



Internet-based parent management training: A randomized controlled study

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ABSTRACT

Objective: The current study evaluated the efficacy of an Internet-based parent-training program for children with conduct problems. Dose–response ratio and costs for the program were also considered. **Method:** Parents of 104 children (aged 3–12 years) were randomly allocated to either parent training or a waitlist control condition. Diagnostic assessment was conducted at baseline and parent ratings of child externalizing behaviors and parent strategies were completed before and after treatment and at 6-month follow-up.

Results: At post-treatment assessment, children whose parent(s) had received the intervention showed a greater reduction in conduct problems compared to the waitlist children. Between group intent-to-treat effect sizes (Cohen's *d*) on the Eyberg Intensity and Problem scales were .42 and .72, respectively (study completers .66 and 1.08). In addition, parents in the intervention group reported less use of harsh and inconsistent discipline after the treatment, as well as more positive praise. Effects on behavior problems were maintained at 6-month follow-up.

Conclusions: The results support the efficacy of parent training, administered through Internet, with outcomes comparable to many of the group-based parent training programs. The efficacy, low cost, and higher accessibility make this intervention a fitting part in a stepped-care model.

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Introduction

Early behavior problems, characterized by serious oppositional, aggressive and disruptive behaviors, often have a major negative impact on child development and family functioning (Loeber & Farrington, 2001). Both the personal and societal costs are huge, with a ten-fold increase in costs for social work, education and criminal justice when disruptive behaviors are untreated (Scott, Knapp, Henderson, & Maughan, 2001). Longitudinal research indicates that the earlier a child shows disruptive behavior problems, the greater is the risk that problems worsen and persist into adulthood (Loeber & Farrington, 2001; Moffitt, 1993). Children with these problems constitute one of the most common referrals to child and adolescent mental health clinics (Loeber & Farrington, 2001). For health-care agencies, it is of superior significance to provide evidence-based treatments at an early age for behavior problems not to become entrenched.

Abbreviations: CD, Conduct Disorder; ODD, Oppositional Defiant Disorder; PMT, Parent Management Training.

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Parent Management Training (PMT) programs focus on teaching parents parenting strategies for handling behavior problems, implementing behavior modification programs and improving the quality of the child–parent relationship. The main aim is to change negative interactions, coercive cycles and processes including harsh and inconsistent parenting, between parent and child (Patterson, 1982). This is for instance achieved through improved positive involvement with the child, parental attention on and praise for alternative good behaviors, enhanced parental communication with the child, shorter instructions, and celebration when a desirable behavior is accomplished. Treatment also includes teaching parents strategies for how to be constructively consistent and predictable in parenting, establish explicit rules for behaviors and how to handle misbehaviors. Several studies report improved parenting practices such as reduced harsh and inconsistent parenting and improved positive incentives to be related to good treatment effects (Beauchaine, Webster-Stratton, & Reid, 2005; Kling, Forster, Sundell, & Melin, 2010; Ogden & Hagen, 2008). PMT programs are among the most extensively studied treatments for conduct problems. There is considerable empirical support for their effectiveness (e.g., Dretzke et al., 2009; Eyberg, Nelson, & Boggs, 2008; Lundahl, Risser, & Lovejoy, 2006; Serketich & Dumas, 1996), suggesting that PMT leads to short-term reductions of conduct problem behavior, with moderate effects sizes. PMT is therefore recommended as selective

and indicated prevention programs for families with children below 12 years of age showing full syndromal or early sign of such problems (NICE, 2006). Today, a host of different PMT programs exists. Some programs are delivered with parents in groups (e.g., the Incredible Years, IY; Webster-Stratton & Reid, 2010) while other programs are delivered individually (e.g., Parent Management Training Oregon, PMTO; Patterson, Reid, Jones, & Conger, 1975). A few programs show video-vignettes of parent–child–interactions to promote discussions about positive parenting (e.g., IY; Webster-Stratton & Reid, 2010; Comet; Kling et al., 2010), and have parallel treatment sessions for children targeting themes such as development of social skills, problem-solving, and anger management (e.g., IY; Webster-Stratton & Reid, 2010), whereas other programs partly include children and parents together in therapy (e.g., Parent–Child Interaction Therapy; PCIT; Brinkmeyer & Eyberg, 2003). Parent Management Training Oregon Model (Patterson et al., 1975) was the first PMT-treatment developed and is regarded a well-established treatment for children with disruptive behavior (Eyberg et al., 2008). A Swedish group-based PMT program, Comet (COMMUNICATION METHOD) was developed including similar parent-training components as in the PMTO (Patterson et al., 1975) and the Incredible Years (Webster-Stratton & Reid, 2010). Comet has been evaluated in three studies (an initial pilot study by Hassler & Havbring, 2003; a pre-post design by Kling, Sundell, Melin, & Forster, 2006; and an RCT by Kling et al., 2010), with moderate to large effect sizes compared to a waiting list (Kling et al., 2010).

Unfortunately, not all families with a child that suffers from conduct problems have access to or possibility to participate in a PMT treatment. This is partly due to lack of professionals educated in PMT, or parental difficulties participating in a program because of working hours, day-care time limits or unawareness about the programs. Often, families have to wait to receive treatment, with a risk for escalating problems. Studies also indicate that about 1/3 of the parents who engage in PMT continue to report behavioral problems after treatment (Kazdin, 2005). In addition, 30–50% treatment-dropouts have been reported (Fonagy & Kurtz, 2002; Kazdin, 2005). To increase treatment availability and cost-effectiveness, different stages of prevention and full treatment interventions with various doses and formats are needed in stepped care models for this group of children and their families as in most other areas within psychiatry and psychosocial care. Self-help programs are becoming promising options as a first step in such models. Further, in psychiatry and psychotherapy in general, a dose–response pattern within some limits has been shown repeatedly (for a review and discussion see Hansen, Lambert, & Forman, 2002). To identify the adequate dose for a significant outcome to be obtained, the dose–response pattern of a specific treatment is an issue worth further investigation.

Internet as a way of distributing PMT

Parallel with the development of self-help programs for various psychiatric disorders, treatment programs are continuously being transformed into Internet-delivered treatments (Marks, Cavanagh, & Gega, 2007). Evaluations of programs for adult psychiatric problems, e.g. panic disorder (Carlbring, Westling, Ljungstrand, Ekselius, & Andersson, 2001), depression (Andersson et al., 2005), and eating disorders (Ljótsson et al., 2007) show similar effects as therapist-delivered treatments (for a review, see Marks et al., 2007). Until today, only a limited number of Internet-based treatments targeting children's problems have been evaluated. Positive effects have been reported for Internet-based CBT for chronic pain (Palermo, Wilson, Peters, Lewandowski, & Somhegyi, 2009), anxiety disorders (March, Spence, & Donovan, 2009), and behavior problems in children with traumatic brain injury (Wade, Oberjohn,

Burkhardt, & Greenberg, 2009; Wade, Wolfe, Brown, & Pestian, 2005). Taylor et al. (2008) describe an implementation of a computer-based Incredible Years with the addition of personal coaching through telephone calls, electronic messages, and home visits. Of the 90 parents of an at-risk population participating in the program, 66% completed the whole program and 76% completed more than half of the program. Generally, the families were positive (87% of 83 parents) and felt confident about how to handle future behavior problems (76%). Treatment effects were not reported. Advantages with Internet-based treatments are that information easily can be up-dated, the format is standardized and not therapist-dependent, and it is more easily accessible for participants. More specifically, the client can get access to treatment strategies when they have the time. For families with conduct-problem children, Internet might be a potent and viable channel for providing support and guidance at an early stage. If found effective, it could also be part of a stepped-care model, enabling families of children with less severe behavior problems to get access to treatment strategies whereas therapists could have time for families with children showing more severe problems or at high risk for continued problems.

Aims

The overall aim of the present study was to evaluate the effects of an Internet-based parent management treatment (PMT) for parents of children aged 3–12 years with conduct problems, compared to a waiting list control group in a randomized controlled trial. The first hypothesis was that the effect of the program, in terms of child behavior problems, child prosocial behavior, and parenting strategies would be both statistically and clinically significant compared to the waiting list control condition, and effects maintained after 6 months for the intervention group. The second hypothesis was that we would find a dose–response relationship to outcome, i.e. those who follow the PMT program to higher extent achieve more beneficial outcomes. The third hypothesis was that the internet-based program would be cost-effective.

Method

Design

The study was an experimental randomized controlled study. Parents were consecutively randomly assigned to either (1) 10 weeks of Internet-based PMT, or (2) a waiting list control group, receiving PMT training after their post-measurement three months after entering the study. Baseline data was collected at the university clinic and through Internet-based questionnaires, and otherwise through the Internet at post-measurement after the end of the treatment. The present paper covers data from pre- and post-measurement and a 6-month follow-up.

Participants

Parents of 129 children reported interest in the study. Of these parents, 109 entered the study after scoring above the criteria for clinically relevant problems, i.e., one SD above the mean in relation to each age group and gender, according to the Swedish norms (Axberg, Johansson Hanse, & Broberg, 2008) of the Eyberg Child Behavior Inventory (ECBI; Eyberg & Pincus, 1999). Five of these parents/families failed to complete the assessments due to technical complications at the web site and are not included in the analyses in the current study, resulting in a sample of 104 children. Of the children, 101 (97%) were born in Sweden. In total, 77 (74%) of

the mothers and fathers had a high school education. In 72 (69.2%) cases, both parents participated in the treatment. In the other families, either the mothers ($N = 29$; 27.9%) or fathers ($N = 3$; 2.9%) participated. In each case, the parent responding to pre-treatment battery of questionnaires was urged to do the post-treatment assessment. Mean age of the children was 6.83 ($SD = 2.3$, range = 3–12) years. There were 60 (57.7%) boys and 44 (42.3%) girls in the sample. In total, 86 parents (82%) participated in the post-measurement and completed questionnaires about their child's aggressive and conduct problem behaviors.

Procedure

The study was undertaken during spring 2009 to autumn 2010. Participants recruited to the study were families with children aged 3–12 years displaying behavioral problems. The families were consecutively reporting to the study after advertisements in newspapers in Mid-Sweden, and information on the Internet, at campus, child- and adolescent psychiatry, and at schools. The parents were referred to a homepage on the Internet where they received information about the study and were invited to contact the research group for more information. The parents were informed that it was voluntary to participate in the study, and that they could choose to withdraw at any time. After obtaining written informed consent, the parents were asked to fill in a questionnaire measuring frequency of child behavior problems, the Eyberg Child Behavior Inventory (ECBI; Eyberg & Pincus, 1999). Those above cut off (109 parents) were scheduled to participate in a face-to-face semi-structured interview of 1.5 h at the university clinic with a trained research assistant/psychologist. The parents were also asked to respond to a set of questionnaires on the Internet with background information about the family, i.e. child age, school functioning, parental education and profession, and to complete child behavior questionnaires. Twenty families were below cut off at the screening, i.e. not one SD above the mean on the ECBI in relation to the age of the child. They were instead given references to appropriate literature and information about how to contact a child- and adolescent psychiatric unit in their community.

The research assistants/psychologists had training in cognitive behavior therapy. Three were experienced psychologists/CBT-therapists. Two were last-year graduate students in a program for Master of Science in Psychology oriented toward cognitive behavior therapy, and supervised by an experienced clinical psychologist/licensed psychotherapist. All research assistants received a 1-day training in how to deliver treatment through the Internet. Since the PMT treatment was standardized and available on the Internet for the parents, this training mainly consisted of training in how to handle the computer system, and how to respond to parents' questions (i.e., helping with clarifications, and providing support in order to help parents follow the program, and not conducting psychotherapy per se).

During the interview, which was undertaken at the university clinic, the research assistants repeated information about the study, that participation was voluntary and that the parents at any time could choose to withdraw from the study. The parents were given opportunity to ask questions about the PMT program and the study. After verbal and written consent was given, the parents provided information about their child's behavior and the family situation, to obtain DSM-IV-based diagnoses and the Early Assessment Risk List (EARL assessments). Explicit difficulties in speaking and understanding the Swedish language constituted an exclusion criterion, since the PMT program was in Swedish. Other exclusion criteria were child psychosis, suicidal risk, or abuse/violence between family members. No family was excluded from the study due to the exclusion criteria.

After the interview was completed, the research assistant opened a sealed envelope with the randomized group for the parents, i.e. PMT program or waiting list. The randomization procedure was undertaken by the research project leader (the last author) using an online Randomizer (<http://www.randomizer.org>). The research assistants were blind until the end of the interview regarding the outcome of randomization for the family. The research assistants were the contact person for the parents and supported the parents in their work with the program. Mean duration of support was 5 h and 10 min per family. Directly after working with the final session of the PMT program, the parents completed the same questionnaires through the Internet, as at baseline. The parents were also contacted for a 6-month follow-up (mean = 7 months, mode = 6 months). The Regional Research Ethics Committee approved of the study.

Attrition

Of the 104 families included in the study, 86 (83%) participated in first post measurements, i.e., 79% of the intervention group and 86% of the control group. All 58 parents randomized to treatment participated in the introduction part of the intervention (see the consort diagram, Fig. 1). Of these families, 38 (65.5%) completed all 7 sessions, 13 (22.4%) completed between 3 and 6 sessions, and 8 (15.5%) completed fewer than 3 sessions. Participants with fewer than 3 sessions ($N = 8$) are defined as dropouts from treatment. There were no significant differences on demographic data or baseline measures between those remaining in treatment and those dropping out. The intervention group was followed up after 6 months. The attrition was rather high with only 46.6% ($n = 27$) of the parents providing follow-up data. The attrition group was not significantly different from the responders on any background variables.

The Internet-based PMT-treatment

The treatment was theoretically based on social learning theory/cognitive-behavior therapy. It was developed from a Swedish PMT program, Comet, with good outcome in recent studies (Kling et al., 2010, 2006) and adapted for Internet and intervention at individual level, compared to Comet, which is delivered as a group intervention. The Internet-PMT covered similar themes as other Parent Management Programs do, but had fewer sessions (7 sessions, compared to 11 sessions for Comet). The Internet-PMT focused more on positive parenting, communication, positive reinforcement, whereas information and work about response-cost/punishment of problematic child behavior was summarized to one session. Comet also includes instructions for a meeting between therapist, parent and the child's schoolteacher, which was not arranged through the Internet-based PMT.

The sessions provided on a secure website were composed of written text, videos of interactions between a parent/child, and illustrations. The films illustrated the main themes that were covered in each session. They contained positive modeling examples of parent/child interactions with positive reinforcement and positive parenting skills, as well as less optimal interactions, such as when a parent missed the opportunity to give positive feedback or had problem to get a child to participate (e.g., to do their homework) with the aim of having the parent reflect on what could have been done differently. Each session on the Internet took about 1.5 h to complete for the parent. The research assistants gave feedback through the website on work, and distributed a new session each week. The feedback could include reinforcement on progress reported by the parents, problem-solving with the parents to guide them in how to establish e.g. play time with their children, or

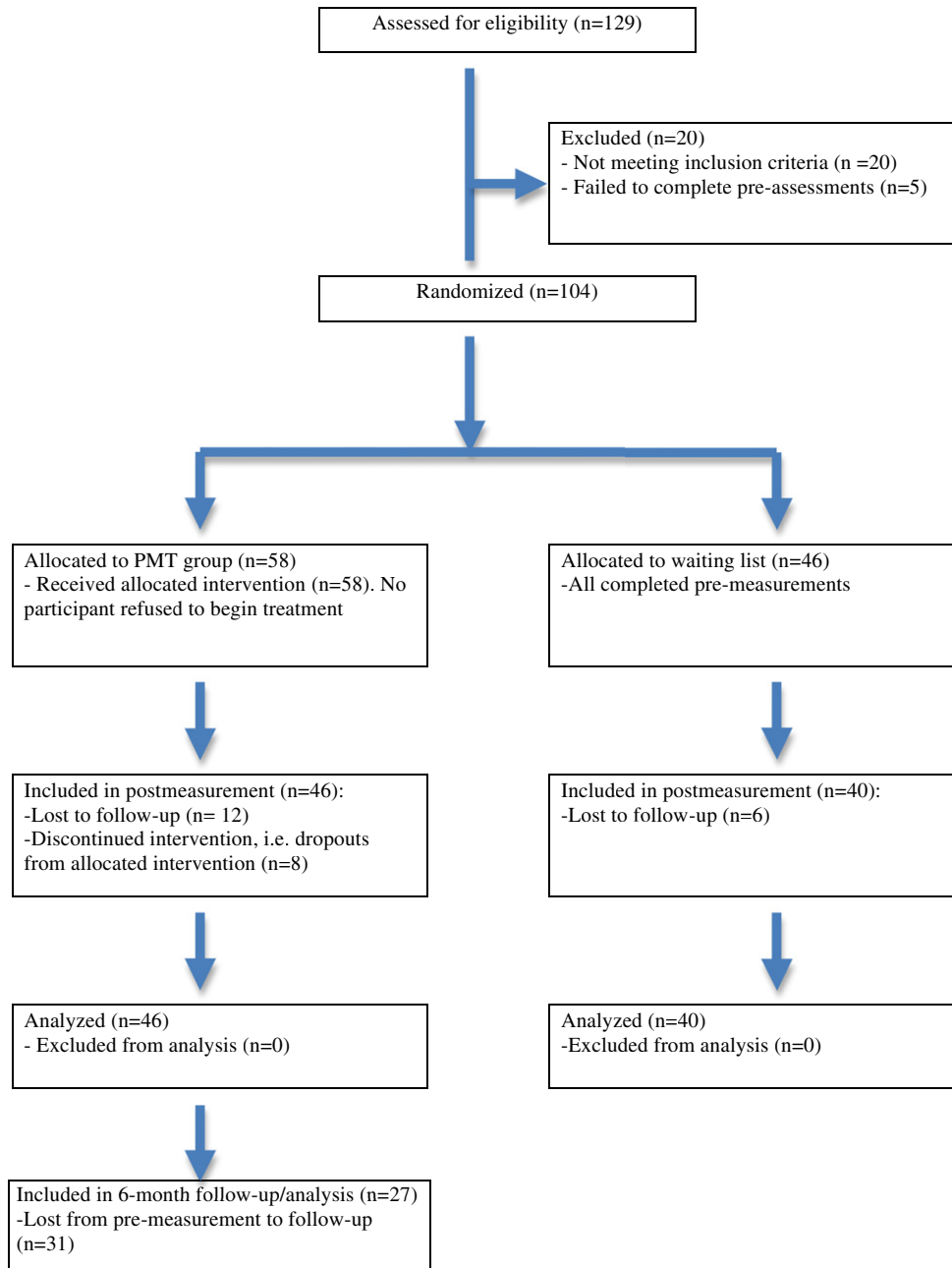


Fig. 1. Flow chart of recruitment and drop-out.

providing advice when specific questions were raised. The 7-session-program was distributed over 10 weeks, i.e., some session homework took two to three weeks to complete. The participants could download information and materials that could be useful in the treatment, e.g. a reward system. After each session, the participants answered multiple-choice questions about the content and were given direct response by the program as to whether the answers were right or wrong, by means of reinforcing statements and explanations. This was to help participants to learn the material as well as possible. A new session always started with a repetition of the most important parts of the earlier session. The participants also completed a diary on the Internet where they reported what they had been training and could comment on how the week had been. The participants had the possibility to pose questions to the research assistant and write comments to

homework or parenting on a monitored parenting discussion forum within the protected communication system of the program. The research assistant followed the parents' work on the program, and provided support and feedback on the diary.

Measures

DSM-IV diagnostics

During the baseline interview, all children were evaluated for psychiatric disorders according to the DSM-IV-TR (American Psychiatric Association, APA, 2000). The assessment was based on the Swedish version of the *Schedule for Affective Disorders and Schizophrenia for school-aged children* (K-SADS), present or lifetime diagnosis (version P/L) (Kaufman et al., 1997). The research assistants were trained through repeated assessments of case vignettes

and discussions about correct diagnosis/risk assessment score, until complete agreement/interrater reliability (100%) was achieved. Throughout the assessment phase, the research assistants had the possibility to discuss complex assessments with the first author (PE). This was undertaken in five cases (5% of the total sample).

Demographic information

The parents were asked to provide information on the following: number of children in the family and their age, school situation for the child (assistant, special class) for whom the parents participated in the study, assistance from psychiatry or social services due to child behavior, parent educational background, and profession.

The *Early Assessment Risk List-20B/21G*, (Augimeri, Koegl, Webster, & Levene, 2001; Levene et al., 2001) are structured decision aids for the assessment of risk for antisocial behavior among boys (EARL-20B), and girls (EARL-21G) up to 12 years of age. The decision aids contain 20 and 21 risk factors, respectively. The main aim with the EARL is to yield more reliable assessments and valid predictions of continued risk of antisocial behavior than unstructured clinical evaluations generally do. The EARL-20B contains items related to the family (e.g. socio-economic status, stress, coping), child factors (e.g. abuse/neglect/trauma, hyperactivity, academic deficits) and two responsiveness factors (motivation for treatment). Each item is scored 0 (absent), 1 (partially present) or 2 (definitely present). The scores of the 20 factors could be summed up into a total sum. Theoretically, the higher the total score, the higher the risk. Based on the results of the evaluation, an overall estimate of “low”, “moderate” or “high” risk of antisocial behavior could also be employed. All EARL-20B assessments were completed by the research assistants/psychologists and based on the semi-structured interview with the parents. In this study, we only included the total sum and not evaluation of risk level, in order to evaluate number of baseline risk factors among the families. Internal consistency (Cronbach’s alpha) at pre-measurement was .69.

The *Eyberg Child Behavior Inventory* (ECBI; Eyberg & Pincus, 1999) is an established, well-validated and standardized parent-rating scale assessing child behavior problems in children between the ages of 2–16 years (Swedish validation, Axberg et al., 2008). It is one of the most commonly used outcome measure in parenting intervention studies and was included as the primary measure of child behavior problems in the present study. The questionnaire consists of 36 items capturing child conduct problems, aggressive behavior, social skills and concentration problems. The ECBI has an Intensity scale, which intends to measure the frequency of various behavior problems on a 7-point Likert scale, where 1 means “never,” 4 “sometimes,” and 7 means “always” (potential range 0–252). The ECBI also includes a Problem scale for parents to indicate whether each behavior is problematic for them (yes/no; total score 0–36). Internal consistencies (Cronbach’s alpha) in the present study for the Intensity scale were .81 at pre- and .94 at post-measurement, and for the Problem scale, .79 and .88.

The *Strengths and Difficulties Questionnaire* (SDQ; Goodman, 2001) is a well-validated 25-item questionnaire for parent and teacher reports of child behavior and symptoms (Swedish validation; Smedje, Broman, Hetta, & von Knorring, 1999). Five subscales capture conduct problems, hyperactivity-inattention, emotional symptoms, peer problems, and prosocial behavior. Internal consistencies of the SDQ summary-scale in the present study were .67 and .76 (Cronbach’s alpha) at the pre- and post-measurement, respectively.

Parenting Practices Interview (PPI; Webster-Stratton, 1998; Webster-Stratton, Reid, & Hammond, 2001) is based on the Oregon Social Learning Centres (USA) questionnaire about parenting. PPI is a 80-item questionnaire measuring parenting practices,

such as how often a parent gives positive reinforcement or a reward to the child, or what strategies the parent undertakes for different problematic behaviors. The parent evaluates how often or likely he/she is to use a certain strategy on a seven-graded Likert scale, yielding a total sum between 80 and 560. In the present sample, the internal consistency (Cronbach’s alpha) was .77 and .80 for the total PPI scale at the pre- and post-measurement, respectively. In previous studies, separate outcomes have frequently been used for positive and parenting practices (e.g., Gardner, Burton, & Klimes, 2006). For that reason, in addition to reporting the total score of PPI, this study also includes analyses of two subscales of the instrument, that have been used by the developers of the instrument (Reid, Webster-Stratton, & Hammond, 2007). The first subscale represents harsh and inconsistent parenting (15 items), and the second represents praise and incentives (11 items).

Statistics

There were few non-systematic missing values for single items (.05% of the data), which were replaced by the median. At post-measurement, one single item was missing for all participants due to a technical failure. In this case, we imputed the pre-measurement item values for each individual. Student’s *t*-tests were conducted to explore differences in continuous variables at baseline between parents in the PMT-group- and waiting list group. Chi-square tests were used to explore possible differences in categorical variables between the groups at baseline. Partial eta squares and Cohens’ *d* are presented for estimation of effect sizes for the continuous variables. A Cohen’s *d* of .2 was considered a small effect, .5 a medium effect and .8 a large effect (Cohen, 1988). Clinical significance was evaluated, using a combination of the Cutoff C-criterion and Reliable Change Index (RCI) as suggested by Jacobson and Truax (1991). The Cutoff C is defined as a weighted midpoint between the means of functional and dysfunctional populations. The RCI determines whether client change is considered reliable from pretest to posttest and not due to measurement error. This procedure allowed us to classify the parents into the categories recovered, improved, unchanged, or deteriorated. Recovered parents made a reliable change and crossed the line separating normal and pathological distribution. Improved parents passed the RCI criterion but not the C cut off. Unchanged parents passed neither criteria. If deteriorated, parents made reliable change, but in the undesirable direction. Since we included several variables at outcome, we performed a multivariate analysis to evaluate the overall outcome effect, as recommended in the literature. We used repeated measures analysis of variance (ANOVA) to evaluate outcome over time for the two groups. For the Intent-to-treat-analysis, last observation carried forward was used. Dose–response analyses were done using Pearson’s correlation coefficient. The α -level was set to .05 (two-tailed). We also calculated cost effectiveness for the internet-based PMT. This was based on the total time research assistants used for supporting the families through the internet-based treatment and the monthly salary for a PMT-therapist.

Results

Baseline differences

There were no significant differences ($p < .05$) between the intervention group and the waiting list control group at baseline in terms of participant characteristics such as child age, gender, ODD-symptoms, ODD/CD-diagnoses, or demographic variables (see Table 1). Further, there were no differences on baseline

Table 1
Baseline demographic and clinical features of the intervention and control groups.

Baseline variable	Intervention (<i>n</i> = 58)	Control (<i>n</i> = 46)	Statistics	<i>p</i>
<i>Child characteristics</i>				
Age <i>M</i> (SD)	6.71 (2.31)	6.98 (2.26)	<i>t</i> (102) = .60	.55
Girls <i>N</i> (%)	27 (46.6)	17 (37.0)	χ^2 (1) = .97	.16
Boys <i>N</i> (%)	31 (53.4)	29 (63.0)	χ^2 (1) = .97	.16
Born in Sweden <i>N</i> (%)	57 (98.3)	44 (95.6)	χ^2 (1) = .63	.43
No ODD-symptoms <i>M</i> (SD)	3.64 (1.84)	3.80 (2.02)	<i>t</i> (101) = .38	.70
ODD diagnosis <i>N</i> (%)	33 (55.9)	24 (52.2)	χ^2 (1) = 1.40	.50
CD diagnosis <i>N</i> (%)	5 (8.6)	3 (6.5)	χ^2 (1) = .14	.71
<i>Parent/family characteristics</i>				
Mothers w university education <i>N</i> (%)	42 (72.4)	30 (65.2)	χ^2 (1) = .62	.43
Fathers w university education <i>N</i> (%)	33 (56.9)	27 (60.0)	χ^2 (1) = .10	.75
Total EARL-score <i>M</i> (SD)	7.9 (4.0)	7.0 (4.1)	<i>t</i> (101) = 1.10	.27
Number of children <i>M</i> (SD)	2.25 (.69)	2.33 (.67)	<i>t</i> (101) = .60	.55

measures between the two groups, and thus no need to add any covariates to the further analyses. Before treatment, 57 (55%) of the children fulfilled criteria for an ODD diagnosis (boys, *N* = 31; 51.7%; girls, *N* = 26; 59.1%) and 8 (7.6%) children had a CD diagnosis (boys, *N* = 7; 11.7%; girls, *N* = 1; 2.3%). At pre-measurement, 97.1% of all children scored above the 90th percentiles (range 114 and 208) on the ECBI Intensity scale according to age and gender in the Swedish norms (Axberg et al., 2008). The risk level according to the EARL-20B/21G total sum ranged between 0 and 19 (boys 0–19; *M* = 7.25, *SD* = 4.5; girls 2–16; *M* = 7.93, *SD* = 3.3). In total, considering presence of general child and family risk factors, the sample could be regarded to be at low to medium risk for continued risk of child conduct problems (Augimeri et al., 2001).

Post-treatment effects: parent-reported child behavior problems and strengths

When the outcome measures of child behavior (Eyberg, SDQ) were entered into a multivariate GLM Analysis, repeated measurement, the overall effect was significant ($F(1, 79) = 5.55$, $p < .001$). Similar pattern of results were obtained in the intent-to-treat-analysis with the pre-measurements imputed to the missing post-measurement variables (18 parents; 17% of the total sample; 12 intervention parents; 6 control parents), why only results for the families who completed the post-measurement are shown in Table 2.

Table 2

Baseline and post-measurement ratings of children's aggressive behavior and conduct problems reported by parents randomized to PMT or a waiting list control group (study completers), and the statistical analysis of the Time \times group interaction.

Variable	Treatment condition				<i>F</i> -analyses (<i>df</i> = 1, 85)	Partial η^2
	PMT-intervention means (SD) (<i>n</i> = 46)		Control group means (SD) (<i>n</i> = 40)			
	Pre-treatment	Post-measurement	Pre-treatment	Post-measurement		
<i>ECBI</i>						
Intensity-scale	149.02 (16.85)	111.22 (40.17)	150.85 (17.95)	133.15 (24.13)	8.95**	.10
Problem-scale	18.28 (5.40)	7.65 (5.99)	18.68 (5.44)	14.13 (6.00)	23.83**	.22
<i>SDQ</i>						
Total sum	11.02 (4.57)	8.04 (5.70)	11.56 (6.00)	12.10 (5.82)	17.01***	.17
Conduct problems	2.98 (1.44)	1.91 (1.55)	2.50 (1.32)	2.55 (1.36)	15.24***	.15
Hyperactivity	4.04 (2.31)	3.20 (2.32)	4.75 (2.79)	5.20 (2.94)	11.56***	.12
Emotional problems	2.13 (1.77)	1.61 (1.96)	2.38 (2.11)	2.48 (2.42)	3.93, $p = .051$.05
Peers	1.87 (2.05)	1.33 (1.80)	1.95 (2.14)	1.88 (1.79)	2.66	.03
Prosocial behavior	6.28 (2.07)	7.24 (1.88)	6.48 (2.31)	6.48 (2.05)	7.48**	.08

Note: ECBI = Eyberg Child Behavior Inventory; SDQ = Strengths and Difficulties Questionnaire.

* $p < .05$; ** $p < .01$; *** $p < .001$.

The between group effect sizes (ITT-analyses) for child behavior problems after treatment were in the medium range for the Eyberg Intensity scale, Eyberg Problem scale and SDQ total (Cohen's $d = .42$; .72; .62, respectively) whereas the SDQ Conduct problems scale produced a small effect size (Cohen's $d = .30$). The analysis of study completers showed somewhat larger effect sizes (Cohen's d ; Eyberg Intensity scale = .66; Eyberg Problem-scale = 1.08; SDQ total = .70; SDQ CD = .42). Secondary analyses among study completers of treatment effects for girls (*N* = 26) and boys (*N* = 20), respectively, showed a significant interaction effect between gender and treatment on the ECBI Problem scale ($F(1,44) = 4.47$, $p = .04$). Number of problematic situations, as measured on this scale, was reduced to a larger extent for girls (before treatment: *M* = 18.65 (*SD* = 4.40), after treatment: *M* = 5.75 (*SD* = 3.82)) than for boys (before treatment: *M* = 18.00 (*SD* = 6.13), after treatment: *M* = 9.12 (*SD* = 6.96)). Otherwise, the treatment effects were not affected by gender. Subgroup-analyses of study completers in the intervention group of how child age affected outcome were non-significant when results for children aged 3–6 year olds (*N* = 21) were compared to 7–12 year olds (*N* = 25). Parental participation in the program with the other parent (*N* = 35) or unaccompanied (*N* = 11), and if parents had (*N* = 37) or had not (*N* = 9) a high school education did not affect outcome.

Follow-up on behavior problems after 6 months

Core outcome was assessed in the intervention group 6 months post-treatment. The attrition was high with only 46.6% (*n* = 27 out of 58) of the parents providing 6-month follow-up data. The attrition group was not significantly different from the 6-month responders on any background variables. Due to the small sample, the magnitude of potential differences was investigated carefully in addition to paying attention to the alpha level of the analyses. There were no mentionable effects. Outcomes were maintained well at follow-up. A small (Cohens $d = .27$) but non-significant, further reduction in behavior problems emerged at follow-up for the intervention group (Eyberg Intensity scale; post-measurement *M* = 111.22 [*SD* = 40.17]; 6-month *M* = 99.30 [*SD* = 21.56]). On the other hand, a similar non-significant increase was reported for behavior problems on the Eyberg Problem scale (*M* = 7.73 post-treatment [*SD* = 4.94] to *M* = 12.35 at follow-up [*SD* = 19.68]). The increase in the Eyberg Problem scale was mostly due to deteriorations for a minority of the cases, which the high *SD* at follow-up is also an indication of. Similarly, the results were maintained for the total sum of the SDQ and all the SDQ subscales with very minor differences from post-treatment

measurement. Future longer-term follow-ups will show whether these results are maintained.

Parenting strategies

When comparing outcome for the intervention and control groups (study completers) on parenting strategies in a multivariate GLM Analysis, repeated measurement, there was an overall positive effect for the treatment group ($F(1,85) = 16.97; p < .001$). The ITT-analysis showed similar positive results. According to the PPI, parents in the intervention group reported less use of harsh and inconsistent discipline after the treatment, and more positive praise and incentives (see Table 3). No subgroup-analyses based on child gender, child age, parental high-school education or parental single or accompanied participation among study completers indicated any differences in treatment effects.

Dose–response relationship to outcome effects

Number of sessions completed by the parents ranged between 1 and 7 ($M = 5.86; SD = 1.89$). The ECBI decreased with, in average, 37.8 points (ECBI Intensity score), and 10.6 points (ECBI Problem score) between pre- and post-measurements. Within the intervention group, there was a significant correlation between the number of completed sessions and the ECBI change score from pre- to post-measurement on the ECBI Intensity scale ($r = .32, p < .05$) as well on the ECBI Problem scale ($r = .61, p < .01$). That is, parents who participated in a majority of the treatment sessions reported more improvements in child behavior problems compared to those who participated in fewer sessions. For every session the parents completed, the child behavior problems decreased by $37.8/5.86 = 6.5$ points (ECBI Intensity score), and $10.6/5.86 = 1.8$ points (ECBI Frequency score).

Reliable-change-index and clinical significance

The criteria for cut off that the participants should pass for a clinical change to be relevant was based on age- and gender-appropriate means and standard deviations of the ECBI Intensity Scale, calculated through the formula for C-criterion by Jacobson and Truax (1991) and Swedish population norms by Axberg et al. (2008). Further, the participants' change scores from pre- to post-measurement and the standard error of differences between the two test scores were used to estimate whether a reliable change had taken place over time, according to the formula for RCI by Jacobson and Truax (1991). Twice as many in the intervention group recovered as in the control group (control group $N = 14$; 35%, intervention group $N = 35$; 76.1%). i.e., the children of these parents both made a reliable change (over 1.96), and had a post-measurement assessment score below the cut off. Further, 9 (22.5%) in the control group and 2 (4.3%) in the intervention group members improved, i.e. made a reliable change but problems were not reduced below the age- and gender-dependent cut off. Finally,

13 (32.5%) and 3 (6.5%) in the control and the intervention group respectively were unchanged, whereas 4 (10%) in the control group, and 6 (13.3%) in the intervention group deteriorated, i.e., made a reliable change but in the wrong direction. Chi-square analyses showed an overall significant difference between the two groups ($\chi^2(3, 86) = 19.78; p < .001$). Within the intervention group, a similar amount of boys ($N = 20$; 76.9%) and girls ($N = 15$; 75%) recovered ($\chi^2(1, 46) = .02; p = .88$).

Costs of the Internet-based treatment

The cost for the 7-session internet-based treatment was estimated to 1106 SEK for each child. This calculation is based on the total time the research assistants worked with their families. The time estimates ranged between (2 h 45 min–5 h 40 min), with a mean of 5 h and 10 min per family. Included into this calculation is the time for registration of new participants on the Internet treatment homepage, diagnostic interview, reading the answers of the parents to multiple-choice questions generated by the program, following the comments from parents on the diary, giving feedback on each session and allowing the parents access to new sessions. Further, the costs were based on the mean monthly salary for a child-welfare officer in Sweden. Including social charges, this was 37 700 SEK. Full-time work is estimated to 176 h per month in Sweden, i.e., 214 SEK/hour. Multiplying the mean time the research assistants had with each family in treatment (5 h 10 min) with the salary/hour for a social secretary (214 SEK), this adds to a total of 1106 SEK/child.

Discussion

This study presents data from one of the first RCT:s of Internet-based PMT. It adds both to the limited knowledge about Internet-based treatments directed at families and children with psychiatric diseases (for a review, see Marks et al., 2007; for example of studies on children, see e.g. March et al., 2009; Wade et al., 2009), as well as to the growing body of modified PMT treatments with extended or limited therapist support targeting various conduct problem subpopulations with different needs.

Our results confirmed the hypothesis that Internet-based PMT would be effective in reducing child behavior problems, increasing prosocial behavior as well as improving parental strategies, compared to a waiting list. The results on behavior problems for the intervention group were well maintained at the 6-month follow-up. The effect sizes (ITT, Cohen's d : ECBI Intensity Scale, .42; ECBI Problem Scale, .72; study completers, Cohen's d ; Eyberg Intensity scale, .66; Eyberg Problem scale, 1.08) for the primary measure of behavior problems (ECBI) were moderate to large and in the same range as when compared to those reported by Dretzke et al. (2009) in a systematic review of parent training (SMD: ECBI Intensity Scale, .67; ECBI Problem Scale, .62). The between group effect sizes (ITT) for Comet when delivered in a face-to-face group format were in the medium to large range (ITT, Cohen's d : ECBI Intensity scale, .79;

Table 3
Baseline and post-measurement ratings (study completers) of parental strategies, and the time \times group interaction (F -analyses).

Variable	Treatment condition				F -analyses ($df = 1, 85$)	Partial η^2
	PMT-intervention means (SD) ($n = 46$)		Control group means (SD) ($n = 40$)			
	Pre-treatment	Post-measurement	Pre-treatment	Post-measurement		
<i>PPI</i>						
Total sum	381.46 (24.36)	398.00 (22.66)	382.68 (20.68)	384.40 (24.97)	16.97***	.17
Harsh and inconsistent discipline	49.48 (9.31)	43.70 (8.36)	51.85 (9.73)	50.28 (10.10)	5.02*	.06
Praise and Positive Incentives	42.65 (6.80)	46.20 (6.85)	42.98 (6.72)	43.70 (6.06)	6.92*	.08

Note: PPI = Parenting Practices Interview (PPI; Webster-Stratton, 1998); * $p < .05$; *** $p < .001$.

ECBI Problem scale, .91; Kling et al., 2010). The present study had a somewhat higher drop-out rate in the treatment group (20%) compared to the group-based PMT program Comet (9%; Kling et al., 2010), but is comparable to drop-out rates reported in other studies (see e.g. Kazdin, 2005).

Recovery, operationalized as making a reliable change and using C-criteria for clinically significant change occurred among 76.1% of children in the intervention group. This is twice as many as in the waitlist group, where 35% recovered. The parents in the present study were self-referred, which could explain the high spontaneous recovery-rate. As Reyno and McGrath (2006) pointed out, studies in which parents are self-referred to parent training report improvements to a higher extent than parents who were referred by social services or psychiatry. We also found that the extent of improvement was associated with the number of sessions the parents worked with the program. A clinical implication of this finding is to increase the potential efforts to help parents stay with the program and work through as many steps as possible.

In this treatment, 69.2% of the parents participated together. This is satisfying due to the reports of more positive (Lundahl, Tollefson, Risser, & Lovejoy, 2008) and maintained changes (Bagner & Eyberg, 2003) for children when both parents participate in parent training. To compare, Kling et al. (2010) reported that only 8% of the parents participated together in group-based Comet. According to a study by Patterson and Dishion (1988), coercion among fathers explained twice as much of the variance in child conduct problems compared to coerciveness among mothers. As described by these studies, there seems to be a need to encourage both mothers and fathers to participate in treatment. Internet could possibly be one way of achieving higher motivation and interest for PMT also among fathers. These evaluations highlight the need for understanding more about the effects of father influences on child problem behaviors, and about how family systems may change when both parents participate in the treatment (Patterson, Forgatch, & DeGarmo, 2010).

We also found that reported parenting practices improved significantly. This is an important finding. Several intervention studies employing meditational analyses report on a relationship between parenting practices and antisocial behavior (e.g. Beauchaine et al., 2005; Dishion, Nelson, & Kavanagh, 2003; Forgatch, Patterson, Degarmo, & Beldavs, 2009), suggesting parenting to be a key mechanism for change in conduct problem behaviors among children (Patterson et al., 2010). The current Internet-program included written facts, illustrations, discussions and video-vignettes modeling good parenting practices. However, there were no role-plays and limited therapist support that individualized parenting strategies to each family. Hence, it is interesting to note that families seem to have incorporated these strategies through an Internet-based approach. To be even more specific, we found reductions in harsh, coercive parenting, whereas positive parenting improved. Patterson et al. (2010) illustrated cascading effects based on their 9-year data of the PMTO program. They suggest that successful parent management training characterized by reduced coercive parenting and improved positive incentives, may lead to increased positive social interactions, altered family interactions, less peer pressure processes, and new social environments, i.e., a multi-component change of possible importance to measure, compared to only focusing on changes in child/parent behaviors. Patterson et al. (2010) therefore suggest that well-turned-out parent management training (PMTO) may release a process based on positive parenting that could continue for a long time.

The cost estimate for the Internet-based PMT was 1106 SEK. This could be compared to earlier estimates of costs for the group-based

PMT reported by Kling et al. (2006) recalculated into current wages. The Swedish group-based PMT program Comet has 11 sessions à 2 h, each requiring additional 2 h of preparation and after work. Further, the mean monthly salary for a social secretary in Sweden during 2010 including social charges was 37,700 SEK. Full-time work is estimated to 176 h per month in Sweden, i.e., 214 SEK/hour. Thus 2 group leaders \times 11 session \times 4 h \times 214 SEK/hour equals 18832 SEK and other costs for copying, coffee, snacks, etc. (estimated to be 200 SEK per session, i.e. $200 \times 11 = 2200$), sum to 21032 SEK for a program with parents of six children. For each child ($21032/6 = 3505$ SEK), the group-based PMT program costed approximately 3500 SEK, which is about three times more than the Internet-based program.

Limitations

Some methodological constraints should be noted. The main objection is that the study contains only one source of information, namely parental ratings of child behavior and parent strategies. It would have been valuable with clinical observations, as well as child and teacher ratings on changes in parental behavior to validate the information on the reported changes and potential generalization effects. Further, the study design included allocation of parents either to a waitlist or to active treatment. While this is not uncommon in psychotherapy research contexts, the lack of another clinically delivered treatment or a placebo condition for the control group makes it difficult to distinguish between effects caused by expectations and specific treatment effects. However, this is the first evaluation of an Internet-based parent training program and it is recommended that future studies include e.g. a group- or individually based PMT group as comparison condition, or a placebo condition. Parents were also self-referred and not clinician referred, possibly reducing the severity of parenting and behavior problems. On the other hand, we only included those families with some indication of child behavior problems, defined as above 1 SD on a validated and internationally used scale (the ECBI; Eyberg & Pincus, 1999) according to Swedish norms (Axberg et al., 2008). Finally, participation in the study required knowledge of the Swedish language, as well as access to a computer and Internet-connection. This might have contributed to a relatively homogenous study population regarding e.g. number of children born in Sweden (97%) and the number of parents with a university education (63.6%), possibly reducing generalizability to other conduct problem samples.

Conclusions

Today, several efficacious PMT programs exist for parents to children with conduct problems. The current evaluation adds to the growing flora of programs with limited therapist support, and is the first to present data from a randomized controlled trial of Internet-based PMT treatment. Earlier evaluations of PMT and limited therapist support for families with conduct problem children suggest that for instance bibliotherapy (Hahlweg, Heinrichs, Kuschel, & Feldmann, 2008; Markie-Dadds & Sanders, 2006), telephone-administered PMT (Morawska & Sanders, 2006), CD-ROM-administered PMT (Cefai, Smith, & Pushak, 2010) and brief/short versions PMT (Kling et al., 2010; Turner & Sanders, 2006) are potentially effective treatments which might serve as initial steps in stepped-care models. The results indicate that it could be possible to reach at least a subgroup of parents with Internet-based PMT-programs, improving their child's problematic behaviors and developing parenting strategies.

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