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CHRONIC KIDNEY DISEASE

CHAPTER

Know the pinetrees. Know the orange dryness of sickness and death in needle and cone. Know them too in green health, those among whom your life is laid.

Denise Levertov

“The Runes”
xpansion of the ESRD program is fueled by growth in the number of chronic kidney disease (CKD) patients who advance to ESRD. Because diabetes or hypertension is listed as the primary cause of renal failure in 71 percent of patients who begin therapy for ESRD, in this chapter we examine data on general Medicare patients with these diagnoses to determine trends in the number with CKD. We also contrast these data with information on employer group health plan (EGHP) patients, which we have obtained from the Medstat MarketScan database.

The largest growth in the CKD population has occurred among general Medicare patients with both diabetes and hypertension; the incident rate of CKD per 1,000 women with both diagnoses rose, for example, from 30 in 1993 to 53 in 2002, a 77 percent increase, while the rate for patients age 75 and older rose 79 percent. Geographic distributions of diagnosed CKD patients in the Medicare and EGHP populations are strikingly similar.

Hospitalization rates for congestive heart failure (CHF), ischemic heart disease, and arrhythmias are 2–7 times higher in CKD patients compared to those without the diagnosis, while rates for infectious hospitalizations—pneumonia and bacteremia/septicemia—are 2–5 times higher. Because these hospitalizations are also associated with poor long-term survival, these data suggest the need for more active management of CHF and increased use of preventive measures to reduce infectious complications.

Preventive healthcare in the CKD population is beginning to improve, though it continues to be an issue of concern. In 2002, for example, lipid testing occurred in 59 percent of CKD patients, compared to 48 percent in 1998. Only half of the CKD population, however, received an influenza vaccination in 2002. In most measures of care examined here, the EGHP population lags behind. Vaccination rates in this population are also particularly low, but may not be representative, since individuals with EGHP coverage may pay directly for these vaccinations or receive them free of charge at their places of work.

Fewer than one in three CKD patients covered by Medicare, and one in five with EGHP coverage, receive calcium phosphorus testing, and monitoring for hyperparathyroidism—a common complication of CKD—occurs in only 5 percent of the Medicare population. Clearly, there is considerable room for improvement in these areas.

The use of medications to treat hypertension, CHF, and cardiovascular disease shows some important trends. In the older EGHP population with a diagnosis of CKD, about 55 percent in 2002 received an ACE inhibitor or angiotensin II receptor blocker (ARB), 43
percent a lipid lowering medication, and 52 percent a diuretic. As expected, use of these medications is higher in the diabetic population. In diabetic CKD patients with CHF, for example, the use of ACE inhibitors reaches nearly 70 percent, and the use of beta blockers reaches 58 percent. It is heartening to see the positive trend in the use of ACE inhibitors/ARBs, lipid-lowering agents, and beta blockers in a population at risk for cardiovascular disease and the progression of kidney disease. Given that CKD is a coronary heart disease risk equivalent, however, and that new, more stringent dyslipidemia guidelines for the general population have been published recently, there are certainly more opportunities for treatment of dyslipidemia in these patients. In addition, most diabetic patients with CKD and CHF should be on an ACE inhibitor/ARB in order to prevent the progression of kidney disease and control CHF. In 2002, only 69.4 percent of these patients were receiving a medication from either of these drug classes.

This year we assessed the demographics and hospitalization rates of CKD patients who have also been diagnosed with one of the less common diseases known to cause ESRD. For patients with some of these diseases, including lipodosis, Goodpasture’s syndrome, Wegener’s granulomatosis, and multiple myeloma, hospitalization rates are considerably higher in the EGHP population; rates for patients with lupus, secondary glomerulonephritis, and AIDS, in contrast, are higher in patients covered by Medicare.

Data in this chapter make a strong case for the more active identification and treatment of cardiovascular disease and diabetes, particularly in the CKD population. According to the clinical practice guidelines of the American Diabetes Association, the American Heart Association, and the National Kidney Foundation, clinical care of CKD patients clearly needs improvement in order to reduce the high cardiovascular disease rates and mortality. It is unclear, however, whether these interventions will reduce the progression of CKD patients to ESRD.

| Medicare & EGHP populations with CKD, by diabetic & hypertensive status |
|---|---|
| Medicare: general Medicare CKD patients continuously enrolled in Medicare Parts A & B for an entire calendar year; patients enrolled in an HMO during the year are excluded. EGHP: CKD patients younger than 65 & continuously enrolled in a fee-for-service plan for an entire calendar year. |

(1.1) Medicare & EGHP populations with CKD, by diabetic & hypertensive status

When comparing CKD and non-CKD populations, hospitalization rates for CHF in Medicare patients are 4–5 times higher, and in EGHP patients are as much as 20 times higher. (1.12) Admission rates for pneumonia in Medicare CKD patients are three times greater than those of non-CKD patients and almost nine times greater between the two groups of EGHP patients. (1.15) Mortality after infectious events appears associated with a more sustained hazard over 36 months. Early mortality is 5–10 times more likely in patients hospitalized for an infection than in the reference population, and at three years the risk of death remains 1.5–2.0 times higher. (1.31) Approximately half of diabetic CKD patients receive lipid lowering agents while only 15 percent of patients under age 44 receive these medications.
In past ADRs, USRDS investigators found a high association between the number of risk factors and the estimated GFR. We look here at the association of CKD rates with the presence or absence of two major risk factors—diabetes and hypertension.

Compared to incident rates of CKD for similarly insured patients without diabetes or hypertension, rates in Medicare patients with both risk factors are 4–8 times higher, depending on age (Figures 1.2 and 1.5). In the EGHP population, rates for patients age 20–44 are more than 24 times higher for those with both diseases.

Rates of CKD in Medicare patients with diabetes only, though somewhat lower than those in patients with both risk factors, are nearly five times higher in patients age 20–44 compared to patients without either risk factor, and 12 times higher for EGHP patients in the same age category (Figure 1.3).

Non-diabetic Medicare patients with hypertension have CKD rates 2–3 times higher than patients with neither disease, and, when compared to those of diabetic patients without hypertension, their rates are 14–35 percent lower; this may indicate an increased risk from diabetes as opposed to hypertension in the development of CKD (Figure 1.4).

Incident and prevalent rates of CKD in Medicare patients are 7–8 times higher than in EGHP patients (Figures 1.6 and 1.11).

Prevalent rates of CKD follow similar patterns. When both risk factors are present,
rates by age for Medicare patients are 10–18 times higher than in patients without these risks (Figures 1.7 and 1.10).

Rates for Medicare patients with diabetes and no hypertension are 3.5–6.5 times higher than in non-diabetics with normal blood pressure (Figure 1.8). In the EGHP population, rates are 8–15 times higher.

Among those covered by Medicare, non-diabetic patients with hypertension have rates of CKD 4–7 times higher than those without either risk factor; rates for EGHP patients are 9.5 times higher in patients age 20–44 (Figure 1.9).

(Figures 1.2–5) Medicare: general Medicare patients age 20 & older, continuously enrolled in Medicare Parts A & B in any two consecutive calendar years. Patients enrolled in an HMO at any time during the study period are excluded. EGHP: patients age 20–64, continuously enrolled in a fee-for-service plan in any two consecutive calendar years. Non-CKD patients identified in the first year of the study period; diabetes & hypertension identified in the same year. Incident CKD patients identified in the second year. Rates are unadjusted. [Figure 1.6] per 1,000 patients, 2002, by state, unadjusted. Medicare: general Medicare patients continuously enrolled in Medicare Parts A & B in 2001–2002 & without CKD in 2001. EGHP: EGHP patients younger than 65, continuously enrolled in a fee-for-service plan in 2001–2002, & without CKD in 2001. [Figures 1.7–10] Medicare: general Medicare patients age 20 & older, continuously enrolled in Medicare Parts A & B in any calendar year. Patients enrolled in an HMO during the year are excluded. EGHP: patients age 20–64, continuously enrolled in a fee-for-service plan in any calendar year. Rates are unadjusted. [Figure 1.11] per 1,000 patients, 2002, by state, unadjusted. Medicare: general Medicare patients continuously enrolled in Medicare Parts A & B in 2002. EGHP: patients younger than 65, continuously enrolled in a fee-for-service plan in 2002. — EGHP data are not available for ages 65 & over.
precursor to end-stage renal disease, chronic kidney disease (CKD) continues to grow in the general population, and findings reveal that the disease is more widespread than previously suspected. While patients suffering from CKD tend to have far higher rates of hospitalization than individuals without the disease, regardless of insurance carrier, admission rates for Medicare patients are noticeably higher than for those insured by employer group health plans (EGHP). Cause-specific hospitalization rates for congestive heart failure, ischemic heart disease, and arrhythmia, for example, are generally 2–7 times higher for Medicare CKD versus non-CKD patients (Figures 1.12–14). The same holds true for patients insured by EGHPs, but their rates of hospitalization for similar conditions tend to be much lower. By race, blacks have the highest hospitalization rates for congestive heart failure in both CKD and non-CKD patients, while rates in whites are highest for those with ischemic heart disease.

Patients with CKD are also more likely to be hospitalized for non-cardiovascular conditions. Rates of admission for pneumonia, for instance, are 2–4 times higher in Medicare CKD patients, and as much as 11 times higher in EGHP patients with CKD who are age 20–44 (Figure 1.15).

Admissions for bacteremia/septicemia are again higher in CKD than in non-CKD patients (Figure 1.16). Medicare patients age 20–44 have rates more than twice those of any other age group, in stark contrast to patients without CKD, in whom the highest rates exist in those age 75 or older. When comparing hospitalization rates by race, blacks tend to have the highest rates regardless of CKD status.

Figures 1.12–16 Medicare: prevalent general Medicare patients age 20 & older, continuously enrolled in Medicare Part A or B during the one-year entry period; patients with HMO status or an ESRD diagnosis any time during the period at risk are excluded. Rates by age are adjusted for gender, race, & diabetic status; rates by gender are adjusted for age, race, & diabetic status; & rates by race are adjusted for age, gender, & diabetic status. EGHP: prevalent patients, age 20–64, continuously enrolled in a fee-for-service plan & alive for the entire calendar year; CKD status determined in the one-year entry period. Rates by age adjusted for gender & diabetic status; rates by gender adjusted for age & diabetic status. Patients from 2002 used as reference cohort. EGHP data are not available by race or for ages 65 & over.
The occurrence of cardiovascular and infectious events in patients with chronic kidney disease can have a devastating effect on survival. We look here at mortality rates in these patients following a hospital admission, and compare their risks of death after each event.

The adjusted mortality rate in patients hospitalized for an acute myocardial infarction is highest in the first six months following the event, at 147 per 100 patient years at risk (Figure 1.17). During this period the risk of death for these patients is more than six times higher than for patients not hospitalized for an AMI, and though the risk decreases over time it is still nearly twice as high at the end of two years. After three years, however, the mortality rates of the two populations are essentially the same.

In patients admitted for ischemic heart disease, mortality rates are nearly three times higher at six months than at twelve months (Figure 1.18). Compared to patients not hospitalized for the disease, the risk of death is more than four times higher at six months, though in patients who survive more than two years after the hospitalization the risks are the same in the two populations.

As is the case with AMI and ISHD, mortality rates for congestive heart failure are highest in the first six months following admission; they tend, however, to remain...
higher over the first two years (Figure 1.19). The risk of death at six months is 5.5 times higher than in patients without CHF, and remains more than three times higher after two years.

Mortality rates for patients hospitalized with bacteremia/septicemia are higher at six months than rates for any of the cardiovascular events studied—232 per 100 patient years at risk—demonstrating the seriousness of this life-threatening condition (Figure 1.20). The risk of death at six months is ten times higher than in patients without these conditions, and remains 2.5 times as high after one year.

Mortality rates following a pulmonary infection are noticeably lower at six months than rates for bacteremia/septicemia; after one year, however, these rates and the relative risk of death tend remain fairly constant, indicating that patients with this type of infection may be difficult to treat.

In patients hospitalized for urinary tract infections, the mortality rate at six months is 113 per 100 patient years, compared to 21 in patients without the diagnosis (Figure 1.22). The relative risk of death changes little over the first 30 months after the hospitalization, illustrating the continued vulnerability of these patients.

(Figures 1.17–22) prevalent Medicare CKD patients, 2000, continuously enrolled in Medicare Parts A & B as primary payor, & without ESRD diagnosed during the 1998–1999 entry period; adjusted for age, gender, race, & comorbidity. For each figure, patients with the diagnosis during 1998 are excluded.
The American Diabetes Association recommends that diabetic patients receive glycosylated hemoglobin (HbA1c) testing 2–4 times per year, and lipid testing at least once per year. While fulfillment of these recommendations has been increasing steadily, 20 percent of diabetic Medicare patients with CKD received only one HbA1c test in 2001–2002, and one quarter were not tested at all; one-third received no lipid testing (Figures 1.23–24). Testing is even less frequent in the EGHP population.

Patients with CKD are more likely than those without it to receive a lipid test (Figure 1.25). The highest testing rates in the CKD population occur in Medicare patients age 45–74; 61–69 percent are tested, compared to 45 percent of those age 20–44, and 54 percent of those age 75 and older.

The CDC’s Advisory Committee on Immunization Practices recommends that CKD patients receive an initial pneumococcal pneumonia vaccination, followed by a revaccination every six years. In each two-year period, then, one-third of the population should be vaccinated. But during 2001–2002 period, the highest rates—in Medicare patients age 65 and older—were...
only 12–14 percent, and fewer than one in ten CKD patients age 20–44 were treated (Figure 1.26).

Although rates of influenza vaccinations have been increasing, one out of every two Medicare patients with CKD was not vaccinated in 2002 (Figure 1.27). Rates are highest among patients age 65 and older; fewer than one-fourth of those younger than 45 receive vaccinations.

Most CKD patients do not receive oral vitamin D hormones, though use has been increasing in the EGHP population (Figure 1.28). Use varies little by gender, and is slightly higher in diabetic patients than in non-diabetics.

For lipid testing and immunizations, rates are far lower in patients covered by employer group health plans (EGHPs) than in those covered by Medicare. Rates for the two populations are closer for calcium phosphorus testing and parathyroid hormone (PTH) testing (Figures 1.29–30). Fewer than one in three Medicare patients with CKD receive calcium phosphorus testing, while PTH testing is given to only 5 percent of Medicare CKD patients, and less than 1 percent of CKD patients under EGHP coverage.

Patients with CKD have elevated risks of morbidity and of sudden death. If the outcomes of these patients are to be improved, and their progression to ESRD slowed, preventive care needs to become a central concern.

**Notes:**
- **Medicare (except for Figure 1.28):** general Medicare patients enrolled in Medicare before January 1 of each one- or two-year period, & alive through the last day of the period. Patients enrolled in an HMO, with Medicare as secondary payor, or diagnosed with ESRD during the period are excluded. Age calculated on the last day of the study period. EGHP: patients younger than 65, & enrolled for the entire study period in a fee-for-service plan; patients with ESRD diagnosed before & during the study period are excluded. Age calculated at the testing year. **(Figures 1.24–25 & 1.29)** codes for lipid & CaPh testing changed in 1998; data for prior years are omitted here. **(Figures 1.23–24)** patients with diabetes & CKD in the first year of the study period; HbA1c & lipid testing tracked in the second year. **(Figure 1.25)** lipid testing tracked each year. **(Figure 1.26)** vaccinations tracked during each year. **(Figure 1.27)** vaccinations tracked between September 1 & December 31 of each year. **(Figure 1.28)** MCBS patients, age 65 & older; data from MCBS “Cost & Use” file. **(Figures 1.28–30)** hormone use, calcium phosphorus testing, & PTH testing tracked during each year.
Because of their increased vulnerability, CKD patients are more likely to require medical intervention for cardiovascular disease (CVD) than those without CKD. Treatments for CVD administered during the early stages of CKD may not only provide cardioprotection in these patients, but slow their progression to ESRD as well.

There has been a small but positive increase in the use of ACE inhibitors/ARBs in CKD patients, with similar growth in the use of lipid-lowering agents (Figure 1.31). Nearly two-thirds of CKD patients with diabetes receive a diuretic. It is notable that only 69.4 percent of diabetic CKD patients with CHF receive ACE inhibitors/ARBs (Figure 1.32). In CKD patients with CVD, ACE inhibitor/ARB use has risen slightly in males and non-diabetics, but has remained stable (67–70 percent) in diabetics; less than two-thirds of these latter patients, however, receive lipid-lowering agents (Figure 1.33). In CKD patients with hypertension, nearly 70 percent use ACE inhibitors/ARBs; use of beta-blockers, calcium channel blockers, and diuretics appears stable (Figure 1.34).

(Figures 1.31–34) EGHP patients age 20–64, 2000–2002. Two-year study period includes a one-year selection period, used to define comorbidity, & a one-year observation period, used to count prescription drug therapy. Months shown are months in the observation period.
(1.33) Cumulative percent of prescription drug use in EGHP CKD patients with CVD, by age, gender, & diabetic status

(1.34) Cumulative percent of prescription drug use in EGHP CKD patients with hypertension, by age, gender, & diabetic status
since 1993, hospitalization rates for Medicare CKD patients who have secondary glomerulonephritis have fallen most sharply in those age 20–44 (49.4 percent) and more moderately in those age 45–64 (22.2 percent, Figure 1.35). In patients age 65–74 and 75 and older, rates have actually increased by 3.7 and 16.4 percent, respectively. Among patients insured by employer group health plans, rates have fallen 5.4 percent for ages 20–44, but have increased 15.6 percent for ages 45–64. By gender, hospitalization rates in Medicare patients converged in 2002, with rates increasing in males by 30.9 percent and decreasing in females by 18.2 percent over the previous decade. When comparing races, hospitalization rates in blacks have decreased 22.2 percent since 1993, while rates for “other” races have decreased 15.1 percent. Rates for whites, however, increased by only 5 percent during this period.

Figures 1.36–44 present data on one-year hospitalization rates in CKD patients with and without rare diseases. Fabry’s disease is caused by an enzyme deficiency which results in the accumulation of glycolipids in the renal and cardiovascular systems. Hospitalization rates for patients with lipidosis, including Goodpasture’s syndrome in the glomerulus of the kidney and in the lungs. There has been a 63 percent increase in hospitalization rates for patients with this disease, while rates for patients without it have remained steady (Figure 1.37).

Wegener’s granulomatosis is characterized by chronic tissue inflammation. The rate of hospitalization for patients with this disease increased 30.5 percent between the two periods, while rates for patients without the disease remained unchanged (Figure 1.38).

Lupus is a disease in which individuals create antibodies to their own body tissues. Hospitalization rates for patients with lupus decreased by 8 percent between the two study periods, but remained constant in patients without the disease (Figure 1.39).

Hospitalization rates in patients with secondary glomerulonephritis, another inflammatory condition, increased only slightly between the two study periods (4.2 percent), and were comparable to rates in patients without the disease (Figure 1.40).

Polycystic kidney disease is an inherited condition of numerous cysts within the kidney. In contrast to what is seen with many of the other diseases, rates of hospitalization were actually higher in patients without the disease during both study periods, at 66.4 and 72.9 percent, respectively (Figure 1.41). Rates for patients with the disease increased slightly (1.7 percent) between the periods.

Patients suffering from multiple myeloma, a cancer in the plasma cells of the bone marrow, exhibited an 18.8 increase in hospitalization rates between the two study periods (Figure 1.42). In the 1998–2002 period, rates for patients with the disease were 47 percent
higher than rates in patients without it. There was a 2.1 percent increase in hospitalization rates for patients without the disease.

Amyloidosis is a disease affecting the immune system. Hospitalization rates for patients with this disease rose 31.1 percent between the study periods (Figure 1.43). During the latter period, rates for patients with the disease were 30 percent higher than rates for patients without it.

Not surprisingly, hospitalization rates for patients with AIDS nephropathy were 2.3 and 1.8 times higher in 1993–1997 and 1998–2002, respectively, than in patients without the disease. It is important to note, however, that rates for infected patients dropped nearly 22 percent between study periods, which may indicate an increase in the effectiveness of treatments being offered to these patients.

With the exception of secondary glomerulonephritis and polycystic kidney disease, hospitalization rates in patients with EGHP coverage were higher in patients with one of these rare diseases than in those without.

Not surprisingly, hospitalization rates for patients with AIDS nephropathy were 2.3 and 1.8 times higher in 1993–1997 and 1998–2002, respectively, than in patients without the disease. It is important to note, however, that rates for infected patients dropped nearly 22 percent between study periods, which may indicate an increase in the effectiveness of treatments being offered to these patients.
Chapter summary

Introduction

[Figure 1.1] The number of CKD patients who carry a diagnosis of diabetes and hypertension has more than tripled over the past 10 years.

Incidence & prevalence of CKD

[Figures 1.2 & 1.5] Incident rates of CKD in Medicare patients with diabetes and hypertension are 4–8 times higher than those found in CKD patients without these risk factors. [Figure 1.6] Geographic patterns of incident and prevalent rates of CKD are similar between the Medicare and EGHP populations.

Hospitalization

[Figures 1.12–13] When comparing CKD to non-CKD populations, hospitalization rates for congestive heart failure in Medicare patients are 4–7 times higher, and in EGHP patients are as much as 21 times higher; rates of hospitalization for ischemic heart disease in Medicare patients are 50 percent higher, and in EGHP patients 2–5 times higher. [Figure 1.14] Hospitalizations for arrhythmia are as much as five times more likely in Medicare CKD than non-CKD patients, and as much as 12 times more likely when comparing EGHP CKD to non-CKD patients. [Figure 1.15] Admission rates for pneumonia in Medicare CKD patients are 2–4 times greater than those of non-CKD patients and 8–11 times greater between the two groups of EGHP patients. [Figure 1.16] Bacteremia/septicemia hospitalizations are 2–13 times more likely in the Medicare CKD versus non-CKD patients and as much as twenty-five times more likely in the employed CKD versus non-CKD populations.

Acute events & implications for mortality

[Figures 1.17–19] Mortality rates for patients hospitalized following an AMI or for ischemic heart disease or congestive heart failure are 4–7 times higher in the first six months than those in patients not suffering these conditions. By 36 months, rates are comparable between AMI and non-AMI patients. Those with a history of CHF at three years still have risks more than twice those found in non-CHF patients. [Figures 1.20–22] Mortality after infectious events appears associated with a more sustained hazard over 36 months. Early mortality is 5–10 times more likely in patients hospitalized for an infection than in the reference population, and at three years the risk of death remains 1.5–2.0 times higher.

Preventive health

[Figures 1.23–24] The use of glycemic control and lipid testing continues to increase in diabetic Medicare CKD patients, while less than 50 percent of EGHP patients receive no tests. [Figures 1.26–27] The percentage of EGHP patients with CKD given influenza vaccinations is 34 percent lower than in Medicare CKD patients, while pneumococcal pneumonia vaccinations are provided to less than 13 percent of either population. [Figures 1.28–30] Less than 3 percent of CKD patients receive oral vitamin D treatment, and less than 30 percent receive mineral metabolism monitoring; parathyroid hormone testing is provided to less than 6 percent of CKD patients.

Prescription drug therapy for cardiovascular disease

[Figure 1.31] In the employed population, ACE inhibitors/ARBs are more widely used in older patients and diabetics; approximately half of diabetic CKD patients receive lipid lowering agents, while only 15 percent of patients under age 44 receive these medications. [Figure 1.32] Approximately 60 percent of CKD patients with congestive heart failure receive ACE inhibitors/ARBs, while beta blocker therapy is provided to 50 percent. Only 69.4 percent of CKD patients with both CHF and diabetes receive ACE inhibitors/ARBs, a low number considering that these are the drug classes of choice to prevent progression of kidney disease in diabetics and to manage CHF. [Figure 1.33] There has been a substantive increase in the use of lipid-lowering agents in CKD patients with cardiovascular disease, especially in older or diabetic patients, but the proportion of these high-risk patients receiving the drugs remains below 65 percent.

Hospitalization & rare diseases

[Figure 1.36] EGHPs have a greater likelihood of identifying patients with Fabry’s disease, and the hospitalization rate in these patients is almost twice that of the older Medicare population. [Figure 1.37] Hospitalization rates for EGHP patients with Goodpasture’s disease are higher than those in Medicare patients. [Figure 1.38] Hospitalization rates in patients with vasculitis associated with Wegener’s granulomatosis are higher in EGHP patients than in Medicare patients. [Figure 1.42] Hospitalization rates for EGHP patients with multiple myeloma are more than 1.5 times higher than those found in Medicare patients with the same diagnosis.

Maps: National means & patient populations

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Chapter summary

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