



Quickly take me up
into the bright child
of your mind.

E.E. CUMMINGS,
The Enormous Room



PEDIATRIC ESRD

Incident rates of ESRD in children have risen two to three percent over the past decade, and the odds of developing ESRD are as much as 2.2 times greater in some states than in others (fig 6.2).

The primary causes of ESRD in pediatric patients are glomerulonephritis and cystic/congenital/hereditary diseases. Boys have a higher likelihood of renal failure from these latter causes than do girls (fig 6.4).

The modalities for treatment of pediatric ESRD vary with patient age and particularly with race (figs 6.9–10). White pediatric patients are more likely to receive a renal transplant than patients in other racial groups, and non-whites are twice as likely to be on hemodialysis as whites. After two years on ESRD treatment black children have an almost equal chance of being treated with either dialysis or transplant whereas more than 60% of white children have

received a transplant. Some of these disparities may be partially explained by the availability of organs for renal transplants, as demonstrated in Chapter Seven (figs 7.1 and 7.3). Since ESRD incidence rates are two to three times higher for black children than for whites, the organ donation rates from the general population would need to be at a comparable rate for there to be a similar proportion of transplants. The ability to match an organ immunologically may also be different in black children compared to whites.

Most young patients with a first renal transplant receive that transplant from a living donor, a pattern opposite to that in the adult population. Children with a repeat renal transplant, in contrast,

are more likely to receive a cadaveric organ (fig 6.11). Pediatric patients younger than five have a 93% survival rate after transplantation in contrast to a 69% rate for children of the same age on dialysis (fig 6.12). Other pediatric age groups have five-year survivals on dialysis of greater than 81% (fig 6.12).

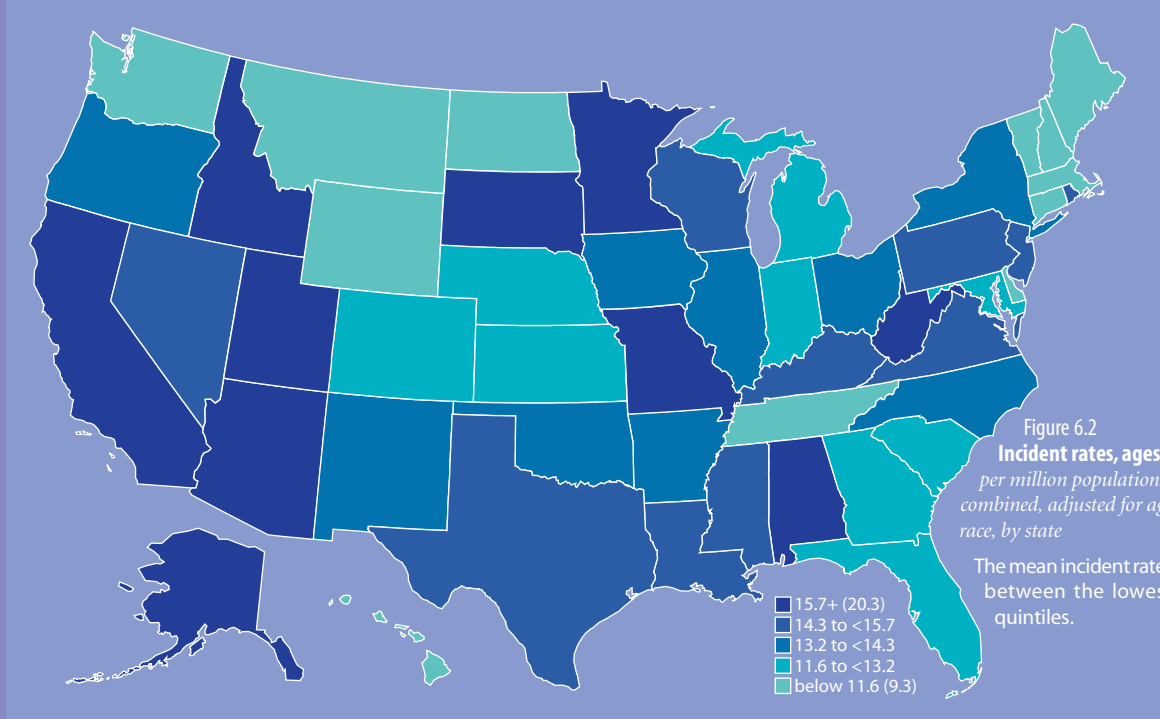
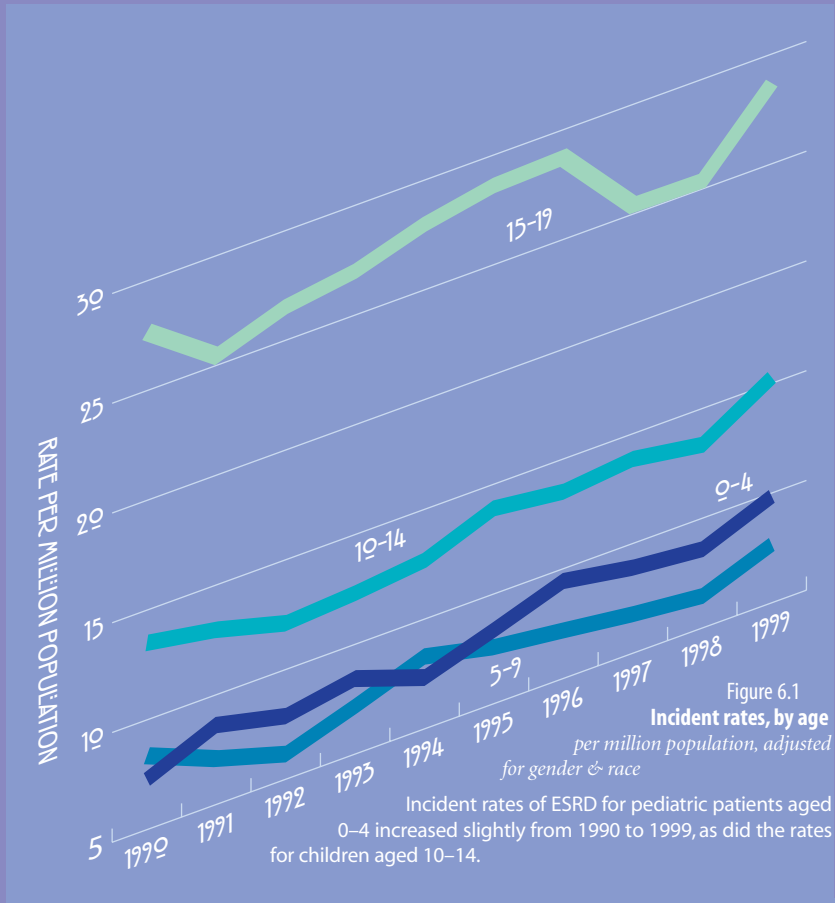
Hospitalizations for children are directly related to age (figs 6.15–17) and are dominated by infectious complications. Although the number of prevalent deaths is low, female children are generally at a greater risk than males regardless of modality (figs 6.18–20). The reasons for these differences have not been explored, but may be related to a higher degree of anemia in girls than in boys. At initiation of dialysis children have lower hematocrits than adults (fig 2.39), with female children having the lowest levels. These findings are present even though children are the most likely to receive EPO before ESRD, as documented on the Medical Evidence form 2728 (fig 2.25). These associations suggest that girls may be iron deficient to a greater degree than boys or adults. Also, the prolonged and more severe anemia may predispose these children to a greater risk of myocardial hypertrophy and subsequent fibrosis, which could place them at risk for arrhythmic disorders. Further investigations are needed to more completely understand the pathobiology of these patients.

COUNTS	1991-1995		1994-1996		1997-1999	
	INCIDENT	PREVALENT	INCIDENT	PREVALENT	INCIDENT	PREVALENT
0-4	493	1,165	502	1,262	529	1,216
5-9	380	2,258	452	2,468	423	2,581
10-14	686	3,708	785	4,453	840	4,812
15-19	1,423	7,104	1,644	8,221	1,616	8,747
RATES PER MILLION POPULATION						
0-4	8.3	19.6	8.4	21.3	9.1	21.0
5-9	6.8	40.1	7.7	42.0	7.0	42.4
10-14	12.5	66.8	13.4	76.9	14.2	81.1
15-19	26.3	133.7	28.4	144.2	26.5	144.1

Table 6.1

Incident & prevalent counts & rates

For patients younger than ten there was little variation in incident and prevalent rates per million population through the 1990s. For older pediatric patients, in contrast, prevalent rates have risen, possibly a reflection of improved survival after transplantation (see Chapter Seven).



INCLUDED IN THIS CHAPTER ♦ A graph of incident rates, and graphs of patient distribution by modality, primary diagnosis, gender, race, and age ♦ Graphs showing treatment modality two years following the onset of ESRD ♦ A graph of the number of first and repeat transplants, and Kaplan-Meier survival curves ♦ Graphs of hospital admissions for infection, by modality, age, and gender ♦ Graphs of causes of death by gender and race

Figure 6.3
Incident rates, by race, age, & gender

1997–1999 combined, unadjusted

Black pediatric patients across all age groups have higher incident rates of end-stage renal disease compared to patients in other racial groups, with the highest incident rates among pediatric patients occurring in blacks aged 15–19.

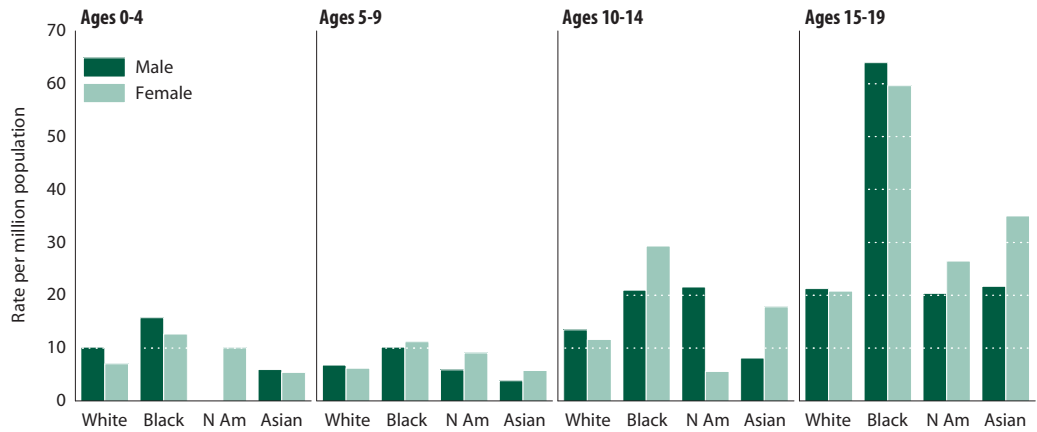


Figure 6.4
Number of patients within primary diagnosis group, by gender: dialysis

incident patients aged 0–19, 1995–1999 combined

Glomerulonephritis and cystic/hereditary/congenital diseases are the most frequent primary diagnoses in the pediatric ESRD population, with both occurring more in boys than girls.

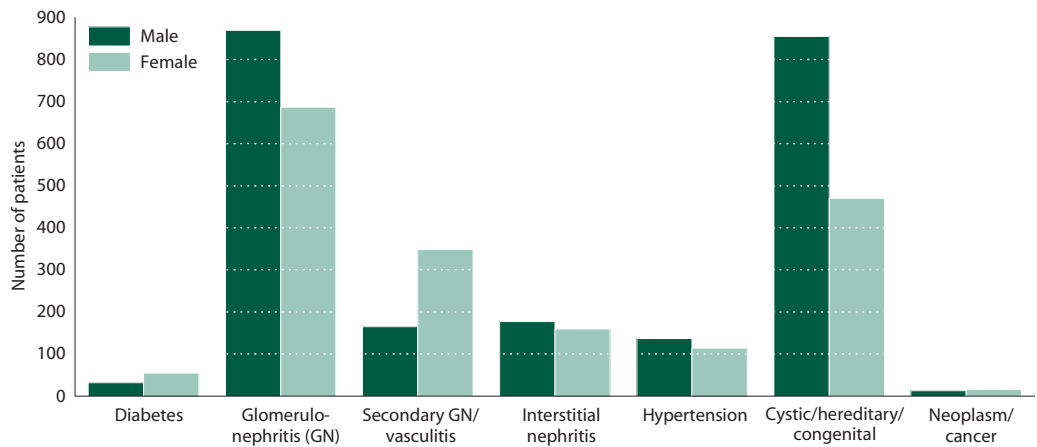
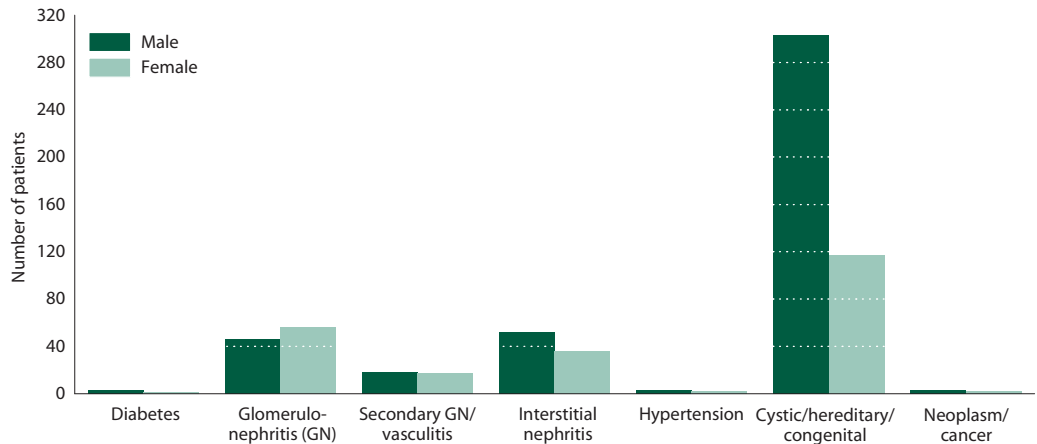


Figure 6.5
Number of patients within primary diagnosis group, by gender: transplant

incident patients aged 0–19, 1995–1999 combined

In the pediatric patients who receive a transplant as their initial modality, cystic/hereditary/congenital diseases are the primary cause of ESRD, and occur in more than twice as many boys as girls.



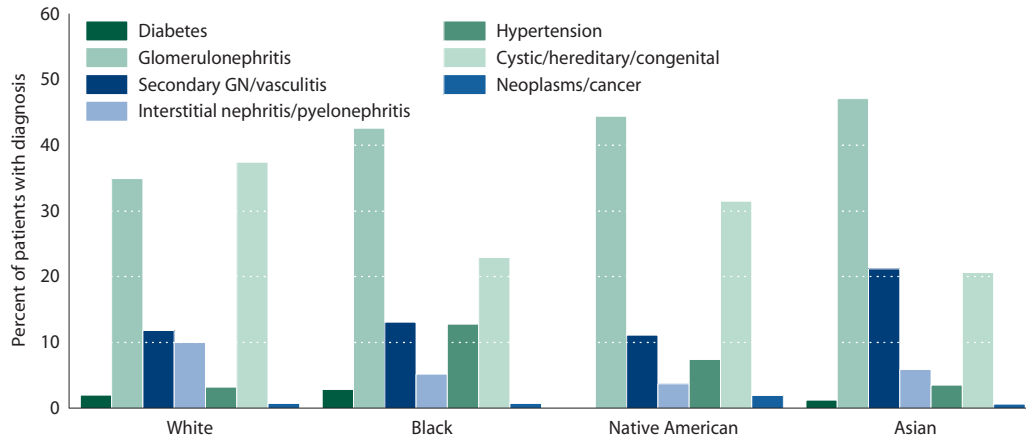


Figure 6.6
Distribution of primary diagnosis within racial group: dialysis
incident patients aged 0–19, 1995–1999 combined

Glomerulonephritis is the most frequent primary diagnosis in black, Native American, and Asian pediatric patients. Cystic/hereditary/congenital diseases occur most often in young white and Native American patients, while Asian children are almost twice as likely than children of other races to have a primary diagnosis of secondary glomerulonephritis/vasculitis.

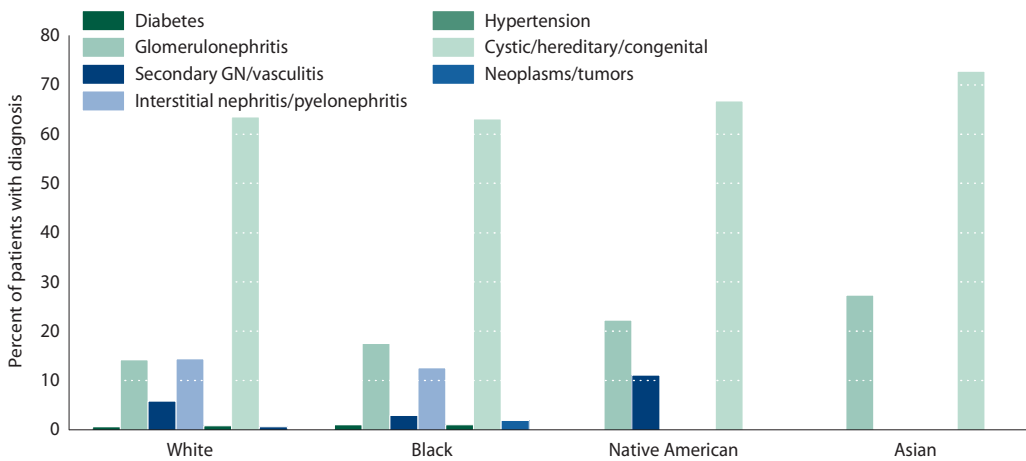


Figure 6.7
Distribution of primary diagnosis within racial group: transplant
incident patients aged 0–19, 1995–1999 combined

Cystic/hereditary/congenital disease is by far the most frequent diagnosis among pediatric patients who receive a transplant at the beginning of ESRD. No Native American or Asian patients with diabetes, secondary glomerulonephritis/vasculitis, interstitial nephritis/pyelonephritis, or neoplasms/tumors were reported.

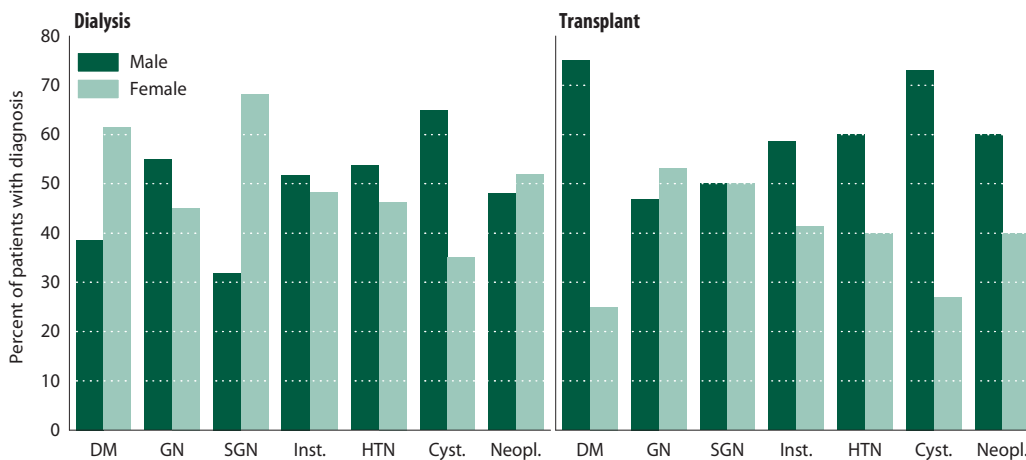


Figure 6.8
Gender distribution within primary diagnosis group
incident patients aged 0–19, 1995–1999 combined

Diabetes, glomerulonephritis, secondary glomerulonephritis, interstitial nephritis/pyelonephritis, hypertension, cystic/hereditary/congenital diseases, and neoplasms/tumors are abbreviated along the axis.

Distribution within primary diagnosis categories differs greatly between the modalities. Girls account for 61% of diabetic children on dialysis, and 68% of those with secondary glomerulonephritis. Among transplant patients, however, boys account for 75% of diabetics, and the population with secondary glomerulonephritis is split evenly between the genders.

Figure 6.9
Treatment modality two years following ESRD onset, within age group

incident patients aged 0–19, 1995–1997 combined

At two years following the onset of ESRD, transplant is by far the most frequent modality among all pediatric age groups. Among patients aged 5–9, 72% have received a transplant; that number is 47%, however, among patients aged 15–19, and 36% of patients in this age group are on hemodialysis two years after beginning ESRD.

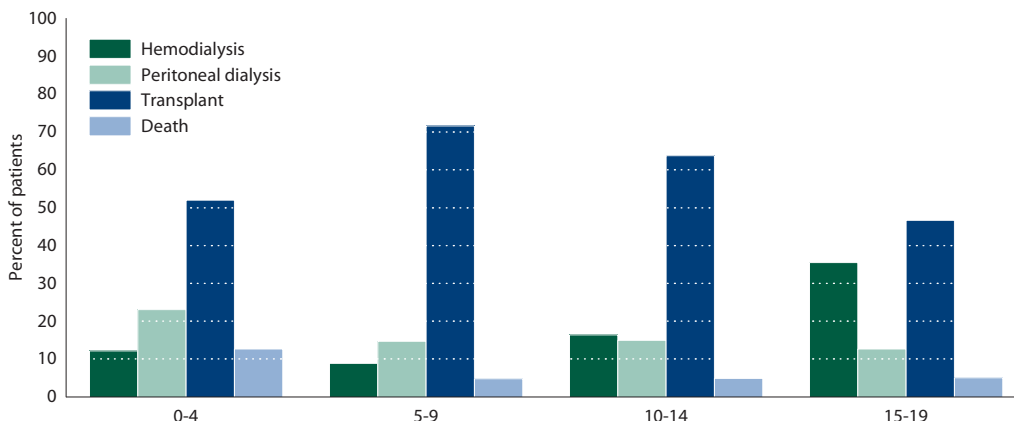


Figure 6.10
Treatment modality two years following ESRD onset, within race group

incident patients aged 0–19, 1995–1997 combined

White children are most likely to have received a transplant by the end of their second year of ESRD, followed by Native Americans. The percentage of black and Asian children with a transplant at two years is only slightly higher than that of their peers on hemodialysis.

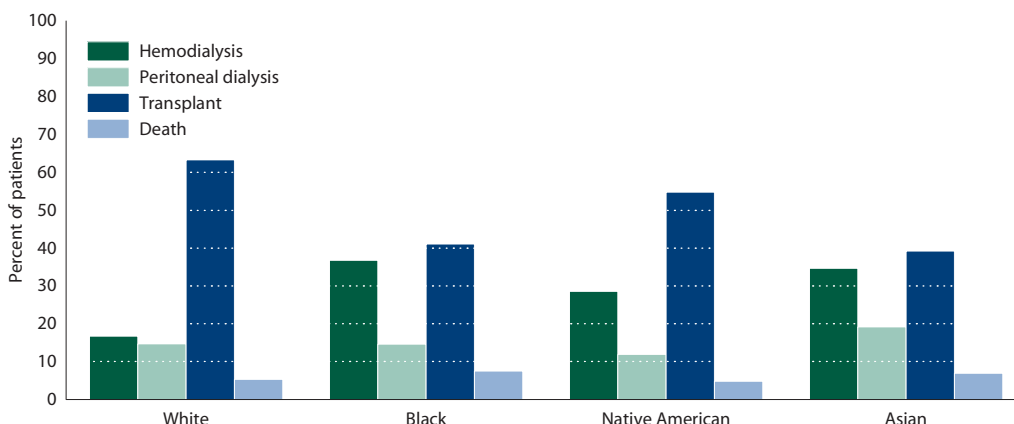
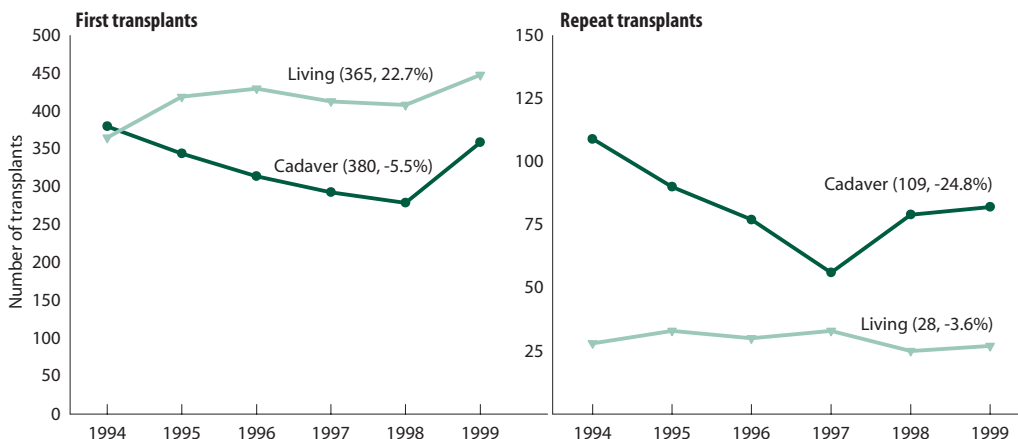


Figure 6.11
Total first & repeat transplants, by donor source

incident patients aged 0–19

Includes patients not eligible for Medicare enrollment. The number of transplants in 1994, and the percent change between 1994 and 1999, are indicated next to the lines.

First transplantation rates among pediatric patients have been relatively steady for transplants from living donors, while the rate of cadaveric transplants declined from 1994 to 1998. Both rates increased in 1999. The number of living unrelated transplants in pediatric patients is extremely small, and reduced organ availability limits the number of repeat transplants in these patients.



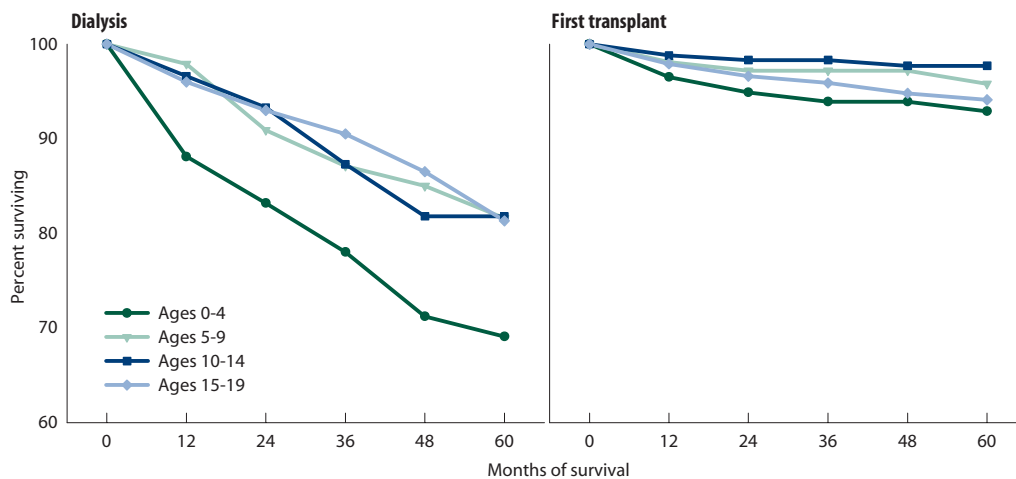


Figure 6.12
Kaplan-Meier five-year patient survival, by age
incident dialysis & transplant patients, 1993–1994 combined

By five years after the start of ESRD, 69% of children whose ESRD began between birth and age 4 are still alive on dialysis, compared to 82% of children in other age groups. For patients who receive their first transplant, survival is best for those aged 10–14 years and lowest for those aged 0–4 years. All age groups, however, have over 93% survival at five years.

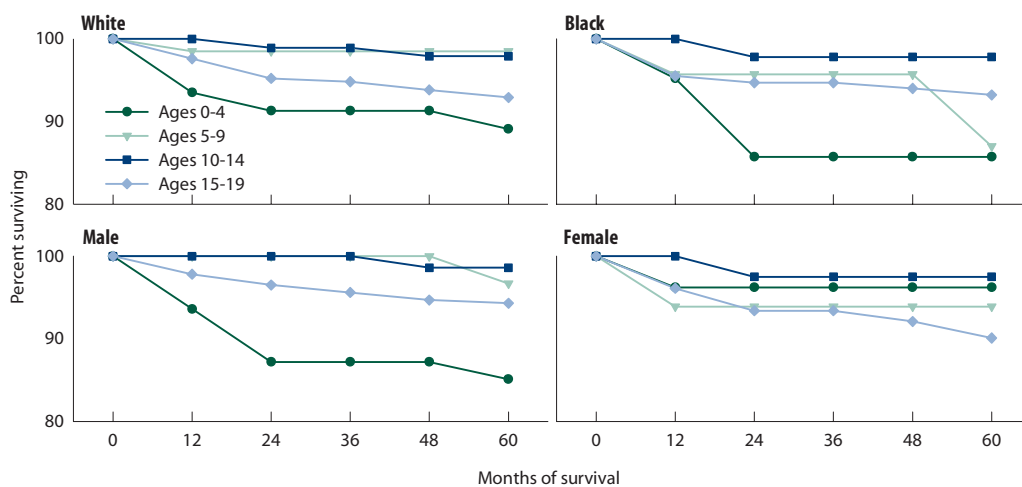


Figure 6.13
Kaplan-Meier five-year patient survival after first transplantation, by race & gender: cadaveric transplants
1993–1994 combined

Because of the small number of patients, data are not shown for Native American or Asian patients.

The lowest five-year survival probabilities for cadaveric transplants occur in black and male patients aged 0–4. Overall, children aged 10–14 have the highest probabilities of survival across racial and gender groups.

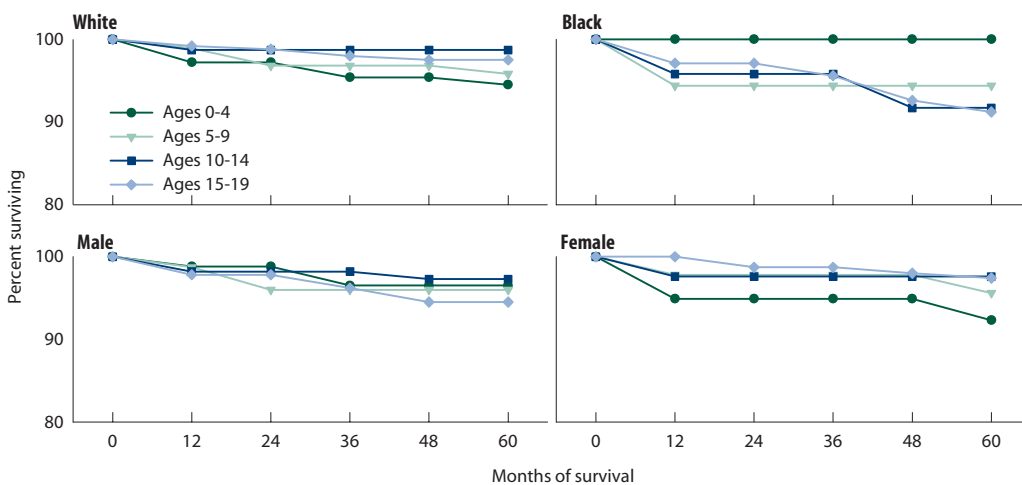


Figure 6.14
Kaplan-Meier five-year patient survival after first transplantation, by race & gender: living donor transplants
1993–1994 combined

Because of the small number of patients, data are not shown for Native American or Asian patients.

Survival probabilities for pediatric patients receiving transplants from living donors are similar across age groups for whites and for males.

Figure 6.15
Admissions for infection (overall), by age, gender, & time on ESRD: hemodialysis
incident & prevalent hemodialysis patients, 1997–1999 combined

The rates of admissions for infection vary little between the genders. Among age groups, however, rates are highest for children younger than ten years of age who have had ESRD for less than one year, and for children aged 5–9 who have had ESRD less than five years.

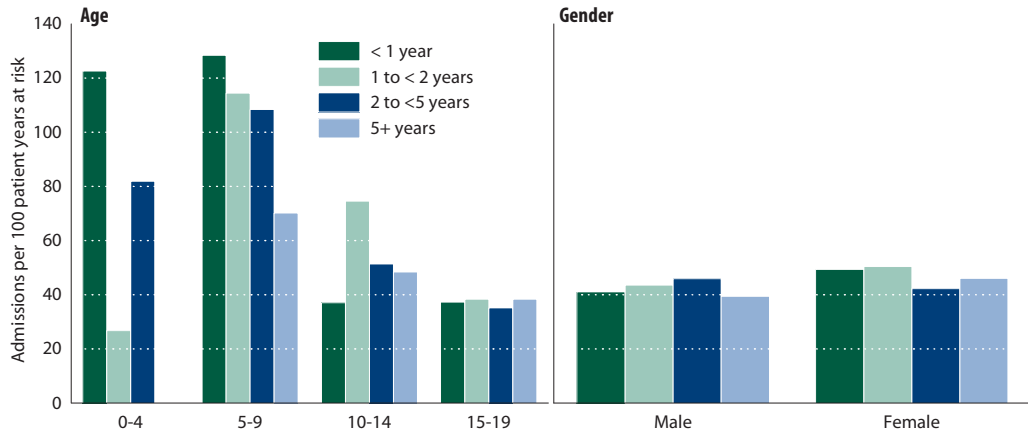


Figure 6.16
Admissions for infection (overall), by age, gender, & time on ESRD: peritoneal dialysis
incident & prevalent peritoneal dialysis patients, 1997–1999 combined

In all age and gender groups except ages 5–9, pediatric patients on peritoneal dialysis have higher rates of admission for infection than their counterparts on hemodialysis. Rates are highest for the youngest patients (ages 0–4), and for children aged 5–9 who have had ESRD for more than five years. Females have slightly higher admission rates than males, and these rates increase with longer patient vintages.

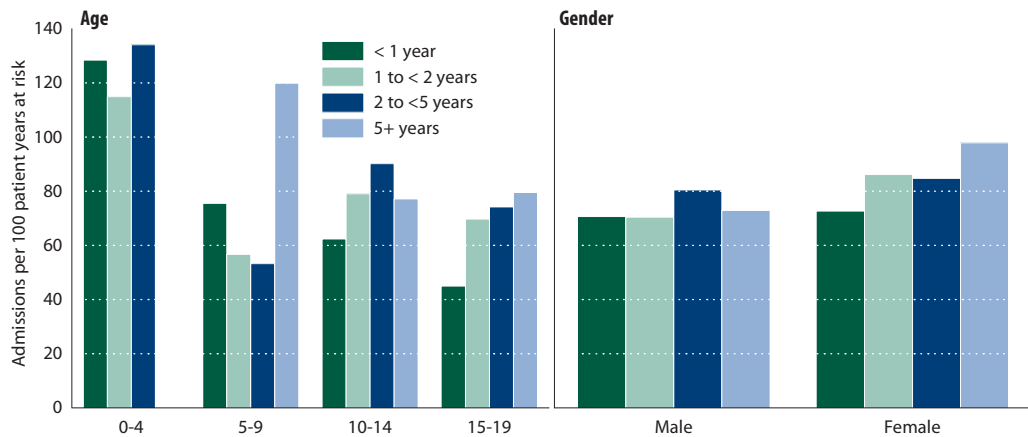
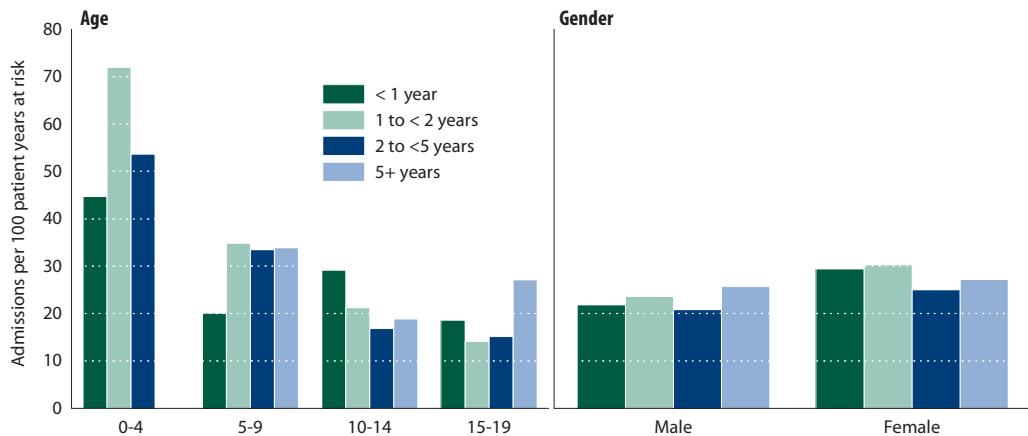


Figure 6.17
Admissions for infection (overall), by age, gender, & time on ESRD: transplant
incident & prevalent transplant patients, 1997–1999 combined

Transplant-related admissions for infection in pediatric patients are the lowest within all modalities, at about half of those of the other dialytic therapies. Age is a significant factor, with transplant patients younger than ten having higher infectious hospitalization rates than their older counterparts.



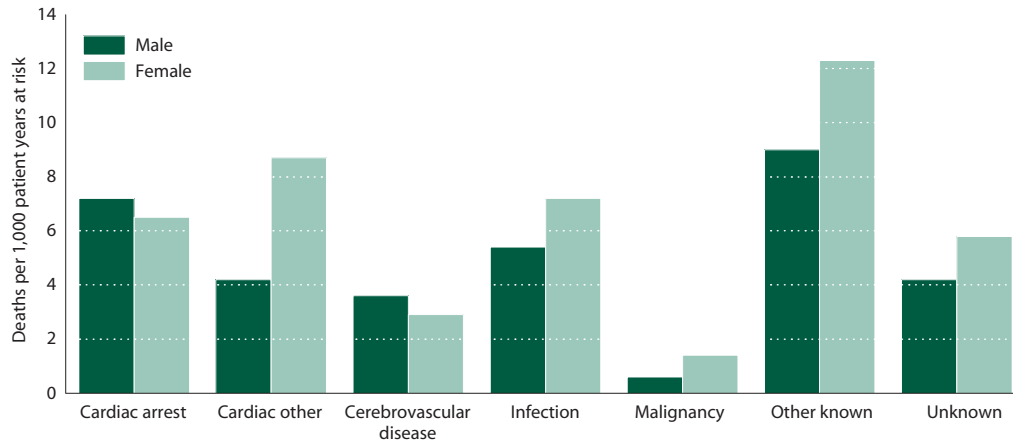


Figure 6.18
Causes of death, by gender:
hemodialysis
*prevalent patients aged 0–19,
 1997–1999 combined*

The “other known” category accounts for the highest number of deaths in pediatric patients on hemodialysis. Death rates are higher for females than for males in this category, “cardiac other,” and infectious death.

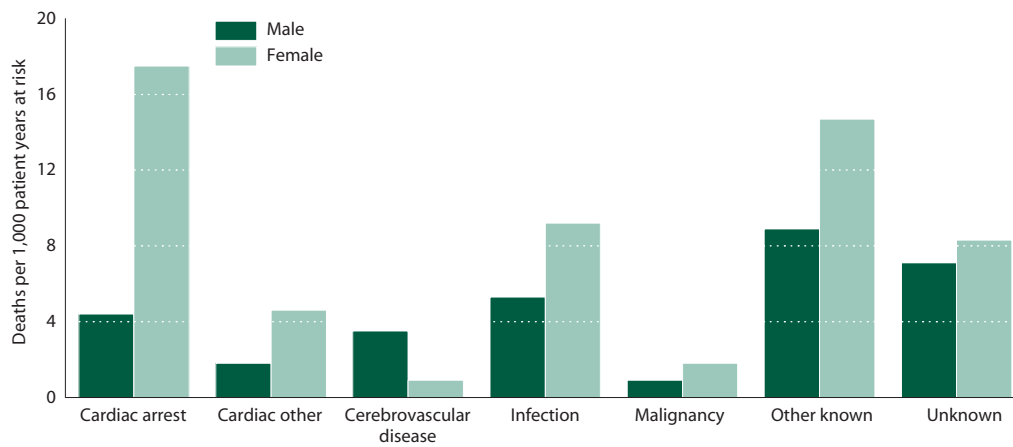


Figure 6.19
Causes of death, by gender:
peritoneal dialysis
*prevalent patients aged 0–19,
 1997–1999 combined*

Female patients on peritoneal dialysis have a more than four-fold difference in rates of death due to cardiac arrest compared to their male counterparts. They also have higher rates of death due to infection and to other cardiac and other known causes.

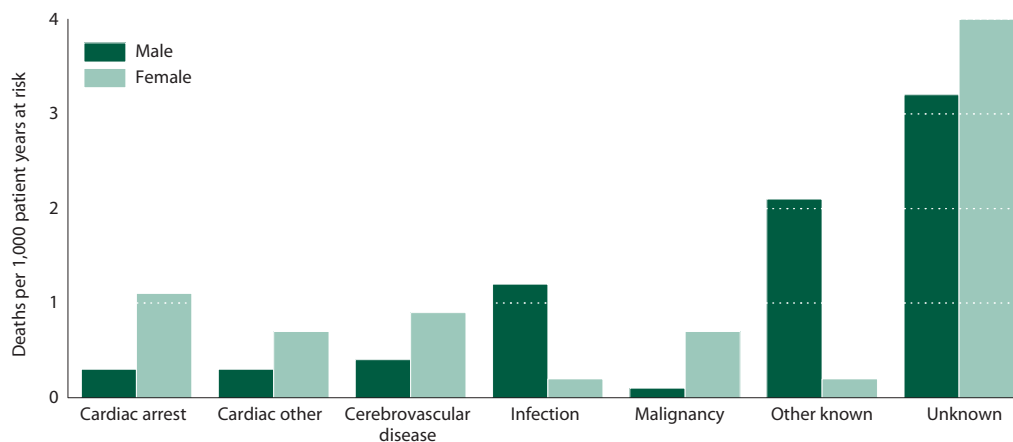


Figure 6.20
Causes of death, by gender:
transplant
*prevalent patients aged 0–19,
 1997–1999 combined*

While mortality rates for pediatric patients with transplants are low, girls again have higher rates than boys in many categories. Males do have higher rates of mortality due to infection and other known causes.

Transplant centers frequently do not receive notification about the deaths of patients who are followed by the primary care doctors. Because graft survival is longest in pediatric patients, causes of death for these patients are frequently unreported.

Figure 6.21
Causes of death, by race:
hemodialysis

*prevalent patients aged 0–19,
 1997–1999 combined*

Because of the small number of patients, data are not shown for Native American or Asian patients.

The rate of mortality due to cardiac arrest is almost three times higher among black pediatric patients on hemodialysis than in their white counterparts. White patients, however, have slightly higher rates of death due to infection and to other cardiac and other known causes.

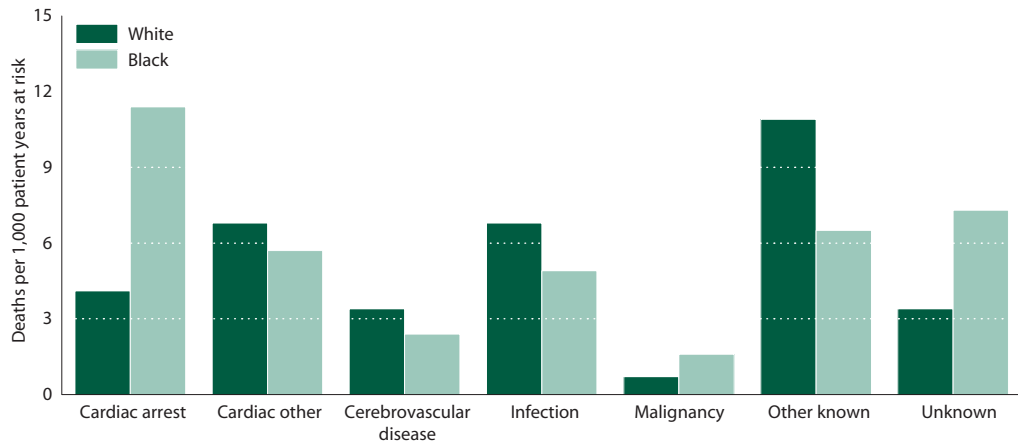


Figure 6.22
Causes of death, by race:
peritoneal dialysis

*prevalent patients aged 0–19,
 1997–1999 combined*

Because of the small number of patients, data are not shown for Native American or Asian patients.

In contrast to rates in the hemodialysis population, rates of mortality due to cardiac arrest show little difference between the races for pediatric patients on peritoneal dialysis. Mortality due to infection or to other known causes is more frequent among black patients, while deaths related to cerebrovascular disease or to other cardiac events occur more often in white patients.

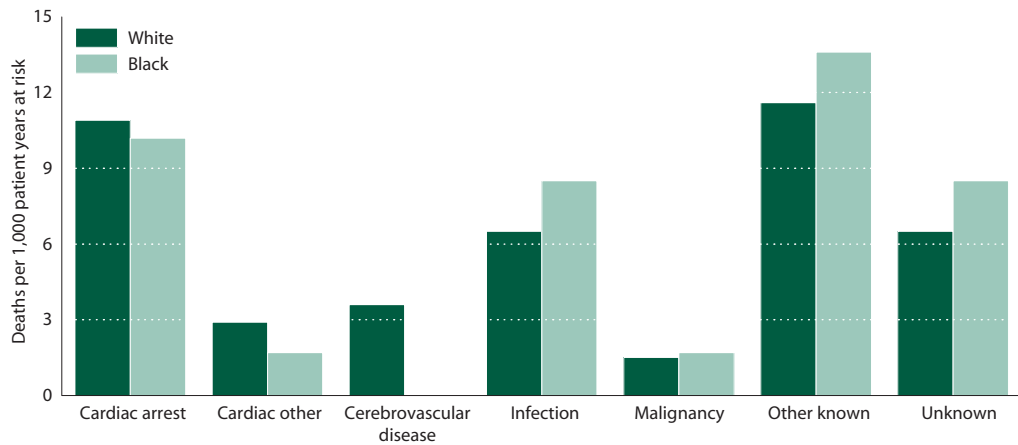


Figure 6.23
Causes of death, by race:
transplant

*prevalent patients aged 0–19,
 1997–1999 combined*

Because of the small number of patients, data are not shown for Native American or Asian patients.

Black patients have higher mortality rates on transplant for all causes of death except “other known,” in several categories (cardiac other, cerebrovascular disease, and infection) rates for blacks are more than twice as high as those for whites.

