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## Variations in Pregnancy Outcomes by Race Among 10–14-Year-Old Mothers in the United States

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### Synopsis .....

*This study used the 1983–86 U.S. Linked Live Birth-Infant Death Files to examine variations in pregnancy outcomes among 38,551 U.S. resident black and white adolescents ages 10 through 14. The birth rate was 4.29 per 1,000 for blacks, more than 7 times the rate for whites (.59 per 1,000). Black*

*mothers had higher proportions of very low and low birth weight infants than did whites (very low birth weight: 3.7 versus 2.6; low birth weight: 15.0 versus 10.5). Neonatal and infant mortality rates were higher among very low birth weight and low birth weight white infants. Neonatal and infant mortality rates were similar for normal birth weight infants of both races, but were 3.7 to 7.4 times higher among black infants with birth weights more than 4,250 grams.*

*Logistic regression indicated that black mothers were at higher risk for having infants who were low birth weight, very low birth weight, small for gestational age, preterm, and very preterm. There were no differences by race for neonatal, postneonatal, and infant mortality.*

*While the risk for poor pregnancy outcomes is great among young adolescents, young black adolescents appear to be particularly vulnerable. Attempts to reduce unintended pregnancies in this group should receive highest priority.*

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**D**ESPITE A PAUCITY of information on pregnancies occurring to adolescents younger than 15 years, the National Research Council recommended in the mid-1980s that this group, as well as youth from disadvantaged backgrounds, be targeted for reduction of unintended pregnancies (1). Although few in number and limited in scope, some studies focusing on the consequences of pregnancy to these young adolescents indicate that they fare worse than older women on a number of health indicators (2–6). For example, findings suggest that younger women are more likely to deliver infants who will die in the perinatal period (2), are low birth weight (2,3,5), and are small for gestational age (6). In contrast, others have found no differences in pregnancy outcomes between younger and older mothers (5,7–10).

Focusing on births to adolescents 10 to 14 years of age apart from births to older adolescents is important for several reasons. The phases of adolescence, early (ages 10–14), middle (15–17), and late (18–20), have distinct characteristics in regards to biologic and cognitive development (11). The consequences of

pregnancy are also likely to be more severe among younger adolescents. Once a girl becomes pregnant at this early age, she is at greater risk for repeat pregnancies while still an adolescent. Evidence indicates that younger adolescents are more likely to have a second pregnancy within 18 months after their first (7). Furthermore, repeat births among adolescents who begin childbearing before age 15 dramatically increase the risk of perinatal death (12). Compared with young adolescents in other developed countries, U.S. adolescents younger than 15 are five times more likely to experience a birth and, additionally, more likely to experience pregnancies and abortions compared with their same age counterparts in other developed countries (13). Finally, appropriate prevention and intervention strategies for younger adolescents may differ from those appropriate for older youth.

Little information is available about possible differences in use of prenatal care and pregnancy outcomes by race among the youngest mothers in the United States. A handful of studies have suggested

Table 1. Single live births to U.S. resident mothers 10–14 years of age, 1983–86

Age (years)	Number of births			Birth rate <sup>1</sup>			Black:white ratio
	White	Black	Total	White	Black	Total	
10 .....	28	6	34	0.0054	0.0059	0.0055	1.09
11 .....	46	68	114	0.0088	0.0670	0.0180	7.61
12 .....	295	627	922	0.0550	0.6000	0.1430	10.91
13 .....	2,240	4,330	6,570	0.4000	4.0200	0.9740	10.95
14 .....	13,459	17,452	30,911	2.3000	15.9100	4.4500	6.92
Total .....	16,068	22,483	38,551	0.5900	4.2900	1.1850	7.27

<sup>1</sup> Birth rates are per 1,000 females in each age group for 1 year and are based on population estimates from the U.S. Bureau of the Census (16).

that young black mothers in comparison with whites of the same age are more likely to have higher rates of birth (2), inadequate prenatal care (3), and have infants with lower mean birth weights and low birth weight (3,5). While differences in pregnancy outcomes between black and whites have been examined by numerous researchers (14,15), it remains unclear if very young adolescents will exhibit patterns similar to those observed in largely adult populations.

Given the dearth of information about possible variations between black adolescents and white adolescents younger than 15 experiencing pregnancy, this study was undertaken. Using U.S. data from 1983–86, we examined the variation in pregnancy outcomes between black and white U.S. resident adolescents ages 10–14 years.

## Methods

Single live births, selected from the 1983–86 U.S. Linked Live Birth-Infant Death Files, were used to examine variations in sociodemographic characteristics, prenatal care utilization, birth rates, and pregnancy outcomes among black and white U.S. resident adolescent mothers ages 10–14 years. Births to adolescents of other racial groups were excluded because of insufficient numbers to allow for comparisons of interest.

Sociodemographic characteristics examined included metropolitan and nonmetropolitan residence (greater than 250,000 population versus 250,000 or less); marital status (married versus not married); educational attainment (high, defined as 2 or more years above grade level appropriate for age), average and low (defined as 2 or more years below grade level appropriate for age); age of father (17 years or younger versus 18 years or older); and parity (primipara versus multipara).

Age- and race-specific birth rates were calculated using, as a denominator, the number of females by race and age in each year beginning in 1983 through

1986, as estimated by the Bureau of the Census (16). Adequacy of prenatal care utilization was estimated using a modification of the Kessner Index which incorporates the trimester prenatal care began, the number of prenatal care visits, and gestational age (17,18).

Pregnancy outcome measures consisted of birth weight (very low, less than 1,500 grams; low, 1,500–2,499 grams; average, 2,500–4,249 grams; high, 4,250 and more grams); gestational age (very preterm, 32 weeks or less; moderately preterm, 33–36 weeks; preterm, 36 weeks or less; term, 37–41 weeks; postterm, 42 and more weeks); and infant weight for gestational age (small, average, large) determined by using Brenner's criteria (19).

Race-specific neonatal, postneonatal, and infant mortality rates were calculated by using the total number of race specific births as the denominator and the number of race-specific deaths that occur within the first 28 days (neonatal), between 28 days and 1 year (postneonatal), and the total number of deaths within the first year of life (infant) as the numerator. Cause-specific mortality rates for infants were also calculated.

Chi-square was used for significance testing of bivariate comparisons. Multiple logistic regression was used to calculate the odds ratios for the independent effects of maternal race and the other study variables on several pregnancy outcomes including low (LBW) and very low birth weight (VLBW); preterm, very preterm, and postterm births; small and large size for gestational age; neonatal, postneonatal, and infant mortality.

The regression analyses considered the following: maternal race, marital status, educational attainment, parity, metropolitan-nonmetropolitan residency, and use of prenatal care. The reference group consisted of mothers who were white, 14 years old, married, residents of areas with more than 250,000 population, who had high educational attainment, who were primiparous, and who demonstrated adequate use of

prenatal care. Although this data base represents nearly a complete census of births to U.S. resident women, ages 10–14 years during the study years, it could also be viewed as a 4-year sample from an ongoing population evolution. Therefore, confidence intervals are provided.

## Results

There were 38,551 live births among young women ages 10 through 14 during the 4-year study period. Forty-two percent of the births occurred among white adolescents. Table 1 presents birth rates by age and race groups. Age-specific birth rates were substantially higher among black adolescents, and their overall birth rate was seven times that of whites (.59 per 1,000 for whites, 4.29 per 1,000 for blacks). The ratio of black to white birth rates by age ranged from a low of 1.09:1 for mothers, age 10 years, to a high of 10.91:1 for mothers who were 12 years of age.

Sociodemographic characteristics by race of mother are displayed in table 2. White mothers were significantly more likely to have a nonmetropolitan residence and to be primipara in comparison with black mothers. In contrast to whites, black mothers were more likely to be not married and to have average, as opposed to high or low, educational attainment.

Most adolescents (70 percent) did not report information about the age of their infant's father (59 percent for whites and 78 percent for blacks). Among the few that reported this information, 70 percent of white mothers and 42 percent of black adolescent mothers reported that the father was 18 years or older.

Table 3 provides characteristics of prenatal care use by race. A greater proportion of white mothers started prenatal care in the first trimester (36 percent). However, white mothers were also more likely to have no prenatal care (6.7 percent) compared with black mothers (5.9 percent). Only 22.2 percent of white mothers and 20.4 percent of black mothers exhibited adequate prenatal utilization. Missing information on when prenatal care began, the number of prenatal case visits, or the gestational age precluded the determination of adequacy of prenatal care utilization in approximately 20 percent of the births.

The infants of black mothers were more likely to be LBW and VLBW than those of white mothers (table 4). Higher percentages of very preterm, preterm, and small for gestational age infants were also observed for black mothers in comparison with whites. Overall infant mortality rates were signifi-

Table 2. Sociodemographic characteristics of resident U.S. mothers, 10–14 years of age, by race, 1983–86, percentages

Characteristics	White	Black	P-value
Age of mother (years):			
10.....	0.17	0.03	...
11.....	0.29	0.30	...
12.....	1.84	2.79	<.01
13.....	13.94	19.26	...
14.....	83.76	77.62	...
Nonmetropolitan residence <sup>1</sup> .....	77.63	60.83	<.01
Not married.....	81.72	98.75	<.01
Maternal educational attainment: <sup>2</sup>			
Low.....	28.31	23.50	...
Average.....	71.24	76.14	<.01
High.....	0.45	0.36	...
Primipara.....	98.06	97.48	<.01
Adequate prenatal care <sup>3</sup> .....	22.24	20.36	<.01

<sup>1</sup> Nonmetropolitan residence is defined as residing in any county or city with less than 250,000 population.

<sup>2</sup> Educational attainment: low educational attainment is defined as 2 years below expected grade level for age. High educational attainment is defined as 2 years above expected grade level for age. Average educational attainment is defined as within 1 year of expected grade level for age.

<sup>3</sup> Adequacy of prenatal care utilization is based on a modification of the Kessner Index (17,18).

Table 3. Adequacy of prenatal care use by trimester care began of black and white mothers 10–14 years of age, United States, 1983–86 (percentages)

Trimester of initiation and adequacy of utilization	White (N = 16,068)	Black (N = 22,483)
First trimester prenatal care.....	35.97	32.46
Adequate.....	22.24	20.36
Intermediate.....	4.95	6.05
Inadequate.....	1.11	1.45
Missing <sup>1</sup> .....	7.67	4.60
Second trimester prenatal care..	38.97	44.52
Intermediate.....	26.98	32.54
Inadequate.....	3.03	5.28
Missing <sup>1</sup> .....	8.96	6.70
Third trimester prenatal care....	14.49	13.34
Inadequate.....	10.88	10.73
Missing <sup>1</sup> .....	3.61	2.61
No prenatal care.....	6.70	5.85
Missing <sup>2</sup> .....	3.87	3.83

<sup>1</sup> While information on trimester prenatal care began was available, these cases were missing data on the number of care visits or gestational age, items also needed to determine the adequacy of utilization.

<sup>2</sup> Data missing on when trimester prenatal care began.

cantly higher for blacks than for whites because of higher neonatal mortality among blacks. However, postneonatal mortality rates for blacks and whites were comparable. Among the cause of death-specific infant mortality rates investigated, a higher black infant mortality rate was found for deaths because of perinatal conditions.

Race-specific neonatal and infant mortality rates by birth weight and gestational age categories are provided in table 5. The neonatal mortality rate of blacks

Table 4. Birth outcomes by race of mothers 10–14 years of age, United States, 1983–86

Birth outcomes	White	Black	P-value
Percent low birth weight (1,500–2,499 grams) .....	10.49	14.97	<.01
Percent very low birth weight (< 1500 grams).....	2.58	3.71	<.01
Percent heavy birth weight (4,250 grams and more).....	2.26	0.86	<.01
Percent preterm (32–36 weeks)...	19.05	28.29	<.01
Percent very preterm (< 32 weeks).....	6.33	10.87	<.01
Percent postterm (42 weeks and more) .....	15.59	11.34	<.01
Percent small for gestational age <sup>1</sup> .....	6.78	9.74	<.01
Neonatal mortality rate .....	14.30	17.60	<.02
Postneonatal mortality rate .....	7.20	8.30	0.22
Infant mortality rate .....	21.40	25.80	<.01
SIDS <sup>2</sup> specific infant mortality rate .....	2.60	3.30	0.19
Perinatal conditions specific to infant mortality rate .....	11.6	15.60	<.01
Congenital anomalies specific infant mortality rate .....	3.20	2.50	0.24

<sup>1</sup> Small for gestational age is based on Brenner criteria (19).

<sup>2</sup> SIDS = sudden infant death syndrome.

NOTE: Rates are per 1,000 live births.

was lower than whites in every gestational age category, although the difference was only significant for gestational ages less than 32 weeks. The neonatal mortality rate was not significantly different in any birth weight category except for the significantly higher rate among black infants weighing 4,250 grams or more. For both infant and neonatal mortality, no significant racial differences were observed for term (37–41 weeks) and normal birth weight (2,500–4,249 gram) infants.

Table 6 presents the results of the logistic regression analyses of LBW and VLBW, small for gestational age, and preterm and very preterm birth outcomes. In contrast to whites, infants of black adolescent mothers exhibited a significantly higher risk for each of the five outcomes investigated. Monotonic increases in the risk for each pregnancy outcome, with the exception of infants who were small for gestational age, were evident as maternal age decreased. Infants of unmarried mothers had significantly higher odds of being very preterm, while low maternal educational attainment increased the risk of VLBW. Infants of multipara mothers demonstrated higher risks for LBW, VLBW, and preterm delivery. Higher odds ratios for the two preterm outcomes were observed for those with non-metropolitan residence. Inadequate prenatal care utilization was a significant high-risk factor for all the pregnancy outcomes.

Logistic regression analyses of neonatal, post-neonatal, and infant mortality were also performed. No significant racial differences were uncovered after controlling for the other maternal sociodemographic variables considered in the analyses portrayed in table 6. For infants of black mothers, the odds ratios for neonatal and infant mortality were 1.05 (confidence interval [CI]: 0.86–1.29) and 1.07 (CI: 0.91–1.27), respectively.

## Discussion

Annually, approximately 9,600 white and black young women, 10 through 14 years of age, residents of the United States, gave birth between the years 1983 through 1986. The birth rate among this group was seven times higher for blacks in comparison with whites. Black mothers were also more likely to have had a previous birth. These factors indicate that, in contrast to young whites, young black women are at higher risk of giving birth at early ages and for experiencing multiple pregnancies throughout the adolescent period.

This study also reveals that young black mothers have poorer pregnancy outcomes compared with whites. Results showed that blacks were at higher risk for delivering infants that were under 2,500 and 1,500 grams. They were also more likely to deliver infants who were preterm and very preterm. Further, their infants were more likely to be small for gestational age. Extremely immature infants are more likely to experience subsequent morbidity and developmental problems that may severely tax the limited financial resources and parenting skills of young mothers (20).

A substantial proportion of information about the use of prenatal care by these young mothers was missing; hence interpretation of available data remains difficult. From available data, it appears that this group of adolescents tend to delay initiation of care until after their first trimester, and they tend to not utilize prenatal care services adequately. Blacks are more likely to wait until their second trimester to begin prenatal care. Compared with blacks, a higher proportion of whites begin care in the first trimester, wait until the third to begin care, and receive no care.

Although significant ethnic differences in maternal sociodemographic risk characteristics, birth weight, and gestational age measures were in evidence, the disparities were less striking than are typically seen in general populations. Compared with whites, blacks have approximately twice the infant and neonatal mortality rates and twice the percentage LBW births in the general U.S. population (21). While higher

Table 5. Birth weight- and gestational age-specific mortality of infants by race of 10-14-year-old mothers, United States, 1983-86

Category	Neonatal mortality rate			Infant mortality rate		
	White	P-value	Black	White	P-value	Black
<b>Gestational age:</b>						
Less than 32 weeks	136.8	<.01	95.5	161.9	<.01	115.4
32-36 weeks	9.3	0.84	8.7	16.9	0.77	18.0
37-41 weeks	2.9	0.40	2.3	8.1	0.38	7.0
42 weeks and more	2.7	0.73	2.2	7.1	0.18	10.8
<b>Birth weight:</b>						
Less than 1,500 grams	388.9	0.23	354.1	451.7	0.11	404.6
1,500-2,499 grams	19.7	0.34	15.4	37.0	0.35	31.3
2,500-4,295 grams	2.5	0.35	2.0	7.1	0.82	7.4
4,250 grams and more	2.8	0.03	20.6	8.3	0.04	30.9

Table 6. Logistic regression analysis of factors associated with birth outcomes of single live births to black mothers 10-14 years of age, United States, 1983-86

Independent variables	LBW (N = 28,970)		VLBW (N = 28,970)		Preterm (N = 26,416)		Very preterm (N = 26,416)		Small for gestational age (N = 26,392)	
	Odds ratio	95 percent CI	Odds ratio	95 percent CI	Odds ratio	95 percent CI	Odds ratio	95 percent CI	Odds ratio	95 percent CI
Black	11.33	1.23-1.44	21.19	1.03-1.38	11.59	1.49-1.70	11.64	1.48-1.82	11.42	1.29-1.58
<b>Age:</b>										
10-11 years	12.09	1.26-3.48	2.15	0.92-5.04	1.40	0.82-2.37	12.66	1.42-5.00	0.83	0.33-2.11
12 years	11.55	1.28-1.88	21.53	1.08-2.17	21.25	1.04-1.49	1.21	0.94-1.56	1.23	0.94-1.60
13 years	11.24	1.14-1.35	11.45	1.24-1.68	11.18	1.10-1.27	11.20	1.08-1.33	1.08	0.96-1.20
Not married	1.12	0.94-1.33	1.09	0.78-1.51	11.20	1.04-1.38	21.30	1.02-1.65	0.92	0.75-1.13
Low educational attainment	2.02	1.06-3.84	1.87	0.57-6.09	1.30	0.82-2.07	2.02	0.91-4.52	1.30	0.65-2.63
Average educational attainment	1.87	0.98-3.56	1.85	0.57-6.01	1.18	0.74-1.86	1.93	0.87-4.52	1.07	0.53-2.14
Multipara	11.44	1.17-1.76	11.81	1.30-2.54	11.36	1.14-1.64	1.26	0.97-1.63	1.22	0.93-1.60
Nonmetropolitan residence	0.97	0.90-1.04	0.89	0.78-1.02	11.13	1.06-1.20	21.11	1.01-1.21	10.87	0.80-0.96
Intermediate prenatal care	1.08	0.98-1.19	0.90	0.74-1.09	21.08	1.01-1.17	1.01	0.89-1.14	1.06	0.95-1.18
Inadequate prenatal care	11.72	1.57-1.89	12.04	1.71-2.43	11.94	1.80-2.09	13.34	2.97-3.76	11.33	1.18-1.49

<sup>1</sup> P < .01

<sup>2</sup> P < .05

NOTE: During the regression analysis, the cohort or sample size decreased because of missing data on some of the variables in the regression model.

LBW = low birth weight; VLBW = very low birth weight. Reference groups: White race of mother, age 14, married, high educational attainment for age, prima-para, metropolitan residence, and adequate prenatal care use.

levels of these outcomes were observed for this study population, the racial disparity was less than the 2 to 1 ratio commonly observed in the total population in the United States. Of particular interest, significantly higher neonatal mortality rates were not observed for infants of black young adolescent mothers in term and normal birth weight categories in comparison with whites. Compared with adults within their respective racial groups, the birth outcomes of white young adolescents appear to be disproportionately poorer. These results underscore the universal risk of very early parenthood, while highlighting the disproportionate benefits to whites of increasing maternal age at delivery. The extent to which this reflects the cumulative impact of poverty on blacks in the United States remains a topic for further research.

The strengths of this study include examination of linked birth and infant death records from a population cohort of adolescents for several years and use of a regression model controlling for possible confounding variables. Unlike other studies that have examined prenatal care use and pregnancy outcomes among young adolescents based on small clinic or hospital samples (2,3,5,7-9), the results of this study can be generalized to the entire United States. The weaknesses of the study include the limited number of variables available.

Modifications to the U.S. certificate of live birth, made in 1989, will provide more detailed information on preexisting conditions in the mother and the presence of health risk behaviors that may influence the use of prenatal care and pregnancy outcomes. In

addition, the problems associated with the completeness of reporting and validity of data recorded on birth and infant death certificates, for example, age of father, gestational age, and adequacy of prenatal care utilization, make interpretation of the results difficult.

Although this study reveals compelling racial variations in health status indices, these data do not begin to answer questions about (a) why adolescents in this age group are becoming pregnant and giving birth, (b) why black youth are more likely to do so, and (c) why young black mothers are more likely to have infants that are underweight, preterm, and small for gestational age. Further study is required to examine these issues and to determine whether the racial differences found here are due to some combination of factors including, among others, lack of access to or availability of sexuality education, family planning, and reproductive health services, poor environmental and familial supports, lack of opportunities for building financial security, or socio-cultural incentives that preclude efforts to prevent early pregnancies.

Further study is also needed to explore the relationship between marital status and pregnancy outcomes among this age cohort. In this study, unmarried adolescents were considered to be at increased risk for poor pregnancy outcomes. Given the small percentages of young mothers married at the time of delivery and the possibility that their marital relationships differ in comparison with those of older women, marital status among this age cohort may not be an important variable to consider.

Although public health and community primary prevention efforts should focus on preventing unwanted pregnancies, strategies for identifying young girls who are pregnant at early stages in their pregnancies should also be devised. When identified, intensive strategies for managing the pregnancies and post-partum needs of these girls and their infants should be developed.

These results indicate that this group of mothers are at elevated risk of poor pregnancy outcomes. Very young black adolescent mothers and their infants appear to be particularly vulnerable. Reduction of unwanted pregnancies to young adolescents should receive distinct attention.

**References** .....

1. Hayes, C. D., editor: Risking the future: adolescent sexuality, pregnancy, and childbearing. Vol. I. National Academy Press, Washington, DC, 1987.
2. Battaglia, F. C., Frazier, T. M., and Hellegers, A. E.: Obstetric and pediatric complications of juvenile pregnancy. *Pediatrics* 32: 902-910 (1963).

3. Spellacy, W. N., Mahan, C. S., and Cruz, A. C.: The adolescent's first pregnancy: a controlled study. *South Med J* 71: 768-771 (1978).
4. Naeye, R. L.: Teenaged and pre-teenaged pregnancies: consequences of the fetal-maternal competition for nutrients. *Pediatrics* 67: 146-150 (1981).
5. Brown, H. L., Yuan-Da, F., and Gonsoulin, W. J.: Obstetric complications in young teenagers. *South Med J* 84: 46-64 (1991).
6. Elster, A. B.: The effect of maternal age, parity, and prenatal care on perinatal outcome in adolescent mothers. *Am J Obstet Gynecol* 149: 845-847 (1984).
7. Duenhoelter, J. H., Jimenez, J. M., and Baumann, G.: Pregnancy performance of patients under fifteen years of age. *Obstet Gynecol* 46: 49-52 (1975).
8. Horon, I. L., Strobino, D. M., and MacDonald, H. M.: Birth weights among infants born to adolescent and young adults women. *Am J Obstet Gynecol* 146: 444-449 (1983).
9. Scholl, T. O., et al.: Early adolescent pregnancy: a comparative study of pregnancy outcome in young adolescents and mature women. *J Adolesc Health* 53: 167-171 (1984).
10. Lee, K., et al.: Maternal age and incidence of low birth weight at term: a population study. *Am J Obstet Gynecol* 158: 84-89 (1988).
11. Millstein, S. G., Petersen, A. C., and Nightingale, E. O., editors: Promoting the health of adolescents: new directions for the twenty-first century. Oxford University Press, New York, 1993.
12. McAnarney, E. R., and Thiede, H. A.: Adolescent pregnancy and childbearing: what we have learned in a decade and what remains to be learned. *Semin Perinatol* 5: 91-103 (1981).
13. Jones, E. F., et al.: Teenage pregnancy in developed countries: determinants and policy implications. *Fam Plann Perspect* 17: 53-63 (1985).
14. Sappenfield, W. M., et al.: Differences in neonatal and postneonatal mortality by race, birth weight, and gestational age. *Public Health Rep* 102: 182-192, March-April 1987.
15. Kleinman, J. C., and Kessell, S. S.: Racial differences in low birth weight trends and risk factors. *N Engl J Med* 317: 749-753, Sept. 17, 1987.
16. U.S. Bureau of the Census: Estimates of the population of the United States, by age, sex, and race: 1980 to 1986. Current Population Reports 1987, Series P25, No. 1000, U.S. Government Printing Office, Washington, DC, 1987.
17. Kessner, D. M., et al.: Contrasts in health status. Vol. I: Infant death: an analysis of maternal risk and health care. Institute of Medicine, National Academy of Sciences, Washington, DC, 1973.
18. Alexander, G., and Cornely, D.: Prenatal care utilization: its measurement and relationship to pregnancy outcome. *Am J Prev Med* 3: 243-261 (1987).
19. Brenner, W. E., Edelman, D. A., and Henricks, C. H.: A standard of fetal growth for the United States. *Am J Obstet Gynecol* 126: 555-564 (1976).
20. Halsey, C. L., Collin, M. F., and Anderson, C. L.: Extremely low birth weight children and their peers: a comparison of preschool performance. *Pediatrics* 91: 807-811 (1993).
21. Kleinman, J. C.: Infant mortality among racial/ethnic minority groups, 1983-1984. *MMWR Morb Mortal Wkly Rep* 39: 31-39, July 1990.