chapter EIGHT

pediatric end-stage renal disease

Who shows a child as he really is? Who sets him in his constellation and puts the measuring-rod of distance in his hand?

Rainer Maria Rilke, Duino Elegies, “The Fourth Elegy”
translated from the German by Stephen Mitchell
what progress may have been made in slowing the development of ESRD, we this year revisit trends in the incidence and prevalence of ESRD among children.

The overall incidence of ESRD in the pediatric population rose slowly between 1984 and 1990, a period when expertise in pediatric dialysis and transplantation was growing. Consistent with findings in the adult population, incidence due to glomerular disease has been declining slowly since 1990, and the number of patients has remained remarkably consistent. Both the incidence of ESRD due to cystic kidney disease and the number of children with this diagnosis, however, have been rising, a finding that merits investigation to determine whether the disease is truly increasing or if earlier recognition and treatment have led to more children coming to ESRD.

Racial disparities in rates of ESRD in children are similar to those noted in adults, but occur to a lesser degree. In adults, for example, the incidence of ESRD is nearly four times greater in African Americans compared to whites. Among children, in contrast, the difference is almost two-fold. These variations have been explored in prior ADRs, and will be addressed again in 2011.

High rates of hospitalization for bacteremia/sepsis in the hemodialysis population, particularly for children age four and younger, is a major concern. Due to the challenges of internal access placement in children, hemodialysis is performed through a dialysis catheter, creating the same risk of infectious complications faced by adult patients. Infection control procedures developed for adults may, with some modification, be applicable for children, and should be investigated.

Influenza and pneumococcal pneumonia can, of course, lead to increased hospitalization rates and higher risks of mortality. Rates of vaccination against these diseases have improved in the pediatric population, but still remain far below both recommended levels and the levels seen in the adult population. There also continue to be discrepancies in vac-
cination rates by modality, with hemodialysis patients more likely to be vaccinated than children on peritoneal dialysis.

We next present data on hospitalizations after dialysis initiation. The pattern of hospitalization is different in children compared to adults, with rates increasing steadily over the first 15 months. Cardiovascular hospitalizations appear to have a bimodal distribution, with rates peaking in the fourth month, declining slightly in months 5–7, then rising again in months 12–15. Rates of hospitalization for infection rise 61 percent between month three and months 12–15. By race, rates are consistently higher among African American children than in their white counterparts.

In contrast to patterns in hospitalization, patterns in mortality rates are similar to those seen in the adult population, with rates peaking in the second month after initiation of treatment, then slowly declining through the rest of the first year. The youngest children are at the highest risk of both hospitalization and death.

The most striking findings related to pediatric ESRD patients center on the extreme vulnerability of patients younger than ten. And issues of infection control, which could lower the rate of complications, need to be addressed. In past ADRs we have also noted issues of uncontrolled hypertension and heart failure, and of sudden death, which still need to be addressed as well. In the 2011 ADR we will investigate the use of cardiovascular medications under the Medicare Part D prescription medication benefit, examining levels of treatment in the pediatric population.

None of these are new challenges, but the community will need to assess them and develop new approaches to improving outcomes in this vulnerable population.

Figure B.1; see page 48 for analytical methods.

Incident ESRD patients age 0–19. Adj: age/gender/race; ref: 2005 ESRD patients.
The total number of children initiating ESRD therapy with a primary diagnosis of glomerulonephritis fell 5.1 percent between the 1999–2003 and 2004–2008 periods, from 1,635 to 1,552, while the numbers with ESRD caused by secondary glomerulonephritis or cystic/hereditary/congenital disease rose 6.4 and 11.9 percent, respectively, to 727 and 2,152. *Figure 8.2*; see page 481 for analytical methods. *Incident ESRD patients age 0–19.*

Between 2000 and 2008, the number of children starting ESRD therapy rose 9 percent, to 1,277; the rate per million population rose 5.9 percent, to 15. By race, the rate of new cases is generally highest among African Americans, although a sharp rise in the number of Asian patients in 2007 accounts for a parallel spike in the rate for patients of other races, which reached 27.7 in 2008. *Figure 8.3*; see page 481 for analytical methods. *Inc. ESRD pts age 0–19. Adj: age/gender/primary diag.; ref: 2005 ESRD patients.*

The number of children beginning ESRD therapy with a transplant has remained quite stable since 2000, reaching 189 in 2008, while the population starting on peritoneal dialysis has increased just 2 percent, to 405. The number initiating on hemodialysis, in contrast, has grown nearly 17 percent, to 673, with a rate per million population of 7.7. *Figure 8.4*; see page 481 for analytical methods. *Incident ESRD patients age 0–19. Adj: age/gender/race/primary diagnosis; ref: 2005 ESRD patients.*
Between 2003 and 2008, the total number of children being treated for ESRD caused by glomerulonephritis fell nearly 5 percent, to 1,488. The prevalent populations with a primary diagnosis of secondary glomerulonephritis or cystic/hereditary/congenital disease, in contrast, rose 16 and 19 percent, respectively, to 582 and 3,303. *Figure 8.5; see page 481 for analytical methods. December 31 point prevalent ESRD patients age 0–19.*

In 2008, the prevalent pediatric ESRD population reached 7,216, nearly 15 percent larger than in 2000. The overall rate per million population rose 11.9 percent in this period, to 85. Growth since 2006 of 36 percent in the number of patients of other races accounts for a corresponding rise in the prevalent rate for this population. *Figure 8.6; see page 481 for analytical methods. December 31 point prevalent ESRD patients age 0–19. Adj: age/gender/race/primary diagnosis; ref: 2005 ESRD patients.*

The number of children receiving hemodialysis therapy has increased nearly 11 percent since 2000, to 1,248 in 2008, while the adjusted rate for this population has grown 7.6 percent, to 14.1 per million population. The transplant population, in contrast, has grown nearly 19 percent in the same period, to 5,092; the rate of 60.6 is 16 percent higher than in 2000. *Figure 8.7; see page 481 for analytical methods. Dec. 31 point prev. ESRD pts age 0–19. Adj: age/gender/race/primary diagnosis; ref: 2005 ESRD patients.*
For pediatric ESRD patients prevalent in 2005–2008, overall rates (unadjusted) of hospital admissions for bacteremia/septicemia are highest in the youngest patients, at 40–48 admissions per 1,000 patient years at risk in those age 0–9. Rates are lowest in those age 10–14, at 22. By race, overall rates are greatest in African Americans and lowest in whites, at 45 and 28, respectively. Patients on hemodialysis generally have higher rates of admission for bacteremia/septicemia than those on peritoneal dialysis or with a transplant.

Overall rates of admission for pneumonia are also greatest in the youngest patients, reaching 93 per 1,000 patient years at risk for those age 0–4. By modality, pneumonia admission rates for transplant patients age 0–4 reach 106, compared to 51 for those of the same age on hemodialysis, and 75 for those treated with peritoneal dialysis.

Rates of admission for respiratory infection — excluding pneumonia — range from 18–19 per 1,000 patient years at risk for patients age 10–19 to 80 for those age 0–4. Rates differ less by race than they do by age. *Figures 8.9–10; see page 481 for analytical methods.*

Period prevalent ESRD patients age 0–19, 2005–2008; unadjusted.
Rates of vaccination against influenza in the pediatric population remain far from the Healthy People 2010 goal of 90 percent, with overall rates highest in those age 15–19 and in whites, at 34.8 and 32.5 percent, respectively. Pneumococcal pneumonia vaccination rates are highest overall in whites and African Americans, at 12.9 and 12.4 percent, respectively. Older children on hemodialysis are more likely to be vaccinated than their counterparts on peritoneal dialysis or with a transplant, while hemodialysis patients of other races are the most likely by race to receive vaccinations. *Figures 8.11-12; see page 481 for analytical methods. Point prevalent ESRD patients, 2005–2008 (8.11) & 2005–2006 & 2007–2008 (8.12).*

**VACCINATIONS**

**8.11** Influenza vaccination rates, by modality, age, & race, 2005–2008

In the 3–15 months following initiation, adjusted all-cause admission rates for patients age 0–9 are 1.6 times greater than those of their counterparts age 10–19, increasing from 1,835 admissions per 1,000 patient years at risk in months 3–<4 to 2,776 in months 12–<15. By race, rates are consistently greatest among African American patients, rising from 1,637 to 2,474. (Follow-up starts at month three after ESRD initiation in order to obtain complete admissions data, as in-center hemodialysis patients younger than 65 cannot bill Medicare for hospitalizations in the first 90 days.)

Across age and race groups, rates of cardiovascular admissions peak in months 4–<5, fall slightly, and then increase again in the later months of the period. At 12–<15 months following initiation, rates reach 396 per 1,000 patient years at risk for patients age 0–9, 1.4 times greater than the rate of 284 found among those age 10–14. The rate among African American patients reaches 447, 1.4 times greater than that of their white counterparts, and 1.8 times higher than that of patients of other races.

As with hospital admission rates, adjusted all-cause mortality rates for children age 0–9 are noticeably higher than those found in their older counterparts. In the first month of therapy, for example, mortality in younger children is nearly five-fold higher, reaching 103.8 per 1,000 patient years at risk compared to 23.3 in older children. White children appear to have a slight survival advantage over African American children during the early course of therapy; rates then tend to converge at six months, and at months 9–12 are 34.1 and 54.1, respectively.

Cardiovascular mortality rates in the first three months of dialysis reach 42–44 per 1,000 patient years at risk in children age 0–9, compared to 13–18 in older children. By race, cardiovascular mortality rates in African American children are 36 percent higher at initiation, and remain higher throughout the first year’s course of treatment.

As is the case with all-cause and cardiovascular mortality, rates of mortality due to infection are highest in the younger pediatric population, ranging from 14.6–24.0 per 1,000 compared to 1.6–6.1 in those age 10–19. Rates by race tend to be similar in white and African American children.

The probability of a child surviving five years on dialysis was 0.8 for those starting therapy in 1999–2003. Patients age 0–4 have the lowest probability of five-year survival, at 0.72 compared to 0.82–0.83 among those age 5–19. Whites have a slight survival advantage over African Americans, at 0.81 and 0.77, respectively. *Figures 8.16–19; see page 48 for analytical methods. Incident dialysis patients age 0–19, 2000–2007. Adj: by age; gender/race/primary diagnosis; by race, age/gender/primary diagnosis; overall: age, gender, race, & primary diagnosis. Ref: ESRD patients age 0–19, 2004–2005.*
Between 2000 and 2008, the number of children starting ESRD therapy rose 9 percent, to 1,277; the rate per million population rose 5.9 percent, to 15. Figure 8.3

The number of children beginning ESRD therapy with a transplant has remained quite stable since 2000, reaching 189 in 2008, while the population starting on peritoneal dialysis has increased just 2 percent, to 405. Figure 8.4

In 2008, the prevalent pediatric ESRD population reached 7,216, nearly 15 percent larger than in 2000; the overall rate per million population rose 11.9 percent in this period, to 85. Figure 8.6

Rates of vaccination against influenza have improved in the pediatric population, yet still remain far from the Healthy People 2010 goal of 90 percent. Figure 8.11

In the 3–15 months following initiation, adjusted all-cause admission rates for patients age 0–4 are 1.6 times greater than those of their counterparts age 10–19. Figure 8.13

Adjusted all-cause mortality rates for children age 0–9 are noticeably higher than those found in their older counterparts. Figure 8.16

White children appear to have a slight survival advantage over African American children during the early course of therapy. Figure 8.16

The probability of a child surviving five years on dialysis was 0.8 for those starting therapy in 1999–2003. Figure 8.19