Funding & chapter contributors
Production of this ADR was solely funded through NIH contract HHSN 267 2007 15002C / NO1-DK-7-5002 with the Minneapolis Medical Research Foundation (MMRF). Most contributors to this report are employed by MMRF, with many of the physician investigators being employed by MMRF’s parent organization, Hennepin Faculty Associates. MMRF has enacted conflict of interest (COI) policies and practices governing the conduct of research within the USRDS and other research not related to the USRDS. In addition to internal controls, USRDS work is overseen by NIDDK Project Officers, the USRDS Steering Committee, and the USRDS External Advisory Committee.

Listed below are those who contributed to this ADR. Unless otherwise noted in parentheses, the contributor’s employer was MMRF or its parent organization, Hennepin Faculty Associates.

Directors & co-investigators
Allan Collins, MD, FACP: USRDS Director (entire ADR, with exception of Chapter 9). Robert Foley, MB, MSc, USRDS Deputy Director (entire ADR, with exception of Chapters 7 and 9). Blanche Chavers, MD (University of Minnesota School of Medicine; Chapter 8). David Gilbertson, PhD (entire ADR, with exception of Chapters 7 and 9). Charles Herzog, MD (Chapter 9). Bertram Kasiske, MD (Chapter 7). Li-Hwa Ma, PhD (Chapter 12). Anne Murray, MD, MSc (Chapter 6). Wendy St. Peter, PharmD, BCPS (Chapter 12). Jay Xue, DVM, PhD (Chapter 2).

USRDS staff
Administrative staff Beth Forrest, BBA (Chapter 12). ADR production Edward Constantini, MA (entire ADR). Susan Everson, PhD (entire ADR). Biostatisticians Qiao Fan, MS (Chapter 1; G tables). Haifeng Guo, MS (Précis, HP2010; Chapters 1, 5, 8, 10). Qi Li, MS (Chapter 6). Shuling Li, MS (HP2010, Chapter 9). Suying Li, PhD (Précis, Emerging Issues; Chapters 6, 8, H tables). Jianrong Liu, PhD (Chapter 10; E tables). Yi Peng, MS (Chapters 1, 7, 8; E & F tables). Yang Qiu, MS (Chapter 9). Tricia Roberts, MS (Précis, Emerging Issues; Chapters 1, 6, 8; G tables). Melissa Skeans, MS (Précis, HP2010; Chapter 7, 8; E & F tables). Jon Snyder, MS (Chapter 7). Craig Solid, MS (Précis, Emerging Issues, HP2010; Chapters 1, 3, 5, 8, 10, 11; L tables). Changchun Wang, MS (Précis; Chapters 1, 9). Eric Weinhandl, MS (Emerging Issues; Chapters 1, 6, 10). David Zanun, MS (Emerging Issues). Rui Zhang, MS (Précis, Emerging Issues; Chapters 5, 6, 8, 10; I tables). Information systems & software development Shu-Cheng Chen, MS (Précis; Chapters 4, 8, 10; D tables). Frederick Dalleska, MS (Précis, Chapter 10; J tables). James Ebben, BS (Précis; Chapters 1, 5, 10; K tables). Eric Frazier, BS (Précis, Emerging Issues, HP2010; Chapters 2, 3, 8, 10; A, B, C & M tables). Mapping Stephan Dunning, MGIS. Data preparation & management (for all chapters) Cheryl Arko, BA. Frank Daniels, BS. Christopher Hanzlik, BS. Roger Johnson. Daniel Sheets, BS. Xinyue Wang, BA/BS.

Disclosures for potential conflicts of interest
MMRF: Research sponsored by Abbott, Amgen, Baxter, Bristol-Myers Squibb, Centers for Disease Control and Prevention, Genzyme, Merck/Schering-Plough, National Institute on Aging / National Institutes of Health, National Kidney Foundation, NxStage, Roche, Sigma-Tau.
Blanche Chavers, MD: Consultant/honoraria: Amgen.
Allan Collins, MD, FACP: Consultant/honoraria: Amgen, Baxter, Merck/Schering-Plough, NxStage, Roche.
Robert Foley, MB, MSc: Consultant/honoraria: Amgen, Baxter, Merck/Schering-Plough, NxStage, Roche.
David Gilbertson, PhD: Consultant/honoraria: Abbott, Amgen, Genzyme, Ortho Biotech, Roche.
Charles Herzog, MD: Consultant/honoraria: Amgen, Roche.
Trustee: RoFAR. Equity ownership exceeding $10,000: Cambridge Heart, Johnson & Johnson.
Anne Murray, MD, MSc: Equity ownership exceeding $10,000: Medtronic.

Suggested citation for this report
Who can open the door who does not reach for the latch?
Who can travel the miles who does not put one foot in front of the other, all attentive to what presents itself continually?
Who will behold the inner chamber who has not observed with admiration, even with rapture, the outer stone?
Information map
For readers of different audiences

Clinicians
CKD 10, 30–31, 54, chapter 1, chapter 9, 228–229

cardiocascular disease 53, 60, 142–143, 166–167, chapter 9 patient

Patients

Policy makers

Researchers
Information map

Topics of particular interest

Diseases
- anemia & anemia treatment
- CKD
- cardiovascular disease
- diabetes
- rare diseases
- CKD
- cardiovascular disease
- diabetes
- rare diseases

Outcomes
- Healthy People 2010
- hospitalization
- clinical indicators
- cardiovascular disease
- survival
- mortality

Costs
- insurance coverage
- PPPM/PPPY costs
- components of care
- vascular access
- CKD

Treatment
- pre-ESRD
- dialysis
- transplantation
- preventive care
- anemia & anemia treatment
- K/DOQI guidelines

Populations
- new patients
- existing patients
- children
- CKD patients
- international patients

Data analysis
- analytical methods
- data files available to researchers
- agreement for release of data

---
A Incidence 3
by age, gender, race, ethnicity, & primary diagnosis
counts (A.1) 5 \div rates (A.2) 9 \div rates
of diabetic ESRD (A.3) 13

B Prevalence 39
by age, gender, race, ethnicity, & primary diagnosis
counts (B.1) 39 \div rates (B.2) 43 \div rates
of diabetic ESRD (B.3) 47

C Patient characteristics 77
by age, gender, race, ethnicity, & diabetic status
lab values (C.2) 76

D Treatment modalities 95
by modality type
percentages & counts (D.1) 93
by age, gender, race, ethnicity, & primary diagnosis
incidence (D.2–5) 95
prevalence (D.6–9) 103

E Transplantation: process 123
by age, gender, race, ethnicity, & primary diagnosis
counts of wait-listed patients (E.1–2) 125
counts of renal transplants (E.7) 141
rates of renal transplants (E.9) 145

F Transplantation: outcomes 147
probabilities, by age, gender, race, ethnicity, primary diagnosis, & number of transplants
one-year graft survival
deceased donors (F.2) 150
living donors (F.14) 162

one-year probability of graft failure
deceased donors (F.14) 162
living donors (F.20) 168

G Morbidity & hospitalization 181
per 1,000 patient years, by age, gender, race, ethnicity, & primary diagnosis
admission rates
ESRD (G.1) 183 \div dialysis (G.2) 184 \div
hemodialysis (G.3) 185 \div
CAPD/CCPD (G.4) 186 \div transplant (G.5) 187
Mortality & causes of death
per 1,000 patient years, by age, gender, race, ethnicity, primary diagnosis, & vintage mortality rates
ESRD (H.2) 205  dialysis (H.4) 207  hemodialysis (H.12) 215  CAPD/CCPD (H.20) 223  transplant (H.28) 231

Patient survival
probabilities, by age, gender, race, ethnicity, & primary diagnosis
ESRD patient survival
one-year (I.3) 259  two-year (I.4) 260  five-year (I.6) 262  ten-year (I.7) 263
dialysis patient survival
one-year (I.10) 266  two-year (I.11) 267  five-year (I.13) 269  ten-year (I.14) 270

Provider characteristics
certified dialysis & transplant facilities (J.1) 299
Economic costs of ESRD
by age, gender, race, ethnicity, & primary diagnosis
total Medicare dollars (K.1) 311
Medicare costs for ESRD patients (K.2) 313
per person per year costs: ESRD (K.4) 316
per person per year costs: dialysis (K.9) 317

Vascular access
by age, gender, race, ethnicity, & primary diagnosis
catheter placements (L.1) 329
AV fistula placements (L.2) 330
catheter intervention events (L.4) 332
AV fistula intervention events (L.5) 334
Coordinating Center (CC) and Special Studies Centers (SSCs) have entered a new contract period, covering the next seven years. There are now three SSCs—Cardiovascular, Nutrition, and Quality of life/Rehabilitation—while the activities previously undertaken by the Economic SSC have been rolled into those of the CC.

This is the nineteenth annual report on the end-stage renal disease (ESRD) program in the United States, and the eighth in our atlas series, which provides an in-depth, graphic presentation of data spanning the last two decades. Based on initial data developed in our previous Annual Data Reports (ADRs), chronic kidney disease (CKD) has been given a designated scope of work under the new contract. In the past several books we have devoted a chapter to CKD, and we anticipate expanding the scope and prominence of these analyses as new surveillance methods and data are developed.

At its inception, the ESRD program was expected to plateau at 40,000 prevalent patients—a number passed more than 20 years ago. ESRD was at first considered a rare disease, as defined by the Orphan Drug Act of 1983 and its subsequent amendments, but that definition also became outdated when the prevalent population exceeded 200,000—the threshold defined by the act—in 1990.

The past five years have seen a sustained slowing of growth in rates of ESRD. This trend, however, should be viewed with caution, as the baby boomers will be reaching their early 60s in the next 5–7 years. To help examine the possible impact of their aging on the ESRD program, the CC has used the most up-to-date patient counts, disease rates, and population demographics (from the Census Bureau and the National Center for Health Statistics) to develop new projections of future growth in the ESRD population.

Aiding in this effort is our new work this year to reconcile patient counts and lost-to-follow-up popula-

Information on data requests can be found in Appendix B, starting on page 296.
tions—a challenge over the entire history of the ESRD program. The work of CMS and the ESRD networks, centered on the SIMS data system, has given the program a more accurate count of existing patients treated in dialysis units, and of those who recover kidney function and discontinue dialysis. This has reduced the number of patients who are lost to follow-up, in turn lowering the prevalent count by nearly 6,000 and altering some past projections, as noted in the new projections presented in Chapter Two.

In 2006 and the first part of 2007 a number of policy, surveillance, and safety issues related to ESRD received considerable public attention. In response we have added a new chapter to the ADR, to be focused each year on a timely area of concern related to the public health of the kidney disease population. This year, this Emerging Issues chapter looks in detail at mortality during the first year of ESRD treatment—an area of particular concern, as it has changed little over the past decade. Comorbidity and disease severity in the incident ESRD population, the frequent use of dialysis catheters at the start of dialysis, the risks of anemia treatment—all may play a role in first-year death rates. We examine these issues, and look as well at anemia treatment and the overshooting of target hemoglobin levels, which have received increased attention since reports of adverse events in CKD patients when hemoglobin levels are targeted over 13 g/dl. And we then use both basic and more comprehensive adjustments to illustrate interval survival in the first months of dialysis.

In this year’s Précis we again provide an overview of the CKD and ESRD populations, their care, and their expenditures. We look at modality use, the transplant wait list, and indicators of quality of care, and illustrate recent changes in hospitalization rates, mortality rates, and five-year survival in the dialysis population. Figures on ESRD expenditures show per person and total costs in the program. And the chapter’s final spread presents data, by race, on the distribution of patients and costs in the CKD population.

Following the Emerging Issues chapter we update our data on progress toward Healthy People 2010 objectives. We also present new data on Objective 4.3, on pre-ESRD care, and update our analyses for Objective 4.8, addressing the medical evaluation and treatment given to patients with both CKD and diabetes.

Chapter One this year presents new information on CKD in the general Medicare and dually-enrolled (Medicare/Medicaid) populations. State departments of health, which cover half of Medicaid expenditures, have generally been unaware of the substantial costs associated with the CKD and ESRD populations. We provide data from the National Health and Nutrition Examination Survey, showing the rising prevalence of CKD, and examine care of CKD patients, which has improved in some areas but has shown little change in others. We look at acute kidney injury, particularly as it relates to the progression to ESRD and to premature death. And we conclude with data on transitional events and costs associated with those who reach CKD Stages 4–5.

Incident and prevalent counts reported in Chapter Two incorporate our recent work to reconcile patient counts and lost-to-follow-up populations. We compare incident rates obtained through two different methods—one from the CDC, which uses the estimated diabetic population on a county level, the other the traditional method of the USRDS, using the overall U.S. population. It appears that ESRD rates in the diabetic population have been declining, though this should be interpreted with caution, as early recognition of diabetes may create a lead-time bias, suggesting improvement when in fact more cases of diabetes are being identified in the base population. We also look here at rates of ESRD in major metropolitan areas.
which have been a concern for many years, and, as new objectives for the country are being developed for the Healthy People 2020 program, provide updated projections of ESRD counts and costs through 2020.

In Chapter Three we present information from added data fields on the newly revised Medical Evidence form, introduced in the spring of 2005. Information on vascular access, for example, shows the high rate of catheter use, with 82 percent of incident patients using a catheter at the first outpatient dialysis treatment. This high rate may contribute to higher mortality in the first year on dialysis, an area discussed in the Emerging Issues chapter and in Chapter Six. Data on anemia treatment prior to initiation of ESRD therapy show that fewer patients are now being treated with ESAs, and that hemoglobin levels after initiation have been rising since 1996. The chapter concludes with new information on institutionalized patients and their access to care in the pre-ESRD period.

Chapter Four presents information on trends in modality use since 1978. Peritoneal dialysis is now used by just 8 percent of the dialysis population, down from 15–17 percent in the mid-1990s. New guidelines on peritoneal dialysis treatment, along with the emergence of daily home hemodialysis as a new modality, may change perceptions about the use of home therapies.

In Chapter Five, on clinical indicators of care assesses dialysis adequacy, vascular access, anemia treatment, overshooting of target hemoglobin levels (an important patient safety issue), and preventive care in the diabetic and general ESRD populations. We show, for instance, that while influenza vaccination rates have grown, they are still far lower than the recommended level, and we look at the marked differences in vascular access complication rates associated with the use of fistulas, catheters, and grafts. We have also added information on darbepoe tin and erythropoietin treatment and associated hemoglobin levels.

Mortality data in Chapter Six show continued gains across most time periods in both the incident and prevalent populations. Although first-year mortality rates have changed little in the last 11 years, it appears that some progress was achieved in 2004 and 2005. New spreads here address disability in the CKD and ESRD populations, looking at patients affected by blindness, amputation, limb paresis, and dementia; at the occurrence of these disabilities over time; at per person per years costs; and at the probability of death. The chapter then concludes with data on care and outcomes of patients affected by Hurricane Katrina.
As we show in Chapter Seven, transplant rates continue to rise. This year we show Bayesian transplant and graft failure ratios, using methods similar to those employed to assess dialysis outcomes. These methods reduce the wide variation in outcomes based on center size, a problem not addressed by the traditional standardized ratios reported in the past. We also look at patient follow-up and care, an increasingly important area. We compare, for instance, rates of cardiovascular screening in high- and non-high-risk populations before and after transplant, and illustrate continued racial disparities in post-transplant care. Patient survival and complications are beginning to receive more attention in the surveillance data, a shift from the past focus on graft survival.

Striking in the data on pediatric patients is the lack of progress in their survival. As shown in Chapter Eight, there has been no change in mortality among young dialysis or transplant patients. Both incident and prevalent rates in the adult population, in contrast, have fallen. We also look here at growth in pediatric patients, a particular concern, as kidney disease retards stature and cognitive development. The median height of the pediatric ESRD population is at the sixth percentile of the general pediatric population. Recombinant human growth hormone treatment is available, but is markedly underutilized: 37 percent of pediatric ESRD patients are at least two standard deviations below normal height, but only 14.6 percent of these patients receive rhGH.

In Chapter Nine the Cardiovascular Special Studies Center addresses CHF in CKD and ESRD patients, showing the disease’s probability in both incident and prevalent populations, its diagnosis and treatment, survival in the three years following diagnosis, and L-carnitine use in CHF patients. Data on cardiovascular disease evaluations, for example, show marked differences in the use of stress tests, echocardiograms, and angiography. The chapter’s final spread presents data on the use of implantable cardioverter defibrillators, and on survival after implantation.

Over the past twenty years the landscape of dialysis providers has altered dramatically, with the consolidation of smaller providers into large dialysis chains. In 2005 it changed even further, with the acquisition of Renal Care Group by Fresenius Medical Care, and the purchase of Gambro Healthcare by DaVita. These transitions create new challenges for the USRDS in assessing care. In Chapter Ten this year we give initial data on the duration of unit ownership, and in future ADRs will explore the impact of the recent corporate acquisitions, comparing patient care and outcomes in units recently acquired to those under management for several years. Since anemia treatment has received considerable attention in this last year, we present data on hemoglobin overshooting at the
provider level, furthering the analyses in the Emerging Issues chapter and in Chapter Five, and illustrating distinct differences in patterns of care. Also new this year is information on provider-specific billing for additional tests beyond those reimbursed in the composite rate, and data showing differences by provider in the use of injectables. The chapter concludes by showing provider differences in mortality and hospitalization ratios since 1999.

Chapter Eleven, on expenditures related to CKD and ESRD, begins with data on the overall costs of both the Medicare and ESRD programs, followed by detailed tables on components of both CKD and ESRD costs. We then update our annual figures on per person per year costs by modality, and illustrate costs for clinical services, injectables, preventive care, and vascular access. The chapter concludes with data on Medicare Advantage patients, looking at enrollment trends, patient characteristics, and patients who disenroll. The program was restructured in 2002 with a new payment method, and data show that health plans have begun to enroll more patients.

In Chapter Twelve we again summarize data from the international renal community, illustrating differences in incidence, prevalence, ESRD caused by diabetes, dialysis, and transplantation, and, this year, presenting additional data from Taiwan. As always, we are grateful to the registries who provide this information and thus allow us to see the U.S. ESRD community through a wider lens.

Overall, surveillance data show improvement in patient survival in both the incident and prevalent ESRD populations. The provision of care to ESRD patients has improved, with an increase in cardiovascular services and diabetic preventive care, though in areas such as vaccination rates there is still much progress to be made.

These improvements, however, may be difficult to reconcile with other recent trends. The overshooting of target hemoglobin levels is more common than ever, with patients reaching higher levels at faster rates, and provider practices contributing to related outcomes. The lack of progress in first-year hemodialysis mortality rates may raise important safety concerns, but it is as yet unclear if anemia correction—rather than other aspects of care such as catheter use, IV iron use, dialyzer reuse, and infectious complications—contributes to these outcomes. More complete adjustments in the first-year death rates in fact show that more progress has been made than previously appreciated. Since the causality of individual aspects of care is very difficult to prove with observational data, we are left with the reality that there are important safety concerns over anemia correction and the use of dialysis catheters. More complex survival analyses are needed to address the problem of confounding by indication. The USRDS is committed to addressing these complex outcomes models in order to help close the gap between clinical trial results and the surveillance data.

Most of the 2007 ADR contains data through December 31, 2005; data on patient characteristics, obtained from the Medical Evidence form, are complete through June, 2006.

www.usrds.org
On our website users can download PDF files of the ADR, Excel files of the tables and the data underlying the graphs, and PowerPoint slides of ADR figures and USRDS presentations. Supplemental tables are also included, with standard errors for rates as well as tables for patient subgroups.

Also available on the website are supplemental tables on ESRD patients covered by Medicare. These tables parallel tables in the printed ADR, and include information on incidence and prevalence, modalities, hospitalization, transplant, mortality, survival, and the costs of ESRD.

RenDER & the Researcher’s Guide
Our real-time online query system allows users to build data tables and maps. The Renal Data Extraction and Referencing System (RenDER) can be accessed on our website.

To assist users of USRDS data, the Coordinating Center annually updates and revises the Researcher’s Guide, which provides information on all analytical methods used by the CC, along with a detailed index of files and variables in the USRDS researcher datasets. It is available on our website in PDF format.

USRDS database
The USRDS dataset is a living record of ESRD care in the U.S., continually updated with new data on the ESRD population. Delays in data reporting are unavoidable, and we add late information as soon as it becomes available. This includes data from the ME form, claims for hospital and physician services, and updates of the Medicare Enrollment Database received after the ADR has gone to press.

Administrative oversight
Lawrence Agodoa, MD, and Paul Eggers, PhD, provide direct oversight of the Coordinating Center and Special Studies Centers, and members of CMS, the ESRD networks, and the renal community provide crucial input and feedback through their committee participation.

The Steering Committee, the governing body of the USRDS, is responsible for the operations of the CC and SSCs. It works under the direction of the Project Officers,
and includes representatives from CMS, the NIH, the CC, and each of the SSCs. Its responsibilities include coordination among the centers, study design, project tracking, data management and validation, assurance of data availability for researchers and government officials, and oversight of Annual Data Report production.

The USRDS External Advisory Committee plays a major role in advising Project Officers on appropriate and necessary special studies, data studies, and analyses. This committee is also responsible for reviewing manuscripts and Annual Data Reports. Members are listed in Table i.d.
introduction

ADRs, proposals for future editions, and ideas for expanded data availability on the USRDS website. The Information Systems Committee (ISC) reviews hardware requirements, systems configuration, documentation, and performance, and evaluates technologies that may enhance database structure, function, and management.

The Special Studies Review and Implementation Committee (SSRIC), the operations committee for SSC proposals and CC project support, is a collaboration of CMS, the ESRD networks, and the providers. The Data Request Review Committee (DRRC) reviews data requests requiring more than two hours of staff time to fulfill, and makes recommendations to the Project Officers based on the types of datasets requested and the ways in which the CC can improve the availability of data.

Reading the maps
The majority of disease mapping in the ADR is by Health Service Area (HSA), a group of counties described by authors of the CDC Atlas of United States Mortality as "an area that is relatively self-contained with respect to hospital care."

Maps here present data divided into quintiles. Each range in a legend contains approximately one-fifth of the included data points. In the sample map below, for example, one-fifth of all data points displayed have a value of 10.8 or above. To facilitate comparisons of maps presenting data for different time periods, we usually apply a single legend to each map in a series, e.g., rates of diabetes in 1990 and 2000. Because such a legend applies to multiple maps, the data in each individual map are not evenly distributed in quintiles, and a map for a single year may not contain all the colors or ranges listed in the legend.

Numbers in parentheses indicate the mean values of data points in the highest and lowest quintiles. These can be used to calculate the percent variation between quintiles. For maps with shared legends we have provided these values by repeating the legends and inserting the unique quintile values.

On the Excel page for each map (found on our website and the CD-ROM in the back of this book) we include several numbers to help you interpret the maps and their relation to other data in the ADR. The map-specific mean is calculated using only the population whose data are included in the map itself. This mean will usually not match data presented in tables elsewhere in the ADR, and should be quoted with caution. The overall mean includes all patients for whom data are available, whether or not their residency is known. We also include the number of patients excluded in the map-specific mean, and the total number of patients used for the overall calculation.

Acknowledgements
The Annual Data Report could not be produced without the extraordinary work of members of the ESRD community—including the staff of CMS and the ESRD networks—and the dedicated efforts of the USRDS staff and investigators. The efforts of providers are crucial in the collection of data used by the USRDS, and their dedication in collecting data is greatly appreciated.

We welcome feedback on all elements of USRDS work, and all comments are reviewed by the Director, Deputy Director, and staff in order to improve future materials and ensure a strong working relationship between the USRDS and clinicians, researchers, patients, and others involved in ESRD care. 

Note: cross-references point to some, but not all, related figures. For a complete list of related data, please see the index. Excel files of atlas data (available both online & on the CD-ROM included at the back of this volume) now present the total cohort size used in graphs & tables showing percentages.