chapter TWO

chronic kidney disease identified in the claims data

Sometimes these cogitations still amaze
The troubled midnight and the noon’s repose.

T. S. Eliot, “La Figlia Che Piange”
The identification of chronic kidney disease 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 NHANES dataset have 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.

The USRDS uses several datasets to assess the recognized CKD population, including the general Medicare 5 percent sample, with an average of 1.2 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 employer group health plans (EGHPs), including the Thomson Reuters MarketScan dataset, with information from 40 Fortune 100 companies, 80 percent of which are self-insured. This dataset contains information on 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 75.4 overall and 77.6 for those with CKD — a contrast to the EGHP population, at 44.4 and 52.3, respectively, for MarketScan patients, and 42.6 and 50.8 for those in the Ingenix i3 dataset. As expected, disease prevalence is lower for EGHP patients. Interestingly, however, is the similar disease burden in the MarketScan and Ingenix i3 datasets, which come from two very different sets of employers with different health plan payment systems.

Defining an incident CKD population requires a baseline population in a given year to have no CKD diagnosis codes; the reporting of codes is then assessed in the next year. New, stage-specific ICD-9-CM codes (585.x) were introduced in the fall of 2005, providing an opportunity to track populations with reported diagnosis codes over time. While use of these codes has been increasing, CKD is also defined through codes for diabetes (250.4x) and hypertension (403.9x). Definition of the total recognized CKD population must therefore take into consideration a variety of codes beyond the 585.x series. The recognized incident CKD population has been growing rapidly since 2003, a year after the new CKD stage classification system was published; similar observations are true for the prevalent population as well.
Approximately 700,000 individuals in the Ingenix i3 dataset had laboratory data in 2008, with lipid and glucose testing the most common. This year we use both the traditional MDRD Study equation and the new CKD-EPI equation to determine how the calculation of eGFR impacts the reported prevalence of biochemical abnormalities. Because CKD-EPI addresses the problem of falsely low eGFRs, its use reduces the total pool in the denominator, and thereby consistently identifies a higher percentage of patients with comorbidity and with biochemical abnormalities.

The changing pattern of CKD coding may ultimately lead to improved reporting of kidney function, with data that can be used for the surveillance system and to assess services and associated costs of care. The new ICD-9-CM codes have improved the classification of CKD patients into risk groups, and it appears that they are also being used by EGHP insurers, allowing comparisons of 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 2.1; see page 167 for analytical methods. Point prevalent general (fee-for-service) Medicare patients age 65 & older; point prevalent MarketScan patients age 50–64. CKD, CHF, cancer, & diabetes determined from claims.*
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 14.65 million patients age 20–64 in the MarketScan database, and the 5.7 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. Ninety-one percent of Medicare CKD patients, for example, have hypertension, compared to 53 and 66 percent, respectively, of those in the MarketScan and Ingenix i3 databases.

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Data on comorbidity in part reflect the older age of the Medicare population. Ninety-one percent of Medicare CKD patients, for example, have hypertension, compared to 53 and 66 percent, respectively, of those in the MarketScan and Ingenix i3 databases. II TABLE 2.4; see page 167 for analytical methods. Prevalent patients surviving 2008, without ESRD, age 65 & older (Medicare) & 20–64 (MarketScan & Ingenix i3).
In 2008, the prevalence of CKD among Medicare patients age 65 and older reached 7.6 percent, 4.6 times greater than the rate of 1.7 seen in 1995. Rates in the younger EGHP populations have grown more slowly, but are still on the rise. Prevalence among MarketScan patients age 20–64 has grown 111 percent since 1999, reaching 0.68 percent in 2008; in the Ingenix i3 cohort, the 2008 rate of 0.72 is 98 percent higher than that seen in 2001. Prevalence for those age 45–64 is, like incidence, slightly higher for Ingenix i3 patients than for their MarketScan counterparts, at 1.16 percent compared to 1.02. By gender, prevalence is 30 percent greater for men in the Medicare population, and 23–24 percent higher for EGHP patients. *Figures 2.7–9; see page 167 for analytical methods. Prevalent patients surviving cohort year, without CKD in prior year & without ESRD, age 65 & older (Medicare) & 20–64 (MarketScan & Ingenix i3).*
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 6.1 percent as having newly diagnosed CKD in 2008, compared to 4.6 percent identified through the combined 585 codes. Among employer group health plan (EGHP) patients — who are younger than the Medicare population, with a mean age of 44 to 46 — claims data identify 0.45–0.48 percent as having incident CKD in 2008, compared to 0.18–0.19 percent identified only through the new 585 codes.

In the African American Medicare population, the rate of new CKD cases identified through all codes is greater than among whites, at 6.1 compared to 4.2 percent, but has risen more slowly; rates in the two populations are now 3.0 and 3.8 times greater, respectively, than in 1995. The most commonly used stage-specific codes are 585.3 (Stage 3) and 585.9 (unspecified stage), at 1.04 and 1.25 percent for whites and 1.44 and 1.99 percent for African Americans. *Figures 2.10–13; see page 167 for analytical methods.* Prevalent patients surviving cohort year, without CKD in prior year & without ESRD, age 65 & older (Medicare) & 20–64 (MarketScan & Ingenix i3).
Patterns in the identification of prevalent CKD are similar to those seen with incidence. Among Medicare patients, for example, claims data identify 11.4 percent of African Americans, and 7.3 percent of whites, as having prevalent CKD in 2008, compared to 9.3 and 5.5 percent identified using only the combined 585 codes. The difference is even more pronounced in the EGHP population, with claims data identifying prevalent CKD rates more than twice as high as those found using solely the stage-specific codes.

The most commonly reported stage-specific code in the prevalent population is 585.3 (Stage 3), at 2.3 and 3.6 percent for whites and African Americans, respectively. *Figures 2.14–17*; see page 167 for analytical methods. Prevalent patients surviving cohort year, without ESRD, age 65 & older (Medicare) & 20–64 (MarketScan & Ingenix i3).
In the population with recognized CKD, the prevalence of comorbidities is similar among those with CKD of Stages 1–2 and Stages 3–5. Diabetes, for example, is reported in 48.2 percent of patients in the early stages of CKD, and 49.4 percent of those in the later stages. The primary exception is anemia, reported in 43.1 percent of Stage 1–2 patients, but nearly 57 percent of those with Stages 3–5. In African Americans, these numbers rise to 48.0 and 63.5 percent.

Comorbidities vary by race. Among patients with CKD of Stages 3–5, for example, 59.4 percent of African Americans have diabetes, compared to 47.3 percent of whites. Cardiovascular disease, in contrast, is more common in white patients. The overall prevalence of diabetes among recognized CKD patients has been stable during the past three years. Among those with Stage 5 CKD, however, it has grown slightly, from 51.9 to 54.0 percent for all patients, and from 58.6 to 64.0 percent for African Americans. *Table 2.8 & Figure 2.18; see page 167 for analytical methods.* Medicare patients age 65 & older, surviving all of 2008; ESRD patients excluded.
The majority of patients with recognized CKD have hypertension— in 2008, 91.4 percent of all patients, 90.7 percent of whites, and 96.0 percent of African Americans. The percentage tends to increase slightly with CKD stage. Among African Americans, for example, 98.2 percent of those with Stage 5 CKD have a diagnosis of hypertension, compared to 93.9 percent of those with CKD of Stage 1.

Across stages, rates of hypertension in 2008 were 2.9–5.3 percentage points greater among African Americans than among whites. *Figure 2.19; see page 167 for analytical methods. Medicare patients age 65 & older, surviving all of 2008; ESRD patients excluded.*

**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/oth.** 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.

CKD stage estimates are from a single measurement. For clinical case definition, abnormalities should be present ≥ 3 months.
As discussed in Chapter One, the Modification of Diet in Renal Disease (MDRD) equation and the recently introduced CKD-EPI equation are two methods used to estimate the glomerular filtration rate (eGFR). In Ingenix i3 patients, the CKD-EPI equation identifies approximately 4 percent more non-CKD patients than does the MDRD equation, most likely due to higher estimates of GFR when using CKD-EPI.

For eGFRs below 60 ml/min/1.73 m², the percentage of patients with the following biochemical abnormalities and with more hospital days and admissions are higher with the CKD-EPI equation than with the MDRD equation: elevated uric acid (56.0 percent compared to 48.3 percent), elevated PTH (33.8/29.8), elevated triglycerides (33.8/29.8), elevated uric acid (56.0 compared to 54.1), anemia (21.4/15.6), COPD (23.4/18.8), 1–7 hospital admissions (9.0/7.6), and one or two or more hospital days (9.0/7.6), and one or two or more hospital admissions (9.0/7.6).

Here we compare estimated GFR 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 a median eGFR of 80.2 ml/min/1.73 m² with the MDRD equation, and 90.4 with the CKD-EPI equation — a difference of 13 percent, suggesting that MDRD underestimates eGFR. Further analysis reveals that for all CKD patients, as well as for those with the diagnosis codes listed here, MDRD estimates for eGFR are approximately 7 percent lower than those obtained using the CKD-EPI equation. + Figure 2.20; see page 167 for analytical methods. Prevalent Ingenix i3 patients age 20–64, surviving all of 2008; ESRD patients excluded.

<table>
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<tr>
<th>Comorbidity</th>
<th>Non-CKD MDRD equation</th>
<th>Non-CKD CKD-EPI equation</th>
<th>CKD Stages 3–5 MDRD equation</th>
<th>CKD Stages 3–5 CKD-EPI equation</th>
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<td>Elevated uric acid**</td>
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</table>

Claims-based comorbidities: “Defined from laboratory values.

Elevated uric acid defined as ≥7 mg/dl for males & ≥6 mg/dl for females.
Abnormality of uric acid & parathyroid hormone defined by ≥95th percentile, NHANES data.
Abnormality of calcium defined by ≤5th percentile, NHANES data.
Abnormality of glucose based on normal range, Ingenix i3 data.
WHO anemia defined as hemoglobin <13 g/dl in males, <12 g/dl in females.
Elevated triglycerides ≥150 mg/dl; reduced HDL (“good”) cholesterol: males <40 mg/dl; females <50 mg/dl; based on criteria proposed by the National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATP III).

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Lower estimated GFRs are often associated with biochemical abnormalities. Here we compare the prevalence of abnormalities in patients with and without CKD, using the MDRD and CKD-EPI equations to define patients with eGFRs less than 60 ml/min/1.73 m².

The prevalence of biochemical abnormalities generally increases with CKD stage. For patients with Stage 3–5 CKD, use of the CKD-EPI equation is associated with a higher prevalence of elevated uric acid (56.0 versus 48.3 percent with the MDRD equation), abnormal calcium (6.5/5.5), elevated PTH (33.8/29.8), low HDL levels (41.2/37.4), elevated triglycerides (40.0/35.8), and elevated fasting glucose (43.1/37.2).

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CKD stage estimates are from a single measurement. For clinical case definition, abnormalities should be present ≥ 3 months.
The incidence of recognized CKD among Medicare patients age 65 and older reached 4.3 percent in 2008, 3.7 times greater than the rate of 1.2 seen in 1995. **Figure 2.4**

In 2008, the prevalence of CKD among Medicare patients age 65 and older reached 7.6 percent, 4.6 times greater than the rate of 1.7 seen in 1995. **Figure 2.7**

In the African American Medicare population, the rate of new CKD cases (identified through all codes) is greater than among whites, at 6.1 compared to 4.2 percent, but has risen more slowly; rates in the two populations are now 3.0 and 3.8 times greater, respectively, than in 1995. **Figure 2.11**

Among Medicare patients, claims data identify 11.4 percent of African Americans, and 7.3 percent of whites, as having prevalent CKD in 2008. **Figure 2.15**

Anemia is reported in 43.1 percent of patients with Stage 1–2 CKD, but nearly 57 percent of those with Stages 3–5. **Table 2.8**

For eGFRs below 60 ml/min/1.73 m², the percentage of patients with biochemical abnormalities and with hospital days and admissions are higher with the CKD-EPI equation than with the MDRD calculation. **Table 2.C**

Overall, non-CKD patients have a median eGFR of 80.2 ml/min/1.73 m² with the MDRD equation, and 90.4 with the CKD-EPI equation—a difference of 13 percent, suggesting that MDRD underestimates eGFR. **Figure 2.20**