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Mortality Patterns Among the Youth of a Northeastern American Indian Cohort

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Synopsis ....

Mortality patterns prevalent among American Indian youth have not been well documented. This investigation reports on mortality patterns among the Seneca Nation of Indians from January 1, 1955, through December 31, 1989. The study co- hort consisted of 3,033 Seneca tribal members born during the study period. Deaths occurring among cohort members younger than age 25 were identi- fied through a computer match against New York State vital record files. Sex-specific standardized mortality ratios were calculated on the basis of mortality patterns exhibited by the general popula- tion of New York State, exclusive of New York City.

Males exhibited significantly elevated mortality for all causes combined, for deaths due to all accidents combined, for motor vehicle accidents, and for suicide. Females demonstrated significantly elevated mortality from all accidents combined, for motor vehicle accidents, and for all other types of accidents. Age-specific mortality patterns also var- ied both by sex and by calendar time.

These findings are important to consider in the design of programs aimed at reducing premature mortality among American Indian populations from preventable causes of death.

While progress has been made in the understanding of mortality patterns among adult American Indian populations, relatively little is known concerning mortality patterns prevalent among American In- dian youth. Adult American Indians, in compari- son with the general population, typically exhibit elevated mortality from unintentional injuries, cir- rhosis, suicide, pneumonia, and complications of diabetes, as well as deficits in mortality from heart disease and most cancers (1). Some of these repre- sent changed mortality patterns among adult Indi- ans over the past few decades, with some causes of death increasing and others decreasing (2,3). The question remains as to whether the temporal mor- tality shifts experienced by Indian adults have also occurred among Indian youth. In an effort to begin to answer these questions, we conducted a dynamic cohort study among the Seneca Nation of Indians (SNI) for the years 1955 through 1989.

Materials and Methods

A retrospective cohort study design was em- ployed to examine childhood and young adult mortality patterns among the SNI from January 1, 1955, to December 31, 1989. This methodology was used successfully in our previous investigations of patterns of mortality in the SNI (2). The study cohort was composed of members of the Seneca Nation born between 1955 and 1989 and identified as residents of New York State. The SNI is a matrilineal society with membership conferred at birth. SNI tribal roll books were used in assembling the current cohort. The entire cohort consisted of 1,550 males and 1,483 females, yielding a total cohort size of 3,033.

Endpoints for person-years calculations were at- tainment of age 25, date of death, or survival to end of followup. Age 25 was set as the cut-off

Table 1. Standardized mortality ratios (SMR) among members of the Seneca Nation of Indians, ages 0–24, 1955–89

Cause of Death and ICD category	Sexes Combined			Males			Females		
	Observed	SMR	95 percent CI	Observed	SMR	95 percent CI	Observed	SMR	95 percent CI
All causes (001–999)	74	144	113,180	47	149	109,196	27	136	89,197
Infectious diseases (001–139)	3	329	68,961	1	200	5,1,111	2	488	59,1,761
Malignant neoplasms (140–208)	5	166	53,387	3	168	34,491	2	164	20,592
Pneumonia and influenza (480–487) ..	6	273	100,594	3	236	48,690	3	323	66,944
Congenital anomalies (740–759)	3	46	9,134	2	57	7,205	1	33	1,183
Perinatal conditions (760–779)........	8	53	23,104	5	57	18,133	3	48	10,140
All accidents (800–949)	31	242	163,345	19	210	126,328	12	319	164,557
Motor vehicle accidents (810–825)	18	390	230,616	12	221	114,386	6	275	101,599
All other accidents (826–949).........	13	250	133,427	7	193	77,397	6	380	139,828
Suicide (950–959)	4	296	80,757	4	370	101,946	0	0	0,1480
Homicide (960–969)	2	192	23,693	2	317	38,1144	0	0	0,975
Other	12	142	73,248	8	162	70,319	4	113	31,289

NOTE: ICD = International Classification of Diseases. CI = confidence interval.

Table 2. Age-specific standardized mortality ratios (SMR) among members of the Seneca Nation of Indians, 1955–89

Age at death (years)	Sexes combined			Males			Females		
	Observed	SMR	95 percent CI	Observed	SMR	95 percent CI	Observed	SMR	95 percent CI
Younger than 1	21	82	51,125	11	74	37,132	10	93	45,171
1–4	16	227	130,369	9	225	103,427	7	230	92,474
5–9	1	26	1,144	0	0	0,178	1	62	2,344
10–14	3	108	22,314	3	175	36,512	0	0	0,373
15–19	12	190	98,332	7	155	62,320	5	279	90,652
20–24	21	358	221,547	17	390	227,624	4	267	73,683

NOTE: CI = confidence interval.

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because of our interest in examining mortality patterns operative throughout childhood and early adulthood. Sex-specific person-years for the study cohort were accumulated over three periods (1955–64, 1965–74, and 1975–89) and were stratified into conventional age categories (younger than 1 year, 1–4 years, 5–9, 10–14, 15–19, and 20–24).

Person-years at risk among SNI cohort members were multiplied by corresponding sex-specific, age-specific, and calendar year-specific New York State mortality rates, exclusive of New York City, to yield expected numbers of deaths during the study period. Calendar year-specific New York State mortality rates were based on the average of the 3-year period around the midpoint of each period. New York State mortality data were garnered from the New York State Bureau of Biometrics.

Since all cohort members were New York State residents, a computerized roster was transmitted to the New York State Department of Health for a computer match against death certificates. The department provided information on date and cause of death of cohort members. The accuracy of all potential death matches was manually verified for each death. Underlying cause of death reported on the certificate of death was transmuted to the ninth revision of the International Classification of Diseases (ICD-9) (4). Mortality data for New York State, used in the calculation of expected numbers of deaths, was transmuted by the same method.

Sex- and age-standardized mortality ratios were calculated by dividing the number of observed deaths by the number expected. The number of

observed deaths in this population was presumed to follow a Poisson distribution, given the expected rates of mortality and the size of the cohort under study. Ninety-five percent confidence intervals (CI) were calculated for each standardized mortality on the basis of published tables of significance (5). The standardized mortality ratio (SMR) was considered to be significant if its 95 percent CI did not include 100.

Results

There were approximately 86 entrants into the cohort each year of the study. New York State death certificate information was obtained for a total of 74 SNI members (47 males and 27 females) identified as having died prior to reaching age 25. Males in the cohort were almost twice as likely as females to die before age 25.

Table 1 presents SMRs, sexes combined, among the SNI for the period 1955 through 1989. Overall, all cause mortality was significantly elevated as well as mortality from pneumonia and influenza, all accidents combined, motor vehicle accidents, and all other accidents. Table 2 demonstrates that age-strata specific mortality was found to be significantly elevated for the 1–4 age group and the 20–24 group. Sex differences were observed in relation to cause- and age-specific mortality and are discussed subsequently.

Males. Age-and sex-standardized mortality ratios among SNI males for the period 1955–89 also are shown in table 1. The standardized mortality ratio for all causes of death combined was significantly elevated among males. Significant elevations in cause-specific standardized mortality ratios also were observed for deaths from all accidents combined, motor vehicle accidents, and suicide. Table 2 reflects that SNI males were also found to have significantly elevated mortality at ages 1–4 years and 20–24 years.

Females. Age-and sex-standardized mortality ratios among SNI females for the period 1955–89 are presented in table 1. The standardized mortality ratio for all causes of death combined among females also was elevated but not significantly. Significant elevations in cause-specific standardized mortality ratios were observed for deaths due to all accidents combined, motor vehicle accidents, and all other types of accidents. As noted in table 2, SNI females were found to have significantly elevated mortality in the 15–19 age group.

Leading causes of mortality, by percentages, of members of the Seneca Nation of Indians, ages 0–24, 1955–89
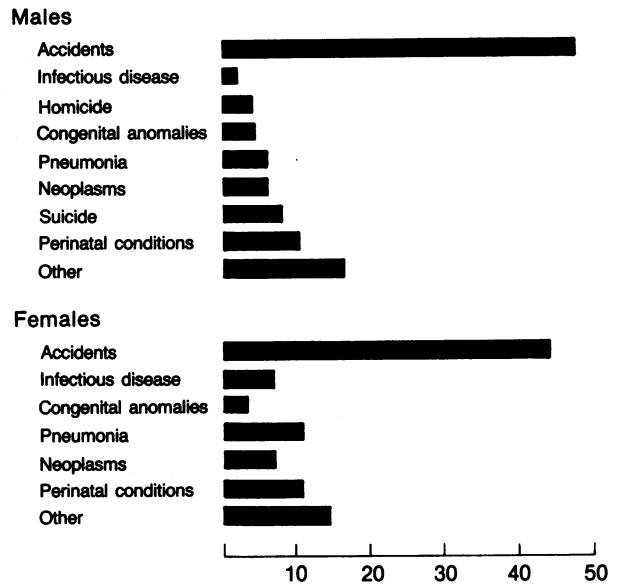
Discussion

Mortality patterns operative among younger Senecas share certain similarities with those experienced by older tribal members. Previous investigations of mortality among the SNI, excluding the current cohort, demonstrated elevated mortality from all causes combined as well as from pneumonia, diabetes, accidents and several other causes (2). Similar to adult mortality patterns, younger tribal members experienced elevated, albeit nonsignificant, mortality from infectious diseases and significantly elevated mortality from accidents and injuries. Unlike older members, younger Indians did not experience elevated mortality from diabetes, nor deficits in cancer mortality. Caution, however, must be employed in the interpretation of these findings in light of the small sample size that precludes over-generalization.

Differences in sex-specific causes of mortality through early adulthood (ages 0–24) are illustrated in the chart. It is noteworthy that more than half of all the deaths may be deemed preventable. Deaths due to accidents and injuries accounted for 42 percent of all deaths. Of all Seneca deaths in this study, 75 percent of those among persons ages 15–19 were the result of accidents and injuries; in ages 20–24, it was 57 percent. In the general population, 58 percent among ages 15–19 are from accidents and injuries; among ages 20–24, it was 54 percent.

The majority of all these deaths were motor vehicle related. Among Senecas ages 15–19, approximately 67 percent were from motor vehicle accidents; among the general population, 74 percent. Among 20–24-year-old Senecas, 83 percent of all accidental deaths were from vehicle accidents; in the general population, 75 percent. More than one-third (37.5 percent) of all Seneca deaths occurring in ages 1–4 were attributable to accidents and injuries (30 percent in the general U.S. population).

Patterns of mortality were somewhat different, however, for the youngest tribal members. The major causes of mortality for Senecas younger than age 1 were perinatal conditions (33 percent) and infectious diseases (14.3 percent). Deaths due to accidents in this group accounted for 9.5 percent of all deaths, 2.6 percent in the U.S. population.

Patterns of mortality among the Senecas are similar to mortality patterns prevalent among other Native Americans. Indian Health Service data indicate that among Native Americans age 1 to 14, accidents are the most common cause of death (27.5 per 100,000 versus 14.8 for all races in the United States) (6). The mortality rate among American Indians ages 15 to 24 is 88.6 per 100,000, compared with 51.2 for all races.

The most striking observation in this study is the continued toll exacted by such preventable causes of death as accidents and injuries. Our findings are in general agreement with those reported in the literature on other American Indian groups. Olson and coworkers reported that American Indian children (ages 0–14) in New Mexico, of the three major ethnic groups studied, experienced the highest mortality rates from all external causes combined (7). They reported that one-third of all deaths occurring among Indians ages 0–14 were due to motor vehicle accidents. Morrison and coworkers, in their study of infant mortality on Canadian Indian reserves from 1976 through 1983, reported similar excess mortality from accidents (8). They reported a significantly elevated SMR of 6.03 for neonates and an elevated SMR of 3.83 for postneonates. Hislop and coworkers in their mortality study of

British Columbia Natives observed that death due to accidental causes was 4 to 5 times as common among Natives ages 0–19 years compared with non-Natives (9).

American Indians represent a relatively young population in the United States compared with the general population as a whole. The median age for Natives in reservation States is 24.4, compared with 32.9 for the general U.S. population. This stems both from higher Indian fertility rates and from significantly excess mortality in American Indians younger than age 45 (10). In general, many of our findings support previous reports for the U. S. population as a whole that identify unintentional injuries (primarily motor vehicle deaths), homicides, and suicides as the three leading causes of death among adolescents and young adults (11).

Many explanations have been advanced to account for the apparent excesses in mortality from motor vehicle accidents among American Indians. Native Americans reside primarily in rural areas where residents are known to experience significantly elevated mortality from motor vehicle accidents compared with their urban and suburban counterparts (12). Reasons for this disparity include more poorly paved roads, lack of guard rails, higher speed limits, greater use of utility vehicles, and underuse of seatbelts. Rural residents also are more likely to have an increased number of occupants in each vehicle (13). Mahoney, in his review of motor vehicle related deaths among New York State American Indians, noted that 55 percent occurred in rural areas as opposed to 31 percent among non-Natives in rural areas (14). Moreover, in his review of available autopsy data, he discovered that 77 percent of those who died had detectable levels of alcohol in their blood at the time of the fatal accident. In their review of circumstances surrounding deaths in Canadian Natives, Jarvis and Boldt reported that 78.6 percent of Natives dying in motor vehicle accidents were under the influence of alcohol at the time of death (15).

In terms of childhood mortality, unintentional injuries have replaced infectious diseases as a leading cause of death in the U. S. population. Motor vehicle crashes were the leading cause of injury among children in the period 1970–90, despite the fact that deaths from vehicle accidents among children ages 1–4 were down 41 percent and among children ages 5–14 down 31 percent primarily because of the use of car seats and seatbelts (11). One explanation for the relatively low number of deaths for children in the 5–9 age group may be

the decreases in injury-related deaths from drownings, fires, falls, and poisonings attributable to greater protective mechanisms and consumer awareness. At the same time, such things as penicillin and vaccines were controlling mortality from infection.

For infants younger than age 1 there has been a general decrease in deaths from preventable infectious diseases such as mumps, measles, rubella, and polio, with Sudden Infant Death Syndrome (SIDS) accounting for the largest proportion of postneonatal deaths. While Native Americans tend to experience greater mortality from SIDS, not a single SIDS death was observed in our cohort, quite surprisingly. Infant mortality rates, despite exhibiting a decline since 1950, continue to be higher for Native Americans than for whites (11).

Findings from this study underscore the need to develop more responsive programs among Native populations to reduce premature mortality from accidents and injuries. Health promotion strategies, especially encompassing healthy lifestyle choices, must be implemented if we are to ameliorate the burden imposed by these preventable deaths. For whatever reasons, based on data from the current study and that reported in the literature, Native populations continue to experience a greater risk of death from accidents and injuries than the general population.

References ....

1. Vital statistics of the United States. National Center for Health Statistics, Hyattsville, MD, 1981.
2. Mahoney M. C., et al.: Mortality in a Northeastern Native American cohort, 1955-1989. Am J Epidemiol 129: 818-826, 1989.
3. Nakamura, R. et al.: Excess infant mortality in an American Indian population, 1940 to 1990. JAMA 266: 2244-2248, Oct. 23-30, 1991.
4. Manual of the international statistical classification of diseases, injuries and causes of deaths, ninth revision. World Health Organization, Geneva 1977.
5. Bailar, J. C., and Ederer, F.: Significance factors for the ratio of a Poisson variable to its expectation. Biometrics 20: 639-643 (1964).
6. Trends in Indian Health, 1990. Indian Health Service, Rockville, MD.
7. Olson, L. M., et al.: Injury mortality in American Indian, Hispanic, and non-Hispanic white children in New Mexico, 1958-1982. Soc Sci Med 30: 479-486 (1990).
8. Morrison, H. I., Semenciw, R. M., Mao, Y., and Wigle, D. T.: Infant mortality on Canadian Indian reserves 1976-1983. Can J Public Health 77: 269-273 (1986).
9. Hislop, T. G., Threlfall, W. J., Gallagher, R. P., and Band, P. R.: Accidental and violent deaths among British Columbia Native Americans. Can J Public Health 78: 271-274 (1987).
10. Trends in Indian Health, 1992. Indian Health Service, Rockville, MD.
11. Health, United States, 1989 and prevention profile. DHHS Publication No. (PHS) 90-1232. National Center for Health Statistics, Hyattville, MD, 1990.
12. Baker, S. P., Whitfield, R. A., and O'Neil, B.: Geographic variations in mortality from motor vehicle crashes. New Engl J Med 316: 1384-1387, May 28, 1987.
13. Regional variation in mortality from motor vehicle accidents. Stat Bull Metrop Insur Co 68: 26-31 (1987).
14. Mahoney, M. C.: Fatal motor vehicle traffic accidents among Native Americans. Am J Prev Med 7: 112-116 (1991).
15. Jarvis, G. K., and Boldt, M.: Death styles among Canada's Indians. Soc Sci Med 16: 1345-1352 (1982).