Chapter 7: Pediatric ESRD

Highlights

- 1,161 children began end-stage renal disease (ESRD) care in 2012
- 7,522 children were being treated for ESRD on December 31, 2012
- The most common initial ESRD treatment modality among children is hemodialysis (45 percent). However, 73 percent of the prevalent pediatric population had a functioning kidney transplant as of the end of 2012
- 43.6 percent of children are transplanted within the first year of ESRD care
- All-cause hospitalization rates are 1.5 per patient year among children with ESRD
- The number of children listed for kidney transplant was at an all-time high of 517 in 2012
- As of 2005, deceased donor transplants were more common than living donor transplants
- The five-year survival probability was 0.89 for children initiating ESRD care between 2003-2007

Introduction

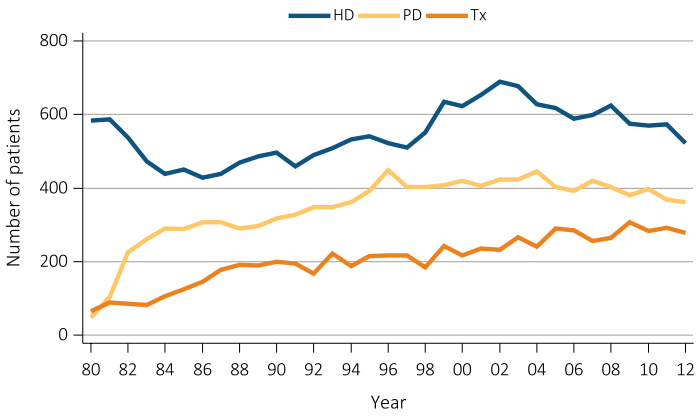
Pediatric ESRD affects children of all ages and with expected patient survival into adulthood. Consequently, children with incident ESRD often traverse the ESRD modality continuum of hemodialysis, peritoneal dialysis, and transplantation. These children are subjected to frequent hospitalizations and have a risk of mortality far exceeding the general pediatric population in the U.S. In the 2014 issue of the *United States Renal Data System (USRDS) Annual Data Report*, for the first time the Pediatric chapter includes the full spectrum of pediatric renal replacement therapy from dialysis to transplant.

Epidemiology of End-Stage Renal Disease in Children

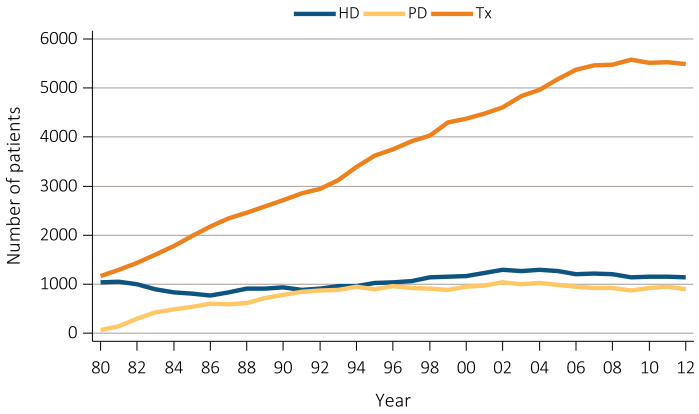
The incidence of ESRD in children has been slowly decreasing in the U.S. since 2008. The incidence peaked in 2003 across all treatment modalities. Between 2011 and 2012, 1,161 children had new onset ESRD. This figure represents a 5.8 percent reduction in incident cases from 2011. The overall prevalence of ESRD appears to have plateaued between 2008 and 2012. As of 2012, 7,522 children had prevalent ESRD, which represents a 1.3 percent decrease from the previous year. The plateau in the prevalence rate is a combination of a decline in the incident ESRD population and patients diagnosed as children who are transitioned to the adult cohort at the twentieth birthday.

vol 2 Figure 7.1 Incident & December 31 point prevalent ESRD patients (aged 0–19 years)

(a) Incidence of ESRD in children



(b) Prevalence of ESRD in children



Data Source: Reference tables D3-D5, D7-D9, and special analyses, USRDS ESRD Database. Peritoneal dialysis consists of continuous ambulatory peritoneal dialysis and continuous cycling peritoneal dialysis. Abbreviations: ESRD, end-stage renal disease; HD, hemodialysis; PD, peritoneal dialysis; Tx, transplant.

Incidence and Prevalence by ESRD Modality

From the earliest reporting year, children have initiated ESRD therapy with hemodialysis more frequently than peritoneal dialysis or transplantation. 2012 data demonstrate the same pattern with 522 (45.0 percent) initiating with hemodialysis, 361 (31.1 percent) peritoneal dialysis, and 278 (23.9 percent) transplant. Over time, transplant has become the most common ESRD treatment modality in children. Of the 7,522 children and adolescents between the ages of 0 and 19 years with prevalent ESRD, kidney transplant was the most common modality (5,485 [72.9 percent]), followed by nearly equal distribution of hemodialysis (1,138 [15.1 percent]) and peritoneal dialysis (899 [12.0 percent]).

Etiology

The underlying etiologies of ESRD are generated from the ESRD Medical Evidence Form (CMS 2728) and summarized in Table 7.1. Consistent with previous years the leading causes of ESRD for 2008-2012 in children are: cystic/hereditary/congenital disorders (38.3 percent), glomerular disease (23.0 percent), and secondary causes of glomerulonephritis (GN) (11.3 percent). The most common individual diagnoses associated with ESRD include: renal hypoplasia/dysplasia (N=691), congenital obstructive uropathies of the ureteropelvic junction, ureterovesical junction and other locations (N=607), focal glomerular sclerosis (N=721), and lupus erythematosus (N=332). In children with ESRD, sickle cell nephropathy, human immunodeficiency virus (HIV) nephropathy and lupus erythematosus are more common among African Americans compared with other racial groups.

Table 7.1 Distribution of reported incident pediatric ESRD patients by primary diagnosis (aged 0-19 years), 2003-2007 (period A) and 2008-2012 (period B) ***(continued on next page)***

	Total Patients		Incident %		Age Median		Male %		White %		African Am %		Other Race %		Transplant first year %		Died first year %	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
All ESRD (reference)	6,544	6,204	100.0	100.0	14	14	57.0	56.5	64.3	65.7	24.7	23.0	11.0	11.3	41.4	43.6	3.7	3.3
Diabetes	58	57	0.9	1.0	18	16	46.6	52.6	55.2	57.9	37.9	36.8	6.9	5.3	8.6	15.8	12.1	12.3
Type 2	30	34	0.5	0.6	15	4	53.3	52.9	56.7	61.8	30.0	32.4	13.3	5.9	13.3	8.8	10.0	17.6
Type 1	28	23	0.4	0.4	19	19	39.3	52.2	53.6	52.2	46.4	43.5	0.0	4.3	3.6	26.1	14.3	4.3
Glomerulonephritis (GN)	1,541	1,336	24.7	23.0	16	16	54.9	52.8	58.5	64.1	33.2	29.0	8.4	6.9	35.4	36.5	2.2	1.7
GN (histologically not examined)	275	194	4.4	3.3	17	18	57.8	56.7	61.1	69.6	26.5	20.6	12.4	9.8	29.5	25.3	3.6	1.5
Focal glomerular sclerosis	824	721	13.2	12.4	15	15	56.8	54.4	51.8	59.2	42.0	36.1	6.2	4.7	37.6	39.4	1.9	1.9
Membranous nephropathy	31	34	0.5	0.6	15	17	48.4	58.8	58.1	47.1	32.3	44.1	9.7	8.8	35.5	41.2	0.0	0.0
MPGN GN type 1, diffuse MPGN	77	75	1.2	1.3	15	16	48.1	48.0	76.6	66.7	14.3	24.0	9.1	9.3	40.3	42.7	2.6	4.0
Dense deposit disease, MPGN type 2	26	20	0.4	0.3	12	15	38.5	60.0	96.2	75.0	3.8	10.0	0.0	15.0	30.8	20.0	3.8	0.0
IgA nephropathy	130	134	2.1	2.3	17	17	58.5	54.5	68.5	76.1	19.2	13.4	12.3	10.4	40.8	44.0	0.8	0.0
IgM nephropathy	*	14	0.1	0.2	16	18	57.1	64.3	42.9	71.4	42.9	21.4	14.3	7.1	42.9	14.3	0.0	0.0
Rapidly progressive GN	77	56	1.2	1.0	14	14	45.5	23.2	66.2	75.0	22.1	16.1	11.7	8.9	27.3	21.4	2.6	1.8
Post infectious GN, SBE	14	21	0.2	0.4	14	16	64.3	52.4	57.1	71.4	28.6	23.8	14.3	4.8	21.4	14.3	0.0	4.8
Other proliferative GN	80	67	1.3	1.2	15	16	41.3	43.3	66.3	65.7	26.3	26.9	7.5	7.5	31.3	43.3	2.5	1.5
Secondary GN/ vasculitis	708	656	11.4	11.3	16	16	31.8	29.3	54.0	57.8	36.7	35.2	9.3	7.0	14.7	18.1	4.5	4.3
Lupus nephritis	405	332	6.5	5.7	17	18	22.7	21.7	38.3	32.8	50.4	59.0	11.4	8.1	6.9	7.2	5.9	4.5
Henoch-Schonlein syndrome	23	28	0.4	0.5	15	14	65.2	53.6	87.0	85.7	4.3	7.1	8.7	7.1	43.5	39.3	0.0	3.6
Scleroderma	*	*	0.1	0.1	18	18	25.0	66.7	50.0	66.7	50.0	33.3	0.0	0.0	0.0	33.3	25.0	33.3
Hemolytic uremic syndrome	119	113	1.9	1.9	6	8	47.1	37.2	77.3	82.3	17.6	12.4	5.0	5.3	27.7	35.4	3.4	4.4
Polyarteritis	11	21	0.2	0.4	14	13	18.2	19.0	72.7	85.7	9.1	4.8	18.2	9.5	9.1	19.0	0.0	0.0
Wegener's granulomatosis	60	56	1.0	1.0	15	16	56.7	42.9	70.0	89.3	23.3	7.1	6.7	3.6	20.0	23.2	3.3	1.8
Other vasculitis and its derivatives	58	54	0.9	0.9	15	13	25.9	33.3	69.0	72.2	25.9	16.7	5.2	11.1	24.1	29.6	1.7	5.6
Goodpasture syndrome	14	33	0.2	0.6	16	17	28.6	27.3	85.7	93.9	7.1	3.0	7.1	3.0	21.4	18.2	0.0	3.0
Secondary GN, other	14	16	0.2	0.3	14	17	42.9	37.5	78.6	81.3	7.1	18.8	14.3	0.0	21.4	25.0	0.0	6.3

Data Source: Special analyses, USRDS ESRD Database. Abbreviations: AIDS, acquired-immune deficiency syndrome; ESRD, end-stage renal disease; GN glomerulonephritis; IgA immunoglobulin A; IgM, immunoglobulin M; MPGN, membranoproliferative glomerulonephritis; SBE, sub-acute bacterial endocarditis.

Table 7.1 Distribution of reported incident pediatric ESRD patients by primary diagnosis (aged 0-19 years), 2003-2007 (period A) and 2008-2012 (period B) ***(continued on next page)***

	Total Patients		Incident %		Age Median		Male %		White %		African Am %		Other Race %		Transplant first year %		Died first year %	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Interstitial nephritis/ pyelonephritis	391	289	6.3	5.0	15	15	52.7	50.9	81.3	81.3	12.8	11.1	5.9	7.6	47.8	54.7	2.0	4.8
Nephropathy caused by other agents	41	37	0.7	0.6	15	14	56.1	56.8	82.9	83.8	14.6	10.8	2.4	5.4	53.7	29.7	9.8	10.8
Nephrolithiasis	*	11	0.1	0.2	12	16	44.4	27.3	100.0	90.9	0.0	0.0	0.0	9.1	100.0	81.8	0.0	9.1
Acquired obstructive uropathy	48	30	0.8	0.5	15	14	77.1	76.7	66.7	80.0	22.9	16.7	10.4	3.3	45.8	46.7	0.0	0.0
Chronic pyelonephritis, reflux nephropathy	201	143	3.2	2.5	15	15	44.3	45.5	88.6	84.6	6.5	7.0	5.0	8.4	48.3	60.8	0.5	2.8
Chronic interstitial nephritis	75	60	1.2	1.0	14	16	57.3	46.7	73.3	73.3	20.0	16.7	6.7	10.0	46.7	56.7	2.7	3.3
Acute interstitial nephritis	*	*	0.0	0.1	11	11	33.3	100.0	33.3	50.0	66.7	50.0	0.0	0.0	0.0	50.0	0.0	50.0
Disorders of calcium metabolism	*	.	0.1	.	15	.	20.0	.	80.0	.	20.0	.	0.0	.	20.0	.	0.0	.
Hypertensive/large vessel disease	283	260	4.5	4.5	17	18	55.8	57.3	52.3	54.6	41.3	41.5	6.4	3.8	23.7	19.6	5.3	3.8
Unspecified with renal failure	266	244	4.3	4.2	18	18	56.8	57.4	50.0	52.9	43.6	43.4	6.4	3.7	22.9	18.0	5.3	4.1
Renal artery stenosis	*	*	0.1	0.2	14	14	57.1	66.7	85.7	77.8	14.3	11.1	0.0	11.1	42.9	55.6	0.0	0.0
Renal artery occlusion	*	*	0.1	0.1	0	17	22.2	20.0	88.9	80.0	0.0	20.0	11.1	0.0	22.2	20.0	11.1	0.0
Cystic/hereditary/ congenital diseases	2,088	2,229	33.5	38.3	10	10	68.1	67.4	75.2	74.8	18.0	18.5	6.8	6.6	51.1	51.1	3.2	2.8
Polycystic kidneys, adult type (dominant)	30	33	0.5	0.6	14	15	43.3	57.6	83.3	72.7	13.3	27.3	3.3	0.0	60.0	51.5	0.0	0.0
Polycystic, infantile (recessive)	142	150	2.3	2.6	9	1	56.3	44.7	76.1	78.0	16.9	16.7	7.0	5.3	53.5	39.3	7.0	11.3
Medullary cystic disease, incl. nephronophthisis	97	106	1.6	1.8	11	13	36.1	50.0	84.5	84.9	4.1	7.5	11.3	7.5	69.1	70.8	1.0	0.0
Tuberous sclerosis	*	*	0.1	0.1	17	18	37.5	40.0	50.0	40.0	50.0	60.0	0.0	0.0	25.0	20.0	0.0	0.0
Hereditary nephritis, Alport's syndrome	152	133	2.4	2.3	16	17	83.6	83.5	74.3	64.7	20.4	24.1	5.3	11.3	50.0	48.9	1.3	0.0
Cystinosis	62	49	1.0	0.8	12	13	51.6	59.2	90.3	91.8	9.7	8.2	0.0	0.0	77.4	75.5	0.0	0.0
Primary oxalosis	17	*	0.3	0.2	8	2	52.9	80.0	82.4	80.0	11.8	10.0	5.9	10.0	47.1	70.0	0.0	0.0
Congenital nephrotic syndrome	136	131	2.2	2.3	2	3	55.9	54.2	71.3	80.2	19.9	12.2	8.8	7.6	50.7	48.9	8.1	4.6
Drash syndrome, mesangial sclerosis	15	29	0.2	0.5	1	0	60.0	58.6	80.0	82.8	0.0	17.2	20.0	0.0	26.7	34.5	13.3	6.9
Congenital ureteropelvic junction obstruction	31	43	0.5	0.7	11	13	80.6	86.0	77.4	60.5	16.1	39.5	6.5	0.0	51.6	48.8	0.0	2.3
Congenital ureterovesical junction obstruction	25	50	0.4	0.9	13	11	88.0	86.0	72.0	70.0	28.0	20.0	0.0	10.0	52.0	50.0	0.0	2.0

Table 7.1 Distribution of reported incident pediatric ESRD patients by primary diagnosis (aged 0-19 years), 2003-2007 (period A) and 2008-2012 (period B)

	Total Patients		Incident %		Age Median		Male %		White %		African Am %		Other Race %		Transplant first year %		Died first year %	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Other congenital obstructive uropathy	514	514	8.2	8.8	11	10	84.6	81.5	68.5	71.8	23.5	23.7	8.0	4.5	45.1	48.2	2.7	1.2
Renal hypoplasia, dysplasia, oligonephronia	698	691	11.2	11.9	10	9	62.3	62.4	76.9	75.5	15.9	16.9	7.2	7.5	50.0	52.2	3.4	2.9
Prune belly syndrome	82	80	1.3	1.4	7	5	97.6	98.8	75.6	67.5	22.0	27.5	2.4	5.0	56.1	55.0	0.0	1.3
Other (congenital malformation syndromes)	79	204	1.3	3.5	14	12	50.6	56.4	83.5	78.9	13.9	10.3	2.5	10.8	55.7	51.0	2.5	4.4
Neoplasms/tumors	161	122	2.6	2.1	14	14	50.9	50.8	71.4	68.0	21.1	22.1	7.5	9.8	32.3	32.0	14.3	15.6
Renal tumor (malignant)	38	33	0.6	0.6	5	5	44.7	39.4	63.2	66.7	28.9	27.3	7.9	6.1	7.9	18.2	26.3	15.2
Renal tumor (unspecified)	*	*	0.1	0.0	17	1	0.0	100.0	50.0	0.0	25.0	100.0	25.0	0.0	50.0	100.0	0.0	0.0
Transplanted organ complication, unspecified	21	*	0.3	0.0	14	16	47.6	50.0	71.4	50.0	23.8	50.0	4.8	0.0	28.6	50.0	19.0	0.0
Transplanted kidney complication	46	13	0.7	0.2	15	17	58.7	76.9	73.9	84.6	19.6	15.4	6.5	0.0	58.7	23.1	0.0	0.0
Transplanted liver complication	*	*	0.1	0.1	17	15	62.5	25.0	62.5	62.5	25.0	12.5	12.5	25.0	50.0	87.5	0.0	0.0
Transplanted heart complication	20	25	0.3	0.4	14	15	55.0	52.0	80.0	64.0	15.0	24.0	5.0	12.0	30.0	48.0	20.0	16.0
Bone marrow transplant complication	12	25	0.2	0.4	12	17	50.0	60.0	91.7	64.0	8.3	28.0	0.0	8.0	8.3	12.0	33.3	12.0
Miscellaneous conditions	406	389	6.5	6.7	13	13	55.4	55.3	66.7	73.8	28.1	18.3	5.2	8.0	36.2	36.2	8.9	6.9
Sickle cell disease/ anemia	14	*	0.2	0.2	18	18	64.3	90.0	0.0	10.0	100.0	90.0	0.0	0.0	14.3	10.0	21.4	0.0
Post-partum renal failure	*	*	0.1	0.1	17	19	11.1	0.0	66.7	71.4	33.3	14.3	0.0	14.3	33.3	0.0	0.0	0.0
AIDS nephropathy	44	15	0.7	0.3	16	18	47.7	53.3	13.6	0.0	86.4	100.0	0.0	0.0	0.0	0.0	13.6	20.0
Traumatic or surgical loss of kidney(s)	15	*	0.2	0.2	8	13	66.7	60.0	93.3	50.0	6.7	40.0	0.0	10.0	40.0	20.0	13.3	10.0
Hepatorenal syndrome	*	*	0.1	0.1	11	16	25.0	50.0	75.0	66.7	25.0	0.0	0.0	33.3	0.0	50.0	75.0	16.7
Tubular necrosis	114	131	1.8	2.3	2	11	51.8	60.3	78.9	79.4	14.0	14.5	7.0	6.1	15.8	20.6	9.6	10.7
Other renal disorders	205	210	3.3	3.6	13	12	60.5	52.4	74.1	80.0	19.5	11.0	6.3	9.0	57.6	51.4	5.4	3.8
Etiology uncertain	600	476	9.6	8.2	15	15	58.5	57.1	71.8	70.2	20.3	21.8	7.8	8.0	39.3	44.1	3.2	1.5
Missing	308	390	4.9	6.7	13	14	62.0	59.2	13.0	14.9	3.9	7.7	83.1	77.4	96.4	90.5	1.3	2.3

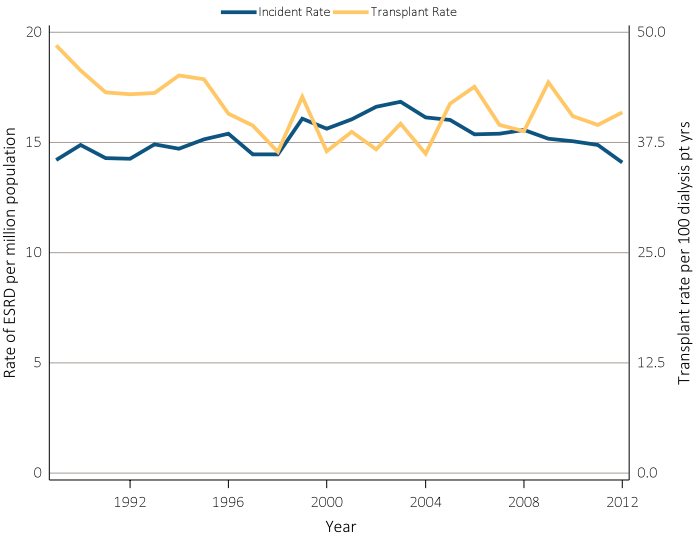
Data Source: Special analyses, USRDS ESRD Database. Abbreviations: AIDS, acquired-immune deficiency syndrome; ESRD, end-stage renal disease; GN glomerulonephritis; IgA immunoglobulin A; IgM, immunoglobulin M; MPGN, membranoproliferative glomerulonephritis; SBE, sub-acute bacterial endocarditis.

Transplantation

Overall, 43.6 percent of patients were transplanted within the first year of ESRD onset in 2008-2012. This is an increase of 41.4 percent from the 2003-2007 period.

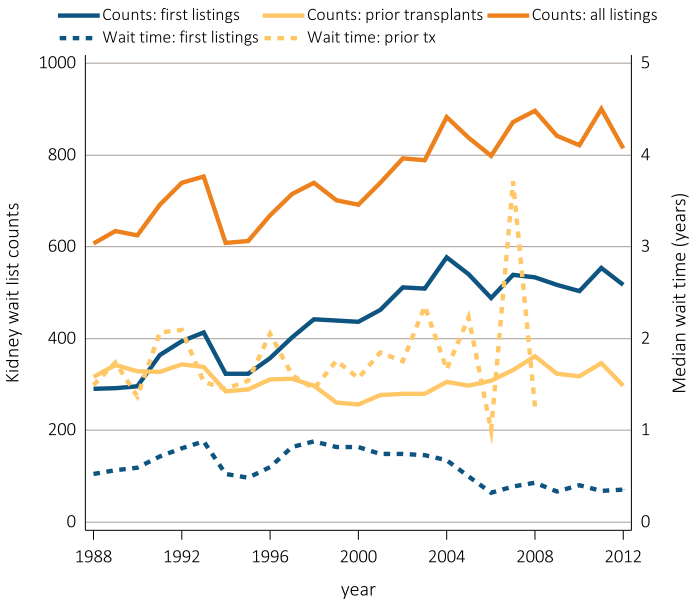
vol 2 Figure 7.2 Trends in pediatric transplantation (aged 0-19 years)

(a) Incidence rate of ESRD and transplant rate in children



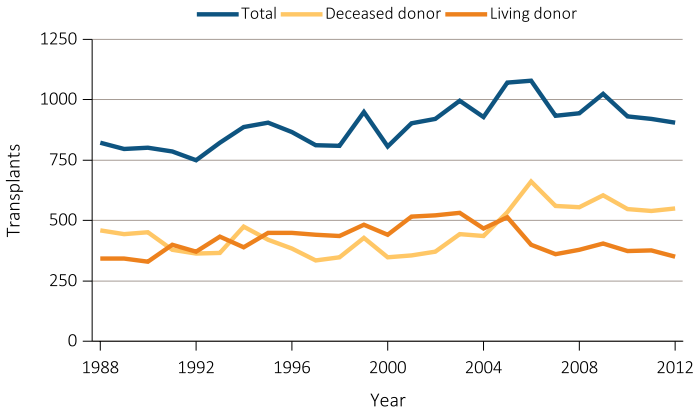
Data Source: Reference tables A1, E9, M1, and special analyses, USRDS ESRD Database. The rate of ESRD per million among the U.S. population aged 0-19 and the rate of transplantation in dialysis patients aged 0-19 at the time of transplant, 1989–2012. Abbreviation: ESRD, end-stage renal disease.

(b) Waiting list count



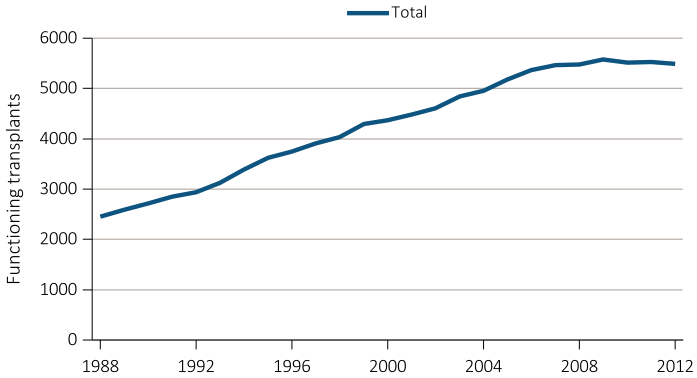
Data Source: Reference tables E2, E3, and special analyses, USRDS ESRD Database. The waiting list count provides the number of pediatric candidates aged 0-19 years on the Organ Procurement and Transplantation Network kidney transplant waiting list on December 31 of each year for first and subsequent kidney alone or kidney plus pancreas transplantation. Candidates listed at more than one center on December 31 are counted only once. There are no data available for median waiting list time for patients with prior transplants listed after 2008. Abbreviation: Tx, transplant.

(c) Total transplants



Data Source: Reference tables E8, E8(2), E8(3), and special analyses, USRDS ESRD Database. This figure represents kidney alone and kidney plus pancreas transplant counts for all pediatric candidates.

(d) Total functioning transplants



Data Source: Reference table D9. This is the cumulative count of functioning pediatric kidney and kidney-pancreas transplants.

The incident ESRD rate among the pediatric population peaked in 2003 and has been decreasing to 14.1 per million in 2012. The number of pediatric patients living with a kidney transplant has more than doubled from 2,455 in 1988 to 5,485 in 2012. The kidney transplant rate was highest in the initial reported years, with an average of 43.0 transplants per 100 dialysis patient years. In the most recent reporting window, 1999 to 2012, the transplant rate was 41.1 transplants per 100 dialysis patient years.

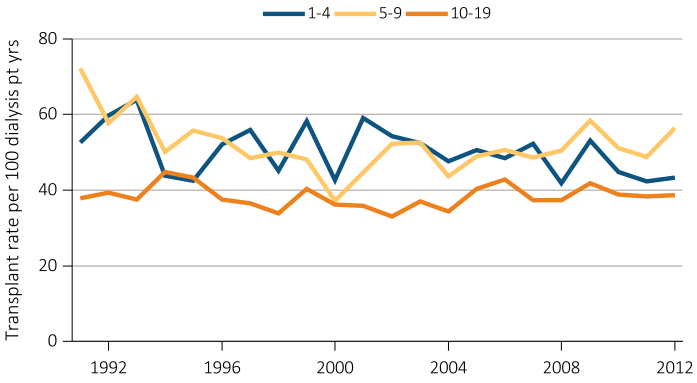
The total number of transplants plateaued in 2005. However, there has been a remarkable shift in donor characteristics coinciding with changes in the Organ Procurement and Transplantation Network organ allocation policy. Prior to 2005, most pediatric ESRD patients received living donor kidneys. After 2005, the majority of pediatric kidney transplants used deceased donor organs.

Over time, the pediatric kidney transplant waiting list has grown with patients awaiting their first transplant

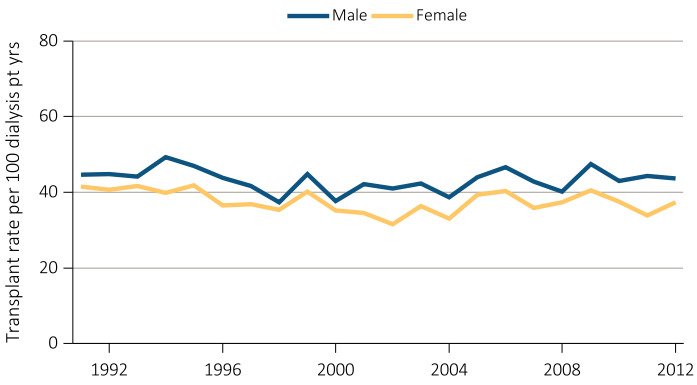
accounting for the majority of wait-listed patients. The number of patients with a previous transplant awaiting a kidney transplant remains stable. The median waiting time for patients who received their first transplant is shorter than those waiting for a repeat kidney transplant, reflecting the complex nature of repeat transplantation. Since 1997 there has been a decrease in the median waiting time for those listed for their first transplant with a flattening of the curve in 2005, which coincides with the change in the Organ Procurement and Transplantation Network organ allocation policy.

vol 2 Figure 7.3 Live and deceased donor transplants in pediatric patients (aged 0-19 years)

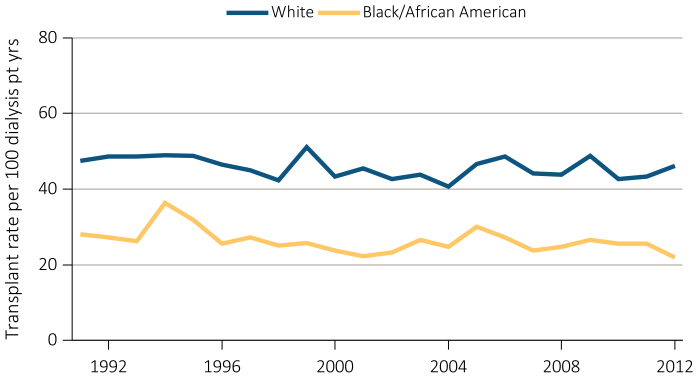
(a) Transplant rate in pediatric dialysis patients by age



(b) Transplant rate in pediatric dialysis patients by sex



(c) Transplant rate in pediatric dialysis patients by race



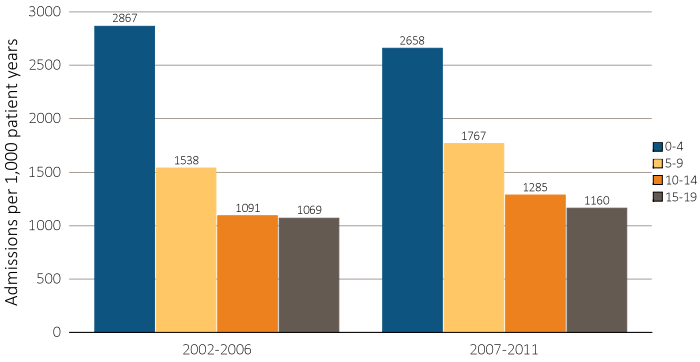
Data Source: Reference Table E9, and special analyses, USRDS ESRD Database. Includes transplant years between 1991–2012.

The transplant rate has been very stable in patients 10-19 years old, ranging from 33.1 to 44.9 per 100 dialysis patient years, and was 38.6 in 2012. Overall, transplant rates are very similar between the 1-4 year old and 5-9 year old cohorts. In 2012, there were 56.5 transplants per 100 dialysis patient years in 5-9 year olds and 43.3 transplants per 100 dialysis patient years in 1-4 year olds. Male dialysis patients have consistently been transplanted at a higher rate than female dialysis patients. The difference ranges from 2.1 transplants to 10.4 transplants per 100 dialysis patient years. There has been little change in the pediatric transplant rate in White and African American dialysis patients from 1991-2012. In 2012, the transplant rate was 46.2 per 100 White dialysis patient years and 22 per 100 African American dialysis patient years, for Whites and African-Americans respectively. The transplant rates are calculated using the number of pediatric dialysis patients. This analysis does not include up to 15 percent of the pediatric ESRD patients who receive pre-emptive transplants.

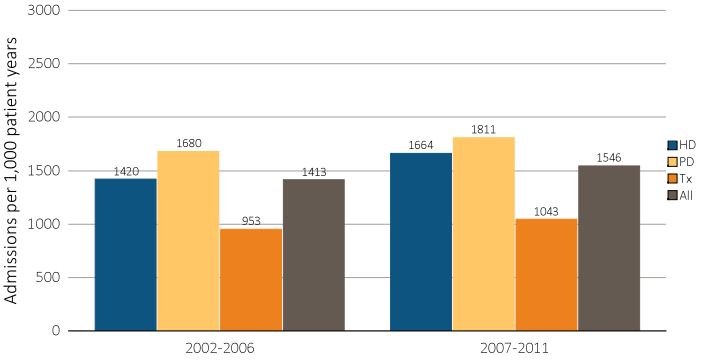
Hospitalizations

vol 2 Figure 7.4 Hospitalization rates in pediatric patients (aged 0-19 years)

(a) One-year adjusted all-cause hospitalization rates in pediatric patients by age



(b) One-year adjusted all-cause hospitalization rates in pediatric patients by modality

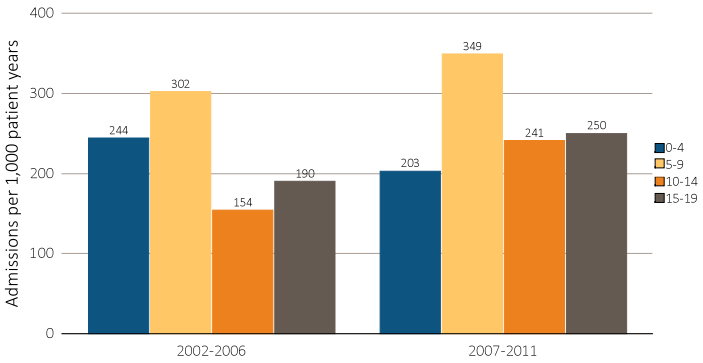


Data Source: Special analyses, USRDS ESRD Database. Includes incident ESRD patients in the years 2002-2011, surviving the first 90 days after ESRD initiation and followed from day 90. Adjusted for sex, race, primary diagnosis and Hispanic ethnicity. Ref: incident ESRD patients aged 0-19 years, 2010-2011. Abbreviations: HD, hemodialysis; PD, peritoneal dialysis; Tx, transplant.

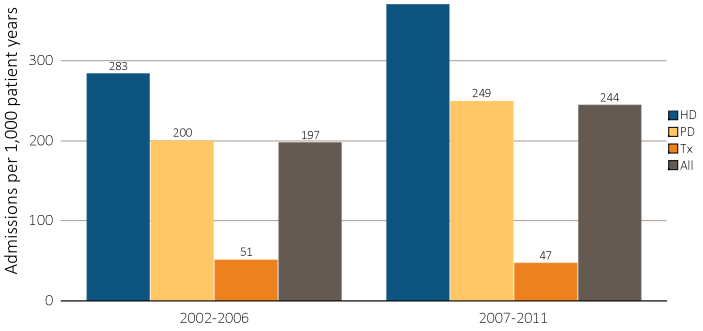
The one-year adjusted all-cause hospitalization rates from 2002–2006 to 2007–2011 in all children on renal replacement therapy rose 9.4 percent from 1,413 to 1,546 admissions per 1,000 patient years. In evaluating each modality the one-year adjusted all-cause hospitalization rates rose as follows: hemodialysis by 17.2 percent, peritoneal dialysis by 7.8 percent, and transplant by 9.4 percent between 2002–2006 and 2007–2011. In examining the rates of hospitalization by age, we find that the hospitalization rates were highest in those aged 0-4 years during both time periods. Despite significantly higher rates of hospitalization, children 0-4 years of age were the only age group that showed an improvement in hospitalization rates from 2002-2006 to 2007-2011.

vol 2 Figure 7.5 Cardiovascular hospitalization rates in children (aged 0-19 years)

(a) One-year adjusted cardiovascular hospitalization rates in pediatric patients by age



(b) One-year adjusted cardiovascular hospitalization rates in pediatric patients by modality

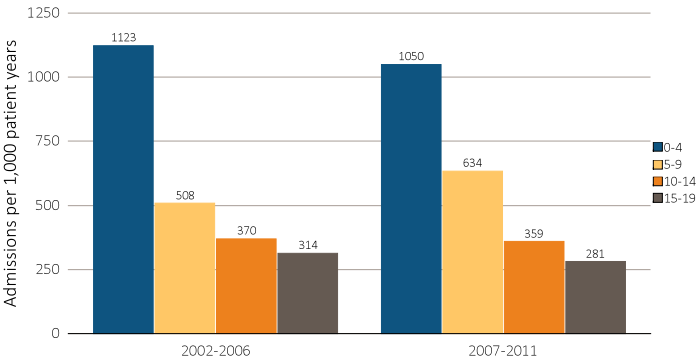


Data Source: Special analyses, USRDS ESRD Database. Includes incident ESRD patients in the years 2002-2011, surviving the first 90 days after ESRD initiation and followed from day 90. Adjusted for sex, race, primary diagnosis and Hispanic ethnicity. Ref: incident ESRD patients aged 0-19 years, 2010-2011. Abbreviations: HD, hemodialysis; PD, peritoneal dialysis; Tx, transplant.

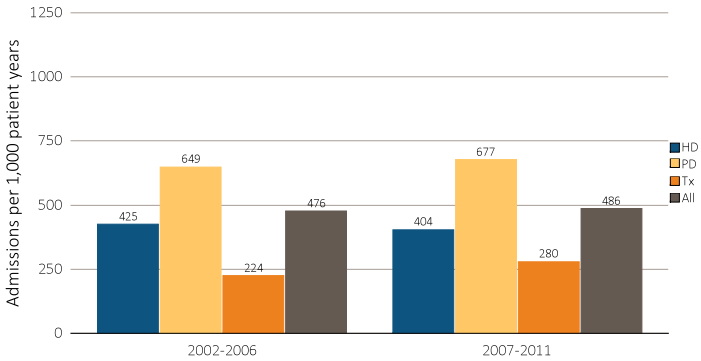
The overall cardiovascular hospitalization rate per 1,000 patient years from 2007-2011 was 244, which is 23.9 percent higher than during 2002-2006. Rates rose by 15.6 percent in ages 5-9, 56.5 percent in ages 10-14, and 31.6 percent in ages 15-19 in the most recent reporting window. Children less than 4 years of age showed a decrease of 16.8 percent in cardiovascular hospitalizations during the same time period. In evaluating modality, there was a 33.9 percent and 24.5 percent rise in cardiovascular hospitalization rates in hemodialysis and peritoneal dialysis patients, respectively. The rate of cardiovascular hospitalization in transplant patients fell by 7.8 percent, which was markedly less than dialysis-associated cardiovascular hospitalizations.

vol 2 Figure 7.6 Infection hospitalization rates in children (aged 0-19 years)

(a) One-year adjusted hospitalization rates for infection in pediatric patients by age



(b) One-year adjusted hospitalization rates for infection in pediatric patients by modality



Data Source: Special analyses, USRDS ESRD Database. Includes incident ESRD patients in the years 2002-2011, surviving the first 90 days after ESRD initiation and followed from day 90. Adjusted for sex, race, primary diagnosis and Hispanic ethnicity. Ref: incident ESRD patients aged 0-19 years, 2010-2011. Abbreviations: HD, hemodialysis; PD, peritoneal dialysis; Tx, transplant.

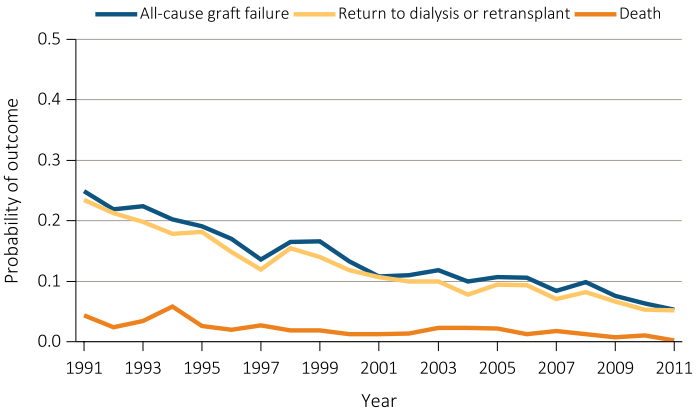
The overall rate of hospitalization for infection per 1,000 patient years was 486 during 2007-2011, which is 2.1 percent higher than during 2002-2006. The rates of infection-related hospitalizations fell by 6.5 percent in children 0-4 years of age, 3 percent in 10-14 years of age, and 10.5 percent in 15-19 years of age. Conversely, children between 5 to 9 years of age showed a rise in infection-related hospitalizations of 24.8 percent during the same time period. In examining modality, children on peritoneal dialysis had the highest rate of

infection-related hospitalization during 2002-2006 and 2007-2011. There was a decrease in infection-related hospitalization rates in hemodialysis patients from the 2002-2006 period to the 2007-2011 period by 4.9 percent. At the same time, there was an increase in infection-related hospitalization rates in patients on peritoneal dialysis and transplant patients by 4.3 percent and 25 percent respectively. While the rate of infection-related hospitalization rose the sharpest in transplant patients, the rates of infection-related hospitalizations in transplant patients were 69.3 percent of those on hemodialysis and 41.4 percent of those on peritoneal dialysis from 2007 to 2011.

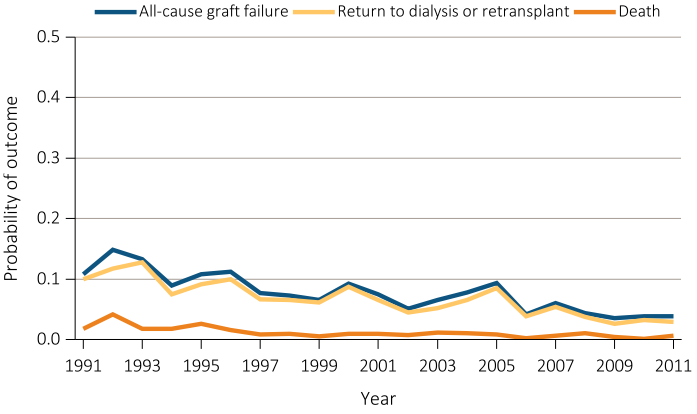
Transplant Outcomes

vol 2 Figure 7.7 One-year transplant outcomes by donor type (aged 0-19 years)

(a) Outcomes: deceased donor transplants in pediatric patients, adjusted



(b) Outcomes: live donor transplants in pediatric patients, adjusted



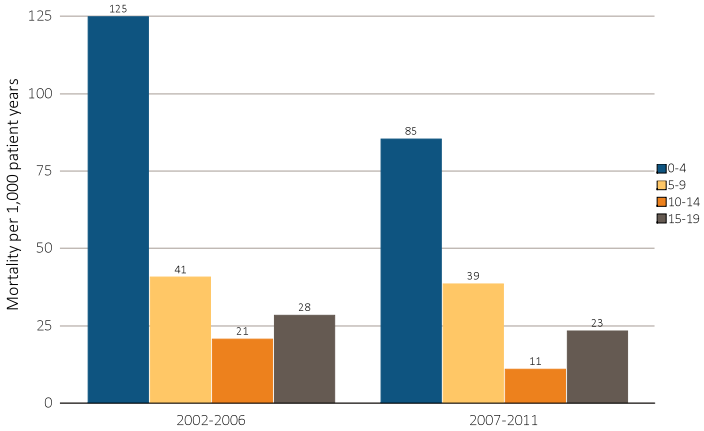
Data Source: 7.7a: Reference tables F2, F14, I26. 7.7b: Reference tables F8, F20, I32. Probabilities for all-cause graft failure and return to dialysis or retransplant are adjusted for age, sex, race, primary diagnosis, and first versus subsequent transplant. All-cause graft failure includes retransplant, return to dialysis, and death. The death outcome is not censored at graft failure, and includes deaths that occur after retransplant or return to dialysis. Probabilities of death are adjusted for age, sex, race, and primary diagnosis. The reference population for all-cause graft failure and return to dialysis or repeat transplantation is all pediatric patients receiving a kidney alone transplant in 2011. The reference population for death is incident pediatric ESRD patients in 2011.

The one-year deceased and living donor transplant outcomes for pediatric patients are presented in figures 7.7a and 7.7b, respectively. The first-year deceased and living donor transplant outcomes have steadily improved over the last 20 years. In the most recent reporting year, 2011, the probability of graft failure was 0.05 and of death was 0.01 for deceased donor transplants, while the one-year probability of graft failure was 0.04 and of death was 0.01 for living donor transplants. 2011 was the first year in which first-year mortality rates were the same for deceased and living donor pediatric transplant recipients.

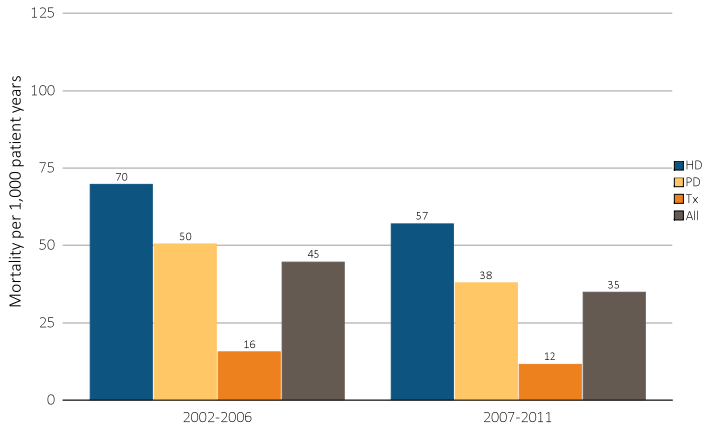
Mortality

vol 2 Figure 7.8 Mortality rates in children with ESRD (aged 0-19 years)

(a) One-year adjusted all-cause mortality rates in pediatric patients by age



(b) One-year adjusted all-cause mortality rates in pediatric patients by modality



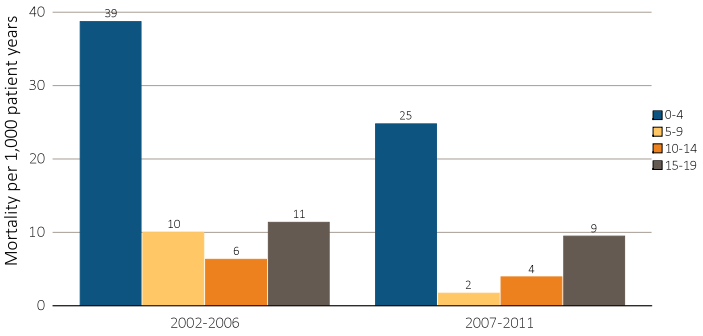
Data Source: Special analyses, USRDS ESRD Database. Incident dialysis and transplant patients defined at the onset of dialysis or the day of transplant without the 60-day rule; followed to December 31, 2012. Adjusted for age, sex, race, Hispanic ethnicity, and primary diagnosis. Ref: incident ESRD patients aged 0-19 years, 2010-2011. Abbreviations: HD, hemodialysis; PD, peritoneal dialysis; Tx ,transplant.

In 2007-2011, the one-year adjusted all-cause mortality was 35 per 1,000 patient years, which represents a

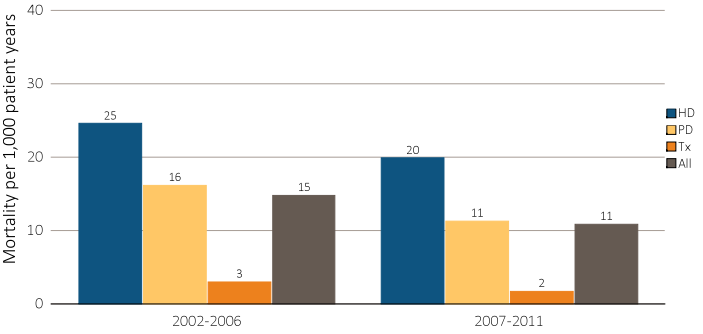
decrease of 22.2 percent from 2002-2006. The adjusted one-year all-cause mortality rates decreased in ages 0-4, 5-9, 10-14, and 15-19 by 32 percent, 4.9 percent, 47.6 percent, and 17.9 percent respectively. Adjusted one-year all-cause mortality rates by modality from 2002-2006 and 2007-2011 show decreases of 18.6 percent among hemodialysis patients, 24 percent among peritoneal dialysis patients, and 25 percent among transplant patients. Across all time windows, transplant-associated mortality is a small fraction compared with other modalities.

vol 2 Figure 7.9 Cardiovascular mortality in children with ESRD (aged 0-19 years)

(a) One-year adjusted all-cause cardiovascular mortality rates in pediatric patients by age



(b) One-year adjusted all-cause cardiovascular mortality rates in pediatric patients by modality

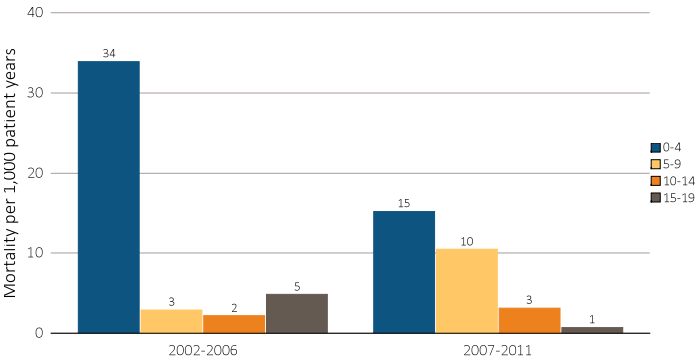


Data Source: Special analyses, USRDS ESRD Database. Incident dialysis and transplant patients defined at the onset of dialysis or the day of transplant without the 60-day rule; followed to December 31, 2012. Adjusted for age, sex, race, Hispanic ethnicity, and primary diagnosis. Ref: incident ESRD patients aged 0-19 years, 2010-2011. Abbreviations: HD, hemodialysis; PD, peritoneal dialysis; Tx, transplant.

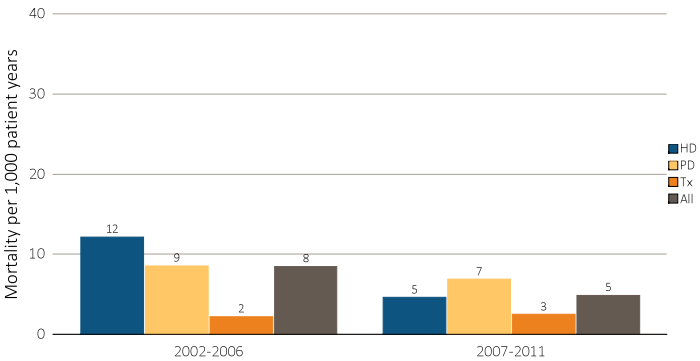
In 2007 to 2011, the one-year adjusted cardiovascular mortality was 11 per 1,000 patients years, which was a decrease of 26.7 percent from the 2002-2006 period. The adjusted one-year cardiovascular mortality decreased across all age groups: ages 0-4 years by 35.9 percent, ages 5-9 years by 80 percent, ages 10-14 years by 33.3 percent, and ages 15-19 by 18.2 percent. Those 0-4 years of age continued to have the highest adjusted one-year cardiovascular mortality. Examining adjusted one-year cardiovascular mortality across the periods 2002-2006 and 2007-2011 by modality, the rate decreased by 20 percent in hemodialysis, 31.3 percent in peritoneal dialysis, and 33.3 percent in transplant patients. During 2007 to 2011, one-year adjusted cardiovascular mortality rates in transplanted children were a fraction of the rates in dialysis-dependent children.

vol 2 Figure 7.10 Infection-related mortality in children with ESRD (aged 0-19 years)

(a) One-year adjusted rates of mortality due to infection in pediatric patients by age



(b) One-year adjusted rates of mortality due to infection in pediatric patients by modality



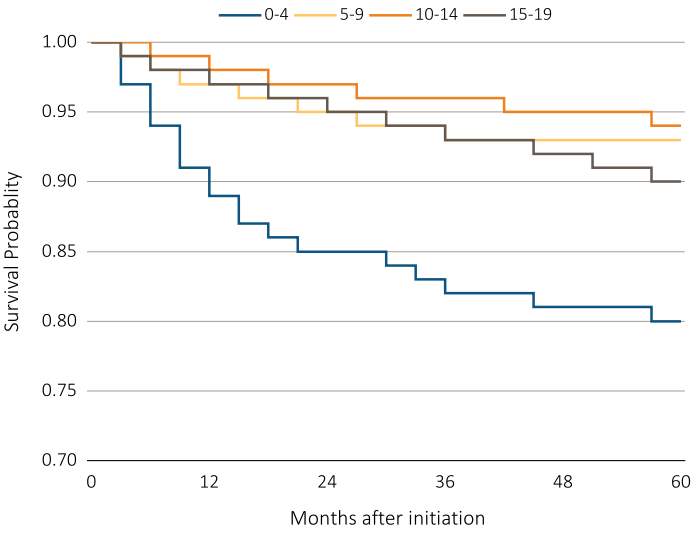
Data Source: Special analyses, USRDS ESRD Database. Incident dialysis and transplant patients defined at the onset of dialysis or the day of transplant without the 60-day rule; followed to December 31, 2012. Adjusted for age, sex, race, Hispanic ethnicity, and primary diagnosis. Ref: incident ESRD patients aged 0-19 years, 2010-2011. Abbreviations: HD, hemodialysis; PD, peritoneal dialysis; Tx, transplant.

In 2007 to 2011, the one-year adjusted infection-related mortality rate decreased by 37.5 percent from that of the 2002 to 2006 period. The adjusted one-year infection-related mortality rate decreased in those 0-4 years of age by 55.9 percent. In the remaining age groups the overall rates remained low. Those 0-4 years of age continued to have the highest adjusted one-year infection-related mortality rate. Examining the adjusted one-year all infection-related mortality rates between the periods 2002-2006 and 2007-2011 by modality, the one-year infection-related mortality rate decreased by 58.3 percent in hemodialysis patients and 22.2 percent in peritoneal dialysis patients. During

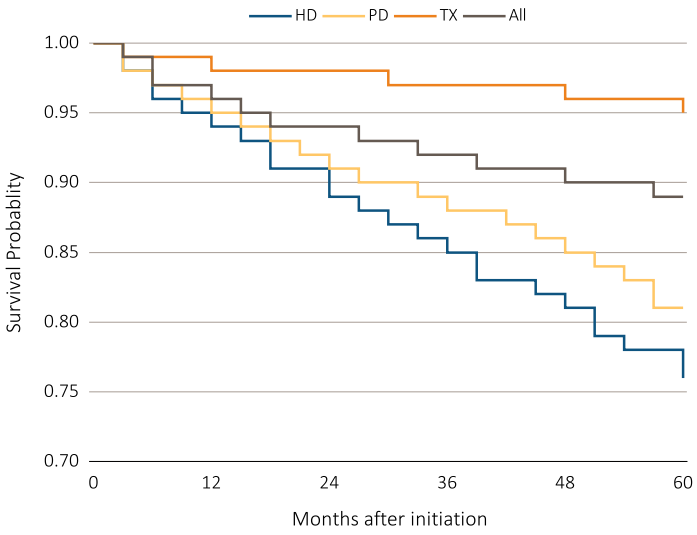
2007-2011, transplant patients had one-year adjusted infection-related mortality rates that were 60 percent of the hemodialysis patient mortality rates and 42.9 percent of peritoneal dialysis patient mortality rates.

vol 2 Figure 7.11 Pediatric ESRD patient survival by age and modality (aged 0-19 years)

(a) Adjusted 5 year survival in pediatric patients from day 1 by age, 2003-2007



(b) Adjusted 5 year survival in pediatric patients from day 1 by modality, 2003-2007



Data Source: Special analyses, USRDS ESRD Database. Incident dialysis and transplant patients defined at the onset of dialysis or the day of transplant without the 60-day rule; followed to December 31, 2012. Adjusted for age, sex, race, Hispanic ethnicity, and primary diagnosis. Ref: incident ESRD patients aged 0-19 years, 2010-2011. Abbreviations: HD, hemodialysis; PD, peritoneal dialysis; Tx, transplant.

For patients beginning ESRD therapy in 2003 to 2007, the probability of five year survival was 0.89. The probability of surviving five years by age was 0.8 for ages 0-4, 0.93 for ages 5-9, 0.94 for ages 10-14, and 0.9 for ages 15-19. Transplant patients had the highest probability of surviving five years with 0.95, as compared to 0.76 in hemodialysis patients, and 0.81 in peritoneal dialysis patients.

Summary

This pediatric chapter of the Annual Data Report includes over 20 years of ESRD care in children. In the most recent reporting year, there was a 5.8 percent decrease in the incidence and a 1.3 percent decrease in the prevalence of ESRD. Kidney transplantation remains the most common modality for treatment of prevalent ESRD. Pediatric kidney transplant recipients continue to have the best outcomes regarding hospitalization rates and mortality compared with other modalities. There are many opportunities to improve our understanding of the pediatric ESRD experience in future USRDS Annual Data Reports, special analyses and special studies including broad topics surrounding vascular access, acute kidney injury, and pre-ESRD chronic kidney disease.