chapter eight
Pediatric End-Stage Renal Disease

And the seasons they go round and round
And the painted ponies go up and down
We're captive on the carousel of time
We can't return, we can only look behind
From where we came
And go round and round and round
In the circle game

Joni Mitchell, "The Circle Game"

Pediatric end-stage renal disease patients pose unique challenges to providers and the healthcare system, which must address not only the disease itself, but the many extra-renal manifestations that affect patients' lives and families. To determine 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, and as shown on the next page, incidence due to glomerular disease has been declining gradually 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.

This year we have included a table showing the full range of diseases that cause ESRD in children, and covering the years 2000–2004 and 2005–2009. The total number of children beginning ESRD therapy grew nearly 4 percent between the two periods. Cystic/hereditary/congenital diseases accounted for 35 percent of new cases in 2005–2009, while 23 percent were caused by glomerular disease; focal glomerular sclerosis accounted for half of these reported cases. The third leading cause was secondary glomerular diseases, at 11 percent (54 percent of these patients had a primary diagnosis of lupus nephritis). In many disease groups males account for close to 60 percent of cases — not a surprising number, as congenital diseases such as posterior urethral valves occur only in males. For other diseases such as lupus nephritis, in contrast, males account for just one in five cases.

In 2005–2009, close to 40 percent of children received a kidney transplant in the first year of ESRD, up from 37 percent in 2000–2004. And in both periods, 4.2 percent of children died in the first year of ESRD treatment.

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 complications from infection 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

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below both recommended levels and the levels seen in the adult population. There also continue to be discrepancies in vaccination rates by modality, with hemodialysis patients more likely to be vaccinated than children on peritoneal dialysis.

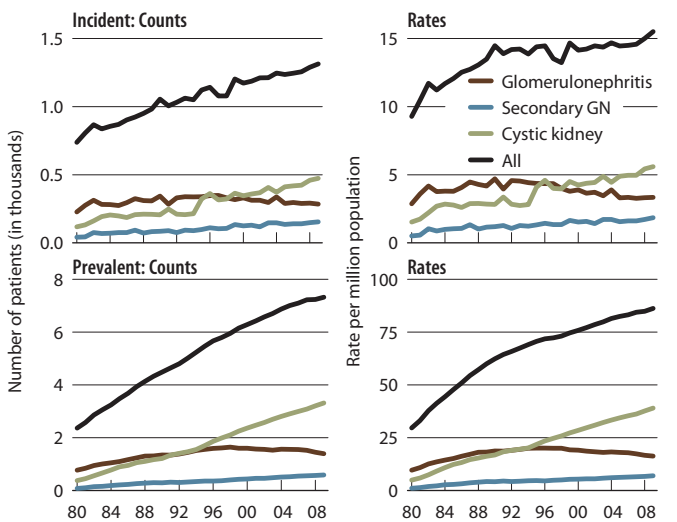
We next present data on hospitalizations after the initiation of ESRD therapy. The pattern of hospitalization is different in children compared to adults, with rates in children increasing steadily over the first 15 months. Among patients younger than 10, rates of hospitalization for infection rise 31 percent between month three and months 12–15; similar increases are noted for older children. By modality, these rates increase a striking 40 percent for hemodialysis patients, and 54 percent for those treated with peritoneal dialysis.

In contrast to patterns in hospitalization, those of mortality rates are similar to what is 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. In the early months of therapy, the youngest children are at the highest risk of both hospitalization and death.

The most striking findings related to pediatric ESRD patients continued to 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 remain issues of concern as well. 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 8.1;** see page 390 for analytical methods. *ESRD patients age 0–19. Adj: age/gender/race; ref: 2005 ESRD patients.*

8 | ii **Incident & prevalent counts & adjusted rates in the pediatric ESRD population, by primary diagnosis**



8 aii **Distribution of reported incident ESRD pediatric patients, by primary diagnosis, 2000–2004 (period A) & 2005–2009 (period B)**

	Total pts		% of inc pts		Median age		% male		White		African Am		Other race		% tx first year		% dying first year	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
All ESRD, (reference)	6,419	6,663	100	100	14	14	56.9	57.2	65.1	65.7	24.8	20.9	10.1	13.4	37.4	39.2	4.2	4.2
Diabetes	60	107	1.0	1.7	17	15	46.7	60.7	58.3	61.7	35.0	30.8	6.7	7.5	8.3	6.5	28.3	18.7
DM w/renal manifestations Type 2	37	73	0.6	1.1	13	0	48.6	61.6	54.1	67.1	37.8	23.3	8.1	9.6	8.1	5.5	40.5	23.3
DM w/renal manifestations Type 1	23	34	0.4	0.5	18	18	43.5	58.8	65.2	50.0	30.4	47.1	4.3	2.9	8.7	8.8	8.7	8.8
Glomerulonephritis (GN)	1,677	1,487	27.2	23.1	16	16	55.4	53.9	58.5	62.4	31.2	29.1	10.3	8.5	31.6	34.9	2.4	1.2
GN (histologically not examined)	354	271	5.7	4.2	17	18	55.6	57.9	58.5	71.2	24.3	20.7	17.2	8.1	23.7	23.6	2.5	1.8
Focal glomer. sclerosis, focal sclerosis GN	824	792	13.4	12.3	15	15	57.8	54.2	51.5	55.8	40.8	37.6	7.8	6.6	30.6	39.8	2.2	1.3
Membranous nephropathy	40	38	0.6	0.6	16	17	40.0	50.0	55.0	47.4	32.5	34.2	12.5	18.4	42.5	31.6	0.0	0.0
Membranopro. GN type 1, diffuse MPGN	97	74	1.6	1.2	16	16	52.6	47.3	77.3	68.9	16.5	14.9	6.2	16.2	38.1	43.2	4.1	0.0
Dense deposit disease, MPGN type 2	29	23	0.5	0.4	13	13	37.9	43.5	89.7	95.7	3.4	0.0	6.9	4.3	27.6	39.1	0.0	4.3
IgA nephropathy, Berger's	128	132	2.1	2.1	17	17	64.1	58.3	73.4	68.2	11.7	19.7	14.8	12.1	46.1	38.6	1.6	0.0
IgM nephropathy	11	13	0.2	0.2	16	15	72.7	61.5	45.5	76.9	36.4	15.4	18.2	7.7	54.5	23.1	0.0	0.0
With lesion of rapidly progressive GN	106	44	1.7	0.7	14	14	37.7	43.2	67.9	70.5	26.4	11.4	5.7	18.2	31.1	13.6	5.7	0.0
Post infectious GN, SBE	14	19	0.2	0.3	15	14	57.1	78.9	64.3	57.9	35.7	31.6	0.0	10.5	42.9	5.3	0.0	0.0
Other proliferative GN	74	81	1.2	1.3	15	15	54.1	39.5	63.5	74.1	27.0	19.8	9.5	6.2	37.8	32.1	1.4	2.5
Secondary GN/vasculitis	695	729	11.3	11.3	16	16	31.7	31.0	56.3	60.2	33.4	30.0	10.4	9.7	17.6	14.7	5.5	4.8
Lupus erythematosus (SLE nephritis)	378	394	6.1	6.1	17	18	22.5	21.1	37.3	43.7	50.8	43.9	11.9	12.4	9.5	5.8	6.9	6.9
Henoch-Schonlein syndrome	35	23	0.6	0.4	13	16	42.9	52.2	74.3	95.7	14.3	4.3	11.4	0.0	45.7	39.1	0.0	0.0
Scleroderma	*	*	0.1	0.1	17	17	60.0	20.0	60.0	80.0	20.0	20.0	20.0	0.0	20.0	20.0	60.0	0.0
Hemolytic uremic syndrome	120	141	1.9	2.2	5	6	42.5	48.9	81.7	76.6	9.2	15.6	9.2	7.8	30.0	25.5	4.2	5.0
Polyarteritis	*	15	0.1	0.2	16	13	37.5	13.3	87.5	73.3	12.5	6.7	0.0	20.0	0.0	13.3	0.0	0.0
Wegener's granulomatosis	57	51	0.9	0.8	16	15	50.9	45.1	73.7	86.3	19.3	9.8	7.0	3.9	17.5	23.5	3.5	0.0
Nephropathy due to drug abuse	*	*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Other vasculitis and its derivatives	51	54	0.8	0.8	13	15	25.5	31.5	76.5	68.5	15.7	25.9	7.8	5.6	29.4	24.1	2.0	0.0
Goodpasture's syndrome	29	28	0.5	0.4	18	17	55.2	32.1	89.7	89.3	6.9	3.6	3.4	7.1	20.7	21.4	3.4	0.0
Secondary GN, other	12	18	0.2	0.3	10	16	41.7	55.6	75.0	88.9	8.3	5.6	16.7	5.6	16.7	27.8	0.0	5.6
Interstitial nephritis/pyelonephritis	447	364	7.2	5.7	14	15	50.8	51.6	80.1	77.5	13.6	10.2	6.3	12.4	46.1	52.7	2.0	4.4
Analgesic abuse	*	*	0.0	0.0	15	17	50.0	66.7	100	33.3	0.0	0.0	0.0	66.7	0.0	33.3	0.0	0.0
Radiation nephritis	*	*	0.0	0.0	18	11	50.0	50.0	100	100	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0
Lead nephropathy	*	*	0.0	.	19	.	100	.	0.0	.	100	.	0.0	.	0.0	.	0.0	.
Nephropathy caused by other agents	37	34	0.6	0.5	13	16	54.1	50.0	83.8	82.4	16.2	11.8	0.0	5.9	43.2	44.1	13.5	17.6
Gouty nephropathy	*	*	.	0.0	.	0	.	100	.	100	.	0.0	.	0.0	.	0.0	.	100
Nephrolithiasis	*	12	0.1	0.2	13	16	57.1	33.3	71.4	83.3	28.6	0.0	0.0	16.7	57.1	75.0	0.0	0.0
Acquired obstructive uropathy	83	43	1.3	0.7	14	14	81.9	81.4	68.7	69.8	25.3	18.6	6.0	11.6	44.6	46.5	2.4	2.3
Chronic pyeloneph., reflux nephropathy	227	198	3.7	3.1	14	15	37.0	44.9	84.6	80.8	7.9	4.5	7.5	14.6	46.7	57.6	0.9	2.0
Chronic interstitial nephritis	75	65	1.2	1.0	14	14	52.0	56.9	78.7	73.8	13.3	20.0	8.0	6.2	52.0	49.2	0.0	4.6
Acute interstitial nephritis	*	*	0.1	0.0	9	15	87.5	50.0	75.0	0.0	25.0	100	0.0	0.0	25.0	0.0	0.0	50.0
Urolithiasis	*	*	0.0	0.0	14	19	50.0	100	100	0.0	0.0	100	0.0	0.0	50.0	0.0	0.0	0.0
Other disorders of calcium metabolism	*	*	0.0	0.0	17	12	33.3	0.0	66.7	66.7	33.3	0.0	0.0	33.3	0.0	33.3	0.0	0.0
Hypertensive/large vessel disease	306	316	5.0	4.9	18	17	56.9	59.8	46.1	56.6	42.5	36.4	11.4	7.0	20.6	22.2	6.9	5.1
Unspecified with renal failure	287	299	4.7	4.6	18	17	56.4	59.9	44.6	54.8	43.6	38.1	11.8	7.0	20.6	20.7	6.3	5.0
Renal artery stenosis	*	*	0.1	0.1	11	15	100	50.0	83.3	75.0	16.7	12.5	0.0	12.5	33.3	62.5	16.7	0.0
Renal artery occlusion	*	*	0.2	0.1	3	2	40.0	50.0	70.0	100	20.0	0.0	10.0	0.0	10.0	33.3	20.0	16.7
Cholesterol emboli, renal emboli	*	*	0.0	0.0	17	7	66.7	100	33.3	100	66.7	0.0	0.0	0.0	33.3	33.3	0.0	0.0

8 a ii Distribution of reported incident ESRD pediatric patients, by primary diagnosis, 2000–2004 (period A) & 2005–2009 (period B)

	Total pts		% of inc pts		Median age		% male		White		African Am		Other race		% tx first year		% dying first year	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Cystic/heriditary/congenital diseases	1,941	2,236	31.4	34.8	10	11	68.0	67.8	74.2	72.9	17.2	14.7	8.6	12.4	48.1	50.2	3.5	3.4
Polycystic kidneys, adult (dominant)	34	36	0.6	0.6	15	15	64.7	44.4	82.4	77.8	14.7	16.7	2.9	5.6	61.8	44.4	0.0	0.0
Polycystic, infantile (recessive)	122	140	2.0	2.2	6	5	51.6	52.9	77.0	75.0	10.7	13.6	12.3	11.4	55.7	47.1	9.0	13.6
Med. cystic dis., inc. nephronophthisis	104	98	1.7	1.5	13	13	39.4	39.8	82.7	84.7	5.8	3.1	11.5	12.2	62.5	72.4	1.9	0.0
Tuberous sclerosis	*	*	0.1	0.1	15	17	57.1	37.5	85.7	50.0	14.3	50.0	0.0	0.0	71.4	12.5	0.0	0.0
Hereditary nephritis, Alport's syndrome	119	141	1.9	2.2	16	16	81.5	85.1	73.1	61.7	16.0	24.8	10.9	13.5	40.3	52.5	0.8	0.0
Cystinosis	54	65	0.9	1.0	12	12	59.3	46.2	87.0	86.2	9.3	4.6	3.7	9.2	74.1	78.5	0.0	0.0
Primary oxalosis	*	18	0.2	0.3	8	5	60.0	55.6	60.0	72.2	20.0	11.1	20.0	16.7	50.0	61.1	0.0	0.0
Fabry's disease	*	*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Congenital nephrotic syndrome	139	121	2.3	1.9	2	2	64.0	57.0	71.9	74.4	15.1	13.2	12.9	12.4	45.3	56.2	7.2	5.8
Drash syndrome, mesangial sclerosis	14	20	0.2	0.3	1	0	50.0	55.0	64.3	80.0	7.1	15.0	28.6	5.0	7.1	35.0	21.4	5.0
Cong. obst. of ureterpelvic junction	28	61	0.5	0.9	11	11	78.6	85.2	60.7	67.2	28.6	19.7	10.7	13.1	53.6	41.0	3.6	0.0
Cong. obst. of uretrovesical junction	*	47	0.0	0.7	13	11	100	91.5	0.0	74.5	0.0	12.8	100	12.8	100	48.9	0.0	0.0
Other congenital obstructive uropathy	523	474	8.5	7.4	10	11	82.4	83.5	70.2	70.0	22.2	17.7	7.6	12.2	46.8	43.7	2.3	3.2
Renal hypoplasia/dysplasia/oligoneph.	657	759	10.6	11.8	10	10	59.2	63.0	75.0	72.2	17.2	13.8	7.8	14.0	45.1	49.0	3.3	3.0
Prune belly syndrome	90	92	1.5	1.4	7	7	97.8	97.8	74.4	71.7	23.3	14.1	2.2	14.1	50.0	52.2	4.4	3.3
Other (cong. malformation syndromes)	39	156	0.6	2.4	15	14	69.2	53.8	87.2	80.8	5.1	10.9	7.7	8.3	38.5	53.2	5.1	4.5
Neoplasms/tumors	107	139	1.7	2.2	11	14	55.1	48.9	69.2	69.8	21.5	12.9	9.3	17.3	31.8	33.1	19.6	23.0
Renal tumor (malignant)	35	30	0.6	0.5	6	5	48.6	43.3	60.0	66.7	28.6	23.3	11.4	10.0	11.4	13.3	25.7	23.3
Urinary tract tumor (malignant)	*	*	0.0	.	15	.	100	.	0.0	.	100	.	0.0	.	0.0	.	0.0	.
Renal tumor (benign)	*	*	.	0.0	.	1	.	0.0	.	100	.	0.0	.	0.0	.	0.0	.	50.0
Urinary tract tumor (benign)	*	*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Renal tumor (unspecified)	*	*	0.0	0.0	1	17	0.0	0.0	100.0	33.3	0.0	0.0	0.0	66.7	0.0	66.7	0.0	0.0
Urinary tract tumor (unspecified)	*	*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lymphoma of kidneys	*	*	.	0.0	.	18	.	100	.	100	.	0.0	.	0.0	.	0.0	.	100
Multiple myeloma	*	*	0.0	0.1	0	8	100	80.0	100.0	60.0	0.0	20.0	0.0	20.0	0.0	0.0	100	80.0
Other immunoproliferative neoplasms (including light chain nephropathy)	*	*	.	0.0	.	9	.	50.0	.	50.0	.	0.0	.	50.0	.	0.0	.	0.0
Amyloidosis	*	*	0.0	0.0	12	10	33.3	33.3	66.7	66.7	0.0	0.0	33.3	33.3	33.3	0.0	33.3	33.3
Complications of tx'ed organ, unspec.	*	*	0.0	0.1	18	15	50.0	50.0	100.0	50.0	0.0	25.0	0.0	25.0	50.0	50.0	50.0	0.0
Complications of transplanted kidney	32	*	0.5	0.1	16	16	65.6	44.4	71.9	88.9	18.8	11.1	9.4	0.0	56.3	88.9	0.0	0.0
Complications of transplanted liver	29	20	0.5	0.3	12	15	55.2	45.0	75.9	60.0	17.2	15.0	6.9	25.0	34.5	55.0	31.0	5.0
Complications of transplanted heart		30		0.5		14		50.0		76.7		10.0		13.3		40.0		20.0
Complications of transplanted lung	*	*	.	0.0	.	12	.	100	.	50.0	.	0.0	.	50.0	.	50.0	.	50.0
Complications of tx'ed bone marrow		19		0.3		15		57.9		89.5		10.5		0.0		10.5		31.6
Complications of transplanted pancreas	*	*	0.0	0.0	7	14	100	100	100.0	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Complications of transplanted intestine	*	*	0.0	.	15	.	0.0	.	0.0	.	100	.	0.0	.	0.0	.	0.0	.
Comps of other specified tx'ed organ		*		0.1		14		42.9		28.6		0.0		71.4		57.1		42.9
Miscellaneous conditions	411	427	6.7	6.6	12	13	56.7	56.7	65.0	64.6	27.5	22.7	7.5	12.6	33.8	34.9	7.5	9.8
Sickle cell disease/anemia	14	17	0.2	0.3	18	18	78.6	76.5	14.3	11.8	85.7	88.2	0.0	0.0	21.4	11.8	7.1	17.6
Sickle cell trait/other sickle cell	*	*	.	0.0	.	18	.	0.0	.	0.0	.	100	.	0.0	.	0.0	.	0.0
Post partum renal failure	*	11	0.1	0.2	17	18	0.0	9.1	57.1	72.7	28.6	18.2	14.3	9.1	14.3	27.3	14.3	0.0
AIDS nephropathy	42	37	0.7	0.6	15	17	45.2	54.1	4.8	18.9	88.1	81.1	7.1	0.0	0.0	0.0	14.3	16.2
Traumatic or surgical loss of kidney(s)	12	15	0.2	0.2	5	9	66.7	66.7	83.3	73.3	8.3	13.3	8.3	13.3	41.7	46.7	0.0	13.3
Hepatorenal syndrome	*	*	0.1	0.1	13	11	25.0	16.7	50.0	83.3	50.0	16.7	0.0	0.0	75.0	0.0	25.0	83.3
Tubular necrosis (no recovery)	118	132	1.9	2.1	6	9	56.8	53.8	81.4	76.5	11.9	15.9	6.8	7.6	15.3	18.2	10.2	10.6
Other renal disorders	214	208	3.5	3.2	13	13	59.3	60.6	70.6	68.3	21.0	12.0	8.4	19.7	50.9	54.3	4.7	5.8
Etiology uncertain	528	628	8.6	9.8	15	15	57.8	59.2	63.1	71.8	23.9	16.6	13.1	11.6	29.9	34.1	2.7	2.4
Missing	247	230	4.0	3.6	12	13	63.6	62.6	62.8	11.7	12.6	3.9	24.7	84.3	84.6	80.4	4.0	3.5

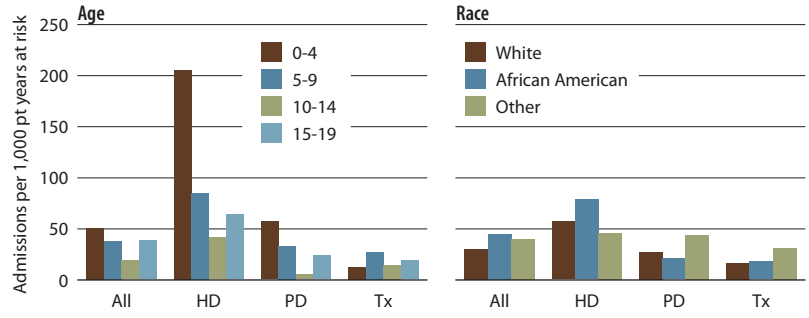
>> **Table 8.a;** see page 390 for analytical methods. *Incident ESRD patients age 0–19. *Values for cells with ten or fewer patients are suppressed. "." Zero values in this cell.*

For pediatric ESRD patients prevalent in 2006–2009, unadjusted rates of hospitalization for bacteremia/septicemia are highest in those age 0–4, at 51 per 1,000 patient years at risk, and lowest in those age 10–14, at 19. By race, overall rates are highest in African Americans and lowest in whites, at 45 and 31, respectively. Patients on hemodialysis have higher rates of admission for bacteremia/septicemia than do those on peritoneal dialysis or with a transplant.

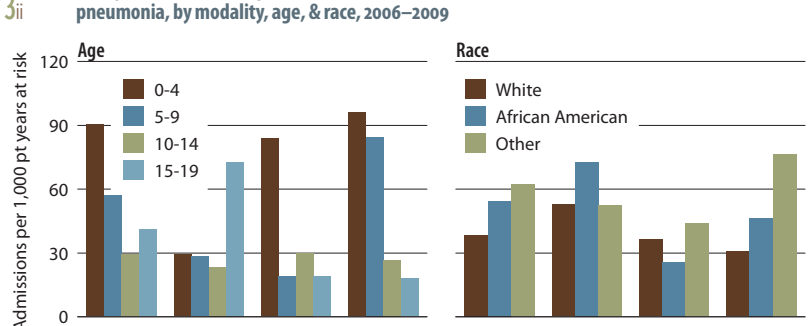
Overall rates of admission for pneumonia are also greatest in patients age 0–4, at 91 per 1,000 patient years at risk. By modality, pneumonia admissions for transplant patients age 0–4 reach 96, compared to 29 for those of the same age on hemodialysis, and 84 for those treated with peritoneal dialysis.

Rates of admission for respiratory infection (excluding pneumonia) range from 24–25 per 1,000 patient years at risk for patients age 10–19 to 83 for those age 0–4. Rates differ less by race than they do by age. >> Figures 8.2–4; see page 390 for analytical methods. *Period prevalent ESRD patients age 0–19, 2006–2009; unadjusted.*

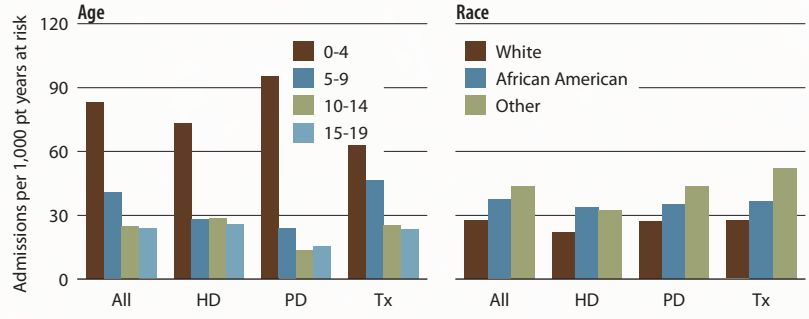
8.2ii Unadjusted rates of hospitalization for bacteremia/septicemia, by modality, age, & race, 2006–2009



8.3ii Unadjusted rates of hospitalization for pneumonia, by modality, age, & race, 2006–2009



8.4ii Unadjusted rates of hospitalization for respiratory infection (excluding pneumonia), by modality, age, & race, 2006–2009

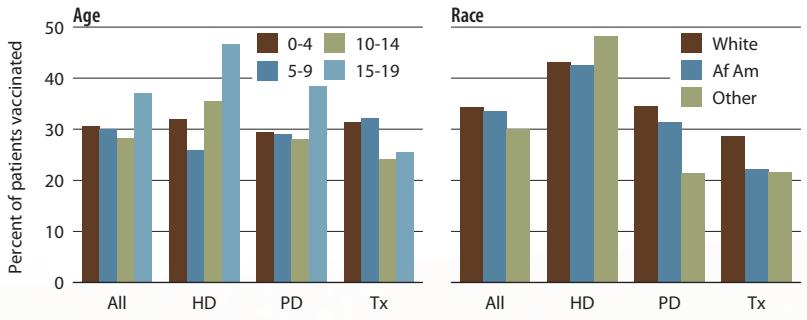


Rates of vaccination against influenza in the pediatric population remained alarmingly low in 2006–2009, with fewer than one in three patients age 14 or younger receiving a vaccination. Rates are highest in those age 15–19, at 37 percent, vary little by race, and are generally higher in patients on hemodialysis.

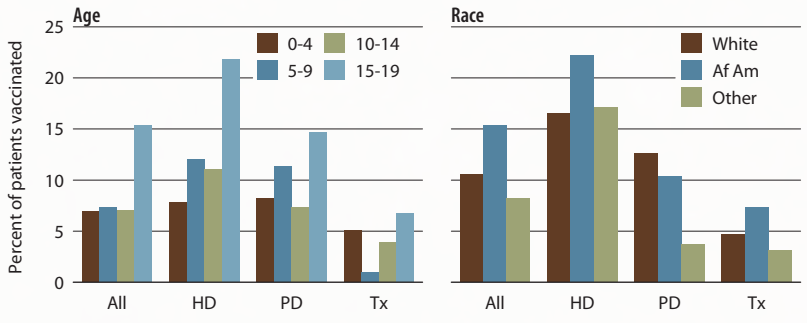
In 2006–2007 and 2008–2009, pneumococcal pneumonia vaccination rates were highest overall in children age 15–19, at 15 percent, and were just 7 percent in those 14 and younger. By race, rates are highest in African Americans, at 15.4 percent compared to 10.6 and 8.2 percent in whites and individuals of other races. And older children on hemodialysis are more likely to receive pneumoccal pneumonia vaccinations than their counterparts on peritoneal dialysis or with a transplant. » **Figures 8.5–6;** see page 390 for analytical methods. *Point prevalent ESRD patients age 0–19 prior to January 1 of each year, initiating therapy 90 days prior to September 1, & living through December 31 of each year, 2006–2009 (8.5). Point prevalent ESRD patients age 0–19 prior to January 1 of the first year of the two-year study period & living through December 31 of the second year, 2006–2007 & 2008–2009 (8.6).*

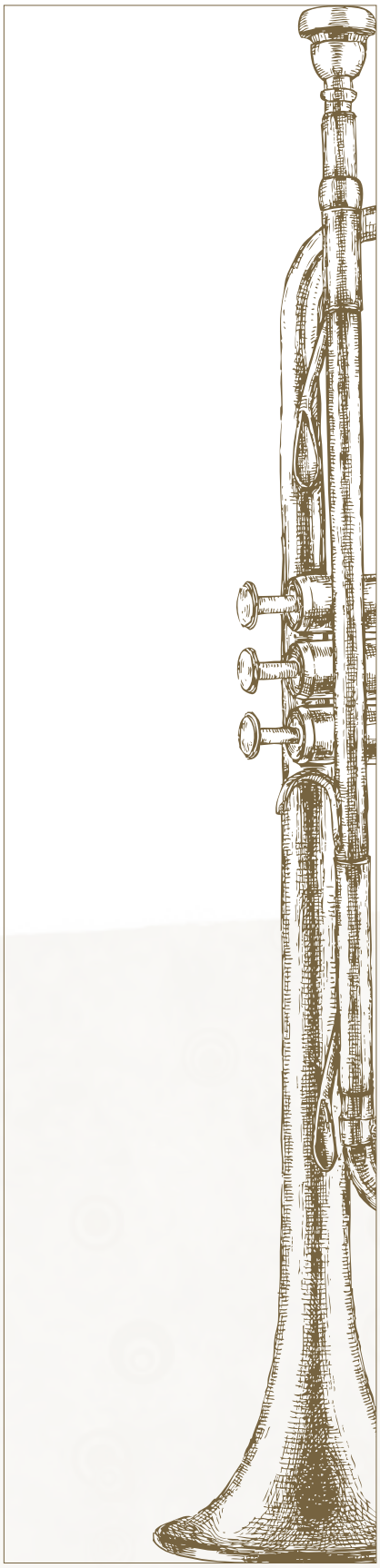
VACCINATIONS

8.5ii Influenza vaccination rates, by modality, age, & race, 2006–2009



8.6ii Pneumococcal pneumonia vaccination rates, by modality, age, & race, 2006–2007 & 2008–2009



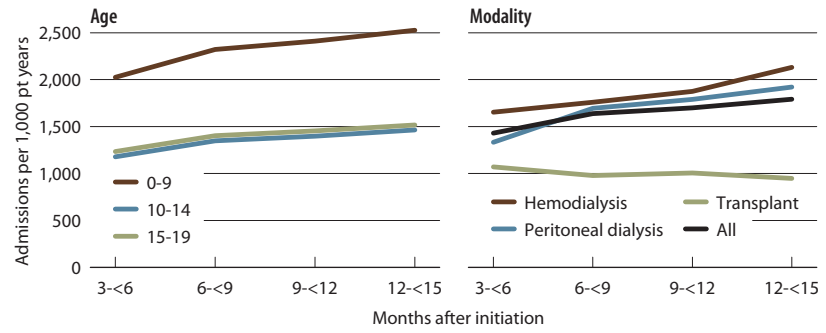


In the 3–15 months following initiation of ESRD therapy, adjusted all-cause admission rates for patients age 0–9 are 1.6–1.7 times greater than those of their counterparts age 10–19, increasing from 2,025 admissions per 1,000 patient years at risk in months 3–<6 to 2,525 in months 12–<15. By modality, admissions are lowest in transplant patients, and decline slightly over time, in contrast to the increase seen for both dialysis modalities. (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.)

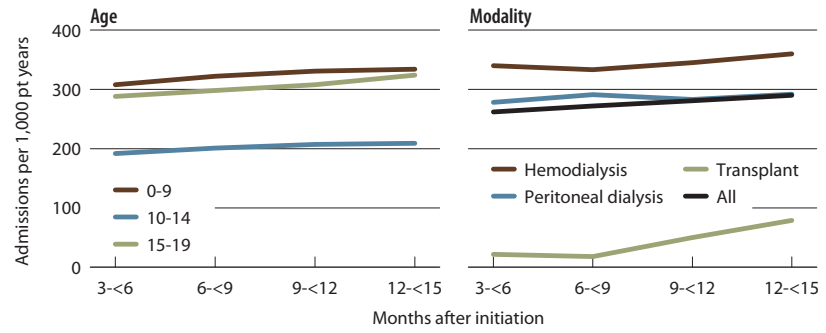
Rates of cardiovascular admissions are greatest by age in patients age 0–9 and 15–19, and reach 324–334 per 1,000 patient years at months 12–<15. Transplant patients have the lowest rates by modality, at just 22 in months 3–<6, compared to 340 and 278 for hemodialysis and peritoneal dialysis patients, respectively.

For each age group, admissions for infection rise between months 3–<6 and 6–<9, then level out; the highest rates occur among the youngest patients. By modality, rates are lowest for transplant patients, and similar over time in both the hemodialysis and peritoneal dialysis populations. » Figures 8.7–9; see page 390 for analytical methods. *Incident ESRD patients age 0–19, 2001–2008. Adj.: rates by age, gender/race/primary diagnosis; rates by modality, age/gender/race/primary diagnosis. Ref: incident ESRD patients age 0–19, 2004–2005.*

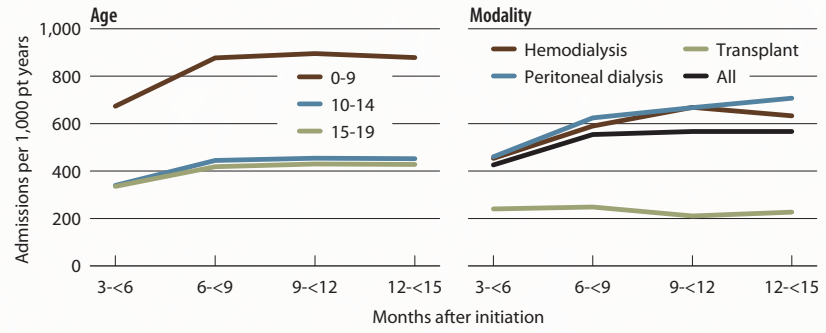
8.7ii Adjusted all-cause hospitalization rates in the first months of ESRD, by age & modality, 2001–2008



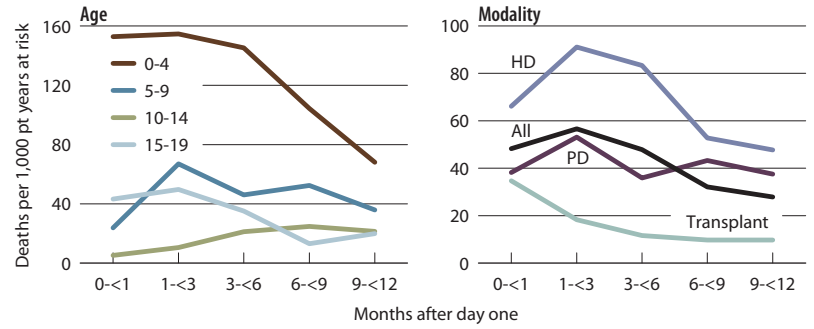
8.8ii Adjusted cardiovascular hospitalization rates in the first months of ESRD, by age & modality, 2001–2008



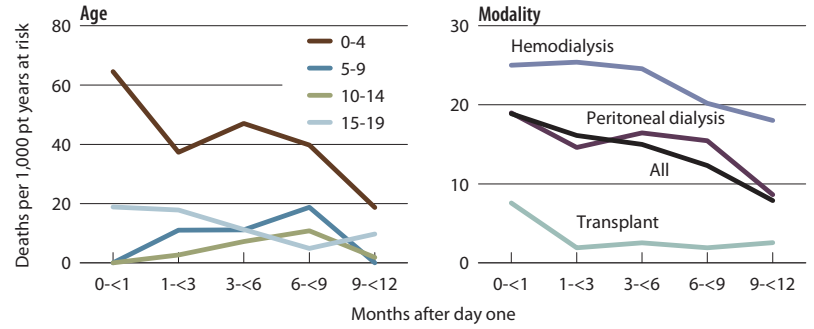
8.9ii Adjusted rates of hospitalization for infection in the first months of ESRD, by age & modality, 2001–2008



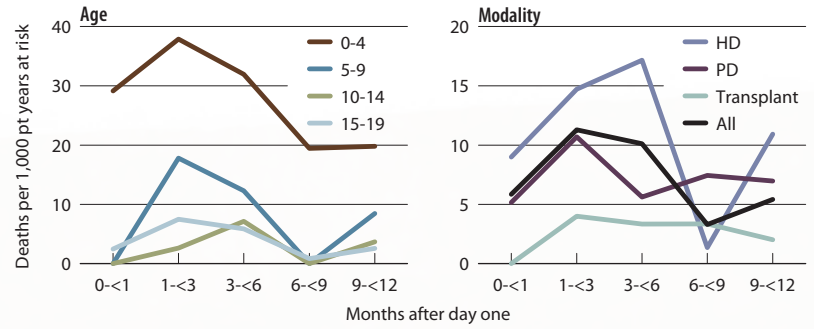
8.10ii Adjusted all-cause mortality rates in the first months of ESRD (from day one), by age & modality, 2001–2008



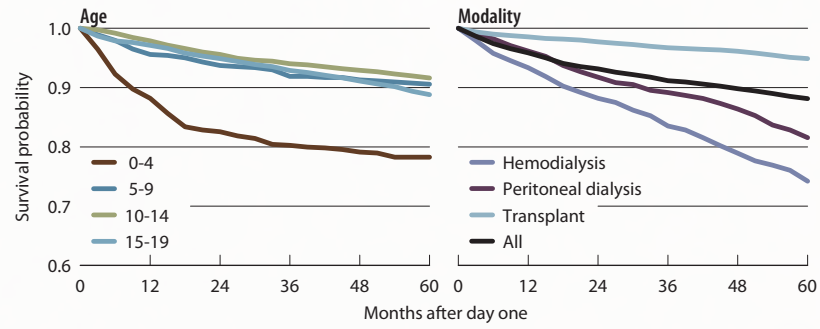
8.11ii Adjusted cardiovascular mortality rates in the first months of ESRD (from day one), by age & modality, 2001–2008



8.12ii Adjusted rates of mortality due to infection in the first months of ESRD (from day one), by age & modality, 2001–2008



8.13ii Adjusted five-year survival (from day one), by age & modality, 2000–2004



Adjusted all-cause mortality rates for children age 0–4 are noticeably higher than those found in their older counterparts. In the first month of therapy, for example, mortality in younger children reaches 153 deaths per 1,000 patient years at risk, compared to 24 in those age 5–9, and 5.3 in those age 10–14.

Overall, the all-cause mortality rate in pediatric patients reaches 48 in the first month after initiation, peaks at 57 in the next two months, then falls to 28 in months 9–<12. Rates are highest in patients treated with hemodialysis, and lowest in those with a transplant.

Rates of mortality due to cardiovascular disease show similar patterns. For the youngest patients, the rate falls from 65 deaths per 1,000 patient years in the first month to 19 at the end of the year; rates for patients age five and older remain lower than 20 throughout the year. The overall rate of cardiovascular mortality is 19 in the first month, and declines to 7.9.

For most age groups, the rate of mortality due to infection peaks in months 1–<3, reaching 38 for the youngest patients. The overall rate is 11.3 during this period, and falls to 5.4 in months 9–<12.

For patients beginning ESRD therapy in 2000–2004, the overall probability of surviving five years was 0.88. By age, this ranges from a low of 0.78 among patients age 0–4 to 0.92 for ages 10–14. By modality, the highest probability is found in patients with a transplant, at 0.95, compared to 0.74 for those treated with hemodialysis. » Figures 8.10–13; see page 390 for analytical methods. *Incident patients age 0–19, 2001–2008 (8.10–12) & 2000–2004 (8.13). Adj: age/gender/race/primary diagnosis. Ref: incident ESRD patients age 0–19, 2004–2005.*

adjusted rate of new pediatric ESRD cases, by primary diagnosis, 2009 16

PER MILLION POPULATION » GLOMERULONEPHRITIS 3.4 » SECONDARY GN 1.9 » CYSTIC KIDNEY DISEASE 5.6 (FIG 8.1)

adjusted rate of prevalent pediatric ESRD cases, by primary diagnosis, 2009 86

PER MILLION POPULATION » GLOMERULONEPHRITIS 16.3 » SECONDARY GLOMERULONEPHRITIS 7.1 » CYSTIC KIDNEY DISEASE 39 (FIG 8.1)

distribution of incident pediatric ESRD patients, by primary diagnosis, 2005–2009

» CYSTIC KIDNEY DISEASE 35% » GLOMERULONEPHRITIS 23% » SECONDARY GN/VASCULITIS 11% (TABLE 8.A)

hospital admissions for pneumonia in pediatric ESRD patients, 2006–2009

ADMISSIONS PER 1,000 PATIENT YEARS AT RISK, UNADJUSTED

BY AGE » 0–4 91 » 5–9 57 » 10–14 29 » 15–19 41 (FIG 8.3)

BY RACE » WHITE 39 » AFRICAN AMERICAN 54 » OTHER RACE 62 (FIG 8.3)

adjusted all-cause hospitalizations for pediatric patients in months 12–<15 of ESRD, 2001–2008 1,792

ADMISSIONS PER 1,000 PATIENT YEARS

BY AGE » 0–9 2,525 » 10–14 1,465 » 15–19 1,519 (FIG 8.7)

BY MODALITY » HEMODIALYSIS 2,132 » PERITONEAL DIALYSIS 1,920 » TRANSPLANT 948 (FIG 8.7)

adjusted cardiovascular hospitalizations for pediatric patients in months 12–<15 of ESRD, 2001–2008 290

ADMISSIONS PER 1,000 PATIENT YEARS

BY AGE » 0–9 334 » 10–14 209 » 15–19 324 (FIG 8.8)

BY MODALITY » HEMODIALYSIS 360 » PERITONEAL DIALYSIS 292 » TRANSPLANT 79 (FIG 8.8)

adjusted five-year survival, from day one, for pediatric patients, 2000–2004 0.88

SURVIVAL PROBABILITY

BY AGE » 0–4 0.78 » 5–9 0.91 » 10–14 0.92 » 15–19 0.89 (FIG 8.13)

BY MODALITY » HEMODIALYSIS 0.74 » PERITONEAL DIALYSIS 0.82 » TRANSPLANT 0.95 (FIG 8.13)