Journal of Attention Disorders
http://jad.sagepub.com/

Acute Effects of MPH on the Parent–Teen Interactions of Adolescents With ADHD

William E. Pelham, David L. Meichenbaum, Bradley H. Smith, Margaret H. Sibley, Elizabeth M. Gnagy and Oscar Bukstein

Journal of Attention Disorders published online 29 March 2013
DOI: 10.1177/1087054713480833

The online version of this article can be found at:
http://jad.sagepub.com/content/early/2013/03/27/1087054713480833

Published by:
SAGE
http://www.sagepublications.com

Journal of Attention Disorders
XX(X) 1–10

DOI: 10.1177/1087054713480833
jad.sagepub.com
SAGE

Acute Effects of MPH on the Parent–Teen Interactions of Adolescents With ADHD

William E. Pelham, Jr.[1], David L. Meichenbaum[2], Bradley H. Smith[3], Margaret H. Sibley[1], Elizabeth M. Gnagy[1] and Oscar Bukstein[4]

Abstract

This study explored the nature of interactions between adolescent males with ADHD and their mothers, and the effects of methylphenidate (MPH) on an analogue parent–teen interaction task. Twenty-five adolescent males with ADHD (*M* = 13.6 years) and their mothers and 14 non-ADHD adolescent males (*M* = 13.4 years) and their mothers completed ratings of perceived dyadic conflict. Behavioral observations of dyads during 10-min conflict-resolution tasks were also collected. The ADHD dyads completed these tasks twice, with adolescents receiving either 0.3 mg/kg MPH or placebo. Videotaped sessions were coded using the Parent–Adolescent Interaction Rating Scale. Following the conflict-resolution task, participants rated their perceived conflict and affect during the interaction. Findings indicated higher conflict in the ADHD dyads, and minimal MPH effects on parent–teen interactions during the analogue task. Results suggest that stimulant medication does not produce meaningful acute effects on parent–teen interactions. *(J. of Att. Dis. 2013; XX(X) 1-XX)*

Keywords

ADHD, stimulant medication, adolescence

The Effect of Methylphenidate (MPH) on Parent-Directed Conflict Behavior in Adolescents With ADHD

In adolescence, parent-directed conflict behaviors intensify as teens attempt to increase personal independence (Larson, Richards, Moneta, Holmbeck, & Duckett, 1996; Laursen, Coy, & Collins, 1998; Steinberg & Morris, 2001). Youth with ADHD display poor emotion regulation skills, problem-solving deficits, and high rates of comorbid oppositional defiant disorder (ODD; Anderson, Williams, McGee, & Silva, 1987; Cantwell, 1986; Sobanski et al., 2010; Wehmeier, Schacht, & Barkley, 2010). These deficits contribute to impaired and strained relationships with family members, which further elevate parent–adolescent conflict (Barkley, Anastopoulos, Guevremont, & Fletcher, 1992; Edwards, Barkley, Laneri, Fletcher, & Metevia, 2001; Montemayor & Hanson, 1985).

A couple of studies highlight family impairment in adolescents with ADHD. Barkley, Anastopoulos, and colleagues (1992) found that parents of adolescents with ADHD reported higher levels of home conflict behavior than parents of non-ADHD controls. These authors also observed that when compared with non-ADHD control families, youth with ADHD and comorbid ODD displayed especially high levels of conflict behavior in a laboratory paradigm. Similarly, Edwards and colleagues (2001) found that when compared with non-ADHD controls, adolescents with ADHD and comorbid ODD displayed higher rates of parent–teen conflict on parent rating scales and in a laboratory tasks. The sources of these conflicts are reported to include the teen's failure to accept responsibility for performing routine tasks, difficulty obeying rules outside of the home, resistance to complying with requests of authority, and excessively high emotions (Barkley, Guevremont, Anastopoulos, & Fletcher, 1992). As a direct result of their son's/daughter's oppositional behavior, parents of adolescents with ADHD report high levels of stress (Evans, Sibley, & Serpell, 2009).

Evidence of elevated familial conflict should cause concern given the documented links between the parent–adolescent relationship and adjustment difficulties, psychopathology (e.g., major depressive disorder and conduct disorder [CD]), and substance abuse in adolescents

[1]Florida International University, Miami, USA
[2]Summit Educational Resources, Buffalo, NY, USA
[3]University of South Carolina, Columbia, USA
[4]University of Texas Health Sciences Center–Houston, USA

Corresponding Author:
Margaret H. Sibley, Center for Children and Families, Florida International University, AHC-1 Room 146, 11200 SW 8th Street, Miami, FL 33199, USA.
Email: msibley@fiu.edu

(Dodge et al., 2009; Hoeve et al., 2009; Reinherz, Paradis, Giaconia, Stashwick, & Fitzmaurice, 2003). Dishion, Nelson, and Bullock (2004) present evidence that many parents of disruptive teens disengage from parenting. Subsequently, this disengagement predicts deviant peer affiliations in adolescence. Conversely, positive parent–adolescent relationships have been shown to buffer against the development of negative psychosocial outcomes (Brennan, Le Brocque, & Hammen, 2003). As a result, unhealthy parent–adolescent relationships warrant intervention in ADHD populations to promote positive outcomes and prevent more serious problem behaviors such as delinquency, substance use, and deviant peer affiliation.

Treatment programs were developed to target parent–adolescent interactions through communication and negotiation skills training (e.g., Barkley, Edwards, & Robin, 1999; Robin & Foster, 1989; Szapocznik et al., 1988). Although these psychosocial treatment programs showed some initial success (McLeary & Ridley, 1999; Robin & Koepke, 1990), the overall reported effectiveness of these parent–adolescent interventions is limited (Barkley, Edwards, Laneri, Flethcher, & Metevia, 2001)—for example, an improvement rate of 35% compared with the improvement rates for parent–child interventions of 60% to 65%. The limitations of current skills training programs with parents and adolescents with ADHD are further illustrated by Barkley and colleagues (1999) who found that although adolescents with ADHD improved following treatment, most did *not* show significant improvement relative to the functioning of control children. These researchers administered intensive behavior management, problem-solving and communication training, and/or structured family therapy to adolescents and their parents. Of the 61 teens targeted in therapy, only 5% to 30% showed clinically significant improvements in the number of family conflicts, and those improvements were maintained in *only* 5% to 20% of this sample at a 3-month follow-up. These findings have been replicated by Barkley et al. (2001) in a sample of comorbid ADHD/ODD adolescents and their parents. These authors found that only 23% of the families changed by either mid- or post-treatment. Thus, the limited efficacy of these psychosocial approaches raises the question of whether additional treatments for ADHD, namely, stimulant medication, better addresses problems in the parent–adolescent relationship.

Central nervous system stimulant medication is the most commonly used and widely studied medication for children and adolescents with ADHD (Smith, Barkley, & Shapiro, 2006). A large body of literature documents the efficacy of stimulant medication as a primary treatment for ADHD in children (Greenhill & Ford, 2002) and these effects have been replicated with adolescents (Berek et al., 2011; Findling et al., 2011). Stimulant medication can lead to decreases in classroom disruption and negative peer interactions and increases sustained attention, on-task behavior, classroom productivity, positive peer interactions, and compliance with adult requests (Evans et al., 2001; Smith et al., 1998). Stimulant medication can also improve parent–child relations by increasing a child with ADHD's quantity of communication and level of compliance, decreasing negative responses from mothers, and increasing positive maternal responses (Barkley, 1985, 1989; Barkley & Cunningham, 1979, 1980; Barkley, Karlsson, Strzelecki, & Murphy, 1984; Chronis, Pelham, Gnagy, Roberts, & Aronoff, 2003; Humphries, Kinsbourne, & Swanson, 1978; Stein et al., 1996). However, the effect of pharmacotherapy on the interpersonal behavior of adolescents with their parents remains unstudied (Robin, 1998).

Despite a lack of direct empirical evidence, practice guidelines recommend stimulant medication to improve parent–adolescent interactions (e.g., American Academy of Pediatrics, 2011). In addition, given the growing number of adolescents prescribed stimulant medication (Centers for Disease Control, 2010), there is an urgent need to better understand the cumulative effects of medication on adolescent functioning. Thus, the purpose of this study is twofold. First, using self-report, parent-report, and observational measures, we compared parent–adolescent interactions in ADHD and control families in a mother–son conflict-resolution task. We hypothesized higher levels of parent–adolescent conflict in dyads with an ADHD teen. Second, we examined acute effects of a common dose of MPH (0.3 mg/kg) on mother–adolescent interactions during the same task. We hypothesized that stimulant medication would improve parent–teen interactions during the analogue task.

Method

Participants

The ADHD group included 25 adolescent males with ADHD, between the ages of 12 and 16 (M = 13.6 years old, SD = 1.2), and their mothers. The adolescents were enrolled in an 8-week summer treatment program (STP-A; Sibley et al., 2011; Smith et al., 1998) provided by the Attention Deficit Disorder Program at Western Psychiatric Institute and Clinic. Participants were part of a larger investigation of MPH effects on adolescents with ADHD (Evans et al., 2001; Smith et al., 1998). The present sample only included participants from the previous studies who were male and who had a mother who was willing to participate. All participants met the criteria for a *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM-IV*; American Psychiatric Association, 1994) diagnosis of ADHD, based on a structured parent interview and standardized parent and teacher Disruptive Behavior Disorders rating scales (Pelham, Gnagy, Greenslade, & Milich, 1992). To participate in this study, an adolescent was required to (a) meet

Table 1. Sample Characteristics.

	ADHD (n = 25)	Control (n = 14)
	M (SD)	M (SD)
Age in years (adolescent)	13.6 (1.2)	13.4 (1.3)
Grade	7.2 (1.0)	7.3 (1.3)
IOWA Conners Parent Rating Scale[a]		
Inattention/Hyperactivity subscale	10.2 (2.7)	1.9 (1.9)
Oppositional/Defiant subscale	8.5 (4.2)	1.4 (1.8)
IOWA Conners Teachers Rating Scale[a]		
Inattention/Hyperactivity subscale	9.3 (5.1)	1.5 (1.8)
Oppositional/Defiant subscale	6.9 (5.5)	0.6 (0.9)

[a]Loney and Milich (1982); Pelham, Milich, Murphy, and Murphy (1989).

diagnostic criteria for ADHD, (b) have his 12th birthday before the study began, (c) have a full-scale IQ higher than 80, and (d) have no conditions that precluded a trial of stimulant medication or full participation in the STP-A academic and athletic activities.

According to *DSM-IV* criteria, 68% of ADHD participants met criteria for ADHD-Combined Type and 32% for ADHD-Predominantly Inattentive Type. The sample also possessed a high rate of comorbid disruptive behavior disorders (ODD = 52%, CD = 36%). A small proportion of the sample (8%) met criteria for a learning disorder. Average full-scale IQ score was 99.76 and the median reported family income was US$48,750.

The control group consisted of 14 male adolescents (M age = 13.4 years, SD = 1.3) and their mothers. The control participants were selected from a group of older siblings of children who had been recruited via radio advertisements to participate as normal control participants in a study comparing ADHD children with comparison children. The adolescents were matched by age and grade level to the clinical sample. Adolescents in the control group could not have clinically significant scores (using available norm-based data) on either the parent IOWA Conners rating scale or the Conners Teacher Rating Scale (Goyette, Conners, & Ulrich, 1978). A summary of participant characteristics is listed in Table 1. Each control dyad received US$25 for participating.

Procedure

Prior to the task, each adolescent and mother independently completed a self-report questionnaire regarding the 2 weeks prior to the session: the Issues Checklist (IC; Prinz, Foster, Kent, & O'Leary, 1979; Robin & Foster, 1988). Research assistants collected these ratings and determined from the IC the major topics of conflict in the home setting. Next, each dyad was instructed to spend two 10-min periods in a problem-solving discussion, attempting to resolve the selected topic of dispute.[1] The order of the adolescent- and mother-selected topics was counterbalanced. The interactions took place in a laboratory room without the presence of the experimenter and were videotaped for later coding. Immediately following the interaction, adolescents and mothers completed a version of the Conflict Behavior Questionnaire-20 (CBQ) relating to their interaction and a Positive and Negative Affectivity Scale (PANAS; Watson, Clark, & Tellegen, 1988).

Adolescents with ADHD further received a double-blind, placebo-controlled assessment of the effects of MPH on parent–adolescent interactions. These dyads completed two separate sessions, 2 weeks apart. On one day, the ADHD adolescents received 0.3 mg/kg of MPH 90 min prior to the session; they received placebo on the other day in counterbalanced order. All participants previously received MPH as part of an STP-A medication assessment (Evans et al., 2001; Smith et al., 1998).

Measures

IC. The IC comprises 44 issues that are a common source of conflict between parents and adolescents (e.g., coming home on time, telephone calls, fighting with siblings). Raters assess the frequency and perceived anger intensity (rated on a 5-point scale; 1 = *calm* and 5 = *angry*) of specific disputes over the course of the last 2 weeks. The IC has been shown to discriminate between distressed and nondistressed families, and it correlates with other self-report and observational family interaction measures (Robin & Koepke, 1990; Robin & Weiss, 1980). Two scores were computed for evaluation. First, anger per discussion was obtained by multiplying each frequency estimate by its associated intensity, summing these cross products, then dividing by total frequency estimates (Barkley et al., 1999). In addition, the frequency of arguments endorsed during the past 2 weeks was calculated and divided by 14 to obtain the average frequency of arguments per day.

CBQ. The parent and adolescent version of the CBQ-20 (Robin & Foster, 1989) assessed the parent–teen relationship after each laboratory interaction. Respondents rated statements about the parent–teen relationship on a 1 to 5 Likert-type scale. The CBQ-20 is a 20-item scale that was adapted from the 73-item CBQ (Prinz et al., 1979). CBQ-20 items are the CBQ items that best discriminated distressed from nondistressed families. It yields a single score that correlates .96 with the full CBQ (Robin & Foster, 1989).

In addition, an item was included at the end of the CBQ that was presented following the laboratory-based interactions. This question asked the mothers and adolescents

whether the interaction in which they engaged was typical of discussions they have in their home. On this item, 66% of ADHD adolescents and 70% of their mothers (and 79% of control dyads) indicated that the laboratory-based discussions were similar to what transpired at home. These results support the validity of the laboratory-based conflict-resolution task in tapping typical mother–son interactions.

PANAS. The PANAS is a 33-item, 5-point self-report mood scale with items that range from *not at all* (1) to *extremely* (5). The PANAS consists of two subscales: Positive Affectivity (PA) and Negative Affectivity (NA). The 13-item PA scale assesses activity and engagement level and ranges from 13 (sadness, lethargy) to 65 (energy and activity). The 20-item NA scale consists of 20 items, such as irritability, anger, guilt, and fear, and can range in score from 20 to 100, with higher scores indicating more negative mood states. Mothers and adolescents completed the PANAS following their dyadic interactions. Only 14 of the 25 ADHD families were administered the PANAS because the measure was added in the third cohort of data collection.

Parent–Adolescent Interaction Rating Scale (PAIRS). The PAIRS (Meichenbaum, Pelham, Gnagy, & Smith, 1997) is an observational coding system developed for this study. It was modified from the 36-item Interaction Behavior Code (IBC; Prinz & Kent, 1978) by converting the dichotomous IBC items into a 7-point Likert-type system (1 = *occurs not all* to 7 = *occurs very much*). Four items were also added to help assess the quality of interactions (e.g., reasoning, active engagement, expression of feelings, and off-task discourse).

A total of 23 of the items are evaluated separately for the parent and adolescent, and 4 are evaluated for the dyad as a unit. An exploratory, principal components factor analysis with varimax rotation (see Table 2) was performed on the PAIRS item scores from the ADHD dyads to reduce the number of measures subject to data analysis. Considering only the 23 PAIRS items that are evaluated separately, the factor analysis indicated that these items load onto two factors: positive communication behaviors and negative communication behaviors. Each item loaded in the direction of its expected valence. Total negative and positive communication scores were thus computed by summing all of the respective items, and were used as dependent measures (range = 9-63 for positive score and 14–98 for negative score). High scores on the behavioral indices reflect more positive or negative communication behaviors during the interaction.

Five separate PAIRS scores were analyzed: (a) overall effectiveness of the dyad to demonstrate appropriate communication and conflict-resolution skills (*least effective* = 1, *most effective* = 7), (b) adolescent's positive communication score, (c) mother's positive communication score, (d) adolescent's negative communication score, and (e) mother's negative communication score. The mean scores across the five observers' ratings were used in all analyses. Interrater reliability was satisfactory, ranging from an alpha coefficient of .87 for evaluating parent positive behaviors to .94 for evaluating the overall effectiveness of the dyad, with a mean alpha reliability coefficient across all PAIRS indices of .93.

Results

All measures were evaluated for between-group differences using one-way ANOVAs. Repeated measures ANOVAs were used to detect medication effects. To explore whether comorbid ODD/CD predicted response to medication, we regressed conduct problems severity (as measured by the IOWA Conners) on individual medication effect sizes for the CBQ filled out by the mother. Prior to the analyses, assumptions were tested. When the homogeneity of variance assumption was not met, a robust F test for equality of means was used to evaluate model significance (Welch's F). Bonferroni adjustments were made for each set of analyses to account for multiple comparisons.

Group Comparisons—Pre-Interaction

On the preinteraction parent and adolescent rating IC, as indicated in Table 3, there were no significant group differences after adjusting for multiple comparisons ($p < .01$). There was a marginal effect ($p = .10$) such that adolescents with ADHD reported greater pre-interaction anger intensity and frequency on the IC than non-ADHD adolescents (see Table 3).

Group Comparisons—Post-Interaction

Although between-group comparisons for several of the postinteraction measures (see Table 4) yielded marginal effects, only one comparison was significant after adjusting for multiple comparisons ($p < .01$). ADHD and control dyads significantly differed in the degree of positive behaviors demonstrated by adolescents (see Table 4). Marginal effects (see Table 4) included the following: adolescents with ADHD reporting greater NA on the postinteraction PANAS than adolescents in the control group, mothers of adolescents with ADHD reporting lower PA on the postinteraction PANAS than mothers of adolescents in the control group, mothers of adolescents with ADHD perceiving more communication conflict on the postinteraction CBQ than mothers of teens without ADHD, observations that ADHD dyads problem-solved less effectively than control dyads, and observations that maternal positive behavior was higher in control dyads during the interaction task.

Table 2. Factor Loadings for PAIRS.

	Adolescent items		Parent items	
	Factor 1	Factor 2	Factor 1	Factor 2
PAIRS item and valence	Positive interaction strategies	Negative interaction strategies	Positive interaction strategies	Negative interaction strategies
1. Ridiculing, make fun of[a] (–)	–.26	.93	–.36	.78
2. Repeat one's opinion with insistence[a] (–)	–.04	.84	–.09	.90
3. Threatening[a] (–)	–.15	.64	–.19	.73
4. Interrupting[a] (–)	–.21	.93	–.11	.87
5. Stating the other's opinion[a] (+)	.78	–.22	.77	–.17
6. Unresponsiveness[a] (–)	–.69	.52	–.62	.49
7. Making appropriate suggestions[a] (+)	.92	–.17	.86	–.12
8. Arguing over small points[a] (–)	–.24	.92	–.16	.82
9. Monopolizing discussion[a] (–)	–.20	.90	–.19	.76
10. Attributing beliefs to other person[a] (–)	–.03	.76	.08	.72
11. Humor (good natured joking)[a] (+)	.51	.10	.43	–.19
12. Praising, complimenting[a] (+)	.73	–.11	.61	–.17
13. Asking what the other would like[a] (+)	.91	–.24	.78	–.19
14. Abrupt changes of subjects[a] (–)	–.13	.82	–.08	.06
15. Anger[a] (–)	–.49	.67	–.53	.63
16. Compromising[a] (+)	.76	–.39	.84	–.12
17. Active engagement (+)	.92	–.25	.88	–.15
18. Demanding[a] (–)	–.14	.92	–.30	.83
19. Acquiescence[a] (–)	.08	–.62	.33	–.33
20. Criticism[a] (–)	–.25	.89	–.36	.70
21. Reasoning (+)	.90	.20	.81	.30
22. Off-task discourse (–)	.04	.79	–.04	.21
23. Express feelings (+)	.93	–.04	.91	.17
Items evaluated for the dyad				
1. Degree of resolution[a] (+)	.82	–.42		
2. Degree of put downs[a] (–)	–.41	.82		
3. Degree of friendliness/pleasantness[a] (+)	.77	–.49		
4. Overall effectiveness at problem solving[a] (+)	.87	–.34		

Note: PAIRS = Parent–Adolescent Interaction Rating Scale.
[a]Items derived from the Interaction Behavior Code (Prinz & Kent, 1978).

Table 3. Adolescent and Mother Ratings of Typical Home Interactions.

	ADHD	Control			
	M (*SD*)	*M* (*SD*)	*F*	*p*	*d*
Issues Checklist—adolescent					
Frequency of discussions (per day)	7.30 (11.30)	2.18 (1.72)	2.81	.10	.55
Anger per discussion	2.16 (.94)	1.67 (.70)	2.81	.10	.56
Issues Checklist—mother					
Frequency of discussions (per day)	6.63 (5.57)	4.49 (3.42)	1.70	.20	.43
Anger per discussion	2.19 (.88)	2.01 (.70)	.392	.54	.21

Note: Frequency of discussions represents the total number of discussions per day across all IC items. Anger per discussion represents the average anger intensity score per discussion across all IC items.

Table 4. Comparison of Control and ADHD Dyads During Laboratory Interaction.

	Control *M* (*SD*)	ADHD-Placebo *M* (*SD*)	Group *F*	Group *p*	Group *d*	ADHD-MPH *M* (*SD*)	MPH *F*	MPH *p*	MPH *d*
PANAS[a]									
Adolescent Positive Affect	39.55 (14.40)	34.00 (15.05)	.87	.36	−.38	38.21 (11.89)	1.15	.30	.27
Mother Positive Affect	41.57 (9.26)	32.64 (12.04)	4.84	.04	−.81	37.21 (14.00)	3.23	.10	.37
Adolescent Negative Affect	24.91 (6.52)	33.50 (12.25)	5.06	.04	.88	32.29 (15.24)	.15	.71	.09
Mother Negative Affect	27.36 (8.89)	31.71 (12.74)	1.10	.30	.40	28.64 (10.22)	1.09	.32	.24
CBQ-Dyadic interaction									
Adolescent report	2.36 (4.36)	4.32 (4.97)	1.52	.23	.40	2.72 (4.30)	1.72	.20	.32
Mother report	2.93 (4.73)	6.56 (6.30)	4.14	.05	.61	3.84 (4.47)	5.06	.03	.43
PAIRS									
Dyad problem-solving skills	12.48 (3.41)	9.00 (5.65)	5.74	.02	−.68	9.52 (4.69)	.31	.58	.09
Adolescent positive behavior	29.07 (5.00)	21.34 (7.96)	13.80	<.001	−1.07	19.67 (7.44)	1.22	.28	.21
Mother positive behavior	33.81 (5.79)	29.90 (6.73)	3.33	.08	−.58	30.16 (6.10)	.06	.82	.04
Adolescent negative behavior	20.64 (3.71)	22.82 (12.71)	.64	.43	.20	20.42 (9.93)	1.12	.30	.19
Mother negative behavior	20.43 (3.92)	20.99 (7.64)	.07	.88	.08	20.08 (6.24)	.67	.42	.12
Time spent discussing issue[b]	469.74 (149.65)	426.66 (172.55)	.61	.44	−.26	450.46 (139.85)	.61	.44	.14

Note: PANAS = Positive Affectivity and Negative Affectivity Scale; CBQ = Conflict Behavior Questionnaire-20; PAIRS = Parent–Adolescent Interaction Rating Scale.
[a]Represents data for *n* = 14 ADHD participants for whom PANAS data were available.
[b]Time measured in seconds.

Medication Effects

The comparisons between the placebo and medicated sessions for the ADHD adolescents, as presented in Table 4, revealed no significant effects of medication on any measure after correcting for multiple comparisons ($p < .004$). Marginal effects were present for mother-rated conflict during dyadic interactions and mother's level of PA (see Table 4). Effect sizes were computed by subtracting the placebo mean from the medication mean and dividing the difference by the standard deviation of the placebo condition (see Table 4). The mean effect size was 0.21 indicating a very small effect of medication.

Comorbid ODD/CD

ODD/CD severity was not significantly related to an adolescent's magnitude of medication response, $F(1, 23) = .30$, $p = .59$, $R^2 = .01$, indicating that adolescents with and without significant levels of ODD/CD severity showed an equally poor response to stimulant medication.

Discussion

This study examined parent–teen interactions in adolescents with ADHD and whether stimulant medication produced acute effects on dyadic interactions during an analogue task. Our results indicated that (a) greater conflict is present in families of adolescents with ADHD and (b) stimulant medication does not produce meaningful acute effects on these interactions. These findings are discussed below.

Consistent with previous findings (Barkley, Anastopoulos, et al., 1992; Edwards et al., 2001), adolescents with ADHD displayed higher levels of conflict behavior with their parents according to parent-report and observations during the laboratory paradigm. It is important to note that some medium to large effects (see Tables 3 and 4) did not reach a level of statistical significance after correcting for multiple comparisons; however, all effects were in the expected direction and possessed similar magnitudes to those reported in previous studies (Barkley, Anastopoulos, et al., 1992; Edwards et al., 2001). One interesting finding of this study is that group differences in parent–adolescent conflict

behavior tended to be larger for adolescent report than parent report (see Table 3). However, it appears that the source of this difference may have been a tendency for control parents to report far higher levels of conflict than their sons. Although we are not entirely sure how to interpret this trend, we speculate that inflated conflict ratings by control parents may have occurred as a reaction to newly arrived conflict behavior that emerges normatively in adolescence (Steinberg & Morris, 2001), reducing between-group effects. In contrast, the relationship between parents and adolescents with ADHD is likely to have been historically conflict ridden (Johnston & Mash, 2001), producing behavioral ratings that were similarly high, but more stable.

Mothers of adolescents with ADHD and of controls reported discussing a similar number of issues with their sons on an average day (ADHD $M = 6.64$ and control $M = 4.49$). We attempted to better understand this finding by exploring item-level endorsement patterns within each group. It appeared that although similar numbers of issues were discussed, the content of these discussions varied widely. For example, 76% of parents in the ADHD group identified talking back as a major issue, versus 43% of control mothers. Similarly, 38% of ADHD parents versus 0% of control parents endorsed discussing their adolescent getting into trouble at school, and 41% of mothers of ADHD adolescents versus 14% of mothers of non-ADHD adolescents discussed their son's cursing. In contrast, the issues discussed most frequently in control families were related to parental efforts to monitor and supervise their teenagers (e.g., selecting new clothes, how the adolescents spend their time). These data suggest that there may be a qualitative difference in the types of parent–adolescent conflicts that emerge in ADHD versus control dyads.

Given the meager effects of family-based psychosocial treatments for adolescents with ADHD and the promise of stimulant medication in improving parent–*child* interactions (e.g., Chronis et al., 2003), the central aim of this study was to evaluate the effect of stimulant medication on parent–*adolescent* interactions. To our surprise, unlike in childhood, MPH did not produce acute effects on parent–adolescent interactions (see Table 4). This finding was stable across observational, self-report, and parent-report measures and across several interaction domains. Our failure to find MPH effects on parent–teen interactions is particularly noteworthy considering that in this same sample, highly significant acute effects of MPH were found on classroom behavior, academic performance, and social behavior with peers (Evans et al., 2001; Smith et al., 1998). The lack of medication effects found in the observed interactions between ADHD adolescents and their mothers is even more surprising because many of the PAIRS items (e.g., interrupting, abrupt changes of subject, unresponsiveness) overlap with the core symptoms of ADHD (hyperactivity, impulsivity, and inattention).

One could argue that the limited effectiveness of medication in this study may have been mitigated by the use of a laboratory-based setting. However, 79% of parents and adolescents in the control group and approximately 70% of parents and adolescents in the ADHD group agreed that the laboratory-based discussions were typical of the discussions their families have in their home. Moreover, the adolescents with ADHD and their parents reported *no* differences in the typicality of the discussions they participated in as a result of the ADHD adolescents' medication status. It may also be the case that simultaneous participation in a treatment program that teaches conflict-resolution skills may have limited the effect of medication on parent/adolescent interactions. However, the failure of MPH to normalize parent/adolescent interactions (see Table 4) suggests that even combined treatment has a minimal effect on parent–teen conflict in adolescents with ADHD.

The absence of group-level acute medication effects on parent–teen interactions, however, does not preclude the potential therapeutic benefits of stimulant medication under certain circumstances. For example, the effect sizes of medication on CBQ scores and on the mothers' report of PA approached moderate levels (d = .37-.43; see Table 4). These effects were largely a result of marked individual medication responses by a small subset of participants. However, our exploratory analyses suggested that these medication responses were unrelated to the severity of an adolescent's oppositional behavior. In addition, it is possible that sustained stimulant medication treatment produces an eventual therapeutic benefit to parent–teen interactions, although there is little support for long-term effects of stimulant medication (Jensen et al., 2007).

There were limitations to this study. Because of our small sample and multiple comparisons, only very large effects in this study reached statistical significance. Further investigation is therefore needed with a larger sample. In addition, our sample consisted of clinic-referred adolescents who were currently participating in an intensive psychosocial treatment program. It may be the case that these findings would differ in an epidemiological sample or among youth who are not receiving psychosocial treatment for ADHD. In addition, our brief analogue task was designed to detect acute MPH effects, but not improvements to the parent–teen relationship that might be produced by *sustained* medication use.

In summary, the failure of stimulant medication to produce acute effects on parent–adolescent conflict behavior is noteworthy. An oft-cited benefit of long-acting stimulant medication is its ability to provide late-day coverage for evening home behavior. Our finding suggests that MPH alone may be insufficient to produce immediate reduction in family conflict. This finding is particularly concerning as research indicates that elevated family conflict provides risk for pathological behavior and adjustment difficulties.

Parent–teen conflict appears to be particularly resistant to psychosocial treatment as well (Barkley, Guevremont, et al., 1992, 2001), which is the only other evidence-based treatment for ADHD. As a result, there is a pressing need to further develop psychosocial treatments that target this domain and to understand whether sustained medication treatment produces improvements in parent–teen interactions.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was supported by a grant from the National Institute of Mental Health (MH45576). Dr. Pelham has also been supported by grants from NIMH (MH 47390, MH48157, MH 50467, MH53554, MH62946, MH069614), NIAAA (AA06267, AA11873), NIDA (DA05605, DA12414), and the Institute of Education Sciences (LO3000665A, R324B060045).

Note

1. No significant differences were found in the nature of discussions of the adolescents' and the mothers' issues; therefore, the discussion of the adolescent's issue was arbitrarily selected to evaluate the effects of medication and group differences.

References

American Academy of Pediatrics (2011). ADHD: Clinical practice guidelines for diagnosis, evaluation, and treatment of attention deficit/hyperactivity disorder in children and adolescents. *Pediatrics, 128*, 1-16.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

Anderson, J. C., Williams, S., McGee, R., & Silva, P. (1987). *DSM-III* disorders in preadolescent children. *Archives of General Psychiatry, 44*, 69-76.

Barkley, R. A. (1985). The effects of methylphenidate on the interactions of preschool ADHD children with their mothers. *Journal of the American Academy of Child & Adolescent Psychiatry, 27*, 336-341.

Barkley, R. A. (1989). Hyperactive girls and boys: Stimulant drug effects on mother-child interactions. *Journal of Clinical Psychology and Psychiatry, 30*, 379-390.

Barkley, R. A., Anastopoulos, A. D., Guevremont, D. C., & Fletcher, K. E. (1992). Attention deficit hyperactivity disorder in adolescents: Mother-adolescent interactions, family beliefs and conflicts, and maternal psychopathology. *Journal of Abnormal Child Psychology, 30*, 263-288.

Barkley, R. A., & Cunningham, C. E. (1979). The effects of methylphenidate on the mother-child interactions of hyperactive children. *Archives of General Psychiatry, 36*, 201-208.

Barkley, R. A., & Cunningham, C. E. (1980). The parent-child interactions of hyperactive children and their modification with stimulant drugs. In R. Knights & D. Bakker (Eds.), *Treatment of hyperactive and learning disordered children* (pp. 219-236). Baltimore, MD: University Park Press.

Barkley, R. A., Edwards, G. H., & Robin, A. L. (1999). *Defiant teens: A clinicians manual for assessment of family intervention*. New York, NY: Guilford.

Barkley, R. A., Edwards, G., Laneri, M., Flethcher, K., & Metevia, L. (2001). The efficacy of problem-solving training alone, behavior management training alone, and their combination for parent-adolescent conflict in teenagers with ADHD and ODD. *Journal of Consulting and Clinical Psychology, 69*, 926-941.

Barkley, R. A., Guevremont, D. C., Anastopoulos, A. D., & Fletcher, K. E. (1992). A comparison of three family therapy programs for treating family conflicts in adolescents with attention-deficit hyperactivity disorder. *Journal of Consulting and Clinical Psychology, 60*, 450-462.

Barkley, R. A., Karlsson, J., Strzelecki, E., & Murphy, J. V. (1984). Effects of age and ritalin dosage on the mother-child interactions of hyperactive children. *Journal of Consulting and Clinical Psychology, 52*, 739-749.

Berek, M., Kordon, A., Hargarter, L., Mattejat, F., Slawik, L., Rettig, K., & Schäuble, B. (2011). Improved functionality, health related quality of life and decreased burden of disease in patients with ADHD treated with OROS® MPH: Is treatment response different between children and adolescents? *Child and Adolescent Psychiatry and Mental Health, 5*, 5-26.

Brennan, P. A., Le Brocque, R., & Hammen, C. (2003). Maternal depression, parent-child relationships, and resilient outcomes in adolescence. *Journal of the American Academy of Child & Adolescent Psychiatry, 42*, 1469-1477.

Cantwell, D. P. (1986). Attention deficit disorder in adolescents. *Clinical Psychology Review, 6*, 237-247.

Centers for Disease Control. (2010). Increasing prevalence of parent-reported attention-deficit/hyperactivity disorder among children-United States, 2003 and 2007. *Morbidity and Mortality Weekly Report, 59*, 1439-1443.

Chronis, A. M., Pelham, W., Gnagy, E. M., Roberts, J. E., & Aronoff, H. R. (2003). The impact of late-afternoon stimulant dosing for children with ADHD on parent and parent-child domains. *Journal of Clinical Child and Adolescent Psychology, 32*, 118-126.

Dishion, T. J., Nelson, S. E., & Bullock, B. (2004). Premature adolescent autonomy: Parent Disengagement and deviant peer process in the amplification of problem behaviour. *Journal of Adolescence, 27*, 515-530.

Dodge, K. A., Malone, P. S., Lansford, J. E., Miller, S., Pettit, G. S., & Bates, J. E. (2009). A dynamic cascade model of the development of substance-use onset: VIII. Adolescent parenting factors. *Monographs of the Society for Research in Child Development, 74*, 71-74.

Edwards, G., Barkley, R. A., Laneri, M., Fletcher, K., & Metevia, L. (2001). Parent-adolescent conflict in teenagers with ADHD and ODD. *Journal of Abnormal Child Psychology, 29*, 557-572.

Evans, S. W., Pelham, W. E., Smith, B. H., Bukstein, O., Gnagy, E. M., Greiner, A. R., & Baron-Mayak, C. (2001). Dose-response effects of methylphenidate on ecologically-valid measures of

academic performance and classroom behavior in ADHD adolescents. *Experimental and Clinical Psychopharmacology, 9*, 163-175.

Evans, S. W., Sibley, M., & Serpell, Z. N. (2009). Changes in caregiver strain over time in young adolescents with ADHD: The role of oppositional and delinquent behavior. *Journal of Attention Disorders, 12*, 516-524.

Findling, R., Childress, A., Cutler, A., Gasior, M., Hamdani, M., Ferreira, C., & Squires, L. (2011). Efficacy and safety of Lisdexamfetamine Dimesylate in adolescents with attention deficit/hyperactivity disorder. *Journal of the American Academy of Child & Adolescent Psychiatry, 50*, 395-405.

Goyette, C. H., Conners, C. K., & Ulrich, R. F. (1978). Normative data on revised Conners Parent and Teacher Rating Scales. *Journal of Abnormal Child Psychology, 6*, 221-236.

Greenhill, L. L., & Ford, R. E. (2002). Childhood attention-deficit/ hyperactivity disorder: Pharmacological treatments. In P. E. Nathan & J. M. Gorman (Eds.), *A guide to treatments that work* (2nd ed., pp. 25-55). New York, NY: Oxford University Press.

Hoeve, M., Dubas, J., Eichelsheim, V. I., van der Laan, P. H., Smeenk, W., & Gerris, J. M. (2009). The relationship between parenting and delinquency: A meta-analysis. *Journal of Abnormal Child Psychology, 37*, 749-775.

Humphries, T., Kinsbourne, M., & Swanson, J. (1978). Stimulant effects on cooperation and social interaction between hyperactive children and their mothers. *Journal of Child Psychology and Psychiatry, 19*, 13-22.

Jensen, P. S., Arnold, L., Swanson, J. M., Vitiello, B., Abikoff, H. B., Greenhill, L. L., & Hur, K. (2007). 3-year follow-up of the NIMH MTA study. *Journal of the American Academy of Child & Adolescent Psychiatry, 46*, 989-1002.

Johnston, C., & Mash, E. J. (2001). Families of children with attention-deficit/ hyperactivity disorder: Review and recommendations for future research. *Clinical Child and Family Psychology Review, 4*, 183-207.

Larson, R. W., Richards, M. H., Moneta, G., Holmbeck, G., & Duckett, E. (1996). Changes in adolescents' daily interactions with their families from ages 10 to 18: Disengagement and transformation. *Developmental Psychology, 32*, 744-754.

Laursen, B., Coy, K. C., & Collins, W. (1998). Reconsidering changes in parent-child conflict across adolescence: A meta-analysis. *Child Development, 69*, 817-832.

Loney, J., & Milich, R. (1982). Hyperactivity, inattention, and aggression in clinical practice. In M. Wolraich & D. K. Routh (Eds.), Advances in developmental and behavioral pediatrics (Vol. 3, pp. 113-147). Greenwich, CT: JAI.

McLeary, L., & Ridley, T. (1999). Parenting adolescents with ADHD: Evaluation of a psychoeducation group. *Patient Education and Counseling, 38*, 3-10.

Meichenbaum, D. L., Pelham, W. E., Gnagy, E. M., & Smith, B. S. (1997). *Parent-Adolescent Interaction Rating Scale (PAIRS)*. Unpublished Scale.

Montemayor, R., & Hanson, E. (1985). A naturalistic view of conflict between adolescents and their parents and siblings. *Journal of Early Adolescence, 5*, 23-30.

Pelham, W. E., Gnagy, E. M., Greenslade, K. E., & Milich, R. (1992). Teacher ratings of DSM-III—R symptoms for the disruptive behavior disorders. *Journal of the American Academy of Child & Adolescent Psychiatry, 31*, 210-218.

Pelham, W. E., Milich, R., Murphy, D. A., & Murphy, H. (1989). Normative data on the IOWA Conners Teacher Rating Scale. *Journal of Clinical Child Psychology, 18*, 259-262.

Prinz, R. J., Foster, S. L., Kent, R. N., & O'Leary, K. D. (1979). Multivariate assessment of conflict in distressed and nondistressed mother-adolescent dyads. *Journal of Applied Behavior Analysis, 12*, 691-700.

Prinz, R. J., & Kent, R. N. (1978). Recording parent-adolescent interactions without the use of frequency or interval-by-interval coding. *Behavior Therapy, 9*, 602-604.

Reinherz, H. Z., Paradis, A. D., Giaconia, R. M., Stashwick, C. K., & Fitzmaurice, G. (2003). Childhood and adolescent predictors of major depression in the transition to adulthood. *American Journal of Psychiatry, 160*, 2141-2147.

Robin, A. L. (1998). *ADHD in adolescents: Diagnosis and treatment*. New York, NY: Guilford.

Robin, A. L., & Foster, S. L. (1988). Issues checklist. In M. Hersen & A. S. Bellack (Eds.), *Dictionary of behavioral assessment techniques* (pp. 278-279). New York, NY: Pergamon.

Robin, A. L., & Foster, S. L. (1989). *Negotiating parent-adolescent conflict: A behavioral family systems approach*. New York, NY: Guilford.

Robin, A. L., & Koepke, T. (1990). Behavioral assessment and treatment of parent-adolescent conflict. *Annual Review of Psychology, 25*, 178-215.

Robin, A. L., & Weiss, J. G. (1980). Criterion-validity of behavioral and self-report measures of problem-solving communication skills in distressed and non-distressed parent-adolescent dyads. *Behavioral Assessment, 2*, 339-352.

Sibley, M. H., Pelham, W. E., Evans, S. W., Gnagy, E. M., Ross, J., & Greiner, A. R. (2011). An evaluation of a summer treatment program for adolescents with ADHD. *Cognitive and Behavioral Practice, 18*, 530-544.

Smith, B. H., Barkley, R. A., & Shapiro, C. J. (2006). Attention-deficit/hyperactivity disorder. In E. J. Mash, R. A. Barkley, E. J. Mash, & R. A. Barkley (Eds.), *Treatment of childhood disorders* (3rd ed., pp. 65-136). New York, NY: Guilford.

Smith, B. H., Pelham, W. E., Evans, S. W., Gnagy, E. M., Molina, B., Bukstein, O., & Willoughby, M. (1998). Dosage effects of methylphenidate on the social behavior of adolescents diagnosed with attention deficit hyperactivity disorder. *Experimental and Clinical Psychopharmacology, 6*, 187-204.

Sobanski, E., Banaschewski, T., Asherson, P., Buitelaar, J., Chen, W., Franke, B., & Faraone, S. V. (2010). Emotional lability in children and adolescents with attention deficit hyperactivity disorder (ADHD): Clinical correlates and familial prevalence. *Journal of Child Psychology and Psychiatry, 51*, 915-923.

Stein, M. A., Blondis, T. A., Schnitzler, E. R., O'Brien, T., Fishkin, J., Blackwell, B., & Roizen, N. J. (1996). Methylphenidate dosing: Twice versus three times daily. *Pediatrics, 98*, 748-756.

Steinberg, L., & Morris, A. (2001). Adolescent development. *Annual Review of Psychology, 52*, 83-110.

Szapocznik, J., Perez-Vidal, A., Brickman, A., Foote, F. H., Santisteban, D., Hervis, O. E., & Kurtines, W. M. (1988). Engaging adolescent drug abusers and their families into treatment: A strategic structural system approach. *Journal of Consulting and Clinical Psychology, 56*, 552-557.

Watson, D., Clark, L., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*, 1063-1070.

Wehmeier, P. M., Schacht, A., & Barkley, R. A. (2010). Social and emotional impairment in children and adolescents with ADHD and the impact on quality of life. *Journal of Adolescent Health, 46*, 209-217.

Author Biographies

William E. Pelham, Jr. is a Professor of Psychology and Psychiatry and Florida International University and Director of the FIU Center for Children and Families.

David L. Meichenbaum is the Director of Consulting Services at Summit Educational Resources in Buffalo, NY.

Bradley H. Smith is an Associate Professor of Psychology at the University of South Carolina.

Margaret H. Sibley is an Assistant Professor of Psychiatry at Florida International University.

Elizabeth M. Gnagy is a senior research support specialist at the Florida International University Center for Children and Families.

Oscar Bukstein is the Director of Child and Adolescent Services at the University of Texas Health Sciences Center at Houston, Department of Psychiatry and Behavioral Sciences.