

# Who Benefits and How Does It Work? Moderators and Mediators of Outcome in an Effectiveness Trial of a Parenting Intervention

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We examined mediators and moderators of change in conduct problems, in a multiagency randomized trial of the Incredible Years parenting program. Preschoolers ( $n = 153$ ) at risk for conduct problems were randomly assigned to intervention ( $n = 104$ ) and wait-list ( $n = 49$ ) groups. Boys and younger children, and those with more depressed mothers, tended to show greater improvement in conduct problems post-intervention. Other risk factors (i.e., teen or single parenthood, very low income, high initial levels of problem behavior) showed no predictive effects, implying intervention was at least as successful at helping the most disadvantaged families, compared to more advantaged. Mediator analyses found change in positive parenting skill predicted change in conduct problems.

There are many parenting interventions for reducing child problem behavior that have been found to be efficacious in randomized controlled trials. Mostly these interventions have been tested in “efficacy” trials, under the relatively ideal conditions of a specialist or research clinic. Recently, because of the importance of informing prevention policy, there has been increasing interest in testing these programs in “effectiveness” trials in real-world settings (Weisz, Sandler, Durlak, & Anton, 2005), including mental health (Scott, Spender, Doolan, Jacobs, & Aspland, 2001), primary care (Turner & Sanders, 2006), schools (Dishion, Nelson, & Kavanagh, 2003), and welfare (Gardner, Shaw, Dishion, Burton, & Supplee, 2007) settings, and in the non-profit sector (Gardner, Burton, & Klimes, 2006) and in community settings for disadvantaged preschoolers (Hutchings, Bywater, Daley, Gardner et al., 2007; Webster-Stratton,

1998). These studies are essential for answering policy questions about whether parenting programs can be rolled out into regular, accessible services. They show that it is possible to deliver effective programs in community settings to high-risk children. However, despite this large number of trials, relatively few so far have tested effectiveness of programs delivered by regular service staff (Weisz et al., 2005).

Trials are not only useful for testing questions about effectiveness. They are also important for understanding which families benefit from intervention when they are rolled out more widely, and what are the critical ingredients that contribute to success under real-world conditions (Weersing & Weisz, 2002). This article explores moderators and mediators of intervention effects within a randomized controlled trial of the Webster-Stratton (1998) “Incredible Years” parenting intervention aimed at preventing conduct problems in high risk preschool children. The trial took place within multiple “Sure Start” services, whose overall goal is to provide support services to communities with high proportions of low-income families. This study represents a true “effectiveness” trial by testing implementation of an

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We thank the families and staff who participated and the Health Foundation (Grant 1583/1566) for support.

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evidence-based parenting program provided by regular staff in multiple community agencies (Hutchings, Bywater, & Daley, 2007). The main trial outcomes reported by Hutchings, Bywater, Daley, Gardner et al. (2007) found robust intervention effects on multiple child and parent outcomes, including parental skill, stress and depression, using both parent-reported and direct observational assessment. Using an intention-to-treat analysis and controlling for site and baseline conduct problems, effect sizes were medium to large. Specifically, the effect sizes for the primary outcome, the Eyberg Child Behavior Inventory (Robinson, Eyberg, & Ross, 1980) Intensity and Problem scales, were .89 and .63, respectively. For improved positive parenting skill, directly observed in the home the effect size was .57, for parent depression (Beck Depression Inventory; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) it was .48, and for parenting stress the effect size was .66. Even with successful interventions, such as this one, there is typically considerable variability in outcomes, which can be harnessed to help understand the therapeutic process and guide better targeting of interventions. Accordingly, we conducted secondary analyses, following up from the main trial outcomes reported by Hutchings, Bywater, Daley, Gardner et al. (2007), to explore moderators and mediators of outcome within a multiagency effectiveness trial.

### MODERATOR ANALYSES

Questions about which subgroups of families and children benefit most (or least) from an intervention are investigated through moderator analyses. Moderator analyses are important for informing the next generation of trials and for directly informing practice. Identifying those who respond differently to intervention may lead to further investigation of subgroups for whom there may be distinct causal patterns or prognoses (Hinshaw, 2002). Clinically, they are helpful in identifying with greater precision the types of clients for whom an intervention may be particularly suitable, or conversely, subgroups for whom extra therapeutic effort may be needed. Findings may reassure practitioners that a particular parenting intervention can be effective for client groups traditionally thought to be hard-to-treat (e.g., children with depressed or teenaged mothers). They may also inform practitioners as to whether interventions meet the needs of different demographic groups, such as for girls and boys and for families with diverse ethnic backgrounds. Within an intervention trial, the relevant question is whether a variable measured prior to randomization influences or “moderates” the relationship between treatment and outcome. The crucial test is whether the moderator is

differentially associated with outcome for the treatment compared to control groups, as shown by a significant interaction effect (Hinshaw, 2002; Kraemer, Wilson, Fairburn, & Agras, 2002). Thus, moderators are distinct from “predictors” of outcome, which may be associated with outcome equally across treatment and control groups (Beauchaine, Webster-Stratton, & Reid, 2005; Hinshaw, 2002) or may be tested within the treatment group only (e.g., Dumas & Wahler, 1983; Kazdin & Wassell, 1999; Reyno & McGrath, 2006; Webster-Stratton, 1985).

Two recent meta-analyses (Lundahl, Risser, & Lovejoy, 2006; Reyno & McGrath, 2006) attempted to combine findings on predictors of outcome across multiple trials (63—31 trials, respectively) of parenting interventions. They focused primarily on the effects of family and parent risk variables as potential moderators of treatment outcome, finding reasonably clear cut results. This was despite synthesizing across a range of intervention and sample types, including clinic treatment, indicated prevention, and low-risk prevention studies. Both reviews concluded that children of disadvantaged parents, including those with depression, low income, and single parents, show poorer intervention outcomes compared to those facing lower levels of adversity.

However, for child effects on outcome, the findings were less clear cut. A recent review (McMahon, Wells, & Kotler, 2006) noted that factors such as severity of child problem behavior and child (older) age were associated in some studies with poorer outcome, but not in others. When findings were meta-analyzed across studies, both Lundahl et al. (2006) and Reyno and McGrath (2006) concluded that children with more severe problem behavior tended to show better outcomes from parent training. Lundahl et al. tested effects of child age, finding only marginal effects of younger age on better outcome. Another important child risk factor for conduct problems (McMahon et al., 2006), and potential moderator of intervention effects, is male gender. We might predict that gender, given that it is a marker for severity, would also predict better intervention outcomes. Although child gender was not addressed in either of the aforementioned meta-analyses, McMahon et al.’s review notes that a number of intervention studies have found no effects of gender on children’s outcomes, including Fast Track (Conduct Problems Prevention Research Group, 2002) and Incredible Years (Beauchaine et al., 2005).

Large inclusive meta-analyses are useful in telling us broadly which characteristics predict intervention success across a wide range of programs. However, their weakness lies in not being able to identify whether specific programs may be more successful with children with high levels of risk factors. Several recent studies,

not included in these meta-analyses, reached somewhat different conclusions about parent risk factors. Werba, Eyberg, Boggs, and Algina's (2006) study of a young clinic-referred group receiving parent-child interaction therapy ( $N=81$ ), although consistent with earlier studies in finding that maternal distress predicted poorer outcome, nevertheless found no effects of socioeconomic status on child outcome. It may be that in more recent trials, where explicit attention is paid to client accessibility and engagement, it is possible to achieve better results with families traditionally found to respond less well to intervention. For example, Beauchaine et al. (2005) pooled data from six treatment trials ( $N=514$ ) of the Incredible Years parent program with 3- to 8-year-olds, carrying out both predictor and moderator analyses. In predictor analyses, they found that children of younger parents, those with a history of drug abuse, and children with comorbid problems did *better* in parent training than families without such risk factors. Furthermore, in moderator analyses, children of mothers with poor marriages or higher levels of depression, also fared better, compared to those who were less distressed; in these analyses there was an interaction between treatment condition and marital distress or depression.

The same group found similar effects in a prevention study, where low-income families were included irrespective of level of child problem behavior. Thus, in a pooled sample from three cohorts in Head Start preschools ( $N=882$ ), Baydar, Reid, and Webster-Stratton (2003) found that mothers who were depressed, or who had a history of abuse or substance use, were just as likely to benefit from the Incredible Years program as those without such risk factors. In essentially the same sample, Reid, Webster-Stratton, and Beauchaine (2001) found that the effectiveness for child behavior, parenting outcomes, and parent satisfaction were equally strong across four ethnic groups.

To sum up this prior literature, two meta-analyses present a reasonably clear picture. They suggest that child risk factors, such as male gender and severity of conduct problems, do not necessarily lead to poorer outcomes and may, in the latter case, confer advantage in terms of intervention effects. On the other hand, they suggest that parent risk factors predict poorer outcomes, implying that parenting interventions generally are less successful at engaging the most distressed and disadvantaged families. In contrast, however, some large recent trials found no adverse effects of family disadvantage on child outcome, in both community preventive and clinic-referred samples. Arguably interventions such as the Incredible Years program can achieve good outcomes with the most troubled families due to their strong focus on collaborative engagement with parents and accessibility of the intervention (Hutchings,

Bywater, & Daley, 2007; Webster-Stratton, 1998). However, it is important to also know whether these beneficial effects for very disadvantaged groups are seen, even when interventions are disseminated to regular practitioners in everyday service settings (Botvin, 2004).

The goal of the present trial was to address this issue. Choice of moderator variables for the present study was guided by the prior literature on moderators of outcome and risk factors for child conduct problems. There is a paucity of theoretical models explicitly covering moderator effects in parenting interventions. Instead, researchers have focused on demographic and psychological distress variables that have been found repeatedly to predict poor child behavioral outcomes in longitudinal studies (Ackerman, Brown, & Izard, 2004; Shaw, Winslow, Owens, & Hood, 1998). These can be conceptualized within an ecological framework, encompassing risk factors at multiple levels (Bronfenbrenner, 1979). These often include factors at a family demographic level, such as parental marital status and income; at a parent psychological resource level, such as depressive symptoms; and at a child characteristics level, such as problem behavior, age, and gender. There is evidence about mechanisms linking these more distal predictors to problem behavior, via their effects on family material and psychological resources, which in turn affect more proximal processes, such as parenting skill, which places stress on the parent-child relationship (Larzelere & Patterson, 1990; Trentacosta et al., 2008). The meta-analyses show that the same factors traditionally appear to predict poor treatment outcome and high attrition from intervention trials (Lundahl et al., 2006; Reyno & McGrath, 2006). Distal family and demographic factors are of course often interlinked. However, we argue that it is important nevertheless to consider these factors separately. It is vital both for the individual clinician and for the further refinement of interventions to identify if there are subgroups (e.g., single parents) who respond less well to the intervention and for whom different or additional therapeutic approaches are needed.

Drawing on this prior literature on predictors and moderators of outcome in parenting interventions, framed within an ecological model of risk factors, we examined several potential moderators of outcome, all assessed at baseline, before randomization. In the family demographic, parent psychological, and child domains the following moderators were tested: Family/parent risk factors included mother a single parent, teen parent, on very low income, mother depressive symptoms. Child risk factors included male gender and baseline level of observed problem behavior. We also examined child age, albeit within the narrow preschool range, as there is little clarity in the literature about whether, and in

what direction, age affects intervention outcome (Lundahl et al., 2006).

## MEDIATOR ANALYSES

To advance understanding of how and why interventions work, and of the processes underlying development and change in psychopathology, researchers have stressed the importance of also examining mediators of intervention. At the same time, they have pointed to the dearth of such studies in child mental health (Hinshaw, 2002; Kraemer et al., 2002; Rutter, 2005). This is despite the fact that many trials measure potential mediators, but do not often utilize these to test mediating mechanisms (Weersing & Weisz, 2002). Clinically, it is important to know which ingredients of a complex intervention predict outcome to ensure these elements are emphasized in training and implementation. Scientifically, mediation studies are important for testing causal hypotheses about parenting influence on child behavior. In combination with naturalistic longitudinal studies, mediation analyses provide powerful tools for understanding the development of psychopathology (Rutter, 2005; Weersing & Weisz, 2002).

There is a modest but growing literature in the parenting field, based on secondary analysis of randomized trials suggesting that change in observed positive parenting skill may be an important predictor of change in child outcome (Dishion et al., 2008; Forgatch & DeGarmo, 1999; Gardner et al., 2006; Gardner et al., 2007; Reid, Webster-Stratton, & Baydar, 2004). Furthermore, several studies suggest that, at least in early childhood, positive rather than negative parenting may be a developmentally more important predictor of child problem behavior outcome, based on converging evidence from both randomized intervention trials (Forgatch & DeGarmo, 1999; Gardner et al., 2006; Gardner et al., 2007) and longitudinal studies of natural development (Gardner, Sonuga-Barke, & Sayal, 1999; Gardner, Ward, Wilson, & Burton, 2003). We chose to focus on overt parenting skill as a postulated intervention mechanism, because this is consistent with the theoretical underpinnings of cognitive-behavioral parenting interventions, which assume that parenting skill is the primary mechanism underlying both development and change in children's conduct problems (Patterson, Reid, & Dishion, 1992). Furthermore, parenting can be measured through direct observations, avoiding the problem of method overlap that besets many studies of mediation, where the primary outcome (e.g., conduct problems) and other potential mediators (e.g., social support, depression) may all be measured by parent report (Weersing & Weisz, 2002). This tends to inflate

the correlation between mediator and outcome and leads to difficulties in interpretation.

Thus the present study aimed to replicate and extend into the context of a multisite effectiveness trial, earlier findings on parenting behavior as a mediator. It might be that the same mechanisms of change do not operate as in more specialist "efficacy" trials (Weisz, 2004), perhaps due to differences in the severity of the presenting problems, or in the skill level and therapeutic ethos of the staff conducting the intervention. Given that few studies have examined mediators and moderators of conduct problem outcome in parenting interventions, especially in "real-world" settings and service staff (Hutchings, Bywater, Daley, Gardner et al., 2007; Hutchings, Bywater, & Daley, 2007), this trial provides a unique opportunity to examine several questions in a multisite community-based trial. Consistent with the primary trial outcome, in all analyses, the dependent variable was child conduct problems, as measured by the Eyberg Child Behavior Inventory (ECBI; Robinson et al., 1980), Problem Scale. However, the following questions related to mediators and moderators of this outcome were tested:

1. Do children who have higher levels of risk factors for conduct problems at baseline benefit less or more from intervention? Potential moderators explored include (a) family risk factors: single or teen parenthood, very low income, maternal depression; (b) child factors: male gender, age, level of conduct problems.
2. Does change in positive (e.g., praise, positive affect) and negative (e.g., criticism, harsh commands) parenting behavior mediate change in child conduct problem outcome?

## METHODS

### Participants

The trial recruited families in 11 socially disadvantaged neighborhoods, in receipt of Government funding as Sure Start areas, identified on the basis of high levels of poverty. Recruitment took place from January 2003 to September 2004. Health visitors administered the ECBI (Robinson et al., 1980) to parents with respect to their preschool child, aged between 36 and 59 months. Health visitors are community nurses who specialize in child development and behavior and provide a universal preventive service with regular checks for all families of young children in the area. Thus, they are in a good position to screen children for problem behavior. Families were eligible if the child scored above the clinical cutoff on the ECBI problem or intensity scale

TABLE 1  
Sample Characteristics at Baseline

<i>Continuous Measures</i>	<i>Intervention<sup>a</sup></i>		<i>Control<sup>b</sup></i>		<i>Range</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Mother Beck Depression	16.9	10.3	16.6	11.0	0–10
Child Age (Months)	46.4	6.6	46.2	4.2	36–59
Eyberg Problem Score (Raw)	16.5	7.0	14.8	7.7	0–33
Observed Child Deviant Behavior	25.9	34.4	23.6	31.6	0–199
Observed Positive Parenting	23.0	19.5	21.9	15.4	2–107
Observed Negative Parenting	18.6	13.9	23.1	16.8	0–63
<i>Categorical Measures</i>		%		%	
Teen Parent		47			60
Single Parent		45			34
Very Low Income (< £200 pw)		57			49
Child Gender (% Male)		57			66

*Note:* There were no significant group differences at baseline.

<sup>a</sup>*n* = 86.

<sup>b</sup>*n* = 47.

(Robinson et al., 1980), and the primary caregiver was able to attend groups. Of the 153 eligible families, 104 were allocated to intervention and 49 to the control condition. At 6-month follow-up 133 (87%) remained in the study—86 in the intervention group and 47 in the control condition (Table 1). There were no differences between those retained and those lost to follow up (see Hutchings, Bywater, Daley, Gardner et al., 2007, for details). Intervention attendance was high. Of the 104 parents allocated to intervention, 86 (83%) completed postintervention assessments, and of these, 71 (83%) attended 7 or more of 12 sessions. Mean attendance was 9.2 sessions ( $SD = 3.2$ ).

**Randomization.** The study used a randomized trial design, with participants block-randomized within Sure Start areas. The unit of randomization was the parent-child pair. The third author blindly allocated participants on a 2:1 basis (intervention: control) after stratification by sex and age, using a random number generator. This design allows evaluation of a larger intervention group, with only a small loss of statistical power (Dumville, Hahn, Miles, & Torgerson, 2006).

**Baseline characteristics.** Table 1 shows baseline characteristics of intervention and control families. Families were very distressed and disadvantaged, compared to norms. Thus, 40% were single parents, compared to the UK average of 7% for this age group, and 56% had income below £200 pw, compared to 12% of the UK population. Mean depression score was 17, which is above the clinical cutoff score (10) for mild-moderate depression. Mean child conduct problem

score was 16, above the clinical cut off score (11; Robinson et al., 1980) used for entry to the present study. There were no differences between groups on any baseline demographic or behavioral characteristics.

### Intervention Program

The Incredible Years BASIC Parent Program was used. It has strong empirical support as both a treatment and prevention program with parents of children aged 2 to 8. Groups of up to 12 parents met weekly for 2 to 2.5 hr, for 12 weeks. Two trained leaders introduced a structured sequence of topics using a collaborative approach, including learning to play with your child, increasing positive behavior through praise and incentives, limit setting and ignoring, and strategies for managing non-compliance and aggression. Sessions discuss home assignments, look at video clips, and practice activities to try out at home. There were 22 group leaders in total, all of whom had run at least one previous group. Approximately half of the leaders received training from the second author, and half from a member of the program developer's team. All leaders received 3 hr supervision weekly from the second author (a certified Incredible Years trainer) throughout the 12-week program. Supervision and training of these staff were part of her role as clinical child psychologist, within local health services. Using group session videotapes, each leader was accredited by a second certified Incredible Years trainer, from a different UK center. Leaders had varied backgrounds: social work, daycare worker, family support, health visiting, and psychology (Hutchings, Bywater, & Daley, 2007). Multiple strategies were used to enhance engagement and retention, including

making home visits to parents who missed sessions, providing meals, daycare and transport.

### Procedures

The relevant regional Research Ethics Committee granted ethical approval for all study procedures. All parents gave written informed consent. Measures included parent-completed questionnaires and home observation of parent-child interactions, collected at two time points, trial entry (Time 1) and 6 months later (Time 2). Families were paid £25 for completing assessments at each time point. Intervention was delivered in the interim. Wait-list control families were offered the program after Time 2.

### Measures

*Parent-reported measures of child problem behavior.* The 36-item Eyberg Child Behavior Inventory (Robinson et al., 1980), Problem scale, was used to assess the number and intensity of conduct problems. This well-used instrument correlates highly with independent observations of child behavior, differentiates clinic-referred and nonclinic populations, and shows high test-retest reliability and internal consistency (Robinson et al., 1980).

*Parent and family characteristics.* The Beck Depression Inventory was used to measure parent depression (Beck et al., 1961). Parents were asked about demographic factors including family income and structure in a standard interview, the Personal Data and Health Questionnaire (Hutchings, Eade, Jones, & Bywater, 2004). We define very low income as below the median for this very disadvantaged sample, or less than £200 per week, a figure that is 25% below the level for receipt of welfare benefits.

*Observational measure.* The Dyadic Parent-Child Interaction Coding System (Eyberg & Robinson, 1981) was used to code parent and child behavior in the home. The Dyadic Parent-Child Interaction Coding System was used in many previous parenting trials and has been shown to be reliable and sensitive to treatment change. Summary variables, based on frequency counts, were constructed according to prior studies (Webster-Stratton, 1998) as follows: (a) positive parenting (sum of categories positive affect, physical positive, praise, problem solving), (b) negative parenting (sum of negative commands, critical statements), and (c) child deviant behavior (sum of hit, destructive, yell, cry, whine, smart talk). Interrater reliability was established during weeklong initial training, and maintained

through weekly training and through reliability visits (20% of home visits). Mean kappa, averaged over the two time points, was .91. Observers were blind to group allocation.

### Data Analysis

The dependent variable for all analyses was ECBI Problem Scale score. The present analyses were conducted using data from all 133 families followed up at Time 2. The pattern of intervention outcomes was very similar for this group, compared to the intention-to-treat analysis (reported in Hutchings, Bywater, Daley, Gardner et al., 2007), where data from the missing 13% of families were imputed, based on the conservative assumption of no change from baseline.

*Moderator analyses.* All potential moderators were measured at baseline. For ease of presentation, we divide these into binary and continuous risk variables. To reduce multicollinearity, centered variables were constructed for the regression analyses. Potential moderators included four binary risk variables: single parent, teen parent at birth of first child, very low income (<£200 pw), male child gender. They also included three continuous risk variables: mother depression, child age, and observed deviant behavior. In all analyses, we controlled for baseline level of conduct problems in the first step of the regression. Correlations between all predictor and outcome variables are shown in Table 2. We examined moderators of intervention effects using multiple regression, conducting a separate regression for each potential moderator variable. In Step 1, baseline conduct problem score was entered, followed by intervention status and potential moderator variable. In Step 2, the interaction term (Potential Moderator  $\times$  Intervention Status) was introduced. To explore the potential moderator effect of having a higher level of problem behavior at baseline, while avoiding method overlap with the outcome measure, we used a different index of conduct problems (observed child deviant behavior) as a potential moderator variable. Effect sizes for moderators were calculated according to Jaccard and Turrisi (2003), based on change in the multiple correlation due to introducing the interaction term in the final step of the regression. Post hoc tests were conducted according to Holmbeck's (2002) method. Significant moderator effects were explored by comparing simple slopes for the association between baseline predictor and outcome for both the intervention and control groups, and testing if they were significantly different from zero. We also tested whether other risk variables might be accounting for moderator effects, first exploring whether any of seven potential moderator

TABLE 2  
Intercorrelations Among Study Variables

	2	3	4	5	6	7	8	9	10	11
1. Eyberg Problem Score Baseline	.35**	.29**	-.00	-.00	-.14	-.16	-.20*	-.07	-.01	.07
2. Eyberg Problem Postintervention	—	.13	-.11	.07	-.20*	.01	-.04	-.11	.17	.04
3. Mother Beck Depression Baseline		—	-.00	-.04	-.09	-.07	.02	-.02	.15	.02
4. Child Age (Months)			—	-.03	.05	.10	.16	-.10	-.05	.01
5. Observed Child Deviant Behavior				—	.01	-.07	.01	-.14	-.11	.31**
6. Teen Parent <sup>a</sup>					—	.14	.07	-.12	-.03	-.14
7. Single Parent <sup>b</sup>						—	.50**	.11	-.04	-.04
8. Very Low Income <sup>c</sup>							—	.08	.06	-.06
9. Child Gender <sup>d</sup>								—	.12	.06
10. Positive Parenting									—	-.03
11. Negative Parenting										—

<sup>a</sup>1 = teen parent, 0 = not teen parent.

<sup>b</sup>1 = single parent, 0 = not single parent.

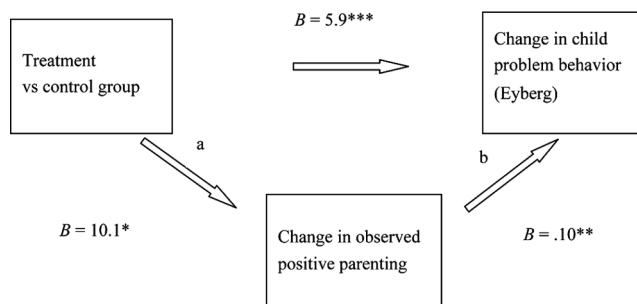
<sup>c</sup>1 = very low income (<£200 pw), 0 = higher income (>£200 pw).

<sup>d</sup>1 = boy, 0 = girl.

\* $p < .05$ . \*\* $p < .001$ .

variables predicted conduct problem outcome, over and above the effects of baseline conduct problems and intervention. None of these variables were significant predictors, and hence we did not introduce these as covariates in the moderator analyses.

**Mediator analyses.** We followed Baron and Kenny's (1986) steps for two potential mediators, negative and positive parenting. First, we examined whether there were significant associations between all three variables (Figure 1): change in putative mediator (observed parenting skill), change in outcome (parent-reported child conduct problems, ECBI) and intervention status. Second, where all these were associated, we conducted hierarchical multiple regression analyses, with change in child conduct problems as the dependent variable. In Step 1, intervention status was entered, and Step 2, parenting was introduced as a mediating variable. Where



<sup>1</sup>Sobel test: Sobel test statistic = 2.4,  $p = .014$ ;  $a = 16.7$   $b = .095$   $SEa = 5.1$   $SEb = .026$

\*\*\*  $p = .001$  \*\*  $p = .002$  \*  $p = .02$

FIGURE 1 Observed positive parenting as mediator of the association between intervention and child outcome.

there was a significant reduction in the association between intervention and outcome, after introduction of the mediator, this suggests a partial mediation effect. Finally, significance of the mediation effect was assessed using the Sobel test (Baron & Kenny, 1986).

## RESULTS

### Moderator Findings

**Family variables.** Table 3 shows there were no significant moderator effects for single parenthood ( $ES = .005$ ), very low income ( $ES = .002$ ), or teen parenthood ( $ES = .002$ ), implying that families with these disadvantages were just as likely to do well following intervention, as other families.

**Gender.** Table 3 shows that child gender was a significant moderator, interacting with intervention status to predict conduct problem outcome. Post hoc tests revealed that boys fared particularly poorly in the control group (significance of slope,  $p = .03$ ), meaning that the intervention produced better conduct problem outcomes for boys relative to girls, as illustrated in Figure 2. The effect size for the moderator effect was  $ES = .03$ ,  $p = .04$ .

**Maternal depression.** Table 4 shows that depression was a significant moderator of intervention effects. Post hoc tests revealed that children of more depressed mothers fared better following intervention, relative to children in the control group (significance of slope,  $p = .004$ ), who had much poorer conduct problem outcomes when their mother was depressed. The effect size for the moderator effect was  $ES = .05$ ,  $p = .004$ . Figure 3

TABLE 3  
Moderator Analyses: Regression Models Predicting Conduct Problems Postintervention, Using Categorical Predictor Variables

Potential Moderator	Teen Parent		Child Gender		Single Parent		Very Low Income	
	$\beta$	$\Delta R^2$	$\beta$	$\Delta R^2$	$\beta$	$\Delta R^2$	$\beta$	$\Delta R^2$
Step 1		.21***		.20***		.21***		.20***
Baseline Conduct Score	.36***		.38***		.40***		.38***	
Potential Moderator	-.12		-.06		.04		.01	
Intervention	-.27***		-.28***		-.28***		-.29***	
Step 2		.00		.03*		.01		.00
Baseline Conduct Score	.36***		.39***		.41***		.38***	
Potential Moderator	-.06		-.29*		-.06		.07	
Intervention	-.23*		-.41***		-.37**		-.25*	
Interaction Term	-.08		.32*		.15		-.08	

Note: Dependent variable = Eyberg Problem scale score postintervention; Step 1 covariate = Eyberg Problem scale at baseline.  
 $\dagger p < .10$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

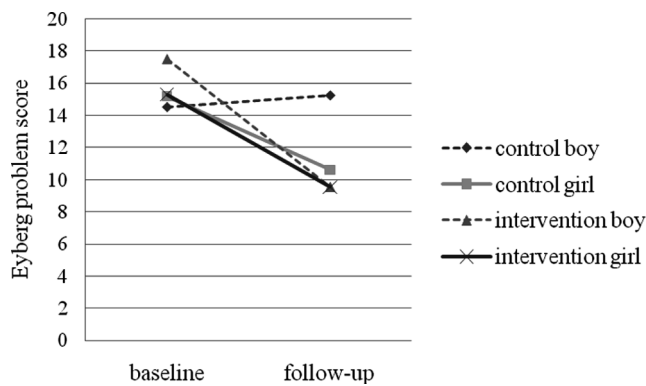


FIGURE 2 Intervention effects on child problem behavior (Eyberg Problem scale) by child gender, for intervention and control groups.

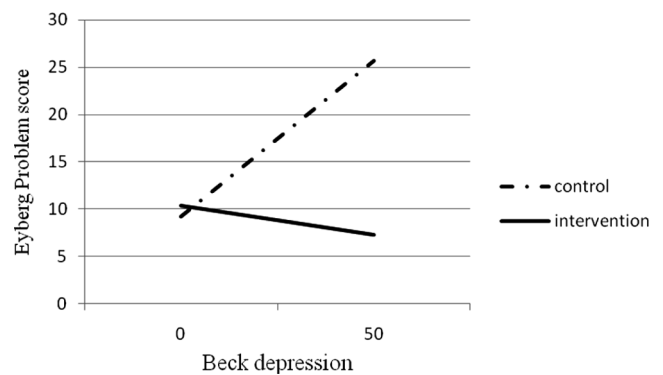


FIGURE 3 Child problem behavior (Eyberg Problem scale, adjusted to mean baseline value) plotted against Mother Beck Depression score for intervention and control groups.

illustrates the slopes for intervention and control group yielded by the moderator analysis.

**Child age.** Table 4 shows that child age was a significant moderator of intervention effects. Post hoc tests

revealed that younger children fared particularly poorly in the control group (significance of slope,  $p = .015$ ), meaning that the intervention produced better conduct problem outcomes for younger relative to older children. The effect size for the moderator effect was  $ES = .03$ ,

TABLE 4  
Moderator Analyses: Regression Models Predicting Conduct Problems Postintervention, Using Continuous Predictor Variables

Potential Moderator	Beck Depression		Child Age		Child Deviant Behavior	
	$\beta$	$\Delta R^2$	$\beta$	$\Delta R^2$	$\beta$	$\Delta R^2$
Step 1		.20***		.21***		.21***
Baseline Conduct Score	.36***		.38***		.38***	
Potential Moderator	.07		-.10		.08	
Intervention	-.30***		-.28***		-.29***	
Step 2		.05**		.03*		.00
Baseline Conduct Score	.34***		.41***		.38***	
Potential Moderator	.42**		-.38*		.10	
Intervention	-.31***		-.34***		-.29***	
Interaction Term	-.41**		-.28*		.02	

Note: Dependent variable = Eyberg Problem scale score postintervention; Step 1 covariate = Eyberg Problem scale at baseline.  
 \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .



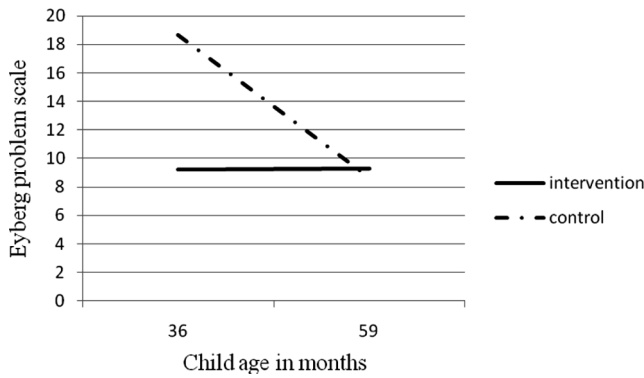


FIGURE 4 Child problem behavior (Eyberg Problem scale, adjusted to mean baseline value) plotted against child age (in months), for intervention and control groups.

$p = .04$ . Figure 4 illustrates the slopes for intervention and control group yielded by the moderator analysis.

**Observed child deviant behavior.** Table 4 shows that there was no moderator effect of baseline level of

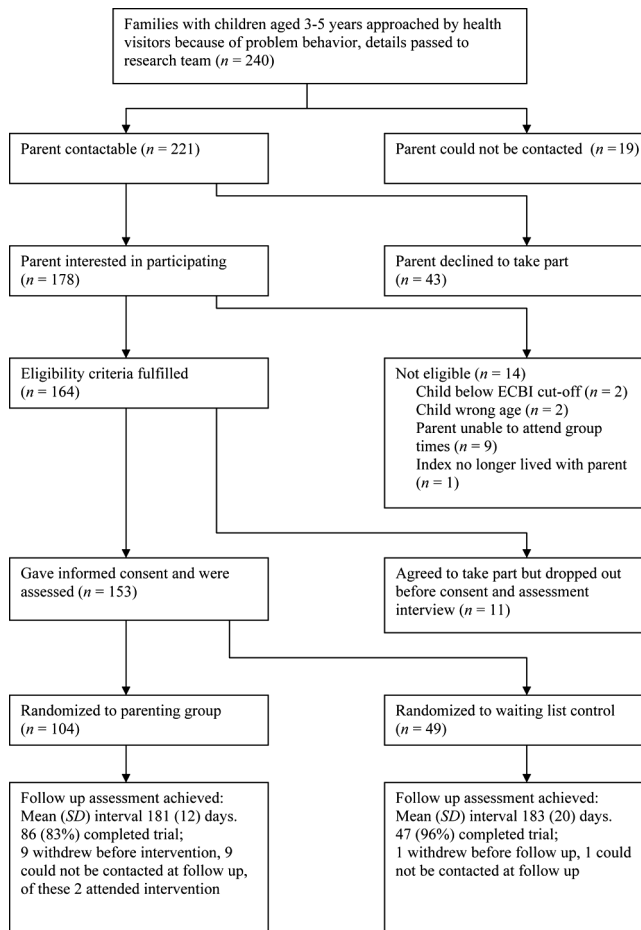


FIGURE 5 Flow chart of trial participants (from Hutchings, Bywater, Daley, Gardner et al., 2007).

TABLE 5  
Mediation Analysis: Regression Models Predicting Change in Conduct Problems from Treatment Status and Change in Positive Parenting

Predictor Variable	R <sup>2</sup>	ΔR <sup>2</sup>	F change, sig F	B	SE B	β	t, p Value
Step 1	.10	.10	13.9, p = .001				
Treatment vs. Control				5.9	1.6	.31	3.7, p = .001
Step 2	.14	.04	6.3, p = .014				
Treatment vs. Control				5.1	1.6	.27	3.2, p = .002
Change in Positive Parenting				.08	.03	.21	2.5, p = .014

observed child deviant behavior ( $ES = 0$ ), suggesting that more and less difficult children had an equal chance of responding well to the intervention.

Mediator Findings

We tested whether observed positive parenting mediates intervention change. First, as shown in Figure 1, all three variables were intercorrelated in the whole sample, including intervention status, mediator, and outcome. Improvement in observed positive parenting correlated with improvement in parent-reported child conduct problems (Eyberg,  $r = .27, p = .002$ ); intervention status correlated with change in positive parenting ( $r = .20, p = .02$ ) and with change in parent-reported child conduct problems ( $r = .31, p = .000$ ). Second, multiple regression was employed (Table 5), with change in conduct problems (Eyberg) as the dependent variable. Independent variables were entered as follows: Step 1, effect of intervention on child conduct problems; Step 2, which shows that that this effect is attenuated when positive parenting is introduced as a potential mediator. There was a significant partial mediation effect (Sobel test,  $p < .014$ ). Negative parenting did not predict change in conduct problems ( $r = .15, p = .08$ ) and therefore did not qualify as a mediator. Specifically, change in negative parenting predicted outcome somewhat better in the control group ( $r = .29, p = .06$ ) than in the intervention group ( $r = .05, p = .65$ ), implying it may have contributed to natural change over time but did not operate as a mediator of intervention change.

DISCUSSION

The moderator analyses suggest that children whose parent is more depressed tend to respond better to intervention, in terms of conduct problem outcome.

There was also a moderator effect for gender: Boys benefited more from intervention, compared to girls, who tended to improve irrespective of intervention allocation. Both these predictors confer higher risk for conduct problems on children in general, yet following intervention, children with these risks nevertheless fared better. Intervention effects were not moderated by having a very low income (compared to the average for these low income areas), by having a single parent, by having a mother who had given birth as a teenager, or by initial severity of observed child problem behavior. Cautiously we note that trends were generally in the direction of children of more disadvantaged parents doing better following intervention. Younger children fared particularly poorly in the control group. However, the effect of the intervention appeared to be to remove this relative age-related disadvantage, such that younger children do relatively better with intervention, compared to their tendency to deteriorate in the control group.

It is noteworthy that the study failed to replicate the traditional pattern of findings, whereby family risk factors predict poor outcome, as found in two recent meta-analyses. However, ours is not an isolated finding, as some of the largest studies broadly concurring with ours were recent ones not included in these meta-analyses (Baydar et al., 2003; Beauchaine et al., 2005; Conduct Problems Prevention Research Group, 2002). In common with these nonincluded studies, we found that children of depressed parents did better with intervention, and children in families with other disadvantages were just as likely to respond well to the intervention. This suggests the program is as effective (and in some respects more so) with some of the hardest-to-reach groups within an already high-risk sample, drawn from communities defined by low income.

It is known that depressed parents tend to rate their children's behavioral problems more severely than non-depressed parents or their partner (Webster-Stratton & Hammond, 1988), which could account for the greater reported benefit for their children, particularly because the intervention demonstrated significant improvements in maternal depression. This is important because without improvements in parental mental health the beneficial effects of parenting interventions for such children may be likely to dissipate over time (Hutchings, Lane, & Kelly, 2004). Improvements in maternal mental health for the intervention group may arise with this program because of the emphasis on developing observational, goal setting and problem-solving skills all known to be deficient among people experiencing depression (Hutchings, Lane, & Kelly, 2004).

The mediator analyses replicate and extend earlier studies which tested mediators within parenting intervention trials conducted in more specialist research

settings (Forgatch & DeGarmo, 1999; Gardner et al., 2006; Gardner et al., 2007). The findings show that improvement in positive parenting, rather than reductions in harsh or negative parenting, appears to be a key factor mediating change in child problem behavior, even in the context of a multisite, multiagency trial, using regular service staff. One of the challenges of implementing preventive interventions more widely is that fidelity, and hence effectiveness, may not be maintained when going "to scale" (Botvin, 2004). Studies of mediators help us to understand an important aspect of fidelity, namely, whether theoretically important ingredients of the intervention are operating to effect change in the "real world" the same ways as in more tightly controlled efficacy studies (Weisz, 2004). These data are also important for testing explanations of the development of conduct problems, especially given that these intervention findings are consistent with those derived from naturalistic longitudinal studies of positive parenting as a predictor of change during the same developmental stage (Gardner et al., 1999; Gardner et al., 2003). As Rutter (2005) has suggested, there is a need for marrying up of longitudinal and experimental intervention studies that measure equivalent constructs to answer causal questions about development.

This study had several strengths. The trial addresses two issues, which have been identified as being of key importance for the field: the need for effectiveness studies in a "real-world" setting (Hutchings, Bywater, & Daley, 2007; Weisz et al., 2005) and the lack of studies of mediators and moderators (Rutter, 2005; Weersing & Weisz, 2002). To our knowledge, this is the first study to examine these issues within an effectiveness trial, in everyday services. Of importance, we were able to avoid the problem of method overlap, by using distinct modes of measurement of mediator (by direct observation) and outcome (by parent report). Furthermore, we were able to show specificity of mediation effects, which were found for positive but not for negative parenting. For the moderator investigations, we were able to use non-overlapping measures for six of the eight analyses. However, for parent depression, predictor and outcome were both measured by maternal report. Other strengths include high levels of parent attendance, and reasonably low levels of attrition, retaining 87% of families at follow up.

This study also had several limitations. Although the trial was powered for the main effectiveness analysis, the sample size is relatively small for moderator and mediator analyses. Thus, the secondary analyses presented here should be viewed as post hoc and exploratory, and findings interpreted with caution. On the other hand, in a field where there have been few studies of intervention moderators and mediators, exploratory studies are worthwhile. As well as needing to be

cautious about our significant findings, there is also the possibility that we were underpowered for detecting moderator effects. It should also be noted that, by reporting data at two time points, pre- and postintervention, we were not able to achieve temporal separation of the three variables in the mediation analysis. This would have been a more ideal design for lending support to a causal mechanism (Kazdin & Nock, 2003), given a situation (as in most trials) where participants are randomized to the intervention but not to the proposed mediator. Bearing in mind cautions about sample size, we note tentatively that despite analyzing multiple predictor variables, we failed to find any evidence that child or family risk predicted poorer child outcomes following intervention. On the contrary, there was a consistent picture from both trends and from significant findings, whereby children who were at greater risk, and who were living in families who were psychologically and materially disadvantaged tended to do as well, or better, following intervention, compared to those in the sample who were more advantaged. It is worth noting that the conclusion that children with a depressed parent fared better would still hold, even if we were to take a more conservative approach, by correcting for multiple testing.

#### Implications for Research, Policy, and Practice

The clinical implications of the study are somewhat at odds with findings from recent meta-analyses (Lundahl et al., 2006; Reyno & McGrath, 2006). Our study suggests that parenting programs can be as effective, or even more so, with the most disadvantaged and distressed families, echoing the findings of some other trials (Baydar et al., 2003; Beauchaine et al., 2005; Conduct Problems Prevention Research Group, 2002). However, to our knowledge, this is the first study to replicate and extend these findings in a multiagency effectiveness trial. This is significant because it means that nonspecialist staff working in a range of community services, who are neither part of a specialist team nor part of the program developer's team can implement this program and achieve good outcomes even with the most hard-to-reach families in a low-income community. However, this is only likely to be the case if considerable attention is paid to fidelity issues, such as supervision and consultation (Hutchings, Bywater, & Daley, 2007). Several other strong interventions have failed to achieve good results when transported to less specialized staff or settings (Littell, Pops, & Forsythe, 2005; Olds et al., 2004; Sonuga-Barke, Thompson, Daley, & Laver-Bradbury, 2004). It is likely that the Incredible Years Program achieves good results through its thorough training mechanisms (Hutchings, Bywater, & Daley, 2007), through its strong emphasis on behavioral principles

and home practice, and on relationship building as well as dealing with discipline. Its strong focus on a collaborative group process and on overcoming practical barriers to attending parenting groups are likely to be particularly important mechanisms for engaging troubled families (Hutchings, Lane, & Gardner, 2004).

There are other promising mechanisms for engaging the most hard-to-reach families within high-risk samples in preventive intervention. For example, Dishion's Family Check-Up model achieves this by locating intervention in the home and employing techniques based on motivational interviewing to enhance engagement (Dishion et al., 2008; Gardner et al., 2007). Moderator analyses in a large trial of this intervention with low income preschoolers (Gardner et al., 2009) found a broadly similar pattern of results to the present study. Again, this suggests that using a strong collaborative approach to engaging families, there need not be a differentially weaker intervention effect with families whose children are at greatest risk of conduct disorder.

There are a number of potential future clinical and theoretical directions suggested by this work. Understanding mediators could be seen as an important first step for investigators wanting to develop briefer, low-cost versions of interventions. It would be logical to focus on ingredients, such as positive parenting skill, found to be most active in mediation studies, although clearly these refined versions would need testing in further randomized trials. Moderator analyses are potentially valuable in pointing to subgroups for which mediating mechanisms might be different (Hinshaw, 2002). For example, gender effects on outcome were found in the present study but not in other studies of similar interventions (Beauchaine et al., 2005), suggesting further clarification is needed. Where consistent gender effects are found in favor of boys, this has led some program developers to design "female specific" adaptations of their intervention (McMahon et al., 2006), especially in adolescents. Another question arising from our moderator findings is that of whether changes in positive parenting skill are only important for those who have difficulties in this area in the first place or whether they are important processes across the whole range of parents. It is also important to test whether there are different mechanisms operating for boys and girls or for different ethnic groups. On the other hand, it might be that moderator groups merely indicate differential effectiveness but similar mechanisms. There is a clear need for the parenting intervention field to develop testable theoretical models of moderator effects, and of how mechanisms might vary by moderator groups (mediated moderation). Recent advances in analytic techniques have made it possible to test more complex models, but these need to be driven by a clear theoretical framework and tested with larger samples than

are common in most intervention studies (MacKinnon, Fairchild, & Fritz, 2007). An innovative study has begun to test questions along these lines, examining moderator groups in a postdivorce parenting intervention (Tein, Sandler, MacKinnon, & Wolchik, 2004). Ultimately, subgroups and corresponding models of intervention change need to incorporate genetic (Bakermans-Kranenburg, Van IJzendoorn, Pijlman, Mesman, & Juffer, 2008) or other biological markers, as well as demographic and behavioral characteristics.

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