Published in final edited form as:

Child Psychiatry Hum Dev. 2012 December ; 43(6): 943–957. doi:10.1007/s10578-012-0305-2.

Perceived Child Behavior Problems, Parenting Stress, and Maternal Depressive Symptoms Among Prenatal Methamphetamine Users

Brandi D. Liles,

Department of Psychology, University of Tulsa, 800 South Tucker Drive, Tulsa, OK 74104-3189, USA

Elana Newman,

Department of Psychology, University of Tulsa, 800 South Tucker Drive, Tulsa, OK 74104-3189, USA

Linda L. LaGasse,

Center for the Study of Children at Risk, Women and Infant's Hospital, Warren Alpert Medical School of Brown University, Providence, RI, USA

Chris Derauf,

Department of Pediatric & Adolescent Medicine, Mayo Clinic, Rochester, MN, USA

Rizwan Shah,

Blank Hospital, Regional Child Protection Center-Children-Iowa Health, Des Moines, IA, USA

Lynne M. Smith,

LABioMed Institute at Harbor-UCLA Medical Center, David Geffen School of Medicine at UCLA, Los Angeles, CA, USA

Amelia M. Arria,

Center on Young Adult Health and Development, University of Maryland School of Public Health, College Park, MD, USA

Marilyn A. Huestis,

Intramural Research Program, National Institute on Drug Abuse, National Institutes of Health, Baltimore, MD, USA

William Haning,

John A. Burns School of Medicine, University of Hawaii, Honolulu, HI, USA

Arthur Strauss,

Miller Children's Hospital at Long Beach (MCHLB), Long Beach, CA, USA

Sheri DellaGrotta,

Center for the Study of Children at Risk, Women and Infant's Hospital, Warren Alpert Medical School of Brown University, Providence, RI, USA

Lynne M. Dansereau,

Center for the Study of Children at Risk, Women and Infant's Hospital, Warren Alpert Medical School of Brown University, Providence, RI, USA

Charles Neal, and

John A. Burns School of Medicine, University of Hawaii, Honolulu, HI, USA

Barry M. Lester

Center for the Study of Children at Risk, Women and Infant's Hospital, Warren Alpert Medical School of Brown University, Providence, RI, USA

Brandi D. Liles: brandi-sebourn@utulsa.edu; Elana Newman: elana-newman@utulsa.edu

Abstract

The present study was designed to examine parenting stress, maternal depressive symptoms, and perceived child behavior problems among mothers who used methamphetamine (MA) during pregnancy. Participants were a subsample ($n = 212$; 75 exposed, 137 comparison) of biological mothers who had continuous custody of their child from birth to 36 months. The subsample was drawn from a larger, ongoing longitudinal study on the effects of prenatal methamphetamine exposure ($n = 412$; 204 exposed, 208 comparison) (Arria et al in *Matern Child Health J* 10:293–302 2006). Mothers who used MA during pregnancy reported more parenting stress and more depressive symptoms than a matched comparison group. There were no differences between groups on perceived child behavior problems. In a hierarchical linear model, depressive symptoms, and perceived child behavior problems, but not MA exposure, were statistically significant predictors of parenting stress. Screening for potential parenting problems among mothers with a history of substance abuse is warranted. Parenting interventions targeting depressive symptoms, parenting stress, and child behavior problems are needed for this population.

Keywords

Parenting stress; Prenatal drug exposure; Methamphetamine; Child behavior problems; Maternal depression

Introduction

Methamphetamine (MA) is a highly addictive stimulant that affects the central nervous system by promoting the release of neurotransmitters, such as dopamine, serotonin, and norepinephrine. According to the 2007 National Survey on Drug Use and Health [2], 1.4 million persons aged 12 or older used MA at least once within the last year. Moreover in 2008, 4.5 % of pregnant women aged 15–44 years, used an illicit drug in the past month [3]. Clinicians and researchers note that MA use among pregnant women is a growing concern [4]. Among 29,494 women giving birth in California, the Infant Development, Environment, and Lifestyle (IDEAL) study found 0.7 % of women reported using an amphetamine during pregnancy [5]. Similarly, 0.7 % of 436 mothers in Hawaii reported using MA during pregnancy [6]. Among 1,632 mothers giving birth in areas known for high MA use, 5.2 % of mothers used MA during pregnancy [1]. Despite increasing evidence that pregnant women use MA, studies on its effects on child development are just beginning.

Few studies have examined the prevalence of MA use during pregnancy and its adverse effects. Among 28 MA exposed infants compared to 45 non-drug exposed infants, MA infants had lower gestational age, shorter birth length, and a smaller occipitofrontal circumference [7]. In addition to length and head circumference, another study found that 52 MA exposed infants had smaller birth weight than 52 non-drug exposed infants [8]. In addition to MA's adverse effects on the infant, the parenting characteristics of mothers who used MA during pregnancy may influence their child's development. Previous research suggests that MA-using mothers are more likely to have ongoing legal difficulties, more substance-using family and friends, greater likelihood of developing a substance use disorder, lower quality of life perceptions, and fewer prenatal care visits, than non MA-using

mothers at their child's birth [9]. Further, MA-using mothers were more likely to be younger, poorer, single, and less educated than non MA-using mothers at their child's birth. MA-using mothers were more likely to use other abusive substances and be involved in domestic violence than a non-MA using control group at their child's birth [9–11]. However little is known about MA-using mothers and their parenting experiences, as their children grow older. Although research suggests that maternal substance abuse is a risk factor for poor parenting and child behavior problems [12], maternal MA use and parenting have not been specifically studied. Understanding potential problems in MA families can help inform future screening and intervention procedures to facilitate healthy family functioning.

Parenting Stress

Parenting stress is defined as the aversive psychological reaction to the demands of being a parent [13], typically when the demands of being a parent are not matched with the perceived resources available to the parent. While all parents may experience a low degree of parenting stress, high levels of parenting stress may have serious negative effects on the family and the parent's psychological health and overall well-being [13]. High levels of parenting stress have been linked with substance use, depression, and perceived child behavior problems [14–19].

Substance Abuse and Parenting Stress—Studies with small samples of treatment-engaged substance-using mothers have indicated that these mothers report high levels of parenting stress [14–16] more maladaptive parent–child interactions [14], more childcare difficulties [14], and lower awareness and supervision of their child's activities [16]. Further, parenting stress mediated the relationship between sociodemographic risk and maladaptive parenting in 74 mothers recruited from a methadone-maintenance clinic. Thus, sociodemographic risk may function as a distal stressor reducing the mother's tolerance of stress [20], although these findings require replication. Moreover, parenting stress among MA-using mothers not seeking treatment is unexamined. Previous research has suggested that non treatment-seeking drug abusers may have less social and emotional problems than treatment-seeking users but may still warrant intervention [21]. It is unknown if non treatment seeking mothers will exhibit parenting problems, such as parenting stress.

Parenting Stress and Depression—Research has indicated that depression is correlated with parenting stress; for example, 77 depressed mothers reported higher parenting stress during depression episodes than 35 non-depressed mothers [17]. Similarly, 73 % of 162 depressed mothers reported parenting stress scores that indicated clinically dysfunctional parent–child relationships [18]. Maternal depression was the strongest predictor of parenting stress in 61 parents of biologically vulnerable toddlers [19]. Given that depression is an attribute that has been linked to substance use in general [22, 23] and MA use specifically [24–26], examination of the relationship between maternal depression and parenting stress among MA-using mothers is warranted.

Parenting Stress and Perceived Child Behavior Problems—Mothers who rate their children's behavior as problematic have reported high parenting stress [27–30]; however the direction of the relationship is unknown. Children with behavior problems may create ongoing stress for mothers and affect the mother's confidence in her ability to care for the child [31]. Further, mothers who exhibit high parenting stress may perceive their child as being more difficult [32]. Perhaps, the relationship between parenting stress and child behavior problems is multidirectional.

Caregiver reports of problematic behavior among substance-exposed children have been inconsistent in the literature [33]. Among children under 7 years old, several studies found

no or subtle differences in caregiver reports of behavioral problems in cocaine or cocaine and opiate exposed and non-exposed children [34–37]; one study found more behavioral problems (i.e. aggression) in cocaine-exposed 3-year-olds when compared to a non-exposed comparison group [38]. Among samples, which included older children (ages 2–18), higher reports of externalizing and internalizing behavior among cocaine-exposed children were found when compared to children not prenatally exposed to cocaine [39, 40]. However, in one study of 607 child-parent dyads, parenting stress reported when the child was 4 months significantly predicted child externalizing behavior at 36 months old irrespective of cocaine exposure [34]. Given the contradictory findings and the sole emphasis on prenatal exposure to cocaine and/or opiates, research endeavors must examine if reported child problematic behavior of preschoolers is linked with prenatal MA exposure.

Depression and Child Behavior Problems—Depression has been linked with increased child behavior problems, although the relationship direction is mostly unknown [41]. Child behavior problems may increase maternal depressive symptoms [42] or maternal depression may indirectly influence child behavior problems through poor parenting practices [43–45]. Lastly, mothers with depressive symptoms may inflate perceived child behavior problems [46, 47] with increased reporting of externalizing behavior problems for sons and internalizing behavior problems for daughters.

Study Aims

Maternal parenting stress has been associated with maternal substance abuse [14–16, 20, 21], maternal depression [17–19], and perceived child behavior problems [27–34]. Further, relationships exist between substance abuse and depression [22–26] as well as depression and perceived child behavior problems [41–47]. Therefore, examining these factors simultaneously among mothers who used MA during pregnancy could give a more comprehensive understanding of the problems experienced by this population. This study examined parenting stress, depressive symptoms, and perceived child behavior problems among mothers of MA-exposed toddlers compared to mothers of non MA-exposed toddlers controlling for race, age, income, marital status, number of children under 18 living in the home, site from which the mother was recruited, other prenatal use (alcohol, tobacco, and marijuana), and postnatal MA use. It was hypothesized that mothers who used MA during pregnancy would report more depressive symptoms, more parenting stress and perceive their child's behavior as more problematic than the matched comparison group. Also, it is hypothesized that MA use, depressive symptoms, and perceived child behavior problems would significantly predict parenting stress. Finally, it is hypothesized that maternal depressive symptoms would moderate the relationship between perceived child behavior problems and parenting stress.

Methods

The 212 mother–child dyads included in the current study are a subset of the participants in the Infant Development, Environment and Lifestyle (IDEAL) Study, an ongoing longitudinal study [1]. Mother–child dyads were recruited, shortly after the infants' birth, from hospitals in specific geographical areas known to have high MA use including Iowa, Oklahoma, Hawaii, and California. Mothers were approached in the hospitals between delivery and discharge. The study screened 34,833 mother–child dyads at the time of the infant's birth. Of those, 26,999 mothers were available and screening for eligibility and approached for participation. After screening, 17,961 were eligible for the study, and 3,705 consented to be part of the study. Exclusionary criteria for mothers included: (1) Non-English speaking (17.7 %), (2) Severe psychological impairment (0.1 %), (3) Low cognitive functioning (0.2 %), (4) Less than 18-years-old (3.5 %), and (5) Cocaine, Opiate, LSD/

Hallucinogens, or PCP use (2.2 %). Exclusionary criteria for infants included: (1) Multiple birth (4.5 %), (2) Congenital or chromosomal anomalies (0.5 %), (3) Unlikely to survive (0.5 %), and (4) Overt TORCH (Toxoplasmosis, Other Agents, Rubella, Cytomegalovirus, Herpes Simplex) infection (0.07 %).

Only mothers with prenatal MA use ($n = 204$) and their matched comparisons ($n = 208$) were enrolled in the longitudinal study. MA exposure was identified through both mothers' self-report and/or gas chromatographic/mass spectrometric confirmation in meconium. To be considered for the comparison group, mothers denied MA use during pregnancy and had a negative MA screen. Comparison mothers were matched to the MA exposure group based on child's birth weight, maternal race and education, and type of insurance. A National Institute on Drug Abuse Certificate of Confidentiality was obtained for the project to assure confidentiality of information and truthfulness in reporting the mother's drug use. Before administering interviews, a gold standard reviewer certified interviewers to ensure intersite reliability on standardized methods. After the initial visit at the child's birth, follow-up visits were conducted when the child was 1, 12, 24 and 36 months. The Institutional Review Board at all participating sites approved the procedures. All participants reviewed and signed a written informed consent. Unless otherwise specified, data for the current study was collected at the 36 month visit. The 36 month visit lasted approximately 3 h. At the end of each visit, the parent and child received an incentive for their time and effort.

Participants

Of the 412 participants in the multisite follow-up study, only 212 biological mothers maintained continuous custody of their children from birth to 36 months (137 matched comparison and 75 prenatally MA-using). The primary reason children were not in the continuous care of their biological mothers was due in large part to physician's mandatory reporting of mother's illicit drug use during pregnancy, resulting in protective services placing children outside the care of their biological mother. The comparison group is larger since this group was more likely to have continuous custody of their child at 36 months old than the MA group. After comparing the demographic characteristics of those included in the study to those excluded, the only statistically significance difference found was that participants in the current study used less tobacco prenatally than the excluded subjects ($p < 0.01$).

Measures and Procedures

Mothers were contacted to schedule a visit at the various clinics when the child was approximately 36-months-old. While the child was given various assessments, a trained interviewer administered the following subset of measures to the mother:

Lifestyle Interview (LI)—The LI was developed for the Maternal Lifestyle Study, a study that examined information about cocaine-abusing mothers, and has been slightly modified for MA-abusing mothers [48]. This structured interview included information about the course of pregnancy, household composition, demographics (SES, education, age, race, and marital status), type of home and environment, services the family receives, changes in residency, details about child protective services involvement, and licit and illicit drug use during pregnancy including tobacco, alcohol, and marijuana use. Education and occupation information were collected to calculate the 4-factor Hollingshead Index of Socioeconomic Status. Participants completed the LI at each visit to update previous information. Administration time was approximately 30 min. The LI, administered at both the child's birth and at the 36-month visit, was used in this study.

Substance Use Inventory (SUI)—The SUI [49], based on the Maternal Inventory Substance Use (MISU) [50], is a structured interview that elicits retrospective reports of frequency and quantity of drug and alcohol use. The MISU was developed on the basis of self-reported tobacco use, which was well validated in a meta-analysis [51]. In this study, the SUI was administered at enrollment and focused on reports of frequency and quantity of drug and alcohol use during each trimester of the pregnancy and the 3 months prior to pregnancy. The questions were designed by using similar language and items regarding prenatal substance use from related studies [50, 52–55]. The mothers were asked to recall which drugs they had used during this pregnancy, how often, how much, and the maximum amount used. Target drugs on the SUI included MA, ecstasy, other amphetamines, cocaine, tobacco, alcohol, marijuana, hashish, benzodiazepines/tranquilizers, and barbiturates/sedatives. Additional details (e.g. cost, route of administration and age at first use) were obtained for MA, ecstasy, and other amphetamines. The 36 month SUI asked the same frequency and quantity questions for drug and alcohol use as did the SUI at enrollment, except past year use was the reference period. Reliability over time for the SUI is demonstrated by comparing self-report of prenatal substance use reported on the LI at recruitment versus the self-reported use on the SUI at enrollment. Less than 1 % of mothers changed their report of prenatal substance use at that time. Administration time was approximately 15–20 min.

Beck Depression Inventory (BDI-II)—The BDI-II [56] was a 21-item self-report instrument that measured the intensity of depressive symptoms in the mother. Although it is based on DSM-IV criteria for depression, the measure is not diagnostic. Each item consisted of four statements that increase in intensity of depressive quality, and the respondent selected the statement that best describes how she felt during the past 2 weeks. Items are summed to produce a single depression summary score. Further, raw scores of 14–19, 20–28, and 29–63 are indicative of mild, moderate, and severe depression, respectively [56]. Psychometric evaluations of the BDI-II revealed that the measure is reliable and valid. Internal consistency correlations ranged from 0.90 to 0.93 [56–59] and 1-week test–retest reliability was 0.93 [56]. Good convergent and discriminate validity of the BDI-II was found when correlated with measures of depression and anxiety [56, 60]. Similar psychometric properties were found for treatment and non-treatment seeking substance users [61, 62]. For this study, the BDI-II was administered via interview to the mother at the 36-month visit with an internal consistency of 0.92.

Parenting Stress Index: Short Form (PSI)—The PSI [63] was a 36-item questionnaire that measured stress arising from parenting. The PSI was administered via interview. The participant rated each item on a 5-point Likert scale ranging from *strongly agree* to *strongly disagree*. Items were summed to produce a Total Stress score. Raw scores at or above 90 were considered clinically significant. Internal consistency coefficients ranged from 0.78 to 0.91 [63, 64] and 6-month test–retest reliability ranged from 0.68 to 0.84 [63]. Similar internal consistency coefficients have been found in substance-using mothers [14]. In a convergent and discriminate validity study, the PSI was correlated with measures of parent psychopathology, parental perceptions of child adjustment, and observed parent and child behaviors while still predicting a unique amount of variance when controlling for other measures [65]. For this study, the PSI was administered via interview to the mother at the 36-month visit with an internal consistency of 0.85.

Child Behavior Checklist for Ages 1.5–5 (CBCL)—The CBCL for Ages 1.5–5 [66] was a 103-item caregiver-report questionnaire that measures perceived child behavior problems. The mother rated their child's behavior on a 3-point scale ranging from *not true* to *very true/often true*. Items are summed to produce three broadband scales including,

Internalizing, Externalizing, and Total Behavior Problems. For each scale, raw scores were converted to T scores based on the normative sample. T scores at or above 70 were considered clinically significant. T scores of 65–70 were considered “at-risk” for behavioral problems. Test–retest ranged from 0.74 to 0.96 and construct validity ranged from 0.84 to 0.90 [66]. For this study, the CBCL was administered via interview to the mother at the 36-month visit with an internal consistency of 0.90.

Statistical Analysis

Maternal characteristics were examined using one-way analysis of variance (ANOVA) for continuous measures or Chi-square for categorical measures. Independent samples *t* tests were used to examine parenting stress between mothers who used MA during pregnancy and comparison mothers.

Hierarchical linear models using SAS PROC MIXED (version 9.1.3, SAS Institute, Cary, NC) examined the effects of prenatal MA exposure, depressive symptoms, and perceived child behavior problems on parenting stress at 36 months of age, after controlling for covariates. Site was included to address the nesting structure within study site. Covariates adjusted for in the models included maternal race, marital status, income, age, number of children under 18 living in the home, prenatal use of alcohol (oz absolute/alcohol/day), tobacco (average cigarettes per day), and marijuana (average joints per day), and postnatal MA use (average number of days per week of use). Covariates were selected on the basis of conceptual reasons, published research, and maternal characteristics that differed between MA exposure and comparison groups ($p < 0.05$) if not highly ($r < 0.70$) correlated with other covariates.

To examine the interaction between maternal depressive symptoms and perceived child behavior problems and to eliminate the problems of multicollinearity, main effect variables were first grand mean centered and then an interaction term was created from the product of the centered variables.

Results

Table 1 reports race of the mother, age of the mother at the child’s birth, number of children under 18 living in the home, and prenatal use of alcohol, tobacco, and marijuana. Of the 212 children, 46.2 % were girls and 53.8 % were boys. Table 2 compares marital status, education, income, insurance status, and self-reported MA use between the MA and comparison mothers at the birth and at the 36-month visit.

Demographics collected at both birth and 36 months suggest more mothers reported being married or living with a partner and income above \$20,000 at the 36-month visit. Comparison mothers had higher income at their child’s birth, and were more likely to be married or living with a partner than MA-using mothers at both visits (Table 2).

In addition, MA use is reported for the exposure group at both visits. As expected, the majority of mothers in the MA group self-reported using MA at least once during the pregnancy. One mother in the MA group denied MA use during pregnancy; however, the child’s meconium tested positive for MA. A small proportion of MA mothers reported using MA within the year before the 36 month visit.

At the 36-month visit, MA mothers reported statistically significant higher parenting stress scores ($M = 78.33$, $SD = 17.90$) than comparison mothers ($M = 72.25$, $SD = 16.72$), $t(210) = -2.42$, $p < 0.05$, $d = 0.35$). Eighteen percent of mothers reported clinically significant parenting stress with raw scores at or above 90. Clinically significant parenting stress among

MA mothers (24 %) and comparison mothers (15 %) was not statistically significant ($\chi^2(1, 212) = 2.35, p = 0.13$).

In addition, depression scores were compared between MA mothers and comparison mothers with MA mothers reporting statistically significant higher levels of depressive symptoms ($M = 11.07, SD = 10.46$) than comparison mothers ($M = 7.64, SD = 6.88$), $t(210) = -2.87, p < 0.05, d = 0.39$ (Table 3). Twenty-three percent of the sample exhibited clinically significant depressive symptoms (BDI score = 14+), with MA mothers (30.7 %) more likely than comparison mothers (19 %) to exhibit clinical depressive symptoms ($\chi^2(1, 212) = 3.72, p = 0.05$).

When perceived child behavior problems were compared between mothers who used MA during pregnancy and comparison mothers when their child was 36-months-old, no statistically significant differences emerged for total behavior problems $t(210) = -1.01, p = 0.31, d = 0.14$. Approximately 30 % of mothers reported at-risk or clinically significant child behavior problems ($M = 54.05, SD = 9.6, \text{range} = 48\text{--}76$) with T scores at or above 65. In addition, no statistically significant differences were found for the Externalizing, $t(210) = -1.46, p = 0.14, d = 0.24$, or Internalizing subscales, $t(210) = -1.03, p = 0.30, d = 0.10$ (Table 3).

To determine if MA use, maternal depressive symptoms, and perceived child behavior problems predicted parenting stress, hierarchical linear regression was conducted with total PSI score as the dependent variable (Table 4). In an initial model, all the covariates were entered. Race, income, number of children under 18 living in the home, prenatal alcohol, tobacco and marijuana use, and postnatal MA use were not significant predictors of parenting stress and were removed from subsequent models. Prenatal MA use, Total BDI scores, and CBCL Total Problem scores were then entered into the model. There were no significant differences in PSI score between the MA exposed and comparison groups ($p = 0.14$). However, total BDI scores and CBCL total problems scores were associated with higher total PSI scores ($p = 0.01$ for both). The addition of the interaction term to this model was not significant ($p = 0.67$).

Discussion

Among mothers with continuous custody of their children from birth to 36 months old, mothers who used MA during pregnancy reported more depressive symptoms and parenting stress, but not more perceived child behavior problems, than mothers who did not use MA during pregnancy. Findings of higher parenting stress and depression in MA mothers are consistent with previous research on cocaine and parenting stress [14, 15] and MA use and depression [25]. This is the first known study to document parenting stress later in child rearing among mothers who used MA during pregnancy. Further, the findings of no differences in behavior problems between MA exposed and comparison children, add to the current literature finding of subtle to no differences in caregiver reports of behavior between younger cocaine-exposed and comparison children [33–37]; however more robust behavioral differences may be found as exposed children get older [39, 40].

The best predictor of parenting stress after controlling for age, race, marital status, income, number of children living in the home, prenatal alcohol, tobacco, and marijuana use, and postnatal MA use was perceived child behavior. Thus, regardless of MA exposure at birth, child behavior problems were linked to maternal stress when their child was 36 months old. However, the direction of this relationship is unknown.

Depressive symptoms did not moderate the relationship between perceived child behavior problems and parenting stress. Previous research has suggested that depressed mood in

mothers can inflate their report of child behavior problems [46]; however, this finding was not supported in this sample. A plausible explanation for the lack of unique effect of maternal depressive symptoms is that the majority of mothers (88 %) reported minimal or mild depressive symptoms. Minimal or mild depressive symptoms may not distort a mother's perception of her child's behavior. In contrast, perceived child behavior problems could significantly influence parenting stress regardless of maternal depressive symptoms.

Strikingly, the majority of both mothers of MA-exposed and non MA-exposed children in this study were not experiencing significant problems when their child was 36 months old; this may be due to the fact that only 11 % of mothers were currently using MA. Current MA use may affect maternal depressive symptoms, parenting stress, and perceived child behavior problems. It would be useful to understand more about the 89 % of women who ceased MA use at least a year prior to their child turning 36 months old. Further, the current study only included mothers who had continuous custody of their children from birth to 36 months old. It may be possible that the majority of mothers continuing to use MA after their child's birth no longer have primary custody of their children.

There are several limitations to the current study. The differences between mothers who did and did not use MA should be interpreted cautiously as effect sizes were small indicating only a slight difference between groups on parenting stress and depressive symptoms. The variance of depressive symptoms among the mothers was restricted, with only a small percentage reporting above mild symptoms. In addition, the BDI-II examined acute depressive symptoms (i.e. last 2 weeks) which may not adequately represent the mothers' mood throughout the entire year. Since the study relied on self-reported measures of parenting stress, depressive symptoms, and child behavior problems, maternal under or over reporting biases may have affected the results. Lastly, it is important to consider that only 20 % of eligible women who were screened at the hospital were included in the IDEAL study and only approximately half of the follow-up mothers were included in this study. Mothers included in this study may not be representative of all MA using mothers. For example, it is possible that biological mothers who lost custody of their child before the 36 month visit had more severe MA use, more depressive symptoms, and more parenting stress. Although the mothers included in this study used less tobacco than the entire sample, this should not affect the generalizations as tobacco use was used as a control variable.

Despite these limitations, the current study is meaningful. Strengths of the study include adequate sample size, a well-matched comparison group, reliable and valid measures, and strong statistical procedures. Also, this is the first study to examine parenting stress, perceived child behavior problems, and depressive symptoms of prenatal MA-using mothers, who had continuous custody of their child from birth to 36 months old. Although this sample may not be representative of all MA-using mothers, it does describe a clinical reality of mothers who used MA during pregnancy that continue as primary caregivers.

This study demonstrates the need for proper screening for at-risk families with a history of substance abuse. Thirty percent of the sample reported clinically significant child behavior problems with 23 and 18 % of mothers reporting clinically significant depressive symptoms and parenting stress, respectively. In addition, families whose mothers use MA at birth appear to be more at-risk for parenting stress and depressive symptoms than comparison mothers. Appropriate screening for maternal depressive symptoms and parenting stress in this high-risk population may offer benefits for the mother thus improving parenting and child outcomes. Identifying families with these challenges and providing resources, such as parenting interventions, could help reduce longer term problems (e.g., child physical abuse, more severe child behavior problems, more severe depression, etc.). For example, one program provided a 12-week parental education and support intervention for 120 drug-

involved mothers and their children. Intervention components included parent and health education, parent–child relationship enhancement, recovery support groups, and therapeutic child care. Completers of the program exhibited significantly decreased parenting stress and depressive symptoms [67].

Future research should continue to examine maternal characteristics among mothers who used MA during pregnancy, especially those continuing to use MA after pregnancy. In addition, effective evidence-based screening and intervention strategies that may be helpful for the family should be developed. Future exploration is warranted to determine other factors, besides depression, that may be contributing to parenting stress among MA using mothers, such as parent and child's physical and mental health and amount of social support.

Summary

In the current study, the relationship between maternal depressive symptoms, perceived child behavior problems, and parenting stress was examined among 212 mothers of MA-exposed and non-MA exposed preschoolers. Results indicate that mothers of MA-exposed children report more depressive symptoms and more parenting stress than mothers of non-MA exposed caregivers when their children were 36 months old. MA mothers were more likely to exhibit clinically significant depressive symptoms than comparison mothers, but similar rates of clinically significant parenting stress. There were no differences among groups on perceived child behavior problems. Perceived child behaviors and maternal depressive symptoms, but not MA-exposure, predicted parenting stress. These findings suggest that although most mothers who used MA during pregnancy are reporting normative levels of depressive symptoms, parenting stress, and perceived child behavior problems, screening for potential problems, and in some cases, parenting interventions targeting these issues is warranted.

Acknowledgments

Infant Development, Environment, and Lifestyle (IDEAL) study was supported by a grant from the National Institute on Drug Abuse (R01DA014948) and in part by the National Center for Research Resources, Grant No. 3M01 RR 00425 and P20 RR 11091.

References

1. Arria AM, Derauf C, LaGasse LL, Grant P, Shah R, Smith L, Haning W, et al. Methamphetamine and other substance use during pregnancy: preliminary estimates from the infant development, environment, and lifestyle study. *Matern Child Health J.* 2006; 10:293–302. [PubMed: 16395620]
2. The National Survey on Drug Use and Health. State estimates of past year of methamphetamine use. 2006. <http://www.oas.samhsa.gov/2k6/stateMeth/stateMeth.htm>. Retrieved from 21 Nov 2008
3. U.S. Department of Health and Human Services. Results from the 2009 National Survey on Drug Use and Health: volume I. summary of national findings. 2009. <http://www.oas.samhsa.gov/NSDUH/2k9NSDUH/2k9ResultsP.pdf>. Retrieved from 14 March 2011
4. Miotto, KA.; Suti, E.; Hernandez, MM.; Pham, PL. Psychiatric disorders in pregnancy and the postpartum. Totowa: Humana Press; 2006. Pregnancy and substance abuse; p. 153-178.
5. Vega WA, Kolody B, Hwang J, Noble A. Prevalence and magnitude of perinatal substance exposures in California. *New Engl J.* 1993; 329:850–854.
6. Derauf C, Katz AR, Frank DA, Grandinetti A, Easa D. The prevalence of methamphetamine and other drug use during pregnancy in Hawaii. *J Drug Issues.* 2003; 33:1001–1016.
7. Dixon SD. Effects of transplacental exposure to cocaine and methamphetamine on the neonate. *West J Med.* 1989; 150:436–442. [PubMed: 2735049]
8. Little BB, Snell LM, Gilstrap LC 3rd. Methamphetamine use during pregnancy: outcome and fetal effects. *Obstet Gynecol.* 1988; 72:541–544. [PubMed: 3419732]

9. Derauf C, LaGasse LL, Smith LM, Grant P, Shah R, Arria A, Huestis M, Haning W, Strauss A, Della Grotta S, Liu J, Lester B. Demographics and psychosocial characteristics of mothers using methamphetamines during pregnancy: preliminary results of the infant development, environment, and lifestyle study. *Am J Drug Alcohol Abuse*. 2007; 33:281–289. [PubMed: 17497551]
10. Smith LM, LaGasse LL, Derauf C, Grant P, Shah R, Arria A, Huestis M, Haning W, Strauss A, Della Grotta S, Liu J, Lester B. The infant development, environment, and lifestyle study: effects of prenatal methamphetamine exposure, polydrug exposure, and poverty on intrauterine growth. *Pediatrics*. 2006; 118:1149–1156. [PubMed: 16951010]
11. Good MM, Solt I, Acuna JG, Rotmensch S, Kim MJ. Methamphetamine use during pregnancy: maternal and neonatal implications. *Obstet Gynecol*. 2010; 116:330–334. [PubMed: 20664393]
12. Kandel DB. Parenting styles, drug use, and children's adjustment in families of young adults. *J Marriage Fam*. 1990; 52:183–196.
13. Deater-Deckard K. Parenting stress and child adjustment: some old hypotheses and new questions. *Clin Psychol Res Prac*. 1998; 5:314–332.
14. Kelley SJ. Stress and coping behaviors of substance-abusing mothers. *J Soc Pediatr Nur*. 1998; 3:103–110.
15. Kelley SJ. Parenting stress and child maltreatment in drug-exposed children. *Child Abuse Negl*. 1992; 16:317–328. [PubMed: 1617467]
16. Zacharias, J. Doctoral dissertation. Vol. 64. Virginia Commonwealth University; 2001. The impact of parenting stress among substance-abusing mothers on children's adjustment: the mediating influences of maternal responsiveness, monitoring, and family rituals; p. 62001. Dissertation Abstr Int
17. Cornish AM, McMahon CA, Ungerer JA, Barnett B, Kowalenko N, Tennant C. Maternal depression and the experience of parenting in the second postnatal year. *J Reprod Infant Psychol*. 2006; 24:121–132.
18. Milgrom J, Ericksen J, McCarthy R, Gemmill AW. Stressful impact of depression on early mother-infant relations. *Stress Health*. 2006; 22:229–238.
19. Secco ML, Askin D, Yu CT. Factors affecting parenting stress among biologically vulnerable toddlers. *Issues Compr Pediatr Nurs*. 2006; 29:131–161. [PubMed: 16923678]
20. Suchman NE, Luthar SS. The mediating role of parenting stress in methadone-maintained mothers' parenting. *Parent Sci Pract*. 2001; 1:285–315. [PubMed: 17710214]
21. Rounsaville BJ, Kleber HD. Untreated opiate addicts: how do they differ from those seeking treatment? *Arch Gen Psychiatry*. 1985; 42:1072–1077. [PubMed: 4051685]
22. Swendsen JD, Merikangas KR. The comorbidity of depression and substance use disorders. *Clin Psychol Rev*. 2000; 20:173–189. [PubMed: 10721496]
23. Conner KR, Pinquart M, Duberstein PR. Meta-analysis of depression and substance use and impairment among intravenous drug users (IDUs). *Addiction*. 2008; 103:524–534. [PubMed: 18261192]
24. London ED, et al. Mood disturbances and regional cerebral metabolic abnormalities in recently abstinent methamphetamine abusers. *Arch Gen Psychiatry*. 2004; 61:73–84. [PubMed: 14706946]
25. Paz MS, Smith LM, LaGasse LL, Derauf C, Grant P, Shah R, Arria A, Huestis M, Strauss A, Della Grotta S, Liu J, Lester B. Maternal depression and neurobehavioral in newborns prenatally exposed to methamphetamine. *Neurotoxicol Teratol*. 2008; 31:177–182. [PubMed: 19059478]
26. Semple SJ, Patterson TL, Rant I. Methamphetamine use and depressive symptoms among heterosexual men and women. *J Subst Use*. 2005; 10:31–47.
27. Mash EJ, Johnston C. Parental perceptions of child behavior problems, parenting self-esteem, and mothers' reported stress in younger and older hyperactive and normal children. *J Consult Clin Psychol*. 1983; 51:86–99. [PubMed: 6826870]
28. Thompson R, Oehler JM, Catlett AT, Johndrow DA. Maternal psychological adjustment to the birth of an infant weighing 1,500 grams or less. *Infant Behav Dev*. 1993; 16:471–485.
29. Creasey G, Jarvis PA. Relationships between parenting stress and developmental functioning among 2-year-olds. *Infant Behav Dev*. 1994; 17:423–429.
30. Webster-Stratton C. Preventing conduct problems in head start children: strengthening parenting competencies. *J Consult Clin Psychol*. 1998; 66:715–730. [PubMed: 9803690]

31. Patterson GR. Mothers: the unacknowledged victims. *Monogr Soc Res Child*. 1980; 45(5, Serial No. 186)
32. Johnson, CS. Doctoral dissertation. University of Cincinnati; 2004. Predictors of child functioning among children of substance-using parents.
33. Lester, BM.; Boukydis, CFZ.; Twomey, JE. Maternal substance abuse and child outcome. In: Zeanah, CH., Jr, editor. *Handbook of infant mental health*. 2nd edn. New York: Guilford Press; 2000. p. 161-175.
34. Banger DM, Sheinkopf SJ, Miller-Loncar C, LaGasse LL, Lester BM, Liu J, et al. The effects of parenting stress on child behavior problems in high-risk children with prenatal drug exposure. *Child Psychiatry Hum Dev*. 2009; 40:73–84. [PubMed: 18626768]
35. Accornero VH, Morrow CE, Bandstra ES, Johnson AL, Anthony JC. Behavioral outcome of preschoolers exposed prenatally to cocaine: role of maternal behavioral health. *J Pediatr Psychol*. 2002; 27:259–269. [PubMed: 11909933]
36. Accornero VH, Anthony JC, Morrow CE, Xue L, Bandstra ES. Prenatal cocaine exposure: an examination of childhood externalizing and internalizing behavior problems at age 7 years. *Soc Psychiatry Psychiatr Epidemiol*. 2006; 15:20–29.
37. Messinger DS, Bauer CR, Das A, Seifer R, Lester BM, Lagasse L, et al. The maternal lifestyle study: cognitive, motor, and behavioral outcomes of cocaine-exposed and opiate-exposed infants through three years of age. *Pediatrics*. 2004; 113:1677–1685. [PubMed: 15173491]
38. Griffith DR, Azuma SD, Chasnoff IJ. Three-year outcome of children exposed prenatally to drugs. *J Am Acad Child Adolesc Psychiatry*. 1994; 33:20–27. [PubMed: 7511139]
39. Stanger C, Higgins ST, Bicker WK, Eilk R, Grabowsky J, Schmitz J, Amass L, et al. Behavioral and emotional problems among children of cocaine- and opiate-dependent parents. *J Child Adolesc Psychiatry*. 1999; 38:421–428.
40. Minnes S, Singer LT, Kirchener KL, Short E, Lewis B, Satayathum S, Queh D. The effects of prenatal cocaine exposure on problem behaviors in children 4-10 years. *Neurotoxicol Teratol*. 2010; 32:443–451. [PubMed: 20227491]
41. Beck CT. Maternal depression and child behavior problems: a meta-analysis. *J Adv Nurs*. 1999; 29:623–629. [PubMed: 10210459]
42. Garstein M, Sheeber L. Child behavior problems and maternal symptoms of depression: a mediational model. *J Child Adolesc Psychiatr Nurs*. 2004; 17:141–150. [PubMed: 15742795]
43. Cummings EM, Davies PT. Maternal depression and child development. *J Child Psychol Psychiatry*. 1994; 35:73–112. [PubMed: 8163630]
44. Goodman S, Gotlib IH. Risk for psychopathology in children of depressed mothers: a developmental model for understanding mechanisms of transmission. *Psychol Rev*. 1999; 106:458–490. [PubMed: 10467895]
45. Lovejoy M, Graczyk P, O'Hare E, et al. Maternal depression and parenting behavior: a meta-analytic review. *Clin Psychol Rev*. 2000; 20:561–592. [PubMed: 10860167]
46. Garstein MA, Bridgett DJ, Dishion TJ, et al. Depressed mood and maternal report of child behavior problems: another look at the depression-distortion hypothesis. *J Appl Dev Psychol*. 2009; 30:149–160. [PubMed: 20161323]
47. Johnston C, Short K. Depressive symptoms and perceptions of child behavior. *J Soc Clin Psychol*. 1993; 12:164–181.
48. Lester BM, Tronick EZ, LaGasse L, et al. The maternal lifestyle study: effects of substance exposure during pregnancy on neurodevelopmental outcome in 1-month old infants. *Pediatrics*. 2002; 110:1182–1192. [PubMed: 12456917]
49. DellaGrotta S, Lagasse LL, Arria AM, et al. Patterns of methamphetamine use during pregnancy: results for the infant development, environment, and lifestyle study. *Matern Child Health J*. 2010; 14:519–527. [PubMed: 19565330]
50. Shankaran S, Das A, Bauer CR, Bada H, Lester B, Wright LL, et al. Association between patterns of maternal substance use and infant birth weight, length, and head circumference. *Pediatr*. 2004; 114:226–234.

51. Patrick DL, Cheadle A, Thompson DC, Diehr P, Koepsell T, Kinne S. The validity of self-reported smoking: a review and meta-analysis. *Am J Public Health.* 1994; 84:1086–1093. [PubMed: 8017530]
52. Singer L, Arendt R, Farkas K, Minnes S, Huang J, Yamashita T. Relationship of prenatal cocaine exposure and maternal postpartum psychological distress to child development outcome. *Dev Psychopathol.* 1997; 9:473–489. [PubMed: 9327234]
53. Jacobson SW, Chidodo LM, Sokol RJ, Jacobson JL. Validity of maternal report of prenatal alcohol, cocaine, and smoking in relation to neurobehavioral outcome. *Pediatr.* 2002; 109:815–825.
54. Richardson GA, Day NL. Detrimental effects of prenatal cocaine exposure: illusion or relation? *J Am Acad Child Adolesc Psychiatry.* 1994; 33:28–34. [PubMed: 8138518]
55. Richardson GA, Hamel SC, Goldschmidt L, Day NL. Growth of infants prenatally exposed to cocaine/crack: comparison of a prenatal care and no prenatal care sample. *Pediatr.* 1999; 104:e18.
56. Beck, AT.; Steer, RA.; Brown, GK. *The Beck Depression Inventory manual.* 2nd edn. San Antonio: Psychological Corporation; 1996.
57. Dozois DJ, Dobson KS, Ahnberg JL. A psychometric evaluation of the Beck Depression Inventory-II. *Psychol Assess.* 1998; 10:83–89.
58. Steer RA, Clark DA. Psychometric properties of the Beck Depression Inventory-II with college students. *Meas Eval Counsel Dev.* 1997; 10:128–136.
59. Steer RA, Kumar G, Ranieri WF, et al. Use of Beck Depression Inventory-II with adolescent psychiatric outpatients. *J Psychopathology Behav Assess.* 1998; 20:127–137.
60. Osman A, Downs WR, Barrios FX, et al. Factor structure and psychometric properties of The Beck Depression Inventory-II. *J Psychopathol Behav Assess.* 1997; 19:359–376.
61. Buckley TC, Parker JD, Heggie J. A psychometric evaluation of the BDI-II in treatment-seeking substance abusers. *J Subst Abuse Treat.* 2001; 20:197–204. [PubMed: 11516588]
62. Johnson ME, Neal DB, Brems C, et al. Depression as measured by the Beck Depression Inventory-II among injecting drug users. *Assessment.* 2006; 13:168–177. [PubMed: 16672731]
63. Abidin R. The determinants of parenting behavior. *J Clin Child Psychol.* 1992; 21:407–412.
64. Roggman LA, Moe ST, Hart AD, Forthun LF. Family leisure and social support: relations with parenting stress and psychological well-being in head start parents. *Early Child Res Q.* 1994; 9:463–480.
65. Haskett ME, Ahern LS, Ward CS, et al. Factor structure and validity of the parenting stress index-short form. *J Clin Child Adolesc Psychol.* 2005; 35:302–312. [PubMed: 16597226]
66. Achenbach, T. *The child behavior checklist/2-3.* Burlington: University of Vermont, Department of Psychiatry; 1992.
67. Kern JK, West EY, Grannemann BD, Greer TL, Snell LM, Cline LL, et al. Reductions in stress and depressive symptoms in mothers of a substance-exposed infants, participating in a psychosocial program. *Matern Child Health J.* 2004; 8:127–136. [PubMed: 15499870]

Table 1

Maternal, child, and family characteristics at child's birth (percentages)

	MA exposed <i>n</i> = 75	Comparison <i>n</i> = 137	Total <i>N</i> = 212
Race of mother			
White	40.0 %	38.7 %	39.3 %
Hispanic	25.3 %	23.4 %	24.3 %
Hawaiian/Pacific Islander	16.0 %	16.1 %	16.1 %
African American	5.3 %	5.0 %	5.2 %
Other	13.4 %	16.8 %	15.1 %
Age of mother			
24	48.0 %	62.0 %	57.5 %
25–34	38.7 %	28.0 %	31.6 %
35	13.3 %	9.0 %	10.9 %
No. of children under 18 living in the home			
0–1	40.0 %	29.0 %	33.0 %
2–3	46.6 %	52.0 %	50.0 %
4+	13.4 %	19.0 %	17.0 %
Other prenatal use			
Alcohol	40.0 %	13.1 %	22.6 %
Average oz. of absolute alcohol/day	0.11 ± 0.66	0.004 ± 0.02	0.04 ± 0.39
Tobacco	77.3 %	23.4 %	42.5 %
Average number of cigarettes/day	7.08 ± 9.46	1.01 ± 3.41	3.16 ± 6.88
Marijuana	34.7 %	3.6 %	14.6 %
Average number of joints per day	0.08 ± 0.26	0.02 ± 0.11	0.04 ± 0.18

Table 2

Maternal demographics by exposure group and assessment time (percentages)

	Birth		χ^2	p	36-month		χ^2	p
	MA (N = 75)	Comparison (N = 137)			MA (N = 75)	Comparison (N = 137)		
Marital status (married/partner)	48.0 %	69.3 %	9.35	0.02 *	53.3 %	70.8 %	6.47	0.01 *
Education 12 years	40.0 %	36.5 %	0.253	0.61	–	–	–	–
Annual income 20,000	41.3 %	37.2 %	14.62	0.02 *	21.3 %	10.9 %	10.25	0.06
Insurance (public insurance)	83.6 %	75.6 %	1.80	0.40	–	–	–	–
Self-reported MA use ^a	98.7 %	–	–	–	10.7 %	0.0 %	15.19	0.01 *
MA use days/week	1.4 ± 1.9	–	–	–	0.26 ± 1.3	0.0	–	–

* $p < 0.05$ ^a 1 subject denied MA use and was identified as exposed by toxicology only

Table 3

Mean and standard deviations for MA and non-MA using mothers at 36 month visit

Group	PSI-SF Mean (SD)	BDI-II Mean (SD)	CBCL Mean (SD)
MA mothers ^a	78.33 (17.90) *	11.07 (10.46) *	54.96 (10.02)
Comparison mothers ^b	72.25 (16.72) *	7.64 (6.88) *	53.55 (9.46)

^a
n = 75,^b
n = 137*
p < 0.05

Table 4

Summary of multivariate analysis for predicting parenting stress at 36 month visit

Variable	Model 1			Model 2			Model 3		
	Estimate	SE	p	Estimate	SE	p	Estimate	SE	p
Step 1									
Race	1.28	1.11	0.251						
Mother's age	-0.45	0.22	0.049	-0.02	0.18	0.869	-0.03	0.18	0.874
No. of children in home	-1.38	1.03	0.181						
Married/living together	-5.41	2.70	0.047	-0.80	2.09	0.703	-0.93	2.11	0.661
Income	3.13	3.59	0.385						
Prenatal alcohol use	-8.13	19.2	0.672						
Prenatal tobacco use	0.28	0.21	0.195						
Prenatal marijuana use	3.89	6.95	0.578						
Postnatal MA use	1.18	1.63	0.472						
Step 2									
MA exposure status				3.13	2.08	0.135	3.08	2.09	0.142
CBCL total				0.86	0.13	0.001*	0.87	0.12	0.001*
BDI-II Scores				0.50	0.13	0.001*	0.476	0.14	0.001*
Step 3									
CBCL ^a BDI							0.01	0.01	0.667

* $p < 0.001$