



A meta-analysis of behavioral parent training for children with attention deficit hyperactivity disorder

Pei-chin Lee^{a,b}, Wern-ing Niew^c, Hao-jan Yang^d, Vincent Chin-hung Chen^{e,f},
Keh-chung Lin^{g,h,*}

^aSchool of Occupational Therapy, Chung Shan Medical University No. 110, Sec. 1, Jiang-Gou N. Road, Taichung, Taiwan

^bChung Shan Medical University Hospital No. 110, Sec. 1, Jiang-Gou N. Road, Taichung, Taiwan

^cDepartment of Special Education, National Kaohsiung Normal University No. 116, Heping 1st Rd., Lingya District, Kaohsiung, Taiwan

^dDepartment of Public Health, Chung Shan Medical University No. 110, Sec. 1, Jiang-Gou N. Road, Taichung, Taiwan

^eDepartment of Psychiatry, Chung Shan Medical University No. 110, Sec. 1, Jiang-Gou N. Road, Taichung, Taiwan

^fDepartment of Psychiatry, Chung Shan Medical University Hospital No. 110, Sec. 1, Jiang-Gou N. Road, Taichung, Taiwan

^gSchool of Occupational Therapy, College of Medicine, National Taiwan University No. 17, F4, Xu Zhou Road, Taipei, Taiwan

^hDivision of Occupational Therapy, Department of Physical Medicine and Rehabilitation, National Taiwan University Hospital, Taipei, Taiwan

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ABSTRACT

This meta-analysis examined the effect of behavioral parent training on child and parental outcomes for children with attention deficit hyperactivity disorder. Meta-analytic procedures were used to estimate the effect of behavioral parent training on children with attention deficit hyperactivity disorder. Variables moderating the intervention effect were examined. Forty studies were included and generated an overall moderate effect size at post-treatment and a small effect size at follow-up. The majority of outcome categories were associated with a moderate effect size at post-treatment that decreased to a small effect size at follow-up. Parenting competence was the only outcome that had a large effect, which decreased to moderate at follow-up. The strength of the effect differed between questionnaire and observation measures. Behavioral parent training is an effective intervention for children with attention deficit hyperactivity disorder. Sustainability of the effects over time is a problem that awaits further scrutiny. Recommendations for further research and clinical practices are provided.

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1. Introduction

Attention deficit hyperactivity disorder (ADHD) is a developmental disorder that may seriously affect a child's home, school, and social functions (American Psychiatric Association, 2000). Observational studies of children with ADHD and their parents found conflicted parent-child interaction patterns and less positive parenting practice (Deault, 2010). Participation in daily activities, such as going to bed or completing homework, might be challenging for children with ADHD and their parents and adversely affect their parent-child relationships (Segal, 2000; Segal & Hinojosa, 2006). Several studies have found that ADHD is associated with significantly increased parenting stress (Deault, 2010).

Behavioral therapy is an empirically supported intervention for children with ADHD, but is often labor intensive (Hinshaw, 2009). Therefore, parent involvement in implementation of behavioral therapy is suggested and may promote

* Corresponding author. Tel.: +886 233668180; fax: +886 223710614.

E-mail addresses: peggy@csmuedu.tw (P.-c. Lee), winiew@nknuc.nknu.edu.tw (W.-i. Niew), hjyang@csmu.edu.tw (H.-j. Yang), hjcch@yahoo.com.tw (V. C.-h. Chen), kehchunglin@ntu.edu.tw (K.-c. Lin).

generalization of the intervention benefits from the clinic or school to the home setting (Matson, Mahan, & LoVullo, 2009). In addition, parent participation in intervention is critically important for improving treatment outcomes for children with ADHD (Chu & Reynolds, 2007).

Behavioral parent training (BPT) is an intervention to help parents stop stressful patterns of parent–child interaction. BPT primarily emphasizes social contingencies in which the parent provides positive reinforcement for the child's prosocial behavior and ignores or punishes negative behavior by nonphysical discipline techniques such as removal of privileges or time out (Antshel & Barkley, 2008). The benefit of BPT is to create better fit among parent–child interactions in social settings such as school, the park, and after-school events (Antshel & Barkley, 2008; Barkley, Robin, & Benton, 2008).

A meta-analysis reviewed 16 studies of parent-involved psychosocial treatment for children with ADHD (Corcoran & Dattalo, 2006). These studies generated a small effect compared with an alternate or no treatment, whereas a higher effect was found on children's emotional disturbance and academic performance. Effects on the ADHD symptoms and behavioral problems were relatively minor and were suggested to be targeted by other interventions. However, the previous meta-analysis only included 16 studies, and no follow-up outcomes were reported. To address the limitations of the previous review, the current meta-analysis used more specific selection criteria (i.e., behaviorally oriented parent training programs), expanded outcomes (i.e., child and parental variables, questionnaire and observational measures, and immediate and follow-up effects), and analyzed a larger number of studies.

2. Methods

2.1. Searching strategies

Electronic databases were searched (Medline, Psych INFO, Pubmed, CINAHL, Cochrane Clinical Trials and ERIC) for possible studies. Key words used to identify articles were *behavioral parent training*, *parent training*, *parent group*, *behavior problem*, *attention deficit*, *hyperactivity*, *hyperactive*, and *ADHD*. References of the retrieved articles were searched. Book chapters, major reviews, and meta-analytic reports about parent training and children with ADHD or disruptive behavior were also searched and their reference lists inspected.

2.2. Inclusion criteria

Studies reported between 1970 and 2011 were included in this meta-analysis if they (a) investigated the effects of BPT, (b) included parents of children with ADHD, (c) included empiric data for the meta-analysis, (d) had a group comparison design, and (e) had at least a comparison group in addition to a BPT group. BPT was defined as the therapy aiming at establishing a behavioral contingency program for parents.

2.3. Data collection and identification of studies

Approximately 1000 abstracts or articles were retrieved and reviewed, and about 200 reports of parent training for children with ADHD were screened. A total of 40 studies from 48 reports met the inclusion criteria and were included in this meta-analysis. The reference lists of excluded studies were provided by requests to the authors.

2.4. Outcome variables

The outcome categories included (1) the child's behavior as measured by parent or teacher questionnaire and by laboratory or home observation, (2) parenting behavior as measured by parent questionnaire and by laboratory or home observation, and (3) parental perception of parenting. Outcomes of the child's behavior referred to increased positive behavior and decreased disruptive behavior. Outcomes of parenting behavior referred to changes in child-rearing behavior. Outcomes of parental perception of parenting included changes in the parent's sense of parenting stress and competence. In this meta-analysis, the effects of BPT on the child's behavior, parenting behavior, and parental perception of parenting were estimated. The overall effect was calculated by including all of the above variables.

2.5. Moderating variables

Because of the theoretic relevance and the availability of data, certain potential methodological or substantive moderators were coded and underwent further analysis:

1. Methodological characteristics: an 8-point methodological vigor index.
2. Participant characteristics: age, child's comorbid diagnosis, single parenthood, parental depression, and family socioeconomic status.
3. Intervention characteristics: type of experimental group (BPT combined with other intervention or BPT only), delivery mode of the BPT program, the intervention program, and types of comparison groups.

The rating for methodological rigor, modified from Lundahl, Risser, and Lovejoy work (2006), ranged from 0 to 8 points. A study received 2 points if participants were randomly assigned to groups or 0 point if it did not randomly assign or mention this in the report. For the other study features, a study received 1 point for including the feature or 0 for not including it. These features included pretreatment equivalence between the experimental and control group, multiple methods for outcome assessment (i.e., questionnaire and observation measure), clarity in intervention description, inclusion of sufficient statistics for effect size calculation, use of standardized measures or well-known measures, and use of a treatment manual. The studies included in this meta-analysis that achieved rigor ratings of 7 and 8 had moderate to strong research designs, whereas those with ratings below 4 had weak designs.

2.6. Calculation of effect size

The effect size r index was used in the present meta-analysis. When the result of a particular hypothesis test supported our hypothesis that BPT enhanced children's behavior or parenting skills and perception, the effect size was designated as positive; otherwise, the effect size was given as negative. According to Cohen's (1988) guidelines for the interpretation of the effect size (r), a larger effect is represented by an r of at least .50, a moderate effect by .30, and a small effect by .10.

We used Friedman (1968) formulas to calculate the r index estimates based on traditional inferential statistics. For meta-analytic combination and comparison procedures, the unit of analysis was a study, which refers to a group of participants going through a set of predesigned procedures. These results were counted as one study and contributed one effect size r to this review.

2.7. Test of homogeneity and analysis of moderator

Borenstein, Hedges, Higgins, and Rothstein (2009) cautioned that the results of studies and associated effect sizes might vary by chance. A heterogeneity analysis was proposed to test whether sample error could explain the variance exhibited in a set of effect sizes. We used Rosenthal (1991) formulas to estimate the statistical significance of the heterogeneity of the r values. If the heterogeneity analysis revealed that the variance in the effect sizes was greater than expected by chance, other sources of variance due to study characteristics or design variables were examined.

3. Results

3.1. Description of included studies

This meta-analysis included 40 studies from 48 articles that met the criteria. The pretreatment data in the included BPT trials indicated that the children were in the clinical range of ADHD. Although 22 of the 40 studies reported percentages of the participating children with ADHD who had other comorbid behavioral disorders, such as oppositional defiant disorder (ODD) and conduct disorder, most of the studies excluded children with developmental disorders, intellectual or sensory impairment, and neurologic problems. Table 1 provides the study characteristics and the effect sizes of the 40 studies included in this review.

Interventions combined with BPT included treatment delivered to the parent, child, and teacher. The 40 studies included in this meta-analysis had a mean methodological rigor rating of 6.7 (range: 3–8; SD: 1.49); of these, 26 were rated as having moderate to strong research designs, and 5 were rated as weak. Outcomes were measured with standardized and mostly well-known questionnaires or observational methods.

3.2. Overall outcome

When compared with the waiting list control or other treatment, 28 studies found small to large positive effects (r range: .90 to .06) supporting the effects of BPT at post-treatment, whereas 12 studies found small negative effects of BPT (r range: $-.01$ to $-.33$). On average, a moderate effect ($r = .34$, $k = 40$) was found that supported BPT as an effective intervention in enhancing child and parent behavior as well as parental perception about parenting. In 17 studies, follow-up outcomes of BPT were measured at 3 months to 3 years after the intervention and found a small positive effect ($r = .17$, $k = 17$, range: .66 to $-.40$). BPT effects remained meaningful but declined at follow-up. Table 2 presents the effect sizes for overall outcomes, child behavior, parental behavior, and parental perception of parenting at post-treatment and follow-up.

3.3. Outcomes of child behavior, parent behavior and parental perception of parenting

The outcome of child behavior measured by observation decreased from moderate to zero at follow-up. Parental perception of parenting was the only outcome that had a large effect, which decreased to moderate. Most outcomes were associated with a moderate effect size that decreased to a small effect at follow-up. The strength of the effect differed between questionnaire and observation measures.

Table 1
 Characteristics of studies included in the meta-analytic review.

Study	Sample characteristics					Treatment description				Methodological rigor ^e	ES	
	<i>n</i> ^a	Child's age (years)	Comorbidity ^b (%)	Family SES ^c	Single parent (%)	Mode of BPT ^d	Comparison group	Participants	BPT delivery		Post Tx	FU
Peed, Roberts, and Forehand (1977)	6, 6	4.97	–	Low	–	BPT	No Tx	P, C	Ind	4	.89	–
Firestone, Kelly, Goodman, and Davey (1981)	13, 12	7.32	–	–	–	En BPT	Other Tx	P, C	Gr, Ind	6	.24	–.08
Dubey, O'Leary, and Kaufman (1983)	18, 12	8.46	–	Average	–	BPT	Other Tx	P	Gr	5	–.18	–.07
Pelham et al. (1983)	22, 10	–	–	–	–	En BPT	Other Tx	P, C, T	Ind	3	.68	–
Horn, Jalongo, Popovich, and Peradotto (1987)	7, 6	9.58	–	–	–	En BPT	Other Tx	P, C	Gr	8	–.02	–.40
Pisterman et al. (1989, 1992a) ^f	23, 23	4.15	–	Average	15	BPT	No Tx	P	Gr	8	.40	.62
Strayhorn and Weidman (1989)	50, 45	–	34	Low	45	BPT	No Tx	P, C	Ind	6	.13	–
Bloomquist, August, and Ostrander (1991)	11, 12	8.75	35	Average	–	En BPT	Other Tx	P, C, T	Gr	8	.90	.18
Barkley, Guevremont, Anastopoulos, and Fletcher (1992)	20, 21	13.37	83	Average	26	BPT	Other Tx	P, A	Ind	8	.10	.04
Pisterman et al. (1992a, 1992b) ^f	23, 22	4.13	–	Average	16	BPT	No Tx	P	Gr	8	.28	.25
Anastopoulos, Shelton, DuPaul, and Guevremont (1993)	19, 15	8.14	41	Average	18	BPT	No Tx	P	Ind	5	.82	–
Beyer (1994)	12, 10	7.10	–	Average	–	BPT	No Tx	P	Gr	8	.24	–
Cunningham, Bremner, and Boyle (1995)	35, 43	4.51	–	–	23	BPT	Other Tx	P, C	Gr	8	.25	.24
Odom (1996)	10, 10	2.73	–	Low	70	BPT	No Tx	P	Gr	5	.50	–
Frankel, Myatt, Cantwell, and Feinberg (1997)	35, 12	8.91	38	Average	–	En BPT	No Tx	P, C	Gr	4	.83	–
Klein and Abikoff (1997)	29, 29	7.80	07	Average	–	En BPT	Other Tx	P, C, T	Gr, Ind	7	.28	–
Pfiffner and McBurnett (1997)	9, 9	9.00	70	Average	7	En BPT	Other Tx	P, C, T	Gr	7	–.21	.16
Fallone (1999)	16, 16	6.72	71	Average	23	En BPT	No Tx	P	Gr	8	.06	–
Barkley et al. (2000)	40, 37	4.85	63	Average	43	En BPT	Other Tx	P, C, T	Gr	7	–.01	–
Burrows (2000)	19, 19	–	–	–	–	En BPT	Other Tx	P, C	Gr	4	.77	–
Wells et al. (2000, 2006) ^f , Arnold et al. (2004), MTA Cooperative Group (2004) and Jensen et al. (2007)	144, 144	8.40	42	Average	34	En BPT	Other Tx	P, C, T	Gr, Ind	8	.12	.19
Barkley, Edwards, Laneri, Fletcher, and Metevia (2001)	39, 58	14.68	100	Average	0	En BPT	Other Tx	P, A	Ind	8	–.27	.32
Lehner-Dua (2001)	23, 25	8.00	–	Average	19	BPT	Other Tx	P	Gr	7	.80	–
Sonuga-Barke, Daley, Thompson, Laver-Bradbury, and Weeks (2001)	30, 28	–	–	Average	–	BPT	Other Tx	P	Ind	8	.41	.13
Bor, Sanders, and Markie-Dadds (2002)	26, 32	3.34	–	Low	38	En BPT	No Tx	P	Ind	8	.73	–
Reddy et al. (2002)	18, 18	6.25	–	Average	–	En BPT	Other Tx	P, C, T	Gr	5	.76	.66
Tutty, Gephart, and Wurzbacher (2003)	59, 41	9.17	–	Average	33	En BPT	No Tx	P, C	Gr	6	.45	.52
Abikoff, Hechtman, Klein, Gallagher, et al. (2004) ^f , Abikoff, Hechtman, Klein, Weiss, et al. (2004), Hechman, Abikoff, Klein, Weiss, et al. (2004) and Hechman, Abikoff, Klein, Greenfield, et al. (2004)	34, 35	8.20	53	Average	13	En BPT	Other Tx	P, C, T	Gr, Ind	8	–.12	–
Sonuga-Barke, Thompson, Daley, and Laver-Bradbury (2004)	59, 30	–	–	Average	–	BPT	No Tx	P	Ind	7	–.07	–
Ercan, Varan, and Deniz (2005)	63, 20	9.10	57	–	–	En BPT	Other Tx	P, C	Gr	4	–.01	–
McGoey, DuPaul, Eckert, Volpe, and Brakle (2005)	30, 27	4.03	42	Average	–	En BPT	No Tx	P, C, T	Gr	8	–.09	–
So (2005)	45, 25	8.00	50	Average	–	En BPT	No Tx	P, C, T	Gr	8	.73	.36
Treacy, Tripp, and Baird (2005)	17, 17	9.42	56	Average	36	En BPT	Other Tx	P	Gr	7	.07	–
Chronis, Gamble, Roberts, and Pelham (2006)	25, 26	9.48	58	Average	1	En BPT	No Tx	P	Gr	6	–.04	–
Hoofdakker et al. (2007)	47, 47	7.40	76	Average	11	BPT	No Tx	P	Gr	7	.13	–

Table 1 (Continued)

Study	Sample characteristics					Treatment description				Methodological rigor ^e	ES	
	n ^a	Child's age (years)	Comorbidity ^b (%)	Family SES ^c	Single parent (%)	Mode of BPT ^d	Comparison group	Participants	BPT delivery		Post Tx	FU
Jones, Daley, Hutchings, Bywater, and Eames (2007)	50, 29	3.86	100	–	39	BPT	No Tx	P	Gr	8	.44	–
Kern et al. (2007)	71, 64	4.47	76	Average	20	En BPT	Other Tx	P, C, T	Gr, Ind	7	–.33	–
Oord, Prins, Oosterlaan, and Emmelkamp (2007)	24, 21	9.90	51	Average	–	En BPT	Other Tx	P, C, T	Gr	7	.15	–
Chacko et al. (2009)	40, 40	7.69	70	Low	100	En BPT	No Tx	P, C	Gr	8	–.03	–
Cruz (2009)	25, 19	6.15	–	Average	11	En BPT	No Tx	P, C, T	Gr, Ind	5	.07	–.08

Note. Dashes indicate no data were reported. SES, social economic status; BPT, behavioral parent training; ES, effect size; Tx, treatment; FU, follow-up; En BPT, enhanced behavioral parent training; P, parent; C, child; Ind, individual; Gr, group; T, teacher; A, Adolescent.

^a The first value refers to the number of parents in the treatment group, the second value is the number of parents in the control group.

^b Percentage of children with attention deficit hyperactivity disorder comorbid with other externalized behavioral problems, mostly oppositional defiant disorder.

^c Based on reports of family income, education, and where available, occupation data, SES indices (e.g., Hollingshead Index).

^d En BPT = in addition to behavioral parent training, the treatment group received other intervention programs for parents, children, or teachers. BPT = the treatment group received only behavioral parent training program.

^e Methodological rigor was rated on a 8-point scale, including random assignment, group equivalency, use of multiple methods of outcome assessment, clarity in program description, inclusion of sufficient statistics for effect size calculation, use of standardized measures, and use of a treatment manual (Lundahl et al., 2006).

^f The effect size was calculated from data presented in the listed references.

Table 2
Average effect sizes by types of outcome by times of measurement.

	Child behavior				Parenting behavior				Parenting perception		Overall results	
	Questionnaire		Observation		Questionnaire		Observation		k^a	r^b	k^a	r^b
	k^a	r^b	k^a	r^b	k^a	r^b	k^a	r^b				
Post-treatment	35	.31	19	.32	14	.38	15	.27	20	.53	40	.34
Follow-up	14	.15	10	-.04	4	.35	5	.12	5	.27	17	.17

^a The number of studies that contributed to the average effect size.

^b Positive value indicated that behavioral parent training (BPT) plus other treatment or BPT alone improved more than non-BPT treatment or no treatment control.

3.4. Results of heterogeneity tests

A test of heterogeneity of the post-treatment effect sizes for the 40 studies was significant ($\chi^2(39) = 86.31, p < .005$). The findings of significant heterogeneity implied that not all of the effect sizes were drawn from the same population and provided justifications for the investigation of how study attributes might have moderated the resultant effects. A test of heterogeneity of the effect sizes for the 17 studies investigating the follow-up effect of BPT was not significant ($\chi^2(16) = 19.87, p \leq .2$); therefore, no moderator analysis was conducted for these follow-up studies.

3.5. Results of moderator analysis

When BPT was investigated alone, the effect sizes were not significantly different from when BPT was integrated in a package of interventions. No significant difference was found between studies that delivered BPT in a group format ($r = .35, k = 25$) and studies that delivered BPT individually ($r = .47, k = 9$). Involving both children and parents in the intervention ($r = .32, k = 23$), compared with parents only ($r = .35, k = 15$), did not significantly enhance the effect of BPT. Table 3 provides a summary of the contrast analyses for categorical variables. Studies that had a higher level of methodological rigor and recruited more percentages of children with ADHD and ODD or other behavioral problems were associated with smaller effect sizes. Table 4 summarizes the results of the correlational analyses for continuous variables.

4. Discussion

In contrast to the findings of Corcoran and Dattalo (2006), the present review showed that BPT is an effective intervention for improving child behavior, parenting behavior, and parental perception in children with ADHD, producing an overall

Table 3
Summary of contrast tests for categorical variables.

Potential moderators	k^a	Mean r	Z	p^b
Mode of BPT				
BPT + other treatment	23	.35		
vs.			.35	.36
BPT	17	.33		
Delivery of BPT				
Group	25	.35		
vs.			.91	.18
Individual	9	.47		
Comparison group				
Other treatment	19	.31		
vs.			.31	.49
No treatment	21	.36		
Program participants				
Parent and child	23	.32		
vs.			.33	.37
Parent alone	15	.35		
Participants' SES				
Average SES	28	.28		
vs.			1.32	.09
Low SES	5	.53		

Note. BPT, behavioral parent training; SES, socioeconomic status.

^a The number of studies that contributed to the average effect size.

^b Significance level for the difference between two mean r values.

Table 4

Summary of correlational analyses for continuous variables.

Potential moderators	k^a	r^b
Rating of methodological rigor ^c	40	-.38**
Percentage of single parents	23	.07
Mother's age ^d	14	-.21
Child's age ^d	35	-.20
Comorbidity rate with ODD	23	-.36*

Note. ODD, oppositional defiant disorder.

^a The number of studies that contributed to the correlational analysis.

^b Pearson product-moment correlations were computed for the relation between effect size and each potential moderator.

^c Methodological rigor was rated on a 8-point scale, including random assignment, group equivalency, multiple methods for outcome assessment, clarity in intervention description, inclusion of sufficient statistics for effect size calculation, use of standardized measures, and use of a treatment manual (Lundahl et al., 2006).

^d Average age across studies under analysis.

* $p < .05$.

** $p < .01$.

moderate effect size immediately after treatment. Up to 3 years after the completion of BPT, the effects remained meaningful but were small in magnitude.

4.1. Sustainability of effects

Difficulty with sustaining changes over time was noted for both parent and child behavior. The effect of BPT dissipated rapidly when the behavioral contingencies were terminated, which was more likely to happen when assistance provided by the group or the therapist ended at follow-up (Hinshaw, 2009). Follow-up sessions of BPT may be necessary to address continuous use of the contingency techniques at home.

Although behavioral contingency techniques outside the treatment session was an important part of BPT, the focus of this regimen was to adapt the contingency techniques to difficult times at home or in public places (Antshel & Barkley, 2008; Barkley et al., 2008). Studies of home activities of children with ADHD found that parents needed to consider the needs and ability of the child with ADHD, needs of other children in the family, and parental work and house chore schedules when the family activities and schedules were arranged (Segal & Frank, 1998). Parental use of behavioral contingency techniques needs to be integrated into the family's daily activities and routine (Segal, 1998). This may contribute to a better fit of BPT with family life and improve the durability of the intervention effects.

4.2. Comorbidity of children with ADHD

This meta-analysis found a negative correlation between the effect sizes of BPT for children with ADHD comorbid with ODD or other behavioral problems. The effects of BPT decreased in these children. Multisystemic therapy was an empirically supported intervention for children with ADHD comorbid with other behavioral problems (Curtis, Ronan, & Bordin, 2004). Multisystemic therapy was based on behavioral principles, parent engagement, and successful participation of the child in home, school, and community activities.

4.3. Implications for developmental intervention

This meta-analysis supported the value of use of BPT for children with ADHD, especially for those without comorbid behavioral problems. A developmental therapist may help parents implement behavioral contingency techniques in their daily activities and adjust to the possible change in the family's daily routines. Durability of the intervention effects should be monitored regularly. Therapists may examine for possible causes when the effects decline.

Developmental therapists should take the child's levels of comorbid behavioral problems into account when evaluating and planning a treatment program for a child with ADHD. An individualized program tailored to the needs of a child with ADHD comorbid with behavioral problems and his or her family is required. It is important to adopt a multidimensional approach and include the child, family, and environmental factors (Chu & Reynolds, 2007). Accordingly, specific interventions may vary widely but may include intrapersonal (e.g., sensory integration therapy for the child), family (e.g., an integrated behavioral management and sensory diet program), and systemic interventions (e.g., engaging the child into more adaptive peer activities in school or community such as school choir) (Henggeler & Lee, 2003).

4.4. Direction for future research

Future studies are needed to examine the outcomes of combining BPT with adaptation of home activities and routines for children with ADHD. How ADHD subtypes and methods of ADHD identification (e.g., by diagnostic interview or by

caregiver's rating) may moderate the effect of BPT should be explored in future studies. In addition, future meta-analyses may examine BPT and non-BPT effect for children with ADHD and include outcomes of the child's adjustment and parental well-being.

4.5. Limitations of this meta-analysis

When an eligible study compared a group receiving BPT with groups receiving other interventions as well as with a no-treatment control group, this meta-analysis chose an alternative treatment group for comparison. The choice of the comparison group might have confounded the contrast between BPT combined with another intervention and BPT alone. No sufficient studies are available to evaluate the interaction effect of the comparison group and BPT that was delivered alone or combined with other interventions. Maintaining treatment outcomes was an important issue in BPT. No sufficient studies were available to explore the possible moderators of follow-up outcomes of BPT. As a further limitation, this meta-analysis excluded outcomes of the child's adjustment and parental well-being or marital satisfaction.

5. Conclusion

This meta-analysis supported BPT as an effective intervention for children with ADHD in the area of child behavior as well as parenting behavior and perception. The immediate effects were moderate and decreased to small at follow-up. Follow-up sessions that address continued use of behavioral contingency techniques may be important for studying the durability of the intervention effects. Embedding BPT within the daily activities of the family may contribute to a better fit of BPT with the family's life and improve the durability of the intervention effects. Children with ADHD and other comorbid behavioral problems benefited less from BPT than children with ADHD only.

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References

References marked with an asterisk indicate studies included in the meta-analysis.

- *Abikoff, H., Hechtman, L., Klein, R. G., Gallagher, R., Fleiss, K., Etcovitch, J., et al. (2004). Social functioning in children with ADHD treated with long-term methylphenidate and multimodal psychosocial treatment. *Journal of the American Academy of Child and Adolescent Psychiatry*, 43, 820–829.
- *Abikoff, H., Hechtman, L., Klein, R. G., Weiss, G., Fleiss, K., Etcovitch, J., et al. (2004). Symptomatic improvement in children with ADHD treated with long-term methylphenidate and multimodal psychosocial treatment. *Journal of the American Academy of Child and Adolescent Psychiatry*, 43, 802–811.
- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text revision). Washington, DC: Author.
- Antshel, K. M., & Barkley, R. A. (2008). Psychosocial interventions in attention deficit hyperactivity disorder. *Child and Adolescent Psychiatric Clinics of North America*, 17, 421–437.
- *Anastopoulos, A. D., Shelton, T. L., DuPaul, G. J., & Guevremont, D. C. (1993). Parent training for attention-deficit hyperactivity disorder: Its impact on parent functioning. *Journal of Abnormal Child Psychology*, 21, 581–596.
- *Arnold, L. E., Chuang, S., Davies, M., Abikoff, H. B., Conners, C. K., Elliott, G. R., et al. (2004). Nine months of multicomponent behavioral treatment for ADHD and effectiveness of MTA fading procedures. *Journal of Abnormal Child Psychology*, 32, 39–51.
- *Barkley, R. A., Edwards, G., Laneri, M., Fletcher, K., & Metevia, L. (2001). The efficacy of problem-solving communication training alone, behavior management training alone, and their combination for parent-adolescent conflict in teenagers with ADHD and ODD. *Journal of Consulting and Clinical Psychology*, 69, 926–941.
- *Barkley, R. A., Guevremont, D. C., Anastopoulos, A. D., & Fletcher, K. F. (1992). A comparison of three family therapy programs for treating family conflicts in adolescents with attention-deficit hyperactivity disorder. *Journal of Consulting and Clinical Psychology*, 60, 450–462.
- Barkley, R. A., Robin, A. L., & Benton, C. M. (2008). *Your defiant teen: 10 steps to resolve conflict and rebuild your relationship*. New York: Guilford.
- *Barkley, R. A., Shelton, T. L., Crosswait, C., Moorehouse, M., Fletcher, K., Barrett, S., et al. (2000). Multi-method psycho-educational intervention for preschool children with disruptive behavior: Preliminary results at post-treatment. *Journal of Child Psychology and Psychiatry*, 41, 319–332.
- *Beyer, M. M. (1994). *Group parent training for attention deficit hyperactivity disorder* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Database. (UMI 9503531).
- *Bloomquist, M. L., August, G. J., & Ostrander, R. (1991). Effects of a school-based cognitive-behavioral intervention for ADHD children. *Journal of Abnormal Child Psychology*, 19, 591–605.
- *Bor, W., Sanders, M. R., & Markie-Dadds, C. (2002). The effects of triple P-positive parenting program on preschool children with co-occurring disruptive behavior and attentional/hyperactive difficulties. *Journal of Abnormal Child Psychology*, 30, 571–587.
- Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to meta-analysis*. Chichester, West Sussex, UK: Wiley.
- *Burrows, F. B. (2000). *The effect of parental involvement on social skills training for children with and without attention deficit hyperactivity disorder* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Database. (UMI 3011618).
- *Chacko, A., Wymbs, B. T., Wymbs, F. A., Pelham, W. E., Swanger-Gagne, M. S., Girio, E., et al. (2009). Enhancing traditional behavioral parent training for single mothers of children with ADHD. *Journal of Clinical Child and Adolescent Psychology*, 38, 206–218.
- *Chronis, A. M., Gamble, S. A., Roberts, J. E., & Pelham, W. E. (2006). Cognitive-behavioral depression treatment for mothers of children with attention-deficit/hyperactivity disorder. *Behavior Therapy*, 37, 143–158.
- Chu, S., & Reynolds, F. (2007). Occupational therapy for children with attention deficit hyperactivity disorder (ADHD). Part 1: A delineation model of practice. *British Journal of Occupational Therapy*, 70, 372–383.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Corcoran, J., & Dattalo, P. (2006). Parent involvement in treatment for ADHD: A meta-analysis of the published studies. *Research on Social Work Practice*, 16, 561–570.

- *Cruz, M. (2009). *Behavior parent training and fathers of young children with ADHD* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Database. (UMI 3356019).
- *Cunningham, C. E., Bremner, R., & Boyle, M. (1995). Large group community-based parenting programs for families of preschoolers at risk for disruptive behaviour disorders: Utilization, cost effectiveness, and outcome. *Journal of Child Psychology and Psychiatry*, 36, 1141–1159.
- Curtis, N. M., Ronan, K. R., & Borduin, C. M. (2004). Multisystemic treatment: A meta-analysis of outcome studies. *Journal of Family Psychology*, 18, 411–419.
- Deault, L. C. (2010). A systemic review of parenting in relation to the development of comorbidities and functional impairments in children with attention-deficit/hyperactivity disorder (ADHD). *Child Psychiatry and Human Development*, 41, 168–192.
- *Dubey, D. R., O'Leary, S. G., & Kaufman, K. F. (1983). Training parents of hyperactivity children in child management: A comparative outcome study. *Journal of Abnormal Child Psychology*, 11, 229–246.
- *Ercan, E. S., Varan, A., & Deniz, Ü. (2005). Effects of combined treatment on Turkish children diagnosed with attention-deficit/hyperactivity disorder: A preliminary report. *Journal of Child and Adolescent Psychopharmacology*, 15, 203–219.
- *Fallone, G. P. (1999). *Treatment for maternal distress as an adjunct to parent training for children with attention-deficit/hyperactivity disorder* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Database. (UMI 9920505).
- *Firestone, P., Kelly, M. J., Goodman, J. T., & Davey, J. (1981). Differential effects of parent training and stimulant medication with hyperactives: A progress report. *Journal of the American Academy of Child Psychiatry*, 20, 135–147.
- *Frankel, F., Myatt, R., Cantwell, D. P., & Feinberg, D. T. (1997). Parent-assisted transfer of children's social skills training: Effects on children with and without attention-deficit hyperactivity disorder. *Journal of the American Academy of Child and Adolescent Psychiatry*, 36, 1056–1064.
- Friedman, H. (1968). Magnitude of experimental effect and a table for its estimation. *Psychological Bulletin*, 70, 245–251.
- *Hechman, L., Abikoff, H., Klein, R. G., Weiss, G., Respitiz, C., Kouri, J., et al. (2004). Academic achievement and emotional status of children with ADHD treated with long-term methylphenidate and multimodal psychosocial treatment. *Journal of the American Academy of Child and Adolescent Psychiatry*, 43, 812–819.
- *Hechman, L., Abikoff, H., Klein, R. G., Greenfield, B., Etcovitch, J., Cousins, L., et al. (2004). Children with ADHD treated with long-term methylphenidate and multimodal psychosocial treatment: Impact on parental practices. *Journal of the American Academy of Child and Adolescent Psychiatry*, 43, 830–838.
- Henggeler, S. W., & Lee, T. (2003). Multisystemic treatment of severe clinical problem. In A. E. Kazdin & J. R. Weisz (Eds.), *Evidence-based psychotherapies for children and adolescents* (pp. 301–322). NY: Guilford.
- Hinshaw, S. P. (2009). Psychosocial interventions for ADHD and comorbidities. In T. E. Brown (Ed.), *ADHD comorbidities* (pp. 385–398). Arlington, VA: American Psychiatric Publishing.
- *Hoofdakker, B., van den Veen-Mulders, L., Sytema, S., Emmelkamp, P. M. G., Minderaa, R. B., & Hauta, M. H. (2007). Effectiveness of behavioral parent training for children with ADHD in routine clinical practice: A randomized controlled study. *Journal of the American Academy of Child and Adolescent Psychiatry*, 46, 1263–1271.
- *Horn, W. F., Ialongo, N., Popovich, S., & Peradotto, D. (1987). Behavioral parent training and cognitive-behavioral self-control therapy with ADD-H children: Comparative combined effects. *Journal of Clinical Child Psychology*, 16, 57–68.
- *Jensen, P. S., Arnold, L. E., Swanson, J. M., Vitiello, B., Abikoff, H. B., Greenhill, L. L., et al. (2007). 3-Year follow-up of the NIMH MTA study. *Journal of the American Academy of Child and Adolescent Psychiatry*, 46, 989–1002.
- *Jones, K., Daley, D., Hutchings, J., Bywater, T., & Eames, C. (2007). Efficacy of the incredible years basic parent training programme as an early intervention for children with conduct problems and ADHD. *Child: Care, Health and Development*, 33, 749–756.
- *Kern, L., DuPaul, G. J., Volpe, R. J., Sokol, N. G., Lutz, G., Arbolino, L. A., et al. (2007). Multisetting assessment-based intervention for young children at risk for attention deficit hyperactivity disorder: Initial effects on academic and behavioral functioning. *School Psychology Review*, 36, 237–255.
- *Klein, R. G., & Abikoff, H. (1997). Behavior therapy and methylphenidate in the treatment of children with ADHD. *Journal of Attention Disorders*, 2, 89–114.
- *Lehner-Dua, L. L. (2001). *The effectiveness of Russell A. Barkley's parent training program on parents with school-aged children who have ADHD on their perceived severity of ADHD, stress, and sense of competence* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Database. (UMI 3030505).
- Lundahl, B., Risser, H. J., & Lovejoy, M. C. (2006). A meta-analysis of parent training: Moderators and follow-up effects. *Clinical Psychological Review*, 26, 86–104.
- Matson, J. L., Mahan, S., & LoVullo, S. V. (2009). Parent training: A review of methods for children with developmental disabilities. *Research in Developmental Disabilities*, 30, 961–968.
- *McGoey, K. E., DuPaul, G. J., Eckert, T. L., Volpe, R. J., & Brakle, J. V. (2005). Outcomes of a multi-component intervention for preschool children at-risk for attention-deficit/hyperactivity disorder. *Child & Family Behavior Therapy*, 27, 33–56.
- *MTA Cooperative Group. (2004). National institute of mental health multimodal treatment study of ADHD follow-up: 24-month outcomes of treatment strategies for attention-deficit/hyperactivity disorder. *Pediatrics*, 113, 754–761.
- *Odom, S. E. (1996). Effects of an educational intervention on mothers of children with attention deficit hyperactivity disorder. *Journal of Community Health Nursing*, 13, 207–220.
- *Oord, S., Prins, P. J. M., Oosterlaan, J., & Emmelkamp, P. M. G. (2007). Does brief, clinically based, intensive multimodal behavior therapy enhance the effects of methylphenidate in children with ADHD? *European Child & Adolescent Psychiatry*, 16, 48–57.
- *Peed, S., Roberts, M., & Forehand, R. (1977). Evaluation of the effectiveness of a standardized parent training program in altering the interaction of mothers and their noncompliant children. *Behavior Modification*, 1, 323–350.
- *Pelham, W. E., Schnedler, R. W., Bender, M. E., Nillson, D. E., Miller, J., Budrow, M. S., et al. (1983). The combination of behavior therapy and methylphenidate in the treatment of attention deficit disorders: A therapy outcome study. In L. Bloomingdale (Ed.), *Attention deficit disorder III: New research in attention treatment & psychopharmacology* (pp. 29–48). Oxford, UK: Pergamon.
- *Pffiffer, L. J., & McBurnett, K. (1997). Social skills training with parent generalization: Treatment effects for children with attention deficit disorder. *Journal of Consulting and Clinical Psychology*, 65, 749–757.
- *Pisterman, S., McGrath, P., Firestone, P., Goodman, J. T., Webster, I., & Mallory, R. (1989). Outcome of parent-mediated treatment of preschoolers with attention deficit disorder with hyperactivity. *Journal of Consulting and Clinical Psychology*, 57, 628–635.
- *Pisterman, S., Firestone, P., McGrath, P., Goodman, J. T., Webster, I., Mallory, R., et al. (1992a). The role of parent training in treatment of preschoolers with ADHD. *American Journal of Orthopsychiatry*, 62, 397–408.
- *Pisterman, S., Firestone, P., McGrath, P., Goodman, J. T., Webster, I., Mallory, R., et al. (1992b). The effects of parent training on parenting stress and sense of competence. *Canadian Journal of Behavioral Science*, 24, 41–58.
- *Reddy, L., Braunstein, D., Springer, C., Bartik, C., & Hauch, Y. (2002). *Randomized trial of three child/parent training groups for ADHD children*. Paper presented at the 110th Annual Conference of the American Psychological Association, Chicago, IL. (ERIC Document Reproduction Service No. ED 472961).
- Rosenthal, R. (1991). *Meta-analytic procedures for social research* (rev. ed.). New York: Irving Press.
- Segal, R. (1998). The construction of family occupations: A study of families with children who have attention deficit/hyperactivity disorder. *Canadian Journal of Occupational Therapy*, 65, 286–292.
- Segal, R. (2000). Adaptive strategies of mothers with children with attention deficit hyperactivity disorder: Enfolding and unfolding occupations. *American Journal of Occupational Therapy*, 54, 300–306.
- Segal, R., & Frank, G. (1998). The extraordinary construction of ordinary experience: Scheduling daily life in family with children with attention deficit hyperactivity disorder. *Scandinavian Journal of Occupational Therapy*, 5, 141–147.
- Segal, R., & Hinojosa, J. (2006). The activity setting of homework: An analysis of three cases and implications for occupational therapy. *American Journal of Occupational Therapy*, 60, 50–59.
- *So, Y.-C. (2005). *Effectiveness of methylphenidate and combined treatment (methylphenidate and psychosocial treatment) for Chinese children with attention-deficit/hyperactivity disorder in a community mental health center* (Doctoral dissertation). Available from ProQuest Dissertations and Theses Database. (UMI 3222723).
- *Sonuga-Barke, E. J. S., Daley, D., Thompson, M., Laver-Bradbury, C., & Weeks, A. (2001). Parent-based therapies for preschool attention-deficit/hyperactivity disorder: A randomized, controlled trial with a community sample. *Journal of the American Academy of Child Adolescent Psychiatry*, 40, 402–408.

- *Sonuga-Barke, E. J. S., Thompson, M., Daley, D., & Laver-Bradbury, C. (2004). Parent training for attention deficit/hyperactivity disorder: Is it as effective when delivered as routine rather than as specialist care? *British Journal of Clinical Psychology, 43*, 449–457.
- *Strayhorn, J. M., & Weidman, C. S. (1989). Reduction of attention deficit and internalizing symptoms in preschoolers through parent–child interaction training. *Journal of the American Academy of Child Adolescent Psychiatry, 28*, 888–895.
- *Treacy, L., Tripp, G., & Baird, A. (2005). Parent stress management training for attention-deficit/hyperactivity disorder. *Behavioral Therapy, 36*, 223–233.
- *Tutty, S., Gephart, H., & Wurzbacher, K. (2003). Enhancing behavioral and social skill functioning in children newly diagnosed with attention-deficit hyperactivity disorder in a pediatric setting. *Developmental and Behavioral Pediatrics, 24*, 51–57.
- *Wells, K. C., Epstein, J. N., Hinshaw, S. P., Conners, C. K., Klaric, J., Abikoff, H. B., et al. (2000). Parenting and family stress treatment outcomes in attention deficit hyperactivity Disorder (ADHD): An empirical analysis in the MTA study. *Journal of Abnormal Child Psychology, 28*, 543–553.
- *Wells, K. C., Chi, T. C., Hinshaw, S. P., Epstein, J. N., Piffner, L., Nebel-Schwalm, M., et al. (2006). Treatment-related changes in objectively measured parenting behaviors in the multimodal treatment study of children with attention-deficit/hyperactivity disorder. *Journal of Consulting and Clinical Psychology, 74*, 649–657.