finding what you need in the annual data report

**tables of contents** listing all chapters in the ckb and esrd volumes, the main topics covered within them, and the reference sections and appendices: pages 8–11 and 130–132.

**chapter tables of contents** listings of all two-page spreads, found on the second page of each chapter.

**guide to topics** listings of central topics in the index: pages 12–13.

**data appearing each year in the adr** list of tables and figures: ckb: page 14; esrd: pages 134–135

**cd–rom** both volumes of the adr, slides of all figures, excel files of all data, and complete reference tables; inside the back cover.

**chapter summaries** central points from each two-page spread; found on the last page of each chapter.

**analytical methods** describing the methods used for each figure and table; ckb: pages 119–127; esrd: pages 371–399.


**glossary** with a list of acronyms; page 406.
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And I’ll tell it and think it and speak it and breathe it
And reflect it from the mountain so all souls can see it
Then I’ll stand on the ocean until I start sinkin’
But I’ll know my song well before I start singin’
And it’s a hard, it’s a hard, it’s a hard, it’s a hard
It’s a hard rain’s a-gonna fall

Bob Dylan, “A Hard Rain’s a-Gonna Fall.”
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1.a Prevalence & odds ratios of CKD in NHANES participants, by method used to estimate GFR, age, gender, race/ethnicity, & risk factor
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2.10 Cumulative probability of a physician visit at month 12 following CKD diagnosis, by physician specialty & dataset
2.14 Medicare Part D & MarketScan CKD patients with at least one claim for an ACEI/ARB/renin inhibitor, by CKD diagnosis code
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Volume One

Highlights

Patients

- Prevalence of eGFR <60 in NHANES 2001-2008 Participants: MDRD formula TABLE 1.A
  - Among those with self-reported diabetes: 21.3%
  - Among those with self-reported cardiovascular disease: 30.1%

- Prevalence of eGFR <60 in NHANES 2001-2008 Participants: CKD-EPI formula TABLE 1.A
  - Among those with self-reported diabetes: 19.8%
  - Among those with self-reported cardiovascular disease: 29.8%

- Prevalence of ACR ≥30 in NHANES 2001-2008 Participants TABLE 1.A
  - Among those with self-reported diabetes: 33.4%
  - Among those with self-reported cardiovascular disease: 24.8%

- Prevalence of recognized CKD in Medicare Patients Age 65 and Older, 2009 TABLE 2.B
  - White: 8.1%
  - African American: 12.8%

Patient Care

- Hypertension among patients with eGFR <60 CKD-EPI formula; Table 1.B
  - 85%

- Patients with eGFR <60 whose hypertension is treated and controlled CKD-EPI formula; Table 1.B
  - 23%

- Hypercholesterolemia among patients with eGFR <60 CKD-EPI formula; Table 1.B
  - 66%

- Patients with eGFR <60 whose hypercholesterolemia is treated and controlled CKD-EPI formula; Table 1.B
  - 24%

- Patients with diabetes and eGFR <60 whose diabetes is uncontrolled CKD-EPI formula; Table 1.B
  - 42%

- Cumulative probability of a nephrologist visit at month 12 after a CKD diagnosis of 585.3 or higher, 2009: Medicare Patients Age 65+ Table 2.H
  - 0.62

- Cumulative probability of a nephrologist visit at month 12 after a CKD diagnosis of 585.3 or higher, 2009: MarketScan Patients Age 50-64 Table 2.H
  - 0.51

- CKD Patients Receiving an ACEI or ARB, 2008 Figure 4.11
  - 55%

- CKD Patients Receiving a beta blocker, 2008 Figure 4.11
  - 65%
outcomes

446
adjusted hospitalization rates in white medicare CKD patients age 66 and older, 2009
ADMISSIONS PER 1,000 PATIENT YEARS; FIGURE 3.3
STAGE 1–2  411 • STAGE 3  441 • STAGE 4–5  554

466
adjusted hospitalization rates in african american medicare CKD patients age 66 and older, 2009
ADMISSIONS PER 1,000 PATIENT YEARS; FIGURE 3.3
STAGE 1–2  437 • STAGE 3  426 • STAGE 4–5  652

75
adjusted mortality rates in white medicare CKD patients age 66 and older, 2009
DEATHS PER 1,000 PATIENT YEARS; FIGURE 3.12
STAGE 1–2  64 • STAGE 3  61 • STAGE 4–5  103

83
adjusted mortality rates in african american medicare CKD patients age 66 and older, 2009
DEATHS PER 1,000 PATIENT YEARS; FIGURE 3.12
STAGE 1–2  71 • STAGE 3  62 • STAGE 4–5  113

expenditures

$3.5 BILLION
total net PART D payment for medicare enrollees with CKD, 2008 FIGURE 5.11

$3,547
PER PERSON PER YEAR medicare PART D costs for enrollees with CKD, 2008 FIGURE 5.12

$708
PER PERSON PER YEAR out-of-pocket PART D costs for enrollees with CKD, 2008 FIGURE 5.12

$34 BILLION
total medicare expenditures for CKD, 2009 FIGURE 6.5 [EXCLUDES PART D]

$18 BILLION
medicare expenditures for patients with CKD AND diabetes, 2009
FIGURE 6.6 [EXCLUDES PART D]

$16 BILLION
medicare expenditures for patients with CKD AND congestive heart failure, 2009
FIGURE 6.7 [EXCLUDES PART D]

$20,432
PER PERSON PER YEAR expenditures for CKD in the general medicare population, 2009
FIGURE 6.8 [EXCLUDES PART D]
NON-DM/NON-CHF $14,449 • CKD + DM • CHF $34,121
February 2002: the National Kidney Foundation introduces a five-stage classification system for chronic kidney disease based on an estimated glomerular filtration rate (eGFR), calculated from serum creatinine levels and levels of proteinuria, and using data from the National Health and Nutrition Examination Survey (NHANES).

Diabetes, congestive heart failure (CHF), and CKD are three interrelated chronic diseases of clear public relevance.

Awareness and control of hypertension (HTN) in NHANES participants with eGFR < 60 ml/min/1.73 m² or ACR > 30 mg/g, 2005–2008 (percent)

New ICD-9-CM stage-specific codes for CKD were introduced in the fall of 2005, providing opportunities to use different datasets — like those from employer group health plans (EGHPs) — to track younger populations with reported diagnosis codes over time.

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

EGHP patients are much younger than Medicare patients.

CKD is recognized more frequently in Medicare patients age 65 and older than in the Ingenix i3 and MarketScan populations, age 20–64.

**MEAN AGE**
- **MEDICARE:** 77.8
- **MARKETSCAN:** 52.4
- **INGENIX i3:** 51.2

**RECOGNIZED CKD**
- **Medicare:**
  - 20–44: 0.4%
  - 45–54: 0.9%
  - 55–64: 2.0%
  - 65–74: 6.1%
  - 75–84: 10.3%
  - 85+: 13.1%
- **Ingenix i3:**
  - 20–44: 0.3%
  - 45–54: 0.7%
  - 55–64: 1.7%
  - 65–74: 6.1%
  - 75–84: 10.3%
  - 85+: 13.1%
- **MarketScan:**
  - 20–44: 0.4%
  - 45–54: 0.9%
  - 55–64: 2.0%
  - 65–74: 6.1%
  - 75–84: 10.3%
  - 85+: 13.1%

The Modification of Diet in Renal Disease (MDRD) Study equation and the new Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equation are two methods used to estimate GFR.

**CKD STAGE MARKERS**
1. eGFR < 60 ml/min/1.73 m², albumin/creatinine ratio (ACR) > 30 mg/g
2. eGFR 60–89, ACR ≥ 30
3. eGFR 30–59
4. eGFR 15–29
5. eGFR < 15

Microalbumin testing: Figure 2.9
Recognition of CKD: Figures 2.6–8
Prevalence of CKD: Figures 2.6–8
The prevalence of recognized CKD has increased significantly since 1995.

**Medicare: age 65+**

<table>
<thead>
<tr>
<th>Year</th>
<th>White 1.5%</th>
<th>2009 8.1%</th>
</tr>
</thead>
</table>

**African American 2.4% | 2009 12.8%**

**MarketScan: age 20–64**

<table>
<thead>
<tr>
<th>Year</th>
<th>585 codes 6.4%</th>
<th>2009 11.0%</th>
</tr>
</thead>
</table>

**MEDICARE**

**All codes 6.3% | 2009 12.8%**

**585 codes 10.5%**

**Ingenix i3: age 20–64**

<table>
<thead>
<tr>
<th>Year</th>
<th>585 codes 6.4%</th>
<th>2009 11.0%</th>
</tr>
</thead>
</table>

**MICROALBUMIN TESTING** can detect early signs of 'KIDNEY DAMAGE' in patients at risk for ckd.

**PROBABILITY OF TESTING IN 2008–2009**

10% All patients

33% Patients with diabetes (no hypertension)

5% Patients with hypertension (no diabetes)

33% Patients with both diabetes and hypertension

In patients with **DIABETES, HYPERTENSION, OR CARDIOVASCULAR DISEASE**, the odds of a CKD diagnosis code are **2–4 TIMES HIGHER** than in patients without these conditions.

<table>
<thead>
<tr>
<th>Plan</th>
<th>Adjusted odds of a CKD diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Medicare</strong></td>
<td><strong>MarketScan</strong></td>
</tr>
<tr>
<td>Diabetes 2.1</td>
<td>3.3</td>
</tr>
<tr>
<td>Hypertension 3.6</td>
<td>3.3</td>
</tr>
<tr>
<td>Cardiovascular disease 2.5</td>
<td>2.8</td>
</tr>
</tbody>
</table>

Prevalence of CKD: Figures 2.3–5
Recognition of CKD: Figures 2.3–5
Microalbumin testing: Figure 2.6
Odd of CKD diagnosis: Table 2.1
Medicare patients age 65 and older are twice as likely to see a cardiologist as a nephrologist following any diagnosis for CKD. Among patients with a CKD diagnosis of Stage 3 or higher, approximately two-thirds see either a cardiologist or nephrologist.

---

### Adjusted All-Cause Hospitalization and Mortality Rates Are Higher in CKD Patients than in Those without the Disease

**Hospitalization rates**

- **Stage 1-2**: 407 hospitalizations per 1,000 patient years
- **Stage 3**: 438 hospitalizations per 1,000 patient years
- **Stage 4-5**: 560 hospitalizations per 1,000 patient years

**Mortality rates**

- **Stage 1-2**: 66 deaths per 1,000 patient years
- **Stage 3**: 62 deaths per 1,000 patient years
- **Stage 4-5**: 105 deaths per 1,000 patient years

---

Physician care: Tables 2.g–h
Hospitalization: Table 3.a
Mortality: Table 3.c
Patients with CKD carry a larger burden of cardiovascular disease than those without CKD.

57% of Stage 3 CKD patients with CHF, and 48% of Stage 4–5 CKD patients with CHF, receive an ACEI/ARB

67% of CKD patients with CHF receive a BETA BLOCKER

JANUARY 1, 2006: MEDICARE PART D GOES INTO EFFECT
to help subsidize the costs of prescription drugs in Medicare beneficiaries

Days supply: top three drugs used by Medicare Part D enrollees with CKD

<table>
<thead>
<tr>
<th>Drug</th>
<th>Days Supply (Million)</th>
<th>% of Total Medicare Part D Drug Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Furosemide</td>
<td>92.8</td>
<td>4.7%</td>
</tr>
<tr>
<td>Metoprolol</td>
<td>82.7</td>
<td>3.0%</td>
</tr>
<tr>
<td>Levothyroxine</td>
<td>66.6</td>
<td>3.2%</td>
</tr>
</tbody>
</table>

Costs: top three drugs used by Medicare Part D enrollees with CKD

<table>
<thead>
<tr>
<th>Drug</th>
<th>Costs (Million)</th>
<th>% of Total Medicare Part D Drug Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulin</td>
<td>$216</td>
<td>6.2%</td>
</tr>
<tr>
<td>Clopidogrel bisulfate</td>
<td>$148</td>
<td>4.3%</td>
</tr>
<tr>
<td>Atravastatin</td>
<td>$104</td>
<td>3.0%</td>
</tr>
</tbody>
</table>

NET PART D COSTS FOR MEDICARE CKD PATIENTS IN 2008

$3.46 BILLION

Overall, CKD patients account for 14% of total Medicare expenditures

Overall Medicare total: $225 billion

CKD: $31.6 billion

CKD patients with diabetes account for 23.5% of Medicare diabetes expenditures

CKD + diabetes: $17 billion

CKD patients with congestive heart failure account for 32% of Medicare CHF expenditures

CKD + CHF: $15.5 billion
This is the twenty-third annual report of the United States Renal Data System, and the twelfth in our atlas series. For the fourth year we include a volume on chronic kidney disease (CKD), defining its burden in the general population, and looking at cardiovascular and other comorbidities, adverse events, preventive care, prescription medication therapy, and costs to Medicare and employer group health plans. In Volume Two we provide information on the size and impact of the end-stage renal disease (ESRD) population — the traditional focus of the USRDS — presenting an overview of the ESRD program, along with detailed data on incidence, prevalence, comorbidity of new ESRD patients, severity of disease, clinical care, hospitalization and mortality rates, pediatric patients, renal transplantation, the provider delivery system, and the economics of the ESRD program.

The ADR has been shortened this year due to budgetary limitations, and the CKD and ESRD volumes have been bound together into one book. Chapters in the CKD volume have been limited to three or four spreads, and previous chapters on cognitive function, the transition to ESRD, and acute kidney injury have been omitted.

This year’s ADR presents data on the breadth of kidney disease and its impact on both individuals and society as a whole. To explore this idea, we turn this year to one of the most human characteristics of all — the ability to express ourselves through music. In the wide diversity of musical expression we see similarities to the far-ranging impact of kidney disease across different racial and ethnic populations; in the lyrics of American music of the twentieth century — ranging from the Big Band era to folk music of the 1960s — we see expressions of emotion that can illustrate how kidney disease touches patients and their loved ones. The emotional implications of life with kidney disease, particularly for those on dialysis, are substantial, and relate not only to the physical elements of the disease but to its enormous financial stresses and its impact on personal relationships. Understanding these broad implications, we hope that the emotional connections expressed through American music help frame our reporting on kidney disease in the United States.

We approach Volume One from the perspective that the implications of CKD were under-appreciated prior to February, 2002, when a new CKD classification staging system was proposed. The five-stage system was developed using population-level data from the National Health and Nutrition Examination Survey (NHANES), a surveillance system coordinated by the National Center for Health Statistics at the Centers for Disease Control and Prevention. The conceptual model of this system was based on similar approaches
for populations at risk for diabetes and hypertension, two well-known diseases that damage the kidney as well as other organ systems. The model characterizes progressive stages of CKD, from early evidence of kidney damage — such as albumin in the urine — to overt reductions in the filtering capacity of the kidney, defined by the estimated glomerular filtration rate (eGFR).

There are many issues related to defining the levels of eGFR and urine albumin which indicate “true disease” in the kidney during the early stages of CKD, as compared to a normal reduction in kidney filtering capacity (particularly in the elderly). Improving on the MDRD method, a new estimating formula — the CKD-EPI equation — was published in the Annals of Internal Medicine in May, 2009; we compare these two equations, providing a perspective for readers on the strengths and weaknesses of each.

While the USRDS and others will continue to investigate these issues in both the clinical and public health arenas, already there are important data available on the impact of CKD, data based both on biochemical information and on the definition of the disease within the Medicare and health plan datasets. The impact of the CKD staging system as a predictor of morbidity and mortality is now well known on a population level, but its translation into the care of individual patients must continue to evolve to help clinicians provide the best care to their patients affected by kidney disease.

In the Précis we highlight some of the most important data from the chapters, and address the burden of CKD — an area of major public policy and public health concern. In Chapter One we then define the CKD population, using NHANES data to examine how chronic conditions such as diabetes and congestive heart failure interact with CKD in a random sample of the U.S. population. We compare CKD populations identified through the MDRD and CKD-EPI equations, and address the burden of CKD across age, gender, and racial groups, as well as among patients with other chronic diseases. We also examine awareness, treatment, and control of hypertension, diabetes, and lipid disorders, and conclude with mortality prediction models, using both the MDRD and CKD-EPI equations.

Using data from the Medicare claims system and the employer group health plan datasets, we consolidate data on identification and care of CKD patients into Chapter Two. We begin by summarizing basic descriptive and comorbidity information from the major datasets used by the USRDS — the 5 percent Medicare sample, and the MarketScan and Ingenix i3 databases. We then illustrate the actual CKD burden in the NHANES population, and show that data gleaned only from the 585 diagnosis codes under-reports this burden. Data on laboratory testing of at-risk patients show that rates of evaluation for kidney disease — through urine microalbumin and serum creatinine testing — are low. We conclude the chapter by looking at the likelihood of receiving nephrologist care after a CKD diagnosis, and at prescription drug therapy among patients with CKD.

In Chapter Three we address morbidity and mortality among patients with CKD. We begin with comparisons of hospitalization rates in CKD and non-CKD patients, looking both at all-cause hospitalizations and at those for cardiovascular disease and infection, and giving particular attention to hospitalizations for infection. We conclude with data on mortality rates by CKD stage and across risk groups.

Cardiovascular disease in the CKD population is the focus of Chapter Four, in which we evaluate, by CKD stage, major cardiovascular diagnoses and interventions, medication use, survival, and hospitalization. Data on prescription drug therapy are obtained from the Medicare Part D database, and address recommended therapies for major cardiovascular diagnoses and for patients receiving certain revascularization procedures.

This year we have added a chapter on Medicare Part D prescription drug use to both the CKD and ESRD volumes, defining the populations using the benefit and looking at various types of coverage, including the low income subsidy (LIS). We begin by looking at enrollment patterns in the general Medicare and CKD populations, then present data on monthly premiums, deductibles, gap coverage, and copayments. Data on the costs of Part D enrollment show total expenditures and per person per year (PPPY) costs; we also look at costs of specific medications in the general Medicare population and among those with early- or late-stage CKD. And, because CKD patients use substantial amounts of prescription drugs, we also look at their likelihood of reaching the coverage gap compared to that of their counterparts in the general Medicare population.

We conclude the CKD volume with Chapter Six, addressing the costs associated with CKD. We look at PPPY costs in the CKD population as a whole and in those with diabetes or cardiovascular disease, examine components of costs for CKD patients, and detail Medicare Part D costs by CKD stage, race, and LIS status.

Data presented in this volume illustrate the challenges that CKD, its complications, and its costs pose to the healthcare system, to policy makers, and to the individuals and families facing this condition. Programs to detect CKD — some of which have been ongoing since 2000 — have been initiated by the CDC and by nonprofit patient organizations. By their nature, detection programs are broad-based approaches to

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Throughout the ADR, with the exception of NHANES data, CKD cohorts exclude ESRD patients.