Birthweight-specific Infant Mortality for Native Americans Compared with Whites, Six States, 1980

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Abstract: We used data from the National Infant Mortality Surveillance (NIMS) project to compare birthweights and birthweight-specific mortality risks among Native American and White infants. Because race categories in NIMS were limited to White, Black, and all, we studied six states in which greater than 85 per cent of newborns who were neither White nor Black were Native American. In these states, the infant mortality risk (IMR) among Native Americans was 15.3 deaths per 1,000 live births compared with 8.7 deaths among Whites, relative risk (RR) = 1.8 (95% CI = 1.5–2.0). The percentage of Native American infants with <2,500 g birthweights was 5.8 per cent versus 5.0 per cent for White infants. Birthweight-specific neonatal mortality risks were similar for the two race groups, but birthweight-specific postneonatal mortality risks (PNMRs) were more than three times as high among Native Americans compared with Whites for infants of ≥2,500 g birthweight. PNMRs were elevated for most causes of death and for all categories for maternal age, educational attainment, trimester prenatal care began, and number of previous live births. Leading causes of postneonatal death among Native Americans of ≥2,500 g birthweight were sudden infant death syndrome and infections. (*Am J Public Health* 1988; 78:499–503.)

Introduction

Despite the long-term decline in infant mortality in the United States, disparities remain among race groups.[1,2] Most research in this area has focused on the approximately two-fold disparity in infant mortality between Black and White infants.[2] In this paper, we examine differences in infant mortality between White and Native American infants using information from linked birth and infant death records. Since the 1950s, the infant mortality rate among Native Americans has declined more rapidly than the national rate; and in 1982, the infant mortality rate for Native Americans was slightly lower than the rate for Whites.[3,4] Despite this favorable trend, the postneonatal mortality rate among Native Americans remains twice that of White infants.[4]

Among the many predictors of infant mortality, birthweight is the most important.[5] Information published by the Indian Health Service and the National Center for Health Statistics (NCHS) has described Native American newborns and the characteristics of infant deaths in this population.[6,7] This information, however, has been based on the numbers of deaths and births in a given year and, thus, has not been able to examine mortality risks by birthweight or other maternal and infant features described on birth but not death certificates. The 1980 National Infant Mortality Surveillance (NIMS) project provides the most recent national information on birthweight-specific infant mortality in the United States.[8] We used NIMS data from six states to compare birthweight-specific infant mortality risks between White and Native American infants and to examine mortality by selected maternal characteristics and underlying causes of death.

Methods

The methods of the National Infant Mortality Surveillance (NIMS) project, including data collection and evaluation, are described elsewhere.[8] In brief, 53 vital statistics reporting areas participated in the project (50 states, New York City, the District of Columbia, and Puerto Rico). All 53 reporting areas (subsequently referred to as "states") linked birth and death certificates for infants who were born alive in 1980 and who died within the first year of life in 1980 or 1981. States provided the Centers for Disease Control (CDC) with the number of infant deaths by birthweight, age at death, and other infant and maternal characteristics. The CDC generated numbers of births by the same characteristics from the computer tape of 1980 natality records produced by NCHS. Because data on race as reported to NCHS were incomplete for New Mexico, we used updated 1980 natality records provided directly to CDC by New Mexico. State of residence was defined as state of mother's residence at time of infant's birth.

Race of infant was based on the race of both parents, using the NCHS algorithm.[9] To facilitate the participation of all states in NIMS, however, categories for reporting the race of infants who died were limited to White, Black, and all races combined. In seven states (Alaska, Arizona, Montana, New Mexico, North Dakota, Oklahoma, and South Dakota) greater than 85 per cent of newborns who were neither White nor Black were Native American.[10] We estimated numbers of births and deaths for Native Americans by subtracting the numbers of Whites and Blacks from the numbers of all races combined. The term Native American as used in this analysis includes groups classified by NCHS[10] as American Indian, Aleut, Eskimo. Oklahoma was excluded because 63 per cent of Native American infants who died had unknown birthweights as reported to NIMS. As determined from NCHS natality records (which permit direct identification of Native American race), the remaining six states accounted for 19.9 per cent of all US Native American births in 1980; 91.0 per cent of infants who were neither White nor Black were Native American in these states.[10]

To assess the degree of bias that may occur from this indirect definition of Native American race, we used NCHS natality records for five of these six states (excluding New Mexico, see above) to compare the maternal characteristics of infants in three race groups: Native Americans defined by our indirect definition, Native Americans defined directly on the basis of maternal and paternal race,[9] and infants whose race was neither White, Black, nor Native American. This last group represents infants who are inappropriately includ-

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ed in the Native American category using the indirect definition. The characteristics of this last group differed from those of directly defined Native American infants by having a lower percentage of mothers who were ≤17 years of age, with <12 years of education, prenatal care beginning after the first trimester, and three or more previous live births (Appendix). However, inclusion of these infants in our indirectly defined Native American group did not substantially alter the distribution of characteristics (Appendix).

Only deaths with certificates linked to a birth certificate were included in NIMS.[8] To estimate the completeness of certificate linkage in NIMS, we compared the number of deaths reported to NIMS to the number reported to NCHS for 1980 and 1981 among the 1980 birth cohort.[8,11] Although this approach is useful in providing a national estimate of the completeness of certificate linkage (95 per cent), it is less reliable for assessing linkages at the state level and by race groups. This occurs because NIMS data are based on state of mother's residence at the time of delivery and race at birth (derived from race of parents) while NCHS mortality data are based on state of residence and race at death. With this limitation in mind, the completeness of certificate linkage for the six states in this study is estimated to be 92 per cent overall, 91 per cent for White infants, and 97 per cent for Native American infants.

Because the NIMS data are for a birth cohort, rather than for births and deaths occurring in a given year, we use the term mortality "risk" instead of "rate."[8] The neonatal mortality risk (NMR) was defined as the number of neonatal deaths (<28 days) per 1,000 live births; the postneonatal mortality risk (PNMR) was defined as the number of postneonatal deaths (28 days to <1 year) per 1,000 neonatal survivors; and the infant mortality risk (IMR) as the number of infant deaths (<1 year) per 1,000 live births.

We aggregated birthweights into four groups (<1,500 g, 1,500–2,499 g, 2,500–3,999 g, and ≥4,000 g) and compared mortality risks within these groups; we determined the relative risk (RR) of death among Native American infants by comparing their risks with those of Whites. Ninety-five per cent confidence intervals (CIs) were calculated using the test-based method and adjusted relative-risk estimates were calculated using the Mantel-Haenszel procedure as described by Rothman and Boice.[12]

For certain birthweight groups, we analyzed mortality risks by four maternal characteristics (age, educational attainment, number of previous live births, and trimester prenatal care began) and underlying causes of death (reported by states using the 9th Revision of the International Classification of Diseases and grouped into seven categories: perinatal conditions [referring to the age at disease onset rather than the age at death], infections, congenital anomalies, injuries, sudden infant death syndrome [SIDS], and all others, except for nonspecific and unknown causes.)[13]

This study is limited to singleton live births. Values for percentage distributions have been rounded within categories and thus may not add to 100.0 per cent as shown in the text and tables.

Results

In these six states, there were 15,674 live births and 240 infant deaths among Native Americans (IMR = 15.3 deaths per 1,000 live births) and 104,511 live births and 909 infant deaths among Whites (IMR = 8.7/1,000 live births), RR = 1.8 (CI = 1.5–2.0).

The proportions of infants of <1,500 g, 1,500–2,499 g, 2,500–3,999 g, and ≥4,000 g birthweights were 0.7, 5.0, 84.3, and 9.9 per cent among Native Americans and 0.6, 4.5, 84.2, and 10.6 per cent among Whites, respectively (after excluding 172 [1.1 per cent] Native American and 660 [0.6 per cent] White infants of unknown birthweight).

Birthweight-specific IMRs were higher for Native Americans than for Whites for nearly all birthweights (Figure 1). Except for NMR for infants with 1,500–2,499 g and unknown birthweights, birthweight-specific NMRs (Table 1) and PNMRs (Table 2) were also higher for Native Americans. Adjusting the NMR and PNMR for birthweight slightly lowered the higher risk of neonatal and postneonatal death for Native Americans (Tables 2 and 3). The most pronounced differences between race groups occurred in the postneonatal period among infants of 2,500–3,999 g and ≥4,000/g birthweights for whom the risk of death was over 3.5 times as

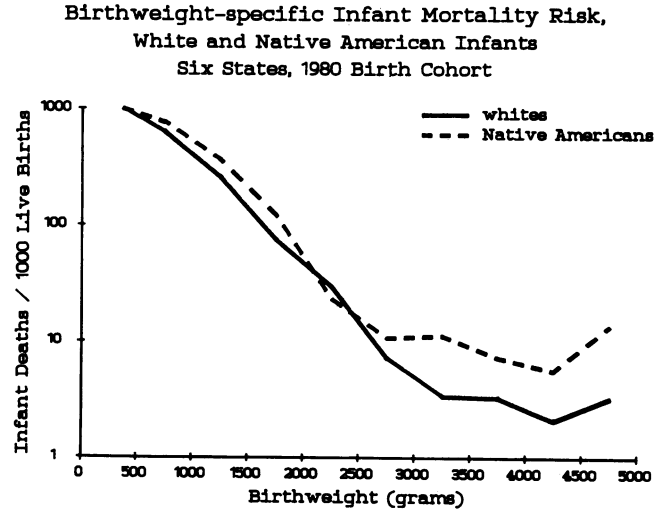

FIGURE 1—Infant Deaths (birth to <1 year) per 1,000 Live Births, by Birthweight, Native American and White Infants, Six States, 1980
NOTE: There were eight Native American and 46 White infants with birthweights 227–499 grams included in these data (all neonatal death).[8]

TABLE 1—Birthweight-Specific Neonatal Mortality Risks (NMR), Native American and White Infants, Six States, 1980

Birthweight/Race	Neonatal Deaths	Live Births	NMR	Relative Risk	95% CI
<1,500 g					
Native Americans	59	115	513.0	1.2	0.9–1.6
Whites	291	671	433.7		
1,500–2,499 g					
Native Americans	19	778	24.4	0.8	0.5–1.4
Whites	135	4,661	29.0		
2,500–3,999 g					
Native Americans	27	13,070	2.1	1.1	0.7–1.6
Whites	172	87,476	2.0		
>4,000 g					
Native Americans	5	1,539	3.2	2.6	1.0–6.9
Whites	14	11,043	1.3		
Unknown					
Native Americans	5	172	29.1	0.6	0.3–1.6
Whites	30	660	45.5		
Total					
Native Americans	115	15,559	7.3	1.2	1.0–1.4
Whites	642	104,511	6.1		
Relative risk adjusted for birthweight (excluding unknown birthweights):				1.1	0.9–1.4

TABLE 2—Birthweight-Specific Postneonatal Mortality Risks (PNMR), Native American and White Infants, Six States, 1980

Birthweight/Race	Post-Neonatal Deaths	Neonatal Survivors	PNMR	Relative Risk	95% CI
<1,500 g					
Native Americans	3	56	53.6	1.2	0.4–4.1
Whites	17	380	44.7		
1,500–2,499 g					
Native Americans	12	759	15.8	1.5	0.8–2.9
Whites	47	4,526	10.4		
2,500–3,999 g					
Native Americans	101	13,043	7.8	3.6	2.9–4.5
Whites	187	87,304	2.1		
>4,000 g					
Native Americans	6	1,534	3.9	3.9	1.6–9.9
Whites	11	11,029	1.0		
Unknown					
Native Americans	3	167	18.0	2.3	0.6–9.1
Whites	5	630	7.9		
Total					
Native Americans	125	15,559	8.0	3.1	2.6–3.8
Whites	267	103,869	2.6		
Relative risk adjusted for birthweight: (excluding unknown birthweights):				3.0	2.4–3.6

high among Native Americans compared with Whites (Table 2).

If Native American infants in these six states had the same birthweight-specific NMRs and PNMRs as Whites in 1980, there would have been 92 fewer deaths (a 40 per cent reduction) among Native American infants with known birthweight, including 73 deaths that would not have occurred in the postneonatal period among infants of 2,500–3,999 g birthweight.

Except for deaths attributed to perinatal conditions, PNMRs among infants of ≥2,500 g birthweight were higher for Native Americans than Whites for all causes of death (Table 3). Among Native American infants, the two leading causes were SIDS and infections (primarily involving the respiratory tract and central nervous system), which accounted for 54 per cent of deaths. In contrast, the leading causes of postneonatal death among Whites in this birthweight group were SIDS and congenital anomalies, which accounted for 56 per cent of deaths.

Focusing on neonatal survivors and PNMRs among infants of ≥2,500 g birthweight, the distributions of maternal age, educational attainment, timing of first prenatal care visit, and number of previous live births were less favorable among Native Americans, and PNMRs were higher among Native Americans for each stratum (Table 4).

Discussion

In the six states that we studied, the IMR among Native Americans was 1.8 times as high as that among Whites. Native American infants in these states had a slightly greater frequency of low birthweight, and neonatal mortality risks were not substantially different between the two race groups. Rather, the disparity between Native Americans and Whites was largely due to a greater risk of postneonatal death among infants who weighed ≥2,500 g at birth. This increase in risk is seen for most causes of postneonatal death and across categories for various maternal characteristics. SIDS was the leading cause of postneonatal death for both Native Americans and Whites, but the risk of death due to SIDS was more than three times as high among Native Americans as among Whites, which is consistent with some but not all previous studies of SIDS in among Native Americans.[14-16] Infectious diseases were a more important cause of postneonatal death among Native Americans compared to Whites for infants with birthweight ≥2,500 g, which is consistent with the recognized problem of infectious diseases in the Native American population.[17]

Previous comparisons of Native Americans and Whites have demonstrated a similarity in birthweight distribution and NMRs and a disparity in postneonatal mortality.[2,3,6,7,18-20] This study takes the next step by providing birthweight-specific mortality risks, using data from the most recent national study of linked birth and infant death records. Efforts to reduce postneonatal deaths for infants with birthweight ≥2,500 g, who comprise the overwhelming majority of births and excess postneonatal deaths in Native Americans, must address not only access to and utilization of medical care but also broader concerns. Traditionally, postneonatal mortality is thought to reflect "environmental" or "social" causes of death while neonatal mortality is thought to reflect "endogenous" or "medical" causes.[2,21] This distinction obscures the importance of factors that contribute to both but may provide a useful construct for interpreting the higher PNMR among Native Americans and is consistent with their lower economic status.[2,22] Recently, the director of the Indian Health Service has emphasized the need to focus on living conditions and on access to medical care as keys to further reductions in infant mortality among Native Americans.[3,17]

This study has several limitations, reflecting the limits of vital records in general and NIMS in particular. Although certain variables from birth certificates may be used as proxy indicators for social and economic status, these are insuffi-

TABLE 3—Cases of Postneonatal Death, Native American and White Infants of ≥2500 g Birthweight, Six States, 1980

	Perinatal Conditions	Infections	Congenital Anomalies	Injuries	SIDS	NS/Unk	All Other	Total
Number of Deaths								
White	3	26	46	26	65	6	26	198
Native American	0	24	13	10	34	9	17	107
Postneonatal Mortality Risk (deaths per 1,000 neonatal survivors)								
White	0.03	0.26	0.47	0.26	0.66	0.06	0.26	2.01
Native American	0.00	1.65	0.89	0.69	2.33	0.62	1.17	7.34
Relative Risk		6.2	1.9	2.6	3.5	10.1	4.4	3.6
95% Confidence Interval		3.8, 10.1	1.0, 3.5	1.3, 5.2	2.4, 5.2	4.4, 23.3	2.5, 7.7	2.9, 4.5

SIDS, sudden infant death syndrome; NS/unk, non-specific/unknown. Nonspecific causes are deaths attributed to cardiac/respiratory arrest.
Calculations based on 14,577 neonatal survivors among Native American and 98,333 among White infants.

TABLE 4—Postneonatal Mortality Risks (PNMR), Postneonatal Deaths (PND) per 1,000 Neonatal Survivors (NNS) among Infants of ≥2,500 g Birthweight, Native American and White Infants, Six States, by Maternal Characteristics, 1980

Maternal Characteristics	Native American			White				
	PND	NNS	PNMR	PND	NNS	PNMR	RR	CI
Age (years)								
≤17	15	1,151	13.0	16	4,526	3.5	3.7	1.9–7.1
18–24	52	7,031	7.4	103	44,315	2.3	3.2	2.3–4.4
25–34	35	5,491	6.4	75	45,303	1.7	3.9	2.7–5.6
≥35	5	898	5.6	4	4,166	1.0	5.8	1.8–18.5
Unknown	0	6	0.0	0	23	0.0	—	
Total	107	14,577	7.3	198	98,333	2.0	3.6	2.9–4.5
Education (years)								
<12	57	5,744	9.9	54	19,208	2.8	3.5	2.5–5.0
12	35	5,471	6.4	81	39,405	2.1	3.1	2.1–4.5
>12	11	2,725	4.0	53	35,508	1.5	2.7	1.4–5.0
Unknown	4	637	6.3	10	4,912	2.0	3.1	1.0–9.3
Total	107	14,577	7.3	198	98,333	2.0	3.6	2.9–4.5
Trimester Prenatal Care Begun								
1st	58	7,374	7.9	113	67,834	1.7	4.7	3.5–6.3
2nd–3rd, None	43	6,110	7.0	67	24,121	2.8	2.5	1.8–3.7
Unknown	6	1,093	5.5	18	6,378	2.8	1.9	0.8–4.8
Total	107	14,577	7.3	198	98,333	2.0	3.6	2.9–4.5
Previous Live Births								
None	24	4,973	4.8	74	41,272	1.8	2.7	1.7–4.2
1–2	59	6,358	9.3	106	45,386	2.3	4.0	3.0–5.3
≥3	18	3,058	5.8	17	10,203	1.7	3.5	1.9–6.5
Unknown	6	161	37.3	1	1,583	0.6	59.0*	
Total	107	14,577	7.3	198	98,333	2.0	3.6	2.9–4.5

RR, relative risk; CI, confidence interval.
*95% confidence interval not calculated.

cient to examine more fully the effect of social and economic status on observed gaps in postneonatal mortality risks. Given the race categories available in NIMS, we used an indirect method to define Native American race which resulted in the inclusion of a few infants who were not actually Native American and whose characteristics are associated with a lower risk of postneonatal death. This would lead to a small underestimation in the mortality gap between Whites and Native Americans. Estimates of the completeness of certificate linkage were slightly higher for Native Americans compared to Whites, which would have the opposite effect. In addition, the majority of Native American infants who reside in other states were excluded. In the six states we studied, mortality among Native Americans was almost twice as high as among Whites, but nationally this gap was much smaller in 1980, and by 1982 Native American infant mortality was slightly lower than that for Whites.[3,4] Thus Native Americans in these six states may not be representative of those in the rest of the United States; the pattern of similar neonatal mortality and higher postneonatal mortality, however, is seen at the national level. State of residence was the smallest geographic category available in NIMS, and we could not compare residents of urban or rural areas, those who lived on or off reservations, or members of different tribes. Furthermore, the quality of information on vital records may vary by race. For example, we determined from computer tapes of NCHS mortality records that the percentage of infant deaths accompanied by autopsy in 1980 was 45 per cent for Native Americans compared with 72 per cent for Whites in these six states.

Despite these limitations, these data identify important gaps between Whites and Native Americans. The findings regarding postneonatal mortality not only highlight broad social concerns but also provide a target for future efforts to lower Native American infant mortality.

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APPENDIX

Distribution of Maternal and Infant Characteristics by Method of Defining Native American Race (see text), Five States, 1980

Characteristics	Native American, Direct Definition (n = 11,086)	Other* Race (n = 1,205)	Native American, Indirect Definition (n = 12,291)
Birthweight (grams)			
<1,500	0.9	0.8	0.9
1,500–2,499	5.4	4.6	5.4
2,500–3,999	81.3	87.9	81.9
≥4,000	11.3	6.5	10.8
Unknown	1.1	0.2	1.0
Total	100.0	100.0	100.0
Maternal Age (years)			
≤17	8.7	2.0	8.0
18–24	49.9	31.9	48.1
25–34	35.2	58.7	37.5
≥35	6.2	7.5	6.4
Total	100.0	100.0	100.0
Maternal Education (years)			
<12	42.4	24.0	40.5
12	38.5	30.9	37.7
>12	16.7	41.7	19.1
Unknown	2.5	3.4	2.6
Total	100.0	100.0	100.0
Month Prenatal Care Begun			
First Trimester	52.0	68.5	53.6
Later or None	42.7	27.9	41.2
Unknown	5.3	3.7	5.2
Total	100.0	100.0	100.0
Previous Live Births, Now Living			
None	33.6	40.2	34.2
1–2	43.0	48.0	43.5
≥3	22.3	11.0	21.2
Unknown	1.2	0.7	1.1
Total	100.0	100.0	100.0
Previous Live Births, Now Dead			
None	93.3	94.6	93.4
1–2	5.4	4.1	5.3
≥3	0.2	0.5	0.2
Unknown	1.2	0.7	1.1
Total	100.0	100.0	100.0

*Infants who are neither White, Black nor Native American (direct definition) and who are inappropriately included in the Native American group using the indirect definition (see text).