Increased Infant Mortality in Jersey City

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Synopsis

The infant mortality rate for 1982 in Jersey City, a medium-sized urban community, was found to have increased sharply from that for 1981. An investigation by health officials revealed that the increase occurred only among infants delivered to Jersey City residents at a large local municipal hospital. An increase in the incidence of newborns with birth weights of 501–1,000 grams (g) and a decrease in their survival rate accounted for much of the increase.

Although local increases in infant mortality are reported in the lay press, the articles usually lack any meaningful analyses. Furthermore, investigations of such increases have not been described in the medical literature. This report describes the investigation of the rise in infant mortality for Jersey City, demonstrates how local officials can approach the problem, and indicates how essential the availability of linked birth and infant death records are to the effort.

REPORTS OF INCREASED infant mortality in several States and metropolitan areas have appeared in the press in recent years (*1,2*). These reports often present the conflicting views of politicians and advocacy group spokespersons rather than analyses (*3*). Nor does the medical literature offer additional information about those increases. Therefore, we are reporting the results of an epidemiologic investigation of increased infant mortality that occurred in a middle-sized American city.

The infant mortality rate (IMR) in Jersey City increased from 12.8 (infant deaths per 1,000 live births) in 1981 to 24.3 in 1982. The New Jersey Department of Health identified this increase after observing that the State IMR, which had been steadily decreasing since 1975, had risen from 11.2 in 1981 to 11.7 in 1982. Upon investigation, the health department discovered that the infant mortality rates were stable across the State except in Jersey City. There were 50 infant deaths in 1981 among Jersey City residents; in 1982 there were 95. The increase of 45 deaths was sufficient to raise the overall New Jersey IMR from 11.2 to 11.7—that is, if the increase in Jersey City infant deaths had not occurred, the State IMR would not have changed.

Jersey City, the second largest city in the State with a population of 223,000, had a poverty rate in 1979 of 21.2 percent compared with 9.5 percent for the State (1980 U.S. Census data, which defines poverty as an annual income below $7,412 for a family of four). Typical of other economically depressed urban areas, Jersey City's IMR had been greater than that for the remainder of New Jersey each year for more than a decade. Nevertheless, the infant mortality rate in Jersey City had declined most years during that decade. This overall pattern of decline changed dramatically in 1982 (table 1). This paper describes the source of the increase in infant deaths.

Methods

For most of the analyses performed, we used data that were available for 1979–82 from New

Jersey's computer tapes of matched birth and infant death certificates. These matched records allowed us to determine the birth weight distribution, certain maternal characteristics, and the hospital of birth for the infants who had died. Such determinations, in turn, allowed us to evaluate those parameters as risk factors for infant death and to determine the birth-weight-specific survival for Jersey City residents by hospital of birth.

Infant death statistics that were determined from these matched records and compiled on a birth cohort basis differ slightly from the statistics mentioned earlier, which are based on the occurrences of births and deaths by calendar year. The matched birth and death records were used to calculate rates of neonatal (NMR), postneonatal (PMNR), and infant mortality (IMR). We also used other vital records data provided by the New Jersey Department of Health, such as fetal and perinatal death ratios. By conventional definition, NMR = deaths occurring at less than 28 days per 1,000 live births; PNMR = deaths occurring from age 28 days to 1 year of age per 1,000 live births; fetal death ratio = number of fetal deaths (pregnancy loss after 20 weeks gestation) per 1,000 live births; perinatal death ratio = fetal + neonatal deaths per 1,000 live births.

We used the Mantel-Haenzsel test to estimate *P* values and 95 percent confidence intervals.

Results

Preliminary analyses did not explain the increase in mortality. The marital status, race, age, and education had not changed over the 1979–82 period. The percentage of infants with birth weights of 2,500 g or less had not changed. There had been an increase over these years in the percentage of infants with birth weights of 1500 g or less, but the increase was greater from 1980 to 1981 than from 1981 to 1982. Further analyses, however, were more revealing.

The IMR and the NMR for 1982 were significantly higher ($P<0.05$) than those for any of the previous 3 years (table 2). Postneonatal mortality rates were comparatively stable. The number of births in Jersey City remained relatively constant (table 2), and as a result, changes in mortality rates reflect changes in the absolute number of infant deaths. The increase in infant deaths in 1982 occurred predominantly among neonates. We reviewed the causes—recorded on the vital records tapes—of the 95 infant deaths that occurred in 1982. The distribution of causes for the postneonatal deaths in 1982 was similar to that for the years 1979–81. However, of the 65 neonatal deaths that occurred in 1982 (by calendar year), 55 were coded "conditions originating in the perinatal period"—27 more than expected based on 1979–81 data. This coding, it turned out, was used to identify deaths due to extreme immaturity or low birth weight. Neonatal deaths from other causes (for example, congenital anomalies, infection, injury, and so forth) were not increased in 1982.

Table 1. Number of infant deaths and infant mortality rate, Jersey City residents, 1972–82

Year	Infant deaths	Infant mortality rate (deaths per 1,000 live births)
1972	106	23.0
1973	96	22.3
1974	119	28.7
1975	83	21.5
1976	84	22.4
1977	80	21.2
1978	85	21.6
1979	62	15.6
1980	73	18.4
1981	50	12.8
1982	95	24.3

The NMR in 1981 was low—lower even than the 1981 NMR for New Jersey. In all other years, the State rate had been appreciably lower than Jersey City's. Because the results for 1981 in Jersey City were substantially lower than expected, we considered it inappropriate to use that year as a basis for comparison. Therefore, the 1979 and 1980 rates were compared with the 1982 rates. When 1982 data are compared with 1980 data, we see from table 2 that the increase in the IMR resulted from approximately 20 additional neonatal deaths—there were 43 and 39 neonatal deaths in 1979 and 1980, respectively, and 59 in 1982.

Table 3 demonstrates that the increase in neonatal deaths in 1982 among Jersey City residents was limited to infants born in a large, local municipal hospital (hospital X). There were only slight fluctuations in neonatal deaths following births in other hospitals for these same years. (The numbers of births to Jersey City residents occurring in these other hospitals were stable over the previous 4 years: 1,878 births in 1979, 1,866 in 1980, 1,887 in 1981, and 1,914 in 1982.)

We then examined the statistics for hospital X for 1979–82 to assess the increase in neonatal deaths at that facility and made the following observations:

Table 2. Number of infant deaths and mortality rates (MR)—fetal MR, infant (IMR), neonatal (NMR), and postneonatal (PNMR)—among infants of Jersey City residents, by birth cohorts, 1979–82

Year	Births	Infant deaths	Neonatal deaths	Postneonatal deaths	Fetal MR	IMR	NMR	PNMR
1979	3,983	63	43	20	10.7	15.8	10.8	5.1
1980	3,962	66	39	27	10.2	16.7	9.8	6.9
1981	3,892	52	27	25	11.9	13.4	6.9	6.5
1982	3,904	87	59	28	10.2	22.3	15.1	7.3

NOTE: Fetal MR = fetal deaths per 1,000 live births. The 1979, 1980, and 1981 IMRs and NMRs were significantly different from the 1982 IMR ($P < 0.05$) and the 1982 NMR ($P < 0.05$).

'The data suggested that in 1982 fewer Jersey City residents delivering at hospital X obtained prenatal care as early or as often as they had in previous years. The percentage of Jersey City residents delivering at the hospital who had fewer than three prenatal care visits—not an adequate number of visits regardless of length of gestation—rose significantly from 5.6 percent in 1979 to 11.6 percent in 1982 . . . .'

1. At hospital X, the total number of births had remained stable, as had the proportions of births to Jersey City residents and nonresidents (table 4).

2. The number of neonatal deaths among infants born to Jersey City residents at hospital X had risen sharply, but the number of neonatal deaths among the infants born to nonresidents at hospital X had remained unchanged. This variation demonstrated the need to examine the results for the hospital with regard to resident status. (The preliminary analyses of the hospital data had not been stratified by resident status and did not reveal the changes in birth weight distribution to be described.) The NMR for 1982 among infants of Jersey City residents at the hospital was significantly higher than that in the previous 3 years; the NMR among infants of nonresidents did not increase significantly (table 4).

3. We examined the birth weights of infants who were born at hospital X to Jersey City residents and who died in the neonatal period; there were 26 such infants born in 1979 and 46 in 1982. We found that 18 of these 20 additional deaths in 1982 had occurred among infants born prematurely and weighing 1,000 g or less and that 15 of these 18 were among infants weighing 501–1,000 g at birth (table 5). Although the distribution in 1980 was quite similar to that in 1979, we used 1979 as the basis for comparison because birth weights were unknown for two of the infants born in 1980 who died as neonates.

4. The number of 501–1,000-g infants born to Jersey City residents at hospital X increased from 13 in 1979 to 29 in 1982, representing an increase from 0.6 percent (6 per 1,000) to 1.5 percent (14.6 per 1,000) of the total hospital births to Jersey City residents (table 6). This increase in the incidence of 501–1000-g infants born to Jersey City residents at hospital X over the 1979–82 period constituted a statistically significant trend ($P < 0.01$). No such increase occurred among nonresidents delivering at hospital X or among Jersey City residents delivering at other hospitals (table 6). These 29 births, weights of 501–1,000 g, occurred throughout the year: there were 9 during January–March, 6 during April–June, 6 during July–September, and 8 during October–December.

Discussion

Using birth cohort data, we demonstrated that the increase in IMR in 1982 for Jersey City was a result of an increase in neonatal deaths among infants born at hospital X to Jersey City residents. There were 20 more neonatal deaths in 1982 than in 1979 and 19 more than in 1980. This increase in deaths occurred chiefly among infants weighing 1,000 g or less at birth. The increase in the number of deaths in this group was a result of both an increase in the incidence of 501–1,000-g infants—particularly infants weighing 501–750 g—born to Jersey City residents at the hospital and a decrease in their survival. Although the percentage

of mothers (Jersey City residents) delivering at the hospital who received fewer than three prenatal care visits doubled over the 4 years 1979–82, we have no accurate way to identify the relative risk for delivering a 501–1,000-g infant associated with this factor. Moreover, the incidence of infants with birth weights of 501–1,000 g also increased among the women with three or more prenatal visits. Therefore, although the evidence suggests that prenatal care was obtained later and less often in 1982 than in previous years, it should not be taken as evidence that the decreased prenatal care accounted for the increase in the percentage of babies with birth weights of 1,000 g or less. (However, this evidence has stimulated efforts to improve access to such care.)

We considered the possibility that the increased number of deaths among infants weighing 1,000 g or less at birth was related to a change in reporting. It was possible that before 1982 deaths of infants in this weight category who died shortly after delivery were registered as fetal deaths but in 1982 such deaths were recorded as live births. Such a situation could have resulted in an apparent increase in 1982 of neonatal deaths among very low birth weight infants. However, this is unlikely to be the case because the fetal death rate was stable (10.7 fetal deaths per 1,000 births in 1979, 10.2 in 1980, 11.9 in 1981, and 10.2 in 1982). More specifically, the criteria that hospital X used to identify fetal deaths did not change, and the number of fetal deaths that occurred in that facility were stable: 31 in 1979, 37 in 1980, 39 in 1981, and 37 in 1982.

It was possible that the increase in deaths and the variability in the infant mortality rate during the earlier years reflected erratic handling of vital records and matching of birth-infant death certificates. However, the increase in neonatal deaths in 1982 occurred only at hospital X, and the inhouse newborn statistics the hospital compiled also demonstrated an increase consistent with the vital records data. (The matching system—started in 1979—was working well; more than 95 percent of each year's infant death certificates for the State of New Jersey had been linked with birth certificate data.)

We analyzed several maternal characteristics of Jersey City residents delivering at hospital X to identify any change in prevalence over the 1979–82 period or association with the birth of a 501–1,000-g infant. Neither maternal age (less than 20 or less than 17 years) nor fewer years of education (less than 12th grade) were consistent

Table 3. Total neonatal deaths among infants of Jersey City residents, by year of birth cohort and hospital of birth, 1979–82

Year	Hospital X	Other hospitals	Total
1979	26	17	43
1980	27	12	39
1981	18	9	27
1982	46	13	59

Table 4. Births, neonatal deaths, and neonatal mortality rate (NMR) for hospital X, by year of birth cohort and residence of mother

Year and residence	Births		Deaths	NMR [1]
	Number	Percent		
1979				
Total	2,809	100	36	...
Jersey City residents	2,105	75	26	12.4
Nonresidents	704	25	10	14.2
1980				
Total	2,737	100	36	...
Jersey City residents	2,096	77	27	12.9
Nonresidents	641	23	9	14.0
1981				
Total	2,609	100	31	...
Jersey City residents	2,005	77	18	9.0
Nonresidents	604	23	13	21.5
1982				
Total	2,668	100	57	...
Jersey City residents	1,990	75	46	23.1
Nonresidents	678	25	11	16.2

[1] Relative risk for NMR for Jersey City residents (at the hospital), 1982 versus 1970–80 = 1.83 $(1.25, 2.70)_{95\%}$. Relative risk for nonresidents (at the hospital), 1982 versus 1979–80 = 1.15 $(0.55, 2.40)_{95\%}$.

Table 5. Neonatal deaths among infants of Jersey City residents at hospital X, by birth weight and birth cohorts 1979, 1980, and 1982

Birth weight (g)	1979	1980	1982	1982 versus 1979	
0–500	4	6	7	+ 3	+18
501–1,000	9	9	24	+15	
1,001–1,500	6	4	5	− 1	+ 2
1,501–2,000	0	1	2	+ 2	
2,001–2,500	2	1	2	0	
More than 2500	5	4	6	+ 1	
Unknown	0	2	0	0	
Total	26	27	46		

Table 6. Incidence of 501–1,000-g neonates at hospital X, by residence, and at other Hudson County hospitals, Jersey City residents, by year of birth cohort and residence of mother

Year and residence	Births in hospital X			Births in other Hudson County hospitals		
	501–1,000-g infants		Total births	501–1,000-g infants		Total births [2]
	Number	Rate [1]		Number	Rate [1]	
1979						
Jersey City residents	13	[3] 6.2	2,105	5	3.2	1,558
Nonresidents	6	(8.6)	704			
1980						
Jersey City residents	19	[3] 9.1	2,096	([4])	([4])	([4])
Nonresidents	6	9.4	641			
1981						
New Jersey residents	19	[3] 9.5	2,005	4	2.5	1,599
Nonresidents	5	8.3	604			
1982						
Jersey City residents	29	[3] 14.6	1,990	4	2.5	1,592
Nonresidents	7	10.3	678			

[1] 501–1,000-g infants per 1,000 live births.
[2] Includes approximately 80 percent of deliveries to Jersey City residents that occurred at hospitals other than hospital X; about 20 percent occurred outside Hudson County.
[3] $P < 0.01$ for significance of trend.
[4] Results for 1980 cannot be relied upon; apparently, resident status for these hospitals was not coded correctly.

Table 7. Percentage of mothers with fewer than 3 prenatal visits, Jersey City residents delivering at hospital X, by birth cohort

Year	Births [1]	Mothers having 0–2 prenatal visits	
		Number	Percent
1979	2,104	117	[2] 5.6
1980	2,096	145	[2] 6.9
1981	1,999	177	[2] 8.9
1982	1,900	220	[2] 11.6

[1] Excludes those with missing prenatal care data.
[2] $P < 0.01$ for significance of trend.

risk factors for delivering a 501–1,000-g infant. Black women were at 1.5 times greater risk of delivering such an infant when compared with white women. Importantly, the prevalence of these characteristics among the Jersey City residents delivering at hospital X did not change over time and thus could not explain the increase in incidence of such births.

The data suggested that in 1982 fewer Jersey City residents delivering at hospital X obtained prenatal care as early or as often as they had in previous years. The percentage of Jersey City residents delivering at the hospital who had fewer than three prenatal care visits—not an adequate number of visits regardless of length of gestation—rose significantly from 5.6 percent in 1979 to 11.6 percent in 1982 (table 7). Similarly, in 1982, 48 percent failed to obtain prenatal care during the first trimester, whereas in 1980 and 1981, 36 percent and 42 percent, respectively, had failed to do so. In 1979, 51 percent had not obtained prenatal care in the first trimester. Among mothers with more than three prenatal visits, the incidence of infants with birth weights 501–1,000 g had increased, rising from 5.0 per 1,000 live births in 1979 to 8.3 in 1982; no temporal pattern, as was found among those women with fewer prenatal care visits, could be identified.

We also looked for changes in survival that might have occurred at hospital X among Jersey City residents from 1979 to 1982. Although the birth-weight-specific mortality in 1982 was not significantly different from that in 1979, it was different from that in 1980. Mortality among 501–1,000-g infants was significantly higher ($P<0.01$) in 1982 (24 of 29 such infants died) than in 1980 (9 deaths among 19 such infants); survival among larger infants did not differ significantly between the 2 years.

To investigate this higher mortality rate, we examined outcomes among the infants with birth weights of 501–750 g and 751–1,000 g (table 8). This revealed that most of the increase in deaths among the 501–1,000-g infants had occurred among the smaller babies, those weighing 501–750 g. There were 15 more deaths among 501–1,000-g infants in 1979 than in 1982; 12 of these 15

occurred among the 501–750-g babies. The increase in births of infants weighing 501–1,000 g was mostly a result of increased births in the 501–750 g category. In addition, in 1982 only 1 of 17 such infants survived past 28 days, whereas 5 of the 16 infants born from 1979 to 1981 survived the neonatal period.

Similarly, we do not believe that the increase could have occurred by chance and thus not represent a true change in mortality rate. The NMR for 1982 is significantly higher than the NMR for each of the previous 3 years (table 2); the probability that such a difference could occur by chance alone is well under 5 percent. More importantly, preliminary data suggest that although the incidence in 1983 of infants with birth weights of 501–1,000 g has decreased slightly, the incidence of infants considered by definition to be of very low birth weight (1,500 g or less)—and still at high risk for death or morbidity (*4*)—did not decrease.

The results of this investigation have enabled local health officials to focus their efforts to reduce infant mortality in Jersey City by

- increasing the availability of prenatal care;
- undertaking a case-control study to evaluate potential risk factors such as occupation, level of exertion at work, welfare status, enrollment in WIC (Women, Infants, and Children Program), previous reproductive history, nature of prenatal care, drug use and abuse—factors associated with delivering an infant with a birth weight of 1,500 g or less;
- assembling a committee of outside consultants for assessing the perinatal care provided at hospital X.

This experience suggests that when an appreciable increase in infant mortality is observed in a community, efforts should be made to identify risk factors (birth weight, age, hospital of birth, and so forth) associated with the increase. These efforts should not be delayed until a subsequent year's data confirm the increased mortality. This experience demonstrates that the availability of matched birth and infant death records is essential to such efforts and is another example of how useful these records can be to health officials (*5*). No firm guidelines can dictate when an occurrence of increased infant mortality in a community should be investigated. Good judgment must be exercised; community size and past trends in infant mortality, as well as other factors, must be considered.

Table 8. Births, neonatal deaths, and neonatal mortality rate (NMR), by birth weight 501–750 g and 751–1,000 g, Jersey City residents delivering at hospital X, by birth cohorts 1979–82

Year	Birth weight	
	501–750 g	751–1,000 g
1979		
Deaths per births	4 of 4	5 of 9
NMR	1,000	555
1980		
Deaths per births	5 of 8	4 of 11
NMR	625	363
1981		
Deaths per births	2 of 4	5 of 15
NMR	500	333
1982		
Deaths per births	16 of 17	8 of 12
NMR	941	667

NOTE: Neonatal mortality rate = neonatal deaths per 1,000 live births in weight category.

Only by undertaking such an investigation promptly can rational and effective action be taken to reduce infant mortality without delay.

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