

Epidemiology and Costs of Chronic Kidney Disease in North Carolina

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End-stage kidney disease (ESKD) is an irreversible and debilitating disease that represents the last stage in the progression and long duration of chronic kidney disease. Chronic kidney disease (CKD) is not only a personal tragedy for patients and their families but is also a serious public health and financial burden for the United States. The burden of CKD in the US and worldwide has reached epidemic levels and is expected to continue to rise.

Epidemiology

Currently the unadjusted prevalence and incidence rates of end-stage (stage 5) kidney disease are 1585 and 350.7 per million, respectively.¹ These numbers do not reflect the burden of earlier stages of CKD (stages 1-4) which are estimated to affect 13.1% of the population nationwide, or 26.3 million Americans.² Throughout the duration of the disease, most of these people will experience adverse conditions and/or events such as cardiovascular disease, congestive heart failure, and premature death. Those who survive the comorbidities associated with CKD will eventually develop ESKD and require dialysis or kidney transplantation.³

North Carolina currently ranks as the 10th highest state in the US for prevalence of ESKD and 12th highest for incidence of ESKD with rates of 175.7 and 37.5 per 100 000 population, respectively. The statewide geographical distribution of ESKD tends to cluster in rural counties which are also disproportionately burdened with Medicare beneficiaries. The North Carolina counties with the highest prevalence of ESKD are Martin, Northampton, Swain, Lenoir, and Bertie, with rates ranging from 347.5 to 350.0 per

100 000 (Figure 1).⁴ Within North Carolina, kidney disease is the 10th most common cause of death, accounting for 7161 deaths between 2001 and 2005. The age-adjusted kidney disease death rate was 18.6 per 100 000 in 2005 and was twice as high for minorities than for Whites.⁴

The rates of incident and prevalent ESKD in North Carolina have demonstrated progressive increases between 1994 and 2005, and these rates have been consistently higher in North Carolina than in the US population. Observed racial differences in North Carolina showed the incidence rate for Black men was 3.3 times higher than it was for White men, and the incidence rate for Black women was 4.3 times higher than for White women.⁴

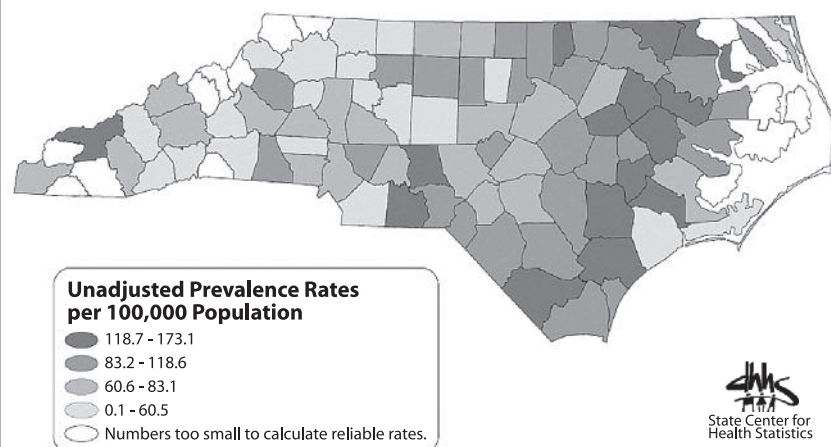
There are no current measures of prevalence for CKD stages

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1-4 in North Carolina. However, if national CKD estimates developed from the National Health and Nutrition Examination Survey (NHANES) are applied to the North Carolina population, an estimated 941 770 North Carolinians may currently be affected by early CKD.

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Figure 1.
Prevalence of End-State Kidney Disease in North Carolina
by County, 1990



SOURCE: US Renal Data System

Cost of Different Treatment Modalities

The economic burden imposed on the health care system by the treatment of ESKD, chronic kidney disease, and chronic kidney disease-related comorbidities is staggering. The US Renal Data System reports Medicare costs for the ESKD program are steadily increasing and now exceed \$20 billion (6.4% of the total Medicare budget). In the Medicare population, the 2005 per person per year cost of dialysis treatment was \$68,585 compared to \$102,637 for patients receiving a kidney transplant. Transitional costs have been on the rise, with costs of care in the month of dialysis initiation at \$16,035 (up \$2927 from 1994), and the costs in the last month of the life of patients who do not reach ESKD at \$12,405 (up \$4171 from 1994). The total inpatient person per year cost is about 8 times greater for patients with ESKD than for patients with CKD. Outpatient costs are, as expected, much higher among ESKD patients whose person per year dialysis costs reach almost \$12,000 and whose therapy with erythropoiesis stimulating agents is \$6000. Further, treatment expenditures differ based on comorbidities. For example, Medicare patients with CKD and diabetes have approximate per person per year costs of \$3000, while patients with CKD and hypertension have approximate per person per year costs of \$4000. CKD patients with both diabetes and hypertension have per person per year costs of \$5000.¹

Several recent publications have reported the economic impact of CKD in the US. In a study by Kaiser Permanente Northwest, among 43 178 residents of the greater Portland, Oregon area, investigators compared health care costs of patients with CKD to age-matched controls without CKD.⁵ During the follow-up period, patients with CKD incurred higher health care costs and showed higher utilization patterns than controls. Overall, the study found increased per person per year costs of between \$2578 and \$4676 in patients with CKD (depending on stage) compared to patients without

CKD. Compared to controls, patients with CKD had 1.9-2.5 times as many prescriptions, had 1.3-1.9 times as many office visits, and were 1.6-2.2 times as likely to be hospitalized.

In the RENAAL (Reduction of Endpoints in Non-insulin dependent diabetes mellitus [NIDDM] with the Angiotensin II Receptor Antagonist Losartan) study, costs associated with Losartan-treated ESKD were examined.⁶ (Losartan is a type of angiotensin II receptor blocker (ARB) that is used to treat hypertension but has also been indicated in delaying kidney disease progression in diabetic nephropathy.⁷) The study included 751 patients treated with Losartan and 762 patients in a placebo-treated conventional antihypertensive treatment group. A significant reduction in costs associated

with ESKD was found in the Losartan group compared to the placebo group. After taking into account the cost of Losartan, the total net savings for ESKD-related costs was \$3522 for patients in the Losartan group. These savings held true for patients at all levels of baseline albuminuria.⁶

A Medicare cost-benefit analysis was performed to examine the potential cost-effectiveness for first-dollar coverage (no patient cost sharing) of angiotensin-converting enzyme (ACE) inhibitors, which are shown to be effective in slowing the progression of kidney disease. Authors hypothesized that the expense of ACE inhibitors was a barrier to patients who would benefit from the drug. Results of this analysis showed that first-dollar coverage of ACE inhibitors saved both money and lives compared to the Medicare drug benefit. Lifetime savings of \$922 per beneficiary were estimated due to the prevention of medical events, especially kidney disease.⁸

Anemia is also a costly condition common among patients with CKD. In a study of managed care members, CKD-related anemia was associated with the highest average annual costs (\$41,292 per patient) compared to those costs associated with other anemia-related diseases (eg, HIV, rheumatoid arthritis, congestive heart failure, cancer).⁹

Finally, a study using the US Renal Data System population examined the economic impact of slowing the progression of CKD. Using mathematical models, this analysis assessed the effect of slowing CKD progression. Results showed that among patients with a glomerular filtration rate (GFR) less than 60 ml/min/1.73m² after December 31, 1999, the cumulative health care savings through 2010 would be \$19, \$39, and \$61 billion dollars for patients with a reduced GFR of 10%, 20%, and 30%, respectively.¹⁰

These studies provide documentation of the heavy economic burden of CKD in the United States and dramatic evidence for the cost-saving potential of CKD prevention. Due to underdiagnosis, undertreatment, and low awareness of early

chronic kidney disease in the population, studies of the estimated cost of chronic kidney disease in the US likely report gross underestimates of the true costs.

In order to successfully manage chronic kidney disease and reduce the burden of the disease, it is crucial that early detection and treatment programs are implemented. The primary health care system is already overextended in its ability to adequately manage chronic diseases. Even when CKD is detected early, there are long delays in referral to nephrologists due in part to

the limited number of practicing nephrologists and the limited number of non-dialysis patients able to be seen in the outpatient setting. Thus, it is paramount that other strategies be developed, such as encouraging proactive behavior among patients through targeted health plan or community-based education programs and expanding the health care management team to include CKD case workers to provide assistance to primary care providers. **NCMJ**

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