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Evidence-Based Psychosocial Treatments for Attention-Deficit/Hyperactivity Disorder

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Pelham, Wheeler, and Chronis (1998) reviewed the treatment literature on attention-deficit/hyperactivity disorder (ADHD) and concluded behavioral parent training (BPT) and behavioral classroom management (BCM) were well-established treatments for children with ADHD. This review updates and extends the finding of the prior review. Studies conducted since the 1998 review were identified and coded based on standard criteria, and effect sizes were calculated where appropriate. The review reinforces the conclusions of Pelham, Wheeler, and Chronis regarding BPT and BCM. Further, the review shows that intensive peer-focused behavioral interventions implemented in recreational settings (e.g., summer programs) are also well-established. The results of this update are discussed in the context of the existing treatment literature on ADHD. Implications for practice guidelines are suggested, as are directions for future research.

Over the past 15 years, increased attention has focused on the identification of evidence-based psychosocial treatment (EBT; i.e., treatments that work). Numerous reviews, task forces, workgroups, and research teams have spearheaded efforts to identify and disseminate EBTs (e.g., Chambless & Ollendick, 2001; Herschell, McNeil, & McNeil, 2004; Task Force on Promotion and Dissemination of Psychological Procedures, 1995; http://www.cochrane.org/). A task force sponsored by what is now American Psychological Association (APA) Division 53, the Society of Clinical Child and Adolescent Psychology, conducted extensive evaluations of the evidence for child-based treatments and presented results in a special issue of the *Journal of Clinical Child Psychology*. Authors used operationalized criteria to identify treatments for specific child disorders that had an evidence base (Lonigan, Elbert, & Johnson, 1998).

As part of this Task Force search for EBT for childhood disorders, Pelham, Wheeler, and Chronis (1998) reviewed the psychosocial treatment literature on ADHD and concluded the following:

1. Behavioral parent training (BPT) barely met criteria for well-established treatment, requiring liberal interpretation of the Task Force criteria, but it met the criteria for a probably efficacious treatment.
2. Behavior contingency management in the classroom (BCM) clearly met criteria for well-established treatment with 23 studies supporting its effectiveness, based on a large number of single subject design studies.
3. Support for classroom interventions was further buttressed by numerous studies that had been conducted prior to the widespread use of the *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed.; *DSM–III;* American Psychiatric Association, 1980), demonstrating the effectiveness of behavior modification with children generally labeled as disruptive or inattentive though not explicitly diagnosed with

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attention-deficit/hyperactivity disorder (ADHD) using the *DSM*.
4. There was not enough evidence for social skills training or other peer-group-based interventions (e.g., summer treatment programming).
5. There was no support for cognitive interventions for children with ADHD.

These conclusions have been supported by other reviews—some dealing with ADHD (e.g., DuPaul & Eckert, 1997; Purdie, Hattie, & Carroll, 2002), some covering conduct problems/antisocial behavior (Brestan & Eyberg; 1998; Lundahl, Risser, & Lovejoy, 2006; Serketich & Dumas, 1996) and some discussing disruptive behaviors in general in home or classroom settings (e.g., Stage & Quiroz, 1997; Taylor & Biglan, 1998). Thus, for children with ADHD and other externalizing disorders, across different reviews and evaluation methods, there has been consensus that BPT and behavioral classroom management (BCM) are EBTs for ADHD.

It is therefore logical to question why an update of the previous article is necessary. There are two main reasons supporting an update at this time: (a) A number of clinical trials investigating the effectiveness of behavior modification for ADHD have been published since the Pelham, Wheeler, and Chronis (1998) article, and a review of these studies can amplify and clarify the conclusions of the initial report; and (b) stimulant medication is also an EBT for ADHD, and there is currently considerable controversy with regard to whether behavior modification has relevance in the treatment armamentarium. For example, prominent researchers have recently stated that behavioral interventions (BIs) are insufficiently effective for treating ADHD (e.g., as compared to medication) and are potentially not needed as part of a typical treatment plan (e.g., Abikoff et al., 2004; Hinshaw, Klein, & Abikoff, 2002, 2007; Jensen, 1999; MTA Cooperative Group (MTACG), 1999a)—conclusions that are difficult to reconcile with the literature just cited (i.e., DuPaul & Eckert, 1997; Pelham, Wheeler, & Chronis, 1998). We briefly review both of these points in turn.

The late 1990s and early 2000s saw a surge in the publication of studies—clinical trials, large crossover studies, and single-subject designs—investigating the effectiveness of behavior modification for treating ADHD (e.g., Barkley et al., 2000; Chronis, Chacko, Fabiano, Wymbs, & Pelham, 2004; Hupp, Reitman, Northup, O'Callaghan, & LeBlanc, 2002; MTACG, 1999b; Pelham, Burrows-MacLean et al., 2005; Sonuga-Barke, Daley, Thompson, Laver-Bradbury, & Weeks, 2001). Perhaps the most well-known and widely cited study of treatments for ADHD is the Multimodal Treatment Study of ADHD (MTA; Conners et al., 2001; Jensen, 2001; MTACG, 1999a, 1999b; Swanson et al., 2001; Wells et al., 2000). Because of its prominence in the literature, at the National Institute of Mental Health, and in professional societies and associated treatment guidelines, the MTA study has become viewed as an archetype for the entire treatment literature on ADHD. Like all studies, the MTA answers some important questions, but it does not resolve all of them and creates others (Barkley, 2000; Pelham, 1999). Thus, this updated review is needed to incorporate the MTA study, as well as the other recent studies of behavioral treatment, within the context of the prior literature on behavioral treatments for ADHD.

A second reason for an update to the Pelham, Wheeler, and Chronis (1998) review is that stimulant medication—the other and more commonly employed EBT for ADHD—has a robust evidence base (Spencer et al., 1996; Swanson, McBurnett, Christian, & Wigal, 1995), producing acute, short-term improvements in on-task behavior, compliance with teacher requests, classroom disruptiveness, and parent and teacher ratings of ADHD symptoms. At the same time, many years of research reveal that stimulants have no long-term benefit on adolescent or adult outcomes (e.g., Loe & Feldman, 2007; Swanson et al., 1995). Further, medication use has increased substantially since 1998 (Greenhill & Ford, 2002). The development of new formulations of the stimulants (e.g., Biederman, Lopez, Boellner, & Chandler, 2002; Michelson et al., 2001; Pelham et al., 2001; Pelham et al., 1999; Pelham, Burrows-MacLean et al., 2005; Swanson et al., 2004; Wigal et al., 2004) has led to dramatically increased detailing of prescribers and subsequent stimulant utilization. Many reviews have concluded that medication is more effective than behavior modification (Hinshaw et al., 2007; Jadad, Boyle, Cunningham, Kim, & Schachar, 1999; Miller et al., 1998). Notably, these reviews have all based their conclusions on the small number of large, between-group studies in the literature—most prominently the MTA. These sources have led recent influential guidelines (e.g., American Academy of Child and Adolescent Psychiatry [AACAP], 2007) to suggest that pharmacotherapy should be the first line intervention in ADHD, with behavioral treatments utilized only after multiple drugs and combinations of drugs have been tried. Service referrals are also far more likely to be made for medication rather than behavioral treatment for ADHD (Leslie & Wolraich, 2007). Thus, medication remains much more widely utilized in the medical profession, and considerable controversy remains regarding the role of behavior modification in treatment planning. It is therefore critical to provide an update to the earlier review to determine whether the evidence base for BIs has improved sufficiently for them to be viewed, particularly by physicians, as viable alternatives to medication, as

first-line treatments, and/or as important adjunctive interventions.

In summary, based particularly on the evolving literature on BIs and on the secular trends in medication usage, an update of the behavioral treatment studies published subsequent to the 1998 special issue is appropriate at this time. The purpose of this review is to update and assimilate the recent literature on psychosocial EBT for ADHD, yielding conclusions regarding the current state of the science for behavior modification for ADHD and guidance regarding future directions for the study of effective interventions for this disorder.

METHODS

To identify ADHD treatment outcome studies, search procedures identical to those used for the 1998 review were used for studies published between January 1997 and September 2006. Thus we conducted literature searches in electronic databases (i.e., Medline, PsycINFO) and contacted researchers in the area of ADHD treatment. In addition, the tables of contents in well-known journals that publish studies of BIs were searched manually, including *Behavior Modification, Behavior Therapy, Child and Family Behavior Therapy, Cognitive and Behavior Practice, Journal of Abnormal Psychology, Journal of Abnormal Child Psychology, Journal of the American Academy of Child and Adolescent Psychology, Journal of Applied Behavior Analysis, Journal of Child Psychology and Psychiatry, Journal of Consulting and Clinical Psychology, Journal of Emotional and Behavioral Disorders, Journal of School Psychology*,and*School Psychology Review*. Papers in press or in preparation were also solicited from well-known researchers in the field (e.g., we searched the CRISP database to identify investigators who were funded to conduct relevant research and requested information). Note that studies were included only if they evaluated behavioral treatment alone or in comparison to another treatment. Thus, studies of multimodal treatment compared to medication but not to behavioral treatment alone (e.g., Klein, Abikoff, Hechtman, & Weiss, 2004) were not included.

Identified studies were then coded based on the following variables: study authors and year of publication, study total sample size, participant characteristics, reporting of recruitment and selection criteria, the outcome measures used, characteristics of treatment providers, and characteristics of the treatment. Using the criteria for classifying study designs listed in Nathan and Gorman (2002), studies were also labeled as study Types 1 to 6. Notably, we did not limit our coding of Type 1 studies in the Nathan and Gorman system to between-group design studies (i.e., "clinical trials"). Although Hinshaw et al. (2002, 2007) restricted Type 1 studies to this category in their application of the Nathan and Gorman criteria, Greenhill and Ford (2002) did not, including crossover studies that met the other required characteristics (e.g. random assignment of conditions, adequate control condition, clearly described and standard diagnostic criteria). Because the Nathan and Gorman criteria do not exclude well-designed, crossover studies from being considered as Type 1 studies, and because only 13% of the 173 studies of behavioral treatment for ADHD are between-group studies (Fabiano, Pelham, Coles et al., 2008), we included appropriate within-subject designs among Type 1 studies. Not doing so would mean not considering 87% of the literature and would risk creating the type of bias that currently accepted methods in reviews strive to avoid.

Effect sizes (ES) were computed using the traditional strategy of subtracting a control mean from a treatment mean and dividing by the control/alternative treatment/baseline standard deviation (Cohen, 1992; Glass, McGaw, & Smith, 1981). Standard deviations were not pooled because one general effect of behavioral and pharmacological treatment is to reduce variability (e.g., Pelham et al., 1990), so using the standard deviation of the control condition yields a more conservative estimate of effect than pooling across conditions. ES were calculated as applicable depending on study design, for (a) BI versus no treatment, (b) BI versus alternative treatment (e.g., medication), and (c) pretreatment versus posttreatment. For studies that included multiple measures, ES were calculated for each measure and averaged. There are inherent limitations in averaging across dependent measures to calculate a single ES. Most important, this review contains only a subsample of the behavioral treatment literature (i.e., articles published after 1998). Because the entire population of studies is not included, it would be inappropriate to make conclusions regarding aggregated ES, whether across studies or particular domains of measurement, and therefore the ES are reported separately for each study as a descriptive indicator of effectiveness. ES were standardized such that positive effect sizes indicate a beneficial effect of BI. For single-subject studies, means and standard deviations were estimated from graphs (with measured reliability) if not reported, which was necessary for 12 of the 14 relevant studies.

RESULTS

The results of the review yielded 46 studies listed in Table 1. Studies included evaluations of BPT programs and BI implemented in clinic, school, and summer program settings. The table includes information regarding

participant characteristics, sample size, dependent measures, nature of the treatment, study quality (Nathan & Gorman criteria), and ES. The approach to this portion of the review was to evaluate studies conducted since the 1998 review and to incorporate them into the conclusions reached by Pelham, Wheeler, and Chronis (1998) while extending the results of that review.

As in Pelham, Wheeler, and Chronis (1998), the discussion that follows is separated into studies that evaluated BPT and BCM in school settings. In addition, a third category, behavioral peer interventions (BPI), is also included in the review, as a number of new studies have appeared since 1998. We discuss the evidence base for each of these interventions in turn. Because many studies include more than one of these broad categories of BI, each study in the table is footnoted to denote the relevant category of intervention (BPT, BCM, BPI) for each study. As we discuss next, disentangling the effects of multicomponent studies is an important step that has not been frequently taken.

Behavioral Parent Training

Twenty-two studies of BPT for ADHD have been published since the Pelham, Wheeler, and Chronis (1998) review, and these studies are listed in Table 1. The BPT were typically group based and consisted of 8 to 16 sessions of BPT (with a higher mean of 25 for the MTA, which had a longer duration than other studies) from a number of different manuals with similar content. Contributing to the criteria for well-established interventions were several new studies listed in Table 1. For example, Sonuga-Barke et al. (2001) demonstrated the efficacy of BPT relative to an attention placebo and a waitlist control group in young children with ADHD. In the MTA study (MTACG, 1999a), behavioral treatment included a course of BPT along with a school intervention, and a summer program over the course of a 14-month intervention (Wells et al., 2000). With respect to ADHD symptoms, the behavioral treatment group was not significantly different from the community comparison group—a randomly assigned condition receiving treatment as usual from community providers, 68% of whom received medication for ADHD during the treatment period (although one fourth of the behavioral group in the MTA were receiving medication by the end of the 14-month intervention, either through parent choice or clinical deterioration, there were no significant differences between those who were and were not receiving concurrent medication). In addition, the behavioral group was superior to the group receiving the MTA medication algorithm with respect to parent satisfaction with treatment and parent-perceived improvement in referring problems (Pelham, Erhardt et al., 2008), as well as on observed parenting skills (Wells et al., 2006).

These two studies add to the support for BPT as a well-established treatment, as the behavioral treatment conditions in each case were equivalent to or better than an alternative treatment, and the studies have adequate statistical power, use a good design, are manualized, and were conducted by independent teams of investigators. The between-groups study conducted by Bor, Sanders, and Markie-Dadds (2002) adds further support for BPT with ADHD children.

Notably, only one Type 1 study (Barkley et al., 2000) failed to find that BPT worked. This negative finding may have been related to the fact that the study recruited young (kindergarten-age) children at risk for ADHD and disruptive behavior and provided treatment at the *school* level; the majority of the parents contacted did not participate in the BPT that was offered. As the table illustrates, other studies offered support for BPT, but they were Type 2 or 3 investigations.

Pelham, Wheeler, and Chronis (1998) concluded that although BPT met criteria for probably efficacious treatment, it could have counted as meeting criteria for a well-established ADHD treatment only if liberal interpretations of the Task Force criteria were made. However, with the addition of the three new studies (Bor et al., 2002; MTACG, 1999b; Sonuga-Barke et al., 2001), BPT interventions now clearly meet task force criteria for a well-established treatment for ADHD and for substantial evidence of efficacy in the Nathan and Gorman system. Although the MTA study included BCM and BPI interventions, the measures just reported reflected home behavior and parenting skills, so it is reasonable to assume that the BPT was the active ingredient in producing these changes. Because all three components were present, however, a contribution of BCM or BPI to these improvements cannot be ruled out.

Behavioral Classroom Management

Twenty-two new studies were identified that investigated BCM. The results of our review replicate the prior review's conclusion that BCM is a well-established treatment for ADHD. Adding to the Klein and Abikoff (1997) investigation and those in the Pelham, Wheeler, and Chronis (1998) studies in the original review, the MTACG (1999a, 1999b); Barkley et al. (2000); and Pelham, Burrows-MacLean et al. (2008a) studies are well-designed group investigations, the results of which place BCM in the category of a well-established treatment. All three new studies utilized contingency management procedures (e.g., teacher implemented reward programs, point systems, time-out) in the classroom setting, though the contingency management procedures

TABLE 1
Summary Table of Behavioral Intervention Studies Published

Study Authors, Year (N, Age Range)	*Ethnicity/Race*	*Gender (% Boys)*	*Recruitment and Selection/Inclusion/ Exclusion*	*Measures*[a]
Between-group studies				
Frankel et al., 1997 (74, 6–12)[b,c]	85% Caucasian, 4% Asian, 4% Hispanic, 3% mixed race; 1% African American	77	Reported	2,6
Tynan et al., 1999 (55, 5–11)[b]	Not reported	76	Reported	2
McCleary & Ridley, 1999 (103, 12–17)[b]	Not reported	77	Reported	2,13
MTACG, 1999[d] (579, 7–9)[b,e]	61% Caucasian, 20% African-American; 8% Hispanic	80	Reported	2,4,6,8,10
Weinberg, 1999 (34, 4.33–12.83)[b]	Not reported	80	Inclusion criteria reported	2,3,13
Pelham et al., 2000 (117, 7–9)[c]	67.5% Caucasian, 18.8% African American, 2.6% Hispanic, 11.1% Other	80	Reported	2,6,7,10,11,12,14
Barkley et al., 2000 (158, 4.5–6)[b,e]	Not reported	66	Reported	1,2,3,5,6,8,9,12
Barkley et al., 2001 (97, 12–18)[b]	86% Caucasian, 9% Hispanic, 2% African American, 3% Asian	90	Reported	1,2,4,11
Sonuga-Barke et al., 2001 (78, 3 years old)[b]	Not reported	62	Reported	2,3,15
Miranda et al., 2002 (50, 8–9)[e]	"Most were white and Spanish speakers"	84	Reported	2,5,6,8,9
Bor et al., 2002 (87, 3)[b]	Predominantly Caucasian	68	Reported	1,2,3,13,14
Hoath & Sanders, 2002 (20, 5–9)[b]	Not reported	80	Reported	2,3,4,13
Antshel & Remer, 2003 (120, 8–12)[c]	93% Caucasian; 5% African American; 2% Asian	75	Reported	2,11
Tutty et al., 2003 (100, 5–12)[b]	87% Caucasian, 6% African American, 6% Asian, 1% Hispanic	75	Reported	2,3,6

Since the 1998 Journal of Clinical Child Psychology Review

Therapists	*Treatment*	*Nathan & Gorman (2002) Study Type*	*ES BI vs. No Treatment*	*ES BI vs. Alternative Treatment*	*ES BI Change Score*
PhD-level psychologists or licensed social worker	1. Waitlist 2. BPT + child SST	2	N/A	N/A	N/A
Therapists	1. Pre-post: BPT + child social skills group	2	N/A	N/A	0.89
Experienced clinicians	1. Pre-post: BPT	2	N/A	N/A	0.49
PhD parent trainers/school consultants; para-professional class/STP	1. Community comparison group (2/3 medicated) 2. BI 3. Medication management 4. 2 + 3	1	N/A	BI vs. community comparison = −0.01; BI vs. MPH = −0.24	0.55
Child psychologists	1. Pre-post assessment of BPT	3	N/A	N/A	0.49
STP counselors and teachers	1. BI 2. BI + MPH	1	N/A	ES BI alone vs. BI + Medication = −0.21	N/A
Child psychologist for control PT; district teacher/aide in class	1. No treatment 2. BCM 3. BPT 4. 2 and 3	1	BCM = −0.03. BPT = −0.02. Combined = −0.02.	N/A	N/A
PhD clinical psychologists	1. PT 2. Problem solving communication training (8 week outcomes used)	2	N/A	− 0.13	0.51 (9-week BPT)
Specially trained health visitor therapists	1. Waitlist 2. Parent counseling/ support 3. BPT	1	PT vs. waitlist = 0.63	PT vs. attention placebo = 0.66	0.82
Regular classroom teachers who received training	1. Teacher training 2. Untreated control group	1	0.44 (only applicable measures)	N/A	0.78
PhD-level clinical psychologists	1. Enhanced BPT 2. Standard BPT 3. Waitlist	1	0.70	N/A	1.63
PhD-level psychologists	1. Enhanced behavioral family intervention 2. Waitlist	1	0.47	N/A	0.59
Graduate students	1. SST program 2. Waitlist	2	0.29	N/A	0.84
Master's level therapists	1. BPT + child SST group 2. Waitlist	2	N/A	N/A	0.61

(*Continued*)

TABLE 1
Continued

Study Authors, Year (N, Age Range)	*Ethnicity/Race*	*Gender (% Boys)*	*Recruitment and Selection/Inclusion/ Exclusion*	*Measures*[a]
Dopfner et al., 2004 (75, 6–10)[b,e]			Reported	2,6
Sonuga-Barke, et al., 2004 (89, 3)[b]	Not reported		Reported	2,3
Evans et al., 2005 Study 1 (27, 11–14)[c,e]	100% Caucasian	78	Reported	2,6,8
Evans et al., 2005 Study 2 (35, 11–14)[c,e]	100% Caucasian	83	Reported	2,6
Kapalka, 2005 (86, 5–10)[b]	54% Caucasian	100	Reported	6
Owens et al., 2005 (42, kindergarten-sixth grade)[b,c]	Not reported	71	Reported	2,6,8,13
Danforth et al., 2006 (49, 4–12)[b]	Not reported	92	Reported	2,14
Evans et al., 2007 (79, 11–14)[b,c,e]	94% Caucasian	77	Reported	2,6
Pelham et al., under review, a (154, 6–12)[b,c,e,f]	79% Caucasian, 12% African American, 9% Other	84	Reported	2,3,6,7,12,14
Within-subject design				
Kolko et al., 1999 (16, 6.9–12.9)[c,e]	75% African American	100	Reported	6,12,14
Chronis, Fabiano, et al., 2004 (44, 6–13)[c,e]	95% Caucasian	90	Reported	6,7,12,14
Fabiano et al., 2004 (44, 6–12)[c,e]			Reported	6,12,14
Pelham, Burrows-MacLean, et al., 2005 (29, 6–12)[c,e]	93% Caucasian; 3% Asian; 3% Native American	93	Reported	2,3,6,7,12,14

Therapists	*Treatment*	*Nathan & Gorman (2002) Study Type*	*ES BI vs. No Treatment*	*ES BI vs. Alternative Treatment*	*ES BI Change Score*
Therapists	1. Behavior modification first 2. Medication first	2	N/A	0.20	0.80
Health visitors	1. BPT 2. Waitlist	2	N/A	N/A	N/A
School-based counselors	1. Behavioral after-school program 2. Community comparison	2	N/A	N/A	N/A
School-based counselors	1. Pre-post assessment of after-school program	3	N/A	N/A	N/A
PhD level psychologists	1. Behavioral consultation. 2. Waitlist control	2	1.31	N/A	1.52
School-based consultants	1. Behavioral Consultation 2. Waitlist	2	0.20	N/A	−0.16
PhD clinical psychologists	1. Pre-post assessment of BPT	3	N/A	N/A	0.57
School psychologists and school staff	1. School-based behavioral consultation 2. Community comparison	2	N/A	N/A	N/A
STP counselors and teachers	1. Low BI 2. High BI 3. No treatment, alone and combined with MPH	1	Low BI = 0.40; high BI = 0.63	Low BI vs. 0.3 mg/kg MPH = −0.18; high BI vs. 0.3 mg/kg MPH = 0.11	N/A
Teachers and para-professionals	Crossover study of MPH and BI	1	0.64	MPH (.3 mg/kg) is alternative treatment. ES = 0.33 in classroom and − 3.39 in enrichment setting	N/A
STP counselors and teachers	Treatment withdrawal study of intensive STP	2	2.39 (reported in tables in paper)	N/A	N/A
Teachers and para-professional counselors	Crossover study of 3 types of time out procedures vs. no time-out	2	0.10 (addition of time out to STP treatment)	N/A	N/A
STP counselors and teachers	Crossover study comparing BI and MPH and combination	1	0.91	BI vs. MPH = −0.30	N/A

(*Continued*)

TABLE 1
Continued

Study Authors, Year (N, Age Range)	*Ethnicity/Race*	*Gender (% Boys)*	*Recruitment and Selection/Inclusion/ Exclusion*	*Measures*[a]
Fabiano et al., in press (48, 5–12)[e,f]	79% Caucasian	92	Reported	7,14
Pelham et al., 2008b (48, 5–12)[c,f]	79% Caucasian	92	Reported	12,14
Single-subject design				
Anhalt, McNeil, & Bahl, 1998 (1, 6 years old)[e]	Caucasian	0	Reported	5
Danforth, 1998 (8, 4.0–7.33)[b]	Not reported	63	Reported	1,2
Danforth, 1999 (1, 4)[b]	Not reported	100	Reported	1,2
Hupp & Reitman, 1999 (3, 8–10)[c]	Not reported	100	Reported	11,13,16
Northup et al., 1999 (3, 7–8)[e]	Not reported	100	Reported	5
Waschbusch, Kipp, & Pelham, 1998 (3, 8–9)[c,e]	Not reported	100	Reported	5,7,14
McGoey & DuPaul, 2000 (4, 4.33–5.08)[e]	100% Caucasian	50	Reported	5,6,13
Smith & Barrett, 2002 (3, 10–11)[b]	Not reported	0	Reported	1,2
Chronis et al., 2001 (1, 7 years old)[b,c,e]	Caucasian	100	Reported	2,14
Pelham & Fabiano, 2001 (1, 8.33 years old)[e]	Caucasian	100	Reported	7,14
Reitman et al., 2001 (3, 6–7)[c]	Not reported	33	Reported	12,16
Hupp et al., 2002 (5, 5.4)[c]	Not reported	Unclear	Reported	16

Therapists	*Treatment*	*Nathan & Gorman (2002) Study Type*	*ES BI vs. No Treatment*	*ES BI vs. Alternative Treatment*	*ES BI Change Score*
STP classroom teachers	Crossover: 3 intensities of BI vs. placebo/3 doses of MPH and their combination	1	Low BI = 0.46; high BI = 0.61	Low BI vs. low MPH (0.3 mg/kg) = −0.27; high BI vs. high MPH (0.6 mg/kg) = −0.23	N/A
STP para-professional counselors	Crossover: 3 intensities of BI vs. placebo/3 doses of MPH and their combination	1	Low BI = 0.29; high BI = 0.42	Low BI vs. low MPH (0.3 mg/kg) = −0.39; high BI vs. high MPH (0.6 mg/kg) = −0.44	N/A
Classroom teacher	Reversal: group contingency behavioral program	2	1.64	N/A	N/A
PhD-level clinical psychologist	Pre-post assessment of behavioral PT	3	N/A	N/A	2.02 (parent ratings only)
Not reported	Pre-post assessment of behavioral PT	3	N/A	N/A	10.09
Summer program counselors	Token economy in recreational settings	2	2.46 (estimated from graphs)	N/A	N/A
Classroom teacher in a STP	Cross over study of MPH and BI; effect of time out is used in ES estimates.	2	6.08[g]	MPH alone is the alternative treatment; ES = 0.56	N/A
STP counselors	MPH combined with BI	3	N/A	N/A	N/A
Preschool classroom teachers	Token economy	2	1.39[h]	N/A	N/A
Experienced PT program clinician	BPT	2	N/A	N/A	N/A
Para-professional counselors	STP, BCM, BPT, MPH	3	N/A	N/A	N/A
STP counselors	STP BI procedures	2	N/A	N/A	1.29
Summer program counselors	Token economy in sports setting	2	3.46	MPH is alternative treatment; ES = 2.56	N/A
Summer program counselors	Token economy compared to a delayed reward and baseline	2	4.38	Delayed reward is alternative treatment; ES = 5.71	N/A

(*Continued*)

TABLE 1
Continued

Study Authors, Year (N, Age Range)	*Ethnicity/Race*	*Gender (% Boys)*	*Recruitment and Selection/Inclusion/ Exclusion*	*Measures*[a]
Fabiano & Pelham, 2003 (1, 8.92 years old)[c,e]	African American	100	Reported	5
Gulley et al., 2003 (3, 4–7)[c]	Not reported	33	Reported	5
O'Callaghan et al., 2003 (4, age not reported)[c]	Not reported	50	Reported	16
Coles et al., 2005 (4, 11–12)[c,e]	100% Caucasian	75	Reported	14
Stahr et al., 2006 (1, 9)[e]	0% Caucasian	100	Reported	14

Note: ES = effect size; BI = behavioral interventions; BPT = parent training; SST = social skills training; N/A = not applicable;

[a] 1 = Parent–child observations, 2 = parent ratings, 3 = parental functioning, 4 = family functioning, 5 = classroom observations, 12 = clinician ratings, 13 = consumer satisfaction ratings, 14 = behavior frequency counts, 15 = activity-level measures, 16 = recreational

[b] Contributed to criteria for behavioral parent training.

[c] Contributed to criteria for contingency management in peer/recreational settings.

[d] In addition to the MTA primary outcome study, numerous other studies report on treatment related outcomes, the total of which would Jensen et al. (2001); MTACG (1999a, 1999b, in press); Owens et al. (2003); and Swanson et al. (2001).

[e] Contributed to criteria for contingency management in classroom settings.

[f] Separate reports from the same study.

[g] These ES are an *underestimate* because one participant's ES could not be computed because of the mean and standard deviation in the

[h] Estimated ES from graphs of on-task behavior for the response cost token economy condition.

Therapists	*Treatment*	*Nathan & Gorman (2002) Study Type*	*ES BI vs. No Treatment*	*ES BI vs. Alternative Treatment*	*ES BI Change Score*
BA-level consultant and teachers	BCM; Daily report card and school-based rewards	2	N/A	N/A	1.78
Summer program counselors	Reward and response cost token economies and/or time out	2	ES = 3.65	BI vs. MPH = −.94	N/A
Summer program counselors	SST + token economy to encourage generalization	2	14.35 (game-situation behaviors)	N/A	N/A
STP counselors	STP BI procedures	2	1.07	N/A	N/A
Teacher		2	2.68	N/A	N/A

STP = summer treatment program; MPH = methylphenidate; PT = parent training; BCM = behavioral classroom management.
6 = teacher ratings, 7 = academic productivity, 8 = academic achievement, 9 = cognitive tests, 10 = peer relationships, 11 = child self-ratings, setting observations.

comprise their own review. For a representative sample, see Arnold et al. (2003); Conners et al. (2001); Hinshaw et al. (2002); Hoza et al. (2000);

no-treatment condition being 0%, but this child evidenced large behavioral improvement favoring BI.

were faded to teacher-implemented Daily Report Cards (DRC) about 6 months before endpoint in the MTA study. Barkley et al. (2000) implemented a contingency management program in a special classroom setting for kindergarten children identified as having ADHD and disruptive behaviors, and Pelham et al. did the same in a summer program classroom setting. Measures tapping classroom behavior in all three studies included ADHD symptoms rated by teachers, teacher-rated social skills, and independent observations of classroom behavior. Pelham et al. also measured daily work productivity. All measures revealed significant improvement relative to control conditions. In addition, five relatively large, well-designed crossover studies (average $N = 35$) with similar dependent measures and similar results support this conclusion (e.g., Chronis, Fabiano et al., 2004; Fabiano et al., 2007; Fabiano et al., 2004; Kolko, Bukstein, & Barron, 1999; Pelham, Burrows-MacLean et al., 2005). All of the studies that supported the effectiveness of BCM were Type 1 studies, and a handful of well-controlled, single-subject studies add to the support for BCM.

In the previous review, Pelham, Wheeler, and Chronis (1998) reported that BCM met criteria for well-established interventions. As with BPT, behavioral conditions had to be collapsed across medication groups to yield sufficient total sample sizes, but 21 single-subject or group crossover design studies of BCM contributed to the classification of well-established treatment. Altogether, considering the studies reviewed in the 1998 review and the new Type 1 between-group and within-subject studies, as well as the Type 2 single-subject investigations included in the current review (e.g., Pelham, Burrows-MacLean et al., 2005), the evidence for the efficacy of BCM for ADHD is substantial.

As previously discussed for BPT, many of these BCM studies also include BPT. Although the dependent measures were taken in classroom settings, the BPT often included training parents to provide a home reward for a DRC that was part of the BCM (e.g., the MTA study). Thus, components of BPT may have contributed to the effects of the BCM in many of these studies.

Behavioral Peer Interventions

Twenty-two of the studies in Table 1 included interventions and measures that focused on peer interactions/relationships. Several of these are traditional, group-based, weekly, clinic-based, social skills training (SST) groups, provided alone or with concurrent BPT and often with medication. Consistent with our prior report (Pelham, Wheeler, & Chronis, 1998) and previous reviews (Taylor, Eddy, & Biglan, 1999), the new studies continue to suggest that traditional, office-based SST produces minimal effects and that the social validity of the interventions is questionable. Tutty, Gephart, and Wurlitzer (2003) and Tynan, Schuman, and Lampert (1999) provided clinic-based SST combined with clinic-based BPT in primary care settings and reported positive effects on parent ratings of ADHD symptoms or problem behaviors. However, neither reported outcomes on a measure of child social interactions/behavior. Frankel, Myatt, Cantwell, and Feinberg (1997) included measures of social skill/peer interactions in a study of weekly social skills groups (with some components of the summer program interventions described next), which were supplemented by concurrent weekly parenting groups to support the children's social skills groups. No differential effects of the intervention were obtained on the measures of social functioning.

The only study that involved a child social skills group *without* a concurrent parenting group also failed to demonstrate differential beneficial effects on parent ratings of social behavior (Antschel & Remer, 2003), leading the authors to conclude that their results "do not strongly support the efficacy of SST" (p. 161). A possible limiting factor in these latter studies is that all of the participants were medicated with stimulants, perhaps limiting the ability to detect the intervention effects. Thus, it is clear that concurrent medication did not *facilitate* the impact of SST. Although Pfiffner and McBurnett (1997) had reported a beneficial effect of concurrent BPT and child social skills groups on parent reports of social behaviors, no studies have replicated their results. As was the case in 1998, traditional, weekly social skills groups are still not an evidence-based intervention for ADHD.

In contrast to traditional, clinic-based social skills groups, which are typically held weekly and focus on discussion and role playing of key social skills, a number of treatment studies have used a different approach to target peer relationships and functioning in recreational settings. The majority of these studies were conducted in summer treatment programs (STP; Pelham & Hoza, 1996; Pelham, Fabiano, Gnagy, Greiner, & Hoza, 2005). STPs have been used in comprehensive treatment approaches to ADHD (e.g., MTACG, 1999a), and many studies of medication effects (e.g., Pelham et al., 1999; Pelham et al., 1999) and classroom functioning (e.g., Abramowitz, Eckstrand, O'Leary, & Dulcan, 1992; Carlson, Pelham, Milich, & Dixon, 1992) have been published based on behavior in these settings.

At the time of the 1998 review, investigations of the effects of BI on peer interactions in recreational settings were limited to analogue studies (e.g., Pelham & Bender, 1982) and uncontrolled pre–post studies (Pelham & Hoza, 1996). Since the initial task force review, however, there have been two large between-group (Pelham et al., 2000; Pelham, Burrows-MacLean et al., 2008a), five large crossover (Chronis, Fabiano et al., 2004; Fabiano

et al., 2004; Kolko et al., 1999; Pelham, Burrows-MacLean et al., 2008b; Pelham, Burrows-MacLean et al., 2005), and a number of well-controlled, single-subject studies (e.g., Coles et al., 2005; Hupp et al., 2002; Reitman, Hupp, O'Callaghan, Gulley, & Northup, 2001) that report on the effect of BI for peer problems in recreational settings—typically STPs. In addition, the STP was a component of the MTA study. The interventions in these settings are typically day-long programs conducted for multiple weeks (5 to 8), delivering 200 to 400 hr of treatment, versus 10 to 20 hr in a typical weekly SST program. Daily activities involve brief segments of SST followed by coached group play in recreational activities concurrent with contingency management systems (e.g., point system, time-out) implemented by paraprofessional staff and often home rewards from parents for DRC goals involving peer interactions (Pelham, Fabiano, Gnagy et al., 2005). In addition to traditional social skills, these programs focus on teaching sports skills and team membership skills. A notable difference between these studies and those that have assessed traditional SST is that the STP-based programs involve objective observations and frequency counts of social behaviors in addition to adult ratings of social skills as outcome measures.

The relevant studies all indicate that BI are effective, often producing acute effects comparable to those produced by medication. In addition to ES calculations, a noteworthy illustration of the impact of the intervention comes from odds ratios reported by Pelham, Burrows-MacLean et al. (2005), which show that with BI, children are 6 (concurrently receiving a high dose of medication) to 19 (concurrently receiving placebo) times more likely to meet their daily behavioral goals, including goals focused on peer interactions, than in the absence of BI. This odds ratio for BPI alone is four to five times greater than that reported for medication alone in an earlier study in the same setting with the same methodology (Pelham et al., 2002). As with BCM, BPT is typically provided concurrently in intensive summer programs, and home-based contingencies are often employed as well, meaning that the incremental benefits of BPT in summer programs cannot be ruled out, and BPT may be quite important for generalization. Analogous to the previous point regarding BCM studies, however, the dependent variables are objective and measured in the peer-based recreational settings, rather than the home setting.

Two large, between-group studies have yielded beneficial results of this type of intensive STP (Pelham, Burrows-MacLean et al., 2008b; Pelham et al., 2000 [MTA study]). Thus, with two Type 1 between group studies and five Type 1 crossover studies, as well as multiple single-subject studies, conducted by four different investigative teams, BI implemented in peer group/recreational settings (e.g., summer programs) meets criteria for a well-established treatment according to the Task Force criteria and the Nathan and Gorman criteria. As we discuss, it is important to note that BPI is more costly than BPT and BCM, more difficult to implement in community settings, and the least available of the EBTs for ADHD.

Other Treatments Considered for EBT Status

As in the previous review, no treatment outcome studies were identified that supported the use of nonbehavioral psychotherapeutic or cognitive–behavioral treatments (i.e., individual therapy, play therapy, cognitive therapy) for ADHD (see Hinshaw et al., 2007, for similar conclusions). Two studies included alternative psychosocial treatment (other than stimulant medication or a variation of contingency management procedures) that could conceivably be evidence based. Sonuga-Barke et al. (2001) included an attention control group (social support) and Barkley, Edwards, Laneri, Fletcher, and Matevia (2001) included a problem-solving communication training (PSCT) group. In the Sonuga-Barke et al. (2001) study, the attention control group was clearly inferior to the BPT group, and it therefore does not meet criteria for an evidence-based treatment.

The situation is less clear for PSCT. Barkley, Guevremont, Anastopoulos, and Fletcher (1992) and Barkley et al. (2001) both compared PSCT to BPT in adolescent samples. Although PSCT did not differ from BPT in either study, it is unclear whether Barkley et al. (1992) had sufficient statistical power ($N = 20$ for BPT and $N = 21$ for PSCT) to conclude that the treatments were equivalent. Therefore, although PSCT for families of adolescents with ADHD warrants continued monitoring in the literature, this treatment was not classified according to task force criteria. B. H. Smith, Waschbusch, Willoughby, and Evans (2000) highlighted the abysmally small literature on treatment for ADHD in adolescents; PSCT appears to have promise for this group and needs more research, along with other interventions.

Effect Sizes

ES is used as a means of describing the magnitude of specific treatment effects in the studies reviewed for the three types of BI. Further, because of the nature of this review, ES are offered as heuristic indicators of study results—they are averaged across the dependent measures in the studies, and therefore specific conclusions regarding the ES on a particular measure are not included in the table. The reader is referred to meta-analyses of ADHD studies for ES that represent the

effect of BI across the entire population of treatment studies for further information (DuPaul & Eckert, 1997, for an early meta-analysis and Fabiano et al., 2008, for a recent one).

BI versus no-treatment control. Positive ES indicate improvement because of BI relative to a control condition. Overall, BI yielded improved functioning. As others have reported (DuPaul & Eckert, 1997), ES varied as a function of the type of study design. In between-group design studies, ES ranged from −0.03 to 1.31 ($Mdn = 0.44$), in within-subject design studies from .10 to 2.39 ($Mdn = 0.46$) and in single-subject studies from 1.07 to 14.35 ($Mdn = 3.46$).

For BPT interventions compared to a waitlist, effect sizes for group-design studies ranged from .47 to .70, with the exception of the Barkley et al. (2000) study (ES = −.02). For BCM interventions, group-design study effect sizes ranged from −.03 (Barkley et al., 2000) to .44 (Miranda, Presentacion, & Soriano, 2002). For within-subject and single-subject designs, ES were considerably larger (e.g., ES = 6.08; Northup et al., 1999). Finally, BPI interventions compared to a waitlist/no treatment resulted in a range of ES, from .29 (Antschel & Remer, 2003) to .40–.63 (Pelham, Burrows-MacLean et al., 2008a). Again, within-subject design studies generally reported effects of larger magnitude (e.g., Hupp & Reitman, 1999; ES = 2.46).

BI versus alternative treatment. Compared to medication, in between-group design studies, ES ranged from −0.24 to 0.20 ($Mdn = 0.11$), indicating little advantage compared to medication. In within-subject studies, ES ranged from −3.39 to 0.47 ($Mdn = -0.27$), meaning larger effects, on average, for medications and in single-subject studies from −0.94 to 2.56 ($Mdn = 0.56$). Table 1 lists the effect sizes comparing BI to alternative treatments.

For BPT interventions, compared to alternative psychosocial treatments such as nondirective parent counseling and support, there is a clear benefit of BPT (Sonuga-Barke et al., 2001; ES = .66). The MTA study (MTACG, 1999a) provides a comparison of BPT/BCM interventions and medication. In this study BI was essentially equivalent (ES = −.01) to community treatment (mostly medication), and the MTA medication management was only modestly better than BI (ES = −0.24), with most of those advantages found for teacher and parent symptom ratings rather than functional impairments. Kolko et al. (1999) found the opposite—a modest advantage (ES = .3) for BCM versus medication. Finally, for PI, there is considerable information from crossover design studies conducted in summer programs comparing BPI to medication. In one study (Kolko et al., 1999), medication was superior to BPI in an unstructured enrichment setting (ES = −.3.39), whereas other studies indicated a benefit of BPI over medication in recreational settings (ES = 2.56, Reitman et al., 2001; ES = 5.71, Hupp et al., 2002).

BI change score. In between-group design studies, ES ranged from −0.16 to 1.63 ($Mdn = 0.61$) and in single-subject studies from 1.29 to 10.09 ($Mdn = 1.78$). Most ES were substantial in magnitude, evidencing a positive effect of BI relative to pretreatment functioning. This pattern was consistent across studies of BPT, BCM, and BPI. For example, the MTA pre–post ES on hyperactivity and inattention as rated by the child's teacher was 1.27.

Moderators and Mediators of Treatment Effects

Mediators and moderators of behavioral treatment are an understudied, yet crucially important area, particularly given that the results presented in Table 1 are not homogeneous with respect to outcomes or ES. The differences across studies might be explained by potential moderators (e.g., participant characteristics, strength of treatment) and/or mediators (e.g., treatment adherence).

Moderators of Behavioral Treatment

Moderators of BI effects are variables, typically measured at baseline, that interact with treatment to influence the magnitude of treatment outcome (Holmbeck, 1997). These include participant and family characteristics (e.g., gender, age, comorbidity, socioeconomic status), therapist characteristics (e.g., level of training), and treatment characteristics (e.g., treatment intensity).

Child characteristics are one potential domain that may be studied as a moderator. Child sex is a moderator that is generally understudied. Because ADHD is more prevalent in boys than girls and participant samples in treatment studies are composed mostly of boys, most studies are underpowered for testing differences between boys and girls. In one study that did have sufficient power, sex was not found to moderate behavioral treatment outcome on the core dependent measure—ADHD and oppositional defiant disorder (ODD) parent and teacher symptom ratings, social skills ratings, and academic achievement (MTACG, 1999b) signaling that a comprehensive treatment package with BPT, BCM, and a summer program BPI does not have differential effects for girls.

Child age is another understudied moderator. The ADHD treatment literature is generally concentrated on school-age children, with a few studies (mostly of BPT) focusing on either preschool children or adolescents (see Table 1). The studies that investigated age as a moderator generally suggest no consistent effect on treatment outcome (e.g., Fabiano et al., 2004; Pelham & Hoza, 1996). Because studies exist for all three major forms of treatment—BPT, BCM, and BPI—in both young (e.g., 4–5) and older (e.g., 6–12) children ages, behavioral treatments are validated across this age range, which may be a function of the fact that behavioral treatments are typically tailored/modified to be appropriate to a child's specific target behaviors and goals.

However, as noted previously, the results for the small number of studies of adolescents are equivocal for BPT. We are not aware of any well-controlled studies of BCM or BPI for adolescents with ADHD. Evans, Langberg, Raggi, Allen, and Buvinger (2005) reported preliminary data on an after-school program for middle-schoolers with ADHD. Their intervention included elements of BPT, BCM, and BPI and resulted in improvement in several domains. Another study by the same group employed a teacher consultation model showing small effects that accumulated over the middle-school years (Evans, Serpell, Schultz, & Pastor, 2007). Clearly, more research needs to focus on behavioral treatments for adolescents with ADHD.

Comorbidity is another potentially important moderator. In a sample of children with ADHD, by far the most common comorbidity is aggression (Lahey, Miller, Gordon, & Riley, 1999; MTACG, 1999a, 1999b), with internalizing disorders and learning disabilities also common (e.g., MTACG, 1999a; Pelham & Fabiano, 2001). Comorbid aggressive disorders appear *not* to moderate treatment outcome in children with ADHD (MTACG, 1999b; Pelham et al., 1993; Pelham & Fabiano, 2001; Pelham & Hoza, 1996). Alternatively, in two studies of children selected for conduct problems, comorbid ADHD was evaluated as a moderator. Hartman, Stage, and Webster-Stratton (2003) found that children with both disorders improved in response to parent training *more than* conduct-problem children without comorbid ADHD. In another study using a similar sample, comorbid ADHD symptoms did not moderate improvement (Conduct Problems Prevention Research Group [CPPRG], 2002). An exception to this pattern of results is comorbid anxiety in the MTA study. Here, children with both ADHD and an anxiety disorder who received behavioral treatment improved *more* than did children with ADHD who did not have a comorbid anxiety disorder (MTACG, 1999b). In other words, there is to date no finding that comorbidity has a *negative* moderating impact on response to behavioral treatment in children with ADHD.

Another child/family level moderator is race/ethni-ethnicity, which has also been grossly understudied. The MTA study provides the only information identified on the impact of this variable on treatment outcomes. Arnold et al. (2003) explored the response to MTA treatments of ethnic minority children. The study reported that ethnic minority children responded better to combined behavioral and pharmacological treatment, relative to unimodal treatments, particularly if comorbid anxiety or disruptive behavior was present.

Because BPT is taught to parents who then act as treatment providers, parental and familial factors could be especially important moderators in BPT studies. Available data yield mixed results. Some studies indicate family factors such as parental psychopathology are generally not moderators of behavioral treatment (MTACG, 1999b; E. B. Owens et al., 2003; Pelham & Hoza, 1996). In contrast, Sonuga-Barke, Daley, and Thompson (2002) reported that the presence of maternal ADHD resulted in less child improvement than non-ADHD maternal status when the mother participated in a BPT class, demonstrating a negative moderating effect of parental psychopathology on treatment outcome.

In terms of socioeconomic status (SES), Rieppi et al. (2002) conducted an analysis of the moderating effect of SES for participants in the MTA study. In this sample, SES moderated outcome differentially depending on the outcome assessed. For core ADHD symptoms, better educated families benefited more from combined treatment. When the target outcome was oppositional/aggressive behavior, it was the less educated families who demonstrated greater benefit from combined treatment. Thus, the moderating effect of SES varied depending on the target of treatment.

A potential moderator of treatment effects is the setting in which the treatment is implemented (e.g., home, school, peer group). For example, Kolko et al. (1999) reported that BI was more effective than medication in the academic setting whereas medication was more effective than BI in the recreational setting. In contrast, other studies (e.g., Fabiano et al., in press; Fabiano et al., 2004; Pelham, Burrows-MacLean et al., 2008a, 2008b; Pelham, Erhardt et al., 2008) found no difference in the effectiveness of behavioral interventions across academic and recreational settings. Although school-based interventions could be subject to potential moderation by teacher characteristics (e.g., experience, personality) or school climate characteristics, these potential moderators of BCM have not been studied in children with ADHD.

Another understudied moderator is previous treatment experience, which may be particularly relevant for prior medication use. For example, in the MTA, previous stimulant medication use moderated "crossing over" from a behavioral treatment to medication (MTACG, 1999a). Children who had previously been prescribed stimulants were more than three times as likely (50% vs. 15%) to require medication treatment before the 14 months of active treatment had ended than were medication naïve participants. Apparently, previous experience with medication makes a parent more willing to use medication even when experiencing a comprehensive behavioral treatment. We are not aware of studies that investigated the converse—whether prior experience with BPT influences likelihood of accepting medication. Notably, the crossovers to medication in the MTA study occurred primarily during the less intensive phases of the BPT, BCM, and BPI, implying that treatment intensity as a moderator may interact with prior experience as a moderator.

The specific aspects of prior treatment experience that may explain such findings are unclear. Because previous experiences with a treatment may affect attitudes toward that treatment, parents or teachers may rate outcomes differently or have different expectations for that treatment. Similarly, parents or teachers may have beliefs about treatments from advertising, word of mouth, or media coverage that may affect their adherence to a treatment regimen or evaluation of the treatment (McLeod, Fettes, Jensen, Pescosolido, & Martin, 2007). These potential moderators have not been investigated in treatment outcome studies for ADHD.

Mediators of Behavioral Treatment Effects

Mediational variables in treatment studies are those that are influenced by the treatment condition and in turn influence the relationship between the treatment and the outcome (Holmbeck, 1997). Many fewer studies have investigated the role of mediators in treatment outcome in ADHD studies. One key variable that has been investigated is treatment adherence—does the degree to which a family adheres to the treatment plan influence the outcome?

For example, consider a study in which Barkley's well-manualized and well-validated parenting program was implemented with young children at risk for ADHD and behavior problems, but no beneficial effects of BPT were obtained (Barkley et al., 2000). Although not directly tested, it is reasonable to speculate that adherence mediated this outcome. Follow-up analyses revealed that up to one third of parents attended no parenting classes, and only approximately 13% attended more than half. Certainly parents who fail to attend the parenting sessions cannot learn the parenting skills taught in them. On the other hand, being present at sessions does not ensure that parents will either learn or implement the skills taught. Thus, in the MTA, a summary measure of adherence to treatment (i.e., attendance at 75% or more of parenting sessions) did not mediate BI outcome (MTACG, 1999b). Further investigations that validate more precise measures of treatment *adherence*— that is, whether parents and teachers actually implement the treatment as intended—are required to permit the investigation of these potentially important mediating relationships.

In addition to measures of participant adherence to treatment, studies need to address the adherence of treatment providers, namely, the integrity of the intervention implemented (Waltz, Addis, Koerner, & Jacobson, 1993). Although studies of efficacy typically have low levels of variability in treatment integrity, this consideration becomes crucial as investigators begin to study the effectiveness of psychosocial treatments when disseminated in naturalistic settings (i.e., schools, community clinics, pediatric offices; see Sonuga-Barke et al., 2001, vs. Sonuga-Barke, Thompson, Daley, & Laver-Bradbury, 2004, for an example). For example, Evans et al. (2007) reported considerable variability in teacher implementation of BCM procedures that may have partially mediated outcome.

The mediating role of treatment variables has also been investigated. Previous reviews (e.g., Hinshaw et al., 2002) and the few case studies that have evaluated it (Pelham, Wheeler, & Chronis, 1998) suggest that the intensity of behavioral treatment influences outcome. Relatively more intensive contingency management approaches (i.e., token economies) result in greater improvement than do less intensive, more clinically based behavioral treatments (e.g., parent-administered DRC; Fabiano et al., 2007; Pelham, Burrows-MacLean et al., 2008a, 2008b; Pelham, Erhardt et al., 2008). For example, peer relationship difficulties are one of the most pronounced and intractable problem domains for children with ADHD, and our review suggests that relatively more intensive peer interventions, conducted in STP settings (e.g., Pelham, Burrows-MacLean et al., 2005; Pelham et al., 2008b), had larger effects than less intensive programs that did not include point systems and daily rewards or that provided only weekly social skills groups. Further, as suggested previously, treatment dose moderators may overcome the negative moderating effects of other variables. Thus, Pelham and Hoza (1996) reported that improvement in an intensive summer treatment program with concurrent BPT was unaffected by SES, which may otherwise moderate treatment outcome to reduce the impact of treatment for children of low social class.

DISCUSSION

The results of this review extend our 1998 report and demonstrate that behavioral interventions for ADHD in the form of BPT, BCM, and intensive, summer program-based peer interventions are supported as evidence-based treatments for ADHD, a conclusion consistent with older reviews and meta-analyses. There are numerous methodological issues that merit consideration as well as limitations in the literature and directions for future research. We group these issues for discussion as participant characteristics, study deign, domains of assessment, and parameters of treatment. Finally, the results have implications for clinical practice that we believe may justify an approach that differs from the current medically oriented treatment guidelines.

Participant Characteristics

First, considering participant characteristics and their potential to moderate outcome, there have been few studies in the literature of individual differences in treatment response. For example, a major concern in the literature remains the relatively few studies that have included racial/ethnic minorities, children from low-SES families, and girls. The majority of participants in studies were male Caucasians. We could find only one new controlled study that investigated the impact of racial/ethnic group on treatment outcome (Arnold et al., 2003; MTACG, 1999b). Even more concerning is that almost half of the studies in Table 1 included no information on the racial/ethnic composition of the participants. Some studies suggested that low-income or ethnic minority families responded less well to behavioral treatment. Clearly more research in this area is needed, particularly studies that investigate whether modifications in parent training are needed for underserved groups (Chronis, Chacko et al., 2004).

The majority of participants across treatment outcome studies were boys, meaning the impact of sex on treatment outcome is at this time an understudied parameter. In the few studies that tested gender effects, there was no differential impact (e.g., MTACG, 1999a, 1999b). Furthermore, we identified only a single study that reported outcomes for different ADHD subtypes (Antschel & Remer, 2003). Although there is no obvious theoretical reason that there might be differential treatment response across subgroups, given that behavioral interventions are individually tailored when implemented, studies of subtype effectiveness might be enlightening.

Studies of comorbidity generally do not suggest differential treatment response, particularly regarding the most common comorbidity of aggressive/disruptive behavior patterns. This nonmoderation is true both for treatment studies of recruited ADHD samples (MTACG, 1999b) and for recruited aggressive samples (CPPRG, 2002; Hartman et al., 2003). However, we could find no behavioral treatment studies that have systematically investigated individual differences in response beyond the level of comorbidity. In some of the studies shown in Table 1 (e.g., Chronis, Fabiano et al., 2004; Fabiano et al., 2007; Pelham, Burrows-MacLean et al, 2008b), there is considerable variability in treatment response—some children respond better than others to the behavioral treatment, a fact that has been known for many years (cf. O'Leary & Pelham, 1978). Factors involved in such variability—individual differences (e.g., severity), treatment variations (e.g., intensity), and their interaction—have important practical importance, but they have not been systematically evaluated (see discussion next).

Study Design

The nature of the study designs utilized in this literature warrants comment. We (see also Fabiano et al., 2008; Pelham, Wheeler, & Chronis, 1998) and others (DuPaul & Eckert, 1997; Greenhill & Ford, 2002; Stage & Quiroz, 1997) have included between group, crossover, and single-subject study designs of BI, whereas others have explicitly *excluded* studies from the within-subject and single-subject literature (Hinshaw et al., 2002, 2007; Jadad et al., 1999; Miller et al., 1998). A systematic meta-analysis of the behavioral treatment literature for ADHD included 183 published and unpublished studies of behavior modification (counting each case study as an independent study; Fabiano et al., 2008). Of these, 24 used a between-group design, 28 used a pre–post uncontrolled design, 23 utilized a crossover design, and 108 were single-subject design studies. Reviews that include only randomized trials need to be considered in that context. Because a large portion of the literature on BI for ADHD includes within-subject designs and because the impact of behavioral interventions is typically far larger in studies with such designs than in the randomized trials, excluding within-subject and single-subject designs from systematic reviews and meta-analyses seriously underestimates the effects of BI and the size of the literature on BI. This is particularly problematic because groups that have generated practice parameters that have described BI as less effective than medication for ADHD (e.g., American Academy of Pediatrics [AAP], 2001; AACAP, 2007) used reviews that only included between-group studies to inform their guidelines for treatment recommendations.

It is important to note that the major reviews of medication effects include crossover studies (e.g., 21 out of 29 Type 1 studies reviewed by Greenhill & Ford, 2002). Indeed, the majority of studies of stimulant

medication are also short-term studies utilizing crossover designs (Conners, 2002), but that fact is rarely recognized in the literature and the treatment guidelines that discuss medication effects. The sole reliance on randomized, controlled clinical trials in the construction of practice parameters is particularly puzzling because such trials have been criticized for an inability to generalize to individual cases (Jacobson & Truax, 1991; Kendall & Grove, 1988) and for being simply inappropriate for answering some types of research questions (G. C. S. Smith & Pell, 2003).

Another methodological consideration in the literature relates to under what conditions to measure acute effects of treatment—that is, whether head-to-head comparisons of behavioral treatment and medication have been "fairly" conducted. For example, it has been common in the field to conduct endpoint outcome assessments after behavioral treatments are faded or withdrawn, but medication is continued and even increased in dose (e.g., Abikoff et al., 2004; Klein & Abikoff, 1997; MTACG, 1999a). However, results in such studies are interpreted as representing comparable head-to-head comparisons. Because the bulk of the evidence in support of both medication and contingency management approaches involves acute manipulations, a more accurate comparison would be actively implemented behavioral interventions versus active medication *or* faded medication versus faded therapist contact in a study. The former comparisons have often shown comparable impact of behavioral and stimulant treatments (e.g., Fabiano et al., 2007; Pelham, Burrows-MacLean et al., 2005), whereas the latter have not been systematically conducted.

Another important facet of behavioral treatment studies concerns the control conditions against which they are compared. The control condition in medication studies in ADHD is simply defined—a placebo pill that ensures that no active medication is provided to the patient on days not intended to have medication. In contrast, the control conditions in behavioral treatment studies are more variable and critical to the outcome of the study. For example, in most studies conducted in natural school settings (e.g., the MTA study), the control condition is school as usual, with the presumption that this gives a control condition equivalent to placebo control for medication. However, a good deal of research documents that behavioral interventions are ubiquitously used in classroom settings, albeit with variable levels of fidelity (Gottfredson & Gottfredson, 2001; Walker, Ramsey, & Gresham, 2003). Specifically, in the MTA study, the majority of teachers in all groups routinely used behavioral interventions in their classrooms (Pelham, 1999). Further, in the MTA, 68% of the children in the community comparison control condition received medication from their community providers (MTACG, 1999). Thus, the control condition to which the behavioral treatment was compared in the MTA (and from which the behavioral intervention group was *not* significantly different on most measures) involved community-level "doses" of the two evidence-based treatments, BCM and stimulant medication. The argument is that in natural settings demonstrating behavioral treatment effects is more difficult than is the case in a placebo-controlled study of medication.

In most single-subject design studies in *controlled* classroom settings, the comparison condition is a baseline in which the contingencies have been removed—a condition more equivalent to a placebo in a drug study than a comparison group in regular school settings. In an attempt to create a comparable condition in crossover and between-group studies, Chronis, Fabiano et al. (2004); Fabiano et al. (2007); Pelham, Burrows-MacLean et al. (2005); and Pelham, Burrows-MacLean et al. (2008a, 2008b) conducted studies in which the behavioral control condition had the behavioral contingencies and behavioral procedures removed. Thus, teachers and counselors conducted classroom and recreational activities, respectively, without using contingent rewards and consequences (e.g., without point systems), while maintaining the same rules, structure, and instruction that were employed in the behavioral conditions. A major finding in these studies was that the effects of BI alone (BCM and BPI) with concurrent BPT relative to medication is considerably larger than previously thought. When all behavioral contingencies are removed, the behavior of ADHD children deteriorates so substantively that treatment effects, particularly behavioral treatment effects, are magnified. One interpretation of this finding is that when a BI study design employs a control condition that is comparable to a placebo condition in a drug study, a more valid comparison of the two treatments can be made.

Domains of assessment. An additional methodological point concerns the dependent measures assessed, and relatedly, the manner in which ES are calculated from identified studies. Simply averaging across dependent measures, as was done in this article, can result in discordant information. For instance, although Antschel and Remer (2003) concluded that social skills training did not result in improved functioning, the ES shown in Table 1 suggests a small effect of treatment. This effect was largely due to improvement on a single domain measured (child- and parent-reported assertiveness on the Social Skills Rating System), whereas the other domains assessed—which have greater social validity for ADHD than increased assertiveness—improved little or worsened. This example illustrates how different patterns of results can emerge when ES

are calculated separately by rater (i.e., parent, teacher, child) and domain (e.g., ADHD symptoms, ADHD-related impairments, parent–child interactions; Fabiano et al., 2008). Only an analysis that considers measures across domains and raters can address this issue and provide a comprehensive picture of clinical responsiveness, and that is beyond the scope of this review.

This point becomes even more important when one considers that the majority of between-group studies have relied on parent and teacher symptom ratings as measures of treatment outcome, whereas studies that used crossover or single-subject designs have routinely used more objective behavioral observations or frequency counts of functioning in daily life activities. Parents and teachers cannot be blind in studies of behavioral intervention, which may influence their ratings—specifically raising questions regarding inflated ratings of improvement. Some (Barkley, 2000) have suggested that this is a problem with the MTA study, in which the primary outcome measure was parent and teacher symptom ratings. Because parents and teachers were not blind to either medication condition or behavioral treatment condition, their validity as records of improvement may be questionable. However, contradictory evidence in the MTA study comes from the fact that objective observations of parenting behaviors in a structured parent–child interaction showed greater effects of the behavioral intervention conditions relative to medication alone than had been apparent on parent symptom ratings (Wells et al., 2006), although other objective outcome measures (observed classroom behavior) did not yield evidence for differential efficacy of the behavioral treatment (MTACG, 1999a). Pelham, Burrows-MacLean et al. (2005) evaluated BCM and reported effect sizes that were four to five times greater for objective records of classroom rule violations than for nonblind teacher ratings of ADHD and ODD behaviors. We discussed earlier that frequency counts on idiographic DRCs showed much greater effects of behavior modification than of medication in similar studies and settings (Pelham, Burrow-MacLean et al., 2005). Thus, it is possible that more widespread use of more objective measures would result in larger effects of behavioral treatment, compared to the rating scale measures typically employed in between-group studies. *Why* this would be the case is an interesting question; it is possible that it results from the nature of behavioral interventions, which typically focus on objective target behaviors rather than the DSM symptoms that constitute most rating scales.

Domains of assessment are important in at least one other facet: the selection of target behaviors and outcomes in treatment. DSM symptoms of ADHD alone do not predict long-term outcome as well as a functional impairment measures (e.g., Mannuzza & Klein, 1999) and are not the primary basis of referrals for treatment (Angold, Costello, Farmer, Burns, & Erkanli, 1999). In contrast, areas of psychosocial impairment common in ADHD children (i.e., difficulties in family functioning, peer relationships, and academic functioning) *are* predictive of negative long-term outcome; are typically the basis of referral; are the targets of BPT, BMC, and BPI; and are arguably the outcomes that must be modified to improve both current and long-term functioning (e.g., Angold et al., 1999; Chamberlain & Patterson, 1995; Fabiano, Pelham et al., 2006; Huesmann, Eron, Lefkowitz, & Walder, 1984). Others have called for a greater emphasis on social validity in outcome measures (Foster & Mash, 1999; Pelham, Fabiano, & Massetti, 2005). Of interest, the relative effects of behavioral and pharmacological treatments are different when symptoms versus impaired functioning and adaptive skills are assessed. Medication generally is superior to behavioral treatments on *DSM*-based symptom rating scales, whereas behavioral treatments match or exceed medication effects on the latter (e.g., MTACG, 1999a, 2004; Pelham, Erhardt et al., 2008; Wells et al., 2006).

Parameters of Treatment

As the literature on treatment effects of ADHD interventions matures, critical questions need to be addressed regarding parameters of behavioral treatment that are currently unknown or understudied. Six key issues are as follows: (a) identification of the *necessary and effective* aspects and *components* of behavioral interventions, (b) how *dose* of BI influences impact, (c) the *sequence* in which the two EBTs for ADHD (stimulants and BI) should be initiated, (d) *generalization* of treatment effects, (e) *dissemination* of behavioral treatments, and (f) *cost* of BI. We believe that these are critical parameters of treatment that will constitute the next phase of research on interventions for ADHD.

Components of intervention. The great majority of the between-group and many of the crossover studies included in this article (e.g., the MTA) used treatment *packages* that included all or some combination of BPT, BCM, and BPI (e.g., school consultation with the teacher, child SST, and parent training groups). However, there are very few studies that dismantle these packages to identify the necessary and effective components (see Webster-Stratton, Reid, & Hammond, 2004, for an example from the conduct disorder literature). Outcomes have typically been measured for each domain somewhat independently, *suggesting* that the intervention component targeted at that domain was responsible for the outcomes and *implying* that each component is necessary to bring about change in the

target domain. Thus, studies that have employed a standard BPT intervention with only a minimal BCM component have produced only weak changes in classroom settings (e.g., Horn et al., 1991; Klein et al., 2004). The extensive literature on behavioral classroom management documents that it produces changes in children's classroom functioning without concurrent BPT. However, BPT or some component thereof (e.g., home-based DRCs) may be necessary to efficiently maintain beneficial changes in the classroom over time (that is for the entire school year or from one teacher to the next; cf. Shelton et al., 2000). The same is true for BPI in summer settings, which have never been studied systematically *without* concurrent BPT and home-based rewards.

Similarly, perhaps SST has not provided clinically significant benefits to date not because the clinic-based skill training has been lacking but because of a lack of procedures for promoting generalization across settings (e.g., BPT, BCM, and school- or home-based rewards—cf. Pelham & Bender, 1982; Pfiffner & McBurnett, 1997). Studies that dismantle treatment packages into BPT, BCM, and BPI components are needed to learn more about which components of treatment are necessary and sufficient. It is noteworthy that few studies of BI have included academic interventions in the treatment, despite the obvious importance of that domain for ADHD (Hinshaw, 1992; Raggi & Chronis, 2006). Although randomized trials to examine all possible treatment conditions for such combinations would be unwieldy, newer analytic approaches such as sequential, multiple, adaptive, randomized trials make such studies more manageable (Collins, Murphy, & Bierman, 2004; Murphy, 2005).

In addition, more research is needed on the parameters *within* each major component. For example, evidence-based BPT packages employ strikingly similar syllabi and format in which 7 to 10 basic concepts/skills are taught. Is it necessary to include all of these skills, or would only a subset produce sufficient change? Are there other important topics or skills not included? Might subsets of sessions/topics be able to be modified to match individual differences in families? Can some components (e.g., time-out) be taught sooner in the sequence, perhaps reducing parental dropout rates? There are only a few single small studies addressing some of these issues (e.g., Eyberg et al., 2001).

Similar questions can be raised regarding BCM and BPI. There are a handful of studies (mostly conducted by S. G. O'Leary and colleagues) examining, in controlled classroom settings, which aspects of a typical BCM program are the active components for a typical ADHD child (e.g., Abramowitz, O'Leary & Rosen, 1987; Fabiano et al., 2004; Pfiffner & O'Leary, 1987). Among other findings, these studies have shown that prudent negative consequences are superior to contingent praise alone, that brief time-outs work as well as longer ones, and that response cost programs are more effective than reward programs. Extension of these well-designed studies into regular school settings is needed to determine the minimal BCM programs that would maximize effectiveness while maximizing teacher follow through in regular schools.

Regarding BPI, traditional, clinic-based SST programs emphasize coaching, discussion, and role-play of a core set of social skills. In contrast, the summer BPI programs minimize SST and emphasize team membership, sportsmanship, and supervised group practice in sports activities with rewards and consequences for negative and positive social interactions. It is presently unknown whether it is this characteristic that accounts for the differential effectiveness of these two approaches or the difference in their intensity or dose (i.e., hours of contact).

Dose/intensity. In the same way that we know little regarding the necessary and sufficient components of BI for ADHD, we know very little regarding the effects of dosage or intensity of BI. Numerous single-subject design studies suggest that more intensive treatment components are more effective than less intensive ones (e.g., Abramowitz et al., 1992; Northup et al., 1999). One group design study has compared BCM to BPT and the combination of these treatments (Barkley et al., 2000) and another has compared standard BPT to an enhanced condition that also addressed co-parenting skills (Bor et al., 2002).

Recently, we extended these studies by conducting a series of large crossover and between-group studies examining the comparative and combined impacts of different doses of BI (none, low, and high) and methylphenidate (pl, .15, .3, and .6 mg/kg per dose t.i.d.; see Table 1; Fabiano et al., 2007; Pelham, Burrows-MacLean et al., 2008b, 2008c). The low BI condition involved rules, consistent staff praise and feedback, daily "when ... then" contingencies, and a DRC with weekly rewards; the enhanced BI condition involved the same conditions plus a point system and daily rewards. All of these were removed in the control, no-treatment condition. Results showed that the higher dose of BI was more effective than the lower dose in both classroom and recreational settings on multiple measures of functioning in classroom and recreational settings. Unexpectedly, the BI function appeared to be quadratic rather than linear—lower BI doses were closer to higher BI doses than to no treatment. The low dose of BI produced effects comparable to the low dose of MPH, whereas the enhanced behavior modification condition produced effects between the moderate and

high doses of medication. As in previous studies (Pelham, Burrows-MacLean et al., 2005; Pelham et al., 2000), effects of MPH were minimal in the presence of the high dose of BI. These studies illustrate the point that comparative studies of BI and medication need to consider the dose of both interventions when drawing conclusions about comparative efficacy.

Consider, for example, the most intensive phase of the MTA, the summer program, in which the impact of the BPI was so large that there were very few incremental benefits from MPH in that setting (Pelham et al., 2000). As previously noted, the summer BPI programs are very intensive in terms of hours of intervention for children (e.g., 350 hr), and staff train intensively for 75 or more hr before working with the children, with the majority of the training consisting of in vivo practice with online feedback (Pelham, Fabiano, Gnagy et al., 2005). In contrast, BPT typically involves 8 to 12 contact hr spread over a similar number of weeks, and teacher consultation or inservice training often no more than 1 or 2 hr per year. There are no comparable studies evaluating whether training provided at the same level as intensive BPI would alter the effectiveness of BPT or BCM.

This low amount of training is counterintuitive, given the goals of parent and teacher training and the complexity of the skills being taught. Arguably, parenting and teaching are far more complex life skills than playing a sport or driving a car. The parents and teachers of a child with ADHD will be asked to parent/teach at a disproportionately greater rate relative to a typical child, making the need for an effective parenting/teaching repertoire all the more important. For example, ADHD children have at least one negative interaction per minute with their parents (e.g., Danforth, Harvey, Ulaszek, & McKee, 2006), two per minute with their teachers or peers in school (e.g., Abikoff, Courtney, Pelham, & Koplewicz, 1993), and 0.7 per minute with peers outside of school (Pelham & Bender, 1982). Based on the amount of time that children spend with parents, in school, and/or with peers, a reasonable estimate is that a typical ADHD child has nearly half a million negative social interactions each year. This enormous number of negative social interactions provides a potent learning history for a child with ADHD and arguably leads to increasing avoidance of or worsening of social interactions over time and the development of increasingly maladaptive adult and child behaviors. Yet prevailing models of mental health and education assume that these parents and teachers and children can be taught effectively to change with only a few hours of intervention.

Contrast this approach with, for example, the field of remediating learning difficulties in children. In the past, it was assumed that a semester of weekly or twice weekly pull-out sessions in school or evening sessions at a learning center would effectively remediate reading problems for elementary-age children. Now it is clear that effective remediation requires appropriate content (a) delivered intensively (1:1 or small group), (b) for 75 to 100 hr *above* regular instruction, and (c) that is initiated by the end of first grade (Lyon, Fletcher, Fuchs, & Chhabra, 2006). If this type of intervention is not provided, the chances of making a reading-disabled child a fluent reader are very small (Lyon et al., 2006).

We posit that ADHD, with its associated domains of impairments that persist through development, is as difficult to remediate as a reading disability and may require at least as intensive an intervention. From this perspective, it appears silly to believe that the severe and long-standing ADHD deficits in social behaviors or parenting deficits can be remediated with a dozen hours of social skills or parent training and a single teacher consultation—that is, with the current model of clinical behavior therapy for children with ADHD.

Clearly, additional studies evaluating dose of BI are needed, including length of treatment (e.g., 3 vs. 6 vs. 9 weeks of summer BPI and BCM; 6 vs. 12 vs. 18 sessions of BPT), intensity *within* component (e.g., length or nature of recess time rewards; potency of daily rewards), delay interval between behavior and consequences, and the nature of antecedent control (e.g., frequency of instructional prompts, nature of commands). There are a handful of studies with children with conduct problems that have examined such parameters (McMahon, Wells, & Kotler, 2006), but we are not aware of any with children with ADHD beyond the few just described.

Sequencing. Next is a central question that faces every practitioner and family of every ADHD child following identification and diagnosis: With which treatment should intervention begin? As we discussed in the introduction and in the discussion next, most guidelines and professional organizations explicitly or implicitly recommend beginning treatment with medication. Certainly, there is an abundance of data validating the acute effectiveness of stimulant medication for ADHD. However, as we have reviewed, there is also an abundance of data supporting the effectiveness of BI. The relevant question is whether there are *data* on which to base a decision regarding which intervention to employ as the first line. The MTA study provides nonsystematic results pertinent to this question. Seventy-five percent of the children treated with behavior modification in the MTA were maintained without medication for the 14 months of treatment (85% among those children who had not been previously medicated). By the end of treatment, they were functioning nearly as

well as children in the medication group on measures of functioning, albeit not as well on *DSM* symptoms rated by parents and teachers. The majority of these children—nearly two thirds of the group—were maintained without medication at 1-year and 2-year follow up, at which point their outcomes matched those of continuously medicated children (MTACG, 1999a, 2004, Jensen et al., 2007). The MTA does not provide comparable data for those who began with medication because systematic records of BI obtained outside of protocol were not obtained. Although this is a naturalistic outcome (need for medication was not systematically evaluated), it suggests that the majority of children with ADHD could function well if the intervention were begun with BI and medication were added as an adjunct only when necessary.

There has been only a single published study that has systematically examined the sequencing of the two modalities (Dopfner et al., 2004). Dopfner et al. used an innovative adaptive treatment design to investigate the sequencing and combination of behavioral and pharmacological treatment for ADHD. Their results suggested that approximately two thirds of children with ADHD were adequately treated with behavior modification (average of 17 treatment sessions) when it was used first, whereas 82% of children treated with medication first required additional behavior modification added to the treatment plan. Three other studies examining sequencing of treatments for ADHD have been completed and presented or are underway by our research group, but they have not yet been published (http://ccf.buffalo.edu).

Notably, the majority of consumers of treatment (parents and teachers) favor the use of behavioral interventions and their use before utilizing stimulant medication (e.g., Corkum, Rimer, & Schachar, 1999; Liu, Robin, Brenner, & Eastman, 1991; McLeod et al., 2007; Pelham, Erhardt et al., 2008), whereas most treatment guidelines and recommendations refer to beginning treatment with medication or simultaneously combining the two (e.g., AACAP, 2007; MTACG, 1999). Resolution of this discrepancy awaits innovative approaches that obtain consumer preference information and use it in treatment design/implementation and well-designed studies that compare the impact of different sequences of treatment implemented at different time points on outcomes, side effects, and costs.

Generalization. An issue in all the studies reviewed in this article, and in the ADHD literature as a whole, concerns the generalization of treatment effects over time and settings. Regarding settings, as previously discussed, the extant literature suggests that BI must be implemented in a given setting (home, school, peer network) to have effects in that setting. Thus, comprehensive interventions involve home, school, and peer foci. If change agents in a given domain (e.g., parents at home) implement the BI across settings (e.g., at home, in the mall), change would be expected in the multiple settings.

The current literature presents mixed findings on whether the effects of behavioral treatments maintain over time once the active treatment regimen is withdrawn. The fact that most crossover and single-subject studies can be conducted at all implies that, at least in the *immediate term*, the effects of BI do not maintain any more than the effects of stimulant medication (once the half-life has been surpassed), and it is well known that medication benefits stop when the medication wears off. This is true for BCM and BPI (e.g., summer programming). Regarding the *longer term*, consider the follow-up investigations of the MTA conducted 10 months and 22 months after the termination of the randomly assigned treatments. The follow-up data points revealed no loss of effect of the BI, raising the possibility that the effects of behavioral treatment maintained over time, whereas medication effects dissipated to the extent that there was no longer a superiority of medication over behavioral treatments at 2-year follow-up, as there had been at the end of active treatment (MTACG, 2004, Jansen et al., 2007). It is perhaps noteworthy that the BI provided in the MTA lasted longer and was more intensive than most other studies (a mean of 25 BPT sessions over 14 months, coordinated school consultation, a BPI summer program, and a half-time in-class aide for 9.5 school weeks following the summer program). Such an intensive and comprehensive intervention may have been necessary to produce the apparent maintenance of effects. The absence of appropriate control conditions precludes concluding with confidence that the MTA BI produced maintenance following termination of treatment, but the possibility that it did is intriguing. In contrast, when Barkley et al. (2000) reported follow-up data 1 year after his intensive BCM for kindergarteners with ADHD and disruptive behavior problems, none of the prior school-based behavioral treatment effects maintained (Shelton et al., 2000). Given these discrepancies in the literature, the issue of long-term treatment effects continues to need study.

At the current stage of research in this field, it appears most parsimonious to conclude that both medication and behavioral treatments need to be maintained for effects to continue (see Hinshaw et al., 2002, 2007, for a similar conclusion). How this is best accomplished in a cost effective manner for behavioral treatments (i.e., can quarterly group booster sessions or quarterly check-ups maintain the effects of BPT or BCM or BPI or does therapist contact need to be maintained weekly?) has not been systematically evaluated in ADHD and indeed little studied overall (see Eyberg, Edwards, Boggs, &

Foote, 1998, for a review of booster interventions for conduct problems). Based on these results, it may be the case that behavioral treatments, perhaps even those most intensively implemented, evince no more maintenance than medication. Given this assumption and given the widespread recognition that ADHD is a chronic disorder (AAP, 2001), long-term management plans for ADHD arguably should include BI over long periods. If that is the case, then the issue becomes not *whether* the behavioral interventions should be maintained over time but rather *how* they should be sustained, modified, and adapted over time by professionals to promote long-term usage by parents and schools.

Dissemination. A discussion of generalization over time becomes a question of how BI can best be delivered in the long run in natural settings—that is, dissemination of BI. Dissemination is a key focus of federal agencies (http://nihroadmap.nih.gov; http://www.modelprograms.samhsa.gov; http://www.whatworks.ed.gov) and has been widely discussed in the professional literature (Chorpita, 2003; Herschell, McNeil & McNeil, 2004; Weisz, Chu, & Polo, 2004). Behavioral interventions are also interwoven into the fabric of society. Every school in America utilizes some form of BI (Gottfredson & Gottfredson, 2001) although there is no doubt variability in the fidelity with which they are employed. The availability of cost-effective programs for children with ADHD in school settings has been well documented (Evans, 2005). Parents commonly use BI with their children (e.g., time-out, grounding), and popular television shows illustrate the use of BI in homes (Sanders, Montgomery, & Brechman-Toussaint, 2000; http://www.fox.com/nanny911; http://abc.go.com/primetime/supernanny). BI for ADHD is also used internationally (e.g., Dopfner, Frolich, Seveckek, & Lehmkuhl, 2002; Miranda et al., 2002; Yamashita & Pelham, 2005).

However, progress in moving EBTs for childhood psychological disorders into the community mental health domain has lagged behind the importance of doing so (Herschell et al., 2004). This is especially the case for two of the three components of comprehensive BI for ADHD. Currently, BCM is widely available in school settings (Gottredson & Gottfredson, 2001; Walker et al., 2003), and efforts to disseminate BPT into community mental health settings are underway (e.g., Sanders & Turner, 2005; Sonuga-Barke et al, 2004). Yet BPT is not currently offered in most community MH or primary care settings (although it certainly could be). And BPI as studied and described here is currently available in only a few places in the country (e.g., Buffalo, Cleveland, New York City, Birmingham, western Pennsylvania). At the same time, we have shown that BPI can be implemented successfully in community mental health settings, currently being offered by three agencies at 13 sites across seven counties in western Pennsylvania (Pelham, Fabiano, Gnagy et al., 2005).

Dissemination of guidelines for pharmaceutical interventions for ADHD has been quite successful (e.g., AAP, 2001; Greenhill et al., 2002), with more than 90% of children with ADHD who are prescribed medication receiving central nervous system stimulants, the pharmacological EBT for ADHD (Greenhill & Ford, 2002). This figure contrasts starkly with psychosocial approaches, with the best-available evidence suggesting that almost no ADHD children receive all three EBTs for ADHD—BPT, BCM, and BPI. The discrepancy relates in part to the fact that the pharmaceutical industry is a powerful force in disseminating FDA-approved medications for ADHD, but no comparable interest group exists for disseminating psychosocial treatments. There is a clear public health need for federal agencies (e.g., National Institute of Mental Health), as well as influential professional associations (e.g., the American Psychological Association) to take an assertive lead in disseminating evidence-based psychosocial treatments for ADHD into the community mental health setting.

Cost. A final point regarding BI for ADHD concerns its costs. Recent papers from the MTA have estimated that the cost of effective BI is far larger than the cost of effective medication at the endpoint assessment—that is, over a 1-year period (Jensen et al., 2005). However, these findings are dependent on the particular cost structure of the MTA BI, the dependent measure used in the analyses (parent and teacher ratings of ADHD symptoms), and the nature of the economic analysis (Foster et al., 2007). For example, if a measure of functioning rather than symptoms is utilized, the difference in cost effectiveness between BI and medication is reduced dramatically. The cost–benefit ratio of a given intervention can only be evaluated in the context of the societal cost of illness of ADHD. Pelham, Foster, and Robb (2007) reviewed the extant literature on the cost of illness and reported a lower bound estimate (based on limited information) that the annual societal cost (e.g., treatment, education, juvenile justice) of a child with ADHD is nearly $15,000 per child. Because BI is so little utilized in health and mental health settings, the contribution of BI to this figure was negligible, whereas annual medication costs ranged from $1,200 to nearly $2,000. Whether BI can reduce this societal cost of ADHD by a sufficient degree to justify its use is an unanswered question at the present time. As discussed previously, further research on the minimally effective types and doses of BI is necessary to provide this important cost information. Studies of the cost of

different doses of BI; different sequences of multimodal treatment; and individual differences in treatment intensity, response, and cost as a function of child characteristics are currently underway in our laboratory. Such studies will have important implications for the health and educational public sectors.

It should be clear that all of these parameters of BI—type and facet of BI, dose/intensity, sequencing, generalization, dissemination, and cost—have been little studied with respect to ADHD. A great deal more research is needed. In particular, studies of moderator variables that predict the need for more intensive treatments, more complex plans for treatment maintenance and dissemination, and more expensive interventions are needed to determine what types of treatment are needed to maximize cost effectiveness and to map onto individual differences in the needs of children with ADHD.

IMPLICATIONS FOR PRACTICE GUIDELINES

Before discussing the practice guidelines that may be drawn from this review, we briefly review recently published practice guidelines by the American Medical Association (AMA; Goldman, Genel, Bezman, & Slanetz, 1998), the AAP (2001), the AACAP (2007), and the report of a task force of the APA Working Group on Psychoactive Medications for Children and Adolescents (Brown et al., 2007). The documents vary in the strength with which they recommend behavioral treatments. The AMA guidelines stated that

> the AMA encourages the use of individualized therapeutic approaches for children diagnosed as having ADHD, which may include pharmacotherapy, psychoeducation, behavioral therapy, school-based and other environmental interventions, and psychotherapy, as indicated by clinical circumstances and family preferences. (p. 1106)

The AAP guidelines state, ''The clinician should recommend stimulant medication (strength of evidence: good) and/or behavior therapy (strength of evidence: fair), as appropriate, to improve target outcomes in children with ADHD (strength of recommendation: strong)'' (p. 1037).

The AACAP guidelines take a decidedly different stance, stating that treatment ''may consist of pharmacological and/or behavior therapy'' (p. 902), but that ''pharmacological intervention for ADHD is more effective than a behavioral treatment alone'' (p. 903) and that ''behavioral treatment might be recommended as an initial treatment if the patient's ADHD symptoms are mild with minimal impairment . . . or parents reject medication'' (p. 902). The AACAP guidelines clearly state that stimulant medication should be the first line treatment and ''if a child has a robust response and shows normative functioning . . . then psychopharmacological treatment alone is satisfactory'' (p. 912). If a child fails to show a robust response with all forms of the three FDA-approved medications, then the clinician should ''consider behavior therapy and/or the use of medications not approved by the FDA for treatment of ADHD'' (p. 907). The guidelines also state that for ADHD children without comorbidity, behavioral treatment will not ''show an additive effect'' (p. 912). In sum, the AACAP guidelines relegate behavioral intervention to the same level as non-FDA-approved medications for the disorder. We contend that this guideline, which cites only two studies of BI/combined treatment, is not consistent with the evidence for BI that we have reviewed herein.

In contrast to the AACAP guidelines, the APA Task Force review of behavioral, pharmacological, and combined treatments, which reviewed the entire literature of BI for ADHD, concluded that all three treatments have a solid evidence base as acute interventions (Brown et al., 2007). It concluded that none of the treatments had an evidence base beyond one year, except as shown in the MTA follow-up study, discussed earlier. It also concluded that only medication causes side effects, and some of these are concerning (e.g., growth in the MTA follow-up study; MTACG, 2004). Thus, in a relative risk:benefit analysis, the review concluded that behavioral treatments should be employed as the first-line intervention and that medication should be added as an adjunct when indicated.

Clearly there are differences of opinion regarding the effectiveness of behavioral interventions for ADHD and their role in treatment of ADHD. How do the results of the present review clarify this state of affairs? We have documented that behavioral treatments (BPT, BCM, and BPI) are well-established treatments with multiple Type 1 studies supporting each. Our review of ES shows that the impact of BI are ES that range from small to much larger—depending on the type of intervention, setting, and control condition, and often approaching and sometimes matching or exceeding the effects of active stimulant medication, particularly in domains of functional importance to ADHD children. Our results are generally consistent with the AAP recommendations but contradict the AAP conclusion that the strength of evidence for behavior therapy is only ''fair,'' as well as the AMA statement that ''behavior therapy has not proved effective alone'' (p. 1104), and the AACAP position that behavior therapy has no greater role to play in treatment of ADHD than do nonapproved drugs. Together with previous reviews and extant meta-analyses (Chronis, Chacko et al., 2004; DuPaul & Eckert, 1997; Fabiano et al., 2008; Pelham, Wheeler, & Chronis, 1998; Brown et al., 2007), the present results demonstrate that BI has sufficiently large effects that it can be

justifiably offered as a first-line intervention. Further, the change-score ES of large behavioral treatment studies (i.e., MTA Cooperative Group; ES = .55) compares favorably to other large treatment studies for disruptive behavior, for which is it commonly accepted that behavioral treatment is the first-line intervention (e.g., CPPRG, 1999; McMahon et al., 2006). Thus, clinicians, organizations, and agencies can be confident in recommending BI as an intervention for ADHD that will have a substantial impact on children's functioning.

In contrast, we found no evidence for office-based psychotherapies conducted solely with the child (as recommended in the AAP guidelines) or for cognitive or other child-directed therapies. Behavioral interventions are the only evidence-based psychosocial intervention for ADHD.

What does the body of literature suggest about how clinicians should be implementing BI with ADHD children? First, evidence-based BI should begin with an evidence-based assessment that is focused on functional outcomes rather than DSM symptoms (Pelham, Fabiano, & Massetti, 2005). Because there is little evidence that psychiatric comorbidities make a difference in treatment planning or outcome of BI, the *diagnostic* process should be conducted as efficiently as possible. Thus, we suggest that rating scales rather than systematic structured clinical interviews be employed so that relatively more professional time can be devoted to treatment development than to diagnosis (Pelham, Fabiano, & Massetti, 2005). Functional analyses should be conducted to select target behaviors and identify the antecedent and consequent variables that influence them and that will be utilized in treatment, and these should be ongoing using simple, inexpensive instruments (e.g., Fabiano et al., 2006; instrument downloadable at http://ccf.buffalo.edu as new targets are identified and addressed; Mash, 2006). When such assessments reveal dysfunction in peer, classroom, and family domains, as will typically but not always be the case, children with ADHD should have school- , home-, and peer-based BI initiated, as indicated, with the management plan developed with the family.

Given the importance of cost of services in a public health model, we propose (a) that initial BI be relatively simple and inexpensive, (b) that need for additional treatment be based on ongoing, inexpensive assessments in domains of impairment (e.g., Fabiano et al., 2006; instrument downloadable at http://ccf.buffalo.edu), and (c) that the treatment be adaptively determined based on need. Thus, a standard course of any one of the evidence-based group BPTs should be implemented initially, with a limited number of individual sessions after the BPT group if indicated. BCM should be concurrently implemented with BPT. In a clinic setting, this would typically involve having a consultant work with the classroom teacher directly or through a school psychologist or counselor, assisting in the development and implementation of BCM in the child's classroom. Because the effectiveness of DRCs has been ubiquitously documented in the BCM studies with ADHD and because they are relatively simple interventions, a DRC would clearly be a first-line BCM, with more intensive BCM programs implemented subsequently as necessary. A standardized packet for developing and implementing a school-based DRC that has been used in multiple studies cited in Table 1 can be downloaded at http://ccf.buffalo.edu. When initial assessment identifies problems in peer relations, a BPI should be included. Note that the literature suggests that clinic-based, weekly social skills groups will *not* be effective. Instead, our review suggests that a more intensive BPI is needed to impact peer relations. It is possible that something approximating the intensive summer BPIs could be conducted in after-school programs or on Saturdays in clinic settings with access to recreational resources, but this approach has not yet been tested.

If such a BI approach has been insufficient, then one of two alternatives for increasing treatment intensity should be initiated—adjunctive or increased dose of stimulant medication (depending on whether it has already been utilized) or enhanced and more complex behavioral interventions and/or more restrictive educational placement. Based on parent preferences, resources, and a discussion of risk: benefit trade-offs, families should be counseled to select one of these alternatives. If the chosen alternative is insufficient, the other would become the only remaining option based on the current literature regarding intervention for children with ADHD.

ADHD is a chronic disorder (AAP, 2001), and, as with other chronic disease states, it is inappropriate to think that a *brief, time-limited* treatment regimen, whether it be behavioral, pharmacological, or combined, will be a sufficient and effective intervention for a child with ADHD. For most children with ADHD, and their families, chronic, intensive, pervasive, palatable treatment that promotes engagement and adherence to the selected regimen for protracted periods of time will be required. It is our hope that this update provides the justification and framework for clinicians and agencies to incorporate evidence-based behavioral interventions into services for their children with ADHD.

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