Incidence of end-stage renal disease and death among insured African Americans with chronic kidney disease

Stephen F. Derose[1], Mark P. Rutkowski[2], Nathan W. Levin[3], In-Lu A. Liu[1], Jiaxiao M. Shi[1], Steven J. Jacobsen[1] and Peter W. Crooks[4]

[1]Research & Evaluation, Kaiser Permanente Southern California, Pasadena, California, USA; [2]Department of Medicine, Baldwin Park Medical Center, Kaiser Permanente Southern California, Los Angeles, California, USA; [3]Renal Research Institute, New York, New York, USA and [4]Renal Program, Kaiser Permanente Southern California, Pasadena, California, USA

African Americans have the highest incidence of end-stage renal disease (ESRD) in the United States. To understand the basis of this disparity, we examined data from a prepaid, integrated health system for this retrospective cohort study of members who had one or more serum creatinine tests performed over a 9-year period. The cohort included 182,959 adults (8% black) with stage 3 or 4 chronic kidney disease based on their estimated glomerular filtration rate (eGFR). Competing-risk methods were used to determine the incidence of ESRD and death prior to ESRD. At all follow-up times and from any entry eGFR, the cumulative incidence of ESRD was significantly greater in blacks. The age and gender-adjusted hazard ratios for ESRD and death prior to ESRD in blacks compared to non-blacks were 1.83 and 1.15, respectively. Increased survival free of ESRD was found in blacks 70 years and older with eGFR stage 4. The hazard ratio for the combined outcomes of ESRD or death was 1.31 in blacks as compared to non-blacks. Despite equivalent health insurance benefits, blacks with chronic kidney disease were at increased risk for ESRD and death prior to ESRD. Compared to non-blacks, blacks with chronic kidney disease were twice as likely to enter into ESRD as to die prior to ESRD.

Kidney International (2009) **76,** 629–637; doi:10.1038/ki.2009.209; published online 10 June 2009

KEYWORDS: chronic kidney disease; epidemiology; ESRD; minority health

Correspondence: *Stephen F. Derose, Research & Evaluation, Kaiser Permanente Southern California, 100 S Los Robles, 2nd Floor, Pasadena, California, USA. E-mail: Stephen.F.Derose@kp.org*

Received 15 December 2008; revised 15 April 2009; accepted 21 April 2009; published online 10 June 2009

End-stage renal disease (ESRD) is a growing public health problem that disproportionately affects African Americans.[1] Although the causes of the disparity remain unclear, the magnitude of the problem is well known. In 2004, the age- and sex-adjusted incidence of ESRD in Blacks was 2.6 times higher than that in non-Blacks.[1] Therapy for ESRD with dialysis or kidney transplantation is life-saving, but mortality after the onset of ESRD remains high: for those starting dialysis in 2001, the 3-year survival probability was just 54%.[1] Although ESRD is a feared result of chronic kidney disease (CKD), death before ESRD is more common.[2–6] Unfortunately, the number of patients with CKD is large (recently estimated at 13% of the US population) and is increasing.[1,7]

The racial disparity in ESRD incidence may be due to several population differences, including the risks that lead to kidney disease, kidney disease type and severity, and comorbidities that affect mortality before ESRD. These population differences may result from more distal causes such as variations in genetic expression, environmental exposures, health-related behavior, health-care access and quality, or response to therapy.[8–11] Regardless of the ultimate causes, the basic epidemiological forces driving the increase in ESRD incidence for Blacks are only partly understood. Driving forces may include increased onset of CKD,[10] increased rate of kidney function loss,[12,13] and a survival advantage in late-stage CKD.[14–16] Better understanding of these forces will help target research and interventions designed to reduce disparities in CKD. For example, if kidney function loss is greater in Blacks, then efforts might be focused on disease initiation or the point at which kidney function diverges and the disparity begins. Alternatively, if there is a survival advantage for Blacks in late-stage CKD, then either early-stage CKD-related mortality in Blacks (resulting in a healthy survivor effect) or late-stage CKD mortality in non-Blacks might be targeted.

In this study, we examined disparities in ESRD and death before ESRD as a first step toward identifying the forces driving racial disparities in ESRD. Estimates of the simultaneous incidence of ESRD and death before ESRD that

account for competing risks are needed to understand the extent of racial disparities in these two linked events. Study subjects were members of a prepaid, integrated health system. This setting is particularly relevant because if racial disparities are substantially smaller under conditions of equivalent health insurance benefits, then access to care may be implicated as a focus area for research and policy.

RESULTS

Of the 2,515,552 potential subjects with estimable kidney function before an end point or censoring, 182,959 had a randomly selected study entry estimated glomerular filtration rate (eGFR) from 15 to <60 ml/min per 1.73 m^2 (the study cohort, see Figure 1). The study cohort is compared with the source population (that is, all adult health plan members) in Table 1. Subjects in the study cohort were significantly ($P<0.001$) older and more often female than in the source population. The racial distribution of the source population and the study cohort is shown in Table 1. In the source population, Blacks were 1.4 times more likely to have had a serum creatinine test ($P<0.001$). Information about race was more complete in persons with one or more serum creatinine tests and at lower eGFR levels. The median household income, based on US Census Block Group, of the study cohort was significantly less in Blacks than that in non-Blacks (median \$47,500 vs \$59,369 per year, $P<0.001$).

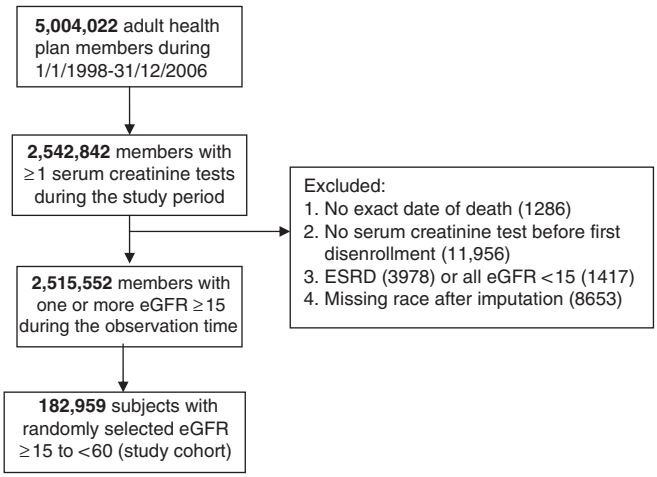

Figure 1 | Flow diagram of study cohort assembly.

Subject characteristics by eGFR strata and race are provided in Table 2. The distribution of Black and non-Black race was significantly different ($P<0.001$) across eGFR strata, with relatively more Blacks at lower eGFR. The median number of serum creatinine tests was greater in Blacks (21 vs 11, $P<0.001$). The mean observation time from the entry eGFR to an end point or censoring was 1.69 years in Blacks and 1.64 years in non-Blacks ($P<0.001$). Before the end of the study period, 11.0% of Blacks and 17.7% of non-Blacks had disenrolled from the health plan before experiencing ESRD.

In the total cohort, death was more common than ESRD, especially in non-Blacks (Table 2). The crude rate of death before ESRD (per 1000 person-years) was 99 (95% confidence interval (CI) 96–102) in Blacks and 87 (95% CI 86–88) in non-Blacks; the crude rate of ESRD (per 1000 person-years) was 37 (95% CI 35–39) in Blacks and 12 (95% CI 11–13) in non-Blacks. Thus, the overall ratio of death/ESRD was 2.7 in Blacks and 7.3 in non-Blacks. Death and ESRD occurred at a younger age in Blacks. The mean age at death was 74.9 years (s.d. 12.0) in Blacks and 79.0 years (s.d. 10.9) in non-Blacks ($P<0.001$). The mean age at the beginning of ESRD treatment was 62.4 years (s.d. 13.7) in Blacks and 63.9 years (s.d. 13.9) in non-Blacks ($P<0.001$).

The Black and non-Black populations had different patterns in the relative incidence of ESRD and death before ESRD. The cumulative incidence curves in Figure 2 show the

Table 1 | Demographic characteristics of adult health plan members (the source population), the subpopulation with one or more serum creatinine tests, and those with an eGFR of 15 to <60 ml/min per 1.73 m^2 (the study cohort)

Characteristic	Source population: adult members (*n*=5,004,022)[a]	Subpopulation: ⩾1 serum creatinine tests (*n*=2,542,842)	Study cohort: eGFR 15 to <60[b] (*n*=182,959)
Age (years): median (25th to 75th percentile)	33.5, 22.3–46.7	41.3, 29.3–53.8	69.4, 60.3–78.4
Female: *n* (%)	2,525,769 (50.5)	1,399,183 (55.0)	104,906 (57.3)
Race: Black and non-Black after imputation			
Black: *n* (%)	290,963 (5.8)	202,823 (8.0)	15,484 (8.5)
Non-Black: *n* (%)	4,419,377 (88.3)	2,230,457 (87.7)	167,475 (91.5)
Not assigned: *n* (%)	293,682 (5.9)	109,562 (4.3)	—
Race: all categories as recorded in health plan files			
Black: *n* (%)	259,494 (5.2)	188,764 (7.4)	15,003 (8.2)
White: *n* (%)	1,354,233 (27.1)	993,879 (39.1)	112,525 (61.5)
Asian: *n* (%)	175,330 (3.5)	125,545 (4.9)	8953 (4.9)
Native American: *n* (%)	3525 (0.1)	2333 (0.1)	142 (0.08)
Other: *n* (%)	53,089 (1.1)	41,043 (1.6)	2909 (1.6)
Multiple: *n* (%)	5151 (0.1)	3114 (0.1)	114 (0.06)
Unknown: *n* (%)	3,153,200 (63.0)	1,188,164 (46.7)	43,313 (23.7)

[a]Greater than 17 years old from 1998 to 2006.
[b]Unit: ml/min per 1.73 m^2.