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Reciprocal influences between girls' conduct problems and depression, and parental punishment and warmth: A six year prospective analysis

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Abstract

Although the reciprocal effects of parenting and child behavior have long been recognized, the emphasis of empirical study in the field of developmental psychopathology has been on parenting effects on children. For girls in particular, little is known about unique parenting effects on conduct problems in comparison to depression, or vice versa. In the current study, data from the large-scale (n=2,451) Pittsburgh Girls Study were used to examine the reciprocal relations between parenting and child behavior over a six year period (child ages 7–12 years). Girls and their caregivers (85% of whom were biological mothers) were interviewed annually in their homes. Girls reported on symptoms of conduct disorder and depression, and caregivers reported on level of parent-child warmth and use of harsh punishment. The results of generalized estimating equation regression models demonstrated that both parenting behaviors were uniquely predictive of changes in girls' conduct problems and depressed mood. When the effects of race and poverty on these associations were controlled for, both parenting effects on girls' conduct problems remained significant, but only low parental warmth remained as a significant predictor of depressed mood. Girls' conduct problems, but not depressed mood, predicted changes in harsh punishment over time. The small effect of girls' depressed mood, on changes in parental warmth, was further weakened when socio-demographic factors were also included in the model.

Keywords

girls; conduct problems; depression; parenting; prospective

It is widely recognized that deficits in parenting practices, such as low parental warmth and harsh discipline styles, are associated with the development of both conduct problems (Dodge et al., 1994; Kruttschnitt, 1996; Patterson, 1982; Patterson et al., 1989) and depressive disorders in children and adolescents (e.g. Blatt & Homann, 1992; Burge & Hammen, 1991; Downey & Coyne, 1990; Ge et al., 1994). While some research finds that these differing aspects of parenting are common to both conduct problems and depression (Conger et al., 1992; Ge et al., 1996), other findings suggest that unique associations exist with particular types of child psychopathology (e.g. Caron et al., 2006).

Although child effects on parenting were hypothesized several decades ago (e.g. Bell & Chapman, 1986; Sameroff, 1975), these effects have received little empirical investigation relative to the large body of work supporting parent effects on child behavior (Lytton, 1990). Among the studies that have been conducted, many have focused on the effects of adolescent behavior on parental monitoring. Thus, it has been demonstrated that parental monitoring is partly dependent on the adolescent's disclosure to the parent, which in turn is associated with disruptive behavior (e.g. Stattin & Kerr, 2000). Less is known about the nature of the effects of child behavioral and emotional problems on other aspects of parenting such as warmth or punishment, and whether these associations are likely to be positive or negative. For example, parents may use increasingly harsh forms of discipline in an effort to control increasingly difficult child behavior, thus yielding a positive association. On the other hand, escalating child behavior problems could lead parents to decrease their efforts over time, as they disengage with the child and abdicate their involvement, leading to a negative association (Hirschi, 1969; Stattin & Kerr, 2000). Both types of parental response could lead to an increase in child behavior problems, either via increasingly aversive parent-child interactions and coercive cycles, similar to those described by Patterson (1982; Patterson et al., 1989), or via parental disengagement. The development of child depression can also be conceptualized in a reciprocal model whereby parenting deficits (e.g. low parental warmth) may heighten the child's feeling of helplessness and rejection leading to emotional withdrawal and depression, which in turn may result in further parental disengagement. Further characterization of child effects on parenting, especially during childhood and early adolescence as problem behaviors are emerging, would significantly add to the existing literature and would help broaden the evidence upon which to generate etiological models of the onset, persistence, and desistence of child psychopathology.

A second gap in knowledge concerns the temporal ordering of parent and child effects, because in many longitudinal analyses the effects of initial levels of child and parent behaviors have not been controlled. Furthermore, prospective studies that have addressed this issue, have produced contradictory findings. For example in some studies, disruptive adolescent behaviors were reported to drive reductions in parental control (Kerr & Stattin, 2003; Stice & Barrera, 1995) and affective ties between parent and adolescent (Jang & Smith, 1997; Kerr & Stattin, 2003), but not vice versa. Other investigators have reported fully reciprocal relations between increasing levels of adolescent delinquency and aggression, and decreasing parental monitoring over a 4 year period (Laird et al., 2003), decreasing supervision over an 18 month period (Jang & Smith, 1997), and increasing paternal (but not maternal) control over two years (Chen et al., 2000). In contrast, Vuchinich et al. (1992) reported no cross-lagged effects between boys' antisocial behavior and maternal discipline practices. Among the few studies of elementary school-aged children, in which initial levels of parent and child problem behavior were controlled, results have been similarly mixed. For example, Kandel and Wu (1995) reported a unidirectional child effect from conduct problems to reduced parental monitoring up to 6 years later. In contrast, Patrick et al. (2005) found only a marginal child effect of early growth in overt conduct problems predicting increased parental monitoring 4 years later. Finally, in a study of preschoolers, O'Leary et al. (1999) reported no prospective associations between over-reactive discipline and child behavior problems over a 2½ year period.

Less research has been conducted on the reciprocal relationships between parenting and child or adolescent depression. Chen et al. (2000) reported a unidirectional parent effect of low maternal warmth predicting higher levels of depression among Chinese adolescents but not vice versa. Garber and Flynn (2001) reported that parental acceptance and psychological control were predictive of adolescents' self-worth and attributional style, even after controlling for self-worth and attributional style in the previous year. The reverse effect however, was not tested.

With a few important exceptions (e.g. Huh et al., 2006; Laird et al., 2003; Patrick et al., 2005), most research examining reciprocity between parenting and behavior problems in particular has either been focused on adolescent males or, when females are also included, has failed to test gender differences in the strength or pattern of associations. Because girls tend to be more oriented towards relationships and gaining social approval compared with boys (e.g. Gabriel & Gardner, 1999; Maccoby, 1990), it is possible that they may be especially vulnerable to the effects of harsh parenting and low levels of parental warmth. Several investigators have proposed that this sensitivity to interpersonal stress and conflict places girls at risk for depression (e.g. Nolen-Hoeksema & Girgus, 1994; Rudolph, 2002). Indeed, females have been shown to be more vulnerable than males to the effects of relationship stressors (Cyranski et al., 2000), and a stronger association between family conflict and depressive symptoms has been shown for adolescent girls compared with boys (Crawford et al., 2001; Gore et al., 1993; Seiffge-Krenke & Stemmler, 2002; Siddique & D'Arcy, 1984). Data also support the hypothesis that parents interact with boys and girls differently, especially with regard to the development of disruptive behavior (see review by Keenan & Shaw, 1997) and that parents tend to monitor girls more closely than boys (Chilcoat et al., 1996; Stattin & Kerr, 2000). In fact, several cross-sectional studies have reported stronger associations between parenting deficits, parent-adolescent conflict and low parental acceptance, and severe disruptive or antisocial behavior among female adolescents, compared with their male counterparts (Cernkovich & Giordano, 1987; Chamberlain & Reid, 1994; Dembo et al., 1998; Henggeler et al., 1987; Viale-Val & Sylvester, 1993; Webster-Stratton, 1996), although the direction of these effects remains unclear.

Two recent studies included analyses of the association between parenting behaviors and behavior problems in adolescent girls. Using path analyses of data collected over a period of one year, Huh, Tristan, Wade and Stice (2006) reported that increasing levels of behavior problems among 13- to 17-year-old girls predicted decreasing levels of perceived parental support and control, but parental variables did not predict change in adolescent girls' behavior problems. In the second study, Laird and colleagues (2003) reported reciprocal effects between parental monitoring (adolescent reported) and delinquent behavior over a 4-year period. The results showed that despite a lack of gender differences in parent-reported delinquency, parents' reports of male delinquency more strongly and consistently predicted reduced levels of monitoring than their reports of delinquency among girls. For girls, only parent-reported delinquent behavior in Grade 10 predicted a reduction in monitoring in the following year. Adolescent self-reports of delinquency however, showed a somewhat different picture, with delinquent behavior at each age predicting reduced monitoring for both boys and girls. In contrast, low parental monitoring predicted increases in delinquent behavior equally well for girls and boys.

A further gap in the existing literature is in the study of reciprocal effects between parenting and behavioural and emotional problems during middle childhood. There are several reasons why a different pattern may be evident during preadolescence than during adolescence. First, parenting behaviours change with the age of the child. Harsh parenting occurs more often during childhood than adolescence (National Center on Child Abuse & Neglect, 1996; Straus & Steward, 1999), and parents report using more aggressive parenting strategies with younger than with older daughters (Sagrestano et al., 1999). Mean levels of parental warmth have also been shown to decrease with child age (e.g. Forehand & Jones, 2002). Second, models of reciprocal relationships between parents and children are likely to be age-dependent given the developmental shift from unilateral authority to more egalitarian relationships that comes with the increasing age of the child (Hartup, 1989). Understanding the nature of the association between parenting and problem behaviors in childhood in particular, is critical for the design and implementation of early interventions to prevent both onset, and escalation, of behavioral and emotional problems.

Finally, there is evidence suggesting that socio-demographic factors moderate the association between parenting and child behavior problems. Economic stress for example, is associated with greater strain in the parental role (Elder et al., 1995; Murry et al., 2001), and may account for higher rates of parent-child conflict (Baer, 1999), child behavior problems and depression in single-, rather than two-parent families (e.g. Jessor et al. 1995; Vaden-Kiernan et al., 1995). In certain cultural contexts, such as the culture of poverty, some kinds of parenting practices may be more adaptive, and may be seen as more normative and socially acceptable than in other cultures (Lansford et al., 2005). Differences in parenting styles between African American and European American families have also been noted with African American families being more likely to use an authoritarian style, which emphasizes the importance of control and child compliance (Baumrind, 1971). Shaw, Bell and Gilliom (2000) speculated that this parenting style may be optimal for families living in low-income environments, including low-income African American families, who are dealing with significant immediate neighborhood risks. In fact, in some studies, the difference in parenting behaviors between races no longer exists once differences due to socioeconomic status (SES) are controlled (e.g., Hinshaw & Park, 1999). However, in other studies race differences remain after controlling for socio-demographic factors (Dodge et al., 1995; Winslow & Shaw, 1996). Thus, examining the interactive effect of socio-demographic factors with parenting on child behavior, and with child behavior on parenting, may reveal whether the pattern of reciprocal relations varies by race or socio-demographic status.

In summary, little research to date has focused on reciprocal processes in the development of girls' behavior problems, or the ways in which girls' early behavior problems contribute to the development of parenting difficulties. Similarly, little work has examined reciprocal relationships between parenting practices and depressive symptoms in girls' development. There is a need for studies with regular assessments examining both the development of girls' conduct problems and depressive symptoms, and changes in parenting starting in preadolescence when parental influences may be especially influential and when rates of child disorder are initially low. In the current prospective study, three aims are addressed by modeling year-to-year changes in girls' conduct problems and depressed mood, and changes in parental harsh punishment and warmth using six waves of data in analyses extending from middle childhood to early adolescence. First, we examine whether low parental warmth and high harsh punishment predict increases in girls' conduct problems and depressed mood between ages 7 and 12 years. We also test whether these prospective relationships are reciprocal: whether girls' conduct problems and depression symptoms will also predict decreases in parental warmth and increases in harsh punishment. Second, we test whether there are unique relationships between parental warmth or harsh punishment with girls' conduct problems or depression. Third, we explore the potential moderating effects of race and poverty on these reciprocal relations over time.

Methods

Participants

Girls and their caregivers were participants in the Pittsburgh Girls Study (PGS); a longitudinal study of the development of female conduct disorder. The study uses an overlapping cohort design of girls initially aged 5 (n = 588), 6 (n = 630), 7 (n = 611) and 8 (n = 622) years (total n = 2,451) at the first annual assessment. This community sample of girls and their caregivers was recruited following the enumeration of 103,238 city households in 1999/2000. In the enumeration process, 89 of the 90 city neighborhoods were classified using 1990 Census data on poverty. Neighborhoods in which more than 25% of families were known to be living in poverty were defined as low-income neighborhoods. Every household in the low-income neighborhoods, and 50% of the households in all other neighborhoods, were enumerated,

yielding 3,241 5- to 8-year old girls (representing 83.7% of the girls identified by the 2000 Census). Of 2,876 girls who were age-eligible at the start of the study, and who could also be located after the enumeration, 2,451 agreed to participate in the longitudinal study (see Hipwell, et al., 2002 for further details). Following this procedure, a sample weight variable was calculated by comparing the proportions of neighborhoods represented in the study, to the proportions of neighborhoods in the City of Pittsburgh in which girls in the same age range were living (using data from the 2000 US Census). Applying this weight to the sample enabled the over-representation of low-income neighborhoods to be corrected, so findings could more closely reflect those of girls living in the City of Pittsburgh.

The current paper utilizes 6 waves of annually collected data for girls aged 7 to 12 years. High rates of participant retention were achieved across this period, ranging from 97.2% (in data collection wave 02), to 92.5% (in wave 06). A small percentage of participants (1.7% in wave 02 to 3.1% in wave 06) were deemed permanently lost to further follow-up. There was, however, no differential attrition of girls on the basis of race or household poverty.

The majority of the caregiver respondents comprised the biological mother (85.2%–86.2% (weighted) across waves). Most other caregiver respondents were biological fathers (6.1–6.9%), followed by grandmothers (2.3–3.1%) and adoptive mothers (2.5–2.9%). Given that most caregivers were either the mother or father, caregivers will be referred to as parents for ease of explanation. Forty-five percent of the girls were described as African American, 50% Caucasian, and 5% multi-racial (22 girls were Asian, and the race of the girl was unknown or not reported by the parent in 4 cases - these 26 cases were excluded from analyses). More than half (54.7%) of parents reported having more than 12 years of formal education. Across the 6 waves, 27.7% to 34.8% of households received public assistance, 32.9–35.4% lived in a household headed by a single female parent, and 4% of girls had a caregiver change at least once during the 6 waves.

Procedures

Approval for all study procedures was obtained from the University of Pittsburgh Institutional Review Board. Written informed consent from the caregiver and verbal assent from the child were obtained prior to data collection. Annual interviews were conducted separately for the parent and child in the home by trained interviewers using a laptop computer. Parents also completed a pen-and-paper booklet containing questionnaires. Girls were interviewed on a range of topics including symptoms of mood and behavior problems starting at age 7 years. All the participants were reimbursed for their participation.

Measures

Information on girls' age, race, household structure (i.e., single or dual parent), and whether the household was in receipt of public assistance (e.g. WIC, food stamps, welfare) was collected by parental report.

Conduct problems were assessed using child reports on the Child Symptom Inventory (CSI-4, Gadow & Sprafkin, 1994). The CSI-4 includes DSM-IV symptoms of Conduct Disorder (CD) (American Psychiatric Association, 1994) scored on a 4-point scale (0 = 'never' to 3 = 'very often'). Adequate concurrent validity, and sensitivity and specificity of CD symptom scores to clinicians' diagnoses are reported for the CSI (Gadow & Sprafkin, 1994). In the present study, the internal consistency coefficients for the CD symptoms ranged from $\alpha = .61$ (at age 11) to $\alpha = .69$ (at age 8). To generate symptom levels that corresponded to the frequency threshold for DSM-IV symptoms of CD, endorsement at the level of often or very often was required for bullying, fighting, lying and staying out at night, and endorsement at the level of sometimes, often, or very often was required for the remaining items.

Depressed mood was assessed by child report using the Short Moods and Feeling Questionnaire (SMFQ, Angold et al., 1995). Thirteen items (e.g. 'I felt miserable and/or unhappy') were scored for the prior 2-week period on a 3-point scale (0 = 'not true', 1 = 'sometimes true', 2 = 'true'). The SMFQ has been shown to discriminate well between children with and without depressive disorders when evaluated using a structured clinical interview (Angold et al., 1995). In the current study, the internal consistency of the SMFQ ranged from $\alpha = .84$ (at age 7) to $\alpha = .89$ (at age 12). All 13 items were added together to create a summary score.

Harsh punishment was assessed using caregiver reports on the Conflict Tactics Scale: Parent-child version (CTSPC; Straus et al., 1998). Because some girls had only one caregiver, only items relating to the primary caregiver were used. Items (e.g. 'In the past year, if your daughter did something that she is not allowed to do or something that you didn't like, how often did you shout, yell, or scream at her') were scored using a 3-point answer format (1 = 'never', 2 = 'sometimes' and 3 = 'often'). Straus et al. (1998) reported adequate discriminant and construct validity for the psychological aggression subscale. The five items from the psychological aggression subscale were combined with a single item on spanking to generate a construct of harsh punishment. In the PGS sample, the internal consistency of this score was moderate with Cronbach's α ranging from .70 (age 7) to .78 (age 12).

Low parental warmth was assessed by parent report using 6 items of the Parent-Child Rating Scale (PCRS, Loeber et al., 1998). Items (e.g. "How often have you wished she would just leave you alone") were scored on 3-point scales (1 = 'almost never,' 2 = 'sometimes', and 3 = 'often'). Cronbach's α ranged from .70 (age 7) to .76 (age 11).

Data analysis—In order to reduce shared method variance, child reports were used to assess girls' mood and behavior, and parent reports were used to assess parenting behaviors. Because girls were only interviewed directly from age 7 on, analyses were necessarily based on data collected between ages 7–12 years.

Bivariate correlations at each age were examined to determine whether the child CD and depression and parent harsh punishment and warmth were sufficiently distinct from one another. The range of correlations between girls' conduct problems and depressed mood was $r = .26$ (at age 12) to $r = .34$ (at age 8), and for harsh punishment and low warmth the range was $r = .38$ (age 7) to $r = .47$ (age 12). These moderate coefficients suggested that collinearity was not an impediment to the planned analyses. Among African American girls, 72% of their families had received public assistance during at least one of the 6 years.

Generalized estimating equation (GEE, Zeger & Liang, 1986) regression models were used to examine the strength of prediction from girls' conduct problems and depression to change in parenting characteristics, and vice versa. GEE is appropriate for longitudinal designs in part because it can specify a working correlation matrix that accounts for within-subject correlations of repeated observations over multiple data waves. Accounting for the correlation structure of the data avoids the assumption that measurements taken at successive points in time are uncorrelated. This results in a more efficient analysis, unbiased regression parameters, and improved power to detect significant changes over time. GEE models can also be used with unbalanced designs (Diggle et al., 1994) in which some children provide more data points than others, as is the case in the current overlapping cohort design where sample sizes varied from 1,224 (in wave 01) to 2,314 (in wave 03) to 1,676 (in wave 06) (see Table 1). Analyses were conducted using STATA software, Version 9 (StataCorp, College Station, TX).

GEE models were used to predict levels of each of the dependent variables (DV) at time T after accounting for levels at time T-1. Thus, predictors were lagged by one year (time T-1) to account for within-construct stability and to enable predictors of relative, rather than absolute,

change to be evaluated. A Poisson model, with a log link (i.e., log-linear), was used to account for the skewed distributions of the discrete DV. Negative binomial or linear regression models were also fit to the data and conclusions remained unchanged (data not shown). Because we were explicitly modeling the correlation between the dependent variable at time T and time T-1, an independent correlation structure was used for each model. In all models, a robust estimator of variance was used to correct for potential model misspecification.

Girls' age and single female parent status were included as time-varying covariates in all models. Our first aim was addressed by examining the main effects of girls' conduct problems and depression on harsh punishment and low parental warmth, as well as the main effects of the two parenting variables on conduct problems and depression. If both child variables predicted the parenting characteristics in separate models, they were entered into a single model to examine whether unique associations held between child and parenting variables (Aim 2). This was repeated with parenting variables predicting child conduct problems and depression. To address the third aim, a model-building approach was then taken by adding in the time-varying covariate: receipt of public assistance, and the time-invariant covariate: race. Additionally, all two-way interactions between these covariates and the child or parenting predictors in each model were tested, but only statistically significant interactions were kept in the final model. To aid in model assessment, the quasi-likelihood under the independence model criterion (QICu, Pan, 2001) was used. A smaller QICu indicates a better model fit. In addition, a pseudo- R^2 for use with GEE models was calculated as described by Zheng (2000) and referred to as R^2_{marg} in Zheng's paper. Although this statistic does not necessarily have the same interpretation or properties as the R^2 in simple linear regression, it can serve as a measure of predictive power or goodness of fit of a GEE model and can be useful in variable selection. It has a value of 1 when a model provides perfect prediction. The contribution of each independent variable was examined by using the exponentiated beta coefficient, which is interpreted as the multiplicative effect on the outcome for a specified increase (e.g. a 1 SD increase for continuous variables) in the independent variable. This format was employed for ease of interpretation and comparability between models since measures were on different scales. Due to the large sample size and multiple analyses performed, significant findings of $p < .01$ are reported. Reported results are from models using weighted data.

Results

Descriptive statistics for the variables over time are shown in Table 2. The average number of CD symptoms, parental warmth, and harsh punishment remained fairly constant across time. There was a significant decrease in mean depressive symptoms over time, according to child report. The intraclass correlation coefficients (ICCs) (see Table 3) calculated across girls' age, showed that the dependent variables were stable and showed moderate to high levels of continuity over time.

Parent effects on girls' conduct problems and depression

After controlling for girls' age, and the significant effects of single female parent status and CD symptoms at time T-1 (see Table 4), increases in conduct problems at time T were predicted by harsh punishment at time T-1 ($\exp(\beta) = 1.26, p < .001, 95\% \text{ CI} = 1.19, 1.32$). This reflected a 26% increase in the mean number of CD symptoms for every one SD increase in harsh punishment. The pseudo- R^2 value for this model was .035, which although small, nevertheless corresponded to a 256% increase from the base model that included only age, single female parent status, and CD symptoms at T-1. An increase in conduct problems was also predicted by low parental warmth at T-1 ($\exp(\beta) = 1.23, p < .001, 95\% \text{ CI} = 1.17, 1.30$) after controlling for the significant effects of T-1 CD symptoms and single female parent, as well as girls' age (Table 4, Model 2). In this case, for a one SD decrease in parental warmth there was a 23%

increase in the mean number of CD symptoms after controlling for girls age, single female parent status and prior CD symptoms. For this model, the pseudo- R^2 was .013, reflecting a 30% increase from the base model.

A similar pattern of parenting effects on girls' depressed mood was obtained (see Table 5, Models 1 and 2). Harsh punishment at time T-1 was predictive of girls' depressed mood at T ($\exp(\beta) = 1.06$, $p < .001$, 95% CI = 1.03, 1.08) after controlling for girls' depressed mood in the previous wave, age and single female parent status. The pseudo- R^2 for this model was .24, reflecting a small percent change from the base model. Similarly, low parental warmth predicted subsequent depressed mood at T ($\exp(\beta) = 1.07$, $p < .001$, 95% CI = 1.05, 1.10) after controlling for prior levels of depressed mood, girls' age and single female parent (pseudo- $R^2 = .24$). These models showed that for every 1 SD increase in the harsh punishment or low parental warmth score at time T-1, there was a 6% and 7% increase (respectively) in girls' depressed mood. In both cases, however, the incremental improvement in the model fit with the addition of the parenting variables was very small. In contrast to the prior models predicting CD symptoms, the effects of single female parent status on girls' depressed mood were non-significant. Girls' age however, was predictive but in a negative direction, i.e. mean levels of depressed mood decreased with increasing age between 7 and 12 years.

Child effects on harsh punishment and low warmth

An increase in harsh punishment at time T was predicted by time T-1 harsh punishment and conduct problems ($\exp(\beta) = 1.008$, $p < .001$, 95% CI = 1.004, 1.012) after controlling for girls' age and single female parent status. Although the pseudo- R^2 for this model (.46) was moderate, there was minimal improvement from the base model with the addition of CD symptoms at T-1 (see Table 6, Model 1). In model 2, harsh punishment at T was also predicted by girls' prior depressed mood ($\exp(\beta) = 1.006$, $p < .001$, 95% CI = 1.002, 1.009) after controlling for the significant effects of prior levels of punishment and single female parent, as well as girls' age. The pseudo- R^2 was .46 for this model, as for model 1, but with little evidence of improvement from the base model indicating that the relative contribution of the child effects was small. The effect size estimates revealed an approximate .8% increase in harsh punishment for every 1 SD increase in conduct problems and a .6% increase in harsh punishment for every 1 SD increase in depressed mood. For reference, a 1 SD increase in CD symptoms amounts to roughly an additional symptom, and a 1 SD increase in depressed mood amounts to an increase of 5 or 6 points.

Girls' conduct problems at time T-1 also predicted low parental warmth at time T ($\exp(\beta) = 1.006$, $p < .01$, 95% CI = 1.002, 1.009) after accounting for parental warmth at time T-1, girls' age and single female headed household (see Table 7, Model 1). As with harsh punishment, the pseudo- R^2 was sizeable (.48), but this was little improvement from the base model. Finally, decreasing levels of parental warmth at time T were also predicted by girls' depressed mood at time T-1 ($\exp(\beta) = 1.006$, $p < .001$, 95% CI = 1.002, 1.010) over and above the significant effects of prior parental warmth and single female parent, in addition to age (Table 7, Model 2). The pseudo- R^2 for this model was .48, but again the incremental improvement in model fit with the addition of the child effects was small; a less than 1% decrease in parental warmth for every 1 SD increase in prior conduct disorder symptoms or depressed mood.

Testing of unique parent and child effects

To examine whether unique parenting effects on girls' adjustment were present (Aim 2), we generated models for each child dependent variable that included both parenting variables, while also controlling for prior levels of the DV, girls' age and having a single female parent. Harsh punishment ($\exp(\beta) = 1.19$, $p < .001$, 95% CI = 1.12, 1.26) and low warmth ($\exp(\beta) = 1.14$, $p < .001$, 95% CI = 1.08, 1.21) at T-1 each uniquely predicted conduct problems across

time (QICu = 5075.6; pseudo- $R^2 = .03$) (see Table 4, Model 3). The same was true for depressed mood: low parental warmth ($\exp(\beta) = 1.06, p < .001, 95\% \text{ CI} = 1.03, 1.08$) and harsh punishment ($\exp(\beta) = 1.03, p < .01, 95\% \text{ CI} = 1.01, 1.06$) at T-1 were uniquely predictive (QICu = 23246.5; pseudo- $R^2 = .24$) (see Table 5, Model 3).

We then examined whether conduct problems or depressed mood were uniquely predictive of increases in harsh punishment and decreases in parental warmth between ages 7–12 years. In this direction, harsh punishment was predicted only by conduct problems at T-1 ($\exp(\beta) = 1.007, p < .001, 95\% \text{ CI} = 1.003, 1.011$) after controlling for time T-1 harsh punishment, girls' age and single female parent status. Girls' depressed mood did not contribute further to this model (QICu = 1977.5; pseudo- $R^2 = .46, .3\%$ change in pseudo- R^2 from base model) (see Table 6, Model 3). In contrast, low parental warmth was predicted only by girls' prior depressed mood ($\exp(\beta) = 1.005, p = .01, 95\% \text{ CI} = 1.001, 1.008$) and not by conduct problems, after controlling for prior low warmth, age and single female parent (QICu = 2396.7; pseudo- $R^2 = .48, .2\%$ improvement in pseudo- R^2 from base model) (see Table 7, Model 3).

Socio-demographic moderators of parent and child effects

The main effects of race and household poverty and their two-way interactions with parenting or child behavioral variables were then examined for each of the models described above and significant interactions were retained. After controlling for prior conduct problems, age, and single female parent status, the analyses revealed a significant main effect of race on CD symptoms, in addition to a significant interaction between low parental warmth and household poverty. For a similar decrease in prior parental warmth, there was a significant increase in the number of CD symptoms among those not receiving public assistance ($\exp(\beta) = 1.27, p < .001, 95\% \text{ CI} = 1.18, 1.37$) after adjusting for the control variables, whereas there was no significant increase among girls living in household poverty ($\exp(\beta) = 1.07, p = .086, 95\% \text{ CI} = .99, 1.15$). The QICu was 4888.5 and pseudo- R^2 was .05 (see Table 4, Model 5). This interaction is depicted in Figure 1. Inclusion of the interaction of household poverty with parental warmth improved the model fit as shown by the greater improvement in the Model 5 pseudo- R^2 (c.f. Model 4) relative to the base model, and by the reduction in the QICu. No statistically significant interaction effects between poverty and harsh punishment, or between race and parenting behaviors, on conduct problems were revealed.

With the addition of socio-demographic indicators, girls' depressed mood was predicted by low parental warmth at time T-1 (but no longer harsh punishment) and by household poverty ($\exp(\beta) = 1.11, p < .001, 95\% \text{ CI} = 1.05, 1.16$) indicating that girls living in a household receiving public assistance reported significantly greater levels of depressed mood than those who did not. In addition, African American girls reported more depressed mood than other girls ($\exp(\beta) = 1.07, p < .01, 95\% \text{ CI} = 1.01, 1.13$). None of the 2-way interactions were significant predictors. The QICu for this model was 23127.3 and the pseudo- R^2 was .24 (see Table 5, Model 4). The QICu for this model was smaller than in Model 3 indicating a better model fit.

After controlling for time T-1 harsh punishment, girls' age, and single female parent, girls' depressed mood did not predict subsequent harsh punishment in the final model (see Table 6, Model 4), but girls' conduct problems did meet our criterion ($p < .01$) in addition to the main effects of race ($p < .001$) and poverty ($p < .01$). Thus, parents of African American girls, and those receiving public assistance, reported significantly greater levels of harsh punishment ($\exp(\beta) = 1.03, p < .001, 95\% \text{ CI} = 1.023, 1.038$; and $\exp(\beta) = 1.011, p < .01, 95\% \text{ CI} = 1.003, 1.018$, respectively). No significant moderating effects, however, were found.

Finally, when race and household poverty were included in the model for low parental warmth, the previously significant effect of girls' depressed mood was attenuated ($p = .02$). There were

no main or interaction effects of these demographic variables. For this model, the QICu was 2398.9, and the pseudo- R^2 was .48 which was a minimal improvement over the base model's pseudo- R^2 (see Table 7, Model 4).

Discussion

The results from the present study add to the growing literature on reciprocal relationships between parenting and child behavior by testing hypotheses using a prospective design and a large, urban sample of African American and Caucasian girls from age 7 to 12 years. Our primary hypotheses, that child behavior would affect parenting behavior and vice-versa, was supported: low parental warmth and harsh parenting predicted increases in depressed mood and conduct problems, and conduct problems and depressed mood predicted decreases in parental warmth and increases in harsh punishment after accounting for prior levels of the dependent variable. This conclusion, however, must be qualified by the fact that the models testing the effects of parenting on child behavior left much of the variance in child behavior unexplained. Nevertheless in both cases, parenting practices produced a significant increase in the girls' symptoms of CD and depression. This was particularly true in the case of parenting effects predicting conduct problems. The large sample size and repeated measures enabled small improvements in model fit to be detected in the case of depressive symptoms. Thus, it is possible that the same findings may not be replicable in smaller studies. In contrast, the parenting models showed a better fit (likely as a result of the greater stability of parenting reports). Nevertheless, unique child effects on parenting were found such that only conduct problems significantly predicted changes in harsh parenting over and above the effects of depressed mood. Additionally, depressed mood had a unique effect on decreasing parental warmth over and above the contribution of CD symptoms. The question is whether these small effects have clinical significance. Documenting reciprocal relations is relevant to clinical practice in that the findings emphasize the need to change behavior at the level of both the child and the parent. In the case of depression, for example, intervention approaches that target the child's cognitions and behaviors may result in less symptom reduction than those that also address parental warmth. In addition, the findings reported here suggest that effects on parenting are evident for each increase in symptom level. Thus, at the clinically significant level of three symptoms of CD and 5 symptoms of MDD, changes in harsh parenting and lack of warmth would be of a moderate level.

One of the strongest results from the current study was that accounting for parents' harsh punishment substantially improved the prediction of future CD symptoms. Such a finding is consistent with theoretical models of the development of conduct disorder. The contribution of increasing CD symptoms to increases in harsh punishment (although the effect size was small) also provides support for the contribution of children to the development of a coercive cycle (Lytton, 1990; Patterson, 1982). The current study advances research by showing that this pattern of association is also evident in a sample of preadolescent girls. Testing whether girls' conduct problems and depression further increase as a result of the changes in parenting would generate additional support for these theoretical models.

Many theories have been advanced to explain the greater prevalence of depression in adolescent girls such as being more socially oriented, more dependent on positive social relationships, and more vulnerable to losses of social relationships than are boys (Allgood-Merten et al., 1990). The results from the present study are consistent with the hypothesis that depression-prone individuals may generate stress in their interpersonal lives (Hammen, 2006), in that girls' depressed mood seemed to uniquely lead to negative changes in the parent-child relationship and potentially a weakening of the affective bond as evidenced by a decrease in feelings of warmth. Such changes in parenting behavior could further exacerbate girls' depressed mood.

Thus, in this case, depressed mood could be viewed as the initiation of a cycle of the accumulation of stressors and a worsening of mood over time.

Our approach was to examine the unique parent and child effects by including two parenting and two child dimensions. As expected, harsh parenting and low warmth were correlated to a moderate degree, as were conduct problems and depressed mood. A next step would be to test whether there are specific combinations of parenting behaviors that explain changes in child behavior over time and/or specific combinations of symptoms that appear to elicit increases in negative parenting behaviors over time. Although a combination of parenting characteristics, such as high parental affection and control (referred to as authoritative parenting) is associated with fewer adolescent behavior problems (e.g. Steinberg et al., 2006; Weiss & Schwarz, 1996), examining the reciprocal relationships between specific parenting dimensions will have greater value for the design of interventions (Patterson, 1996). The ultimate goal is to be able to generate a profile of risk that includes both early emerging problem behaviors and parenting contexts. The results of the present study suggest that for some types of child psychopathology, negative parenting behaviors may worsen over time leading to an exacerbation of child problems.

The results from the test of socio-demographic moderators revealed an interaction effect between poverty and low parental warmth on girls' increasing CD symptoms. This interaction indicated that although CD symptoms were higher among girls living in poverty, changes in CD symptoms were relatively unaffected by levels of parental warmth within this group of girls. For girls whose families did not receive public assistance however, CD symptoms increased as parental warmth decreased. This pattern of results is consistent with the literature showing a lack of association between disruptive behavior problems and, what are traditionally thought of as parenting risk factors such as low warmth, among families living in poverty (e.g. Shaw et al., 2000; Deater-Deckard et al., 1994). Socio-demographic factors did not moderate the relationships between parenting factors and girls' depressed mood, nor between girls' behavior and emotional problems and parenting. However, higher levels of both depressed mood and harsh punishment were evident among African American families and families receiving public assistance. Consistent with some prior studies, household poverty did not account for the main effects of race on harsh parenting (Dodge et al., 1995; Winslow & Shaw, 1996).

Limitations

Despite the important contributions of the current findings, the study is not without limitations. First, single rather than multiple informants were used for each variable. This decision was made to avoid the problems of shared method variance by utilizing child report for child behavior and depressed mood, and parent report for parenting variables. Although there is consensus that depressed mood is best assessed using self-report, the same may not be the case for conduct problems. Similarly, the study may have been strengthened using multiple informants of parenting characteristics. For example, Smetana (1988) reported that adolescents report more conflicts than do parents. In addition, we cannot rule out the possibility that the limited variability in parenting practices may reflect a social desirability bias by the caregivers. Our levels of harsh punishment, therefore, may have been underestimated, and contrasting results by informant may reveal a more comprehensive assessment of reciprocal relations. Nevertheless, the fact that harsh punishment predicted increases in girls' conduct problems over time suggests that not all parents presented themselves positively.

Although the sample weight variable enabled findings to reflect a more representative population than if left unweighted, higher income African American families were still significantly under-represented in the current sample. Different relations could therefore be observed in samples that have a more equal distribution of racial groups across income levels.

Furthermore, the results reflect only a partial picture of the parenting likely to occur in two-parent families, and the reciprocal relations between girls' problems and the parenting practices of fathers. It is possible, for example, that one parent may buffer the child from the harsh punishment of the other. In our analyses single female parent status was consistently associated with parenting difficulties, and also with girls' conduct problems as has been shown in previous work (Jessor et al. 1995; Vaden-Kiernan et al., 1995).

There are likely to be smaller effects of the relationships in community versus clinic samples because of the overall low prevalence of serious conduct problems and depression. As in many population-based studies, symptoms of psychopathology on average declined in prevalence across the preadolescent period in the present study (e.g. Anderson et al., 1987; Angold et al., 1996; Ezpeleta et al., 2001). That is not to say that some girls are not demonstrating an increase or remain at a high stable level of symptoms. Testing the reciprocal relations between parenting and a child's individual rank order within a group on measures of psychopathology over time should be examined further (Alder & Scher, 1994).

Although our analyses began at age 7, which is relatively early in development for a population-based study, we acknowledge the fact that we are not capturing the beginning of the developmental trajectory of psychopathology. Thus, we are not able to determine the origins of patterns of parent and child influence which may have already become established in the pre-school period (Shaw et al., 2000). For example, child temperamental characteristics such as negative emotionality, which typically precedes the onset of disruptive behavior problems and depression (e.g. Fagot & Leve, 1998; Goodyer et al., 1993), may set the initial stage for decreases in parental warmth and increases in harsh punishment. Capturing the period during which parent and child effects on each other begin to lead to more stable and intractable patterns of behavior will be critical for secondary intervention efforts.

Conclusion

In conclusion, the current findings highlight the importance of increasing specificity of risk models of early onset behavioral and emotional problems in order that better-fitting interventions can be designed according to race and socio-demographic backgrounds. The process of reciprocal influence has implications for development more generally as children learn strategies for interacting with others that affect future behavior and relationships. The results from the present study suggest that children may have a small but significant effect on eliciting negative parenting behaviors, and that such effects need to be considered when developing interventions.

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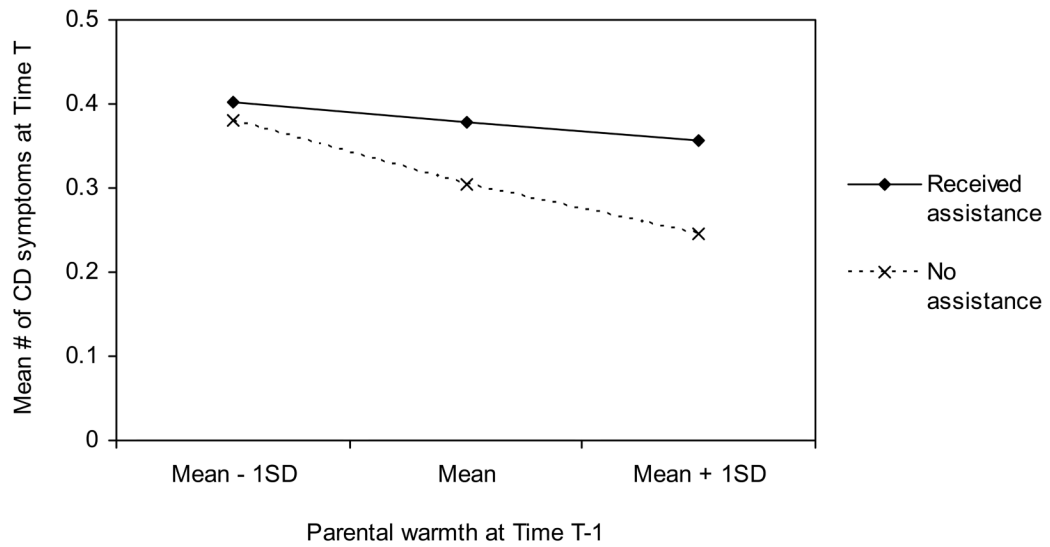


Figure 1. Interaction between household poverty and low parental warmth (T-1) in predicting CD symptoms at time T

Note: This plot is based on predictions from the model for 10 year old African American girls with a non-single female parent, no prior CD symptoms, and prior harsh punishment score of 10.

Table 1

Sample sizes at each wave.

Cohort	1	2	3	Wave		6	Total
				4	5		
5	0	0	551	546	539	532	2,168
6	0	604	591	586	580	580	2,941
7	605	590	578	573	564	564	3,474
8	619	600	594	580	575	0	2,968
Total	1,224	1,794	2,314	2,285	2,258	1,676	11,551

Note: 22 Asian girls and 4 girls with missing race were excluded. In addition, observations were deemed missing if data were missing for all the dependent variables used in the current analyses.

Table 2

Descriptive statistics for dependent variables over time.

Dependent variable	Age					
	7	8	9	10	11	12
Conduct disorder symptoms (range 0–11)	.40 (.96)	.40 (.95)	.38 (.90)	.29 (.76)	.29 (.72)	.39 (.89)
Depressed mood (range 0–26)	6.5 (5.7)	6.4 (5.7)	5.4 (5.4)	3.6 (4.8)	3.2 (4.4)	2.9 (4.1)
Harsh punishment score (range 6–18)	9.2 (1.8)	9.2 (1.9)	9.1 (2.0)	9.0 (1.9)	9.1 (2.0)	9.0 (2.1)
Low parental warmth score (range 6–18)	9.0 (2.1)	8.9 (2.1)	8.8 (2.2)	8.8 (2.1)	8.9 (2.2)	8.8 (2.3)

Note. Data shown are mean (SD), and are based on a weighted sample.

Table 3
Weighted intraclass correlation coefficients (ICCs) representing year-to-year stability for each dependent variable.

Dependent Variable	Age span					7-12*
	7-8	8-9	9-10	10-11	11-12	
Conduct problems	0.541	0.567	0.624	0.652	0.588	0.724
Depressed mood	0.651	0.650	0.631	0.644	0.689	0.747
Harsh punishment	0.803	0.819	0.818	0.833	0.835	0.917
Low parental warmth	0.814	0.823	0.840	0.840	0.828	0.928

* This statistic was calculated using girls who were 7 in the first wave of the PGS and thus had data at all ages.

Table 4
GEE models for conduct disorder symptoms (between ages 7–12 years).

Models	exp(β) ^a	95% CI	QICu	Pseudo R ²	% change in R ² from base model ^b
MODEL 1					
Conduct disorder (CD) symptoms at T-1 ^c	1.41***	(1.37, 1.46)	5107.0	0.035	256
Age	1.01	(0.97, 1.05)			
Single female parent	1.29***	(1.16, 1.43)			
Harsh punishment at T-1 ^c	1.26	(1.19, 1.32)			
MODEL 2					
CD symptoms at T-1 ^c	1.41***	(1.37, 1.46)	5114.1	0.013	30
Age	1.01	(0.97, 1.05)			
Single female parent	1.34***	(1.21, 1.49)			
Low parental warmth at T-1 ^c	1.23	(1.17, 1.30)			
MODEL 3					
CD symptoms at T-1 ^c	1.40***	(1.36, 1.45)	5075.6	0.030	204
Age	1.01	(0.97, 1.05)			
Single female parent	1.30***	(1.17, 1.44)			
Low parental warmth at T-1 ^c	1.14***	(1.08, 1.21)			
Harsh punishment at T-1 ^c	1.19	(1.12, 1.26)			
MODEL 4					
CD symptoms at T-1 ^c	1.36***	(1.32, 1.41)	4904.5	0.033	245
Age	1.01	(0.97, 1.05)			
Single female parent	1.10	(0.99, 1.22)			
Low parental warmth at T-1 ^c	1.18***	(1.11, 1.25)			
Harsh punishment at T-1 ^c	1.11	(1.05, 1.18)			
African-American race	1.79***	(1.56, 2.07)			
Public assistance	1.19	(1.06, 1.32)			
MODEL 5					
CD symptoms at T-1 ^c	1.37***	(1.32, 1.41)	4888.5	0.050	417
Age	1.01	(0.97, 1.05)			
Single female parent	1.10	(0.99, 1.22)			
Low parental warmth at T-1 ^c	1.27***	(1.18, 1.37)			
Harsh punishment at T-1 ^c	1.11	(1.05, 1.18)			
African-American race	1.79***	(1.56, 2.07)			
Public assistance	2.55***	(1.66, 3.91)			
Public assistance × Low parental warmth at T-1 ^c	0.84	(0.76, 0.92)			

^aNote. Interpreted as the multiplicative effect on the outcome for a specified increase in the independent variable.

^bBase model includes age, single female parent status, and CD symptom count at T-1.

^cFor a 1 SD increase.

*** $p < .01$;

 $p < .001$

Table 5
GEE models for depressed mood (between ages 7–12 years).

Models	exp(β) ^a	95% CI	QICu	Pseudo R ²	% change in R ² from base model ^b
MODEL 1					
Depressed mood at T-1 ^c	1.51***	(1.49, 1.54)	23298.4	0.239	0.2
Age	0.87***	(0.85, 0.89)			
Single female parent	1.01	(0.97, 1.06)			
Harsh punishment at T-1 ^c	1.06***	(1.03, 1.08)			
MODEL 2					
Depressed mood at T-1 ^c	1.51***	(1.48, 1.54)	23271.4	0.242	1.3
Age	0.87***	(0.85, 0.89)			
Single female parent	1.02	(0.98, 1.07)			
Low parental warmth at T-1 ^c	1.07***	(1.05, 1.10)			
MODEL 3					
Depressed mood at T-1 ^c	1.51***	(1.48, 1.54)	23246.5	0.241	1.1
Age	0.87***	(0.85, 0.89)			
Single female parent	1.01	(0.97, 1.06)			
Low parental warmth at T-1 ^c	1.06***	(1.03, 1.08)			
Harsh punishment at T-1 ^c	1.03**	(1.01, 1.06)			
MODEL 4					
Depressed mood at T-1 ^c	1.50***	(1.47, 1.53)	23127.3	0.244	2
Age	0.87***	(0.85, 0.89)			
Single female parent	0.98	(0.93, 1.02)			
Low parental warmth at T-1 ^c	1.06***	(1.04, 1.09)			
Harsh punishment at T-1 ^c	1.02	(0.99, 1.04)			
African-American race	1.07***	(1.01, 1.13)			
Public assistance	1.11	(1.05, 1.16)			

^aNote. Interpreted as the multiplicative effect on the outcome for a specified increase in the independent variable.

^bBase model includes age, single female parent status, and depressed mood at T-1.

^cFor a 1 SD increase.

**
 $p < .01$;

 $p < .001$.

Table 6
GEE models for harsh punishment (between ages 7–12 years).

Models	$\exp(\beta)^a$	95% CI	QIC _u	Pseudo R ²	% change in R ² from base model ^b
MODEL 1					
Harsh punishment at T-1 ^c	1.151 ***	(1.145, 1.156)	1982.9	0.461	0.3
Age	0.998	(0.996, 1.000)			
Single female parent	1.027 ***	(1.020, 1.034)			
CD symptoms at T-1 ^c	1.008 ***	(1.004, 1.012)			
MODEL 2					
Harsh punishment at T-1 ^c	1.151 ***	(1.146, 1.156)	1979.8	0.460	0.1
Age	0.990 ***	(0.996, 1.001)			
Single female parent	1.028 ***	(1.021, 1.035)			
Depressed mood at T-1 ^c	1.006 ***	(1.002, 1.009)			
MODEL 3					
Harsh punishment at T-1 ^c	1.150 ***	(1.145, 1.156)	1977.5	0.461	0.3
Age	0.999 ***	(0.996, 1.001)			
Single female parent	1.027 ***	(1.020, 1.034)			
CD symptoms at T-1 ^c	1.007 ***	(1.003, 1.011)			
Depressed mood at T-1 ^c	1.003	(1.000, 1.007)			
MODEL 4					
Harsh punishment at T-1 ^c	1.146 ***	(1.141, 1.152)	1958.9	0.467	1.8
Age	0.999 ***	(0.996, 1.001)			
Single female parent	1.017 ***	(1.010, 1.024)			
CD symptoms at T-1 ^c	1.005 **	(1.001, 1.009)			
Depressed mood at T-1 ^c	1.003	(0.999, 1.007)			
African-American race	1.030 ***	(1.023, 1.038)			
Public assistance	1.011 **	(1.003, 1.018)			

^aNote. Interpreted as the multiplicative effect on the outcome for a specified increase in the independent variable.

^bBase model includes age, single female parent status, and harsh punishment at T-1.

^cFor a 1 SD increase.

**
 $p < .01$;

 $p < .001$.

Table 7
GEE models for low parental warmth (between ages 7–12 years).

Models	exp(β) ^a	95% CI	QIC _u	Pseudo R ²	% change in R ² from base model ^b
MODEL 1			2404.3	0.480	0.1
Low parental warmth at T-1 ^c	1.183***	(1.178, 1.187)			
Age	0.999	(0.997, 1.002)			
Single female parent	1.015***	(1.008, 1.022)			
CD symptoms at T-1 ^c	1.006**	(1.002, 1.009)			
MODEL 2			2396.5	0.480	0.1
Low parental warmth at T-1 ^c	1.183***	(1.178, 1.187)			
Age	1.000	(0.997, 1.003)			
Single female parent	1.015***	(1.008, 1.023)			
Depressed mood at T-1 ^c	1.006***	(1.002, 1.010)			
MODEL 3			2396.7	0.480	0.2
Low parental warmth at T-1 ^c	1.182***	(1.178, 1.187)			
Age	1.000	(0.997, 1.003)			
Single female parent	1.015***	(1.007, 1.022)			
CD symptoms at T-1 ^c	1.004	(1.000, 1.008)			
Depressed mood at T-1 ^c	1.005**	(1.001, 1.008)			
MODEL 4			2398.9	0.481	0.3
Low parental warmth at T-1 ^c	1.182***	(1.177, 1.186)			
Age	1.000	(0.997, 1.003)			
Single female parent	1.015***	(1.007, 1.022)			
CD symptoms at T-1 ^c	1.004	(1.000, 1.008)			
Depressed mood at T-1 ^c	1.005	(1.001, 1.008)			
African-American race	0.994	(0.987, 1.002)			
Public assistance	1.007	(0.999, 1.016)			

^aNote. Interpreted as the multiplicative effect on the outcome for a specified increase in the independent variable.

^bBase model includes age, single female parent status, and low parental warmth at T-1.

^cFor a 1 SD increase.

**
 $p < .01$;

 $p < .001$.