that may accelerate skills use among those parents with less optimal adherence. Additionally, given the CLS intervention is implemented by school personnel at school sites, it is possible that teachers' awareness of treatment or parent's DRC usage may have influenced their post-intervention ratings. Objective child outcome measures for assessing response to treatment (e.g., masked behavioral observations) would avoid possible rater bias or expectancy and are important to include in future studies. Finally, given parent adherence predicted teacher-rated treatment outcomes in the school setting, future research should examine adherence across components (i.e., parenting, classroom, child skills interventions) and explore potential interactive effects across multiple levels of intervention with a larger sample.

CONCLUSIONS

This study examined trajectories of parent strategy use during the Collaborative Life Skills (CLS) intervention program for youth with ADHD and is the first study to examine latent growth trajectories of parental adherence. By assessing differences in levels and change in parent adherence, we identified three unique trajectories of between strategy use that were differentially associated with post- and follow-up treatment outcomes including child behavior, organization, academic functioning, as well as parenting outcomes. A key finding is approximately half of families (47%) display generally high strategy use that increases throughout treatment. The remaining majority exhibit stable adherence, using BPT strategies "about half of the time" during treatment. This study contributes to a small but growing literature examining the impact of parent skill acquisition and utilization for promoting positive immediate and sustained treatment. Overall, findings suggest that differences in trajectories of adherence exist across parents and that high and increasing strategy use is associated with significantly better treatment outcomes at posttreatment and follow-up. Further, stagnant strategy use may be an important factor in explaining the lack of treatment response for some youth with ADHD. Our findings support the need for future work that focuses on monitoring and optimizing parent strategy use, particularly during the beginning of treatment. Specifically, these findings support the need for interventions focused on addressing parent engagement, reducing or compensating for inherent barriers, and facilitating effective skill use beyond the treatment setting.

Conflict of Interest Statement

The authors declare that there are no conflicts of interest.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.beth.2020.09.007.

References

Abikoff, H., and Gallagher, R. (2009). Children's Organization Skills Scales: Technical Manual. Multi-Health Systems Inc.

Becker, K. D., Lee, B. R., Daleiden, E. L., Lindsey, M., Brandt, N. E., & Chorpita, B. F. (2015). The common elements of engagement in children's mental health services: Which elements for which outcomes?. *Journal of Clinical Child and Adolescent Psychology 44*(1), 30–43. https://doi.org/10.1080/15374416.2013.814543.

Breaux, R. P., Langberg, J. M., Bourchtein, E., Eadeh, H.-M., Molitor, S. J., & Smith, Z. R. (2019). Brief homework intervention for adolescents with ADHD: Trajectories and predictors of response. *School Psychology Quarterly, 34*(2), 201–211.

Bowerman, B. L., & O'Connell, R. T. (1990). *Linear statistical models: An applied approach* (2nd ed.).

Chacko, A., Jensen, S. A., Lowry, L. S., Cornwell, M., Chimklis, A., Chan, E., Lee, D., & Pulgarin, B. (2016). Engagement in Behavioral Parent Training: Review of the literature and implications for practice. *Clinical Child and Family Psychology Review, 19*(3), 204–215. https://doi.org/10.1007/s10567-016-0205-2.

Chacko, A., Wymbs, B. T., Chimiklis, A., Wymbs, F. A., & Pelham, W. E. (2012). Evaluating a comprehensive strategy to improve engagement to group-based behavioral parent training for high-risk families of children with ADHD. *Journal of Abnormal Child Psychology, 40*(8), 1351–1362. https://doi.org/10.1007/s10802-012-9666-z.

Chronis-Tuscano, A., Wang, C. H., Woods, K. E., Strickland, J., & Stein, M. A. (2017). Parent ADHD and evidence-based treatment for their children: review and directions for future research. *Journal of Abnormal Child Psychology, 45*(3), 501–517.

Clarke, A. T., Marshall, S. A., Mautone, J. A., Soffer, S. L., Jones, H. A., Costigan, T. E., Patterson, A., Jawad, A. F., & Power, T. J. (2015). Parent attendance and homework adherence predict response to a family–school intervention for children with ADHD. *Journal of Clinical Child & Adolescent Psychology, 44*(1), 58–67. https://doi.org/10.1080/15374416.2013.794697.

Coles, E. K., Pelham, W. E., Fabiano, G. A., Gnagy, E. M., Burrows-MacLean, L., Wymbs, B. T., Mazzant, J. R., Garefino, A., Hoffman, M. T., Massetti, G. M., Page, T. F., Waschbusch, D. A., Waxmonsky, J. G., & Pelham, W. E. (2020). Randomized trial of first-line behavioral intervention to reduce need for medication in children with ADHD. *Journal of Clinical Child and Adolescent Psychology*. https://doi.org/10.1080/15374416.2019.1630835.

DuPaul, G. J., Kern, L., Volpe, R., Caskie, G., Sokol, N., Arbolino, L., Brakle, J. V., & Pipan, M. (2013). Compar-

ison of parent education and functional assessment-based intervention across 24 months for young children with attention deficit hyperactivity disorder. *School Psychology Review, 42*(1), 56–75. https://doi.org/10.1080/02796015.2013.12087491.

Dvorsky, M. R., & Langberg, J. M. (2016). A review of factors that promote resilience in youth with ADHD and ADHD symptoms. *Clinical Child and Family Psychology Review, 19*(4), 368–391. https://doi.org/10.1007/s10567-016-0216-z.

Dvorsky, M. R., Langberg, J. M., Becker, S. P., & Evans, S. W. (2019). Trajectories of global self-worth in adolescents with ADHD: Associations with academic, emotional, and social outcomes. *Journal of Clinical Child & Adolescent Psychology, 48*(5), 765–780. https://doi.org/10.1080/15374416.2018.1443460.

Dvorsky, M. R., Langberg, J. M., Evans, S. W., & Becker, S. P. (2016). The protective effects of social factors on the academic functioning of adolescents with ADHD. *Journal of Clinical Child & Adolescent Psychology, 47*(5), 713–726. https://doi.org/10.1080/15374416.2016.1138406.

Essau, C. A., Sasagawa, S., & Frick, P. J. (2006). Psychometric properties of the Alabama parenting questionnaire. *Journal of Child and Family Studies, 15*(5), 595–614. https://doi.org/10.1007/s10826-006-9036-y.

Evans, S. W., Owens, J. S., Wymbs, B. T., & Ray, A. R. (2018). Evidence-based psychosocial treatments for children and adolescents with attention deficit/hyperactivity disorder. *Journal of Clinical Child & Adolescent Psychology, 47*(2), 157–198. https://doi.org/10.1080/15374416.2017.1390757.

Fabiano, G. A., Pelham, W. E., Waschbusch, D. A., Gnagy, E. M., Lahey, B. B., Chronis, A. M., Onyango, A. N., Kipp, H., Lopez-Williams, A., & Burrows-MacLean, L. (2006). A practical measure of impairment: Psychometric properties of the impairment rating scale in samples of children with attention deficit hyperactivity disorder and two school-based samples. *Journal of Clinical Child and Adolescent Psychology, 35*(3), 369–385.

Gadow, K., & Sprafkin, J. (1997). Child symptom inventory. *Checkmate Plus*.

Green, C., Dvorsky, M. R., Langberg, J. M., Jones, H., & Floyd, A. (2020). The impact of social determinants of health on the efficacy of school-based interventions for ADHD. *School Mental Health, 12*, 580–594. https://doi.org/10.1007/s12310-020-09367-w.

Gresham, F., & Elliot, S. (2008). *Social skills improvement system rating scales*.

Haine-Schlagel, R., & Walsh, N. E. (2015). A review of parent participation engagement in child and family mental health treatment. *Clinical Child and Family Psychology Review, 18*(2), 133–150. https://doi.org/10.1007/s10567-015-0182-x.

Hawes, D. J., & Dadds, M. R. (2006). Assessing parenting practices through parent-report and direct observation during parent-training. *Journal of Child and Family Studies, 15*(5), 554–567. https://doi.org/10.1007/s10826-006-9029-x.

Joseph, H. M., Farmer, C., Kipp, H., Kolko, D., Aman, M., McGinley, J., Arnold, L. E., Gadow, K. D., Findling, R. L., & Molina, B. S. G. (2019). Attendance and engagement in parent training predict child behavioral outcomes in children pharmacologically treated for attention-deficit/hyperactivity disorder and severe aggression. *Journal of Child and Adolescent Psychopharmacology, 29*(2), 90–99. https://doi.org/10.1089/cap.2018.0119.

Kazantzis, N., Whittington, C., Zelencich, L., Kyrios, M., Norton, P. J., & Hofmann, S. G. (2016). Quantity and quality of homework compliance: A meta-analysis of relations with outcome in cognitive behavior therapy. *Behavior Therapy, 47*(5), 755–772. https://doi.org/10.1016/j.beth.2016.05.002.

Kling, A., Forster, M., Sundell, K., & Melin, L. (2010). A randomized controlled effectiveness trial of parent management training with varying degrees of therapist support. *Behavior Therapy, 41*(4), 530–542. https://doi.org/10.1016/j.beth.2010.02.004.

Lindhiem, O., Bennett, C. B., Rosen, D., & Silk, J. (2015). Mobile technology boosts the effectiveness of psychotherapy and behavioral interventions: A meta-analysis. *Journal of Clinical Child & Adolescent Psychology, 39*(6), 785–804. https://doi.org/10.1177/0145445515595198.

Lindhiem, O., Vaughn-Coaxum, R. A., Higa, J., Harris, J. L., Kolko, D. J., & Pilkonis, P. A. (2020). Development and validation of the parenting skill use diary (PSUD) in a nationally representative sample. *Journal of Clinical Child and Adolescent Psychology*.

Lindsey, M., Romanelli, M., Ellis, M., Barker, E., Boxmeyer, C., & Lochman, J. L. (2019). The influence of treatment engagement on positive outcomes in the context of a school-based intervention for students with externalizing behavior problems. *Journal of Abnormal Child Psychology, 47*, 1437–1454. https://doi.org/10.1007/s10802-019-00525-6.

Lubke, G., & Muthén, B. O. (2007). Performance of factor mixture models as a function of model size, covariate effects, and class-specific parameters. *Structural Equation Modeling, 14*(1), 26–47. https://doi.org/10.1207/s15328007sem1401_2.

McArdle, J. J. (2009). Latent variable modeling of differences and changes with longitudinal data. *Annual Review of Psychology, 60*, 577–605. https://doi.org/10.1146/annurev.psych.60.110707.163612.

Muthén, L. K., and Muthén, B. O. (1998–2019). Mplus User's Guide, 8th Edition. Muthen and Muthen.

Molina, B. S. G., Hinshaw, S. P., Swanson, J., Arnold, L., Vitiello, B., Jensen, P., Epstein, Jeffery N., Hoza, Betsy, Hechtman, Lily, Abikoff, Howard B., Elliott, Glen R., Greenhill, Laurence L., Newcorn, Jeffrey H., Wells, Karen C., Wigal, Timothy, Gibbons, Robert D., Hur, Kwan, & Houck, Patricia R. (2009). The MTA at 8 Years: Prospective Follow-Up of Children Treated for Combined-Type ADHD in a Multisite Study. *Journal of the American Academy of Child & Adolescent Psychiatry, 48*(5), 484–500. https://doi.org/10.1097/CHI.0b013e31819c23d0.

Muthén, B. O., & Muthén, L. K. (2000). Integrating person-centered and variable-centered analyses: Growth mixture modeling with latent trajectory classes. *Alcoholism: Clinical and Experimental Research, 24*(6), 882–891. https://doi.org/10.1111/j.1530-0277.2000.tb02070.x.

Owens, E. B., Hinshaw, S. P., McBurnett, K., & Pfiffner, L. (2018). Predictors of response to behavioral treatments among children with ADHD-inattentive type. *Journal of Clinical Child and Adolescent Psychology, 47*(suppl1), S219–S232. https://doi.org/10.1080/15374416.2016.1228461.

Pfiffner, L. J., Dvorsky, M. R., & Kaiser, N. M. (2020). Behavioral parent training. In M. K. Dulcan (Ed.), *The textbook of child and adolescent psychiatry* (3rd ed., pp. 901–935). American Psychiatric Publishing.

Pfiffner, L. J., Rooney, M., Haack, L., Villodas, M., Delucchi, K., & McBurnett, K. (2016). A randomized controlled trial

of a school-implemented school-home intervention for attention-deficit/hyperactivity disorder symptoms and impairment. *Journal of the American Academy of Child and Adolescent Psychiatry, 55*(9), 762–770. https://doi.org/10.1016/j.jaac.2016.05.023.

Pfiffner, L. J., Villodas, M., Kaiser, N., Rooney, M., & McBurnett, K. (2013). Educational outcomes of a collaborative school-home behavioral intervention for ADHD. *School Psychology Quarterly, 28*(1), 25–36. https://doi.org/10.1037/spq0000016.

Rieppi, R., Greenhill, L. L., Ford, R. E., Chuang, S., Wu, M., Davies, M., Abikoff, H. B., Arnold, L. E., Conners, C. K., Elliott, G. R., Hechtman, L., Hinshaw, S. P., Hoza, B., Jensen, P. S., Kraemer, H. C., March, J. S., Newcorn, J. H., Pelham, W. E., Severe, J. B., Swanson, J. M., Vitiello, B., Wells, K. C., & Wigal, T. (2002). Socioeconomic Status as a Moderator of ADHD Treatment Outcomes. *Journal of the American Academy of Child and Adolescent Psychiatry, 41*(3), 269–277. https://doi.org/10.1097/00004583-200203000-00006.

Rooney, M. E., Hinshaw, S. P., McBurnett, K., & Pfiffner, L. J. (2018). Parent adherence in two behavioral treatment strategies for the predominantly inattentive presentation of ADHD. *Journal of Clinical Child and Adolescent Psychology, 47*(sup1), S233–S241. https://doi.org/10.1080/15374416.2016.1236341.

Ros, R., Graziano, P. A., & Hart, K. C. (2017). Parental homework completion and treatment knowledge during group parent-child interaction therapy. *Journal of Early Intervention, 39*(4), 299–320. https://doi.org/10.1177/1053815117718491.

Stokes, J. O., Jent, J. F., Weinstein, A., Davis, E. M., Brown, T. M., Cruz, L., & Wavering, H. (2016). Does practice make perfect? The relationship between self-reported treatment homework completion and parental skill acquisition and child behaviors. *Behavior Therapy, 47*(4), 538–549. https://doi.org/10.1016/j.beth.2016.04.004.

Vermunt, J. K. (2010). Latent class modeling with covariates: Two improved three-step approaches. *Political Analysis, 18*(4), 450–469. https://doi.org/10.1093/pan/mpq025.

Villodas, M. T., McBurnett, K., Kaiser, N., Rooney, M., & Pfiffner, L. J. (2014). Additive effects of parent adherence on social and behavioral outcomes of a collaborative school-home behavioral intervention for ADHD. *Child Psychiatry and Human Development, 45*(3), 348–360. https://doi.org/10.1007/s10578-013-0405-7.

Visser, S. N., Danielson, M. L., Bitsko, R. H., Holbrook, J. R., Kogan, M. D., Ghandour, R. M., Perou, R., & Blumberg, S. J. (2014). Trends in the parent-report of health care provider-diagnosed and medicated attention-deficit/hyperactivity disorder: United States, 2003–2011. *Journal of the American Academy of Child and Adolescent Psychiatry, 53*(1), 34–46.

RECEIVED: January 7, 2020
ACCEPTED: September 30, 2020
AVAILABLE ONLINE: XXXX