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Risky Health Behaviors among Mothers-to-Be: The Impact of Adverse Childhood Experiences

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Abstract

Objectives—Adverse childhood experiences (ACEs) are risk factors for health problems later in life. This study aims to 1) assess the influence of ACEs on risky health behaviors among mothers-to-be, and 2) determine whether a dose response occurs between ACEs and risky behaviors.

Methods—Prospective survey of women attending health centers conducted at the first prenatal care visit, and 3 and 11 months postpartum. Surveys obtained information on maternal sociodemographic and health characteristics, and 7 ACEs prior to age 16. Risky behaviors included smoking, alcohol use, marijuana use and other illicit drug use during pregnancy.

Results—Our sample (n=1,476) consisted of low-income (mean annual personal income: \$8272), young (mean age: 24 yrs), African American (71%), single (75%) women.

Twenty-three percent of women reported smoking even after finding out they were pregnant, 7% reported alcohol use, and 7% reported illicit drug use during pregnancy. Nearly three-fourths (71%) had one or more ACE(s). There was a higher prevalence of each risky behavior among those exposed to each ACE than among those unexposed. The exception was alcohol use during pregnancy where there was not an increased risk among those exposed when compared to those unexposed to witnessing a shooting or having a guardian in trouble with the law or in jail. The adjusted odds ratio for each risky behavior was greater than 2.5 for those with ≥ 3 ACEs when compared to those without.

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Conclusions—ACEs were associated with risky health behaviors reported by mothers-to-be. Greater efforts should target the prevention of ACEs to lower the risk for adverse health behaviors that have serious consequences for adults and their children.

Keywords

risky health behaviors; smoking in pregnancy; adverse childhood experiences; childhood adversity

Introduction

Tobacco, alcohol, and drug use are risky health behaviors that often begin in adolescence and early adulthood. These behaviors share many of the same risk factors including the following adverse childhood experiences: physical abuse, sexual abuse, domestic violence, parental substance abuse, lack of parental involvement, single-parent household, young maternal age, homelessness, and poverty.¹⁻⁸ Risky health behaviors often cluster, with individuals reporting one behavior also being more likely to report other behaviors.^{6, 7, 9}

The well-described, direct consequences of tobacco smoking include an increased risk for chronic lung disease, lung cancer, thrombotic events, and coronary artery disease.¹⁰⁻¹² Alcohol and illicit drug use have adverse health consequences for affected individuals including an increased risk of homicide, suicide, motor vehicle accidents, and impaired family and peer relationships.¹³⁻¹⁵

The negative effects of risky health behaviors extend beyond health risks to the individual. Tobacco smoking during pregnancy increases the risk of fetal growth restriction, preterm birth, stillbirth, perinatal mortality, and behavioral problems.¹⁶⁻¹⁹ For women of childbearing age, alcohol and illicit drug use may impact the women directly, but also have significant impact on their children directly during fetal life and after birth. In utero exposure to alcohol or illicit drugs is associated with congenital defects, intrauterine growth retardation, low birthweight, preterm birth, cognitive deficits, and behavioral problems.^{20, 21} Increasingly, policy makers and investigators, including the American Academy of Pediatrics, the American College of Obstetricians and Gynecologists, and the Centers for Disease Control and Prevention, are stressing the importance of addressing alcohol and drug use not only during pregnancy but also during the preconception period,²²⁻²⁷ because it is often too late to counsel against these risk factors and their teratogenic effects by the time women seek prenatal care.²⁶ A recent Pregnancy Risk Assessment Monitoring System (PRAMS) found high rates of alcohol use preconception, with 50% of women reporting use.²⁷ As much as 40% of women do not realize they are pregnant until at least 4 weeks gestation, and approximately half of all births are unplanned, making the preconception period a particularly important time for counseling.^{28, 29}

The Adverse Childhood Experiences (ACE) Study of the Center for Disease Control and Prevention was one of the first studies to assess ACEs and their cumulative impact on a number of health outcomes and risky health behaviors, including smoking, early alcohol use, and drug abuse.^{9, 30-32} Subsequent to the ACE Study, there has been a growing literature on early life experiences and their relationship with health conditions and behaviors.^{33, 34} The ACE Study has major strengths including its large sample size, its findings, and its influence on research and health policy. The ACE Study is limited, however, by use of a retrospective, self-administered survey and the population studied: 46% of participants were ≥ 60 years at the time of the survey, 75% were Caucasian, >75% of participants had completed some or more college education, and all were insured by Kaiser Permanente.⁹

This study was conducted with the following objectives: 1) to assess the influence of ACEs on risky health behaviors among low-income, expectant mothers, and 2) to determine if there is a dose response associated with cumulative ACEs and the risk of adverse health behaviors. We hypothesized that ACEs are associated with risky health behaviors – smoking, alcohol use, marijuana use, and other illicit drug use during pregnancy. The study below contributes to the existing literature on early life experiences and risky health behaviors by focusing on low-income, urban mothers-to-be.

Methods

The study is part of a larger prospective cohort study on maternal stress, birth outcomes and infant health. The original cohort consisted of women who received prenatal care at health centers in Philadelphia, PA, and who were recruited consecutively from February 2000 to November 2002. These health centers consisted of Federally Qualified Health Center Look Alikes (FQHC-LAs) and FQHCs and have been described previously.³⁵ The ability to speak English or Spanish and having an intrauterine pregnancy were the two major enrollment criteria. This research was approved by the Thomas Jefferson University, the University of Pennsylvania, and Drexel University institutional review boards.

For this study, we use data from three surveys. The first survey was administered to women at their first prenatal care visit (mean gestational age $\pm$ standard deviation = 13.8 ± 6.3 weeks), and the second and the third were respectively conducted at 3 ± 1 months and 11 ± 1 months postpartum in their homes. Among the 2,374 eligible women, 42 declined participation, 190 had an unknown birth outcome, and 158 had a miscarriage, abortion, ectopic pregnancy or stillbirth. The remaining 1,984 women were known to have a live birth and completed the prenatal interview, and both postpartum surveys were completed by 1,482 (75%) women. Of the outstanding 502 participants, 126 moved, 129 refused to participate, 28 were excluded because they were unable to participate or no longer lived with their child, 10 had children who died, and 209 did not complete the postpartum interviews. Six additional women who completed the postpartum surveys were dropped from the study due to missing information for a final sample of 1,476 women. When compared to the final sample of 1,476, the 508 women, who lacked or had incomplete postpartum information, did not differ with respect to education, marital status, and parity; however, they were slightly older, more likely to be Latina and less likely to be white, and more likely to have lower annual personal income (data not shown). Trained female interviewers surveyed the women using standardized questionnaires in either English or Spanish. Maternal sociodemographic characteristics were assessed in the initial prenatal interview. Risky health behaviors were assessed in the first two surveys. Childhood experiences, prior to the age of 16, were assessed by 32 items in the third survey at 11 ± 1 months postpartum.

Study Variables

The dependent variables consisted of four risky health behaviors. Smoking in pregnancy, assessed in the prenatal survey, was defined as an affirmative response to the question, “*After you found out that you were pregnant this time, have you smoked at all?*” Alcohol, marijuana and other illicit drug use were assessed during the second survey. Alcohol use during pregnancy was defined any “beer, wine, 40's, coolers, liquor, or other alcoholic beverages when you were pregnant with [CHILD]?” Marijuana use during pregnancy was defined as any “marijuana, pot, joints or blunts when you were pregnant with [CHILD]?” Other illicit drug use during pregnancy was defined as any “other drugs, such as cocaine, heroine, crack, crank, LSD, uppers, downers, or similar drugs you can get on the street when you were pregnant with [CHILD]?”

Independent variables consisted of sociodemographic variables and adverse childhood experiences (ACEs). The following sociodemographic characteristics were obtained prenatally: maternal age, education, race/ethnicity, marital status, and annual personal income.

ACEs, based on events occurring before age 16, consisted of 7 variables: physical abuse, sexual abuse, verbal hostility, domestic violence, having witnessed a shooting, having a guardian in trouble with the law or in jail, and having a guardian with substance use. All questions were preceded by the clause, "Before you were 16 years old..."

Measures that overlapped with the ACE Study included assessments of verbal hostility, physical and sexual abuse, household violence, household substance abuse, and a household member being incarcerated. Measures differed from the ACE Study in that the 7 ACEs were assessed before age 16, whereas the 10 ACEs in the ACE Study were assessed before age 18. The ACE Study, however, assessed living with household members that were substance abusers or incarcerated rather than specifying substance abuse in or incarceration of a parent or guardian. ACE Study variables not assessed were emotional and physical neglect (measured in less than 50% of the ACE Study sample), household mental illness, and parental separation or divorce. One measured variable not found in the ACE Study was witnessing a shooting.

The seven ACE variables used in our study were defined as follows: (1) Physical abuse was defined by "rarely, sometimes, or often" as opposed to "never" to a combination of survey items, separated below by semicolons, and summarized by, "How often did you experience *slapping you in the face; punching, pushing, kicking, or beating you with fists; hitting you with an object such as a belt, spoon; or burning you with an object such as a cigarette or iron* by the person or people who raised you when you did something wrong?" *Spanking* was a separate question not included in our analysis. (2) Sexual abuse was based on a confirmatory answer to the question, "Were you ever *sexually abused*?" (3) Verbal hostility was defined by "often" as opposed to "sometimes, rarely or never" to the question, "How often did you experience *yelling* by the person or people who raised you when you did something wrong?" We believe that considering "sometimes or rarely" yelling as "verbally hostile" would overestimate verbal hostility.

(4) Domestic violence was based on an affirmative answer to, "Was *anyone in your house being hit or beaten up*?" In the ACE Study, "mother treated violently" was measured rather than any "domestic violence." (5) Witnessing a shooting was based on an affirmative response to, "Did you ever see someone get shot?" (6) Having a guardian in trouble with the law or in jail was based on an affirmative answer to two items summarized by, "Did your main parent/guardian ever have trouble with the law or ever spend any time in jail?" (7) Having a guardian with substance use was based on an affirmative answer to the question, "Did your main parent/guardian ever have a drug or alcohol problem?"

Statistical Analyses

Frequencies were calculated for categorical variables while means, medians and standard deviations were calculated for continuous variables. For each participant, we totaled the number of ACEs to create a summary score, which ranged from 0 to 7. Due to the low prevalence of reported illicit drug use other than marijuana during pregnancy (2%), marijuana use was combined with other drug use to record any illicit drug use in pregnancy. Bivariate analyses were performed comparing the prevalence of each of the risky health behaviors among those with and without each of the ACEs, using the Chi-square test for categorical variables and the Student's t test for continuous variables to test for statistical significance.

In addition, bivariate analyses were performed to determine if there was a dose response for each risky health behavior based on the total number of ACEs. For increasing ACEs, there was

a plateau effect for the risky behaviors after ACEs reached 3 or more; therefore, we combined those with 3 or more ACEs into a category of “3 or more.” Collapsing the higher categories also increased the number of subjects in cells of 2×2 comparison tables and increased the strength of comparisons between groups.

For each dependent variable – smoking, alcohol and any illicit drug use during pregnancy -- further analyses were performed to adjust for confounding variables. For each of the dependent variables, we conducted a logistic regression analysis to adjust for potential confounding variables and to derive maximum likelihood estimates of combined relative odds with 95% confidence intervals (95% CIs). Risk factors and confounders for inclusion in our final models were identified *a priori* based on our review of the literature, which is summarized above. Each of the models contained the following independent variables: age, race/ethnicity, marital status, education, annual personal income, and total ACEs. The Hosmer-Lemeshow goodness-of fit χ^2 statistic was calculated for each final model to assess model fit.³⁶

Results

The sociodemographic characteristics and the overall prevalence of risky health behaviors are shown in Table 1. The sample largely consisted of young, African American, low-income, single women of low education. Twenty-three percent of women reported smoking even after finding out they were pregnant, 7% reported alcohol use, and 7% reported illicit drug use during pregnancy. Of those reporting any illicit drug use, 5% reported any marijuana use, 2% other illicit drugs, and 1% reported marijuana and other illicit drug use.

Table 2 shows the overall prevalence for the individual and total ACEs. More than half of our sample reported a history of childhood physical abuse. For each of the other 6 ACEs, more than 10% of the sample was represented. The majority (72%) of participants had at least one ACE, and 21% reported three or more ACEs.

Figure 1 shows that those exposed to each ACE when compared to those unexposed had higher prevalence rates of each risky health behavior. The prevalence of each of the risky health behaviors was highest among those who experienced childhood sexual abuse suggesting that this is a particularly strong predictor of risky health behaviors. Using the Chi-square test for all comparisons, the p-value was <0.05 except for alcohol use among those witnessing a shooting or among those with a guardian in trouble with the law or in jail when compared to those without these experiences. The higher the number of total ACEs, the higher the prevalence of each risky health behavior, as shown in Figure 2.

In Table 3, adjusted odds ratios are shown for each independent variable. Older women were at a slightly higher risk for smoking, alcohol use, and any illicit drug use during pregnancy. In this low-income, urban sample, non-white race/ethnicity was associated with lower risks of the risky health behaviors when compared to white race/ethnicity. Single mothers were more likely to report smoking during pregnancy than married women. Women with less than a high school education had four times the risk of smoking during pregnancy and over twice the risk of illicit drug use during pregnancy than those with more than high school education. Consistent with bivariate analyses, a dose response was noted for each risky behavior. Those with three or more ACEs had over 2.5 times the risk of smoking, alcohol use, and any illicit drug use during pregnancy when compared to women who reported no ACEs. The multivariate logistic regression models for smoking, alcohol use, and any illicit drug use during pregnancy, were respectively associated with Hosmer-Lemeshow χ^2 statistics of 6.49 ($P = 0.59$), 7.59 ($P = 0.47$), and 5.25 ($P = 0.73$), suggesting a good fit for each of the models.

Discussion

This study investigated the relationship between childhood experiences and subsequent risky health behaviors among low-income, urban, mothers-to-be. Individual and total ACEs were associated with smoking, alcohol use, and any illicit drug use during pregnancy.

In this sample of urban, low-income women, the prevalence of ACEs was high. Reports of physical abuse (52%) were high, despite a strict definition that excluded spanking. This rate is higher than previous estimates of physical abuse.^{37, 38} The prevalence of child sexual abuse was lower than in the ACE Study (13% vs. 24%)³⁷ and lower than previous estimates of 20% to 40%.³⁹ The prevalence of domestic violence was nearly identical to that found in the ACE Study, 13% vs. 13.9%.³⁷ The majority (71%) had at least one ACE and one in five (21%) reported major childhood adversity, with 3 or more ACEs.

The findings that individual and total ACEs, in a dose-response manner, were associated with the risky health behaviors are consistent with previous literature showing an association between childhood adversity and risky health behaviors in adulthood. Prior studies have shown a significant relationship between childhood adversity and an increased risk for low self-esteem, behavior problems and depression,^{40, 41} outcomes that are associated with substance use. Affected individuals may partake in high-risk behaviors as a means of coping with or self-regulating stress, low self-esteem and pain. In addition, evidence suggests that childhood trauma and stress are associated with neurodevelopmental deficits, such as inhibition of neurogenesis and lower volumes of certain regions of the brain, and alterations of biological stress systems, which may play a role in subsequent health behaviors.^{42, 43}

Furthermore, the intergenerational impact of risky health behaviors is highlighted by the finding that children with parents/guardians with a history of substance use were more likely to use substances, a finding supported by previous research on alcohol and drug use.^{41, 44} This intergenerational transmission is thought to be related to many causes, including genetic and environmental factors.

This study has a number of limitations. Not all mothers completing the prenatal survey completed the postpartum surveys. The fact that these mothers had lower annual personal incomes suggests that they may have had more financial hardship. It is possible that they had more childhood adversity; therefore, our results may underestimate some exposures and outcomes. Reports of childhood experiences were retrospective, with women being asked to report childhood experiences before age 16 when they were on average 24. Reports are subject to recall bias, although evidence suggests that this bias has been overestimated.⁴⁵ Our study, building on the ACE Study, may be subject to less recall bias since our sample is younger (average age of 24 vs. 56).³¹ Survey questions may not capture the complexity and diversity of childhood experiences. For instance, this study did not measure the severity or frequency of experiences. Our assessment of sexual abuse used the term “sexual abuse,” which may have underestimated exposure. A recent study showed that use of the word “abuse” in questions, when compared to questions describing abusive experiences, resulted in lower reported abuse in community samples.⁴⁶ In addition, patient reports have been shown to underestimate actual substance use; therefore, we may have underestimated the prevalence of risky health behaviors. Alcohol use during pregnancy may have been overestimated in that we assessed any alcohol use, which could have included occasional “social” drinks. This study also did not quantitatively assess cigarette, alcohol, or illicit drug.

This study adds to the growing literature on adverse childhood experiences and their association with adverse health conditions and risky health behaviors among affected individuals, including mothers in the perinatal period.^{9, 30, 35, 41} Health professionals should use the perinatal period as a “window of opportunity” to discuss parental experiences and attitudes

and to educate parents about the harmful effects of physical and sexual abuse, and verbal hostility. Medical histories should include questions that elicit information about domestic violence, exposure to gun violence, and household substance use. Health care professionals should partner with local community organizations to provide available resources to families and to improve social and health policies in an effort to reduce childhood adversity.

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Figure 1.

Comparison between the Prevalence of Risky Behaviors among Those Exposed and Those Not Exposed to Adverse Childhood Experiences (N =1,476)

* All difference were significant at or below the 0.05 level except there were no significant differences in alcohol use among those witnessing a shooting or among those with a guardian in trouble with the law when compared to those without these experiences.

Figure 2. Prevalence of Risky Health Behaviors during Pregnancy and Total Number of ACEs

Table 1
Sociodemographic Characteristics and Prevalence of Risky Health Behaviors for Overall Study Population (N = 1,476)

Characteristic	Value
Sociodemographic Characteristics	
Maternal age, y, mean $\pm$ SD	24 $\pm$ 6
Education, n (%)	
Less than high school	590 (40)
High School/ GED *	620 (42)
College or more	266 (18)
Race/Ethnicity, n (%)	
African American	1048 (71)
Latina	251 (17)
White	133 (9)
Other	44 (3)
Marital Status, Single, n (%)	1107 (75)
Annual Personal Income, n (%)	
<\$6450	738 (50)
\$6450 - \$11 758	369 (25)
>\$11 758	369 (25)
Risky Health Behaviors, n (%)	
Smoking in Pregnancy	334 (23)
Alcohol Use in Pregnancy	99 (7)
Any Illicit Drug Use in Pregnancy	97 (7)
Marijuana Use	80 (5)
Other Illicit Drug Use	27 (2)
Marijuana and Drug Use	10 (1)

* GED indicates General Educational Development certificate.

Table 2
Prevalence of Individual and Cumulative Adverse Childhood Experiences (ACEs) for the Study Population (N = 1,476)

Adverse Childhood Experiences	n (%)
Individual Adverse Childhood Experience	
Physical Abuse	763 (52)
Sexual Abuse	188 (13)
Verbal Hostility	398 (27)
Domestic Violence	198 (13)
Witnessed a Shooting	272 (18)
Guardian in Trouble with the Law or in Jail	157 (11)
Guardian with Substance Use	249 (17)
Total Adverse Childhood Experiences	
0	421 (28)
1	440 (30)
2	303 (21)
≥ 3	308 (21)

Table 3
Adjusted Odds Ratios (aORs) from Models Predicting Smoking, Alcohol Use, and Any Illicit Drug Use during Pregnancy (N= 1,418)

Variable	Smoking aOR (95% CI)	Alcohol Use aOR (95% CI)	Any Illicit Drug Use aOR (95% CI)	p-value for comparison of aORs across models
Sociodemographic Characteristics				
Age (continuous variable)	1.11 (1.08, 1.13)	1.10 (1.07, 1.14)	1.08 (1.04, 1.12)	0.361
Race/Ethnicity				
African American	0.19 (0.13, 0.29)	0.37 (0.21, 0.65)	0.52 (0.29, 0.93)	0.008
Latina	0.10 (0.06, 0.17)	0.35 (0.16, 0.77)	0.24 (0.10, 0.61)	0.017
Caucasian	Reference	Reference	Reference	---
Other	0.13 (0.05, 0.38)	0.35 (0.07, 1.64)	0.24 (0.03, 1.93)	0.595
Marital status				
Single	1.44 (1.01, 2.07)	1.43 (0.81, 2.52)	1.62 (0.85, 3.09)	0.929
Married	Reference	Reference	Reference	---
Education				
College or more	Reference	Reference	Reference	---
High school/GED	2.26 (1.45, 3.53)	0.97 (0.53, 1.77)	2.14 (0.97, 4.75)	0.059
Less than high school	4.04 (2.55, 6.41)	1.12 (0.60, 2.09)	2.54 (1.14, 5.68)	0.003
Annual personal income				
<\$6450	Reference	Reference	Reference	---
\$6450-11,700	1.03 (0.71, 1.51)	1.21 (0.65, 2.24)	1.95 (0.98, 3.88)	0.233
>\$11,700	0.96 (0.68, 1.36)	1.63 (0.93, 2.86)	2.57 (1.35, 4.89)	0.023
Adverse Childhood Experiences (ACEs)				
None	Reference	Reference	Reference	Reference
One	1.37 (0.93, 2.01)	1.32 (0.67, 2.64)	1.88 (0.85, 4.14)	0.702
Two	1.77 (1.18, 2.65)	2.55 (1.31, 4.97)	3.57 (1.67, 7.65)	0.208
Three or More	2.60 (1.77, 3.83)	3.67 (1.95, 6.91)	6.08 (2.95, 12.53)	0.088

CI, confidence interval.

Significant results are shown in bold font.

All variables included in the models are shown above.