Diabetes and Renal Mortality in the United States

LINDA S. GEISS, MA, WILLIAM H. HERMAN, MD, AND STEVEN M. TEUTSCH, MD, MPH

Abstract: The risk of renal death is examined in the United States population 15 years of age and older with and without diabetes. The renal mortality rate is 174.6 per 100,000 among people with diabetes and 42.5 per 100,000 among people without diabetes. The relative risk of renal mortality is 4.1 for diabetics, age-adjusted relative risk, 2.6. The risk of renal mortality is highest in young people with diabetes. Rates of renal mortality are higher than previously believed among Whites with diabetes and among women with diabetes. (*Am J Public Health* 1985: 75:1325–1326.)

Introduction

Renal disease is a major cause of death and years of life lost among diabetics. In autopsy series, renal disease caused 8 to 12 per cent of diabetic deaths.[1,2] Renal disease accounted for 9 per cent of deaths among diabetic patients followed at the Joslin Clinic between 1956 and 1964.[3] In patients who were diagnosed as having diabetes at less than 20 years of age, renal disease accounted for 48.5 per cent of deaths. In those diagnosed after age 39, renal disease accounted for 5.3 per cent of deaths.[3]

Studies comparing renal mortality rates among diabetics and control groups have yielded mixed results. In one study, diabetic life insurance policy holders were 17 times more likely to die from renal disease than nondiabetic policy holders.[4] In another study, male diabetic employees with albuminuria were almost four times more likely to die than matched controls.[5]

A recent review of the literature noted several risk factors for diabetic renal disease.[6] Among the risk factors were duration of diabetes (increased prevalence associated with increased duration), race (increased prevalence in races other than White), and sex (slightly increased prevalence in men).

Prior to the release of public use tapes of multiple cause of death data by the National Center for Health Statistics (NCHS), national mortality rates could not be calculated for combinations of two or more diseases. The purpose of this paper is to take advantage of this new opportunity by examining the risk of renal death in the US resident population with and without diabetes.

Methods

Numerator data came from the NCHS' most recent release of national multiple cause of death data (calendar year 1979). The ICDA-9 codes employed to define renal diseases were 250.4 and 580 through 589. To determine deaths in which diabetes was also a cause, ICDA-9 codes 250 and 251.0 were used.

Denominator data were calculated by applying 1979 National Health Interview Survey (NHIS) diabetes prevalence rates (unpublished data compiled by the Division of Diabetes Control, Centers For Disease Control from NCHS data tapes) to 1979 US resident population estimates.[7] Descriptions of NHIS design, estimation procedure, qualifications, and limitations are published elsewhere.[8–14] Groups less than 15 years of age were excluded from the analysis because of the unreliability of NHIS diabetes prevalence estimates.

Age-, race-, sex-, and cause-specific rates were formed using the mortality data and population estimates. Rates were age-adjusted by the direct method to the 1979 total resident population of the United States. The relative risks of diabetic renal mortality were defined as the ratios of diabetic renal mortality rates to the nondiabetic renal mortality rates.[15] Attributable risks were defined as the differences between the diabetic renal mortality rates and the nondiabetic renal mortality rates.[15]

Results

Table 1 presents age-specific renal mortality rates for people with diabetes and people without diabetes by race and sex. Renal mortality rates increase with age and are generally much higher in people with diabetes than in people without diabetes.

Without exception, sex-specific non-diabetic renal mortality rates are higher among races other than Whites, and race-specific non-diabetic renal mortality rates are higher among men than women. In contrast, sex-specific total diabetic renal mortality rates are similar among Whites and other races, and age-specific rates are actually higher among White men 15 to 44 years of age than men of other races, and higher among White women over 65 years of age than other women. Race-specific total diabetic renal mortality rates are

TABLE 1—Age-specific Renal Mortality Rates for People with and without Diabetes by Race and Sex, US Resident Population 15 Years of Age and Older, 1979

	Diabetes Renal Mortality Rates per 100,000				
	White		Other Races		
Age (years)	Men	Women	Men	Women	Total
15–44	99.63	59.53	41.48	85.71	71.68
45–64	88.57	88.96	100.00	122.65	93.62
65+	354.82	308.57	429.76	256.05	321.86
Total	183.88	172.91	144.30	174.08	174.59
Age-Adjusted	133.84	103.23	112.86	119.91	113.63
	Non-Diabetes Renal Mortality Rates per 100,000				
	White		Other Races		
Age (years)	Men	Women	Men	Women	Total
15–44	2.97	2.10	7.64	5.58	3.11
45–64	34.08	21.03	81.99	61.83	31.83
65+	308.56	171.76	400.78	284.67	236.44
Total*	47.61	35.13	58.93	45.26	42.45
Age-Adjusted	55.31	31.59	83.79	60.52	44.35

*Total includes deaths for which age was not stated.

SOURCES: National Center for Health Statistics: Public use multiple cause of mortality data tape, 1979.

National Center for Health Statistics: National Health Interview Survey, public use data tape, 1979.

US Bureau of the Census.[7]

Address reprint requests to Linda S. Geiss, MA, Division of Diabetes Control, Centers for Disease Control, Atlanta, GA 30333. This paper, submitted to the Journal February 15, 1985, was revised and accepted for publication May 3, 1985.

TABLE 2—Relative Risk and Attributable Risk of Renal Mortality due to Diabetes by Race and Sex, US Resident Population, 1979

	Relative Risks (DM/Non-DM)				
	White		Other Races		
Age (years)	Men	Women	Men	Women	Total
15–44	33.57	28.33	5.42	15.36	23.08
45–64	2.60	4.23	1.22	1.98	2.94
65+	1.15	1.80	1.07	0.90	1.36
	Attributable Risks (DM-NonDM) per 100,000				
	White		Other Races		
Age (years)	Men	Women	Men	Women	Total
15–44	96.66	57.43	33.84	80.13	68.58
45–64	54.49	67.93	18.01	60.82	61.80
65+	46.25	136.81	28.98	−28.62	85.42

similar among women and men, and age-specific rates are actually higher among women of other races 15 to 64 years of age than among men of other races.

Table 2 presents age-specific relative risks and attributable risks of renal mortality by race and sex. The relative risks of renal mortality are greatest in the 15–44 year age groups and decline in the older age groups. The impact of diabetes on renal mortality is not as great among other races as it is among Whites. In general, the highest attributable risks are in the 15–44 year age groups. The exception is among White women in whom attributable risk increases with age.

Discussion

The diabetes renal mortality rates presented in this paper underestimate true diabetes renal mortality since only about 40 per cent of people with diabetes who die have diabetes recorded anywhere on their death certificates.[16] Nevertheless, the results confirm that renal mortality rates are higher among diabetics than among those without diabetes. They also confirm that the relative risk and attributable risk of renal mortality are generally greatest in the 15 and 44 year age group and suggest that the risk of renal mortality is greatest among people with Type I diabetes.

This study also defines important differences in nondiabetic and diabetic renal mortality rates among Whites and other races, and among men and women. The observed differences between Whites and others could be due to a true difference in the natural history of diabetic renal disease. Earlier studies have failed to use appropriate denominators. If race-specific diabetes renal mortality rates are expressed per general population, the true difference between races is obscured because rates of diabetes differ between Whites and other races: Type I diabetes is more common in Whites than in other races, and Type II diabetes is more common in other races than in Whites. It is also possible that the racial differences we observed are due to better reporting of diabetes and renal disease on the death certificates of Whites, and to underreporting of these conditions on the death certificates of people of other races.

Previous studies based on rates of initiation of dialysis therapy have reported higher rates of diabetic renal failure among men than among women. The present data suggest that diabetic renal mortality is similar among women and men, and suggest that higher rates of initiation of dialysis therapy among men may be due to a treatment bias rather than a higher incidence of diabetic end-stage renal disease among men.

REFERENCES

1. Robbins SL, Tucker AW Jr: The cause of death in diabetes. N Engl J Med 1944; 231:865–868.
2. Warren S, LeCompte PM, Legg MA: *The Pathology of Diabetes Mellitus*, 4th Ed. Philadelphia: Lea and Febiger, 1966.
3. Balodimos MC: Diabetic nephropathy. *In:* Marble A, White P, Bradly RF, Krall LP (eds): Joslin's Diabetes Mellitus, 11th Ed. Philadelphia: Lea and Febiger, 1971.
4. Entmacher PS, Root HF, Marks HHH: Longevity of diabetic patients in recent years. Diabetes 1964; 13:373–377.
5. Pell S, D'Alonzo CA: Factors associated with long-term survival of diabetics. JAMA 1970; 214:1833–1840.
6. Herman WH, Teutsch SM: Renal disorders associated with diabetes mellitus. *In:* Diabetes Data-Compiled 1983, National Diabetes Data Group, NIH, (in press, 1985).
7. US Bureau of the Census: Preliminary estimates of the population of the United States, by age, sex, and race: 1970 to 1981. Current Population Reports, Series P-25, No. 917. Washington, DC: Govt Printing Office, 1982.
8. National Center for Health Statistics: Health survey procedure: concepts, questionnaire development, and definitions in the Health Interview Survey. Vital and Health Statistics. PHS Pub. No. 1000-Series 1-No. 2. Public Health Service. Washington, DC: Govt Printing Office, May 1964.
9. National Center for Health Statistics: Health Interview Survey Procedure, 1957–74. Vital and Health Statistics. Series 1-No. 11. DHEW Pub. No. (HRA) 75-111. Health Resources Administration. Washington, DC: Govt Printing Office, April 1975.
10. National Center for Health Statistics: Estimation and sampling variance in the Health Interview Survey, by J.A. Bean. Vital and Health Statistics. PHS Pub. No. 1000-Series 2-No. 38. Public Health Service. Washington, DC: Govt Printing Office, June 1970.
11. National Cancer for Health Statistics: Quality control and measurement of nonsampling error in the Health Interview Survey, by D.A. Koons. Vital and Health Statistics. Series 2-No. 54. DHEW Pub. No. (HSM) 73-1328. Health Services and Mental Health Administration. Washington, DC: Govt Printing Office, March 1973.
12. National Center for Health Statistics: Health interview responses compared with medical records, by E. Balamuth. Vital and Health Statistics. PHS Pub. No. 1000-Series 2-No. 7. Public Health Service. Washington, DC: Govt Printing Office, July 1965.
13. National Center for Health Statistics: Interview data on chronic conditions compared with information derived from medical records, by W.G. Madow. Vital and Health Statistics. PHS Pub. No. 1000-Series 2-No. 23. Public Health Service. Washington, DC: Govt Printing Office, May 1967.
14. National Center for Health Statistics: The influence of interviewer and respondent psychological and behavioral variables on the reporting in household interviews, by C.F. Cannell, F.J. Fowler Jr, K.H. Marquis. Vital and Health Statistics. PHS Pub. No. 1000-Series 2-No. 26. Public Health Service. Washington, DC: Govt Printing Office, March 1968.
15. Mausner JS, Bahn AK: *Epidemiology*. Philadelphia: W.B. Saunders, 1974.
16. Herman WH, Sinnock P, Brenner E, *et al:* An epidemiologic model for diabetes mellitus: incidence, prevalence and mortality. Diabetes Care 1984; 7:367–71.