Chapter Three

Chronic kidney disease identified in the claims data

The acquisition of any knowledge whatever is always useful to the intellect, because it will be able to banish the useless things and retain those which are good. For nothing can be either loved or hated unless it is first known.

Leonardo da Vinci
The identification of chronic kidney disease (CKD) is a significant challenge, as most datasets lack the biochemical data that provide, in comparison to diagnosis codes, the greatest precision in identifying the disease. And while random samples such as the dataset from the National Health and Nutrition Examination Survey (NHANES) do include biochemical information, such studies rarely include event rates or economic data, making it difficult to evaluate access to care for this high-risk population, or to examine the interactions of CKD with diabetes and cardiovascular disease (CVD). The USRDS uses several datasets to assess the recognized CKD population, including the general Medicare 5 percent sample, which contains an average of 1.3 million individuals each year. Few datasets, however, are large enough to allow assessment of younger CKD populations, and few contain laboratory data that can be used to look at actual disease burden. To address these issues we use data from several employer group health plans (EGHPs), including the Thomson Reuters MarketScan dataset, which includes information from 40 Fortune 100 companies, 80 percent of which are self-insured. This dataset contains approximately 12 million lives per year, with claims for services but no laboratory data. We also employ data from United Health Group’s Ingenix i3 LabRx dataset, with information on 5.5 million lives per year from employers that are only 20 percent self-insured. This dataset contains provider charges but no paid claims. It does, however, contain biochemical data provided by contract laboratories in the United Health Care system. Other ordered labs can be tracked, but results are not available. The mean age of the Medicare population is 75.5 overall and 77.5 for those with CKD — a contrast to the EGHP population, at 44.4 and 56.3, respectively, for MarketScan patients, and 42.6 and 50.4 for those in the Ingenix i3 dataset. As expected, disease prevalence is lower for EGHP patients. Interesting, however, is the similarity of disease prevalence in the MarketScan and Ingenix i3 datasets. The chronic disease burden in the Medicare and MarketScan populations is illustrated on the next page. In the Medicare population age 65 and older, nearly 25 percent carry a diagnosis of diabetes, 17 percent have chronic obstructive pulmonary disease (COPD), and 50 percent have CVD; CKD is reported in 10 percent. In the MarketScan population age 50–64, 11 percent carry a reported diagnosis of diabetes, 35 percent have COPD, and 10 percent have CVD; CKD is recognized in 1.3 percent. Defining an incident CKD population requires a baseline population in a given year to have no diagnosis codes for CKD; the reporting of codes is then assessed in the next year. New, stage-specific ICD-9-CM codes were introduced in the fall of 2005. Use of these codes has been increasing, and much of the difference in CKD recognized from claims for services and that recognized from the new codes can be attributed to additional codes for diabetes and hypertension with kidney disease. Rates of recognized CKD are more than 50 percent higher in the African American population, a striking finding, and one consistent with the higher rates of ESRD noted in Volume Two. We next assess comorbidity in the CKD populations. Almost half of Medicare CKD patients carry a diagnosis of diabetes, compared
to 37–38 percent of EGHP patients. And 90 percent have hypertension, compared to 51–64 percent of EGHP patients. Patterns are similar for other comorbidities, with prevalence generally greater in the older Medicare population. The prevalence of cancer is particularly notable: almost 20 percent of Medicare CKD patients, and 14–15 percent of those in the EGHP populations, carry this diagnosis, rates considerably higher than those in the overall population. It is not clear how intensive chemotherapy may impact long-term kidney function, but several chemotherapeutic drugs, such as the platinum compounds and some antimetabolites, are associated with tubular damage. Approximately 500,000 individuals in the Ingenix i3 dataset had laboratory data in 2007, with lipid and glucose testing being the most common. As expected, the prevalence of reported abnormal levels increases with more advanced stages of CKD; this is consistent with the abnormalities noted in the population-level NHANES data (see Chapter One). We also found a consistent relationship between the CKD stage reported on claims and the estimated glomerular filtration rate (eGFR) calculated from laboratory serum creatinine. The changing pattern of coding for CKD may ultimately lead to improved reporting of kidney function, and to data that can be used for the surveillance system and to assess services and associated costs of care. The new ICD-9-CM CKD codes have improved the classification of patients into risk groups, and it appears the new codes are also being used by EGHP insurers, allowing comparisons to laboratory data for risk factor assessment, treatment, and control. Identifying the CKD population within health plans and Medicare service data can be challenging, since codes for services require access to the healthcare system. It is not surprising that CKD is under-recognized in the service and administrative data compared to the population-level NHANES data, which uses direct data collection from health questionnaires and examinations. The high specificity of the CKD diagnosis codes helps to define a population that is known to have the disease, and to evaluate access to care. Future ADRs will examine these areas in greater detail to give a more complete view of the risks of adverse events and of the progression of CKD to ESRD.

**Figure 3.4:** see page 143 for analytical methods. Period prevalent non-ESRD patients with Medicare as primary payer & Part A & B coverage (fee-for-service data), age 65 & older, & period prevalent non-ESRD MarketScan patients age 50–64, 2007.
This table presents descriptive data on patients in the three datasets used throughout Volume One of the ADR: the 1.2 million Medicare patients age 65 and older in the 5 percent sample, the 12.4 million age 20–64 in the MarketScan database, and the 5.5 million, also age 20–64, in the Ingenix i3 database. Information on race and ethnicity is not available in the MarketScan and Ingenix i3 data.

Data on comorbidity in part reflect the older age of the Medicare population. Hypertension, for example, is found in 90 percent of Medicare CKD patients, compared to 51 and 64 percent, respectively, of those in the MarketScan and Ingenix i3 datasets. For Table 3.4, see page 143 for analytical methods. Medicare patients age 65 & older (5 percent sample, fee-for-service data); MarketScan & Ingenix i3 patients age 20–64.

In the MarketScan and Ingenix i3 databases, the percentage of individuals with insurance shows similar patterns nationwide. At the end of 2007, it averaged 6.1 and 5.6 percent, respectively, in the upper quintile for California, Texas, Florida, Georgia, Illinois, and Ohio. And with few exceptions, both databases appear more highly populated with insured individuals residing in states east of the Mississippi River. For Figure 3.2, see page 143 for analytical methods. MarketScan & Ingenix i3 patients age 20–64, 2007.
In 2007, the percentage of Medicare patients with incident CKD was highest in North Dakota, Missouri, Louisiana, Michigan, Kentucky, West Virginia, Georgia, and Maine, averaging 4.5 percent in the upper quintile. By race, rates of incident CKD are higher in African Americans compared to whites, at 8.9 and 4.4 percent, respectively, in the upper quintile, and in general show similar geographic patterns nationwide. Not surprisingly, CKD in the Hispanic population is most evident in the southwestern and western portions of the country, but is also prominent in Michigan, New Hampshire, and the Ohio Valley, averaging 7.3 percent in the upper quintile. **Figure 3.3** see page 143 for analytical methods. Medicare patients age 65 & older, alive on December 31, 2007.

The presence of CKD in prevalent Medicare patients averages 8.2 percent in the upper quintile overall, and is more than twice as high in African Americans as in whites, at 16.2 and 7.9 percent, respectively. As in the incident population, Hispanics show a higher presence in the South and Southwest and in areas of the Ohio Valley, averaging 12.9 percent in the upper quintile. **Figure 3.4** see page 143 for analytical methods. Period prevalent Medicare patients age 65 & older, alive on December 31, 2007.
The standard methodology of identifying CKD patients in claims data—one or more inpatient diagnosis codes or two or more outpatient codes—continues to find a higher percentage of patients with incident CKD than that obtained solely with the new stage-specific codes. (The standard methodology includes the 585 codes.) Among African American Medicare patients, for example, claims data identify 5.6 percent as having newly diagnosed CKD in 2007, compared to 4.4 percent using the combined 585 codes. Among the employer group health plan patients (younger than the Medicare population, with a mean age of 44–46), 0.42–0.43 percent are identified as having incident CKD using complete claims data, compared to 0.18–0.19 percent with the new 585 codes.

In the Medicare population, rates of new CKD cases (identified through all codes) are greater among African American patients than among whites, at 5.6 compared to 3.8 percent in 2007. The most commonly used stage-specific codes are 585.3 (Stage 3) and 585.9 (unspecified stage), at 0.84 and 1.33 percent for whites and 1.22 and 2.06 percent for African Americans. **Figures 3.5–8; see page 143 for analytical methods.**

Point prevalent patients, age 65 & older, without CKD in the prior year & without ESRD.
Patterns in the identification of prevalent chronic kidney disease are similar to those seen with incident cases. Among Medicare patients, for example, claims data identify 10.1 percent of African Americans, and 6.5 percent of whites, as having prevalent CKD in 2007, compared to 8.4 and 5.0 percent using only the combined 585 codes. The difference is even more pronounced in the population with employer group health plan coverage, with claims data identifying prevalent CKD rates more than twice as high as do the stage-specific codes alone. The use of these codes began late in 2005, and providers are still adjusting to their use. Both the frequency and accuracy of their use should increase over time. [Figures 3.9–12; see page 143 for analytical methods. Point prevalent patients, age 65 & older, without ESRD.]

ICD-9-CM codes

- 585.1 Chronic kidney disease, Stage 1
- 585.2 Chronic kidney disease, Stage 2 (mild)
- 585.3 Chronic kidney disease, Stage 3 (moderate)
- 585.4 Chronic kidney disease, Stage 4 (severe)
- 585.5 Chronic kidney disease, Stage 5 (excludes 585.6: Stage 5, requiring chronic dialysis."
- 585.9 Chronic kidney disease, unspecified

* In USRDS analyses, patients with ICD-9-CM code 585.6 are considered to have code 585.5; see Appendix A for details.
More than one in two Medicare CKD patients age 65 and older are anemic, compared to 19–20 percent in the younger MarketScan and Ingenix i3 populations. Hospital days per year reach 7.6 for Medicare patients (down from 11.1 in 1999), compared to 3.4 and 3.8 among MarketScan and Ingenix i3 patients. Table 3.8; see page 144 for analytical methods. Medicare patients age 65 & older; MarketScan & Ingenix i3 patients age 20–64.

### Comorbidity in the CKD population, by dataset (percent)

<table>
<thead>
<tr>
<th></th>
<th>Medicare (65+)</th>
<th>MarketScan (20–64)</th>
<th>Ingenix i3 (20–64)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1999</td>
<td>2001</td>
<td>2003</td>
</tr>
<tr>
<td>Diabetes</td>
<td>44.1</td>
<td>46.8</td>
<td>47.8</td>
</tr>
<tr>
<td>Hypertension</td>
<td>78.6</td>
<td>83.1</td>
<td>86.2</td>
</tr>
<tr>
<td>CVD</td>
<td>76.9</td>
<td>77.4</td>
<td>77.2</td>
</tr>
<tr>
<td>ASHD</td>
<td>48.6</td>
<td>49.5</td>
<td>49.3</td>
</tr>
<tr>
<td>PVD</td>
<td>32.8</td>
<td>33.6</td>
<td>33.8</td>
</tr>
<tr>
<td>COPD</td>
<td>24.9</td>
<td>25.1</td>
<td>25.8</td>
</tr>
<tr>
<td>GI</td>
<td>13.0</td>
<td>12.1</td>
<td>11.0</td>
</tr>
<tr>
<td>CVA/TIA</td>
<td>21.3</td>
<td>21.0</td>
<td>20.5</td>
</tr>
<tr>
<td>Dysrhythmia</td>
<td>35.8</td>
<td>36.2</td>
<td>36.9</td>
</tr>
<tr>
<td>Cancer</td>
<td>20.4</td>
<td>19.8</td>
<td>19.5</td>
</tr>
<tr>
<td>Anemia</td>
<td>50.8</td>
<td>51.3</td>
<td>52.6</td>
</tr>
<tr>
<td>Liver disease</td>
<td>4.5</td>
<td>3.1</td>
<td>2.9</td>
</tr>
<tr>
<td>Hospital days</td>
<td>11.1</td>
<td>10.3</td>
<td>9.4</td>
</tr>
<tr>
<td>Hospital admissions</td>
<td>1.5</td>
<td>1.5</td>
<td>1.4</td>
</tr>
</tbody>
</table>

The prevalence of diabetes has been rising steadily in all three CKD populations. Nine in ten Medicare CKD patients age 65 and older, for example, now have a diagnosis of hypertension, up from 72 percent in 1995. Ingenix i3 patients are more likely than their MarketScan counterparts to have the diagnosis, at 64 compared to 51 percent in 2007. Figure 3.14; see page 144 for analytical methods. Medicare patients age 65 & older; MarketScan & Ingenix i3 patients age 20–64.
The prevalence of cardiovascular disease among Medicare patients with chronic kidney disease is two and a half times greater than in the younger, employed CKD population, at 76 percent in 2007 compared to 30–31 percent among both MarketScan and Ingenix i3 patients. **Figure 3.15;** see page 144 for analytical methods. Medicare patients age 65 & older; MarketScan & Ingenix i3 patients age 20–64.

Cancer rates in the CKD population have been declining slightly for patients in all three datasets. Nearly 19 percent of Medicare CKD patients, for example, have a diagnosis of cancer, down from 21.4 percent in 1995. Prevalence in the MarketScan population has fallen from 18.6 percent in 1999 to 15.3 percent in 2007. **Figure 3.16;** see page 144 for analytical methods. Medicare patients age 65 & older; MarketScan & Ingenix i3 patients age 20–64.

The prevalence of liver disease is similar across datasets, despite the age differences in the populations. In 2007, 2.3–2.7 percent of Medicare, MarketScan, and Ingenix i3 patients with CKD had a diagnosis of liver disease. **Figure 3.17;** see page 144 for analytical methods. Medicare patients age 65 & older; MarketScan & Ingenix i3 patients age 20–64.

More than one in four Medicare CKD patients now have a diagnosis of chronic obstructive pulmonary disease — a rate slightly higher than that in 1995, and one 3.0–3.2 times greater than those found in the younger MarketScan and Ingenix i3 populations. **Figure 3.18;** see page 144 for analytical methods. Medicare patients age 65 & older; MarketScan & Ingenix i3 patients age 20–64.
The Ingenix i3 dataset contains a subset of individuals with laboratory data reported from their contract labs. Biochemical abnormalities by CKD stage, such as the increasing prevalence of hyperuricemia, reduced calcium levels, elevated parathyroid hormone levels, and reduced HDL levels, are very similar to those reported in the NHANES population (Chapter One, Table 1.d); the prevalence of comorbidities such as hypertension, cardiovascular disease, anemia, and cancer parallels that seen in the NHANES data as well.

Concern that a representative cohort may not be achieved for Ingenix i3 patients with laboratory data appears to be partially overcome by the large sample size, and by benchmarking Ingenix i3 laboratory data to population-level data from NHANES 1999–2002 participants. (Table 3.c; see page 144 for analytical methods. Prevalent Ingenix i3 patients age 20–64, 2007.)

Here we compare estimated GFRs (from laboratory data) by ICD-9-CM diagnosis codes for kidney disease, including the new 585 codes for CKD Stages 1–5, and codes for CKD patients with diabetes or hypertension. Overall, non-CKD patients have an eGFR of approximately 77 ml/min/1.73 m², though this may be underestimated since it uses the MDRD formula, which is less accurate above 60. Those with kidney disease and diabetes or hypertension have an eGFR of 41–56. The ICD-9-CM claim code and the creatinine level used to compute the eGFR may come from different sources, a concern we will address in future ADRs. (Figure 3.19; see page 144 for analytical methods. Prevalent Ingenix i3 patients age 20–64, 2007; error bars represent 25th & 75th percentiles.)
Lower estimated GFRs are associated with many clinical and laboratory abnormalities. Here we focus on patients without CKD and those with eGFRs less than 60 ml/min/1.73 m² (Stages 3–5). Increased uric acids levels in Stage 4 and 5 patients may reflect true reductions in clearance, but could also result from the use of diuretics, which interfere with uric acid excretion. Parathyroid hormone levels increase with advancing CKD stage, a finding previously reported by other investigators, as do lipid and serum glucose levels, in concert with similar findings reported in the NHANES population random sample. Figures 3.20–25 see page 144 for analytical methods. Prevalent Ingenix i3 patients age 20–64, 2007.

**ICD-9-CM codes**

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Hypertension is found in 90% of Medicare patients, compared to 51 & 64% of those in the MarketScan & Ingenix i3 datasets.  

For Medicare patients with CKD, the most commonly used stage-specific codes are 585.3 (Stage 3) & 585.9 (unspecified).  

Complete CLAIMS DATA identify CKD in 0.4% of EGHP patients, compared to 0.18–0.19% using only the new 585 codes.  

Claims data identify 10.1% of African American Medicare patients as having prevalent CKD in 2007, compared to 8.4% using only the combined 585 codes.  

Diabetes is reported in 49% of Medicare CKD patients, & 37–38% of CKD patients in the MarketScan & Ingenix i3 databases.  

The prevalence of CVD is more than two times higher in MEDICARE CKD patients than in their EGHP counterparts, at 76% in 2007.  

Nearly 19% of Medicare CKD patients have a diagnosis of CANCER.