United States Renal Data System

2009 Annual Data Report

Volume One

Atlas of Chronic Kidney Disease in the United States
Finding what you need in the Annual Data Report

Tables of contents listing all chapters in the ckd and esrd volumes, the main topics covered within them, & the appendices & reference sections; pages 6–9 of Volume One & pages 174–177 of Volume Two.

Information map listings of central topics in the adr; page 11 of Volume One & page 179 of Volume Two.

Chapter table of contents listings of all two-page spreads; found on the second page of each chapter.

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

cd-rom all volumes of the adr, plus slides of all figures, Excel files of all data, & supplemental reference tables; shipped with the three volumes of the adr.

Glossary with a list of acronyms; page 158 of Volume One & page 394 of Volume Two.

Index to the ckd & esrd volumes; page 163 of Volume One & page 415 of Volume Two.

Reference tables detailed data tables; titles & subtitles listed on the second page of each reference section; Volume Three.

in the design of this book we honor the World Congress of Nephrology 2009, held in Milan, Italy
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Consider now, O reader! what trust we can place in the ancients, who tried to define what the Soul and Life are — which are beyond proof — whereas those things which can at any time be clearly known and proved by experience remained for many centuries unknown or falsely understood.

Leonardo da Vinci
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This is the twenty-first annual report of the United States Renal Data System, and the tenth in our Atlas series, which now presents information on chronic kidney disease (CKD) and the transition to end-stage renal disease (ESRD), as well as on the ESRD population. In Volume One we define the CKD burden in the prevalent population, and look at cardiovascular and other comorbidities, rates of adverse events, preventive care, prescription medication therapy, care delivered in the transition to ESRD, and the costs to Medicare and employer group health plans. In Volume Two we go on to provide information on the size and impact of the 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.

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 the CKD classification 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 that 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. The USRDS and others will continue to investigate these issues in both the clinical and public health arenas, but already there is important data available on the impact of CKD, data based not only on biochemical information, but on the disease as defined 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 is another matter.

The 2008 ADR was the first to include a volume dedicated to CKD; this year we expand the volume to ten chapters, including an analysis of acute kidney injury. We begin with the Précis, highlighting some of the most important data from the chapters, and addressing the burden of CKD in the Medicare and employer group health plan (EGHP) datasets — an area of major public policy and health concern.

In Chapter One we define the CKD population, by stage, using the NHANES cohorts. We also illustrate the sensitivity of eGFR (calculated by both the creatinine and cystatin C methods) and of the albumin/creatinine ratio in predicting the risk of death.

Next we introduce a new chapter on renal function measures in adolescents, defining a “normal” adolescent population by assessing kidney function, blood pressure, obesity, and biochemical parameters associated with declining kidney function.

Basic descriptive and comorbidity information from the major datasets used by the USRDS is summarized in Chapter Three. We use laboratory data from the Ingenix i3 LabRx dataset to define, by CKD stage, the levels of typical biochemical parameters. Remarkably, the abnormalities identified here are quite similar.
to those noted in the NHANES population-level data. We also demonstrate the consistency of the relationship between CKD defined from actual laboratory data and that reported by diagnosis codes on claims for services.

In Chapter Four we address care of the at-risk and CKD populations, looking at the likelihood of a reported CKD diagnosis code, of seeing a nephrologist, and of seeing a nephrologist after CKD has been identified. We also look at treatment of the CKD population with kidney protective medications, beta blockers (for congestive heart failure and hypertension), and diuretics, and at control of total cholesterol, LDL cholesterol, and glycosylated hemoglobin.

Hospitalization and mortality in CKD and non-CKD patients are examined in Chapter Five. We also look at cardiovascular events — including stroke — and infectious hospitalizations, and examine all-cause mortality with both unadjusted and adjusted models, addressing the ways in which increasing recognition of CKD may create recognition bias. Adjustments for comorbid disease burden address some of this bias.

Cardiovascular disease in the CKD population is the focus of Chapter Six, which begins by assessing the use of echocardiograms, nuclear imaging, and coronary angiography. We then evaluate major cardiovascular diagnoses and interventions, looking at predictors, geographic patterns, survival, and access to care.

Chapter Seven addresses the transition from CKD to ESRD, a period of great concern, and one which may contribute to high mortality in the first months and year on dialysis. We illustrate the timeline for recognition of CKD prior to ESRD, and present data on visits to primary care physicians and to specialists, including cardiologists and nephrologists. We also examine the monitoring of biochemical data on kidney function, the use of medication treatments as patients approach ESRD, and vascular access placement — providing a perspective on the high use of catheters at the initiation of dialysis therapy.

Chapter Eight is a new chapter devoted to acute kidney injury (AKI), and to its relationship to CKD and ESRD. Figures present data on trends in AKI hospitalizations over time, and on care after an AKI hospitalization — including testing for kidney function and referral to primary care physicians and nephrologists. We also look at the likelihood of death versus ESRD, demonstrating the competing events which contribute to the high rates of mortality and cardiovascular events in this population.

Volume One concludes with Chapter Nine, addressing the expenditures associated with CKD and various comorbid conditions, and looking at costs during the transition from CKD to ESRD.

Data presented in this volume of the ADR illustrate the challenges that CKD, its complications, and its costs pose to the healthcare system and to policy makers. Programs to detect CKD have been initiated by the CDC, and the National Kidney Foundation's Kidney Early Evaluation Program (KEEP) has been ongoing since 2000. By their nature, detection programs are broad-based approaches to define, through the use of simple tests, populations at risk of a disease or its complications, targeting individuals for detailed evaluation and intervention. These approaches have been used to define populations with hypertension, diabetes, lipid abnormalities, and cardiovascular disease. The data we present in Volume One indicate that the CKD population is under-recognized, and that care of both the CKD population as a whole and of those patients transitioning to ESRD is less than optimal; both issues may contribute to the increased morbidity and mortality of this high-risk population.

The CKD education benefit for Medicare patients begins in 2010, with the intent to improve access to care, selection of a treatment modality, consideration of home therapies, access to preemptive kidney

Continued on page 16
transplant, planned vascular access, management of CVD risk factors, and referral to nephrologists and nutritional counseling. We plan to follow the trends in these key aspects of care to determine the impact of this new benefit, and to examine how it might affect the high first-year mortality among hemodialysis patients.

Information about the USRDS website, the Researcher’s Guide, the USRDS database, and administrative oversight of the USRDS is presented in the introduction to Volume Two.

**Reading the maps**

Maps in the ADR present data divided into quintiles, with each range in a legend containing approximately one-fifth of the data points. In the sample map, for example, one-fifth of all data points displayed have a value of 10.8 or above. Ranges include the number at the lower end of the range, and exclude that at the upper end (i.e., the second range in the sample map is 8.2 < 9.2). To facilitate comparisons of maps showing data for different periods, we commonly apply a single legend to each map in a series. 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 colors or ranges listed in the legend.

Numbers in red 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. Mean numbers within the quintiles can be calculated as a simple half-way point.

On the Excel page for each map (found on our website and on the CD-ROM) 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.