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Prevalence of prenatal drinking assessed at an urban public hospital and a suburban private hospital

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Background: Although the prevalence of fetal alcohol syndrome (FAS) varies within the population, few data are available concerning variation in the prevalence of prenatal drinking.

Methods: Postpartum women delivering singleton infants at two Atlanta hospitals in 1993 or 1994 were interviewed. Those delivering infants who were small for gestational age (SGA) ($n = 638$) were over-sampled relative to those delivering infants with birth weights that were appropriate for gestational age (AGA) ($n = 247$). The prevalence of prenatal drinking was estimated as a weighted average of reports from mothers of SGA and AGA infants. Estimates of the prevalence of FAS come from the Metropolitan Atlanta Congenital Defects Program (MACDP) of the Centers for Disease Control and Prevention.

Results: The prevalence of first-trimester drinking was half that reported for the three previous months (private hospital: 72% vs. 35%; public hospital: 52% vs. 28%). Most women (85%) reported abstaining throughout the second trimester. Fewer than 10% of women delivering at the public hospital (7.5%), but one-quarter of those delivering at the private hospital, reported third-trimester drinking. Binge, moderate and heavy drinking in pregnancy were more common among women delivering at the public hospital. Eight infants born at the public hospital during this period, but none of those born at the private hospital, were identified as possibly having FAS; four of the eight were identified as probably having FAS.

Conclusions: These results have implications for health education programs. For example, obstetricians in private practice may wish to reaffirm their advice to abstain from drinking in the third trimester. They also suggest that prenatal abstinence programs be targeted at populations identified as most likely to engage in risky drinking.

Key words: PREVALENCE; PREGNANCY; DRINKING BEHAVIORS; SOCIOECONOMIC STATUS; FETAL ALCOHOL SYNDROME

INTRODUCTION

The Surgeon General advises all pregnant women, and those contemplating pregnancy, to abstain from drinking[1,2] because of the possibility of delivering a child with fetal alcohol syndrome (FAS), intrauterine growth restriction, low birth weight, postpartum growth restriction and attention difficulties[3–7]. Most physicians provide this advice to their pregnant patients[8–10]. Even alcoholic beverage containers and bars in the USA provide the public health message that women should not drink during pregnancy[11]. This message appears to have reached the general public, since national survey data suggest that most women reduce their use of alcohol during pregnancy and report that drinking during pregnancy can adversely affect the growing fetus[8,12,13]. In spite of these facts, cross-sectional surveys suggest that 15–25% of pregnant women consume alcohol each month, and that five to ten in 1000 pregnant women consume an average of seven or more drinks per week[8,11,12,14–23]. Therefore, it is not clear whether the public health message is reaching women at highest risk for delivering a child with FAS.

The reported prevalence of FAS differs dramatically in different studies[6,24]. These observed differences may represent differences in study design, differences in susceptibility to the effects of prenatal alcohol exposure, diagnostic

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differences and/or differences in the pattern and use of prenatal alcohol in different segments of the population[6,25]. However, limited data are available concerning the patterns of prenatal drinking in different segments of the population. Such data would be useful for the understanding of the epidemiology of FAS. They would also be useful to health professionals in targeting their advice to pregnant women, and in developing brief intervention and health education programs. This analysis provides some of this information by estimating the prevalence of prenatal drinking reported by postpartum women delivering at two hospitals which serve distinct segments of the population: a public hospital in an urban setting, and a private, suburban hospital.

METHODS

Data for this analysis come from the Fetal Growth and Development Study. The primary objective of the project was to develop a methodology for conducting neonatal surveillance for FAS. The study was designed as a case–control study of infants who were small for gestational age (SGA), since growth restriction is included as part of the diagnostic criteria for FAS[4].

Data were collected from women delivering singleton infants at either of the two largest delivery hospitals in metropolitan Atlanta. One of these hospitals is a private hospital located in the northern suburbs of Atlanta. The other hospital is a county, teaching hospital located in urban Atlanta. Together, these two hospitals account for more than one-third of all deliveries in the five central counties of metropolitan Atlanta. The study was approved by the Institutional Review Boards of Emory University, the Centers for Disease Control and Prevention, and the two hospitals.

Between 1 February 1993 and 31 December 1994, the study staff was randomly assigned to identify deliveries at one of the two hospitals each week. Each hospital had an equal chance of selection (i.e. 50%) in a given week. Hospital selection was blocked in weeks of four to ensure a uniform seasonal distribution of deliveries at each hospital. Thus, the final cohort from each hospital includes deliveries from 50 weeks, over a 2-year period.

Study participants were identified by reviewing labor and delivery logs at the public hospital and nursery logs at the private hospital. Six days each week (i.e. Monday to Saturday), the race, sex, birth weight, plurality and gestational age of all deliveries, including those on Sundays and holidays, were abstracted into a laptop computer. A unique study identification number was assigned to all singleton infants who were either Black or White with a gestational age of 32–42 weeks. Multiple births, infants with gestational ages less than 32 weeks or more than 42 weeks, and infants with races other than White or Black were excluded from the sample because of the relatively small number of such deliveries.

As the infants were identified, they were categorized as either SGA, or appropriate for gestational age, race and sex (AGA). SGA was defined as a birth weight less than the 10th centile for gestational age using fetal growth curves for singleton infants delivered at sea level (Yip, CDC Internal Document). We used these race- and sex-specific norms to minimize the chance that the birth prevalence of FAS would be overestimated in Blacks or females, relative to Whites and males, simply because of known differences in the birth weight distribution[26]. In most instances, gestational age was the clinician's best estimate of gestational age, since we abstracted gestational age data from nursery and labor and delivery logs. Subsequently, birth weight and gestational age estimates were confirmed against data abstracted from birth certificates, medical records and gestational age estimates obtained during a Ballard examination conducted by a study nurse[27]. All (100%) SGA deliveries, and a simple, random 3% sample of AGA infants were selected for this study at the time of abstraction. The mothers of selected infants were approached about this project prior to discharge from the hospital, following confirmation by the hospital staff that both the mother and the child were medically stable enough to participate. Prior to any data collection, written informed consent was obtained from the mothers, and from a maternal grandparent if the mother was under the age of 18. The mothers were interviewed, using a structured interview, about their use of alcohol, drugs and cigarettes during pregnancy, and about various demographic, reproductive, behavioral and medical factors. Nearly all (98%) of the maternal interviews were conducted in the hospital, usually (95%) within 48 h of delivery.

The questions about prenatal drinking behaviors were modeled after those used in previous studies of pregnancy outcomes conducted by the Centers for Disease Control and Prevention (CDC)[28,29]. Women were asked about their alcohol consumption during pregnancy and in the 3 months prior to conception. Specifically, women reported the frequency of alcohol consumption, the usual number of drinks consumed on days on which they drank, the largest number of drinks consumed in a single day and, for women who reported consuming more than four drinks in a single day, the frequency of binge drinking. These data were used to estimate the average number of drinks consumed each week, and whether or not a woman had binged (defined as consuming at least five drinks in a single day). We defined moderate drinking as consumption of an average of 7–13 drinks per week. Heavy alcohol consumption was defined as an average of at least 14 drinks per week. These two groups were combined into a category of moderate and heavy alcohol use.

Questions about alcohol consumption were asked for each of four time periods: the 3 months before conception, the first trimester (i.e. gestational age 2–13 weeks), the second trimester (i.e. gestational age 14–24 weeks) and the third trimester (i.e. gestational ages 25 weeks to delivery). Women were given a calendar listing these dates to assist their recall and to minimize reporting differences resulting from differences in the time that the pregnancy was confirmed.

Using data collected during the neonatal period, we were unable to establish a diagnosis of FAS because of our inability to confirm central nervous system (CNS) deficits and because of difficulties identifying the FAS facial phenotype in neonates as a result of facial edema and head molding. However, data from the Metropolitan Atlanta Congenital Defects Program[30] were available to assess the probable and possible rates of FAS in these two populations. Probable cases were those in which an entry on a medical chart stated that the child had FAS; possible cases are those in which information abstracted from clinical charts was consistent with diagnostic criteria for FAS.

This paper presents prevalence estimates, and 95% confidence intervals, of drinking behaviors by hospital and trimester. The prevalence of drinking was estimated at each hospital as a weighted average of the prevalence among mothers of AGA and SGA infants, assuming a binomial distribution. The sampling probabilities and the participation rates were taken into account using the SUDAAN statistical software (SAS Institute, Cary, NC, USA).

RESULTS

Information on 11 656 singleton deliveries with gestational ages between 32 and 42 weeks was abstracted from hospital logs. This represents 48.1% of the 24 210 singleton deliveries at these two hospitals in 1993 or 1994. A total of 835 (7.2%) of the infants in the cohort were classified as SGA. Three per cent of the remaining 10 821 AGA infants were randomly selected for inclusion in the final sample.

At the public hospital, 88.0% of the 474 selected mothers were interviewed. A significantly lower percentage (69.0%) of women delivering at the private hospital were interviewed ($p < 0.01$) (Table 1). This difference primarily reflects two phenomena: a higher refusal rate among women delivering at the private hospital than among women delivering at the public hospital (17.6% vs. 5.3%), and a greater tendency for women at the private hospital than at the public hospital to be discharged before they could be approached about participating in the study (8.6% vs. 2.3%). The latter usually occurred when women were discharged within 24 h of delivery, especially if they had delivered late on Saturday, on Sunday or on a holiday, since abstractions were not performed on Sundays or holidays. Although there were differences in the participation rate by hospital, the participation rate did not differ between mothers of SGA and AGA infants at either hospital ($p = 0.62$ for the public hospital; $p = 0.86$ for the private hospital).

The two hospitals served demographically distinct populations (Table 2). For example, 98% of all deliveries at

Table 1 Participation rates by hospital and birth weight for gestational age

	Public hospital ($n = 4073$)				Private hospital ($n = 7583$)			
	SGA ($n = 365$)		AGA ($n = 3708$)		SGA ($n = 470$)		AGA ($n = 7113$)	
	n	%	n	%	n	%	n	%
Selected	365	100.0	109	2.9	470	100.0	217	3.1
Interviewed	319	87.4	98	89.9	318	67.7	149	68.7
Consent only*	5	1.4	2	1.8	10	2.1	9	4.1
Refused	21	5.8	4	3.7	85	18.1	36	16.6
Discharged†	8	2.2	3	2.8	43	9.1	16	7.4
Medical‡	7	1.9	1	1.0	9	1.9	3	1.4
Other**	5	1.4	1	1.0	5	1.1	4	1.8

SGA, small for gestational age; AGA, appropriate for gestational age

*Consented to other parts of the study, but not interviewed

†Participant was discharged before she could be approached about participating

‡Could not approach participant for medical reasons (e.g. woman died, or hospital staff felt woman was too sick to be approached)

**Did not obtain consent for other reasons such as language barriers, mental or hearing disabilities, etc.

Table 2 Demographic characteristics of women delivering at a public and a private hospital, metropolitan Atlanta, 1993–94

	Public hospital			Private hospital		
	SGA (n = 319)	AGA (n = 98)	Est %	SGA (n = 318)	AGA (n = 149)	Est %
Race						
African-American	296	2	97.5 (95.9, 99.1)	56	20	13.7 (12.7, 14.6)
White	23	96	2.5 (0.9, 4.1)	262	129	86.3 (85.4, 87.3)
Maternal age (years)						
< 20	96	23	24.1 (21.9, 26.2)	11	3	2.1 (1.8, 2.4)
20–34	210	72	72.8 (70.4, 75.3)	255	127	84.9 (83.8, 86.1)
≥ 35	13	3	3.2 (2.8, 3.5)	52	19	13.0 (12.1, 13.8)
Maternal education						
< High school	148	41	42.3 (40.8, 43.7)	17	2	1.6 (0.7, 2.5)
High school diploma	121	31	32.2 (30.2, 34.2)	44	20	13.5 (13.3, 13.6)
Some college	42	22	21.7 (18.8, 24.5)	92	48	32.0 (31.2, 32.8)
College graduate	7	4	3.9 (3.3, 4.5)	165	79	53.0 (52.7, 53.2)
Annual family income						
< $10 000	168	50	55.3 (54.0, 56.5)	13	3	2.2 (1.7, 2.7)
$10 000–< $25 000	82	29	31.6 (30.6, 32.6)	27	9	6.3 (5.7, 6.9)
$25 000–< $55 000	32	12	13.3 (12.4, 13.6)	125	51	56.5 (54.1, 58.9)
≥ $55 000	3	0	0.1 (< 0.1, 0.4)	144	84	56.5 (54.1, 58.9)
Missing	34	7	—	9	2	—
Marital status						
Single	284	79	81.4 (78.4, 84.1)	42	11	7.8 (6.4, 9.1)
Married*	35	19	18.6 (15.9, 21.3)	275	138	92.3 (90.9, 93.6)
Missing	0	0	—	1	0	—
Insurance						
Self-pay	26	1	1.7 (< 0.1, 4.0)	7	1	0.8 (0.4, 1.1)
Medicaid	280	91	93.3 (87.0, 97.7)	40	12	8.3 (7.3, 9.4)
Private	12	5	5.0 (4.5, 5.5)	270	136	90.9 (89.5, 92.3)
Missing	0	1	—	1	0	—

SGA, small for gestational age; AGA, appropriate for gestational age; Est %, estimated proportion based on weighted sample of all women delivering singleton infants of 32–42 weeks' gestation
*Married or living as married

the public hospital, but only 14% of deliveries at the private hospital, were to African-American women. Similar differences were seen for maternal age, maternal education, family education and insurance coverage. The observed demographic differences paralleled those reported on the birth certificates of all infants delivered.

Table 3 shows reported alcohol use by hospital and trimester. Of note is the fact that prenatal alcohol use was more common in women delivering at the private hospital than the public hospital, particularly before pregnancy (72.1% vs. 51.9%, respectively) and in the third trimester (25.0% versus 7.5%, respectively). On the other hand, prior to pregnancy, heavy drinking was equally common at the two hospitals (2.1% at the private hospital versus 2.7% at the public hospital). Later in pregnancy, such drinking was nearly non-existent among women delivering at the private hospital, but was reported by three of 1000 women who delivered at the public hospital.

The observed pattern of binge drinking paralleled that of heavy drinking (Table 4). Prior to pregnancy and in the first trimester, the reported prevalence of binge drinking was similar among women delivering at the two hospitals. Only one participant, the mother of an SGA infant, who delivered at the private hospital, reported binge drinking in the second trimester, and none reported third-trimester binge drinking. In contrast, more than one of every 100 (1.5%) women delivering at the public hospital reported binge drinking throughout pregnancy.

Table 3 Prevalence of self-reported average prenatal alcohol consumption among women delivering at a public and a private hospital, metropolitan Atlanta, 1993–94

	Public hospital			Private hospital		
	SGA (n = 319)	AGA (n = 98)	Est %	SGA (n = 319)	AGA (n = 149)	Est %
Any alcohol use						
Pre-pregnancy	160	51	51.9 (51.4, 52.4)	210	108	72.1 (70.7, 73.5)
First trimester	117	27	28.4 (25.4, 31.3)	109	52	34.9 (34.7, 35.0)
Second trimester	73	14	15.1 (12.3, 17.8)	37	21	13.9 (13.4, 14.5)
Third trimester	70	6	7.5 (2.5, 12.6)	55	38	25.0 (23.1, 26.9)
*At least moderate alcohol use**						
Pre-pregnancy	53	4	5.2 (1.2, 9.2)	31	15	10.1 (9.6, 10.6)
First trimester	35	1	1.9 (< 0.1, 5.1)	6	4	2.6 (2.5, 2.8)
Second trimester	21	0	0.6 (< 0.1, 2.7)	1	0	< 0.1 (< 0.1, 0.1)
Third trimester	15	0	0.4 (< 0.1, 1.9)	1	0	< 0.1 (< 0.1, 0.1)
Throughout[†]	12	0	0.3 (< 0.1, 1.5)	1	0	< 0.1 (< 0.1, 0.1)
Heavy alcohol use[‡]						
Pre-pregnancy	30	2	2.7 (0.3, 5.1)	10	3	2.1 (1.8, 2.3)
First trimester	17	0	0.5 (< 0.1, 2.2)	4	0	0.1 (< 0.1, 0.4)
Second trimester	9	0	0.3 (< 0.1, 1.2)	1	0	< 0.1 (< 0.1, 0.1)
Third trimester	9	0	0.3 (< 0.1, 1.2)	0	0	< 0.1
Throughout[†]	9	0	0.3 (< 0.1, 1.2)	0	0	< 0.1

SGA, small for gestational age; AGA, appropriate for gestational age; Est %, estimated proportion based on weighted sample of all women delivering singleton infants of 32–42 weeks' gestation
*≥ 7 drinks per week
[†]Reported during all three trimesters
[‡]≥ 14 drinks per week

Table 4 Prevalence of self-reported binge drinking* among women delivering at a public and a private hospital, metropolitan Atlanta, 1993–94

	Public hospital			Private hospital		
	SGA (n = 319)	AGA (n = 98)	Est %	SGA (n = 319)	AGA (n = 98)	Est %
Pre-pregnancy	79	10	11.5 (6.8, 16.2)	47	19	12.9 (12.4, 13.4)
First trimester	41	4	4.9 (2.1, 2.8)	17	6	4.1 (3.8, 4.4)
Second trimester	31	2	2.7 (0.3, 5.2)	1	0	< 0.1 (< 0.1, 0.1)
Third trimester	24	1	1.6 (< 0.1, 3.7)	0	0	< 0.1
Throughout[†]	19	1	1.5 (< 0.1, 3.0)	0	0	< 0.1

SGA, small for gestational age; AGA, appropriate for gestational age; Est %, estimated proportion based on weighted sample of all women delivering singleton infants at 32–42 weeks' gestation
*≥ 5 drinks in a single day
[†]Reported during all three trimesters

None of the children born at the private hospital were identified as probably or possibly having FAS by routine surveillance methods (Table 5). Four children born at the public hospital were identified as probably having FAS (five per 10 000 live births) and a total of eight were identified as possibly or probably having FAS (nine per 10 000 live births).

Table 5 Prevalence (per 1000 livebirths) of probable* and possible† fetal alcohol syndrome (FAS) by hospital ascertained by the metropolitan Atlanta Congenital Defects Program, 1993–94

	Public hospital (n = 8487)		Private hospital (n = 15 723)	
	Cases	Est %	Cases	Est %
Probable	4	0.5 (0.1, 1.2)	0	< 0.1 (< 0.1, 0.2)
Possible + probable	8	0.9 (0.4, 1.9)	0	< 0.1 (< 0.1, 0.2)

Est %, estimated proportion based on all women delivering singleton infants
*Probable cases are those in which a chart entry by a clinician states the child has FAS
†Possible cases are those in which the abstracted clinical information is consistent with diagnostic criteria for FAS

DISCUSSION

Overall, the prevalence of drinking reported in this study was similar to that in previous surveys[8,11,12,14–23]. Additionally, our analyses confirm earlier reports that suggest that most women report abstaining in the latter two-thirds of pregnancy, and that most of those who report drinking during pregnancy drink at low levels[8,11,31]. Our data also support reports that alcohol consumption, especially preconceptionally and in the first trimester, is more common among private than public patients[31].

Conversely, moderate, heavy and binge drinking during pregnancy were more prevalent among public than private patients. This is consistent with previous reports that suggest that African-American women, and those from the lower social classes, are less likely than White women, and women with higher socioeconomic status, to drink[14,22,32]. However, among those who drink, African-American women are more likely than White women to drink at higher levels[6,14,22]. These reports would also tend to support the finding of a higher birth prevalence of FAS observed at the public than the private hospital[24], since women at the public hospital were more likely to engage in 'risky' drinking.

We did, however, find that private patients were more likely than public patients to report consuming alcohol late in pregnancy. This finding has not been previously reported. The observed difference is too large to be attributed to differences in the incidence of preterm delivery (13.9% versus 5.9%) or to differences in maternal age at the two hospitals. The third-trimester drinking reported by women delivering at the private hospital was very light. For example, only two of the 13 women from the private hospital who reported drinking in the third trimester, but not the second, reported drinking more than once a month. The observation that some women abstain during the first two trimesters of pregnancy, but consume some alcohol in the third trimester may reflect the health education provided to pregnant women[9] and/or their beliefs about the likelihood that light drinking late in pregnancy will not affect fetal development. However, the Surgeon General, the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists advise against any drinking in pregnancy[2,33].

These observed differences exemplify the need to examine the prevalence of drinking within different segments of the population, since these differences would have been hidden in cross-sectional, population-based surveys of drinking in pregnant women. However, we cannot determine whether the observed differences in the pattern and level of prenatal alcohol use are attributable to differences in race, social class, or the content of prenatal care, since these variables are strongly correlated with each other in our data. We chose to present patterns of drinking by hospital rather than race, because delivery hospital is associated with social class, which some have suggested may influence an infant's susceptibility to prenatal alcohol exposure[25] and because health education programs are likely to be implemented for groups of women defined by prenatal care, source of payment for prenatal care, or by location of delivery, rather than by race or social class, *per se*. Furthermore, it would have been difficult to develop prevalence rates for groups defined by income or social class using data from nursery and delivery logs, because of problems delineating the population by these variables.

Our data also highlight the importance of oversampling women likely to drink heavily. We did this by oversampling mothers of SGA infants. Given our overall sample size of nearly 1000 women, we would have had much lower precision in our estimates of moderate, heavy and binge drinking had we not oversampled such women, since heavy and binge drinking in pregnancy were uncommon among the mothers of average-sized infants at either hospital.

As with any study of this type, the validity of these findings depends on the overall quality of self-reported alcohol use in pregnancy. Previous analyses have cautioned that drinking, and particularly prenatal drinking, may be under-reported[34,35]. Furthermore, this under-reporting may differ by social class, education, race, age or pregnancy outcome. Some authors have noted that women report higher alcohol consumption when they are asked to report use of wine, beer and spirits separately[6]. Therefore, we may have underestimated the prevalence of prenatal alcohol use and of moderate to heavy alcohol use. Although this is a concern, the overall prevalence of preconceptional and prenatal drinking that we report is similar to that reported by others[8,14,36]. Few other methods are available to estimate the prevalence of prenatal alcohol use throughout pregnancy. We were unable to confirm prenatal drinking biochemically, because of the short half-life of alcohol and its metabolites. As earlier studies have suggested, birth certificates and medical records were inadequate for documenting even moderate or heavy drinking in pregnancy[37]. In the current sample, neither the birth certificate nor the medical records indicated any prenatal alcohol use for many women who either reported binge (> 20%) or moderate drinking (> 45%) at some time in pregnancy. Additionally, the quality of data concerning alcohol use recorded on birth certificates and prenatal records differed at the two hospitals. Records obtained for women delivering at the private hospital were less likely than those obtained for women delivering at the public hospital to confirm binge (< 25%) or moderate drinking (< 50%) that was reported during the interview. Thus, the prevalence estimates that we obtained are higher than would have been observed using other retrospective methods, and provide data about patterns of use over time that would be unavailable with cross-sectional methods.

The accuracy of reporting should not have differed by pregnancy outcome[37–40]. Many of the mothers of SGA infants would have been unaware that their children were considered to be small for gestational age, since most of the SGA infants (86%) had birth weights above 2500 g and three-quarters were discharged at the same time as their mothers. Furthermore, 25% of the SGA infants at the private hospital and 10% of those born at the public hospital weighed more than 2700 g.

We tried to minimize differences in reporting that may have resulted from differences in the timing of pregnancy confirmation at the two hospitals[41] by providing women with a calendar listing the dates of each trimester. Even so, it is possible that women at the private hospital reduced their drinking and/or reported reducing their drinking to a greater extent in the first trimester than women at the public hospital, since by the end of this period a physician had confirmed 95% of the pregnancies among women delivering at the private hospital, but only 75% of those in women delivering at the public hospital. The gestational age when prenatal care is initiated is also important, because it reflects the earliest time at which health-care professionals can advise women about drinking during pregnancy. Since nearly all women at both hospitals knew they were pregnant by the second trimester, the observed differences in second- and third-trimester drinking between the two hospitals are likely to represent real differences in drinking behaviors rather than reporting differences.

The low participation rate, particularly at the private hospital, raises concern about selection bias. We assessed this possibility by comparing our sample with all singleton deliveries at the two hospitals in 1993 and 1994. There were no statistically significant differences between participants and all deliveries at the private hospital in gestational age, infant sex, maternal age, maternal education, prenatal alcohol use, prenatal smoking, infant mortality, gestational age or birth weight as reported on birth certificates. African-Americans were somewhat over-represented in our sample relative to the population as a whole (14.3% versus 13.7%). Among deliveries at the public hospital, those women who were included were slightly more educated (11.1 ± 6.0 years versus 10.9 ± 2.5 years), the infant mortality rate was slightly lower (0.6% versus 0.9%) and the infant's father was less likely to be specified on the birth certificate (52% versus 56%) than all mothers delivering at the public hospital. However, the impact these differences may have on our findings is unknown.

Even though these data come from the two largest delivery hospitals in the area, additional studies need to establish the extent to which our results are generalizable to other hospitals or other parts of the USA. However, if confirmed, our analyses suggest two important features of prenatal alcohol use. First, a number of women abstain early in pregnancy but resume light drinking late in pregnancy. Therefore, providers of prenatal care, particularly those delivering care to upper-middle-class women, may need to remind their patients to abstain late in pregnancy. Second, a small number of women, primarily at the urban, public hospital, continued to binge and/or to drink at moderate to heavy levels throughout pregnancy. Such differences are likely to contribute to the observed differences in the birth prevalence of FAS between these two hospitals, even if they do not entirely explain it. Therefore, health education programs to assist women in abstaining may be appropriately targeted towards populations with high rates of FAS. However, since these women represent a minority of women delivering in these settings, additional work is needed to identify women at risk of continued 'risky' alcohol use and to determine the best way to provide them with education and intervention services. Our data also highlight the need to study drinking patterns within different segments of the population in order to target public health messages and to evaluate their impact.

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