My dopamine has been busy: Research on gene by environment interactions in child externalizing behavior

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Intervention Effectiveness of The Incredible Years: New Insights into Sociodemographic and Intervention-Based Moderators
Abstract

We tested the effectiveness of the preventive behavioral parent training (BPT) Incredible Years (IY) and the effects of previously suggested sociodemographic and intervention-based moderator variables (i.e., initial severity of externalizing behavior, child gender, social economic status, family composition, and number of sessions parents attended), in a large scaled randomized-controlled-trial. Using full intention-to-treat analyses, questionnaire and observation data from 387 parents and children aged 4-8 years (Mage = 6.21, SD = 1.33; 55.30 % boys), across pretest, posttest, and 4-month follow-up, were analyzed, correcting for multiple testing. IY was successful in decreasing parent-reported child externalizing behavior (Cohen’s d = .20 at posttest; d = .08 at follow-up), increasing parent-reported positive parent behavior (d = .49; d = .45) and observed behavior (d = .06; d = .02), and decreasing parent-reported negative parenting behavior (d = .29; d = .25). No intervention effects were found for reported and observed child prosocial behavior, observed child externalizing behavior, and observed negative parenting behavior. Out of 40 tested moderation effects (i.e., eight outcomes times five moderators), only three significant moderation effects appeared. Thus, no systematic evidence emerged for moderation of IY effects. The present multi-informant trial demonstrated that many previously suggested moderators may not be as potent in differentiating BPT effects as once thought.

Keywords

Prevention
Randomized-controlled-trial
Externalizing disorders
Incredible Years
Moderators


The first two authors contributed equally to this work.
as well as on BPT in both prevention and intervention settings more broadly defined
(Leijten, Raaijmakers, Orobio de Castro, & Matthys, 2015, Lundahl, Risser, & Lovejoy,
2006), suggested that specifically initial severity of child externalizing behavioral
problems, child gender, socioeconomic status (i.e., SES), family composition (i.e., single
parent families vs. two-parent families), and the number of sessions parents attended
might be important moderators of the intervention effects of the BPT program IY.

Initial severity of externalizing behavior

Initial severity of child externalizing behavior is one of the strongest predictors of
intervention effects (Leijten et al., 2015; Lundahl et al., 2006; Menting et al., 2013).
However, moderation has been found in both directions. On the one hand, initial
severity might account for a threshold that confers advantage in terms of intervention
effectiveness; larger initial severity leaves more room for improvement (Gardner et al., 2010). Also, larger initial severity might be related to increased motivation in parents
to change, leading parents to more readily agree to and engage in treatment (i.e.,
larger treatment adherence). On the other hand, it has also been found that initial
severity of externalizing behavior could reduce intervention responsivity (e.g., Kazdin,
1995, Ruma, Burke, & Thompson, 1996). Possibly, this is because more severe levels
of externalizing behavior are related to increased numbers of child, parental and
environmental risk factors (e.g., comorbid psychopathology, severe child dysfunc-
tioning, parental stress, and parents’ perception of failing), that in turn negatively
affect parents’ motivation and engagement in BPT. Initial severity of externalizing
behavior might therefore be a specifically important moderator of effectiveness in
a prevention setting, where severity might vary more between families, compared
to treatment settings.

Child gender

Child gender might be another moderator of BPT effectiveness. A previous study
suggested that the effects of BPT in a prevention setting were stronger for boys
than for girls (Gardner et al., 2010, but see review McMahon, Wells, & Kotler, 2008)
for conflicting results). However, the influence of child gender as a moderator might
partly be due to confounding effects of initial severity (i.e., boys showing more
externalizing behavioral problems than girls) (Menting et al., 2013). It might there-
fore be specifically important to control for initial severity when testing for possible
moderating effects of gender.

SES

Although the meta-analysis by Lundahl and colleagues (2006) suggested that BPT
is less effective for economically disadvantaged families, a recent meta-analysis
showed that—when initial externalizing behavior was controlled for—economically
disadvantaged and advantaged families benefited equally from the intervention
effects directly post intervention (Leijten et al., 2013). SES and initial problem sever-
ity are likely to be confounded. Therefore, the unique influence of SES is unknown.

Family composition

It has been suggested that single parents possibly benefit less from BPT programs
compared to two-parent families, which may be linked to limited financial resourc-
es, fewer coping resources, and/or greater isolation in single parent families (e.g.,
Griffin, Batvin, Scheier, Diaz, & Miller, 2000). However, findings on single parenting
as a moderator of BPT effectiveness in indicative prevention and treatment settings
are inconclusive (e.g., Kazdin, 1995; Reyno & McGrath, 2006, but see Fossum, March,
Handegård, Drugli, & Larsson, 2009; Gardner et al., 2010) for conflicting results).
Single parents and/or parents from a low SES background might be less able to
attend sessions due to a lack of social and economic resources to meet precon-
ditions for attending, such as transportation and child care. Again, this moderator
might therefore be confounded with other possible moderators (SES and number of
sessions attended).

The number of intervention sessions parents attended

Meta-analyses by Wilson and Lipsey (2001) and Menting and colleagues (2013)
suggested that a higher amount of sessions parents attend is positively related to
effect sizes of BPT in both prevention and treatment settings. BPT programs teach
specific parenting techniques and during training sessions parents have opportunities
to see how such techniques can be implemented, practiced, and refined. Missing one
or more training sessions means missing specific intervention content. The number of
sessions parents attend might therefore be relevant for intervention success (i.e.,
dosage effect). However, the number of sessions attended might be associated with
other moderators, specifically SES and family composition. Therefore, it is important
to investigate possible confounding effects of different moderators.

Methodological limitations of previous studies

Besides conflicting findings about the direction and unique (vs. confounding) effects
of moderators of intervention effectiveness, the reviewed findings should be viewed
as preliminary because of several methodological limitations that have plagued
previous studies (see Weersing & Weisz, 2002). Specifically, most previous research
on preventive BPT programs relied exclusively on parent reports of both parenting
and child behavior. However, these reports might be biased and confounded (Sessa,
Avenevoli, Steinberg, & Morris, 2001; Stifter, Willoughby, & Towe-Goodman, 2008).
By providing a blinded assessment of changes in parenting and child behavior, observa-
tions besides questionnaires have important methodological advantages, (Daley et
al., 2014, Scott, 2001; Sonuga-Barke et al., 2013). In addition, most intervention studies
have a modest sample size. For instance, studies incorporated in the meta-analys
on IY intervention effects by Menting and colleagues (2013) contained on average 95 families. This is problematic given that small sample sizes lead to an increased risk for both Type I error (i.e., incorrectly concluding there is an effect) and Type 2 error (i.e., concluding there is no effect when one actually exists). This is especially the case in moderation analyses where the sample is split up in multiple subgroups (Sullivan & Feinn, 2012). Therefore, a rigorous evaluation trial of preventive BPT is required, including observational assessments of both parenting and child behavior, with a sufficiently large sample size to test the effects of specific sociodemographic and intervention-based moderators. The current study tested moderation (i.e., initial severity of externalizing behavior, child gender, SES, family composition, and number of sessions parents attended) of the effectiveness of the BPT program IY in an indicated preventive context, by assessing parent reports and observational data on both child and parenting behavior, within one multivariate model, controlling for the possible confounding effects of the moderators. This study can mainly be seen as an effectiveness trial as it was conducted in conditions of routine clinical practice.

METHODS

Design

The current study is a randomized controlled indicated prevention trial with two conditions (intervention vs. control) and three measurement waves (pretest, posttest, and follow-up). It was built up in two stages. In stage one, all families with children aged 4-8 in the targeted municipalities were invited for a screening. In stage two, all eligible families were invited to participate in anRCT: the Observational Randomized Trial on Childhood Differential Susceptibility (i.e., The ORCHIDS study). Enrolled families participated in the following three waves: pretest before randomization, posttest immediately after the intervention (i.e., 4 months after pretest procedure), follow-up 4 months after intervention (i.e., 8 months after pretest procedure). Randomization to either control or experimental condition (1:1) occurred after pretest and consent to participate. An independent researcher drew a ticket (which read either control or experimental condition) that was put back afterwards. Both assessors and parents were blind to allocation status at initial assessment.

Screening

Families were screened and recruited through community records via two Dutch regional health care organizations. All families with children aged 4-8 years (N = 20,048) of four (i.e., two large and two small) municipalities received a personalized information letter, including a consent form and the screening questionnaire (i.e., Eyberg Child Behavior Inventory, Eyberg & Pincus, 1999). Families were offered €750 for returning the questionnaire within two weeks. A total of 5,876 questionnaires were returned timely (response rate 22.52 %). Children scoring at or above the 75th percentile of their relative cohort (i.e., sum score of 112 for girls and 120 for boys aged 4 and 5, 107 for girls and 116 for boys aged 6 to 8, 110 for girls and 115 for boys aged 4 and 5, 106 for girls and 112 for boys aged 6 to 8, for the two cohorts respectively) were eligible for participation in the study (n = 1,524). One parent-child dyad per family (N = 1,393) was invited to participate. Parents of either sex and of any ethnic group (mastering the Dutch language) were eligible. Eligible families received an invitation letter to participate in the RCT. One week later parents were individually contacted by a researcher or trained research assistant who briefly explained the study process.

We were able to reach approximately 61% (N = 850) of eligible families, of which 46% agreed to participate (see Figure 1 for an overview on the selection-process of participants). The ECBI intensity scores of participating and non-participating children slightly differed (F (1, 140) = 6.66, p < .01), in that parents’ perceptions of children’s externalizing behavior were higher in participating families (M = 3.65; SD = .45) than in families who did not participate (M = 3.58; SD = .46).

Participants

In total, 387 parent-child dyads eventually participated in the RCT. Children were between 4 and 8 years of age at baseline (Mage = 6.31, SD = 1.33), mostly born in The Netherlands (97.4%), and about half of them (55.30%) were boys. Participating parents (91% mothers) were between 23 and 51 years of age at baseline (Mage = 38.10, SD = 4.84), mostly born in The Netherlands (i.e., 86% of mothers, 84% of fathers), and about half of them completed a higher form of education (i.e., higher vocational training or university level educational tracks) (see Tables 1-3 for demographic and descriptive statistics). For descriptive purposes of our sample, parents also reported—on a 3-point scale (1 = not true to 3 = certainly not true)—on levels of child peer problems (M = .41; SD = 29), conduct problems (M = .45; SD = 37), emotional problems (M = .66; SD = .48), hyperactivity (M = 1.16; SD = .53), and prosocial behavior (M = 1.34; SD = .42) at pretest (i.e., Strength and Difficulties Questionnaire, Goodman, 1997). About a third (28.6%) of participating families received additional (mental health or family) care or help (e.g., mental health care parents or social services) and 8% of children used psychoactive medication (mainly psychostimulants) between pretest and posttest.

Randomization check

Participants in the intervention and control condition did not significantly differ in age (child or parent), gender (child or parent), country of birth (child or parent), parental education level, work status, marital status, religion, parent-reported and observed parenting behavior, and parent-reported child behavior at baseline (ps > .06) (see Tables 1-3 for descriptive statistics). Observed negative child behavior significantly differed between the two conditions (F (1, 161) = 5.40, p = .02), indicating that children in the intervention condition scored higher on observed negative behavior (M = 52; SD = 62) compared to children in the control condition (M = 39; SD = .46). This difference was controlled for in all analyses.
Dropouts

During the study 28 families dropped out, of which 23 at posttest and 5 at follow-up. Reasons for dropping out were inability to reach parents, (upcoming) divorce of parents, and/or moving house. There was no difference between conditions in the number of families that dropped out of the study (p = .19). When comparing parents that participated in all three waves with parents who dropped out, no significant differences were found at baseline regarding reported and observed measurements (ps > .09). Also, we found no significant differences regarding sociodemographic and intervention variables except for marital status ($\chi^2 (8, N = 386) = 11.30, p = .02$) and mother’s education level ($\chi^2 (8, N = 386) = 21.52, p < .01$). Mothers who participated in all three waves were more likely to be married (71% vs. 51% married) and higher educated (81% vs. 51% high educated), compared to parents who dropped out during the study.

Procedure

At each measurement wave, parent-child interactions were filmed during a structured play situation and parents filled out a digital questionnaire. During pretest researchers or trained research assistants took time to explain the study in more detail, to answer questions, and in turn asked parents to sign the informed consent form. During this wave, pretest questionnaire data were collected, parent-child interactions during structured play situations were videotaped, and saliva samples for genotyping were collected (Chhangur, Weeland et al., 2012). During posttest and follow-up assessment, the observation and questionnaire procedures were repeated. In addition, parents were interviewed by a trained researcher about children’s genetic ancestry (i.e., country of birth great-grandparents) and family mental health care.
The Parenting Practice Inventory (PPI) consists of 15 sections, each containing multiple items, asking for a response of the parents about their parenting behavior. We combined the dimensions positive and negative parenting behavior, assessed the frequency of behavior in a range of social situations. Two observation sessions were conducted; one before (Pretest) and one after (Posttest) the intervention. A standardized observation period of 20 minutes was established during which the child and parent were engaged in an age-appropriate activity (e.g., doing a puzzle or playing with toys). The Dyadic Parent-Child Interaction Coding System (DPCIC) was used to observe the interaction. The DPCIC is a home observational measure of interactions between child and parent (Stratton, 1989). Parent and child were observed for 20 minutes while playing with a set of toys at pretest and posttest. The observation procedure included a 30-second break halfway through the play activities. The parent was instructed to pretend to be busy with something else and to tell the child to follow along. The child was asked to participate in the activity. The child's and parent's behavior was rated on a five-point Likert scale (1 = never, 5 = very much) for a range of behavioral categories.

Parent Behavior Measures

Table 2. Descriptive Statistics of Child and Parent Behavior Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pretest M (SD)</th>
<th>Posttest M (SD)</th>
<th>Change M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed positive behavior</td>
<td>2.38 (0.96)</td>
<td>2.43 (0.95)</td>
<td>0.05 (0.97)</td>
</tr>
<tr>
<td>Observed negative behavior</td>
<td>1.56 (1.06)</td>
<td>1.54 (1.05)</td>
<td>-0.02 (1.07)</td>
</tr>
<tr>
<td>Reported negative behavior</td>
<td>2.75 (0.61)</td>
<td>2.80 (0.62)</td>
<td>0.05 (0.59)</td>
</tr>
<tr>
<td>Observed prosocial behavior</td>
<td>1.33 (0.64)</td>
<td>1.34 (0.67)</td>
<td>0.01 (0.61)</td>
</tr>
<tr>
<td>Reported prosocial behavior</td>
<td>0.64 (0.61)</td>
<td>0.64 (0.66)</td>
<td>-0.01 (0.58)</td>
</tr>
<tr>
<td>Observed externalizing behavior</td>
<td>0.46 (0.55)</td>
<td>0.52 (0.62)</td>
<td>0.06 (0.59)</td>
</tr>
<tr>
<td>Reported externalizing behavior</td>
<td>2.13 (0.45)</td>
<td>2.18 (0.44)</td>
<td>0.05 (0.43)</td>
</tr>
</tbody>
</table>

In total, four summary scales were extracted from the questionnaire: harsh and inconsistent discipline (13 items, e.g., 'Talks to the child'), physical punishment (6 items, e.g., 'Slapping or hitting when misbehavior occurs'), and praise and incentives (11 items, e.g., 'Discussing the problem with the child'). The four subscales were combined into two factors: parents' behavior (positive and negative) and children's behavior (positive and negative).

Table 3. Correlations between Sociodemographic and Intervention-based Moderators

<table>
<thead>
<tr>
<th>Correlation</th>
<th>r</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>-.205**</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>Family status</td>
<td>-.134**</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>Initial severity of externalizing behavior</td>
<td>-.204**</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>Treatment group</td>
<td>-.038</td>
<td>&gt; .05</td>
</tr>
<tr>
<td>Time point (pre/post)</td>
<td>.204*</td>
<td>&lt; .05</td>
</tr>
</tbody>
</table>

Note. *p < .05, **p < .01. None of the groups differed significantly on the moderators with independent samples t test.
The observations were coded by trained research assistants who were not involved in the study and who were blind to condition and measurement wave. Monthly calibration meetings were held to prevent observer drift. To provide estimates of interrater reliability, a random 237 of the 1161 observations (20%) were independently coded by two coders. Coders were unaware of which observations were used to assess observer agreement. Intraclass correlation (ICCs) was assessed through a two-way mixed effects model using SPSS 22.0. Interrater reliability was excellent at .96 to .97 for positive parenting; from .85 to .93 for negative parenting; from .82 to .93 for positive child behavior; and from .70 to .83 for negative child behavior.

### Intervention: The Incredible Years BASIC program

The IY program is developed to prevent and intervene in the development of child externalizing behavior by building a warm parent-child relationship through increasing positive parenting strategies such as child directed play, social and emotional coaching, praise and incentives and decreasing negative parenting strategies such as being critical and inconsistent (Webster-Stratton, 2001b). IY is a group behavioral parent training program consisting of 15 weekly sessions. The program starts with the focus on positive parenting strategies such as play, praise and incentives, before discussing effective limit setting, ignoring unwanted behavior, and finally time out strategies. During the sessions parents watch video-vignettes of parents and children interacting (in our study Dutch subtitles were used in the vignettes), act in role-plays, have brainstorm sessions, and exchange experiences and ideas in small groups. After each vignette, the group leader asks questions to stimulate discussion about what parents found particularly (in)effective and to practice alternative responses. Parents are encouraged to role-play new skills in front of the group and in small subgroups during the meeting. Before each session, parents read a book chapter on the topic of that particular session. Additionally, they receive home assignments to practice the discussed skills at home. Parents are also assigned a “buddy” (i.e., another parent of the same group), which they call weekly to check in with and discuss successes and difficulties with the new learned skills. The program uses a collaborative setting, in which group leaders establish themselves as facilitators rather than as experts. Group leaders encourage parents to solve problems and to help each other solve problems in order to ensure maintenance of the intervention effects.

Fourteen IY intervention groups (consisting of 8-15 parents) were delivered across three different Dutch municipalities (i.e., large urban city, medium urban city, and a suburban area). The groups consisted of 14 weekly 2-hour sessions and a “booster” session one month after termination of the program (i.e., total of 15 sessions). Every group was led by two group leaders who had followed a commensurate three-day basic training. All main leaders had a background in clinical child psychology, had experience running IY groups before the study commenced, and were officially certified by The Incredible Years, Inc. (two group leaders got certified during the study). Parents completed weekly satisfaction questionnaires to ensure the session contents address the specific goals parents have. To boost attendance, child-care was arranged for parents who attended the course during office hours. Parents were compensated for travel costs when needed. At the start of the program all parents received the program book and an IY magnet. During the sessions group leaders provided the groups with coffee, tea, and snacks. Candy or stickers (parent’s choice) were handed out during the sessions as a reward for active participation. During the sessions on ‘tangible rewards’ leaders also brought small surprise rewards for parents (worth approximately 1 euro, such as stickers, stamps, or small games, which they had to blindly grab from a ‘treasure bag’). At the last session, all parents received a certificate, a personal felicitation talk, and a plant as a reminder of the program.

### Analyses

#### Preliminary analyses

The preliminary analyses showed that there were no outliers but that the data were skewed. Therefore, we used maximum likelihood robust (MLR) to deal with non-normally distributed data. Also, two-level MvN models were run as preliminary analyses to test the nesting of families within intervention groups (i.e., families formed a part of fourteen groups). There was no variance at the group level at pretest, and at posttest variance did not exceed 4% of total variance. Therefore, group-level was not included in the final models.
Main analyses

In the primary analyses, latent growth curve modeling (LGCM) in Mplus (Muthén & Muthén, 2008-2015) was used to assess the development of observed and reported parenting and child behavior across pretest, posttest, and follow-up assessments. LGCM estimates individual growth for each child or parent separately, which is an excellent approach for examining variation in the development of the outcome variables, while controlling for baseline levels. Model fit is considered good if the Root Mean Square Error of Approximation (RMSEA) is < .05 and Confirmatory Fit Index (CFI) values are > .95 (Hu & Bentler, 1999). To calculate effect sizes of the intervention effectiveness Cohen’s d was used, where d ≥ .20 is considered a small effect, ≥ .50 as a moderate effect and ≥ .80 as a large effect. In total, 197 parents were assigned to the IY intervention groups, of whom 44 decided not to participate in the program or never attended a session. We found no differences on any pretest measures (ps > .09) between parents who actively participated in the intervention and parents who did not. Therefore, the 44 allocated-to-intervention families who did not attend any sessions were still included in the analyses. In total, we assessed eight separate outcome measures (i.e., four parent-reported and four observed) in the full intention-to-treat analyses. Benjamini-Hochberg False Discovery Rate correction (Benjamini & Hochberg, 2005) was used to correct for chance capitalization.

After assessment of the intervention effectiveness, moderator variables (i.e., initial severity of externalizing behavior, child gender, SES measures by parental education, family composition, and number of sessions parents attended) were assessed using eight multivariate mixture models, controlling for possible confounding effects of the moderator variables. The effects of the moderator variables on the slope of the outcome variables were estimated for the two classes (intervention and control) separately, since the variable ‘number of sessions attended’ is only relevant in the intervention class.

RESULTS

Intervention integrity

A total of 197 parents were assigned to the IY intervention groups. Active participants attended on average 11.01 (SD = 3.69) out of 15 sessions. Of these participants, 74% attended at least 10 sessions and 84% at least half of the sessions. If parents missed a session, group leaders called them to discuss the content and sent them home assignments. If parents missed three subsequent sessions, a home visit was scheduled by the trainers to discuss the missed program content with the parent(s). Besides the IY intervention about a third of the families in the experimental condition (31.30%) received additional (mental health) care or help between baseline and posttest, which was significantly less than families in the control condition.

### Table 4. Intervention Effects of Reported and Observed Child and Parent Behavior

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Intervention Effects of Reported Behavior</th>
<th>Intervention Effects of Observed Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretest Follow-up</td>
<td>Posttest Follow-up</td>
</tr>
<tr>
<td></td>
<td>Report positive behavior</td>
<td>Report positive behavior</td>
</tr>
<tr>
<td></td>
<td>Observed prosocial behavior</td>
<td>Observed prosocial behavior</td>
</tr>
<tr>
<td></td>
<td>- .05 (.06)***</td>
<td>- .01 (.07)</td>
</tr>
<tr>
<td></td>
<td>.08 (.04)</td>
<td>.06 (.06)</td>
</tr>
<tr>
<td></td>
<td>7.12 (4)</td>
<td>3.77 (2)</td>
</tr>
<tr>
<td></td>
<td>0.94</td>
<td>0.96</td>
</tr>
<tr>
<td></td>
<td>&lt; .001</td>
<td>&lt; .001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Report negative behavior</td>
<td>Report negative behavior</td>
</tr>
<tr>
<td></td>
<td>Observed externalizing behavior</td>
<td>Observed externalizing behavior</td>
</tr>
<tr>
<td></td>
<td>- .12 (.08)*</td>
<td>.12 (.06)*</td>
</tr>
<tr>
<td></td>
<td>.06</td>
<td>.08</td>
</tr>
<tr>
<td></td>
<td>3.77 (2)</td>
<td>1.37 (1)</td>
</tr>
<tr>
<td></td>
<td>0.96</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>&lt; .05</td>
<td>&lt; .05</td>
</tr>
</tbody>
</table>

As per the火花 (χ² (1, N = 350) = 3.71, p = .05). The IY program can only be implemented by officially certified group leaders. To ensure and monitor implementation fidelity group leaders followed a treatment manual for each session (i.e., standardized manuals and session guidelines, check-lists, books, DVDs, handouts, tangible rewards etc.) and completed weekly protocol checklists of standards (e.g., vignettes, brainstorming, role-plays) to be covered in each session. Checklists showed that on average 70.4% of the standards were executed by trainers. It has been suggested that that positive intervention effects are often obtained with levels of program integrity exceeding 60% (Durlak & DuPre, 2008). Furthermore, co-leaders filled out standardized peer-feedback forms and parents filled out standardized feedback forms. All sessions were videotaped for feedback. Group leaders received ongoing supervision, feedback, and training throughout the study. Treatment integrity of IY overall is very high because of the close monitoring, standardized materials, and comprehensive training manuals (see Webster-Stratton & Hammond, 1997).
Intervention Effectiveness of The Incredible Years: New Insights into Sociodemographic and Intervention-based Moderators

my dopamine has been busy – chapter 5

For observed child externalizing behavior, after correction for multiple testing, condition proved neither significant at intercept (B0 = .008, corrected p = .95) but significant at slope (B1 = -.125, corrected p = .002), indicating that observed levels of child externalizing behavior between the intervention group and control did not significantly differ before or over time (see Table 4).

For parent-reported child externalizing behavior on the ECBI intensity scale, condition proved non-significant at intercept (B0 = -.21, corrected p = .62) but significant at slope (B1 = -.175, corrected p = .073), indicating that observed externalizing behavior of children did not differ between control and intervention group at pretest, but that parents in the intervention group reported a significantly stronger decrease of negative parenting behavior over time compared to parents in the control group.

Intervention and Control Group

Table 3 shows correlations between the initial severity of the problem (measured as the child’s child behavior problems at baseline), the number of sessions attended, the socioeconomic status (SES) and the family composition (e.g., the number of family members) and the single parent status (indicating that change in observed levels of negative parenting behavior did not significantly differ between groups).

Table 5. Moderator Variables of Slopes in Intervention and Control Group

Note. *p < .05. **p < .01. ***p < .001.
parents and parents of boys reported more initial severity of externalizing behavior. SES was significantly negatively correlated with family composition ($r = -1.3, p < .01$) and positively correlated with number of sessions parents attended the intervention group ($r = .16, p < .05$), indicating that low SES families included more single parents and attended less intervention sessions when allocated to the intervention group. As planned, these correlations between moderator variables were taken into account to control for their possible mutually confounding effects.

Initial severity of externalizing behavior

Initial severity of child externalizing behavior was a significant predictor of the slope of parent-reported externalizing behavior over time in the intervention group ($B_1 = -.27, t = 3.74, df = 374, p = .000$) but not in the control group ($B_0 = .015, t = 1.56, df = 364, p = .011$). Initial severity did not influence intervention effects on observed child externalizing behavior, reported and observed child prosocial behavior, reported and observed negative parenting behavior, and reported and observed positive parenting behavior. Thus, no moderation of intervention effects by initial severity was found.

Child gender

Child gender predicted the slope of observed child prosocial behavior over time in the intervention group ($B_1 = .023, p = .03$) but not in the control group ($B_0 = .015, p = .85$). This indicates that girls in the intervention group showed a larger increase in prosocial behavior compared to boys in the intervention group. However, comparison of the coefficients of the control and intervention group showed, that the coefficients were not significantly different from each other ($t = 2.7, df = 374, p = .000$). Child gender did not influence intervention effects on reported and observed child externalizing behavior, reported child prosocial behavior, reported and observed negative parenting behavior, and reported and observed positive parenting behavior. Thus, no moderation of intervention effects by child gender was found.

SES

SES (parental education) was a predictor of the slope of reported negative parenting behavior in the control group. Low SES families in the control group reported more negative parenting over time ($B_0 = .087, p = .03$) but there was no such effect of SES on slope of reported negative parenting in the intervention group ($B_1 = .005, p = .ns$). However, comparison of the coefficients of the control and intervention group showed, that the coefficients were not significantly different from each other ($t = 1.45, df = 364, p = .15$). Also, we found that SES was a predictor of the slope of observed child externalizing behavior in the control condition ($B_0 = -.156, t = .04$) but not in the intervention condition ($B_1 = .000, t = .000$). This indicates that in the control condition higher SES predicted lower levels of child externalizing behavior over time. However, comparison of the coefficient of the control and intervention group showed, that the coefficients were not significantly different from each other ($t = 1.56, df = 374, p = .12$). In addition, SES was a predictor of the slope of observed child prosocial behavior in the intervention condition ($B_1 < .000, p = .000$) but not in the control condition ($B_0 = -.020, p = .ns$). However, comparison of the coefficients of the control and intervention group showed, that the coefficients were not significantly different from each other ($t = 3.3, df = 374, p = .74$). Thus, no moderation of intervention effects by SES was found.

Family composition

Family composition was not a significant predictor of the slope of any of the outcomes, indicating that single parent and two-parent families benefited equally from the IY intervention.

The number of intervention sessions parents attended

Number of attended IY sessions predicted the slope of parent-reported negative parenting behavior ($B_1 = -.020, p = .000$), parent-reported positive parenting behavior ($B_1 = .011, p = .001$), and observed positive parenting behavior ($B_1 = .018, p = .001$) in the intervention group. These results indicate that parents who attended more IY sessions reported a higher decrease in negative and higher increase in positive parenting behavior and also showed a larger increase in observed positive parenting behavior than parents who attended less IY sessions. The number of intervention sessions parents attended did not influence intervention effects on reported and observed child externalizing behavior, reported and observed prosocial child behavior, reported positive parenting behavior, and observed negative parenting behavior.

Discussion

Previous research demonstrated that the behavioral parenting training (BPT) Incredible Years (IY) is effective in preventing externalizing behavior. In addition, studies suggested that specific sociodemographic and intervention-based factors (i.e., initial severity of externalizing behavior, child gender, social economic status (SES), family composition, and number of sessions attended) may influence the intervention effectiveness of the program. However, the effects of these moderators were mostly studied in isolation rather than in multivariate analyses, inhibiting insight into "real" moderation effects when different moderators are controlled for each other. Also, these effects were studied in modestly sized samples (e.g., average N = 95; Menting et al.,...
Intervention Effectiveness of The Incredible Years: New Insights into Sociodemographic and Intervention-based Moderators

Intervention effects were neither found for observed child externalizing behavior and observed negative parenting behavior nor for reported and observed child prosocial behavior. Therefore, even though a recent meta-analysis found convincing proof that IY is effective in preventing observed child externalizing behavior ($d = 37$ for all 23 studies, $d = 35$ for the four indicative prevention studies; Menting et al., 2013), we did not establish this effect in the present study. In interpreting these findings it is important to note that reliability of the two observed child behavior scales was relatively low and that we adhered to stringent controls for multiple testing. This resulted in low power to detect effects on observed child behavior. We found no effects of IY on child prosocial behavior. This is contradictory to the outcomes of a recent meta-analysis by Menting and colleagues (2013), who found IY to be effective in reducing externalizing behavior as well as increasing child prosocial behavior. This might be partly explained by differences in how prosocial behavior is operationalized and assessed between studies.

Our results illustrate the importance of using multi-informant data when assessing intervention effects. Including both reported and observed data on parent and child behavior gave a more complete picture of changes herein. Specifically, although we found significant intervention effects on most parent-reported measures, on the observed measures we only found a significant effect on positive parenting behavior. It has been argued that parents might justify the time and effort they have invested through attending the intervention by reporting a decrease in child externalizing behavior, without the occurrence of an actual change in such behavior (Leijten, Overbeek, & Janssens, 2012). However, both the recent Menting and colleagues (2013) meta-analysis, including 25 studies with observational measures, and a Dutch study by Posthumus and colleagues (2012) did establish effects on observed child behavior. Among those studies the DPICS is often used as observation instrument, however there is little correspondence between studies in which DPICS categories for parent and child behavior are being used. For instance, some studies used a composite score of the categories child smart talk, Cry/Whine/Yell, and physical negative, excluding (Posthumus et al., 2012) or including non-compliance (Webster-Stratton, Reid, & Hammond, 2001) and destructive behavior (Webster-Stratton, 1998), whereas others used separate categories such as non-compliance or physical negative to index child externalizing behavior (Eyberg et al., 2001). It might be that previous studies also encountered difficulties in forming a reliable scale for this behavior. In our case, inability to create a reliable scale for observed child behavior combined with small variance might have precluded detection of an intervention effect in the present study. Another possible explanation might be differences between the parenting questionnaire and observation measure. The questionnaire asks parents about child behavior over a longer period of time and across different contexts, whereas the observation is conducted in a period of 20 minutes and is restricted to a play-session. Future research could explore whether different effects can be captured with observations using a more extensive timeframe and/or in different settings (e.g., morning routines or mealtimes).

The discrepancy between specifically our findings on observed positive parenting behavior and observed negative parenting behavior, might also suggest that the increase in positive parenting behavior is the most rapidly evoked and/or most robust intervention induced behavioral change. This seems plausible, considering that the IY program highly invests in strengthening the parent-child relationship by advocating positive parenting strategies (such as regular playtime and praise). Furthermore, it might be easier to stimulate parents to increase the use of novel positive parenting behaviors than to change coercive parent-child interaction patterns. In addition, it may be that, although parents already perceive and report a decrease in their own negative parenting behavior and their child's externalizing behavior, these behaviors have not yet observably changed enough to be detected by the limited observation measure at the time of the follow-up.

The simultaneous inclusion of multiple potential moderators in our analyses proved worthwhile, as moderators that have previously been studied in isolation were found to be correlated. Initial severity of externalizing behavior and number of sessions parents attended were the only moderators that influenced significant IY intervention effects. However, we did not find a consistent pattern of moderation across all outcome measures examined. For example, the number of sessions that parents attended moderated the intervention effects on reported negative parenting behavior and observed positive parenting behavior, but not on any child behavior outcome measures. Out of 40 tested moderation effects (i.e., eight outcomes × five moderators), we eventually found three significant moderation effects. This raises the question how potent these independent moderators are in differentiating the effect of the intervention, and consequently, the true clinical relevance of these moderators. The current findings indicate that IY may be an effective intervention, specifically for reducing perceived externalizing child behavior, across a broader range of child and family subgroups.

However, our findings do not rule out that the intervention effects are indeed different for different children and families and/or are influenced by moderators other than the ones currently examined. For example, the operationalization of parenting may...
be culture-bound, in that parenting practices related to negative child behavior may differ by ethnicity. The current study had a homogenous sample for which the number of parents not born in the Netherlands was only 16%, and the number of parents not born in a Western-European country was less than 13%. As our sample was a predominantly indigenous Dutch sample we were unable to examine ethnicity as a possible moderator. On the other hand, a previous study on IY, targeting Dutch ethnic minority mothers, showed that ethnic minorities benefited equally from IY compared to Dutch families (Leijten, Raaijmakers, et al., 2015). Furthermore, a more theoretically informed search for moderators may be fruitful. We know that externalizing behavior is a very heterogeneous behavioral cluster and has different etiologies in different children (e.g., Frick, 1998). This suggests that intervention effects may depend on the extent to which a specific intervention addresses the specific factors pertinent to the development of these behaviors in individual children. Thus, interesting moderators to investigate might be those factors that are likely to make children more or less susceptible to specific intervention techniques. Some of these factors indicated by previous studies relate to the neurocognitive domain such as inhibitory control (Lochman et al., 2015; Matthis et al., 2012), to child temperament (e.g., Gallocco, 2015; Scott & O’Connor, 2012), and to children’s genetic make-up (Bakermans-Kranenburg & Van Uzendoorn, 2015). More insight into “what works for whom” might also help to tailor interventions and to improve their effectiveness.

Using a full intention-to-treat model, the overall effect sizes of the intervention were small ranging between $d = .06$ and $d = .49$ at posttest and $d = .02$ and $d = .45$ at follow-up. However, the effect size on reported externalizing child behavior at follow-up was comparable to meta-analytical findings on the effectiveness of IY in an indicated prevention context (Menting et al., 2013). Another way to further improve effectiveness of prevention programs is by unraveling the active components why interventions are effective (i.e., mediators). One way to gain more insight into such mechanisms of change, is by conducting micro trials (i.e., small-scale randomized experiments using a brief and focused environmental manipulation, designed to target one specific risk mechanism) focused on discrete parenting intervention elements (Collins, Murphy, & Strecher, 2007; Howe et al., 2010; Leijten, Dishon, et al., 2015).

Our findings have to be interpreted in the light of some limitations. First of all, because of the indicated prevention setting we had a large group of parents who were attributed to the intervention but never participated. We used an intention-to-treat model to estimate more realistic intervention effects of IY in a real-world outreach prevention setting, including those parents allocated to the intervention that did not participate. However, as such an analysis might lead to a conservative estimation of intervention effects we also conducted “completers-only” analyses that showed similar intervention effects (see Supplementary Material). Secondly, our follow-up was on average only 4 months after the intervention. Therefore, we cannot say whether the improvements in parenting and child behavior remain over a longer period of time. However, previous longitudinal and quasi experimental studies do suggest long-term effects of IY up to adolescence (Jones, Daley, Hutchings, Bywater, & Eames, 2008, Posthumus et al., 2012; Webster-Stratton, Rinaldi, & Reid, 2011). More experimental research is needed to confirm these long term findings, but also to further investigate the longitudinal role of the sociodemographic and intervention-based moderators. Third, IY is a highly protocolled program, which overall yields high treatment integrity (Webster-Stratton & Hammond, 1997). Following IY standard procedure, program integrity is measured using group leader self-reported checklists. However, the use of therapist-reported treatment integrity has been criticized (Perpeletikova & Kazdin, 2005). It might be that other measures of integrity (e.g., observational coding of sessions) would yield lower integrity scores.

Fourth, our study also only included a small number of single parent and low SES families, which might cause a power issue to detect possible moderator effects of family composition and low generalizability to other samples (see Table 1). Finally, it is worth mentioning that the reliability of observed child behavior was low ($\alpha = .49$ to .67), which could have led to less reliable estimations of intervention effects. Nonetheless, for reasons of transparency, we decided to report the analyses because they were conducted to test previously published hypotheses (see for a priori hypotheses in Chhangur, Weeland et al., 2012). Despite these limitations, our current trial may be considered a major step forward.

### Table 1. Intervention Effects of Reported and Observed Child and Parent Behavior – Completers Only

<table>
<thead>
<tr>
<th>Outcome</th>
<th>intercept</th>
<th>Slope</th>
<th>Corrected intercept</th>
<th>Slope Corrected</th>
<th>df</th>
<th>CFI</th>
<th>RMSEA</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed positive behavior</td>
<td>1.14 (0.01)</td>
<td>0.00</td>
<td>1.14 (0.01)</td>
<td>0.00</td>
<td>26.81 (0.01)</td>
<td>0.99</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Reported positive behavior</td>
<td>0.13 (0.07)</td>
<td>0.32</td>
<td>0.13 (0.07)</td>
<td>0.32</td>
<td>0.97 (0.00)</td>
<td>0.97</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Observed negative behavior</td>
<td>-0.62 (0.03)</td>
<td>0.57</td>
<td>-0.62 (0.03)</td>
<td>0.57</td>
<td>0.57 (0.00)</td>
<td>0.57</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Reported negative behavior</td>
<td>-0.00 (0.01)</td>
<td>0.00</td>
<td>-0.00 (0.01)</td>
<td>0.00</td>
<td>0.00 (0.00)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Observed externalizing behavior</td>
<td>0.94 (0.02)</td>
<td>0.07</td>
<td>0.94 (0.02)</td>
<td>0.07</td>
<td>0.99 (0.00)</td>
<td>0.99</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Reported externalizing behavior</td>
<td>-0.05 (0.02)</td>
<td>0.00</td>
<td>-0.05 (0.02)</td>
<td>0.00</td>
<td>0.00 (0.00)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Observed prosocial behavior</td>
<td>-0.45 (0.02)</td>
<td>0.00</td>
<td>-0.45 (0.02)</td>
<td>0.00</td>
<td>0.98 (0.00)</td>
<td>0.98</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Reported prosocial behavior</td>
<td>0.00 (0.00)</td>
<td>0.00</td>
<td>0.00 (0.00)</td>
<td>0.00</td>
<td>1.00 (0.00)</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Note. df = degree of freedom; CFI = comparative fit index; RMSEA = root mean square error of approximation. As $x < d$, the CFI is set to 10 and RMSEA to .01, which makes it sufficient to read of whether the $p$ value is not significant. $p$ values are corrected with Benjamini-Hochberg False Discovery Rate correction. *$p < .05$. **$p < .01$. ***$p < .001$. 

### Notes
- $\alpha$ = .49 at posttest and $d = .45$ at follow-up.
- The current study had a homogenous sample for which the number of parents not born in the Netherlands was only 16%, and the number of parents not born in a Western-European country was less than 13%.
- We used an intention-to-treat model to estimate more realistic intervention effects of IY in a real-world outreach prevention setting, including those parents allocated to the intervention that did not participate.
- Our findings have to be interpreted in the light of some limitations. First of all, because of the indicated prevention setting we had a large group of parents who were attributed to the intervention but never participated. We used an intention-to-treat model to estimate more realistic intervention effects of IY in a real-world outreach prevention setting, including those parents allocated to the intervention that did not participate. However, as such an analysis might lead to a conservative estimation of intervention effects we also conducted "completers-only" analyses that showed similar intervention effects (see Supplementary Material).
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- Fourth, our study also only included a small number of single parent and low SES families, which might cause a power issue to detect possible moderator effects of family composition and low generalizability to other samples (see Table 1). Finally, it is worth mentioning that the reliability of observed child behavior was low ($\alpha = .49$ to .67), which could have led to less reliable estimations of intervention effects. Nonetheless, for reasons of transparency, we decided to report the analyses because they were conducted to test previously published hypotheses (see for a priori hypotheses in Chhangur, Weeland et al., 2012). Despite these limitations, our current trial may be considered a major step forward.
in terms of its large scale, the use of observational data to establish intervention effects on child and parenting behavior, the use of sophisticated statistical analyses, controlling for multiple testing, and high level of attendance at the intervention meetings and little overall attrition (retaining 93% of participants at follow-up). Moreover, we sought to extend recent work in this area by examining multiple moderators indicated by previous meta-analyses and by investigating the unique effects (i.e., controlling for possible confounding effects of different moderators) of these moderators on the intervention effectiveness. Our result show that previously suggested moderators may not be as potent in differentiating BPT effects as once thought. Based on this approach, IY has proven to be an effective prevention strategy to reduce parent perceived child externalizing behavior in a prevention setting.

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**Supplementary Material**

Table 1a.