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Time Trends in Neonatal Mortality Among Twins and Singletons in New York City, 1968-1986

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Abstract. The objective of this study was to compute yearly neonatal mortality rates (NMRs) in twins and compare these to rates in singletons during the same time period. The focus was on time trends in birthweight-specific twin mortality in the birth population of New York City during the years 1968 to 1986. The study population was all twin livebirths ≥500 g birthweight (N=45,605), with a comparison group of all singleton livebirths in the same birthweight range (N=2,191,144). Data came from the New York City Department of Health's computerized vital records on livebirths and infant deaths. Between 1968 and 1986 the crude NMR declined 39% in twins and 47% in singletons. In twins there were birthweight-specific declines of 69% to 84% between 1000 g and 2499 g. However, there was only a 19% decline in the twin NMR over 2499 g. This contrasts with a 50% decline in the singleton NMR over 2499 g. In New York City, modern medical care has been remarkably successful in lowering the NMR in low birthweight twins. However, more effort must be made to understand the etiology of perinatal problems in twins with birthweights greater than 2500 g.

Key words: Twins, Infant mortality, Neonatal intensive care, Pregnancy outcome, Low birth weight

Reduction of perinatal, neonatal, and infant mortality has long been a major goal of the obstetric and pediatric communities. In recent years, much of the effort to prevent neonatal death has emphasized special care for high-risk infants such as twins. Neonatal mortality rates (NMRs) among twins have been reported to be four to ten times those of singletons [2,5-7,9-11,13,14]. With the exception of one large study [11] comparing twins born in the United States in 1960 and 1983, little is known about how changes in perinatal and newborn intensive care have affected survival in twins infants as a popula-

tion. This contrasts markedly with our extensive knowledge of birthweight-specific declines in perinatal mortality in singletons [1,3,4,12,15].

This paper is one of two reports from a large study of the epidemiology of perinatal mortality in multiple births. Elsewhere, in a report on births in New York City during the seven-year period 1978-84 [10], we compared birthweight-specific neonatal death rates in twins and singletons, examined the effect of mode of delivery (vaginal vs cesarean) on neonatal mortality in twins, and compared rates of fetal death during labor in twins and singletons.

In this paper we consider time trends in birthweight-specific neonatal mortality among twins born in New York City in the years 1968-86. These trends are compared to those in singletons born during the same 19-year period.

METHODS

The study population included all twin and singleton livebirths weighing 500 g or greater born in New York City in the years 1968-86. Data sources were two sets of certified vital statistics: livebirths and infant deaths. These records were entered into computer storage by the New York City Department of Health. Data on neonatal deaths were taken from certificates of death in the first year of life, which are routinely linked to their matched birth certificates and jointly stored in a separate computer file. We used the 19 yearly livebirth files from 1968 to 1986 and the 20 yearly infant death files from 1968 to 1987 to create a data set consisting of birth and death information on all babies born in New York City between 1 January 1968 and 31 December 1986. A total of 45,605 liveborn twins with birthweights greater than 500 g were born during the 19-year study period, of whom 2,683 died during the neonatal period. Time trends in these twins were compared to trends in 2,191,144 singleton livebirths, of whom 22,018 died during the neonatal period.

Crude NMRs for each year were calculated for twins and singletons separately. Birthweight was categorized in 250 g and 500 g groups between 500 and 2499 g. Newborns who weighed 2500 g or more were grouped into one birthweight category. Yearly NMRs were calculated for each birthweight category. In addition, the rates in the first three years of the study period (1968-70) were compared to the rates in the last three years (1984-86).

For twins and singletons separately, the percent decline,

$$\frac{\text{(Rate in 1968-70)} - \text{(Rate in 1984-86)}}{\text{Rate in 1968-70}} \times 100$$

was calculated for the entire birthweight range and for each birthweight category. Also, 95% confidence intervals (CI) were calculated using a first-order Taylor series approximation method [8].

RESULTS

In both twins and singletons, the crude neonatal death rate declined steadily between 1968 and 1986 (Fig. 1). Table 1 shows the magnitude of the percent decline. In singletons there was a 47% decline and in twins a 39% decline (from 71 to 44 neonatal deaths per 1000 livebirths).

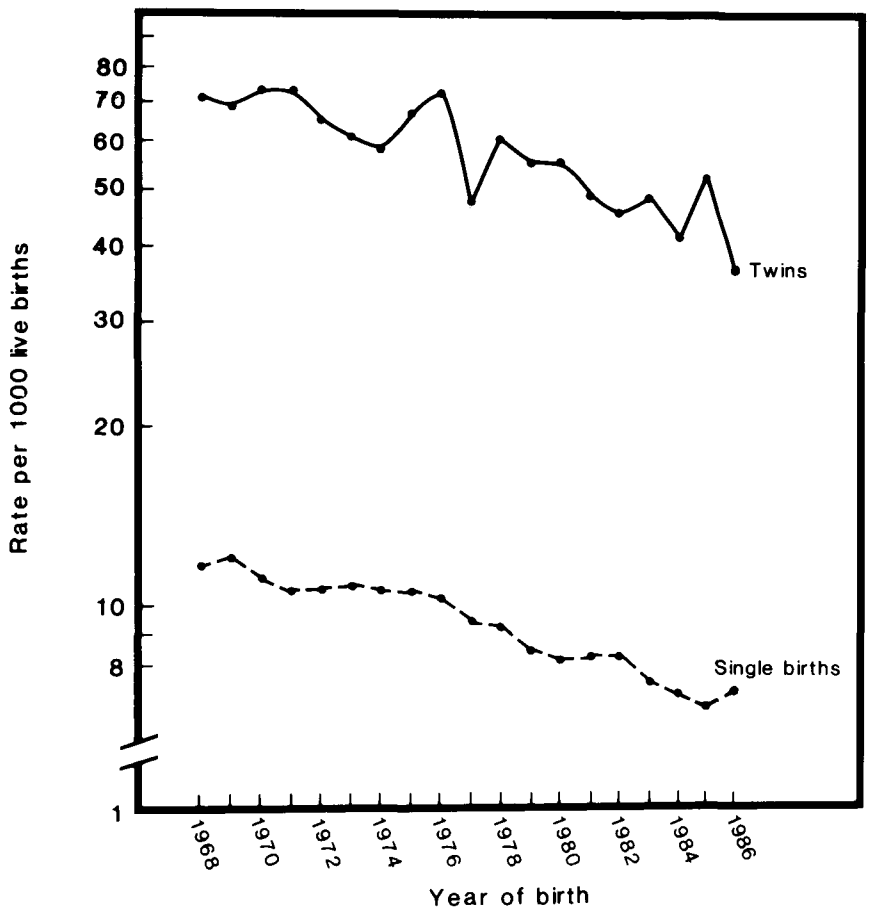

Fig.1. Time trends in neonatal mortality rates (per 1000 live births) for twins and single births in New York City, 1968-1986.

The findings from birthweight-specific analyses are shown in Fig. 2 and Table 2. In the 500-749 g category, there were decreases in the NMR in both twins (24%) and singletons (30%), but these were not nearly as marked as the decreases in the birthweight groups between 1000 and 2499 g.

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Table 1 - Comparison of neonatal mortality in 1968-70 and 1984-86 for twins and singletons, New York City

Plurality	1968-1970			1984-1986			Decline	
	Neonatal deaths	Livebirths	Rate/1000 livebirths	Neonatal deaths	Livebirths	Rate/1000 livebirths	%	95%CI
Twins	641	8,978	71.4	326	7,477	43.6	39	30-46
Singletons	5,664	425,752	13.3	2,426	345,449	7.0	47	45-50

In the 750-999 g category, there was a 45% decline in the twin neonatal death rate. This was substantially less than the 58% decline in the singleton NMR in this birthweight category.

Between 1000 and 2499 g, birthweight-specific analyses of the twin data showed that there were marked declines in mortality during the study period. In this weight range, declines ranged from 69% to 84% (Table 2). These declines were especially marked during the late 1970s and early 1980s (Fig. 2). The pattern of mortality declines among twins was in general similar to the pattern in singletons. However, the twin mortality rate dropped more precipitously than the singleton rate both in the 1500-1999 g category (84% vs 66% declines) and in the 2000-2499 g (69% vs 53% declines).

When the two periods 1968-70 and 1984-86 were compared, there was a nonsignificant 19% decline in the twin NMR in infants weighing 2500 g or more at birth (Table 2). This contrasts with a 50% decline in singleton neonatal mortality at 2500 g or greater.

Table 2 - Birth weight-specific neonatal mortality in twins and singletons: Comparison of two time periods, New York City

Birth weight (g)	Twins				Singletons			
	Rate 1000 livebirths				Rate 1000 livebirths			
	1968-70	1984-86	Decline		1968-70	1984-86	Decline	
			%	95% CI			%	95% CI
500-749	918.9	698.2	24	15-32	913.0	636.5	30	26-34
750-999	738.7	405.4	45	33-55	730.4	303.6	58	54-62
1000-1249	446.7	123.5	72	58-82	482.4	118.2	76	71-79
1250-1499	203.6	40.8	80	64-89	276.1	82.6	70	64-75
1500-1999	57.6	9.4	84	68-92	115.9	39.6	66	60-71
2000-2499	13.1	4.0	69	35-86	24.4	11.5	53	44-60
≥2500	7.2	5.8	19	-43-53	4.1	2.0	50	45-55

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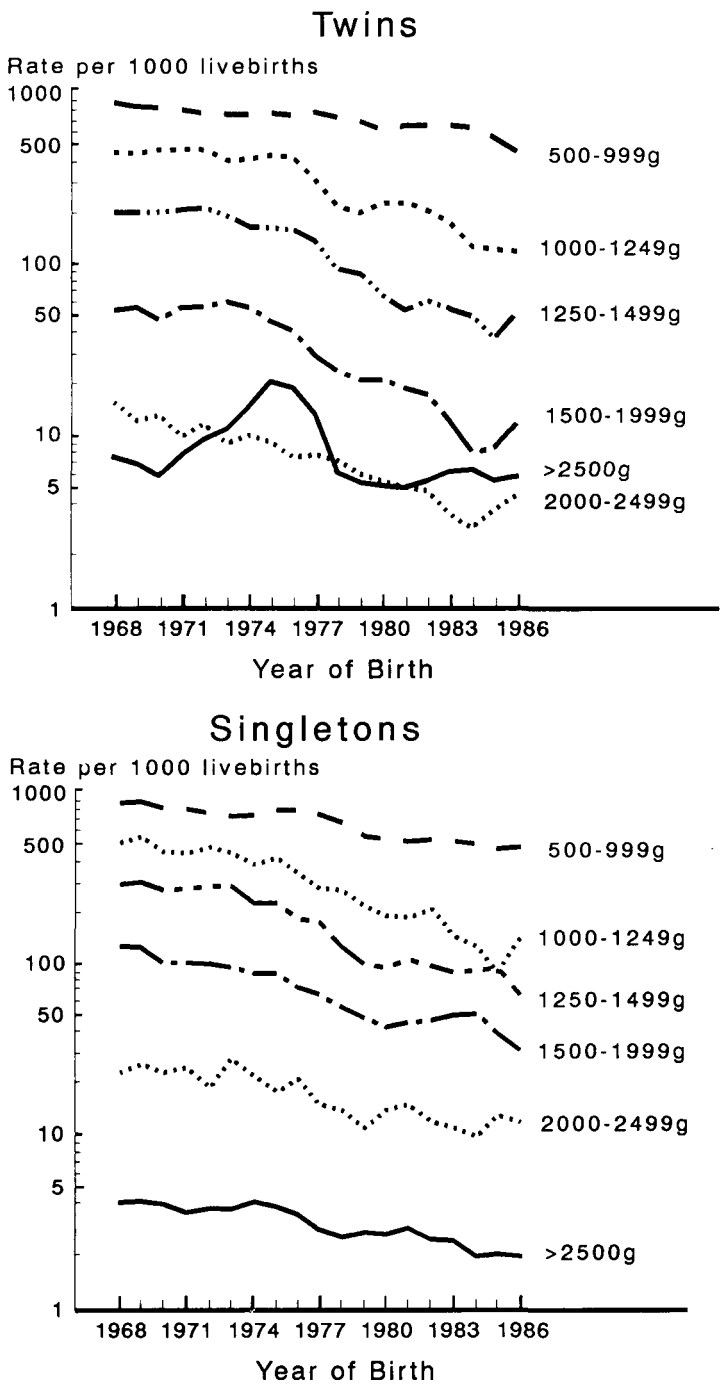

Fig. 2. Time trends in birthweight-specific neonatal mortality rates (per 1000 live births) for twins and singletons in New York City, 1968-1986.

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Indeed: in 1968-70, twins with birthweights of ≥2500 g had a lower risk of neonatal mortality than twins with birthweights of 2000-2499 g (relative risk = 0.55; 95% confidence limits: 0.34, 0.90) By 1984-86, however, twins with birthweights of ≥2500 g had a higher risk of neonatal mortality than twins with birthweights of 2000-2499 g (relative risk = 1.45, 95% CI = 0.65-3.28). Of course, this crossover of the rates in these two birthweight categories was partly due to the 69% decline in the NMR in twins with birthweights between 2000 and 2499 g.

Fig. 2 shows that, for twins ≥2500 g, the NMR actually increased between 1970 and 1975. In 1974-76, the rate was 21.8/1000 livebirths, an increase of 202% (95% CI = 92-374) since 1968-70. The rate then dropped rapidly and remained stable at about 6/1000 livebirths during the period 1978-86.

DISCUSSION

Since several investigators have reported marked declines in neonatal mortality among singletons in all birthweight categories [1,3,4,12,15], it was expected that a similar pattern would emerge for twins. In New York City, there were indeed striking declines in twin neonatal mortality in all birthweight categories between 1000 and 2499 g. In twins weighing between 750 and 999 g at birth, the mortality decline was significant, but it was much slower than the decline in singletons.

One unexpected finding was the small and nonsignificant difference between NMRs in 1968-70 and rates in 1984-86 for twins weighing 2500 g or more. This may have been partly the consequence of the small numbers of deaths in heavier twins. In the ≥2500 g weight group, there were only 27 neonatal deaths in 1968-70 and 21 neonatal deaths in 1984-86. Thus, the 95% confidence interval around the 19% decline is quite wide. However, the lack of a long-term decline in the rate in heavier twins in New York City is consistent with the national trend for the United States between 1960 and 1983 [11].

The rise and fall of the twin NMR in the ≥2500 g weight group during the years 1970-1978 (Fig. 2) is difficult to explain. In twins ≥2500 g, an *a posteriori* statistical test indicates that the increase in rates from 1968-70 to 1974-76 was significant ($p < 0.001$). It is unlikely, however, that this increase can be explained by changes over time in medical care or in the use of new perinatal technologies. The practices of neonatology and obstetrics were changing throughout the 1970s, but it is doubtful that changes in perinatal care could have caused an increase in mortality among heavier twins while singleton mortality in this birthweight range was steadily decreasing.

Although mortality rates in twins with birthweights ≥2500 g are low compared to smaller twins, heavier twins are often a problem for both obstetricians and pediatricians. Previous studies have reported that twins with birthweights ≥2500 g have rates of neonatal death that are two to four times higher than singletons in the same weight range [2,5,6,10,11,13]. In our previously published analyses of the effects of mode of delivery on twin survival, heavier twins appeared to be at unusually high risk if they were not delivered by cesarean section. For twins in vertex presentation who weighed more than 3000 g, the NMR was more than four times higher in vaginal deliveries than in cesarean sections [10].

The findings reported here are obviously specific to New York City. Trends in twin

neonatal mortality may be different in other areas of the industrialized world. In New York City, it appears that modern obstetric and neonatal practices have been remarkably successful in lowering mortality in low birthweight twins. However, more effort must be made to understand the etiology of perinatal problems among twins weighing more than 2500 g.

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