Great Plains Sociologist

Volume 10 | Issue 1 Article 4

1997

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Abstract

The infant mortality among Indian people living on the Northern Plains reservations (18.4 per 1,000) is nearly double that of the U.S. infant mortality rate (9.8 per 1,000). Data were collected for 19 reservations through the Healthy Start Program established to combat this problem, using the reservation as the unit of analysis. Relationships were hypothesized between reservations with high infant mortality rates and high alcohol consumption, tobacco use, poverty levels, and low availability of certain social services. The analysis substantiated only one major variable--poverty. Further analysis suggested that mortality rates were higher on reservations that did not provide social support programs such as smoking cessation, child care, substance abuse, or family planning. The authors contend that the causes of high infant mortality in this area are more social than medical in nature.

INTRODUCTION

Mortality among the minority population in the United States is a problem which weighs heavily on Americans. This is especially true among American Indians, for whom the overall mortality rate ranged between 21.0 and 22.9 per 1,000 between 1980 and 1990, while the white rate held steady at 9 deaths per 1,000 of the population (Snipp, 1996). Infant deaths among the American Indian people continue to rise from the 1990 rate of 18.4 per 1,000. This is nearly double that of the U.S. rate of 9.8 per 1,000, which continues to decline. (For example, the 1995 infant mortality rate for Minnesota is down to 7.0 per 1,000.) Furthermore, the postneonatal death rate is about 40 percent higher for American Indians than it is for the U.S. population as a whole (Bachman, 1992). The literature contains a number of explanations for the deaths of this excess number of infants: political, medical, and social/environmental conditions are all blamed. Although most of the literature points to medical causes of infant mortality, we make a case that the emphasis should shift to social/environmental causes and suggest imperative policy changes.

The argument is based on a secondary analysis of data gathered for a report prepared for the Interagency Committee on Infant Mortality and the Office of Healthy Start Resources and Services Administration in Rockville, Maryland. This report was part of an application for the Healthy Start Program, and focused on a 19 Indian reservation service area in the Northern Great Plains. The Northern Plains Service Area (NP) encompasses four states (see Figure 1). This project area is recognized

geographically by the Indian Health Service, as well as by the Tribal Nations and Indian people. The reservation communities are acknowledged as rural sites and designated as frontier and health professional shortage areas.

The primary goal of the Healthy Start Program was to reduce infant mortality by 50 percent over a period of five years. In the application, Smith (1992) described the assumptions of these efforts. This initiative respected the intricacies of the complex interactions between the social, emotional, physical, and spiritual environments of a family and their newborn infant. The basic institution of American Indian society is the family, and the most fundamental part of this unit is the role of the woman. She is referred to by traditional people as the center pole in the tripod used in the erection of the tepee, the outside covering represents the man, and the pegs surrounding and holding it down represent the children. Over the past decades a subjective sense of dejection and failing spirit has eroded the general health and well-being of Indian people. A reawakening of personal values through relationships within the family, which begin with each new pregnancy, is fundamental to the needs of the NP Indian people (Smith, 1992).

The 1990 U.S. Census counted 96,411 American Indians residing in the states included in this service area. The median family income was about $11,000, or half of U.S. median household income. The majority of families in the area lived under the poverty level. Census figures also revealed that some of the poorest counties in the U.S. lay within this service area, in South Dakota. On the reservations, economic development lagged far behind that in urban areas. Only 51 percent of Indian children graduated from high school, compared to the national rate of 67 percent. Economic indicators from the service area social programs for 1992, for Indian women of childbearing years showed that 37 percent were enrolled in Medicaid, 57 percent were receiving Food Stamps and 37 percent were receiving AFDC payments. During pregnancy, when those needs increased, Medicaid enrollment increased, as evidenced by the fact that over half of the 1990 obstetrical deliveries were paid for by Medicaid (Smith, 1992).

In the NP area, the population is younger (median age of 20) than the U.S. general population, and is growing at a much faster rate. There are 23,028 Indian women of childbearing age in the area, who contribute to a crude birth rate which is two-and-a-half times higher than the U.S. rate. The three-year average fertility rate (births per 1,000 women of child bearing age) for the NP area is 126, which us around twice the U.S. rate.

The Indian Health Service in the NP area records the infant mortality for American Indians living within this service area. They obtain information from state vital statistics records, which include birth and death certificates which are compiled for the National Center for Health Statistics. According to Smith (1992) there are some important variations within the total spectrum of American Indian infant mortality.

One difference is regional. Infant mortality rates have been consistently higher in the northern tier of states than in the southern states. The second difference has to do with causality. Those conditions associated with low birth weight and short gestation have made a much smaller contribution to all Indian infant deaths than to infant deaths among White or Black Americans. However, rates for other causes are

higher, and these unique factors create the discrepancy in total rates (Smith, 1992).

In the early 1980s, a Perinatal Infant Mortality Review (PIMR) Committee was established in Aberdeen, SD, the seat of the Indian Health Service area for the NP area. This committee had the responsibility of reviewing all infant deaths as to cause and potential preventability. Since infant mortality data are reported for the neonatal period (birth through 28th day) and post-neonatal period (29th through 365th day), useful comparisons can be made. The PIMR committee found patterns indicating that infants in their area were born healthy, went home healthy, and died prior to one year of age (Smith, 1992). This pattern gives initial credence to the thesis that the cause of infant mortality is social/environmental rather than medical.

Smith also reported that one of the most unsettling aspects of the high level of infant deaths and infant health problems was that it appeared that many easily could have been prevented if Indian families fully utilized available medical services. Reasons for under-use are multifaceted, but are often rooted in poverty. Among the most obvious are lack of transportation, lack of child care, and family dysfunction. Personal barriers to medical care include inconsistent providers, lack of privacy, lack of female health care providers, fear of pelvic examinations, and guilt over pregnancy, especially in young women. In the NP area there was a 25 percent deficiency in the recommended well-baby visits after delivery. Poverty, alcoholism, harsh weather, and residence in rural, sparsely populated areas all contributed to the problem, adding to the high loss of Indian babies in this area (Smith, 1992).

A literature review revealed a number of variables which affected infant mortality in general. The variables most often cited include: **access to health care** (Sullivan, 1989; Thouez et al., 1990), **pre-natal care** (Curry, 1990), **socio-economic status** (Rogers, 1984; Rent et al., 1984; Campbell, 1989; Curry, 1990; Wilson, 1991; Smith, 1992), **smoking and alcohol abuse** (Bulterys, 1990; Godel et al., 1992), and **geographic location** Brenneman et al, 1990; Johnson, 1991). In addition, other variables cited are **low birth weight** (Riley, 1986; Griner and Rogers, 1987, Rogers, 1989; Smith, 1992), **fetal alcohol syndrome** (Burd, 1992), **sudden infant death syndrome** (Oyen et al., 1990; Burd, 1992; Smith, 1992), and **accident and injury** (Olson et al., 1990; Smith, 1990). These
factors are interrelated and play a part in the total mortality scenario.

The literature suggested a number of hypotheses which might be tested using the NP data. These hypotheses would be relevant to all populations, however they are being applied to American Indians in this case. The hypotheses included here are:

H1: The greater the percentage of women reporting alcohol consumption during pregnancy the higher the infant mortality rate;

H2: The greater the percentage of women reporting tobacco use during pregnancy, the higher the infant mortality rate;

H3: The greater the percentage of women reporting poverty, the higher the infant mortality rate; and,

H4: The lower the percentage of service availability, the higher the infant mortality rate.

It is important to keep in mind that these data are aggregated at the reservation level.

METHODOLOGY

The main data sources used were the Public Health Departments (Research for Vital Statistics) for the states of Iowa, Minnesota, Montana, Nebraska, North Dakota and South Dakota (documentation for the vital statistics was assisted by Mary Williams-Ahmed, Ph.D). Population characteristics by race/ethnicity were taken from the 1990 Census or most recent data available. State or local departments of Labor or Employment Security, local homeless coalitions, and local planning departments also provided information.

Documentation for services provided by the public programs was collected from the Department of Social Services and Human Services. Each public program, including Medicaid, AFDC, WIC, and Food stamps provided the number of unduplicated recipient American Indians for county for each of the service areas within delimited geographical boundaries of the six states involved. Eligible recipients refers to American Indians who applied for assistance and were approved for the public assistance program and therefore were listed in the Department of Public Health program files as recipients during that year. To be eligible, recipients must be within the income eligibility guidelines (at or below 185 percent of poverty level) and have a nutrition-related or medical risk.

A needs assessment was required from each of the 19 service areas for the Healthy Start application. Each needs assessment included health care related services with documentation of services reported by the Indian Health Service Data Processing Center in Albuquerque, New Mexico. Locally, the reports were prepared by the Aberdeen Area Office. The data reported described health care related services provided to American Indians by the Indian Health Service (IHS), and health care vendors (contract care providers) rendering health services during 1990. The IHS reports included information on ambulatory-outpatient, contract health service-outpatient, contract health services inpatient hospital care (non-IHS), and IHS direct inpatient care. This information was important in determining the type of services and availability of those services to pregnant women and infants in the NP area.

The summary of infant (0 to 12 months) immunizations were submitted by the Aberdeen Area office of Epidemiology for 13 of the 19 service areas. Maternal and infant health risk status was taken from vital statistics reports and birth and death certificates, hospital records, birth defect registries, hospital records, and special studies. Also included in the needs assessment is a list of community assistance programs thought to be necessary for healthy family live on the reservations. Each community coordinator reported the availability of family oriented counseling, transportation, child care programs, teen pregnancy programs, programs for male teens, alcohol treatment, substance abuse treatment (non-alcoholic), and smoking cessation programs.

Finally a summary of problems, concerns, and issues of the community

residents on each reservation was included in the needs assessment. This report was designed to provide information about the service area, and was gathered by community coordinators trained to conduct these meetings. Focus groups were used to list the problems in order of perceived importance for the needs assessment.

FINDINGS

The following descriptive information depicting the NP reservations is reported in a three-year format for 1988-1990. In summary, the profile of this population reveals that over the three year period there were 8703 births and 160 infant deaths. The mortality rate ranged from 15.3 in 1988 to 20.5 in 1989 (see Table 1). The majority of babies were born to women in the 20-34 year age group. SIDS is the leading cause of death, accounting for the loss of 58 (36%) infants over the period covered, followed by congenital anomalies in 23 (14%) of the deaths (Table 2). A curious fact is that in 46 (29%) of the cases, mortality was classed as "other," suggesting that these were not commonly occurring causes of infant mortality. Furthermore, in this time frame, neonatal and post-neonatal deaths did not decrease at any noticeable rate.

Table 1: **Births, Deaths, and Infant Mortality Rates for 19 Reservation Service Areas, 1988-90**

Year	*Births*	*Deaths*	*Infant Mortality Rate*
1988	2885	44	15.3
1989	2976	61	20.5
1990	2842	55	19.4
3 Year Total	8703	160	19.1

Up to half of the women did not enter into prenatal care until the second trimester or beyond, and 113 women **never** received prenatal care. Health risks were clearly evident, and in some cases occurred at very high levels among the women. One third reported tobacco use during pregnancy. Also, many of the reservations reported women with other health risk indicators such as hypertension, diabetes, low weight gain, anemia, herpes, and previous pre-term infants. There are a few bright spots in an otherwise bleak scenario. Several reservations with early entry into prenatal care figures do show low infant mortality rates. Also, the data indicate that births to the younger, high risk groups, are decreasing.

The hypotheses listed above regarding the relationship between infant mortality and relevant characteristics of women on the 19 reservations were tested. dependent variable, infant mortality rate for 1990 was computed as the number of infant deaths / number of births * 1000. Since this is population data and not a random sample, statistical significance probabilities are not reported. Also, caution must be exercised in this aggregate data analysis, where the unit of analysis is the reservation, not individual women.

In the first and second hypotheses, regarding alcohol and tobacco use, slight negative correlations were found (see Table 3). When examining the scatter plots for these correlations, it was clear that several outliers created by reservations with very small population bases skewed the distribution.

Table 2: **Causes of Infant Death, 1988-1990 Totals for 19 Reservations**

Fertility/Mortality	*3 Year Totals*
Births	8703
Deaths	160
Respiratory Distress	5
Congenital Anomaly	23
Complications of Labor/Delivery	4
Sudden Infant Death Syndrome	58
Prematurity/Low Birth Weight	10
Accidental Injuries	11
Infections	3
Other	46
Neo-natal ((< 28 days))	64
Post-neo-natal (>28 days)	96

Thus we are not suggesting that lack of support for these hypotheses can be interpreted that alcohol and tobacco use are not harmful to pregnancies, but that we could not demonstrate it with these data. One explanation could be related to the fact that these two variables are measured on self-report data, and are under reported.

In testing the third hypothesis, poverty was operationalized as births paid for by Medicaid. This seemed a valid measure since to be eligible, the recipient must be 180 percent below the poverty level. There was a moderately strong

relationship (r=.426) between poverty and the dependent variable of infant mortality. Since the poverty measure was based on official records, we can be reasonable certain that levels of poverty provide an important predictor of infant mortality.

Finally, the availability of six different service programs was compared with infant mortality rates. A comparison of group means for infant mortality was made to demonstrate the differences between service availability to pregnant women and their families and levels of infant mortality. The availability of family planning services was not found to be associated with reduced mortality. However, each of the other five programs are correlated with reduced infant mortality. The availability of teen pregnancy programs, male teen programs, and substance abuse programs were all correlated with lower infant mortality rates. Moreover, the availability of child care and smoking cessation programs are related to substantially lower infant mortality rates.

Table 3: **Correlation Coefficients for Hypotheses**

Variable	*r*
Alcohol use during pregnancy	-.267
Tobacco use during pregnancy	-.187
Poverty	.426

Unfortunately, firm conclusions cannot be drawn from the data presented here, due to several limitations. These include the aforementioned difficulties with aggregate data analysis, the relatively small population size, and the fact that numerators for the dependent variable were very small in several cases, skewing the results. However, the detailed enumeration of these social (not medical) factors related to infant mortality do lead us to some interesting conclusions.

Perhaps the most insightful observation made from the formation of this data set came from the community meetings held in the early planning stages, where citizens were asked to list and rank order the concerns of the community as they saw them. Several categories emerged from these open-ended responses. In order of importance, these categories included: alcohol, infant health care concerns, general health care concerns, transportation, drug and substance abuse, teen pregnancy, education, cultural issues, child care, lack of patenting skills, unemployment, community apathy, lack of programs for youth, sex education and family planning, domestic abuse and violence, no health care facility, low self-esteem, irresponsible male teens, unstable tribal government, and, finally, lack of housing.

The most vital piece of information taken from these community statements has to do with what was **not** overtly reported as a community problem. Infant mortality, and the leading causes of it was conspicuously absent from these community listings. Only one of the 19 reservations recorded a concern for any of the causes of infant mortality, which included SIDS, congenital abnormality, complications of labor

and delivery, respiratory distress, prematurity/low birth weight, accidents and injuries, infections, and others. Community members must identify causes of infant mortality if they are to participate in reducing its prevalence in their midst.

DISCUSSION AND POLICY IMPLICATIONS

This analysis did substantiate one predictor affecting infant mortality which was cited in the literature, although many of the hypothesized predictors were prevalent in the population. A large portion of women lived below poverty levels and poverty may easily be linked to other causal variables.

In the case of this population, poverty is a social fact that can be ameliorated somewhat by the mother's behavior. A woman who is living at 180 percent below the federal poverty guidelines is likely to be eligible for services which will benefit her and her pre-or post-natal infant, and may be educated to that fact. Awareness of the outcome of not using these services is a major concern. Since poverty levels ranged from 28 percent to 100 percent in the Northern Plains, educational efforts must be expanded to encourage participation.

Smoking, while not strongly confirmed as problematic by this analysis, is another behavior which can be changed. Percentages reported for the various reservations ranged up to 61 percent, which is substantially higher than in the general population. An addictive behavior such as smoking may be more likely to be altered if the parents are made aware of the damage smoking can do to the fetus, and the effects of second hand smoke on the newborn baby. As difficult as it may be, family support and smoking cessation programs may be influential in encouraging pregnant women to quit using cigarettes. Much of the same can be said about alcohol use, which has been clearly linked to Fetal Alcohol Syndrome. Alcohol may not be a direct cause of mortality, but which certainly has other negative effects on children.

Poverty, smoking, and drinking rates were high enough to cause any policy maker to recommend enhancement of programs to address these issues. Overall, the educational attainment levels were low, and a majority of the mothers who lost infants were single. These are the social facts of an environment which can be altered through addressing the behavior of the mother through the support of the community.

The type of education which is culturally relevant to pregnancy and child care is clearly not available on all reservations. These services now exist on a limited basis, and the data examined suggest that where they do not exist, there are higher levels of infant mortality. There were only nine reservations offering teen pregnancy programs. Only seven reservations offered educational programs for young men about their contribution in preventing conception or assisting in a safe outcome of childbirth and child-rearing. Only five of the reservations listed availability of family planning services. Without an effort to provide and encourage utilization of these services, infant mortality rates will continue to remain high.

Another concern, although not substantiated with these data, is trimester of entry into prenatal care. It does appear, however, that reservations that indicated the lowest rates of infant mortality did have a high percentage of mothers who entered prenatal care in the first trimester. This choice is important since it is during the first trimester when important development takes place, and maternal behavior can

seriously impair this development. During this time medical personnel can play an important role in educating the mother about healthful behavior necessary to meet the needs of the unborn child.

Clearly, policy recommendations are in order. We have shown that infant mortality is a problem; in the NP area the rate is twice the national average. A clear picture of health issues, demographic characteristics, and behaviors which are related to high rates of infant mortality has been provided. Logic dictates that programs of intervention are crucial to reducing infant mortality. In fact, some action has been taken through the creation of programs at the national level like Healthy Start. However, the review of this material suggests that an agenda for action must also take place at the community level for success to be insured. Each individual community must clearly recognize specific needs and develop programs around those needs.

There must be more knowledge delivered at the community level, through education, about the fact that infant mortality is a problem on individual reservations. Many clinics, doctors offices, WIC offices, or other public places display posters about health issues; posters should also be designed to inform the reservation public about infant mortality rates. If reservation residents advertised the leading causes of infant mortality and the risks associated with them in the same manner that AIDS awareness has been promoted, communities could see the need for actions supporting the reduction of infant mortality.

American Indian culture places much value on children in general. The focus must shift from attention solely on the well child, to include encouraging the behaviors that bring the child into the world, and keep that child well, from conception to adulthood. In valuing the unborn fetus as much as the well child, support network in the community need to help the pregnant woman and her family. Programs can be developed to increase the self-concept, self-esteem, and problem-solving skills of women. If a woman smokes, is told of the health risk to her and her unborn fetus, and wants to quit, a community based program can help her.

Indian women must be empowered--given the skills to take control of their lives. The reservation community can play a significant role in this process. Culturally relevant education programs supported by community involvement can give American Indian women these skills. Education programs filled with insight from the appropriate American Indian cultural point of view can be made available to both reservation residents and health care providers. Empowering a woman with high levels of self-worth is an important goal, but teaching her non-Indian doctor how to interpret her behaviors in a culturally relevant way is just as worthy.

Families are the main source of support on most reservations. Thus families should be used as the focus of such programs. Family counseling sessions to inform the husbands, parents, grandparents, and boyfriends of appropriate pre- and post-natal behaviors may be most helpful. The program that includes family members could suggest remedies for inappropriate behaviors, and enhance the status of the young mother.

Finally, the idea of hopelessness and passivity must be overcome. There is hope that the reservation communities can implement programs that will bring about change. It may seem a hopeless task if reservations wait for official action. One concerned individual in a community can bring about change, one mother who wants

her grandchild to be born without life threatening birth defects; one grandmother who does not want her granddaughter to make the same mistakes she made; one father who wants his child to be a better parent than he was; or one sister who did not know that her second-hand smoke could cause respiratory distress in her new niece or nephew. These individuals are all potential agents of change who could be mobilized with a creative agenda for action.

References

Bachman, Ronet. 1992. *Death and Violence on The Reservation.*New York, NY: Auburn House.

Brenneman, George, Craig Vanderwagen, and John Porvazik. 1990. "Infant Mortality Among American Indian and Alaska Native Populations: Successes and Challenges." *Children Today* 19(2):21-24.

Bulterys, Marc. 1990. "High Incidence of Sudden Infant Death syndrome Among Northern Indians and Alaska Natives Compared With Southwestern Indians: Possible Role of Smoking." *Journal of Community Health* 15: 185-194.

Bulterys, Marc, Hal Morgenstern, Thomas K. Welty, and Jess F.Kraus. 1990. "The Expected Impact of a Smoking Cessation program for Pregnant Women on Infant Mortality Among Native Americans." *American Journal of Preventive medicine* 6(5):267-273.

Burd, Larry. 1992. "Reducing Indian Infant Mortality in the Aberdeen Area of Indian Health Service."Unpublished Paper, University of North Dakota School of Medicine.

Burd, Larry. 1992. "Prevention of Fetal Alcohol Syndrome."Unpublished Paper, University of North Dakota School of Medicine.

Campbell, Gregory R. 1989. "The Changing Dimension of native American Health: A Critical Understanding of Contemporary Native American Health Issues."*American Indian Culture and Research Journal* 13(3&4):1-20.

Campbell, Gregory R. 1989. "The Political Epidemiology of Infant Mortality: A Health Crisis Among Montana American Indians." *American Indian Culture and Research Journal* 13(3&4): 105-148.

Curry, Mary Ann. 1990. "Factors Associated With Inadequate Prenatal Care." *Journal of Community Health Nursing* 7(4):245-252.

Godel, John C., Henry F. Pabst, Phyllis E. Hodges, Karen E.Johnson, Glory J. Froese, and Michel R. Joffres. 1992."Smoking and Caffeine and Alcohol Intake During Pregnancy in a Northern Population: Effect on Fetal Growth." *Canadian Medical Association Journal* 147(2):181-188.

Griner, Eve Powell and Richard G. Rogers. 1987. "Strong Compounding Effects of Multiple Risks During Pregnancy on Birthweight and Infant Survival." *Sociology and Social Research* 72:49-54.

Johnson, Kay. 1991 August. "Infant Survival in Rural America." Available from March of Dimes Birth Defects Foundation, National Office, 1275 Mamaroneck Avenue, White Plains, NY.

MacMiller, P. and M.J. Wilson. 1983. Dictionary of Social Science Methods. Ed. John Wiley & Sons Limited. New York, NY.

Olson, Lorna M., Thomas Becker, Charles L. Wiggins, Charles R. Key and Jonathan M. Samet. 1990. "Injury Mortality in American Indian, Hispanic, and Non-Hispanic White Children in New Mexico, 1958-1982." *Medicine* 30(4): 479-486.

Oyen, Nina, Marc Bulterys, Thomas K. Welty, and Jess F. Kraus. 1990. "Sudden Unexplained Infant Deaths Among American Indians and Whites in North and South Dakota." *Pediatric and Perinatal Epidemiology* 4: 175-183.

Rent, Clyda S., George, S. Rent, and Ferando Bertoli. 1982. Infant Mortality by Socio-Economic Status for Blacks, Indians, and Whites: A Longitudinal Analysis of North Carolina, 1968-1977." *Sociology and Social Research* 68(3): 364-377.

Riley, Richard W. 1986. "Keeping Infants from Becoming Statistics: The Southern States are Making Important Strides." *Public Welfare* 44(4):23-29.

Rogers, Richard G. 1984. "Infant Mortality Among New Mexican Hispanics, Anglos, and Indians." *Social Science Quarterly* 65(3):876-884.

Rogers, Richard G. 1989. "Ethnic and Birth Weight Differences in Cause-Specific Infant Mortality." *Demography* 26(2):335-343.

Smith, Cynthia A. 1992. "Northern Plains Healthy Start Grant Application." Available from: Grant and Management Branch, Maternal & Child Health Bureau, 5600 Fishers Lane Room 18-22, Rockville, MD. 29857.

Sullivan, Deborah A. 1989. "Conventional Wisdom Challenged: Trends in the Infant Mortality of Minority Groups in Arizona, 1976-1986." *Research in the Sociology of Health Care* 8:197-204.

Thouez, Jean-Pierre, Peter Foggin, and Andre Rannou. 990."Correlates of Health-Care Use: Inuit and Cree of Northern Quebec." *Social Science Medicine* 30(1): 25-34.

U.S. Department of Commerce, Bureau of Census. 1992. "Live Births, Deaths, Marriages, and Divorces: 1950- 1990." *Statistical Abstract of the United States*. Government Printing Office, Washington, DC.

U.S. Public Health Service, Centers for Disease Control, National Center for Health Statistics. 1988. "Vital Statistics of the United States 1988." Vol. I-III: Rockville, MD. and Atlanta, GA.

U.S. Public Health Service, Centers for Disease Control, National Center for Health Statistics. 1989. Various annual vital statistics reports compiled from vital statistics transmitted from each state.

U.S. Public Health Service Aberdeen Area Indian Health Service. 1990. "Chart Book Series, October, 1990." Aberdeen, SD.

U.S. Public Health Service, Indian Health Service. 1991. Trends In Indian Health. "Chart Series, 1991." Rockville, MD.

Wilson, Ann L. 1990. "The State of South Dakota's Child:1990." *South Dakota Journal of Medicine* 44: 17-32.

Wilson, Ann L. 1991. "The State of South Dakota's Child:1991." *South Dakota Journal of Medicine* 45: 13-22.