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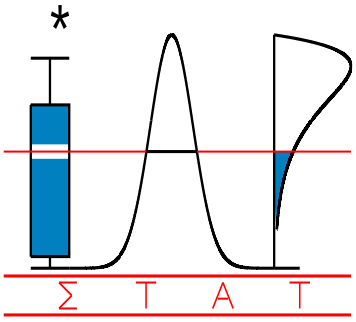

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A Multivariate Latent Growth Curve Analysis of Children's Aggressive and Delinquent Problem Behavior: Associations with Harsh Discipline and Gender

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Abstract

The aim of this study was to examine the developmental trajectories of aggressive and delinquent behavior in young children. Univariate latent growth curve modeling (LGM) analyses were employed to conceptualize and analyze intraindividual changes in children's aggressive and delinquent behavior and interindividual differences in these changes. A multivariate model was tested that related the two developmental trajectories to each other and to harsh discipline. The longitudinal data included mother and father ratings on the Child Behavior Checklist (CBCL, Achenbach, 1991), the 'Leuvens Instrument voor Coërcief Opvoedingsgedrag' ([Leuvens Instrument of Coercive Parenting Behavior] LICO; Hellinckx et al., 2000) and the Parenting Scale (Arnold, O'Leary, Wolff, & Acker, 1993) of 674 school-aged boys and girls of a proportional stratified general population sample, assessed annually for 3 years. A significant nonlinear decline in aggressive and delinquent problem behavior was found both in the mother and in the father ratings. A multivariate latent growth analysis indicated that trajectories in aggressive and delinquent problem behavior were mutually positive associated. Parenting behaviors were differentially related to children's aggressive and delinquent problem behavior. Coercion was significantly related to aggressive behavior but not to delinquent behavior. Higher scores on coercion were related to higher initial levels and a lower decrease of aggressive behavior. High scores on overreactivity were associated with higher initial levels of aggressive and delinquent problem behavior but not with the growth rates. Boys were higher than girls in initial status. Conversely, the rate of change was not related to gender. The results were replicated in the father data.

Keywords: aggressive behavior; delinquent behavior; externalizing behavior; development; latent growth analysis; harsh discipline; sex differences; CBCL.

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Introduction

Externalizing problem behaviors are the most common and persistent forms of childhood maladjustment (Campbell, 1995) and change not only in frequency but also in expression over the course of development. Therefore, there is a growing consensus that externalizing behavior must be studied from a developmental perspective (Loeber & Farrington, 1997; Sroufe, 1997). Several studies investigated the development of externalizing behavior in the general population (e.g., Bongers, Koot, van der Ende, & Verhulst, 2003; Hofstra, van der Ende, & Verhulst, 2000; Loeber, Green, Lahey, Frick, & McBurnett, 2000; Moffitt, Caspi, Harrington, & Milne, 2002). Most of these studies focused on the development of externalizing behavior problems in boys or were based on mother ratings. Although the significance of developmental trajectories is emphasized, there has been little attention to relations between trajectories and their etiologically relevant time-varying covariates.

Within cross-sectional studies, empirically based multivariate studies have identified two general types of externalizing behavior problems: overtly aggressive behavior and more covertly delinquent behavior (Achenbach, Conners, Quay, Verhulst, & Howell, 1989; Frick et al., 1993; Hinshaw, Simmel, & Heller, 1995). The aggressive behavior syndrome includes behaviors such as teasing, fighting, or hitting, but also incorporates aspects of aggressive personality such as arguing, bragging and hot temper. The delinquent behavior syndrome includes behaviors such as stealing, lying and cheating. Because relatively little

developmental studies have made a distinction between different forms of externalizing behavior (see e.g., Bongers, Koot, van der Ende, & Verhulst, 2004; Stanger, Achenbach, & Verhulst, 1997), little is known about the normative development of aggressive and delinquent behavior in the general population. The differentiation of externalizing behavior in these two clusters enables the investigation of different developmental patterns for different manifestations of externalizing behavior. Moreover, distinguishing different clusters of externalizing behaviors allows the study of comorbidity of behavior clusters and developmental pathways both within and across clusters. For example, studies by Loeber and colleagues (e.g., Loeber et al., 1993) suggest three different pathways of externalizing behavior problems in males that predict different outcomes. Recently, Barnow, Lucht and Freyberger (2005) found in a cross-sectional study different correlates for aggressive and delinquent behaviors in adolescents.

During the last decade, important advances in the field of measurement and analysis of change enabled scientists to incorporate both invariant characteristics and continuous change in developmental models (Collins & Sayer, 2001; Singer & Willett, 2003). Examples of this quantitative methods are hierarchical models (Bryk & Raudenbush, 1992), mixed models (Nagin, 1999), and latent growth models (Duncan, Duncan, Strycker, Li, & Alpert, 1999). Although these procedures differ in important ways (Collins & Sayer, 2001; Willett & Sayer, 1994), all estimate trajectory parameters (e.g., initial level and rate of change) for each person and specify how these parameters vary throughout the population. Until recently, technical limitations restricted analyses of individual change to one measurement series at a time. However, advances in latent growth modeling now allow the investigation of developmental trajectories in several domains simultaneously and to investigate how these trajectories relate to one another (Blozis, 2004; Willett & Sayer, 1996). The present study examined the codevelopment of aggressive and delinquent behavior in a general population based sample of

children aged 4 to 9 years including boys as well as girls. In addition, the relations between these trajectories and parenting factors were investigated. Fathers as well as mothers provided information. Because the aim of this study was to describe the normative development of aggressive and delinquent behavior, we reviewed only studies including samples from the general population. Further, we restricted our review to studies that used the CBCL (Achenbach, 1991; Verhulst, Van der Ende, & Koot, 1996), because the data in this study were obtained with this instrument.

Average Development of Aggressive and Delinquent Behavior Problems

With regard to age effects, findings are not unambiguous. To our knowledge, the study by Stanger et al. (1997) is one of the first studies that investigated the aggressive and delinquent syndromes separately. The aggressive syndrome was found to be more stable over time than the delinquent syndrome. Using repeated measures analysis of variance (ANOVA) of data from 7 cohorts of Dutch children, they reported that aggression declined steadily from about age 4 on, whereas delinquency declined slightly from age 4 until age 10 and then started to increase again, reaching a peak at about age 17. However, ANOVA-analyses focus only on the factor means. A fully expanded latent growth curve analysis on the other hand, takes into account both factor means and variances. This combination of individual and group levels of analysis is unique to the LGM procedure. Therefore, growth curve modeling is well suited to answer questions concerning systematic differences in individual developmental processes.

Bongers et al. (2003) showed a declining trajectory of mother-reported aggressive behavior over time for both boys and girls. Children with a lower initial value on aggressive behavior changed at a faster rate than did children with a higher initial level. Delinquent behavior showed a curvilinear developmental trajectory peaking at age 11 years. Children

with a lower initial score had a greater quadric change than did children with a higher initial value on delinquent behavior. In a review of Loeber, Lahey and Thomas (1991) it appears that most symptoms of oppositional defiant disorder are common by at least age 4-5 years and then decline in prevalence with increasing age in most children (see also, Achenbach & Edelbrock, 1981). In a longitudinal study from preschool to third grade, Munson, McMahon and Spieker (2001) found an increasing trend in externalizing behavior problems of children of adolescent mothers. Other studies reported also that the trajectories of boys' externalizing behaviors tend to increase or remain fairly stable through the period from kindergarten to seventh grade (see e.g., Loeber et al., 1993).

Gender differences in the Development of Aggressive and Delinquent Behavior Problems

With regard to gender differences there is also no consensus (for a review, see Coie & Dodge, 1998). Moreover, findings are not ubiquitous or clear because of variations in sampling, informants, measurement strategies, and statistical analysis (Lahey, Miller, Gordon, & Riley, 1999). In the study by Stanger et al. (1997) boys were scored higher than girls on both aggressive and delinquent behaviors. The study by Keiley, Bates, Dodge, and Pettit (2000) used a single-cohort longitudinal design and reported that mothers and teachers differed in their reports on externalizing behavior. Teachers reported significantly more externalizing behaviors in boys than in girls and a decline over time that was faster for boys than for girls. A similar declining trajectory was found for mother-reported externalizing behavior, but no effect for gender was found. Recently, Bongers et al. (2003) showed that for aggressive behavior boys at age 4 scored higher than girls and that boys decreased at a faster rate than girls. For delinquent behavior at age 4, boys had higher scores than girls. No gender differences on the slope were reported. In a cross-sectional study, Lahey et al. (2000) reported no gender differences in opposition but aggression and property violations were more

common among boys. However, in the study by Munson et al. (2001), from preschool through third grade no significant gender difference was observed for raw externalizing scores of children of adolescent mothers. Recently, Bongers et al. (2004) reported that the shape of the developmental trajectories of aggressive and oppositional behavior hardly differed between males and females. Moffitt and Caspi (2001) found that with regard to adolescent delinquency, males and females in the life-course persistent antisocial pathway shared the same childhood risk factors measured at age 3 years. It is important to note that most of these studies did not explicitly model individual change but rather statistically controlled for previous levels of problems.

The Role of Harsh Parenting in the Development of Externalizing Behavior

In contrast to the divergent findings with regard to the impact of age and gender, extensive empirical work exists linking parenting practices to childhood externalizing behavior problems (Patterson, 1982; Patterson, Reid, & Dishion, 1992; Shaw & Bell, 1993; Snyder, Cramer, Afrank, & Patterson, 2005). From a social interactional perspective Patterson and his colleagues (e.g., Patterson et al., 1992) stated that family members inadvertently provide reinforcements for antisocial behavior and fail to provide effective punishment for misbehaviors. While some of the reinforcement for coercive behaviors is positive (attend, laugh, or approve), the most important set of contingencies for coercive behavior consists of escape-conditioning contingencies (Patterson et al., 1992). In the latter, the child uses aversive behaviors to stop aversive intrusions by other family members. These reinforcing contingencies embedded in social interactions are actually the direct determinants for children's aggression. As this process continues, the child and other family members progressively escalate in the intensity of their coercive behaviors, often leading to high-amplitude behaviors such as hitting and physical attacks. In this training, the child eventually

learns to control other family members through coercive means (Patterson, 1982; Patterson et al., 1992).

Research questions

The purpose of this study was to extend prior research on young children's development of externalizing problem behavior by modeling an appropriate growth curve that parsimoniously and accurately depicts intraindividual changes in aggressive and delinquent problem behavior and interindividual differences in these changes from age 4 to 9 years, using latent growth analyses. We estimated the initial status and rate of change in both domains simultaneously and modeled how the changes in these domains relate to one another. Until now, most longitudinal studies that investigated growth curves of antisocial behaviors have focused on change in only one domain at a time (e.g., Bongers et al., 2003). To our knowledge, no studies have used an integrative analytical model to longitudinal data on problem behavior in a gender and time balanced sample of young children to describe the intraindividual changes of aggressive and delinquent behavior over time and the interindividual differences in these changes. Adequately describing these changes is a necessary condition to link more closely the conceptualization of children's development of externalizing problem behavior and the associated longitudinal data. These analyses provide initial insight into the characteristics of developmental trajectories in problem behavior prior to introducing additional explanatory measures of interest.

This study used mother and father reports on children's problems on the Child Behavior Checklist (CBCL; Achenbach, 1991; Verhulst, et al., 1996) obtained at three time points with 1-year intervals. The focus was on five questions related to the development of aggressive and delinquent behavior problems in young children: First, is there evidence for systematic change and individual variability in change in aggressive and delinquent behavior

during childhood? We expected a declining normative developmental trajectory on the aggressive and delinquent behavior scale. Second, are the developmental trajectories of aggressive and delinquent behavior related to each other? We expected developments in aggressive and delinquent behavior to be mutually positively associated. Third, are developmental pathways the same for boys and girls? Based on previous research, we expected that boys scored higher on aggressive and delinquent behavior compared to girls. With respect to the growth, we had no expectation on differences in growth. Fourth, to what extend are harsh discipline and the child's age related to developmental processes in aggressive and delinquent problem behavior? Based on the literature, we expected significant associations between harsh discipline and the initial levels and growth of aggressive and delinquent problem behavior. Fifth, are the developmental pathways the same for mother as for father ratings?

Methods

Participants

A sample of regular elementary-schools was randomly selected. Within the schools who agreed to participate, a proportional stratified sample of school-aged children was randomly selected. Strata were constructed according to geographical location (province), sex and age. Parents received an invitation letter to participate in "a study of parenting and child development". If these parents agreed to be contacted by the investigators, the first author called the parents, explained the study and obtained written permission. All subjects took part voluntarily, and anonymity and confidentiality were guaranteed. The initial sample consisted of 800 families from which 674 (84.3%) responded to the mailed questionnaires with two postal reminders and two telephone calls. Target children in these families ranged in age from 4 to 7 years (M = 5 years 10 months, SD = 1.12). There were 337 boys (M = 5 years 10

months, range: 4 years months – 7 years 11 months, *SD* = 1.12) and 337 girls (*M* = 5 years 10 months, range: 4 years – 7 years 11 months, *SD* = 1.12). From 627 children, both parents provided data. From 42 children only the mother and from 5 children only the father rated the questionnaires. All parents had the Belgian nationality. The mean age of the mothers was 34 years 11 months (range: 25 years 1 month – 50 years, *SD* = 3. 62) and of the fathers 37 years (range: 25 years 11 months – 59 years 10 months, *SD* = 4.26). Percentages of mothers (M) and fathers (F) with various educational levels: elementary school (M: 0.9; F: 3.0), secondary education (M: 41.1, F: 43.3), non-university higher education (M: 45.2; F: 34.4), university (M: 12.8; F: 19.2). The mean occupational level of mothers on a six-point scale (6 = highest; Van Westerlaak, Kropman, & Collaris, 1975) was 3.49 (SD = 1.38), and of fathers 3.59 (SD = 1.58). Mothers and fathers rated children's aggressive and delinquent behavior problems at 3 time points with an approximately 1-year interval between consecutive time points. At the second and third assessment wave, parents completed a parenting questionnaire. Both parents completed independently the questionnaires. Attrition and other forms of missing data (e.g., omissions) across the 3 years approximated 16% for the mother data and 19% for the fathers, resulting in a sample of 555 and 511 respectively, with complete data. We compared the subjects with data at all three assessments to the subjects missing data at one or two assessments. In the mother and father data, subjects with missing data had higher Time1 externalizing problem scores than subjects with no missing data, but the difference was not significant. Also with respect to sex, age, parental occupational and educational level, no significant differences were found between the two groups. By estimating the maximum likelihood function at the individual level (Arbuckle, 1996; Schafer & Graham, 2002; Wothke, 2000), data from all fathers (*N* = 632) and all mothers (*N* = 669), regardless of their pattern of missingness, could be included in these analyses. EM is a maximum likelihood procedure that uses iterations to impute missing values based on all available data. Schafer

and Graham (2002) recommend this procedure as being a highly efficient way to use the available data under the assumption that data is missing at random.

Measures

Aggressive and Delinquent problem behavior

Parent's global perceptions of their child's problem behaviors were assessed using the Dutch translation of the Child Behavior Checklist (CBCL; Achenbach, 1991; Verhulst, et al., 1996). This widely used instrument has two parts, one part measuring children's competencies and a second part consisting of 113 items describing a broad range of problems. Only the findings from the latter part of the CBCL were used for the purpose of this study. Each item on the CBCL is rated as 0 (not true), 1 (somewhat or sometimes true), or 2 (very true or often true). The Child Behavior Checklist is an extensively validated instrument that has adequate reliability and validity when describing child behavior (Achenbach, 1991; Vignoe, Bérubé, & Achenbach, 2000). The CBCL broadband externalizing scale encompasses the syndromes aggressive behavior and delinquent behavior. The aggression subscale contains 20 items, including overt aggressive behaviors such as arguing a lot, destroying one's own and other's belongings, being disobedient at home and at school, fighting with other children, attacking others, and threatening others. The delinquency subscale is made up of 13 items including more covert behaviors such as lying, cheating, being truant, having no guilt, stealing at home and elsewhere, using drugs and alcohol. These scales are traditionally used in raw score form by summing the score across all items (Achenbach, 1991). Cronbach's alphas for the aggression subscale were in mother data 0.89 and in the father data 0.88 at each wave. Cronbach's alphas for the delinquency subscale ranged in the mother data from 0.48 to 0.58 and in the father data from 0.44 to 0.49.

Harsh discipline

At the second assessment, both parents rated the 'Leuvens Instrument voor Coërcief Opvoedingsgedrag' (LICO; [Leuvens Instrument of Coercive Parenting Behavior] Hellinckx et al., 2000). This questionnaire intends to measure coercion as described by Patterson et al. (1992). When parents are inconsistent and capitulate to the child, Patterson (1982) hypothesized that they enter a "reinforcement trap" where short-term gains (e.g., peace and quiet) are obtained at the cost of strengthening the child's difficult behavior. This instrument is novel in that it is based on the outcome of whole sequences of conflict rather than on immediate reactions to particular individual behaviors. The LICO contains 10 descriptions of a situation in which the child is confronted with an aversive intrusion of the parents (e.g., clean up toys, go to bed, take a bath). For each situation, parents rated at maximum 6 items, i.e., three sequences of actions of the child (e.g., when you ask your child to go to bed, how will your child usually act?) and reactions of the parent (e.g., given that your child acts like that… how do you usually react?). The response categories of the child behavior range on a continuum from 1 (obey) to 4 (get angry, hit). Parent behaviors range from 1 (give in) to 5 (punish severely). If the child complies during the first or second sequence, parents go on with the next situation. If the parents capitulate to the child, a coercion score is calculated taking the duration of the conflict (i.e., the longer the child resists the request, the higher the coercion score) and the intensity of the aversive child behavior (i.e., the more aversive the child reacts, the higher the coercion score) into account. The total score for coercion is summated over the 10 situations. Cronbach's alphas for the LICO were in the mother and father sample 0.88 and 0.91, respectively.

At the third assessment, participants rated a translated version of the Parenting Scale (Arnold, O'Leary, Wolff, & Acker, 1993). The Parenting Scale was originally developed as a parent-report measure of dysfunctional parenting practices. The scale consists of 30 items

presenting discipline encounters (e.g., “When my child misbehaves…”) followed by two options that act as opposite anchor points for a 7-point scale (e.g., “I do something about it right away” versus “I do something about it later”). Based on factor analytic findings, three subscales were developed: overreactivity, laxness and verbosity. The overreactivity and laxness factor have adequate test-retest reliability, distinguish clinical from nonclinical samples, and have been validated against behavioral observations of parenting (Arnold et al., 1993). An exploratory factor analysis of the translated version revealed two interpretable factors corresponding with the overreactivity and laxness factors identified in previous studies of the parenting scale (Prinzie, Onghena, Ghesquière, & Hellinckx, 2005). This study focused on the overreactivity (OVR) scale. The OVR scale contains 9 items and measures a tendency exhibited by parents to respond with anger, frustration, meanness and irritation, impatiently and aversively to problematic behavior of their children. Arnold et al. (1993) equated the overreactivity factor with an authoritarian parenting style, which included threats and physical punishment. Cronbach’s alphas for the Overreactivity scale were in the mother and father sample 0.78 and 0.77, respectively.

Statistical analysis

The techniques of latent growth curve modeling (LGM) were used to examine changes in aggressive and delinquent behavior problems across time. LGM is a powerful and flexible technique that can be used to model longitudinal change in repeated observations of one variable (e.g., Duncan et al., 1999; Meredith & Tisak, 1990). The focus in latent growth analysis is not so much on the observed repeated measures of a theoretical construct over time but on the *unobserved* latent factors that are thought to have given rise to the set of observed measures. The strongest advantage of latent growth curve analyses for time ordered approaches is that LGC modeling has the ability to incorporate information concerning the

group or population and also contains specific information concerning changes in the individual. In other words, the subjects differ in their level at the first measurement occasion and develop at different rates. Meredith and Tisak (1990) noted that repeated measures polynomial analysis of variance (ANOVA) models are actually special cases of LGMs in which only the factor means are of interest. In contrast, a fully expanded growth analysis takes into account both factor means and variances. This combination of the individual and group levels of analysis is unique to the procedure.

In this study, statistical analyses were performed in 5 steps. In the first step, univariate latent growth models were fitted to the mother ratings of children's aggressive and delinquent problem behavior to determine the form of the growth trajectory that most adequately described intraindividual change and interindividual differences in each setting. These analyses provided initial insight into the characteristics of developmental trajectories in aggressive and delinquent problem behavior. In the second step, multivariate latent growth curves were tested to investigate the covariation between the developmental processes of aggressive and delinquent behavior. In the third step, we performed a multigroup analysis to investigate the effect of child's gender. In the fourth step, the effect of harsh discipline and child's age on the intercept and the slope was explored. Finally, to address possible problems with post hoc model fitting, we tested whether the final multivariate model with predictors could be replicated across the father sample. This invariance testing strategy gives an indication for the stability of the model. As Bollen (1989) has indicated this excessively rigid test of cross-validation is appropriate when a multigroup focus is directed more toward the equality of structural – rather than measurement – parameters. We opted for this approach and not for a full latent variable model approach because we had only two indicators (mother and father ratings) for the major latent constructs. Bollen (1989), among others suggests that three

indicators are a minimum and others point out that four indicators per latent variable are necessary to avoid a just-identified model.

The model depicted in Figure 1 represents a univariate latent growth model where the basic parameters describe a systematic pattern of individual differences in change over time. The variables AGG1 to AGG3 refer to the dependent variable (i.e., children's aggressive problem behavior) measured annually for three years. The εs represent error variances in the repeated measures. In our analyses, error variances are constrained to be equal. The first latent factor is labeled the *intercept* and corresponds to the initial status of children's aggressive problem behavior, that is, the aggressive score at Time 1. The intercept is a constant for any individual across time and represents information concerning the mean, represented by μ_I, and variance, represented by σ^2_I, of the collection of individual intercepts that characterize each individual's growth curve. Hence, in our models all measured variables from the three assessments have loadings with the common factor representing the intercept or initial status, constrained to 1.0. The second factor, labeled *slope*, represents the rate of change (increase or decrease) in aggressive problem behavior over the period of study (i.e., from Time 1 to Time 3). The slope factor has a mean, μ_S, and variance, σ^2_S, across the whole sample. The mean and the variance can also be estimated from the repeated measures. The variances of the slope and the intercept indicate how much individuals in the group vary. A large value means that the initial level, or rate of change, varies widely from person to person. Small variances mean that the group is homogeneous, starting at much the same level and changing at much the same rate. The double-headed curved arrow between the two factors indicates that both latent factors are allowed to covary (estimated as σ_{SI}). This happens if people who start at a lower level of aggressive behavior decrease/increase less/more rapidly than people who start at a high level of aggressive behavior. The factor loadings on the slope factor carry the information of the underlying time metric. The interpretation of the factors is determined by

the fixed values of the factor loadings. Meredith and Tisak (1990) have shown that at least two slope factor loadings must be fixed to two different values to identify the model. Because in this study the time intervals are equal, a trajectory corresponding to a linear change can be evaluated by fitting a model that specified the slope factor loadings to be 0, 1, 2, for AGG1, AGG2 and AGG3, respectively. Freely estimating the third parameter makes it possible to model an unspecified trajectory where the shape of the trajectory is determined by the data (i.e., an unspecified two-factor model, as in Figure 1). Within this approach, the freely estimated parameters reflect the developmental function with maximal fit to the data (Rao, 1958). In the unspecified two-factor model, the 'slope' factor is more accurately a 'slope/shape' factor in which information about the slope (i.e., the general linear trend) and the shape of the growth curve are confused. The difference in fit between the unspecified two-factor model and the linear trajectory model provides an index of the incremental gain in model fit due to the inclusion of information about the shape (i.e., curvilinearity). The chi-square difference test performed in the nested model comparison is used to determine the statistical significance of incremental fit due to the inclusion of curvilinearity in model specification.

For all latent growth models reported in this study, the LISREL 8.54 structural equation modeling software (Jöreskog & Sörbom, 2003) was used to fit the growth model to the observed mean vector and covariance structure. In addition to the chi-square, three model fit indices were used to assess model fit. They were Jöreskog and Sörbom's (1989) goodness-of-fit index (GFI), Bentler's (1990) comparative fit index (CFI), and Steiger's (1990) root mean square of error of approximation (RMSEA). For values of GFI and CFI, the convention of above .90 was adopted here as an indication of good fit. Browne and Cudeck (1993) indicated that an RMSEA-value of about .05 or less suggests a close fit of the model in relation to the degrees of freedom. All three model fit indices were used in evaluating each

model to provide convergent validity evidence in model fit assessment. The chi-square difference test was used to assess statistical significance of incremental fit in nested model comparisons. Multiple imputation with Expected Maximization (EM) (Schafer, 1997) is a new feature implemented in the LISREL 8.5 generation for imputing incomplete data that are missing at random under the assumption of an underlying multivariate normal distribution.

Results

Descriptive statistics

Table 1 represents the mean and standard deviations for the Time 1, Time 2 and Time 3 measures of aggressive and delinquent problem behavior rated by mothers (N = 669) and fathers (N = 632). Because the aggressive syndrome has more items, it has a wider range of possible scores (0 - 40) and a higher mean than the delinquent syndrome (range = 0 - 26). It can be seen that for all informants mean levels of aggressive and delinquent problem behavior showed a decreasing trajectory over time and that boys scored higher than girls. Because these means are computed from observed scores, measurement error may obscure the nature of the true growth trajectory. Latent growth analysis models the true growth trajectory by separating observed scores into a component describing true growth and a component representing the stochastic effect of the measurement error. Additionally, Table 2 shows that pairwise correlations of measures of aggressive problem behavior were higher than the correlations for delinquent problem behavior. Pairwise correlations were high to moderate within waves of measurements (mean r_{agg} = 0.72; mean r_{del} 0.55) and highly to moderately correlated across waves (mother mean r_{agg} = 0.76; r_{del} = 0.61; father mean r_{agg} = 0.73; r_{del} = 0.51). Correlations between the two individual correlates (gender and age) and aggressive and delinquent problem behavior respectively were generally lower and negative. Moderate

positive correlations were found between harsh discipline and aggressive and delinquent problem behavior.

Because the CBCL has demonstrated test-retest reliability (Achenbach, 1991) and there was a relatively long time period separating consecutive time points in the present study (i.e., approximately 12-month interval), all latent growth models assumed that within-informants errors were homoscedastic and uncorrelated across time.

Univariate Latent Growth Models

From the hypotheses, developmental processes can be deduced for aggressive and delinquent problem behavior. However, specific hypotheses about the functional form, of shape, of the developmental trajectories have not been formulated. Therefore, in a first step, univariate latent growth models for children's aggressive and delinquent problem behavior were tested separately for mother ratings. Table 3 contains the fit indices for the different models. The first model (Model 1.1 and 2.1) fitted to the data was a 'no-growth' or strict-stability model (Stoolmiller, 1994) which specified that no growth occurred at all over the 3 time points (i.e. a model with only an intercept factor). This model is the most restricted model and is nested under the other models in the table. The second model (Model 1.2 and 2.2) fitted to the data was a linear trajectory model, which specified a straight-line growth over the 3 time points. The third model (Model 1.3 and 2.3) fitted to the data was the unspecified two-factor model discussed above. The second model is nested under the third. In a second step, a multivariate latent growth model (Model 3) was specified to investigate the relationship between the intercept and growth of aggressive and delinquent problem behavior. In a third step, a multigroup analysis was performed to examine a possible gender effect (Model 4). The associations of harsh discipline and child's age with the intercept and slope of

aggressive and delinquent behavior were explored in Model 4. Finally, we investigated whether the final model for the mother data could be replicated in the father data (Model 5).

Univariate latent growth analysis of aggressive problem behavior

As shown in Table 3, the no-growth model (Model 1.1) didn't fit the aggressive problem behavior problems rated by the mothers, $\chi^2(6, N = 669) = 114.58$, $p < 0.001$, GFI = 0.949, CFI = 0.916, RMSEA = 0.165 indicating that some form of growth was present over the 3 time points. The linear trajectory model (Model 1.2), provided a better fit, $\chi^2(3, N = 669) = 15.93$, $p = 0.001$, GFI = 0.992, CFI = 0.989, RMSEA = 0.080. The nested model comparison using the chi-square difference test showed that the linear trajectory model provided significant incremental fit over the no-growth model, $\Delta_\chi^2 = 98.65$, $\Delta df = 3$, $p < .001$, indicating that a linear growth model represented the nature of intraindividual change over the 3 time points better than a no-growth model. To parameterize an unspecified model, the first two slope/factor loadings were fixed to 0 and 1 to identify the model. This model (Model 1.3) provided an excellent fit to the data, $\chi^2(2, N = 669) = 0.41$, $p = 0.82$, GFI = 1.000, CFI = 1.000, RMSEA = 0.000. The nested model comparison showed that this unspecified two-factor model provided significant incremental fit over the linear trajectory model, $\Delta_\chi^2 = 15.52$, $\Delta df = 1$, $p < .001$, indicating that a curvilinear growth trajectory represented the nature of intraindividual change over the 3 time points better than a linear growth trajectory. Therefore, this unspecified two-factor model was selected as the final growth model for children's aggressive behavioral problems rated by the mothers.

The parameter estimates of the final univariate model are presented in Table 4. The significant mean estimate ($\mu_{I(Agg)} = 7.62$, $t = 33.07$, $p < 0.05$) for the intercept indicates that on average, children had a significant initial score on aggressive behavior problems of 7.62. Also the slope factor means departs significantly from 0, $\mu_{S(Agg)} = -0.91$, $t = -6.75$, $p < 0.05$,

indicating that in the mother data there was a decline in aggressive problem behavior over time. The slope factor loadings were [0, 1, 1.34]. The Time 3 loading (1.34, $t = 11.94$, $p < 0.05$) was significantly different from 0. This means that aggressive problem behavior in the mother data were best described with a nonlinear trajectory. In the final model, all obtained R^2 were large (.80 - .83) indicating that most of the variance in the observed measures was accounted for by growth factors. This suggests that most of the observed change in children's aggressive problem behaviors in the mother data was related to time and that latent growth analysis was appropriate. Table 4 also shows that the variance for the intercept factor departs significantly from zero, $\sigma^2_{I(Agg)} = 29.51$, $t = 15.03$, $p < 0.05$, indicating that there were systematic individual differences in aggressive behavior problems in the mother ratings at initial status (T1). The slope factor variance, was also significantly different from zero, $\sigma^2_{S(Agg)} = 3.50$, $t = 4.49$, $p < 0.05$, indicating systematic individual differences in rate of change. The factor covariance between intercept and slope was also significant, $\sigma_{S(Agg)I(Agg)} = -4.03$, $t = -4.51$, $p < 0.05$, indicating that mothers of children with higher initial levels of aggressive behavior problems tended to report lower rates of change in behavior problems over time.

Univariate latent growth analysis of delinquent problem behavior

Analysis of the univariate latent growth curves for delinquent behavior problems rated by the mothers indicated that the no growth curve (Model 2.1) did not fit the data, $\chi^2(6, N = 669) = 71.30$, $p < 0.001$, GFI = 0.949, CFI = 0.912, RMSEA = 0.128. The linear trajectory model (Model 2.2), provided a better fit, $\chi^2(3, N = 669) = 35.71$, $p < 0.001$, GFI = 0.967, CFI = 0.955, RMSEA = 0.128. The nested model comparison using the chi-square difference test showed that the linear trajectory model provided significant incremental fit over the no-growth model, $\Delta_\chi^2 = 35.59$, $\Delta df = 3$, p < .001. The unspecified model provided a better fit to

the data, $\chi^2(2, N = 669) = 9.25$, $p = 0.01$, GFI = 0.991, CFI = 0.990, RMSEA = 0.074. The nested model comparison showed that this unspecified two-factor model provided significant incremental fit over the linear trajectory model, $\Delta_\chi^2 = 26.46$, $\Delta df = 1$, $p < .001$, indicating that also for delinquent behavior problems a curvilinear growth trajectory represented the nature of intraindividual change over the 3 time points better than a linear growth trajectory.

The parameter estimates of the final univariate model are presented in Table 4. The significant mean estimate ($\mu_{I(Del)} = 1.33$, $t = 22.19$, $p < 0.05$) for the intercept indicates that on average, children had a significant initial score on delinquent behavior problems of 1.33. Also the slope factor means departs significantly from 0, $\mu_{S(Del)} = -0.18$, $t = -3.78$, $p < 0.05$, indicating that in the mother data there was a decline in delinquent problem behavior over time. The Time 3 loading (1.12, $t = 12.16$, $p < 0.05$) was significantly different from 0. This means that delinquent problem behaviors in the mother data were best described with a nonlinear trajectory in which delinquent behavior decreased from T1 to T3. In the final model, all obtained R^2 are large (.69 - .73). The estimated variances for the intercept and slope were 1.75 ($t = 12.91$), 0.57 ($t = 5.29$), ($p < 0.05$), respectively, indicating that there were systematic individual differences in the mother ratings at initial status (T1) and in rate of change. The factor covariance between intercept and slope was also significant, $\sigma_{S(Del)I(Del)} = -0.46$, $t = -4.95$, $p < 0.05$. Mothers of children with higher initial levels of delinquent behavior problems tended to report lower rates of change in delinquent behavior problems over time.

Multivariate Latent Growth Curves

In the second step, the focal variables of the univariate models were entered in one multivariate model to investigate the relationships between growth processes in aggressive and delinquent behavior. Step 1 was prerequisite to step 2 because the validity of the parameters obtained in a multivariate model is strongly dependent on the adequate

specification of growth in the associate univariate models (Stoolmiller, 1994). In this multivariate model, the parameters of interest are the between variables growth factor covariances. Under the assumption that mothers' measurement errors for aggressive problem behaviors were related to those for delinquent behavior problems, we allowed the error variances to covary within time points. This multivariate model (Model 3) provides a good fit to the data, $\chi^2(6, N = 669) = 14.40$, $p = 0.03$, GFI = 0.993, CFI = 0.998, RMSEA = 0.046. The parameter estimates of the multivariate model are presented in Table 4 and Figure 2. The focus of this analysis is on the interrelationships between the level and growth of aggressive and delinquent problem behavior. The significant positive intercept-intercept covariance ($\sigma_{IAggDel} = 5.93$, $t = 9.46$) indicates a positive association between initial scores on aggressive and delinquent behavior. The significant slope-slope covariance ($\sigma_{SAggDel} = 1.22$, $t = 2.83$) indicates a positive association between changes in aggressive and delinquent behavior. Finally, the initial status of one problem behavior was negative correlated with the slope of the other problem behavior, indicating that high initial scores in one domain were related to slower decreases in the other domain. Table 5 represents the concurrent correlations between the intercept and the growth rates for aggressive and delinquent behavior. We found a high positive correlation between the intercept (r = 0.83) and the slope parameters (r = 0.88) of aggressive and delinquent problem behavior. A high start on aggressive behavior corresponded to a high start on delinquent behavior and children who remained elevated in aggressive behavior also tended to remain elevated in delinquent problem behavior and vice versa.

Gender differences

To investigate a possible gender effect, we performed a multivariate multigroup analysis on the boys and girls data. In Model 3.2, model specifications describing the

multivariate model (Model 3.1) were similarly specified for boys and girls. As presented in Table 3 the goodness-of-fit statistics indicate an adequate fit to the data representing both boys and girls (GFI = 0.994, CFI = 0.998, RMSEA = 0.040). In Model 3.3, equality constraints were placed on the parameters across the two groups. Results from the estimation of this highly restrictive multigroup model yielded a χ^2 value of 85.95 with 28 degrees of freedom. To assess the tenability of these equality constraints, this model was compared with Model 3.2 in which no constraints were imposed. Accordingly, this comparison yielded a $\Delta \chi^2_{(16)} = 67.66$, which is statistically significant ($p < 0.001$). In a next step, to pinpoint the non-invariant parameters, we inspected modification indices of the parameters for which equality constraints were imposed. The equality constraint for the mean of the aggression and delinquent intercept factor, the variance of the latent delinquency intercept, the covariance between the aggression and delinquency intercept and the variance of the aggression slope were released. The goodness-of-fit statistics of this model (Model 3.4) indicated an acceptable fit, $\chi^2(22, N = 669) = 35.25$, $p = 0.04$, GFI = 0.987, CFI = 0.997, RMSEA = 0.043. A comparison with Model 3.2 yielded a $\Delta \chi^2_{(10)} = 16.96$, which is statistically not significant ($p = 0.07$). The mean of the intercept for aggressive ($\mu_{I(Gagg)} = 6.50$, $t = 21.96$, $p < 0.05$) and delinquent behavior ($\mu_{I(Gdel)} = 1.11$, $t = 16.25$, $p < 0.05$)was lower for girls; compared to boys ($\mu_{I(Bagg)} = 8.72$, $t = 29.02$, $p < 0.05$. $\mu_{I(Bdel)} = 1.54$, $t = 19.09$, $p < 0.05$). The variances of the slope for aggression ($\sigma^2_{S(Bagg)} = 4.80$, $t = 4.51$, $p < 0.05$) and the intercept for delinquency ($\sigma^2_{I(Bdel)} = 1.85$, $t = 11.69$, $p < 0.05$) were higher for boys; compared to girls ($\sigma^2_{S(Gagg} = 2.05$, $t = 3.02$, $p < 0.05$; $\sigma^2_{I(Gdel)} = 1.34$, $t = 10.45$, $p < 0.05$) indicating that there were for boys more systematic individual differences in the rate of change of aggressive problem behavior and in the initial level of delinquent problem behavior. Finally, the relation between the initial levels of aggressive and delinquent behavior was stronger for boys ($\sigma_{IAggIDel} = 5.87$, $t = 9.46$) compared to girls ($\sigma_{IAggIDel} = 5.13$, $t = 8.85$).

Harsh Discipline and Age as Correlates

Because significant individual variability was found in the intercept and slope factors, it is appropriate to try to explain this variability by explanatory variables. In model 4.1, the effects of harsh discipline and child's age were added to model 3.4. This model (model 4.1) fitted very well to the data ($\chi^2(38, N = 669) = 45.87$, $p = 0.18$, GFI = 0.989, CFI = 0.998, RMSEA = 0.025). In a next step, the effects were set equal for boys and girls. The fit of this model (Model 4.2) was $\chi^2(50, N = 669) = 65.92$, $p = 0.06$, GFI = 0.984, CFI = 0.996, RMSEA = 0.031. A comparison with Model 4.1 yielded a $\Delta \chi^2_{(12)} = 20.05$, which is statistically not significant ($p = 0.07$). Finally, in a trimming process (Model 4.3), nonsignificant paths were removed from the model, one at a time, beginning with the path with the smallest *t* value (Kline, 1998). Model 4.3 provided a good fit to the data, $\chi^2(57, N = 669) = 72.90$, $p = 0.08$, GFI = 0.981, CFI = 0.996, RMSEA = 0.029. The comparison with model 4.2 yielded a $\Delta \chi^2_{(7)} = 6.98$, which is statistically not significant ($p = 0.43$). Table 6 presents the estimated coefficients of the regression of the growth parameters on harsh discipline and age. The significantly positive effects of overreactivity on the aggression and the delinquency intercept indicated that high scores on overreactivity were related to higher initial levels of aggressive ($B = 2.05$, $t = 9.23$, $p < 0.01$) and delinquent ($B = 0.36$, $t = 6.30$, $p < 0.01$) behavior problems. Higher scores on coercion were related to higher scores on the initial level of aggressive behavior ($B = 0.52$, $t = 5.40$, $p < 0.01$) and to slower decreases ($B = -0.19$, $t = -2.92$, $p < 0.01$) of aggressive behavior. The negative association between age and the intercept for aggressive behavior (-0.37, t= -3.36, $p < 0.01$) indicated that older children started at a significant lower level of aggressive behavior. The three explanatory variables accounted in the data for boys for 15% of the variance in the initial level of aggression, for 2% of the variance in the growth of aggression and for 5% of the variance in the initial level of

delinquent behaviors and in the data for girls for 15% of the variance in the initial level of aggression, for 4% of the variance in the growth of aggression and for 6% of the variance in the initial level of delinquent behaviors.

Father data

To investigate the stability of this final model, we used the father sample as validation sample and tested if the final model could replicate across this sample. First, a multigroup baseline model was established against which subsequent models that include equality constraints were compared. In Model 5.1, model specifications describing the final model for the mother (Model 4.3) sample were similarly specified for the father sample. The goodness-of-fit statistics reflect the simultaneous estimation of the final model for both the mother and the father sample and are presented in Table 2. The GFI value of 0.960 and the CFI values of 0.988 indicate an adequate fit to the data representing both mothers and fathers. This model was used as the yardstick against which to determine the tenability of the imposed equality constraints. In Model 5.2, equality constraints were placed on the parameters across the mother and the father sample. Results from the estimation of this highly restrictive multigroup model yielded a χ^2 value of 234.94 with 143 degrees of freedom. To assess the tenability of these equality constraints, this model was compared with Model 5.1 in which no constraints were imposed. Accordingly, this comparison yielded a $\Delta \chi^2_{(29)} = 40.79$, which is statistically not significant ($p = 0.07$). This means that the developmental trajectories for aggressive and delinquent behaviors and the effects of the explanatory variables could be replicated in the father data.

Discussion

The goal of this study was to identify interrelationships between aggressive and delinquent behavior problems. This investigation contributes to research on the development of different forms of externalizing problem behaviors in several ways. Using a longitudinal design, this study is one of the first developmental studies investigating significant relations between growth trajectories of different forms of externalizing behavior in a stratified proportional general population sample of young children. Boys as well as girls were included in the sample. In addition, the impact of the child's gender, harsh discipline and the child's age on the development of aggressive and delinquent problem behavior was explored. The latent growth analysis approach allowed identifying an appropriate growth curve form that parsimoniously and accurately depicts intraindividual changes over time for the entire sample in the study. The results presented in this study demonstrate the power and utility of growth curve methodology for addressing questions concerning correlates of growth and changes over time.

The analyses in this study suggest that in the mother data as well as in the father data significant developmental decreases existed in the repeated measures for aggressive and delinquent behavior problems. A decreasing nonlinear growth trajectory most adequately described the development of these behaviors in young children. Caution is needed in the interpretation of the results for delinquent behavior problems. Due to the age range of the children included and the normal population sample, several items had a very low prevalence. However, the lower Pearson correlations indicating the lower stability of delinquent behavior over time have also been reported in both clinical and nonclinical samples (e.g., McConaughy, Stanger, & Achenbach, 1992, Stanger et al., 1997). Higher heritability (Edelbrock, Rende, Plomin, & Thompson, 1995) and higher correlations of the aggressive

syndrome with biochemical variables for both boys (Gabel, Stadler, Bjorn, Shindledecker, & Bowden, 1993) and girls (Paikoff, Brooks-Gunn, & Warren, 1991) are possible explanations.

The results of the multivariate analyses illuminate the strong linkages between individual-level aggressive and delinquent behavior trajectories in young children. The strong positive association between the initial scores and the growth rates on aggressive and delinquent behavior indicated the comorbidity between the aggressive and delinquent syndromes. These associations corroborate and extend previous cross-sectional findings on the comorbidity of aggressive and delinquent behaviors (Barnow et al., 2005). Not only are levels of aggressive behavior problems related to levels of delinquent behavior problems, but also changes in one domain correspond with changes in the other domain. The negative association between the initial level of aggressive and delinquent behavior on the one hand and the decline in aggressive and delinquent behavior on the other hand pointed to the stability of this problem behavior. This strong continuity is in accordance with findings for the developmental trajectories of other forms of externalizing behavior. A strong continuity for physical aggression from childhood to adolescence across informants was found for boys (Broidy et al., 2003) and for girls (Côté, Zoccolillo, Tremblay, Nagin, & Vitaro, 2001).

The decreasing trend of these problem behaviors is in accordance with previous studies. According to the review of Coie and Dodge (1998) infancy and toddlerhood can be considered as the period of highest frequency in aggression. Loeber et al. (1991) found that temper tantrums, irritable and annoying behaviors are common among preschool children but usually have largely disappeared by 8 or 9 years. Several explanations are possible for the gradual decline in problem behaviors. The development of language and communicative skills may result in an inhibition of aggressive or irritable motor behaviors. Young children are still developing their communication skills and often rely on aggressive and oppositional behavior to control their environment (Tremblay, 2000). Epidemiological studies have shown an

association between language delays and aggressive behavior problems in normative samples (Richman, Stevenson, & Graham, 1982). Whereas language development may contribute to a decrease of externalizing behaviors, language delays may lead to peer relationships problems and aggressive conflicts (Campbell, 1990). Another explication is offered by Mischel (1974) who suggested that the emerging ability to delay satisfaction might explain the decline in problem behaviors. Through self-distraction and mentally representing delayed rewards children learn to avoid hitting or impulsive grabbing others' possessions. The ability to delay gratification, in turn, may be stimulated by the further development of perspective taking (Selman, 1980), empathy (Zahn-Waxler, Radke-Yarrow, & King, 1979) and memory strategies (Brown, Bransford, Ferrara, & Campione, 1983). Block and Block (1980) associated these emerging skills with the development of ego-control in young children. The cognitive changes are a reflection of increases in neural sophistication that also may account for a decline of impulsive and aggressive reactions. During the elementary school years, feedback of peers and the extension of relations contribute to the understanding of social rules and the decline of externalizing behavior problems.

The declining trend of externalizing problem behavior seems to continue later on in the development. Loeber (1982) pointed out that most longitudinal studies of children show a negative trend in ratings of aggressive behavior as they enter adolescence. This evidence suggests that, although some new forms of antisocial behavior (e.g., delinquent acts such as theft and vandalism) are emerging at later ages, other forms are decreasing (e.g., interpersonal aggression) (Patterson, 1993).

Gender differences

Significant gender differences were found only with respect to the mean aggressive and delinquent scores. Boys had higher initial levels than girls. In addition, the positive

relation between the initial level of aggressive and delinquent problem behavior was stronger for boys compared to girls. The rate of change was not related to gender. This finding suggests that the developmental trajectory of aggressive and delinquent problem behavior ran parallel in boys and girls. This result is congruent with the findings of Broidy et al. (2004) who reported that the shape of the developmental trajectory of aggressive behavior hardly differed between males and females. Moffitt and Caspi (2001) reported that in the Dunedin Study a single model described the antisocial development of both males and females. This conclusion was based on childhood predictors at age 3 years and peer delinquency in adolescence. The finding that boys and girls follow a same trajectory during the elementary school age years is an important contribution of this study.

The consistent gender differences in mean aggressive and delinquent scores is in line with other empirical studies (Bongers et al., 2003; Loeber & Hay, 1994). There is some evidence that boys are at greater risk for developing externalizing behavior than girls (Sanson, Oberklaid, Pedlow, & Prior, 1991). It is likely that biological differences have an important contribution to the development of sex differences in externalizing behavior problems (Keenan & Shaw, 1997). In his extensive review on causes of aggressive and disruptive behaviors in childhood and adolescence, Hill (2002) suggested that testosterone is a strong candidate to explain gender differences. However, no definite causal relationship has been proven between hormones and aggression, but the evidence suggests that they are strongly associated.

A second possible explanation is that girls' faster development during early childhood may partially account for the differences in aggressive and disruptive behavior (Keenan & Shaw, 1997). As outlined in the previous section, the development of cognitive and emotional abilities contributes to the decline of externalizing problem behavior. The developmental

advantage of girls may imply that fewer behavior problems are found in girls compared to boys.

Gender differences in externalizing problem behavior can also be explained by differences in social interactions. In contacts with peers, boys are more likely than girls to be more physical in their interactions. Charlesworth and Dzur (1987) and Leaper (1991) found that supremacy exchanges and forceful styles are more common in the social interactions of boys. Boys develop styles of relating to one another that encourage and maintain assertive competitive and even aggressive ways of interacting. Girls on the other hand develop more cooperative styles of group interaction and use more verbal objection and negotiation during conflicts, which may prevent the escalation of conflicts into aggressive behaviors.

A fourth possible explanation concerns differential socialization practices of parents (Keenan & Shaw, 1997). As a result of being reinforced for sex-stereotyped behavior, girls' problems may be directed more in the direction of internalizing problem behaviors. For boys parents are more likely to use physical punishment whereas for girls more inductive techniques (e.g., explaining the reasons behind a rule or prohibition) are preferred (Block, 1978). In the same way, mothers stimulate girls to have more apprehension for others and to behave prosocially (Ross, Tesla, Kenyon, & Lollis, 1990). Dodge and Frame (1982) have documented that deficits in these perspective-taking skills are linked to antisocial behavior among school-age children. Also with regard to parenting behaviors, the developmental advantage of girls may contribute to sex differences. Fast language development and better self-regulation skills may result in parents finding girls easier to manage, promoting a more positive parent-child relationship and thus having fewer behavior problems (Sanson, Prior, Smart, & Oberklaid, 1993).

Parenting effects

An important finding of this study is that dysfunctional parenting behaviors were differentially related to children's aggressive and delinquent problem behavior. Coercion was significantly related to aggressive behavior but not to delinquent behavior. Higher scores on coercion were related to higher initial levels and a lower decrease of aggressive behavior. High scores on overreactivity were associated with higher initial levels of aggressive and delinquent problem behavior. The stronger association between harsh discipline and aggressive problem behavior is consistent with Patterson's coercion model (Patterson, 1982; Patterson et al., 1992). Overreactive and coercive parenting behavior might lead to inconsistent behavioral contingencies, a capricious and unpredictable environment, and a decreased sense of control. This in turn might increase the likelihood of externalizing problem behaviors. As described in the coercion theory of Patterson (Patterson et al., 1992), the negative reinforcement of externalizing behavior may increase the frequency and intensity of this problem behavior. A more direct explanation is offered by Bandura (e.g., Bandura, Ross & Ross, 1963; Bussey & Bandura, 1999) who showed that children readily imitate the aggressive behavior of adults. Many overreactive parenting behaviors, such as overt expression of anger, verbal and psychical aggression or arguing have direct parallels among the externalizing CBCL-items.

Dysfunctional parenting practices were not related to changes in delinquent behaviors. This suggests that harsh discipline is partly responsible for the onset of delinquent problem behaviors, but not their persistence. Previous studies reported that delinquent problem behaviors are more environmentally influenced. They may reflect circumstances, such as a context of delinquent peer affiliation, and the use of social mimicry or attempts to gain peer-group respect (Eley, Lichtenstein, & Moffitt, 2003). Richman et al (1982) observed that family factors, measured when children were 3 years old had an influence on the development of problem behaviors 5 years later, whereas they had no effect on the outcome of problem

behavior once established. The time-limited effect of parenting indicates that changes in growth rates are sensitive to ongoing changes in the family environment or to the introduction to and changes in other environments (e.g., school settings). Also in the Dunedin Study, other variables than parenting practices (such as neurocognitive deficits, undercontrolled temperament, and hyperactivity) were found to have a stronger predictive effect (Moffitt & Caspi, 2001).

No differences were found in the relation between harsh parenting and developmental trajectories for boys and girls. Eddy, Leve and Fagot (2001) reported that similar coercion processes apply to both boys and girls. Recently, Prinzie et al. (2003) found that significant effects of children's personality characteristics and negative parenting practices on children's externalizing behavior were not differentially patterned for boys and girls.

Informant effects

No differences between the mother and fathers ratings were found. Baker and Heller (1996) reported that fathers and mothers did not differ in actual perceived level of child behavior problems. In a meta-analysis containing 60 studies and 126 independent effect sizes Duhig, Renk, Epstein and Phares (2000) focused on interparental agreement. They also found a large correspondence between mother and father ratings of externalizing problem behavior.

Limitations and future directions

The findings of this study contribute to the developmental study of aggressive and delinquent problem behavior in young children. However, some limitations should be noted.

First, although the CBCL is a commonly used and well-validated instrument to measure externalizing behavior problems, several researchers have noticed that forms of aggression characteristic of boys are over-represented (e.g., Bjorkqvist & Niemela, 1992;

Crick & Grotpeter, 1995). Reconceptualizations of the topography of aggressive behavior have emphasized a type of relational aggression that is peculiar to girls (Coie & Dodge, 1998). Relational aggression includes attempts to exclude peers from group participation, defame another's reputation, and gossip about another's negative attributes. Current findings with regard to relational aggression are not consistent. Crick (1995) and Crick and Grotpeter, (1995) found that girls more frequently made use of relational aggression than boys who more likely displayed overt aggression. Tomada and Schneider (1997) on the other hand reported that in an Italian sample relational aggression was more common among boys than girls.

A second limitation lies in the absolute reliance on questionnaire measures. This increases the likelihood of method bias or confound among the measures. Therefore, a multimethod measurement strategy (by the inclusion of observational measures) may more accurately assess children's individual differences and hence further strengthen the results.

The design of this study accounted for the requirements that three waves of data is the minimum number to evaluate trends in the change of problem behavior. Additional time points would allow consideration of more complex forms of growth (e.g., a quadratic growth factor) as well as increased power to detect effects.

The focus in this study was on harsh discipline. However, other unmeasured parenting behaviors may also have an important influence (Locke & Prinz, 2002). Future research is necessary to test the possible effects of positive parenting (gentle, nonpower) on the development of children's behavior.

Finally, the developmental trajectories obtained in this study may constitute the background for additional and smaller range studies. The development of externalizing problem behaviors in specific clinical groups may be contrasted with the present normative data. In addition, it will be interesting to identify children within the present sample who follow individual developmental trajectories that diverge from the normative trajectories

found in this study. Several studies used semi-parametric mixture models to investigate the developmental trajectories of physical aggression in boys (Brame, Nagin, & Tremblay, 2001; Broidy et al., 2003; Nagin & Tremblay, 1999) and girls (Côté et al., 2001).

References

Achenbach, T. M. (1991). *Manual for the Child Behavior Checklist/4-18 and 1991 Profile.* Burlington: University of Vermont, Department of Psychiatry.

Achenbach, T. M., Conners, C. K., Quay, H. C., Verhulst, F. C., & Howell, C. T. (1989). Replication of empirically derived syndromes as a basis for taxonomy of child/adolescent psychopathology. *Journal of Abnormal Child Psychology, 17*, 299-323.

Achenbach, T. M., & Edelbrock, C. S. (1981). Behavioral problems and competencies reported by parents of normal and disturbed children aged four through sixteen. *Monographs of the Society for Research in Child Development, 46* (1, Serial No. 188).

Arbuckle, J. L. (1996). Full information estimation in the presence of incomplete data. In G.A. Marcoulides & R E. Schumacker (Eds.), *Advanced structural equation modeling: Issues and techniques* (pp. 243-277). Mahwah, NJ: Erlbaum.

Arnold, D. S., O'Leary, S. G., Wolff, L. S., & Acker, M. M. (1993). The Parenting Scale: A measure of dysfunctional parenting and discipline situations. *Psychological Assessment, 5*, 137-144.

Baker, B. L., & Heller, T. L. (1996). Preschool children with externalizing behaviors: Experiences of mothers and fathers. *Journal of Abnormal Child Psychology, 24,* 513-532.

Bandura, A., Ross, D., & Ross, S. A. (1963). Imitation of film-mediated aggressive models. *Journal of Abnormal and Social Psychology, 66*, 3-11.

Barnow, S., Lucht, M., & Freyberger, H. J. (2005). Correlates of aggressive and delinquent conduct problems in adolescence. *Aggressive Behavior, 31*, 24-39.

Bentler, P. M. (1990). Comparative fit indices in structural models. *Psychological Bulletin, 107*, 238-246.

Bjorkqvist, K., & Niemela, P. (1992). New trends in the study of female aggression. In K. Bjorkqvist & P. Niemela (Eds.), *Of mice and women: Aspects of female aggression* (pp. 3-16). New York: Academic Press.

Block, J. H. (1978). Another look at sex differentiation in the socialization behavior of mothers and fathers. In J. Sherman & F. L. Denmark (Eds.), *The psychology of women: Future directions of research* (pp. 29-87). New York: Psychological Dimensions.

Block, J. H., & Block, J. (1980). The role of ego-control and ego-resiliency in the organization of behavior. In W. A. Collins (Ed.), *The Minnesota Symposia on Child Psychology* (Vol. 13, pp. 39-101). Hillsdale, N.J.: Erlbaum.

Blozis, S.A. (2004). Structured latent curve models for the study of change in multivariate repeated measures. *Psychological Methods*, *9*, 334-353.

Bollen, K.A. (1989). *Structural Equations with Latent Variables*. NY:Wiley.

Bongers, I. L., Koot, H. M., Van der Ende, J., & Verhulst, F. C. (2003). The normative development of child and adolescent problem behavior. *Journal of Abnormal Psychology, 112*, 179–192.

Bongers, I. L., Koot, H.M., Van der Ende, J., & Verhulst, F. C. (2004). Developmental trajectories of externalizing behaviors in childhood and adolescence. *Child Development, 75*, 1523-1537.

Brame, B., Nagin, D. S., & Tremblay, R. E. (2001). Developmental trajectories of physical aggression from school entry to late adolescence. *Journal of Child Psychology and Psychiatry, 42*, 503-512.

Broidy, L.M., Nagin, D.S., Tremblay, R.E., Bates, J.E., Brame, B., Dodge, K.A., et al. (2003) Developmental trajectories of childhood disruptive behaviors and adolescent delinquency: A six site, cross-national study. *Developmental Psychology 39*, 222-245.

Brown, A. L., Bransford, J. D., Ferrara, R., & Campione, J. C. (1983). Learning, remembering, and understanding. In J. N. Flavell & E. M. Markham (Eds.), *Handbook of Child Psychology: Vol. 3. Cognitive Development* (4th ed., pp. 77-166). New York: Wiley.

Browne, M. W., & Cudeck, R. (1993) Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing Structural Equation Models* (pp. 132-162). Beverley Hills, CA: Sage.

Bryk, A. S., & Raudenbush, S. W. (1992) *Hierarchical linear models: Applications and data analysis methods.* Newbury Park: Sage.

Bussey, K., & Bandura, A. (1999). Social cognitive theory of gender development and differentiation. *Psychology Review, 106*, 676-713.

Campbell, S. B. (1990). *Behavior problems in preschool children: Clinical and developmental issues*. New York: Guilford Press.

Campbell, S. B. (1995). Behavior problems in preschool children: A review of recent research. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 36,* 113–49.

Charlesworth, W. R., & Dzur, C. (1987). Gender comparisons of preschoolers' behavior and resource utilization in group problem solving. *Child Development, 58*, 191–200.

Coie, J. D., & Dodge, K. A. (1998). Aggression and antisocial behavior. In W. Damon (Series Ed.) & N. Eisenberg (Vol. Ed.), *Handbook of child psychology: Vol. 3. Social, emotional, and personality development* (5th ed., pp. 779-862). New York: Wiley.

Collins, L. M., & Sayer, A. G. (2001). *New methods for the analysis of change.* Washington, DC: American Psychological Association.

Côté, S., Zoccolillo, M., Tremblay, R. E., Nagin, S., & Vitaro, F. (2001). Predicting girls' conduct disorder in adolescence from childhood trajectories of disruptive behaviors.

Journal of the American Academy of Child & Adolescent Psychiatry, 40, 678-684.

Crick, N. R. (1995). Relational aggression: The role of intent attributions, provocation type, and feelings of distress. *Development and Psychopathology, 7*, 313-322.

Crick, N. R., & Grotpeter, J. K. (1995). Relational aggression, gender, and social-psychological adjustment. *Child Development, 66*, 710-722.

Dodge, K. A., & Frame, C. M. (1982). Social cognitive biases and deficits in aggressive boys. *Child Development, 53*, 620-635.

Duhig, A. M., Renk, K., Epstein, M. K., & Phares, V. (2000). Interparental agreement on internalizing, externalizing, and total behavior problems: A mets-analysis. *Clinical Psychology: Science and Practice, 7*, 435-453.

Duncan, T. E., Duncan, S. C., Strycker L. A., Li, F., & Alpert, A. (1999). *An introduction to latent variable growth curve modeling: Concepts, issues and applications*. Mahwah, NJ: Erlbaum.

Edelbrock, C., Rende, R., Plomin, R., & Thompson, L.A. (1995). A twin study of competenceand problem behavior in childhood and early adolescence. *Journal of Child Psychology and Psychiatry, 36,* 775-785.

Eddy, J. M., Leve, L. D., & Fagot, B. I. (2001). Coercive family processes: A replication and extension of Patterson's coercion model. *Aggressive Behavior, 27*, 14-25.

Eley, T. C., Lichtenstein, P., & Moffitt, T. E. (2003). A longitudinal behavioral genetic analysis of the etiology of aggressive and nonaggressive antisocial behavior. *Development and Psychopathology,* 15, 383-402.

Frick, P. J., Lahey, B. B., Loeber, R., Tannenbaum, L. E., Van Horn, Y., Christ, M. A. G., et al. (1993). Oppositional defiant disorder and conduct disorder: A meta-analytic review of factor analyses and cross-validation in a clinic sample. *Clinical Psychology Review 13*, 319-340.

Gabel, S., Stadler, J., Bjorn, J., Shindledecker, R., & Bowden, C. (1993). Dopamine-beta-hydroxylase in behaviorally disturbed youth. Relationship between teacher and parent ratings. *Biological Psychiatry, 34*, 434–442.

Hellinckx, W., Prinzie, P., Onghena, P., Ghesquière, P., Colpin, H., Grietens, H., & Hellinckx, E. (2000). *Het Leuvens Instrument voor Coërcief Opvoedingsgedrag (LICO)*. Leuven: Katholieke Universiteit Leuven, Section orthopedagogics.

Hill, J. (2002). Biological, psychological and social processes in the conduct disorders. *Journal of Child Psychology and Psychiatry, 43*, 133-164.

Hinshaw, S. P., Simmel, C., & Heller, T. L. (1995). Multimethod assessment of covert antisocial behavior in boys with ADHD: Laboratory observations, maternal ratings, and child self-report. *Psychological Assessment, 7*, 209-219.

Hofstra, M. B., Van der Ende, J., & Verhulst, F. C. (2000). Continuity and change of psychopathology from childhood into adulthood: a 14-year follow-up study. *Journal of the American Academy of Child and Adolescent Psychiatry, 39,* 850-858.

Jöreskog, K. G., & Sörbom, D. (1989). *LISREL 7: A guide to the program and applications (2nd ed.)*. Chicago: SPSS.

Jöreskog, K. G., & Sörbom, D. (2003). LISREL 8.54 [Computer software]. Chicago: Scientific Software International.

Keenan, K., & Shaw, D. S. (1997). Developmental influences on young girls' behavioral and emotional problems. *Psychological Bulletin, 121*, 95-113.

Keiley, M. K., Bates, J. E., Dodge, K. A., & Pettit, G. S. (2000). A cross-domain growth analysis: Externalizing and internalizing behavior during 8 years of childhood. *Journal of Abnormal Child Psychology, 28*, 161-179.

Kline, R. (1998). *Principles and practice of structural equation modeling*. New York: Guilford Press.

Lahey, B. B., Miller, T. L., Gordon, R. A., & Riley, A. W. (1999). Developmental epidemiology of the disruptive behavior disorders. In H. C. Quay & A. E. Hogan (Eds.), *Handbook of disruptive behavior disorders* (pp. 23-48). New York: Plenum.

Lahey, B. B., Schwab-Stone, M., Goodman, S. H., Waldman, I. D., Canino, G., Rathouz, P. J., Miller, T. L., Dennis, K. D., Bird, H., & Jensen, P. S. (2000). Age and gender differences in oppositional behavior and conduct problems: A cross-sectional household study of middle childhood and adolescence. *Journal of Abnormal Psychology, 109*, 488-503.

Leaper, C. (1991). Influence and involvement in children's discourse: Age, gender and partner effects. *Child Development, 62*, 797-811.

Locke, L. M., & Prinz, R. J. (2002). Measurement of parental discipline and nurturance. *Clinical Psychology Review, 22*, 895-929.

Loeber, R. (1982). The stability of antisocial and delinquent child behavior: A review. *Child Development, 53,* 1431-1446.

Loeber, R., & Farrington, D. P. (1997). Strategies and yields of longitudinal studies on antisocial behavior. In D. M. Stoff, J. Breiling, & J. D. Maser (Eds.), *Handbook of antisocial behavior* (pp. 125-139). New York: Wiley.

Loeber, R., Green, S. M., Lahey, B. B., Frick, P. J., & McBurnett, K. (2000). Findings on disruptive behavior disorders from the first decade of the Developmental Trends Studies. *Clinical Child and Family Psychology Review, 3*, 37-60.

Loeber, R., & Hay, D. F. (1994). Developmental approaches to aggression and conduct problems. In M. Rutter & D. F. Day (Eds.), *Development through life: A handbook for clinicians* (pp. 488-516). Oxford: Blackwell.

Loeber, R., Lahey, B., & Thomas, C. (1991). Diagnostic conundrum of oppositional defiant disorder and conduct disorder. *Journal of Abnormal Psychology, 100*, 379-390.

Loeber, R., Wung, P., Keenan, K., Giroux, B., Stouthamer-Loeber, M., VanKammen, W. B., & Maughan, R. (1993). Developmental pathways in disruptive child behavior. *Development and Psychopathology, 5*, 103–133.

McConaughy, S. H., Stanger, C., & Achenbach, T. M. (1992). Three-year course of behavioral/emotional problems in a national sample of 4- to 16-year-olds: I. Agreement among informants. *Journal of the American Academy of Child and Adolescent Psychiatry, 31*, 932–940.

Meredith, W., & Tisak, J. (1990). Latent curve analysis. *Psychometrika, 55*, 107-122.

Mischel, W. (1974). Processes in delay of gratification. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 7, pp. 249-292). New York: Academic Press.

Moffitt, T. E., & Caspi, A. (2001). Childhood predictors differentiate life-course persistent and adolescence-limited antisocial pathways among males and females. *Development and Psychopathology, 13*, 355-375.

Moffitt, T. E., Caspi, A., Harrington, H., Milne, B. (2002). Males on the life-course persistent and adolescence-limited antisocial pathways: Follow-up at age 26. *Development and Psychopathology, 14*, 179-206.

Munson, J. A., McMahon, R. J., & Spieker, S. J. (2001). Structure and variability in the developmental trajectory of children's externalizing problems: Impact of infant attachment, maternal depressive symptomatology, and child sex. *Development and Psychopathology, 13*, 277-296.

Nagin, D. S. (1999). Analyzing developmental trajectories: A semi-parametric, group-based approach. *Psychological Methods, 4,* 139-157.

Nagin, D. S. & Tremblay, R. E. (1999). Trajectories of boys' physical aggression, opposition, and hyperactivity on the path to physically violent and nonviolent juvenile delinquency. *Child Development, 70,* 1181-1196.

Paikoff, R. L., Brooks–Gunn, J., & Warren, M. P. (1991). Effects of girls' hormonal status on depressive and aggressive symptoms over the course of one year. *Journal of Youth and Adolescence, 2*, 191–215.

Patterson, G. R. (1982). *Coercive family process*. Eugene, OR: Castalia.

Patterson, G. R. (1993). Orderly change in a stable world: The antisocial trait as a chimera. *Journal of Consulting and Clinical Psychology, 61*, 911-919.

Patterson, G. R., Reid, J. B., & Dishion, T. J. (1992). *Antisocial boys*. Eugene, OR: Castalia.

Prinzie, P., Onghena, P., Ghesquière, P., & Hellinckx, W. (2005). *The validity of the Parenting Scale for assessing the discipline practices of parents of elementary school-aged children*. Manuscript submitted for publication.

Prinzie, P., Onghena, P., Hellinckx, W., Grietens, H., Ghesquière, P., & Colpin, H. (2003). The additive and interactive effects of parenting and children's personality on externalising behaviour. *European Journal of Personality, 17*, 95-117.

Rao, C. R. (1958). Some statistical models for comparison of growth curves. *Biometrics, 14*, 1-17.

Richman, M., Stevenson, J., & Graham, P. J. (1982). *Preschool to school: A behavioral study*. London: Academic Press.

Ross, H., Tesla, C., Kenyon, B., & Lollis, S. (1990). Maternal intervention in toddler peer conflict: The socialization of principles of justice. *Developmental Psychology, 26*, 994-1003.

Sanson, A., Oberklaid, F., Pedlow, R., & Prior, M. (1991) Risk indicators: Assessment of infancy predictors of pre-school behavioural maladjustment. *Journal of Child Psychology and Psychiatry, 32*, 609-626.

Sanson, A., Prior, M., Smart, D., & Oberklaid, F. (1993). Gender differences in aggression in childhood: Implications for a peaceful world. *Australian Psychologist, 28*, 85-92.

Schafer, J. L. (1997). *Analysis of incomplete multivariate data*. London: Chapman & Hall.

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological methods, 7*, 147-177.

Selman, R. (1980). *The growth of interpersonal understanding*. New York: Academic Press.

Shaw, D. S., & Bell, R. Q. (1993). Developmental theories of parental contributors to antisocial behavior. *Journal of Abnormal Child Psychology, 21*, 493-518.

Singer, J. D., & Willett, J. B. (2003). *Applied Longitudinal Data Analysis*. New York: Oxford University Press.

Snyder, J., Cramer, A., Afrank, J., & Patterson, G. R. (2005). The contributions of ineffective discipline and parental hostile attributions of child misbehavior to the development of conduct problems at home and school. *Developmental Psychology, 41*, 30-41.

Sroufe, L. A. (1997). Psychopathology as an outcome of development. *Development and Psychopathology, 9*, 251-268.

Stanger, C., Achenbach, T. M., & Verhulst, F. C. (1997). Accelerated longitudinal comparisons of aggressive versus delinquent syndromes. *Developmental Psychopathology, 9*, 43-58.

Steiger, J. H. (1990). Structural model evaluation and modification: An interval estimation approach. *Multivariate Behavioral Research, 25*, 173-180.

Stoolmiller, M. (1994). Antisocial behavior, delinquent peer association, and unsupervised wandering for boys: Growth and change from childhood to early adolescence. *Multivariate Behavioral Research. 29*, 263-288.

Tomada, G., & Schneider, B. H. (1997) Relational aggression, gender, and peer acceptance: Invariance across culture, stability over time, and concordance among informants. *Developmental Psychology*, *33*, 601-609.

Tremblay, R. E. (2000). The development of aggressive behavior during childhood: What have we learned in the past century? *International Journal of Behavioral Development, 24*, 129-141.

Van Westerlaak, J. M., Kropman, J. A. & Collaris, J. W. M. (1975). *Beroepenklapper*. [Manual for occupational level]. Nijmegen, The Netherlands: Instituut voor Toegepaste Sociologie.

Verhulst, F. C., Van der Ende, J., & Koot, H. M. (1996). *Handleiding voor de CBCL/4-18*. [Manual for the CBCL/4–18]. Rotterdam, the Netherlands: Erasmus University and Department of Child and Adolescent Psychiatry, Sophia Children's Hospital.

Vignoe, D., Bérubé, R. L., & Achenbach, T. M. (2000). *Bibliography of published studies using the Child Behaviour Checklist and related materials: (1999 ed.)*. Burlington: University of Vermont, Department of Psychiatry.

Willett, J. B., & Sayer, A. G. (1994). Using covariance structure analysis to detect correlates and predictors of change. *Psychological Bulletin, 116*, 363-381.

Willett, J. B., & Sayer, A. G. (1996). Cross-domain analyses of change over time: Combining growth modeling and covariance structure analysis. In R. Schumacher & G. Marcoulides (Eds.), *Advanced structural equation modeling techniques*. Hillsdale, NJ: Erlbaum.

Wothke, W. (2000). Longitudinal and multigroup modeling with missing data. In T. D. Little, K. U. Schnabel, & J. Baumert (Eds.), *Modeling longitudinal and multilevel data: Practical issues, applied approaches and specific examples* (pp. 219-240). Mahwah, NJ: Erlbaum.

Zahn-Waxler, C., Radke-Yarrow, M., & King, R. A. (1979). Child rearing and children's prosocial initiations toward victims of distress. *Child Development, 50*, 319-330.

Table 1.

Descriptive Statistics for Aggressive and Delinquent Behavior Problems Mother (N = 669) and Father Data (N = 632)

	Boys						Girls					
Age	4	5	6	7	8	9	4	5	6	7	8	9
Mothers												
Aggressive behavior (n)	82	159	233	232	145	73	79	156	233	235	156	73
M	9.05	9.92	7.97	7.35	6.96	6.60	7.24	6.04	5.85	6.02	4.86	5.10
SD	6.48	6.80	5.98	5.78	6.05	6.24	5.36	4.61	5.07	5.32	4.82	5.54
Delinquent Behavior												
M	1.52	1.71	1.35	1.27	1.31	1.38	1.18	1.02	1.01	1.02	0.88	0.89
SD	1.62	1.80	1.51	1.57	1.74	1.97	1.27	1.18	1.17	1.33	1.30	1.69
Fathers												
Aggressive behavior (n)	66	133	202	198	130	67	65	126	200	199	138	69
M	9.41	8.74	7.01	6.66	6.09	5.88	6.62	5.90	5.56	5.26	4.43	4.49
SD	6.11	6.20	5.85	5.66	5.69	5.79	4.61	4.82	4.87	4.72	4.33	4.09
Delinquent Behavior												
M	1.55	1.20	1.17	1.18	1.05	1.42	1.23	0.85	0.98	0.88	0.67	0.75
SD	1.50	1.35	1.60	1.45	1.44	1.55	1.57	1.00	1.14	1.22	1.15	1.02

Table 2.

Intercorrelations between Aggressive and Delinquent Behavior Problems, Harsh Discipline and Age for Mother (N = 669) and Father Data (N = 632)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	MEAN	SD
1. Gender[1]	---																		1.50	0.50
2. Age	.025	---																	5.51	1.11
3. Mother AGG1	-.189***	-.066	---																7.63	5.96
4. Mother AGG2	-.211***	-.120*	.770***	---															6.68	5.59
5. Mother AGG3	-.189***	-.087†	.722***	.797***	---														6.42	5.56
6. Mother DEL1	-.144**	-.001	.668***	.536***	.506***	---													1.32	1.55
7. Mother DEL2	-.140**	-.052	.564***	.672***	.587***	.570***	---												1.17	1.37
8. Mother DEL3	-.152***	-.027	.543***	.610***	.734***	.571***	.687***	---											1.11	1.49
9. Mother Coercion	.016	-.052	.221***	.191***	.158***	.081†	.069	.086†	---										1.86	1.60
10. Mother OVR	-.134**	.037	.318***	.325***	.376***	.211***	.205***	.269***	.164***	---									3.17	0.81
11. Father AGG1	-.127*	-.133**	.716***	.629***	.546***	.480***	.444***	.390***	.147**	.233***	---								6.97	5.54
12. Father AGG2	-.203***	-.148**	.657***	.744***	.642***	.472***	.506***	.469***	.119*	.290***	.720***	---							6.14	5.18
13. Father AGG3	-.169***	-.101†	.607***	.638***	.689***	.425***	.443***	.500***	.146**	.334***	.697***	.773***	---						5.68	5.08
14. Father DEL1	-.080†	-.027	.458***	.390***	.374***	.518***	.379***	.364***	.049	.206***	.638***	.509***	.483***	---					1.18	1.43
15. Father DEL2	-.122*	-.076	.529***	.529***	.474***	.491***	.595***	.485***	.098†	.206***	.469***	.653***	.534***	.480***	---				0.95	1.22
16. Father DEL3	-.139**	-.024	.435***	.435***	.496**	.373***	.459***	.524***	.077	.252***	.427***	.539***	.647***	.488***	.552***	---			0.99	1.25
17. Father Coercion	-.067†	-.062	.196***	.196***	.156***	.095***	.182***	.123**	.255***	.133**	.153***	.175***	.129*	.108†	.186***	.139***	---		1.82	1.50
18. Father OVR	-.116*	-.042	.249***	.249***	.262***	.159***	.181***	.209***	.017	.282***	.261***	.304***	.380***	.246***	.205***	.312***	.125*	---	3.16	0.79

Note: †: $p < 0.05$ * $p < 0.01$ ** $p < 0.001$ *** $p < 0.0001$. AGG = aggressive problem behavior, DEL = delinquent problem behavior, Age in years.

[1] gender is coded boys = 1, girls = 2

Table 3.

Model Fit Indices and Nested Model Comparisons of Children's Aggressive and Delinquent Problem Behavior in Mother and Father Data

Model	χ^2	*df*	p	model comparison	$\Delta\chi^2$	Δdf	GFI	CFI	RMSEA	$RMSEA_{90}$
MOTHER DATA										
1. AGGRESSION (univariate latent growth)										
Model 1.1 (no growth)	114.58	6	0.000				0.949	0.916	0.165	0.139 - 0.192
Model 1.2 (linear trajectory)	15.93	3	0.001	M1 vs M2	98.65	3	0.992	0.989	0.080	0.045 - 0.121
Model 1.3 (unspecified trajectory	0.41	2	0.816	M2 vs M3	15.52	1	1.000	1.000	0.000	0.0 - 0.047
2. DELINQUENCY (univariate latent growth)										
Model 2.1 (no growth)	71.30	6	0.000				0.949	0.912	0.128	0.102 - 0.155
Model 2.2 (linear trajectory)	35.71	3	0.000	M1 vs M2	35.59	3	0.967	0.955	0.128	0.092 - 0.167
Model 2.3 (unspecified trajectory	9.25	2	0.010	M2 vs M3	26.46	1	0.991	0.990	0.074	0.031 - 0.125
MULTIVARIATE LATENT GROWTH										
Model 3.1	14.40	6	0.03				0.993	0.998	0.046	0.015 - 0.077
Model 3.2	18.29	12	0.11				0.994	0.998	0.040	0.0 - 0.074
Model 3.3	85.95	28	0.00	M3.3 vs M3.2	67.66	16	0.979	0.985	0.079	0.060-0.098
Model 3.4	35.25	22	0.04	M3.4 vs M3.2	16.96	10	0.987	0.997	0.043	0.011-0.068
MULTIVARIATE LATENT GROWTH + HARSH PARENTING										

Model 4.1	45.87	38	0.18				0.989	0.998	0.025	0.000 - 0.048
Model 4.2	65.92	50	0.06	4.1 vs 4.2	20.05	12	0.984	0.996	0.031	0.000 - 0.050
Model 4.3	72.90	57	0.08	4.2 vs 4.3	6.98	7	0.981	0.996	0.029	0.000 - 0.047
MOTHERS + FATHERS										
Model 5.1	194.15	114	0.00				0.960	0.988	0.047	0.035-0.058
Model 5.2	234.94	143	0.00	5.1 vs 5.2	40.79	29	0.951	0.986	0.045	0.034-0.055

Table 4.

Parameter Estimates of the Univariate and Multivariate Latent Growth Models for Aggressive and Delinquent Problem Behavior. *T*-values between Parentheses.

	Univariate		Multivariate	
	AGG	DEL	AGG	DEL
Mean initial level	7.62 (33.07)	1.33 (22.19)	7.62 (32.99)	1.33 (22.29)
Variance of initial level	29.51 (15.03)	1.75 (12.91)	29.63 (15.00)	1.73 (12.93)
Mean rate of growth	-0.91 (-6.75)	-0.18 (-3.78)	-0.93 (-6.84)	-0.17 (-3.83)
Variance of growth rate	3.50 (4.49)	0.57 (5.29)	3.60 (4.51)	0.53 (5.27)
Covariance between level and growth	-4.03 (-4.51)	-0.46 (-4.95)	-4.25 (-4.62)	-0.43 (-4.86)
Covariance between level Agg and level Del			5.93 (9.46)	
Covariance between growth Agg and growth Del			1.22(2.83)	
Covariance between growth Agg and level Del			-1.31 (-2.84)	
Covariance between level Agg and growth Del			-1.06 (-2.10)	

Table 5.

Correlations between Growth Parameters in the Multivariate Latent Growth Curve Model

	Mean initial level AGG	Mean slope AGG	Mean initial level Del	Mean slope Del
Mean initial level AGG	1.00			
Mean slope AGG	-0.41	1.00		
Mean initial level DEL	0.83	-0.53	1.00	
Mean slope DEL	-0.27	0.88	-0.45	1.00

Table 6.

Regression Coefficients of the Growth Parameters on Harsh Parenting and Age. T-values between parentheses.

	Mean initial level AGG	Mean slope AGG	Mean initial level Del	Mean slope Del
Growth parameters on age	-0.37 (-3.36)	---	---	---
Growth parameters on coercion	0.52 (5.40)	-0.19 (2.92)	---	---
Growth parameters on overreactivity	2.05 (9.23)	---	0.36 (6.30)	---

Figure 1. Representation of the Basic Univariate Latent Growth Model. *Note*. A parameter with a figure is fixed at that value. * indicates that the factor loading may be freely estimated.

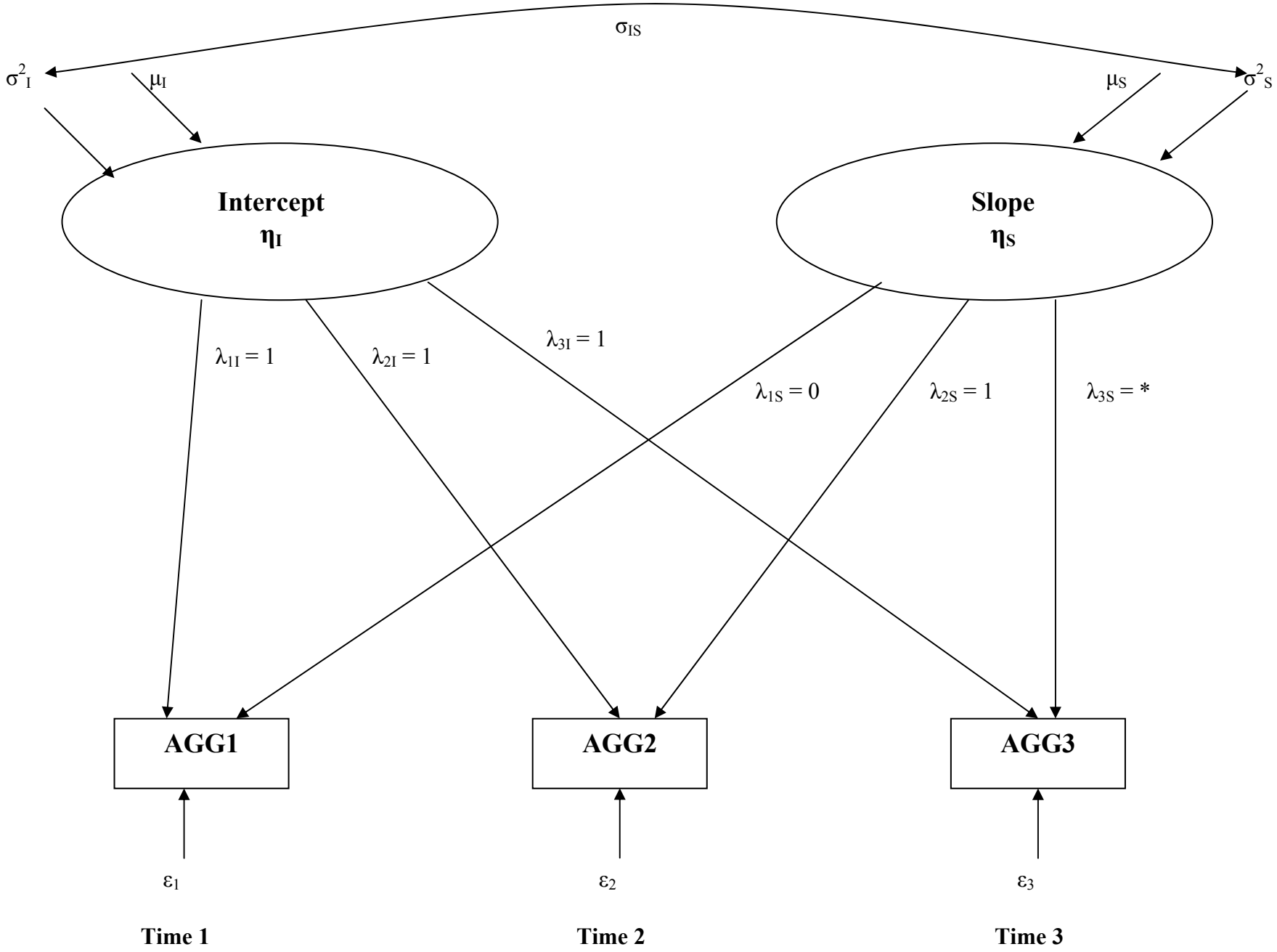

Figure 2. The Final Multivariate Latent Growth Model of the Mother Data. Unstandardized Estimates and *t*-values between Parentheses.