Acute Effects of Parent Stimulant Medication Versus Behavioral Parent Training on Mothers' ADHD, Parenting Behavior, and At-Risk Children

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ABSTRACT

Background: Attention-deficit/hyperactivity disorder (ADHD) is present in 25%–50% of parents of children with ADHD, compromising parenting and child behavioral treatment. Efforts to treat multiplex ADHD families have not compared behavioral parenting interventions to parent psychopharmacology without confounds of other treatments. This report describes a pilot early intervention study directly comparing parent lisdexamfetamine dimesylate (LDX) to behavioral parent training (BPT) in families in which the mother had currently untreated ADHD and the young child displayed ADHD symptoms.

Methods: Mothers with ADHD (N = 35) of 4- to 8-year-old stimulant-naive children (N = 35) were randomly assigned to an 8-week trial of LDX (starting at 20 mg/d and titrated to a maximum of 70 mg/d) or BPT. Outcomes included multi-method, multi-informant measures of (1) maternal ADHD symptoms (Conners' Adult ADHD Rating Scales) and impairment (Clinical Global Impressions–Severity of Illness scale [CGI-S] and CGI-Improvement scale [CGI-I]), (2) parenting (Alabama Parenting Questionnaire [APQ] and Dyadic Parent-Child Interaction Coding System, Fourth Edition), and (3) child ADHD symptoms (Conners Parent Rating Scale Revised-Short Form and Conners Early Childhood Scale) and impairment (CGI-S, CGI-I, and Child Impairment Rating Scale).

Results: At 8 weeks, both treatments improved mothers' self-reported emotion regulation and mothers' functioning on the CGI, but only LDX improved mothers' self-reported core ADHD symptoms. LDX was associated with improvement in parents' perception of their own ADHD symptoms (Conners Inattention [$P < .0001$] and ADHD Index scores [$P < .0001$]) and their child's ADHD symptoms ($P = .009$). Fifty-six percent of the mothers treated with LDX (n = 10) were "much" or "very much" improved with regard to their adult ADHD based on the CGI-I scores versus 6% of mothers receiving BPT (n = 1; $P = .003$). BPT improved parenting on self-reported positive parenting ($P = .007$), inconsistent discipline ($P > .0001$), and corporal punishment ($P = .001$), while LDX improved reported inconsistent discipline ($P = .001$) and corporal punishment ($P = .04$) on the APQ, consistent with prior research. In contrast to parental LDX, which did not improve observed parenting, BPT was associated with increased positive parenting during child-directed play ($P = .0002$) and clean-up ($P = .04$) and less negative parenting ($P = .04$) during child-directed play. Six percent of children (n = 1) whose mothers were randomized to LDX (n = 18) were "much" or "very much" improved on the CGI-I compared to 35% (n = 16) of those treated with BPT ($P = .04$).

Conclusions: LDX and BPT each had unique effects on maternal ADHD symptoms and parenting, but modest effects on at-risk children. In general, LDX was more effective at treating mothers' core ADHD symptoms, but both LDX and BPT improved mothers' emotion regulation, and BPT resulted in more consistent effects on parenting measures via both maternal report and direct observation. As most children remained significantly impaired after 8 weeks of unimodal treatment, combination treatment and/or longer treatment duration may be necessary to improve functioning of multiplex ADHD families.

Trial Registration: ClinicalTrials.gov identifier: NCT01816074

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Attention-deficit/hyperactivity disorder (ADHD) is characterized by developmentally aberrant symptoms of inattention, impulsivity, and/or hyperactivity across settings.[1] Evidence-based treatments (EBTs) for youth with ADHD include stimulant medication and behavioral interventions.[2] Compromising the effective delivery of EBTs for youth with ADHD is the high incidence of ADHD in parents.[3] An estimated 25%–50% of children with ADHD have a parent with ADHD.[4] Because EBTs require parents to implement and sustain treatment, parents with ADHD are often ill-equipped to scaffold their children's academic and social development and demonstrate parenting characterized by inconsistency, disorganization, and negativity.[5] Indeed, behavioral treatments yield poor outcomes when parents have ADHD in many,[3,6,7] but not all studies.[3]

Given deleterious effects of untreated parental ADHD, treating the parent with ADHD represents a novel approach to early intervention for children at risk. Several studies have examined the impact of pharmacotherapy on parental ADHD, with the goal of improving parent ADHD, parenting, and child outcomes; a recent review[3] found limited effects of parent ADHD medication on parenting and child outcomes despite robust effects on adult ADHD.

In the largest study to date, the ADHD in Mothers and Children Study (AIMAC),[8] mothers with ADHD were randomized to (1) group dialectical behavior therapy (DBT) + methylphenidate + individual BPT or (2) supportive counseling + individual BPT. Child externalizing behaviors improved in both conditions; only maternal methylphenidate + DBT improved mothers' ADHD.[8] Unfortunately, the design did not allow for interpretation of unique effects of maternal methylphenidate or BPT since the treatment group received both psychotherapy

Clinical Points

- This study sought to identify and compare effects of family-based interventions (behavioral parent training and parent stimulant medication) in families of young children with attention-deficit/hyperactivity disorder (ADHD) symptoms who have not yet been treated with medication.
- Although both treatments were associated with improvements in overlapping and unique aspects of parental ADHD and parenting, the majority of children were still impaired following brief treatment.
- Combining medication and behavioral treatments, lengthening treatment duration, and/or intervening earlier might be needed to alter the trajectory of ADHD in at-risk children who have a caregiver with ADHD.

and medication, all mothers received BPT, and most children were concurrently treated with stimulants.[9]

No study to date has compared ADHD pharmacotherapy to BPT for parents with ADHD and their children without confounds of other concurrent therapies. The present study fills that gap by directly comparing parent lisdexamfetamine (LDX) to BPT in mothers with ADHD and their 4- to 8-year-old, stimulant-naive children with elevated ADHD symptoms and impairment. We examine acute treatment effects on (1) parents' ADHD symptoms and impairment, (2) parenting measured using the gold-standard combination of observation and questionnaires, and (3) child ADHD symptoms and impairment. We hypothesized that LDX would improve parental ADHD, whereas BPT would improve parenting and child functioning, relative to the alternative treatment. However, given findings suggesting that BPT effects are reduced when parents have ADHD, it is possible that the effects of BPT on parenting and child behavior would be minimal in the context of parent ADHD.

In an effort to intervene early to interrupt negative parent-child transactional processes early in development,[7] prevent the worsening of ADHD symptoms, and delay the need for child ADHD medication, we selected young children with ADHD symptoms prior to initiation of child medication. Consistent with this approach, the American Academy of Pediatrics (AAP) ADHD practice guidelines[10] state that behavioral treatments should be initiated prior to stimulants for young children. Thus, this study could be viewed as early intervention or secondary prevention in that we are comparing two approaches to intervening early in development with a population that is at risk for severe and impairing ADHD (ie, children of mothers with ADHD).

METHOD

Participants

The study was approved by the local ethics committee, informed consent was obtained, and the study was registered at ClinicalTrials.gov (identifier: NCT01816074). This 8-week analysis represents the first phase of a sequential multiple assessment randomization trial pilot (SMART Pilot) examining the sequencing and personalization of treatments for mothers with ADHD and their children.[3] Families were recruited from internal clinic referrals, clinic newsletters, flyers, media advertisements (eg, radio, website, magazine), and community support groups.[11] Parents who scored 1.5 SD above the mean on the Conners' Adult ADHD Rating Scale, Self-Report Short Version (CAARS-S:SV) during a phone screen were invited for the baseline assessment. Parents were required to have *DSM-IV* ADHD based on the Adult Clinician Diagnostic Scale v1.2 (ACDS v1.2)[12] and Wender-Reimherr Adult Attention Deficit Disorder Scales (WRAADDS); the Structured Clinical Interview for *DSM-IV* (SCID)[13] was administered to assess comorbidity. Child diagnoses were based on the Kiddie-Schedule for Affective Disorders for Schizophrenia–Present and Lifetime Version (K-SADS PL).[14] Diagnostic interviews and Clinical Global Impressions scale (CGI) ratings were completed by licensed clinical psychologists trained by the senior author who were unaware of treatment condition. Exclusion criteria included medical disorders for which stimulants are contraindicated, pregnancy/breast feeding, bipolar illness, schizophrenia, suicidal risk, or recent alcohol/substance abuse (warranting other, immediate treatment). Concomitant parent psychotropic medications were allowed; 17% of mothers (n = 6) received antidepressants, and 11% of mothers (n = 4) received anxiolytics. Fifteen percent of mothers had a history of prior stimulant treatment. Participant characteristics are presented in Table 1.

Children were required to display elevated ADHD symptoms (t score > 60) on Conners 3 or Conners Early Childhood scales,[15,16] be between ages 4 and 8 years (mean [SD] = 6.26 [1.45] years) and stimulant naive. Sixty-six percent of children (n = 23) met *DSM-IV* criteria for ADHD combined type, and 37% (n = 13) met criteria for predominantly inattentive type; 23% (n = 8) had comorbid oppositional defiant disorder (ODD), and none had conduct disorder (CD). Only 1 child per parent with ADHD symptoms was included, so the number of parents was the same as the number of children in each treatment group.

Screen failures occurred in 19% of families. Thirty-five mothers were randomized to 8 weeks of LDX or BPT (see CONSORT diagram in Figure 1).

Treatment

This study reporting 8-week outcomes comprised the first phase of a SMART Pilot, which had as a larger goal of examining the optimal sequencing of BPT and maternal stimulant medication.[17] Parent, family, and child measures were similar at baseline for each treatment group (Table 2).

Parents randomized to LDX began on 20 mg/d, which was titrated weekly to a maximum dosage of 70 mg/d, until CGI-Improvement scale (CGI-I) score was ≥ 2 (improved or very much improved), with minimal side effects. Similar to in the Texas Children's Medication Algorithm Project,[18]

Table 1. Demographics and Baseline Characteristics of Mothers and Children[a]

Variable	LDX (n = 18)	BPT (n = 17)	*P* Value
Parent Characteristics			
Age, mean (SD), y	39.3	40.0	.74
	n (%)	n (%)	
White (non-Hispanic)	15 (83)	15 (88)	.21
Hispanic/Latino	1 (6)	1 (6)	.51
Married or living with partner	15 (83)	13 (76)	.89
ADHD symptoms			.70
Inattentive	10 (56)	11 (65)	
Hyperactive-impulsive	3 (17)	1 (6)	
Combined presentation	5 (28)	5 (29)	
Psychiatric comorbidities			
Depressive disorder	5 (28)	3 (18)	.69
Anxiety disorder	3 (17)	1 (6)	.60
Substance use disorder	0 (0)	0 (0)	.99
History of previous stimulant treatment	1 (6)	4 (24)	.18
Parent Symptoms and Impairment			
	Mean (SE)	Mean (SE)	
CAARS self-report score			
Inattention	74.6 (2.1)	73.1 (2.5)	.63
Hyperactivity/Impulsivity	63.1 (1.9)	59.5 (3.4)	.35
ADHD Index	69.2 (2.2)	68.3 (2.2)	.78
WRAADS score			
Temper	3.2 (0.2)	1.9 (0.3)	.0004
Affective Lability	2.0 (0.3)	1.7 (0.3)	.43
Emotional Overreactivity	3.3 (0.2)	2.6 (0.3)	.07
Disorganization	3.4 (0.2)	3.1 (0.2)	.43
CGI-S score	4.8 (0.2)	4.5 (0. 1)	.26
BDI score	18.3 (3.2)	14.7 (2.1)	.35
Parenting			
Self-reported parenting (APQ score)			
Involvement	38.5 (1.0)	36.0 (1.3)	.13
Positive Parenting	24.6 (0.7)	23.4 (0.8)	.28
Poor Monitoring/Supervision	15.1 (2.2)	12.9 (1.5)	.39
Inconsistent Discipline	16.4 (1.0)	17.7 (1.1)	.37
Corporal Punishment	6.4 (0.5)	6.1 (0.4)	.57
Observed parenting (DPICS-IV score)			
Homework: Positive Parenting	18.1 (3.1)	12.0 (2.0)	.28
Homework: Negative Parenting	5.9 (1.1)	5.1 (0.9)	.74
Child-directed: Positive Parenting	4.1 (0.9)	1.5 (0.4)	.02
Child directed: Negative Parenting	1.4 (0.5)	1.5 (0.1)	.70
Clean-up: Positive Parenting	10.5 (2.2)	6.3 (1.5)	.12
Clean-up: Negative Parenting	2.6 (1.0)	2.7 (0.8)	.29
Child Symptoms and Impairment			
	n (%)	n (%)	
ADHD symptoms			.99
Inattentive	6 (33)	5 (29)	
Hyperactive-impulsive	0 (0)	0 (0)	
Combined presentation	9 (50)	9 (53)	
Other ADHD, unspecified	0 (0)	1 (6)	
Does not meet criteria	3 (17)	2 (12)	
Oppositional defiant disorder	5 (28)	3 (18)	.69
Conduct disorder	0 (0)	0 (0)	.99
	Mean (SE)	Mean (SE)	
Conners 3/Early Childhood Scale *t* score	82.9 (1.9)	82.1 (1.8)	.75
C-IRS score, mean (SE)	3.2 (0.3)	3.5 (0.3)	.52
Child CGI-S score	4.5 (0.2)	4.6 (0.4)	.87

[a]The total n value represents parents or children in their respective analyses (ie, the number of parents was the same as the number of children in each treatment group).

Abbreviations: ADHD = attention-deficit/hyperactivity disorder; APQ = Alabama Parenting Questionnaire; BDI = Beck Depression Inventory; BPT = behavioral parenting training; CAARS = Conners' Adult ADHD Rating Scales; CGI-S = Clinical Global Impressions–Severity of Illness scale; C-IRS = Child Impairment Rating Scale; DPICS = Dyadic Parent-Child Interaction Coding System, Fourth Edition; LDX = lisdexamfetamine; WRAADDS = Wender-Reimherr Adult Attention Deficit Disorder Scales.

in cases of poor response or tolerability, an alternative stimulant was used following the initial 8-week LDX trial.[11] The mean optimal LDX dose was 41.76 mg.

Parents assigned to BPT received eight 1-hour weekly sessions of Barkley's *Your Defiant Child*[19] delivered by doctoral students or psychologists supervised by the first author.

Safety Measures

At each titration visit, weight, blood pressure, and pulse were obtained, and an open-ended interview was conducted to elicit adverse events. Depressive symptoms were monitored using the Beck Depression Inventory (BDI),[20] given high comorbidity rates between ADHD and depression in adult women[21] and the established link between maternal depression and parenting.[22]

Parent Functioning

Parent ADHD symptoms were measured with the CAARS,[21] a reliable and valid 93-item measure assessing core features of ADHD. The WRAADDS[23] is a clinician rating of adult ADHD symptoms, including emotional dysregulation. The WRAADS has demonstrated clinical utility and sensitivity to medication effects.[23,24]

The Barkley Functional Impairment Rating Scale (BFIS)[24] is a 15-item self-report assessing difficulties averaged across life domains (eg, organizing daily responsibilities, relationships, work, child rearing) using a 9-point scale (0 = not at all to 9 = severe). Whenever possible, the CAARS and BFIS were also completed by collateral informants (n = 24; 10 for those receiving BPT and 14 for those receiving LDX).

Global severity was assessed with the CGI-Severity of Illness scale (CGI-S) and CGI-I completed by a blinded rater clinician. The CGI-S was used to measure illness severity (1 = normal/not ill to 7 = extremely ill), and the CGI-I was used to assess change (1 = very much improved to 7 = very much worse); positive responders were defined as "much" or "very much" improved.

Parenting

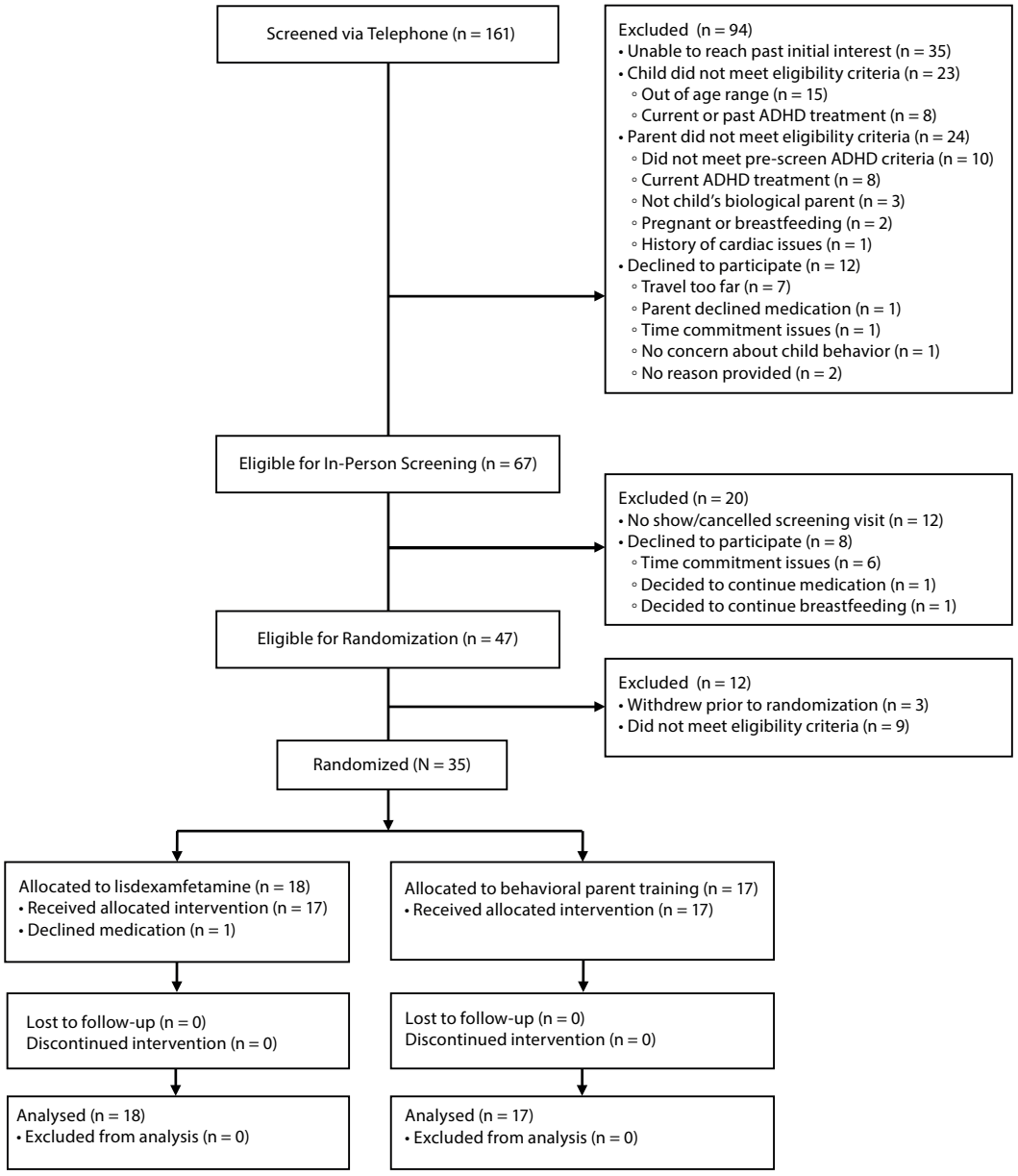
The Alabama Parenting Questionnaire (APQ)[25] is an extensively validated[26] 2-item parent self-report measure assessing positive parenting, corporal punishment, inconsistent discipline, and poor monitoring/supervision.

The Dyadic Parent-Child Interaction Coding System, Fourth Edition (DPICS-IV),[27] yielded frequencies of Positive Parenting (praise, reflections, behavioral descriptions), Negative Parenting (parent negative talk) and Child Deviance (child negative talk, noncompliance) during parent-child interaction tasks: cleanup, free play, and homework.[7,28] Intraclass correlations were 0.99 for Positive Parenting, 0.82 for Negative Parenting, and 0.96 for Child Deviance.

Child Functioning

The Conners Parent Rating Scale Revised–Short Form (CPRS)[15] is a 27-item scale yielding Oppositional Behavior,

Figure 1. CONSORT Diagram



Abbreviation: ADHD = attention-deficit/hyperactivity disorder.

Cognitive Problems, and Hyperactivity factor scores. For 4- to 6-year-old children, the Conners Early Childhood scale[15] was utilized. These scales have extensive normative data and evidence of reliability, validity, and clinical utility.

The Child Impairment Rating Scale (C-IRS)[29] is a validated parent-report scale consisting of 7 items measured on a scale from 0 (no problem/definitely does not need treatment/services) to 6 (extreme problem/definitely needs treatment/services); mean scores are reported.

Global severity was assessed with the CGI-S and CGI-I completed by a blinded rater. As was the case for parents, the CGI-S was used to measure severity of illness (1 = normal/not ill to 7 = extremely ill), and the CGI-I was used to assess baseline changes (1 = very much improved; 7 = very much worse). Responders were defined as "much" or "very much" improved.

Analytic Plan

Analyses were conducted on all 35 mothers who were randomized to treatment (and their children) using an intent-to-treat approach. Baseline characteristics are presented in Table 1. For primary analyses, LDX and BPT response rates are reported, and compared via Fisher exact test. To address missing data, child measures at baseline were imputed based on non-missing parent measures at baseline to achieve monotone missingness to which control-based pattern imputation was then applied under the monotone missingness assumption

Table 2. Effect of Parental Treatment With Lisdexamfetamine (LDX) or Behavioral Parent Training (BPT) on Parents and Children[a]

Variable	LDX (n = 18) Mean (95% CI)	*P* Value	BPT (n = 17) Mean (95% CI)	*P* Value	Difference of Differences (LDX – BPT) Difference (95% CI)	*P* Value
Parent Symptoms and Impairment						
ADHD symptoms (CAARS scores)						
Inattention (self)	−13.5 (−16.6 to −10.4)	<.0001	0.5 (−2.7 to 3.8)	.72	−12.5 (−17.3 to −7.7)	<.0001
Hyperactivity/Restlessness (self)	−9.7 (−15.2 to −4.2)	.005	−2.3 (−8.0 to 3.4)	.66	−7.0 (−15.1 to 1.2)	.09
ADHD Index (self)	−13.5 (−18.0 to −9.1)	<.0001	0.3 (−4.3 to 4.9)	.74	−12.4 (−19.0 to −5.8)	.0002
Inattention (observer)	−2.8 (−6.0 to 0.5)	.10	−2.9 (−6.4 to 0.5)	.09	0.2 (−4.6 to 4.9)	.94
Hyperactivity/Restlessness (observer)	0.6 (−4.4 to 5.7)	.81	−0.9 (−5.7 to 3.9)	.72	1.5 (−5.1 to 8.1)	.65
ADHD Index (observer)	−1.8 (−5.0 to 1.4)	.27	−2.3 (−5.4 to 0.9)	.16	0.5 (−4.0 to 5.0)	.84
ADHD symptoms (WRAADS scores)						
Temper	−1.3 (−1.8 to −0.7)	<.0001	−0.9 (−1.5 to −0.4)	.001	0.3 (−1.2 to 0.5)	.45
Affect Lability	−1.1 (−1.6 to −0.6)	<.0001	−0.6 (−1.0 to −0.1)	.02	−0.6 (−1.2 to 0.1)	.10
Emotional Overreactivity	−1.4 (−1.9 to −0.9)	<.0001	−0.8 (−1.3 to −0.2)	.005	−0.6 (−1.4 to 0.2)	.13
Disorganization	−1.6 (−2.0 to −1.1)	<.0001	−0.4 (−0.9 to 0.0)	.06	−1.1 (−1.8 to −0.5)	.0005
Functional impairment (BFIS scores)						
Percent impaired domains (self)	0.33 (0.10 to 1.08)	.12	0.67 (0.27 to 1.70)	.31	−0.22 (−1.33 to 0.90)	.34
Mean impairment score (self)	−0.5 (−1.4 to 0.5)	.51	0.2 (−1.0 to 0.5)	.36	0.1 (−1.0 to 1.2)	.65
Percent impaired domains (other)	0.45 (0.11 to 1.89)	.61	0.67 (0.21 to 2.11)	.73	−0.10 (−1.43 to 1.22)	.66
Mean impairment score (other)	−0.5 (−1.3 to 0.3)	.21	−0.4 (−1.1 to 0.3)	.25	−0.1 (−1.0 to 0.8)	.83
ADHD impairment						
CGI-S score	−1.5 (−2.0 to −1.1)	<.0001	−0.9 (−1.3 to −0.5)	<.0001	−0.6 (−1.2 to 0.0)	.04
CGI-I score, week 8[b]	2.4 (2.1 to 2.7)	<.0001	3.3 (3.0 to 3.7)	<.0001	−0.9 (−1.4 to −0.5)	<.0001
Parenting						
Self-reported (APQ scores)						
Involvement	0.6 (−1.4 to 2.6)	.56	1.4 (−0.8 to 3.6)	.11	−1.1 (−3.9 to 1.8)	.47
Positive Parenting	1.0 (−0.4 to 2.3)	.16	2.1 (0.7 to 3.6)	.007	−0.9 (−2.7 to 1.0)	.36
Inconsistent Discipline	−2.8 (−4.2 to −1.4)	.0001	−4.6 (−5.9 to −3.2)	<.0001	1.8 (−0.1 to 3.6)	.06
Poor Monitoring	−0.9 (−4.3 to 2.4)	.59	−0.9 (−2.3 to 0.4)	.46	0.3 (−3.8 to 4.5)	.88
Corporal Punishment	−0.7 (−1.4 to −0.1)	.04	−1.7 (−2.3 to −1.0)	<.0001	0.9 (0.0 to 1.9)	.04
Observed (DPICS scores, adjusted for child deviance)						
Homework: Positive Parenting	−1.7 (−7.0 to 3.7)	.54	7.5 (0.8 to 14.3)	.03	−9.2 (−17.9 to −0.5)	.04
Homework: Negative Parenting	2.9 (−1.6 to 7.4)	.21	−1.7 (−4.3 to 1.0)	.22	4.5 (−1.6 to 10.6)	.14
Child Directed: Positive Parenting	−0.3 (−2.3 to 1.8)	.79	6.1 (2.9 to 9.3)	.0002	−6.4 (−10.2 to −2.6)	.001
Child Directed: Negative Parenting	1.4 (−1.5 to 4.2)	.35	−1.1 (−2.1 to −0.1)	.04	2.4 (−0.6 to 5.4)	.11
Clean-Up: Positive Parenting	−0.3 (−3.0 to 2.4)	.85	8.6 (2.8 to 14.4)	.004	−8.9 (−17.9 to −0.5)	.006
Clean-Up: Negative Parenting	1.2 (−0.8 to 3.1)	.23	−1.1 (−2.9 to 0.6)	.21	4.5 (−1.6 to 10.6)	.09
Child Symptoms and Impairment						
ADHD Symptoms (Conners scales[c])						
Overall, *t* score	−5.0 (−8.8 to −1.3)	.009	−2.1 (−6.0 to 1.7)	.28	−2.9 (−8.3 to 2.5)	.29
C-IRS score						
Impairment	−0.4 (−1.0 to 0.2)	.21	−0.5 (−1.2 to 0.2)	.21	0.1 (−0.8 to 1.0)	.87
ADHD impairment						
CGI-S score	−0.6 (−1.0 to −0.2)	.009	−0.8 (−1.3 to −0.4)	.001	0.2 (−0.4 to 0.8)	.44
CGI-I score, week 8[b]	3.5 (3.1 to 3.9)	<.0001	2.8 (2.3 to 3.2)	<.0001	0.7 (0.1 to 1.3)	.02

[a]Baseline level of the outcome variable included as covariate in models unless otherwise indicated. The total n value represents parents or children in their respective analyses (ie, the number of parents was the same as the number of children in each treatment group).
[b]Adjusted for baseline CGI-S score.
[c]Due to using different versions of the Conners scales (ie, Connors Early Childhood and Conners 3 scales) in this study, this reflects a composite of symptom *t* scores on the Connors Early Childhood scale or the overall ADHD score on the Conners 3 scale.
Abbreviations: ADHD = attention-deficit/hyperactivity disorder; APQ = Alabama Parenting Questionnaire; BFIS = Barkley Functional Impairment Rating Scale; CAARS = Conners' Adult ADHD Rating Scales; CGI-I = Clinical Global Impressions–Improvement scale; CGI-S = CGI–Severity of Illness scale; C-IRS = Child Impairment Rating Scale; DPICS = Dyadic Parent-Child Interaction Coding System, Fourth Edition; WRAADDS = Wender-Reimherr Adult Attention Deficit Disorder Scales.

(5 imputations). Parent measures at baseline were then imputed using fully conditional specification (5 imputations with each of the original 5 imputations = 25 imputation sets). Parent and child measures posttreatment were imputed via control-based pattern imputation with fully conditional specification (10 imputations). In secondary analyses, within-subject change scores were calculated as ($measure_{posttreatment}$ – $measure_{baseline}$). Analyses of covariance were performed to compare LDX versus BPT, adjusted for baseline, on each measure change score. Marginal mean change score and associated 95% confidence intervals (CIs) were estimated for each group. To adjust for "child effects," DPICS parenting composites were modeled longitudinally via generalized linear mixed models, adjusted for visit-specific child deviance, with random intercepts and robust residual-based sandwich estimators.[30] Safety measures are summarized for those assigned to LDX.

All analyses were conducted using SAS 9.4.[31] $P < .05$ was considered statistically significant. For this pilot study, no correction for multiple comparisons was implemented.

RESULTS

Safety

All mothers randomized to LDX who received at least 1 dose of drug completed the trial. The mean optimal LDX dose for mothers was 41.76 mg (range, 30–70 mg). No serious adverse events were reported. Vital sign changes were as expected for LDX. BPT sessions were well-attended; all BPT sessions were attended by 16 of 17 mothers.

Treatment with LDX was associated with significant decreases on the BDI among mothers (mean = −7.6; 95% CI, −12.2 to −2.9). BPT was not associated with significant BDI score improvements (mean = −2.4; 95% CI, −7.1 to 2.2). Parents enrolled in the study while receiving concomitant psychiatric medications tolerated LDX, and all completed the study.

Parental ADHD Symptoms and Related Impairment

Maternal LDX was associated with significant improvements in adult ADHD (Table 2), including CAARS Inattention and Hyperactivity/Restlessness and WRAADS Temper, Affect Lability, Emotional Overreactivity, and Disorganization. BPT was associated with significant improvements in WRAADS Temper, Affect Lability, and Emotional Overreactivity. However, BPT did not significantly improve CAARS Inattention or Hyperactivity/Restlessness or WRAADS Disorganization. Improvements in CAARS Inattention and ADHD Index and WRADDS Disorganization were significantly larger for LDX versus BPT (Table 2).

Both LDX and BPT resulted in significant improvements as measured by the CGI-S and CGI-I, although mothers receiving LDX versus BPT displayed significantly greater reduction in CGI-S scores. At 8 weeks, 56% of the mothers treated with LDX (n = 10) were "much" or "very much" improved with regard to their adult ADHD based on CGI-I scores versus 6% of mothers receiving BPT (n = 1; $P = .003$). However, neither BPT nor LDX yielded fewer BFIS impaired domains or significant changes in BFIS total score (Table 2).

No significant effects of treatment on maternal ADHD symptoms or impairment were found on collateral reports.

Parenting

LDX was associated with significant reductions in APQ Inconsistent Discipline and Corporal Punishment scores, but not significant reductions in frequencies on any of the DPICS observational scales (Table 2).

BPT was associated with significantly increased Positive Parenting scores on the APQ and DPICS during homework, free play, and clean-up and significantly decreased APQ Inconsistent Discipline and Corporal Punishment and DPICS Negative Parenting scores during free play.

Child ADHD Symptoms and Related Impairment

Children of mothers treated with LDX exhibited significant reductions in Conners overall symptoms and CGI-S and CGI-I scores, but not on the C-IRS (Table 2). At 8 weeks, 6% of children (n = 1) whose mothers were randomized to LDX treatment (n = 18) were "much" or "very much" improved per the CGI-I compared to 35% (n = 6) of those treated with BPT ($P = .04$).

BPT resulted in significantly reduced child CGI-S scores and significant CGI-I improvement, but not the other indices of child ADHD symptoms or impairment.

DISCUSSION

In this 8-week study of multiplex ADHD families, we compared parent treatment with LDX versus BPT on maternal ADHD symptoms and functioning, parenting, and child symptoms and functioning outcomes using a multimethod, multi-informant assessment approach. This study was the first to directly compare and isolate these two treatment components for multiplex families in a randomized controlled trial design. Overall, administering stimulant medication to mothers with ADHD improved maternal ADHD with limited effects on parenting and parent report of child ADHD symptoms; BPT improved maternal emotion regulation as measured with self- and clinician ratings, child global functioning as measured by the clinician-rated CGI scales, and parenting as measured with parent report and standardized behavioral observations.

With regard to parental ADHD, LDX had significant effects on more symptom domains, including inattention, hyperactivity/impulsivity, temper, affective lability, emotional overreactivity, and disorganization. Perhaps surprisingly, BPT also had beneficial effects on mothers' temper, affective lability, and emotional overreactivity that were comparable to the effects of LDX on these indices. These aspects of emotion regulation, now considered a third dimension of ADHD,[32] can certainly interfere with calm and consistent parenting and functioning across broader domains (eg, relationships, work). This study suggests that LDX and BPT have comparable effects on the emotional aspects of maternal ADHD.

In line with this finding, both LDX and BPT resulted in improvements in mothers' functioning as measured by the CGI scales, with significantly greater improvement in functioning resulting from LDX than from BPT. More specifically, LDX resulted in almost 60% of mothers being rated as "much" or "very much improved" on the CGI-I posttreatment versus only 6% of mothers receiving BPT. Thus, to derive the most benefit in their ADHD-related functioning for mothers with ADHD, stimulant medication is recommended.

No effects of LDX or BPT were found with collateral informant data; however, these analyses were limited by very small numbers of subjects.

With regard to parenting, mothers receiving LDX self-reported improvements in inconsistent discipline and corporal punishment, precisely in line with our prior trial[28] of OROS methylphenidate for mothers with ADHD. It is notable that LDX administered to mothers reduces corporal punishment use and therefore risk for abuse among mothers

with ADHD. However, objective laboratory observations of parenting (considered the "gold standard" parenting assessment) showed no effects of LDX on positive or negative parenting, also consistent with our prior research.[28,33] BPT, however, was consistently associated with improved maternal parenting across self-report and observational measures. Specifically, BPT improved self-reported positive parenting, inconsistent discipline, and corporal punishment use as well as observed positive and negative parenting across the 3 laboratory parent-child interaction tasks used in our observational paradigm. The extant literature suggests that behavioral treatments often yield poor outcomes when parents have ADHD[3,6,7]; however, this literature is mixed.[3] Perhaps the BPT providers' knowledge and training regarding parent ADHD in the present study was beneficial in terms of BPT delivery to this population. Future studies using community clinicians may elucidate this possibility.

Finally, with regard to child functioning, results based on the CGI and Conners scales were divergent. On the clinician-rated CGI-I, only 6% of children whose mothers were receiving LDX were "much" or "very much" improved after 8 weeks despite symptomatic improvement, whereas 35% of children whose mothers received BPT showed global improvement. Medication may have improved parents' perceptions of their child's ADHD, but not associated behavior problems. Observational and teacher report data could elucidate reasons for this unexpected finding.

One limitation of this study is that we exclusively examined mothers. We attempted to recruit fathers for a separate study using similar methods; however, recruiting fathers proved quite difficult, and they had twice the screen failure rate due to substance abuse (mostly marijuana), which was exclusionary. Future research on multiplex ADHD will ideally include samples of both mothers and fathers. Other limitations include the small sample size, absence of teacher reports, lack of correction for multiple statistical tests, and limited collateral informant data.

Despite its limitations, this study extends the literature in important ways. It is the very first to provide a direct comparison of parent ADHD medication versus BPT in families in which the child had never been treated with medication, in contrast to the AIMAC study,[8] in which parents received BPT in both conditions and ADHD medication and psychotherapy were confounded, preventing conclusions about the impact of each individual treatment component. Here, we found that, in general, LDX improved mothers' core ADHD symptoms, both LDX and BPT improved mothers' emotion regulation, and BPT improved parenting across assessment methods. Clinically, these findings suggest that providers treating mothers with ADHD who are reporting ADHD-related impairment should consider a medication trial; however, referrals for BPT are recommended if parents with ADHD are struggling in the parenting domain, particularly since parenting predicts the onset of comorbidity in youth with ADHD.

It remains unclear how to optimally sequence or combine these treatments[34] and how to best identify families who might benefit from family-based treatment versus treatment for the parent and/or child alone. It will also be important to examine longer-term effects of these approaches. Importantly, neither treatment was sufficient for most families, as most children remained impaired at 8 weeks. Combining medication and behavioral treatments, lengthening treatment duration, and/or intervening earlier might be needed to alter the trajectory of child ADHD in multiplex families.

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