

The large deficit in mortality from diseases of the cardiovascular-renal system and from diabetes mellitus among Navajo Indians is too great to be accounted for by certain types of errors in death certification. Further epidemiological studies are required to explain why this tribe enjoys a more favorable experience with these diseases than white and other nonwhite Americans.

Cardiovascular-Renal and Diabetes Deaths Among the Navajos

By ROBERT LINCOLN SMITH, M.D., M.P.H.

IN A PREVIOUS paper Salsbury, Gilliam, and I showed that deaths certified as caused by cancer and by diseases of the circulatory and central nervous systems were substantially fewer among the Navajo Indians than would have been expected had observed white or non-white death rates prevailed (1). However, we pointed out that the apparent deficit of cancer alone could not be regarded as established beyond all reasonable doubt because of the large number of deaths in older Navajos for whom the cause of death was uncertain. Either the deceased had not been attended by the physician signing the death certificate or the cause of death had been assigned to senility. Nevertheless, the study clearly showed that the deficit in cancer and in cardiovascular-renal diseases,

taken all together, was too great to be accounted for by faulty death certification alone.

Other authors have also called attention to apparent deficits in these diseases among the Navajo Indians. Dealing with death certificate data, Hadley has noted that diseases of the heart, cancer, and vascular lesions affecting the central nervous system were not among the 6 leading causes of death for Navajos in 1950 (2).

Salsbury has observed that a diagnosis of some form of heart disease was made on only 0.4 percent of 4,826 admissions (mostly of Navajos) to the Sage Memorial Hospital at Ganado, Ariz., during the years 1931-35 (3).

Gilbert has reported that no clinically proved case of coronary thrombosis was found among 10,276 Navajos admitted to the Navajo Medical Center for the years from 1949 to 1952 (4).

In addition, Joslin (5, 6), Salsbury (7), and Cohen (8) have remarked on the infrequent recognition of diabetes among Navajo Indians.

Because of these observations, I have extended the analyses of the previous study on the Navajos (1) and have compared expected mortality with recorded mortality for the various specific causes that make up the broad cardiovascular-renal group of diseases. Since the data comprising this study approximate all of

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the deaths occurring in a whole and fairly well defined population group, the results provide a better idea of forces of mortality among the Navajos than could be obtained from analyses of admissions to, or deaths in, any one hospital serving the tribe.

Method of Study and Results

The first article described how the Navajo deaths recorded by the Navajo Indian Agency were tabulated for the 5-year period 1948-52 (1). Because we were uncertain about the exact population base from which death certificate data were available, we estimated the Navajo population on the basis of the published 1950 census enumeration (64,374) of Indians resid-

ing in the area served by the Navajo Agency and on the basis of the total number (70,567) of Navajos estimated by the Navajo Agency for the same year, distributing the population by sex and age as in the census enumeration. These population estimates yielded a minimum and a maximum number of expected deaths, computed by multiplying the 1950 age-specific, sex-specific, and cause-specific death rates for the entire white United States population by the corresponding estimate in each of the two Navajo population groups. The results summed for all age groups and multiplied by 5 comprise the number of deaths from each cause that might be expected to occur among the Navajo Tribe in the 5 years centering around 1950 if all Navajos had been subjected

Figure 1. Recorded deaths among Navajo Indians, 1948-52, which were attributed to cardiovascular-renal diseases and diabetes mellitus, and deaths expected on the basis of 1950 age-specific, sex-specific, and cause-specific death rates for the white and nonwhite populations of the United States.

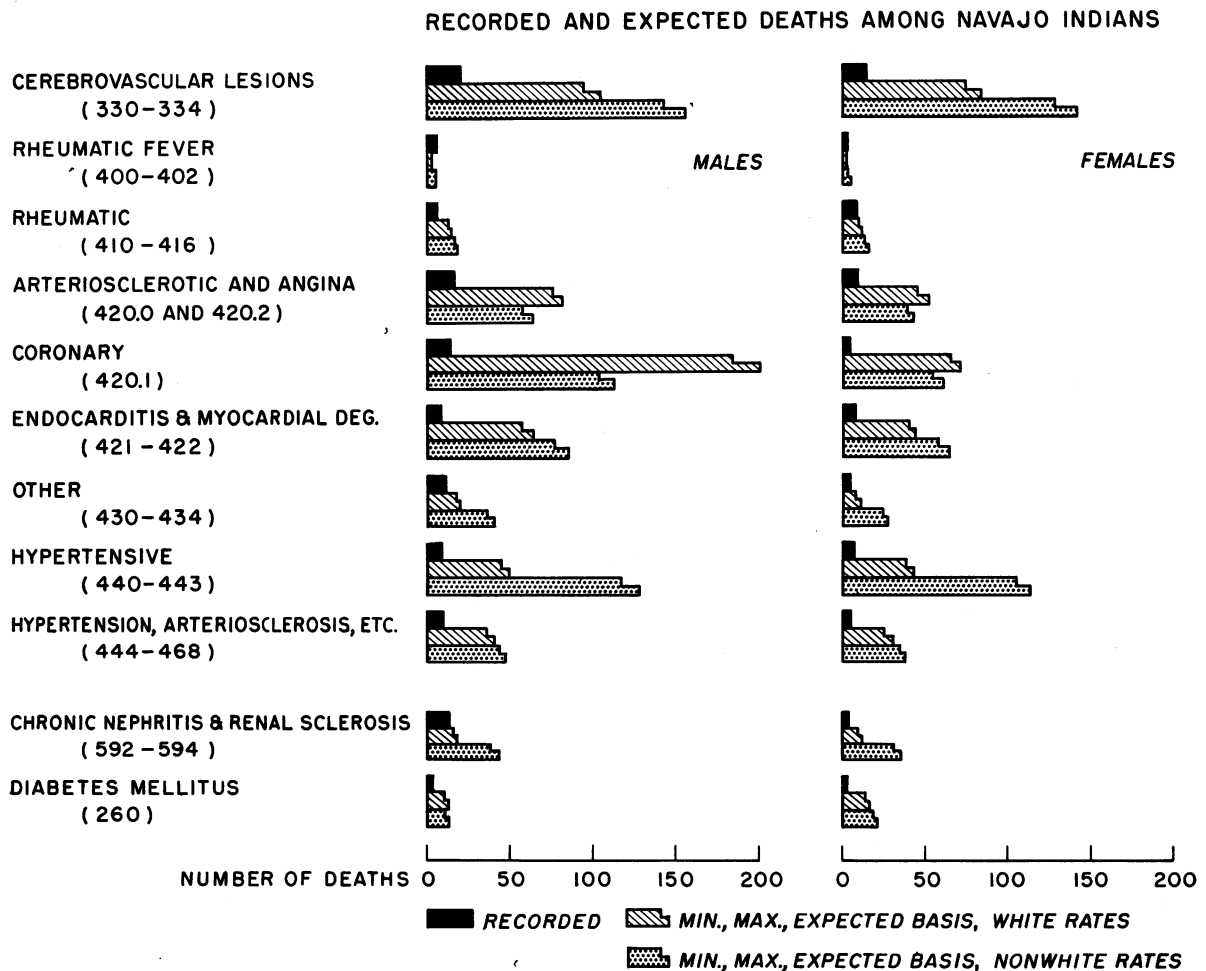


Table 1. Deaths among the Navajos attributed to cardiovascular-renal diseases and to diabetes mellitus during the 5-year period 1948-52 and deaths expected on the basis of age- and sex-specific rates observed in 1950 among the white and nonwhite United States populations

Cause of death ¹	Men					Women				
	Number of re-recorded deaths	Expected ² deaths on basis of—				Number of re-recorded deaths	Expected ² deaths on basis of—			
		White rates		Nonwhite rates			White rates		Nonwhite rates	
		Minimum	Maximum	Minimum	Maximum		Minimum	Maximum	Minimum	Maximum
Major cardiovascular-renal diseases (330-334, 400-468, 592-594)-----	105	534.5	587.0	629.7	691.5	73	324.1	356.0	494.2	542.6
Vascular lesions affecting central nervous system (330-334)-----	³ 19	93.9	103.1	141.6	155.5	⁵ 15	75.2	82.6	129.2	141.9
Diseases of the circulatory system (400-468)-----	73	425.0	466.7	448.6	492.6	54	238.0	261.4	332.7	365.3
Rheumatic fever (400-402)-----	5	1.8	2.0	3.8	4.2	⁶ 3	2.0	2.2	4.3	4.7
Diseases of the heart (410-443)-----	59	388.2	426.2	402.8	442.3	46	211.0	231.7	294.4	323.3
Chronic rheumatic heart disease (410-416)-----	5	13.1	14.4	16.2	17.7	⁶ 10	11.2	12.2	14.3	15.7
Arteriosclerotic heart disease including coronary disease (420)-----	29	257.6	282.9	159.2	174.9	15	111.1	122.0	94.9	104.2
Arteriosclerotic heart disease, so described (420.0)-----	⁷ 14	72.8	79.9	55.4	60.8	³ 10	45.4	49.9	37.7	41.4
Heart disease specified as involving coronary arteries (420.1)-----	⁸ 13	183.0	200.9	101.8	111.8	⁶ 5	65.0	71.3	55.9	61.4
Angina pectoris (420.2)-----	⁵ 2	1.8	2.0	2.0	2.3	0	.7	.8	1.2	1.3
Nonrheumatic chronic endocarditis and other myocardial degeneration (421-422)-----	7	57.1	62.7	76.2	83.7	8	40.7	44.7	57.1	62.7
Chronic endocarditis not specified as rheumatic (421)-----	1	6.4	7.1	14.4	15.8	1	4.2	4.6	10.0	11.0
Other myocardial degeneration (422)-----	⁶ 6	50.7	55.6	61.8	67.9	7	36.5	40.1	47.1	51.7
Other diseases of the heart (430-434)-----	³ 10	16.8	18.5	35.7	39.2	⁶ 6	8.7	9.6	24.7	27.1
Hypertension with heart disease (440-443)-----	8	43.6	47.7	115.5	126.8	7	39.3	43.2	103.4	113.6
Hypertensive heart disease with arteriolar nephrosclerosis (442)-----	4	15.0	16.4	37.2	40.8	⁴ 6	11.1	12.2	28.3	31.1
Essential hypertension with heart disease, etc. (440, 441, 443)-----	⁶ 4	28.6	31.3	78.3	86.0	1	28.2	31.0	75.1	82.5
Hypertension without mention of heart (444-447)-----	3	7.4	8.1	17.0	18.7	0	5.6	6.1	14.9	16.5
Hypertension with arteriolar nephrosclerosis (446)-----	3	4.0	4.4	7.8	8.6	0	2.5	2.7	5.5	6.1
Essential hypertension and other hypertensive disease (444, 445, 447)-----	0	3.4	3.7	9.2	10.1	0	3.1	3.4	9.4	10.4
General arteriosclerosis (450)-----	3	22.4	24.6	19.8	21.7	3	16.2	17.8	13.8	15.1
Other diseases of circulatory system (451-468)-----	3	5.2	5.8	5.2	5.7	2	3.2	3.6	5.3	5.7
Chronic and unspecified nephritis and other renal sclerosis (592-594)-----	⁴ 13	15.6	17.2	39.5	43.4	4	10.9	12.0	32.3	35.4
Diabetes mellitus (260)-----	3	11.7	13.0	11.6	12.8	3	14.2	15.6	18.9	20.7

¹ Numbers in parentheses represent diseases listed in the International Statistical Classification of Diseases, Injuries, and Causes of Death, 6th revision.

² The minimum and maximum numbers of deaths expected are dependent on different estimates of the number and age composition of the Navajo population at risk.

³ In 2 cases death certificate signed by physician not in attendance.

⁴ In 1 case death certificate not signed by a physician.

⁵ In 2 cases death certificate not signed by a physician.

⁶ In 1 case death certificate signed by physician not in attendance.

⁷ In 4 cases death certificate signed by physician not in attendance.

⁸ In 3 cases death certificate signed by physician not in attendance.

to the same age-specific and sex-specific rates prevailing in the population of the United States as a whole.

The results of these computations are shown in figure 1 and table 1. Numbers in parentheses refer to diseases listed in the International Statistical Classification of Diseases, Injuries, and Causes of Death, sixth revision.

Only 105 male deaths during the 5-year period were charged to the major cardiovascular-renal diseases although from 534 to 692 deaths would have been expected on the basis of rates prevailing among the white and nonwhite United States populations (table 1). Deaths recorded from these causes were, therefore, only 15 to 20 percent of the deaths expected. Similar results are noted among women. Seventy-three deaths were recorded as compared with an expectation of 324 and 543 deaths. The standardized mortality ratios thus computed for women vary between 13 and 23.

Further examination of table 1 shows that this very large total deficit is contributed to by all of the individual causes of death except rheumatic fever. Rheumatic fever, however, accounted for only a small number and proportion of deaths. Five deaths were recorded for men and three for women. Note also that the differences between recorded and expected deaths are not great for chronic rheumatic heart disease, especially among Navajo women. When comparisons are made on the basis of rates prevailing among the white population, little difference is noted between expected and observed deaths for chronic and unspecified nephritis and other renal sclerosis (592-594), for hypertension with arteriolar nephrosclerosis without mention of heart (446), and for the category that includes acute and subacute endocarditis, acute myocarditis, acute pericarditis, and functional and other unspecified heart diseases (430-434). For these same diseases, however, substantial differences are noted in comparison with nonwhite experience.

Among the causes of death tabulated, the greatest deficit is observed for coronary disease (420.1), for which the mortality recorded is only 6 to 13 percent of that expected in men and only 7 to 9 percent of that expected in women. This deficit is equally as outstanding in the age

group 45 to 64 as it is in the group 65 years of age and older.

Diabetes mellitus (260) was the assigned cause of death for 3 men and 3 women, but the number of expected deaths varied from 12 to 13 for men and from 14 to 21 for women.

Discussion and Conclusion

In the foregoing I have shown that deaths attributed to cardiovascular-renal diseases among the Navajo Tribe are substantially less than would be expected had United States white or nonwhite death rates prevailed. With the exception of rheumatic fever, all of the major causes of death that were considered have contributed to this deficit. In evaluating the deficit, however, consideration must be taken of three facts to which the first study called attention (1).

The first is that deaths other than violent deaths among Navajos in the ages of highest cancer risk (45 years of age and older) which were unattended by a physician or which were assigned to senility and to other ill-defined

Table 2. Deaths attributed to cardiovascular-renal diseases,¹ difference between recorded and expected deaths

Age (years)	Re- corded deaths	Expected deaths		Difference	
		Mini- mum	Maxi- mum	Mini- mum	Maxi- mum
Men					
Under 45-----	37	31.8	75.4	+5	-38
45-64-----	18	140.7	246.4	-123	-228
65 and over-----	50	362.0	369.7	-312	-320
Total-----	105	534.5	691.5	-430	-586
Women					
Under 45-----	29	20.1	83.6	+9	-55
45-64-----	15	51.9	178.7	-37	-164
65 and over-----	29	252.1	280.3	-223	-251
Total-----	73	324.1	542.6	-251	-470

¹ Numbered 330-334, 400-468, 592-594 in the International Statistical Classification of Diseases, Injuries, and Causes of Death, 6th revision.

Table 3. Deaths (except violent deaths) which were either unattended by the physician signing death certificate or attributed to senility or other ill-defined cause

Age	Men	Women
Under 45	244	269
45-64	50	35
65 and over	76	54
Total	370	358

causes were more than enough to account numerically for the recorded deficit of cancer. When this point is examined for cardiovascular-renal diseases, however, the deficit is too large to be accounted for in this way. Because of the greater uncertainty of correct diagnosis in the very old, we compared the deficit of mortality in the cardiovascular-renal diseases with the number of unreliably certified deaths among Navajos in the age groups 45 to 64 and 65 and older. The deficit in recorded mortality attributed to cardiovascular-renal diseases is shown in table 2, and the deaths assigned to senility or ill-defined causes and unattended deaths are shown in table 3.

Comparison of tables 2 and 3 clearly shows a much larger deficit of recorded cardiovascular-renal diseases in Navajos 65 years of age and older than could be accounted for even if all of the unreliably certified deaths were due to these causes. This is also true for Navajos 45 to 64 years of age, though to a lesser extent. For deaths occurring among members of the tribe under 45 years of age, the calculated deficit of cardiovascular-renal diseases for both men and women is much less than the unreliably certified deaths. There are, in fact, a few more deaths recorded from these causes than would be expected on the basis of the minimum estimate. However, it is reasonable to assume that most of the unreliably certified deaths in Navajos under 45 are properly assignable to causes other than cardiovascular-renal, especially since 200 of the 244 deaths in males and 209 of the 269 deaths in females occurred in individuals under 25 years of age.

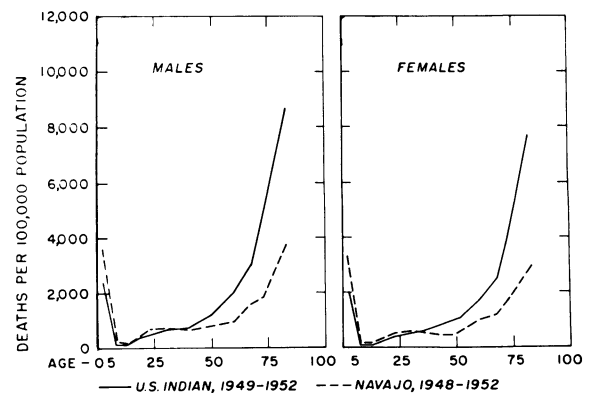
Second, there was a question whether some of the excess Navajo mortality certified as caused by respiratory and digestive diseases might ac-

tually be due to cancer or cardiovascular-renal diseases. That this is unlikely is indicated by the fact that the excess mortality in these diseases is almost entirely limited to Navajo children less than 5 years old. This is also true, though to a lesser degree, for the excess mortality attributed to respiratory tuberculosis. Excess mortality for respiratory tuberculosis occurred principally in Navajos under 45 years of age. For those 45 years and over mortality from respiratory tuberculosis was only moderate.

A third consideration is the fact that age-specific death rates for all causes in older ages are lower among the Navajo Indians than among all Indians. The difference between these rates becomes progressively greater with age as is seen in figure 2. While this fact is suggestive of under-reporting of Navajo deaths in the older age groups, it is also consistent with the idea that the Navajo Tribe is subject to different forces of mortality from those operating for Indians as a whole. In any event, under-reporting must be considered as a potential factor contributing to the observed deficit in mortality attributed to cardiovascular-renal disease.

To test the possible effect of under-reporting, deaths for all causes recorded among the Navajos were compared with deaths expected had the tribe experienced the overall mortality of all American Indians. Though the results of these calculations are not illustrated, they did show fewer deaths from all causes among

Figure 2. Average annual age-specific and sex-specific death rates for all causes among all American Indians, 1949-52, and among the Navajo Indians, 1948-52.



older Navajo Indians, such as might have been anticipated from the rates shown in figure 2. It seems highly unlikely that all postulated under-recording of deaths could be attributed to cardiovascular-renal diseases alone. Even if it were, however, under-recording at its maximum was hardly sufficient to account for the deficit of cardiovascular-renal mortality shown in table 2. The evidence therefore favors the view that the Navajo Tribe experienced a real deficit of cardiovascular-renal disease. The true magnitude of this deficit cannot be assessed accurately from these data.

Analysis of mortality recorded among Navajo Indians supports the view that cardiovascular-renal diseases are less commonly encountered among this tribe of American Indians than in the general white and nonwhite populations of the United States.

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