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Are There Effects of Intrauterine Cocaine Exposure on Delinquency during Early Adolescence? A Preliminary Report

Jessie Gerteis, MPH,

Boston University School of Public Health, now Abt Associates Inc. Cambridge, MA

Molinda Chartrand, MD,

Department of Pediatrics, Boston Medical Center, now Education and Developmental Intervention Services, Spangdahlem Air Force Base, Germany

Brett Martin, MS,

Data Coordinating Center, Boston University School of Public Health, Boston, MA

Howard J. Cabral, PhD,

Biostatistics Department, Boston University School of Public Health, Boston, MA

Ruth Rose-Jacobs, ScD,

Department of Pediatrics, Boston University School of Medicine, Boston, MA

Denise Crooks, MPH, and

Department of Pediatrics, Boston Medical Center, Boston, MA

Deborah A. Frank, MD

Department of Pediatrics, Boston University School of Medicine, Boston, MA

Abstract

Objective—To ascertain whether level of intrauterine cocaine exposure (IUCE) is associated with early adolescent delinquent behavior, after accounting for prenatal exposures to other psychoactive substances and relevant psychosocial factors.

Methods—Ninety-three early adolescents (12.5–14.5 years old) participating since birth in a longitudinal study of IUCE reported delinquent acts via an audio computer assisted self interview (ACASI). Level of IUCE and exposure to cigarettes, alcohol, and marijuana were determined by maternal report, maternal and infant urine assays, and infant meconium assays at birth. Participants reported their exposure to violence on the Violence Exposure Scale for Children – Revised (VEX-R) at ages 8.5, 9.5, 11 years and during early adolescence, and the strictness of supervision by their caregivers during early adolescence.

Results—Of the 93 participants, 24 (26%) reported ≥ 3 delinquent behaviors during early adolescence. In the final multivariate model (including level of IUCE and cigarette exposure, childhood exposure to violence, and caregiver strictness/supervision) ≥ 3 delinquent behaviors were not significantly associated with level of IUCE but were significantly associated with intrauterine exposure to half a pack or more of cigarettes per day and higher levels of childhood exposure to violence, effects substantially unchanged after control for early adolescent violence exposure.

Conclusions—In this cohort, prospectively ascertained prenatal exposure to cigarettes and childhood exposure to violence are associated with self-reported delinquent behaviors during early

adolescence. Contrary to initial popular predictions, intrauterine cocaine is not a strong predictor of adolescent delinquent behaviors in this cohort.

Key Terms

Pregnancy; cocaine; cigarettes; violence; adolescent delinquency

INTRODUCTION

During what came to be known as the “crack epidemic” of the 1980s and early 1990s, the popular press disseminated dire predictions that children with intrauterine cocaine exposure (IUCE) would grow up to become deviants and criminals.^{1,2} However, longitudinal studies prospectively following cohorts with intrauterine cocaine exposure (IUCE), including this one, only now have participants old enough to evaluate whether IUCE is in fact a predictor of adolescent delinquent behavior.

There is conflicting evidence in the research literature regarding whether IUCE increases the risk of childhood externalizing behaviors,³⁻⁴ which may be precursors of later delinquency. Prior studies of children with IUCE use Achenbach’s Child Behavior Checklist (CBCL)⁵ to measure externalizing behaviors in general, and delinquency in particular.

One study found that higher IUCE was significantly associated with CBCL externalizing and total behavior problem scores at three, five, and seven years of age.⁴ Another study found that IUCE was associated with an increase on the CBCL’s aggression subscale of externalizing behavior, but not the delinquency subscale, and only for girls aged 6–7 years.⁶ However, a recent report⁷ which followed children with and without IUCE age 10, noted increased odds of elevated scores on the delinquency subscale of the CBCL for girls, but not boys. In that cohort, foster/adoptive compared to biologic/relative caretakers of children with IUCE were more likely to report scores in the borderline/clinical range for all subscales including delinquency. However, other analyses have found no association between IUCE and behavior problems reported on the CBCL, including a study of our cohort.^{8,9}

Prenatal exposures other than cocaine have been found to be associated with delinquent behavior in the exposed offspring. Studies have found a relationship between prenatal exposure to cigarettes and conduct disorder during childhood¹⁰ and adolescence,¹¹ delinquent behavior during adolescence,¹² and persistent criminal behavior in adulthood.¹³ While these studies controlled for socioeconomic status and other family factors, only one included exposure to physical discipline and sexual abuse¹¹, and none controlled for exposure to violence in a broader sense. None, as far as we, know controlled for IUCE.

Studies looking at the relationship between prenatal alcohol or marijuana exposure and delinquency have similar, but less consistent or less well replicated findings than the prenatal cigarette exposure studies. Prenatal exposure to alcohol has been linked with conduct problems in children¹⁴ and conduct disorder in adolescents.¹⁵ One study, however, found no statistically significant association between prenatal alcohol exposure and adolescent delinquency after controlling for the effects of concurrent adolescent psychosocial risk factors, including exposure to family and community violence.¹⁶ A single study, controlled for multiple prenatal and postnatal factors but not for the child’s exposure to violence, found that prenatal marijuana exposure was associated at age 10 with delinquency scores in the clinical range on both the caregiver and teacher report versions of the CBCL¹⁷

Many studies have found an association between exposure to violence and problem behaviors. In studies that do not consider prenatal substance exposures, exposure to violence has been found to be associated with delinquency,^{18,19} aggression,²⁰ and violent behavior in pre-adolescents and adolescents.^{21,22} Studies with cohorts recruited to study IUCE also suggest a relationship between both prior and concurrent exposure to violence and problem behaviors including delinquency.^{8, 23} A previous analysis with our cohort found that concurrent exposure to violence was significantly associated with externalizing behaviors on the CBCL at age six, after controlling for IUCE,⁸ while The Maternal Lifestyle Study found that delinquency at age 11 (as measured by the CBCL) was not associated with IUCE, but was associated with having violent friends (measured at ages 9 through 11), and exposure to community violence (measured at ages 8 and 9).²³ Another important post-natal factor associated with early adolescent delinquency is the adequacy of parental supervision. In research that does not consider intrauterine substance exposures, adolescents who experience lower levels of parental supervision (defined as parental knowledge of the adolescent's whereabouts and companions) have also been found to be at greater risk for delinquency than their more closely supervised peers.²⁴ The goal of the current study is to evaluate whether there is an independent association between IUCE and delinquency in early adolescence, after considering commonly co-occurring prenatal substance exposures and environmental risks.

METHODS

Design

As has been published elsewhere^{25–29} data were collected as part of a masked, prospective, longitudinal cohort study evaluating the effects of intrauterine cocaine exposure. Approximately one half (123) of the initial sample of 252 was prenatally exposed to cocaine. The comparison group consists of participants with similar ethnic and socioeconomic backgrounds as the exposed group, without prenatal cocaine exposure.

Mothers and their newborns were recruited for participation following term or near term birth on the maternity ward of Boston Medical Center (then Boston City Hospital) between 1990 and 1993. To be eligible for recruitment the following criteria needed to be met at the time of delivery: Infant gestational age greater than or equal to 36 weeks; no requirement for level III neonatal intensive care for more than 24 hours; no obvious major congenital malformations; no diagnosis of fetal alcohol syndrome in the neonatal record; no indication by toxic screen or medical record of mother's use of opiates, benzodiazepines, amphetamines, phencyclidines, barbiturates, or hallucinogens during pregnancy; no history of HIV seropositivity noted in the mother's or infant's medical record; mother aged 18 years or older, and able to communicate fluently in English.^{8, 30} These criteria were primarily established to exclude infants with known major risk factors for developmental impairments that might confound or obscure the effects, if any, of the IUCE.³⁰ English fluency was required because the neuropsychological measures planned for this cohort at older ages were not standardized for non-English speakers.

The Institutional Review Board of Boston University School of Medicine/Boston Medical Center (Boston City Hospital) approved this study. A legal guardian provided written informed consent to allow for each child's/adolescent's participation, and the participants additionally provided written assent beginning at age eight. A Certificate of Confidentiality was obtained from the federal government to protect participants from subpoena of research data. This study is in full compliance with the Health Insurance Portability and Accountability Act of 1996 (HIPAA).

Participants were evaluated at multiple time points between their birth and adolescence. Data included in the present report were collected shortly after birth and during research visits at ages 8.5, 9.5 and 11 years and again at an early adolescent visit between the ages of 12.5 and 14.5 years. All tests and questionnaires were administered by trained research assistants masked to the participant's IUCE status. Questions about delinquent behavior were asked as part of a longer audio computer assisted self interview (ACASI). In the ACASI, the computer "asks" the participant questions both visually on the screen and audibly over head phones, and the participant answers directly into the computer. When questions are administered using the ACASI, research staff remained unaware of the responses. It is believed that this technique not only assures confidentiality, but encourages more truthful answers about potentially sensitive topics than would be obtained via face to face interviews.³¹

Primary Exposure Variable

Intrauterine Cocaine Exposure (IUCE)—At intake, mothers were interviewed in the hospital during the postpartum period about their cocaine use using an adapted version of the Addiction Severity Index, fifth edition.³² The child's intrauterine exposure was determined by the mother's report of cocaine use during the index pregnancy and/or a positive biological marker (i.e. maternal urine, infant urine and/or meconium). Participants with IUCE were further classified as having either heavier or lighter exposure based on a composite of information derived from the maternal report and meconium assays. "Heavier" exposure was defined a priori as the top quartile of mother's self-reported number of days of use during the pregnancy (top quartile = 61 days or more; mean = 20.6 days; range = 0–264 days) and/or the top quartile of concentration for cocaine metabolites (benzoylecgonine) in the infant's meconium (top quartile = more than 3314 ng per gram; mean = 1143 ng per gram; range = 0–17,950 ng per gram).²⁵ All other participants with IUCE who did not meet these criteria were classified into the "lighter" category. This classification scheme showed ordinal association in this cohort with infant's birth weight, neonatal behavior, and odds of neonatal hemorrhage over the head of the caudate.^{26, 27}

Covariate measures

Candidate covariates were selected based on existing literature^{1–24} and earlier findings from this cohort^{33, 34}. Immediately after birth we ascertained from mother's report and the medical record the participant's gender, level of prenatal exposures to marijuana, cigarettes, and alcohol and race/ethnicity defined by the mother's choice of options based on census classifications. Caregivers reported at the childhood and adolescent visits the identity of the participant's current caregiver (i.e., if they lived with their birth mother, in kinship care, or in non-kinship care with an unrelated foster or adoptive parent), the maximum educational attainment of the participant's current caregiver (a proxy for socioeconomic status in our cohort), and the incarceration history of the participant's parents and current caregiver (if other than a birth parent). Participants reported their own exposure to violence at childhood and early adolescent visits as measured by the Violence Exposure Scale for Children – Revised (VEX-R);^{35, 36} and their perception of their current caregiver's strictness and supervision from a parenting style measure by Lamborn³⁷ at early adolescence.

The Violence Exposure Scale for Children – Revised (VEX-R) is designed to assess children's exposure to violence through self-report using a 21 item, cartoon-based interview. The items on the VEX-R use a 4-point Likert scale (0=never, 1=once, 2=a few times, 3=lots of times) to determine how many times the child has witnessed different types of violence (e.g., someone being yelled at, being beaten up, or stabbed with a knife) and how many times these violent things have happened to the child him/herself. At the early adolescence research visit, we modified the VEX-R to make it more appropriate for adolescent subjects

by removing questions related to spanking and administering only the text of the questions (rather than cartoons) using ACASI.

There is no standard method for scoring the VEX-R. In our previous work³⁰ the VEX-R was analyzed using a total score, calculated by simply summing the number of times the participant reported experiencing each violent event, without weighting for severity. In the current analysis, to address the non-interval scaling, age effects, and the skewed nature of the VEX-R total score, we created quartiles for the childhood VEX-R scores by subdividing into four groups of approximately equal size the total scores obtained at each of the 8.5, 9.5 and 11 year old research visits (the early adolescent VEX-R score is used in a secondary analysis described below). The highest quartile for age obtained by each participant from at least one of these three testing time points was then used as the variable in our analyses, with the 4th quartile representing the highest level of violence exposure and the 1st quartile representing the lowest level of exposure. In the absence of consensus standardization norms, analyzing the VEX-R score using sample and age-specific quartiles avoids making assumptions about the distribution of the scores, allows for the assessment of non-linearity in the relationship of the scores to outcome, and provides an age-appropriate ordinal assessment of violence exposure that, in this and other analyses³⁸ appears to have consistent external validity with a range of adolescent outcomes in the current sample. Eighty-six percent had two or more VEX-R assessments in childhood; all had at least one. Consistent with the work of Lewis et al³⁹ that a single report of a violent event ever is a strong predictor of behavioral difficulty, we modeled violence exposure in the form of a dummy variable indicating that the child had a VEX-R score in the 4th quartile at one or more of the three assessments up to age 11.

Outcome Measure

Delinquent behavior—We selected the seven self report delinquency questions for this study from the National Longitudinal Study of Adolescent Health (Add Health)⁴⁰ (see Table 1), rather than the more widely used Child Behavior Problem Checklist (CBCL),⁴¹ as the most appropriate measure of delinquency for our cohort at this age. The Add Health survey asks the adolescent directly how often s/he has engaged in intentional property damage, stealing (shoplifting and car theft), breaking and entering, group fighting, selling drugs, and running away from home in his/her lifetime.⁴⁰

The delinquency subscale of the CBCL⁴¹, which covers children from ages four to eighteen years, also asks about stealing and vandalism and status offenses (truancy and running away from home), but largely focuses on activities that are considered deviant for children (e.g. lying/cheating, swearing, thinking about sex too much), but are not illegal, and does not measure fighting and selling drugs. The CBCL also relies on parental, rather than adolescent self report. Parental report is not as appropriate for this age group as it is for younger children, because parents of adolescents are unlikely to be aware of all of the delinquent activities of their adolescent children. .

Sample Definition

The sample for this study, a subsample of the larger study, is comprised of the 93 participants who completed the VEX-R at least one time between the 8.5, 9.5, and 11 year old visits, and also answered the delinquency questions during the early adolescent visit. Administration of the delinquency questions was postponed until some of the cohort had been already evaluated in early adolescence because of Institutional Review Board (IRB) delays, so the sample presented here (n=93) does not include all the participants (n=139) evaluated at the early adolescent time point .

Statistical Methods

Using two-sample t-tests for continuous covariates and cross-tabulations with chi-square testing for categorical covariates, we examined the unadjusted associations between IUCE and each candidate covariate enumerated above, as well as between delinquent behavior, each candidate covariate, and IUCE. The unadjusted association between IUCE and delinquent behavior was then assessed using odds ratios computed from cross-tabulations with chi-square testing. We constructed multivariable logistic regression models by evaluating each covariate singly as a potential confounding variable for the association between IUCE and delinquent behavior. To maximize ability to detect effects of IUCE according to the method of Mickey and Greenland⁴¹ for selecting confounding variables for inclusion in a multivariable model, we retained in the final model only those covariates that changed the unadjusted estimate of the association between IUCE and delinquency more than 10%. In the final model all variables identified by this method were entered simultaneously. Statistical significance required two tailed p-values less than 0.05. (Table 4). The sample size was too small to permit evaluation of interaction terms. All analyses were conducted using SAS for Windows, version 9.1.⁴³

RESULTS

Sample Characteristics

As seen in Table 2, 51% of 93 participants in the current report experienced IUCE; 59% are male; 88% are African American/African Caribbean; and the mean age at outcome is 14.2 years (standard deviation of 0.6 years). Delinquent behaviors were not normally distributed. Of the 93 participants, 40 (43%) reported having committed no delinquent acts, 17 (18%) one act, 12 (13%) two acts, 14 (15%) three acts, 6 (6%) four acts, 3 (3%) five acts, and 1 (1%) seven delinquent acts. The twenty-four participants (26%-the top quartile) who reported engaging in three or more delinquent acts were classified as engaging in “delinquent behavior.” Our final model has a reduced sample of 91 participants because two participants did not complete the parenting style measure from which the caregiver strictness/supervision covariate is drawn. This sample of 91 is representative of the study’s initially recruited sample. No statistically significant differences were found between the retained subset of the initial sample included in this analysis and those who were not included (due to withdrawals from the study, inconsistent or incomplete participation, and participants missed due to IRB delay) in terms of: mother’s age at the time of the participant’s birth; birth mother’s level of education; birth mother’s race/ethnicity and country of origin; and child’s gender, birth weight, and prenatal exposures to cocaine, cigarettes, marijuana, and alcohol.

Bivariate and Multivariable Analyses

As Tables 3 and 4 show, we found that early adolescent delinquent behavior was not significantly associated with IUCE or strict supervision by caregivers, but was associated with higher levels of childhood exposure to violence, and higher levels of prenatal exposure to cigarettes in a way that suggests a dose-response relationship. The other variables enumerated above including prenatal exposure to marijuana, parental incarceration, and current caregiver were tested but did not meet the criteria of Mickey and Greenland⁴² to be retained in the final model. Table 4 shows that the adjusted odds ratio (AOR) of delinquent behavior for those with prenatal exposure to cigarettes greater than or equal to half a pack per day was 12.6 (95% CI 2.51–63.37) and for children ever in the 4th quartile of violence exposure in childhood (8.5, 9.5, and 11 years) in comparison to those who were not, the adjusted odds ratio was 4.03 (95% CI 1.25–12.97).

Secondary Analysis

Childhood exposure to violence was considered the primary measure of violence exposure for our analyses because it temporally precedes adolescent delinquent behavior and therefore provides an indication regarding the direction of effect. However, given the established association between exposure to violence and delinquency across developmental epochs,^{18–23} concurrent exposure to violence during adolescence may be a potential confounder of the effect of childhood violence exposure on delinquency. Therefore, VEX-R scores collected during the early adolescent visit were added to the final model in a secondary analysis with the understanding that the direction of effect would not be clear, given that delinquent youth may expose themselves to more violence than their non-delinquent peers. For the early adolescent VEX-R measure, we used only questions related to violence exposure during the past 12 months, concurrent with the measure of delinquent behavior. As expected, we found that higher early adolescent exposure to violence had a weak-to-moderate correlation with higher childhood exposure ($r = .23$, $p = .03$). This degree of correlation, however, is not enough to cause collinearity between these variables. In our analyses, early adolescent exposure to violence was strongly associated with delinquent behavior; however it is logically difficult to ascertain whether it was a predictor or a consequence. When entered into the same regression model, adolescent exposure to violence attenuates the impact of childhood exposure in the multivariable analyses (4th quartile of the childhood VEX-R vs. all other quartiles AOR = 3.57; CI = 0.87, 14.75; $p = 0.08$), such that the relationship is no longer formally statistically significant, but the odds ratio is only slightly diminished and remains substantial. Intrauterine cigarette exposure (more than 1/2 pack a day) remained a significant ($p < .01$) predictor of early adolescent delinquent behavior.

DISCUSSION

Limitations

This preliminary study has a number of limitations. First, the findings are derived from a small sample. Confidence intervals are wide and conclusions of the magnitude of effect at the upper bounds of confidence intervals are tentative, although the lower bounds (for example the 2.51 AOR of heavy intrauterine tobacco exposure on delinquent behavior) are credible. Power is also limited. In a sample of 91, with 22 reporting delinquent behavior compared to 69 not, there is 80% power to detect an odds ratio of 4.45 or greater of IUCE on delinquent behavior, of similar size to those observed in our study for intrauterine tobacco exposure and for those who were ever in the 4th quartile of the VEX childhood exposure to violence scale, so lack of IUCE effect must be interpreted with caution.

Secondly, the VEX-R does not specify where the violence exposure occurs, so we cannot make any conclusions about what type of violence exposure (i.e., that which occurs in the home, the community, or elsewhere) is most strongly associated with later delinquency. Also, because delinquent behaviors were not measured in this sample until adolescence, we can not be sure of the timing of the onset of delinquent behaviors. Moreover, the sole measure of delinquent behaviors is the adolescent's self report since we did not have access to court records, which may have lead us to underestimate behaviors the adolescents were unwilling to disclose, although there is no reason to expect such unwillingness would vary with IUCE. Finally, because this is not a randomly selected, nationally representative sample, results cannot be generalized beyond a population that is demographically similar to this sample (i.e., urban, impoverished, term or near term at birth, and largely African American/ African Caribbean). Because our sample was restricted to term and near term children who did not require extended NICU stay and were not exposed to intrauterine opiates, we cannot generalize our findings to populations with IUCE and these additional risk factors. However, our previous work in another cohort at Boston Medical Center and

work of other investigators has shown that 80% or more of newborns with IUCE are not extremely preterm, not admitted to NICU, and are not born to women who are opiate users^{44,45, 46} Our definition of “heavier” cocaine exposure (>61 days during the pregnancy) is comparable to that of others who do not exclude children with opiate exposure or prematurity.⁴⁷ On the other hand, unmeasured covariates such as intrauterine or post-natal lead exposure may influence outcomes.⁴⁸

Comment

This is the first study of which the authors are aware that looks at self-reported participation in illegal activities during adolescence following intrauterine cocaine exposure. In spite of its limitations, the findings from this preliminary study have potential clinical, public health, policy, and research implications. While assumptions were made in the popular press that prenatal exposure to cocaine would lead to increased delinquency in the exposed offspring, we have found no indication of such an association. Rather, like previous investigators whose samples were not recruited on the basis of IUCE^{10–13}, we found that tobacco, a legal substance, is strongly associated with early adolescent delinquent behavior, even after controlling for IUCE. This is also the only study the authors are aware of that controls for exposure to violence when examining the relationship between prenatal cigarette exposure and later delinquency. While smoking during pregnancy is certainly discouraged by medical authorities, it is not widely understood that prenatal tobacco exposure, which, by recent national estimates, occurs in 19% of pregnancies⁴⁹ may exert more deleterious effects on the behavioral outcomes of the exposed offspring than exposure to cocaine, an illegal and more stigmatized substance which occurs in 0.3% of pregnancies⁴⁹. Clearly, tobacco use in pregnancy warrants more intensive identification and treatment. Our analysis also suggests that efforts to reduce childhood exposure to violence, regardless of prenatal exposures, may also have the potential to reduce the incidence of adolescent delinquency. Work is needed in larger and more representative samples to further define the relationships between intrauterine exposures, childhood and adolescence experiences, and early adolescent delinquent behavior.

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Table 1**Delinquency Questions and Frequencies¹**

Question	Frequency Answered Yes* N=93	Percent
1) In your life, how often have you deliberately damaged property that didn't belong to you?	31	33
2) In your life, how often have you taken something from a store without paying for it?	42	45
3) In your life, how often have you run away from home?	10	11
4) In your life, how often have you driven a car without its owner's permission?	7	8
5) In your life, how often have you gone into a house or building to steal something?	6	7
6) In your life, how often have you sold marijuana or other drugs?	3	3
7) In your life, how often have you taken part in a fight where a group of your friends was against another group?	30	32

* Response options for each question were: never, once or twice, three or four times, five or more times. Answers of once or twice, three or four times and five or more times were collapsed into "yes".

¹ Adolescent In-Home Questionnaire Code Book, S. 29, Delinquency Scale. *The National Longitudinal Study of Adolescent Health*
[<http://www.cpc.unc.edu/projects/addhealth>].

Table 2

Description of Sample by Level of Cocaine Exposure (n=93)

	Level of Cocaine Exposure No. (col. %)			
	Unexposed (n=46)	Lighter Exposure (n=34)	Heavier Exposure (n=13)	p-Value
Gender:				
Male	27 (59)	19 (56)	9 (69)	0.70
Female	19 (41)	15 (44)	4 (31)	
Prenatal alcohol exposure:				
Unexposed	44 (96)	24 (71)	4 (31)	<0.001
<.5 drinks per day	2 (4)	8 (24)	6 (46)	
>/=.5 drinks per day	0 (0)	2 (5)	3 (23)	
Prenatal cigarette exposure:				
Unexposed	34 (74)	10 (29)	2 (15)	<0.001
<1/2 pack per day	5 (11)	9 (27.)	5 (38)	
>/=1/2 pack per day	7 (15)	15 (44)	6 (46)	
Prenatal marijuana exposure:				
Unexposed	42 (91)	22 (65)	7 (54)	0.003
Exposed	4 (9)	12 (35)	6 (46)	
Current caregiver:				
Birth mother	40 (87)	21 (62)	7 (10)	0.06
Kinship care	5 (11)	11 (32)	5 (24)	
Non-kinship care	1 (2)	2 (6)	1 (25)	
History of incarceration of parents/caregiver:				
No	21 (46)	19 (56.)	4 (31)	0.29
Yes	25 (54)	15 (44)	9 (69)	
Educational attainment of caregiver:				
< high school	12 (26)	11 (32)	2 (15)	0.49
High school or more	34 (74)	23 (68)	11 (85)	
Caregiver strictness/supervision^a:				
All other quartiles	32 (73)	24 (71)	11 (85)	0.61
4 th quartile	12 (27)	10 (29)	2 (15)	
Cumulative childhood exposure to violence (VEX-R):				
All other quartiles	32 (70)	19 (56)	8 (62)	0.45
4 th quartile	14 (30)	15 (44)	5 (38)	
Delinquent behavior:				
0–2 acts	35 (76)	26 (76)	8 (62)	

	Level of Cocaine Exposure No. (col. %)			
	Unexposed (n=46)	Lighter Exposure (n=34)	Heavier Exposure (n=13)	p-Value
3 or more acts	11 (24)	8 (24)	5 (38)	0.53

^aThe total n for this variable is 91 rather than 93 because two subjects in our sample did not complete the parenting style measure from which the caregiver strictness/supervision covariate is drawn.

Table 3

Bivariate Analysis by Delinquent Behavior (n=93, 24 with delinquent behavior, 69 without)

	No.	Delinquent behavior/ 3 or more delinquent acts No. (row %)	p-Value
Cumulative childhood exposure to violence (VEX-R):			
4 th quartile	34	14 (41)	0.04
All other quartiles	59	10 (17)	
Prenatal cocaine exposure:			
Unexposed	46	11 (24)	0.53
Lighter exposure	34	8 (24)	
Heavier exposure	13	5 (39)	
Prenatal alcohol exposure:			
Unexposed	72	16 (22)	0.20
<.5 drinks per day	16	7 (44)	
>/.5 drinks per day	5	1 (20)	
Prenatal cigarette exposure:			
Unexposed	46	5 (11)	0.003
<1/2 pack per day	19	6 (32)	
>=1/2 pack per day	28	13 (46)	
Prenatal marijuana exposure:			
Unexposed	71	18 (25)	0.86
Exposed	22	6 (27)	
Current caregiver:			
Birth mother	68	17 (25)	0.95
Kinship care	21	6 (29)	
Non-kinship care	4	1 (25)	
History of incarceration of parents/caregiver:			
No	44	10 (23)	0.52
Yes	49	14 (29)	
Educational attainment of caregiver:			
< high school	25	8 (32)	0.41
High school or more	68	16 (24)	
Caregiver strictness/supervision:			
4 th quartile	24 ^a	2 (8)	0.03
All other quartiles	67 ^a	20 (30)	

^aThe total n for this cell is 91 rather than 93 because two subjects in our sample did not complete the parenting style measure from which the caregiver strictness/supervision covariate is drawn.

Table 4Final Model, Logistic Regression^a of Delinquent Behavior (n=91; 22 with delinquent behavior, 69 without)

	Adjusted Odds Ratio (95% CI)	p-Value
Prenatal cocaine exposure:		
Lighter exposure vs. unexposed	0.34 (0.07, 1.57)	0.17
Heavier exposure vs. unexposed	0.64 (0.10, 4.06)	0.64
Prenatal cigarette exposure:		
<1/2 pack per day vs. unexposed	4.48 (0.68, 29.37)	0.12
>=1/2 pack per day vs. unexposed	12.60 (2.51, 63.37)	0.002
Cumulative childhood Exposure to violence (VEX-R):		
4 th quartile vs. all other quartiles	4.03 (1.25, 12.97)	0.02
Caregiver strictness/supervision:		
4 th quartile vs. all other quartiles	0.33 (0.06, 1.81)	0.20

* Wald p-value=0.02; pseudo R^2 =0.22; c statistic=0.80; Hosmer-Lemeshow chi-square=2.63 (df=8), p-value=0.96