Maternal Marijuana Use and Neonatal Outcome: Uncertainty Posed by Self-Reports

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Abstract: To assess the validity of self-reported marijuana use during pregnancy, this study randomly allocated pregnant women into a group who were told their urine would be tested for marijuana, alcohol, and other drugs and another group not so tested. Women told they would be tested reported more marijuana use during pregnancy than did untested women. Moreover, urine assays identified more women who used marijuana during pregnancy than were willing to admit it in the interview even after being told their urine would be tested. No differences in reported drinking or cigarette smoking during pregnancy were found between tested and untested women. (*Am J Public Health* 1986;76:667–669.)

Introduction

Research on maternal smoking and drinking during pregnancy has consistently revealed that women who smoke cigarettes during pregnancy on average deliver infants whose birthweight is 150–250 grams lower and experience a one to two day lower mean duration of gestation than nonsmoking women.[1] This association has held up through social classes, and over different age groups, ethnic groups, and geographic locations. In contrast, the relation of maternal drinking during pregnancy and low birthweight or pre-term delivery has been less consistently observed.[1]

Only four published studies of the effects of maternal marijuana use on fetal development have examined samples of at least 500 mother-child pairs and analytically controlled for potential confounding. Two studies in Boston interviewed mothers after delivery about their habits during pregnancy. One study of 12,718 mother-child pairs[2] found a suggestive association between maternal marijuana use during pregnancy and congenital malformations, but no association between maternal marijuana use and shorter gestation or lower infant birthweight. Another Boston study of 1,690 mother-child pairs[3] found an independent association between maternal marijuana use during pregnancy and lower infant birthweight. The mean reduction was 105 grams. Mothers who smoked marijuana during pregnancy delivered infants who were also more likely to have features compatible with the fetal alcohol syndrome. Both findings were observed after the effects of maternal cigarette smoking, drinking, weight gain, and illnesses were analytically controlled. An association with shorter duration of gestation, however, was not observed.

Prospective studies of 7,301 births[4] in Australia and 583 infants in Canada[5] both found independent associations between maternal marijuana intake during pregnancy and shorter gestation after cigarette use, alcohol use, and several other variables were controlled analytically. Only the Australian study noted an independent association with low birthweight, and neither identified an association with congenital malformation. Mothers in these two studies were interviewed prior to delivery about their habits during pregnancy.

A possible reason for the inconsistency in study results is the reliance by these studies on maternal self-report of marijuana use, smoking, and drinking with disproportionate underreporting by different study populations. Maternal marijuana use during pregnancy in particular may be underreported relative to cigarette and alcohol use because marijuana is illegal.

This study explores whether self-reported maternal marijuana use is underreported relative to self-reported cigarette and alcohol use during pregnancy.

Methods

We undertook a study of pregnant women who spoke English or Spanish and who received prenatal care at Boston City Hospital between June and December 1984. Women were asked if they would be interviewed for 20 minutes about their nutrition, work, illnesses, and habits such as marijuana use, drinking, and cigarette smoking during pregnancy. The mothers were told these factors were being explored to assess what effects, if any, they might have on the development of the child they were carrying. Prior to the interview, these women were randomly divided into two groups. One group of women was told, "Urine samples are requested as part of standard prenatal care from you to examine sugar, protein, nutritional problems, and infections. As part of this study we would also like to recheck the sample for kidney function and presence of alcohol, marijuana, prescription, and non-prescription drugs." The other group of women was not told about urine testing and their urine was not tested for marijuana or other drugs. Approval to conduct this study was granted by the Boston City Hospital Human Subjects Committee in May 1984. A member of the study team other than the interviewer explained the urine testing to respondents.

Interviewers did not know which women were told their urines would be tested. In the interview women were asked if they had ever used marijuana and those responding affirmatively were asked if they had used it during the three months prior to pregnancy and if they used it since they became pregnant. The bogus pipeline paradigm[6,7] offers reason to expect higher self-reported marijuana use in the group given urine assays. Of 276 women asked to participate

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266 (96 per cent) agreed to be enrolled in the study. Of the ten refusals, four were originally assigned to the urine tested group, three to the nontested group, and three initial assignments were not recorded.

After the interview, the urine specimen provided by each subject in the first group of women was immediately labeled with subject identification number and refrigerated in the clinic. Within 24 hours, the urine samples were received in the Massachusetts State Laboratory and frozen at −20°C in plastic containers until analyses were performed. Use of cannibinoids was determined by a positive result from the EMIT d.a.u. Urine Cannabinoid Assay (EMIT) which is designed to detect 11-nor-delta-9-tetrahydrocannabinol-9-carboxylic acid (THC-COOH).[8] THC-COOH is the major urinary metabolite of delta-9-tetrahydrocannabinol (delta-9-THC). The assay also detects other delta-9-THC metabolites. When sufficient urine was available, samples that tested positive by EMIT assay were tested by High Pressure Liquid Chromatography (HPLC) to confirm the presence of THC-COOH.[9]

Levels of urinary metabolites are detectable within a few hours after exposure of marijuana[10] and can remain detectable seven to ten days after smoking.[11] Frequent users often have continually detectable baseline levels. Only as much as 50 per cent of an initial dose may be excreted within 72 hours.

One hundred twenty-nine samples were tested for cannabinoid use by EMIT. Eight women were unable to provide samples because of an inability to urinate during their clinic visit. Nineteen samples yielded a positive result. Sixteen of those samples were confirmed by HPLC. The remaining three samples were not tested because there was an insufficient amount of urine.

Results

Forty-five per cent of women in the urine assay group reported ever smoking marijuana, compared to 51 per cent in the non-assayed group (Table 1). There were no important differences between groups in race, religion, marital status, and trimester of pregnancy at the time of interview. No differences were observed in the proportions of respondents who had ever drank or smoked cigarettes, who drank or smoked cigarettes during pregnancy, or during the three months prior to pregnancy.

Subjects within the group that had ever smoked marijuana did not differ appreciably in age, race, marital status, education, religion, or trimester of pregnancy, nor did they differ in their reported use of cigarettes prior to pregnancy or during pregnancy, drinking either during the three months prior to pregnancy or the first three months during pregnancy. As shown in Table 2, women in the group that knew their urine would be assayed were more likely to report using marijuana during the three months prior to pregnancy (63 per cent vs 41 per cent) and more likely to report marijuana use during pregnancy (37 per cent vs 24 per cent). During pregnancy, women in the group told their urine would be assayed reported greater frequency (Table 3) and greater amounts of marijuana use during pregnancy (Table 4) than women in the non-assayed group. No differences in reported frequency or amount of either cigarette smoking or drinking were observed between the groups. This was also true when the two total groups (137 and 129) were compared.

In the urine assay group, 23 women acknowledged smoking marijuana during pregnancy. The urine test further identified five subjects whose urine was positive for marijuana but who did not report such use in the interview. By combining urine and self-report results, overall use during pregnancy was identified among 20 per cent in the assay group, compared to a reported level of 12 per cent in the group that were not told about urine testing (95 per cent confidence interval of difference: 1, 15).

TABLE 1—Characteristics of Pregnant Mothers in Urine Assay and No Urine Assay Groups

	Urine Assay	No Urine Assay
Ever Smoked Marijuana	45% ($62/_{137}$)	51% ($66/_{129}$)
	Of Respondents Who Ever Smoked Marijuana	
Characteristics	Assay (N = 62) %	No Assay (N = 66) %
Race		
White	18	20
Black	71	61
Other	11	20
Religion		
No Religion	13	8
Catholic	32	44
Protestant	34	36
Other	21	12
Education		
Elementary	8	6
Some High School	39	33
High School	37	42
College	16	18
Marital Status		
Single	60	57
Single, Living w/Father of child	23	12
Married	11	19
Separated, Divorced, Widowed	7	12
Mean Age	22.2	22.8
Trimester of Pregnancy at time of Interview		
1st	16	20
2nd	39	33
3rd	45	47

TABLE 2—Self-Reported Marijuana Use, Cigarette Smoking, and Drinking Prior to and during Pregnancy of Respondents in the Two Groups Who Ever Smoked Marijuana

Self-reported Use	Urine Assay (N = 62) %	No Urine Assay (N = 66) %	Difference (95% C.I.; one-tailed)
Smoked Cigarettes			
Prior to Pregnancy	65	59	6 (−9, 21)
During Pregnancy	50	53	−3 (−18, 12)
Drank			
Prior to Pregnancy	66	68	−2 (−16, 12)
During Pregnancy	55	49	6 (−8, 20)
Smoked Marijuana			
Prior to Pregnancy	63	41	22 (7, 37)
During Pregnancy	37	24	13 (0, 27)

Discussion

All of the epidemiologic studies of maternal marijuana use during pregnancy and fetal development have recognized that marijuana users also tend to smoke cigarettes, drink, and take more illicit psychoactive drugs. When the independent variables are so highly interrelated, measurement becomes a major concern. None of the published studies with large samples have attempted to verify maternal self-report with urine or blood testing. This comparison of interviews with

TABLE 3—Reported Frequency of Marijuana Use (%) in the Two Groups Prior to and during Pregnancy

Reported Frequency of Marijuana Use	Urine Assay (N = 62) %	No Urine Assay (N = 66) %
Prior to Pregnancy		
None	37	59
Monthly	21	20
Weekly	31	11
Daily	11	11
During Pregnancy		
None	63	76
Monthly	23	11
Weekly	10	14
Daily	5	0

TABLE 4—Usual Number of Marijuana Joints Reported Consumed on Days Respondents in the Two Groups Smoked Marijuana

Reported Joints Smoked	Urine Assay (N = 62) %	No Urine Assay (N = 66) %
Prior to Pregnancy		
None	37	59
1	21	19
2	19	6
3+	23	15
During Pregnancy		
None	63	76
1	24	11
2+	13	14

pregnant women told and not told that their urine would be tested for marijuana, alcohol, and other drugs indicates that women told their urine would be tested report more marijuana use during pregnancy than untested women. (We obtained similar results in our pilot study [12] conducted in our own clinic.) Little difference between groups in reported cigarette smoking or alcohol use during pregnancy was observed. Further, the urine test results revealed even more women who smoked marijuana during pregnancy than those willing to admit to it in an interview. Because this study was conducted at an inner-city hospital with a high proportion of unmarried subjects and of ethnic and racial minority groups, the study will need to be replicated with a sample more representative of the US population.

Nevertheless, these findings raise concern about conclusions that have been reached in studies on fetal outcome that rely entirely on maternal self-report of marijuana, alcohol, and cigarette use during pregnancy. If marijuana use is underreported relative to alcohol and cigarettes as this study suggests, it is possible the potentially adverse effects of marijuana may be inadvertently misattributed to alcohol or nicotine. It is also possible that potentially interactive effects of marijuana with alcohol, tobacco, or other drugs have not been adequately examined.

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