

ies, indicates that a surveillance system based solely on traditional passive reporting by health care providers may lead to substantial underreporting of certain diseases (3-6). To improve the surveillance of ND, State health departments should consider making laboratory reporting for selected diseases a requirement. While laboratories can provide an important source of disease reports to a State surveillance system, it is not a substitute for physician reporting and does not eliminate physicians' legal responsibility to report disease. There are a number of reportable diseases, such as invasive *Haemophilus influenzae* disease and meningococcal infections for which timeliness of reporting is an important factor, and waiting for a test result is not practical. Other reportable diseases have no definitive laboratory determination. Multiple sources should be required to contribute to the surveillance system.

References

1. Sacks, J. J.: Utilization of case definitions and laboratory reporting in the surveillance of notifiable communicable diseases in the United States. *Am J Public Health* 75: 1420-1422, December 1985.
2. Godes, J. R., Hall, W. N., Dean, A. G., and Morse, C. D.: Laboratory-based disease surveillance. A survey of state laboratory directors. *Minn Med* 65: 762-764 (1982).
3. Vogt, R. L., Larue, D., Klauke, D. N., and Jillson, D. A.: Comparison of an active and passive surveillance system of primary care providers for hepatitis, measles, rubella, and salmonellosis in Vermont. *Am J Public Health* 73: 795-797, July 1983.
4. Konowitz, P. M., Petrossian, G. A. and Rose, D. N.: The underreporting of disease and physicians' knowledge of reporting requirements. *Public Health Rep* 99: 31-35 January-February 1984.
5. Marier, R.: The reporting of communicable diseases. *Am J Epidemiology* 105: 587-590 (1977).

Differences Between Oklahoma Indian Infant Mortality and Other Races

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Synopsis

Indian infant mortality rates (IMR) in the State of

Oklahoma follow a downward linear trend from 13 per 1,000 live births in the 1975-76 period to 5.8 in 1987-88. Data from 7,631 death certificates matched to birth certificates, however, reveal much higher Indian IMR across the time interval than is currently documented.

Matching (linking) of infant deaths to birth certificates from 1975 to 1988 indicates that infants born Indian had a 28 percent chance of being misclassified as another race (usually white) on the death certificate. Infants born white or black had less than a 1 percent chance of being misclassified.

Misclassification of Indian deaths strongly alters the overall IMR for the Oklahoma Indian population from the currently reported 5.8 per 1,000 (1987-88) to an estimated actual rate of 10.4 per 1,000 for the same period.

Misclassification of race on Oklahoma death certificates strongly affects mortality rates of Oklahoma infants. Misclassification occurs among four races: white, black, Indian, and others. It is predominant in the Indian race.

All-race IMR in Oklahoma have followed the national trend downward. Yearly fluctuations have put the State slightly above or below the rate for the United States. Vital records show infant mortality across a 14-year period for all Oklahoma races to be 12.1 per 1,000. Indian infant mortality for this period was 8.9 (27 percent lower), for blacks it was 18.5 (53 percent higher), and for whites it was 11.8 (3 percent lower)

(1). When the 1985 national Indian IMR (excluding Alaska) is compared with Oklahoma's, the national rate is 80 percent higher (2). Table 1 summarizes the 14-year comparison of IMR among all Oklahoma races with Oklahoma Indians, blacks, and whites.

For some years now, Terry Rice and Pat Gideon of the Oklahoma City Area Office of the U.S. Indian Health Service and Dick Lorenz and Roger Deapen from the Oklahoma State Health Department have been looking at the differences between Oklahoma Indian infant mortality and that of other races of Oklahoma infants and wondering why Oklahoma Indian infant mortality was unusually low. The discussions of Fed-

Reported Indian infant mortality rate versus estimated Indian infant mortality rate on Oklahoma infant deaths linked to births, 1975-88

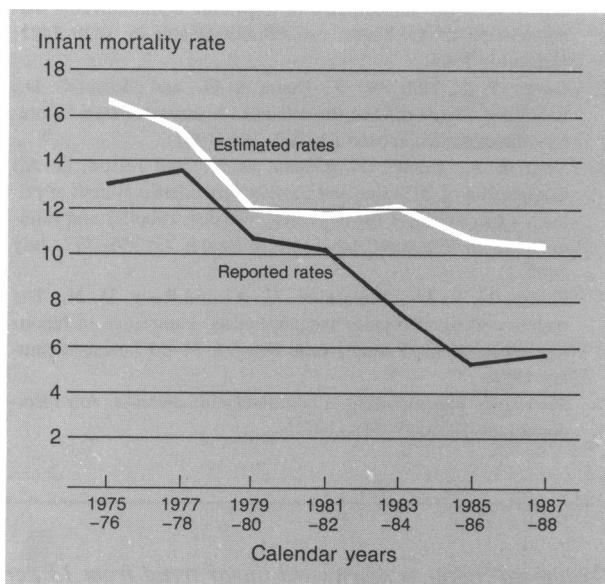


Table 1. Oklahoma infant mortality rates per 1,000 live births, 1975-88

Years	All races	White	Black	Indian
1975-76	16.38	15.71	26.02	12.97
1977-78	13.98	13.01	21.43	13.71
1979-80	12.58	11.87	20.23	10.76
1981-82	12.05	11.87	17.40	8.80
1983-84	10.65	10.62	14.45	7.61
1985-86	10.55	10.35	18.19	5.40
1987-88	9.33	9.32	13.47	5.79
14 year average ¹	12.10	11.75	18.43	8.87

¹Computed by dividing all infant deaths from 1975 to 1988 by total number of live births for the same period.

Table 2. All live births, infant deaths, and number of matched infant deaths in Oklahoma, 1975-88

Years	Live births	Infant deaths	Matched deaths
1975-76	86,795	1,422	1,309
1977-78	91,334	1,277	1,163
1979-80	101,072	1,271	1,134
1981-82	112,368	1,354	1,180
1983-84	111,182	1,184	1,073
1985-86	103,636	1,093	999
1987-88	94,980	886	773
Totals	701,367	8,487	7,631

eral and State statisticians have led to the conclusion that conventional methods of computing infant mortality seem inadequate.

The race of a newborn child is determined by an

Table 3. Race on matched infant death and birth certificates, Oklahoma, 1975-88

Race at death	Race at birth					Total
	White	Black	Indian	Other	Unknown	
White	5,549	26	246	35	18	5,874
Black	42	1,103	4	1	2	1,152
Indian	37	2	484	4	1	528
Other	7	2	0	49	0	58
Unknown	11	3	3	1	1	19
Totals	5,646	1,136	737	90	22	7,631

algorithm specified by the National Center for Health Statistics (NCHS) according to the race of the parents (3). Generally, race of the infant is determined by race of the father, unless the father is white or the mother is Hawaiian. The race the parent declares is accepted.

The classification of the race on the death certificate is the responsibility of the funeral director, in accordance with State guidelines (4). In practice, the race on the death certificate seems to be based on observation of the decedent's family by funeral home personnel.

Linking of death to birth certificates has been done for several years by the Maternal and Child Health Service Division (MCH) of the Oklahoma Department of Health to obtain additional information on the infants who have died. This can provide a great deal of data on parents' characteristics or infant profiles to create an epidemiologic database not otherwise available. There were 8,487 deaths of infant residents in Oklahoma during the 1975-88 period, and MCH has matched 7,631 to birth certificates, a rate of 89.9 percent.

Table 2 shows seven 2-year intervals with the frequency of all infant deaths, live births, and matched birth-death certificates. Two-year intervals were selected to stabilize the rates of the small numbers of deaths.

Table 3 shows the matched infant deaths giving race on the death certificate versus race computed from the birth certificate for the 1975-88 period.

Race misclassification occurs in all categories and in both directions, that is, an infant born black may die Indian (2 occurrences) and an infant born Indian may die black (4 occurrences). Infants born black have the lowest chance of being misclassified at death (1,136:1,152). Infants born white have a slightly higher chance (5,646:5,874) of being misclassified at death. Only 72 percent of infants born Indian died Indian (538:737).

For the 14-year period there are 737 death certificates that can be linked to Indian birth certificates. Partitioning these 737 matches into the seven 2-year intervals delineates the distribution of the misclassification across time. Table 4 summarizes the number of infants born

Indian who died Indian and the percent born Indian who died another race.

Since 1975 the proportion of infants who were born Indian but died another race in a 2-year period has varied from 9 percent to 49 percent (table 4). In the last 5 years (1983–88), there is a higher incidence of misclassification (averaging more than 40 percent) of Indian infant deaths misclassified under other races.

A check was made to see if infants born Indian were consistently misclassified as either black or white at death. Table 5 further partitions the mortality differential into the reported race of birth versus the reported race at death. An estimate of the true Indian infant mortality can be made by using a ratio of all infants who died to those who were matched. For example, for the years 1975–76 (table 6), the 108 deaths of infants who were born Indian multiplied by the ratio of all infant deaths (1,422) to the number of matched infant deaths (1,309) gives an estimated 117.3 Indian infant deaths. The estimated true Indian infant mortality is 1,000 times 117.3 divided by 7,015 or 16.72 per 1,000 Indian live births. Table 6 summarizes these calculations by seven 2-year intervals.

These estimates of Indian infant mortality strongly differ from the currently reported data. The accompanying figure plots the mortality differential between currently reported Indian infant mortality and the estimated true Indian infant mortality based on the matched data. It shows that over the 14-year period, reported Indian infant mortality underreports the estimated true rate.

Race misclassification in the Indian infant population has steadily worsened. A 5-year (1984–88) Indian infant mortality estimate (10.43 per 1,000) is 80 percent higher than the reported rate (5.81 per 1,000) calculated by conventional methods.

Although consideration is given to the possibility of race misclassification on the birth certificate (we believe this problem exists because of 'self' reporting), mortality estimates found in this paper assume misclassification of race on birth certificates to be independent of misclassification of race at death.

Currently, the Indian infant mortality picture in Oklahoma is presented as one of the best in the country when compared with other Indian Health Service areas (2). These estimates show, however, that the Oklahoma Indian IMR is actually 10 percent higher than the national Indian IMR for the year of 1985 (10.65 versus 9.7). The majority of the misclassifications of race can be attributed to death certificates incorrectly completed, most prevalent when the races of the parents differ. The increasing differential between reported Indian IMR and this estimate of the true rate suggests a problem exists in the use of conventional methods to determine race-specific mortality.

Table 4. Race matched on death and birth certificates, Oklahoma Indians, 1975–88

Years	Identified Indian		Percent other race on death certificate
	on birth certificate	on death certificate	
1975–76	108	87	19.44
1977–78	108	98	9.26
1979–80	98	85	13.27
1981–82	110	81	26.36
1983–84	115	68	40.87
1985–86	101	52	48.51
1987–88	97	57	41.24
Totals ...	737	528	28.35

Table 5. Registered race at birth (b) and death (d), Oklahoma infants, 1975–88

Years	b Indian d White	Percent of Indians	b White d Indian	Percent of whites	b Indian d black	b black d Indian
1975–76	25	23.1	6	0.6	1	0
1977–78	13	12.0	4	0.5	1	1
1979–80	18	18.4	6	0.7	1	0
1981–82	37	33.6	5	0.6	0	0
1983–84	53	46.1	7	0.9	1	1
1985–86	54	53.5	5	0.7	0	0
1987–88	46	47.4	4	0.7	0	0
Totals ..	246	33.4	37	0.7	4	2

Table 6. Estimate of actual Indian deaths and corresponding mortality rates based on matched records, Oklahoma, 1975–88

Years	Reported born Indian	Estimated infant deaths	Reported live births	Estimated mortality rate ¹	Reported mortality rate ¹
1975–76	108	117.3	7,015	16.72	12.97
1977–78	108	118.6	7,660	15.48	13.71
1979–80	98	109.8	9,073	12.10	10.76
1981–82	110	126.2	10,568	11.93	8.80
1983–84	115	126.9	10,513	12.07	7.61
1985–86	101	110.5	10,310	10.72	5.40
1987–88	97	111.2	10,650	10.44	5.79
Totals	737	820.5	65,789	12.47	8.87

¹per 1,000 live births.

References

1. Oklahoma infant birth and death trends by county, 1975–88. Oklahoma State Department of Health, Maternal and Child Health Service, Oklahoma City, 1990.
2. Trends in Indian health, 1989. U. S. Indian Health Service, Rockville, MD, 1990.
3. Vital Statistics of the United States, 1987, vol. 1, sec. 4, technical appendix, natality. U.S. Government Printing Office, Washington, DC, 1990.
4. Oklahoma State Statutes, Title 63, ch. 1, sec. 317, West Publishing Company, St. Paul, MN, 1982.