Changing Prevalence of Prenatal Substance Abuse in Utah

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OBJECTIVE: To estimate the current prevalence of prenatal exposure to methamphetamines and other drugs of abuse among infants born in Utah and compare the results with those of a maternal substance abuse prevalence study performed in 1991 in the same geographic area.

METHODS: Thirteen well baby nurseries in calendar year 2000 and six neonatal intensive care units (NICUs) in 2001–2002 collected anonymous meconium samples and associated, but nonidentifiable, demographic data on consecutively born infants. Samples were screened by enzyme immunoassay and confirmed by gas chromotography/mass spectroscopy for methamphetamines, cannabinoids, and benzoylecognine.

RESULTS: Meconium samples were collected from 1202 well baby nursery infants and 317 NICU infants. There were no significant differences in the rates of positivity for methamphetamines (0.6% versus 0.4%) or marijuana (2.9% versus 1.8%) between the 1991 and 2000/2001 studies. Cocaine prevalence declined from 1.1% in 1991 to 0.3% in 2000/2001 ($P = .04$). The prevalence of positivity for any of these three drugs declined over the 10-year period from 4.4% to 2.4% ($P = .02$). The prevalence for positivity for any of these three drugs was higher in the NICUs (4.7%) than in the well baby nurseries (1.9%, $P = .008$).

CONCLUSION: The rate of drug-positive infants declined during the decade of the 1990s in a geographic area that is experiencing a sharp rise in the use of methamphetamine among women of childbearing age. Further studies that focus on women of childbearing age who use methamphetamine may help determine factors that impact their drug use during pregnancy and after the infant is born. (Obstet Gynecol 2003;102:27–30. © 2003 by The American College of Obstetricians and Gynecologists.)

Research clearly shows that infants born to drug- and alcohol-abusing mothers are at risk for developmental and behavioral problems resulting from prenatal exposure and dysfunctional parenting.[1,2] It is important for prenatal and pediatric care providers to be aware of evolving trends in maternal substance abuse to improve detection and facilitate intervention. During the 1990s, the use of methamphetamine increased in prevalence throughout the West and Southwest United States, and there is evidence that the problem is currently reaching into rural and urban areas of the South and Midwest.[3] In 1991, 0.38% of the total admissions for substance abuse treatment in Utah were for methamphetamine addiction. By 2001, that percentage had risen to 18.5%, outpacing marijuana as the primary illicit drug of choice for patients in treatment.[4] In 2001, 37% of the female treatment population in Utah were treated for addiction to methamphetamine, compared with 1.2% in 1992. This study was undertaken to investigate the impact of the alarming and changing patterns of drug abuse in women of childbearing age in Utah on the newborn population.

The first objective of this study was to estimate the current prevalence of prenatal exposure to methamphetamines and other drugs of abuse among infants born in northern Utah. The second objective was to compare the results of this study with those of a maternal substance abuse prevalence study performed in 1991 in the same geographic area.[5]

MATERIALS AND METHODS

After approval from the respective institutional review boards, 13 well baby nurseries in calendar year 2000 and six neonatal intensive care units (NICUs) in 2001–2002 collected anonymous meconium samples and associated, but nonidentifiable, demographic data on consecutively born infants. These hospitals were all located along the Wasatch Front in northern Utah, where 78% of the state's births occur. Of the 17 well baby nurseries in this area, the 13 with the highest birth volume participated, and six of the seven NICUs in Utah participated. A history of maternal drug and alcohol use was recorded if this information was documented in the medical record. All samples were sent to United States Drug Testing Laboratories Inc., where they were screened by enzyme

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Supported, in part, by the Division of Substance Abuse, Utah Department of Human Services (contract no. 001515).

0029-7844/03/$30.00
doi:10.1016/S0029-7844(03)00367-3

Table 1. Drug Prevalence Rates

	2000/2001 Meconium (n = 1519) n (%)	95% CI	1991 Maternal urine (n = 792) n (%)	95% CI	P
Marijuana	27 (1.8)	1.20, 2.54	23 (2.9)	1.89, 4.26	.11
Cocaine	5 (0.3)	0.12, 0.73	9 (1.1)	0.56, 2.08	.04
Methamphetamines	6 (0.4)	0.16, 0.82	5 (0.6)	0.23, 1.39	.65
Overall*	37 (2.4)	1.75, 3.31	35 (4.4)	3.15, 6.03	.02

CI = confidence interval.
* Unduplicated counts of all samples with at least one positive test.

immunoassay (SYVA EMIT Drugs of Abuse Reagent System, Palo Alto, CA) for amphetamines (cutoff value 500 ng/g), cannabinoids (40 ng/g), and benzoylecognine, a cocaine metabolite (75 ng/g). All positives were confirmed by gas chromatography/mass spectroscopy. An enzyme immunoassay amphetamine-positive sample was reported to be methamphetamine positive when the gas chromatography/mass spectroscopy detected methamphetamine. Statistical analysis included χ^2 analysis for discrete variables, Student two-sided t test for continuous variables, and step-wise logistic regression for multivariate regression. A P value of $< .05$ was considered to be significant.

RESULTS

Meconium samples were collected from 1202 well baby nursery infants and 317 NICU infants. The mean maternal age was 26.3 years; 35% were primigravid; 79% were white, non-Hispanic; and 76% had private insurance. The 1991 cohort did not differ from the 2000/2001 cohort in mean maternal age or percentage of primigravid women. The 2000/2001 cohort had a higher percentage of Hispanic women (9% versus 7%, $P = .05$) and more women with private insurance (76% versus 72%, $P = .04$) than the 1991 cohort of women.

Table 1 reports the drug screen results of the 2000/2001 study in comparison with the 1991 maternal urine study. There were no significant differences in the rates of positivity for methamphetamine or marijuana between the 1991 and 2000/2001 studies. Cocaine prevalence declined from 1.1% in 1991 to 0.3% in 2000/2001 ($P = .04$). Overall, the prevalence of positivity for any of these three drugs declined over the 10-year period from 4.4% to 2.4% ($P = .02$).

Univariate analysis of the 2000/2001 data was performed comparing maternal and infant characteristics between samples positive for cocaine, methamphetamine, and/or marijuana and samples negative for those drugs (Table 2). There were no significant differences between the two groups in regard to maternal age, minority status, insurance status, or history of maternal alcohol use. Meconium samples positive for cocaine, methamphetamine, and/or marijuana were more likely to be associated with mothers who were unmarried, had a reported history of maternal tobacco use or a history of maternal social drug use, and had infants of lower birth

Table 2. Univariate Analysis of Maternal and Neonatal Factors in Relation to Positivity for Cocaine, Methamphetamine, and/or Marijuana of 2000/2001 Meconium Study

	Positive cocaine, methamphetamine, and/or marijuana (n = 37) n (%)	95% CI	Negative cocaine, methamphetamine, and/or marijuana (n = 1482) n (%)	95% CI	P	Logistic regression OR (95% CI)
Mean maternal age (y)	24.6	22.46, 26.74	26.4	26.11, 26.69	.07	
Unmarried	13/31 (42)	25.67, 59.69	249/1405 (18)	15.79, 19.79	<.001	
Minority	8/33 (24)	11.94, 40.89	227/1407 (16)	14.28, 18.13	.2	
Medicaid or no insurance	11/30 (37)	21.02, 54.78	309/1311 (24)	21.65, 25.58	.09	
History of maternal tobacco use	14/25 (56)	34.42, 74.26	98/1082 (9)	7.45, 10.88	<.001	9.01 (3.45, 23.81)
History of maternal alcohol use	2/22 (9)	1.55, 26.92	26/1166 (2)	1.49, 3.20	.09	
History of maternal social drug use	7/24 (29)	13.74, 49.36	15/1166 (1)	0.75, 2.07	<.001	13.89 (3.68, 52.63)
Birth weight (g)	2747	2535.2, 2958.8	3161	3124.8, 3197.2	<.001	
Gestational age (wk)	35.6	34.21, 36.99	37.5	37.32, 37.68	.003	

CI = confidence interval; OR = odds ratio.

Table 3. Drug Prevalence Rates of Well Baby Nursery and Neonatal Intensive Care Unit Cohorts

	WBN (n = 1202) n (%)	95% CI	NICU (n = 317) n (%)	95% CI	P
Marijuana	17 (1.4)	0.85, 2.21	10 (3.2)	1.61, 5.55	.05
Cocaine	3 (0.2)	0.06, 0.68	2 (0.6)	0.11, 2.07	.33
Amphetamine	3 (0.2)	0.06, 0.68	3 (0.9)	0.24, 2.55	.11
Overall*	23 (1.9)	1.25, 2.81	15 (4.7)	2.78, 7.51	.008

WBN = well baby nursery; NICU = neonatal intensive care unit; CI = confidence interval.
* Unduplicated counts of all samples with at least one positive test.

weight and younger gestational age. A step-wise logistic regression was performed using meconium results for cocaine, methamphetamines, or marijuana as the dependent variable and the factors found to be associated with positivity with univariate analysis as the independent variables. Only a reported history of maternal tobacco use and social drug use remained independently associated with drug positivity.

A comparison between the well baby nursery and NICU cohorts was also performed. There were no differences between the cohorts in regard to mean maternal age, percentage of primigravid women, and race or ethnicity. The NICU cohort had significantly fewer women with private insurance (67%) than the well baby nursery cohort (79%, $P < .0001$). The rates of drug positivity for the two cohorts are shown in Table 3. The prevalence of marijuana-positive samples was higher in the NICU cohort (3.2%) than in the well baby nursery cohort (1.4%, $P = .05$). Overall, the prevalence for positivity for any of these three drugs was higher in the NICU cohort (4.7%) than in the well baby nursery cohort (1.9%, $P = .008$).

DISCUSSION

The objectives of this study were to estimate the current prevalence of prenatal exposure to methamphetamine and other drugs of abuse among infants born in northern Utah and to compare those results with those obtained in 1991. We found a decrease in the prevalence of prenatal illicit substance abuse in northern Utah over the last decade, as opposed to an increase in prevalence reported nationally. The rate of marijuana, cocaine, and/or methamphetamine use among pregnant women in Utah documented in the 1991 prevalence study was 4.4%; it was 2.4% in 2000/2001. The National Household Survey on Drug Abuse reports that illicit drug use in the United States within the past month for women aged 15–44 years was 6.7% in 1994 and 7.5% in 2000. This same data set reports illicit drug use rates among pregnant women to be 1.8% in 1994 and 3.3% in 2000.[6] The National Household Survey relies on self-report of drug use and is therefore biased to under-reporting; however, when the same methodology is used over time, the reported trends are meaningful.

Although the study performed in 2000/2001 analyzed meconium and not maternal urine, as in the 1991 study, this difference in methodology does not impact the finding of a decreasing prevalence. Urine drug screens can detect drug metabolites up to 72 hours after use, whereas meconium screening can detect use from 20 weeks' gestation onward.[7] The fact that the rate of drug detection decreased when a more sensitive test was used for analysis indicates a true decrease in prevalence.

We were particularly interested in the current prevalence of methamphetamine positivity because of the rapid increase in its use by women as reported by the Utah Division of Substance Abuse.[4] The Division collects extensive information on individuals seeking drug treatment that includes primary, secondary, and tertiary drugs of abuse. From 1992 to 2001, the percentage of women reporting methamphetamine to be their primary substance of use rose from 1.2% to 37%. We were surprised to find no difference in the rate of methamphetamine positivity between the 2000/2001 and the 1991 studies. We do not believe that our study methodology can explain this. Meconium analysis is a well-established and verified means of drug detection.[8] Our samples came from the busiest hospitals in northern Utah, including six of the seven NICUs in the state. We questioned whether the time of year the samples were collected (summer through fall) influenced the findings. The substance abuse specialists in Utah, however, have not documented a variable supply of methamphetamine in the community from season to season and attribute this to the relative ease of its manufacture at the local level. Our findings are similar to findings reported by Derauf et al in Hawaii, presented at the 2001 Society for Pediatric Research meeting (Derauf C, Katz A, Easa D. The prevalence of methamphetamine and other drug use during pregnancy [abstract]. Pediatr Res 2001;49:166A). They, too, had data based primarily on drug treatment admissions that suggested the methamphetamine abuse is epidemic in Hawaii. In their anonymous meconium

screening study, they found a rate of less than 1% for methamphetamine.

We have several theories about the reasons behind the lack of increase in methamphetamine-positive newborns despite the rise in use in the general female population. One reason may be that methamphetamine-abusing women have trouble getting pregnant and/or staying pregnant. Another may be that methamphetamine-abusing women, once they discover they are pregnant, abstain from use later in pregnancy, and thus the meconium screen will be negative. An explanation supported by anecdotal reports from users as reported by the Division of Substance Abuse is that methamphetamine use often begins after the infant is born, starting with the desire to lose weight and gain control, then turning into an addiction. Another theory could be that an increase in knowledge of clinicians and the general public about prenatal substance abuse over the past decade has had a positive impact on the prevalence of use during pregnancy. Further studies that focus on women of childbearing age who are methamphetamine users may help determine factors that impact their drug use during and after pregnancy.

REFERENCES

1. Zuckerman B, Bresnahan K. Developmental and behavioral consequences of prenatal drug and alcohol exposure. Pediatr Clin North Am 1991;38:1387–406.
2. Eyler FD, Behnke M. Early development of infants exposed to drugs prenatally. Clin Perinatol 1999;26:107–50.
3. National Institutes of Health. Methamphetamine abuse and addiction. NIDA Research Report NIH publication no. 98-4210. Washington: National Institute of Drug Abuse, 1998.
4. 2001 Annual Report. Division of Substance Abuse, Department of Human Services, State of Utah, Salt Lake City, UT. Available at: http://www.hsdsa.state.ut.us/Annual_Report.htm. Accessed 2002 Sept 13.
5. Buchi K, Varner M, Chase R. The prevalence of substance abuse among pregnant women in Utah. Obstet Gynecol 1993;81:239–42.
6. 2000 National Household Survey on Drug Abuse. Substance Abuse and Mental Health Services Administration, Department of Health and Human Services, Washington. Available at: http://samhsa.gov/oas/NHSDA/2kNHSDA/2kNHSDA.htm. Accessed 2002 Sept 13.
7. Schmitz J. Digestive and absorptive function. In: Walker WA, Durie PR, Hamilton JR, Walker-Smith JA, Watkins JB, eds. Pediatric gastrointestinal disease. 2nd ed. St. Louis: Mosby, 1996:263–79.
8. Moore C, Negrusz A, Lewis D. Determination of drugs of abuse in meconium. J Chromatogr B 1998;713:137–46.

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Received October 16, 2002. Received in revised form January 6, 2003. Accepted February 6, 2003.