

Characteristics of Patients Referred for Treatment of End-Stage Renal Disease in a Defined Population

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Abstract: We studied the incidence of referral for treatment of end-stage renal disease (ESRD) in the Kaiser Foundation Health Plan (KFHP) in northern California from 1972 through 1977. In this population of over 1 million persons, we found an age-adjusted annual incidence of 44.9 per million after 1973, when the Federal ESRD Program went into effect. Age-specific incidence was highest in men ≥ 70 years of age and in women in the 50- to 59-year age group; the male/female ratio was 1.4:1. The most common diagnoses of patients referred with ESRD were glomerulonephritis

(11.4 per million per year), diabetic nephropathy (5.0 per million per year), primary hypertensive disease (3.1 per million per year), and polycystic kidney disease (2.4 per million per year). Estimated rates of referral for ESRD were highest for Blacks, lowest for Whites, and intermediate for Asians. Incidence varied by geographic area within the health plan service area and was highest where the percentage of the Black population was highest. (*Am J Public Health* 1982; 72:829-833.)

Introduction

In 1972, the Federal End-Stage Renal Disease Program was enacted to extend Medicare coverage to virtually all patients with end-stage renal disease (ESRD). Costs of this program, which were \$902 million in 1977, are now well over \$1 billion a year and are expected to exceed \$3 billion by 1984.¹ These enormous costs have raised fundamental social, economic, and ethical questions and have led to a broad reassessment of research directions in the field of kidney and urinary tract diseases. Efforts in the direction of prevention have been hampered by a basic deficiency in the epidemiologic information available on ESRD.^{2,3} At its 1972 meeting, the Advisory Committee on Epidemiology and Statistics of Kidney Diseases, sponsored by the National Kidney Foundation, found little accurate data on the risk of ESRD or kidney disease in general in the United States population.¹ Since that time, few population-based data have been published on the characteristics of patients receiving treatment for ESRD in this country.⁴⁻⁹

To address part of this deficiency, we have taken advantage of existing data on the membership of the Kaiser Foundation Health Plan (KFHP) in northern California. Hemodialysis and transplantation services are almost always

performed outside KFHP facilities but must be approved through a centralized administrative process. Review of the file of persons referred for treatment of ESRD and of their previous medical records has provided incidence data for the period from 1972 through 1977.

Methods and Study Population

The KFHP of northern California serves over 1 million members in the San Francisco Bay Area and Sacramento. Comparison of the 1970 US Census population in the San Francisco-Oakland Standard Metropolitan Statistical Area with that of the health plan members in the same area is provided in Table 1. The KFHP membership increased from 1,089,206 in June 1972 to 1,381,672 in June 1977, but the age and sex distribution remained substantially unchanged. Most members join this prepaid health plan through their place of employment and are eligible for complete medical care for themselves and their dependents at the most convenient KFHP facility. Some special services, such as hemodialysis and renal transplantation, are supplied by outside facilities and covered by the KFHP.

For this study, a central file containing basic identifying information was used to create a list of all patients who were referred for hemodialysis or transplantation from KFHP facilities in northern California. Beginning in 1973, when Medicare coverage was extended to the ESRD Program, the acceptance criteria were liberal, and virtually all patients who could benefit from hemodialysis in the judgment of their physicians were accepted for treatment.

We reviewed the medical records of all 271 patients accepted for hemodialysis for the first time between January 1, 1972, and December 31, 1977. On a precoded standardized form, basic identifying information, race, place of residence,

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TABLE 1—Comparison of the Age and Sex Distribution of Kaiser Foundation Health Plan (KFHP) Members Served by Facilities in the San Francisco-Oakland Standard Metropolitan Statistical Area in March 1970 to the Population Enumerated by the 1970 US Census in the Same Region

Age	KFHP Members		US Census Population	
	Men %	Women %	Men %	Women %
0-9	19.7	18.7	16.9	15.5
10-19	20.9	19.8	18.0	16.8
20-29	14.2	17.0	17.1	17.0
30-39	13.2	12.7	12.4	11.6
40-49	13.1	13.4	12.7	12.8
50-59	10.5	10.3	10.8	11.0
60-69	5.9	5.6	7.1	7.9
70+	2.6	2.5	4.9	7.5
Total	100.1	100.0	99.9	100.1
Number	287,504	293,637	1,520,252	1,598,267

referring KFHP facility, and occupation were recorded. Additional medical data were coded, including the documentation and date of the renal disease diagnosis and major associated medical conditions.

We used membership counts from June of each year as the denominators for incidence rates, except for rates by race. For these, we used denominators extrapolated from the results of a 1976 administrative telephone survey of a random sample of 2,395 members of the northern California KFHP. Interviews were completed in only 44 per cent of those listed for survey; in 17 per cent, either the telephone number was wrong, the telephone was disconnected, or the respondent was not a KFHP member at the time; in 30 per cent, there was no answer or no KFHP informant available;

9 per cent refused to participate. Despite the low response rate, the age and sex distribution of the members of respondent families was virtually identical to that of the health plan membership in 1976. Comparison of the sample interviewed with the 1970 US Census population in the same area showed no important differences by race and a somewhat smaller proportion of health plan members in the lowest and highest income groups (Table 2).

We placed patients into categories of renal diagnoses according to a modification of the classification used by the California Kidney Disease Information System.⁵ We accepted the diagnosis of glomerulonephritis if confirmed by histologic evidence or if the attending physician's diagnosis was supported by the presence of proteinuria predating the development of hypertension; primary hypertensive disease necessitated obtaining either histologic confirmation or the attending physician's diagnosis accompanied by evidence of hypertension before the first manifestation of renal disease; pyelonephritis necessitated obtaining radiographic evidence or the physician's diagnosis with a clear history of urinary tract infections. The category "unknown" included cases without sufficient evidence to make a diagnosis, and the category "multiple contributory factors" included cases without enough evidence to identify the primary etiologic condition.

Methods of diagnostic confirmation were grouped by renal biopsy, radiography, and other techniques. Biopsies which provided diagnostic information were performed in 23.8 per cent of ESRD patients, whereas 50.6 per cent of the diagnoses were documented by renal roentgenography without biopsy and 25.5 per cent by other techniques, such as radionuclide scanning and cystoscopy.

Results

The incidence of referral for treatment of ESRD in 1972 was 23.0 per million members per year (Table 3). The increased incidence subsequent to this time was probably

TABLE 2—Comparison of Race and Income Level of a Random Sample of Kaiser Foundation Health Plan (KFHP) Members in June 1971 to the Population Enumerated by the 1970 US Census in the San Francisco-Oakland Standard Metropolitan Statistical Area

	KFHP Members	US Census Population
	%	%
Race		
White*	84	83
Black	8	11
Other	8	6
Total	100	100
Number	1,046	3,109,519
Income		
Under \$7,000	17	22
\$ 7,000- 9,999	19	11
\$10,000-14,999	36	35
\$15,000 and over	21	32
Not reported	7	
Total	100	100
Number	1,046	776,750

*Includes Latin (and Mexican) Americans.

TABLE 3—Crude Incidence of Referral for Treatment of ESRD per Million KFHP Members, 1972–1977

Year	Men		Women		Total	
	No.	Rate*	No.	Rate	No.	Rate
1972	14	26.0	11	20.0	25	23.0
1973	21	36.6	15	25.7	36	31.1
1974	28	47.7	20	33.4	48	40.5
1975	26	42.7	15	24.0	41	33.3
1976	33	51.2	25	37.7	58	44.4
1977	31	45.6	25	35.6	56	40.5

*Denominator = membership in June of each year.

TABLE 4—Mean Annual Incidence by Age at Year of Referral for Treatment of ESRD per Million KFHP Members, 1973–1977*

Age (years)	Men		Women		Total	
	No.	Rate	No.	Rate	No.	Rate
0–9	1	2.0	0	0.0	1	1.0
10–19	9	13.8	6	9.5	15	11.7
20–29	17	33.4	10	16.8	27	24.4
30–39	18	38.6	9	19.1	27	28.8
40–49	23	64.7	21	59.0	44	61.8
50–59	32	102.1	34	105.0	66	103.6
60–69	23	129.0	12	68.7	35	99.1
70+	16	218.0	8	97.4	24	154.3
Total crude rate	139	45.6	100	32.1	239	38.8
Age-adjusted rate†		51.5		37.2		44.9

*Excludes 1972 data.

†Direct method, standard = 1970 US Census.

the result of the increased federal health insurance coverage available since 1973; for this reason, we will present data for the post-1972 period only.

The age-specific mean annual incidence for 1973–1977 is presented in Table 4. The male/female ratio of age-adjusted rates was 1.4:1, and 59 (24.7 per cent) of all those referred were ≥ 60 years of age.

The majority of ESRD patients (70.3 per cent) were White; Blacks accounted for 20.9 per cent. Rates of ESRD referral based on the racial composition of the survey sample of the membership (Table 5) were much higher in Blacks than Whites, and intermediate in Asians.

Among specific forms of renal disease, the conditions having the greatest annual incidence in the 1973–1977 period were glomerulonephritis (11.4 per million members), diabetic nephropathy (5.0 per million members), primary hypertensive disease (3.1 per million members), and polycystic kidney disease (2.4 per million members). Glomerulonephritis was the most common diagnosis in all ethnic groups. Primary hypertensive disease accounted for relatively more patients among Blacks (14.0 per cent) than Whites (5.7 per cent). The proportion of persons with specific diagnoses by sex is presented in Table 6.

Forty-nine cases (20.5 per cent) of ESRD had either multiple contributing factors or were of unknown cause.

Examples of multiple contributing factors were infection with hypertension, or hydronephrosis and hypertension with proteinuria. The average age of patients with ESRD of either multiple or unknown causes (51.5 years) was higher than in other diagnostic groups (46.7 years). The causes of the renal conditions in these categories were frequently obscured by the presence of arteriosclerotic vascular disease and other diseases that are found frequently in older persons.

Rates of referral for treatment of ESRD varied considerably in the ten geographic areas served by the KFHP (Table 7). When examined by area of residence, the mean age-adjusted rate was highest in Richmond and lowest in San Rafael and San Francisco. The Richmond and Oakland areas are the areas with the highest percentage of Black population as indicated by the 1970 US Census. When rates of referral were examined by referring facility, the highest age-adjusted rates were from the San Francisco and Oakland facilities.

The primary occupations of patients were grouped into four major, relatively homogeneous categories plus a fifth, which included retired and unemployed persons, students, and housewives. Among men, the largest proportion (36.7 per cent) of ESRD patients were craftsmen, mechanics, and operatives; 23.7 per cent were service and labor workers; 14.4 per cent were managers, clerical, and sales; 11.5 per cent were professional and technical; 10.1 per cent were

TABLE 5—Approximate Mean Annual Crude Incidence of ESRD Referral by Race per Million KFHP Members,* 1973–1977

Race	Men		Women		Total	
	No.	Rate	No.	Rate	No.	Rate
White†	105	39.6	64	23.6	169	31.5
Black	24	98.5	26	104.2	50	101.4
Asian	8	87.6	6	65.1	14	75.7
Unknown	2	32.8	4	64.1	6	48.7
Total	139	45.6	100	32.1	239	38.8

*Denominators for rates by race derived from sample survey of membership in 1976.

†Includes Latin and "other" categories.

retired, students, or unemployed; and 3.6 per cent had unknown occupations. Among women, 44.0 per cent were in the not employed, retired, and student categories, which also included housewives, and 27 per cent were in managerial, clerical, and sales positions.

Discussion

Incidence rates for ESRD based on defined populations are difficult to obtain,⁷ and, until recently, little such data have been available.¹ At least six US studies⁴⁻⁹ have now provided incidence data derived from patients receiving treatment, instead of from death certificates or morbidity statistics.

Our age-adjusted mean annual incidence rates per million for 1973–1977 of 44.9 for all persons, 51.5 for men, and 37.2 for women, were similar to those obtained for all of California in 1973 by the California Kidney Disease Information System,⁷ i.e., 43.9, 52.7, and 36.7, respectively. Possibly because of their greater frequency of Blacks, two other areas, northeast Pennsylvania⁷ and southeast Michigan,⁸ had

higher incidence rates than were found in these two California studies.

As in New York State,⁹ preliminary data suggest that KFHP referral rates may have increased since 1977, possibly because of the acceptance of more elderly persons⁹ and diabetics for dialysis.

Age-specific incidence of ESRD referral was almost identical to the overall California figures,⁵ except that the KFHP rates are higher in the ≥60 year age group. Our data, like those from Pennsylvania,⁷ show that rates continued to climb with increasing age, whereas in the earlier California study rates peaked in the 60- to 69-year age group, then markedly decreased. This difference probably resulted from increases in the proportion of persons over 60 years of age since the time of the California study. The continued increase with age over 60 years was limited to men in both our study and the Pennsylvania study, suggesting that some sex-based differences in causal factors of ESRD manifested late in life or in noncausal factors that determine whether a person with ESRD is treated.

In our study, the rates for Blacks were over three times as high as those for Whites; further, these differences were

TABLE 6—Proportion of Persons with Specific Diagnoses Referred for Treatment of ESRD among KFHP Members, 1973–1977

Diagnosis	Men (N = 139)	Women (N = 100)	Total (N = 239)
Glomerulonephritis	31.7	26.0	29.3
Diabetic nephropathy	12.2	14.0	13.0
Primary hypertensive disease	7.9	8.0	7.9
Pyelonephritis	3.6	10.0	6.3
Polycystic kidney disease	7.2	5.0	6.3
Obstructive nephropathy	4.3	2.0	3.3
Collagen vascular disease	0.7	6.0	2.9
Other hereditary and congenital renal disease	2.9	2.0	2.5
Gouty nephropathy	1.4	1.0	1.3
Tumors (amyloidosis, myeloma)	1.4	1.0	1.3
Analgesic abuse	0.7	2.0	1.3
Other	1.4	6.0	3.3
Multiple contributing factors	14.4	6.0	10.9
Unknown	9.4	10.0	9.6
No information	0.7	1.0	0.8

*Denominator = membership in June 1975.

TABLE 7—Mean Age-Adjusted* Annual Incidence of ESRD Referral by KFHP Area of Residence and Referring Facility per Million KFHP Members, 1973–1977

Community	Area of Residence†		Referring Facility	
	No.	Rate	No.	Rate
Hayward	22	49.7	24	57.8
Oakland	35	56.9	36	58.2
Redwood City	14	35.0	11	34.2
Richmond	13	75.0	7	43.5
Sacramento	37	57.5	35	55.2
San Francisco	30	31.6	54	59.2
San Rafael	7	31.0	5	20.0
Santa Clara	36	45.7	35	37.4
Vallejo	13	35.6	9	24.6
Walnut Creek	32	58.4	23	41.7
Total	239	44.9	239	44.9

*Direct method, standard = 1970 U.S. Census.
†KFHP residence areas determined by zip code.

more marked among women than men. However, our race-specific rates were based on denominators estimated by a phone survey. High rates in Blacks and Asians may be partially the result of undercounting persons who did not respond and persons without operating telephones. Nevertheless, our estimated rates by race were roughly similar to those in southeast Michigan;⁸ we found the highest ESRD referral rates from the Richmond and Oakland areas, where Blacks make up the highest proportion of the population.

Our data support the suggestion¹⁰ that regional variation in the prevalence of persons receiving dialysis may be partly associated with race. "Commercialism"¹³ is probably not responsible for regional differences in our study population since the opportunity of referral for ESRD treatment is essentially uniform throughout the KFHP. The presence of renal specialists in the Oakland and San Francisco facilities probably explains the high referral rates from these institutions.

A larger proportion of our ESRD cases, 20.5 per cent, has ESRD of multiple or unknown causes compared to that reported elsewhere.^{5,8} This discrepancy may partially be caused by our collecting information by review of medical charts as opposed to interviewing attending physicians, but, again, increased age of our ESRD population may have led to the inclusion of more elderly persons with multiple illnesses and the resultant increased difficulty of assigning a primary diagnosis. Differences in diagnostic effort did not seem substantial compared to those reported by others.⁵

The descriptive data presented in this report confirm previous reports of incidence by age and sex of persons treated for ESRD. Although based on estimated denominator populations, estimates of incidence by race also support the observation that the Black population sustains the highest risk of ESRD. This higher risk does not appear to be the result solely of their preponderance among patients with primary hypertensive disease, and further study of factors associated with race and ESRD is needed. Finally, it is unlikely that "commercialism" is responsible for skewed

differences in rates of referral by geographic areas within the health plan service area. Rather, patterns of medical care referral and socioeconomic factors, some associated with race, may be more important.

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