Chapter Four

Care of patients with chronic kidney disease

All our knowledge has its origins in our perceptions.

Leonardo da Vinci
The chronic kidney disease (CKD) population poses a unique challenge to the healthcare system. Adverse event rates are high, and the risk of death rises with CKD stage, as does the likelihood of reaching end-stage renal disease (ESRD)—a state of high morbidity, mortality, and cost.

Detection of CKD can be accomplished with simple tests such as serum creatinine and microalbumin. These tests have specific CPT service codes, and are covered in the Medicare system. In the Medicare and fee-for-service employer group health plans (EGHPs), laboratory tests can be billed based on physician clinical management under a fee schedule. In other EGHP populations, however, global contracts for areas such as laboratory services may make it difficult to determine exactly which tests are ordered. This is particularly true for the MarketScan dataset, in that the self-insured groups are with companies that hold the funds for services. We have thus limited our analyses of laboratory data in this chapter to the Ingenix i3 dataset.

Definitions of populations at risk for the development of CKD have focused on those with diabetes, hypertension, or cardiovascular disease (CVD). Using a full year of follow-up, we define the probability of a CKD claim in these at-risk populations. Among Medicare patients with both diabetes and CVD, the likelihood of a CKD claim within this year is 15 percent, compared to 8–9 percent in those with only one diagnosis. And regardless of CKD status, only 10 percent of Medicare patients with both diabetes and CVD see a nephrologist in a year. Both probabilities are approximately half as high in the EGHP population. Within the CKD population, the probability of seeing a nephrologist nears 0.4 for Medicare patients with diabetes, but is only 0.28 for those with CVD. Similar referral patterns are noted in the MarketScan and Ingenix i3 populations, with the highest likelihood of nephrology referral found in CKD patients with both diabetes and CVD.

The use of serum creatinine testing appears to be relatively high in the CKD population, exceeding 90 percent within a year in the Medicare population. Testing for bone and mineral parameters related to kidney disease, however, is far less common, at only 22–29 percent for calcium and phosphorus measurements and 12–19 percent for parathyroid hormone testing. Approximately two-thirds of CKD patients receive lipid testing within a year—a positive finding, given the high cardiovascular event rates in the CKD population. Of diabetic CKD patients, 77–82 percent receive at least one glycosylated hemoglobin (A1c) measurement, and hemoglobin testing ranges from 64 percent among Ingenix i3 patients to 88 percent in the Medicare population.

We next examine the use of prescription drug therapy in the CKD population. Overall, treatment with ACE-Is/ARBs/renin inhibitors ranges from 54 to 58 percent within the general CKD population; in those with diagnosed diabetes or hypertension this number reaches 72–76 percent. Use of other medications—including beta blockers, dihydropyridine calcium channel blockers, and lipid lowering agents—has also been growing. Thiazide diuretics are now used in more than 30 percent of patients with CKD of Stage 3 or higher. Bone and mineral therapy with oral vitamin D and/or phosphate binders, however,
is received by fewer than 10 percent of the population. These practice patterns do not address progressive treatment over time of the same patients, an issue which needs to be examined. Also in question is the consistency of therapy, and whether doses are titrated to maximize their clinical benefit in relation to the progression of kidney disease. One measure of effective treatment centers on control of a number of biochemical parameters that are risk factors for cardiovascular disease. Three in four CKD patients given cholesterol testing, for example, have controlled levels below the recommended 200 mg/dl, while 65 percent have controlled LDL cholesterol. Among diabetic patients with CKD, A1c levels are controlled in 53 percent of those receiving thiazolidinediones (TZDs), and in 29.5 and 48.0 percent, respectively, of those on insulin and sulfonylureas. This may represent selection bias, in that those treated with insulin may have diabetes that is more difficult to control. Only 30 percent of those on insulin, for example, have a controlled A1c, compared to 53 percent of those on TZDs. These findings suggest that there is considerable room for improvement of risk factor control in the CKD population. Considering the reality that a CKD patient is more likely to have a cardiovascular event and die than to reach ESRD, it is imperative to identify this high-risk population, to monitor risk factors for cardiovascular events and death, and to address the progression of kidney damage by monitoring kidney function and the level of proteinuria. Although kidney protective treatment appears to be common on a cross-sectional level, adherence to this treatment and adjustments to changing kidney function are yet to be determined. The relatively high rates of kidney protective treatment may help explain the flattening of the overall rates of ESRD incidence shown in Volume Two, as well as the declines noted in subpopulations with glomerular disease, diabetes, and hypertension. There are, however, subpopulations which need particular attention, including the younger African American and Native American populations, which have increasing rates of obesity and diabetes, and, as shown in Chapter One of Volume Two, higher rates of ESRD.

Figure 4.1: see page 144 for analytical methods. Medicare patients age 65 or older on January 1, 2006; Ingenix i3 patients age 50–64 during 2006.
The cumulative probability of a CKD claim is greatest in patients with both diabetes and cardiovascular disease, and at the end of one year is twice as high in Medicare patients age 66 and older as in the younger MarketScan and Ingenix i3 cohorts, at 0.15 compared to 0.07–0.08. *(Figure 4.2)* see page 144 for analytical methods. December 31 point prevalent Medicare (age 66 & older) & MarketScan & Ingenix i3 (50–64) patients, 2006, surviving all of 2007.

For patients with diabetes, CVD, or both, the probability of seeing a nephrologist is lower than that of having a CKD claim, reaching only 0.10 at the end of one year in Medicare patients with both diagnoses. The probability reaches just 0.06–0.07 in younger MarketScan and Ingenix i3 patients. *(Figure 4.3)* see page 144 for analytical methods. December 31 point prevalent Medicare (age 66 & older) & MarketScan & Ingenix i3 (50–64) patients, 2006, surviving all of 2007.

Among Medicare CKD patients age 66 and older, the one-year probability of seeing a nephrologist is highest in those also carrying a diagnosis of diabetes, at 0.38. In the younger Ingenix i3 population, in contrast, it is greatest in patients with both diabetes and cardiovascular disease, at 0.40. *(Figure 4.4)* see page 144 for analytical methods. December 31 point prevalent Medicare (age 66 & older) & MarketScan & Ingenix i3 (50–64) patients, 2006, surviving all of 2007.
In the year after being diagnosed with CKD, the majority of patients—across datasets and diagnoses—visit a primary care physician. The cumulative probability of this visit ranges from 0.85 in the MarketScan CKD population (age 50–64) to 0.95 in Medicare CKD patients age 66 and older. Among patients with cardiovascular disease in addition to their CKD, the cumulative probability of seeing a cardiologist within a year ranges from 0.63 among MarketScan patients to 0.78 in their Medicare counterparts.

While these patients have diagnosed chronic kidney disease, the probability of them being evaluated by a nephrologist within a year of this diagnosis is alarmingly low; patients in each cohort here are more likely to see a cardiologist. In the CKD population as a whole, for example, just one in three Medicare patients will receive nephrology care (a probability of 0.33); the probability drops to 0.29 among MarketScan patients. The numbers are even lower for those with both CKD and cardiovascular disease, at 0.31 and 0.28, respectively. **Figures 4.5–8; see page 144 for analytical methods. Medicare (age 66 & older) & MarketScan & Ingenix i3 (50–64) patients with CKD identified in 2006.**
The cumulative probability of a CKD patient receiving a creatinine test has changed little since 2003. For the most recent cohorts, this probability reaches 0.95 at 12 months for Medicare patients age 66 and older, and 0.75 for Ingenix i3 patients age 50 to 64 — slightly lower than the probability of 0.79 seen in 2003. FIGURE 4.9; see page 144 for analytical methods. Medicare (age 66 & older) & Ingenix i3 (50–64) patients with CKD.

Among Medicare CKD patients, the cumulative probability of receiving a calcium/phosphorus test within a year has increased since 2003, but is still less than 0.30. The younger patients in the Ingenix i3 cohort are even less likely to receive this test, with a one-year probability in 2007 of 0.22. FIGURE 4.10; see page 144 for analytical methods. Medicare (age 66 & older) & Ingenix i3 (50–64) patients with CKD.

The probability of parathyroid hormone testing has increased since 2003 in both the Medicare and Ingenix i3 populations. It remains low, however, at 12 months reaching only 0.19 in Medicare patients age 66 and older, and 0.12 in Ingenix i3 patients age 50–64. FIGURE 4.11; see page 144 for analytical methods. Medicare (age 66 & older) & Ingenix i3 (50–64) patients with CKD.
n the Medicare population with CKD (age 66 and older), the cumulative probability of lipid testing within a year has increased since 2003, from 0.61 to 0.70 in 2007. Among Ingenix i3 patients age 50–64, in contrast, it has remained essentially unchanged, with a probability of 0.62 in 2007. (Figure 4.12; see page 144 for analytical methods. Medicare (age 66 & older) & Ingenix i3 (50–64) patients with CKD.

Patients with both CKD and diabetes are likely to receive glycosylated hemoglobin testing, with a one-year cumulative probability of 0.82 among Medicare patients age 66 and older, and of 0.77 in their Ingenix i3 counterparts age 50–64. In this latter population, however, the probability has fallen from 0.80 in 2003. (Figure 4.13; see page 144 for analytical methods. Medicare (age 66 & older) & Ingenix i3 (50–64) patients with CKD.

The likelihood of hemoglobin testing varies quite dramatically between the Medicare and Ingenix i3 populations. At one year, the cumulative probability of this testing reaches 0.88 for 2007 Medicare patients — significantly higher than the 0.64 seen among patients in the Ingenix i3 database. (Figure 4.14; see page 144 for analytical methods. Medicare (age 66 & older) & Ingenix i3 (50–64) patients with CKD.
Between 2003 and 2007, use of ACE-I, ARBs, and renin inhibitors increased slightly in CKD patients overall as well as in those with hypertension. In those with diabetes, in contrast, use has remained fairly constant, at around 77 percent. Interestingly, use of these protective agents decreases as patients move towards ESRD (see Figure 7.13).

Since 2003, beta blocker use has continued to climb in CKD patients overall as well as in those with congestive heart failure or hypertension. In 2007, beta blockers were used in 75–76 percent of Stage 3–5 CKD patients with congestive heart failure who were identified through the stage-specific CKD codes. (See Figure 7.16; see page 145 for analytical methods. Point prevalent MarketScan & Ingenix i3 CKD patients age 20–64.)

Dihydropyridine calcium channel blocker use is not nearly as prevalent in CKD patients as that of ACE-I or ARBs. Use of these agents, however, has increased to 37–41 percent in CKD patients with hypertension identified through Stage 3–5 CKD-specific codes. Use increases as patients move towards ESRD (see Figure 7.15).

Use of lipid-lowering agents increased steadily between 2003 and 2007, reaching 74–75 percent in patients with diabetes and stage-specific coding for CKD. As patients move closer to ESRD, however, use of these agents does not appear to increase (see Figure 7.16). (See Figure 7.18; see page 145 for analytical methods. Point prevalent MarketScan & Ingenix i3 CKD patients age 20–64.)
Loop and thiazide diuretics are commonly used in Stage 3–5 CKD patients; loop diuretic use is twice that of patients identified with the less specific codes. Practitioners appear more likely to assess loop diuretic need once CKD is identified. Thiazide or thiazide-like diuretics are typically ineffective with GFRs less than 30 ml/min/1.73 m² (Stage 4–5 CKD). Figure 4.19; see page 145 for analytical methods. Point prevalent CKD patients age 20–64. *potassium-sparing & thiazide.

Erythropoietin (EPO) use in the EGHP population has declined, while that of darbepoetin (DPO) has increased slightly. Overall, however, use of both has fallen, for reasons that are unclear. This decline began before publication of the CREATE and CHOIR trials in 2006, showing higher cardiovascular event rates in patients with higher hemoglobin values. Figure 4.20; see page 145 for analytical methods. Point prevalent MarketScan & Ingenix i3 CKD patients age 20–64.

Use of active vitamin D products has risen to about 9 percent (calcitriol) and 7 percent (paricalcitol and doxercalciferol) in CKD patients identified through stage-specific codes. Use of precursor products (ergocalciferol or cholecalciferol) has also grown. Since both, however, are inexpensive and available over-the-counter, use may be vastly underreported. Figure 4.21; see page 145 for analytical methods. Point prevalent MarketScan & Ingenix i3 CKD patients age 20–64.

Phosphate binder use is extremely low in CKD patients, even those who have been identified using stage-specific codes. Use increases drastically, however, when dialysis is reached (see Figure 7.20), suggesting a strong opportunity for education on the need for phosphate binders, particularly in late-stage CKD patients. Figure 4.22; see page 145 for analytical methods. Point prevalent MarketScan & Ingenix i3 CKD patients age 20–64.
It appears that 25 percent or more of patients with CKD defined by diagnosis codes and who are taking statins have total and LDL cholesterol exceeding the risk factor target levels for intervention of 200 and 100 mg/dl, respectively. (Figure 4.23; see page 145 for analytical methods. Ingenix i3 CKD patients age 50–64. The boundaries of the box closest to & farthest from zero indicate the 25th & 75th percentiles, the line within the box marks the median, & error bars represent the 10th & 90th percentiles.
Three in four CKD patients using statins have a controlled total cholesterol (less than 200 mg/dl), while 63 percent have a controlled LDL (less than 100 mg/dl). These numbers rise to 81 and 73 percent among patients with combined diagnoses of CKD, diabetes, and cardiovascular disease. [Figure 4.24; see page 145 for analytical methods. Ingenix i3 CKD patients age 50–64, surviving all of 2007.]

Hemoglobin (A1c) levels appear lowest in diabetic patients taking thiazolidinediones (TZDs), and highest in those on insulin. Levels do not differ significantly by the presence of cardiovascular disease. [Figure 4.25; see page 145 for analytical methods. Ingenix i3 diabetic CKD patients age 50–64. The boundaries of the box closest to & farthest from zero indicate the 25th & 75th percentiles, the line within the box marks the median, & error bars represent the 10th & 90th percentiles.]

Just 29–31 percent of diabetic CKD patients using insulin have a controlled glycosylated hemoglobin level (less than 7 percent). This rises to 48 percent among patients using sulfonylureas, and to 53 percent of those taking thiazolidinediones. These numbers vary little regardless of the presence of cardiovascular disease. [Figure 4.26; see page 145 for analytical methods. Ingenix i3 diabetic CKD patients age 50–64, surviving all of 2007.]
The cumulative probability of a **CKD CLAIM** is twice as high in the Medicare population age 66 & older as in the younger EGHP cohorts. • 4.2

Just one in three Medicare patients receives **NEPHROLOGY** care in the year after CKD diagnosis. • 4.5

In the year after CKD diagnosis, the probability of a patient with **CVD** receiving nephrology care is just **0.28–0.37**. • 4.7

Among Ingenix i3 CKD patients, the cumulative probability of **CREATININE** testing is 0.75. • 4.9

Among CKD patients, the cumulative probability of **CALCIUM/PHOSPHORUS** testing in a year is **0.22–0.29**. • 4.10

The cumulative probability of **PARATHYROID HORMONE** testing is just **0.12–0.19** among CKD patients. • 4.11

Use of ACE-Is, ARBs, & renin inhibitors **FALLS** as patients move toward ESRD. • 4.15

Practitioners appear more likely to assess the need of a **LOOP DIURETIC** once CKD is identified. • 4.19

For reasons that are unclear, overall use of **EPO & DPO** has fallen among CKD patients. • 4.20

Of CKD patients using statins, three in four have a controlled total **CHOLESTEROL**, while 63% have a controlled **LDL**. • 4.24

Just 29–31% of diabetic CKD patients using **INSULIN** have a controlled hemoglobin A1c level (less than 7%). • 4.26