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Cumulative environmental risk in substance abusing women: early intervention, parenting stress, child abuse potential and child development[☆]

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Abstract

Objective—To assess the relationship between cumulative environmental risks and early intervention, parenting attitudes, potential for child abuse and child development in substance abusing mothers.

Method—We studied 161 substance-abusing women, from a randomized longitudinal study of a home based early intervention, who had custody of their children through 18 months. The intervention group received weekly home visits in the first 6 months and biweekly visits from 6 to 18 months. Parenting stress and child abuse potential were assessed at 6 and 18 months postpartum. Children's mental and motor development (Bayley MDI and PDI) and language development (REEL) were assessed at 6, 12, and 18 months postpartum. Ten maternal risk factors were assessed: maternal depression, domestic violence, nondomestic violence, family size, incarceration, no significant other in home, negative life events, psychiatric problems, homelessness, and severity of drug use. Level of risk was recoded into four categories (2 or less, 3, 4, and 5 or more), which had adequate cell sizes for repeated measures analysis.

Data analysis—Repeated measures analyses were run to examine how level of risk and group (intervention or control) were related to parenting stress, child abuse potential, and children's mental, motor and language development over time.

Results—Parenting stress and child abuse potential were higher for women with five risks or more compared with women who had four or fewer risks; children's mental, motor, and language development were not related to level of risk. Children in the intervention group had significantly higher scores on the PDI at 6 and 18 months (107.4 vs. 103.6 and 101.1 vs. 97.2) and had marginally better scores on the MDI at 6 and 12 months (107.7 vs. 104.2 and 103.6 vs. 100.1), compared to the control group.

Conclusion—Compared to drug-abusing women with fewer than five risks, women with five or more risks found parenting more stressful and indicated greater inclination towards abusive and neglectful behavior, placing their infants at increased risk for poor parenting, abuse and neglect. Early home-based intervention in high-risk families may be beneficial to infant development.

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Keywords

Drug abuse; Environmental risk; Early intervention; Parenting; Child abuse; Child development

Introduction

Substance abusing women are at high risk of experiencing multiple problems that may undermine their ability to care for their children. These include depression, increased exposure to parental and partner violence, sexual abuse, psychiatric disorders, violent behavior, and criminal behavior (Amaro, Fried, Cabral, & Zuckerman, 1990; Anglin & Perrochet, 1998; Barnett, Duggan, Wilson, & Joffe, 1995; Davis, 1997; Hans, 1999; McGaha & Leoni, 1995; Schuler & Nair, 2001; Swartz et al., 1998). Any one or a combination of these factors can increase risk for poor parenting, placing the children at risk of poor developmental and behavioral outcome and child neglect and/or abuse (Caliso & Milner, 1992; Deren, 1986; Hans, Bernstein, & Henson, 1999; Jaudes, Ekwo, & Van Voorhis, 1995; Johnson & Leff, 1999; Johnson, Nusbaum, Bejarano, & Rosen, 1999; Kelley, 1992; Leventhal et al., 1997; Millar & Stermac, 2000; Wasserman & Leventhal, 1993; Wolock & Magura, 1996).

Compared to nondrug users, substance abusing women experience higher stress related to parenting, are often more punitive towards their children—frequently associated with their own experience of parental and partner violence, and may be less responsive to their infants (Arellano, 1996; Hans et al., 1999; Kelley, 1998; Miller, Smyth, & Mudar, 1999; Schuler & Nair, 2001; Young, 1997). Children of drug abusers are also at greater risk for child abuse and neglect and experiencing disruption in primary care giving (Arellano, 1996; Jaudes et al., 1995; Johnson & Leff, 1999; Peterson, Gable, & Saldana, 1996; Nair et al., 1997). It has, however, been difficult to define why some children of substance abusing women are at greater risk than others for poor developmental and behavior outcomes. Mothers' parenting ability, life style and ongoing drug use may be factors that affect child outcome. High levels of parenting stress have been associated with unfavorable outcomes in children (Baker, Heller, & Henker, 2000; Kelley, 1998; Scher & Mayseless, 2002). In a study of treatment outcome in children with anxiety disorders, family dysfunction appeared to be related to less favorable treatment outcome (Crawford & Manassis, 2001). Psychological mechanisms, including parenting stress has been shown to mediate the relationship between environmental risk and the development of type 1 diabetes, indicating parental stress can have long-term effects on children's health (Sapa, Frodi, & Ludvigsson, 2002).

Fetal drug exposure can affect infants' behavior (Addis, Moretti, Ahmed Syed, Einarson, & Koren, 2001; Chasnoff, 1988; Finnegan, 1985; Singer, Arendt, Minnes, Farkas, & Salvator, 2000; Wagner, Katikaneni, Cox, & Ryan, 1998). The risk of neonatal withdrawal is greatest with narcotic drugs, but has been reported in neonates following exposure to alcohol, cocaine, nicotine, and amphetamines. Neonatal abstinence syndrome (NAS) from exposure to opiates in utero occurs in 50 to 80% of exposed infants, usually occurs during the first 72 hours after birth, and can continue for several weeks postpartum. Infants who are withdrawing, in addition to other symptoms, tend to be irritable, sleep less, have problems with feeding, and are in general more difficult to care for than healthy newborns. Studies on neurobehavioral outcome of cocaine exposed infants have noted higher incidence of movement and tone abnormalities, jitteriness, and attention problems with higher concentrations of the cocaine metabolites (Singer et al., 2000). A greater percentage of heavily cocaine-exposed infants, compared to nonexposed controls showed less enjoyment during en face play with their mothers and continued to show negative expressions during the resumption of play following a period when the interaction was interrupted (Bendersky

& Lewis, 1998). All of the above infant characteristics can make parenting less rewarding and can compromise mothers' parenting ability.

Early home intervention programs have been used with high-risk women, including drug abusers and their children with the goal to improve parenting, child development and in drug abusers to reduce drug use. The effectiveness of these programs has been variable; some have indicated reduction in child abuse and neglect, and positive effects in parenting ability, and child behavior, while others have not noted early measurable effects of the intervention (Black et al., 1994; Butz et al., 2001; Catalano, Gainey, Fleming, Haggerty, & Johnson, 1999; Fraser, Armstrong, Morris, & Dadds, 2000; Gruber, Fleetwood, & Herring, 2001; Hofkosh et al., 1995; Navaie-Waliser, Martin, Tessaro, Campbell, & Cross, 2000; Schuler, Nair, & Black, 2002; Schuler, Nair, Black, & Kettinger, 2000).

Nurse home visitation among low-income, unmarried mothers and their first-born children, reduced the number of maltreatment incidents (Eckenrode et al., 2001). The presence of domestic violence appeared to be a limiting factor in the effectiveness of interventions to reduce the occurrence of child abuse and neglect (Eckenrode et al., 2000).

Patterns of drug use vary. Although for some women, drug use is a social or recreational activity that does not necessarily disrupt their daily care giving responsibilities (Kearney, Murphy, & Rosenbaum, 1994), for most women, drug abuse is a part of a deviant, often violent life style, characterized by daily stress and chronic psychiatric problems (Amaro et al., 1990; Anglin & Perrochet, 1998; Barnett et al., 1995; Davis, 1997; Hans, 1999; Hans et al., 1999; McGaha & Leoni, 1995; Swartz et al., 1998). Within populations of drug abusing women, some are exposed to more negative environmental risk factors than others (Kettinger, Nair, & Schuler, 2000). Among drug abusing women, those with multiple risk factors including psychological problems, cognitive impairment, chronic health problems and HIV/AIDS, were at higher risk of early termination of drug treatment compared to those with few risk factors (Brown, Huba, & Melchior, 1995; Brown, Melchior, & Huba, 1999).

A conceptualization of cumulative effect of multiple risks may, therefore, be helpful in understanding why there is variability in the behavior and development of children born to drug abusing women (Rutter, Pickels, Murray, & Eaves, 2001; Sameroff, 1998; Sameroff, Seifer, Barocas, Zax, & Greenspan, 1987). When drug use occurs in the context of multiple other risks, it may interfere with the mothers' ability to care for their children. In contrast, when drug use occurs alone or without the complications of other risk factors, mothers may be better prepared to fulfill their parenting role. In studies of outcome of prenatal drug exposure, the paucity of long-term effects in early childhood may be due to the failure to examine confounding, moderating and mediating variables (LaGasse, Siefer, & Lester, 1999; Tronick & Beeghly, 1999). For example, Carta et al. (2001) found that cumulative environmental risk accounted for more variance in development among children (3 to 57 months of age, followed over a 2-year period) than prenatal drug exposure.

This investigation focused on inner city children of women who abused substances, and had varying levels of environmental risks. We hypothesized that mothers with a greater number of risk factors, would have worse scores on scales assessing parenting attitudes (e.g., perception of parenting stress and potential for child abuse) compared to mothers with fewer risks. In addition, because environmental risk may also affect children's development, we hypothesized that a greater number of risk factors would be associated with worse cognitive, motor and language development. As this investigation was done in the context of an intervention study, we hypothesized that outcomes would be better for those in the intervention group than in the control group.

Method

Subjects

The subjects for this study were a subgroup from a larger on going, longitudinal randomized clinical trial of a home-based intervention among drug using women and their infants. Recruitment procedures and the home intervention protocol have been reported previously and are summarized here for clarity (Schuler et al., 2000, 2002). Women were recruited from a University Hospital that serves a largely inner city, African American population. Women were eligible for recruitment if they or their infants had a positive urine toxicology screen at birth or if a history of substance abuse was noted in the maternal chart. Infants who were not being discharged into the care of their mother were not eligible. Infants with serious medical problems requiring special services were not eligible. Over a period of 30 months (from February 1992 to July 1995) eligible women were approached in the hospital shortly after delivery. Of the drug-using women who were approached, 28% declined to participate. Mothers who agreed to participate signed an informed consent form approved by the Institutional Review Board of the University, and completed a short demographic and tracking form, administered orally. Perinatal data were collected from the infant's medical chart and mothers were given an appointment for a 2-week baseline visit. Thirty-one of 296 who agreed to participate did not keep the 2-week postpartum appointment: 9 infants were placed in foster care, 1 died allegedly of SIDS, 4 could not be found, 15 were noncompliant, and 2 withdrew. At the end of the 2-week baseline visit, mothers ($n = 265$) were randomly assigned to the intervention or control group.

Intervention

The intervention families received weekly home visits by trained lay visitors from 0 to 6 months, and biweekly from 6 to 24 months. The home intervention included developmentally oriented child and parent components and was based on the program used by the Infant Health and Development Program (IHDP, 1990). Since the IHDP program was not focused on drug-abusing parents, we added information about drug use and drug treatment to the content of the home intervention. The goal of the parent component was to increase maternal empowerment by enhancing the mother's ability to manage self-identified problems by using existing services and family and social supports. The goal of the child component was to promote child development using a program of games and activities. The home visitors were trained using the HELP at Home Curriculum from the Hawaii Early Learning Program (HELP, 1991), a comprehensive curriculum containing 650 developmental skills for children aged birth to 36 months. The home visitors modeled the behaviors/activity from an activity sheet used in HELP as a guide for each age-appropriate developmental skill. By teaching mothers appropriate ways to play with their children, our goal was to enhance communication between mothers and children and to help mothers provide a developmentally stimulating play environment.

The control families received brief monthly tracking visits. Mothers and infants in both groups were seen for follow-up assessments at 6, 12, 18, and 24 months and then yearly. Research assistants who were not aware of the intervention status of the mothers and infants conducted all evaluation visits in a hospital clinic. To control for differences in reading ability, research assistants read all the questionnaires to the mothers. Mothers were paid for each clinic evaluation visit and given a bus token to get home.

Assessment of environmental risk

Ten factors were examined to quantify environmental risk: depression, domestic violence, nondomestic violence, family size, homelessness, incarceration, absence of significant other in home, negative life events, psychiatric symptomatology, and severity of drug use. These

are considered as risk factors for parenting problems and negative child outcomes, and are relatively common among drug abusing women.

Maternal depression—Maternal depression was measured at 2 weeks postpartum using the Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977). The CES-D is a 20-item self-report depression symptom scale developed to assess depressive symptomatology in the general population. The total score ranges from 0 to 60, with higher scores indicating more depressive symptomatology. Scores of 16 or greater are indicative of depressive symptomatology. Mothers were given a score of zero (0) if their depression score was less than 16 or a score of one (1) if their depression score was 16 or greater (70.9%).

Domestic violence—Domestic violence was defined as physical abuse by the mother's husband or boyfriend, and was assessed over the entire 18 months. At each evaluation visit, the women were asked, "Since we saw you last have you been a victim of domestic violence?" A score of zero (0) was given if the mother reported no abuse since entrance into the study. A score of one (1) was given if the mother reported being abused by her husband or boyfriend at the 6, 12, or 18 month visit (14.2%).

Nondomestic violence—At each evaluation visit the women were asked, "Since we saw you last have you been a victim of violence outside the home by someone other than husband or boyfriend?" Nondomestic violence includes rape, mugging, and forms of violence by a perpetrator other than her husband or boyfriend. Mothers who reported no violence since entrance into the study were given a score of zero (0). Those who reported being the victim of violence any time during the 18 months, were given a score of one (1) (22.8%).

Family size—The number of children in the home can affect the emotional, social and physical resources available for individual children. We used the same criteria that Sameroff et al. (1987) used in their longitudinal study of relationship of social-environmental risk and intellectual development, where families with 4 or more children were placed in the high-risk category (the top quartile in their population) (Sameroff, 1998; Sameroff et al., 1987). A mother was given a score of zero (0) if she had fewer than 4 children at entrance in the study and a score of one (1) if she had 4 or more children (29%).

Homelessness—At each evaluation visit women were asked, "Have you been homeless any time since the last visit?" Mothers who reported no homelessness since entrance into the study were given a score of zero (0). Those who reported being homeless at any time since the birth of their infant were given a score of one (1) (12.6%).

Incarceration—At each evaluation visit women were asked, "Have you been incarcerated over a day, anytime since your last visit?" Mothers who reported no incarceration since entrance into the study were given a score of zero (0). Mothers who reported being incarcerated at any point since entrance into the study were given a score of one (1) (20.5%).

Absence of boyfriend or husband—At each evaluation visit women were asked, "Does the baby's father or a male partner live with you?" Mothers who reported the presence of a father or male partner in the household were given a score of zero (0). Mothers who reported the absence of a father or male partner at any point, were given a score of one (1) (82.7%).

Life events—Events experienced by the mother during the past year, such as changes in household structure, job status, or financial resources, were assessed at the baseline 2-week

visit using the Life Experience Survey (LES) (Sarason, Johnson, & Seigel, 1978). The LES is a 47-item measurement, which asks the subject to rate whether or not each event has occurred, if the event was positive or negative, and the perceived impact of the event on their lives. Mothers whose index of negative life events was less than their index of positive life events were given a score of zero (0). Mothers whose index of negative life events was greater than their index of positive life events were given a score of one (1) (70.1%).

Psychological status—Maternal psychiatric symptomatology was assessed at the baseline 2-week visit using the Brief Symptom Inventory (BSI) (Derogatis & Melisaratos, 1983). Each symptom is rated on a 5-point scale from 0 (not at all) to 4 (extremely). The BSI has nine primary symptom dimensions that provide a profile of the individual's psychological status: somatization, obsessive compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism (symptoms of schizophrenia or psychosis). Since the CES-D was used to assess depression, the depression symptom factor on the BSI was not used in the calculation of psychiatric symptoms. Mothers with a *T*-score over 63 in any 2 dimensions (excluding depression) were given a score of one (1) (30.7%), all others were given a score of zero (0).

Drug severity—Drug use was measured by three methods: Neonatal and maternal urine toxicology screen at birth and at 2 weeks by a focused interview and the Addiction Severity Index (ASI) (McLellan et al., 1992). The 2-week postpartum focused interview and the ASI addressed patterns of use for alcohol, heroin, cocaine, smoking tobacco, marijuana, tranquilizers, hallucinogens, and methadone. The age of onset of use for each method and frequency of use and when last used were obtained. At the hospital women and infants get routine urine toxicology screen at delivery. All women in this study population had a history of drug abuse. Crack use was not prevalent in this community at the time of recruitment of the study group. We therefore used intravenous heroin and/or cocaine use and frequency of use to assess severity of drug use. Mothers who were intravenous drug users and/or had a drug use frequency of greater than once per week were given a score of one (1) (59.1%). Mothers who were not intravenous drug users and/or had a drug use frequency of less than twice per week were given a score of zero (0). Only data from the 2-week visit were used for this assessment.

Cumulative risk index—The scores on the 10 environmental risk factors were summed to produce a cumulative risk score for each mother. The cumulative scores ranged from 0 to 8, one mother had 8 risks and 2 mothers had 0 risks. Based on the very low number of participants in the lowest categories of zero or one risk, these categories were combined with the two risks category, to form one category of two or fewer. Sufficient numbers of participants had three or four risks (49 and 35, respectively) to keep these as separate categories. Finally, because so few participants had five or more risks, they were all combined into one category of five or more, resulting in a risk variable with four categories: two or fewer, three, four, and five or more risks. See Table 1 for frequencies of the cumulative risk categories.

Maternal parenting attitudes

Two measures were used to evaluate maternal parenting attitudes: The Child Abuse Potential Inventory and the Parenting Stress Index.

Child Abuse Potential Inventory (CAP)—The CAP assessed the mother's inclination towards abuse and neglect (Caliso & Milner, 1992; Haskett, Scott, & Fann, 1995; Milner, 1986, 1989). The CAP is a 160-item physical abuse measure that asks the respondents to agree or disagree with each statement. The measure is divided into six factor scores: distress,

rigidity, unhappiness, problems with child and self, problems with family, and problems with others. The factor scores are summed to produce a total abuse score. Higher scores indicate a greater likelihood of abuse. Psychometric properties of the scale indicate high internal consistency coefficients for total abuse score (.92 to .98) with slightly lower, though still acceptable coefficients for the six factor scores. When only African American subjects were considered, the rates of internal consistency remained above .85. The CAP includes items related to problem areas known to be associated with probability for maltreatment. Acceptable levels of content and construct validity have been reported based on studies comparing the factors from CAP and constructs associated with child abuse. Correlation analysis reported significant related findings between the CAP scores and observed parental styles, supporting construct validity of the CAP. The CAP was administered at 6 and 18 months.

Parenting Stress Index (PSI)—The PSI is a self-report questionnaire used to measure areas of stress associated with parenting (Abidin, 1990). The PSI was administered at 6 and 18 months. The PSI contains 101 items, which are divided into two domains reflecting major areas of stress in mother-child relationships. The PSI consists of child and parent domains, each with a set of subscales. The subscales in the child domain are designed to reveal stresses the mother may experience from the way she perceives her child and the demands her child makes on her. The 6 child subscales are acceptability, adaptability, demandingness, distractibility, mood, and child reinforces parent. The 7 subscales in the parent domain are sense of competence, attachment, role restriction, depression, relationship with spouse, social isolation, and health. The total child and parent domain scores are summed to give a single PSI score. Higher scores indicate higher levels of stress. The reliability coefficients are .89 for the child domain, .93 for the parent domain and .95 for the Total Stress Score.

Assessment of infant characteristics

Neonatal outcome—The neonatal medical records were reviewed for birth anthropometric measurements (head circumference, length, and birth weight), gestational age, length of stay, and neonatal problems, including neonatal abstinence syndrome. The neonatal abstinence score was used to evaluate NAS in the nursery (Finnegan, Connaughton, Kron, & Emich, 1975).

Development—The Bayley Scales of Infant Development (BSID) was administered at 6, 12 and 18 months (Bayley, 1969). The scales have been standardized on a national sample of children ranging in age from 2 to 30 months. The scales yield a Mental Developmental Index (MDI) and a Psychomotor Developmental Index (PDI), both of which have a mean of 100 and a standard deviation of 16. The MDI assesses vocalizations and early verbal communication; memory, learning, and problem-solving ability; sensory-perceptual discriminations and early evidence of abstract thinking. The PDI assesses the degree of control of the body, coordination of the large muscles, and fine motor skills of the hands and fingers.

Language—The Receptive-Expressive Emergent Language Scale (REEL) was administered at 6, 12, and 18 months, to assess the infant's language skills (Bzoch & League, 1971). This scale has two parts, each making an independent contribution to clinical assessment. The Receptive Language domain measures the infants' decoding skills, or ability to recognize and understand vocabulary and sentences. The Expressive Language domain measures the infants' "encoding skills," or ability to communicate verbally. Standard scores are produced, with lower scores indicating delayed language development.

Data analysis

Statistical analyses were performed using the Statistical Package for Social Science 11.0 (SPSS Inc., Chicago, IL, 1999). An initial analysis was conducted to examine whether there were demographic differences related to sample attrition and substitute caregivers ($n = 265$). The second analysis was limited to 161 infants who remained in the care of their mothers at 18 months. Two MANOVAs were performed comparing the intervention and control groups; one for the maternal demographics and one for the infant characteristics and both were nonsignificant suggesting that the two groups did not differ in terms of maternal or infant characteristics. Level of risk was recoded into four categories (two or fewer, three, four, and five or more), which have adequate cell sizes for use in the repeated measures analysis, while providing more detail about level of risk than would be possible with fewer categories (Table 1).

Cumulative risk and demographics—The following maternal variables were evaluated: demographic variables, 6- and 18-month PSI scores and 6- and 18-month CAP scores. The following infant variables were evaluated: 6-, 12-, and 18-month Bayley motor and mental ratings, and expressive and receptive language scores (REEL).

Cumulative risk and parenting—Two repeated measures analyses were performed to examine whether level of risk was related to parenting attitudes. The first repeated measures analysis examined how perceived parenting stress at 6 and 18 months, for the parent and child domains were related to group (control or intervention) and level of risk (2 or fewer, 3, 4, or 5 or more risks). The second repeated measures analysis examined how child abuse potential (total CAP scores) at 6 and 18 months were related to group and level of risk. Post hoc Tukey comparisons were performed to identify the locus of significant main effects.

Cumulative risk and child development—Two repeated measures analyses were performed to examine whether level of risk was related to child developmental outcomes. The first repeated measures analysis examined how mental and motor scores from the Bayley Scales of Infant Development at 6, 12, and 18 months were related to group (control or intervention) and level of risk (2 or fewer, 3, 4, or 5 or more risks). The second repeated measures analysis examined how language development at 6, 12, and 18 months was related to group and level of risk. Post hoc Tukey comparisons were performed to identify the locus of significant main effects.

Results

Of the initial cohort of 265 mother/infant dyads, at 18 months 161 (62%) infants were with their mother; 42 (16%) were with substitute caregivers and 62 (23%) had no follow-up visit at 18 months. Mothers who completed the 18-month visit were older at the entrance to the study than mothers whose children were with substitute caregivers or who had no follow-up at 18 months (27.6 years vs. 25.4 years, $p < .001$). The demographic characteristics of the 161 mother/infant dyads, by level of risk, are presented in Table 2. The only difference in maternal, neonatal characteristics or drug use between the risk levels was that the women in the highest risk level were younger when they had their first child than the women with fewer risks.

Parenting Stress Index

Parenting Stress Index differed by time, PSI domain, level of risk, and the interaction of time by PSI domain (see Table 3 for F values, df , and significance levels for the significant main and interaction effects); all other main effects and interactions were nonsignificant ($p > .05$). The time by PSI domain interaction indicated that in the child domain, stress

increased from 6 to 18 months ($M = 108.2$ and $M = 116.3$, respectively); however, the parent domain did not change from 6 to 18 months ($M = 134.0$ and $M = 135.3$, respectively). Post hoc Tukey comparisons indicated that perceived parenting stress was higher for women with five or more risks than for women with four or fewer risks at both 6 and 18 months. Perceived parenting stress did not differ for women with two or fewer, three or four risks. See Table 4 for means and standard deviations on the PSI by level of risk and group.

Child Abuse Potential

Child Abuse Potential scores differed significantly by level of risk (see Table 3 for F values, df , and significance levels for the significant main and interaction effect). Post hoc Tukey comparisons indicated that child abuse potential was higher for women with more than five risks than for women with two or fewer at both 6 and 18 months. Child abuse potential did not differ for women with two or fewer, three or four risks. All other main effects and interactions were nonsignificant ($p > .05$). See Table 5 for means and standard deviations on the CAP by level of risk and group.

Mental and motor development

Developmental scores significantly differed by group, time, developmental domain, and the interaction of time by developmental domain (see Table 3 for F values, df , and significance levels for significant main and interaction effects); all other main effects and interactions were nonsignificant ($p > .05$). The time by developmental domain interaction suggests that the change in mental and motor scores differ over time. By 18 months, mean motor scores ($M = 98.9$) are higher than mean mental scores ($M = 92.4$). At earlier points (6 and 12 months) mental and motor scores did not differ. See Table 6 for mental and motor scale means and standard deviations by level of risk and group. Children in the intervention group had significantly higher scores on the PDI at 6 and 18 months (107.4 vs. 103.6 and 101.1 vs. 97.2) and had marginally better scores on the MDI at 6 and 12 months (107.7 vs. 104.2 and 103.6 vs. 100.1) compared to the control group.

Language development

Language scores significantly differed by time and language domain (see Table 3 for F values, df , and significance levels for significant main and interaction effects); all other main effects and interactions were nonsignificant ($p > .05$). Children had higher receptive language scores across all three time periods ($M = 98.3$) than expressive language scores ($M = 97.3$). The time main effect suggests that language scores were lower at 18 months ($M = 95.9$) than at 6 months ($M = 99.4$), but scores at 12 months ($M = 98.2$) did not differ from those at 6 and 18 months, across language domain. See Table 7 for expressive and receptive language means and standard deviations by level of risk and group.

Discussion

This study examined how psychosocial risk factors accumulated over the first 18 months of a child's life influenced changes in parenting attitudes and children's development. The unique aspect of the study is that it focused exclusively on substance-abusing women. Rather than comparing substance-abusing women with nonsubstance-abusing women, we examined how psychosocial risks altered early parenting patterns among a very high-risk group of mothers. Another strength is the inclusion of dynamic risks that emerge over the caregiving period. In addition to static risks, such as family size, life events, psychological status, and severity of drug use, we also included measures of domestic and nondomestic violence and incarceration that occurred after the birth of the study infant, and therefore may have had a direct effect on parenting attitudes.

The risks experienced by these women were often severe and varied considerably. Over 70% reported depressive symptoms and a predominance of negative life events. During the 18-month study period, 20% had been incarcerated, 13% had been homeless, 23% had been a victim of violence, and only 13% had lived consistently with a male partner. The women in the highest risk group (5 or more risks) were younger when they had their first pregnancy, compared to women with fewer risks (Table 2). Younger mothers have a greater chance of being exposed to negative risk factors, including problems with family and coping with stress, which places their infants at greater risk of poor developmental outcome and greater risk of abuse and neglect (Botting, Rosato, & Wood, 1998; Sommer et al., 2000; Wellings, Wadsworth, Johnson, Field, & Macdowall, 1999). Infant outcome at birth revealed no significant differences between the four risk groups, indicating that the infants of high-risk mothers were not inherently different from those of low risk mothers.

Psychosocial risks

As the number of risks increased, women reported more stress related to caring for their children. Effects were stronger at 18 months than earlier in life, probably reflecting the additional challenges that are associated with parenting toddlers, in comparison to infants. In addition, as the number of risks increased, women reported higher CAP scores, suggesting that increasing psychosocial risks may be associated with a greater likelihood of abusing or neglecting their children.

Risk was not related to children's development for the first 18-months of life, either directly or indirectly. That is, children of drug-abusing women with multiple risks were at no greater risk of mental, motor, or language delay than were children of drug-abusing women with few risks. In addition, risk did not moderate the effect of the intervention. The effectiveness of the intervention was equally strong among families, regardless of their level of risk.

One reason for the lack of effects of psychosocial risks on children's development may be the young age of the children. Bernstein and Hans (1994) reported that cumulative psychosocial risk factors were predictive of child mental development among methadone-exposed children at 2 years of age. As the children age into the preschool and school years, the variability in psychosocial risk may become more apparent on their development (Johnson et al., 1999). Sameroff et al. (1987) found that by age 4, children of parents with multiple risks were more likely to experience delays in cognitive development than were children of parents with few risks. In an investigation of toddlers and preschool age children of drug-using mothers, Carta et al. (2001) found that the effects of multiple environmental risks increased over time and were greater for older children (54 months) than for younger children.

Intervention

The intervention was associated with improved scores in both mental and motor development, but not language development. Children in the intervention group had better motor development at 6 and 18 months and did marginally better in mental development at 6 and 12 months compared to the control group. These findings are encouraging, and suggest that within a high-risk population, early intervention can be beneficial. However, factors such as ongoing maternal drug use and domestic violence may limit the effectiveness of interventions (Eckenrode et al., 2000; Schuler et al., 2002). In addition, the limited predictability from early developmental assessments and the high-risk nature of the sample emphasize the importance of long-term follow-up to examine the impact of the intervention over time.

Drug abuse

Drug abuse has associated psychosocial characteristics that place women at increased risk for poor parenting. Psychosocial characteristics that have a negative impact on parenting such as feelings of distress, unhappiness, incompetence and social isolation are common among drug abusers (Barnet et al., 1995; Hans, 1999; Hans et al., 1999). In addition high levels of stressful life events, psychological problems and chaotic home environment, which are also common in drug abusers are strongly related to poor parenting ability and child outcome (Chasnoff et al., 1998; Hans et al., 1999; Jaudes et al., 1995; Sameroff, 1998).

Most of the research among substance-abusing women and their children has compared their parenting environment and their children's development with that of nondrug-abusing women and their children. Although such research can be useful in highlighting differences related to drug use, it does not provide information on the mechanisms linking drug use to parenting behavior or to children's development. The relationship between psychosocial risk and parenting attitudes illustrates the variability that occurs among drug abusing women and the importance of helping women reduce their risk. This group of women may be the best of a very high-risk group, as they returned for scheduled visits over 18 months.

Limited power is a potential issue in this study; Stevens (2002) reports that in a single group repeated measures analysis with an average correlation between repeated measures of .50 and alpha of .05, 24 to 27 participants would be needed to achieve power of .80 for medium effect sizes with four to six repeated measures. Only 13 to 14 participants would be needed for large effect sizes. Although the current study had more than one group, cell sizes ranged from 14 to 33, suggesting that power is adequate to detect at least medium effect sizes; this study probably does not have adequate power to detect small effect sizes.

Conclusion

This study assessed the relationship between cumulative environmental risks and early intervention, parenting attitudes (parenting stress and potential for child abuse) and child development in substance abusing mothers. Research that focuses on the number of risk factors, rather than specific risk factors relies on a theory of risk accumulation (Rutter et al., 2001; Sameroff et al., 1987) that posits a pile-up effect. That is, regardless of the specific risk, as the number of risks increase or when they reach a threshold, there is a negative impact on parenting and on children's development.

Our findings support the detrimental effects of an accumulation of risk over the first 18 months of parenting. Parents reported highest levels of parenting stress and child abuse potential when they had five or more risks, lending perceived support to the detrimental aspect cumulative risks.

The improved developmental outcome in the intervention group is encouraging, and suggests that early home-based intervention can benefit such high-risk families. Longitudinal studies however are needed to determine the long-term effects of early intervention on maternal behaviors and child development. Studies that identify women at risk of poor parenting should take into consideration that high levels of environmental risks may be associated with high levels of parenting-related stress and potential for abuse and neglect. High parenting stress has been associated with long-term detrimental effects on children's physical and emotional well-being. Early intervention, targeted at parenting, reduction of environmental risks and drug treatment may reduce parental stress, prevent abuse and neglect, and promote early child development.

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Table 1

Level of cumulative risk for control and intervention groups

Number of risks	Risk level	Frequency (%)		
		Control group ^a	Intervention group	Total ^b
0–2	1	21 (23)	17 (24)	38 (24)
3	2	34 (37)	15 (21)	49 (30)
4	3	21 (23)	14 (20)	35 (22)
5–8	4	15 (16)	24 (34)	39 (24)
Total ^b		91 (57)	70 (43)	161 (100)

^aPercent within group.^bPercent within total.

Table 2

Maternal and neonatal characteristics by level of risk

	0-2 risks (N = 38)		3 risks (N = 49)		4 risks (N = 35)		5 or more risks (N = 39)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Maternal characteristics								
Age at 1st pregnancy	19.5	4.3	19.4	4.3	18.5	5.8	16.9	2.4*
Age at entrance into study	27.3	5.8	28.8	4.8	28.1	5.6	25.9	5.1
Education	10.9	1.5	11.1	1.7	10.9	1.6	10.5	1.5
Used heroin in pregnancy (%)	57		70		80		76	
Used cocaine in pregnancy (%)	57		64		60		62	
Used heroin and/or cocaine in pregnancy (%)	81		87		86		89	
Positive urine toxicology at delivery (%)								
Heroin	31		42		53		35	
Cocaine	63		63		59		59	
Neonatal characteristics								
Length of hospital stay	5.0	4.8	5.1	8.0	5.3	7.0	4.5	4.7
Birth weight (g)	2781	500	2810	398	2742	390	2759	488
Birth length (cm)	48.2	3.0	48.4	2.8	47.4	2.3	47.7	2.7
Head circumference (cm)	32.5	1.4	32.9	1.2	32.7	1.5	32.8	1.7
Gestational age (week)	38.8	2.5	38.4	2.2	38.7	2.2	38.4	1.8
Neonatal abstinence (%)	32		35		46		45	

*
 $p = .025$.

Table 3

Significant main and interaction effects for the repeated measures analyses for Parenting Stress, Child Abuse Potential, Development, and Language Outcomes

Outcome	Effect	F	Hypothesis df	Error df	Significance
Parenting Stress	Time	15.64	1	148	<.0005
	Parent/child domain	513.34	1	148	<.0005
	Time $\times$ domain	21.39	1	148	<.0005
	Risk	9.08	3	148	<.0005
Child Abuse Potential	Risk	11.70	3	148	<.0005
Bayley Mental and Motor Development	Group	6.54	1	142	<.012
	Time	43.40	2	141	<.0005
	Domain	7.26	1	142	.008
	Time $\times$ domain	16.31	2	141	<.0005
Receptive and Expressive Emergent Language	Time	4.50	2	142	.013
	Domain	8.83	1	143	.003

Table 4

Parenting Stress Index child and parent domain scores at 6 and 18 months by level of risk

Level of risk	Control ^a		Intervention ^b		Total group ^c	
	Mean	SD	Mean	SD	Mean	SD
PSI child domain at 6 months						
0–2 risks	104.7	13.0	109.1	13.0	106.6	13.0
3 risks	104.3	16.7	103.3	8.4	104.0	14.5
4 risks	111.0	17.7	103.5	14.0	108.0	16.5
5 or more risks	115.4	12.1	115.3	12.2	115.4	12.0
Total	107.7	15.9	108.8	12.9	108.2	14.6
PSI parent domain at 6 months						
0–2 risks	121.6	17.1	132.2	16.4	126.3	17.4
3 risks	127.9	21.9	129.4	12.4	128.4	19.3
4 risks	135.2	15.6	135.1	15.8	135.1	15.4
5 or more risks	143.7	19.4	147.5	19.0	146.0	19.0
Total	130.7	20.2	137.4	17.8	134.0	19.4
PSI child domain at 18 months						
0–2 risks	109.8	10.9	117.3	17.0	113.2	14.3
3 risks	114.2	14.7	108.7	13.5	112.4	14.4
4 risks	118.3	22.2	114.0	12.0	116.5	18.7
5 or more risks	125.6	18.9	123.3	13.6	124.0	15.6
Total	116.0	17.3	116.8	14.9	116.3	16.3
PSI parent domain at 18 months						
0–2 risks	124.8	10.4	135.5	17.4	129.6	14.8
3 risks	134.2	18.5	127.6	10.3	132.1	16.5
4 risks	136.0	20.0	135.4	10.4	135.7	16.6
5 or more risks	143.4	23.2	145.6	18.1	144.8	19.9
Total	133.9	18.9	137.1	16.3	135.3	17.8

^aControl group: Risks 0–2 $N = 20$; 3 risks $N = 33$; 4 risks $N = 21$; 5 or more risks $N = 14$; total $N = 88$.

^bIntervention group: Risks 0–2 $N = 16$; 3 risks $N = 15$; 4 risks $N = 14$; 5 or more risks $N = 23$; total $N = 68$.

^cSignificance of 5 or more risks vs. fewer than 5 risks: PSI child domain at 6 months, $p = .001$; PSI parent domain at 6 months, $p = .003$; PSI parent domain at 18 months, $p = .006$; PSI child domain at 18 months, $p = .001$.

Table 5

Child Abuse Potential (CAP) total scores at 6 and 18 months by level of risk

Level of risk	Control ^a		Intervention ^b		Total group ^c	
	Mean	SD	Mean	SD	Mean	SD
CAP total at 6 months						
0-2 risks	112.7	69.9	149.4	67.3	129.0	70.2
3 risks	180.2	174.2	162.0	100.8	174.5	154.1
4 risks	175.2	90.2	164.5	91.3	170.9	89.4
5 or more risks	260.4	99.3	266.7	100.9	264.4	99.0
Total	176.4	132.9	195.0	103.9	184.6	121.1
CAP total at 18 months						
0-2 risks	101.0	60.4	146.6	83.4	122.5	72.1
3 risks	165.5	99.2	166.7	109.1	165.8	101.2
4 risks	183.7	91.7	148.1	74.1	169.4	85.8
5 or more risks	234.8	107.2	236.4	99.1	235.8	100.8
Total	166.2	99.4	181.7	99.7	173.0	99.5

^aRisks 0-2 $N = 20$; 3 risks $N = 33$; 4 risks $N = 21$; 5 or more risks $N = 14$; total $N = 88$.

^bRisks 0-2 $N = 16$; 3 risks $N = 15$; 4 risks $N = 14$; 5 or more risks $N = 23$; total $N = 68$.

^cSignificance of 5 or more risk vs. fewer than 5 risks: CAP score at 6 months, $p = 0.001$; CAP score at 18 months, $p = .001$.

Table 6

Bayley Mental and Motor Scales at 6, 12, and 18 months by level of risk

	Control ^a		Intervention ^b		Total	
	Mean	SD	Mean	SD	Mean	SD
Mental Score at 6 months						
0–2 risks	104.1	14.3	112.7	16.8	107.8	15.8
3 risks	107.2	14.1	109.7	18.3	107.9	15.3
4 risks	100.5	7.9	104.6	9.2	102.2	8.6
5 or more risks	102.3	13.4	104.7	11.8	103.8	12.3
Total mean scores	104.2	12.9 ^c	107.7	14.3 ^c	105.7	13.6
Motor Scores at 6 months						
0–2 risks	105.3	12.6	111.7	13.6	108.1	13.2
3 risks	104.3	13.6	108.1	16.4	105.4	14.4
4 risks	103.2	11.3	106.6	11.8	104.6	11.5
5 or more risks	100.0	13.8	104.3	11.4	102.7	12.4
Total mean scores	103.6	12.8 ^d	107.4	13.2 ^d	105.2	13.1
Mental Scores at 12 months						
0–2 risks	99.9	8.4	106.6	12.3	102.7	10.6
3 risks	101.7	14.0	98.6	11.2	100.8	13.2
4 risks	99.2	14.0	103.8	9.0	101.1	12.3
5 or more risks	97.5	8.6	104.6	11.5	101.9	10.9
Total mean scores	100.1	12.1 ^e	103.6	11.2 ^e	101.6	11.8
Motor Scores at 12 months						
0–2 risks	98.4	12.5	110.1	9.2	103.2	12.5
3 risks	104.3	17.7	97.2	17.1	102.3	17.7
4 risks	97.2	15.3	101.7	13.4	99.1	14.5
5 or more risks	95.5	11.4	100.6	11.6	98.7	11.6
Total mean scores	100.0	15.4	102.3	13.4	101.0	14.6
Mental Scores at 18 months						
0–2 risks	88.8	11.9	95.0	15.0	91.5	13.4
3 risks	90.9	13.0	95.7	20.6	92.3	15.5

	Control ^a		Intervention ^b		Total	
	Mean	SD	Mean	SD	Mean	SD
4 risks	91.6	12.7	91.6	9.0	91.5	11.2
5 or more risks	93.0	12.5	95.0	15.2	94.2	14.1
Total mean scores	90.9	12.4	94.4	15.2	92.4	13.7 ^g
Mental Scores at 18 months						
0–2 risks	95.0	9.6	104.9	6.4	99.3	9.6
3 risks	97.9	8.9	98.7	9.7	98.2	9.0
4 risks	97.2	10.7	101.1	8.3	98.8	9.8
5 or more risks	98.4	7.2	100.1	8.4	99.4	7.9
Total mean scores	97.2	9.2 ^f	101.1	8.3 ^f	98.9	9.0 ^g

^aControl group: Risks 0–2 $N = 20$; 3 risks $N = 33$; 4 risks $N = 21$; 5 or more risks $N = 14$; total $N = 88$.

^bIntervention group: Risks 0–2 $N = 16$; 3 risks $N = 15$; 4 risks $N = 14$; 5 or more risks $N = 23$; total $N = 68$.

^cIntervention > control, $p = .055$.

^dIntervention > control, $p = .041$.

^eIntervention > control, $p = .08$.

^fIntervention > control, $p = .01$.

^gMotor > mental, $p < .05$.

Table 7

Receptive and expressive language at 6, 12 and 18 months by level of risk

Level of risk	Control ^a		Intervention ^b		Total	
	Mean	SD	Mean	SD	Mean	SD
REEL receptive language at 6 months						
0–2 risks	100.0	9.6	103.9	15.2	101.7	12.2
3 risks	102.7	8.8	97.9	11.1	101.3	9.6
4 risks	96.0	7.1	99.8	13.4	97.6	10.2
5 or more risks	97.0	9.9	99.7	8.6	98.7	9.0
Total mean scores	99.7	9.1	100.3	11.8	99.9	10.3
REEL expressive language at 6 months						
0–2 risks	101.7	7.6	104.0	13.8	102.7	10.6
3 risks	98.1	5.3	97.1	11.2	97.8	7.4
4 risks	96.8	6.5	100.7	9.8	98.4	8.1
5 or more risks	95.8	8.2	99.0	10.5	97.8	9.7
Total mean scores	98.3	6.8	100.1	11.4	99.1	9.1
REEL receptive language at 12 months						
0–2 risks	98.8	7.2	103.6	10.2	100.8	8.8
3 risks	99.1	7.3	98.5	10.4	98.9	8.2
4 risks	98.0	8.0	98.1	6.3	98.1	7.2
5 or more risks	95.4	6.5	96.7	8.8	96.2	8.0
Total mean scores	98.2	7.3	99.0	9.2	98.5	8.2
REEL expressive language at 12 months						
0–2 risks	98.3	6.7	103.6	10.2	100.6	8.7
3 risks	96.4	8.3	96.8	9.8	96.5	8.7
4 risks	97.4	9.6	97.4	6.5	97.4	8.3
5 or more risks	95.3	5.6	98.9	9.9	97.6	8.7
Total mean scores	96.9	7.9	99.2	9.5	97.9	8.6
REEL receptive language at 18 months						
0–2 risks	96.6	9.6	101.3	12.1	98.3	10.7
3 risks	95.2	10.0	98.6	15.5	96.3	11.8

Level of risk	Control ^a		Intervention ^b		Total	
	Mean	SD	Mean	SD	Mean	SD
4 risks	92.9	9.1	98.1	10.1	95.0	9.7
5 or more risks	97.2	11.5	95.9	11.0	96.3	11.1
Total mean scores	95.3	9.9	98.2	12.1	96.6	11.0
REEL expressive language at 18 months						
0–2 risks	96.0	10.6	97.9	15.3	96.8	12.7
3 risks	94.9	13.0	96.7	20.3	95.4	15.2
4 risks	91.0	11.7	94.9	12.6	92.6	12.0
5 or more risks	90.8	19.9	96.9	11.1	93.5	15.0
Total mean scores	93.6	13.4	96.6	14.4	94.9	13.9

^a Control group: Risks 0–2 $N = 20$; 3 risks $N = 33$; 4 risks $N = 21$; 5 or more risks $N = 14$; total $N = 88$.

^b Intervention group: Risks 0–2 $N = 16$; 3 risks $N = 15$; 4 risks $N = 14$; 5 or more risks $N = 23$; total $N = 68$.