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Declines in Nonwhite and White Neonatal Mortality in Mississippi, 1975–80

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Synopsis

Linked birth and death records provided the population for an investigation of declines in nonwhite and white neonatal mortality rates (NMR) in Mississippi between 1975 and 1980. The effect of changes in the characteristics of women giving birth and in perinatal care on declining NMRs was analyzed. A decomposition of the difference in the 1975–76 and 1979–80 NMRs was performed to determine whether declines in NMRs were due to shifts in population characteristics or in characteristic-specific rates.

Between 1975 and 1980, the NMR declined significantly by 1 death per 1,000 live births per year among nonwhites and by 0.8 per 1,000 among

whites. Increases in the number of prenatal visits during the study period were associated with part of this decline, especially for nonwhites. The effect of rising use of prenatal care on NMRs was not, however, a result of shifts in the birth weight distribution. The decrease in NMRs was also associated with declining birth weight-specific rates; 75 percent of the decrease in rates was noted among low birth weight infants. Shifts in the distribution of birth weight and in maternal characteristics had little effect on declining NMRs.

A strong commitment of the Mississippi State Board of Health to provide prenatal care to indigent women may be responsible for the large increases in use of prenatal care among Mississippi women. The decline in NMRs among low birth weight infants is likely linked to greater availability of specialized care for the sick neonate, although survival of these infants increased across the State, even where specialized care was not available.

DURING THE LATE 1960s and early 1970s, Mississippi had the highest neonatal mortality rate (NMR) of all States (*1,2*). In 1978 and 1979, its rate was higher than all States except South Carolina (*1*). Nonwhite neonates in Mississippi were especially at a disadvantage relative to nonwhites in other States. In Mississippi, nonwhite rates were almost two times greater than white rates. Evidence from 1970 and earlier suggests that as NMRs have declined, the absolute difference in white and nonwhite rates has decreased, while the ratio of nonwhite to white rates has increased (*3*).

Nonwhite and white NMRs declined in Mississippi in the late 1970s (*1*), but the reasons for the declines are unknown. The purpose of this report is to present the results of an investigation of the factors associated with declines in NMRs for white and nonwhite infants born in Mississippi between 1975 and 1980 and to determine whether there were factors that could explain declines for nonwhites and whites. Declines in NMRs were studied in relation to changes in the characteristics of women giving birth and changes in perinatal care during the study period.

Five demographic characteristics of the childbearing population were studied: maternal age, maternal education, parity, marital status, and outcome of last pregnancy. These five maternal characteristics have been associated in cross-sectional studies with variation in NMRs (*2,4–8*). Furthermore, the distribution of each characteristic changed in the United States between 1975 and 1980 (*9*). If similar changes occurred in Mississippi, they might explain the declines in NMRs between 1975 and 1980.

Changes in when prenatal care is begun, the number of prenatal visits, and birth weight were also investigated in relation to declines in NMRs. Birth weight has been reported to be the single most important factor associated with NMRs (*10*). Neonatal mortality rates increase with the trimester of initiating prenatal care, while they vary inversely with the number of prenatal visits (*11,12*). These three variables were expected to reflect broad changes in perinatal care in Mississippi during the study period.

The Mississippi State Board of Health instituted a number of projects in the late 1970s to improve the availability of prenatal care to indigent women that would be expected to increase the use of prenatal care. In addition, specialized care for the sick newborn was intensified at major hospitals in Jackson; there was an increase in transport of sick infants to these hospitals. A more elaborate network was developed for referral of the sick infants to regional hospitals in the rural areas of the State. These changes in neonatal care would be expected to be associated with declines in birth weight-specific NMRs, especially among low birth weight infants.

Methods and Materials

Linked birth and infant death records are the source of data for this study of all singleton liveborn infants of Mississippi residents between 1975 and 1980. Birth tapes and computerized records of infant deaths in a given year, linked to live births in that year or the previous year, were obtained from the Mississippi State Board of Health. The percentage of infant death records that could be linked with a birth record was between 95 and 98 percent during the study period. Cohort files of linked birth and infant death records were generated from the tapes by merging the linked birth and death records with the birth file based on the year of birth.

The study population comprised 268,093 live births—128,208 nonwhite and 139,885 white births. The nonwhite births are almost exclusively to

blacks, with the exception of a few hundred births per year among the small band of Choctaw Indians in Mississippi.

The yearly NMR is defined as the number of deaths in the first 28 days of life to infants born during a given year per 1,000 live births during the same year. The measures of maternal age, maternal education, marital status, birth weight, the trimester that prenatal care began, and number of prenatal visits are self-explanatory. Parity is defined as the number of children born alive including the current pregnancy, and a prior fetal loss is defined by the outcome of the last pregnancy, assuming that the most accurate reporting of prior losses would be for the most recent pregnancy.

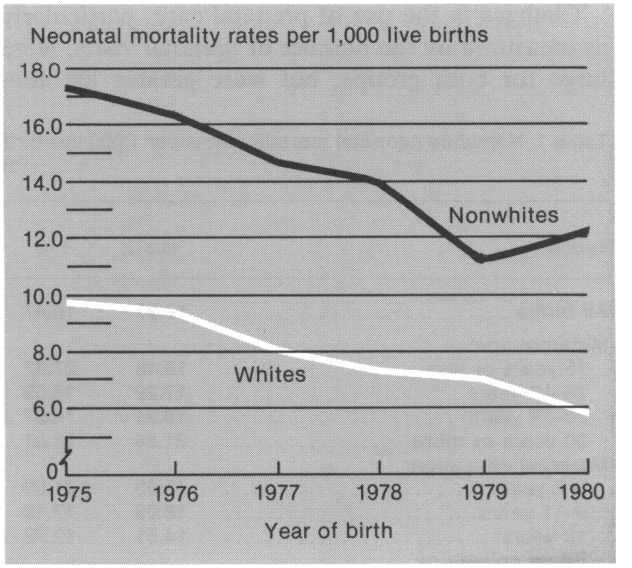
Analysis of the vital statistics data was performed separately for white and nonwhite births. The first step was to compare the yearly distribution between 1975 and 1980 of the five childbearing characteristics and three perinatal care measures to investigate whether fluctuations might be associated with changes in NMRs. Next, the NMRs were compared by year for each variable. The test for a linear trend in proportions (*13,14*) was used to test the statistical significance of the trends for the selected characteristics of the childbearing population. A significance level of 0.05 was used in this analysis.

The final step in the analysis was to determine the extent to which changes in NMRs were associated with two components of the rates, the population characteristics and the specific rates for the variables studied. For example, using birth weight, the extent to which changes in NMRs were due to shifts in the birth weight distribution or to changes in the birth weight-specific NMRs was investigated. To do this, the difference between the 1975–76 NMRs and the 1979–80 NMRs were partitioned into the two components for each variable using the method defined by Kitagawa (*15*). Two years were combined on each end of the period to ensure stability of the specific rates. A similar approach was taken by Kleinman and coworkers (*16*) in studying changes in NMRs in selected States between 1960 and 1973–74.

A two-variable hierarchical decomposition, as defined by Kim and Strobino (*17*), was also used when appropriate. This decomposition treats one variable as proximate or direct in its effect on changes in NMRs and a second as indirect. It was used to investigate the extent to which changes in use of prenatal care were associated with declining NMRs through an effect on the birth weight distribution. In this analysis, birth weight was the proximate variable and prenatal care, the indirect

'Declines in neonatal mortality rates were studied in relation to changes in the characteristics of women giving birth and changes in perinatal care during the study period.'

White and nonwhite neonatal mortality rates, 1975–80, Mississippi



one. The method permitted determination of the effect of changes in prenatal care on declines in NMR without regard to birth weight and, then within categories of prenatal care, decomposed the decline in NMRs into a birth weight distribution effect and a specific rate effect.

Results

For both nonwhites and whites, the crude NMRs declined significantly between 1975 and 1980 (see figure). The absolute difference between the 1975 and 1980 rates was greater for nonwhites—5.3—than whites—3.8, as was the yearly rate of decline, 1.07 deaths per 1,000 live births among nonwhites compared with 0.77 among whites (tables 1 and 2). Conversely, the percentage decline was 38.7 for whites but only 30.6 for nonwhites, and the ratio of nonwhite to white rates was greater in 1980 (2.01) than in 1975 (1.77).

In general, changes in the distribution of the maternal characteristics between 1975 and 1980 were greater among nonwhites than whites, but they

were not remarkable for either group (tables 3 and 4). The level of maternal education showed the greatest changes of the maternal characteristics; the percentage of births to women with less than a high school education dropped from its 1975 level by 11.8 percentage points among nonwhites and by 5.0 among whites. For both groups, but especially for nonwhites, there was a decrease in births to mothers under 20 years of age and an increase in births to unmarried mothers. Parity and outcome of last pregnancy showed minor changes during the 6-year period.

Changes in the use of prenatal care, particularly as measured by the number of prenatal visits, were large for both groups, but were greater for nonwhites than whites. Among nonwhites, the percentage of women with 8 or fewer prenatal visits dropped by 15.8 percentage points between 1975 and 1980; it dropped by 6.1 points among whites and was accompanied by a 2 percentage point decline in births to women with 9–10 visits. The percentage of births to women initiating prenatal care in the first trimester rose during the study period. The birth weight distribution, on the other hand, changed slightly. For both groups, especially whites, there was an increase in infants weighing 3,500 grams or more at birth.

The yearly NMRs and average annual rate of change in the NMR for each maternal characteristic and perinatal care variable are given in tables 1 and

Table 1. Nonwhite neonatal mortality rates per 1,000 live births by maternal characteristics and perinatal variables, Mississippi, 1975–80

Variable	1975	1976	1977	1978	1979	1980	Yearly slope	SD
All births	17.27	16.47	14.95	14.23	11.29	11.99	[1]−1.07	0.20
Maternal age:								
15 years or less	16.48	27.32	22.89	19.75	25.69	17.77	0.05	0.11
16–19 years	17.22	16.59	19.21	16.34	13.49	12.51	[2]−1.01	0.38
20–29 years	16.21	14.27	12.25	13.65	11.68	11.32	[1]−0.87	0.26
30 years or more	21.54	20.01	13.37	9.42	13.70	11.81	[1]−1.99	0.53
Maternal education:								
0–8 years	19.63	21.09	23.22	19.88	18.23	15.32	−0.85	0.63
9–11 years	18.09	17.19	15.69	12.58	13.69	12.36	[1]−1.21	0.32
12 years	14.51	12.72	11.83	15.42	10.22	10.60	[3]−0.69	0.33
Some college or more	16.54	13.23	10.85	9.79	12.48	10.23	[3]−0.88	0.45
Parity:								
First child	16.06	17.89	16.69	14.87	15.01	13.22	[3]−0.70	0.33
Second child	17.45	16.41	13.66	12.83	12.83	10.93	[1]−1.25	0.38
Third child	17.56	13.25	14.17	16.97	10.67	11.54	[3]−1.02	0.49
Fourth child or more	19.36	16.44	14.68	11.08	11.30	11.21	[1]−1.71	0.42
Marital status:								
Married	16.88	15.25	13.98	12.13	11.01	10.68	[1]−1.30	0.21
Unmarried	17.74	17.86	16.03	16.14	15.16	13.26	[2]−0.89	0.29
Outcome last pregnancy:								
No prior pregnancy	14.62	15.90	15.68	14.23	13.62	11.73	[3]−0.65	0.33
Live birth	16.28	14.35	12.42	13.34	11.01	10.91	[1]−1.02	0.25
Fetal death	37.55	38.82	27.87	17.81	26.88	20.85	[2]−3.53	1.09
Trimester prenatal care began:								
First	17.46	16.23	14.37	12.90	13.03	11.54	[1]−1.15	0.25
Second	14.69	13.62	13.44	14.04	12.17	9.40	[2]−0.87	0.33
Third	11.12	11.16	9.24	9.77	[4] 0.85	12.05	−0.76	0.62
No care	50.53	64.52	89.20	46.51	91.30	79.68	5.55	3.54
Number of prenatal visits:								
0–2	46.42	49.93	59.71	44.36	48.60	45.23	−0.52	1.37
3–6	21.36	21.37	22.03	24.43	23.65	19.71	0.08	0.48
7–8	12.48	10.25	8.33	11.25	11.04	9.81	−0.23	0.42
9–10	7.17	9.32	7.96	5.44	8.52	7.88	−0.03	0.33
11–13	10.01	8.27	5.90	6.54	3.99	5.79	[2]−0.89	0.30
14 or more	10.50	10.05	5.04	4.06	4.40	3.92	[1]−1.35	0.36
Birth weight:								
1,500 grams or less	522.39	473.21	449.59	411.60	412.09	336.66	[1]−33.08	6.22
1,501–2,500 grams	33.65	38.27	30.98	30.54	25.53	23.81	[2]−2.27	0.93
2,501–3,500 grams	5.51	4.58	5.13	4.56	4.31	3.32	−0.36	0.14
3,501 grams or more	5.24	5.29	3.86	3.92	3.17	4.07	−0.34	0.21

[1] $P < 0.001$. [2] $P < 0.01$. [3] $P < 0.05$. [4] Fewer than 10 deaths.

2. For both nonwhites and whites, the NMR dropped significantly between 1975 and 1980 in almost all categories of maternal characteristics. There were two exceptions for both groups. Among nonwhites, there was no significant decline for births to mothers 15 years old or less and to mothers with 0–8 years of completed education; among whites, no significant decline was noted for births to women completing high school and to women whose last pregnancy ended in a fetal loss.

The decline in NMRs varied by use of prenatal care. It was significant among nonwhites for births to women with 11–13 and 14 or more prenatal visits and among whites for births to women with 7–8 and 9–10 visits. For both nonwhites and whites, NMRs declined significantly for births to women who began prenatal care in the first or second trimester. By far, however, the greatest decline in NMRs during the study period was found for infants weighing 1,500 grams or less; the yearly rate of decline was 33.1 neonatal deaths per 1,000 live births for nonwhites and 33.8 for whites. This finding was not surprising, since the yearly NMRs for these small infants were at least 10 times greater than for any other weight group. The respective slopes for infants weighing 1,501–2,500 grams were −2.3 and −5.7. The variation in NMRs was greatest by birth weight during the study period.

Table 5 shows the results of the decomposition of the difference in the crude NMRs between 1975–76 and 1979–80. The declines in NMRs can be explained by distinguishing between changes associated with specific rates and changes in the distribution of the maternal characteristics or use of

Table 2. White neonatal mortality rates per 1,000 live births by maternal characteristics and perinatal variables, Mississippi, 1975–80

Variable	1975	1976	1977	1978	1979	1980	Yearly slope	SD
All births	9.76	9.56	8.20	7.27	7.12	5.98	[1]−0.77	0.14
Maternal age:								
19 years or less	13.73	11.05	10.77	9.21	10.14	6.39	[2]−1.17	0.37
20–29 years	8.27	8.91	7.17	6.64	6.70	5.92	[1]−0.54	0.16
30 years or more	10.35	10.57	9.57	7.45	5.74	5.52	[2]−1.17	0.36
Maternal education:								
0–8 years	15.17	15.00	14.67	11.99	10.95	6.63	[1]−3.71	0.80
9–11 years	14.33	10.73	8.85	7.70	8.13	8.10	[1]−1.16	0.32
12 years	7.44	8.86	7.81	6.76	7.39	5.86	−0.38	0.21
Some college or more	6.89	7.60	5.94	6.40	5.09	4.71	[3]−0.52	0.22
Parity:								
First child	9.95	11.00	8.46	7.10	8.61	6.04	[1]−0.80	0.21
Second child	8.85	6.56	7.40	7.32	6.11	4.00	[1]−0.74	0.22
Third child or more	10.75	11.75	9.14	7.28	5.53	8.84	[2]−0.81	0.32
Marital status:								
Married	9.14	9.33	7.95	7.23	6.90	5.88	[1]−0.69	0.14
Unmarried	24.18	14.55	13.30	[4]8.07	11.22	7.68	[1]−2.64	0.79
Outcome last pregnancy:								
No prior pregnancy	9.74	10.66	8.63	6.45	7.95	5.86	[1]−0.83	0.22
Live birth	8.88	7.87	6.83	9.57	4.92	5.43	[1]−0.74	0.19
Fetal death	13.98	11.82	11.96	10.27	13.60	7.71	−0.80	0.56
Trimester prenatal care began:								
First	8.46	8.88	7.87	6.98	6.75	5.87	[1]−0.58	0.15
Second	14.38	11.00	7.19	7.15	6.47	6.41	[1]−1.57	0.39
Third or no care	13.66	[4]9.57	[4]9.78	[4]10.32	22.36	[4]8.00	0.28	0.98
Number of prenatal visits:								
0–2	42.66	38.76	39.47	30.30	46.92	24.26	−2.75	2.30
3–6	34.96	30.46	28.25	29.95	31.19	27.97	−0.93	1.00
7–8	16.02	17.41	14.12	9.85	12.70	10.27	[3]−1.38	0.62
9–10	7.98	8.40	4.71	6.24	4.79	4.42	[2]−0.78	0.29
11–13	3.75	3.41	4.09	3.64	3.96	3.41	−0.02	0.16
14 or more	4.69	5.35	4.51	3.84	3.66	3.81	−0.06	0.14
Birth weight:								
1,500 grams or less	562.50	554.84	554.22	415.20	449.70	353.66	[1]−33.83	9.55
1,501–2,500 grams	58.10	55.19	31.60	35.88	32.98	30.96	[1]−5.67	1.46
2,501–3,500 grams	3.72	3.48	3.25	3.34	2.80	2.13	[1]−0.28	0.12
3,501 grams or more	1.79	1.80	1.43	1.66	2.12	1.67	0.02	0.10

[1] $P < 0.001$. [2] $P < 0.01$. [3] $P < 0.05$. [4] $P <$ Fewer than 10 deaths.

prenatal care. The first and fourth columns in the table give the difference in the NMR due to changes in the distribution of each variable, the second and fifth columns, the difference due to the category-specific rates, and the third and sixth, the overall difference. The difference in rates is measured by the 1975–76 rate subtracted from the 1979–80 rate. It varies somewhat for each variable because of exclusions for cases with unknown values. The percentage of the total arithmetic decline associated with each component is also presented.

For both nonwhites and whites, shifts in the distribution of the maternal characteristics accounted for little of the decline in NMRs. Even for maternal education, only about 10 percent of the decline for nonwhites and 7 percent for whites were associated with shifts in the education distribution.

Unlike the maternal characteristics, shifts in the distribution of the number of prenatal visits appear to account for part of the decline in NMRs. The single variable decomposition suggests that the increases in the number of prenatal visits were asso-

Table 3. Percentage distribution of nonwhite live births by maternal characteristics and perinatal variables, Mississippi, 1975–80

Variable	*1975*	*1976*	*1977*	*1978*	*1979*	*1980*
Maternal age:						
10–15 years	5.7	5.1	5.1	4.5	4.5	4.5
16–19 years	31.5	30.3	28.9	27.8	27.2	25.9
20–29 years	49.0	51.0	52.5	54.0	54.5	53.3
30 years or more	13.7	13.5	13.5	13.8	12.9	14.3
Total number	*20,257*	*19,908*	*21,604*	*21,576*	*22,314*	*22,518*
Maternal education:						
0–8 years	16.7	15.1	13.6	12.4	11.1	10.2
9–11 years	42.0	41.4	39.8	38.5	37.7	36.7
12 years	28.7	29.8	30.7	32.0	32.5	33.6
Some college or more	12.6	13.7	15.9	17.1	18.7	19.6
Total number	*20,148*	*19,805*	*21,473*	*21,487*	*22,278*	*22,481*
Parity:						
First child	39.5	38.7	37.5	35.8	36.4	35.6
Second child	24.0	25.4	26.0	27.3	26.9	27.2
Third child	13.3	14.2	15.5	15.9	16.4	16.9
Fourth child or more	23.2	21.7	21.0	21.0	20.2	20.2
Total number	*20,048*	*19,651*	*21,406*	*21,439*	*22,295*	*22,510*
Marital status:						
Married	54.4	53.3	52.6	51.2	50.0	48.3
Unmarried	45.6	46.7	47.4	48.8	50.0	51.7
Total number	*20,261*	*19,915*	*21,611*	*21,581*	*22,319*	*22,474*
Outcome last pregnancy:						
No prior pregnancy	37.5	37.0	35.8	34.4	34.2	33.3
Live birth	56.5	57.3	58.5	59.8	59.1	59.8
Fetal loss	6.0	5.7	5.8	5.9	6.7	6.9
Total number	*19,137*	*18,870*	*20,514*	*21,067*	*22,130*	*22,250*
Trimester prenatal care began:						
First	55.5	58.9	60.3	60.9	62.5	63.3
Second	34.4	33.4	32.6	32.2	31.1	30.4
Third	8.3	6.5	6.2	5.8	5.3	5.2
No care	1.9	1.3	1.0	1.2	1.0	1.1
Total number	*19,617*	*19,367*	*21,019*	*21,274*	*22,204*	*22,428*
Number of prenatal visits:						
0–2	9.1	7.2	6.6	6.5	5.5	5.4
3–6	31.3	29.1	27.9	25.1	22.7	21.1
7–8	17.1	17.2	16.6	16.3	14.3	15.2
9–10	17.7	18.9	19.8	19.9	19.6	20.0
11–13	15.7	16.9	17.8	19.4	22.6	23.4
14 or more	9.2	10.8	11.4	12.8	15.3	14.9
Total number	*19,724*	*19,318*	*20,979*	*21,234*	*22,180*	*22,167*
Birth weight:						
1,500 grams or less	1.7	1.7	1.7	1.7	1.6	1.8
1,501–2,500 grams	9.5	8.9	9.0	9.0	9.2	8.8
2,501–3,500 grams	65.1	63.7	64.1	64.4	63.6	64.3
3,501 grams or more	23.8	25.7	25.2	24.9	25.6	25.2
Total number	*20,067*	*19,888*	*21,590*	*21,464*	*22,221*	*22,466*

NOTE: Cases with unknown values have been omitted for each variable, so the total number will vary for each.

ciated with 59 percent of the decline in the nonwhite NMR and 42 percent for the white NMR. Shifts in the trimester of initiating prenatal care, on the other hand, appear to have little impact on declining NMRs for either group.

The effect of birth weight on declining NMRs was almost exclusively confined to declining birth weight-specific rates. In fact, among nonwhites, the slight shift in the birth weight distribution was in a direction of increasing rather than decreasing NMRs between 1975 and 1980. Although not shown in table 5, more than 75 percent of the decline in the white and nonwhite NMRs occurred among infants weighing 2,500 grams or less at birth.

These results suggest that both increases in the number of prenatal visits and declining birth weight-specific NMRs were associated with declines in nonwhite and white crude NMRs. A hierarchical decomposition of the difference between the 1979–80 and 1975–76 NMRs was performed to investigate whether the effect of increases in use of prenatal visits was related to shifts in the birth weight distribution. This decomposition separated the difference in the NMRs into the effect

Table 4. Percentage distribution of white live births by maternal characteristics and perinatal variables, Mississippi, 1975–80

Variable	*1975*	*1976*	*1977*	*1978*	*1979*	*1980*
Maternal age:						
19 years or less	20.4	19.6	18.7	17.8	16.8	16.7
20–29 years	65.6	66.8	66.3	66.4	66.8	66.8
30 years or more	13.7	13.7	15.1	15.8	16.3	16.4
Total number	*22,128*	*22,180*	*22,932*	*23,796*	*24,566*	*24,262*
Maternal education:						
0–8 years	7.8	7.2	7.2	6.7	6.3	6.2
9–11 years	24.3	23.6	23.2	21.9	21.1	20.9
12 years	39.4	39.3	38.7	39.3	39.7	38.7
Some college or more	28.5	29.8	30.9	32.2	32.9	34.1
Total number	*21,864*	*22,090*	*22,849*	*23,755*	*24,525*	*24,238*
Parity:						
First child	45.2	45.4	44.1	44.6	44.0	44.5
Second child	32.9	33.2	34.4	34.0	34.7	33.6
Third child	13.2	13.8	14.3	14.4	14.4	14.3
Fourth child or more	8.8	7.7	7.3	7.0	6.9	6.4
Total number	*22,019*	*22,055*	*22,813*	*23,698*	*24,547*	*24,251*
Marital status:						
Married	95.9	95.7	95.4	95.3	94.9	94.1
Unmarried	4.1	4.3	4.6	4.7	5.1	5.9
Total number	*22,135*	*22,180*	*22,936*	*23,803*	*24,566*	*24,241*
Outcome last pregnancy:						
No prior pregnancy	41.7	41.7	40.6	40.4	39.8	40.5
Live birth	49.6	49.8	51.3	50.5	50.9	49.8
Fetal loss	8.7	8.5	8.1	9.1	9.4	9.7
Total number	*20,664*	*20,918*	*21,680*	*23,410*	*24,350*	*24,032*
Trimester prenatal care began:						
First	79.4	80.3	81.3	83.3	84.2	85.2
Second	16.9	15.9	15.5	13.8	13.3	12.2
Third	3.0	3.2	2.7	2.4	2.0	2.1
No care	0.7	0.7	0.4	0.5	0.5	0.5
Total number	*21,437*	*21,743*	*22,492*	*23,378*	*24,454*	*24,210*
Number of prenatal visits:						
0–2	2.0	1.8	1.7	1.7	1.4	1.5
3–6	9.1	8.6	8.0	7.3	6.3	6.1
7–8	9.9	10.4	9.5	9.5	8.1	7.3
9–10	19.3	19.8	18.0	18.4	17.9	16.9
11–13	34.8	35.2	38.1	37.5	37.2	38.8
14 or more	24.9	24.2	24.7	25.5	29.1	29.4
Total number	*21,427*	*21,642*	*22,444*	*23,439*	*24,427*	*24,125*
Birth weight:						
1,500 grams or less	0.7	0.7	0.7	0.7	0.7	0.7
1,500–2,500 grams	4.8	4.7	4.3	4.5	4.2	4.4
2,501–3,500 grams	53.3	51.9	52.3	51.6	51.0	50.4
3,501 grams or more	41.2	42.6	42.7	43.2	44.1	44.6
Total number	*21,681*	*22,154*	*22,918*	*23,764*	*24,536*	*24,236*

NOTE: Cases with unknown values have been omitted for each variable, so the total number will vary for each.

Table 5. Decomposition of the difference in nonwhite and white neonatal mortality rates per 1,000 live births in Mississippi between 1975–76 and 1979–80

Variable	Nonwhites			Whites		
	Changes in composition	Changes in specific rates	Total difference[1]	Changes in composition	Changes in specific rates	Total difference[1]
Maternal age:						
Absolute change	−0.13	−4.19	−4.32	−0.12	−2.96	−3.08
Percent change	3.0	87.0		3.9	96.1	
Maternal education:						
Absolute change	−0.43	−3.85	−4.28	−0.20	−2.76	−2.96
Percent change	10.0	90.0		6.8	93.2	
Parity:						
Absolute change	−0.07	−4.45	−4.52	−0.03	−3.12	−3.15
Percent change	1.5	98.5		1.0	99.0	
Marital status:						
Absolute change	0.12	−4.45	−4.33	0.08	−3.18	−3.10
Percent change	−2.8	102.8		−2.6	102.6	
Outcome last pregnancy:						
Absolute change	−0.27	−4.11	−4.38	−0.08	−2.72	−2.80
Percent change	6.2	93.8		2.9	97.1	
Trimester prenatal care began:						
Absolute change	−0.11	−3.73	−3.84	−0.15	−2.74	−2.89
Percent change	2.9	97.1		5.2	94.8	
Number of prenatal visits:						
Absolute change	−2.39	−1.64	−4.03	−1.25	−1.72	−2.97
Percent change	59.3	40.7		42.1	57.9	
Birth weight:						
Absolute change	0.24	−4.76	−4.52	−0.13	−2.83	−2.96
Percent change	−5.3	105.3		4.4	95.6	

[1] Total difference varies somewhat for each variable depending on the number of cases with unknown values.

Table 6. Hierarchical decomposition of the difference between the 1975–76 and 1979–80 neonatal mortality rates per 1,000 live births in Mississippi

Component of difference	Nonwhite births	White births
Prenatal visit distribution:		
Absolute change	−2.02	−0.82
Percent change	42.4	25.2
Birth weight distribution within prenatal visit distribution:		
Absolute change	1.80	0.58
Percent change	−37.8	−17.8
Prenatal care-birth weight specific rates:		
Absolute change	−4.54	−3.02
Percent change	95.4	92.6
Total absolute change	−4.76	−3.26

of changes in the distribution of number of prenatal visits (table 6, first row), the changes in the birth weight distribution within categories of number of prenatal vists (second row), and the changes in the prenatal care-birth weight specific NMRs (third row). This hierarchical approach was taken because the changes in number of prenatal visits should theoretically affect NMRs through an effect on the birth weight distribution.

For white and nonwhite births, the hierarchical decomposition indicates that both the increase in number of prenatal visits and the decline in prenatal care-birth weight specific mortality rates were associated with declining crude NMRs. The percentage decline as well as the absolute decline in the NMR associated with increases in prenatal visits were somewhat reduced from the figures in table 5. This reduction results in part from the joint effect of changes in the birth weight distribution in the categories of prenatal visits and changes in the prenatal visit-birth specific rates. Within categories of prenatal visits, declines in birth weight-specific rates were solely responsible for declines in the overall NMR for both nonwhites and whites. In fact, the effect of shifts in the birth weight distribution within categories of prenatal visits was unfavorable; they would have resulted in increases in NMRs if the prenatal visit-birth weight specific rates had not dropped. Thus, it appears that the effect of increases in use of prenatal care on NMRs is not related to shifts in the birth weight distribution.

Discussion

The results of this investigation indicate significant declines in white and nonwhite NMRs in Mississippi between 1975 and 1980. The absolute decrease in the rates is greater for nonwhites than whites, and the absolute difference between nonwhite and white rates is greater in 1975 than in 1980. However, the percentage decline in the rates was less for nonwhites, and the ratio of nonwhite to white rates was greater in 1980 than in 1975. These results are similar to previous reports for the United States (*18*) and for southern States (*3*) through the early 1970s.

For both nonwhites and whites, increases in the number of prenatal visits account for part of the drop in NMRs between 1975 and 1980. The larger absolute decrease in NMRs for nonwhites appears to result in part from their larger increase in number of prenatal visits relative to white mothers, although whites continue to have more prenatal visits than nonwhites. The decline in NMRs associated with increases in the number of prenatal visits is not attributable to a shift in the birth weight distribution. The decrease in NMRs is also associated with declines in birth weight-specific NMRs, particularly among low birth weight infants for whom more than 75 percent of the drop in NMRs was noted. Shifts in maternal characteristics had little impact on declining rates between 1975 and 1980. This finding is in contrast to the results of analyses during the late 1960s and early 1970s showing declines in infant mortality associated with shifts in the maternal age and parity distribution (*19,20*).

A direct association between the rise in use of prenatal care from 1975 to 1980 and the introduction of new perinatal projects cannot be determined from the present results. A subsequent analysis has been performed to compare counties where new perinatal projects were begun by the Mississippi State Board of Health with control counties. Two important projects were the Improved Pregnancy Outcome (IPO) Project and the Improved Child Health Project (ICHP). Our analysis suggests that increases in the use of prenatal care occurred throughout the State and that, even where increases were greater in IPO or ICHP counties, the projects were not responsible for all of the rise in the use of prenatal care.

The effect of the rise in use of prenatal care, although associated in part with declining NMRs, was attenuated by unfavorable shifts in the birth weight distribution for women with fewer than seven prenatal visits, particularly among nonwhites. The percentage of low birth weight infants rose from 19.4 percent in 1975–76 to 23.7 in 1979–80 among nonwhite women with 0–2 visits and from 13.1 to 15.5 percent for women with 3–6 visits. Because of these increases, there was little change in NMRs for these two groups, despite declining birth weight-specific rates. For nonwhite women with 8–13 visits, the percentage of low birth weight infants dropped from 8.8 to 8.4 percent, while it remained at about 7 percent in both periods for women with more than 13 visits.

The rise in the percentage of low birth weight infants among low users of prenatal care may have been due to a greater concentration of women with short gestations in these groups in 1979–80 and, thus, with less opportunity to receive much prenatal care. Alternatively, women who received little prenatal care in the face of rising utilization of care may have been increasingly composed of women with social risks. Among white women, a rise in the percentage of low birth weight infants was noted only for women with 3–6 visits as the following table shows.

	Percent with low birth weight infants	
Number of prenatal visits	*1975–76*	*1979–80*
0–2	16.5	16.3
3–6	13.9	15.9
7–13	4.8	4.6
14 or more	3.1	2.9

The reasons why the rise in use of prenatal care was related to declining NMRs independent of changes in the birth weight distribution can only be speculated. Increased use of prenatal care could result in elimination of dietary or health care practices that may be harmful for the developing fetus. These changes may not increase the weight of the infant at birth but may, nevertheless, result in a "more healthy" infant at any given weight and, in turn, reduced mortality. There may also have been a shift in the composition of women at risk who made several prenatal visits. In 1975, when women sought less prenatal care, the group with 11 or more visits may have been largely composed of women with problem pregnancies. In 1980, as 11 or more visits became the norm, this group would likely be composed of fewer women with problem pregnancies. The possible explanations for a relationship between neonatal mortality and use of prenatal care need to be investigated in more tightly controlled studies.

The possibility of a spurious association between increased use of prenatal care and declining

'The reasons why the rise in use of prenatal care was related to declining neonatal mortality rates independent of changes in the birth weight distribution can only be speculated.'

neonatal mortality cannot be dismissed. A major limitation of the results presented here is that they do not separate the effects of confounding variables on declining NMRs, except for prenatal care and birth weight. Although such an analysis is beyond the scope of this report, an adjustment for multiple variables has been performed in the analysis of outcomes for IPO and ICHP counties and their controls. This adjustment supports the conclusions for the State that shifts in maternal characteristics have had little impact on declining rates of poor pregnancy outcomes; they also appear to have little effect on increases in the use of prenatal care.

The quality of the vital statistics data in Mississippi must also be considered in interpreting the results of the present study. During the mid- and late 1970s, a computerized system was begun by the Department of Health Statistics of the State Board of Health to improve the quality and coverage of vital records. This system includes contacting any institution or person when either a record or an item of a record is not completed as well as procedures to evaluate the internal consistency of the reported data. Between 1975 and 1980, there was an increase in the completeness of items on the birth certificate (tables 3 and 4). For example, the percentage of cases with unknown information on the number of prenatal visits dropped from just under 3 percent in 1975–76 for both groups to 1 percent for nonwhites and 0.5 percent for whites in 1979–80. Among neonatal deaths, however, the drop in the percentage of unknown values was less, especially for prenatal care and birth weight combined (from 4.2 to 3.8 percent for whites and from 6.0 to 3.0 among nonwhites).

These selective changes in the frequency of unknown values increased the estimated magnitude of the difference in the NMR between 1975–76 and 1979–80 when it was partitioned by prenatal care and birth weight. They explain why there is variation in the estimated magnitude of the difference in NMRs in tables 5 and 6. However, these changes in unknown values do not explain the decline in NMRs, but rather reduce the magnitude of the decline estimated to be associated with increases in prenatal visits in table 6.

Whether large increases in use of prenatal care would be seen in other States, especially for nonwhites, needs to be investigated. In the United States, the percentage of women with more than six prenatal visits rose between 1975 and 1980 (*9*) but much less so than in Mississippi. The Mississippi State Board of Health has made a strong commitment to provide prenatal services directly to indigent women in the State. In fiscal year 1979, the board provided care to about 40 percent of all pregnant women (*21*). Furthermore, the University of Mississippi has been actively involved in attempting to upgrade prenatal care in the private sector. Efforts include continuing education activities, introducing prenatal risk rating forms in hospitals throughout the State, and working with the State board of health to develop a regionalized referral system of care for pregnant women as well as infants.

The declines noted in NMRs for low birth weight infants were not surprising and are consistent with national data (*18*). Lee and coauthors argue that the most plausible explanation for these declines is the proliferation of neonatal intensive care units. Changes in the availability and upgrading of care for the sick neonate may explain part of the decline in NMRs in Mississippi. However, although tertiary care was available only in Jackson, increases in the survival of low birth weight infants occurred throughout the State. Transport of low birth weight infants to Jackson would account for only part of the decline in NMRs; in 1980, about 500 infants (of unknown birth weight) were transported to University Hospital or other hospitals in Jackson compared with 565 infants weighing 1,500 grams or less, 709 infants weighing 1,501–2,000 grams, and 2,331 infants weighing 2,001–2,500 grams born in the State. One explanation for increases in survival may be changes in the management of the low birth weight infant by the obstetrician at birth, as suggested by Goldenberg and coworkers (*22*). Delay of the time at which death occurs does not appear to be a likely explanation, since postneonatal mortality rates did not rise for low birth weight infants between 1975 and 1980.

The present study must be duplicated in other States before its implications can be clearly understood. Certainly, the possibility that the findings for prenatal care are spurious cannot be dismissed without further investigation. If they are noted elsewhere, then we must re-examine our thinking about the role that prenatal care plays in affecting

pregnancy outcome. Our findings showing improvements in the survival of low birth weight infants are not new. Nevertheless, they suggest the need to investigate more adequately efforts to regionalize perinatal services because survival rates improved across the State. Finally, the results suggest that perinatal care, in terms of prenatal as well as neonatal care, may be promising in improving outcomes in the poorest State in the United States. The implications of this finding for Mississippi and for other poor States are especially important in a time of reduced funding for public programs.

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Credentialing and Job Practice in Environmental Health: An Empirical Study

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Synopsis

To investigate the validity of the credentialing examination for entry-level practitioners in environmental health, 15 work measures, simulating or assessing important components of job practice, were developed. These work measures, along with the written examination, were administered to a sample of 128 entry-level practitioners drawn from 10 test sites throughout the country.