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A Transactional Model of Parent–Infant Interactions in Alcoholic Families

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Abstract

This study examined the transactional nature of parent–infant interactions over time among alcoholic and nonalcoholic families. The sample consisted of 222 families assessed at 12, 18, and 24 months of child age. Results indicated that infant behavior did not influence parental behavior across time, but parental behavior was longitudinally predictive of infant behavior during play interactions. Higher paternal alcohol consumption at 12 months was longitudinally predictive of negative parental behavior at 24 months. Other significant risk factors included marital conflict, fathers' depression, and fathers' education. Results highlight the nested nature of risk in alcoholic families and the direction of influence from parent to child during interactions and suggest that 1 pathway to risk among these children is through negative parent–infant interactions.

Theoretical explanations of the impact of parental alcoholism on the development of children's problem behavior have suggested that one of the major pathways to dysfunction is through problematic parent–child interactions (e.g., Jacob & Leonard, 1994). This approach suggests that parental alcoholism interferes with being consistently warm and supportive during parent–child interactions. In spite of the theoretical importance of parent–child interactions in predicting maladjustment in alcoholic families, few longitudinal studies have examined this issue, especially in early childhood. Studies with older children of alcoholic fathers have generally not been longitudinal in nature and with a few exceptions (Eiden, Chavez, & Leonard, 1999; Whipple, Fitzgerald, & Zucker, 1995) have been focused on adolescence (e.g., Jacob, Haber, Leonard, & Rushe, 2000; Jacob, Leonard, & Haber, 2001). Thus, little is known about the transactional nature of parent–child interactions among alcoholic families during the infant–toddler period. Theories of development among alcoholic families also postulate that other risk factors associated with parental alcoholism are likely to play a critical role in the relationship between alcoholism and parenting (Zucker, Fitzgerald, & Moses, 1995). Thus, some effects of alcoholism on parenting may be direct, whereas others may be indirect via associations with other risk variables.

The direction of influence in parent–infant play has historically been assumed to be from parent to infant, with the primary responsibility for quality of interaction being on the parent. More recently, studies have emphasized the role of infant behavior as influencing parental behavior as well (see Bornstein, 2002). Transactional models of development (e.g., Lewis, 2000; Sameroff & Chandler, 1975; Sameroff & Fiese, 2000) have emphasized that both child and environment (parenting and other risk factors) play a role in determining the course of development. These models favor the idea that there is an active environment and an active child adapting to and influencing the environment and that parent and children influence each other over time. For instance, parent behavior affects subsequent child behavior, but parent behavior itself was influenced by previous child behavior (Lewis, 2000). However, little is known empirically about how parent and infant behaviors during play influence each other over time. Indeed, in a recent review of the literature, Patterson and Fisher (2002) noted the lack of longitudinal studies examining bidirectional effects. They suggested that one approach to examining bidirectional effects would be to “use structural equation modeling to directly specify the magnitude of both paths” (p. 70), parent to child and child to parent, and stated that a longitudinal data set measuring similar behaviors across time would be ideally suited to examining this issue.

In addition to parents and children influencing each other, models of parenting based on the developmental literature have noted three major domains of influence: (a) individual child characteristics, (b) individual parent characteristics, and (c) contextual sources of stress or support (Belsky, 1984; Snyder & Huntley, 1990). Conceptual models (e.g., Belsky 1984) and empirical studies (e.g., Lewis & Feiring, 1989) have noted that child temperament can influence subsequent maternal behavior. Among individual parent characteristics, two are especially relevant for alcoholic families: (a) parental depression and (b) antisocial behavior. Some aspects of parental characteristics, such as depressed mood, have been well studied to date. For instance, maternal depression is known to be a significant risk factor for poor mother–infant interactions and subsequent child outcomes. Studies have demonstrated that depressed mothers have lower levels of involvement and are less verbally and emotionally responsive toward their infants (Jameson, Gelfand, Kulcsar, & Teti, 1997; Martinez, Malphurs, Field, & Pickens, 1996; Rosenblum, Mazet, & Benony, 1997). Their infants are, in turn, likely to demonstrate lower positive affect and higher irritability (Martinez et al., 1996; Murray, Fiori-Cowley, Hooper, & Cooper, 1996) and to interact more negatively with their mothers as well as strangers as early as 3 months of age (Field, 1992). However, little is known about the potential impact of fathers’ depression on the family and on father–infant interactions.

Although aspects of parental characteristics or mood states, such as depression, have been well studied, the impact of other aspects, such as antisocial behavior, have not been well examined in early childhood. Antisocial behavior is of importance, not only because of the link with alcoholism and potential to influence parenting (see Zucker, Ellis, Bingham, & Fitzgerald, 1996) but also because of possible genetic linkages to infant temperament (see Jansen, Fitzgerald, Ham, & Zucker, 1995; Tarter, Alterman, & Edwards, 1985; Windle, 1991). Moreover, little is known about the relative impact of parents’ alcoholism and other risk factors related to alcoholism on parent and child behavior across time.

One of the major contextual sources of influence on parenting is the marital relationship. From a family systems perspective, the quality of the marital relationship influences the quality of parenting. Several studies indicate that the degree of emotional support that fathers provide mothers is related to the quality of maternal caregiving behavior and infant–mother attachment (e.g., Amato & Rivera, 1999; Cummings & O’Reilly, 1997). Some evidence also suggests that the association between marital satisfaction and parenting behavior may be stronger for fathers than for mothers (Belsky, Gilstrap, & Rovine, 1984; Belsky & Volling, 1986). Moreover, infant responsiveness toward fathers may also differ as a function of fathers’ marital satisfaction. For

instance, 12-month-old infants are less likely to look at fathers with low marital satisfaction compared to infants of fathers with high marital satisfaction (Parke, 2002). One aspect of the marital relationship that is salient among alcoholic families is marital aggression. Although there is some debate over the role of alcohol in causing marital aggression, the literature linking alcoholism to marital aggression clearly demonstrates that alcoholism is associated with increased interparental conflict and violence (Leonard, 1993; Leonard & Quigley, 1999; Murphy & O'Farrell, 1996; Quigley & Leonard, 2000; Spaccarelli, Sandler, & Roosa, 1994; West & Prinz, 1987). Thus, the marital relationship may be a particularly critical predictor of the quality of parent–infant interaction.

The major purpose of this study was to examine the association between parents' alcoholism and the quality of parent–infant interactions over time. A secondary goal was to examine the transactional nature of parent–infant interactions over time in a model including other potential predictors of interactional quality that were also theoretically associated with parental alcoholism. We tested a conceptual model that included alcoholism and other risk factors (depression, antisocial behavior, and infant temperament) as a set of interrelated predictors of parent and child behavior concurrently and longitudinally. This model also included associations between parent and child behavior within time (12, 18, and 24 months of child ages). Finally, we tested the hypothesis that parents and children would influence each other over time by testing paths from parent behavior at the preceding time point to child behavior at the subsequent time point, and vice versa.

Method

Participants

The final sample consisted of 222 families with 12-month-old infants (109 girls and 113 boys) out of a total sample of 227 families who were recruited for an ongoing longitudinal study of parenting and infant development. Families were classified as being in one of two major groups: (a) the nonalcoholic group, consisting of parents with no or few current alcohol problems ($n = 101$), and (b) the father-alcoholic group ($n = 121$). Within the father-alcoholic group 90 mothers were light drinking or abstaining, and 31 mothers were heavy drinking or had current alcohol problems. As would be expected of longitudinal studies involving multiple family members, there were incomplete data for some participants at one or more of the three assessments. Incomplete data were of two types. A small number of participants provided data at a given assessment but did not provide responses to all items. Others did not provide any data at all at a given time point. Of the 227 original families, 1 family provided complete data at 12 months, but not at 18 or 24 months. Data from this family were not included in the study. Four additional families did not provide any data at 24 months, 1 family provided only partial data at 12 months, 2 families provided only partial data at 18 months, and 4 families provided only partial data at 24 months. We used the expectation-maximization algorithm to derive maximum-likelihood estimates of missing values to reach an analysis sample size of 226 for 12-, 18-, and 24-month data.

The majority of the mothers in the study were Caucasian (94%), approximately 5% were African American, and 1% were Hispanic or Native American. Similarly, the majority of fathers were Caucasian (89%), a few were African American (7%), and the rest were Hispanic or Native American (4%). Although parental education ranged from less than high school degree to master's degree, about half the mothers (57%) and fathers (55%) had received some post high school education or had a college degree. Annual family income ranged from \$4,000 to \$95,000 ($M = \$41,824$, $SD = \$19,423$). All of the mothers were residing with the father of the infant in the study at the time of recruitment. Most of the parents were married to each other (88%), about 11% were unmarried, and 1% were divorced or separated from a previous partner. Mothers' age ranged from 19 to 40 ($M = 30.43$, $SD = 4.58$), and fathers' age ranged from 21

to 58 ($M = 32.94$, $SD = 6.06$). Approximately 61% of the mothers and 91% of the fathers were working outside the home when the child was 1 year old. Mothers' work hours ranged from 5 to 72 hr per week ($M = 16.63$, $SD = 16.38$ hr), and fathers' work hours ranged from 4 to 84 hr per week ($M = 40.71$, $SD = 16.65$ hr). A few of the families were on welfare (Aid to Families With Dependent Children, 6%), and about 4% of the fathers were receiving unemployment compensation. Parity ranged from one to five, with the majority of families having one to two children, including the target child (68%). About 18% of the infants in the study were only children. Thus, the majority of the families were middle-income, Caucasian families with one to two children in the household.

Procedure

The names and addresses of these families were obtained from the New York State birth records for Erie County. These birth records were preselected to exclude families with premature (gestational age of 35 weeks or lower) or low birth weight infants (birth weight <2,500 g); maternal age of less than 18 and greater than 40 at the time of the infant's birth; plural births (e.g., twins); and infants with congenital anomalies, palsies, or drug withdrawal symptoms. Introductory letters were sent to a large number of families ($n = 9,457$) who met the above-mentioned basic eligibility criteria. Each letter included a form that all families were asked to complete and return (average response rate = 25%). Of these, approximately 2,285 replies (96%) indicated an interest in the study. Only a few of the replies ($n = 97$, or 4%) indicated lack of interest. Respondents were compared to the overall population with respect to information collected on the birth records. These analyses indicated a slight tendency for infants of responders to have higher Apgar scores ($M_s = 8.97$ vs. 8.94), higher birth weight ($M_s = 3,516$ g vs. 3,460 g), and higher number of prenatal-care visits ($M_s = 10.50$ vs. 10.31). Responders were also more likely to be Caucasian (91% of responders vs. 88% of total births), have higher educational levels, and have a female infant. These differences were significant given the very large sample size, even though the size of the differences was minimal.

Parents who indicated an interest in the study were screened by telephone with regard to sociodemographic characteristics and additional eligibility criteria. Initial inclusion criteria consisted of both parents cohabiting since the infant's birth, infant being the youngest child in the family, mother was not pregnant at recruitment, no mother–infant separations for over 1 week, parents were the primary caregivers, and the infant did not have any major medical problems. These criteria were important to control, because each of these has the potential to markedly alter parent–infant interactions. We used additional inclusion criteria to minimize the possibility that any observed infant behaviors could be the result of prenatal exposure to drugs or heavy alcohol use. These additional criteria were that there could be no maternal drug use during pregnancy or the past year except for mild marijuana use (no more than twice during pregnancy), mothers' average daily ethanol consumption was 0.50 oz or less (one drink a day), and she did not engage in binge drinking (five or more drinks per occasion) during pregnancy. During the telephone screen, mothers were administered the Family History Research Diagnostic Criteria (RDC; Andreasen, Rice, Endicott, Reich, & Coryell, 1986) for alcoholism with regard to their partners' drinking, and fathers were screened with regard to their alcohol use, problems, and treatment.

Families who met the basic inclusion criteria were provisionally assigned to one of two groups on the basis of parental screens (nonalcoholic, father alcoholic), with final group status assigned on the basis of both the telephone screen and questionnaires administered at the first visit. Mothers in the nonalcoholic group scored below 3 on an alcohol screening measure (TWEAK, Chan, Welte, & Russell, 1993), were not heavy drinkers (average daily ethanol consumption <1.00 oz), did not acknowledge binge drinking, and did not meet *Diagnostic and Statistical Manual of Mental Disorders (DSM–IV*; American Psychiatric Association, 1994) criteria for

abuse or dependence. Fathers in the nonalcoholic group did not meet RDC criteria for alcoholism according to maternal report, did not acknowledge having a problem with alcohol, had never been in treatment, and had alcohol-related problems in fewer than two areas in the past year and three areas in their lifetimes (according to responses on a screening interview based on the University of Michigan Composite Diagnostic Index [UM-CIDI]; Anthony, Warner, & Kessler, 1994). The father-alcoholic group consisted of two subgroups: one with partners who had low alcohol problems and the other with partners who had high alcohol problems. A family could be classified in the father-alcoholic group by meeting any one of the following three criteria: (a) the father met RDC criteria for alcoholism according to maternal report; (b) he acknowledged having a problem with alcohol or having been in treatment for alcoholism, was currently drinking, and had experienced at least one alcohol-related problem in the past year; or (c) he indicated having alcohol-related problems in three or more areas in the past year or met *DSM-IV* criteria for abuse or dependence in the past year. The subgroup of alcoholic fathers with light-drinking partners consisted of couples in which the women did not have alcohol-related problems, that is, they met nonalcoholic group criteria. The subgroup of alcoholic fathers with heavy drinking partners consisted of couples in which the women acknowledged alcohol-related problems (TWEAK score of 3 or higher, or met *DSM-IV* diagnosis for abuse or dependence) or were heavy drinking (average daily ethanol consumption of 1.00 oz or higher, and/or binge drinking). All of the women in this group met *DSM-IV* criteria for abuse or dependence.

It should be noted that women who reported drinking moderate to heavy amounts of alcohol during pregnancy (see criteria above) were excluded from the study to control for potential fetal alcohol effects. Because we had a large pool of families potentially eligible for the nonalcoholic group, alcoholic and nonalcoholic families were group matched on race–ethnicity, maternal education, child gender, parity, and marital status.

Families were asked to visit the Research Institute on Addictions at five different infant ages (12, 18, 24, and 36 months and on entry into kindergarten), with three visits at each age. Extensive observational assessments with both parents were conducted at each age. This article focuses on the 12-, 18-, and 24-month questionnaire and observational assessments, which have been completed and coded for the entire sample. At each assessment age, mother–infant observations were conducted at the first visit, followed by a developmental assessment at the second visit. Father–infant observations were conducted at the third visit. There was a 4- to 6-week lag between the mother–infant and father–infant visits.

Measures

Parental alcohol use—Although parental alcohol abuse and dependence problems were partially assessed from the screening interview, self-report versions with more detailed questions were used to enhance the alcohol data and check for consistent reporting. We used a self-report instrument based on the UM-CIDI interview (Anthony et al., 1994; Kessler et al., 1994) to assess alcohol abuse and dependence. Several questions of the instrument were reworded to inquire as to “how many times” a problem had been experienced, as opposed to whether it happened “very often.” We used *DSM-IV* criteria for alcohol abuse and dependence diagnoses for current alcohol problems (in the past year) to assign final diagnostic group status. For abuse criteria, recurrent alcohol problems were described as those occurring at least three to five times in the past year or one to two times in three or more problem areas. This UM-CIDI was also used to derive continuous measures of the number of alcohol-related abuse and dependence symptoms in the past year. We used a quantity–frequency index (QFI) of alcohol use adapted from Cahalan, Cisin, and Crossley (1969) to obtain a measure of average daily ethanol intake for both parents. Finally, two measures of heavy drinking were obtained. The first indicated the frequency of getting drunk, and the second indicated the frequency of

drinking 5 or more drinks on a single occasion. The average QFI in the father-alcoholic group was about 3 drinks a day/21 drinks per week, the average frequency of binge drinking was 2–3 days a month, and the average number of abuse and dependence symptoms was about 11 in the past year. The average QFI for heavy-drinking mothers was about 1–2 drinks a day/7–14 drinks a week, the average frequency of binge drinking was about once a month, and the average number of abuse and dependence symptoms in the past year was about 3.

All of the alcohol consumption measures were highly skewed and were transformed using square root transformations. The resulting alcohol-consumption variables for each parent were strongly correlated with each other. Confirmatory factor analyses revealed that fathers' QFI, frequency of binge drinking (drinking five or more drinks on a single occasion), and frequency of getting drunk loaded on a single factor reflecting fathers' current alcohol consumption. Confirmatory factor analyses on mothers' QFI, frequency of binge drinking, and frequency of getting drunk loaded on a single factor reflecting mothers' current alcohol consumption. We used the alcohol-consumption measures in subsequent analyses involving latent variables.¹

Parents' depression—Parents' depression was assessed with the Center for Epidemiological Studies Depression Scale (Radloff, 1977), an instrument designed to measure depressive symptoms in community populations. It is a widely used, self-report, 4-point Likert-type measure. Parents were asked to report how often they had experienced 20 depressive symptoms (e.g., poor appetite, feeling sad, inability to concentrate) during the past week with, responses including *rarely or none*, *some or a little of the time (1–2 days)*, *occasionally or a moderate amount of time (3–4 days)*, or *most or all of the time (5–7 days)*. The scale has high internal consistency (Radloff, 1977) and strong test–retest reliability (Boyd, Weissman, Thompson, & Myers, 1982; Ensel, 1982). Parental depression was measured at each assessment point, and the internal consistency of the scale ranged from .87 for fathers at 12 months to .90 for mothers at 12 months.

Antisocial behavior—We used a modified version of the Antisocial Behavior Checklist (Zucker & Noll, 1980) in this study. Because of concerns about causing family conflict as a result of parents reading each other's responses, items related to sexual antisociality and those with low population base rates (R. A. Zucker, personal communication, 1995) were dropped. This resulted in a 28-item measure of antisocial behavior. Parents were asked to rate their frequency of participation in a variety of aggressive and antisocial activities along a 4-point scale ranging from 1 (*never*) to 4 (*often*). The measure has been found to discriminate among groups with major histories of antisocial behavior (e.g., prison inmates, individuals with minor offenses in district court, and university students; Zucker & Noll, 1980) and between alcoholic and nonalcoholic adult men (Fitzgerald, Jones, Maguin, Zucker, & Noll, 1991). Parents' scores on this measure were also associated with maternal reports of child behavior problems among preschool children of alcoholics (Jansen et al., 1995). The internal consistency of the 28-item measure in the current sample was quite high for both parents (α s = .90 for fathers and .82 for mothers). The antisocial behavior scores for both fathers and mothers were skewed and were transformed using square-root transformations.

Family conflict—Mother and father reports of physical aggression were obtained from a modified version of the Conflict Tactics Scale (CTS; Straus, 1979). The items focusing on moderate (e.g., push, grab, or shove) to severe (e.g., hit with a fist) physical aggression, but

¹The measured indicators for alcohol-related variables assessed two conceptually separate areas: (a) alcohol consumption and (b) alcohol-related problems. We conducted correlational analyses to examine whether amount and frequency of alcohol consumption, or alcohol-related symptoms, or both, would be associated with parent and child behaviors. These analyses yielded few associations between alcohol-related abuse and dependence symptoms but consistent associations with the alcohol consumption variables. Thus, the measured indicators for alcohol consumption were used in further analyses.

not the very severe items (e.g., burnt or scalded, use of weapons), were used in this study. Parents were asked to report on the frequency of their own and their partner's aggression toward each other on a 7-item scale. We created two composite physical aggression scores, one for each parent, by taking the maximum of each parent's and the partner's reports of total aggression. The resulting scores were highly skewed and were transformed using square-root transformations. We measured psychological aggression with items taken from the Index of Spouse Abuse (ISA; Hudson & McIntosh, 1981). The original scale included both physical and psychological aggression items. Because physical aggression items were measured with the CTS, we dropped those items from the ISA in this study. The ISA is a reliable and valid measure of spousal abuse. Scores on the ISA and CTS were highly correlated. Confirmatory factor analysis revealed that the four subscales of physical and psychological aggression for each parent loaded on the same latent variable for marital aggression.

Infant temperament—Mother and father reports of infant temperament were obtained with the Infant Characteristics Questionnaire (Bates, Freeland, & Lounsbury, 1979). The scale yields four factors: Fussy–Difficult, Unadaptable, Dull, and Unpredictable (Bates et al., 1979), as well as a total score. We used the total infant temperament score in this study; high scores reflect a more difficult temperament. We created a composite measure of infant temperament by combining maternal and paternal ratings of infant temperament at 12 months. The internal consistency of this composite score was .80.

Parent–infant interactions—Parents were asked to interact with their infants as they normally would at home for 5 min in a room filled with toys. The free-play interactions were followed by 8 min of structured play. During structured play, parents were given four sets of problem-solving tasks. They were asked to help their infants complete these tasks one at a time and then move on to the next task. These interactions were coded using a collection of global 5-point rating scales developed by Clark, Musick, Scott, and Klehr (1980), with higher scores indicating more positive affect or behavior. These scales have been found to be applicable for children ranging in age from 2 months to 5 years (Clark, 1999; Clark et al., 1980). Further details about these scales were reported in an earlier article (Eiden et al., 1999).

Two female coders rated the free-play interactions, and two other coders rated the structured-play interactions. The coding of maternal and paternal behavior was alternated between the two coders so that the coder who coded one parent did not code the other parent. Both coders were trained on the Clark scales by Rina D. Eiden and were unaware of group membership and all other data. The interrater reliability was fairly high, ranging from $r = .89$ to $r = .95$ (Pearson correlations) for each of the six composite scales across the two interaction settings.

We conducted confirmatory factor analyses on a combination of free-play and structured-play variables at 12 months to examine the fit of four measurement models, one for each parent and for the child's behavior with each parent. The three composite scales (summing similar items from free-play and structured-play variables) for each parent were used as measured indicators of the latent construct reflecting parental sensitivity. Confirmatory factor analyses indicated that the three parenting behavior scales for fathers loaded on one factor reflecting father's sensitivity (high positive involvement, low negative affect, and high sensitive responding). Similarly, the three parenting behavior scales for mothers loaded on one factor reflecting mother's sensitivity. Confirmatory factor analyses indicated that the three child behavior scales also loaded on a latent construct reflecting child responsiveness (high positive affect, low negative affect, and high responsiveness to parental behavior).

Plan of Analyses

We used structural equation modeling (SEM) to examine the major hypotheses regarding the transactional nature of parent–child interactions over time. The first step in the SEM analyses was to fit the measurement model for each latent variable. The second step was to test the structural model. Separate models were estimated for mother–infant and father–infant interactions. These models included latent variables for parents’ alcohol consumption (separated for mother and father) and marital aggression. Measured indicators of parents’ depression, antisocial behavior, infant temperament, fathers’ education, and child gender were also included in these models.

We conducted all SEM analyses using AMOS (Arbuckle, 1997). We used maximum-likelihood estimation procedures, and standardized parameter estimates are presented. We examined the goodness of fit of the models using the comparative fit index (CFI) and the root-mean-square error of approximation (RMSEA). The CFI varies between zero and 1.0, and values of .90 or higher indicate acceptable fit (Hu & Bentler, 1995). The RMSEA is bounded by zero and will take on that value when a model exactly reproduces a set of observed data. A value of .05 to .06 is indicative of close fit, a value of .08 is indicative of marginal fit, and higher values are indicative of poor fit (Browne & Cudeck, 1994). We used the chi-square difference test to compare the fit of successive nested models.

Analysis of the measurement model—For the latent variables involving 12-month variables (marital aggression, father’s alcohol consumption, and mother’s alcohol consumption), we tested the measurement model using confirmatory factor analysis, as described previously. For the latent variables reflecting parent and child behaviors during interactions at 12, 18, and 24 months, we analyzed the measurement model in two steps. First, we evaluated the fit of an overall measurement model for parenting and child behavior across time. There were three indicators for parenting behavior and three for child behavior at each time. Serial correlations among measurement errors were included in this model, because repeated measurement of the same variables is likely to result in correlated measurement errors. We used confirmatory factor analysis to determine the fit of the measurement model.

If the fit of the measurement model was satisfactory, we evaluated the consistency of the measurement model across time according to guidelines by Bollen (1989) and Byrne (1994). According to these guidelines, we tested a set of hypotheses reflecting increasing levels of measurement invariance across time: (a) the factor loadings were equal at each wave, (b) the factor loadings and the measurement error variance were identical across time, and (c) the factor loadings and the measurement error variances and covariances were identical across time. Following Byrne, we imposed these constraints until the model received a significantly poorer fit than the previous one, using the chi-square test for nested models. At that point, we retained the less constrained model.

Analysis of the structural model—After testing the measurement model, we tested the overall structural model. The structural model specified the hypothesized relationships among the latent variables. We tested the overall structural model in a series of steps or nested models. In the first step, we evaluated a baseline model that included the autocorrelations between parent and child behavior in adjacent time points, associations among predictors, and paths from predictors to parent and child behavior at 12 months. In the next step, the associations between the disturbance terms of parent and child behaviors within time were included in the model. In the third step, the cross-lagged paths (across time) were added to the model. We used the chi-square difference test to compare the fit of successive nested models.

Results

Demographics

We conducted correlational analyses to examine associations between parent–child behaviors and the following demographic variables measured at 12 months of child age: parental education, age, work hours, and parity. Maternal education was consistently associated with all maternal and child behaviors with mother across time, with correlations ranging from $r = .19$ to $r = .31$. Father's education was consistently associated with all paternal and child behaviors with father across time, with correlations ranging from $r = .14$ to $r = .22$. There were sporadic associations between parent and child behaviors on one hand and mother's age and father's number of work hours on the other. We conducted correlational analyses to examine associations between the alcohol, psychopathology, and marital measures and the demographic variables. Only father's education was consistently associated with alcohol measures and with maternal and paternal antisocial behaviors. Higher education was associated with lower paternal alcohol problems ($r = -.14$ at 12 months), QFI ($r = -.23$ at 12 months), binge drinking ($rs = -.15$ to $-.26$ across time), and antisocial behavior ($rs = -.31$ for fathers and $-.25$ for mothers). Thus, father's education at 12 months was used as a covariate in all analyses involving alcohol measures and antisocial behaviors. Correlations between predictors and parent–infant interaction variables are presented in Tables 1 and 2.

SEM Analyses of Mother–Infant Interactions

Measurement models—Measurement invariance across time for maternal behavior was tested first. We compared a model that allowed the factor loadings to freely vary (baseline model) and a model that constrained the loadings to be equal. The two models differed significantly from each other, $\chi^2(4, N = 226) = 11.96, p < .05$, indicating that at least a subset of the equality constraints were not tenable. We then tested a model in which only the 12- and 18-month factor loadings were constrained to be equal. This model did not differ from the baseline model, $\chi^2(2, N = 226) = 1.19, ns$. We then constrained one factor loading at 24 months to be equal. This model did not differ from the previous one, $\chi^2(1, N = 226) = 3.49, ns$. Thus, the factor loadings at 12 and 18 months and one factor at 24 months were constrained to be equal. The fit indices suggested that this model fit the data well, $\chi^2(28, N = 226) = 57.16, p = .001$, CFI = .98, RMSEA = .06 (90% confidence interval [CI] = .043, .090).

Measurement invariance across time for child behavior with mother was tested next. We compared a model that allowed the factor loadings to freely vary (baseline model) and a model that constrained the loadings to be equal. The two models did not differ from each other, $\chi^2(4, N = 226) = 8.56, ns$. We then further constrained the error variances of the variables to be equal. This resulted in a significantly poorer fit than the less restricted model, $\chi^2(10, N = 226) = 98.48, p < .01$. As a result, no further constraints were imposed. Only the factor loadings were constrained to be equal across time. The fit indices suggested that this model fit the data well, $\chi^2(25, N = 226) = 39.85, p = .03$, CFI = .98, RMSEA = .052 (90% CI = .016, .081).

Measurement invariance across time for paternal behavior was tested next. The model with factor loadings constrained to be equal across time did not differ significantly from one in which they were freely estimated, $\chi^2(4, N = 226) = 8.56, ns$. We then further constrained the error variances of the variables to be equal. This resulted in a significantly poorer fit than the less restricted model, $\chi^2(6, N = 226) = 31.41, p < .05$. Thus, the model with factor loadings constrained to be equal across time was retained. This model fit the data well, $\chi^2(25, N = 226) = 45.57, p = .01$, CFI = .98, RMSEA = .061 (90% CI = .031, .089).

Measurement invariance across time for child behavior with father was tested in the next series of steps. The baseline model with no constraints was compared to one in which the factor

loadings were constrained to be equal. This resulted in a significantly poorer fit, $\chi^2(4, N = 226) = 12.30, p < .05$. Individual factor loadings were constrained next. When only one factor loading was constrained to be equal across time, the model did not differ significantly from one in which they were free to vary, $\chi^2(2, N = 226) = 2.29, ns$. Any other constraints on factor loadings resulted in a significantly poorer fit. The model with one factor loading constrained to be equal across time was retained and fit the data well, $\chi^2(24, N = 226) = 40.05, p = .02$, CFI = .96, RMSEA = .055 (90% CI = .02, .084).

In summary, the final model for maternal behavior indicated that there was time invariance in factor loadings from 12 to 18 months and only partial time invariance in factor loadings from 18 to 24 months. The final model for child behavior with mothers suggested that there was time invariance in factor loadings from 12 to 24 months. The final model for paternal behavior also suggested that there was time invariance in factor loadings from 12 to 24 months. The final model for child behavior with fathers indicated that there was only partial time invariance in factor loadings from 12 to 24 months. These tests indicated that although there was not perfect invariance in measurement models across time, there was sufficient invariance to allow for meaningful comparisons across time for parental and child behaviors (Byrne, Shavelson, & Muthén, 1989).

Structural models—The baseline structural model for mother–infant interactions included the associations among the predictors, paths from predictors to maternal and child behavior at 12 months, and the autocorrelations between adjacent time points for maternal and infant behavior. The initial baseline model included infant temperament, but parent report of infant temperament was not associated with parents' alcohol consumption or the latent variables for maternal or child behavior. Thus, we dropped this variable from the model. The second model included within-time covariances between the disturbance terms of parent and child behavior and resulted in a significant improvement in fit (see Table 3). All three disturbance terms were significantly associated with each other. The addition of the cross-lagged paths from maternal to child behavior and vice versa improved the fit of the model (Model 3). Finally, modification indices suggested the addition of a direct path from fathers' alcohol consumption at 12 months to maternal behavior at 24 months. The addition of this path resulted in a significant improvement in fit (Model 3b, see Table 3). The final model predicting mother–infant interactions is depicted in Figure 1. This model fit the data well (CFI = .93, RMSEA = .052, 90% CI = .044, .059). Infant behavior did not influence maternal behavior across time, but maternal behavior at 12 months was associated with more positive infant behavior at 18 months. Higher alcohol consumption by fathers was associated with more sensitive maternal behavior during interactions at 12 months. By 24 months, the direction of this association had changed. Higher alcohol consumption by fathers at 12 months was associated with less sensitive maternal behavior during interactions at 24 months. Fathers' education and marital conflict were also significantly associated with maternal behavior at 12 months of infant age.

We evaluated the structural model for father–infant interactions in a similar fashion. The initial baseline model included parent reports of infant temperament. Infant temperament was not associated with parents' alcohol consumption and was not associated with paternal or child behavior during play. Thus, infant temperament was not included in the models. Compared to the baseline model, Model 2, including the within-time associations between the disturbance terms of father and child behaviors, resulted in a significant improvement in fit (see Table 3). The addition of the cross-lagged paths in Model 3 also resulted in the significant improvement in fit. Finally, modification indices indicated the addition of two paths, one from fathers' alcohol consumption to fathers' behavior at 24 months and a second from fathers' depression to child behavior at 24 months. The addition of these two paths in Model 3b resulted in a significant improvement in fit. The final model for father–infant interactions is displayed in Figure 2 and fit the data well (CFI = .91, RMSEA = .057, 90% CI = .05, .064). Infant behavior

did not predict fathers' behavior across time, but more positive paternal behavior at 18 months was associated with more positive infant behavior at 24 months. Fathers' alcohol consumption was a significant predictor of fathers' behavior at 24 months. Higher alcohol consumption at 12 months was associated with less sensitive behavior at 24 months. Fathers' depression was a significant predictor of infant behavior at 24 months. Higher depression at 12 months was associated with more negative infant behavior toward fathers at 24 months. Fathers' education, marital conflict, and child gender were concurrently associated with paternal behavior at 12 months. Higher education was associated with more sensitive parenting. Higher marital conflict was associated with less sensitive parenting and more negative infant behavior toward fathers at 12 months. Fathers behaved more positively toward girls.

Discussion

A conceptual model for the prediction of parent–infant interactions was tested in a study that compared a high-risk sample characterized by fathers' alcoholism with a demographically matched nonalcoholic group. The results of the study were generally supportive of several aspects of this model. The results support the hypothesis that fathers' heavy drinking is associated with the quality of parent–infant interactions prospectively, such that fathers' heavy drinking at 12 months was longitudinally predictive of more negative paternal behavior at 24 months.

The results for maternal parenting behavior were more complicated but nevertheless generally supportive of the model. Fathers' heavy drinking was not concurrently associated with more negative maternal behavior at 12 months. Indeed, mothers with heavy-drinking partners were more positive during interactions with their infants at 12 months. However, by 24 months, fathers' heavy drinking was prospectively predictive of more negative maternal behavior. One explanation for this may be that mothers with heavy-drinking partners were more protective of their infants and, as a result, more positive during play interactions with their infants at 12 months. However, this was difficult to sustain over the long term, and by 24 months fathers' heavy drinking predicted more negative maternal behavior, even after controlling for maternal heavy drinking.

Other researchers have noted the significant developmental changes in child behavior that occur over the 2nd year of life and corresponding changes in parental behavior as well (e.g., Demick, 2002; Kopp, 1992). For instance, Kopp (1992) noted that temper tantrums and negative emotionality peaks around 21 months of age and then declines between 2 and 3 years of age. Others have noted the 2-year mark as the beginning of a period of intense parent–child conflict and negotiation and the period during which there is a marked shift in parenting from a predominant focus on caretaking and nurturance to a focus on handling of authority issues and limit setting (Demick, 2002). In one of the few studies examining changes in parental representations of their young children, Aber, Belsky, Slade, and Crnic (1999) reported increases in maternal anger from 15 to 28 months, the period corresponding with significant developmental changes in child behavior. Our results indicate that associations between fathers' heavy drinking and more negative parental behavior are not apparent until there are significant demands on parents to modulate their behavior in response to negative child behavior.

It is also worth noting that overall levels of parental drinking over this time period remained fairly stable, such that heavy drinking at 12 months was fairly representative of drinking patterns from 12 to 24 months. Thus, it is possible that the 12-month measure of parental heavy drinking approximates the association between parental heavy drinking at time points more proximal to the 24 months of child age.

In one of the few studies on the role of paternal depression for parent–child interactions, Jacob and Johnson (2001) noted that family interactions of depressed fathers were characterized by *positivity suppression*, defined as decreased rates of positive expressions following a positive communication by other family members. Father's depression in the present study was uniquely predictive of more negative child behavior at 24 months but was not associated with paternal behavior per se. Given the general lack of studies on the role of fathers' depression, these results are intriguing and highlight the importance of examining paternal depression and its role in predicting child behavior.

Apart from examining the role of fathers' alcohol problems and associated risk characteristics, a major goal of this study was to examine how parent and infant behaviors during play influence each other over time. The results indicate that the direction of influence for both mother–infant and father–infant interactions were from parent to child. For mothers, this direction of influence was apparent from 12-month maternal behavior to 18-month infant behavior. For fathers, this influence was significant from 18-month paternal behavior to 24-month child behavior. There are few published findings from studies examining bidirectional influences in parent–infant interactions over time. This study begins to fill this gap in the literature identified by reviews of the literature on bidirectional influences (e.g., Patterson & Fisher, 2002) and suggests that, at least in the 2nd year of life, the direction of influence seems to be predominantly from parent behavior to infant behavior.

Researchers have speculated that certain groups of parents may be particularly reactive to child behaviors. For instance, a few studies have noted that parents are generally more reactive to externalizing behaviors from their sons compared to their daughters (see Patterson & Fisher, 2002). Other studies have noted that fathers are more reactive to their children's behaviors than are mothers. Finally, evidence suggests that parents in particular high-risk groups (e.g., abusive, antisocial, or depressed parents) are more negatively reactive to their children's coercive behaviors compared to well-functioning parents (e.g., Patterson, 1982). It has also been noted that permissive parents often react to children's coercive behavior in a neutral or positive way (Granic, 2000). These differences may be a function of both parental vulnerability to negative affect and the biological predisposition of children of high-risk parents to behave in more negative ways. Thus, the issue of bidirectionality in parent–child interactions may be more salient in particular subgroups than others and may vary as a function of parent or child gender or as a function of psychological risk status. We were unable to examine these issues in the present study because of sample size limitations, but this is a fruitful area of research for future studies.

Among the multiple risk factors associated with alcohol problems, two were notable in predicting parent–infant interactions, father's depression, and marital conflict. However, it is important to note that the majority of risk characteristics examined in this study were associated with each other. For instance, fathers' depression and marital conflict were associated with each other and with fathers' heavy drinking and antisocial behavior. Thus, although some of these risk characteristics were uniquely predictive of father–infant interactions over time, their importance can be evaluated only in the context of overall parental and family risk characteristics.

Unlike previous literature suggesting stronger associations between marital quality and parenting for fathers compared to mothers (e.g., Belsky & Volling, 1986), the findings from the present study suggest that marital conflict was predictive of more negative parenting behavior for both mothers and fathers. The present results are supportive of conclusions drawn in a recent review indicating that there was limited evidence that marital conflict had a more pronounced impact on fathers' parenting than on mothers' parenting (see Coiro & Emery, 1998). The results from the present study also indicate that marital conflict was uniquely

associated with infant behavior toward fathers at 12 months of infant age. These results are supportive of previous findings that marital conflict had independent associations with child maladjustment for young children, even after accounting for parenting (Buehler & Gerard, 2002; Frosch & Mangelsdorf, 2001).

Although the findings from our study fill an important gap in the literature, there are several significant limitations as well. For instance, although generating our sample from birth records has important advantages over newspaper- or clinic-based samples, there are also limitations. The response rate to our open letter of recruitment was slightly above 25%. This raises the possibility that respondents to our recruitment may have been a biased group. Our comparison of respondents with the entire population of birth records suggested that the bias was small with respect to the variables that we could examine. However, there could have been more significant biases in variables that we could not assess. Second, this study used only self-report data with respect to parental alcohol problems and psychopathology. Finally, given the nature of the design, the role of mothers' alcohol problems could not be examined independently from fathers' alcohol problems. Furthermore, because only a small proportion of the mothers in our sample experienced alcohol problems, our ability to fully examine the role of maternal alcohol problems was limited. However, it is important to note that in the majority of families with alcohol problems, maternal alcohol problems exist in the context of paternal alcohol problems. In other words, women with alcohol problems are more likely to have partners with alcohol problems than vice versa (see Roberts & Leonard, 1997, for further discussion). Future studies including samples of mothers with and without alcoholic partners may be able to better answer the question of the role of maternal alcohol problems in the development of infant attachment.

The results of this study indicate that fathers' heavy drinking and associated risk characteristics longitudinally predict maternal and paternal behavior during play interactions with their infants. In regard to the bidirectional influences in parent–infant interactions that we also examined in this study, results indicate that the direction of influence, at least in the 2nd year of life, is from parent to infant. Future studies with larger sample sizes will be able to examine whether the nature of these bidirectional influences changes as a function of family risk status or child gender.

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Figure 1.

Structural model for mother–infant interactions. ASB = antisocial behavior.

Figure 2.
Structural model for father–infant interactions. ASB = antisocial behavior.

Table 1
Means, Standard Deviations, and Correlations Between Predictors and Father–Infant Interaction Variables

Variables	1	2	3	4	5	6	7	8	9	10	11	M	SD
F: Positive eng., 12 m	-.13 [*]	-.08	.18 ^{***}	.11 [*]	-.18 ^{**}	-.15 ^{**}	-.21 ^{***}	-.03	-.16 ^{**}	-.06	-.12 [*]	3.72	0.74
F: Negative affect, 12 m	-.09	.02	.26 ^{***}	.16 ^{***}	-.19 ^{***}	-.04	-.18 ^{***}	-.01	-.09	-.04	.01	4.42	0.51
F: Sensitivity, 12 m	-.06	-.07	.27 ^{***}	.18 ^{***}	-.17 ^{**}	-.12 [*]	-.17 ^{***}	-.24 ^{***}	-.12 [*]	-.06	.03	3.88	0.71
F: Positive eng., 18 m	-.02	-.08	.12 [*]	.19 ^{***}	-.09	.04	-.14 ^{**}	.00	-.10	.01	-.05	3.68	0.70
F: Negative affect, 18 m	-.05	-.08	.22 ^{***}	.14 ^{***}	-.13 [*]	.03	-.15 ^{**}	-.02	-.21 ^{***}	-.01	.05	4.38	0.49
F: Sensitivity, 18 m	.03	-.11 [*]	.17 ^{**}	.16 ^{**}	-.11	.04	-.19 ^{***}	-.12 [*]	-.19 ^{***}	.01	.05	3.89	0.71
F: Positive eng., 24 m	-.21 ^{***}	-.16 ^{**}	.25 ^{***}	.17 ^{***}	-.22 ^{***}	-.10	-.22 ^{***}	-.10	-.20 ^{***}	-.16 ^{**}	-.10	3.73	0.74
F: Negative affect, 24 m	-.07	-.17 ^{**}	.24 ^{***}	.26 ^{***}	-.20 ^{***}	-.10	-.20 ^{***}	.01	-.18 ^{***}	-.11	.02	4.50	0.47
F: Sensitivity, 24 m	-.05	-.24 ^{***}	.24 ^{***}	.27 ^{***}	-.16 [*]	-.04	-.17 ^{***}	-.18 ^{***}	-.14 ^{**}	-.12 [*]	.04	4.35	0.58
C: Positive affect, 12 m	.03	.05	.05	.00	.03	.00	-.12 [*]	-.03	-.14 ^{**}	-.04	-.15 ^{**}	3.29	0.86
C: Negative affect, 12 m	.02	-.07	.03	.14 ^{**}	-.03	.02	-.06	-.01	-.03	.02	-.14 ^{**}	4.29	0.62
C: Resp., 12 m	-.01	-.03	.09	.12 [*]	-.06	-.03	-.16 ^{**}	-.12 [*]	-.16 ^{***}	-.13 ^{***}	-.10	3.14	0.84
C: Positive affect, 18 m	-.01	-.01	.04	.18 ^{***}	-.03	.08	-.05	.00	-.05	-.06	-.13 ^{**}	3.40	0.79
C: Negative	.12 [*]	-.06	.05	.04	.04	.14 ^{**}	-.11	.02	-.12 [*]	-.01	-.16 ^{**}	4.38	0.62

Variables	1	2	3	4	5	6	7	8	9	10	11	M	SD
affect, 18 m													
C: Resp., 18 m	.05	-.07	.03	.17***	.01	.03	-.08	-.08	-.06	-.06	-.12*	3.91	0.79
C: Positive affect, 24 m	-.12*	-.07	.22***	.27***	-.10	-.03	-.11	-.10	-.05	-.03	-.06	4.66	0.44
C: Negative affect, 24 m	.05	-.03	.16**	.18***	-.03	-.13*	-.17**	.01	-.11	.05	-.04	4.42	0.61
C: Resp., 24 m	-.08	-.13**	.14**	.22***	-.05	-.06	-.11	-.05	-.02	-.02	-.05	4.38	0.76
M			3.24		39.91	7.65	2.28	.50	4.86	.66	103.40		
SD			1.56		8.89	7.05	4.57	0.57	9.82	0.61	17.49		

Note. 1 = father (F) alcoholic vs. control (C); 2 = both parents alcoholic vs. control; 3 = father's education; 4 = child gender; 5 = father's antisocial behavior; 6 = father's depression; 7 = physical aggression father to mother; 8 = psychological aggression father to mother; 9 = physical aggression mother to father; 10 = psychological aggression mother to father; 11 = infant temperament; eng. = engagement; m = months; resp. = responsiveness.

*
p < .10.

**
p < .05.

p < .01.

Table 2
Means, Standard Deviations, and Correlations Between Predictors and Mother-Infant Interaction Variables

Variables	1	2	3	4	5	6	7	8	9	10	11	M	SD
M: Positive eng., 12 m	.04	-.12*	.13*	.04	-.03	-.12	-.15**	-.08	-.16**	.00	-.03	3.94	0.72
M: Negative affect, 12 m	.11	-.13**	.13*	.05	-.18***	-.08	-.16**	-.09	-.17***	.01	-.01	4.38	0.56
M: Sensitivity, 12 m	.18***	-.15**	.04	.18***	-.08	-.12*	-.10	-.06	-.04	.02	.00	3.76	0.77
M: Positive eng., 18 m	-.04	-.12*	.16**	.10	-.15**	-.19***	-.20***	-.13**	-.15**	-.08	-.01	4.02	0.67
M: Negative affect, 18 m	.07	-.16**	.11	.20***	-.25***	-.20***	-.30***	-.13**	-.23***	-.13**	-.08	4.47	0.51
M: Sensitivity, 18 m	.10	-.14**	.09	.19***	-.21***	-.15***	-.16**	-.12*	-.04	-.04	-.11	4.07	0.67
M: Positive eng., 24 m	-.25***	-.03	.07	.17***	-.19***	-.10	-.12*	-.07	-.10	-.05	-.02	4.12	0.69
M: Negative affect, 24 m	-.17***	-.01	.09	.16**	-.21***	-.10	-.22***	-.10	-.15**	-.07	-.01	4.64	0.42
M: Sensitivity, 24 m	-.10	-.06	.17***	.14**	-.18***	-.11	-.12*	-.08	-.05	-.03	-.04	4.47	0.56
C: Positive affect, 12 m	-.04	.07	.14**	.09	-.05	-.11	-.07	.02	-.07	.00	-.11	3.17	0.86
C: Negative affect, 12 m	-.03	.00	.09	.08	-.07	-.12*	-.07	-.17***	-.11	-.09	-.06	4.04	0.76
C: Resp., 12 m	.02	-.04	.27***	.08	.02	-.10	-.07	-.04	-.08	.03	-.12*	3.09	0.77
C: Positive affect, 18 m	-.04	.02	.18***	.07	-.11	-.15***	-.11	.00	-.05	-.12*	-.01	3.47	0.79

Variables	1	2	3	4	5	6	7	8	9	10	11	M	SD
C: Negative affect, 18 m	.02	.03	.14**	.06	-.01	-.06	-.08	-.01	.05	-.05	-.10	4.21	0.74
C: Resp., 18 m	-.05	-.08	.21***	.17***	-.05	-.13*	-.06	.00	.01	-.07	-.08	4.01	0.74
C: Positive affect, 24 m	-.09	-.05	.06	.20***	-.14**	-.04	-.10	-.06	-.04	.02	-.03	3.92	0.70
C: Negative affect, 24 m	.02	-.00	.11	.08	-.14**	-.08	-.16**	-.12*	-.04	-.04	-.04	4.61	0.53
C: Resp., 24 m	-.01	-.03	.21***	.15***	-.05	-.16**	-.06	-.01	-.03	-.03	-.10	4.45	0.67
M			13.24		36.08	8.60					101.55		
SD			1.57		5.68	7.32					17.72		

Note. 1 = father alcoholic vs. control (C); 2 = both parents alcoholic vs. control; 3 = father's education; 4 = child gender; 5 = Mother's (M) antisocial behavior; 6 = mother's depression; 7 = physical aggression father to mother; 8 = psychological aggression father to mother; 9 = physical aggression mother to father; 10 = psychological aggression mother to father; 11 = infant temperament; eng. = engagement; m = months; resp. = responsiveness.

* $p < .10$.
 ** $p < .05$.
 *** $p < .01$.

Table 3

Structural Models for Parental Interactions

Model	$\chi^2(N = 226)$	df	p	χ^2 change	df	p
Mother-child						
Baseline model	891.77	337	.000			
Model 2	659.67	334	.000	232.10	3	.000
Model 3	647.35	332	.000	12.32	2	< .05
Model 3b	584.01	328	.000	63.34	4	< .01
Father-child						
Baseline model	839.21	335	.000			
Model 2	655.15	332	.000	184.06	3	.000
Model 3	649.56	331	.000	7.95	1	< .05
Model 3b	576.69	325	.000	72.87	6	< .01

Note. The baseline model includes all the autocorrelations, all significant associations among predictors, and all significant paths from predictors to parent and child behavior at 12 months; Model 2 includes the associations between the disturbance terms within time; Model 3 includes the cross-lagged paths (across time); Model 3b includes the theoretically relevant paths suggested by modification indices.