

Introduction: Chronic Kidney Disease: A Burgeoning Health Epidemic

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ABSTRACT

BACKGROUND: The kidneys function as excretory, biosynthetic, and metabolic organs, vital for maintaining normal physiology. Although dialysis can replace some kidney functions, it cannot replicate the biosynthetic and metabolic activities of the normal kidney. Chronic kidney disease (CKD) and its terminal complication, end-stage renal disease (ESRD), may progress undetected until immediately before symptomatic kidney failure develops. At this point in the disease process, few opportunities exist to prevent adverse outcomes.

OBJECTIVES: To (1) review the incidence, prevalence, and staging of CKD and ESRD and (2) elucidate that the management of CKD is suboptimal and costly.

SUMMARY: CKD is defined according to the presence or absence of kidney damage and level of kidney function. The Kidney Disease Outcomes Quality Initiative designates 5 stages of CKD, with stage 5 being ESRD—the point at which patients' loss of kidney function precipitates a need for dialysis or kidney transplant. The United States Renal Data System has documented monumental growth of the ESRD population and its significant impact on Medicare and its budget. In 2005, approximately 1.2% of Medicare's 31 million beneficiaries who had ESRD generated 6.4% of Medicare's total costs. One of the most important aspects of CKD diagnosis and treatment is early detection and aggressive management of underlying causes. However, care for CKD patients is fragmented. Primary care physicians, cardiovascular specialists, endocrinologists, dietitians, and pharmacists may be engaged in the patient's care early but the nephrologist may not be approached until late, if at all.

CONCLUSION: CKD is costly. Preventing progression to ESRD may improve quality of life and help save health care dollars. A concerted approach to manage CKD patients effectively starts with early detection and integrated management by multiple specialties. Delaying disease progression is crucial and must include patient education and aggressive treatment and management of CKD and its comorbidities. Interdisciplinary care models in which pharmacists are integrally involved should be replicated.

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In the normal person, the kidneys, weighing about 4 ounces each, process about 200 liters of blood daily to remove waste products and excess water. They metabolize 25-hydroxy-vitamin D to active 1,25 dihydroxy-vitamin D (calcitriol), which regulates absorption of calcium from foods and affects bone formation. Kidneys are critical to erythropoietin formation, which stimulates red blood cell production. They also regulate renin, which regulates blood volume and blood pressure. The kidneys function as excretory, biosynthetic, and metabolic organs, vital for maintaining normal physiology. Although dialysis can replace some kidney functions, it cannot replicate the biosynthetic and metabolic activities of the normal kidney.

CKD and Risk Factors

In the United States, about 1 in 9 adults has chronic kidney disease (CKD) and a minority suffer from its terminal complication, end-stage renal disease (ESRD).^{1,2} CKD is usually silent until its late stages, and without aggressive screening, detection may not occur until immediately before symptomatic kidney failure develops. At this point in the disease process, few opportunities exist to prevent adverse outcomes, such as further decline in kidney function necessitating dialysis, cardiovascular complications, shortened lifespan, and poor quality of life. The Kidney Early Evaluation Program (KEEP) is a national CKD screening program supported by the National Kidney Foundation (NKF) to identify patients at risk of developing CKD. The NKF organizes KEEP from its central offices, but the program is conducted in most states through NKF affiliates by a cadre of volunteer health professionals. Patients learn about KEEP in many ways; they may be referred by a health care provider or may learn about the program through the NKF's outreach efforts in the lay literature and poster campaigns.

Patients at higher risk for CKD include patients with diabetes, hypertension, or a family history of hypertension, diabetes, or CKD. CKD appears more often in minority groups; black American, Native American, Hispanic, Asian, and Pacific Islander populations are at higher risk of developing CKD than are white Americans. In these populations, diabetes and hypertension, which are the predominant causes of ESRD, are more common and tend to be familial.^{1,2} Patients who have a family history of those disorders or CKD are also at risk for developing CKD.¹

Until 2002, a common staging system for CKD did not exist and numerous terms were used to describe it. In 2002, the NKF Kidney Disease Outcomes Quality Initiative (KDOQI) Work Group developed a staging system (see Table). CKD is now defined according to the presence or absence of kidney damage and level of kidney function—regardless of the patient's underlying diagnosis. KDOQI designates 5 stages, with stage 5 being ESRD, when loss of kidney function (a glomerular filtration rate [GFR] < 15 mL per minute per 1.73 m²) precipitates

a need for dialysis or kidney transplant. Patients in stages 1 and 2 may have robust, normal, or slightly lowered GFR with evidence of underlying kidney damage, including proteinuria; large or small kidneys on an ultrasound; or other evidence of compromised function. All people with GFR <60 mL per minute per 1.73 m² for more than 3 months are classified as having CKD. This classification represents a loss of 50% or more of the adult level of normal kidney function.¹ Additionally, all people with kidney damage are classified as having CKD regardless of their GFR.¹

Approximately 450,000 Americans are in stage 5 CKD, or ESRD. The majority of patients—almost 20 million—occupy the lower stages. Almost 6 million patients have stage 1, more than 5 million have stage 2, approximately 8 million have stage 3, and 400,000 have stage 4 disease. Experts in the field now consider CKD epidemic and estimate another 20 million patients are at risk of developing CKD.^{1,2}

Not all patients with CKD progress to the later stages of CKD or to ESRD because they die prematurely from other causes.³ CKD comorbidities, such as cardiovascular disease (CVD), contribute to the high death rate in CKD. Patients usually have numerous comorbidities; therefore, managing the whole patient becomes a major challenge for CKD health care teams. The patients who progress and survive to reach ESRD might be considered lucky, although they rarely feel that way.

CKD Prevalence

The United States Renal Data System (USRDS) uses data from the Centers for Medicare & Medicaid Services (CMS) and other databases to provide information about CKD patients. Since 1990, the number of patients newly diagnosed with ESRD has increased from slightly less than 50,000 to more than 102,000 in 2005.³ The number of ongoing ESRD patients has also increased, from approximately 186,000 in 1990 to nearly 485,000 in 2005.³ Although the rate of new ESRD cases has been slowing, a recent prediction model estimates that there will be more than 785,000 ESRD patients in the United States by 2010.³

CKD Costs

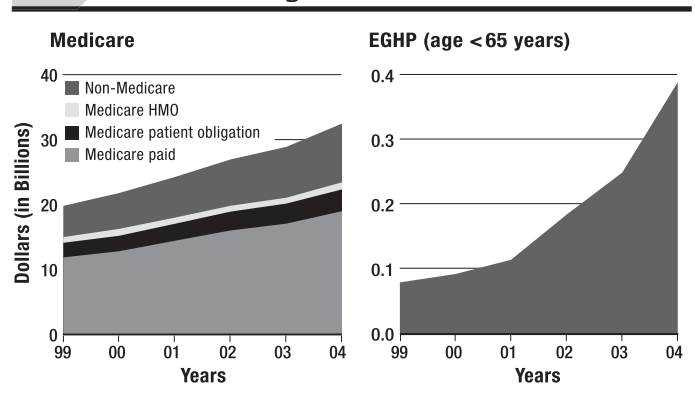
In 2005, approximately 1.2% of Medicare’s 31 million beneficiaries had ESRD. This small part of the Medicare population generates a disproportionate share—6.4%—of Medicare’s total costs.³ The Figure charts Medicare and employer group health plan (EGHP) ESRD spending for people less than 65 years old. The Figure (left side) shows that in the United States, about \$32 billion was spent on ESRD care in 2004, with about \$20 billion being the expense of Medicare and Medicare patients.³ The remainder is non-Medicare spending. Data from the Thomson-Medstat database, which includes approximately 4 million lives from roughly 100 EGHPs (Figure, right side), indicate that EGHP costs are also rising drastically.³

TABLE Stages of CKD

Stage	Description	GFR (mL per minute per 1.73 m ²)
1	Kidney damage* with normal or increased GFR	>90
2	Kidney damage* with mildly decreased GFR	60-89
3	Moderately decreased GFR	30-59
4	Severely decreased GFR	15-29
5	Kidney failure	<15 or dialysis

* Kidney damage is defined as pathologic abnormalities or markers of damage, including abnormalities in blood or urine tests or imaging studies. Adapted from K/DOQI Clinical Practice Guidelines on Hypertension and Antihypertensive Agents in Chronic Kidney Disease. Available at: www.kidney.org/professionals/kdoqi/guidelines_bp/executive_summary.htm#table2. Accessed September 19, 2007. CKD=chronic kidney disease; GFR=glomerular filtration rate.

FIGURE Non-Medicare ESRD Spending Is Rising



United States Renal Data System. USRDS 2006 Annual Data Report: Atlas of End-Stage Renal Disease in the United States. Bethesda, MD: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases; 2006.

EGHP=employer group health plan; ESRD=end-stage renal disease; HMO=health maintenance organization.

CKD care is costly. Researchers have tracked economic costs of CKD and its transition to ESRD. Some of these findings show that after patients begin dialysis, costs spike to about \$70,000 annually. Dialysis costs have been stable at \$1,000 per patient per month since the early 1990s.³ Although many of the drugs used to treat CKD are inexpensive, medication costs have increased as new agents have been developed to treat the complications of CKD. Some of these newer and more expensive therapies include erythropoietin-stimulating agents, intravenous iron, intravenous vitamin D, and phosphate binders.³ Transplant patients are even more costly, with associated medical costs of about \$102,000, on average, in the year of transplant.^{3,4} One

could hypothesize that identifying CKD patients early and preventing progression to ESRD might improve quality of life and save health care dollars.⁵

■ A Problem: Fragmented Care

A CKD patient has several affected organ systems in addition to the renal system. Cardiovascular system involvement (i.e., electrolytes, lipids, and blood pressure); diabetes management; and dietary restrictions require that many different practice areas be involved in the care of a CKD patient. While the primary care physician may play a role in care coordination, dieticians, nephrologists, endocrinologists, and cardiologists are essential when addressing the many interacting disorders. Without interdisciplinary communication, care for patients may become fragmented.⁵ Their education, too, suffers, as they are prevented from being involved in their own care.⁵

Care fragmentation delays CKD detection, preventing early use of evidence-based management principles like early screening and aggressive adherence to treatment guidelines to stop progression and to manage underlying comorbidities (e.g., anemia, hypertension, CVD, diabetes, malnutrition, and bone disease). An example of an area that is subject to fragmented care is vascular access for dialysis patients. Temporary vascular access, as opposed to the more appropriate permanent arteriovenous fistula, at the first dialysis visit is common but is detrimental and usually avoidable. In dialysis, a normal vein cannot accommodate the volume and rate of blood withdrawal that occurs during hemodialysis (blood is returned to the patient after purification). A surgeon sews an artery and vein in the arm together to create a fistula, and arterial pressure eventually enlarges the vein so it can accommodate a large needle for dialysis. Patients referred early to a nephrologist are more likely to have better blood pressure control, less risk for pulmonary edema, and acceptable arteriovenous fistula.

Treating comorbidities and modifying risk factors is an interdisciplinary challenge. Early detection, aggressive management, and patient education are critical to preventing CKD progression. For optimal benefits, health care professionals need a concerted approach to manage CKD patients effectively. Health care providers must involve and educate patients from the moment they are diagnosed, empowering them to make informed decisions with their health care team. Delaying progression is crucial and must include aggressive blood pressure control using angiotensin-converting enzyme inhibitors (ACEIs) or angiotensin II receptor blockers (ARBs) and optimal diabetes management.⁵ It is imperative that complications— anemia, malnutrition, bone and mineral metabolism disorders, calcification, and acidosis—are prevented and that smoking cessation is aggressively promoted. When indicated, the team will need to refer the patient to a nephrologist to either initiate dialysis or have a kidney transplant. These areas represent opportunity for pharmacist involvement.^{5,6}

■ Pharmacist Involvement: Possibilities

CKD is epidemic and under-diagnosed. Management principles are under-used and cost is high. Numerous opportunities exist for managed care and clinical pharmacists. Pharmacists can organize screening programs for their patient population(s) using tools available through KEEP. Once patients are identified, they need to be referred to an appropriate health care provider for evaluation and management.

Managed care pharmacists can develop medication therapy management protocols to ensure that CKD patients are initiated on ACEIs or ARBs to reduce rate of kidney disease progression. They can work to ensure that comorbidities such as hypertension, diabetes, anemia, and bone and mineral metabolism disorders are appropriately evaluated and managed. Managed care pharmacists can develop educational materials for CKD patients that focus on the above issues. Pharmacists who work in health maintenance organizations can also work directly with patients. For example, at Kaiser Permanente's Southern California locations, pharmacists monitor serum creatinine. If a patient's serum creatinine is elevated more than once, pharmacists examine the patient's medical history and can refer the patient appropriately to a nephrologist, primary care practitioner, social worker, or dietician. Multidisciplinary CKD clinics in Canada often have access to pharmacists under their government health care plan.⁷ Some U.S. pharmacists are integrally involved in providing CKD care.⁸

Ideally, these models will become ubiquitous. Comprehensive, coordinated, collaborative health care must eliminate barriers and employ measurable quality indicators to improve patient outcomes.

DISCLOSURES

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