

BRIEF REPORT

Illicit Drug Use Among Pregnant Women Enrolled in Treatment for Cigarette Smoking Cessation

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ABSTRACT

Introduction: Smoking during pregnancy is the leading preventable cause of poor pregnancy outcomes in the United States. In population studies and nationwide surveys, pregnant smokers report more illicit drug use than pregnant nonsmokers. The purpose of this study was to examine the prevalence of illicit drug use among pregnant women enrolled in clinical trials for smoking cessation.

Methods: Urine specimens from 115 pregnant women were tested for illicit drug use during a study intake visit (~10th week of pregnancy) and during the final antepartum (FAP) smoking-status assessment (~28th week of pregnancy). Participants smoked about 18 cigarettes/day pre-pregnancy, were generally young (<25 years), Caucasian, with a high school education and without private insurance.

Results: About 34% of specimens from the intake visit and 25% of those from the FAP assessment tested positive for an illicit drug. The most common drug detected was marijuana (90% of positive specimens), followed by opioids (18%), cocaine (5%), benzodiazepines (3%), and methadone (3%). None tested positive for amphetamines. The majority of women (53%) who tested positive for an illicit substance at intake also tested positive at the FAP assessment.

Conclusions: Approximately a quarter to a third of pregnant women enrolled in these smoking-cessation trials were determined to be using illicit drugs, with marijuana use being the most prevalent. Those providing smoking-cessation services to pregnant women may want to be prepared to assist with obtaining services for other drug use as well.

INTRODUCTION

Cigarette smoking is the leading preventable cause of poor pregnancy outcomes in the United States and other developed countries (Bonnie, Stratton, & Wallace, 2007), increasing risk for infertility, pregnancy complications, intrauterine growth restriction, infant death, and later-in-life metabolic and other diseases (e.g., Dietz et al., 2010; Guerrero-Preston et al., 2010; Hackshaw, Rodeck, & Boniface, 2011; Rogers, 2009). Approximately 22% of U.S. women of childbearing age are regular cigarette smokers, with a higher prevalence (>30%) among economically disadvantaged women (Higgins & Chilcoat, 2009; U.S. CDC, 2008). Nationally, approximately 45% of those smokers report quitting upon learning of a pregnancy (Tong, Jones, Dietz, D'Angelo, & Bombard, 2009). However, biometrically confirmed quit rates are closer to 20% (Higgins et al., 2009; Solomon & Quinn, 2004).

Of interest in this study, other drug use appears to be more prevalent among pregnant smokers compared with pregnant

nonsmokers. In a U.S. population-based survey, 24.2% of pregnant women who reported smoking in the last month also reported illicit drug use in the last month compared with only 2.4% of nonsmoking pregnant women (SAMHSA, 2010). In an Australian population-based study, 85% of women with substance use disorder smoked during pregnancy compared with 15% of women without a substance use disorder (Burns, Mattick, & Cooke, 2006).

Despite these higher rates of other drug use, most smoking interventions for pregnant women focus exclusively on cigarette smoking, leaving other risky behaviors unaddressed. In clinical trials performed in our research clinic for smoking during pregnancy at the University of Vermont, for example, we refrain from detailed queries about illicit drug use to encourage all women who need these services to apply for them without concern about reports to child protective services regarding illicit drug use. However, it is worth knowing the rates of illicit drug use that one might overlook with such policies. To our knowledge, there are no reports on prevalence of illicit

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drug use among women participating in smoking-cessation treatment during pregnancy. As such, an institutional review board (IRB)-approved retrospective analysis of illicit drug use using limited identifiers was conducted as an initial step toward measuring the prevalence of illicit drug use among pregnant women enrolled in smoking-cessation treatment.

MATERIALS AND METHODS

Participants

Participants were 115 pregnant smokers enrolled in university-based outpatient research clinical trials for smoking cessation. Participants were recruited from obstetric practices in the greater Burlington, Vermont area. Participants were largely young (<25 years), Caucasian women, most with a high school education (average 12.2 years) and most without private insurance (Table 1). On average, they started smoking at about 15, smoked about 18 cigarettes/day prior to the pregnancy and were smoking about 9 cigarettes/day upon entering the clinical trials.

Procedure

Women in this study participated in trials examining the efficacy of an incentive-based smoking-cessation program. They were assigned to either an abstinence-contingent condition wherein they received vouchers exchangeable for retail items contingent on biochemically verified smoking abstinence or to a noncontingent control condition where they received vouchers independent of smoking status. For treatment details, see Higgins et al. (2011). Women were included who self-reported smoking, were less than 25 weeks pregnant at intake, lived in the local county with no plans to move for at least 6 months after delivery, and spoke English. Women were excluded if they were incarcerated, had participated in, or lived with someone who had participated in, a previous incentive program, or were taking antipsychotic or opioid-maintenance medications.

All participants completed regularly scheduled assessments of smoking status, including an intake assessment (at ~10 weeks gestation) and a final antepartum (FAP) assessment (at 28-weeks gestation or later). At both assessments, women were queried about any medication use and were required to provide a urine specimen. Each specimen was divided into three parts. One third was analyzed for cotinine immediately using an onsite benchtop enzyme multiplied immunoassay machine. The second third was frozen and shipped monthly to LabStat International (Kitchener, Ontario, Canada) for quantitative urine cotinine testing using well-established gas chromatography methods. The remaining third was frozen and retained for future use, including in this study. To allow for re-testing of the specimens for illicit drug use, urine specimens were de-identified and attached to only a limited amount of demographic and treatment-outcome information in line with recommendations from the University of Vermont IRB. Specimens and demographics were given new identifiers, the sets of data were connected by a third party, and the file containing the recoding scheme was destroyed.

The urine specimens provided during intake and FAP assessments were used to examine drug use. These time periods were selected for analysis as they represented drug use early and late in pregnancy. Specimens were collected over a 5-year period and stored at -20 °C until tested. For this study, specimens were brought to room temperature and tested for amphetamines (>300 ng/ml cutoff), benzodiazepines (>300 ng/

Table 1. Participant Characteristics

Population characteristics	<i>n</i> = 115		
Caucasian, %	94		
Married, %	16		
Weeks pregnant at intake	10.0 (0.4)		
Living with other smoker(s), %	82		
With private insurance, %	23		
Age started smoking, years	15.5 (0.3)		
Intake CO, ppm	9.4 (0.6)		
Intake urinary cotinine, ng/ml	867.6 (54.9)		
First pregnancy, %	65		

Group characteristics	Drug negative (<i>n</i> = 75)	Drug positive (<i>n</i> = 40)	<i>p</i> Values
Demographics			
Age, years	25.2 (0.6)	23.6 (0.7)	0.07
Education, years	12.2 (0.2)	12.1 (0.1)	0.78
BDI score	10.3 (0.9)	10.8 (0.9)	0.71
Smoking characteristics			
Cigarettes/day prepregnancy	17.5 (0.9)	19.8 (1.4)	0.16
Cigarettes/day in past 7 days	8.9 (0.8)	7.9 (0.8)	0.39

Note. Values shown as mean (standard error) unless indicated otherwise. BDI = Beck Depression Inventory.

ml), tetrahydrocannabinols (THC; >100 ng/ml), cocaine (>300 ng/ml), opioids (>300 ng/ml), and methadone (>150 ng/ml) using an onsite Siemens Viva-E analyzer. Any drug use that was detected, but had not been reported as medicinal by the participant, was considered illicit use. As methadone maintenance was an exclusion from the study, methadone-positive results were considered as illicit use.

Statistical Analyses

Demographic characteristics between study participants who ever versus never tested drug positive were compared using two-tailed *t* tests and chi-square tests. Demographics were also examined to see if any characteristics were predictive of drug use. Associations between urine toxicology results and smoking-cessation treatment outcomes were examined using Cochran–Mantel–Haenszel (CMH) tests to evaluate the effects of ever testing drug positive (intake or FAP assessment), or testing drug positive at the FAP assessment, on smoking abstinence rates at the end-of-pregnancy assessment using treatment condition as strata. Breslow–Day tests were performed to evaluate the homogeneity of the effect of drug use on abstinence rates across treatment conditions.

RESULTS

Drug Use Prevalence

There were 169 specimens contributed by the 115 participants in this study; 97 specimens were from the intake and 72 from the FAP assessment; 53 women contributed specimens from

Table 2. Urine Toxicology Results for Pregnant Smokers in Clinical Trials Early and Late in Pregnancy

Drugs	Either intake or FAP (<i>n</i> = 115)	Intake (<i>n</i> = 97)	FAP (<i>n</i> = 72)	Both (<i>n</i> = 53)	
				Intake	FAP
None	75 (65%)	64 (66%)	54 (75%)	34 (64%)	41 (77%)
Any drug	40 (35%)	33 (34%)	18 (25%)	19 (36%)	12 (23%)
Cocaine	2 (2%)	1 (1%)	1 (1%)	1 (2%)	1 (2%)
Benzodiazepine	1 (1%)	1 (1%)	1 (1%)	1 (2%)	1 (2%)
Methadone	1 (1%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)
Opiates	7 (6%)	4 (4%)	4 (6%)	1 (2%)	2 (4%)
THC	36 (31%)	29 (30%)	16 (22%)	17 (32%)	10 (19%)
Amphetamines	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Note. Numbers of women (%) testing positive for illicit drug use either across the intake (~10th week of pregnancy) or FAP (~28th week of pregnancy) assessments, during their intake visit, during their final antepartum visit (FAP), and among those individuals for whom samples from both intake and FAP were available, the number testing positive at each time period. Due to some women testing positive for multiple substances, not all percentages add up to 100%. THC = tetrahydrocannabinols.

both intake and FAP assessments. No significant differences in demographics were detected between those who ever versus never tested drug positive (Table 1) and as such no further analyses on demographics as potential predictors of drug use were conducted.

Among the 115 participants, 35% (40) tested drug positive at least once (Table 2). Of those 40 individuals who tested positive, 90% (36/40) tested positive for THC. Also represented were cocaine, 5% (2/40); benzodiazepines, 3% (1/40); methadone, 3% (1/40); and other opioids, 18% (7/40). About 15% (6/40) tested positive for multiple substances.

Across all 169 specimens examined, 34% (33/97) from the intake assessments and 25% (18/72) from the FAP assessments tested positive (Table 2). These results are similar to the results for individuals for whom both intake and FAP specimens were available, which had a positive rate of 36% (19/53) at intake and 23% (12/53) at FAP. Within this group, 53% (10/19) of those who tested positive at intake also tested positive at FAP.

Within the group where both intake and FAP specimens were available, of the 20 that ever tested drug positive, half showed the same usage at both timepoints (eight positive for THC, one for both THC and opioids, and one for benzodiazepines). Additionally, one woman tested positive for cocaine and opioids, and another for THC, at FAP but not intake. Seven women tested positive for THC at intake, but not at FAP.

Effects of Drug Use on Smoking Cessation

No significant differences were found in smoking abstinence rates between those who ever versus never tested drug positive across the two assessments (CMH $\chi^2(1) = 0.07, p = .79$) or at FAP (CMH $\chi^2(1) = 2.78, p = .10$). There was no evidence that the effect of drug use on smoking abstinence was heterogeneous across treatment groups at any time during pregnancy (Breslow–Day $\chi^2(1) = 0.33, p = .57$) or at FAP (Breslow–Day $\chi^2(1) = 0.77, p = .38$). Although differences in smoking abstinence for those testing drug-positive at FAP is not significant, 72% (13/18) of those who tested positive for drug use at the FAP assessment were also positive for cotinine (i.e., recent cigarette smoking) as compared with 51% (28/55) of those testing drug negative.

CONCLUSIONS

The present results demonstrate that illicit drug use, especially marijuana, is common in a sample of pregnant women enrolled in smoking-cessation treatment. The approximately 30% prevalence rate for marijuana use in this study corresponds well with the 23% of pregnant smokers reporting use in the last month in a U.S. national survey of drug use (SAMHSA, 2010) and is considerably higher than the 2%–4% of pregnant women in general who report marijuana use (e.g., Havens, Simmons, Shannon, & Hansen, 2009). Additionally, the majority of women who tested positive for illicit drug use at the beginning of their pregnancy in this study also tested positive near the end of their pregnancy, suggesting ongoing use. It should be noted that our measurements of drug use likely underestimate illicit use in pregnant smokers, as those who were receiving opioid-maintenance therapy (buprenorphine or methadone) were excluded from the current trials as opioids are known to alter smoking rates (e.g., Mello, Mendelson, Sellers, & Kuehnl, 1980). As opioid-maintained pregnant smokers have relatively high rates of illicit drug use (Choo, Huestis, Schroeder, Shin, & Jones, 2004; Haug, Stitzer, & Svikis, 2001; Jones et al., 2009), any trial that excludes them will likely underestimate illicit drug use in pregnant smokers.

One concern about drug use during pregnancy is possible detrimental effects on smoking cessation. While this study was not powered to investigate effects on treatment success, many abused drugs are known to increase smoking rates (e.g., cocaine, Roll, Higgins, & Tidey, 1997; alcohol, Griffiths, Bigelow, & Liebson, 1976; opioids, Mello et al., 1980) and interfere with quit attempts in nonpregnant populations (Richter, Ahluwalia, Mosier, Nazir, & Ahluwalia, 2002; Stapleton, Keaney, & Sutherland, 2009), although marijuana use has not been demonstrated to do so (Nemeth-Coslett, Henningfield, O’Keeffe, & Griffiths, 1986). However, we know of one study where marijuana use was correlated with failure to quit smoking during pregnancy (Haskins, Bertone-Johnson, Pekow, Carbone, & Chasan-Taber, 2010).

While not examined in this study, a major concern about drug use during pregnancy is adverse fetal effects. While marijuana was the most common drug seen in this study effects

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of marijuana use on birth outcomes are not well established. Indeed, when potentially confounding influences of sociodemographic variables and cigarette smoking are controlled for, marijuana use may have no discernible adverse effects on birth outcomes (Bada et al., 2002; Bailey, McCook, Hodge, & McGrady, 2012). Cigarette smoking during pregnancy continues to be the strongest predictor of adverse fetal effects of drug use. In a large, multisite trial cigarette smoking was shown to have greater adverse effects on birth weight, intrauterine growth restriction, and premature birth than illicit drug use (Bada et al., 2005). Abolishing maternal smoking appears to be the most effective way to improve fetal health, especially when the higher prevalence of maternal smoking, compared with maternal drug use, is considered (Burstyn, Kapur, & Cherry, 2010).

A few limitations of this study merit mention. We were not able to test the samples for buprenorphine, which is abused in the study area; therefore, the number of opioid users may be an underestimation. Additionally, this sample consists of treatment-seeking pregnant smokers, which may be inherently different than the general population of pregnant smokers (e.g., perhaps less likely to use other drugs). As this study was retrospective, we could only examine a limited number of characteristics as potential predictors of drug use.

Overall, considering the relatively high prevalence of illicit drug use in this pregnant smoker population, as well as possible adverse consequences of such use on smoking cessation, it may be prudent for those providing smoking-cessation therapy to be prepared to assist pregnant women with obtaining services for other drug use as well. The American College of Obstetricians and Gynecologists (ACOG) provides guidelines regarding screening, assessment, and brief intervention in this population (ACOG, 2008).

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