

Trends in Maternal and Infant Health Factors Associated with Low Infant Birth Weight, United States, 1972 and 1980

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Synopsis

Today, low birth weight—weight less than 2,500 grams (5 pounds 8 ounces)—is recognized as the single most significant characteristic of the newborn associated with a greater risk of mortality and morbidity. This paper highlights maternal and infant health factors associated with low birth weight, using data from the 1972 and 1980 National Natality Surveys. Both surveys provide important information related to low birth weight that is not typically available from standard birth certificates and therefore not part of the usual natality vital statistics. In addition, induction of labor and cesarean section deliveries (first and repeat cesareans) were examined for 1980 to assess whether their use has exerted an influence on low birth weight.

LOW BIRTH WEIGHT—weight less than 2,500 grams (5 pounds 8 ounces)—is the most important correlate of infant mortality (1-4). Low birth weight has also become recognized as the most significant characteristic of the newborn associated with a greater risk of morbidity (5,6). Factors associated with increased risk of giving birth to a low weight infant have been studied extensively, primarily using national vital statistics (7-10). However, these factors are limited to the relatively few items on the birth certificate, such as maternal age, parity, education, race, marital status, and prenatal care obtained. Hospital-based studies and other special studies have further contributed to the litany of characteristics associated with low birth weight, including maternal smoking, consumption of alcohol, nutrition, and weight gain (11).

This paper highlights maternal and infant health factors associated with low birth weight, using data from the 1972 and 1980 National Natality Surveys conducted by the National Center for Health Statistics. The availability of these surveys has allowed the authors to focus on a variety of nationally representative characteristics not available from natality vital statistics.

Materials and Methods

Details of the natality survey design and sampling techniques are discussed in the article introducing this section of the journal (pp. 111-116). Some methodological issues, however, are important to underscore. The 1980 National Natality Survey oversampled low birth weight infants to permit more in-depth studies of

these high-risk infants; each sampled birth received an appropriate case weight so that accurate national estimates of all survey characteristics (including low birth weight) are reconstructed. Furthermore, the larger number of low birth weight infants in the sample allows greater statistical confidence in studies of low birth weight.

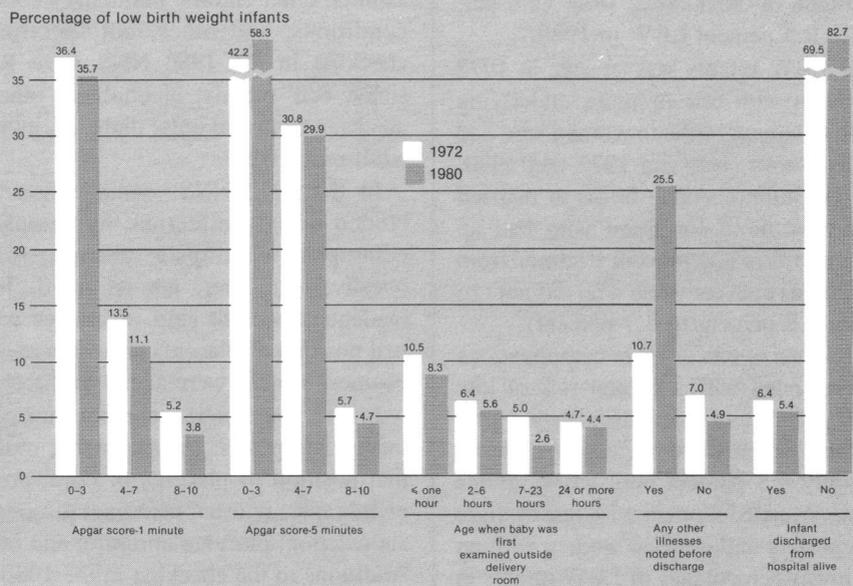
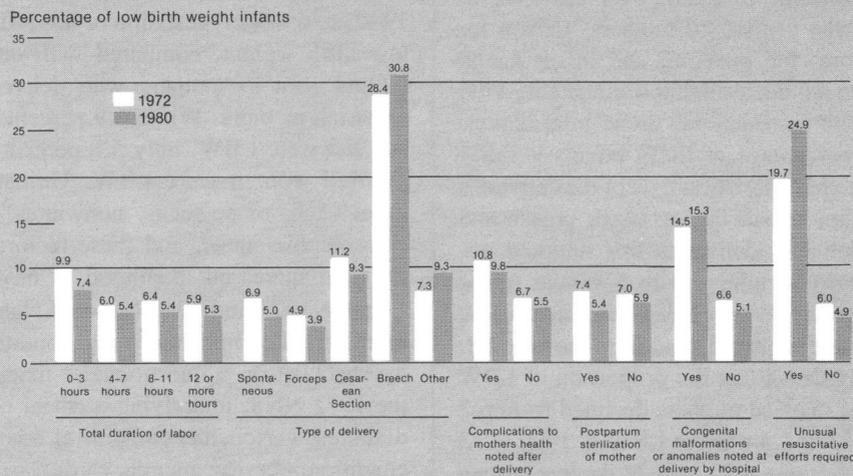
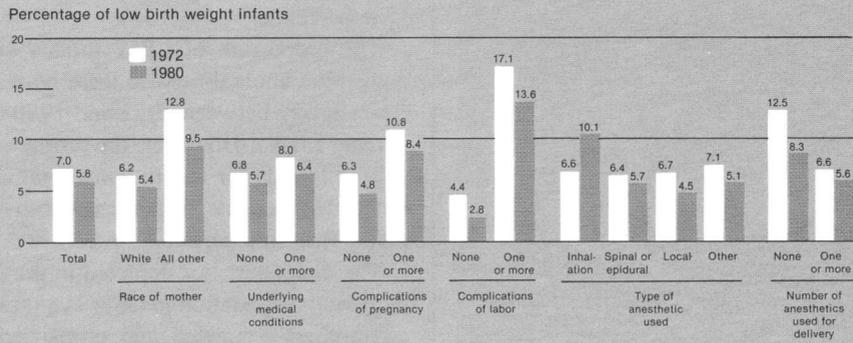
The 1980 NNS included information on births to both married and unmarried women. The 1972 NNS, however, included information on births to married women only; therefore, comparisons in this paper between the 1972 and 1980 data are limited to hospital births to married women only. This report updates a study of maternal and infant health factors associated with low birth weight that was based on the 1972 NNS (12). Also, data for all hospital births, regardless of maternal marital status, are presented for 1980. Both the 1972 and 1980 surveys produced nationally representative estimates, even though oversampling of low birth weight (LBW) infants was done in the 1980 NNS.

Finally, new data items for 1980 that were not available in the 1972 NNS (induction of labor and primary and repeat cesarean section delivery) are examined in relation to low birth weight and length of gestation to assess whether these technologies have exerted an influence on the incidence of LBW infants.

Findings

The decline in the proportion of births of LBW infants to married mothers—from 7.0 percent in 1972 to 5.8 percent in 1980—is summarized in the chart. This repre-

Percentage of infants of low birth weight born to married mothers in hospitals, according to selected maternal and infant characteristics: United States, 1972 and 1980



NOTE: Low birth weight was defined as less than 2,500 grams in 1980 and as 2,500 grams or less in 1972. Likewise, there was a shift of 1 gram for other birth weight categories.

SOURCE: National Center for Health Statistics: final data from the 1972 National Natality Survey and data from the 1980 National Natality Survey.

'The findings from the 1972 and 1980 National Natality Surveys suggest that there has been a significant reduction in the proportion of low birth weight infants born to married women. Moreover, these declines have occurred across race, with married women other than white showing the greatest decline . . .'

sents a 17 percent decline in LBW, over the 1972 to 1980 period, for births to married mothers. Except for race and Apgar score, the maternal and infant health characteristics shown are not available from natality vital statistics and therefore represent new trend information. The decline in the percentage of LBW infants is fairly uniform across most characteristics, except for deliveries in which an inhalation anesthetic was used, breech and "other" types of delivery, deliveries that required unusual resuscitative efforts, infants with 5-minute Apgar scores of 0-3, infants with "other illnesses" noted before discharge, and infants discharged dead from the hospital.

By race, the chart shows that the proportion of LBW infants born to white married mothers declined from 6.2 percent LBW in 1972 to 5.4 percent LBW in 1980 (a 13 percent decline). There was a 26 percent decline among births to married women of other races, from 12.8 percent LBW in 1972 to 9.5 percent LBW in 1980.

The proportion of LBW infants was greater in 1972 among births to women with one or more underlying medical conditions than among births to women who had no such condition. However, between 1972 and 1980, the proportion of LBW infants among births to married women declined slightly more for those who had an underlying medical condition (20 percent decline, from 8.0 percent to 6.4 percent) than for those who did not (16 percent decline, from 6.8 percent to 5.7 percent).

As in 1972, the presence of one or more complications of pregnancy was associated with a greater risk of low birth weight in 1980. Among married women, 8.4 percent bore LBW infants when there were one or more complications, but only 4.8 percent bore LBW infants when there were none. Married women with one or more complications of pregnancy and married women with no complications bore lower percentages of LBW infants in 1980 than in 1972.

The proportion of LBW infants among births to married women delivering by cesarean section declined by 17 percent between 1972 and 1980—from 11.2 percent

to 9.3 percent. Still, in 1980, the proportion of LBW infants born to married mothers delivering by cesarean section (9.3 percent) was 86 percent higher than the proportion among the infants delivered spontaneously (5.0 percent).

The proportion of LBW infants among infants with congenital anomalies who were born to married women rose slightly between 1972 and 1980 (from 14.5 to 15.3 percent LBW). However, the proportion of LBW infants among infants for whom congenital anomalies were not noted declined by 23 percent (from 6.6 percent to 5.1 percent) in this period.

The characteristics depicted in the chart are presented by period of gestation in table 1; moreover, 1980 data for all mothers—married and unmarried—are shown. Of infants born to all mothers who delivered in hospitals in 1980 at 36 weeks' gestation or less, 41.2 percent were of low birth weight, compared with only 1.8 percent of infants born to mothers who delivered at 40 weeks' gestation or more. While 6.9 percent of all infants born in 1980 were LBW, only 5.8 percent of infants born to married women were LBW. Unmarried mothers are more likely to be teens, nonwhites, and of lower socioeconomic status, and these factors partially account for their increased likelihood of having LBW infants.

In the 1972 and 1980 National Natality Surveys, data on maternal complications and conditions were obtained by checklist on a questionnaire mailed to hospitals. In the 1972 NNS, underlying medical conditions included diabetes; varicosity; congenital heart disease; thyroid condition; obesity; anemia; cardiovascular-renal disease; asthma; other chronic pulmonary conditions; orthopedic conditions; and other, not specified. Added to this checklist in the 1980 NNS were Rh incompatibility; sickle cell anemia; alcoholism; other drug abuse; diabetes, gestational only; diabetes, juvenile; and diabetes, adult-onset type.

In the 1972 NNS, complications of pregnancy included urinary infection; hypertension; toxemia pre-eclampsia; eclampsia; anemia; rubella; embolism; obesity; and other, not specified. In the 1980 NNS, inadequate weight gain, excessive weight gain, abnormal position of placenta (placenta previa), and abnormal position of cord were added to the checklist.

In the 1972 NNS, complications of labor included inadequate pelvis; transverse lie; multiple birth; abnormal position of placenta or cord; premature rupture of membranes; unusual bleeding; prolonged labor; anesthesia reaction; placenta abruptio; and other, not specified. Additions to the checklist in the 1980 NNS were hypertension, toxemia preeclampsia, eclampsia, and embolism.

Of infants born in 1980 to married and unmarried mothers with no underlying medical conditions, 6.7 per-

Table 1. Percentage of live hospital births weighing less than 2,500 grams, by selected maternal and infant health characteristics and period of gestation: 1972 and 1980 National Natality Surveys

| Maternal and infant health characteristics | Total | Period of gestation | | | |
|--|-------|---------------------|-------------|----------|------------------|
| | | 36 weeks or less | 37-39 weeks | 40 weeks | 41 weeks or more |
| 1972 NNS—married mothers only | 7.0 | 32.2 | 6.1 | 2.4 | 3.3 |
| 1980 NNS—married mothers only | 5.8 | 39.9 | 4.5 | 1.7 | 1.3 |
| 1980 NNS—all mothers | 6.9 | 41.2 | 5.1 | 1.8 | 1.8 |
| <i>Mothers' race</i> | | | | | |
| White: | | | | | |
| 1972 NNS—married mothers only | 6.2 | 32.4 | 5.4 | 2.0 | 2.7 |
| 1980 NNS—married mothers only | 5.4 | 38.6 | 4.3 | 1.4 | 1.2 |
| 1980 NNS—all mothers | 5.8 | 38.8 | 4.5 | 1.5 | 1.4 |
| All other: | | | | | |
| 1972 NNS—married mothers only | 12.8 | 31.4 | 10.8 | 6.8 | 9.6 |
| 1980 NNS—married mothers only | 9.5 | 46.9 | 6.1 | 3.8 | 2.5 |
| 1980 NNS—all mothers | 11.9 | 46.9 | 7.7 | 3.5 | 3.9 |
| <i>Underlying medical conditions¹</i> | | | | | |
| None: | | | | | |
| 1972 NNS—married mothers only | 6.8 | 32.5 | 6.2 | 2.3 | 3.1 |
| 1980 NNS—married mothers only | 5.7 | 40.0 | 4.6 | 1.7 | 1.3 |
| 1980 NNS—all mothers | 6.7 | 41.4 | 5.1 | 1.8 | 1.7 |
| One or more: | | | | | |
| 1972 NNS—married mothers only | 8.0 | 31.1 | 5.6 | 3.2 | 4.5 |
| 1980 NNS—married mothers only | 6.4 | 39.5 | 4.1 | 1.5 | 1.7 |
| 1980 NNS—all mothers | 7.8 | 40.3 | 5.3 | 1.9 | 2.1 |
| <i>Complications of pregnancy¹</i> | | | | | |
| None: | | | | | |
| 1972 NNS—married mothers only | 6.3 | 28.7 | 6.0 | 2.3 | 3.0 |
| 1980 NNS—married mothers only | 4.8 | 34.3 | 3.9 | 1.7 | 1.1 |
| 1980 NNS—all mothers | 5.8 | 36.7 | 4.5 | 1.7 | 1.5 |
| One or more: | | | | | |
| 1972 NNS—married mothers only | 10.8 | 43.4 | 6.6 | 3.4 | 4.9 |
| 1980 NNS—married mothers only | 8.4 | 50.4 | 6.0 | 1.6 | 2.0 |
| 1980 NNS—all mothers | 9.7 | 48.8 | 6.8 | 2.0 | 2.5 |
| <i>Complications of labor¹</i> | | | | | |
| None: | | | | | |
| 1972 NNS—married mothers only | 4.4 | 17.4 | 4.3 | 2.4 | 2.8 |
| 1980 NNS—married mothers only | 2.8 | 20.3 | 2.9 | 1.0 | 1.8 |
| 1980 NNS—all mothers | 3.6 | 22.6 | 3.4 | 1.2 | 1.2 |
| One or more: | | | | | |
| 1972 NNS—married mothers only | 17.1 | 60.7 | 14.1 | 2.8 | 5.3 |
| 1980 NNS—married mothers only | 13.6 | 60.4 | 9.1 | 3.7 | 2.8 |
| 1980 NNS—all mothers | 15.1 | 61.2 | 9.9 | 3.7 | 3.3 |
| <i>Type of anesthetic used</i> | | | | | |
| Inhalation only: | | | | | |
| 1972 NNS—married mothers only | 6.6 | 25.5 | 7.2 | 2.6 | 3.3 |
| 1980 NNS—married mothers only | 10.1 | 54.1 | 6.8 | 3.9 | 2.6 |
| 1980 NNS—all mothers | 11.9 | 53.4 | 8.0 | 4.1 | 3.0 |
| Spinal and/or epidural only: | | | | | |
| 1972 NNS—married mothers only | 6.4 | 32.3 | 5.5 | 2.0 | 3.2 |
| 1980 NNS—married mothers only | 5.7 | 39.8 | 4.2 | 1.6 | 1.5 |
| 1980 NNS—all mothers | 6.5 | 42.2 | 4.5 | 1.7 | 2.1 |
| Local only: | | | | | |
| 1972 NNS—married mothers only | 6.7 | 34.2 | 5.7 | 1.8 | 3.1 |
| 1980 NNS—married mothers only | 4.5 | 34.6 | 4.0 | 1.2 | 1.0 |
| 1980 NNS—all mothers | 5.5 | 35.6 | 4.7 | 1.4 | 1.4 |
| Other only: | | | | | |
| 1972 NNS—married mothers only | 7.1 | 35.4 | 6.2 | 1.7 | 2.7 |
| 1980 NNS—married mothers only | 5.1 | 30.0 | 3.1 | 2.6 | 1.2 |
| 1980 NNS—all mothers | 5.7 | 31.4 | 3.7 | 2.5 | 1.5 |

Continued

Table 1. Percentage of live hospital births weighing less than 2,500 grams, by selected maternal and infant health characteristics and period of gestation: 1972 and 1980 National Natality Surveys—Continued

| Maternal and infant health characteristics | Total | Period of gestation | | | |
|--|-------|---------------------|------------------|------------------|------------------|
| | | 36 weeks or less | 37–39 weeks | 40 weeks | 41 weeks or more |
| <i>Number of anesthetics used for delivery</i> | | | | | |
| None: | | | | | |
| 1972 NNS—married mothers only | 12.5 | 44.7 | 7.4 | 7.9 | 6.2 |
| 1980 NNS—married mothers only | 8.3 | 50.7 | 5.8 | 1.4 | 1.8 |
| 1980 NNS—all mothers | 9.8 | 51.0 | 6.4 | 1.6 | 2.3 |
| One or more: | | | | | |
| 1972 NNS—married mothers only | 6.6 | 30.7 | 6.0 | 2.1 | 3.1 |
| 1980 NNS—married mothers only | 5.6 | 38.3 | 4.4 | 1.7 | 1.3 |
| 1980 NNS—all mothers | 6.6 | 39.6 | 5.0 | 1.9 | 1.7 |
| <i>Total duration of labor</i> | | | | | |
| 0–3 hours: | | | | | |
| 1972 NNS—married mothers only | 9.9 | 40.7 | 8.6 | 4.2 | 3.2 |
| 1980 NNS—married mothers only | 7.4 | 39.4 | 5.1 | 2.7 | 2.1 |
| 1980 NNS—all mothers | 8.6 | 41.7 | 5.9 | 2.9 | 2.4 |
| 4–7 hours: | | | | | |
| 1972 NNS—married mothers only | 6.0 | 27.8 | 4.9 | 1.9 | 3.5 |
| 1980 NNS—married mothers only | 5.4 | 37.8 | 4.6 | 1.1 | 1.2 |
| 1980 NNS—all mothers | 6.4 | 37.5 | 5.1 | 1.3 | 1.7 |
| 8–11 hours: | | | | | |
| 1972 NNS—married mothers only | 6.4 | 26.8 | 6.4 | 2.6 | 3.3 |
| 1980 NNS—married mothers only | 5.4 | 46.1 | 4.2 | 1.6 | 1.9 |
| 1980 NNS—all mothers | 6.5 | 46.6 | 4.8 | 1.6 | 1.3 |
| 12 or more hours: | | | | | |
| 1972 NNS—married mothers only | 5.9 | 35.5 | 5.2 | 1.3 | 3.0 |
| 1980 NNS—married mothers only | 5.3 | 38.9 | 3.8 | 1.7 | 1.3 |
| 1980 NNS—all mothers | 6.4 | 41.8 | 4.7 | 1.9 | 1.9 |
| <i>Type of delivery</i> | | | | | |
| Spontaneous: | | | | | |
| 1972 NNS—married mothers only | 6.9 | 30.7 | 5.9 | 2.1 | 3.2 |
| 1980 NNS—married mothers only | 5.0 | 36.0 | 4.2 | 1.3 | 1.1 |
| 1980 NNS—all mothers | 6.1 | 37.3 | 4.9 | 1.5 | 1.5 |
| Forceps: | | | | | |
| 1972 NNS—married mothers only | 4.9 | 22.9 | 4.5 | 2.4 | 3.7 |
| 1980 NNS—married mothers only | 3.9 | 28.6 | 3.8 | 0.9 | 0.6 |
| 1980 NNS—all mothers | 4.7 | 31.7 | 4.3 | 0.8 | 1.1 |
| Cesarean section: | | | | | |
| 1972 NNS—married mothers only | 11.2 | 45.0 | 10.9 | 1.5 | 0.9 |
| 1980 NNS—married mothers only | 9.3 | 55.4 | 5.1 | 4.3 | 2.8 |
| 1980 NNS—all mothers | 10.7 | 55.1 | 5.9 | 4.2 | 3.5 |
| Breech: | | | | | |
| 1972 NNS—married mothers only | 28.4 | 62.4 | 23.7 | 18.4 | 3.4 |
| 1980 NNS—married mothers only | 30.8 | 77.6 | 21.7 | 1.4 | 9.3 |
| 1980 NNS—all mothers | 33.5 | 80.0 | 21.6 | 4.9 | 9.6 |
| Other: | | | | | |
| 1972 NNS—married mothers only | 7.3 | (²) | (³) | (²) | (²) |
| 1980 NNS—married mothers only | 9.3 | 40.7 | 8.1 | 1.9 | 5.9 |
| 1980 NNS—all mothers | 10.0 | 37.6 | 8.1 | 2.3 | 5.2 |
| <i>Complications to mothers' health noted after delivery</i> | | | | | |
| Yes: | | | | | |
| 1972 NNS—married mothers only | 10.8 | 51.3 | 9.7 | 1.3 | 2.9 |
| 1980 NNS—married mothers only | 9.8 | 47.8 | 6.8 | 3.0 | 2.9 |
| 1980 NNS—all mothers | 11.8 | 53.3 | 8.8 | 3.1 | 4.0 |
| No: | | | | | |
| 1972 NNS—married mothers only | 6.7 | 30.6 | 5.9 | 2.5 | 3.3 |
| 1980 NNS—married mothers only | 5.5 | 38.9 | 4.3 | 1.6 | 1.2 |
| 1980 NNS—all mothers | 6.5 | 39.7 | 4.8 | 1.7 | 1.6 |

Table 1. Percentage of live hospital births weighing less than 2,500 grams, by selected maternal and infant health characteristics and period of gestation: 1972 and 1980 National Natality Surveys—Continued

| Maternal and infant health characteristics | Total | Period of gestation | | | |
|--|-------|---------------------|------------------|------------------|------------------|
| | | 36 weeks or less | 37-39 weeks | 40 weeks | 41 weeks or more |
| <i>Postpartum sterilization of mother</i> | | | | | |
| Yes: | | | | | |
| 1972 NNS—married mothers only | 7.4 | 24.7 | 6.5 | 3.9 | 3.6 |
| 1980 NNS—married mothers only | 5.4 | 32.4 | 4.4 | 1.4 | 1.4 |
| 1980 NNS—all mothers | 5.9 | 32.6 | 4.7 | 1.9 | 1.5 |
| No: | | | | | |
| 1972 NNS—married mothers only | 7.0 | 33.0 | 6.1 | 2.3 | 3.3 |
| 1980 NNS—married mothers only | 5.9 | 40.8 | 4.5 | 1.7 | 1.3 |
| 1980 NNS—all mothers | 7.0 | 42.1 | 5.2 | 1.8 | 1.8 |
| <i>Congenital malformations or anomalies noted at delivery by hospital</i> | | | | | |
| Yes: | | | | | |
| 1972 NNS—married mothers only | 14.5 | 56.8 | 12.1 | 3.3 | 5.0 |
| 1980 NNS—married mothers only | 15.3 | 62.2 | 11.2 | 4.3 | 4.4 |
| 1980 NNS—all mothers | 17.3 | 63.7 | 12.5 | 3.9 | 5.9 |
| No: | | | | | |
| 1972 NNS—married mothers only | 6.6 | 30.4 | 5.9 | 2.4 | 3.2 |
| 1980 NNS—married mothers only | 5.1 | 36.5 | 4.0 | 1.5 | 1.1 |
| 1980 NNS—all mothers | 6.0 | 37.8 | 4.5 | 1.7 | 1.5 |
| <i>Unusual resuscitative efforts required</i> | | | | | |
| Yes: | | | | | |
| 1972 NNS—married mothers only | 19.7 | 60.7 | 12.6 | 8.4 | 6.1 |
| 1980 NNS—married mothers only | 24.9 | 84.2 | 13.0 | 2.1 | 6.6 |
| 1980 NNS—all mothers | 26.3 | 84.0 | 13.5 | 2.1 | 6.2 |
| No: | | | | | |
| 1972 NNS—married mothers only | 6.0 | 27.1 | 5.7 | 2.0 | 3.1 |
| 1980 NNS—married mothers only | 4.9 | 33.6 | 4.1 | 1.7 | 1.1 |
| 1980 NNS—all mothers | 5.8 | 35.0 | 4.7 | 1.8 | 1.6 |
| <i>Apgar score—1 minute</i> | | | | | |
| 0-3: | | | | | |
| 1972 NNS—married mothers only | 36.4 | 78.2 | 29.9 | (²) | (³) |
| 1980 NNS—married mothers only | 35.7 | 86.0 | 14.9 | 8.9 | 7.1 |
| 1980 NNS—all mothers | 39.0 | 87.0 | 18.4 | 7.7 | 7.0 |
| 4-7: | | | | | |
| 1972 NNS—married mothers only | 13.5 | 54.0 | 9.6 | 4.6 | 4.5 |
| 1980 NNS—married mothers only | 11.1 | 54.9 | 8.1 | 2.8 | 2.1 |
| 1980 NNS—all mothers | 12.6 | 56.6 | 8.6 | 2.9 | 2.5 |
| 8-10: | | | | | |
| 1972 NNS—married mothers only | 5.2 | 21.2 | 5.3 | 2.2 | 2.8 |
| 1980 NNS—married mothers only | 3.8 | 26.9 | 3.6 | 1.3 | 1.1 |
| 1980 NNS—all mothers | 4.6 | 28.0 | 4.1 | 1.5 | 1.5 |
| <i>Apgar score—5 minutes</i> | | | | | |
| 0-3: | | | | | |
| 1972 NNS—married mothers only | 42.2 | (²) | (²) | (²) | (³) |
| 1980 NNS—married mothers only | 58.3 | 87.8 | 38.9 | 14.3 | 6.4 |
| 1980 NNS—all mothers | 61.7 | 90.3 | 32.9 | 12.0 | 8.2 |
| 4-7: | | | | | |
| 1972 NNS—married mothers only | 30.8 | 82.4 | 19.7 | (²) | 6.5 |
| 1980 NNS—married mothers only | 29.9 | 84.6 | 12.6 | 3.8 | 7.1 |
| 1980 NNS—all mothers | 32.6 | 84.8 | 14.5 | 3.7 | 7.5 |
| 8-10: | | | | | |
| 1972 NNS—married mothers only | 5.7 | 25.8 | 5.1 | 2.2 | 3.5 |
| 1980 NNS—married mothers only | 4.7 | 32.1 | 4.1 | 1.6 | 1.2 |
| 1980 NNS—all mothers | 5.5 | 33.1 | 4.7 | 1.8 | 1.6 |

Continued

Table 1. Percentage of live hospital births weighing less than 2,500 grams, by selected maternal and infant health characteristics and period of gestation: 1972 and 1980 National Natality Surveys—Continued

| Maternal and infant health characteristics | Total | Period of gestation | | | |
|---|------------------|---------------------|------------------|------------------|------------------|
| | | 36 weeks or less | 37–39 weeks | 40 weeks | 41 weeks or more |
| <i>Age when baby was first examined outside delivery room</i> | | | | | |
| 1 hour or less: | | | | | |
| 1972 NNS—married mothers only | 10.5 | 48.3 | 9.3 | 3.5 | 3.1 |
| 1980 NNS—married mothers only | 8.3 | 46.9 | 5.5 | 1.9 | 2.0 |
| 1980 NNS—all mothers | 9.8 | 49.7 | 6.2 | 2.2 | 2.4 |
| 2–6 hours: | | | | | |
| 1972 NNS—married mothers only | 6.4 | 30.4 | 4.5 | 2.6 | 3.5 |
| 1980 NNS—married mothers only | 5.6 | 40.0 | 5.0 | 1.3 | 1.3 |
| 1980 NNS—all mothers | 6.6 | 39.9 | 5.7 | 1.6 | 2.1 |
| 7–23 hours: | | | | | |
| 1972 NNS—married mothers only | 5.0 | 22.0 | 4.4 | 0.3 | 4.4 |
| 1980 NNS—married mothers only | 2.6 | 23.1 | 2.5 | 1.4 | 0.4 |
| 1980 NNS—all mothers | 3.2 | 24.3 | 3.0 | 1.3 | 0.6 |
| 24 or more hours: | | | | | |
| 1972 NNS—married mothers only | 4.7 | 15.9 | 5.1 | 3.0 | 2.3 |
| 1980 NNS—married mothers only | 4.4 | 28.6 | 4.1 | 1.9 | 1.2 |
| 1980 NNS—all mothers | 4.9 | 28.0 | 4.6 | 1.9 | 1.5 |
| <i>Birth injuries noted before discharge from hospital</i> | | | | | |
| Yes: | | | | | |
| 1972 NNS—married mothers only | (²) | (²) | (²) | (²) | (²) |
| 1980 NNS—married mothers only | 6.7 | 34.4 | 5.2 | 2.1 | 1.3 |
| 1980 NNS—all mothers | 7.0 | 37.3 | 5.3 | 1.8 | 1.8 |
| No: | | | | | |
| 1972 NNS—married mothers only | 7.0 | 32.3 | 6.2 | 2.5 | 3.3 |
| 1980 NNS—married mothers only | 5.8 | 40.2 | 4.5 | 1.7 | 1.3 |
| 1980 NNS—all mothers | 6.9 | 41.3 | 5.1 | 1.8 | 1.8 |
| <i>Other illnesses noted before discharge</i> | | | | | |
| Yes: | | | | | |
| 1972 NNS—married mothers only | 10.7 | (²) | (²) | (²) | (²) |
| 1980 NNS—married mothers only | 25.5 | 83.1 | 14.6 | 6.7 | 4.6 |
| 1980 NNS—all mothers | 27.7 | 79.4 | 15.0 | 6.9 | 5.3 |
| No: | | | | | |
| 1972 NNS—married mothers only | 7.0 | 32.1 | 6.1 | 2.5 | 3.3 |
| 1980 NNS—married mothers only | 4.9 | 34.3 | 4.1 | 1.5 | 1.2 |
| 1980 NNS—all mothers | 5.9 | 36.1 | 4.7 | 1.6 | 1.7 |
| <i>Infant discharged from hospital alive</i> | | | | | |
| Yes: | | | | | |
| 1972 NNS—married mothers only | 6.4 | 28.6 | 5.9 | 2.4 | 3.2 |
| 1980 NNS—married mothers only | 5.4 | 37.1 | 4.3 | 1.6 | 1.2 |
| 1980 NNS—all mothers | 6.4 | 38.4 | 4.9 | 1.8 | 1.6 |
| No: | | | | | |
| 1972 NNS—married mothers only | 69.5 | 85.7 | (²) | (²) | (²) |
| 1980 NNS—married mothers only | 82.7 | 96.3 | 63.0 | 100.0 | 42.6 |
| 1980 NNS—all mothers | 84.7 | 93.3 | 66.3 | 100.0 | 52.6 |

¹ For explanation, see text, p. 164.

² Figure does not meet standards of reliability or precision; that is, the relative standard error is 25 percent or more.

³ Quantity zero.

NOTE: Low birth weight was defined as less than 2,500 grams in 1980 and as 2,500 grams or less in 1972. Likewise, there was a shift of 1 gram for other birth weight categories.

cent were LBW, whereas among mothers with one or more such conditions, the proportion of LBW infants was 7.8 percent. Of infants delivered to mothers with one or more underlying medical conditions, 40.3 percent born at 36 weeks' gestation or less were LBW, compared with only about 2 percent of infants born at 40 weeks'

gestation or more. Note also that among births to mothers with no underlying medical condition and a gestation period of 36 weeks or less, 41.4 percent of infants were LBW—equivalent to the 40.3 percent of LBW infants born to mothers with the same gestation period and one or more underlying conditions. In short, the overall dif-

ference in percentage of LBW infants when women with underlying medical conditions are compared with women without such conditions (7.8 percent LBW versus 6.7 percent LBW) is eliminated when specific gestation periods are controlled for. This type of observation does not hold, however, for maternal complications of labor, where the proportion of LBW infants was 3.6 percent among women with no complications and 15.1 percent among women with one or more complications. For women in the latter category, the percentage of low birth weight infants remains about three times higher within specific gestation periods—for example, for pregnancies of 36 weeks' gestation or less, 22.6 percent of infants born to mothers with no complications of labor were LBW; however, among mothers with one or more complications, the proportion of LBW infants was 61.2 percent. Thus, the utility of showing percentage of LBW infants by maternal and infant characteristics *and* period of gestation is demonstrated, since controlling for gestation may or may not account for apparent differences in the LBW percentages.

In 1976, Dr. Kenneth R. Niswander speculated:

There is no doubt that elective induction of labor has in the past exerted a substantial impact on the low birthweight incidence, in this country at least. Obstetricians have finally become aware of this and, at least in good medical centers, methods are now being used to determine fetal maturity before the induction is done. So I doubt if it is going to be a very large contributing factor in the next five years (11a).

The 1980 National Natality Survey may allow a partial answer to Niswander's speculation. Question 4a on the hospital questionnaire asked:

Was any drug or surgical procedure used to induce or maintain labor? Yes_____. No_____. (If yes) What method was used? (Check *all* that apply.) Prostaglandin_____. Rupture of membranes_____. Pitocin drip_____. Saline injection_____. Ergot_____. Other (specify)_____.

It should be stressed that this is a somewhat vague question; it is not possible to determine whether these procedures were used to initiate labor or to stimulate its progress, since induction also implies augmentation. These limitations being stressed, we may nonetheless shed some light on the issue. We examined the percentage of live hospital births of LBW infants by race, according to induction procedure (table 2). We found that infants whose delivery was induced (6.1 percent LBW) were less likely to be of low birth weight than those whose deliveries were not induced (7.5 percent LBW). This held true for births to both white mothers and mothers of all other races.

In table 3, it is evident that the percentages of births at 37 weeks or more gestation are similar, whether or not

'The proportion of low birth weight infants born to white married mothers declined from 6.2 percent LBW in 1972 to 5.4 percent LBW in 1980 (a 13 percent decline). There was a 26 percent decline among births to married women of other races, from 12.8 percent LBW in 1972 to 9.5 percent LBW in 1980.'

the births were induced (89.4 percent versus 90.6 percent). This suggests that there is not much difference between the percentages of premature and full-term births that were induced. In fact, 43 percent of the births at 37 weeks' gestation or more, and 40 percent of the births at less than 37 weeks' gestation, were induced (table not shown). Thus, the smaller percentage of LBW infants among induced deliveries (table 2) is not explained by a low rate of induction of births at shorter gestational periods. Dr. Niswander's question whether induction would contribute to LBW is unanswered by our data based on the rather tentative questionnaire item, and we would like to see more evidence based on data that better separates induction from augmentation.

The 1980 National Natality Survey data can also be used to examine whether another prevalent obstetrical strategy—delivery by cesarean section—is associated with a higher probability of low birth weight (table 4). Infants delivered by first cesareans were approximately twice as likely to be of low birth weight (13.3 percent LBW) as those delivered by repeat cesareans (6.5 percent LBW) and those delivered vaginally (6.1 percent). These relative differences were greater for infants born to white mothers than for those born to mothers of all

Table 2. Percentage of live hospital births weighing less than 2,500 grams, by method of induction and race of mother: 1980 National Natality Survey

| Method of induction | All races | White | All other |
|--|-----------|-------|-----------|
| All methods | 6.9 | 5.8 | 11.9 |
| Not induced | 7.5 | 6.2 | 13.0 |
| Induced ¹ | 6.1 | 5.2 | 10.3 |
| Pitocin drip only | 6.9 | 5.9 | 11.1 |
| Rupture of membranes only | 4.3 | 3.7 | 6.9 |
| Pitocin drip and rupture of membranes only | 3.8 | 2.6 | 10.7 |
| All other methods and combinations | 7.2 | 6.2 | 11.1 |

¹ Induced or augmented; see discussion in text.

other races. The 13.3 percent LBW for infants delivered by first cesarean may be associated with the maternal complication or fetal condition that prompted the cesarean.

Many repeat cesareans are performed to avoid uterine rupture at the site of surgical incision for the previous cesarean delivery. To the extent that this reason—rather than some other medical crisis or condition—motivated the cesarean section, low birth weight would not be associated with repeat cesareans unless they were scheduled too early in the gestational period.

The data in table 5 imply that cesareans do not occur too early in the gestation period. Almost 90 percent of births by cesarean section, whether first cesarean or

repeat, occurred at 37 weeks' gestation or more. However, note that 55.0 percent of births by repeat cesarean occurred at 37–39 weeks' gestation—about 20 percentage points higher than the proportion of births by other types of delivery occurring in the same gestational period. This may not be reflected in the percentage of LBW infants delivered by repeat cesarean (table 4), since deliveries of this type may not be scheduled until the fetus is judged to be of adequate weight. Although the proportion of cesarean deliveries increased from 7.3 percent of live births to married mothers in 1972 to 17.2 percent of live births to married mothers in 1980 (13), the proportion of LBW infants among such births declined from 11.2 percent in 1972 to 9.3 percent in 1980.

Table 3. Percentage distribution of live hospital births by method of induction, race of mother, and period of gestation: 1980 National Natality Survey

| Race of mother and method of induction | Total | | Period of gestation | | | | | | | | 36 weeks or less | 37 weeks or more |
|--|-----------|---------|---------------------|-------------|-------------|----------|-------------|----------|------------------|------|------------------|------------------|
| | Number | Percent | Under 28 weeks | 28–31 weeks | 32–35 weeks | 36 weeks | 37–39 weeks | 40 weeks | 41 weeks or more | | | |
| All races | 3,580,733 | 100.0 | 0.7 | 1.2 | 4.7 | 3.5 | 34.4 | 24.3 | 31.2 | 10.1 | 89.9 | |
| Not induced | 2,037,839 | 100.0 | 0.7 | 1.4 | 5.0 | 3.6 | 35.3 | 24.5 | 29.6 | 10.6 | 89.4 | |
| Induced ¹ | 1,542,894 | 100.0 | 0.7 | 0.9 | 4.3 | 3.5 | 33.2 | 24.0 | 33.4 | 9.4 | 90.6 | |
| Pitocin drip only | 888,392 | 100.0 | 0.6 | 0.9 | 5.0 | 3.7 | 34.4 | 21.5 | 34.0 | 10.1 | 89.9 | |
| Rupture of membranes only | 277,372 | 100.0 | 0.5 | 1.1 | 3.4 | 2.8 | 30.4 | 29.9 | 32.0 | 7.7 | 92.3 | |
| Pitocin drip and rupture of membranes only | 166,465 | 100.0 | 1.0 | 0.4 | 2.6 | 1.8 | 28.3 | 25.6 | 40.2 | 5.8 | 94.2 | |
| All other methods and combinations | 210,665 | 100.0 | 1.0 | 1.4 | 3.7 | 4.9 | 35.5 | 26.0 | 27.5 | 11.1 | 88.9 | |
| White | 2,910,055 | 100.0 | 0.5 | 1.0 | 3.9 | 3.4 | 33.7 | 24.7 | 32.8 | 8.8 | 91.2 | |
| Not induced | 1,655,892 | 100.0 | 0.5 | 1.2 | 4.1 | 3.4 | 34.4 | 25.3 | 31.0 | 9.3 | 90.7 | |
| Induced ¹ | 1,254,162 | 100.0 | 0.5 | 0.7 | 3.7 | 3.3 | 32.7 | 24.0 | 35.1 | 8.2 | 91.8 | |
| Pitocin drip only | 715,162 | 100.0 | 0.5 | 0.8 | 4.3 | 3.7 | 33.9 | 21.3 | 35.5 | 9.3 | 90.7 | |
| Rupture of membranes only | 227,861 | 100.0 | 0.4 | 0.7 | 3.0 | 2.1 | 29.2 | 30.7 | 33.9 | 6.2 | 93.8 | |
| Pitocin drip and rupture of membranes only | 141,133 | 100.0 | 0.6 | 0.5 | 2.1 | 1.6 | 29.7 | 23.6 | 42.0 | 4.7 | 95.3 | |
| All other methods and combinations | 170,006 | 100.0 | 0.6 | 0.9 | 3.3 | 4.6 | 34.8 | 26.5 | 29.4 | 9.4 | 90.6 | |
| All other | 670,679 | 100.0 | 1.4 | 1.9 | 7.9 | 4.2 | 37.6 | 22.4 | 24.6 | 15.4 | 84.6 | |
| Not induced | 381,947 | 100.0 | 1.5 | 2.0 | 8.7 | 4.2 | 39.3 | 21.0 | 23.4 | 16.3 | 83.7 | |
| Induced ¹ | 288,732 | 100.0 | 1.3 | 1.8 | 6.8 | 4.3 | 35.3 | 24.3 | 26.0 | 14.3 | 85.7 | |
| Pitocin drip only | 173,230 | 100.0 | 0.9 | 1.4 | 7.8 | 3.6 | 36.4 | 22.1 | 27.8 | 13.7 | 86.3 | |
| Rupture of membranes only | 49,511 | 100.0 | 0.7 | 2.9 | 4.9 | 6.0 | 36.3 | 26.2 | 23.0 | 14.6 | 85.4 | |
| Pitocin drip and rupture of membranes only | 25,332 | 100.0 | 3.0 | ... | 5.8 | 3.0 | 20.9 | 36.8 | 30.5 | 11.8 | 88.2 | |
| All other methods and combinations | 40,659 | 100.0 | 3.0 | 3.2 | 5.6 | 6.4 | 38.6 | 23.7 | 19.6 | 18.1 | 81.9 | |

¹ Induced or augmented; see discussion in text.

Discussion

The data that have been presented comparing LBW incidence rates for 1972 and 1980 are limited to births to married women only, and trends among this population are likely to be more favorable than those among unmarried women. However, improvements in pregnancy outcome for these women suggest what outcomes are achievable. The findings from the 1972 and 1980 National Natality Surveys suggest that there has been a significant reduction in the proportion of LBW infants born to married women. Moreover, these declines have occurred across race, with married women other than white showing the greatest decline in percentage of LBW infants. In 1972, about 12 percent—and in 1980, 18 percent—of all U.S. births were to unmarried women. The proportion of births out of wedlock for whites increased from 6 percent to 11 percent; for women of all other races, from 40 percent to 48 percent (14,15). To the extent that marriage preselects women more likely to have healthier infants, this trend toward a smaller per-

centage of births occurring in wedlock may account for some of our findings.

Other explanations can also be inferred from our findings. The association between low birth weight and congenital anomalies is well known. The Centers for Disease Control has reported that the overall incidence rate of congenital anomalies has remained fairly constant during the past decade, and that the proportion of LBW infants among infants born with one or more anomalies has not changed (16). This, combined with our finding of a decline in the percentage of LBW infants without a congenital anomaly, suggests that the improvement may be a result of better medical care or changing maternal behaviors such as improved nutrition. The reduction in the proportion of LBW infants born to women with underlying medical conditions and complications of pregnancy suggests that antenatal medical care may have improved pregnancy outcome for pregnant women at high medical risk. An analysis of the incidence of low birth weight by specific maternal complications and medical care received would shed much light on this question.

Incidence of low birth weight could be affected by a shortened gestation. Questions have been raised regarding increased rates of induced births and delivery by cesarean section as possible contributors to the premature delivery rate, thus increasing the proportion of low birth weight infants; however, the data we have presented suggests that this is unlikely. The proportion of LBW infants was actually lower among women whose labor was classified as induced, although we would like to see other evidence based on data that separates induction from augmentation. While the picture regarding cesarean sections is much clearer, certain questions re-

Table 4. Percentage of live hospital births weighing less than 2,500 grams, by type of delivery and race of mother: 1980 National Natality Survey

| Type of delivery | All races | White | All other |
|------------------|-----------|-------|-----------|
| All deliveries | 6.9 | 5.8 | 11.9 |
| First cesarean | 13.3 | 12.2 | 17.7 |
| Repeat cesarean | 6.5 | 4.9 | 12.7 |
| Vaginal | 6.1 | 5.0 | 10.9 |

Table 5. Percentage distribution of live hospital births by type of delivery, period of gestation, and race of mother: 1980 National Natality Survey

| Type of delivery | Total | | Period of gestation | | | | | | | | |
|------------------|-----------|---------|---------------------|-------------|-------------|----------|-------------|----------|------------------|------------------|------------------|
| | Number | Percent | Under 28 weeks | 28-31 weeks | 32-35 weeks | 36 weeks | 37-39 weeks | 40 weeks | 41 weeks or more | 36 weeks or less | 37 weeks or more |
| All races | 3,580,733 | 100.0 | 0.7 | 1.2 | 4.7 | 3.5 | 34.4 | 24.3 | 31.2 | 10.1 | 89.9 |
| First cesarean | 376,001 | 100.0 | 0.6 | 2.0 | 6.8 | 3.3 | 31.8 | 22.3 | 33.2 | 12.6 | 87.4 |
| Repeat cesarean | 236,009 | 100.0 | 0.3 | 0.5 | 5.1 | 4.4 | 55.0 | 18.0 | 16.7 | 10.3 | 89.7 |
| Vaginal | 2,968,723 | 100.0 | 0.7 | 1.1 | 4.4 | 3.5 | 33.1 | 25.0 | 32.1 | 9.7 | 90.3 |
| White | 2,910,055 | 100.0 | 0.5 | 1.0 | 3.9 | 3.4 | 33.7 | 24.7 | 32.8 | 8.8 | 91.2 |
| First cesarean | 303,351 | 100.0 | 0.5 | 1.9 | 6.4 | 2.8 | 31.4 | 23.0 | 33.9 | 11.6 | 88.4 |
| Repeat cesarean | 187,752 | 100.0 | 0.1 | 0.3 | 3.6 | 4.5 | 56.3 | 18.0 | 17.1 | 8.6 | 91.4 |
| Vaginal | 2,418,951 | 100.0 | 0.6 | 0.9 | 3.6 | 3.4 | 32.2 | 25.5 | 33.8 | 8.5 | 91.5 |
| All other | 670,679 | 100.0 | 1.4 | 1.9 | 7.9 | 4.2 | 37.6 | 22.4 | 24.6 | 15.4 | 84.6 |
| First cesarean | 72,650 | 100.0 | 0.9 | 2.2 | 8.4 | 5.2 | 33.4 | 19.3 | 30.5 | 16.7 | 83.3 |
| Repeat cesarean | 48,257 | 100.0 | 0.9 | 1.4 | 10.6 | 4.1 | 49.8 | 17.9 | 15.2 | 17.1 | 82.9 |
| Vaginal | 549,772 | 100.0 | 1.6 | 1.9 | 7.6 | 4.1 | 37.1 | 23.2 | 24.6 | 15.2 | 84.8 |

main. One might suggest, for example, that the preterm rate for repeat cesarean deliveries should be lower than that for spontaneous vaginal deliveries. This should at least hold true for women undergoing a cesarean section simply because of a prior section, in the absence of the condition that precipitated the first procedure or some other complication. However, some women having repeat cesareans may still have the condition that precipitated their first cesarean, and further investigation is needed for better understanding of these issues.

A separate, noteworthy study based on U.S. natality vital statistics for 1970–1980 found a greater decline in low birth weight among babies who were delivered at full term than among those delivered preterm (17). (Full-term LBW infants are often called “IUGR,” or “intra-uterine growth retarded.”) Our survey findings are consistent with this, since we also found evidence of a greater relative decline in the percentage of full-term LBW infants than in that of LBW infants born preterm.

Conclusion

We have presented some important trends showing reductions in the proportion of low birth weight infants between 1972 and 1980. The few maternal and infant characteristics for which the proportion of LBW infants has increased from 1972 to 1980 may indicate areas for future study. The trend data are limited to married women (thus disproportionately excluding teens and nonwhites) and have not been disaggregated by ethnic origin. Moreover, multivariate analysis is needed for better understanding and interpretation of these results.

The National Natality Survey provides a unique opportunity for examination of numerous factors not otherwise available from national vital statistics. Such examination can add to knowledge about low birth weight and help in the design, implementation, and evaluation of strategies for its prevention.

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