



Prenatal cocaine exposure and age of sexual initiation: Direct and indirect effects



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ABSTRACT

Background: Prenatal cocaine exposure (PCE) has been linked to child behavior problems and risky behavior during adolescence such as early substance use. Behavior problems and early substance use are associated with earlier initiation of sexual behavior. The goal of this study was to examine the direct and indirect effects of PCE on sexual initiation in a longitudinal birth cohort, about half of whom were exposed to cocaine in utero.

Methods: Women were interviewed twice prenatally, at delivery, and 1, 3, 7, 10, 15, and 21 years postpartum. Offspring (52% female, 54% African American) were assessed at delivery and at each follow-up phase with age-appropriate assessments. At age 21, 225 offspring reported on their substance use and sexual behavior.

Results: First trimester cocaine exposure was a significant predictor of earlier age of first intercourse in a survival analysis, after controlling for race, sociodemographic characteristics, caregiver pre- and postnatal substance use, parental supervision, and child's pubertal timing. However, the association between PCE and age of first sexual intercourse was mediated by adolescent marijuana and alcohol use prior to age 15.

Conclusions: Most of the effect of PCE on age of sexual initiation occurred between the ages of 13–18, when rates of initiation were approximately 10% higher among exposed offspring. This effect was mediated by early adolescent substance use. These results have implications for identification of the exposed offspring at greatest risk of HIV risk behaviors and early, unplanned pregnancy.

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1. Introduction

In the medical literature on sexual behavior, a primary focus has been on the debut of sexual intercourse because earlier initiation of sex is a powerful predictor of HIV risk behaviors, sexually transmitted infections (STIs), as well as early and unintended pregnancy (Bachanas et al., 2002; Melchert and Burnett, 1990; Smith, 1997). One of the strongest correlates of early sex is substance use (Madkour et al., 2010; Zimmer-Gembeck and Helfand, 2008). A review of 35 longitudinal studies confirmed that substance use is linked to earlier sexual intercourse (Zimmer-Gembeck and Helfand, 2008). In a comparative study, substance use was significantly and positively associated with early sexual behavior in each country,

even though age of initiation and rates of substance use and sexual behavior varied by country (Madkour et al., 2010). And in a genetically informed design, Australian twins who experienced drunkenness earlier had sexual intercourse earlier than their co-twins who experienced drunkenness later (Deutsch et al., 2014).

In addition to substance use, there are other important correlates of early sexual intercourse. Boys report having sex earlier than girls (Nkansah-Amankra et al., 2011), and African American youth, on average, engage in intercourse earlier than White youth (Cavazos-Rehg et al., 2009; De Rosa et al., 2010; Upchurch et al., 1998). Other child characteristics associated with early sexual initiation include behavior problems, earlier pubertal timing, and depressive symptoms (Epstein et al., 2013; Longmore et al., 2004; Oberlander et al., 2011; Zimmer-Gembeck and Helfand, 2008). The environment is also an important predictor of sexual behavior including exposure to child abuse and neglect (Putnam, 2003; Upchurch and Kusunoki, 2004), violence (Berenson et al., 2001), and lower levels of parental supervision (Huang et al., 2011; Zimmer-Gembeck and Helfand, 2008).

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Many of these correlates of age of sexual initiation have also been documented in youth with prenatal cocaine exposure (PCE). For example, PCE is associated with increased child behavior problems (Ackerman et al., 2010; Bada et al., 2012; Bennett et al., 2013; Delaney-Black et al., 2004; McLaughlin et al., 2011; Minnes et al., 2010; Richardson et al., 2011; Whitaker et al., 2011). Children with PCE are often raised in less than optimal environments that are also linked to poor behavioral outcomes (Bradley and Corwyn, 2002; McLeod et al., 2007). Nonetheless, recent reviews evaluating studies that control for many factors in the postnatal environment have found a consistent relationship between PCE and child behavior problems (Ackerman et al., 2010; Buckingham-Howes et al., 2013).

Findings from longitudinal studies show that the effects of PCE continue into adolescence, involving new problem behaviors that emerge during this developmental period (Buckingham-Howes et al., 2013). For example, adolescents with PCE are more likely to initiate substance use at a younger age than non-exposed adolescents. Delaney-Black et al. (2011) reported that youth with PCE were more likely to initiate cocaine use by age 14 than non-exposed youth. PCE has also been associated with the early onset of alcohol and/or marijuana use (Frank et al., 2011; Minnes et al., 2014; Richardson et al., 2013b), and with substance use related problems (Min et al., 2014). Further, some researchers have reported a gender by PCE interaction, with boys with PCE having poorer inhibitory control (Carmody et al., 2011), a greater propensity for risk-taking (Allen et al., 2014), more behavior problems (Bennett et al., 2007; Delaney-Black et al., 2004), earlier initiation of substance use (Bennett et al., 2007), and increased frequency of sex without a condom (Lambert et al., 2013) than girls with PCE. Thus, it is possible that gender may moderate the effect of PCE on age at sexual initiation and interaction effects should be considered in analyses.

To our knowledge, sexual behavior as a function of PCE has only been examined in one other sample. Lambert et al. (2013) assessed adolescent sexual behavior at the 15-year follow-up of the Maternal Lifestyle Study of prenatal cocaine and/or opiate exposure. At delivery, the mothers reported on their cocaine use during pregnancy. Adolescents with any PCE were slightly more likely to report sexual intercourse by age 14 than non-exposed adolescents (37% versus 30%, respectively), but this was not statistically significant in multivariate models controlling for child gender, prenatal marijuana exposure, parental involvement, and community violence. PCE did significantly predict oral sex by age 14 in multivariate models: 31% of adolescents with PCE reported oral sex by this age compared to 22% of adolescents without PCE. Lambert et al. (2013) found no moderating effect of gender on oral sex by age 14. In another study of the same cohort, Conradt et al. (2014) found that boys, but not girls, prenatally exposed to multiple substances displayed physiological signs of neurobehavioral dysregulation that predicted sexual intercourse by age 16. It is not known if these findings are replicable in other cohorts of PCE individuals, or if they will apply to the initiation of sexual behavior after age 16.

This report is from a longitudinal, prospective study of PCE in which African American and White women were enrolled early in pregnancy and seen with their offspring at several time points across childhood, adolescence, and at 21 years post-partum. Extensive data on the mothers, offspring, and the home environment were collected at these phases. The purpose of these analyses was to examine the direct and indirect effects of PCE on the initiation of sexual behavior in offspring. We investigated whether there was a direct effect of PCE on sexual behavior, while controlling for other correlates of sexual behavior (e.g., race, gender, early puberty, lower parental monitoring). We also investigated whether the earlier effects of PCE on child behavior problems and early substance use, as summarized above, would mediate any direct effects on sexual behavior. A Gender \times PCE interaction term was also entered into

the direct and indirect models to determine if gender moderated the effect of PCE on age at sexual initiation.

2. Methods

2.1. Study design

Women attending the Magee-Womens Hospital (MWH) prenatal clinic who were at least 18 years of age were approached by research staff. Written informed consent was obtained prior to interviewing the women. Ninety percent of the women approached agreed to participate. Medical chart reviews were conducted on a random sample of the women who refused to participate and only 5% had a history of drug use during the current pregnancy. The University of Pittsburgh's Institutional Review Board and the Research Review and Human Experimentation Committee of MWH approved this research. A Confidentiality Certificate (DA-04-177) obtained from the Department of Health and Human Services assured participants that their responses could not be subpoenaed.

The first interview took place during the fourth or fifth prenatal month visit when women were asked about drug use in the year prior to pregnancy and the first trimester (including cocaine/crack, alcohol, tobacco, marijuana, and other illicit drugs). Any woman who reported any amount of cocaine/crack use during the first trimester was enrolled. The next woman interviewed who reported no cocaine/crack use during both the year prior to pregnancy and the first trimester was also enrolled. Those selected for the study ($N=320$) were subsequently interviewed during the seventh prenatal month and at ~24 h after delivery about their substance use during the second and third trimesters, respectively. Newborns were examined by research nurses unaware of exposure status. Follow-up assessments occurred at 1, 3, 7, 10, 15, and 21 years postpartum. At all phases, mothers were interviewed about substance use over the past year, sociodemographic and psychosocial characteristics, and psychiatric symptoms.

2.2. Participants

Between enrollment and delivery, 20 participants were eliminated for the following reasons: home delivery ($n=1$); miscarriage, abortion, or fetal death ($n=5$); moved out of the Pittsburgh area ($n=11$); lost to follow-up ($n=1$); or refused further participation ($n=2$). Four pairs of twins and one child with Down Syndrome were excluded from follow-up, resulting in a birth cohort of 295 mother/infant pairs. At 21 years of age, 70 offspring were not included in the current analyses for the following reasons: 6 died; 2 were placed for adoption; 5 were incarcerated or in a rehabilitation facility; 18 refused to participate; 20 moved out of the area, and 19 were lost to follow-up. Thus, 225 subjects were completed at the 21-year phase, representing 76% of the birth cohort. Offspring who were ($n=225$) and were not ($n=70$) included in these analyses did not differ on PCE. Among those who were assessed, 41%, 7.8%, and 10.8% were exposed to cocaine during the first, second, and third trimesters of pregnancy compared to 47%, 6.5%, and 8.6% among non-assessed subjects, respectively. There were also no differences between the two groups in sociodemographic characteristics. The two groups differed on offspring gender and maternal depression assessed at delivery. Seventy-three percent of those who were not assessed at 21 years were male compared to 48% who participated in the study at 21 years ($p<.001$). The mean maternal CES-D (Radloff, 1977) depression score at birth for those who were not assessed at 21 years was 44.2 compared to 41.4 among those who were assessed ($p<.05$).

2.3. Measures

2.3.1. Maternal drug use. Maternal cocaine, crack, alcohol, tobacco, marijuana, and other illicit drug use were assessed during confidential interviewing at each of the nine interview phases described above. Cocaine and crack use were reported in lines, rocks, or grams. Reported use of lines of cocaine or rocks of crack was converted into grams based on information from toxicology laboratories and law enforcement officials. One line was estimated to be 1/30th (0.03) of a gram; one rock was estimated to be 0.2 g. Usual, maximum, and minimum quantity and frequency of reported cocaine/crack use were converted into average number of grams/day. For descriptive purposes, cocaine/crack use was converted back to lines/day. First trimester cocaine use was initially analyzed as: (1) a continuous variable (g/day); (2) any use versus no use; and (3) frequent use (≥ 1 line/day) versus non-frequent use (<1 line/day). Cocaine use was dichotomized into use/no use (PCE/no PCE) for the second and third trimesters because of the small number of women who reported use during those time periods. The alcohol, marijuana, and tobacco variables were average number of reported drinks, joints, or cigarettes per day, respectively. A drink was defined as 12 ounces of beer, 4 ounces of wine, or 1.5 ounces of liquor. Alcohol, tobacco, and marijuana use for each trimester of pregnancy and at the 15-year follow-up phase were used as continuous variables in the analyses, with one exception. At the 15-year phase, too few mothers reported use of marijuana and cocaine for them to be analyzed as separate variables: Other illicit drug use at 15 years was defined as any reported use of marijuana, cocaine, or other illicit drugs. Further information about the maternal drug measures can be found in Day and Robles (1989) and Richardson et al. (2008).

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