

The Underreporting of Deaths of American Indian Children in California, 1979 through 1993

ABSTRACT

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Objectives. This study linked birth and death certificates to determine misclassification of deaths of American Indian children in California.

Methods. Birth records for 1979 to 1993 were matched with mortality records through a computerized system.

Results. The number of deaths to American Indians was estimated to be three to four times greater than that reported on death certificates. Children in urban counties and those who died before 1987 were more likely to be misclassified.

Conclusions. California death certificates identify less than one third of the deaths among American Indian children. Adjusting for racial misclassification provides a more accurate accounting of child mortality among American Indians. (*Am J Public Health.* 1997;87:1363-1366)

Introduction

Health care objectives in the Congressional Indian Health Care Improvement Act¹ are based on national reports of morbidity and mortality among American Indians. Although the National Center for Health Statistics has distributed instructions to funeral directors and medical examiners for completing demographic data requested on the death certificate, there continues to be significant underreporting of mortality rates as a result of race misclassification of American Indians.

Reports published by the Indian Health Service often exclude or separate mortality data for California American Indians because of suspected inaccuracies in race reporting.² Racial misclassification of infant deaths among American Indians has been widely acknowledged³ and reported in studies in California and Montana,⁴ Oklahoma,⁵ and Washington.⁶ When birth and death files were linked, the number of deaths for American Indian infants increased from 20% to 150%, depending on the study. In Oregon, racial misclassification led to underreporting of injury rates among American Indians.⁷

The objectives of this study were to determine the extent of racial misclassification in mortality reported for American Indian infants and children in California, provide more accurate data adjusted for misclassification errors, and ascertain counties with the highest levels of racial misclassification in order to improve reporting.

Methods

Approximately 5000 infants are born each year in California whose mother or father (or both) is American Indian. An automated computer mortality linkage system⁸ was used to establish a record match of personal identifiers on birth certificates of American Indians born between 1979 and 1993 and death certificates for all races in California during this same period.

The program used a probabilistic evaluation of matches on date of birth, mother's maiden name (available after 1985), gender, county of residence, and phonetic recognition of first and last names. The record pairs were classified as either high or low likelihood linkages. Records that were complete but inconclusive (i.e., a common name in a large county) were labeled as "questionable matches."

The following predictors were tested to determine their association with probability of race misclassification: age at death, year of death, sex, and county of residence at time of death. Fisher's exact test was used to obtain *P* values for univariate associations with misclassification, and logistic regression was used for multivariate analyses. Because there was no significant difference in the results obtained with and without "questionable matches," all records were included in the final analyses. Age was aggregated (less than 30 days, 1 to 11 months, 1 to 4 years, 5 to 9 years, 10 to 14 years). Date of death was dichotomized into two time categories: 1979 to 1986 and 1987 to 1993. Residence at time of death was divided into two categories: Contract Health Service Delivery Area counties that receive support from the Indian Health Service and counties outside the Indian Health Service areas. The Indian Health Service funds health services for federally recognized land-based tribes in 38 largely rural counties in California. The 20 counties excluded from Contract Health Service Delivery Area services encompass mostly urban areas. (The 20 excluded counties are Alameda, Contra Costa, Los

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TABLE 1—Misclassification of Deaths among American Indian Children Less than 15 Years of Age, by County, California, 1979 through 1993

County of Residence	No. with Indian Race Code	No. with Other Race Code	Misclassified, %
Merced	0	4	100
San Benito	0	2	100
San Luis Obispo	0	6	100
Santa Barbara	0	5	100
Stanislaus	0	16	100
Sutter	0	4	100
Tehama	0	1	100
Monterey	1	8	89
El Dorado	1	6	86
Orange	6	37	86
Yuba	1	6	86
San Bernardino	12	55	82
Ventura	2	9	82
Kern	7	29	81
Sonoma	5	21	81
Lassen	1	4	80
Nevada	1	4	80
San Mateo	2	8	80
Los Angeles	36	135	79
Fresno	5	18	78
Santa Clara	8	28	78
Butte	1	3	75
Placer	1	3	75
Solano	3	8	73
Sacramento	15	38	72
San Joaquin	6	14	70
Napa	1	2	67
San Diego	43	88	67
Contra Costa	5	9	64
Riverside	24	39	62
San Francisco	5	7	58
Siskiyou	5	6	56
Tuolumne	4	5	56
Santa Cruz	14	16	53
Shasta	12	13	52
Amador	1	1	50
Colusa	1	1	50
Mariposa	1	1	50
Trinity	1	1	50
Yolo	4	4	50
Imperial	5	4	44
Alameda	21	13	38
Humboldt	32	12	27
Tulare	11	4	27
Kings	3	1	25
Mendocino	22	6	21
Lake	5	1	20
Del Norte	9	2	18
Inyo	11	1	08
Alpine	0	0	0
Calaveras	1	0	0
Glenn	6	0	0
Madera	4	0	0
Marin	1	0	0
Modoc	2	0	0
Mono	2	0	0
Plumas	1	0	0
Sierra

Angeles, Marin, Orange, Sacramento, San Francisco, San Mateo, Santa Clara, Santa Cruz, Kern, Merced, Monterey, Napa, San Benito, San Joaquin, San Luis Obispo, Solano, Stanislaus, and Ventura.)

Trends in infant mortality were calculated from 1979 through 1993. We were unable to calculate annual mortality rates for children 1 through 14 years of age because of the small number of

deaths. We examined race misclassification for leading causes of death for infants less than 1 year of age and for children 1 to 14 years old. We included all mortality records of American Indian children born in California after 1978. We merged the mortality files of additional children identified as American Indian by our birth/death file linkage system. Records were sorted by county of residence at time of death. Although critically ill children may have died outside of their county of residence, race classification is usually completed by funeral directors in the county of residence.

Results

Misclassification Error Factor

Through the computerized linkage, 2240 possible matches between birth and death certificates of American Indian children were found. The computer program weighted the linked files, on a scale ranging from less than 1.0 to 10.0, in terms of the probability of the linkage's validity. Using only records with high compatibility scores (80% had weighted scores above 7), we found matches for 953 American Indian children who died during this period. Of these children, 233 were coded as American Indian on death certificate records, and 720 had been classified as a race other than American Indian (75.6% of all files; 95% confidence interval [CI] = 72.7%, 78.2%). On the basis of the matched records, we found that the number of deaths among American Indian children was 4.1 times greater than that reported on death certificates.

There were 331 deaths reported among American Indian children born between 1979 and 1993 in California. We found matches for 233 of these records. The computerized linkage system could not match birth and death files if (1) race was missing or not coded as American Indian on the birth certificate, (2) an error coded the date of birth as before 1979, or (3) the name was incomplete or had significantly changed since birth.

We identified four times as many American Indian infants and children as had been reported on state death certificates. However, our computerized system did not find matches for all of the American Indian children who died during this study period. If we include all deaths reported for American Indian children who were born in California after 1978 (even records not matched to our

birth certificates), we estimate that the actual number of American Indian infants and children who die in California may range from 2.9 to 4.1 times greater than what is reported on state death certificates when adjustments are made for errors in racial misclassification.

Race Classification and Predictors of Misclassification

On the 953 linked records, 233 children (24.4%) were coded as American Indian, 676 (70.9%) were coded as White, 39 (4.1%) were coded as Black, and 5 (1%) were coded as "other" or unknown on the death record. Because ethnicity is coded separately from race, Hispanic children may have been included in any of the racial groups.

Misclassification at time of death was more likely if the child resided in the more urbanized counties outside of the Indian Health Service delivery areas (87.7% vs 65.5%; $P < .01$) or died between 1979 and 1986 (87.8% vs 72.6%; $P < .01$). Multivariate analyses revealed that the differences in misclassification by time period were confined to children living in Contract Health Service Delivery Area counties. The 58 counties were ranked by percentage of deaths to American Indian children who were misclassified (Table 1).

The majority (80%) of the deaths occurred during the first year of life. Infants less than 1 month of age had a higher likelihood of being misclassified than children in other age groups ($P = .07$). No other risk factors or interaction terms resulted in substantial improvement in predictive ability when added to the multivariate model.

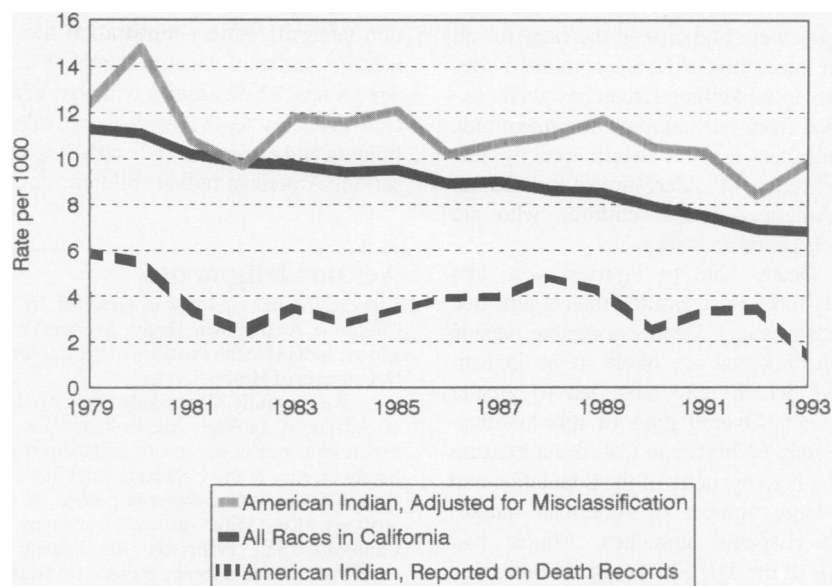
Adjusted Infant-Death Rates and Leading Causes of Death

Annual infant mortality rates were calculated for American Indian infants. After adjustment for racial misclassification, infant mortality rates for American Indians exceeded those for all races in California (Figure 1).

Misclassification of race for leading causes of death was identified for American Indian infants less than 1 year old and children 1 through 14 years of age (Table 2). The numbers of deaths increased markedly for most categories after adjustment for race misclassification.

Discussion

Health care providers in American Indian communities have long suspected



Source. Rates were derived from California vital statistics and misclassification error factor determined by this study.⁹

FIGURE 1—Trends in infant mortality among American Indians and all races: California, 1979 through 1993.

TABLE 2—Misclassification of Race by Cause of Death among American Indian Children in California, 1979 through 1993: Leading Causes of Death for Infants Less than 1 Year of Age and Children 1 to 14 Years of Age

Cause of Death	Race Coded American Indian, No.	Additional Misclassified Files, No.	Total	American Indian Deaths Reported by State, %
Infants 0–11 months of age				
Sudden infant death syndrome	72	140	212	34
Congenital anomalies	52	113	165	32
Respiratory distress syndrome	11	39	50	22
Disorders related to low birthweight	18	29	47	38
Accidents	11	15	26	42
All other causes	115	240	355	32
Total	279	576	855	33
Children 1–14 years of age				
Accidents	42	46	88	48
Congenital anomalies	8	20	28	29
Malignant neoplasm	4	13	17	24
Homicide	6	8	14	33
Diseases of the heart	3	7	10	30
All other causes	25	40	65	38
Total	88	134	222	39

that American Indian children are at greater risk of illness and death, yet mortality data have not always confirmed these concerns. In this study, we found significant levels of underreporting of deaths to American Indian children in

California. Race coding, as reported on state death certificates, identified one quarter to one third of deaths among American Indian children. Rates of racial misclassification were similar for all age groups of children included in our study.

When adjusted for racial misclassification, infant mortality rates for American Indians were higher than the rates for all other races in California combined. Because low-likelihood matches were excluded from our analyses, the magnitude of misclassification determined by this study may still underestimate the number of American Indian children who are misclassified at death.

Deaths due to injuries were less likely to be misclassified than deaths due to other causes. Deaths occurring outside of the hospital are likely to be investigated, which may have led to greater accuracy. Overall rates of misclassification may be higher in California because of the heterogeneity of the population and the large number of American Indians with Hispanic surnames. Almost two thirds of the 310 000 American Indians in California reside in urban counties, where misclassification of Indian race is much more likely to occur.

Underreporting of deaths among American Indian populations may affect the way state health care resources are allocated. County agencies may need to provide additional education to persons responsible for race classification of health data to improve reporting accuracy. The

Indian Health Service recently conducted a nationwide study of racial misclassification using its patient registration files to identify deaths of American Indians in all age groups. These studies will alert health care agencies to the need to reevaluate funding and resources for health programs serving American Indian children. □

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