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# Treatment-Related Changes in Objectively Measured Parenting Behaviors in the Multimodal Treatment Study of Children With Attention-Deficit/Hyperactivity Disorder

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The present study examined treatment outcomes for objectively measured parenting behavior in the Multimodal Treatment Study of Children with Attention-Deficit/Hyperactivity Disorder (ADHD). Five hundred seventy-nine ethnically and socioeconomically diverse children with ADHD-combined type (ages 7.0–9.9 years) and their parent(s) were recruited at 6 sites in the United States and Canada and randomly assigned to 1 of 4 treatment groups for 14 months of active intervention: medication management (MedMgt), intensive behavior therapy, combination of the 2 (Comb), or a community-treated comparison (CC). Baseline and posttreatment laboratory observations of parent–child interactions were coded by observers blind to treatment condition. Comb produced significantly greater improvements in constructive parenting than did MedMgt or CC, with effect sizes approaching medium for these contrasts. Treatment effects on child behaviors were not significant. The authors discuss the importance of changes in parenting behavior for families of children with ADHD and the need for reliable and objective measures in evaluating treatment outcome.

*Keywords:* ADHD, MTA study, parenting, parent–child interactions, direct observations

Attention-deficit/hyperactivity disorder (ADHD) is a prevalent, chronic, and impairing disorder occurring in 3%–7% of the school-aged population (Angold, Erkanli, Egger, & Costello, 2000; Jensen et al., 1999) and constituting one third to one half of referrals to child mental health facilities. The disorder often coexists with comorbid conditions, the most prevalent being oppositional defiant disorder (ODD; 35%–60% of cases), conduct disorder (CD; 30%–50% of cases), and anxiety disorders (20%–40% of cases).

An associated feature of ADHD is problematic parent–child interactions (Barkley, 2006; Wells, 2005). Higher than normal levels of discord and disharmony characterize parent–child interactions within families in which a child has ADHD. Children with ADHD are less compliant to their parents' instructions, sustain their compliance for shorter time periods, are less likely to remain on task, and display more negative behavior than their typical, same-age counterparts (Wells, 2004, 2005). In what Johnston (1996) labeled a *negative–reactive* response pattern, parents of these children display more directive or commanding behavior, more disapproval, and fewer rewards that are contingent on the child's prosocial and compliant behaviors than parents of typical children (Anderson, Hinshaw, & Simmel, 1994; Barkley, Karlsson, & Pollard, 1985; Befera & Barkley, 1984; Cunningham & Barkley, 1979; Mash & Johnston, 1982). Elevated rates of reciprocal negative behaviors persist into adolescence, characterizing parent–teen interactions in ADHD (Edwards, Barkley, Laneri, Fletcher, & Metevia, 2001). Although the presence of comorbid ODD and aggression is associated with some of the parent–child interactional conflict and distress in ADHD families (Barkley, Anastopoulos, Guevremont, & Fletcher, 1992; Podolski & Nigg, 2001), parents and youths with ADHD alone also display interaction patterns that are more deviant than parents and youths without ADHD (Fletcher, Fischer, Barkley, & Smallish, 1996; Johnston, 1996; Johnston & Mash, 2001).

In addition to alleviating family distress and disharmony (Wells, 2005), targeting poor parent–child interactions may also reduce risk for the development of ADHD and comorbid conditions (Wells, 2004). For example, longitudinal studies suggest that for some high-risk toddlers and preschoolers, dysfunctions in parenting may play a role in the origins of ADHD (Campbell, 1994; Carlson, Jacobvitz, & Sroufe, 1995; Pierce, Ewing, & Campbell, 1999). Furthermore, maternal warmth may temper the effects of biologically relevant risk factors (e.g., low birth weight) on children's risk for developing ADHD symptoms (Tully, Arseneault, Caspi, Moffitt, & Morgan, 2004). In addition, disruptive parent–child interactions play an important role in the development, escalation, and maintenance of oppositional and aggressive behaviors (Patterson, Reid, & Dishion, 1992), which have high rates of comorbidity with ADHD. Along with other important risk factors, such parent–child problems add to elevated rates of later substance abuse, criminality, and antisocial spectrum disorders in adulthood (Klein & Mannuzza, 1991; Weiss & Hechtman, 1993). For all these reasons, despite the clear biological pathways related to ADHD symptomatology (Tannock, 1998), enhancing parent–child interactions is an important treatment target in any treatment plan for children with ADHD.

Both medication and behavioral intervention alone produce beneficial changes in parent–child interaction. Medication's most replicable effect is in reducing negative parental behaviors (Humphries, Kinsbourne, & Swanson, 1978; Barkley, Karlsson, Pollard, & Murphy, 1985; Wells, Epstein, et al., 2000), largely via its reductions of noncompliant and negative child behaviors. Behavioral interventions produce decreases in negative interactions but also tend to enhance positive aspects of parenting (Pisterman et al., 1989, 1992; Sonuga-Barke, Daley, Thompson, Laver-Bradbury, & Weeks, 2001). The combined effects of medication and behavioral intervention would appear to have the potential for optimal impact on parent–child

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The Multimodal Treatment Study of Children with Attention-Deficit/Hyperactivity Disorder was a National Institute of Mental Health cooperative agreement randomized clinical trial involving six clinical sites. Collaborators from the National Institute of Mental Health were the following: Peter S. Jensen, L. Eugene Arnold, Joanne B. Severe, Benedetto Vitiello, John Richters (currently at National Institute of Nursing Research), and Donald Vereen (currently at National Institute on Drug Abuse). Principal investigators and coinvestigators from the six sites were the following: University of California, Berkeley/San Francisco: Stephen P. Hinshaw (Berkeley), Glen R. Elliott (San Francisco); Duke University: C. Keith Conners, Karen C. Wells, John March; University of California, Irvine/Los Angeles: James Swanson (Irvine), Dennis P. Cantwell (deceased, Los Angeles), Timothy Wigal (Irvine); Long Island Jewish Medical Center/Montreal Children's Hospital: Howard B. Abikoff (Long Island Jewish Medical Center), Lily Hechtman (McGill University); New York State Psychiatric Institute/Columbia University/Mount Sinai Medical Center: Laurence L. Greenhill (Columbia), Jeffrey H. Newcorn (Mount Sinai School of Medicine); University of Pittsburgh: William E. Pelham, Betsy Hoza. Statistical and design consultant: Helena C. Kraemer (Stanford University). Collaborator from the Office of Special Education Programs/U.S. Department of Education: Ellen Schiller.

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interactions because both child negative behavior and positive and maladaptive parenting behaviors are targeted by the combination of these two interventions. However, previous investigations have not consistently supported an interactive or synergistic effect of combined treatment on parent–child interactions (e.g., Pollard, Ward, & Barkley, 1983).

The Multimodal Treatment Study of Children with ADHD (MTA; MTA Cooperative Group, 1999a; 1999b), a multisite randomized clinical trial with six research sites across the United States and Canada, compared the relative effectiveness of unimodal medication management (MedMgt), unimodal behavioral intervention (Beh), the combination of these treatments (Comb), and a community comparison group (CC) with respect to key symptom- and impairment-related outcomes. At the end of 14 months of active treatment, results showed that Comb and MedMgt treatments were superior to Beh treatment or CC when primary ADHD and some comorbid symptoms were examined (MTA Cooperative Group, 1999a). On the other hand, composite measures and indicators of categorically defined optimal response did show evidence of the significant but small superiority of the Comb treatment relative to the unimodal approaches (Conners et al., 2001; Swanson et al., 2001). When parent–child interactions were examined by means of parent ratings of negative parenting practices (e.g., physical punishment, inefficient commands), Comb and Beh, but not MedMgt, had superior outcomes to CC (MTA Cooperative Group, 1999a). No other between-groups comparisons were statistically significant for negative parenting practices.

A subsequent analysis of the effects of MTA treatments on parent–child relationships examined specific, self-reported parenting behaviors, rather than overall negative parenting as had been done in the primary MTA analyses. Specifically, parent-reported negative or ineffective discipline and positive parenting were used as treatment outcomes (Wells, Epstein, et al., 2000). All three MTA treatments produced significantly greater decreases than CC in negative or ineffective discipline (with no multimodal treatment superiority detected), but no differences were found with respect to positive parenting. Thus, just as in the primary study, interactive or synergistic effects were not demonstrated.

One criticism of the MTA has been that significant findings on primary ADHD and secondary outcomes have been based on the reports of parents and teachers who were themselves involved in treatment. Because of their lack of blindness to treatment condition, such informants may well have been subject to rater bias and expectancy effects (Caspi & Bootzin, 2002). On objective measures reported to date, including classroom observations and peer sociometrics (see Hoza et al., 2005; MTA Cooperative Group, 1999a), few significant between-groups effects of the MTA treatments were found. These negative findings on more objective measures reported from the MTA study raise questions regarding conclusions obtained by means of parent and teacher self-reports alone. Greater clarity and convergent validity could be achieved by examining reliable and objective measures on other important domains associated with ADHD, such as parent–child interactions.

Our primary purpose in the current study is to elucidate the effects of multimodal and unimodal treatments on parent and child behaviors during a videotaped interaction. A further purpose is to extend previous findings on the immediate outcome effects of the MTA treatments by means of objective parenting observation measures obtained from blind, independent, trained observers. For the reasons noted above, we hypothesized that multimodal treatment (Comb) would produce superior effects compared with either unimodal treatment (Beh or MedMgt) or CC on objective parenting measures. MedMgt and Beh were expected to be equivalent but superior to CC.

## Method

### *Participants*

Participants were 579 boys and girls, 7.0–9.9 years of age ($M = 8.5$, $SD = 0.8$) and in Grades 1–4, who were in residence with the same primary caretaker for at least the previous 6 months. Participants were enrolled at six participating sites around the United States and Canada. All met *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM–IV*; American Psychiatric Association, 1994) criteria for ADHD, combined type, by means of the Diagnostic Interview Schedule for Children–Parent, Version 3.0 (see Hinshaw et al., 1997, for details). Children with co-occurring aggressive-spectrum disorders (ODD or CD; 54%), anxiety disorders (33.5%), and mood disorders (3.8%) were included in the sample. Sixty-one percent of the sample was Caucasian, 20% was African-American, 8% was Hispanic, and 11% belonged to other ethnic groups. Eighty percent were boys, and 20% were girls. Sample selection and other ascertainment issues are addressed in detail in Hinshaw et al. (1997). Informed consent was obtained from all parents (or legal guardians) and assent obtained from the child participants. The study was conducted in compliance with the Internal Review Boards of all the respective institutions at the study sites.

The majority of the MTA sample provided data for laboratory observations of parent–child interaction at baseline (BL) assessment ($N = 565$). Data were not available for the remaining 14 participants at BL primarily because of technical difficulties in videotaping the interactions. At the end-of-treatment, 14-month follow-up assessment (14FUP), laboratory observations of parent–child interaction were collected on 508 families (89.9% of the BL sample). Sample attrition from BL to 14FUP for this outcome was related to several factors: dropout; families' nonavailability for the in-person, end-of-treatment assessment; and technical difficulties and data loss at the 14FUP. Those participants with complete data did not differ from participants with missing data on age, $t(576) = 0.06$, $p = .95$; sex, $\chi^2(1, N = 579) = 0.40$, $p = .53$; ethnic minority status, $\chi^2(1, N = 576) = 0.01$, $p = .95$; or measures derived from BL coding of the laboratory parent–child interaction ($ps = .35$–$.90$). Most relevant to the present set of analyses, rates of missing data did not differ significantly across the four MTA treatment conditions, $\chi^2(3, N = 579) = 3.72$, $p = .29$.

### *Independent Variable: MTA Design and Treatment Groups*

In a four-group parallel design, children were randomly assigned to one of four treatment arms for 14 months of intervention: MedMgt, Beh, Comb, or CC. All interventions were delivered at each of the six MTA sites for 14 months. Each active MTA treatment arm was designed as a management strategy, sufficiently robust and flexible to stand on its own and respond to clinical needs. MedMgt began with a 4-week, double-blind, placebo-controlled titration period followed by monthly medication management (see Greenhill et al., 1996). Beh included 35 sessions of group and individual parent training; an intensive, child-focused 8-week summer treatment program (Pelham & Hoza, 1996); 12 weeks of a half-time paraprofessional aide in the classroom; and school-based teacher consultation, all delivered in a coordinated fashion (see Wells, Pelham, et al., 2000). The Beh treatment arm began intensively and was tapered toward the end of the 14-month treatment interval. All three active interventions (MedMgt, Beh, and Comb) were manualized, with careful ascertainment of treatment fidelity and therapist competence throughout the intervention period. Participants in the CC group received no active MTA treatments, but families were provided a report of their initial assessments, along with a list of community mental health services and resources. For elaboration of study design issues, see Arnold et al. (1997). Periodic follow-up assessments have occurred over the ensuing years. Analyses reported in this study were performed on data obtained at the pretreatment BL and 14FUP assessments.

## *Dependent Variables: Observations of Parent–Child Interactions*

*The laboratory task.* Laboratory observations of parent–child interactions (PCIs) were included in the MTA to assess parent–child relationships objectively. Identical procedures were followed at BL and 14FUP; observations were made of interactions with the child's primary caregiver. The entire task consisted of four separate segments that included (a) free play with toys and games in the laboratory (free play), (b) the child's sitting quietly while the mother was working (parent busy), (c) a schoolwork assignment (schoolwork), and (d) playroom cleanup (cleanup). We omitted free play because past research has shown that undirected play rarely distinguishes families of children with ADHD from families of typically developing children (e.g., Tallmadge & Barkley, 1983).

Following free play, a research assistant entered the room, handed the parent a work packet to complete during the parent busy segment, and left before video recording commenced. During parent busy, the parent was instructed to tell the child to stop playing and sit quietly on a chair in the corner (out of reach of the toys and games) without interrupting him or her. After 3 min, the child was temporarily escorted out of the room by another research assistant, and the parent was given further instructions about the last 10 min of the PCI. In the schoolwork segment (5 min) the parent was instructed to give the child a work packet (consisting of age-appropriate spelling or math questions), assist the child, if necessary, wait for the signal (tapping on the two-way mirror) to clean up, and ask the child to clean up the room. Finally, in the cleanup segment, on hearing a slight tapping on the two-way mirror, the parent asked the child to stop working and start cleaning the room for 5 min by putting away the work packet, the toys, and some paper on the ground.

*Codes and rater training.* Six research assistants from three MTA sites—who were blind to the diagnostic status of the participants, treatment assignment, and the hypotheses of the study—rated the PCI behaviors. The research assistants used a 6-point Likert metric (1 = *very poor*, 6 = *excellent*; wording adjusted for different categories) to measure the quality of both parental (5 codes) and child (4 codes) behaviors during the PCI segments. These relatively global codes were based on past literature regarding the parental and child behaviors pertinent to ADHD, as discussed below; a more finely grained, microanalytic system would have been unfeasible given the magnitude of the sample size.

The five parental behaviors included setting stage (parent prepares the child for upcoming events by giving a synopsis of what is going to happen and his or her expectations of the child), behavior management (parent sets limits when child negative behavior is high and backs off when child is behaving appropriately), annoy (level of verbal and nonverbal anger and annoyance expressed by the parent toward the child; this item was reverse scored), positive reinforcement (rate of verbal and nonverbal positive reinforcement and praise expressed by the parent toward the child), and warmth (level of positive emotional expression toward the child by the parent). Note that setting stage was not scored for the cleanup segment because setting stage was not relevant for this activity. The child behaviors included complaining/whining (how often the child showed dissatisfaction and/or displeasure with the task, with the parent–child interaction, or any other aspects of the situation), verbal abuse (how often the child directed a negative verbal/nonverbal communication toward the parent, such as a derogatory name, a hand gesture, or anything verbal or nonverbal that would usually elicit a clear indication of distress from the parent), compliance (how often the child followed the parent's directions), and likable (how generally likable is the child). These parenting and child behaviors were chosen because research has shown the importance of balancing both limit-setting and positive reinforcement with hyperactive–aggressive children (Patterson, 1995) and the centrality of child defiance in parent–child discord in ADHD children (Barkley, Fischer, Edelbrock, & Smallish, 1991). Likable was included as a way to tap the general impression of the child by the raters as generally positive or generally negative.

Raters received extensive training in the coding system during a 2-day training seminar hosted by the MTA site that developed the PCI coding system (University of California, Berkeley). Prior to training, each rater was required to memorize the operational definitions of the nine codes by passing a definition exam. Daily training consisted of group instruction on the PCI codes, recoding criterion tapes (which had already been coded by the training staff) of participants who dropped out of the study prior to randomization, and daily feedback sessions. After the training seminar, all existing PCI tapes were randomly assigned to the six raters, with each PCI being rated at least twice, across different rater pairs.

After initial training, continuous monitoring of rater reliability, fidelity, and drift were carried out through the coding of randomly assigned PCI tapes (50 families, approximately 5% of the total taped sessions). Over the next 4 months, these tapes were rated by the original trainers (coding system developers) and contrasted with those of the raters. Weekly phone supervision sessions were conducted by the original trainers with the raters to discuss discrepancies, technical problems, and other conceptual questions related to the PCI coding system.

During these gold standard rating sessions, for all of the parent behaviors coded across the three segments, the alpha coefficients ranged from .81 to .97 across the six coders. The coders were also consistent for child behaviors, with alpha coefficients ranging from .76 to .98. We also assessed the proportion of instances in which raters diverged more than 2 points from the training staff ratings. Instances of large discrepancy were relatively infrequent during the 50 sessions: Fewer than 7% of the parent codes (range = 6%–9%) and about 3% of the child codes (range = 0%–7.5%) were discrepant by 2 or more points. For these gold standard rating sessions, any ratings that were discrepant by more than 1 point were resolved through a re-viewing of the session, and if discrepancies were still present, a written summary of the discrepant opinion was submitted to the training staff, and individual recalibration sessions were scheduled. Formal interrater reliability was measured by the average intraclass correlation coefficients (ICCs; Fleiss, 1975) for each behavior across the three parts of the observational measure. Please refer to Table 1 for average ICCs for the PCI codes during BL and 14FUP.

## *Data Analytic Plan*

Principal component analysis (PCA) was used to yield a smaller number of components of both parental and child data. PCAs were performed separately for parent and child codes in each of the three PCI segments (parent busy, schoolwork, and cleanup), by means of BL data, so that extracted dimensions would not be confounded with treatment. Hence, six

Table 1
*Average Intraclass Correlation Coefficients for Parent–Child Interaction (PCI) Codes Collapsed Across Segments*

| PCI codes | Baseline | 14 months | PCI codes | Baseline | 14 months |
|---|---|---|---|---|---|
| Parent | | | Child | | |
| Setting stage | 0.56 | 0.59 | Complaining/whining | 0.79 | 0.85 |
| Behavior management | 0.54 | 0.59 | Verbal abuse | 0.62 | 0.66 |
| Positive reinforcement | 0.69 | 0.79 | Compliance | 0.85 | 0.79 |
| Warmth | 0.61 | 0.65 | Likable | 0.82 | 0.82 |
| Annoy | 0.68 | 0.57 | | | |

separate PCAs were performed (three each for parent and child codes). To be retained as a component, the eigenvalues had to be at or above 1.00; we also examined scree plots. We desired a consistent component structure across the three PCI segments. Because one-component solutions were deemed optimal (see below), rotation criteria were not needed.

We conducted separate 4 (treatment group) × 3 (PCI segment) analyses of covariance (ANCOVAs) for the parent and child components. BL component scores were entered as covariates, with 14-month component scores serving as the dependent measures. To examine specific contrasts between each pair of randomly assigned MTA treatment conditions, we conducted a series of six (total number of possible pairwise contrasts for four treatment groups) single degree of freedom comparisons for all significant omnibus effects. In these multiple contrasts, to ensure an overall familywise alpha level of .05 to guard against Type I errors (falsely rejecting the null), we required a significance alpha level of .008 (i.e., .05/6 = .008, which represents a conservative Bonferroni correction; Dunn, 1961). Although a conservative correction for multiple contrasts such as ours may increase Type II error rates (missing a truly significant effect; see Rosenthal & Rubin, 1983), psychometricians have discussed the higher costs incurred by falsely rejecting the null (see Ryan, 1985; Tukey, 1960). We include Cohen's *d* effect size estimates to aid in the interpretation of the clinical significance of any differences between treatment groups.

Because of the multisite nature of the MTA, previous MTA treatment outcome analyses have included treatment site as an independent variable to test for any potential interactions between site and treatment (e.g., MTA Cooperative Group, 1999a). Consistent with these previous MTA analyses, we assessed interactions of site by treatment condition for all multivariate and univariate ANOVAs reported below. Similar to other MTA treatment outcome analyses, none of these interactions approached significance (*p*s > .40), signifying the generalizability of findings across the six performance sites. We, therefore, dropped the site variable in all analyses reported below.

## Results

### *Data Reduction*

A separate PCA was conducted for each of the three PCI segments by means of the five parental PCI codes (see Table 2 for item loadings). In each PCA, the first component accounted for between 42.2% and 51.8% of the variance. In only one of the PCAs—with data from the schoolwork segment—did a second component emerge that had an eigenvalue greater than 1.00 (eigenvalue = 1.11). Because scree plots (Cattell, 1978) revealed evidence for a one-component solution, and to retain a consistent component structure across the three PCI segments, we decided to use a single component structure for the sake of parsimony and interpretability. The loadings for this single component were highly consistent across all three PCI segments: Warmth, positive reinforcement, setting stage, and behavior management all revealed positive loadings, whereas annoy had a negative loading. We termed this component *constructive parenting* and computed unweighted scores: (warmth + positive reinforcement + behavior management + setting stage – annoy). Note that for the cleanup segment, which does not include a setting stage code, this formula became (warmth + positive reinforcement + behavior management – annoy). This constructive parenting component refers to a proactive and positive approach to parenting in which the parent establishes clear, age-appropriate expectations for children and responds with consistent and appropriate limits and consequences as needed, while at the same time being warm and positive in his or her interactions.

Table 2
*Component Loadings From Principal Component Analyses of Parent PCI Codes Across Segments*

| | Segment | | |
|---|---|---|---|
| Behavior and measure | Parent busy | Schoolwork | Cleanup |
| Annoyance | −.66 | −.68 | −.73 |
| Behavior management | .63 | .62 | .69 |
| Positive reinforcement | .46 | .53 | .59 |
| Setting stage | .74 | .55 | —[a] |
| Warmth | .83 | .82 | .85 |
| Eigenvalue | 2.28 | 2.11 | 2.07 |
| % variance | 45.6 | 42.2 | 51.8 |

*Note.* PCI = parent–child interaction.
[a] Because of the nature of the cleanup segment, the setting stage code was not scored.

Separate PCAs were also conducted with the four child PCI codes from each PCI segment (see Table 3 for item loadings). A single component solution appeared to most accurately characterize the child PCI data. The one component accounted for a substantial proportion of the variance in each PCI segment (range = 69.2%–71.0%). Eigenvalues for potential second components were well below 1.00 (range = .52–.68). Across the three PCI segments, the loadings for the four child PCI codes were highly similar. The unweighted component score was computed as the following: (complaining/whining + verbal abuse) − (compliance + likable). Note that higher scores on this component indicate more problematic behavior. We termed this component *child negativity*.

### *Treatment Effects for Constructive Parenting*

We conducted a 4 (treatment group) × 3 (PCI segment) ANCOVA analysis, with BL constructive parenting scores as the covariate and 14FUP constructive parenting scores serving as the dependent measure. Statistically significant main effects were observed for both treatment group, $F(3, 465) = 6.41$, $p = .000$, and PCI segment, $F(2, 464) = 7.27$, $p = .001$, without a significant interaction between the two components, $F(6, 928) = 1.16$, $p = .323$. Treatment group contrasts are reported below. In terms of the segment effect, ratings of constructive parenting were lower for segments in which the child was required to comply with several parental commands or requests (e.g., parent busy and cleanup) than the schoolwork segment, in which the parent–child interactions involved more cooperative behaviors. Because primary hypotheses pertained to treatment condition effects, we present in Table 4 the mean values for each treatment group at BL and 14FUP, collapsed across the three segments.

As described above, we followed up the significant omnibus effects with six single degree of freedom contrasts to determine the specific loci of any effects across the four treatment conditions, using the adjusted alpha level of .008. Because there was no significant treatment by PCI segment interactions, we averaged the constructive parenting component across the three segments before conducting the single degree of freedom contrasts. Two of the six contrasts attained the .008 level of significance: Comb vs. CC, $F(1, 254) = 15.65$, $p = .000$, Cohen's $d = .49$;[1] and Comb vs. MedMgt, $F(1, 249) = 9.02$, $p = .003$, Cohen's $d = .38$. The remaining four contrasts were not significant (*p*s = .066–.354) with small related effect size estimates (Cohen's *d*s = .12–.23). Thus, the multimodal combination of medication management plus intensive behavior therapy (Comb) yielded superior outcomes,

[1] These values are based on the overall standard deviation from the two groups that were contrasted, not the overall standard deviation from the four treatment groups.

Table 3
*Component Loadings From Principal Component Analyses of Child PCI Codes Across Segments*

| Behavior and measure | Segment | | |
|---|---|---|---|
| | Parent busy | Schoolwork | Cleanup |
| Complaining/whining | −.79 | −.82 | −.78 |
| Compliance | .87 | .81 | .87 |
| Likable | .93 | .94 | .94 |
| Verbal abuse | −.73 | −.79 | −.80 |
| Eigenvalue | 2.77 | 2.85 | 2.88 |
| % variance | 69.2 | 71.3 | 72.0 |

*Note.* PCI = parent–child interaction.

with respect to our measure of constructive parenting, in relation to MedMgt and to CC. Comb was not superior to Beh alone. Neither MedMgt nor Beh yielded superior outcomes on constructive parenting relative to CC.

### *Treatment Effects for Child Negativity*

For the 4 (treatment group) × 3 (PCI segment) ANCOVA analysis, with BL child negativity scores as the covariate and 14FUP child negativity scores serving as the dependent measure, the treatment effect was not significant, $F(3, 483) = 2.28$, $p = .078$, but there was a significant main effect of PCI segment, $F(2, 482) = 5.68$, $p = .004$. Ratings of child negativity were higher for parent busy and cleanup segments and lower for the schoolwork segment. The interaction was not significant, $F(6, 964) = 1.48$, $p = .182$. See Table 4 for mean values for each group across the two time points.

## Discussion

In the present article, we extend prior analyses of the MTA study's effects on parenting behavior to objectively coded parent–child interactions. First, we obtained objective codes of both parent and child behaviors. Second, the parenting codes were reduced to a component that refers to a proactive approach to parenting in which the parent establishes clear, age-appropriate expectations for children and responds with consistent and appropriate limits and consequences as needed in a warm and loving manner, termed constructive parenting. Third, the child codes were reduced to a single dimension of child negative behavior termed child negativity. Fourth, and crucially, we found that the MTA's multimodal intervention, Comb (which blended careful medication management with intensive behavior therapy) yielded significant effects on the constructive parenting component relative to MedMgt (14 months of carefully titrated medication management) alone and to CC (treatment available in the community that is not managed by the MTA). Significant effects were not found for the child negativity component score. Overall, the key finding is that a multimodal treatment strategy yielded optimal effects on an objectively coded measure of positive and constructive parenting.

The sample for the MTA study was a culturally diverse sample, and we acknowledge that ethnicity and cultural background may exert a moderating effect on these results. We did not examine these effects in the present article, the aim of which was to examine primary outcome effects on objective measures of parent and child behavior. We view this as a very important question,

Table 4
*BL and 14FUP PCI Component Scores Averaged Across Segments[a] for Each MTA Treatment Group*

| PCI component | BL scores | | | | | | | | 14FUP scores | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Beh ($n$ = 137–141)[b] | | MedMgt ($n$ = 141–143) | | Comb ($n$ = 137–141) | | CC ($n$ = 138–140) | | Beh ($n$ = 129–132) | | MedMgt ($n$ = 120–121) | | Comb ($n$ = 130) | | CC ($n$ = 125) | |
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| Constructive parenting | 9.73 | 2.59 | 9.97 | 2.58 | 10.16 | 2.42 | 10.05 | 2.52 | 10.75 | 2.61 | 10.47 | 2.17 | 11.32 | 2.28 | 10.18 | 2.30 |
| Child negativity | −4.75 | 2.68 | −5.09 | 2.76 | −5.33 | 2.36 | −4.96 | 2.67 | −6.31 | 2.10 | −6.41 | 2.02 | −6.46 | 2.37 | −5.83 | 2.47 |

*Note.* BL = baseline; 14FUP = 14-month follow-up; MTA = Multimodal Treatment Study of Children with Attention-Deficit/Hyperactivity Disorder; PCI = parent–child interaction; Beh = behavioral intervention; MedMgt = medication management; Comb = combination of medication and behavioral therapy; CC = community comparison group.
[a] These were averaged across the three segments because there was no Treatment × Segment interaction.
[b] Sample sizes are different because of different patterns of missing data across time, treatment conditions, and PCI components.

deserving of careful examination; it is a planned direction for future analyses and reports.

In a previous analysis of the effects of the MTA treatments, the hypothesis that the combination of behavioral treatment and medication management (Comb) would produce more positive outcomes on measures related to parenting behavior than either unimodal treatment (Beh or MedMgt) was not confirmed. Specifically, in Wells, Epstein, et al. (2000), each unimodal treatment as well as Comb were significantly more effective than CC but were not significantly different from each other. However, in that study, measures of parenting behavior were confined to parent self-report and child self-report measures. Because parents and children were not blind to treatment condition (given their involvement in the implementation of the treatments), their ratings were subject to possible rater bias and expectancy effects. Indeed, this criticism has been leveled toward many of the primary MTA outcome results (Klein, 2001). Our current aim was therefore to examine the relative effects of the MTA treatments on objective measures of outcome in the parenting domain.

Results for constructive parenting revealed that multimodal treatment produced significantly greater improvements in parents' use of proactive parenting strategies than did CC, whereas MedMgt and Beh did not yield such relative improvements. These treatment effects were consistently observed over the three different segments of the parent–child laboratory tasks. Moreover, the effect size for the Comb versus CC contrast was $d = .49$, a level generally interpreted as reflecting medium strength (Cohen, 1992).

The superiority of combination treatment in enhancing positive aspects of parenting confirms our earlier hypotheses regarding interactive or synergistic effects of behavior therapy and medication on important measures of parent–child interaction. Behavioral or medication treatments alone appear to be insufficient to attain the superiority effect relative to community comparison. That the multimodal treatment also showed superiority to medication alone in the present study—whereas it did not in the previous examination of parenting outcomes (Wells, Epstein, et al., 2000)—may be related to the more precise measurement obtained with blind, objective observers in the present study. It may also be related to the use of variables measuring slightly different aspects of parenting behavior in the two studies. Whereas the earlier study used a self-report measure of negative/ineffective discipline—a measure of negative, emotionally reactive, and inconsistent parenting—the present study examined a measure of a deliberative, planful, and proactive parenting style. The latter may be a more direct measure of the effects of the behavioral treatments provided in the MTA, especially the parent training component (see Wells, Pelham, et al., 2000, for a description of this component of the MTA behavioral intervention). Indeed, previous studies reported a substantial effect of medication alone on reducing negative aspects of parenting (Wells, Epstein, et al., 2000) but not consistently on enhancing positive aspects of parenting (see Hinshaw et al., 2000). On the other hand, teaching proactive parenting skills is the major activity in parent training sessions, with reductions in harsh, reactive parenting an important by-product. That is, when parents learn to implement a planned, proactive approach to management of difficult child behavior, they display lowered negative emotional reactivity and greater consistency in responding appropriately to negative child behaviors.

Treatment findings regarding the child negativity component were not significant. Possible reasons may be the brevity of the interaction tasks and the controlled nature of the laboratory setting, potentially constraining the full range of negative child behaviors. Although designed to represent previously validated aspects of parent and child behavior and to mimic aspects of family life (e.g., parents supervising schoolwork and cleanup), the observations were contrived for the laboratory setting and were time-limited (e.g., 13 min). These constraints may have affected child behavior in particular, attenuating possible treatment differences among groups on this measure. It may also be that the artificial and relatively controlled setting of the laboratory observation enhanced the ability of parents to perform at an optimal level across the various parenting tasks, contributing to the positive results on this component. If so, the generalizability of these findings to natural settings may be limited.

One limitation regarding the conclusions that can be drawn from this study is that some of the ICCs for the individual behavioral codes, primarily the parent codes, were not in the greater than .70 range (see Table 1), in spite of our efforts at gold standard ratings and ongoing supervision of raters. One reason for this may be that ratings were done by raters across sites in this multisite study. Though these ratings produced codes whose reliability was lower than might be expected if done at a single site, the advantage of cross-site coding is in the potential gain in generalizability of the findings. Nevertheless, the lower reliability of some codes suggests caution in the interpretation of the results.

Keeping these limitations in mind, the clinical significance of these findings may be cautiously interpreted as follows: If one wishes to have an impact on positive aspects of parenting in the treatment of children with ADHD, then it may be important to provide a combination of behavioral with medication treatment to achieve this impact. Medication alone and behavior therapy alone do not appear to be sufficient, at least not in more controlled circumstances. Furthermore, combination treatment provides a greater impact than medication alone. Given that decades of research have revealed that disrupted parenting practices are associated with behavior problems that commonly occur in ADHD, the most effective treatment (i.e., combination treatment) optimally should be directed toward improvement in these parenting practices. However, the current study only examined immediate posttreatment outcome; continued longitudinal follow-up will be important to ascertain if initial treatment efficacy for parenting practices sustains beyond treatment termination.

Beyond our conclusions regarding parenting behavior specifically, we comment more generally that this is one of the few studies from the MTA using objective measures of treatment outcome rather than self-report measures. It can be argued, on the one hand, that self-report information is important because in the final analysis, the perceptions of those individuals who are most affected by the clinical syndrome are what count clinically. However, scores from rating scales have been regarded as "soft data" because they are affected not solely by the behavior of the individual being evaluated but also by variations (such as bias and expectancy) from the source completing the ratings (Kraemer, 1992). Therefore, such ratings result in less precise and accurate measurement of the behavioral phenomenon in question than do objective ratings. The present findings, which are based on ratings by blind, detached, trained observers, add weight to our belief that those who uncritically consider medication as the only effective treatment for ADHD in all situations have not considered the full range of important outcomes in reaching such a conclusion.

In the original publication of the overall MTA results (MTA Cooperative Group, 1999a), statistical analyses of numerous individual outcome variables revealed that MedMgt and Comb did not differ significantly and that both were superior to Beh. However, secondary analyses using a composite variable cutting across symptom and impairment domains produced a more reliable score and fewer comparisons, revealing that Comb emerged as the most effective, with significantly greater benefits than MedMgt (Conners et al., 2001). Likewise, Swanson et al. (2001) used a categorical measure of "excellent response" spanning ADHD and disruptive symptomatology, again demonstrating that combination treatment outperformed medication alone. Thus, across previous studies in which measures became more reliable by means of various methods to increase measurement precision, and in which impairment domains were added to symptom improvement per se (Conners et al., 2001), the multimodal treatment condition emerged as the most effective. The same conclusion applies to the present study using objective measures. Such findings add to the contention that multimodal treatment is often optimal for youth with ADHD (see also Conners et al., 2001; Swanson et al., 2001).

On the other hand, observations made in highly controlled and constrained situations may reflect different aspects of parenting behavior compared with information obtained from questionnaires. The latter presumably assess a perceptual amalgamation of a broader range of naturalistic situations, including those in which parents are coping with serious negative behaviors on the part of their children or other ongoing naturalistic stresses. The combination superiority effect may be most readily obtained in more controlled situations in which highly disruptive child behaviors and other stressors are not as salient. Future research is needed in which the information obtained from questionnaires is compared in the same study with observations of parent–child interactions in home settings.

With regard to the MTA data set, future analyses will examine whether differential changes across treatments in constructive parenting are related to child outcomes in naturalistic settings such as school. Future studies will also examine whether the benefits of multimodal treatment for positive parenting mediate longer term benefits for the children in the MTA beyond the period of active intervention. These studies should further extend our understanding of the nature of parenting as it relates to short- and long-term outcomes for youth with ADHD.

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