The Challenge of Neonatal Mortality in an Urban Hospital

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THE NEONATAL MORTALITY RATE in the United States was 18.7 per 1,000 live births in 1960; 17.7 in 1965 (*1*), a decline of 5.3 percent; and 14.9 (provisional) in 1970 (*2*), a further decline of 15.8 percent. The major portion of this significant decline (20.3 percent) in the past decade occurred during the latter half.

The neonatal mortality rates have declined less in large metropolitan centers, presumably because of a proportionate increase of births among the poor, especially the nonwhites and Puerto Ricans, and the exodus of middle-class whites to the suburbs. In Philadelphia, the neonatal mortality rate fell from 24.2 per 1,000 live births in 1960 to 20.7 (*3*) in 1970—14.4 percent in contrast to the nationwide decline of 20.3 percent during the same 11-year period. In New York City, the neonatal mortality rate declined from 19.2 per 1,000 live births in 1960 to 18.0 in 1969 (6.2 percent), whereas in Detroit, the rate declined from 23.5 per 1,000 live births in 1960 to 19.8 in 1968 (15.7 percent).

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Temple University Hospital Data

At Temple University Hospital in Philadelphia, there were 26,377 live births during the 10 years from 1960 to 1969. The neonatal mortality data for the two 5-year periods, 1960 to 1964 and 1965 to 1969, are compared in this paper. Also, some factors responsible for the high neonatal mortality rate in this university-affiliated, private, nonprofit hospital are discussed.

The patients who use the hospital's obstetrical services consist of a large group from the lower socioeconomic class, predominantly nonwhite and Puerto Rican (house patients) and a smaller group of private patients who receive prenatal care in the offices of board-certified obstetricians. Approximately 10 percent of the house patients who come for delivery have had no prenatal care.

The data presented here include all live-born

infants who exhibited a heart beat, respiratory effort, or muscular movement, regardless of birth weight or gestational age. The neonatal deaths include those live-born infants who died in the first 28 days of life.

Comparisons of Data

Live births and neonatal deaths for the two 5-year periods are presented in table 1. During the second 5-year period, 3,423 fewer infants were delivered than in the first period. The proportion of infants born on the private service (95 percent white) decreased from 36 to 26 percent —a decrease of 2,443 infants. Although births on the house service decreased by 980, they increased from 64 to 74 percent of the total births from the first to the second 5-year period. With the increasing proportion of house patients during the second 5-year period, the incidence of low birth weight rose from 13.7 percent to 16.5 percent.

Comparison of the mortality rates for the two 5-year periods reveals that, despite reductions in each low birth weight category and a corresponding decrease in the low birth weight mortality from 164.6 to 147.4 per 1,000 live births, between the first and second 5-year periods the total neonatal mortality rate increased from 25.3 to 27.5 per 1,000 live births.

The increase in neonatal mortality in the second 5-year period reflects the increase of the low birth weight rate from 13.7 to 16.5 percent and an increase in the number of births of infants weighing less than 1,500 grams from 2.7 to 3.3 percent of the total births. If the low birth weight rate in the second 5-year period had been 13.7 percent (that of the first period), 321 fewer low birth weight infants would have been born, and a neonatal mortality rate of 23.4, rather than 27.5, per 1,000 live births would have occurred.

The increase in full-term mortality from 3.1 to 3.8 per 1,000 live births during the second 5-year period was responsible for an increase in the neonatal mortality of 0.5 per 1,000 live births. The infants who weighed less than 1,500 grams in the second 5 years accounted for 73.8 percent of the neonatal deaths and 83.4 percent of the deaths of low birth weight infants. Of all the neonatal deaths, 88.3 percent were among low birth weight infants.

The mortality rates for the low birth weight groups in the second 5-year period at Temple University Hospital were lower than those reported elsewhere (*4–6*). These lower rates at Temple may be due to the preponderance of nonwhite infants who are known to have increased survival rates in the low birth weight categories.

The percentage distributions of live births by birth weight groups for the United States in 1968 (*7*), Sweden in 1965 (*8*), and Temple University Hospital from 1965 to 1969 are shown in table 2. At the hospital, the incidence of low birth weight infants was twice that of the United States as a

Table 1. Live births and neonatal deaths, according to birth weight groups, 1960–64 and 1965–69, Temple University Hospital, Philadelphia

Birth weight (grams)	Live-born infants			Neonatal deaths			
	Absolute numbers	Percent of total	Percent of low birth weight	Absolute numbers	Per 1,000 live births	Percent of total	Percent of low birth weight
			1960–64				
0–1,000	204	1.4	10.0	187	916.6	49.6	55.5
1,001–1,500	194	1.3	9.5	83	427.8	22.0	24.6
1,501–2,000	449	3.0	21.9	42	93.5	11.1	12.5
2,001–2,500	1,200	8.0	58.6	25	20.8	6.6	7.4
0–2,500	**2,047**	**13.7**	**100.0**	**337**	**164.6**	**89.4**	**100.0**
2,501 and over	12,853	86.3	....	40	3.1	10.6	....
Total	14,900	...	....	377	25.3	...	....
			1965–69				
0–1,000	182	1.6	9.6	162	890.1	51.3	58.0
1,001–1,500	193	1.7	10.2	71	367.8	22.5	25.4
1,501–2,000	372	3.2	19.6	24	64.5	7.6	8.6
2,001–2,500	1,146	10.0	60.5	22	19.2	6.9	7.9
0–2,500	**1,893**	**16.5**	**99.9**	**279**	**147.8**	**88.3**	**100.0**
2,501 and over	9,584	83.5	....	37	3.8	11.7	....
Total	11,477	...	....	316	27.5	...	....

Table 2. Percentage distribution of live births, by birth weight, United States, Sweden, and Temple University Hospital

Birth weight (grams)	United States, 1968[1]	Sweden, 1965[2]	Temple University Hospital, 1965–69
0–1,000	0.6	0.2	1.6
1,001–1,500	.7	.4	1.7
1,501–2,000	1.6	1.0	3.2
2,001–2,500	5.4	2.9	10.0
0–2,500	**8.2**	**4.5**	**16.5**
2,501 and over	91.8	95.6	83.5

[1] SOURCE: reference 7.
[2] SOURCE: reference 8.

Table 3. Neonatal mortality rates, by birth weight, United States, Sweden, and Temple University Hospital

Birth weight (grams)	United States 1960[1]	Sweden 1965[2]	Temple University Hospital, 1965–69
0–1,000	912.8	881.3	890.1
1,001–1,500	521.5	475.9	367.8
1,501–2,000	180.6	153.7	64.5
2,001–2,500	41.4	47.5	19.2
0–2,500	**171.6**	**151.5**	**147.8**
2,501 and over	5.5	2.8	3.8
Total	18.4	9.2	27.5

[1] SOURCE: reference 9.
[2] SOURCE: reference 8.

whole and almost four times that of Sweden. Infants weighing less than 1,500 grams are born almost three times as frequently at Temple as in the United States and more than five times as frequently as in Sweden.

The neonatal mortality rates by birth weight groups for the United States in 1960 (*9*), Sweden in 1965 (*8*), and Temple University Hospital from 1965 to 1969 are shown in table 3—the U.S. figures are the most recent available. The mortality rates in each weight category for the hospital were less than those for the United States, but the total neonatal mortality rate was 48 percent higher. The mortality rates for the groups weighing between 1,000 and 2,500 grams at the hospital were considerably less than those for Sweden, whereas the rates for the infants weighing less than 1,000 grams and more than 2,500 grams were slightly higher than those of Sweden.

The total neonatal mortality among low birth weight infants at Temple was slightly less than that of Sweden and considerably less than that for the total United States in 1960. However, the total neonatal mortality rate at the hospital for 1965–69 was almost three times that for Sweden in 1965 and slightly less than twice that of the provisional figure of 14.9 for the United States in 1970 (*2*).

Discussion

The high neonatal mortality rate at Temple University Hospital is a result of the high rate of low birth weights and the birth of excessive numbers of infants weighing less than 1,500 grams. Geijerstam (*8*), in an analysis of Swedish and U.S. neonatal mortality data, also concluded that the higher rates for the United States as compared with Sweden is caused mainly by a higher proportion of low weight births.

The excessive proportion of infants weighing less than 1,000 grams in our study reflects the inclusion of all live births, regardless of weight or gestational age. Other studies, however, have excluded very small infants. Potter and Davis reported that in their study 38 percent of the neonatal deaths occurred among infants weighing between 400 and 1,000 grams (*6*). In our study, 51.3 percent of the neonatal deaths occurred among infants weighing less than 1,000 grams. Potter and Davis' data covered the 5 years from 1961 to 1966 in a population with a low birth weight rate of 8.4 percent. In a large maternity hospital in Helsinki where 43,420 births took place over a 6-year period and the low birth weight rate was 5.06 percent, 64 percent of the neonatal deaths occurred among infants weighing between 601 and 2,500 grams (*10*). At Temple University Hospital, 88 percent of the neonatal deaths occurred among infants weighing less than 2,500 grams.

Thus, as the preceding figures clearly show, reports of neonatal mortality should include all live births—regardless of weight or gestational age—so that the data can be directly compared.

Race and social class are related to low birth weight and to neonatal and perinatal mortality rates. The U.S. 1968 low birth weight rates were 7.1 for whites and 13.7 for nonwhites (*7*); the neonatal mortality rates per 1,000 live births were 14.7 for whites and 23.0 for nonwhites (*11*). In Philadelphia in 1970 the neonatal mortality rates per 1,000 live births were 15.0 for whites and 27.7 for nonwhites; the low birth weight rates were 8.2 for whites and 16.0 for nonwhites (*3*).

In a report of the 1958 British Perinatal Mortality Survey (*12*), high perinatal mortality was associated with low socioeconomic class. Bedger and associates (*13*) reported a high incidence of low birth weight and infant mortality in the low socioeconomic class in Chicago. Donabedian and associates (*14*), in a study of data for Boston for 1950 to 1954, found a fivefold difference in perinatal mortality between census tracts having the highest and lowest socioeconomic status. Yerby (*15*), in an analysis of births in New York City, and Hendricks (*16*), in a study of patients in Cleveland, reported the association of high rates of low birth weight and perinatal mortality with low socioeconomic status. Baird (*17*) related low birth weight rates to lower socioeconomic station in Aberdeen. Naeye and Blanc (*18*), in an analysis of autopsy data, reported that the poorest families had twice the rate of infections as the most prosperous, and blacks had about double the rate for whites and Puerto Ricans. Balfe (*19*) stated that "infant mortality is for the most part a social rather than a medical problem."

Conclusion

Clifford (*20*) stated that the prevention of prematurity is the sine qua non for reduction of mental retardation and other neurologic disorders. This statement can be extended to include neonatal mortality as well.

The improvement of neonatal mortality rates in the United States in the latter half of the past decade, during which time there was a stationary low birth weight rate (from 1965 to 1968 it ranged from 8.2 to 8.3 percent), seems to have resulted from improved obstetric and pediatric care. In Philadelphia, the neonatal mortality rate decreased over the past few years despite an increase of the low birth weight rate from 11.5 in 1968 to 11.7 in 1970. Any further reduction of the low birth weight rate with concomitant reduction in neonatal mortality in urban centers and urban hospitals will depend, in addition to improvement of obstetric and pediatric care, upon improvement of other aspects of the quality of life of the indigent population. These aspects may include improvement of health care in the areas of nutrition, sanitation, sex and health education, and family planning services. Better housing, jobs, and education may also be essential to maximal health gains.

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