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Preventing Disruptive Behavior in Elementary Schoolchildren: Impact of a Universal Classroom-Based Intervention

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A population-based, randomized universal classroom intervention trial for the prevention of disruptive behavior (i.e., attention-deficit/hyperactivity problems, oppositional defiant problems, and conduct problems) is described. Impact on developmental trajectories in young elementary schoolchildren was studied. Three trajectories were identified in children with high, intermediate, or low levels of problems on all 3 disruptive behaviors at baseline. The intervention had a positive impact on the development of all disruptive behavior problems in children with intermediate levels of these problems at baseline. Effect sizes of mean difference at outcome were medium or small. In children with the highest levels of disruptive behavior at baseline, a positive impact of the intervention was found for conduct problems.

Attention-deficit/hyperactivity (ADH) problems, conduct problems, and oppositional defiant problems in childhood are associated with many negative outcomes in adolescence and adulthood. These outcomes include greater risk for school failure and academic difficulties (Fergusson, Lynskey, & Horwood, 1997), poor relations with peers (Coie, Dodge, Terry, & Wright, 1991), early initiation of substance use (Milberger, Biederman, Faraone, & Chen, 1997), conduct disorder (Loeber, Green, Keenan, & Lahey, 1995), juvenile delinquency (Nagin & Tremblay, 1999), conviction for violent crimes (Jeglum-Bartusch, Lynam, Moffitt, & Silva, 1997; Moffitt, Caspi, Dickson, Silva, & Stanton, 1996), and increased risk for mental disorders in adulthood (Caspi, Moffitt, Newman, & Silva, 1998). In the present study, the impact of a universal, classroom-based preventive intervention on the reduction of disruptive behavior in young, elementary schoolchildren was examined.

ADH problems are the most frequently found of all disruptive behavior problems in young children (Loeber & Keenan, 1994). The prevalence of ADH disorder (ADHD; American Psychiatric Association, 1994), however, decreases when children move into adolescence and young adulthood (Hill & Schoener, 1996), whereas the prevalence of oppositional defiant disorder (ODD) and conduct disorder (CD; American Psychiatric Association, 1994) increases (Loeber & Keenan, 1994). Despite these differences in development across age, the co-occurrence of ADHD with ODD and CD is substantial (Loeber, Green, Lahey, Frick, & McBurnett, 2000). Furthermore, ADHD predicts the early onset of CD (Loeber et al., 1995). Van Lier, Verhulst, van der Ende, and Crijnen (2003) found that 7-year-old elementary schoolchildren with ADH problems typically also had comorbid ODD problems and conduct problems. Moreover, especially ADH and ODD problems at school entry (van Lier, Verhulst, & Crijnen, 2003) marked children that remained highly disruptive over a 1-year follow-up. Therefore, research on the impact of preventive interventions on disruptive behavior in young elementary schoolchildren should focus on the impact on all disruptive syndromes, with emphasis on those forms of disruptive behavior most applicable to these children.

In studies on risk factors for the development of disruptive problems in childhood, attention has been given to early child characteristics, such as coercion, impulsivity, and poor self-control, as well as to parental characteristics, such as poor parenting practices, parental psychopathology, and substance abuse. Although these factors are important in the early development of disruptive behaviors, the social context of children becomes of importance as the number and intensity of relations with peers and teachers increase with the transition from early childhood to elementary school age. These relations play a crucial role in the emergence, the manifestation, and the maintenance of disruptive syndromes (Coie & Jacobs, 1993; Patterson, Reid, & Dishion, 1992). Research has shown that young children are well aware of differences in levels of disruptive behavior in their peers as early as elementary school entry (van Lier & Crijnen, in press). Coie et

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al. (1991) reported that peers reinforce the disruptive or aggressive child's acts by backing down and allowing them to succeed. As a result, disruptive children believe that their behavior has positive consequences ensuing in a prolongation of disruptive and coercive behavior. As disruptive children grow older, they are increasingly regarded as deviant by their nondisruptive peers and are frequently rejected by them (van Lier & Crijnen, in press). The disruptive and increasingly disliked child is finally left with few social settings that provide correction on his or her behavior and will ultimately drift toward similarly deviant peers (Patterson et al., 1992; Reid & Eddy, 1997). The interaction between disruptive children and their teachers is characterized by disobedience, coercion, and many corrections and punishments, resulting in a negative spiral of emphasis on disruptive behavior (Reid, 1993). Classroom observations, for instance, have shown that of all initiations of teachers with disruptive children, only 11% involved support for appropriate behavior compared with 82% of the initiations with nondisruptive classmates involving support for appropriate behavior (Walker & Buckley, 1973). Therefore, the interaction between the disruptive early elementary schoolchild and his or her peers and teachers will ultimately result in stable patterns of coercive and aggressive behavior, in maladaptive associations with similarly deviant children (Warman & Cohen, 2000), and in poor outcomes associated with disruptive behavior in adolescence and adulthood. Programs aimed at the reduction of disruptive behavior in the social context of the classroom are therefore important for the prevention of disruptive behaviors.

The Good Behavior Game (GBG; Barrish, Saunders, & Wolfe, 1969; Dolan, Jaylan, Werthamer, & Kellam, 1989) is a classroom-based, behavior management program aimed to improve children's behavior. The GBG promotes prosocial behavior through (a) explicitly defining and systematically rewarding appropriate behavior, thus placing emphasis on positive rather than on negative behavior, and (b) by facilitating the interaction between disruptive and nondisruptive children through a team-based approach. The program results in a positive and safe classroom environment. In studies in the United States, the GBG was proven effective in the reduction of disruptive behavior in elementary schoolchildren (Dolan, Kellam, Brown, Werthamer-Larsson, et al., 1993; Ialongo, Poduska, Werthamer, & Kellam, 2001; Ialongo et al., 1999; Kellam, Rebok, Ialongo, & Mayer, 1994; Rebok, Hawkins, Krener, Mayer, & Kellam, 1996; Reid, Eddy, Fetrow, & Stoolmiller, 1999) and was able to delay experimentation with tobacco in early adolescence (Kellam & Anthony, 1998; Storr, Ialongo, Kellam, & Anthony, 2002). The GBG is listed as promising for the reduction of aggressive behavior by Blueprints for Violence prevention (Center for the Study and Prevention of Violence, 2002) and was awarded the Exemplary Substance Abuse Prevention Award by the Substance Abuse and Mental Health Services Administration (2002).

It is common knowledge that children may differ in the age of onset and subsequent development of disruptive behavior. Moffitt (1993), for instance, recognized three different patterns in the development of aggressive behavior: an early onset (life-course persisters), a late onset, and a stable, low-aggressive pattern, whereas Nagin and Tremblay (1999) identified four groups of children differing in initial level and change over time of their disruptive behavior. Information on the early characteristics of children following a specific developmental trajectory, on the sequences in their development, and on the malleability of their disruptive behavior would greatly enhance our knowledge of the syndromes of disruptive behavior and would further the basis for prevention science. To gather this information, a study is required (a) on the characteristics of disruptive behavior for groups of young children differing in patterns of disruptive behavior, (b) on children's developmental trajectories, and (c) on the impact of a preventive intervention on these developmental trajectories.

Because ADH problems are the most frequently occurring disruptive behaviors in young children, attention is primarily given to the early detection and the impact of a preventive intervention to these problems and is secondarily given to the impact of the intervention to oppositional defiant and conduct problems. In the present study, the following questions were addressed: (a) Is there an overall effect of the GBG preventive intervention on the developmental trajectory of teacher-rated ADH problems in young elementary schoolchildren? (b) How many developmental trajectories of ADH problems can be identified across early elementary schoolchildren? (c) What are the characteristic ADH problems of children following a specific developmental trajectory at baseline? (d) What is the impact of the GBG intervention on classes of children following a specific developmental trajectory of ADH problems? (e) What is the impact of the GBG intervention on comorbid oppositional and conduct problems?

Method

Study Sample and Design

In the spring of 1999, 13 schools in the metropolitan areas of Rotterdam and Amsterdam, the Netherlands, were recruited. In these 13 schools, 794 children attending 1st grade were assessed in the spring of 1999. However, only 722 children who moved on to 2nd grade were eligible for inclusion in the study. Twenty-two children who repeated 2nd grade in 1999, and thus moved into the study cohort before the implementation of the preventive intervention, were included in the sample, making the total sample 744 children. All 744 parents or parent substitutes were approached to obtain written informed consent; 666 parents (89.5%) agreed that their child could participate in the study. Sixty-nine percent of the children were Caucasian, 10% were Turkish, 9% were Moroccan, 5% were Surinam–Dutch Antilles, and 7% were from other ethnic groups. Fifty-one percent of the children were male, which did not differ for ethnic groups, $\chi^2(7, N = 666) = 4.67$, $p > .05$. Mean age of the children at baseline was 6.9 years ($SD = 0.6$).

Because this study aimed to determine the impact of a school-based program, only data of children who remained in the control or intervention classes over the intervention period were used. Ninety-two children were lost to follow-up because they either left school or were kept down a grade. Loss to follow-up was not related to gender nor to intervention status of the child. However, loss to follow-up children had higher teacher-rated ADH problems, $F(1, 665) = 18.751$, $p < .05$, ODD problems, $F(1, 665) = 8.243$, $p < .05$, and conduct problems, $F(1, 665) = 9.733$, $p < .05$, at baseline. The available data of these 92 children were included in the analyses.

At the start of the trial, each of the 13 schools had at least two Grade 1 classes. During the summer vacation between first and second grade, classes within one school were randomly appointed to either the intervention or control condition. Of the 31 classes in the 13 schools, 16 became intervention and 15 became control class, resulting in 363 children in the GBG program and 303 children attending the control class. Shortly after summer vacation, teachers were instructed about the GBG intervention that started in the fall of Grade 2.

Preventive Intervention

The GBG is a classroom-based behavior management strategy that promotes prosocial and reduces disruptive behavior. Teachers discuss the necessity of formulating class rules and choose with their students the rules for their class. The positively formulated rules are accompanied by pictograms that are attached to the blackboard. After observing children on well-defined behaviors in the class, teachers assign children to one of three or four teams. Teams contain equal numbers of disruptive and nondisruptive children. Children are encouraged to manage their own and their teammates' behavior through a process of group reinforcement and mutual self-interest. Each team receives a number of cards, and teams are rewarded when at least one card remains on their desk at the end of a 15- to 60-min period. Teachers, however, take a card when a student violates one of the rules. Teams and students are always rewarded with compliments. Winning teams receive tangible rewards (stickers) directly after each game, in addition to weekly rewards (if they won at least two out of three games that week) and monthly rewards. In the first intervention year, the GBG was implemented in three different stages. In the introduction stage, the GBG was played for three times a week for approximately 10 min. The goal was to experience children and teachers with the GBG. The introduction phase lasted for about 2 months. In the expansion stage, teachers were encouraged to expand the duration of the GBG (up to three times 1 hr per week), expand the settings in which the GBG was played, and expand the behaviors targeted by the GBG. Rewards were delayed until the end of the week and month. The expansion phase lasted until the early spring of the school year. In the final phase, the generalization phase, attention was focused on promoting prosocial behavior outside GBG moments by explaining to children that the rules used during the GBG were also applicable when the game was not in process. Children received compliments for appropriate behavior by their teachers. The GBG sessions were used as a booster. The same three phases were used in the second intervention year; however, because children were already familiar with the GBG, teachers swiftly moved to the expansion and generalization phase.

The GBG was played in 2nd and 3rd grade. Teachers received two afternoons of GBG training prior to the intervention and one afternoon of instruction in the middle of the year. In the first intervention year, teachers were coached in their classroom by well-trained advisors from the school advisory services during ten 60-min classroom observations. In the second intervention year, teachers were supervised during 10 school visits by either these advisors or their schools' internal supervisor.

The GBG had to be adapted for use in the Dutch school system to ensure a proper implementation in Dutch schools (van der Sar, 2002; van der Sar & Goudswaard, 2001). In contrast to the United States's GBG, Dutch teams do not compete for weekly winners, and teachers do not mention the children who violate GBG rules. In addition, children in the teams are encouraged to actively support each other in behaving appropriately.

Measures

Children's problem behaviors over the last 2 months were rated with the Teacher's Report Form (TRF/6–18; Achenbach, 1991), which contains a list of 120 behavior items. Teachers rated the child's behavior on a 3-point scale (0 = *not true*, 1 = *somewhat true*, 2 = *very true or often true*). The TRF/6–18 has been translated and validated for use in the Netherlands (Verhulst, van der Ende, & Koot, 1997).

Problem behavior at school was assessed with the Problem Behavior at School Interview (PBSI; Erasmus Medical Center, 2000). The PBSI is a 32-item teacher interview that assesses disruptive behavior and shy–withdrawn behavior in children. Teachers rated the child's behavior on a 5-point Likert scale ranging from 1 (*never applicable*) to 5 (*often applicable*). The ADH Problems Scale consists of eight items. Items include "*This child has difficulty with concentration,*" "*This child is impulsive*," or "*This child finds it hard to sit still*." The interrater reliability of the ADH Problems Scale was .45 ($p < .01$). The ODD Problems Scale consists of eight items, which include "*This child argues frequently*" and "*This child disobeys teachers' instructions*." The Conduct Problems Scale consists of 13 items, which include "*This child fights,*" "*This child attacks other children physically*" and "*This child is truant*."

Procedure

Teacher assessments at baseline were conducted in the spring (T1) and early summer (T2) of Grade 1. During intervention, a 12-month assessment (T3; end of 1st year of intervention), 18-month assessment (T4), and 24-month assessment (T5; end of 2nd year of intervention) was conducted. At the preintervention (T1 and T2), 12-month (T3), and 24-month assessment (T5), the TRF/6–18 was completed for all students by the teachers. Five forms with preprinted names were sent to the teacher per week, and they were asked to fill out the forms during that week. Teachers completed the TRF/6–18 for each child in their class in approximately 5 weeks. For this, teachers received a gift certificate of about $50. At the 18-month and 24-month assessment, teachers were interviewed at school with the PBSI by trained research assistants. Interviews were completed for all children attending these teachers' classes.

Statistical Analyses

The developmental trajectories of ADH problems were analyzed first, followed by analyses of ODD problems and conduct problems. In this section, the analyses of ADH problems are described (the same procedure was followed for ODD problems and conduct problems). The TRF/6–18 and PBSI scales were used. The model used to analyze ADH problems is given in Figure 1. To account for the missing-by-design data, the ADH scale scores of the TRF/6–18 and PBSI were integrated. Items from the TRF/6–18 and PBSI reflecting similar content were selected, which resulted in the selection of eight ADH problem items from both the TRF and PBSI. These eight items were summed to a total ADH problem score for the TRF and PBSI separately. Total ADH problem scores were computed for the first baseline assessment (T1) and the three assessments during intervention (T3, T4, and T5). To study change in a common construct across time, the following approach was used. A latent variable was considered for each of the 4 time points. The four continuous latent variables served as the indicators for the continuous growth factors (intercept and slope). Indicators for these latent variables were the observed total ADH problem scores of the TRF and the PBSI at the given time points. ADH problem scores from both the TRF and PBSI were present at T5; at the other assessment, either the scores from the TRF or PBSI were present. Measurement invariance of the construct across the 4 time points was approached as follows: (a) To put the four latent variables in the same metric at each of the 4 time points, the factor loading of the TRF on the latent variables at each time point was set at 1 by default. To reflect measurement invariance, the factor loading for PBSI was held equal across Time Points 4 and 5. (b) The measurement intercepts were held equal across time for both the TRF and PBSI scores. (c) The residual variances of the observed ADH problem scale of the TRF and PBSI were held equal over time.

The following procedure was used to answer the research questions. We started by defining the model needed to describe the relations between the observed data with conventional growth modeling. The fit of the model was determined on the control group and then on the intervention group. The overall effect of the GBG intervention on the developmental trajectory of ADH problems was determined in a multiple group analysis. We then moved to growth mixture modeling (GMM; B. O. Muthén, 2001; B. O. Muthén & Shedden, 1999) to determine the number of developmental trajectories needed to describe the data in the control and intervention group separately. The objective of GMM is to find the smallest number of classes of individuals with similar developmental trajectories. GMM estimates mean growth curves, that is, initial status (intercept) and change

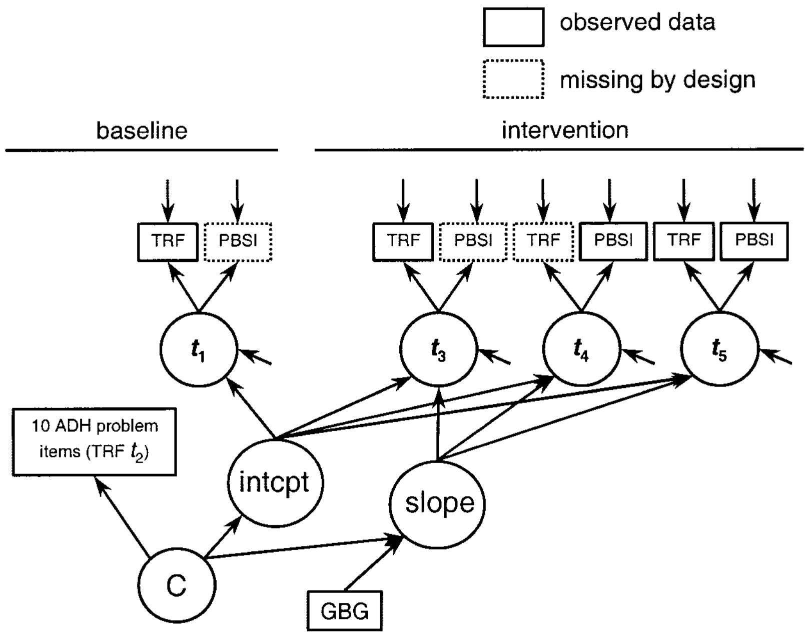

Figure 1. Observed and latent variables to analyze the impact of the Good Behavior Game (GBG) intervention on the development of attention-deficit/hyperactivity (ADH) problems. TRF = Teacher's Report Form; PBSI = Problem Behavior at School Interview; intcpt = intercept.

(slope), for each class of children and captures individual variation around these growth curves by the estimation of factor variances for each class. Because models with different numbers of trajectories are not nested, the usual log likelihood chi-square difference test cannot be used. Instead, Baysian Information Criterion values (BIC; Kass & Raftery, 1993) were used with lower BIC values indicating improvement over the previous model with one class less.

To analyze the effects of the intervention on the development of ADH problems, ODD problems and Conduct problems, GMM was incorporated into a more general framework, general growth mixture modeling (GGMM; B. O. Muthén & L. K. Muthén, 2000a; B. O. Muthén et al., 2002). In this framework, the slope of the developmental trajectories is regressed on intervention status.

To assess the baseline characteristics of children in a particular class, the GGMM on ADH problems was estimated simultaneously with a latent class analysis (LCA; McCutcheon, 1987) on items of TRF/6–18 ADH problems at baseline. LCA describes the probabilities of a set of observed categorical variables across groups of individuals when group membership of the individuals is unknown. First, the GGMM of the GBG intervention on children's disruptive behavior was modeled without the LCA. The LCA was then combined and analyzed simultaneously with the GGMM on intervention effects. In this overall (LCA) GGMM, characteristic patterns of ADH problems in young elementary schoolchildren following subsequent developmental trajectories of ADH problems, which may or may not be influenced by the GBG intervention, were identified. The estimated parameters of the final GGMM were (a) latent class membership probabilities giving the probability for each individual to belong to each of the classes, (b) class-specific symptom endorsement profiles giving the probabilities for individuals in a class to endorse ADH problems at baseline, (c) means and variances of the continuous growth factors for each of the classes, and (d) estimates of the regression coefficient of the GBG on the slope for each of the classes.

For the LCA on items of teacher-rated ADH problems, TRF/6–18 items reflecting similar content as *DSM-IV* criteria for ADHD were used (Achenbach & Rescorla, 2001). Items were dichotomized, in which 0 = *not true* and 1 = *somewhat/sometimes or very true or often true*. Teacher reports of the early summer assessment at Grade 1 (T2) were used for the LCA.

The overall GGMM, the GMMs, and multiple group analysis were analyzed with Mplus 2.02 (L. K. Muthén & B. O. Muthén, 2000b). The Mplus missing data module was used to optimally use the data available and to take into account that children that were lost to follow-up had higher levels of initial disruptive behavior than did the remaining children.

Results

Implementing the GBG

Teachers were willing to comply with the basic assumptions underlying the GBG intervention although some found it difficult to emphasize positive behavior and not to respond immediately to negative behavior. To enhance support for the program, teachers were invited to attend training sessions in which hard-to-manage classroom situations were discussed and solutions sought. Almost all teachers attended these sessions. Teachers frequently reported the GBG to be an effective tool to manage children's behavior in their class and reported using the GBG in situations when children were required to work quietly. Teachers also reported that children enjoyed the GBG and that they put in a great effort to win every session. Children were involved in deciding on the rewards, especially the week or month rewards; dress-up day or washing the teacher's car are examples of interesting rewards children came up with.

To determine the level of implementation, the external school advisor evaluated whether the school implemented all phases of the GBG program in the two intervention years. Of the 13 schools, 9 implemented the GBG program completely. Three schools implemented the program but did not move on to the generalization phase. In one school, the GBG was implemented poorly—only the introduction phase was used.

In general, teachers and children were satisfied with the program, although some children had difficulties to accept that cards were withdrawn from their team without the child himself violating a GBG rule. As a result, a few parents called to complain about the GBG program. An explanation about the function of the card, which is to remind children about the rules of GBG and the procedure that withdrawal of a card from the group does not immediately result in not receiving a reward, indicating that children had actually behaved very well, satisfied parents. It was then agreed with parents that when a child would come home complaining about cards being withdrawn, they would be complimented with their behavior if the group did not miss the reward.

Teachers in the control condition were asked about their knowledge of the GBG program. Although they were aware of the project, they did not indicate having specific knowledge about the GBG instructions, nor did they implement the GBG or part of the program in their class. After 1-year intervention, the three Grade 2 classes of one school were merged to two Grade 3 classes during the summer vacation. The research team had no influence on placing children in a particular class. However, at the start of Grade 3, one class was randomly appointed to the intervention condition, which resulted in 17 children moving from a control class to the intervention class. In the analyses, these children were included in the intervention group.

Model of ADH Problems

Exploration of the data indicated that a linear slope was needed to describe the relationships between the repeatedly measured ADH problem scores, both for children in the control and intervention condition. Allowing for correlations between the adjacent assessments and freely estimating the variance of the continuous latent, repeatedly measured, ADH problems improved model fit. The final model had a good fit to the data for the control group, $\chi^2(6, N = 303) = 13, p > .01$; comparative fit index (CFI) = .99; Tucker–Lewis index (TLI) = .98; root-mean-square error of approximation (RMSEA) = .06, and for the intervention group, $\chi^2(6, N = 361) = 11, p > .01$; CFI = .99; TLI = .99; RMSEA = .05. Cronbach's alpha was .90 for the TRF-ADH Problem Scale and ranged from .92 to .94 for the PBSI-ADH Problem Scale. The correlation between the PBSI and TRF-ADH Problem Scale at T5 was .73 ($p < .01$).

Multiple Group Analysis

Intervention children had slightly, but not significantly higher ADH problem scores at baseline, as can be seen in Figure 2. The development of children in the intervention classes was characterized by significantly decreasing levels of ADH problems, whereas children in the control classes had significantly increasing levels of ADH problems. To assess whether there was an overall GBG intervention effect on the development of ADH problems, the slope of ADH problems in the intervention group was fixed to be equal to the slope of ADH problems in the control group, and model fit was examined. The chi-square difference test showed that the difference in slopes between children in the intervention and control group was significant, $\chi^2(1, N = 666) = 11, p < .01$, indicating that, on average, children in the control classes followed a significantly different developmental trajectory of teacher-rated ADH problems than did children in the intervention classes.

Mixture Modeling

The number of developmental trajectories of ADH problems was identified in control- and intervention-class children separately. Following the procedure described by L. K. Muthén and B. O. Muthén (2000b) to find the optimal number of trajectories, the variances of the continuous growth factors and the covariance between the growth factors were initially set to zero. Moving from two to three trajectories resulted in a drop in BIC points of 90 for the control and 35 for the intervention condition. Four trajectories resulted in nonconverging solutions in both the control and intervention group. The model with three developmental trajectories was therefore used for the remaining analyses. The three trajecto-

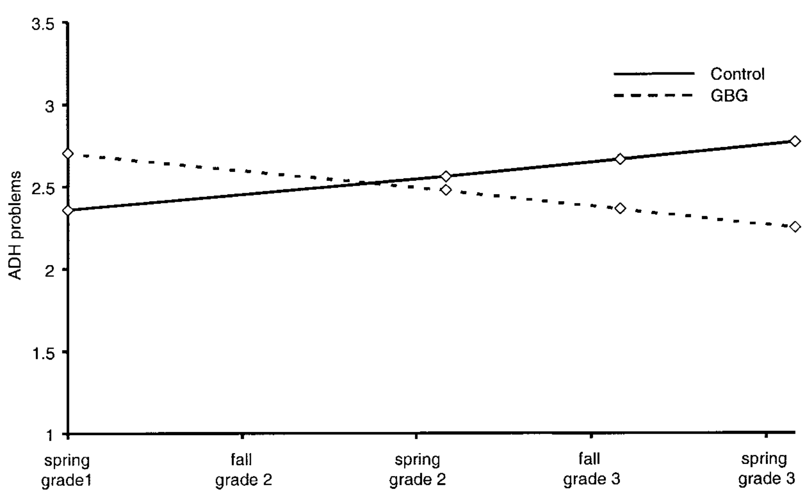

Figure 2. Results of the multiple group analysis: developmental trajectories for control group children and Good Behavior Game (GBG) children. ADH = attention-deficit/hyperactivity.

ries had respectively high, intermediate, and low levels of ADH problems at baseline.

Developmental trajectories and intervention effects were first modeled without the baseline characteristics. In this GGMM, starting values of the separate GMMs were used. Again, the variances of the continuous growth factors and the covariance between the growth factors were initially set to zero. The slopes were regressed on intervention status for each class separately to allow for class-specific intervention effects. Children were classified to one of the three developmental trajectories on the basis of their highest membership probability. The average class membership probability was .94 for children in Class 1, .86 for children in Class 2, and .97 for children in Class 3.

The baseline characteristics of ADH problems were taken into account in the analyses. The LCA was therefore included in the GGMM. For the LCA part of the model, starting values were set negative for Class 1 (high-ADH problems trajectory), which indicated high probabilities to endorse ADH problems were anticipated; neutral for Class 2 (intermediate trajectory), and positive for Class 3 (low trajectory). On the basis of likelihood ratio chi-square testing, the variance of the slope and covariance between intercept and slope were freed in the overall model. Children were classified with higher precision when the baseline characteristics of ADH problems were included in the analyses. Across both models, 73.3% of the children remained in the same class. Children that changed from class from the first to the second model were classified with less precision in the first model. The average class membership probability of the final model was .95 for children in Class 1, .93 for children in Class 2, and .97 for children in Class 3. These high average probabilities indicated that all children were classified to one of the classes with high precision. Categorization was not related to the level of implementation, $\chi^2(6, N = 666) = 9.64$, $p > .05$. To study whether loss to follow-up impacted the model estimation, the final model was also run with only children for which all data were available. The parameter estimates and percentage of children classified to each of the classes were highly similar to the model that included all children. Therefore, the model including all children was used for the remainder of the analyses.

ADH Problems at Baseline, Developmental Trajectories, and Impact of GBG Intervention

Fourteen percent of the children were classified in Class 1, 78% of whom were boys (Table 1). On average, Class 1 children had 9.3 of the 13 (range: 5–12) ADH problems scored by their teachers. Symptom endorsement profiles for each of the three classes are shown in Figure 2 (top). Items are from the TRF/6–18. Children in Class 1 had the highest probabilities of all children to have ADH problems endorsed. These children had especially high probabilities for the items "*Impulsive or acts without thinking,*" "*Disrupts class discipline,*" "*Fidgets,*" "*Can't concentrate, can't pay attention for long,*" "*Can't sit still, restless, or hyperactive*" and "*Disturbs other pupils.*" The probabilities to endorse these items were all above .8, which indicates that almost all of the children in this class showed these ADH problems. The developmental trajectories are shown in Figure 3 (bottom). Class 1 children were characterized by high levels of ADH problems in Grade 1, followed by a significant decrease in ADH problems over the intervention period. The regression coefficient of GBG on the slope was not significant (Table 1), indicating that the decline in ADH problems was similar for control and intervention children.

One hundred seventy-six children (26%) were classified in Class 2, of which 62% were boys. These children had on average 4.1 (range: 0–9) ADH problems scored, and the probabilities of Class 2 children to have these items endorsed were all lower than for children in Class 1. However, the probabilities for the items "*Talks out of turn,*" "*Fidgets,*" "*Can't concentrate, can't pay attention for long,*" "*Can't sit still, restless, or hyperactive,*" and "*Disturbs other pupils*" still indicated that children in this class showed on average half of these symptoms. Control children had significant increasing levels of ADH problems over time. The coefficient of GBG on this slope was negative and significant, indicating that Class 2 intervention children had a significant better development than their control group counterparts. This indicates that the increase in levels of ADH problems found for Class 2 control children was not found in Class 2 children receiving the GBG intervention. To assess the clinical relevance, the effect size (Cohen's *d*) for the estimated mean difference at outcome (spring Grade 3) was calculated by dividing the difference in estimated mean ADH problems of intervention and control-group children by the standard deviation of the estimated mean at outcome. Cohen's *d* was .71, which is a medium effect size (Cohen, 1988).

The remaining 398 children were in Class 3, of which 42% were boys. Children in this class had on average 0.4 ADH problems endorsed (range: 0–2), which is also shown by the very low probabilities. Low levels throughout the intervention period characterized the developmental trajectory of ADH problems in these children, which was not different for intervention children as it was

Table 1
Number and Percentage, Percentage Intervention, Gender Distribution, Mean TRF/6-18 ADH Problems, Parameter Estimates of the Developmental Trajectories, Impact and Effect Size of the GBG on ADH Problems for High, Intermediate, and Normative Children

	Children				ADH problems Grade 1		Developmental trajectory			
Class	*N*	%	% GBG	% boy	*M*	*SD*	Intercept	Slope	Slope on GBG	ES
High—Class 1	92	14	60	78	9.3	2.0	9.53	−1.75**	0.04	
Intermediate—Class 2	176	26	54	62	4.1	1.8	3.24	0.76**	−0.81**	0.71
Normative—Class 3	398	60	54	42	0.4	0.6	0.67	0.28**	−0.28	

Note. TRF = Teacher's Report Form; ADH = attention-deficit/hyperactivity; GBG = Good Behavior Game; ES = effect size.
** $p < .05$.

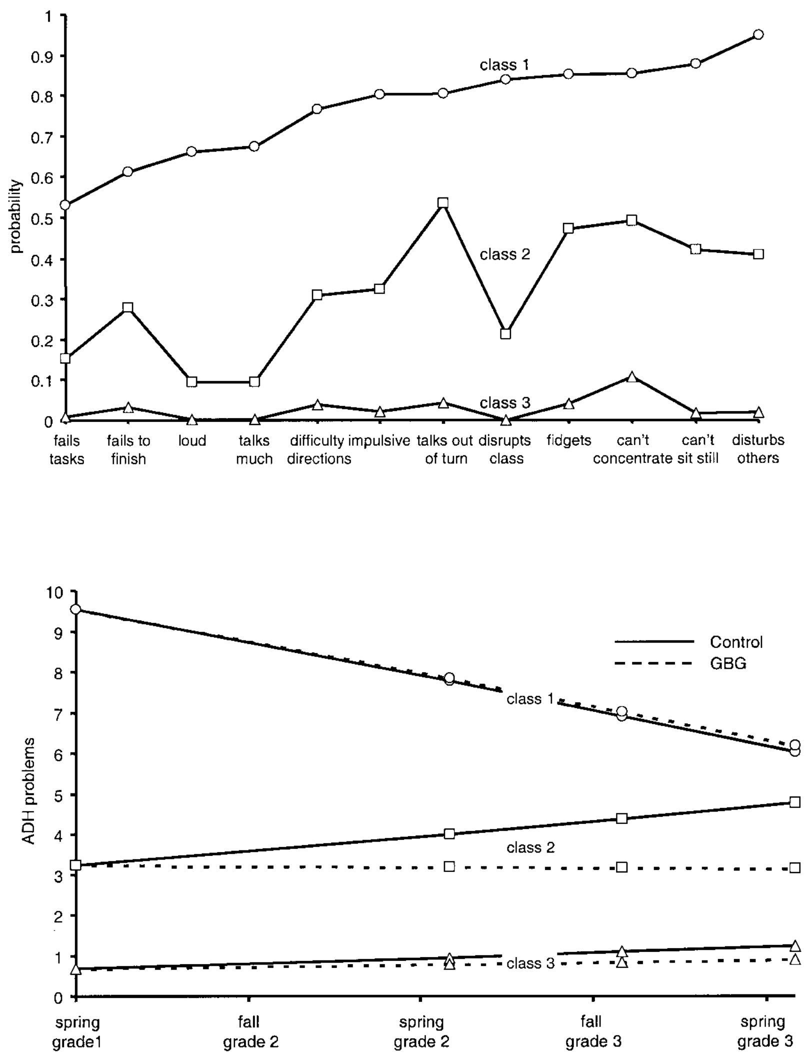

Figure 3. Results of the general growth mixture modeling framework: attention-deficit/hyperactivity (ADH) endorsement profiles (top panel) and developmental trajectories (bottom panel) for control group and Good Behavior Game (GBG) children.

for control children. The percentage of children categorized to the developmental trajectories differed between schools, $\chi^2(24, N = 666) = 77.79, p < .05$, although children from each school were present in all three trajectory classes.

Implications for Comorbid Conduct Problems and ODD Problems

The impact of the GBG intervention on conduct problems (9 items; Cronbach's alpha TRF: .76–.81; PBSI: .90–.91; Pearson correlation: .77, $p < .01$) and ODD problems (4 items; Cronbach's alpha TRF: .70–.78; PBSI: .85–.90; Pearson correlation: .73, $p < .01$) for children classified in each of the three classes was assessed. Exploration of the data indicated that a linear slope was needed for ODD problems, whereas a quadratic slope was needed for conduct problems. Allowing for correlation between the adjacent assessments improved model fit for both ODD and conduct problems. Freely estimating the variances of the continuous latent variables improved model fit for ODD problems but not for conduct problems; variances were held at zero. Fit indices indicated good fit for ODD problems, CFI = .97, TLI = .95, and for conduct problems, CFI = .99, TLI = .96. A three-class solution was analyzed for both ODD and conduct problems.

Figure 4 (top) shows the results for ODD problems, and Figure 4 (bottom) shows the results for conduct problems. Children classified in Class 1 as having ADH problems had the highest comorbid ODD and conduct problems in Grade 1. As found in children with ADH problems, the developmental trajectory of ODD problems was similar for intervention as for control-group children (Table 2). Although the estimate of the slope was negative, it was not significantly different from zero (95% CI: −0.49, 0.06). In contrast to ADH and ODD problems, a trend toward significance was found for the coefficient of GBG on the slope for conduct problems in Class 1 children (estimated $SE = 1.84$, $p = .06$) indicating lower levels of conduct problems for intervention children. The

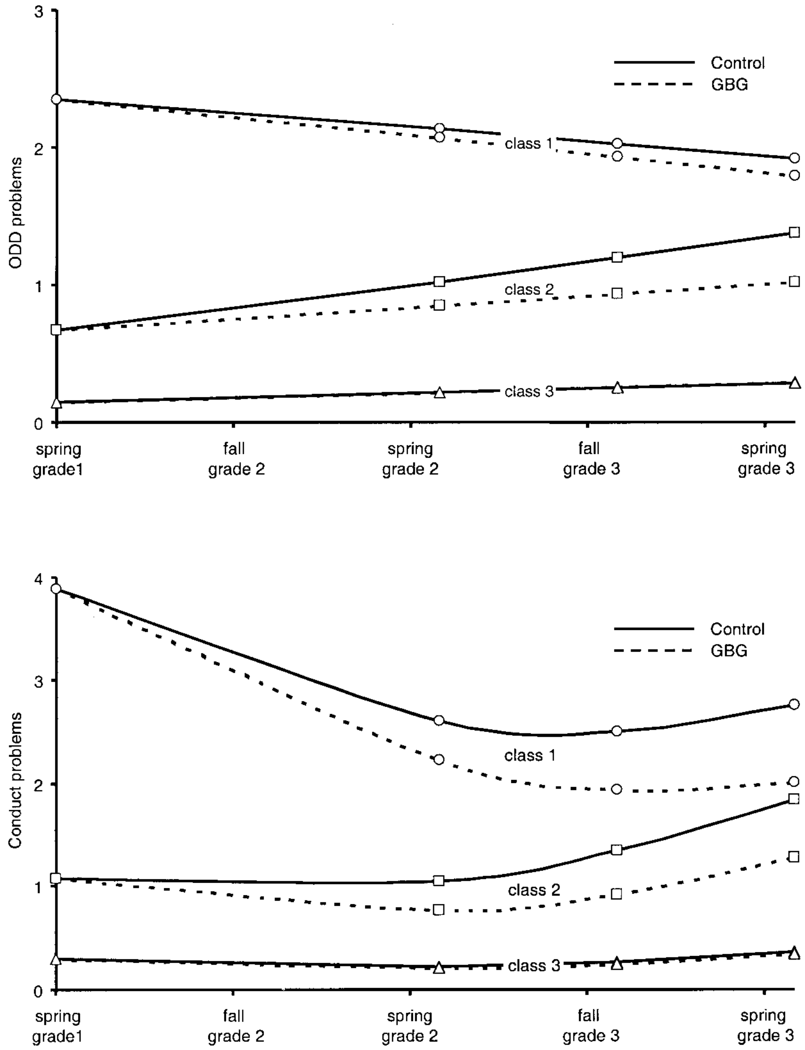

Figure 4. Developmental trajectories for oppositional defiant problems (top) and conduct problems (bottom) for control group and Good Behavior Game (GBG) children. ODD = oppositional defiant disorder.

effect size of the mean difference at outcome ($d = .55$) is medium according to Cohen's criteria.

Class 2 children had intermediate levels of ODD problems and conduct problems at baseline. The finding that Class 2 intervention children had a significant different developmental trajectory on ADH problems was substantiated by their development on both conduct and ODD problems. Control group children showed an increase in levels of ODD problems and conduct problems, although this was not found in children in the GBG program. The effect sizes of the intervention effect were medium for ODD

Table 2
Parameter Estimates of the Developmental Trajectories, Impact and Effect Size of the GBG on ODD Problems and Conduct Problems for High, Moderate, and Normative Children

	ODD problems				Conduct problems				
Class	Intercept	Slope	Slope on GBG	ES	Intercept	Slope	Qslope	Slope on GBG	ES
High	2.35	−.22	−.06		3.88	−2.00**	.72**	−.37*	.55
Intermediate	.67	.35**	−.17**	.41	1.07	−.43**	.41**	−.28**	.42
Normative	.15	.07**	.00		.30	−.19**	.11	−.01	

Note. ODD = oppositional defiant disorder; GBG = Good Behavior Game; ES = effect size; Qslope = quadratic slope.
* $p < .06$. ** $p = .05$.

problems (d = .41) and conduct problems (d = .42). Class 3 children had low levels of comorbid conduct problems and ODD problems, which was the same for control group children and children in the GBG program.

Discussion

The impact of a universal, classroom-based preventive program targeting young children's disruptive behavior was examined. We used a step-wise approach to study this impact by first analyzing the overall impact of the program followed by analyses of this impact on groups of children differing in developmental trajectories of ADH problems. The development of ADH problems, as determined in the control group, was characterized by an increase in the level of problems over the intervention period. Intervention children, in contrast, showed on average a decrease in levels of ADH problems. The difference in slopes was significant, indicating an overall effect of the GBG intervention on ADH problems.

Because we anticipated groups of children with different levels of ADH problems in Grade 1 and a fundamentally different development of ADH problem over the intervention period, classes of children following different trajectories were identified. Three classes were found. Children in Class 1 had the highest probabilities of all children for having any ADH symptom endorsed. These probabilities were always highest for children in Class 1, intermediate for children in Class 2, and lowest for children in Class 3. In a general population sample studied by Hudziak, Wadsworth, Heath, and Achenbach (1999), similar classes of children differing in ADH problems were found. Of the three developmental trajectories of ADH problems that were identified, the GBG had a positive effect on children with intermediate ADH problems across Grades 1–3. The size of the effect at the end of the intervention period was medium. This effect is best described as a preventative effect because the increase in levels of ADH problems found in control children was transformed in stable levels of ADH problems in intervention children.

The impact of the intervention on conduct problems and ODD problems was then examined. In line with the many relationships between the three disruptive behavior syndromes reported in the literature, Class 1 children had the highest levels of comorbid conduct problems and ODD problems, followed by intermediate levels in Class 2 children and very low levels in Class 3 children. For Class 2 children, preventative effects on conduct problems and ODD problems substantiated the previously found preventative effect on ADH problems for Class 2 children. The effect sizes, however, were small. In addition, Class 1 children had a trend toward significant improvement in conduct problems, indicating lower levels of these problems as a result of the intervention. The size of this effect at outcome was medium. Of interest is that the decrease in level of conduct problems of Class 1 intervention children resulted in similar levels of conduct problems as control-group Class 2 children at the end of Grade 3.

The fact that the GBG intervention resulted in preventative effects on the three disruptive behavior syndromes warrants further attention. Nagin and Tremblay (1999) identified groups of children characterized by intermediate levels of aggression, opposition, and hyperactivity at age 6 years, an increase in levels through age 10 years, followed by a decrease in levels into adolescence. This could imply that the GBG may largely affect children following this trajectory. Although the outcomes for these children in the Nagin and Tremblay (1999) study, in terms of self-reported delinquency and juvenile infractions, were better than the outcomes for consistently high-disruptive children, these children still had considerable levels of delinquency and juvenile infractions in adolescence.

There are limitations to this study. First, teacher ratings were used to study the impact of the intervention, but teachers also implemented the intervention. Independent observers thus did not conduct these ratings. However, a class generally had a new teacher at the start of every grade, and in no classes did the teacher move along with the grade over the entire intervention period. This indicates that the developmental trajectories and impact of the GBG on these trajectories are based on the ratings of, on average, three different teachers per class. Second, children were clustered within schools. The percentage of children classified to the identified trajectories differed between schools, although children from each school were present in the three identified trajectory classes. To obtain sufficient power for detecting school-level influences on intervention effectiveness through multilevel analyses and to obtain reliable estimates of these influences, 13 schools, as involved in this study, are not sufficient (Jo, Muthén, Ialongo, & Brown, submitted for publication in 2002; Kreft & De Leeuw, 1998). Variations at the school level were therefore not included in the analyses. Third, no data are yet available to assess the impact of the currently found positive effects on the manifestation of disruptive problems when children grow older. It is not correct to assume a priori that the short-term positive intervention effect will consistently be found in follow-up assessments. A short-term impact of the GBG on aggressive behavior was reported by Dolan et al. (1993). However, a sleeper effect was found in the follow-up period, in which levels of disruptive behavior of GBG children increased after the intervention ended, but decreased again once these children grew older. This decrease in disruptive behavior was not found in control-group children (Kellam, Ling, Merisca, Brown, & Ialongo, 1998). The positive GBG effects also resulted in less children starting tobacco smoking 6 years after the intervention (Kellam & Anthony, 1998; Storr et al., 2002). This suggests that a long follow-up period is needed to tap the impact of the currently found positive effects. Fourth, the decline in levels of ADH problems for Class 1 children, with the highest ADH problems at Grade 1, could suggest a good prognosis for these children. This decline in levels of ADH problems is in accordance with studies showing decreasing levels of ADH problems when children grow older (Hill & Schoener, 1996; Loeber & Keenan, 1994). However, caution is warranted, because Nagin and Tremblay (1999) identified a group of young children with stable, high levels of hyperactivity through adolescence. The developmental trajectories in our study were based on a 2-year period. When repeatedly measured variables correlate less than perfectly, subjects that are at one extreme on the first assessment will be less extreme on the second, referred to as regression to the mean (Cohen & Cohen, 1983). This implies that the high levels of disruptive behavior of Class 1 children in Grade 1 were expected to decrease in the next assessment. With the limited number of assessments due to the relatively short time period of this study, this influence is relatively large. It may well be that once follow-up assessments are added, the trajectory of Class 1 children will show a stable level or a less pronounced decrease in level of ADH problems. Symptoms of oppositional defiant problems and conduct problems are expected to increase in high-risk children (Loeber & Keenan, 1994), a pattern that was not clearly reflected in children in this study. However, the coefficient of the slope of ODD problems of Class 1 children was not significantly different from zero, and the slope of Class 2 control children was significantly positive, indicating increasing ODD problems. The slope of conduct problems became positive when children grew older for Class 1 and Class 2 children, which suggests the developmental trajectories to be in accordance with earlier findings. Regardless of this, the good fit of the models used indicates that the short-term development and impact of the GBG is well described by the estimated developmental trajectories.

The findings of this study have implications for research on syndromes of disruptive behavior, for preventative programs, and for the identification of children developing disruptive behavior. Although a preventative effect of the GBG on the development of ADH problems was found, this effect was mainly accounted for by a subsample of 26% of all children with intermediate levels of disruptive behavior. Children with high levels of disruptive behavior were partially affected by the intervention because the positive impact was limited to reductions in conduct problems. Preventative interventions like the GBG are thus effective at intermediate levels of disruptive behavior problems and partially effective at high levels of disruptive problems. Second, the GBG intervention prevented an increase in levels of disruptive problems, which enhances the importance of applying these programs as early as possible. Third, Offord, Kraemer, Kazdin, Jensen, and Harrington (1998) argued that those children at high risk are likely to be the ones who will remain high on disruptive problems despite a preventative program. The partial impact on the high-disruptive children argues for combinations of universal and selective programs in which a classroom intervention is combined with more intensive efforts to reduce disruptive behavior in children at highest risk. These selective interventions could use the universal intervention as a screenings phase to detect children in need for more intensive intervention. To detect children at risk at an earlier stage (elementary school entry), the behavior endorsement profiles of children in each of the classes, shown in Figure 2 (top) are of importance. Although the differences in the behavior endorsement profiles of the children are best described as differences in severity of ADH problems, children who responded to the universal program were the ones who occasionally showed ADH problems in Grade 1. In contrast, children showing all types of ADH problems at Grade 1 mark children in need for selective programs. Of interest was that the behavioral profiles as generated in the model did not lead to clear cut-off scores. Class 1 children had at least five symptoms of ADH problems. However, Class 2 children had between 0–9 symptoms of ADH problems at baseline. This indicated a poor specificity of a cut-off score on ADH problems at baseline, especially given that the GBG impact on Class 2 children was better than on Class 1 children. This argues for the use of behavioral profiles rather than cut-off scores for screening purposes, which was previously demonstrated by van Lier, Verhulst, and Crijnen (2003).

The GBG has been proven to be effective in both the United States and in the Netherlands. Crijnen, Achenbach, and Verhulst (1997, 1999) reported cross-cultural similarities and differences in levels of parent-reported disruptive problems between children in the United States, the Netherlands, and 10 other countries. In both the United States and the Netherlands, the intervention effects of the GBG were determined through a randomized controlled trial. The fact that the GBG has been proven to be effective in multiple cultures indicates that despite cross-cultural differences in levels of disruptive behavior, cross-cultural consistency exists in the malleability of disruptive behavior problems in young elementary schoolchildren.

Finally, the outcomes of this study can be used to improve the efficacy of prevention programs by relating the developmental trajectories as identified in this study to the risk factors identified in models on the development of disruptive behavior. By comparing the children with high-disruptive behavior and a partial response to the intervention with the children whose disruptive behavior was effectively targeted by the GBG intervention on risk factors in the child, parenting–familial and contextual domains (van Lier & Crijnen, submitted for publication in 2003) and more effective preventive intervention programs, tailored to the needs of this specific group of children, can be developed.

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