Ethnic Differences in Preterm and Very Preterm Delivery

PATRICIA H. SHIONO, PHD, AND MARK A. KLEBANOFF, MD, MPH

Abstract: Ethnic differences in preterm (<37 weeks) and very preterm (<33 weeks) delivery were evaluated in a prospective cohort of 28,330 women. Blacks had the highest rate of preterm and very preterm delivery, followed by Mexican-Americans, Asians, and Whites. Adjustment for maternal age, education, marital status, employment, parity, number of previous spontaneous or induced abortions, smoking and drinking during pregnancy, infant sex, and gestational age at initiation of prenatal care resulted in the following odds ratios for preterm delivery: 1.79 (1.55–2.08) for Blacks, 1.40 (1.19–1.63) for Mexican-Americans, 1.40 (1.16–1.69) for Asians, and 1.00 for Whites. The corresponding odds ratios for very preterm delivery were 2.35 (1.72–3.22) for Blacks, 1.31 (0.88–1.94) for Mexican-Americans, 1.10 (0.67–1.83) for Asians, and 1.00 for Whites. Exclusion of cases of premature rupture of membranes, placenta previa, and abruptio placenta did not explain the large ethnic differences. Although Whites and Mexican-Americans had similar birthweight distributions, Mexican-Americans had an increased risk for preterm delivery. Fifty-five per cent of low birthweight babies in Kaiser were preterm and this fraction did not vary substantially by ethnic group. *(Am J Public Health* 1986; 76:1317–1321.)

Introduction

In 1980, 8.9 per cent of all live births in the United States were preterm, and 56 per cent of all babies weighing less than 2.5 kg were born before 37 weeks.[1] The decrease in the rate of low birthweight (LBW) over the past 15 years has been due to a decline in the rate of term LBW infants; however, the rate of preterm LBW has remained stable.[2] Therefore, to reduce the overall LBW rate, the causes of preterm births must be addressed.

Ethnicity is one of the strongest factors associated with LBW, but even after adjustment for confounding variables the reasons for the large ethnic differences in birthweight are unknown.[3] Moreover, there have been few investigations of the relative contributions of early delivery and intrauterine growth retardation to these differences. This is especially important for Mexican-Americans. There are no published data to determine whether the similarities in low birthweight between Mexican-Americans and Whites are reflected in equivalent rates of early delivery.

Potential risk factors for preterm delivery, such as smoking and pregnancy complications, are not generally available on birth certificates, and gestational age is not recorded on a large fraction of these documents. The Northern California Kaiser-Permanente Birth Defects study is one of few sources to have reliable data on gestational age and pregnancy complications in a large multi-ethnic population. In this paper, we report on the ethnic differences in preterm and very preterm births.

Methods

The Kaiser Birth Defects Study enrolled women who received prenatal care during the period 1974–77 at any of the 13 clinics serving Northern California. Women were generally given prenatal clinic appointments after missing two menstrual periods. As part of their routine prenatal care, the women completed a self-administered questionnaire in English or Spanish at their first prenatal visit. The questionnaire included questions on ethnicity, prior reproductive and medical history, use of tobacco and alcohol during the first three months of the current pregnancy, and a variety of other subjects. Clinical and medical charts were abstracted for information on previous pregnancy outcomes, health during the present pregnancy, and pregnancy outcome.

Pregnancy outcomes were ascertained from computer tapes containing information on Kaiser Hospital admissions. If a woman passed her due date without having been delivered, then her chart was examined to find out why. If the chart did not contain information about the pregnancy outcome, then it was checked to see if the women was still a Kaiser member. Women who left the plan during pregnancy were excluded. For those who remained, information was sought from the other participating Kaiser Health Plan centers for records of her pregnancy termination. In this way, pregnancy outcomes or reasons for dropping out of the study were obtained for 99.6 per cent of the women.

Women were asked to classify themselves into one of the following ethnic groups: White, Black, Oriental/Asian, Spanish/Mexican or Other. For these analyses, the Spanish/Mexican group was assumed to be Mexican, since 90 per cent of Spanish/Mexican births in California are to women of Mexican ancestry.[4]

Gestational age was determined by subtracting the estimated date of conception from the date of delivery. The estimated date of conception, determined by the obstetrician at the woman's first visit to the prenatal clinic, was based on the menstrual history and physical examination.

Preterm delivery was defined as a live birth of 24 to 36 completed weeks of gestation; very preterm delivery was defined as a live birth of 24 to 32 completed weeks gestation. In these analyses, both total and idiopathic early delivery are analyzed. Idiopathic early delivery was defined as preterm or very preterm birth not preceded by premature rupture of membranes, placenta previa, or abruptio placenta.

Multiple linear logistic regression was used to estimate the ethnic group specific adjusted odds ratios for preterm births. The BMDPLR program was used to estimate the logistic coefficients.[5]

Results

A total of 36,504 women were initially recruited into the study from October 1974 through March 1977. Women were excluded from the study if information on the outcome of pregnancy was not available. This included those women who delivered at home (2 per cent), delivered at a non-Kaiser hospital (1.2 per cent), left the area (0.9 per cent), had induced

From the Epidemiology Branch, NICHD, NIH, Bethesda, Maryland. Address reprint requests to Patricia H. Shiono, PhD, at National Institutes of Health, National Institute of Child Health and Human Development, Epidemiology and Biometry Research Program, Landow Building, Room 7C16, Bethesda, MD 20892.

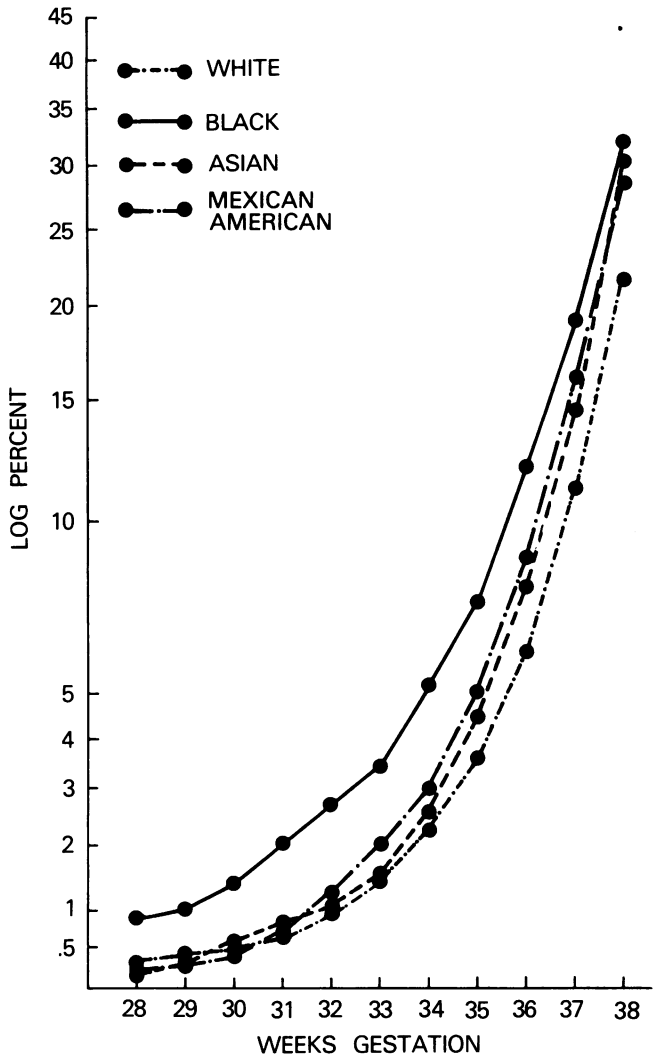

FIGURE 1—Gestational Age Cumulative Distributions by Ethnic Group

abortions (0.8 per cent), were found not to be pregnant (0.4 per cent), wanted the baby to be adopted (0.2 per cent), or were lost to follow-up (0.4 per cent). After these exclusions, data were available for 33,344 women and 34,660 babies.

For these analyses, all women delivery a live born singleton infant of 24 or more weeks gestational age and at least 500 grams birthweight were eligible (31,682). Repeat study pregnancies by the same woman were excluded (1,086), as were women who started prenatal care after 24 weeks gestational age (2,266). This left a total of 28,330 women in the analyses.

The ethnic group specific cumulative distribution of gestational age is shown on Figure 1. The vertical axis is in a log scale to stress the lower end of the distribution. Blacks have a substantially greater per cent of preterm births than Whites. Mexican-Americans are as likely as Whites to deliver up to 33 weeks gestation but are more likely to deliver from 34 to 38 weeks. Asians are as likely as Whites to deliver before 34 weeks and are more likely than Whites to deliver by 35 to 38 weeks.

The number of women in each ethnic group, the rates of early delivery, and crude odds ratios are shown in Table 1. Black women had the highest rates of preterm delivery followed by the Others, Mexican-Americans, Asians, and Whites. The relative rankings remained the same for preterm and very preterm births. The unadjusted odds ratios for delivery between 33 and 36 weeks were: 1.96 (1.69–2.28) for Blacks; 1.60 (1.31–1.96) for Others; 1.51 (1.30–1.77) for Mexican-Americans; and 1.36 (1.13–1.65) for Asians. These data indicate that Blacks and Others are at highest risk during the period of maximum perinatal mortality (<33 weeks gestation) while Mexican-Americans and Asians are at highest risk during the time period where the risk of perinatal mortality is considerably lower (33 to 36 weeks).

The adjusted odds ratios for preterm delivery are shown in Table 2. Multiple linear logistic regression was used to adjust the ethnic group specific odds ratios for early delivery for the confounders listed in the Table. The crude and adjusted odds ratio are similar for all groups except Blacks, for whom the odds ratio decreased with adjustment. However, all racial-ethnic groups were at higher risk of preterm delivery than Whites. The other factors that were positively associated with preterm delivery were: maternal age less than 20 years, being unmarried, having had three or more induced abortions, starting prenatal care before nine weeks or after 16 weeks, and heavy smoking or drinking during the first trimester of pregnancy. Factors that were negatively associated with preterm delivery were having had one or two previous live births and light drinking during pregnancy.

Adjusted odds ratios for very preterm delivery are shown in Table 3. Relative to the adjusted odds ratios for preterm birth, the odds ratios for very preterm delivery were increased for Blacks, slightly decreased for Mexican-Americans, and decreased for Asians. The odds ratio was highest for Blacks and Others. Other factors positively associated with very preterm delivery were heavy smoking, unmarried status, and beginning prenatal care during the first or second month of pregnancy. Light alcohol drinking again had a negative association with very preterm delivery.

To determine if known precipitating causes for preterm delivery explain the ethnic differences in preterm birth, we excluded preterm births associated with premature rupture of membranes, placenta previa, or abruptio placenta. Of all preterm and very preterm births, 76 per cent and 71 per cent,

TABLE 1—Ethnic Group Specific Rates and Crude Odds Ratios for Preterm Births

Ethnicity	N	Per Cent <37 weeks	Odds Ratio (95% CI)	Per Cent <33 weeks	Odds Ratio (95% CI)
Black	2,534	12.08	2.12 (1.86–2.43)	2.72	2.82 (2.14–3.73)
Other	1,429	9.66	1.65 (1.37–1.99)	1.82	1.87 (1.24–2.83)
Mexican-American	2,781	8.74	1.48 (1.28–1.71)	1.26	1.29 (0.90–1.85)
Asian	1,923	7.90	1.33 (1.11–1.58)	1.09	1.11 (0.71–1.75)
White	19,663	6.07	1.00 —	0.98	1.00 —
Total	28,330	7.18		1.21	

TABLE 2—Adjusted Odds Ratios for Preterm Births

Factors	N*	Adjusted Odds Ratio	95% Confidence Interval
Ethnicity			
Black	2,453	1.79	1.55–2.08
Other	1,331	1.65	1.36–2.00
Mexican-American	2,647	1.40	1.19–1.63
Asian	1,860	1.40	1.16–1.69
White	19,225	1.00	—
Maternal Age (years)			
<20	1,689	1.29	1.05–1.59
20–24	7,717	1.02	0.90–1.15
25–29	11,083	1.00	—
30–34	5,595	0.96	0.83–1.10
35+	1,432	1.20	0.96–1.50
Education (years)			
<6	314	1.00	—
7–12	11,780	0.85	0.57–1.26
13–16	11,219	0.79	0.53–1.18
17+	3,670	0.75	0.49–1.14
Unknown	533	0.74	0.44–1.22
Married	25,253	0.74	0.63–0.88
Employed	15,649	0.98	0.89–1.09
Female Baby	13,269	0.91	0.83–1.00
Parity			
0	12,396	1.00	—
1	9,842	0.85	0.76–0.95
2	3,592	0.65	0.54–0.77
3+	1,686	0.92	0.74–1.15
No. Previous Spontaneous Abortions			
0	24,855	1.00	—
1	2,205	1.07	0.90–1.27
2	356	1.29	0.87–1.90
3+	100	1.55	0.80–3.02
No. Previous Induced Abortions			
0	24,522	1.00	—
1	2,560	0.94	0.80–1.11
2	357	1.31	0.92–1.87
3+	77	2.79	1.56–4.99
Week Prenatal Care Started			
≤8	1,739	2.67	2.31–3.08
9–16	21,514	1.00	—
17–24	4,263	1.22	1.08–1.38
Smoking during Pregnancy			
None	20,800	1.00	—
<1 pack/day	3,962	1.03	0.90–1.18
1+ packs/day	2,754	1.24	1.06–1.44
Drinking during Pregnancy			
None	14,262	1.00	—
<1 drink/day	12,481	0.89	0.81–0.99
1+ drinks/day	773	1.42	1.11–1.81

*814 observations deleted because of missing data.

TABLE 3—Adjusted Odds Ratios for Very Preterm Births

Factors	N*	Adjusted Odds Ratio	95% Confidence Interval
Ethnicity			
Black	2,453	2.35	1.72–3.22
Other	1,331	1.83	1.17–2.85
Mexican-American	2,647	1.31	0.88–1.94
Asian	1,860	1.10	0.67–1.83
White	19,225	1.00	—
Maternal Age (years)			
<20	1,689	1.37	0.85–2.22
20–24	7,717	1.03	0.77–1.37
25–29	11,083	1.00	—
30–34	5,595	0.90	0.64–1.26
35+	1,432	0.83	0.46–1.52
Education (years)			
<6	314	1.00	—
7–12	11,780	1.14	0.35–3.66
13–16	11,219	1.14	0.35–3.69
17+	3,670	1.07	0.32–3.66
Unknown	533	1.15	0.29–4.53
Married	25,253	0.62	0.44–0.89
Employed	15,649	1.07	0.83–1.36
Female Baby	13,269	0.87	0.69–1.08
Parity			
0	12,396	1.00	—
1	9,842	0.81	0.62–1.07
2	3,592	0.70	0.46–1.07
3+	1,686	0.85	0.49–1.49
No. Previous Spontaneous Abortions			
0	24,855	1.00	—
1	2,205	1.38	0.95–2.00
2	356	1.11	0.41–3.02
3+	100	1.90	0.46–7.85
No. Previous Induced Abortions			
0	24,522	1.00	—
1	2,560	0.97	0.68–1.39
2	357	1.76	0.89–3.47
3+	77	—	—
Week Prenatal Care Started			
≤8	1,739	2.29	1.64–3.19
9–16	21,514	1.00	—
17–24	4,263	1.06	0.78–1.43
Smoking during Pregnancy			
None	20,800	1.00	—
<1 pack/day	3,962	1.10	0.80–1.51
1+ packs/day	2,754	2.12	1.55–2.89
Drinking during Pregnancy			
None	14,262	1.00	—
<1 drink/day	12,481	0.76	0.59–0.97
1+ drinks/day	773	1.12	0.64–1.97

*814 observations deleted because of missing data.

respectively, were idiopathic. The adjusted odds ratios for these idiopathic preterm and very preterm births are shown in Table 4. After these exclusions, the odds ratios for the Asian group changed from 1.4 to 1.6 but those for the other ethnic groups changed little or not at all. Relatively small numbers of very preterm births among Asian and Mexican Americans make comparisons difficult but no important changes from Table 3 are noted.

Ethnicity was the strongest predictor of preterm and very preterm delivery. Of the ethnic groups studied, Blacks had the highest rate of both preterm and very preterm delivery. The rate of preterm birth was nearly doubled and the rate of very preterm birth was more than twice as high for Blacks, as compared to Whites. To determine whether the previously described increased risk for low birthweight among Blacks[3] was due exclusively to an increase in preterm delivery or also due to an decrease in intrauterine growth, the mean birthweight at each gestational age was examined (Figure 2). Black newborns were smaller than Whites at each gestational age. Thus, the differences in the low birthweight rates are likely to be due to both differences in gestation and intrauterine growth.

Discussion

The Kaiser population is largely middle class and from one geographic area. Since the extremes of socioeconomic status were generally underrepresented, it was possible to study ethnic differences in preterm delivery without some of the confounding socioeconomic extremes seen in national data. According to the 1980 Vital Statistics, 6.2 per cent of White, 12.0 per cent of Black, and 5.7 per cent of Asian births were preterm.[1] These rates are similar to those found in the Kaiser study. However, 19 per cent of reported births in the US were of unknown gestation and these births were biased towards low birthweight and presumably preterm infants. It

TABLE 4—Adjusted* Odds Ratios for Idiopathic Preterm Births

Ethnicity	N	Odds Ratio	95% Confidence Interval
Preterm Births			
Black	2,296	1.79	1.51–2.12
Other	1,263	1.77	1.42–2.19
Mexican-American	2,499	1.42	1.19–1.69
Asian	1,741	1.61	1.31–1.97
White	18,279	1.00	—
Very Preterm Births			
Black	2,296	1.90	1.24–2.91
Other	1,263	1.92	1.10–3.34
Mexican-American	2,499	1.31	0.80–2.13
Asian	1,741	1.53	0.85–2.74
White	18,279	1.00	—

*Adjusted for the factors listed in Table 2.

is therefore likely that the rate of preterm delivery for the United States was higher than reported. Preterm delivery is a major cause of low birthweight for all ethnic groups. Fifty-five per cent of low birthweight babies in Kaiser were preterm and this fraction did not vary by ethnic group.

Although Whites and Mexican-Americans had similar birthweight distributions,[3] Mexican-Americans were at increased risk for preterm delivery. These results were unexpected. Study of mean birthweight at each gestational age showed that, compared to Whites, Mexican-Americans had higher mean birthweights at less than 36 weeks gestational age and similar birthweights at 36 or more weeks. That Mexican-American women had heavier babies at the earlier gestational ages could explain the apparent inconsistency between the present results and those previously published.[3]

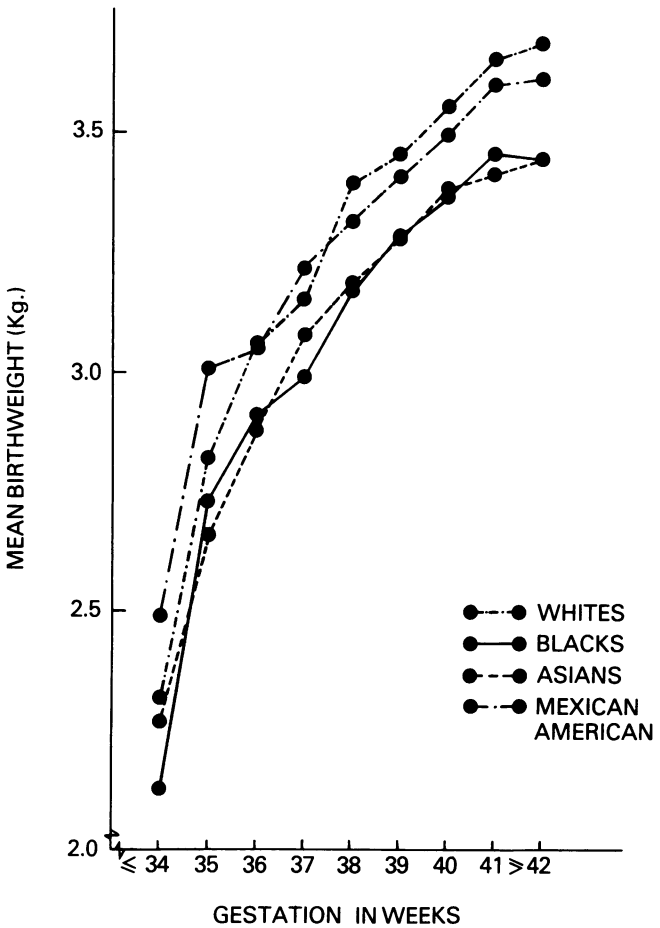

FIGURE 2—Mean Birthweight by Gestational Age and Ethnicity

There are several possible reasons why Mexican-Americans tended to have larger babies than Whites at early gestational ages. One reason may be inaccurate estimation of gestational age. Since women who registered after 24 weeks gestation were excluded, the time over which the last menstrual period had to be recalled was minimized. This would tend to decrease biases in gestational age. In addition, the estimated date of delivery was determined by obstetricians using the menstrual history as well as physical examination findings. For the above reasons, inaccuracies in gestational age are minimized.

An alternative explanation for the similarity in birthweight distribution between Mexican-Americans and Whites, in spite of differences in the gestational age distribution, could be a higher prevalence of diabetes among Mexican-American women. It has been estimated that diabetes is three times more prevalent among Mexican-Americans than among the general population.[6] Maternal diabetes is a well known risk factor for delivery of a large for gestational age infant.[7] Furthermore, diabetes during pregnancy often results in the induction of labor before the estimated date of delivery.[8] If the prevalence of diabetes in the Kaiser population is similar to national estimates, then this might account for the disparity between the birthweight and gestational age distributions of Mexican-Americans and Whites. This hypothesis could not be tested because data on gestational diabetes were not collected in this study.

Differential rates of induction of labor among the ethnic groups may have accounted for some of the variability in gestational age at birth. Common reasons why labor might have been induced are premature rupture of membranes, preeclampsia, diabetes, and physician/patient convenience. The analyses of idiopathic preterm delivery excluded women with premature rupture of membranes and the large ethnic differences in preterm and very preterm delivery remained. Exclusion of women with preeclampsia did not affect the odds ratios. The overall cesarean delivery rate was 13.0 per cent and varied little by ethnic group. Although data on induction were unavailable, it is unlikely that iatrogenic preterm delivery accounts for a substantial fraction of the ethnic differences.

A previous study of preterm delivery showed that Whites were twice as likely to deliver preterm than Blacks.[9] In that case-control study, potential cases were selected based on hospital records, and gestational age was assessed for these selected infants using the Dubowitz examination. If gestational age as recorded in the hospital record was in error, then a potential case might not have been examined and would therefore not be included in the study. These errors in gestational age might have differed between the Whites and Blacks. In addition, disagreements between gestational age as determined by dates and Dubowitz examination were in opposite directions for Blacks and Whites. Blacks were more likely to be preterm by dates and term by Dubowitz, while Whites were more likely to be term by dates and preterm by Dubowitz. Until more research is conducted on the validity of the Dubowitz examination among different ethnic groups, it would be prudent to continue to rely on gestational ages based on obstetrical examinations done in early pregnancy.

Women who registered early in the first trimester for prenatal care were at greatly increased risk for preterm and very preterm delivery. This is contrary to previous findings which have shown that women who register early are at decreased risk of an adverse pregnancy outcome.[10] A likely explanation for this discrepancy is that women were normally given appointments for prenatal care only after they had missed at least two menstrual periods. Earlier appointments were given mainly to women who sought care because of symptoms or because of an obstetric history that placed them at high risk.

Preterm birth continues to be the most important cause of low birthweight and largely accounts for the less than optimal performance in infant mortality in the United States. Three-fourths of preterm births in the Kaiser population were not preceded by premature rupture of membranes, placenta previa, or abruptio placenta. Available therapy is not particularly effective, as tocolytic agents to inhibit labor are contraindicated in a substantial fraction of women with preterm labor. Research on the causes of the large ethnic differences in preterm delivery may provide insights into the etiology of preterm birth in general. Rather than being causal, ethnicity may be a surrogate for other unknown risk factors for preterm birth. The relationship between preterm labor and other factors such as stress, physical activity, poverty, and failure to recognize the symptoms of early labor merits additional attention.

ACKNOWLEDGMENTS

An earlier version of this paper was presented at the American Public Health Association Annual Meeting, November 1985, Washington, DC. These data were collected at the Northern California Kaiser Permanente Clinics under the NICHD contract N01-HD-2861.

REFERENCES

1. National Center for Health Statistics: Advance report of final natality statistics, 1980. Monthly Vital Statistics Report, Vol. 31, No. 8, Supp. DHHS Pub. No. (PHS) 83-1120. Hyattsville, MD: NCHS, November 1982.
2. Kessel SS, Villar J, Berendes HW, Nugent RP: The changing pattern of low birth weight in the United States: 1970 to 1980. JAMA 1984; 251:1978–1982.
3. Shiono PH, Klebanoff MA, Graubard BI, Berendes HW, Rhoads GG: Birth weight among women of different ethnic groups. JAMA 1986; 255:48–52.
4. National Center for Health Statistics, SJ Ventura: Births of Hispanic parentage, 1979. Monthly Vital Statistics Report. Vol. 31-No. 2 Supp. DHHS Pub. No. (PHS) 79-1120. Hyattsville, MD: NCHS May 13, 1982.
5. Dixon WJ (ed): BMDP Statistical Software. Berkeley, CA: University of California Press, 1983.
6. US Department of Health and Human Services: Report of the Secretary's Task force on Black and Minority Health Vol. 1. Washington, DC: Govt Printing Office 1985 0-487-637 (QL 3).
7. Stevenson DK, Hopper AO, Cohen RS, Bucalo LR, Kerner JA, Sunshine P: Macrosomia: Causes and consequences. J Pediatr 1982; 100:515–520.
8. Pritchard JA, McDonald PC: William's Obstetrics, 16th Ed. New York: Appleton-Century-Crofts, 1980.
9. Berkowitz GS: An epidemiologic study of preterm delivery. Am J Epidemiol 1981; 113:81–92.
10. Stickle G, Ma P: Some social and medical correlates of pregnancy outcome. Am J Obstet Gynecol 1977; 127:162–166.

Menstrual Cycle Research Conference Issues Call for Abstracts

The Center for Nursing Research, University of Michigan School of Nursing, has issued a call for abstracts for their conference, "Sexuality and the Menstrual Cycle: Clinical and Sociocultural Implications," to be held June 4–6, 1987 in Ann Arbor, MI. The *deadline* for submission of abstracts is *December 1, 1986.*

For details, contact: Susan M. DeGroote, Program Coordinator, Center for Nursing Research, University of Michigan, Ann Arbor, MI 48109–0482. Tel: (313) 747–0352.