Heart Disease Mortality Among Alaska Native People, 1981–2007

Janet M. Johnston, PhD, MPH[a]
Gretchen Ehrsam Day, MPH[b]
Mark A. Veazie, DrPH[c]
Ellen Provost, DO, MPH[b]

SYNOPSIS

Objectives. Historically, Alaska Native (AN) people have exhibited low overall rates of heart disease mortality compared with the U.S. white (USW) population. We compared AN and USW heart disease mortality rates during the 27-year period from 1981 through 2007.

Methods. We compared AN and USW heart disease mortality rates overall and by gender, age, and disease subtype. We calculated age-adjusted rates for AN people for three nine-year periods from 1981 through 2007 and compared them with the rates for USW people.

Results. AN people ≥35 years of age had a significantly lower rate of heart disease mortality compared with their USW counterparts (rate ratio [RR] = 0.80). The lower overall RR was due primarily to a lower ischemic heart disease mortality RR (RR=0.63). Overall heart disease mortality decreased during the 27-year study period for both the AN (33.1%) and USW (35.0%) populations. However, hypertensive heart disease mortality increased 155.2% for AN people and 13.7% for USW people. Age-specific heart disease mortality was about 30.0% lower for AN people ≥75 years of age compared with their USW counterparts, while it was virtually identical for the two racial/ethnic groups among people 35–74 years of age.

Conclusions. The age-adjusted AN heart disease mortality rate was consistently about 20.0% lower than the USW rate from 1981 through 2007, with similar RRs for men and women. However, combining all ages and all heart disease subgroups into a single, age-adjusted statistic obscures many important differences across ages and disease subtypes.

[a]Department of Health Sciences, University of Alaska Anchorage, Anchorage, AK

[b]Alaska Native Epidemiology Center, Division of Community Health Services, Alaska Native Tribal Health Consortium, Anchorage, AK

[c]Native American Cardiology Program, Indian Health Service, Flagstaff, AZ

Address correspondence to: Janet M. Johnston, PhD, MPH, Department of Health Sciences, University of Alaska Anchorage, 4500 Diplomacy Dr., Anchorage, AK 99508; tel. 907-786-6522; fax 907-786-6572; e-mail <afjj5@uaa.alaska.edu>.

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In the 1950s, heart disease accounted for a small proportion of deaths among Alaska Native (AN) people. Infectious diseases and injuries were the major causes of death, and life expectancy was short.[1] During the second half of the 20th century, life expectancy increased, and infectious-disease mortality dropped to less than 2% of all deaths. With the aging of the population, however, chronic diseases such as cancer and heart disease have become the leading causes of death (CODs). For the period 1999–2003, heart disease was the second leading COD for AN people after cancer.[2] Among U.S. white (USW) people, the top two CODs were reversed, with slightly more deaths caused by heart disease than cancer.[3]

Our study examined heart disease mortality among AN people for the three most recent nine-year periods (1981–1989, 1990–1998, and 1999–2007), overall and for the following subtypes: ischemic heart disease, heart failure, hypertensive disease, cardiomyopathy, rheumatic heart disease, non-rheumatic valvular disease, and other heart diseases. We report age-adjusted rates for AN people overall, by gender, and by age group (35–74 years and ≥75 years of age). Comparisons were made with similar rates for USW people.

METHODS

Study population

Our population-based heart disease mortality study utilized death certificate data for AN people living in Alaska during the period 1981–2007. AN people include those individuals whose ancestors occupied the geographic area that is now the state of Alaska. Traditionally, under federal reporting systems, the AN population is classified into three major racial/ethnic groups: Aleut, Eskimo, and Indian.

Cause of death

We obtained information on COD from the Alaska Bureau of Vital Statistics, which maintains a database comprised of the data elements recorded on the death certificate of any person dying in Alaska. From this database, we acquired information on AN people who were residents of Alaska and for whom heart disease was listed as the underlying COD in the years 1981 through 2007. Before being released by the state, the COD data from the death certificates were modified by National Center for Health Statistics (NCHS) software to follow the Automated Classification of Medical Entry rules.

We defined AN people as those whose death certificate race/ethnicity codes indicated AN, Eskimo or Canadian Eskimo, Indian or Canadian Indian, Aleut, or a mixture of any of these groups. Among those identified as Indian, there may be a small percentage of individuals from American Indian (AI) tribes of the contiguous United States. Overall, racial/ethnic misclassification of deceased AN people is estimated to be less than 5%.[4]

We identified heart disease deaths based on the underlying COD using the International Classification of Diseases' (ICD) ninth and 10th revision codes for heart disease (ICD-9 codes 390–429 and ICD-10 codes I00–I51). Subgroups of heart disease deaths were defined by the following ICD-9 or ICD-10 codes: chronic rheumatic heart disease (ICD-9 codes 393–398 or ICD-10 codes I05–I09), hypertensive disease (ICD-9 codes 401–404 or ICD-10 codes I10–I13), ischemic heart disease (ICD-9 codes 410–414 or ICD-10 codes I20–I25), non-rheumatic valve disorders (ICD-9 code 424 or ICD-10 code I35), cardiomyopathy (ICD-9 code 425 or ICD-10 code I42), heart failure (ICD-9 code 428 or ICD-10 code I50), and other heart disease (ICD-9 codes 415–423 and 426–429, or ICD-10 codes I26–I34, I36–I40, I44–I49, and I51). We obtained the heart disease mortality data to calculate the rates for USW people (the referent population) from the Centers for Disease Control and Prevention's (CDC's) WONDER database.[5,6]

Data analysis

The fundamental measure of analysis was the mean annual age-adjusted mortality rate for each of the three nine-year periods. The numerators for the AN heart disease mortality rates were the number of heart disease deaths that occurred during the time period. The denominators were calculated as shown in the subsequent paragraph. A single source for denominator data was not available for the entire 27-year study period; however, we used a single source within each nine-year time period.

We obtained bridged race/ethnicity population data for the most recent time period, 1999–2007, from NCHS estimates (2000–2006).[7] NCHS created the bridged race/ethnicity population data to bridge the 31 race/ethnicity categories used in U.S. Census 2000 to the four race/ethnicity categories specified under the U.S. Office of Management and Budget's 1977 Standards for Data on Race and Ethnicity (Asian or Pacific Islander, black or African American, American Indian or Alaska Native, and white). We multiplied these seven years of estimates by 1.29 (nine years divided by seven years) to create estimates for 1999 through 2007. We calculated AN population data for the time period 1990–1998 using bridged race/ethnicity annual totals provided by the Alaska Area Indian

Health Service (IHS).[8] We applied a mean of 1990 and 2000 U.S. Census estimates of AN people by age and gender to the population totals for 1990–1998 to give age- and gender-specific estimates. The same procedure and data sources were used for the time period 1981–1989; however, we applied a mean of 1980 and 1990 U.S. Census figures.

We performed age adjustment by the direct method, using the U.S. 2000 standard population with age groups: 35–44 years, 45–54 years, 55–64 years, 65–74 years, 75–84 years, and ≥85 years. In addition, we calculated mortality rates by age group, gender, heart disease subgroup, and time period. Two age groups (35–74 years and ≥75 years of age) were used for age group comparisons due to the small number of heart disease deaths among AN people younger than age 35. We age-adjusted each group according to the U.S. 2000 standard population using the age groups previously listed.

The nine-year time periods (1981–1989, 1990–1998, and 1999–2007) represented the smallest periods of time for which reasonably stable heart disease mortality rates could be calculated for AN people. We tested change in heart disease mortality rates over time using Mantel-Haenszel Chi-square tests for trend.[9] We calculated the percent change by subtracting the mean annual age-adjusted rate for the earliest time period (1981–1989) from the most recent time period (1999–2007) and dividing by the earliest time period.

We used rate ratios (RRs) to compare the heart disease mortality of AN people with the referent USW population. We calculated 95% confidence intervals (CIs) around the RRs to test for statistically significant differences.[10] We considered rates significantly different if the 95% CI around the ratio did not contain 1. We used StatsDirect® software to calculate the CIs.[11]

RESULTS

Heart disease mortality (ICD-9 codes 390–429 or ICD-10 codes I00–I51)

From 1999 through 2007, 954 AN people died from heart disease in Alaska. The largest proportion of these deaths was from ischemic heart disease (54.3%, n=518), followed by heart failure (8.9%, n=85), hypertensive disease (8.3%, n=79), cardiomyopathy (8.0%, n=76), non-rheumatic valve disorders (4.2%, n=40), and chronic rheumatic heart disease (2.8%, n=27). Among USW people, subtypes of heart disease ranked in identical order, although a larger proportion of deaths were due to ischemic heart disease (69.8%). Heart disease accounted for 14.6% of all deaths among the AN population vs. 29.6% for the USW population.

For the period 1999–2007, the annual age-adjusted heart disease mortality rate for AN people ≥35 years of age (372.6 per 100,000 population) was 20.3% lower than the USW rate (467.6 per 100,000 population). This difference was statistically significant. This pattern was similar for both men (AN: 427.4 per 100,000 population; USW: 577.2 per 100,000 population) and women (AN: 298.6 per 100,000 population; USW: 382.4 per 100,000 population). For both the AN and USW populations, men had higher heart disease mortality rates than women (Table 1).

As shown in Table 2, there was no significant difference between the AN and USW mortality rates for adults 35–74 years of age. However, AN people ≥75 years of age were 29% less likely to die from heart disease than their USW counterparts. This pattern was similar for men and women.

During the 27-year study period (1981–2007), heart disease mortality rates decreased 33.1% among AN people, with a similar 35.0% decline among USW people. This pattern was the same for men and women (Table 1).

Ischemic heart disease (ICD-9 codes 410–414 or ICD-10 codes I20–I25)

As shown in Table 1, AN people had significantly lower ischemic heart disease mortality rates than USW people across all three time periods (mean RR=0.61). Gender-specific rates were also significantly lower among AN people. For both populations, men had higher rates of ischemic mortality than women.

As shown in Table 2, ischemic mortality rates were significantly lower for AN people than for USW people across age groupings as well. However, this difference was more marked for the younger age group than for the older age group (1999–2007: RR=0.79 for those aged 35–74 years, RR=0.55 for those aged ≥75 years). Figures 1 and 2 show age-specific ischemic mortality by 10-year age group for men and women for the most recent time period, 1999–2007.

From 1981 through 2007, ischemic heart disease mortality rates decreased 27.9% among AN people, compared with a decrease of 35.7% among USW people. Decreases were slightly greater among men than women (Table 1).

Heart failure (ICD-9 code 428 or ICD-10 code I50)

As shown in Table 1, AN and USW heart failure mortality rates were similar (AN: 40.7 per 100,000 population; USW: 38.4 per 100,000 population) for the time

Table 1. Annual age-adjusted mortality rates per 100,000 population for heart disease and its subtypes among Alaska Native people (1981–2007) and U.S. white people (1981–2005) ≥35 years of age

Characteristic	*AN total rate (N)*	*USW total rate*	*RR*	*95% CI*	*AN male rate (N)*	*USW male rate*	*RR*	*95% CI*	*AN female rate (N)*	*USW female rate*	*RR*	*95% CI*
All heart disease (ICD-9 codes 390–429 or ICD-10 codes I00–I51)												
1981–1989	556.6 (721)	719.4	0.77	0.72, 0.84	677.3 (447)	939.2	0.72	0.65, 0.80	443.5 (274)	562.7	0.79	0.70, 0.89
1990–1998	470.7 (848)	574.5	0.81	0.76, 0.88	632.7 (535)	732.2	0.86	0.79, 0.95	335.4 (313)	460.0	0.73	0.65, 0.82
1999–2007	372.6 (919)	467.6	0.80	0.75, 0.85	427.4 (517)	577.2	0.82	0.74, 0.90	298.6 (402)	382.4	0.78	0.71, 0.86
Percent change[a]	−33.1[b]	−35.0[b]	NA	NA	−36.9[b]	−38.5[b]	NA	NA	−32.7[b]	−32.0[b]	NA	NA
Ischemic heart disease (ICD-9 codes 410–414 or ICD-10 codes I20–I25)												
1981–1989	285.2 (399)	509.9	0.56	0.50, 0.62	394.7 (278)	687.2	0.57	0.51, 0.65	182.9 (121)	384.3	0.48	0.39, 0.57
1990–1998	239.7 (44)	382.1	0.63	0.57, 0.69	357.9 (317)	505.7	0.70	0.63, 0.80	138.8 (127)	293.5	0.47	0.40, 0.57
1999–2007	205.7 (513)	327.9	0.63	0.57, 0.69	291.9 (318)	425.3	0.69	0.61, 0.78	144.4 (195)	253.9	0.57	0.49, 0.66
Percent change[a]	−27.9[b]	−35.7[b]	NA	NA	−26.0[b]	−38.1[b]	NA	NA	−21.0[b]	−34.0[b]	NA	NA
Heart failure (ICD-9 code 428 or ICD-10 code I50)												
1981–1989	76.6 (78)	35.6	2.15	1.71, 2.71	76.2 (36)	41.1	1.85	1.32, 2.60	77.7 (42)	32.0	2.43	1.77, 3.33
1990–1998	60.8 (86)	35.9	1.69	1.36, 2.11	69.3 (42)	39.2	1.77	1.28, 2.44	54.4 (44)	33.6	1.62	1.23, 2.19
1999–2007	40.7 (84)	38.4	1.06	0.85, 1.32	40.7 (36)	40.5	1.01	0.70, 1.44	40.1 (48)	36.5	1.09	0.83, 1.46
Percent change[a]	−46.9[b]	+7.9[b]	NA	NA	−46.6[b]	−1.5	NA	NA	−48.4[b]	+14.1[b]	NA	NA
Hypertensive disease (ICD-9 codes 401–404 or ICD-10 codes I10–I13)												
1981–1989	11.6 (15)	24.8	0.47	0.27, 0.81	14.5 (11)	26.0	0.56	0.30, 1.05	NC (4)[c]	23.2	NC[c]	NC[c]
1990–1998	13.6 (26)	24.9	0.55	0.36, 0.82	17.6 (15)	25.7	0.68	0.39, 1.20	10.6 (11)	23.4	0.45	0.25, 0.84
1999–2007	29.6 (76)	28.2	1.05	0.83, 1.33	32.0 (41)	28.1	1.14	0.81, 1.61	26.1 (35)	27.1	0.97	0.69, 1.35
Percent change[a]	+155.2[b]	+13.7[b]	NA	NA	+120.7[b]	+8.1	NA	NA	+146.2[d]	+16.8[b]	NA	NA
Cardiomyopathy (ICD-9 code 425 or ICD-10 code I42)												
1981–1989	18.2 (32)	11.7	1.56	1.08, 2.24	25.2 (21)	17.3	1.45	0.92, 2.30	11.9 (11)	7.5	1.59	0.87, 2.91
1990–1998	23.0 (49)	17.9	1.29	0.95, 1.74	38.0 (34)	25.8	1.47	1.01, 2.16	11.8 (15)	12.1	0.97	0.57, 1.65
1999–2007	21.7 (62)	16.1	1.34	1.03, 1.75	32.0 (42)	22.7	1.41	1.00, 1.99	13.3 (20)	11.4	1.17	0.75, 1.84
Percent change[a]	+19.2	+37.6[b]	NA	NA	+27.0	+31.2[b]	NA	NA	+11.8	+52.0[b]	NA	NA
Non-rheumatic valve disorders (ICD-9 code 424 or ICD-10 code I35)												
1981–1989	24.6 (26)	9.2	2.67	1.78, 4.01	24.7 (12)	10.9	2.26	1.25, 4.11	24.6 (14)	8.0	3.06	1.75, 5.35
1990–1998	24.2 (45)	12.9	1.88	1.38, 2.57	26.5 (23)	14.2	1.86	1.17, 2.95	22.4 (22)	11.9	1.88	1.21, 2.90
1999–2007	19.0 (39)	8.8	2.15	1.55, 2.96	21.8 (15)	9.5	2.29	1.32, 3.95	18.5 (24)	8.3	2.23	1.49, 3.34
Percent change[a]	−22.8	−4.3[b]	NA	NA	−11.7	−12.8[b]	NA	NA	−24.8	+3.8	NA	NA

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Table 1 (continued). Annual age-adjusted mortality rates per 100,000 population for heart disease and its subtypes among Alaska Native people (1981–2007) and U.S. white people (1981–2005) ≥35 years of age

Characteristic	*AN total rate (N)*	*USW total rate*	*RR*	*95% CI*	*AN male rate (N)*	*USW male rate*	*RR*	*95% CI*	*AN female rate (N)*	*USW female rate*	*RR*	*95% CI*
Chronic rheumatic heart disease (ICD-9 codes 393–398 or ICD-10 codes I05–I09)												
1981–1989	13.8 (20)	6.0	2.40	1.42, 3.74	NC (8)[c]	4.5	NC[c]	NC[c]	18.5 (12)	7.0	2.63	1.41, 4.88
1990–1998	13.7 (26)	4.2	3.29	2.17, 4.99	NC (9)[c]	3.1	NC[c]	NC[c]	16.5 (17)	4.9	3.37	2.05, 5.54
1999–2007	10.1 (27)	2.4	4.25	2.86, 6.33	8.8 (10)	1.7	5.07	2.53, 10.18	11.4 (17)	2.8	4.06	2.48, 6.62
Percent change[a]	−26.8	−60.0[b]	NA	NA	NC[c]	−62.2[b]	NA	NA	−38.4	−60.0[b]	NA	NA
All other heart disease (ICD-9 codes 415–423 and 426–429 and ICD-10 codes I26–I34, I36–I40, I44–I49, and I51)												
1981–1989	126.5 (151)	122.1	1.04	0.87, 1.23	133.5 (81)	152.2	0.88	0.69, 1.11	119.2 (70)	100.6	1.18	0.92, 1.52
1990–1998	95.7 (172)	97.1	0.99	0.84, 1.16	113.2 (95)	118.5	0.96	0.76, 1.20	80.9 (77)	80.6	1.00	0.79, 1.27
1999–2007	45.9 (118)	45.8	1.00	0.83, 1.21	45.7 (55)	49.4	0.92	0.69, 1.24	44.8 (63)	42.4	1.06	0.82, 1.36
Percent change[a]	−63.7[b]	−62.5[b]	NA	NA	−65.8[b]	−67.5[b]	NA	NA	−62.4	−58.2[b]	NA	NA

[a]Percent change = (rate for 1999–2007 – rate for 1981–1989) / (rate for 1981–1989) × 100, unless otherwise noted.

[b]$p<0.05$

[c]Not calculated due to fewer than 10 deaths

[d]Percent change = (rate for 1999–2007 – rate for 1990–1998) / (rate for 1990–1998) × 100.

AN = Alaska Native

USW = U.S. white

RR = rate ratio

CI = confidence interval

ICD-9 = International Classification of Diseases, Ninth Revision

ICD-10 = International Classification of Diseases, 10th Revision

NA = not applicable

NC = not calculated

Table 2. Age-specific mortality rates per 100,000 population for heart disease and its subtypes among Alaska Native people (1981–2007) and U.S. white people (1981–2005)

	35–74 years of age					*≥75 years of age*				
	AN N	*AN rate*	*USW rate*	*RR*	*95% CI*	*AN N*	*AN rate*	*USW rate*	*RR*	*95% CI*
All heart disease										
1981–1989	423	257.1	291.0	0.88	0.80, 0.97	298	2,793.7	3,918.5	0.71	0.64, 0.80
1990–1998	478	210.5	216.9	0.97	0.89, 1.06	370	2,414.4	3,249.6	0.74	0.67, 0.82
1999–2007	491	163.1	166.9	0.98	0.89, 1.07	428	1,937.8	2,712.7	0.71	0.65, 0.78
Percent change[a]	NA	−36.6[b]	−42.6[b]	NA	NA	NA	−30.6[b]	−30.8[b]	NA	NA
Ischemic heart disease										
1981–1989	269	164.8	211.8	0.78	0.69, 0.88	130	1,184.8	2,736.8	0.43	0.36, 0.51
1990–1998	266	120.2	146.7	0.82	0.73, 0.92	178	1,132.7	2,140.5	0.53	0.46, 0.61
1999–2007	286	96.3	121.3	0.79	0.71, 0.89	227	1,022.7	1,870.8	0.55	0.48, 0.61
Percent change[a]	NA	−41.6[b]	−42.7[b]	NA	NA	NA	−13.7	−31.6[b]	NA	NA
Heart failure										
1981–1989	19	12.0	8.1	1.49	0.95, 2.33	59	558.6	240.8	2.32	1.79, 3.00
1990–1998	23	10.6	6.8	1.57	1.04, 2.38	63	435.5	253.8	1.72	1.34, 2.20
1999–2007	20	7.2	7.0	1.02	0.66, 1.59	64	291.4	272.5	1.07	0.84, 1.37
Percent change[a]	NA	−40.0	−13.5[b]	NA	NA	NA	−47.8[b]	+13.2[b]	NA	NA
Hypertensive disease										
1981–1989	8	NC[c]	9.5	NC[c]	NC[c]	7	NC[c]	138.6	NC[c]	NC[c]
1990–1998	15	6.2	9.0	0.69	0.41, 1.15	11	69.0	143.9	0.48	0.26, 0.87
1999–2007	45	14.7	9.8	1.49	1.11, 2.01	31	141.1	165.6	0.85	0.60, 1.21
Percent change[a]	NA	+137.1[d]	+3.2	NA	NA	NA	+104.5[d]	+20.5[b]	NA	NA
Cardiomyopathy										
1981–1989	27	15.2	8.2	1.85	1.26, 2.70	5	NC[c]	37.8	NC[c]	NC[c]
1990–1998	35	14.1	10.2	1.38	0.98, 1.93	14	89.8	75.1	1.20	0.71, 2.03
1999–2007	45	14.3	8.0	1.80	1.34, 2.42	17	76.9	77.3	0.99	0.62, 1.60
Percent change[a]	NA	−5.9	−2.4	NA	NA	NA	−14.4[d]	+104.5[b]	NA	NA
Non-rheumatic valve disorders										
1981–1989	9	NC[c]	3.2	NC[c]	NC[c]	17	166.6	53.9	3.09	1.91, 5.00
1990–1998	28	12.4	3.2	3.80	2.61, 5.53	17	112.3	84.6	1.33	0.82, 2.14
1999–2007	12	4.3	1.5	2.79	1.57, 4.93	27	128.5	63.3	2.03	1.39, 2.96
Percent change[a]	NA	−65.3[d]	-53.1[b]	NA	NA	NA	−22.9	+17.4	NA	NA
Chronic rheumatic heart disease										
1981–1989	15	8.8	3.8	2.35	1.41, 3.92	5	NC[c]	22.8	NC[c]	NC[c]
1990–1998	16	6.6	2.1	3.09	1.88, 5.08	10	66.6	19.3	3.46	1.85, 6.46
1999–2007	17	5.5	1.1	5.19	3.21, 8.41	10	44.4	12.2	3.64	1.96, 6.78
Percent change[a]	NA	-37.5	−71.1[b]	NA	NA	NA	−33.3	−46.5[b]	NA	NA
All other heart disease										
1981–1989	76	46.1	46.4	0.99	0.79, 1.25	75	727.2	687.8	1.06	0.84, 1.33
1990–1998	95	40.4	38.8	1.04	0.85, 1.28	77	508.4	532.4	0.95	0.76, 1.20
1999–2007	66	20.9	18.3	1.14	0.89, 1.46	52	232.7	251.0	0.93	0.71, 1.22
Percent change[a]	NA	−54.7[b]	−60.6[b]	NA	NA	NA	−68.0[b]	−63.5[b]	NA	NA

[b]Percent change = (rate for 1999–2007 – rate for 1981–1989) / (rate for 1981–1989) × 100, unless otherwise noted.

[b]$p<0.05$

[c]Not calculated due to fewer than 10 deaths

[d]Percent change = (rate for 1999–2007 – rate for 1990–1998) / (rate for 1990–1998) × 100.

AN = Alaska Native

USW = U.S. white

RR = rate ratio

CI = confidence interval

NA = not applicable

NC = not calculated

period 1999–2007. Heart failure rates for AN men (40.7 per 100,000 population) and AN women (40.1 per 100,000 population) for this time period were virtually identical. There were no significant differences in gender- or age-specific rates between the two populations (Tables 1 and 2). Heart failure mortality decreased 46.9% among AN people during the overall study period. Decreases were similar for AN men (46.6%) and women (48.4%). Heart failure mortality increased 7.9% among USW people due to a 14.1% increase among USW women (Table 1).

Hypertensive disease (ICD-9 codes 401–404 or ICD-10 codes I10–I13)

There was no significant difference in hypertensive disease mortality rates (AN: 29.6 per 100,000 population; USW: 28.2 per 100,000 population) for the period 1999–2007. Patterns were similar for men and women. In both populations, men had higher rates than women (Table 1). As shown in Table 2, hypertensive disease mortality was 49% higher among AN people compared with USW people for adults 35–74 years of age. There was no significant difference for those ≥75 years of age. From 1981 through 2007, hypertensive disease mortality increased 155% among AN people, while rates increased only 14% among USW people (Table 1). Large increases occurred in both AN age groups (Table 2).

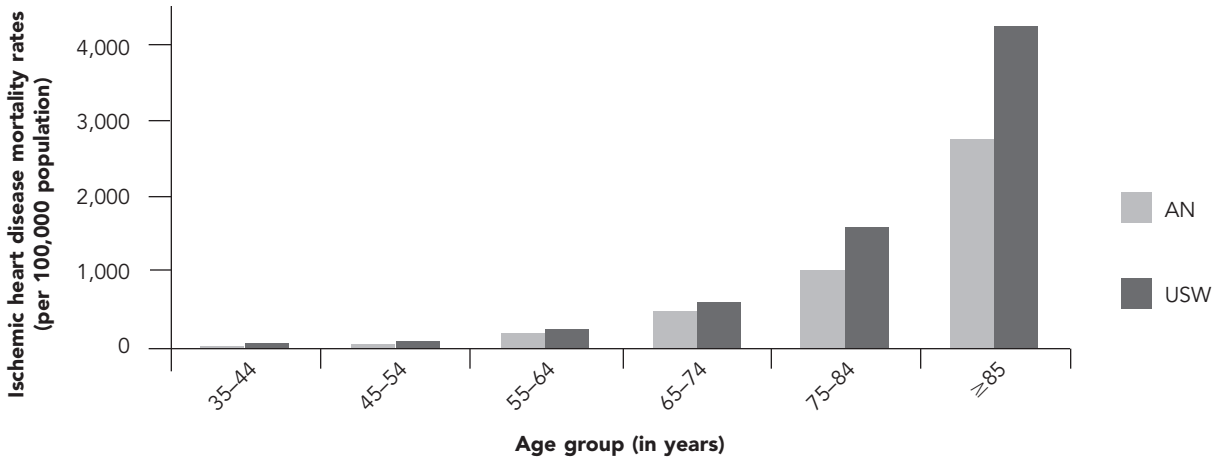
Cardiomyopathy (ICD-9 code 425 or ICD-10 code I42)

AN people were 34% more likely to die from cardiomyopathy than USW people (AN: 21.7 per 100,000 population; USW: 16.1 per 100,000 population) for the time period 1999–2007. Patterns were similar for men and women. In both populations, men had significantly higher rates than women (Table 1). As shown in Table 2, AN cardiomyopathy mortality was 80% higher than the USW rate for adults 35–74 years of age, while AN and USW rates were similar for those ≥75 years of age. During the overall study period, cardiomyopathy mortality increased 19% among AN people and 38% among USW people (Table 1).

Non-rheumatic valve disorders (ICD-9 code 424 or ICD-10 code I35)

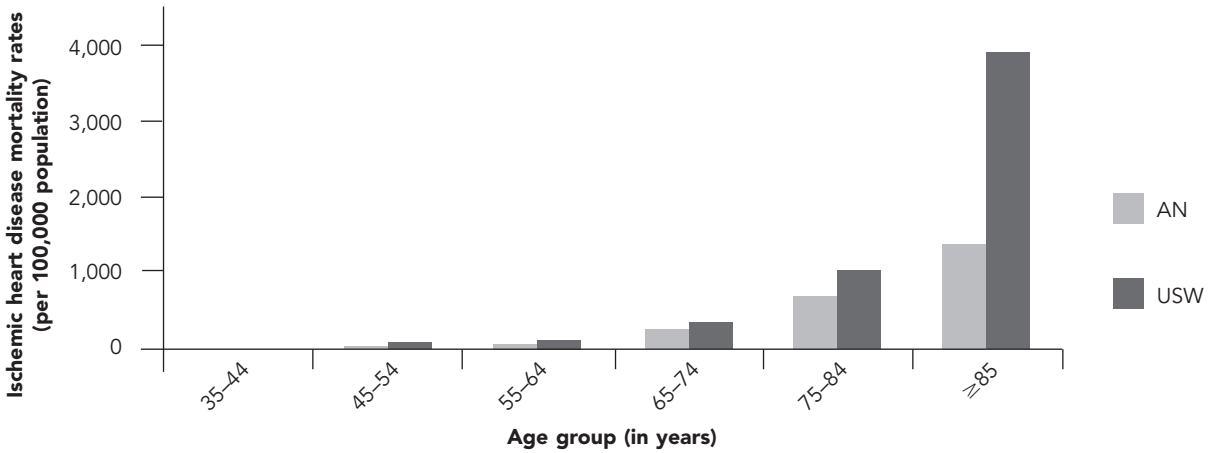
AN people were 2.2 times as likely to die from non-rheumatic valve disorders as USW people (AN: 19.0 per 100,000 population; USW: 8.8 per 100,000 population) for the time period 1999–2007. Patterns were similar for men and women and across age groups. In both populations, men had slightly higher rates than women (Tables 1 and 2). From 1981 through 2007, mortality from non-rheumatic valve disorders decreased 22.8% among AN people and 4.3% among USW people (Table 1).

Figure 1. Ischemic heart disease mortality rates per 100,000 population among Alaska Native and U.S. white men, by age group, 1999–2007



AN = Alaska Native
USW = U.S. white

Figure 2. Ischemic heart disease mortality rates per 100,000 population among Alaska Native and U.S. white women, by age group,[a] 1999–2007



[a]There were only two ischemic heart disease deaths among AN women 35–44 years of age; therefore, the rate for this age group is not displayed.

AN = Alaska Native

USW = U.S. white

Chronic rheumatic heart disease (ICD-9 codes 393–398 or ICD-10 codes I05–I09)

AN people were 4.3 times as likely to die from chronic rheumatic heart disease as USW people (AN: 10.1 per 100,000 population; USW: 2.4 per 100,000 population) for the time period 1999–2007 (Table 1). The difference in AN and USW mortality rates was more pronounced in the younger age group (Table 2). During the study period, mortality from chronic rheumatic heart disease decreased 26.8% among AN people and 60.0% among USW people (Table 1).

Other heart disease (ICD-9 codes 415–423 and 426–429 or ICD-10 codes I26–I34, I36–I40, I44–I49, and I51)

There was no difference in age-adjusted mortality rates between the AN and USW populations for all other types of heart disease for men and women, separately or combined (Table 1). This similarity was also seen across age groups (Table 2). From 1981 through 2007, all other heart disease mortality decreased 63.7% among AN people and 62.5% among USW people (Table 1).

Premature heart disease mortality

From 1999 through 2007, 32.1% (n=306) of AN heart disease deaths were considered premature deaths, defined as deaths of people <65 years of age. The heart disease subgroup with the highest percentage of premature deaths among AN people from 1999 through 2007 was cardiomyopathy (56.6%, n=43), followed by all other heart diseases (42.6%, n=55), chronic rheumatic heart disease (40.7%, n=11), and hypertensive disease (38.0%, n=30) (data not shown).

DISCUSSION

Annual age-adjusted heart disease mortality was consistently about 20% lower among AN people than USW people from 1981 through 2007. The majority of heart disease deaths—54% for AN people and 70% for USW people—were due to ischemic heart disease, followed by heart failure and hypertensive heart disease. The proportional distribution of heart disease deaths by subtype within a population is related to the population's age distribution. AN people have a younger age distribution than USW people.

Age-adjusted mortality due to ischemic heart disease was approximately 40% lower among AN people than USW people during the 27-year study period. Age-adjusted mortality due to hypertensive heart disease was approximately 50% lower among AN people than USW people from 1981 through 1998; however, due to a much greater rate of increase in hypertensive heart disease mortality among AN people compared with USW people, the age-adjusted hypertensive heart disease mortality rates were similar for the two groups from 1999 through 2007. Conversely, age-adjusted mortality due to heart failure was higher for AN people during

the earlier time periods, 1981–1989 and 1990–1998. However, due to a 47% decrease in AN heart failure mortality rates from the earliest time period studied (1981–1989) to the latest time period (1999–2007) compared with an 8% increase for USW people, the age-adjusted heart failure mortality rates were similar for the two groups from 1999 through 2007. Annual age-adjusted mortality rates for all other subgroups of heart disease were similar or higher among AN people than USW people for all three time periods, and separately and combined for men and women.

Findings of lower heart disease mortality among AN people than USW people differs from similar comparisons with AI tribes in other parts of the country. For example, heart disease mortality among AIs in Montana was significantly higher than among white people in that state (1991–1995 age-adjusted rate of 326 per 100,000 population; 95% CI ± 36 for AIs vs. 237 per 100,000 population; 95% CI ± 5 for white people).[12] The Strong Heart Study, a community mortality surveillance study conducted from 1984 to 1988, found higher rates of cardiovascular disease (CVD) mortality among AIs aged 45–74 years in Oklahoma and South Dakota/North Dakota compared with the USW population. In Arizona, the study found higher CVD mortality among AIs aged 45–64 years compared with their USW counterparts but slightly lower CVD mortality among AIs 65–74 years of age compared with their USW counterparts.[13]

Using the underlying COD from AI or AN (AIAN) death certificates across the 12 areas served by IHS from 1999 to 2001, IHS found that the AIAN heart disease mortality rate (243.8 per 100,000 population), adjusted for age and misreporting of AIAN race/ethnicity on state death certificates, was 5% lower than the U.S. rate for all races/ethnicities (257.9 per 100,000 population). Rates across IHS areas ranged from a low of 141.7 per 100,000 population in the Albuquerque, New Mexico, area to a high of 392.1 per 100,000 population in the Bemidji, Minnesota, area. The rate for the Alaska area was 225.6 per 100,000 population.[14]

Premature heart disease mortality

From 1999 through 2007, 31% of AN heart disease deaths were considered premature deaths, defined as deaths of people <65 years of age. This is similar to the percentage of premature heart disease deaths reported nationwide for AIAN people in 2001 (36%), which was about double the percentage of premature heart disease deaths reported that year for USW people (18%).[15]

The percentage of premature heart disease deaths in a population is related to the age distribution of that population. The difference in the percentage of premature AIAN heart disease deaths and premature USW deaths may be due, in part, to differences in the age distribution of the two populations. To better understand the burden of premature heart disease deaths, it is necessary to examine age-specific mortality rates.

Heart disease mortality among older AN people

It is possible that the relatively lower burden of heart disease among older AN people is related to a healthy cohort effect (i.e., the result of the healthier lifestyle experienced throughout their entire life compared with the less healthy lifestyle experienced by younger AN people who may get less physical exercise and eat a more western diet). However, given the increasing westernization of the AN lifestyle over time, one would expect this healthy cohort effect to decrease over time. Therefore, the similarity in the age-specific AN:USW heart disease mortality RRs over time suggests that the lower heart disease burden for older AN people is not due primarily to a healthy cohort effect.

Historical perspective

Historical data on AN heart disease mortality are limited. The first population-based study of AN heart disease mortality, examining the period 1955–1965, found that the AN age-adjusted heart disease mortality rate was 50% lower than the U.S. rate for all races/ethnicities.[16] A study examining AN heart disease for the period 1979–1988 found higher mortality rates, but they were still 20% lower than the USW rates. Calculating rates for heart disease by subtype, Davidson et al. found that lower overall rates were primarily due to low rates of ischemic heart disease, which offset higher AN mortality rates due to cardiomyopathy, rheumatic heart disease, non-rheumatic valvular disease, and other heart diseases.[17] Our findings showed a similar 20% lower rate for AN heart disease mortality compared with USW heart disease mortality from 1981 through 2007, with much of the difference being due to lower rates for ischemic heart disease mortality.

Increase in hypertensive disease

Although the total number of deaths due to hypertensive disease was small, the increase over time is concerning. Hypertension was believed to be uncommon among AN people as recently as the 1950s, but a study of 1,124 Yup'ik Eskimo and Athabascan Indians in 15 villages in southwest Alaska in 1987 and 1988 found that 24% of the population had blood pressure ≥140/90 millimeters of mercury (mmHg), and 8% had blood pressure ≥160/95 mmHg.[18] In that

study, hypertension was found to be associated with overweight, non-indigenous diet, mechanized activities, and glucose intolerance. More recently, the Education and Research Towards Health (EARTH) study found that 48% of AN men and 40% of AN women in 26 villages and communities in three distinct regions of Alaska had elevated blood pressure (≥130/85 mmHg).[19]

Effect of differences in age distribution

It is possible that the relatively lower heart disease mortality rates among AN people compared with USW people is related to the difference in the age distribution of the two populations. The Alaska Bureau of Labor and Workforce Development estimates that the median age for the AN population was 25.2 years in 2006, with 41% 0–19 years of age and 6% ≥65 years of age.[20] The U.S. Census estimated that, in 2006, the USW population had a median age of 37.8 years, with 26% 0–19 years of age, 14% ≥65 years of age, and 2% ≥85 years of age.[21] This younger age distribution overall, with the much lower percentage of individuals ≥85 years of age, may result in residual confounding that cannot be totally corrected by age adjustment.

Racial/ethnic misclassification

One of the limitations of death certificate data is the possibility of racial/ethnic misclassification. While some degree of misclassification occurs in all racial/ethnic groups, AIAN people are more likely than USW people to be misclassified. The nationwide 1996–1998 age-adjusted mortality rate for diseases of the heart for AIAN people combined increased 18%, after correcting for miscoding of race/ethnicity on death certificates.[22] However, it has been shown in at least one other study that racial/ethnic misclassification for AN people in Alaska occurs much less frequently than among AIAN populations in other areas of the country.[23] Geographic variation in AIAN misclassification is believed to be related to the proportion of the population that is AIAN and the proportion of the AIAN population receiving care through tribal or IHS facilities.[24] Alaska has a high proportion of AIAN residents and an extensive tribal health system, resulting in lower rates of AIAN racial/ethnic misclassification.

Areas for future research

The findings of consistently lower heart disease mortality among AN people compared with USW people during the 27-year period from 1981 through 2007 begs the question of whether this difference is due to lifestyle, genetics and physiology, or both. The traditional subsistence-based AN diet is high in fat, including very high levels of omega-3 fatty acids from fish and marine mammals. While it may be reasonable to expect that high omega-3 fatty acid intake would be protective against heart disease, the Genetics of Coronary Artery Disease in Alaska Natives study found that consumption of omega-3 fatty acids was not associated with a reduction in carotid atherosclerosis.[25] The EARTH study, which included AN people in three regions of Alaska, found age-adjusted prevalence of metabolic syndrome among AN women to be higher than among USW women in two regions (south-central and southeastern Alaska) and similar in the third region (western Alaska). Prevalence of metabolic syndrome was also higher among AN men in south-central and southeastern Alaska compared with USW men, but was lower among AN men in western Alaska compared with USW men.[19] There is concern that changes in lifestyle, with a more western diet and less exercise, may be contributing to the high prevalence of metabolic syndrome and eventually to higher rates of heart disease.

CONCLUSIONS

Overall, age-adjusted AN heart disease mortality was consistently about 20% lower than USW heart disease mortality from 1981 through 2007, with similar AN:USW RRs for men and women. However, lumping all ages and all heart disease subtypes into a single, age-adjusted statistic obscures many important differences across ages and disease subtypes. Most importantly, while ischemic heart disease mortality was lower among AN people compared with USW people, AN mortality rates due to other types of heart disease were similar (heart failure and hypertensive heart disease) or higher (cardiomyopathy, non-rheumatic valvular disease, and chronic rheumatic heart disease) than the USW rates. Age-specific heart disease mortality was approximately 29% lower for AN people ≥75 years of age compared with USW people, while it was virtually identical for the two groups for people 35–74 years of age. Additional research is needed to determine what factors have contributed to the lower rates of heart disease mortality to date and how this trend can be continued in the future.

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