renal disease in the United States

Précis: an introduction to end-stage renal disease in the United States

Every beginning is a promise
born in light and dying in dark
determination and exaltation of springtime
flowering the way to work.
New data on the prevalence of CKD in the U.S. show a 30 percent increase between 1988–1994 and 1999–2004 (Coresh et al., 2007). For several years the USRDS has presented data on recognized CKD patients within the Medicare system. As illustrated on the next page, this population has grown to 7.9 percent of the Medicare population. Comparing these data from diagnosis codes and services to information reported by the NHANES surveys, however, it is clear that most CKD remains unrecognized—a sharp contrast to ESRD, with each patient registered through the Medical Evidence form (2728), submitted by all dialysis and transplant providers. For this year’s Annual Data Report we have created a new volume addressing the CKD population and the transition to ESRD; Volume Two focuses on ESRD itself.

While long-term data on the ESRD population continue to show a flattening of incident rates, between 2005 and 2006 the number of new cases grew 3.4 percent—the first growth of more than 3 percent since 2001. The number of new dialysis patients rose nearly 4 percent, while growth was also seen in the populations returning to dialysis from a failed kidney transplant or restarting dialysis after the recovery of kidney function. Patients in these latter groups were previously registered in the ESRD system, but contribute to the total number of individuals starting or restarting dialysis across the country. In 2006, for example, 7.2 percent of patients beginning dialysis were returning after a failed kidney transplant or the loss of kidney function.

Peritoneal dialysis now accounts for 6.2 and 7.4 percent of the incident and prevalent dialysis populations, proportions that have continued to decline over the past decade from peaks of 13 and 11 percent. The number of kidney transplants reached a high of 18,052 in 2006, while the prevalent transplant population, at 151,502, rose 5.5 percent in 2006, despite continued growth in the number of dialysis patients on the transplant wait list. Time on the list before transplantation has reached a median of 681 days.

Data on clinical care show that the percentage of prevalent dialysis patients with a functioning fistula grew to 53.8 in 2005 (see Figure h.p.11 in the Healthy People 2010 chapter), exceeding the target of 40 set by K/DOQI in 1997, and thereby leading to a new target of 66 percent by 2009. Placement rates for fistulas have continued to climb, while rates for graft placements have fallen to less than half of those in 1992. This decline may raise concerns about the under-utilization of grafts, as their associated morbidity, while slightly higher than that of fistulas, remains far lower than that of catheters.

Mean monthly hemoglobin levels remain slightly below 12.0 g/dl. In December, 2006, only 18.7 percent of patients had a mean monthly hemoglobin of less than 11 g/dl, and just 6.1 percent had a level lower than 10 g/dl. Transfusion rates continue to decline, but these data need to be reviewed for the impact of ESA dosing changes introduced by the FDA and CMS.

After rising steadily over several years, hospitalization rates for infection fell slightly in 2006 for period prevalent ESRD patients, a finding which will need to be confirmed in future data. The decrease in catheter placement rates may be consistent with this lower rate of hospitalization. Incident-based mortality rates continue to fall for those receiving ESRD treatment for two or more years, with even first-year rates for hemodialysis patients now showing two years of successive declines when adjusted for age, gender, race, and cause of ESRD. The use of dialysis catheters is still an important issue here, as more than 80 percent of patients have a catheter at their first outpatient dialysis.

Greater growth in general Medicare costs compared to those for ESRD—7.1 versus 5.9 percent between 2005 and 2006—has led to a decline in the percentage of the Medicare budget spent on ESRD, now at 6.4 percent. In absolute dollars, however, the program still grew 5.9 percent in 2006.

In the Medicare population, costs for both diabetic and non-diabetic patients with ESRD continue to rise. The same is true for patients with employer group health plan (EGHP) coverage, though costs here are significantly higher. The average Medicare ESRD patient with diabetes costs slightly over $71,000 per year, compared to $88,000 in the EGHP population. Costs during the transition from CKD to ESRD are also considerably different, with a diabetic Medicare patient incurring $15,710 in the month of initiation, compared to $30,411 for the diabetic patient with EGHP coverage.
General Medicare: population, 1996
(n = 32,667,561; mean age 69.6)

Diabetes 15.2%
CHF 11.7%
ESRD 0.8%

CKD 2.9%

General Medicare: costs, 1996
($161 billion)

Diabetes 29.3%
CHF 35.9%
ESRD 5.9%

CKD 10.7%

General Medicare: population, 2006
(n = 33,974,234; mean age 69.2)

Diabetes 23.5%
CHF 12.6%
ESRD 1.1%

CKD 7.9%

General Medicare: costs, 2006
($259.6 billion)

Diabetes 39.3%
CHF 36.6%
ESRD 7.4%

CKD 22.1%

**Highlights**

Medicare spending for ESRD reached $22.7 billion in 2006, showing a one-year growth of 5.9 percent — down from 8.6 percent in 2005. Since 2000, ESRD spending has accounted for 6.3–6.5 percent of the Medicare program. After a one-year growth of 4.1 percent in 2005, total per person per year costs for ESRD rose just 1.8 percent in 2006, to reach $81,106. Inpatient PPPY costs fell nearly 2 percent, to $21,006, while outpatient and physician/supplier costs rose 4.3 and 3.1 percent, to $23,846 and $12,846. Table A.3 Total Medicare expenditures in 2006 reached $17.8 billion for patients on dialysis, and for the first time topped $1 billion for those with a transplant event during the year. Figure A.3 At month six after the initiation of ESRD, costs for EGHP patients remain 1.8–2.2 times greater than those for patients with Medicare coverage.

**Contents**

- Trends in ESRD patient counts & spending
- Summary statistics
- Counts of new & returning dialysis patients
- Trends in modalities
- Patient counts & rates
- Transplant wait list & wait times
- Geographic variations in incident & prevalent rates
- Pre-ESRD care & access use
- Anemia
- Anemia treatment
- Dialysis adequacy
- Trends in hospitalization & mortality
- Five-year survival
- Trends in ESRD expenditures
- Total & per person expenditures
- PPPY costs before & after ESRD initiation
- Costs for injectables
### Summary statistics on reported ESRD therapy in the United States, 2006

#### Incidence

<table>
<thead>
<tr>
<th>Age</th>
<th>Count</th>
<th>%</th>
<th>Adj. ratea</th>
<th>Count</th>
<th>%</th>
<th>Adj. rateb</th>
<th>Dialysisb</th>
<th>%T</th>
<th>%</th>
<th>Deceased donor</th>
<th>Living donor</th>
<th>ESRD deathsb</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–19</td>
<td>1,303</td>
<td>1.2</td>
<td>14</td>
<td>7,465</td>
<td>1.5</td>
<td>83</td>
<td>2,177</td>
<td>0.6</td>
<td>5,888</td>
<td>3.5</td>
<td>670</td>
<td>405</td>
</tr>
<tr>
<td>20–44</td>
<td>13,977</td>
<td>12.7</td>
<td>127</td>
<td>96,677</td>
<td>19.1</td>
<td>875</td>
<td>52,233</td>
<td>14.7</td>
<td>44,444</td>
<td>29.3</td>
<td>3,274</td>
<td>2,477</td>
</tr>
<tr>
<td>45–64</td>
<td>41,729</td>
<td>37.6</td>
<td>625</td>
<td>233,347</td>
<td>44.1</td>
<td>3,236</td>
<td>145,576</td>
<td>41.0</td>
<td>77,798</td>
<td>51.4</td>
<td>5,883</td>
<td>2,901</td>
</tr>
<tr>
<td>65–74</td>
<td>25,500</td>
<td>23.0</td>
<td>1,452</td>
<td>99,431</td>
<td>19.6</td>
<td>5,700</td>
<td>79,521</td>
<td>22.4</td>
<td>19,910</td>
<td>13.1</td>
<td>1,568</td>
<td>585</td>
</tr>
<tr>
<td>75+</td>
<td>28,346</td>
<td>25.6</td>
<td>1,744</td>
<td>79,308</td>
<td>15.7</td>
<td>4,963</td>
<td>75,246</td>
<td>21.2</td>
<td>4,062</td>
<td>2.7</td>
<td>181</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Race

- **White**: 73,048 (65.9%)
- **African American**: 31,344 (28.3%)
- **Native American**: 1,070 (0.5%)
- **Hispanic**: 96,119 (86.7%)
- **Asian/Pacific Islander**: 504 (0.5%)
- **Unknown**: 48,911 (44.1%)

#### Gender

- **Male**: 61,940 (55.9%)
- **Female**: 48,911 (44.1%)

#### Ethnicity

- **Non-Hispanic**: 96,119 (86.7%)
- **Hispanic**: 14,735 (13.3%)

#### Prevalent patients

- **Diabetes**: 49,224 (44.4%)
- **Hypertension**: 29,662 (26.8%)
- **Glomerulonephritis**: 7,982 (7.2%)
- **Cystic kidney disease**: 2,651 (2.4%)
- **Other known cause**: 4,834 (4.4%)
- **Missing cause**: 1,075 (1.0%)

#### Kidney transplants

- **Total transplants**: 110,854 (360,169)

#### Medicare & non-Medicare spending

- **Medicare spending for ESRD, 2006**: (billions of dollars)
  - **Transplant**: 24,951
  - **Hemodialysis**: 71,889
  - **Peritoneal dialysis**: 61,164

---

A. Incident counts: include all known ESRD patients, regardless of any incomplete data on patient characteristics and of U.S. residency status.
B. Includes only residents of the 50 states and Washington D.C. Rates are adjusted for age, race, and gender using the estimated July 1, 2004 U.S. resident population as the standard population. All rates are per million population. Rates by age are adjusted for race and gender. Rates by gender are adjusted for race and age. Rates by race are adjusted for age and gender. Rates by disease group and total adjusted rates are adjusted for age, gender, and race. Adjusted rates do not include patients with other or unknown race.
C. Patients are classified as receiving dialysis or having a functioning transplant. Those whose treatment modality on December 31 is unknown are assumed to be receiving dialysis. Includes all Medicare and non-Medicare ESRD patients, and patients in the U.S. Territories and foreign countries.
D. Deaths are not counted for patients whose age is unknown.
E. Age is computed at the start of therapy for incidence, on December 31 for point prevalence, at the time of transplant for transplants, and on the date of death for death.
F. Includes patients whose modality is unknown.
G. Unadjusted total rates include all ESRD patients in the 50 states and Washington D.C.
H. Total transplants as known to the USRDS; 45 transplants with unknown donor type excluded from counts.

* Values for cells with ten or fewer patients are suppressed. **Zero patients in this cell.
In 2006, 110,854 new dialysis and transplant patients initiated ESRD therapy, for an adjusted rate of 360 per million population — a 2.1 percent increase from the rate of 353 in 2005. More than 506,000 patients were receiving treatment on December 31, 2006, for an adjusted rate of 1,626 per million — 2.3 percent higher than the 2005 rate of 1,589. Nearly 355,000 of these patients were being treated with dialysis, while 151,502 had a functioning transplant. A total of 18,052 kidney transplants were performed during the year, and 87,654 patients died. The annual percent change in the rate per million for incident hemodialysis patients fell from 1.99 to 1.04 percent between 1998–2002 and 2002–2006, while growth in the prevalent population decreased from 3.4 to 1.8 percent. Annual growth in the transplant rate fell from 7.7 to 4.8 percent in the incident population, and from 4.4 to 3.6 percent in the prevalent population. Both incident and prevalent rates in the peritoneal dialysis have continued to fall, but not as dramatically during 2002–2006.

The number of new dialysis patients continues to trend upward, as demonstrated by a 3.6 percent growth rate in 2006. More than 5,500 patients with graft failure returned to dialysis from transplant, a 4.0 percent increase from the previous year. The number of patients restarting dialysis increased from 2,479 in 2005 to 2,700 in 2006 — a change of 8.9 percent, and generally in keeping with rates of growth since 2002.

The prevalent dialysis population has increased more than three-fold since 1988, and in 2006 exceeded 350,000 patients. From 2000 to 2006, the prevalent transplant population grew nearly 40 percent, and increased 5.5 percent in 2006, a rate similar those seen each year since 2000. The incident ESRD population shows the lowest rate of growth among the three populations, increasing 17.3 percent since 2000.
At 101,306 patients, the population on hemodialysis accounted for nearly 92 percent of 2006 incident patients, with a rate per million population of 330. The number of new patients placed on peritoneal dialysis continues to fall, nearly 3 percent in 2006, with the rate per million declining more than 4 percent, from 22.9 to 21.9. Transplant patients now comprise just over 2 percent of the incident population, at 2,635, up slightly from the 2,409 transplant patients entering the program in 2005.

In 2006, hemodialysis patients accounted for nearly 65 percent of the prevalent ESRD population, for a rate of 1,053 per million population — 27 percent greater than in 2000. The number of peritoneal dialysis patients grew just 3.6 percent, from 25,168 in 2000 to 26,082 in 2006. This slow rate of growth is reflected in the prevalent rate for peritoneal dialysis, which has fallen nearly 7 percent since 2000. The prevalent transplant population has grown close to 40 percent in that same period, while the rate per million population has increased 25 percent, to 487.

More than 66,000 patients were listed for a kidney-only transplant on December 31, 2006 — nearly three times more than in 1995. The annual rate of growth in this number has ranged from 7.0 to 12.7 percent. The median wait time for patients receiving a transplant during 2006 was 681 days — down from a peak of 717 days in 2004, but nearly twice as long as in 1995.
Maps of geographic patterns in ESRD rates show that, in 2006, both incident and prevalent rates for hemodialysis patients were greatest in the Gulf Coast states and along the eastern seaboard, with an average in the upper quintile of 484 and 1,742 per million population, respectively. Rates for peritoneal dialysis were also highest in the southeastern states, with averages in the upper quintile of 38 per million population for incident patients and 132 for the prevalent population.

In the transplant population, both incident and prevalent rates continue to be highest in the Upper Midwest and in several of the eastern states, with averages in the upper quintile of 14.4 and 648 per million population, respectively.
These data suggest that insufficient numbers of contemporary patients began maintenance hemodialysis with adequate pre-dialysis care, as judged by presence of a preferred vascular access, prior use of an ESA, and care by a nephrologist. Although the mechanisms underlying these findings are not entirely clear, their constellation is compatible with the hypotheses that progressive renal dysfunction continues to be poorly identified, and that identified cases of clinically relevant and progressive renal dysfunction are not being referred early enough for specialist care. As two of these factors—late case identification and vascular access at initiation of hemodialysis—have been associated with higher mortality rates in several studies, these findings raise concerns and suggest an unmet need at a public health level.

Vascular access data show that 62.3 percent of new patients starting hemodialysis in 2006 did so with a catheter as their primary access. Thirteen percent started with an arteriovenous fistula, while 4.1 percent initiated with an arteriovenous graft. Nearly 17 percent of patients had a catheter with a maturing fistula, and 2.6 percent a catheter with a maturing graft.

In 2006, 58 percent of new ESRD patients received care under the direction of a nephrologist. Far fewer had dietary counseling, at 10.5 percent, and less than a third received ESAs prior to initiation.
Recent clinical trials (CHOIR and CREATE) presented evidence of potential harm in high hemoglobin levels, and K/DOQI guidelines released in 2006 indicated no benefit related to morbidity and mortality with a hemoglobin above 13 g/dl. Recommendations in 2007 returned to the target of 11–12 g/dl, after a previous target of 11 g/dl or higher. In 2006, 27 percent of prevalent dialysis patients had a mean monthly hemoglobin of 12–<13 g/dl, and 23 percent had a mean level exceeding 13 g/dl. We further address high hemoglobin levels in Chapters Five and Eight, and this year introduce data on levels lower than 10 g/dl.

Since the early days of the dialysis program, the use of transfusions in the outpatient setting has dropped dramatically. In the late 1970s and early 1980s, 15–19 percent of hemodialysis patients received at least one transfusion in a three-month period. This number fell after the introduction of EPO, and since the middle of 2002 has been at less than 1 percent.

Dialysis adequacy, as represented by the urea reduction ratio (URR) and Kt/V, continues to improve. In 1993, only 43 percent of hemodialysis patients had a URR of 65 or greater (corresponding to a per treatment Kt/V of 1.2). This proportion has now more than doubled, reaching 88 percent in 2005. In peritoneal dialysis patients, 92.2 percent had a Kt/V meeting or exceeding the new K/DOQI adequacy benchmark of 1.7 per week, established in 2006.
After remaining stable since 1993, the rate of all-cause hospitalization among prevalent ESRD patients fell in 2006 to a level 4.1 percent lower than that of 1993. Hospitalizations for cardiovascular disease and infection declined as well, but remain 7.9 and 22.7 percent greater than in 1993.

Cause-specific rates across modalities also fell in 2006. In the hemodialysis population, however, the rate of admission for infection is still 34 percent greater than in 1993, while for peritoneal dialysis patients it has returned to its 1993 level, and in the transplant population it is 3.2 percent lower. Cardiovascular admissions for hemodialysis patients remain 6.6 percent higher than in 1993; peritoneal dialysis and transplant patients have seen declines of 11.7 and 28.1 percent, respectively. The greatest change in admission rates has occurred in vascular access admissions for hemodialysis patients, which are now 38 percent lower than in 1993. This decline has paralleled a growth in the number of vascular access procedures performed in an outpatient setting.
Patient vintage — the time on ESRD therapy — continues to have a dramatic effect on adjusted mortality rates, though the effect itself has changed over time. In both the overall and hemodialysis populations, rates in the late 1980s were greatest for the newest patients, but since 1992 the highest rates have occurred in patients treated for five or more years. Rates across all populations, however, have been falling since the beginning of this decade, from 6.0 percent in hemodialysis patients with ESRD for five or more years to more than 26 percent for the newest peritoneal dialysis patients.

Since 1980, first-year mortality among incident dialysis and first transplant patients has fallen nearly 28 percent, from 331 per 1,000 patient years at risk to 239 in 2005. This improvement, however, has varied widely across modalities. In the hemodialysis population, first-year mortality has fallen just 10.2 percent since 1980, and 4.8 percent since 2000, reaching 254 in 2005. Among peritoneal dialysis patients, in contrast, the rate has decreased 64.8 percent since 1980, and 25.5 percent since 2000, standing now at 162. And in the transplant population, the improvement over 25 and five years, respectively, has been 80.7 and 19.6 percent, with mortality in 2005 at 78 per 1,000 patient years. First-year mortality is discussed in further detail in Chapter One.
Medicare spending for ESRD reached $22.7 billion in 2006, showing a one-year growth of 5.9 percent — down from 8.6 percent in 2005. Since 2000, ESRD spending has accounted for 6.3–6.5 percent of the Medicare program, which reached a total of $335 billion in 2006.

Total ESRD expenditures were $20.3 billion in 2006 — 3.7 times greater than in 1991. Outpatient costs have grown the most rapidly, increasing more than four-fold to reach $7.8 billion in 2006. Inpatient costs have risen from $2.2 billion to $7.0 billion, while costs for physician/supplier services reached $4.3 in 2006, up from $1.2 billion in 1991.

After a one-year growth of 4.1 percent in 2005, total per person per year costs for ESRD rose just 1.8 percent in 2006, to reach $61,164. Inpatient PPPY costs fell nearly 2 percent, to $21,006, while outpatient and physician/supplier costs rose 4.3 and 3.1 percent, to $23,846 and $12,846.

Total Medicare expenditures in 2006 reached $17.8 billion for patients on dialysis, and for the first time topped $1 billion for those with a transplant event during the year. Costs for patients with a functioning graft during the year neared $1.2 billion, while those for patients with a graft failure exceeded $204 million. Across all modalities, however, one-year rates of growth slowed from those seen in 2005 — from 7.4 to 3.6 percent for dialysis, from 7.1 to 4.0 percent for a transplant, from 7.9 to 3.8 percent for a graft failure, and, most dramatically, from 11.9 to 1.2 percent for patients with a functioning graft. Costs per patient year for these latter patients actually fell 3.1 percent in 2006, reaching $6,874, just one-quarter of the yearly costs for dialysis patients of $69,681.
Per person per month expenditures for patients initiating in 2005, by diabetic status incident ESRD patients

- Medicare: DM
- Medicare: NDM
- Medstat: DM
- Medstat: NDM

Medicare spending ($, in billions)

Medicare DM
Medicare NDM
Medstat DM
Medstat NDM

Other injectables
IV iron
IV vitamin D hormone
ESAs

Total Medicare spending on injectables period prevalent dialysis pts

Medicare expenditures ($, in thousands)

0 10 20 30 40

Medicare: DM
Medicare: NDM
Medstat: DM
Medstat: NDM

Medicare: period prevalent ESRD patients
Medstat: period prevalent ESRD patients age <65

Medicare: incident ESRD patients, age 67 & older at initiation, 2005, with Medicare as primary payor & not enrolled in Medicare Advantage. Medstat: incident ESRD patients, age <65 at initiation, 2005. Diabetic status for all patients determined from claims (see Appendix A for details).

Medicare: period prevalent ESRD patients with Medicare as primary payor. Medstat: period prevalent ESRD patients age <65. Diabetic status determined from claims. Parallels methods as those used in Table K.2; see Appendix A for details.

In the Medicare ESRD population, per person per month costs for diabetic and non-diabetic patients initiating in 2005 were $7,547 and $5,369, respectively, in the month prior to initiation, and rose to $15,710 and $12,472 in the month following. But while costs for employer group health plan (EGHP) patients were lower in the month before initiation, at $5,536 and $3,978, in the next month they rose to levels twice as high as those for Medicare patients — reaching more than $30,000 for diabetes patients and nearly $27,000 for non-diabetics. At month six, costs for EGHP patients remain 1.8–2.2 times greater than those for patients with Medicare coverage.

Total Medicare spending for ESAs rose only 0.5 percent in 2006, to $1.88 billion. Costs for IV vitamin D increased 8.9 percent, after falling nearly 12 percent the previous year, to reach $416 million, while spending on IV iron followed a similar pattern, rising 5 percent after a 17 percent decrease in 2005, and reaching $244 million in 2006.

Per person per years ESRD costs are significantly higher for diabetic patients compared to those with no diabetes. In the Medicare population, for instance, yearly costs for patients with diabetes totaled $73,233, 35 percent higher than costs incurred for those with no diabetes. Similar disparities occur in the employed population, where costs for patients with diabetes totaled $87,847 in 2006 compared to $47,358 among non-diabetics. Costs for diabetic patients are higher in the Medstat population than for patients covered by Medicare, with the difference increasing in the past three years. For non-diabetic patients, in contrast, Medstat costs have been lowest, not reaching the level of expenditures in the Medicare population until 2006.

Total Medicare expenditures obtained from the CMS Office of Financial Management, Division of Budget. Figure p.21 period prevalent ESRD patients. Includes payments for MSP patients, but no estimate for HMO costs or organ acquisition. Figure p.22 period prevalent ESRD patients with Medicare as primary payor. Table p.2 total expenditures: period prevalent ESRD patients; patients with Medicare as secondary payor included. Totals are paid claims for all ESRD patients, starting at first ESRD service date & continuing until death or the end of the study period. Expenditures per patient year: period prevalent ESRD patients; patients with Medicare as secondary payor excluded. Modalities determined using Model 2 methodology, as described in Appendix A. Figure p.23 Medicare: incident ESRD patients, age 67 & older at initiation, 2005, with Medicare as primary payor & not enrolled in Medicare Advantage. Medstat: incident ESRD patients, age <65 at initiation, 2005. Diabetic status for all patients determined from claims (see Appendix A for details).

Figure p.24 period prevalent ESRD patients with Medicare as primary payor. Medstat: period prevalent ESRD patients age <65. Diabetic status determined from claims. Figure p.25 period prevalent dialysis patients. Some methods as those used in Table K.2; see Appendix A for details.