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

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Abstract

Pelham, Wheeler, and Chronis (1998) reviewed the treatment literature on attention-deficit/hyperactivity disorder (ADHD) and concluded that 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 EBPs (e.g., Chamberles & Ollendick, 2001; Herschell, McIntosh, & McNeil, 2004; Task Force on Promotion and Dissemination of Psychological Procedures, 1995; http://www.cochrane.org/). A task force sponsored by what is now the 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 childhood disorders that had an evidence base (Longtin, 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 ordainment in the management (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 and not explicitly diagnosed with 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, Hatfield, & Carroll, 2002; some covering conduct problems/antisocial behavior (Brestan & Ebyder, 1998; Lundahl, Reiser, & Lovejoy, 2006; Serkelitch & Dumas, 2004) and some discussing disruptive behaviors in general in home or classroom settings (e.g., Stage & Quinlan, 1997, Taylor & Biglan, 1998). For example, with children with ADHD and other externalizing disorders, across different reviews and evaluation methods, there has been consensus that BPT and BCM are EBTs for ADHD.

It is therefore logical to question why an update of the prior 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., Abildoff et al., 2004; Hinshaw, Klein, & Abildoff, 2002, 2007; Jensen, 1999; MTA Cooperative Group [MTACG], 1999a)—conclusions that are difficult to reconcile with the literature just cited (e.g., DuPaul & Eckert, 1997; Pelham, Wheeler, & Chronis, 1998).

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, Chadko, Fabiano, Wymb, & Pelham, 2004; Hupp, Raiman, Northup, OCallaghan, & LeBlanc, 2002; MTACG, 1999b; Pelham, Burrows-MacLean et al., 2005; Sonuga-Banks, 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., 1999b; Swanson, Mounts, 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 & Faltow, 2007; Swan, 2007). Further, medication use has increased substantially since 1998 (Greenhill & Ford, 2002). The development of new formulations of the stimulants (e.g., Biederman, Lopez, Boelher, & Chandler, 2002; Nichelson et al., 2001; Pelham et al., 2001; Pelham et al., 1999; Pelham, Burrows-MacLean et al., 2005; Swanston 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; Jacobson, 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 more likely to be made for medication rather than behavioral treatment for ADHD (Leesl & Wierich, 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 significantly sufficient for them to be viewed, particularly by physicians, as viable alternatives to medication, as first-line treatments, and 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

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, 1988; 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 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 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.

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.

### TABLE 1 Summary Table of Behavioral Intervention Studies Published Since the 1998 Journal of Clinical Child Psychology Review

<table>
<thead>
<tr>
<th>Study Authors, Year (N, Age Range)</th>
<th>Ethnicity/Race (% Boys)</th>
<th>Gender</th>
<th>Recruitment and Selection/Inclusion/Exclusion</th>
<th>Measures</th>
<th>Therapists</th>
<th>Treatment</th>
<th>Nathan &amp; Gorman (2002) Study Type</th>
<th>ES BI vs. No Treatment</th>
<th>ES BI vs. Alternative Treatment</th>
<th>ES BI Change Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frankel et al., 1997 (74, 6-12)§</td>
<td>85% Caucasian, 4% Asian, 4% Hispanic, 3% mixed race, 1% African American</td>
<td>77 Reported</td>
<td>2, 6 PhD-level psychologists or licensed social worker</td>
<td>1. Waitlist2. BPT + child SST</td>
<td>2</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
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<tr>
<td>Tyans et al., 1998 (65, 8-11)§</td>
<td>Not reported</td>
<td>76 Reported</td>
<td>2 Therapists</td>
<td>1. Pre-post BPT + child social skills group</td>
<td>2</td>
<td>N/A</td>
<td>N/A</td>
<td>0.89</td>
<td></td>
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</tr>
<tr>
<td>McCleary &amp; Ridley, 1999 (103, 12-17)§</td>
<td>Not reported</td>
<td>77 Reported</td>
<td>2, 13 Experienced clinicians</td>
<td>1. Pre-post BPT</td>
<td>2</td>
<td>N/A</td>
<td>N/A</td>
<td>0.49</td>
<td></td>
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<tr>
<td>MTACG, 1999-2007 (7,9)§</td>
<td>61% Caucasian, 20% African-American; 8% Hispanic</td>
<td>80 Reported</td>
<td>2, 4, 6, 8, 10 PHD parent trainers/school consultants; para-professional class/STP</td>
<td>1. Community comparison (2/3 medicated); 2. B3. Medication management; 2 + 3</td>
<td>1</td>
<td>N/A</td>
<td>BI vs. community comparison = 0.01; BI vs. MPH = 0.24</td>
<td>0.55</td>
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<tr>
<td>Weinberg, 1999 (34, 4.33-12.83)§</td>
<td>Not reported</td>
<td>80 Inclusion criteria reported</td>
<td>2, 3, 13 Child psychologists</td>
<td>1. Pre-post assessment of BPT</td>
<td>3</td>
<td>N/A</td>
<td>N/A</td>
<td>0.49</td>
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<tr>
<td>Pelham et al., 2000 (117, 7-9)§</td>
<td>67.5% Caucasian, 18.8% African American, 11.1% Other</td>
<td>80 Reported</td>
<td>2, 6, 7, 10, 11, 12, 14 STP counselors and teachers</td>
<td>1. BI2. MPH</td>
<td>1</td>
<td>N/A</td>
<td>ES BI alone vs. BI + Medication = 0.21</td>
<td>N/A</td>
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<tr>
<td>Barkley et al., 2000 (158, 4.5-6)§</td>
<td>Not reported</td>
<td>66 Reported</td>
<td>1, 2, 3, 5, 6, 8, 9, 12 Child psychologist for control PT; district teacher/aide in class</td>
<td>1. No treatment2. BCM3. BPT4. 2 and 3</td>
<td>1</td>
<td>BCM - 0.03. BPT = 0.02. Combined = 0.02.</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
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<tr>
<td>Barkley et al., 2001 (97, 12-15)§</td>
<td>86% Caucasian, 9% Hispanic, 2% African American, 3% Asian</td>
<td>90 Reported</td>
<td>1, 2, 4, 11 PhD clinical psychologists</td>
<td>1. PT2. Problem solving communication training (8 week outcomes used)</td>
<td>2</td>
<td>N/A</td>
<td>-0.13</td>
<td>0.51 (9-week BPT)</td>
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<tr>
<td>Sonuga-Barke et al., 2001 (78, 3 years old)§</td>
<td>Not reported</td>
<td>62 Reported</td>
<td>2, 3, 15 Specialized trained health visitor therapists</td>
<td>1. Waitlist2. Parent counseling/support3. BPT</td>
<td>1</td>
<td>PT vs. waitlist = 0.63 PT vs. attention placebo = 0.68</td>
<td>0.82</td>
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<tr>
<td>Miranda et al., 2004</td>
<td>Most were 84 Reported</td>
<td>2, 5, 6, 8, 9 Regular</td>
<td>1. Teacher training2.</td>
<td>1</td>
<td>0.44 (only N/A</td>
<td>0.78</td>
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<tr>
<td>Study</td>
<td>Year</td>
<td>Design</td>
<td>Sample Characteristics</td>
<td>Intervention</td>
<td>Control Group</td>
<td>Applicable Measures</td>
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<tr>
<td>Bor et al., 2002</td>
<td>87, 3</td>
<td>Predominantly Caucasian</td>
<td>68 Reported</td>
<td>PhD-level clinical psychologists</td>
<td>1. Enhanced BPT2. Standard BPT3. Waitlist</td>
<td>1 0.70 N/A 1.63</td>
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<tr>
<td>Heath &amp; Sanders, 2002</td>
<td>Predominantly Caucasian</td>
<td>Not reported</td>
<td>80 Reported</td>
<td>PhD-level psychologists</td>
<td>1. Enhanced behavioral family intervention2. Waitlist</td>
<td>1 0.47 N/A 0.59</td>
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<tr>
<td>Antshel &amp; Remer, 2003</td>
<td>93% Caucasian, 6% African American, 2% Asian</td>
<td>75 Reported</td>
<td>2,11 Graduate students</td>
<td>1. SST program2. Waitlist</td>
<td>2 0.20 N/A 0.80</td>
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<tr>
<td>Evans et al., 2005</td>
<td>100% Caucasian</td>
<td>78 Reporteds</td>
<td>2,6,8 School-based counselors</td>
<td>1. Behavioral after-school program2. Community comparison</td>
<td>2 N/A N/A N/A</td>
<td></td>
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<tr>
<td>Evans et al., 2005</td>
<td>100% Caucasian</td>
<td>83 Reported</td>
<td>2,6 School-based counselors</td>
<td>1. Pre-post assessment of after-school program</td>
<td>1 N/A N/A N/A</td>
<td></td>
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<tr>
<td>Kapelka, 2005</td>
<td>Predominantly Caucasian</td>
<td>100 Reported</td>
<td>6 PhD level psychologists</td>
<td>1. Behavioral consultation2. Waitlist control</td>
<td>2 1.31 N/A 1.52</td>
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<tr>
<td>Owens et al., 2005</td>
<td>Predominantly Caucasian, 9% Other</td>
<td>71 Reported</td>
<td>2,6,8,13 School-based consultants</td>
<td>1. Behavioral Consultation2. Waitlist</td>
<td>2 0.20 N/A -0.16</td>
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<tr>
<td>Danforth et al., 2006</td>
<td>Predominantly Caucasian</td>
<td>92 Reported</td>
<td>2,14 PhD clinical psychologists</td>
<td>1. Pre-post assessment of BPT</td>
<td>2 N/A N/A N/A</td>
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<tr>
<td>Evans et al., 2007</td>
<td>Predominantly Caucasian</td>
<td>77 Reported</td>
<td>2,6 School psychologists and school staff</td>
<td>1. School-based behavioral consultation2. Community comparison</td>
<td>2 N/A N/A N/A</td>
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<tr>
<td>Pelham et al., 2004</td>
<td>Predominantly Caucasian, 12% African American, 9% Other</td>
<td>84 Reported</td>
<td>2,3,6,7,12,14 STP counselors and teachers</td>
<td>1. Low B12. High BI3. No treatment, alone and combined with MPH</td>
<td>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</td>
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<tr>
<td>Kolko et al., 1999</td>
<td>Predominantly Caucasian</td>
<td>100 Reported</td>
<td>6,12,14 Teachers and para-professionals</td>
<td>Crossover study of MPH and BI</td>
<td>1 0.64 MPH (.3 mg/kg) is alternative treatment. ES = 0.33 in classroom and - 3.39 in enrichment setting</td>
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<tr>
<td>Chronis, Fabiano et al., 2004</td>
<td>Predominantly Caucasian</td>
<td>90 Reported</td>
<td>6,7,12,14 STP counselors and teachers</td>
<td>Treatment withdrawal study of intensive STP</td>
<td>2 2.39 (reported in tables in paper) N/A N/A</td>
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<tr>
<td>Fabiano et al., 2004</td>
<td>Predominantly Caucasian</td>
<td>Reported</td>
<td>6,12,14 Teachers and para-professional counselors</td>
<td>Crossover study of 3 types of time out procedures vs. no time-out</td>
<td>2 0.10 (addition of time out to STP treatment) N/A N/A</td>
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<tr>
<td>Pelham, Burrows-MacLean, et al., 2005</td>
<td>Predominantly Caucasian, 3% Native</td>
<td>93 Reported</td>
<td>2,3,6,7,12,14 STP counselors and teachers</td>
<td>Crossover study comparing BI and MPH and combination</td>
<td>1 0.91 BI vs. MPH = -0.30 N/A</td>
<td></td>
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<tr>
<td>Fabiano et al., 2004</td>
<td>Predominantly Caucasian</td>
<td>92 Reported</td>
<td>7,14 STP</td>
<td>Crossover: 3</td>
<td>1 Low Low Bi vs. low N/A</td>
<td></td>
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<tr>
<td>Study</td>
<td>Design</td>
<td>Sample Size</td>
<td>Teachers</td>
<td>Classroom Behavior</td>
<td>Interventions</td>
<td>BI vs Placebo</td>
<td>MPH vs BI</td>
<td>MPH vs MPH</td>
<td>Notes</td>
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<tr>
<td>Pelham et al., 2008b</td>
<td>Single-subject design</td>
<td>Caucasian</td>
<td>92</td>
<td>STP para-professional counselors</td>
<td>Crossover: 3 intensities of BI vs. placebo/3 doses of MPH and their combination</td>
<td>1 Low BI vs. low MPH (0.3 mg/kg) = 0.39, high BI vs. high MPH (0.6 mg/kg) = 0.44</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
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<tr>
<td>Anhalt, McNeil, &amp; Bahl, 1998</td>
<td>Single-subject design</td>
<td>Caucasian</td>
<td>5</td>
<td>Classroom teacher</td>
<td>Reversal group contingency behavioral program</td>
<td>2 1.64</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Danforth, 1998</td>
<td>Single-subject design</td>
<td>63</td>
<td>PhD-level clinical psychologist</td>
<td>Pre-post assessment of behavioral PT</td>
<td>3 N/A</td>
<td>N/A</td>
<td>2.02 (parent ratings only)</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Danforth, 1999</td>
<td>Single-subject design</td>
<td>Not reported</td>
<td>100</td>
<td>Not reported</td>
<td>Pre-post assessment of behavioral PT</td>
<td>3 N/A</td>
<td>N/A</td>
<td>10.09</td>
<td></td>
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<tr>
<td>Hupp &amp; Reitman, 1999</td>
<td>Single-subject design</td>
<td>100</td>
<td>Summer program counselors</td>
<td>Token economy in recreational settings</td>
<td>2 2.46 (estimated from graph)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td></td>
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<tr>
<td>Northup et al., 1999</td>
<td>Single-subject design</td>
<td>Not reported</td>
<td>100</td>
<td>Classroom teacher in a STP</td>
<td>Cross over study of MPH and BI; effect of time out is used in ES estimates.</td>
<td>2 6.08</td>
<td>MPH alone is the alternative treatment; ES = 0.56</td>
<td>N/A</td>
<td></td>
<td></td>
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<tr>
<td>Waschbusch, Kipp, &amp; Pelham, 1998</td>
<td>Single-subject design</td>
<td>Not reported</td>
<td>100</td>
<td>STP counselors</td>
<td>MPH combined with BI</td>
<td>3 N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>McCloy &amp; DuPaul, 2000</td>
<td>Single-subject design</td>
<td>50</td>
<td>preschool classroom teachers</td>
<td>Token economy</td>
<td>2 1.39</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smith &amp; Barnett, 2002</td>
<td>Single-subject design</td>
<td>Not reported</td>
<td>1</td>
<td>Experienced PT program clinician</td>
<td>BPT</td>
<td>2 N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronis et al., 2001</td>
<td>Single-subject design</td>
<td>Caucasian</td>
<td>100</td>
<td>Para-professional counselors</td>
<td>STP, BCM, BPT, MPH</td>
<td>3 N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pelham &amp; Fabiano, 2001</td>
<td>Single-subject design</td>
<td>Caucasian</td>
<td>100</td>
<td>STP counselors</td>
<td>STP BI procedures</td>
<td>2 N/A</td>
<td>N/A</td>
<td>1.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retman et al., 2001</td>
<td>Single-subject design</td>
<td>Not reported</td>
<td>33</td>
<td>Summer program counselors</td>
<td>Token economy in sports setting</td>
<td>2 3.46</td>
<td>MPH is alternative treatment; ES = 2.56</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hupp et al., 2002</td>
<td>Single-subject design</td>
<td>Not reported</td>
<td>16</td>
<td>Summer program counselors</td>
<td>Token economy compared to a delayed reward and baseline</td>
<td>2 4.38</td>
<td>Delayed reward is alternative treatment; ES = 5.71</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fabiano &amp; Pelham, 2003</td>
<td>Single-subject design</td>
<td>African American</td>
<td>100</td>
<td>STP counselors</td>
<td>STP BI procedures</td>
<td>2 N/A</td>
<td>N/A</td>
<td>1.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gulley et al., 2003</td>
<td>Single-subject design</td>
<td>Not reported</td>
<td>5</td>
<td>Summer program counselors</td>
<td>Reward and response cost token economies and/or time out</td>
<td>2 ES = 3.65</td>
<td>BI vs. MPH = .94</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O'Callaghan et al., 2003</td>
<td>Single-subject design</td>
<td>Not reported</td>
<td>50</td>
<td>Summer program counselors</td>
<td>SST + token economy to encourage generalization</td>
<td>2 14.35 (game-situation behaviors)</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coley et al., 2005</td>
<td>Single-subject design</td>
<td>100% Caucasian</td>
<td>75</td>
<td>STP counselors</td>
<td>STP BI procedures</td>
<td>2 1.07</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stahr et al., 2006</td>
<td>Single-subject design</td>
<td>0% Caucasian</td>
<td>100</td>
<td>Teacher</td>
<td>2 2.68</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
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</tr>
</tbody>
</table>

Note: ES = effect size; BI = behavioral interventions; BPT = parent training; SST = social skills training; N/A = not applicable; STP = summer treatment program; MPH = methylphenidate.
PT = parent training; BCM = behavioral classroom management.
1 = Parent-child observations, 2 = parent ratings, 3 = parental functioning, 4 = family functioning, 5 = classroom observations, 6 = teacher ratings, 7 = academic productivity, 8 = academic achievement, 9 = cognitive tests, 10 = peer relationships, 11 = child self-ratings, 12 = clinician ratings, 13 = consumer satisfaction ratings, 14 = behavior frequency counts, 15 = activity-level measures, 16 = recreational setting observations.

Contributed to criteria for behavioral teacher training.

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

In addition to the MTA primary outcome study, numerous other studies report on treatment-related outcomes, the total of which would comprise their own review. For a representative sample, see Arnold et al. (2003), Connors et al. (2001), Hinshaw et al. (2002); Hoza et al. (2005), Jensen et al. (2005); MTACG (1999a, 1999b); in press); Owens et al. (2003); and Swanson et al. (2001).

Contributed to criteria for contingency management in classroom settings.

Separate reports from the same study.

These ESs are an underestimate because one participant’s ES could not be computed because of the mean and standard deviation in the no-treatment condition being 0%, but this evidence showed large behavioral improvement favoring BPT.

Estimated ESs from graphs of on-task behavior for the response cost economy condition.

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, is also included in the review of new studies. Two general issues are discussed for the new studies: (a) the number of new studies (N = 18) and (b) the range of new studies which used a variety of procedures. Although these 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 multimodal 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-control 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 Markle-Dadds (2003) 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 (elementary-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 literal 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 in behavioral peer interventions as well as traditional weekly social skills groups have(level of evidence B) for substantial evidence of efficacy in the Nathan and Swanson 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 these two studies. 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. As we discuss next, disentangling the effects of multimodal studies is an important step that has not been frequently taken.

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 Alkoff (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., a teacher-implemented reward programs, point systems, time-out) in the classroom setting, though the contingency management procedures were used in a classroom setting for kindergarten children identified as having ADHD and disruptive behavior, 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, Kolk, Burstein, & Barron, 1999, Pelham, Burrows-MacLean et al., 2005). All of the studies that supported the effectiveness of Type 1 conditions, 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), 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. Tuty, Gephart, and Wurflin (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, Myat, Cantwell, and Feinberg (1997) included measures of social skill behaviors (both self-rated and teacher-rated), and measured the effectiveness of the weekly social skills groups (both components of the social skill 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 Pilliteri 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
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, 2004, 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 a attention control group (social support) and Barkley, Faraone, Guevremont, and Newcorn (2001) both compared BI to PSCT 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 = 24 for PSCT) to conclude that the treatments were equivalent. Therefore, although PSCT for families of adolescents with ADHD is a well-established treatment according to the Task Force criteria and the National Institute for Health and Clinical Excellence (2006), we recommend that BI is more costly than BPT and BCM, more difficult to implement in community settings, and the least available of the EBTs for ADHD.

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).
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 measures—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 (most 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 Bursuck (2008) 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, Schuitz, & Pastor, 2007). Clearly, more research needs to focus on behavioral treatments for adolescents with ADHD.

Comorbidity is another potentially important moderator. In terms of socioeconomic status (SES), Rieppi et al. (2003) 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 prenatal 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 based on the outcome assessed. For core ADHD symptoms, better educated families benefited more from combined treatment. When the target outcome was

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 prenatal psychopathology on treatment outcome.

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 BTP was more effective than medication in the academic setting whereas medication was more effective than BTP 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, Ehrhardt 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-naive 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 crossover 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 of children may have markedly different beliefs about the relative efficacies of different treatments from advertising, word of mouth, or media coverage that may affect their adherence to a treatment regimen or evaluation of treatment outcomes (McLeod, Fattes, Jensen, Pescecollodi, & Martin, 2007). These potential moderators have not been investigated in treatment outcome studies for ADHD.

Mediators of Behavioral Treatment Effects

Mediation 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, 1996). 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 observed (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. Clearly 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 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 validity in treatment integrity, this consideration becomes crucial as investigators begin to study the effectiveness of treatment across different settings (i.e., schools, community clinics, pediatric offices, see Sonuga-Barke et al., 2001; vs. Sonuga-Barke, Daley, & Lavar-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, Ehrhardt 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., 2008; Pelham et al., 2008b), had larger effects than less intensive programs that did not include peer 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 improved 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 design, 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 currently medical orientation of treatment.

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, in addition to 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 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, Chasko 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 effect (e.g., MTACG, 1999a, 1999b). Furthermore, we identified only a single study that reported outcomes for different ADHD subtypes (Antshel & Raimer, 2001). 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 support differential treatment response, particularly regarding the most common comorbidity of aggressive/disruptive behavior patterns. This nonmoderation is true both for treatment studies of inpatient ADHD studies (MTACG, 1999b) and for inpatient recidivism studies (CPPRC, 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’Cryall & 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, Wheelar & Chronis, 1998) and others (DuPaul & Eckert, 1997; Greenhill & Ford, 2002; Stage & Gourin, 1997) have included between-group, crossover, and single-subject design studies 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., 2001. Of these, 24 used a between-group design, 28 used a pre-post/control condition design, 23 utilized a control design that included siblings as controls. Reverses that include only single-case designs risk not capturing the full range of individual variability. 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 (Connors, 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 “fairy” conducted. For example, it has been common in the field to use endpoints at monitoring after behavioral treatments are faded or withdrawn, but medication is continued and even increased in dose (e.g., Akibto et al., 2004; Klein & Akibto, 1997; MTACG, 1999b). However, in studies of natural settings demonstrating behavioral treatment effects is more difficult than in a placebo-controlled study of medication. In most single-subject design studies in classroom settings, the comparison condition 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.

In most single-subject design studies 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. (2008a); Pelham, Burrows-MacLean et al. (2008b); and Pelham, Burrows-MacLean et al. (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 instructions that were employed in the behavioral conditions. A major finding in these studies was that the effects of BI were (e.g., MTA) and in the behavioral intervention group was no longer significantly different on most measures involved community-level “doses” of the two evidence-based treatments. However, we could find no behavioral treatment studies of stimulant treatment effects, a finding that may indicate that a BI study design can be used as an endpoint in drug study, a more valid comparison of the two treatments can be made. A major finding in these studies was that the effects of BI were stronger than those of stimulant medication (e.g., MTACG, 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’Cryall & 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).

Domains of assessment

As an additional 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 participant over a period of time not intended to have medication. In contrast, the control conditions in behavior 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 commonly used behavioral interventions in their classrooms (Gottfredson & Gottfredson, 2001). Further, in the MTA, 68% of the children in the MTA 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 the case in a placebo-controlled study of medication.

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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 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, Chasko et al., 2004).

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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., Maurozzi & Klein, 1999) and are not the primary basis of referrals for treatment (Angold, Costello, Farmer, Burns, & Erkkinen, 1999). In contrast, identifying psychosocial impairment comes in areas of functioning (child, i.e., difficulties in family functioning, peer relationships, and 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,

The 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 activities and require an extensive amount of time. 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 more) before working with the children, with the majority of the training consisting of in vivo practice with online feedback (Pelham, Fabiano, Gnagy et al., 2004, Klein et al., 2004). The extensive literature on behavioral classroom management documents that it produces changes in children's classroom functioning without concurrent BPT.

In addition, BPT and BPI components are needed to learn more about which components of treatment are necessary and sufficient. It is noteworthy that few studies of BPI have included academic components in the intervention, despite the obvious importance of this domain for ADHD (Hinshaw, 1992; Flagg & Chronis, 2006). Although randomized trials to examine all possible treatment conditions for such combinations would be unnecessary, newer analytic approaches such as sequential, multiple, adaptive, randomized trials make such studies more manageable (Collins, Murphy, & Bierman, 2004, Murphy, 2005).

In the same way that we know what is necessary to the different domains and sufficient components of BPI 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 BCP to BPI and the combination of these treatments (Bankley et al., 2000) and another has compared standard BPI 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-Massett, & Birmaher, 2006). These low BI condition involved, rules, consistent staff praise and feedback, daily “when … then” contingencies, and a DRC with weekly feedback; the enhanced BI condition involved the same conditions plus a point system and daily rewards. All of these were removed in the no-condition, 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 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 behavioral modification condition produced effects between the moderate and high doses of medication. As in previous studies (Pelham, Burrows-Massett, & Birmaher, 2006), effects of MPH were minimal in the presence of the high dose of BI. These studies illustrate the point that point that comparative studies of BI and medication need to consider the dose of both interventions when drawing conclusions about comparative efficacy.

Dose/intensity

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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). 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 for the other components of the intervention, and yet the MTA findings indicate that each component is necessary to bring about important changes in behavior.

Contrast this approach with, for example, the field of remodeling 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 delivery of instruction that is initiated by the end of first grade; Lyon, Fletcher, Fuchs, & Choate, 2000). 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 disorders of interactions 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 that permit one to make 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 available. Thus, 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 pharmaceutical 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., Corruccini, Rimer, & Schachar, 1999; Liu, Robin, Brenner, & Eastman, 1991; McLeod et al., 2007; Pelham, Erdahl et al., 2008), whereas most treatment guidelines and recommendations refer to beginning treatment with medication or simultaneously combining the two (e.g., AACP, 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 BPT (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 suppressor effect of medication over behavioral treatments. At 2-year follow-up, as there had been at the end of medication over behavioral treatments (Dopfner 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, while Barkey 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 effect continues to need study.

At the current stage of research in this field, it appears parsimonious to conclude that both medication and behavioral treatments need to be maintained for effects to continue (see Hinshaw et al., 2007, for a similar conclusion). How is this best accomplished in a cost effective manner for behavioral treatments (i.e., can quarterly group booster sessions or quarterly check-ins be implemented in BI or BCM or BPT as seen over 12 months weekly?) has not been systematically evaluated in ADHD and indeed little studied overall (see Eyberg, Edwards, Boga, & 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, invoke 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 whether 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. BI is a key focus of federal agencies (http://mrihad.mp.nih.gov; http://www.modelprograms.samhsa.gov; http://www.whatworks.ed.gov) and has been widely discussed in the professional literature (Horripita, 2003; Herschel, Michalick & Michalick, 2004; Weiss, Zhu, & 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, & Bernhard-Toussaint, 2004; http://www.fox.com/nanny911, 2005). BI for ADHD is also used internationally (e.g., Dopfner, Forslid, Svenstedt, & Lehmkull, 2002; Miranda et al., 2002; Yamashita & Pelham, 2005).

However, progress in moving EBIs for childhood disorders into the community mental health domain has lagged behind the progress available for adults (Dishchierl, 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 (Gottfredson & Gottfredson, 2001; Walker et al., 2003), and efforts to disseminate BPT into community mental health settings are underway (e.g., Sanders & Turner, 2006; Sonuga-Barker et al., 2003). Yet BPT is not currently offered within most community MH or primary care settings (although it certainly could be). And BI 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 BI 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, Grigory et al., 2005).

Dissemination of guidelines for pharmacological 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 EBI for ADHD (Greenhill & Ford, 2002). This figure contrasts starkly with psychosocial approaches, with the broad availability suggesting that almost everyone eligible for BI receives this intervention. Thus it is possible that the broad implementation of these three EBIs—BPT, BCM, and BI—may mean that the pharmacological 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 (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.

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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), Golden, Genz, 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 psychopharmacology, as indicated by clinical circumstances and family preferences. (p. 1106)

The AAP guidelines state, “The clinician should recommend simultaneous 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 intervention 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 parents are enthusiastic...then psychologic intervention...then psychologic intervention alone is a reasonable 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 BIcombined 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. No studies indicated that BI can control all effects, and some of these were considered cautiously (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 EIS 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 the active stimulant medications among ADHD children. Our results are consistent with the AAP recommendations but contradict the AACAP 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 nonproven drugs. Together with previous reviews and extant meta-analyses (Chronic, 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 it is 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 psychotherapy interventions for ADHD. 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 in a manner that is efficient and timely. Thus, the evidence suggests that using scales rather than the systematic structured clinical interviews may 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 assessment 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 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, expensive services 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 BCMs 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 be effective in improving social skills. 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.

Adoption of 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 prolonged 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.

Acknowledgments

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<td>Frankel et al., 1997</td>
<td>(74, 6-12)</td>
<td>85% Caucasian, 4% Asian, 4% Hispanic, 3% mixed race, 1% African American</td>
<td>PhD-level psychologists or licensed social worker</td>
<td>1. Waitlist2. BPT + child SST</td>
<td>2 N/A N/A N/A</td>
</tr>
<tr>
<td>Tyanan et al., 1999</td>
<td>(55, 5-11)</td>
<td>Not reported</td>
<td>77 Reported</td>
<td>2 N/A N/A N/A</td>
<td></td>
</tr>
<tr>
<td>McCleary &amp; Ridley, 1999</td>
<td>(103, 12-17)</td>
<td>Not reported</td>
<td>77 Reported</td>
<td>2 N/A N/A N/A</td>
<td></td>
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<tr>
<td>MTACG, 1999</td>
<td>(579, 7-9)</td>
<td>61% Caucasian, 20% African-American, 8% Hispanic</td>
<td>2,6,8,10</td>
<td>1 N/A</td>
<td>BI vs. community comparison = 0.01; BI vs. MPH = -0.24</td>
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<tr>
<td>Weinberg, 1999</td>
<td>(34, 4.33-12.83)</td>
<td>Not reported</td>
<td>80 Inclusion criteria reported</td>
<td>2 N/A N/A 0.49</td>
<td></td>
</tr>
<tr>
<td>Pelham et al., 2000</td>
<td>(117, 7-9)</td>
<td>67.5% Caucasian, 18.8% African-American, 2.6% Hispanic, 11.1% Other</td>
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<td>1. BI2. BI + MPH</td>
<td>N/A</td>
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<tr>
<td>Barkley et al., 2000</td>
<td>(158, 4.5-6)</td>
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<tr>
<td>Barkley et al., 2001</td>
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<td>86% Caucasian, 9% Hispanic, 3% African American, 1.1% Other</td>
<td>1. PT2. Problem solving communication training (8-week outcomes used)</td>
<td>2 N/A -0.13</td>
<td>0.78</td>
</tr>
<tr>
<td>Sonuga-Barke et al., 2001</td>
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<td>Not reported</td>
<td>62 Reported</td>
<td>2.5,6,8,9</td>
<td>0.82</td>
</tr>
<tr>
<td>Miranda et al., 2002</td>
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<td>84 Reported</td>
<td>1 PT vs. waitlist = 0.63; PT vs. attention placebo = 0.68</td>
<td></td>
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<tr>
<td>Bor et al., 2002</td>
<td>(87, 3)</td>
<td>Predominantly Caucasian</td>
<td>Not reported</td>
<td>1.2,3,13,14</td>
<td>1.07 N/A N/A 1.63</td>
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<td>Health &amp; Sanders, 2002</td>
<td>(20, 5-9)</td>
<td>Not reported</td>
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<td>2.3,4,13</td>
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<td>Antshel &amp; Remer, 2003</td>
<td>(120, 8-12)</td>
<td>93% Caucasian, 6% African American, 2% Asian</td>
<td>75 Reported</td>
<td>2.11</td>
<td>0.29 N/A N/A 0.84</td>
</tr>
<tr>
<td>Tutty et al., 2003</td>
<td>(100, 5-12)</td>
<td>87% Caucasian, 6% African American, 6% Hispanic, 1% Asian</td>
<td>75 Reported</td>
<td>2.36</td>
<td>0.61</td>
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<td>Dopher et al., 2004</td>
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<tr>
<td>Sonuga-Barke et al., 2004</td>
<td>(89, 3)</td>
<td>Not reported</td>
<td>Reported</td>
<td>2.3</td>
<td>0.20 N/A N/A N/A</td>
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<tr>
<td>Evans et al., 2005 Study 1</td>
<td>(78, 11-14)</td>
<td>100% Caucasian</td>
<td>78 Reported</td>
<td>2.6</td>
<td>0.84</td>
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<td>100% Caucasian</td>
<td>83 Reported</td>
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<td><strong>Kaplan, 2005 (66, 5-10y)</strong></td>
<td>54% Caucasian</td>
<td>Not reported</td>
<td>6</td>
<td>PHD level psychologists</td>
<td>Pre-post consultation; Waitlist control</td>
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<td><strong>Owens et al., 2004 (2), kindergarten-sixth grade</strong></td>
<td></td>
<td>Not reported</td>
<td>71</td>
<td>School-based consultants</td>
<td>Behavioral Consultation; Waitlist</td>
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<tr>
<td><strong>Pelham et al., 2006b (49, 4-12)</strong></td>
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<td>Not reported</td>
<td>92</td>
<td>PHD clinical psychologists</td>
<td>Pre-post assessment of BPT</td>
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<tr>
<td><strong>Evans et al., 2007 (79, 11-14)</strong></td>
<td>94% Caucasian</td>
<td>Reported</td>
<td>77</td>
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<td>1. School-based behavioral consultation; Community comparsion</td>
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<td><strong>Pelham et al., under review</strong></td>
<td>79% Caucasian, 12% African American, 9% Other</td>
<td>Reported</td>
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<td><strong>Kolko et al., 1999 (16, 6-12)</strong></td>
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<td>Reported</td>
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<td>Crossover study of MPH and BI</td>
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<td>Reported</td>
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<td>STP counselors and teachers</td>
<td>Treatment withdrawal study of intensive STP</td>
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<td>Reported</td>
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<tr>
<td><strong>Pelham et al., 2006b (48, 5-12)</strong></td>
<td>79% Caucasian</td>
<td>Reported</td>
<td>92</td>
<td>STP para-professional counselors</td>
<td>Crossover. 3 intensities of BI vs. placebo/3 doses of MPH and their combination</td>
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<tr>
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<td>5</td>
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<td><strong>Danforth, 1998 (8, 4-6, 7-3)</strong></td>
<td></td>
<td>Reported</td>
<td>63</td>
<td>PHD-level clinical psychologist</td>
<td>Pre-post assessment of behavioral PT</td>
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<td><strong>Danforth, 1999 (1, 4)</strong></td>
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<td>Reported</td>
<td>100</td>
<td>Not reported</td>
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<tr>
<td><strong>Hupp &amp; Reisman, 1999 (3, 8-10y)</strong></td>
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<td>Reported</td>
<td>100</td>
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**Notes:**
- (55, 11-14y)
- (44, 9-13y)
- (48, 5-12y)
- (66, 5-10y)
- (29, 6-12y)
- Reported: data from publications.
- Not reported: data not reported in publications.
- N/A: Not available.

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**Table Footnotes:**
- BI: Behavioral Intervention
- MPH: Methylphenidate
- PT: Psychoeducation
- STP: Social Skills Training Program

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**Table Notes:**
- Results are presented as effect sizes (ES), with 95% confidence intervals (95% CI).
- All reported studies have significant effect sizes.
- ES > 0.50 indicates a moderate effect size.
- ES > 0.80 indicates a large effect size.

---

**References:**
- Kaplan, 2005
- Owens et al., 2004
- Pelham et al., 2006b
- Evans et al., 2007
- Pelham et al., under review
- Kolko et al., 1999
- Chronis, Fabiano et al., 2004
- Fabiano et al., 2004
- Pelham, Burnes-Charles, MacLean, et al., 2005
- Fabiano et al., in press
- Pelham et al., 2006b
- Anhalt, McNeil, & Bain, 1998
- Danforth, 1998
- Danforth, 1999
- Hupp & Reisman, 1999
- Northrup et al., 1999

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**Additional Notes:**
- All studies were conducted in school settings, with the exception of Danforth and Northrup et al.
- The majority of studies used classroom teachers as the primary implementers of the interventions.
- The effectiveness of the interventions was evaluated using a variety of methods, including pre-post designs, randomized controlled trials, and naturalistic observations.
- The results of these studies suggest that psychosocial treatments can be effective in managing ADHD symptoms.

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<td>Not reported</td>
<td>0</td>
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<tr>
<td>Chronis et al., 2001 (1, 7 years old)</td>
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<td>100</td>
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<tr>
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<td>100</td>
<td>Reported</td>
<td>7, 14</td>
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<tr>
<td>Reitman et al., 2001 (3, 6-7)</td>
<td>Not reported</td>
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<td>Reported</td>
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<tr>
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<td>100</td>
<td>Reported</td>
<td>14</td>
<td>Teacher</td>
<td>N/A</td>
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</tbody>
</table>

Note: ES = effect size; BI = behavioral interventions; BPT = parent training; SST = social skills training; N/A = not applicable; STP = summer treatment program; MPH = methylphenidate; PT = parent training; BCM = behavioral classroom management.

*1 = Parent-child observations, 2 = parent ratings, 3 = parental functioning, 4 = family functioning, 5 = classroom observations, 6 = teacher ratings, 7 = academic productivity, 8 = academic achievement, 9 = cognitive test, 10 = peer relationships, 11 = child self-ratings, 12 = clinician ratings, 13 = consumer satisfaction ratings, 14 = behavior frequency counts, 15 = activity-level measures, 16 = recreational setting observations.

*Contributed to criteria for behavioral parent training.

*Contributed to criteria for contingency management in peer/recreational settings.

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

*Contributed to criteria for contingency management in classroom settings.

Separate reports from the same study.

These ES are an underestimate because one participant's ES could not be computed because of the mean and standard deviation in the no-treatment condition being 0, but this child evidenced large behavioral improvement favoring BI.

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