

There is no cure for Chronic Kidney Disease (CKD). Characterized by a progressive inability of the kidneys to function properly, CKD, if left untreated, will ultimately result in complete kidney failure and death. Fortunately, the progression of CKD can be slowed with proper disease management and many patients never reach the point where dialysis or kidney transplant are the only treatment options available. Approximately 15% or 30 million adults in the US have CKD (Centers for Disease Control and Prevention [CDC], 2017). Medicare provides both dialysis and kidney transplant coverage for people of all ages with end stage renal disease (ESRD) (Centers for Medicare & Medicaid Services [CMS], 2018). In 2016, Medicare expenditures for patients with CKD were about \$79 billion, representing 25% of all Medicare spending for patients over 65 and 18% of spending for those under 65. “Growth in total CKD spending has primarily been driven by an increase in the number of identified cases, particularly those in the earlier stages (CKD Stages 1-3)” (United States Renal Data System [USRDS], 2018, Vol.1, p.133).

#### **KIDNEY FUNCTION**

The kidneys have several important functions in maintaining a healthy body. In addition to the well-known function of filtering waste products from the blood, they also produce hormones that serve to regulate blood pressure, stimulate red blood cell production, and produce an active form of vitamin D necessary for bone health (National Institute of Diabetes and Digestive and Kidney Diseases [NIDDK], 2018c).

The primary functional unit of a kidney is called a nephron and there are approximately 900,000 in each kidney (Puelles, Kanzaki, and Bertram, 2016). Nephrons contain a network of small blood vessels (capillaries), called glomeruli, which drain waste and water into tubules that drain into ureters, eventually collecting the drainage (as urine) in the bladder. Cellular waste products are passed to the blood which is then passed through the nephrons. Excess water and chemicals are filtered out in the glomeruli and continue to the tubules. The tubules further filter what was extracted in the glomeruli, either adding or removing the required amounts of water and chemicals such as sodium, calcium, phosphorus, and potassium back into the bloodstream to maintain the proper balance for normal function (National Kidney Foundation [NKF], 2017b; NIDDK, 2018c).

Healthy kidneys filter an average of 150 quarts of blood, removing approximately one to two quarts of waste products and extra water, per day. Declines in renal function can happen over time as one ages or as a result of disease or injury. Many never notice or feel any symptoms. Blood and urine tests are necessary to discover early declines in renal function (CDC, 2017; NIDDK, 2018c).

#### **DETERMINING RENAL FUNCTION**

The most common tests used to determine renal function are urine albumin-to-creatinine ratio (UACR) and estimated glomerular filtration rate (eGFR). Albumin is a blood protein that should not be filtered out of the blood by the kidney and creatinine is a blood protein that should be filtered out. When renal

function declines, levels of albumin show up in the urine and levels of creatinine rise in the bloodstream. Elevated levels of albumin and/or other proteins in the urine is called albuminuria or proteinuria and can be measured by a urine protein test. Elevated levels of creatinine in the blood can be determined by a serum creatinine blood test. eGFR is determined by a calculation that combines the measure of creatinine in the blood with values for age, sex, and race (NIDDK, n.d.a.; NKF, 2017b).

The National Kidney Foundation introduced a five-stage system for classifying CKD based on eGFR (USRDS, 2018a):

- Stage 1.** eGFR >90 with ACR  $\geq$ 30 mg/g (minimal kidney damage)
- Stage 2.** eGFR 60-89, ACR  $\geq$ 30 (mild kidney damage)
- Stage 3.** eGFR 30-59 (moderate kidney damage)
- Stage 4.** eGFR 15-29 (severe kidney damage)
- Stage 5.** eGFR <15 (kidney failure)

While all five stages represent some level of kidney disease, Stages 1-4 are most commonly referred to as CKD and Stage 5 is identified as end stage renal disease (ESRD) or kidney failure. In 2016, the mortality rate for CKD patients over 65 was approximately 122.6 per 1,000. The mortality rate for those over 65 without CKD was 43.1 per 1,000 (USRDS, 2018a).

#### RISK FACTORS FOR CKD

The two most common causes of kidney disease are diabetes and hypertension (high blood pressure). Other causes include congenital (present at birth) abnormalities such as structural defects that cause urine to back up into the kidney causing infections; and hereditary conditions such as polycystic kidney disease where many fluid-filled sacs grow in the kidney eventually leading to kidney failure (NKF, 2017b). Individuals who have diabetes, hypertension, cardiovascular disease, an older age, or a body mass index (BMI)  $\geq$ 30 kg/m<sup>2</sup> are more likely to develop CKD than those who do not have those conditions (USRDS, 2018a).

Increased risk for kidney disease is associated with:

- Diabetes
  - Approximately 36.0% of adults with diabetes also have CKD (USRDS, 2018a)
- Hypertension
  - 31.2% of those with hypertension also have CKD
  - 72.3% of patients with CKD had hypertension (USRDS, 2018a)
- Cardiovascular disease
  - 64.5% of those with CKD also have cardiovascular disease
  - 76.5% of patients aged 85 and older with CKD have cardiovascular disease
  - 18.3% of CKD patients aged 66-69 have heart failure; 36.1% of patients aged 85 and older (USRDS, 2018a)
- Family history of CKD (NKF, 2017a)
- Age
  - Rates are highest in those 60 and older with 32.2% of patients having CKD (USRDS, 2018a)
- Gender
  - 16.7% of women have CKD compared to the 12.9% of men (USRDS, 2018a)
  - While women are more likely to develop CKD, men with CKD are 64% more likely than women to progress to kidney failure (ESRD) (CDC, 2017)
- Ethnicity/Population group (% of CKD in population)
  - 15.6% Non-Hispanic white
  - 15.9% Non-Hispanic Black/African-American
  - 12.6% Mexican American
  - 11.4% Other Hispanic
  - 12.6% Other Non-Hispanic (USRDS, 2018a)

#### MANAGEMENT OF KIDNEY DISEASE

The first step in managing CKD is diagnosing the existence of decreased renal function. Due to an unlikely recognition of symptoms, the probability that a person will be tested for early signs of kidney damage is low (USRDS 2018a).

Symptoms of kidney disease are usually not present in its earliest stages. Worsening CKD is often characterized by:

- Fatigue
- Trouble concentrating
- Poor appetite
- Trouble sleeping
- Muscle cramps at night
- Swelling in hands or feet
- Puffiness around the eyes, primarily in the morning
- Dry, itchy skin
- Need to urinate frequently, especially at night

(NKF, 2017a)

Treatment strategies to slow the progression and reduce the complications of CKD include nutritional and lifestyle interventions along with medical management of co-existing conditions such as high blood pressure and diabetes.

#### *Nutrition*

Dietary recommendations for CKD patients are similar to other heart-healthy diets. Salt intake should be limited to 2,300 mg/day to help control blood pressure. In addition, an excess amount of protein, phosphorus, and potassium should be avoided (NIDDK, n.d.b.).

#### *Lifestyle*

Cigarette smoking is associated with abnormal urine albumin and therefore smoking cessation is recommended. Physical activity, both aerobic and strength training, is recommended to help prevent cardiovascular disease, improve glucose control, and maintain muscle mass (NIDDK, n.d.b.).

#### *Medicine*

ACE inhibitors and ARBs are drugs used to control blood pressure. In CKD patients, they have been shown to reduce albuminuria because they lower glomerular capillary blood pressure and systemic blood pressure. Blood pressure goals of 120/80 mm Hg have been the norm. Professionals recommend that CKD patients maintain a blood pressure lower than 140/90 mm Hg in efforts to slow the progression towards End Stage Renal Disease.

Controlling glucose levels for diabetic patients is essential (NIDDK, n.d.b.).

#### **END STAGE RENAL DISEASE (ESRD)**

Once CKD progresses to Stage 5 (ESRD), the only treatment options are to replace the functions of the kidney through dialysis (using a machine to filter the blood) or a kidney transplant. In 2016, 726,331 patients were diagnosed with ESRD; 124,675 of whom were new patients (USRDS, 2018a). 57% of hemodialysis patients and 70% of peritoneal dialysis patients are still alive three years after the start of ESRD therapy. "Dialysis patients younger than 80 years old were expected to live less than one-third as long as their counterparts without ESRD" (USRDS, 2018b, p424).

#### *Hemodialysis (HD)*

A dialyzer is a special filter which removes waste, extra salt, and excess water out of the blood in much the same way a functioning kidney does. In hemodialysis, the blood travels through tubes from the patient through the dialyzer and back into the patient. In order to facilitate this blood flow, an access point must be created (usually in the forearm) to attach the tubes. Treatment is usually done three times a week and lasts 4 hours when done in a treatment facility. Some treatment facilities offer nighttime options. These treatments are typically done 3 nights a week. Benefits of this option are a better quality of life, more time during the day, and fewer diet changes. In-home hemodialysis is becoming more popular as dialysis machines become smaller and easier to use. There are now three in-home options. Standard home hemodialysis is typically 3 times a week for 3 to 5 hours. Short daily hemodialysis is generally done 5 to 7 times a week for 2 to 4 hours at a time. Nightly home hemodialysis is usually 3 to 6 times a week while sleeping (NIDDK, 2018a).

#### *Peritoneal Dialysis (PD)*

In this filtration method, the peritoneum (lining of the abdomen) is used to filter waste products from the blood. A dialysis solution, composed of various minerals and sugar dissolved in water, is introduced into the

abdominal cavity through a catheter. The solution draws waste products through the peritoneal membrane. After several hours the “dirty” solution is drained and the abdomen is filled with fresh solution (NIDDK, 2018b). There are two methods of performing peritoneal dialysis (PD):

1. *Continuous Ambulatory PD* where the solution is introduced, left 4-6 hours, drained, and new solution introduced at least four times per day, and the patient sleeps with the abdomen filled
2. *Automated PD* where a machine is used to fill and empty the abdomen 3- 5 times per night while the patient is sleeping, and the abdomen is left filled for the day (NIDDK, 2018b).

NUMBER OF ESRD PATIENTS IN THE U.S. IN 2016	
HD	457,957
PD	51,057
Transplant	215,061
<b>Total</b>	<b>724,075</b>
(USRDS, 2018b)	

### *Kidney Transplant*

Kidney transplant involves the surgical placement of a healthy kidney into the body. In successful transplants, the donated kidney functions well enough to keep the patient healthy. Many factors affect whether a person is a good candidate to receive a donated organ to ensure that the body does not reject the organ. Kidneys can be transplanted from living or deceased donors. Living donors are generally family members who share compatible blood and tissue types. If no living donor is available, the patient will be placed on a waiting list for a deceased organ donation. There are currently (as of March 27, 2019) 94,841 individuals on the waiting list for a kidney transplant.

In 2018, 21,168 individuals received kidney transplants (Organ Procurement and Transplantation Network [OPTN], 2019).

NUMBER OF KIDNEY TRANSPLANT RECIPIENTS, 2018		
Age	U.S.	TX
< 1	0	0
1-5 Years	167	17
6-10 Years	160	17
11-17 Years	428	55
18-34 Years	2,509	251
35-49 Years	5,225	532
50-64 Years	8,259	643
65+ Years	4,419	304
<b>Total</b>	<b>21,168</b>	<b>1,819</b>
(OPTN, 2019)		

Kidney transplant patients under the age of 75 have an estimated remaining lifetime of 69% to 85% of the expected lifetimes in the general population (USRDS, 2018b).

### **RENAL DISEASE HELP IN TEXAS**

The Texas Department of State Health Services (DSHS) manages a Kidney Health Care Program (KHC) which provides assistance to Texans with ESRD. Services include providing assistance with obtaining dialysis treatments, access to surgery, prescription drugs, travel to health care visits, and help with Medicare premiums (DSHS, n.d.).

The End Stage Renal Disease Network of Texas (ESRDNT), under contract to CMS, serves as a liaison between the federal government and providers of ESRD services (2019). It also provides services to patients, such as patient education and facilities locators. The official Medicare website lists 707 Medicare-certified dialysis facilities in Texas as well as 54 dialysis facilities in the Bexar County area (Medicare.gov, n.d.).

The State of Texas Kidney Foundation (n.d.) provides a variety of education activities and support resources, including free kidney screenings, as well as facilitating organ donation.

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