Chapter One

Chronic kidney disease

Illness is the doctor to whom we pay most heed; to kindness, to knowledge, we make promise only; pain we obey.

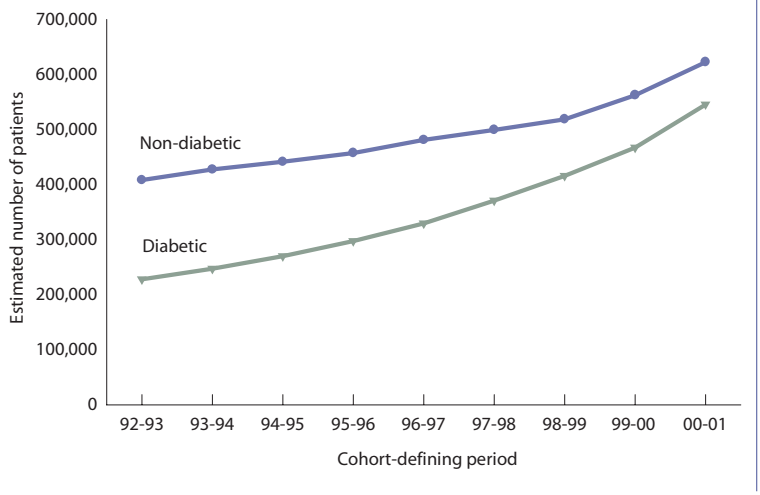
Marcel Proust, Remembrance of Things Past

With continued growth in the ESRD program, and a documented rise in the presence of severe comorbidity at the initiation of dialysis, chronic kidney disease (CKD) has begun to receive increasing attention. In the spring of 2002 the National Kidney Foundation published a classification system for CKD, using information collected in 1988–1994 by NHANES III, the third National Health and Nutrition Examination Survey. Based on estimates for this random sample of the population, it appears that approximately eight million people in the U.S. have an estimated GFR of less than 60 ml/min/1.73 m^2, indicating disease stages of III or higher. ■ In the 2002 ADR we showed that 5.9 million of these people are in the Medicare senior population. Adapting data analysis methods previously used to search for diabetics in the Medicare system, we assessed the clinically apparent CKD in this population. This year we have applied these methods, which utilize diagnosis codes, to examine trends in the prevalence of diabetes and CKD over the past decade. Individuals whose claims contain diagnosis codes for these diseases appear to have late Stage III CKD. There are clearly others, not counted by this method, whose disease is less severe, but our approach does provide insight into a large number of CKD patients and their differences both from patients without CKD and from those on dialysis. ■ We look here, then, at trends in the number of Medicare CKD patients with and without diabetes, the leading cause of ESRD. To examine outcomes in these patients, and compare them to outcomes in the non-CKD population, we look at first-year mortality and ESRD rates in two-year cohorts starting in 1992. General Medicare patients without CKD have, as expected, a very low likelihood of advancing to ESRD, and have lower death rates as well. ■ Comparing the CKD, non-CKD, and dialysis populations, we next report trends in hospitalization rates for congestive heart failure, ischemic heart disease, all-cause infections, and specific types of infection. ■ We look as well at mortality in these three populations. In the 2002 ADR we showed that a CKD patient is 5–10 times more likely to die than to reach ESRD. Here we present data on the location in which patients die, showing a strikingly disproportionate rate of sudden death in the CKD population. This rate is 3.1 times higher than that seen in non-CKD patients, while being 44 percent less than that of the dialysis population. These findings, along

CHAPTER HIGHLIGHTS ■ **Figure 1.1** Between 1992 and 2001 the size of the Medicare CKD population increased 53 percent for diabetics, and 140 percent for non-diabetics—a total of 84 percent overall. ■ **Figure 1.3** Admission rates for CHF in patients with chronic kidney disease are seven times greater than in those without the disease. ■ **Figures 1.10–11** Approximately 80 percent of Medicare CKD patients age 67 and older carry a diagnosis of cardiovascular disease, which includes ASHD, CHF, CVA/TIA, PVD, and other cardiac disease, while rates are approximately half as high in patients without CKD. The incidence of a new cardiovascular diagnosis is 24 percent in the CKD population and 15 percent in patients without CKD. ■ **Figure 1.16** Only 56 percent of CKD patients with evidence of cardiovascular disease receive lipid testing even once a year.

1.1 · Trends in the size of the Medicare CKD population, by diabetic status

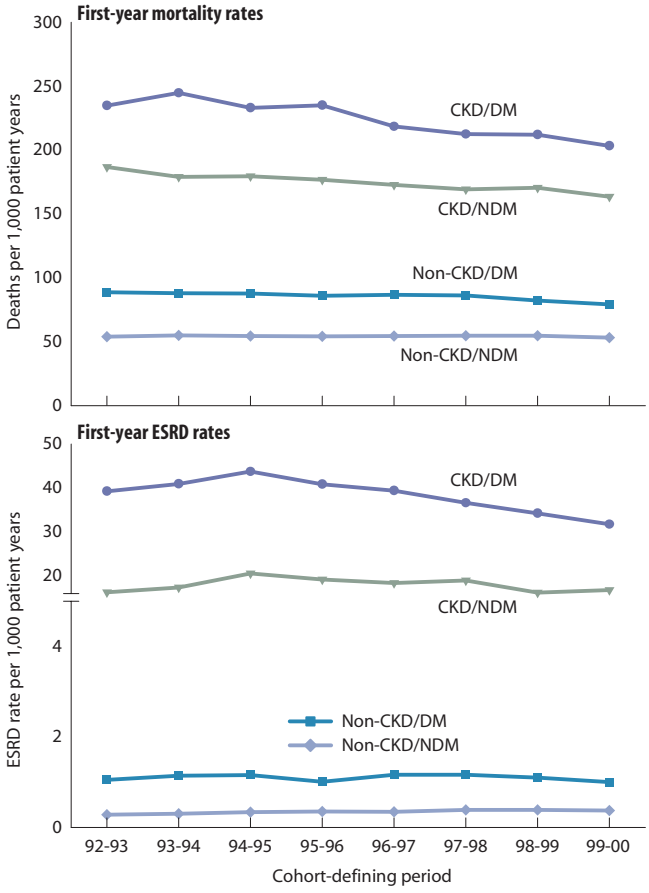
patients continuously enrolled in Medicare Part A & Part B in any two consecutive calendar years from 1992 to 2001 (entry period), & alive on the last day of the entry period. Patients enrolled in an HMO or diagnosed with ESRD any time during the entry period are excluded. Estimates of the general Medicare population are based on the 5 percent Medicare sample.



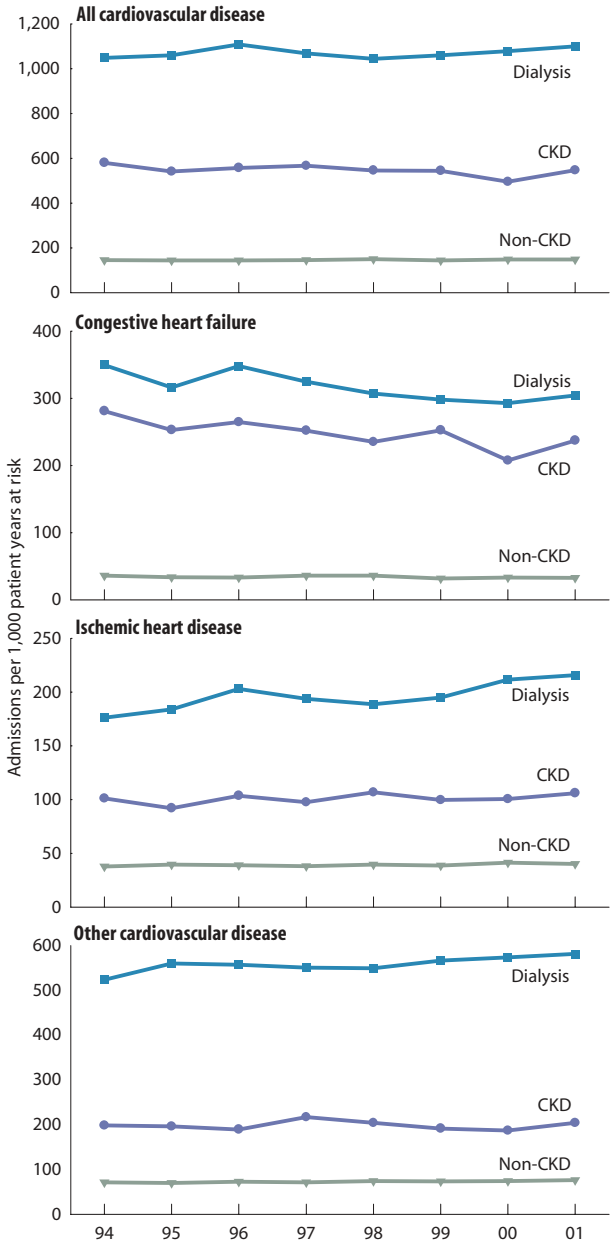
with high rates of hospitalization for cardiovascular disease (particularly congestive heart failure), suggest that the CKD population's greater likelihood of advancing to death than to ESRD is cardiac in origin, a conclusion fitting with the high prevalence of cardiovascular disease in the general CKD population. ■ To examine the rate at which CKD patients develop cardiovascular disease (CVD), we look at a cohort of Medicare patients who have no CVD services or diagnoses during a two-year entry period, noting their CVD diagnoses in the following year. Compared to non-CKD patients, those with CKD are 1.6 times more likely to require services for cardiovascular disease—1.7 times more likely for atherosclerotic heart disease and CVA/TIA, and 2.3 times more likely for congestive heart failure. ■ Given the elevated occurrence of sudden death in CKD patients, their increased rates of cardiovascular disease, and their high number of hospital admissions, preventive care is central to improving outcomes in this population. Only 56 percent of CKD patients with a history of CVD, however, receive lipid monitoring. Diabetic care has improved slowly over the last decade, yet over one-quarter of diabetic CKD patients are not given a single glycosylated hemoglobin test, and 37 percent do not receive a lipid test. If outcomes in CKD patients are to be improved, this element of their care clearly needs to be addressed.

1.2 · First-year ESRD & mortality rates, by CKD & diabetic status

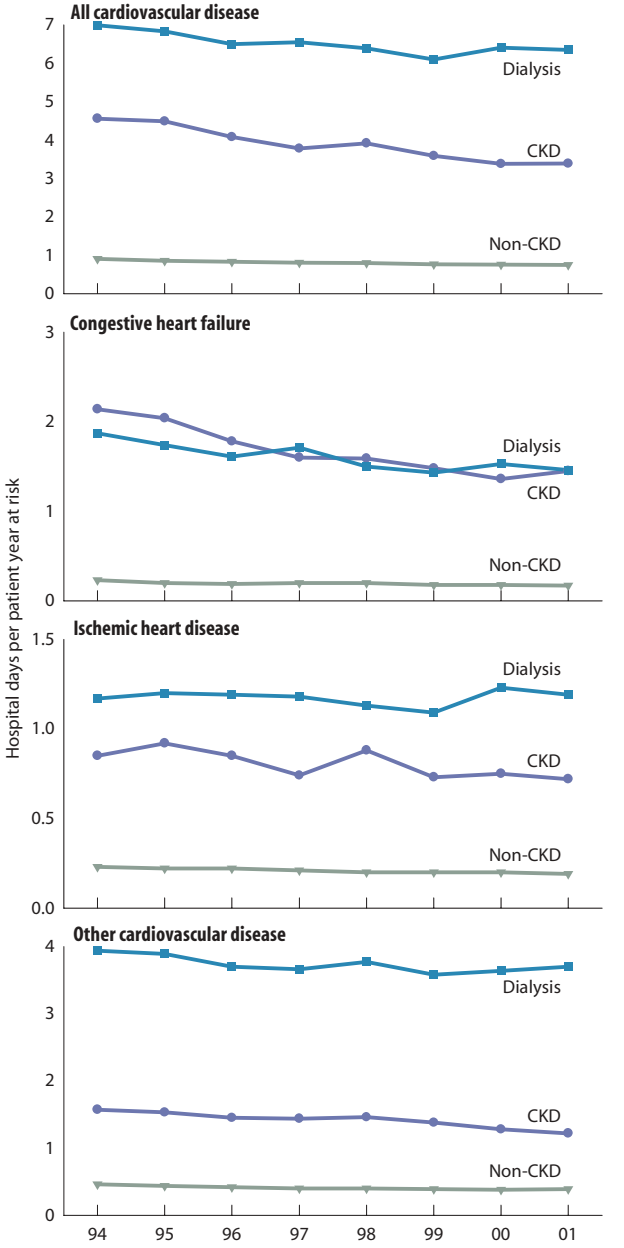
general Medicare patients age 67 & older; rates adjusted for age, gender, & race, & determined for the first year after the cohort-defining period. Reference population: 1999–2000 cohort.



1.3 · Adjusted admission rates: cardiovascular disease



1.4 · Adjusted hospital days: cardiovascular disease



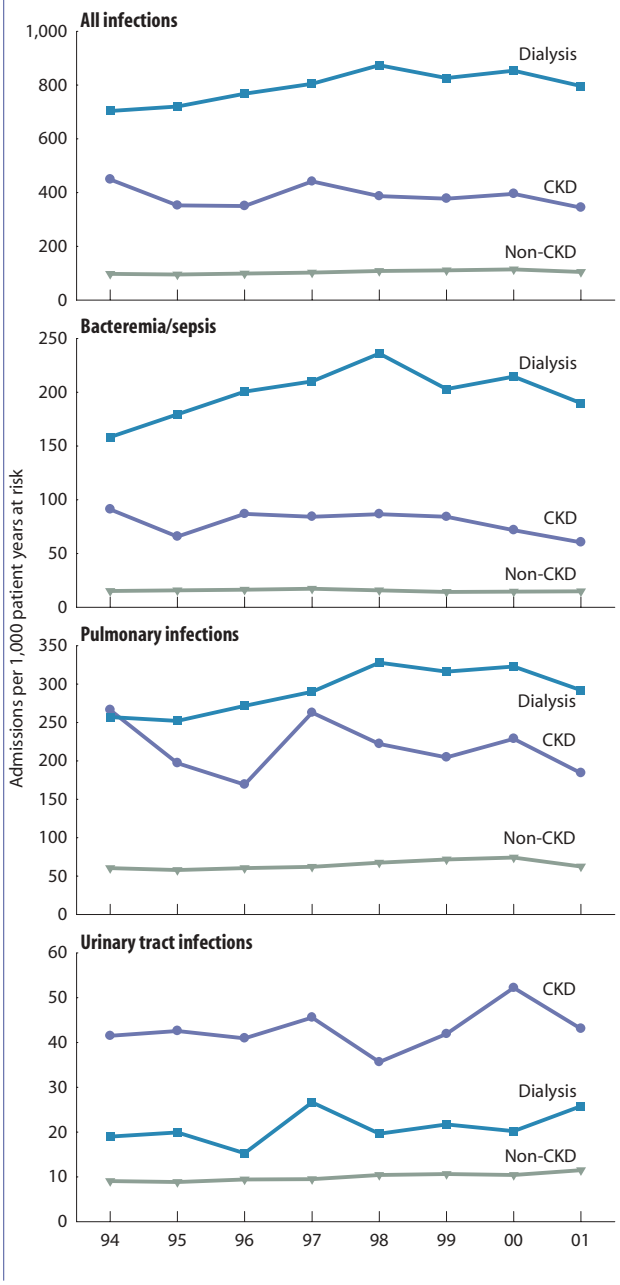
Hospitalization

On this spread we compare hospital admissions and days for general Medicare patients with chronic kidney disease, those without the disease, and ESRD patients on dialysis. For admissions related to cardiovascular disease, 2001 rates in the dialysis population were up to nine times higher than those in non-CKD patients, and up to three times higher than those in patients with CKD (Figure 1.3). Since 1994, the greatest changes in admission rates have been for congestive heart failure, with rates decreasing 10–16 percent, and ischemic heart disease, which increased 5–6 percent for general Medicare patients, but 22 percent for those on dialysis.

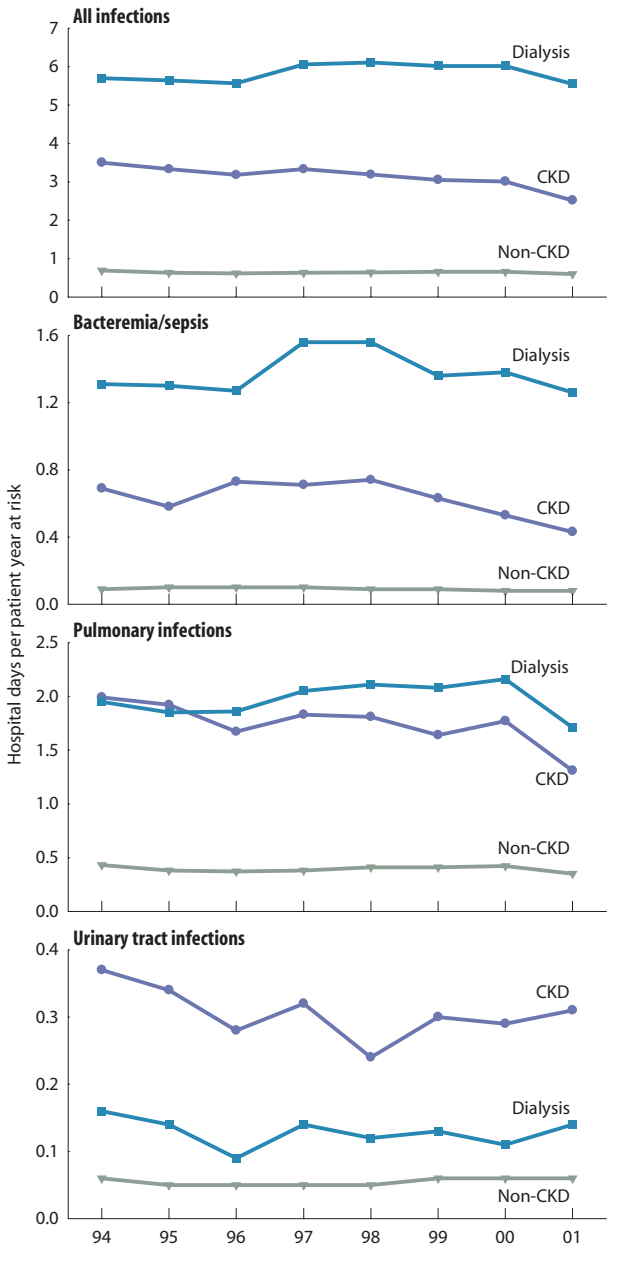
Hospital days for cardiovascular disease have decreased since 1994 (Figure 1.4). Compared to those of non-CKD patients, the number of days remains up to 8.5 times higher for dialysis patients. Rates for CKD patients are lower than those of dialysis patients for most cardiovascular diagnoses; for congestive heart failure, however, CKD and dialysis patients have similar rates.

Since 1994 the overall rate of hospital admissions for infection has decreased 23 percent for CKD patients; it has increased 6.6 percent, however, in non-CKD patients, and 13 percent in patients on dialysis (Figure 1.5). Similar differences are seen for specific diagnoses of infection. Admissions for bacteremia have decreased 34 percent in CKD patients, are unchanged in those

1.5 · Adjusted admission rates: infection



1.6 · Adjusted hospital days: infection



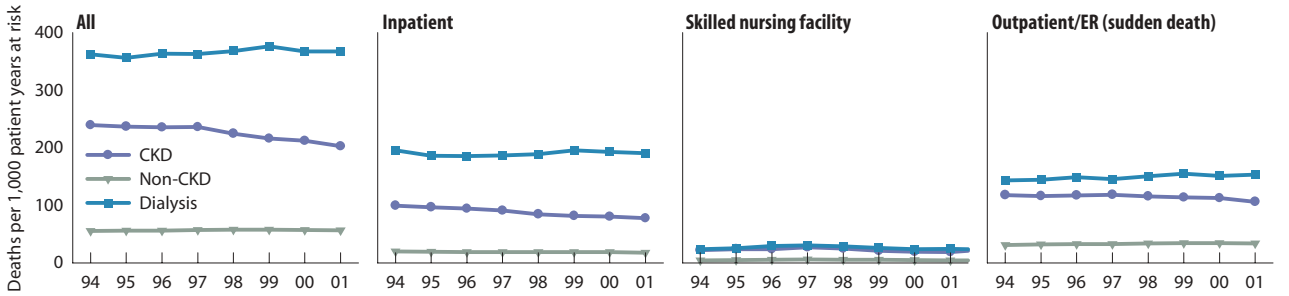
without CKD, and have increased 20 percent in dialysis patients. And admissions for pulmonary infections have fallen 31 percent in CKD patients, while rising 4 and 14 percent in the non-CKD and dialysis populations. Rates for most infections are highest among patients on dialysis—up to three times higher than those in CKD patients, and up to 13 times higher than those in patients without CKD. Rates for urinary tract infections in CKD patients, however, are 1.7 times higher than in those on dialysis, and 3.8 times higher than in patients without CKD.

Hospital days for infection have decreased since 1994 for all three populations (Figure 1.6). The greatest changes have again been in the CKD population, in whom rates have decreased 28 percent overall, 38 percent for bacteremia, 34 percent for pulmonary infections, and 16 percent for urinary tract infections.

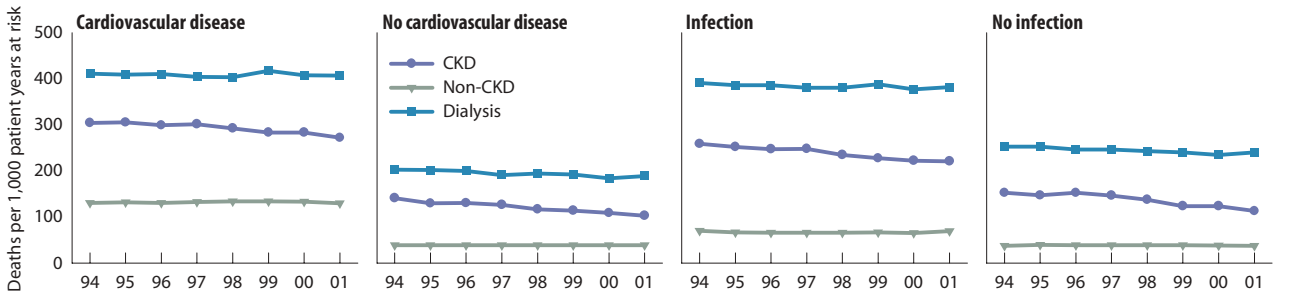
Despite the improvement since 1994 in cardiovascular admission rates and hospital days for CKD patients, admission rates for these patients remain 2.6–7.3 times higher than for patients without a diagnosis of CKD, and hospital days are 3.1–8.5 times greater. With an estimated 1.2 million CKD patients in the Medicare system (Figure 1.1), care of these patients clearly requires considerable resources.

■ ***Figures 1.3–6*** *period prevalent patients; rates adjusted for age, gender, race, & diabetic status. Cohort from 2001 used as reference.*

1.7 · Unadjusted mortality rates, by location of death event



1.8 · Unadjusted all-cause mortality, by presence of prior cardiovascular disease or infection



Mortality & comorbidity development

Since 1994 the rate of inpatient deaths has fallen 2.6 percent for dialysis patients, but 8.6 percent for non-CKD patients, and 22 percent for those with CKD (Figure 1.7). Almost half of CKD deaths occur out of the hospital. The rate of deaths occurring in a skilled nursing facility has risen slightly for non-CKD and dialysis patients, but has decreased 14 percent for CKD patients; the CKD population has also seen an almost 10 percent decrease in the rate of sudden deaths. Even with these changes, however, sudden death rates for CKD patients remain three times higher than those in patients without the disease.

Differences in all-cause mortality parallel those seen in the hospitalization data on the previous spread. Rates have decreased 10.6 and 14.6 percent in CKD patients with cardiovascular disease (CVD) and infection, but they are still 2.1 and 3.2 times higher in these patients than in those without CKD (Figure 1.8).

On the following page we present results of our study on the development of cardiovascular disease in general Medicare patients age 67 and older. Eighty percent of the CKD patients in this study had CVD claims during the entry period, compared to 45 percent of those without the disease (Figure 1.10). During the one-year study period, CVD was newly diagnosed in 24 percent of CKD patients and 15 percent of non-CKD patients, rates of 280 and 167 diagnoses per 1,000 patient years (Figure 1.11).

After excluding ESRD and HMO patients, we tracked all patients who survived the two-year entry period and the one-year study period, looking at the relation of their comorbidity development in the study period and their outcomes in the following year.

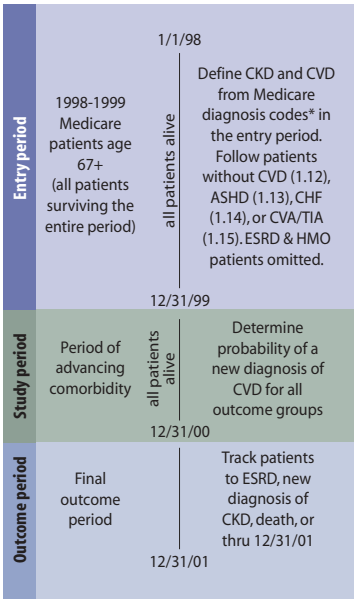
Figure 1.12 shows that CKD patients were 1.6 times more likely to develop cardiovascular disease by the end of the study period than those without CKD. Probabilities for both CKD and non-CKD patients were lowest in those who, in the outcome period, had no events—ESRD, a new diagnosis of CKD, or death. The likelihood of developing cardiovascular disease was the same, however, for patients who did have one of these events; i.e., whether they progressed to ESRD or death in the outcome period, CKD patients were equally likely to develop CVD during the study period, and the same was true of non-CKD patients progressing to CKD/ESRD or death.

Patterns were similar for patients with ASHD, CHF, or CVA/TIA, with CKD patients 1.8–2.3 times more likely than non-CKD patients to develop these conditions (Figures 1.13–15). Compared to CKD patients who developed ESRD, those who died in the outcome period were more likely to have developed ASHD, but less likely to have a new diagnosis of CHF.

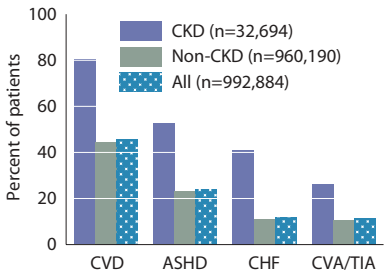
■ ***Figures 1.7–8*** *period prevalent patients age 67 & older; unadjusted.* ■ ***Figure 1.9*** **Hebert et al., Am J Med Qual 1999 Nov–Dec;14(6):270–7.* ■ ***Figures 1.10–15*** *general Medicare patients age 67 & older.*

■ ***Figures 1.10–12*** *CVD includes ASHD, CHF, CVA/TIA, PVD, & other cardiac disease; rates in Figure 1.11 are unadjusted.* ■ ***Figures 1.12–15*** *relative risks adjusted for age, gender, & race.*

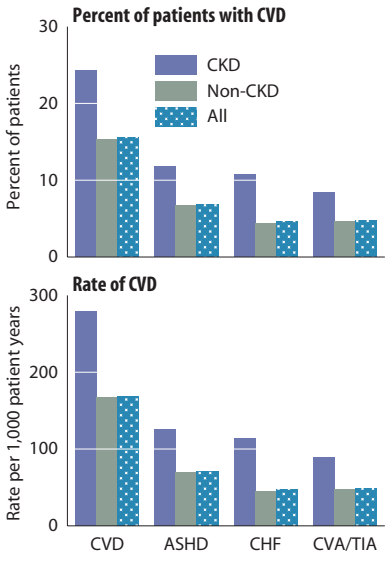
1.9 · CV disease in Medicare patients: study design



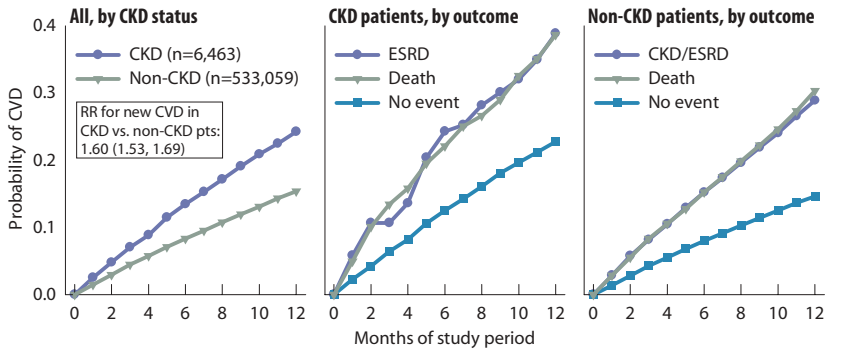
1.10 · Prevalence of CVD in general Medicare pts



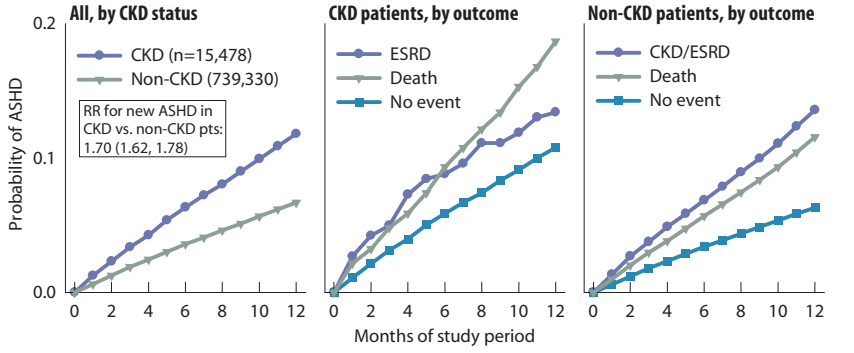
1.11 · Incidence of CVD in general Medicare pts



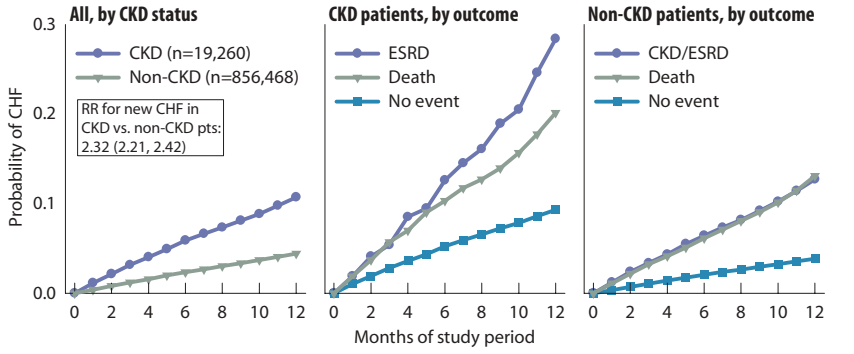
1.12 · Life table estimates for probability of incident CVD: patients without CVD in entry period



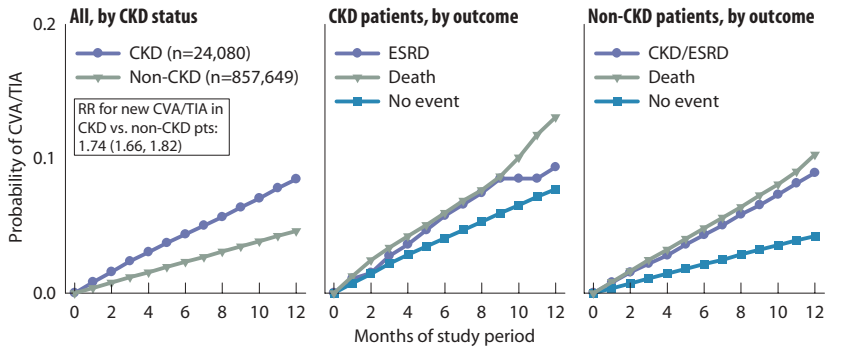
1.13 · Life table estimates for probability of incident ASHD: patients without ASHD in entry period



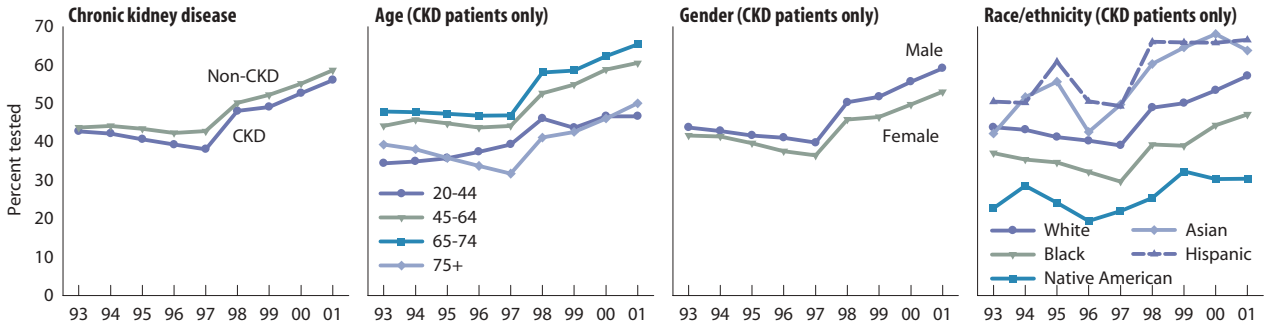
1.14 · Life table estimates for probability of incident CHF: patients without CHF in entry period



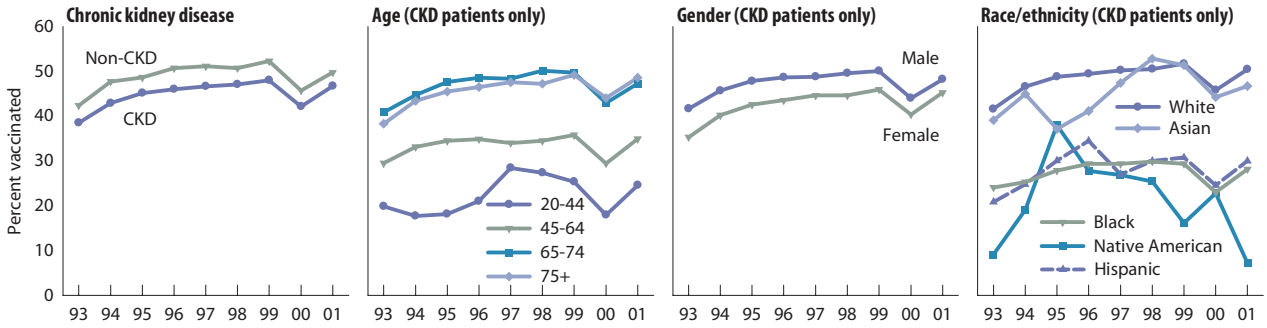
1.15 · Life table estimates for probability of incident CVA/TIA: patients without CVA/TIA in entry period



1.16 · Percent of patients with cardiovascular disease receiving lipid testing

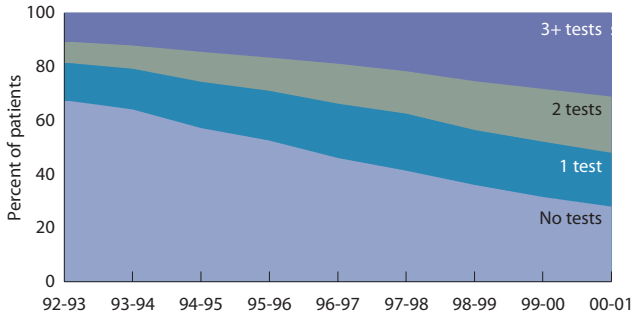


1.17 · Percent of patients with cardiovascular disease receiving influenza vaccinations

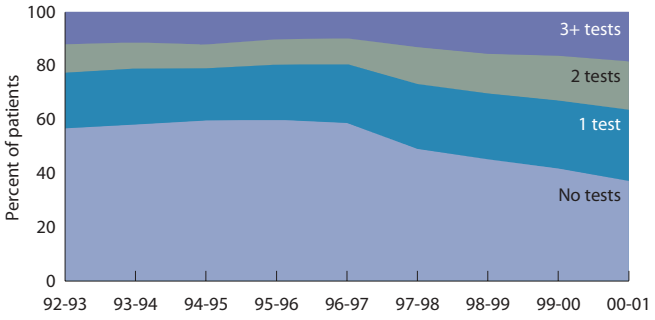


Diabetic monitoring

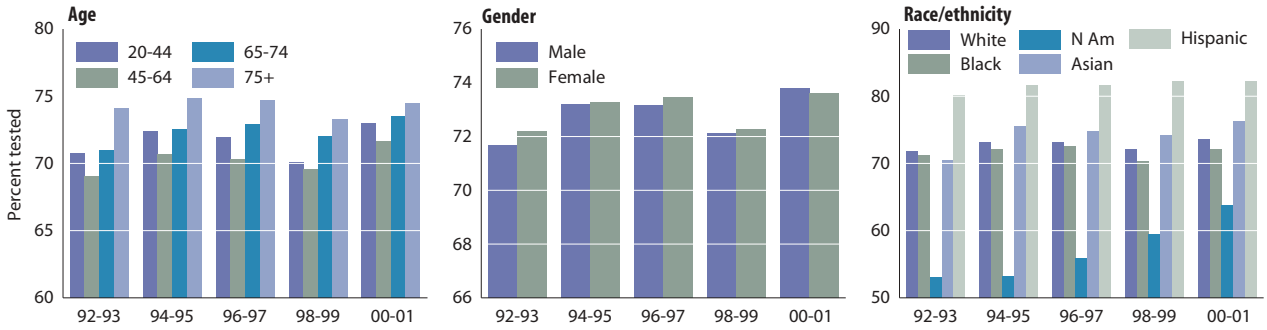
1.18 · Diabetic CKD patients receiving glycosylated hemoglobin testing



1.19 · Diabetic CKD patients receiving lipid testing



1.20 · Patients receiving diabetic nephropathy monitoring



Preventive health in CKD patients

We previously reported that patients with CKD, diabetes, or congestive heart failure contribute significantly to the increase in new ESRD cases each year, especially patients with a combination of these diseases. Such patients are clearly at a high risk for increased morbidity, and should be closely monitored to prevent or slow their progression to future disease states.

Fifty-six percent of patients with both CKD and cardiovascular disease received lipid testing in 2001, compared to 59 percent of non-CKD patients with cardiovascular disease (Figure 1.16). Since 1993, testing rates have increased 31.3 and 34.1 percent, respectively. Hispanic and Asian patients tend to have the highest rates of testing, while the greatest rise in the percent tested has occurred among Asians.

Fewer than half of CKD and non-CKD patients receive influenza vaccinations (Figure 1.17). Whites had the highest rates in 2001—50.4 percent—while rates for blacks, Native Americans and Hispanics were alarmingly low, falling below 30 percent.

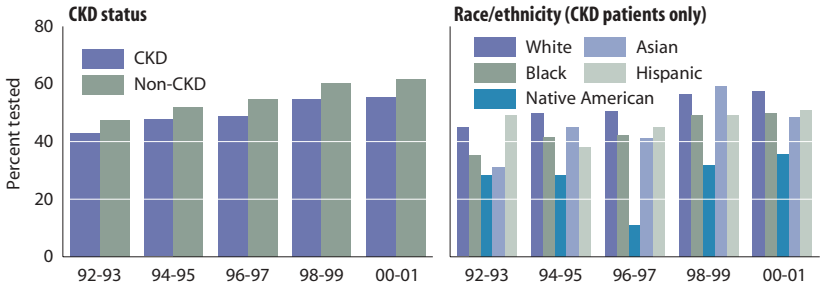
The American Diabetes Association recommends that diabetic patients receive glycosylated hemoglobin (HbA1c) testing at least two to four times per year, and lipid testing at least annually. The percent of patients reaching the HbA1c target has risen from 19 in 1993 to more than half in 2001, while the percent of patients receiving at least one annual lipid test has also increased, from 43 in 1993 to 63 in 2001 (Figures 1.18–19).

Diabetics are at high risk for diabetic nephropathy. Rates of monitoring for this condition in 2000–2001 were consistent across all age groups, at 72–75 percent (Figure 1.20). By race and ethnicity, Hispanic patients were most likely to receive a test (82 percent), while Native Americans were least likely (64 percent).

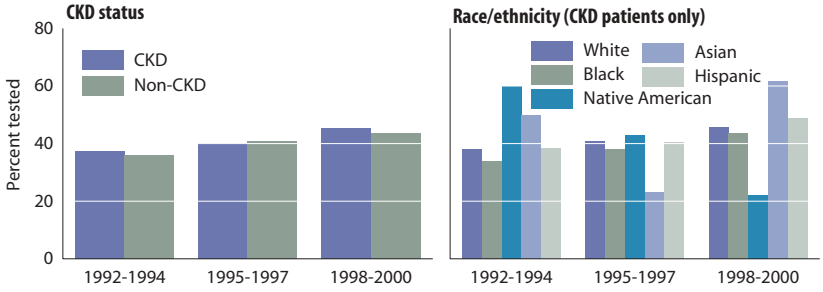
Fifty-six percent of women with CKD received mammograms in 2000–2001, compared to 62 percent of those without CKD (Figure 1.21). Screening rates in CKD patients are highest in whites and Hispanics, at 58 and 51 percent, but are only 35 percent in Native Americans. Cervical cancer screening rates have increased overall but remain below 50 percent, and in CKD patients are lowest for Native Americans (Figure 1.22). Prostate cancer screening rates exceeded 50 percent in all populations except Native Americans with CKD, in whom rates were only 28 percent in 1998–2000 (Figure 1.23).

Cancer screening

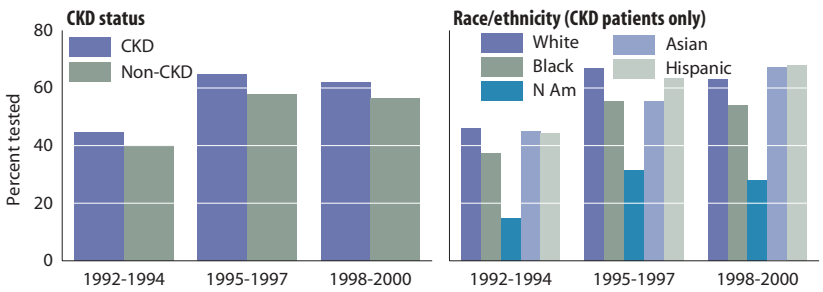
1.21 · Breast cancer



1.22 · Cervical cancer



1.23 · Prostate cancer



■ ***Figures 1.16–23*** *general Medicare patients enrolled in Medicare before January 1 of each study 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. Rates for Native Americans should be interpreted with caution since tests may be billed to IHS rather than Medicare. Because of categorization in the general Medicare database, racial & ethnic categories are mutually exclusive.* ■ ***Figures 1.16–17*** *patients with CHF, ASHD, CVA/TIA, PVD, or other cardiovascular disease in each year, & with or without CKD during the same year.* ■ ***Figures 1.18–19*** *patients with diabetes & CKD in the first year of study period, rates calculated from the second year of the study period.* ■ ***Figure 1.20*** *patients with diabetes in each study period; patients with steroid-induced or gestational diabetes in the same year are excluded. Diabetic nephropathy monitoring is identified through CPT codes for microalbuminuria or macroalbuminuria tests & evidence of a diagnosis of or treatment for nephropathy.* ■ ***Figure 1.21*** *female patients age 52–69 with or without CKD in the study period; patients with bilateral mastectomies before or during the study period are excluded.* ■ ***Figure 1.22*** *female patients age 21–64 with or without CKD in the study period; patients with hysterectomies before or during the study period are excluded.* ■ ***Figure 1.23*** *male patients age 50 or older with or without CKD in the study period; patients with prostatectomies before or during the study period are excluded.*

chapter summary

INTRODUCTION ■ **Figure 1.1** Between 1992 and 2001 the size of the Medicare CKD population increased 53 percent for diabetics, and 140 percent for non-diabetics—a total of 84 percent overall. ■ **Figure 1.2** Mortality rates for patients with diabetes and/or CKD declined 11–13 percent between 1992 and 2000. Rates of the development of ESRD fell almost 20 percent for patients with both CKD and diabetes, and 5 percent for those with diabetes only. ESRD rates for non-diabetics with CKD are unchanged. **HOSPITALIZATION** ■ **Figure 1.3** Admission rates for CHF in patients with chronic kidney disease are seven times greater than in those without the disease, and reach levels more than three-quarters those of patients on dialysis. ■ **Figure 1.4** Hospital days for CHF in dialysis and CKD patients have declined during the past eight years, but remain almost eight times greater than those in patients without CKD. ■ **Figures 1.5–6** Hospitalization rates and hospital days for infections, including pulmonary and urinary tract infections, are considerably higher in CKD than in non-CKD patients. **MORTALITY & COMORBIDITY DEVELOPMENT** ■ **Figure 1.7** Overall mortality rates are nearly four times greater in patients with CKD than in those without the diagnosis, and rates of sudden death are three times higher. ■ **Figures 1.10–11** Approximately 80 percent of Medicare CKD patients age 67 and older carry a diagnosis of cardiovascular disease, which includes ASHD, CHF, CVA/TIA, PVD, and other cardiac disease, while rates are approximately half as high in patients without CKD. The incidence of a new cardiovascular diagnosis is 24 percent in the CKD population and 15 percent in patients without CKD. ■ **Figures 1.12–15** Compared to patients without CKD, those with the disease are 60 percent more likely to develop cardiovascular disease, 70 percent more likely to develop ASHD, two to three times more likely to develop CHF, and 74 percent more likely to have a CVA/TIA. Patients who later develop ESRD or die before ESRD in the fourth year have comparable rates of cumulative probability for cardiovascular disease. **PREVENTIVE HEALTH IN CKD PATIENTS** ■ **Figure 1.16** Only 56 percent of CKD patients with evidence of cardiovascular disease receive lipid testing even once a year. ■ **Figure 1.17** Fewer than 50 percent of patients with a diagnosis of cardiovascular disease receive influenza vaccinations, and rates are slightly lower in patients with CKD. ■ **Figures 1.18–19** Though the use of diabetic preventive care has increased, 28 percent of diabetic CKD patients still received no glycosylated hemoglobin testing in 2001, and only 31 percent had three or more tests within the year. More than one-third of patients received no lipid testing, and only 18 percent received three or more tests.