CHAPTER 2

MATERNAL CHARACTERISTICS PREDICTING YOUNG GIRLS' DISRUPTIVE BEHAVIOR

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ABSTRACT

Little is known about the relative predictive utility of maternal characteristics and parenting skills on the development of girls' disruptive behavior. The current study used five waves of parent and child-report data from the ongoing Pittsburgh Girls Study to examine these relationships in a sample of 1,942 girls from age 7 to 12 years. Multivariate Generalized Estimating Equation (GEE) analyses indicated that European American race, mother's prenatal nicotine use, maternal depression, maternal conduct problems prior to age 15, and low maternal warmth explained unique variance. Maladaptive parenting partly mediated the effects of maternal depression and maternal conduct problems. Both current and early maternal risk factors have an impact on young girls' disruptive behavior, providing support for the timing and focus of the prevention of girls' disruptive behavior.

INTRODUCTION

Studies agree that maternal characteristics and dysfunctional family interactions are related to the onset and development of disruptive behavior in children (Loeber & Stouthamer-Loeber, 1986; Patrick, Snyder, Schrepferman, & Snyder, 2005). However, the majority of studies on disruptive behavior are based on male samples and little is known about the development of disruptive behavior in girls (Keenan, Stouthamer-Loeber, & Loeber, 2005). This paper expands knowledge on girls' disruptive behavior, and specifically, on the contributions played by maternal characteristics and child rearing practices.

Although disruptive behavior is more prevalent in boys, a growing body of research has shown that a proportion of girls also display disruptive behaviors (Hipwell et al., 2002; Keenan & Shaw, 1997; Odgers et al., 2008). Moreover, Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD) are among the most prevalent psychiatric disorders in girls (American Psychiatric Association, 1994; Zoccolillo, 1993). In addition, when disruptive behavior disorders (DBD) occur in girls, both behavioral problems and comorbidity reach higher levels compared to boys, a phenomenon known as 'the gender paradox' (Loeber & Keenan, 1994; Zahn-Waxler, Shirtcliff, & Marceau, 2008).

Studies that have focused on the onset and development of disruptive behavior in boys frequently distinguished between an early and a late onset of disruptive behavior (Farrington & Hawkins, 1991; Loeber & Farrington, 2000). Compared to late onset, early onset disruptive behavior is associated with more detrimental outcomes later in life (Moffitt, 1993). Among girls, the majority of studies also provide support for early onset persistent disruptive behavior (for a review, see Fontaine, Carbonneau, Vitaro, Barker, & Tremblay, 2009). The prognosis for girls with an early onset of disruptive behavior through adolescence and adulthood can be unfavorable, resulting in mental and physical health problems and serious delinquency (Pajer, 1998; Silverthorn & Frick, 1999). However, studies that have examined risk factors associated with young girls' development of disruptive behavior are few and often based on small samples, even though large samples are essential for studying low base-rate behaviors (Fontaine et al., 2009). Moreover, most of these studies are limited by cross-sectional designs. The current study advances understanding of the prevalence and risk factors of young girls' disruptive behavior, using a prospective longitudinal design and a large sample of girls.

Maternal factors and disruptive behavior

Studies have been consistent in confirming the intergenerational transmission of disruptive behavior from mothers to children. For example, twin research has shown a strong general heritability for externalizing behaviors (heritability index .80) in offspring (Hicks, Krueger, Iacono, McGue, & Patrick, 2004). Besides a genetic predisposition (Bartels et al., 2004; van den Oord, Verhulst, & Boomsma, 1996), many studies show that several maternal characteristics and behaviors (e.g., family structure, maternal psychopathology, parenting skills) influence

the development of disruptive behavior in the offspring (Loeber & Stouthamer-Loeber, 1986; Moffitt, Caspi, Rutter, & Silva, 2001; Wasserman & Seracini, 2001). Disadvantageous family demographics such as poverty, poor maternal education and single parenthood (Côté, Vaillancourt, Leblanc, Nagin, & Tremblay, 2006; Jaffee, Caspi, Moffitt, Belsky, & Silva, 2001), and maternal psychopathology have also been repeatedly associated with child's disruptive behavior. For example, depressed mothers or mothers with a history of conduct problems are more likely to have children with disruptive behavior (Goodman & Gotlib, 1999; Ehrensaft et al., 2003). Furthermore, distinct aspects of adverse parenting behaviors such as harsh discipline, low maternal warmth, and inconsistent discipline are associated with the onset, escalation and worsening of disruptive behavior in the offspring (Patterson, DeBayshe, & Ramsey, 1989; Patrick et al., 2005; Stormshak, Bierman, McMahon & Lengua, 2000). Relatively little is known about mother's lifestyle during pregnancy as a predictor of child's disruptive behavior. Research suggests that maternal substance use during pregnancy has a negative impact on child development by damaging the brain at critical times (Brennan, Grekin, & Mednick, 2003; Linnet et al., 2003). For example, prenatal smoking increased the risk on boys' disruptive behavior even after controlling for socioeconomic status, maternal age, parental antisocial behavior and maladaptive parenting (e.g., Wakschlag, Pickett, Kasza, & Loeber, 2006). In summary, maternal factors associated with offspring's disruptive behavior may be present across childhood and adolescence. Moreover, maternal characteristics and parenting behaviors are considered to have a relatively strong impact because they are present early, and remain part of the environment across child's development (Tremblay, 2010). As such, maternal characteristics and parenting behaviors are important variables to study when establishing girls' disruptive behavior.

Adverse maternal characteristics often cluster. For example, early motherhood is correlated with a history of conduct problems in the mother herself (Zoccolillo & Rogers, 1991) and both are associated with disruptive behavior in the offspring. Research on single maternal risk factors does not demonstrate the combination of the most important maternal factors on the development of girls' disruptive behavior. Therefore, it is important to consider the impact of multiple maternal risk factors on girls' disruptive behavior in childhood as well (Kroneman, Loeber, Hipwell, & Koot, 2009), and it is also conceivable that some maternal risk factors have their effect on girls' disruptive behavior via other maternal risks. Specifically, the presence of maternal psychopathology may operate on offspring via poor parenting behaviors, such as inconsistent discipline and harsh parenting (Blatt-Eisengart, Drabick, Monahan, & Steinberg, 2009; Wasserman & Seracini, 2001). For instance, maternal depression may negatively influence emotional availability and parenting behavior, which affects children through lowered parental involvement (Goodman & Gotlib, 1999). However, poor parenting, which is among the strongest predictors of early conduct problems (Patterson et al., 1989; Patrick et al., 2005), may have a direct effect on girls' disruptive behavior regardless of maternal

psychopathology or other maternal social disadvantages. Few studies have examined direct effects and mediational models of poor parenting on maternal psychopathology (Burke, Loeber, & Birmaher, 2002). Knowledge of the strength and possible mediating mechanisms of adverse maternal characteristics predicting disruptive behavior in childhood potentially provides critical information about targets for intervention. It is thus essential to examine maternal characteristics independently as well as simultaneously to understand their effects on girls' disruptive behavior.

The purpose of the current study is threefold. The first aim is to investigate the prevalence and stability of girls' disruptive behavior in middle and late childhood in a large community sample. The second aim is to examine to what extent maternal environmental factors uniquely predict girls' disruptive behavior in childhood. Therefore, to take account of clustering of adverse maternal characteristics, multiple maternal factors will be studied separately, but also in combination. The final aim is to determine whether maternal psychopathology (i.e., maternal depression and maternal conduct problems prior to age 15) operate through poor parenting to heighten the risk of girls' disruptive behavior.

METHOD

Participants

The participants in the current study were 2,451 girls enrolled in the longitudinal Pittsburgh Girls Study (PGS). Recruitment of the PGS sample was achieved between 1999–2000 by means of a citywide survey of 103,238 households. Disadvantaged neighborhoods were oversampled to increase the prevalence of girls' externalizing behavior. The survey identified 3,241 girls aged between ages 5 and 8 of whom 2,451 (85.3%) agreed to participate. The sample consisted of four age cohorts: 5 (N = 588), 6 (N = 630), 7 (N = 611) and 8 (N = 622) at the first assessment. Ongoing follow-up assessments occur annually and data are collected from multiple informants, including the primary caregiver, the teacher and the girls themselves (for further details, see Hipwell et al., 2002).

The present paper focuses on girls from middle to late childhood using data collected between 7 and 12 years (across assessment waves 3 to 7). The overlapping cohort design resulted in a varying number of participants at each age (see Figure 1). In wave 3, the majority of the girls were African American (53.0%) and 41.2% were European American. The remainder (5.8%) were mainly multiracial or another race. The retention rate was high, ranging from 95.1% at age 7 through 92.6% at age 12. Only a small percentage of participants were permanently lost to further follow-up (2.0% at age 7 and 2.6% at age 12).

Figure 1. Distribution of participants (N) by age and wave.

Assessment wave	Age					
	7	8	9	10	11	12
3	Cohort 5	Cohort 6	Cohort 7	Cohort 8		
4		Cohort 5	Cohort 6	Cohort 7	Cohort 8	
5			Cohort 5	Cohort 6	Cohort 7	Cohort 8
6				Cohort 5	Cohort 6	Cohort 7
7					Cohort 5	Cohort 6
	N					
Total N original sample	588	1218	1829	2451	2451	1863
Total biological mothers	467	960	1440	1931	1914	1448

Note. Because some measurements of interest were initiated at wave 3, data from the first two waves were not used.

Given our interest in maternal factors, analyses were restricted to the data of the girls in which the reported caregiver was the biological mother (participation of biological mothers ranged from 87.7% at age 7 through 84.2% at age 12). Table 1 shows that biological mothers gave birth to their first child at age 23.0 (SD = 6.0), 37.5% were single parents and 54.5% received more than 12 years of education. Of the families with a biological mother, 28.2% were on welfare. Biological mothers were compared with other caregivers and there was no difference in minority race distribution ($\chi^2 = 2.32$, df = 1, $p = .128$), maternal education level ($\chi^2 = 2.45$, df = 1, $p = .117$) and disruptive behavior score ($t = 1.50$, $p = .14$) between girls of biological mothers compared to girls of other caregivers. However, biological mothers were more often single mothers ($\chi^2 = 4.78$, df = 1, $p < .05$) and on welfare ($\chi^2 = 7.05$, df = 1, $p < .01$) than other caregivers.

Procedure

All study procedures were approved by the University of Pittsburgh Institutional Review Board. Informed consent from the caregiver and verbal assent from the child were obtained prior to data collection. Interviews were conducted separately at home with mother and daughter by trained interviewers and lasted about 2-3 hours each. The interview questions were read aloud and the responses were entered by the interviewer into a laptop computer. Parents also filled out a booklet containing additional self-report questionnaires. The participants were reimbursed for their involvement in the study.

Measures

Girls' disruptive behavior was measured by maternal report using items from the Child Symptom Inventory-4 (CSI-4; Gadow & Sprafkin, 1994) that assessed *Diagnostic and*

Statistical Manual of Mental Disorders – fourth edition (DSM-IV; American Psychiatric Association, 1994) symptoms of Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD). Adequate concurrent validity, and sensivity and specifity of symptom scores to clinicians' diagnoses have been conducted for the CSI (Gadrow & Sprafkin, 1994). Each symptom was scored on a 4-point scale and ranged from 0 (never) to 3 (all the time). All eight DSM-IV ODD symptoms (e.g., takes anger out on others, refuses to do what told) were assessed each year. All 15 DSM-IV CD items were assessed in PGS waves 4-7. In wave 3 symptoms referring to truancy and running away were not assessed because they were not deemed age appropriate. Because prior analyses have shown that CD and ODD load on the same factor (Loeber et al., 2009), a total disruptive behavior score was created by summing all ODD and CD symptoms scores. The internal consistency of this score was good with Cronbach's α ranging from 0.86 (wave 3) to 0.87 (wave 7).

Single motherhood, Low maternal education level and Public assistance were reported by the mother each year and information on *girls' race* was collected at wave 1. Responses were reduced to binary variables: single mother (yes/no), less than 12 years of education (yes/no) and receipt of public assistance (yes/no).

Maternal age at first birth, Prenatal nicotine use and Prenatal alcohol use were measured by retrospective maternal report using the Pre- and Perinatal Risk Factors scale (PPRF; Keenan & Stouthamer-Loeber, 2000) administered in PGS wave 2 and in following waves for any new biological mother participants. In addition to reporting the age when their first child was born, mothers reported on their nicotine and alcohol use during the pregnancy of the participating girl. Binary variables were created for both prenatal nicotine use and prenatal alcohol use (present/absent).

Maternal depression was measured each year using the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996). The BDI-II has demonstrated excellent test-retest reliability and moderate to high convergent validity (Beck et al., 1996). The BDI-II consists of 21 items assessing the presence and intensity of depression over the past two weeks (e.g., sadness, loss of interest, irritability). Each item is scored on a 4-point scale ranging from 0 (absent) to 3 (severe). In the present study, the internal consistency coefficients of this total depression scale ranged from $\alpha = 0.92$ (at wave 3) to $\alpha = 0.93$ (at wave 5).

Maternal conduct problems prior to age 15 was retrospectively examined using the Structured Clinical Interview for DSM-IV, Conduct Disorder (SCID-I / CD; First, Spitzer, Gibbon, & Williams, 1996) administered in wave 3. The SCID-I has demonstrated good interrater reliability (Ventura et al., 1998). The total score ranging from 0-15 was created by summing all symptoms. The internal consistency of this scale was $\alpha = 0.79$.

Maternal alcohol use and Maternal drug use was measured each year using maternal report on the Alcohol Use Disorders Identification Test (AUDIT; Babor, Steer, & Brown, 1992) and the Parent Substance Use Inventory (SUI; White, Hipwell, & Mizelle, 2002). The AUDIT is

a self-report instrument on alcohol use and mothers reported on 10 items resulting in total scores ranging from 0 to 40. The Audit has demonstrated good test-retest reliability, and favorable sensitivity and acceptable specificity for current alcohol use disorders (Babor et al., 1992; Selin, 2003). In this study, the internal consistency ranged from α = 0.72 (at wave 4) to α = 0.76 (at wave 7). Frequency of drug use (marijuana, cocaine, stimulants, sedative-hypnotics, opioids and hallucinogens) during the past year was assessed using six items of the SUI scored on 5-point scales ranging from 0 (never) to 4 (4 or more times a week/daily). The data were reduced to a binary variable indicating the use of any drugs.

Harsh parenting was assessed each year using girls' report on six items from the Conflicts Tactics Scale: Parent-Child version (CTSPC; Straus, Hamby, Finkelhor, Moore, & Runyan, 1998). The construct was created by combining items of the Psychological Aggression subscale and a single item on spanking. The Verbal Aggression subscale has shown to have good predictive validity to child behavioral and emotional problems (Kolko, Kazdin, & Day, 1996). Girls responded on items concerned with family conflict, parents' verbal and physical conflict resolution (e.g., 'when you do something that you are not allowed to, how often does your mother say she will send you away or kick you out of the house?'). Items were scored on a 3-point scale ranging from 1 (never) to 3 (often) and were summed to a total score. The internal consistencies of this scale were moderate with Cronbach's α ranging from 0.72 at wave 4 to 0.75 at wave 6.

Poor communication and low parent-child involvement were investigated each year using two corresponding subscales of the Supervision Involvement Scale (SIS; Loeber, Farrington, Stouthamer-Loeber, & van Kammen, 1998). Girls responded on 5 questions of the *Poor communication* scale, with 4 questions focused on when and how often the mother discussed her daughter activities, scored on a 4-point scale. Two 'when' items ranged from 1 (yesterday/today) to 4 (more than a couple of weeks ago), and two 'how often' items ranging from 1 (often) to 4 (never). The remaining question, scored on a 4-point scale ranging from 1 (often) to 4 (never), referred to the frequency of the mother talking with her daughter about school. All items were summed to create a total communication score. Internal consistency coefficients of this scale ranged from α = 0.68 at wave 3 to α = 0.81 at wave 7. *Low parent-child involvement* was examined each year by girls responding on 5 items about the frequency of undertaking activities with their mother (e.g., 'do things together on the weekend'), scored on a three-point scale ranging from 1 (almost never) to 3 (often) summed to create a total involvement score. Cronbach's alpha ranged from 0.72 at wave 3 to 0.82 at wave 7. The supervision subscale was not included due to low internal consistency (ranging from α = 0.55 in wave 4 tot α = 0.60 in wave 5).

Inconsistent discipline was measured each year by means of the Discipline Scale (Loeber et al., 1998). This scale consists of 4 questions scored on a 3-point scale ranging from 0 (almost never) to 2 (almost always) summed to a total score. Mothers responded to questions such

as: 'If a punishment has been decided upon, can your daughter change it by explanations, arguments or excuses?' Internal consistency coefficients ranged from $\alpha = 0.61$ (wave 7) to $\alpha = 0.63$ (wave 5).

Low maternal warmth was measured each year with mothers' report on the Parent-Child Relationship Scale (PCRS; Loeber et al., 1998), consisting of 6 questions scored on a 3-point scale ranging from 1 (almost never) to 3 (often) and were summed to create a total score. An example of the questions asked is: 'how often have you wished your daughter would just leave you alone?' Alpha coefficient ranged from $\alpha = 0.73$ at wave 3 to $\alpha = 0.77$ at wave 7.

Data analyses

To obtain results representative of the population of girls in Pittsburgh, a weight variable was used to correct for the oversampling of families from disadvantaged neighborhoods (see Hipwell et al., 2002). Missing data within instruments were prorated if more than 67% were present. In addition, at least 80% of the repeated measeurments of the dependent variable needed to be present within each subject to be included in analyses (0.8% was excluded as a result of this criterion). We selected PGS study variables that were associated with maternal characteristics and parenting behaviors, and empirically related to childs' disruptive behavior. To minimize shared method variance, mother reports were used to assess maternal psychopathology and daughters' disruptive behavior, and girls' reports were used to assess parenting practices. However, mother reports on 'consistency in discipline' and 'emotional warmth' were used, because girls reported on these questions only at older ages in the study.

Analyses proceeded as follows. First, prevalence rates of girls' disruptive behavior were determined at each age between 7 and 12 years and the stability of the disruptive behavior score was ascertained by year-to-year Intraclass Correlation Coefficients (ICCs). Second, maternal factors predicting girls' disruptive behavior were investigated individually and in combination using bivariate and hierarchical regression analyses. For these analyses, generalized estimating equation (GEE; Zeger & Liang, 1986) regressions were used in order to account for autocorrelations between data points and to permit the analysis of multiple, successive waves of independent and dependent variables. To take account of the temporal sequence of a possible cause and effect, a time-lagged model was used in which independent variables (including prior level of girls' disruptive behavior) were lagged by one year (T-1) in relation to the dependent variable assessed at time T (Twisk, 2003). This enabled us to measure the overall degree to which a maternal factor is related to *change* in girls' disruptive behaviors scores over time.

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Table 1. Descriptive Statistics and Correlations among Predictor Variables at Wave 3.

Variable			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Dichotomous	**N**	**%**																
1. Girls' minority race	966	50.0	-															
2. Single motherhood	718	37.5	.36[a]	-														
3. Low maternal education	872	45.5	.14[a]	.15[a]	-													
4. Welfare	540	28.2	.26[a]	.24[a]	.24[a]	-												
5. Prenatal nicotine use	575	29.8	.02	-.01	-.00	-.00	-											
6. Prenatal alcohol use	135	7.0	-.04	-.00	.00	-.02	.24[a]	-										
7. Maternal drug use	246	12.7	.02	-.03	.04	-.02	.11[a]	.11[a]	-									
Continuous	**M**	**SD**																
8. Maternal age at first birth	23.0	6.0	-.49[a]	-.28[a]	-.27[a]	-.31[a]	-.06[b]	-.02	.01	-								
9. Maternal depression	7.3	7.8	.02	-.04	.02	-.00	.14[a]	.08[a]	.16a	.04	-							
10. Maternal CD prior to age 15	1.4	2.1	.05	.01	.02	.03	.23[a]	.13[a]	.24a	-.06b	.24a	-						
11. Maternal alcohol use	2.3	2.7	-.03	.00	.01	.02	.13[a]	.14[a]	.19a	.01	.07a	.15a	-					
12. Harsh parenting	8.7	2.3	.03	.04	.02	.03	.05	.04	.04	-.01	.08a	.11a	-.02	-				
13. Poor communication	8.6	3.0	.03	.03	.03	.03	.06[a]	.04	-.01	-.05a	.09a	.10a	.05	.18a	-			
14. Little parent-child involvement	8.2	2.2	.03	.05	-.02	.04	.07[a]	.03	.01	-.02	.12a	.04	.04	.23a	.49a	-		
15. Inconsistent discipline	3.0	1.7	.02	.04	.02	.01	.08[a]	.05[b]	-.07a	.01	.18a	.10a	.07a	.01	.05	.04	-	
16. Low maternal warmth	8.9	2.1	-.04	-.02	.01	-.02	.02	-.04	.14a	-.02	.26a	.23a	.12a	.13a	.07a	.10a	.12a	-

Note. Descriptive data on dichotomous variables are shown N (%), data on continuous variables are [a] Correlations are statistically significant ($p < .01$) shown mean (SD); total N= 1942.

Maternal demographic variables were first introduced in the hierarchical GEE models together with the following control variables: girls' disruptive behavior at T-1, cohort, and girls' minority race status (European American = 0, minority = 1). Next, a block with both prenatal substance use variables was added, followed successively by a block of maternal psychopathology and a block of maternal parenting behaviors. This made it possible to examine whether specific maternal factors (such as prenatal substance use) had an independent effect on disruptive behavior in girls, even when other relevant maternal factors (such as parenting behaviors) were taken into account. Finally, two mediation models tested whether maternal parenting mediated the impact of maternal psychopathology (i.e., maternal depression and maternal conduct problems prior to age 15) on girls' disruptive behavior.

A negative binomial model was used due to the skewed distribution of the disruptive behavior score variable. Most variables used in the analyses were measured repeatedly, with the exception of minority race status, maternal age at first birth, prenatal substance use and maternal conduct problems prior to age 15, which were entered in the analyses as time-invariant variables. Correlations among predictor variables at wave 3 ranged from 0.00 to 0.49, significant at $p < .01$ or $p < .001$ (see Table 1), indicating that collinearity was not a great concern. STATA software was used (version 11, StataCorp, 2009) to conduct the regression analyses.

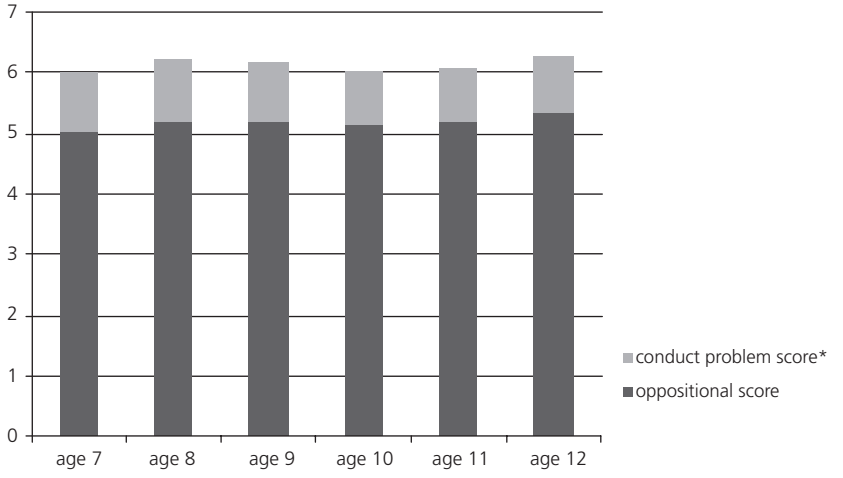
RESULTS

In order to address the first aim, girls' mean disruptive behavior was examined at each age. Mean scores were similar across ages examined and varied from 6.0 (SD = 4.4) at age 7 to 6.3 (SD = 4.89) at age 12 (range 0-69). Figure 2 shows that at each age the mean oppositional score contributed more than the conduct problem score to the total disruptive behavior score. The most common symptoms were 'loses temper', 'argues with adults' and 'deliberately destroys other's property' (prevalence rates ranged from 7.0 to 12.1%). The least common symptoms were 'forces sex', 'breaks into someone else's house, building or car' and 'runs away from home overnight' (ranging from not present at all to 0.5%). The disruptive behavior score displayed good levels of stability from one year to the next with ICC's ranging from 0.78 (between ages 7 to 8) to 0.84 (between ages 8 to 9).

Table 2 shows bivariate GEE regression effects of the individual maternal factors in predicting girls' disruptive behavior when controlling for disruptive behavior at T-1. Single motherhood (IRR = 1.01, $p < .05$), low maternal education (IRR = 1.04, $p < .05$), and both prenatal nicotine (IRR = 1.10, $p < .001$) and prenatal alcohol use (IRR = 1.09, $p < .01$) were related to an increase in girls' disruptive behavior. All indicators of maternal psychopathology, that is maternal depression (IRR = 1.01, $p < .001$), maternal conduct problems prior to age 15 (IRR = 1.03, $p < .001$), maternal alcohol use (IRR = 1.01, $p < .01$), and maternal drug use (IRR = 1.06, $p < .05$) predicted girls' disruptive behavior. Of the parenting behavior variables

at T-1, harsh parenting (IRR = 1.01, $p < .05$), inconsistent discipline (IRR = 1.02, $p < .01$), and low maternal warmth (IRR = 1.06, $p < .001$) predicted girls' disruptive behavior at T.

Figure 2. Weighted mean girls' disruptive behavior score in middle childhood.



Note. Disruptive behavior score (range 0-69) consists of mean oppositional and mean conduct problem score. * two age-inappropriate symptoms were not assessed in wave 3, but were measured in waves 4-7

Next, we examined a multivariate GEE model of maternal factors (see Table 3). Results following entry of the first variable block showed that an increase in disruptive behaviors at time T was predicted by earlier disruptive behavior of girls at T-1 (IRR = 1.11, $p < .001$) and single motherhood (IRR = 1.07, $p < .01$). A negative relation was found for girls' race (IRR = .91, $p < .001$) indicating a reduced likelihood of increasing disruptive behavior among girls of minority race. Prenatal substance use variables were added in the next step. Prenatal nicotine use increased girls' disruptive behavior (IRR = 1.07, $p < .001$), whereas prenatal alcohol use explained no additional variance. Furthermore, the prior covariates remained significant. Maternal psychopathology factors were added in the third step. Maternal depression (IRR = 1.01, $p < .001$) and maternal conduct problems prior to age 15 (IRR = 1.02, $p < .001$) both significantly added to the predictive accuracy of the model.

Finally, parenting behaviors were added. Only low maternal warmth predicted an increase in disruptive behavior in girls (IRR = 1.06, $p < .001$) over and above all variables included in the model. Prior variables remained significant except for single motherhood. Thus in the final model after controlling for disruptive behavior score on Time T-1, an increase in girls' disruptive behavior between age 7 and 12 was predicted by European American race, prenatal nicotine use, maternal depression, maternal conduct problems prior to age 15, and low maternal warmth.

Table 2. Bivariate GEE Effects of Maternal Predictors at T-1 on Disruptive Behavior Symptoms at Time T.

Variable	IRR[a]	95% CI
Maternal demographics		
Maternal age at first birth	1.00	(1.00, 1.00)
Single motherhood	1.05*	(1.01, 1.08)
Low maternal education	1.04*	(1.01, 1.08)
Welfare	1.03	(1.00, 1.07)
Maternal prenatal substance use		
Prenatal nicotine use	1.10***	(1.06, 1.14)
Prenatal alcohol use	1.09**	(1.03, 1.16)
Maternal psychopathology		
Maternal depression	1.01***	(1.00, 1.01)
Maternal conduct problems	1.03***	(1.02, 1.03)
Maternal alcohol use	1.01**	(1.00, 1.01)
Maternal drug use	1.06*	(1.01, 1.11)
Maternal parenting behaviors		
Harsh parenting	1.01*	(1.00, 1.02)
Poor communication	1.01	(1.00, 1.01)
Low parent-child involvement	1.00	(1.00, 1.01)
Inconsistent discipline	1.02**	(1.00, 1.03)
Low maternal warmth	1.06***	(1.05, 1.07)

Note. Predictor effects are each accounted for earlier disruptive behavior at time T-1 [a] Incidence rate ratio (IRR) represents the amount of change in girls disruptive behavior across ages 7- 12 per unit change in maternal factor
* p <.05, ** p < .01, ***p < .001

After observing that race was among the largest effects, we decided to run separate models by race. For girls in the minority group, results were consistent with the final model. Girls' disruptive behavior between age 7 and 12 was predicted by prior (T-1) disruptive behavior of girls (IRR = 1.09, p < .001), prenatal nicotine use (IRR = 1.09, p < .001), maternal depression (IRR = 1.00, p < .05), maternal conduct problems prior to age 15 (IRR = 1.02, p < .001), and low maternal warmth (IRR = 1.06, p < .001). For European American girls, disruptive behavior between age 7 and 12 was also predicted by earlier disruptive behavior of girls at T-1 (IRR = 1.10, p < .001), maternal conduct problems prior to age 15 (IRR = 1.01, p < .05), and low maternal warmth (IRR = 1.05, p < .001), but not by prenatal nicotine use (IRR = 1.02, p = 0.43) and maternal depression (IRR = 1.00, p = 0.05). Other changes to the model for European American girls were that maternal alcohol use (IRR = 0.99, p < .05) and low parent-child involvement (IRR = 0.99, p < .05) were negatively related to girls' disruptive behavior. Also, harsh parenting (IRR = 1.02, p < .01) and poor communication (IRR = 1.01, p < .05) predicted an increase in girls' disruptive behavior over and above all other variables in the model.

Table 3. Multivariate GEE Model for Maternal Predictors at Time T-1 on Girls' Disruptive Behavior Symptoms at Time T.

	Block 1: adding maternal demographics		Block 2: adding prenatal substance use		Block 3: adding maternal psychopathology		Block 4: adding maternal parenting behaviors	
Variable	IRR[a]	95% CI	IRR[a]	95% CI	IRR[a]	95% CI	IRR[a]	95% CI
Girls' disruptive behavior T-1[b]	1.11***	(1.11, 1.12)	1.11***	(1.11, 1.12)	1.11***	(1.10, 1.11)	1.09***	(1.09, 1.10)
Cohort[b]	1.01	(0.99, 1.02)	1.00	(0.99, 1.02)	1.01	(0.99, 1.02)	1.01	(0.99, 1.02)
Girls' minority race[b]	0.91***	(0.88, 0.95)	0.91***	(0.88, 0.95)	0.90***	(0.86, 0.93)	0.89***	(0.85, 0.93)
Single motherhood	1.07**	(1.03, 1.11)	1.06**	(1.02, 1.10)	1.05**	(1.01, 1.09)	1.04	(1.00, 1.08)
Low maternal education	1.04*	(1.01, 1.08)	1.03	(1.00, 1.06)	1.01	(0.98, 1.05)	1.01	(0.97, 1.05)
Welfare	1.04	(1.00, 1.08)	1.03	(1.00, 1.07)	1.01	(0.97,1.05)	1.01	(0.97, 1.05)
Prenatal nicotine use			1.07***	(1.03, 1.11)	1.05**	(1.01, 1.09)	1.06**	(1.02, 1.10)
Prenatal alcohol use			1.06	(1.00, 1.13)	1.03	(0.97, 1.09)	1.03	(0.97, 1.10)
Maternal depression					1.01***	(1.00, 1.01)	1.00**	(1.00, 1.01)
Maternal conduct problems					1.02***	(1.02, 1.03)	1.02***	(1.02, 1.03)
Maternal alcohol use					1.00	(1.00, 1.01)	1.00	(0.99, 1.00)
Maternal drug use					1.01	(0.96, 1.06)	1.00	(0.96, 1.06)
Harsh parenting							1.01	(1.00, 1.02)
Poor communication							1.00	(1.00, 1.01)
Low parent-child involvement							1.00	(0.99,1.00)
Inconsistent discipline							1.01	(1.00, 1.02)
Low maternal warmth							1.06***	(1.05, 1.07)

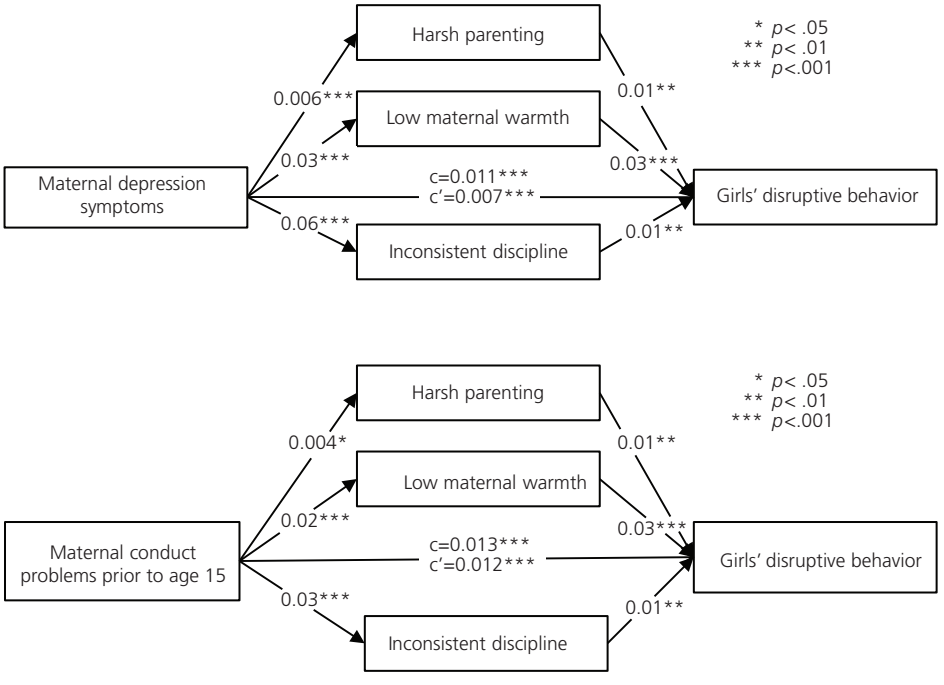
[a] Incidence rate ratio (IRR) represent the amount of change in girls' disruptive behavior across ages 7- 12 per unit change in maternal factor

[b] Girls' disruptive behavior T-1, cohort and minority race status are included in block 1 as control variables

* $p < .05$, ** $p < .01$, ***$p < .001$. Predictors measured at Time T-1

The final aim concerns whether the effect of maternal psychopathology on girls' disruptive behavior operates through suboptimal parenting behaviors. Figure 3 shows two mediational models for maternal depression and for maternal conduct problems prior to age 15 respectively. Each model takes account of the control variables (girls' earlier disruptive behavior at T-1, cohort and race). Standardized regression coefficients are presented to allow comparisons of effects of both types of psychopathology, regardless of the variables underlying scale of units. The effects of both maternal depression and maternal conduct problems prior to age 15 on girls' disruptive behavior are reduced when parenting variables are included ($c' < c$). This indicates that the direct effects of maternal depression and maternal conduct disorder prior to age 15 on girls' disruptive behavior partially depended on maladaptive parenting behavior. The Sobel test (using unstandardized regression coefficients) demonstrated each independent parenting behavior (i.e., harsh parenting, low maternal warmth and inconsistent discipline) to be a significant mediator, except for harsh parenting in the prior maternal conduct problems model ($p = 0.07$). Note that the magnitude of reduction is relatively smaller in the model concerning prior maternal conduct problems compared to the model on maternal depression (13% and 34% respectively).

Figure 3. Mediation models for maternal psychopathology and parenting behaviors on girls' disruptive behavior when taken account of the control variables (standardized coefficients).



DISCUSSION

The current study aimed to extend knowledge of the development of girls' disruptive behavior in middle to late childhood. The prevalence rates were remarkably similar through this developmental period (age 7 through 12). Disruptive behavior is known to peak in early childhood and declines with age. Our finding is consistent with earlier research on normative development, in which the decline of externalizing behavior between ages 2 to 7 flattens out in mid-to late-childhood (e.g., Bongers, Koot, van der Ende, & Verhulst, 2003; Miner & Clarke-Stewart, 2008). Furthermore, the disruptive behavior score consisted predominantly of oppositional rather than conduct disorder behaviors. This is in concordance with previous reports that ODD tends to be more prevalent than CD in girls (Costello et al., 1996; Hipwell et al., 2002). CD is deemed the most severe disruptive behavior disorder, whereas oppositional behaviors are considered to be partly normative in children's development. However, research has shown that ODD may play a role as a precursor to a wide range of child psychopathology, including CD (Loeber, Burke, & Pardini, 2009). Therefore, oppositional behavior in girls cannot merely be considered benign. Follow-up research into adolescence is required to examine the developmental course of these behaviors.

In analyses examining the impact of maternal characteristics and parenting behaviors on change in girls' disruptive behavior, bivariate GEE results showed that most of the potential maternal risk factors predicted girls' disruptive behavior, even when controlling for earlier disruptive behavior. However, when multiple maternal risk factors were examined in the same model, fewer significant predictors were identified. Prenatal nicotine use, maternal depression, prior maternal conduct problems and low maternal warmth predicted an increase in girls' disruptive behavior. Mothers' smoking during pregnancy increased young girls' disruptive behavior, even with many relevant cofounding maternal factors also included in the model. These results are concordant with previous studies (e.g. Wakschlag et al., 2006). However, prenatal nicotine exposure in female offspring is an understudied topic (Brennan et al., 2003). Therefore, findings of this study also make an important contribution to knowledge of the association between prenatal smoking and other maternal risk factors on girls' disruptive behavior from middle to late childhood. Several researchers have suggested that the effect of prenatal smoking on the offspring's behavior operates through a link with neuropsychological deficits (Maughan, Taylor, Taylor, Butler, & Bynner, 2001; Wakschlag et al., 2006). Therefore, despite the fact that prenatal nicotine use appears to be a robust predictor, studies on the physiological mechanisms that explain the link with disruptive behaviors in affected offspring are needed

The findings of this study also corroborate the importance of maternal psychopathology on the development of disruptive behavior in the offspring. Transmission of parental psychopathology is considered to operate through both genetic and environmental influences (Rhee & Waldman, 2002). Besides the fact that both depressed mothers and mothers with

prior maternal conduct problems possibly pass hereditary defects onto their offspring, maternal psychopathology is expected to provoke offspring's exposure to several contextual stressors. For example, exposure to mothers' maladaptive depressive affect and related stressors (such as a negative interacting style and family poverty) appears to be associated with disruptive behavior in the offspring (Goodman & Gottlib, 1999). However, our results identified unique effects of both maternal depression and prior maternal conduct problems, even after controlling for other potential risk factors, including maladaptive parenting.

Single motherhood, low maternal education, welfare and maternal age at first birth are a proxy of a low social economical status, which is often associated with disruptive behavior in children. However, not one of these variables added significantly to the model, when examined simultaneously with other maternal characteristics and parenting behaviors. Correlation analyses of predictor variables showed that all maternal demographics examined in this study were partly overlapping with girls' race, which was one of the largest effects on girls' disruptive behavior. A plausible explanation for not predicting girls' disruptive behavior may be that, when considered simultaneously, disadvantageous maternal demographics do not directly explain girls' disruptive behavior, but are more closely associated with other characteristics, such as girls' race.

While significant effects of other parenting practices (i.e., harsh parenting and inconsistent discipline) disappeared when multiple relevant maternal characteristics were examined concurrently, only low maternal warmth had a unique effect on girls' disruptive behavior. These results suggest that girls may be relatively more vulnerable to lowered positive parenting (such as maternal warmth) compared to increased levels of negative parenting (such as harsh parenting). Note however, that mother-daughter interactions may be reciprocal and that girls' disruptive behavior itself may lead to lowered levels of maternal warmth (Hipwell et al., 2008). Nevertheless, these results underscore the importance of a warm relationship between mother and daughter, which may be a clear point for interventions to reduce the likelihood of girls' developing disruptive behavior.

Note that the examination of the relation between maternal psychopathology and parenting behaviors showed small but significant effects. It is conceivable that much variance is left unexplained by other predictors of child disruptive behavior that were not investigated in this present study (Loeber, Slot, & Stouthamer-Loeber, 2006). Nonetheless, these results reveal that the effects of maternal depression and prior maternal conduct problems were partially mediated by adverse parenting behaviors (i.e., low maternal warmth, harsh parenting and inconsistent discipline). Whereas the direct effect of maternal depression was clearly attenuated by maladaptive parenting behaviors, a relatively small mediation effect of maladaptive parenting was found in the model concerning prior maternal conduct problems. In other words, a history of conduct problems in mothers was more directly related to their daughters' disruptive behavior. In previous research, it is posed that the gender paradox may

be transmitted along the female line of the offspring of affected women (Loeber et al., 2009). Therefore, the transfer of conduct problems between mothers and daughters may need specific attention. Future studies must further examine the role of genetic transmissions and the interplay between environment and genes by examining the transfer of risk of maternal depression and prior maternal conduct problem behavior on daughters.

The model examining multiple maternal risk factors showed that European American race predicted an increase in girls' disruptive behavior. Previous studies have shown equivocal findings on racial differences in child disruptive behavior. Most studies found African American children having higher levels of externalizing behavior compared to European American children, although differences are often accounted for by differential exposure to risk factors (e.g., neighborhood disadvantage, low SES) (e.g., Dodge, Petit, & Bates, 1994). Other studies have found that mothers report more conduct problems for European American children (Miner & Clarke-Stewart, 2008). Post-hoc analyses of this study suggest that the associations between maternal risk factors and girls' disruptive behavior do indeed differ by race, even when accounting for socio-demographic disadvantage. Prior research in the PGS study also showed race differences, for example in girls' early substance use and the level of depressive symptoms in late childhood among African American compared to European American girls. Differences in cultural beliefs (e.g., ethnic identity, religiosity) were suggested to be an underlying factor, leading to different risk profiles that may exist between racial groups in the explanation of girls' disruptive behavior (Keenan et al., 2010). More research is needed to address the question of whether child disruptive behavior and associated risk factors are consistent across cultures. In future research, race should be considered as a possible moderator of risk in predicting girls' disruptive behavior

This study has several limitations. Hierarchical multivariate analyses provided a stringent test of the impact of maternal predictors when earlier disruptive behavior was taken into account. Maternal factors measured one year before the girls' behavior in a lagged design, made predictive conclusions more powerful because of the temporal sequence. Nevertheless, important risk factors, which might have altered the results, may have been omitted (e.g., neighborhood risk and peer delinquency). In addition, because specific risk factors and a specific, urban population were used in this paper, results of these analyses may not generalize to other samples.

As we were interested in the impact of maternal behaviors on their daughters' disruptive behavior, only biological mothers and daughters were used as informants. Although we used a study design that tried to avoid shared variance as much as possible, two variables on parenting behaviors (i.e., inconsistent discipline and low maternal warmth) were reported by the mother. Since mothers were also used as informants on girls' disruptive behavior, this may have led to stronger associations between these variables.

Implications for research, policy, and practice

This study has a number of implications. First, results provide important information on the mean levels of young girls' disruptive behavior within a non-referred community sample, against which girls' deviant behavior can be compared. In future research, longitudinal analyses will be used to further specify the course of girls' disruptive behavior, since different developmental trajectories may exist with constant diminishing and increasing prevalence patterns. Also, the current follow up of the girls through adolescence will provide clues to the early identification of girls who are vulnerable to ongoing difficulties.

Second, this study extends knowledge on risk factors associated with the development of girls' disruptive behavior. The results underline the influence of adverse maternal characteristics and parenting behaviors on young girls' disruptive behavior. Building on these findings, future research could continue to investigate the effects of multiple factors on girls' disruptive behavior. Earlier research indicated a dose-response relationship between the number of risk factors and the impact on child problem behavior, just as in research on violence in boys (Loeber et al., 2006). Because maternal factors tend to cluster, it is likely that multiple, rather then single factors produce the strongest risk on girls' disruptive behavior. Also, factors associated with a lowered risk, called promotive factors, could be valuable to investigate. Promotive factors may play a role in buffering the negative effects of risk factors (Loeber et al., 2006), but have rarely been investigated in research concerning girls. Analyses on dose-response relationships of risk and promotive factors add to more complete knowledge of the development of girls' disruptive behavior and provide valuable information to select targets of intervention.

Third, findings revealed that some independent maternal risk factors were currently related to girls' disruptive behavior (e.g., maternal depression and low maternal warmth), whereas other factors were active during pregnancy (e.g. maternal smoking) or even earlier (e.g., maternal conduct problems prior to age 15). These latter findings are concordant with previous research focused on the first 7 years of life (Petitclerc & Tremblay, 2009). Apparently, very early maternal risk factors remain important in the development of girls' disruptive behavior during middle and late childhood. However, most prevention programs are directed at parenting factors, and preventive intervention research has thus far underused knowledge on early family risk factors. The benefit of these early maternal risk factors is that they can already be identified prior to or during pregnancy. Therefore, it may be necessary for clinical practice to focus also on prenatal nicotine use and prior maternal conduct problems, to enable prevention to occur earlier in the life course. For example, recent research on prenatal and infancy home visitation for girls born to high-risk mothers demonstrated promising effects in reducing the proportion of girls entering the criminal justice system (Eckenrode et al., 2010). Further research on this is warranted.