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# OPTN/SRTR 2011 Annual Data Report: kidney

**ABSTRACT** A shortage of kidneys for transplant remains a major problem for patients with end-stage renal disease. The number of candidates on the waiting list continues to increase each year, while organ donation numbers remain flat. Thus, transplant rates for adult wait-listed candidates continue to decrease. However, pretransplant mortality rates also show a decreasing trend. Many kidneys recovered for transplant are discarded, and discard rates are increasing. Living donation rates have been essentially unchanged for the past decade, despite introduction of desensitization, non-directed donations, and kidney paired donation programs. For both living and deceased donor recipients, early posttransplant results have shown ongoing improvement, driven by decreases in rates of graft failure and return to dialysis. Immunosuppressive drug use has changed little, except for the Food and Drug Administration approval of belatacept in 2011, the first approval of a maintenance immunosuppressive drug in more than a decade. Pediatric kidney transplant candidates receive priority under the Share 35 policy. The number of pediatric transplants peaked in 2005, and decreased to a low of 760 in 2011. Graft survival and short-term renal function continue to improve for pediatric recipients. Posttransplant lymphoproliferative disorder is an important concern, occurring in about one-third of pediatric recipients.

**KEY WORDS** End-stage renal disease, kidney transplant, transplant outcomes, transplant waiting list.

*This transplant impacted my life and the lives of my friends, family and community. I am especially grateful to be able to raise my son, to take him out of foster care and give him a good home and loving family.*

Towana, kidney/pancreas recipient

Perhaps the most striking highlight of the 2010 and 2011 data is how little has changed. Organ donation numbers are relatively flat and the waiting list continues to grow. The shortage of kidneys remains a major problem for patients with end-stage renal disease (ESRD). Thus, there are attempts to increase the donor pool, and the kidney donor profile index (KDPI), which reflects the overall quality of deceased donor kidneys, continues to increase, especially for expanded criteria donors (ECD) (Figures 2.11, 2.12).

## Adults

### **WAITING LIST**

The number of kidney transplant candidates on the waiting list continues to increase each year (Figure 1.1). In 2003, a major change in Organ Procurement and Transplantation Network (OPTN) kidney allocation policy allowed candidates listed as inactive to accumulate points for waiting time. As a consequence of this change, and of the increasing time between wait-listing and transplant, many transplant centers now list candidates before evaluation is complete. The number of candidates who are inactive at any time within 7 days of wait-listing increased from 718 in 2003 to 9,628 in 2011. The most common reasons for inactive status among these candidates were incomplete candidate work-up (69.0%), insurance issues (9.5%), and candidate too sick (7.7%) (Figure 1.3). Importantly, however, the number of active candidates on the waiting list at the end of each year continued to increase, from 7,404 in 2003 to 32,501 in 2011 (Figure 1.1).

The wait-listed population continues to age. Since 1998, candidates aged 50 years or older represent an increasing proportion of wait-listed candidates (Figure 1.4). From a patient perspective, the steady annual trend of increased wait-listing of prevalent dialysis patients of all ages is encouraging (Figure 1.6).

Increases in the number of candidates on the waiting list and relatively flat organ donation rates have resulted in steady decreases in transplant rates for adult wait-listed candidates since 1998 (Figure 1.7). In 1998, the deceased donor transplant rate was 20.6 transplants per 100 wait-list years, compared with 11.4 transplants per 100 wait-list years in 2011. As a con-

sequence, in the past 3 years, more than 20,000 wait-listed candidates have been removed from the waiting list because they died or became too sick to undergo transplant (Figure 1.8). A positive note is a steady trend toward decreasing pre-transplant mortality rates in wait-listed candidates (Figure 1.14). The percentage of wait-listed candidates who received a deceased donor kidney within 5 years of listing varies greatly by donation service area (DSA) (Figure 1.11); this observation is worthy of more detailed study. Notably, 30.5% of candidates with panel-reactive antibody (PRA) of 80% to 100% undergo transplant within 5 years, not greatly dissimilar to the 36.0% who undergo transplant with less than 1% PRA (Figure 1.12). This rate of transplant in candidates with PRA of 80% to 100% is due to the allocation priority points provided to these high-PRA candidates.

### **DONATION**

After several years with little change, the deceased donor kidney donation rate (per 1,000 deaths) has increased slightly (Figure 2.1). However, many kidneys recovered for transplant are discarded. The discard rate increased steadily from 12.7% in 2002 to 17.9% in 2011 (Figure 2.5). Figure 2.6 lists reasons for deceased donor organ discard after nephrectomy. Importantly, donor kidneys are discarded only after being offered locally, regionally, and nationally. Given the tremendous organ shortage, the continuing high rate of discard is of concern. Currently, each organ procurement organization (OPO) is responsible for notifying OPTN of the reason for discard. Yet different centers may turn down the same kidney offer for different reasons (e.g., patient too sick versus donor quality). A kidney that might not be accepted for one patient (e.g., new on the list, 0% PRA) might be accepted for another (100% PRA). Determining how many centers rejected a kidney before it was discarded will be important, as will determining whether kidneys discarded in one region have characteristics similar to kidneys used in another region.

In 2011, kidneys were not recovered from 734 (9.0%) donors from whom at least one organ was recovered for transplant (Figure 2.8). The major reasons for non-recovery of deceased donor kidneys at the time another organ was

recovered were poor organ function (44.3%), donor medical history (11.1%), other (9.3%), and organ refused by all national programs (6.6%) (Figure 2.9). The major reasons for discard after recovery were biopsy findings (37.3%), no recipient identified (16.6%), poor organ function (9.2%), anatomic abnormalities (7.1%), and other (17.5%) (Figure 2.6). The relatively high discard rate may be related to the steady increase in the KDPI. However, given the organ shortage, it would be beneficial to better understand how 16.6% of discarded kidneys were discarded because no recipient could be identified.

Although donation rates have not greatly changed, the percentage of transplants performed from donation after circulatory death (DCD) has steadily increased, from 1.4% in 1998 to 15.8% in 2011 (Figure 4.6). Percentages of DCDS vary widely by DSA, ranging from less than 5% to more than 30% (Figure 4.7). At the same time, there is considerable variation by DSA in kidney transplant rates per 100 patient-years on the waiting list (Figure 1.11). Of note, some centers with low DCD use have high deceased donor transplant rates (Figure 4.8). It would be interesting to determine if this is due to low listing rates, different donor management protocols, or other reasons.

Nationally, living donation rates have been essentially unchanged for the past decade (Figures 3.1, 3.3), despite introduction of desensitization, non-directed donations, and kidney paired donation programs. Although national rates are unchanged, since 2005 donation rates per million population have increased in some areas of the country and decreased by 5% to 10% in other areas (Figure 3.4). Comparison of living donation rates by state (Figure 3.4) with deceased donation rates by state (Figure 2.2) reveals interesting differences. Some states have high rates for both; others, low rates for both; still others, high rates for one and low rates for the other. Reasons for this variability should be studied.

The number of paired donation transplants increased steadily, from 2 in 2000 to 429 in 2011 (Figure 3.5). Hopefully, with the development of donor chain transplants, and with a national system for paired donation, the numbers will continue to grow.

Poor follow-up of living donors remains an important issue. At 12 months after donation, readmission data are unreported for 20.0% of donors (Figure 3.9), and estimated glomerular filtration rate (eGFR) is unknown for 49.7% of donors (Figure 3.7).

### **TRANSPLANTS**

Commensurate with the increasing age of candidates on the waiting list, the number of transplants performed annually in patients aged 50 years or older has steadily increased, and the number performed annually in patients aged 65 years or older tripled between 1998 and 2011 (Figure 4.2). Also of note, since 2006 the number of transplants performed in black, Hispanic, and Asian patients has increased, and the number performed in white patients has decreased (Figure 4.2). However, transplant rates (per 100 patient-years on the waiting list) have been steadily decreasing since 1998 (Figure 4.3).

### **OUTCOMES**

The steady improvement in early post-transplant results is an exciting observation. Over the past 15 years, for both living and deceased donor transplant recipients, 90-day, 6-month, and 1-, 3-, and 5-year results have shown ongoing improvement (Figures 6.1, 6.3, 6.4). There is now a suggestion of improvement in 10-year results (Figures 6.3, 6.4), and, in the past decade, for both living and deceased donor transplants, half-life has improved by about 1 year (for grafts functioning beyond the first year) (Figure 6.7). This improvement has been driven by a decrease in the rate of graft failure and return to dialysis. Rates of death with graft function have not declined. As of June 30, 2011, 164,200 adults in the US were surviving with a functioning kidney graft, about twice as many as a decade earlier (Figure 6.8).

Of concern is the rate of post-transplant lymphoproliferative disorder (PTLD) in recipients who were negative for the Epstein-Barr virus (EBV) at the time of transplant (Figure 6.11). EBV status has been recognized as a risk factor for PTLD in children. However, by 5 years post-transplant, close to 2% of EBV-negative adults have developed PTLD. Rates are similar for patients receiving EBV-negative or EBV-positive donor organs.

### **IMMUNOSUPPRESSIVE MEDICATION USE**

The types and combination of types of immunosuppressive drugs used over the past few years have differed little. However, a highlight of 2011 was the first US Food and Drug Administration approval in more than a decade of a new maintenance immunosuppressive drug, belatacept. Although the drug was approved in June 2011, OPTN data submission forms were not changed to allow reporting of its use until fall 2011 (until then, the box marked “other” had to be checked). The 2012 report will provide the first annual snapshot of the clinical use of belatacept.

### **Children and Adolescents**

#### **WAITING LIST**

On September 28, 2005, the kidney allocation system was modified to give priority to pediatric candidates ahead of adult candidates locally, regionally, and nationally for non-zero mismatch kidney offers from donors aged 35 years or younger (OPTN Policy 3.5.11.5.1). The intent of this modification, referred to as “Share 35,” was to prioritize allocation of younger donor kidneys to address established goals of rapidly providing transplants to pediatric candidates with minimal impact on adult transplant rates. The effect of this policy on pediatric kidney transplant outcomes is an area of ongoing evaluation.

In 2011, almost half of new pediatric candidates added to the kidney transplant waiting list were listed as inactive. This number has continued to increase since the policy change in 2003 permitting waiting time to accrue while candidates are listed as inactive. Similarly, among prevalent pediatric wait-listed candidates, those listed as inactive outnumber those listed as active (Figure 8.1). Since 2007, the age distribution of pediatric candidates waiting for kidney transplant has changed (Figure 8.2). Candidates aged 11 to 17 years remain the most common pediatric age group listed (71.3%); however, candidates aged 1 to 5 years now represent the second-largest pediatric age group, having surpassed the group aged 6 to 10 years. The racial/ethnic distribution of wait-listed pediatric candidates has also changed. While the proportions of white and Asian candidates have remained relatively constant, the

proportion of Hispanic candidates has increased and the proportion of black candidates has decreased. The etiology of ESRD has remained relatively constant; structural abnormalities are the most common cause in the youngest patients, and focal segmental glomerulosclerosis and glomerulonephritis increase in frequency with increasing age (Figure 8.3).

In 2011, 13.1% of candidates on the waiting list had undergone a previous kidney transplant (Figure 8.4). The number of children and adolescents on the waiting list who had undergone a previous transplant varied from 98 in 1998 to 141 in 2008 and 119 in 2011 (data not shown). Of all candidates on the waiting list in 2011, 4.3% of those aged 0 to 5 years, 14.7% of those aged 6 to 10 years, and 15.5% of those aged 11 to 17 years were waiting for re-transplant. Among patients undergoing transplant in 2008, within 1 year of listing, 45.7% underwent deceased donor transplant, 13.9% underwent living donor transplant, 38.0% were still waiting at the end of 2011 (Figure 8.6). In contrast to mortality among patients waiting for other organs, pre-transplant mortality among pediatric candidates waiting for kidney transplant is low, 1.5 per 100 wait-list years in 2011 (Figure 8.8).

#### **TRANSPLANTS**

The number of pediatric kidney transplants peaked in 2005 at 899 and decreased to a low of 760 in 2011 (Figure 8.9). Retransplant accounted for 9.1% of transplants performed in 2011 (Figure 8.10). The rate of deceased donor kidney transplants decreased from a peak of 60.2 per 100 wait-list years in 2006 to 44.4 per 100 wait-list years in 2011. The rate of living donor transplants increased from a nadir of 13.0 per 100 wait-list years in 2007 to 16.1 per 100 wait-list years in 2011 (Figure 8.11).

In the past decade, the proportion of pediatric patients undergoing preemptive kidney transplant has remained steady at about 25% (Figure 8.12). The number of HLA mismatches has increased, which may be partly attributable to implementation of the Share 35 deceased donor kidney allocation system.

Donation to pediatric recipients from related living donors has declined dramatically, by about 50%. Donation from “other” living donors has increased, possibly reflecting

increased participation in kidney paired donation (Figure 8.13). Use of DCD kidneys increased over time to 4.6% in 2011 (Figure 8.14). No ECD kidneys have been used in pediatric recipients since 2006. The mean KDPI in pediatric recipients in 2011 was 40% (Figure 8.15). The KDPI is a numerical measure that combines 10 donor characteristics to express the quality of a donor kidney relative to other donors. It is derived by first calculating the Kidney Donor Risk Index (KDRI) using donor characteristics only, and then mapping the values against a reference group to obtain percentiles. The reference group used here is all kidneys recovered for transplant in 2011. Higher values of KDPI indicate poorer donor quality. For example, a kidney donor with a KDPI of 90% has a higher KDRI (and therefore higher estimated risk of post-transplant graft failure) than 90% of the reference group. The KDPI is based on these donor characteristics: age, race/ethnicity, hypertension status, diabetes status, serum creatinine level, cause of death (cerebrovascular, cardiac, etc.), height, weight, DCD status, and hepatitis C status.

The age of deceased donor organs allocated to pediatric transplant recipients has changed over time, guided by changes in both clinical practice and allocation policy such as Share 35. Figure 8.16 shows the increase in deceased donor organs from donors aged younger than 35 years.

## OUTCOMES

Graft survival (patient survival with a functioning graft) has continued to improve among pediatric recipients over the past decade. Graft failure for deceased donor transplants was 3.7% at 6 months and 5.3% at 1 year for transplants in 2009-2010, 15.3% at 3 years for transplants in 2007-2008, 29.1% at 5 years for transplants in 2005-2006, and 51.4% at 10 years for transplants in 2001-2002 (Figure 8.24). Corresponding graft failure for living donor transplants was 1.6% at 6 months and 2.7% at 1 year for transplants in 2009-2010, 8.4% at 3 years for transplants in 2007-2008, 18.1% at 5 years for transplants in 2005-2006, and 35.7% at 10 years for transplants in 2001-2002 (Figure 8.25). The rate of late graft failure is traditionally measured by the graft half-life conditional on 1-year survival, defined as the time to when half of grafts surviving at least 1

year are still functioning. For deceased donor transplants, the estimated 1-year conditional half-life was 11.9 years for transplants in 2011 (Figure 8.26). For living donor transplants, the estimated 1-year conditional half-life was 15.3 years for transplants in 2011.

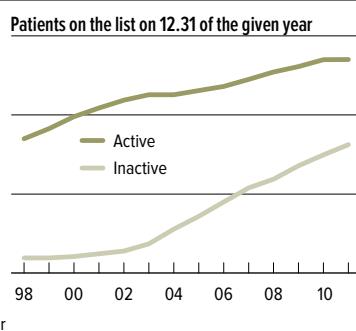
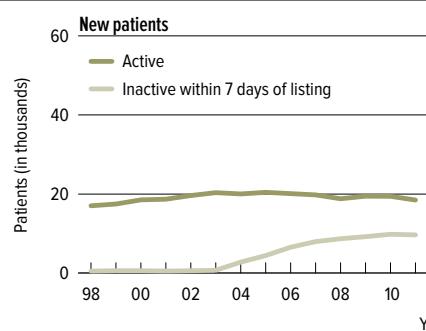
Short-term renal function, measured by eGFR, has improved substantially in pediatric recipients over the past decade. The proportion of patients with eGFR of 90 mL/min/1.73 m<sup>2</sup> or greater at discharge increased from 17.1% in 2000 to 33.9% in 2011, at 6 months post-transplant from 10.3% in 2000 to 25.7% in 2011, and at 1 year post-transplant from 6.7% in 2000 to 24.5% in 2010 (Figure 8.28). Almost 70% of patients in the 2011 cohort had eGFR of 60 mL/min/1.73 m<sup>2</sup> or greater at discharge, CKD stage 1-2.

PTLD is an important concern in pediatric transplantation. The highest risk for EBV infection and PTLD occurs for EBV-negative recipients of EBV-positive donor kidneys. This occurred in 32.5% of deceased donor recipients and 33.5% of living donor recipients (Figure 8.19). The incidence of PTLD among EBV-negative recipients was 4.5% at 5 years post-transplant, compared with 0.6% among EBV-positive recipients (Figure 8.21). Although PTLD is the most common type of malignancy in pediatric kidney transplant recipients, other types of malignancies are reported and they increase over time post-transplant (Figure 8.22).

## IMMUNOSUPPRESSIVE MEDICATION USE

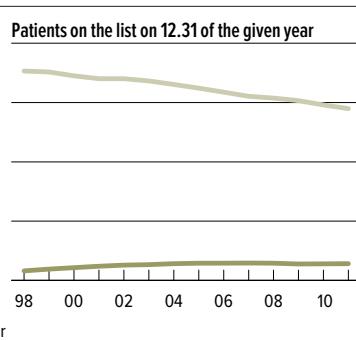
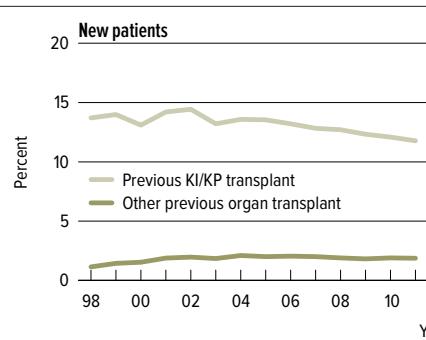
Trends in maintenance immunosuppressive medications used in children and adolescents are similar to trends for adults. In 2011, 94.0% of pediatric transplant recipients received tacrolimus as part of the initial maintenance immunosuppressive medication regimen, and 92.6% received mycophenolate mofetil (Figure 8.23). In 2010, corticosteroids were used in 62.1% of transplant recipients at the time of transplant and in 62.5% at 1 year post-transplant. Induction therapy has changed in pediatric kidney transplantation. Decreased availability of the interleukin-2 receptor antagonist daclizumab likely contributed to decreased utilization. There has been a corresponding increase in the proportion of patients receiving T-cell depleting agents or no induction therapy.

# wait list



## KI 1.1 Adult patients waiting for a kidney transplant

Patients waiting for a transplant. A “new patient” is one who first joins the list during the given year, without having listed in a previous year. However, if a patient has previously been on the list, has been removed for a transplant, and has relisted since that transplant, the patient is considered a “new patient.” Patients concurrently listed at multiple centers are counted only once. Those with concurrent listings and active at any program are considered active; those inactive at all programs at which they are listed are considered inactive.



## KI 1.2 Prior transplant status of adults waiting for a kidney transplant

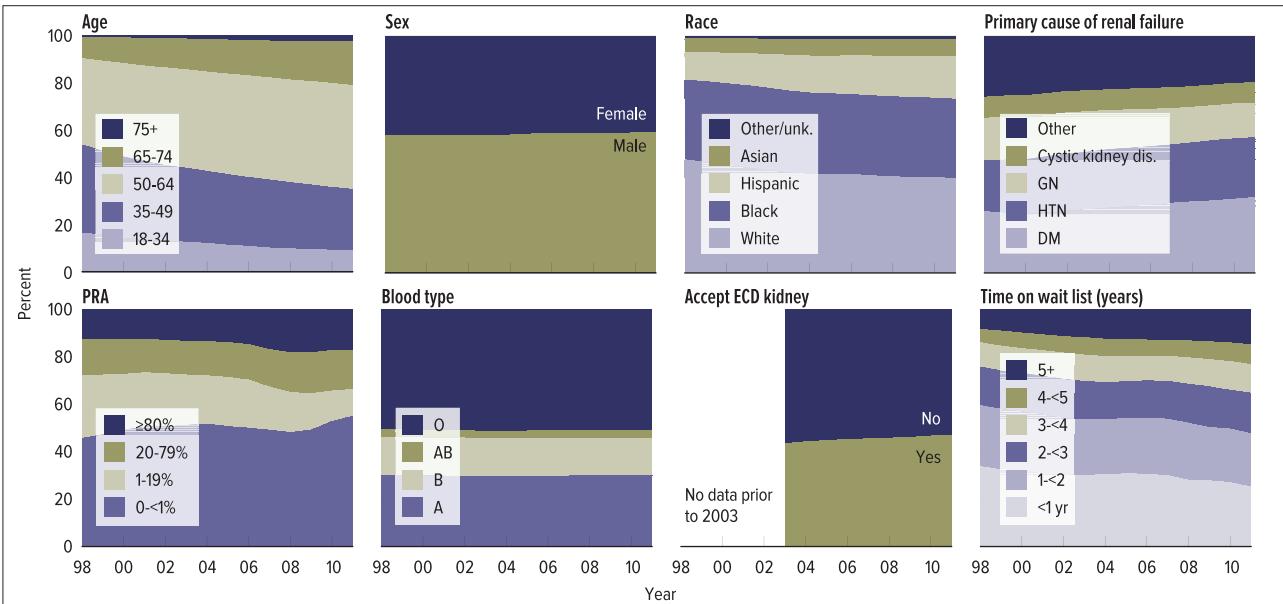
Prior transplant status of patients waiting for a kidney transplant. Prior kidney transplant defined as kidney or kidney-pancreas transplant. Other solid organ transplant defined as all other organs beside kidney or kidney-pancreas. Prevalent patients as of December 31 of each year. Each patient is counted only once.

Reason for inactive status	Inactive w/i 7 days of listing		Active at 12.31	
	N	%	N	%
Candidate work-up incomplete	8,029	69.0	5,414	29.1
Insurance issues	1,107	9.5	1,698	9.1
Too sick	897	7.7	6,596	35.5
Weight inappropriate for tx	553	4.8	1,057	5.7
Too well	542	4.7	870	4.7
Candidate choice	302	2.6	1,026	5.5
Tx pending	107	0.9	55	0.3
Medical non-compliance	47	0.4	635	3.4
Inappropriate substance use	37	0.3	276	1.5
Candidate could not be contacted	12	0.1	431	2.3
Physician/surgeon unavailable	3	0.0	2	0.0
Unknown	2	0.0	535	2.9
Transplanted; removal pending data correction	1	0.0	-	0.0

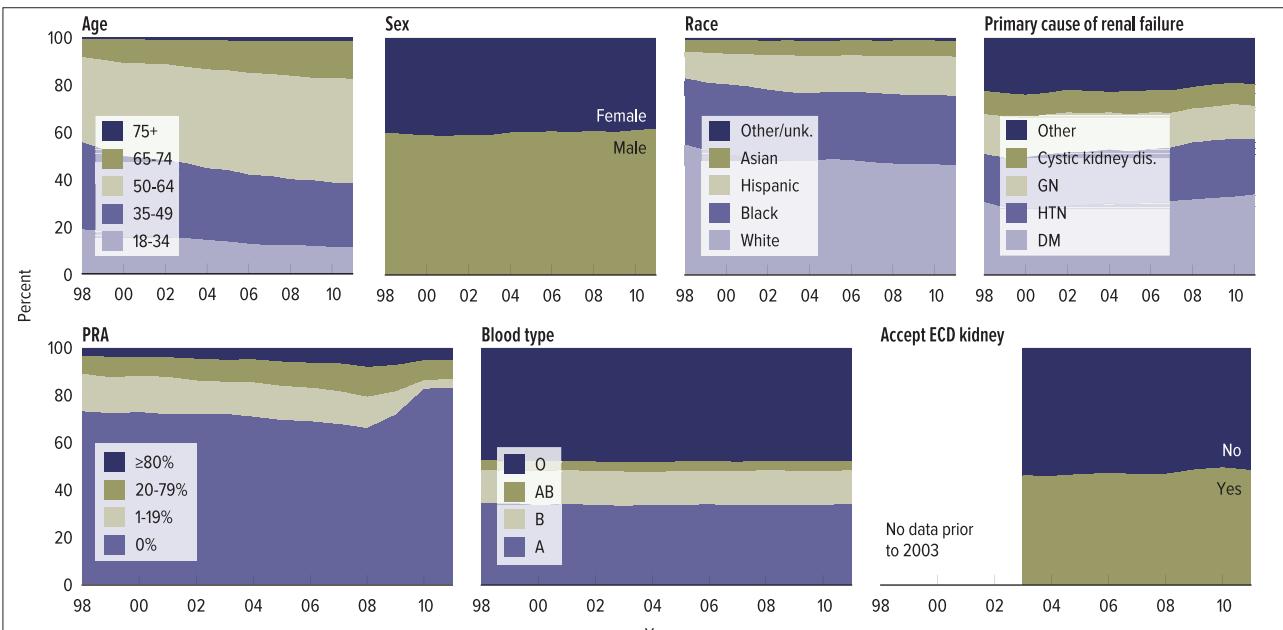
## KI 1.3 Reasons for inactive status among kidney transplant listings, 2011

Reasons for inactive status of listings in 2011. Since patients can be concurrently listed at more than one center and have different reasons for going inactive at each center, each listing is counted separately.

# wait list

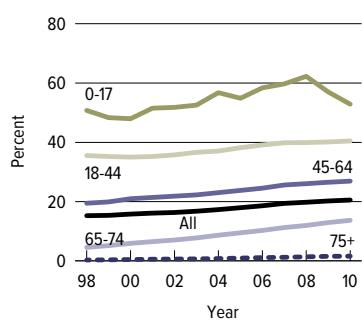
**KI 1.4 Distribution of adult patients waiting for a kidney transplant**

Patients waiting for a transplant any time in the given year. Age determined on the earliest of listing date or December 31 of the given year. Concurrently listed patients are counted once.

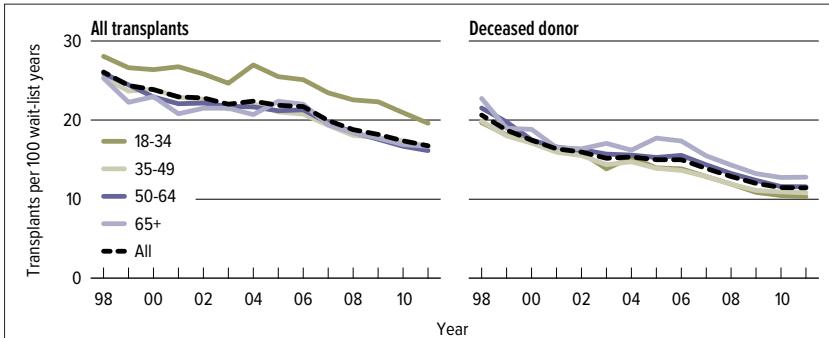
**KI 1.5 Distribution of adult patients newly listed for a kidney transplant**

A newly listed patient is one who first joins the list during the given year, without having listed in a previous year. However, if a patient has previously been on the list, has been removed for a transplant, and has relisted since that transplant, the patient is considered a newly listed patient. Patients concurrently listed at multiple centers are counted only once.

# wait list


**KI 1.6 Prevalent dialysis patients wait-listed for a kidney transplant, by age**

Prevalent dialysis patients, all ages, wait-listed for a kidney-alone transplant. Percentage calculated as the sum of wait-list patients divided by the sum of point prevalent dialysis patients on December 31 of each year (data from the United States Renal Data System).

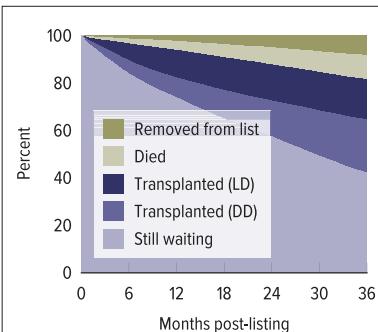

**KI 1.7 Kidney transplant rates among adult waiting list candidates, by age**

Patients waiting for a transplant; age as of January 1 of the given year. Yearly period prevalent rates for all transplants/deceased donor transplants are computed as the number of all transplants/deceased donor transplants per 100 patient years of waiting time in the given year. All waiting time per patient per listing is counted, and all listings that end in a transplant for the patient are considered transplant events.

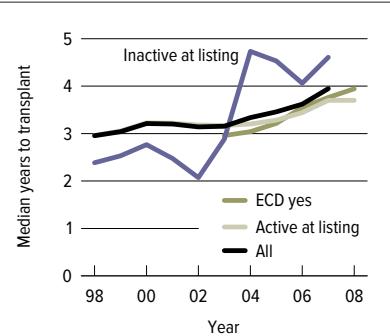
	2009	2010	2011
Patients at start of year	74,572	79,365	83,879
Patients added during year	28,645	29,216	28,131
Patients removed during year	23,820	24,662	25,463
Patients at end of year	79,397	83,919	86,547
Removal reason			
Deceased donor transplant	9,713	9,980	10,399
Living donor transplant	5,170	5,235	4,922
Tx (type not specified)	54	89	81
Patient died	5,181	5,172	5,139
Patient refused transplant	271	318	406
Improved, tx not needed	131	101	135
Too sick to transplant	1,358	1,467	1,903
Changed to kid.-pan. list	165	191	194
Other	1,777	2,109	2,284

**KI 1.8 Kidney transplant waiting list activity among adult patients**

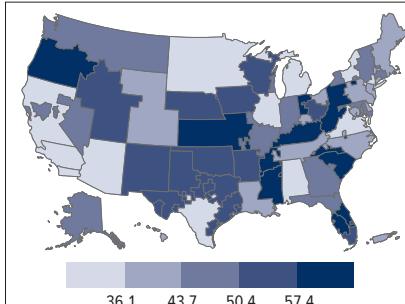
Patients with concurrent listings at more than one center are counted once, from the time of earliest listing to the time of latest removal. Patients listed, transplanted, and re-listed are counted more than once. Patients are not considered "on the list" on the day they are removed. Thus, patient counts on January 1 may be different from patient counts on December 31 of the prior year.


**KI 1.9 Outcomes for adult patients waiting for a kidney transplant among new listings in 2008**

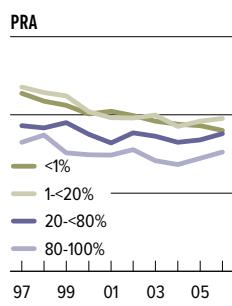
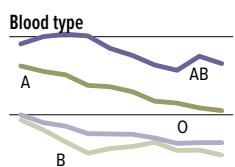
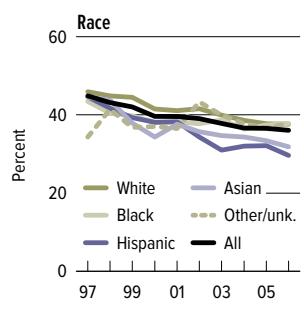
Patients waiting for a transplant and first listed in 2008. Patients with concurrent listings at more than one center are counted once, from the time of the earliest listing to the time of latest removal.


**KI 1.10 Median years to kidney transplant for wait-listed adult patients**

Patients waiting for a transplant, with observations censored at December 31, 2011; Kaplan-Meier method used to estimate time to transplant. If an estimate is not plotted for a certain year, 50% of the cohort listed in that year had not been transplanted at the censoring date. Only the first transplant is counted.

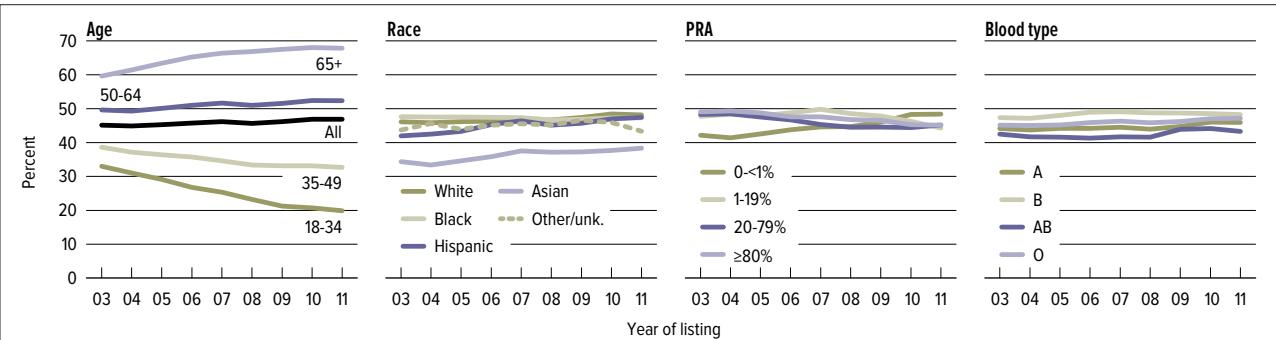

**KI 1.11 Percent of adult wait-listed patients, 2006, who received a deceased donor kidney transplant within five years, by DSA**

Patients with concurrent listings in a single DSA are counted once in that DSA, and those listed in multiple DSAs are counted separately per DSA.


**KI 1.12 Adult wait-listed patients who received a deceased donor kidney transplant within five years**

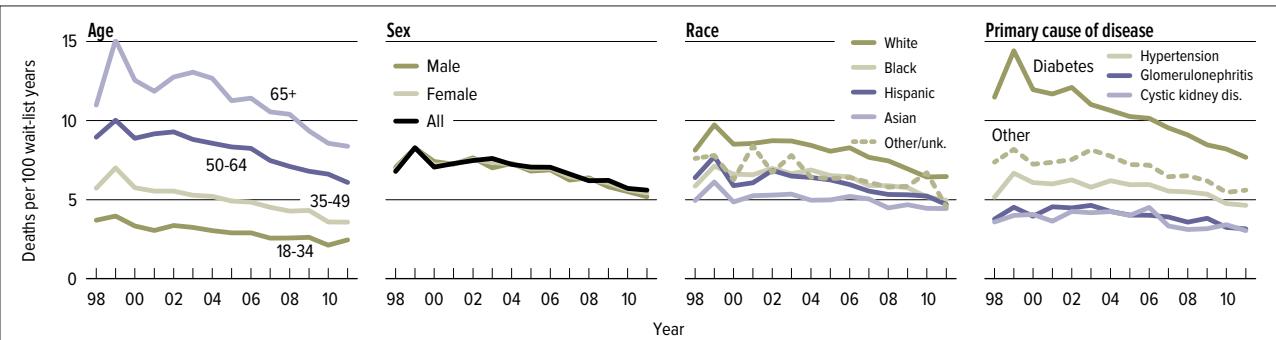
Patients with concurrent listings at more than one center are counted once, from the time of earliest listing to the time of latest removal. Patients listed, transplanted, and re-listed are counted more than once.

# Wait list



### KI 1.13 Adult listings willing to accept an ECD kidney

Patients waiting for a kidney-alone transplant, 2003 (beginning of ECD program) to 2011. Patients are counted for each listing. Data by sex are not shown; percentages for men and women are similar to overall.



### KI 1.14 Pre-transplant mortality rates among adult patients wait-listed for a kidney transplant

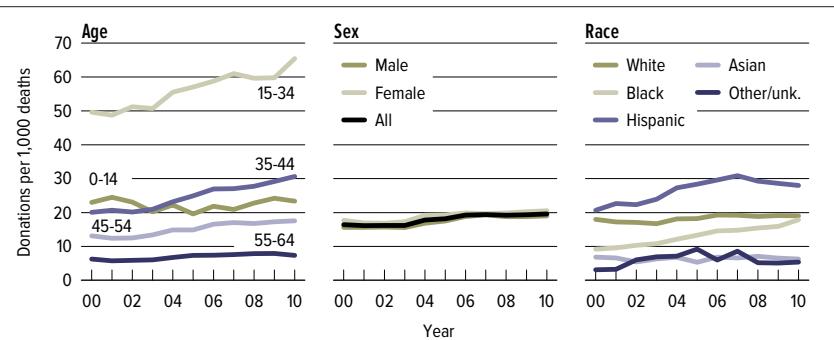
Patients waiting for a transplant. Mortality rates are computed as the number of deaths per 100 patient-years of waiting time in the given year. For rates shown by different characteristics, waiting time is calculated as the total waiting time in the year for patients in that group. Only deaths that occur prior to removal from the waiting list are counted. Age is calculated on the latest of listing date or January 1 of the given year. Other patient characteristics come from the OPTN Transplant Candidate Registration form.

	2001		2011			2001		2011			2001		2011			
	Level	N	%	N	%	Primary	N	%	N	%	PRA &	N	%	N	%	
Age	18-44	16,021	34.3	21,461	24.8	DM	11,602	24.9	27,852	32.2	<20%	33,414	71.6	57,954	67.0	
	45-64	24,952	53.5	48,071	55.5	HTN	11,596	24.9	22,203	25.7	≥20%	13,163	28.2	28,594	33.0	
	65-74	5,210	11.2	15,148	17.5	GN	8,183	17.5	12,550	14.5	Unknown	72	0.2	0.0	0.0	
	75+	466	1.0	1,868	2.2	Cyst. kid	4,063	8.7	7,256	8.4	Time	<1 year	15,942	34.2	24,418	28.2
Sex	Male	26,797	57.4	51,238	59.2	Oth/unk	11,205	24.0	16,687	19.3	on list	1-2	11,085	23.8	19,714	22.8
	Female	19,852	42.6	35,310	40.8	Tx history	38,040	81.5	73,566	85.0	2-3	7,331	15.7	14,525	16.8	
Race	White	19,130	41.0	32,695	37.8	List 1st tx	8,609	18.5	12,982	15.0	3-4	4,668	10.0	9,629	11.1	
	Black	17,230	36.9	29,731	34.4	List sub. tx	8,609	18.5	12,982	15.0	4-5	2,872	6.2	6,602	7.6	
	Hispanic	6,590	14.1	16,203	18.7	Blood type	A	13,013	27.9	25,068	29.0	5+	4,751	10.2	11,660	13.5
	Asian	3,078	6.6	6,737	7.8	B	7,903	16.9	13,804	15.9	ECD	Will not accept		46,418	53.6	
	Other/unk.	621	1.3	1,182	1.4	AB	1,242	2.7	2,529	2.9	kidney	Will accept		40,130	46.4	
						O	24,491	52.5	45,147	52.2						

### KI 1.15 Characteristics of adult patients on the kidney transplant waiting list on December 31, 2001 & December 31, 2011

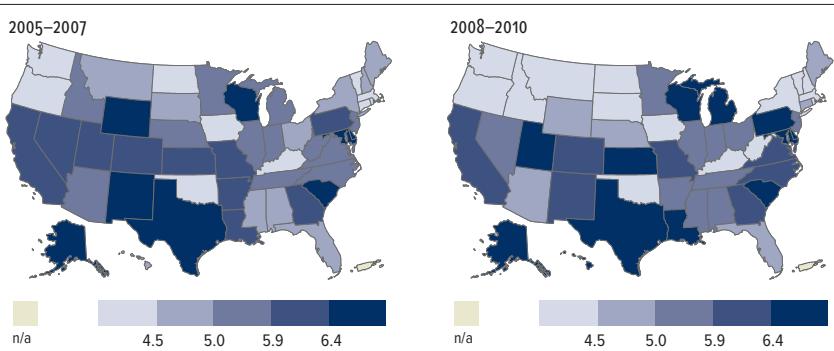
Patients waiting for a transplant on December 31, 2001 and December 31, 2011, regardless of first listing date; active/inactive status is on this date, and multiple listings are not counted.

# deceased donation



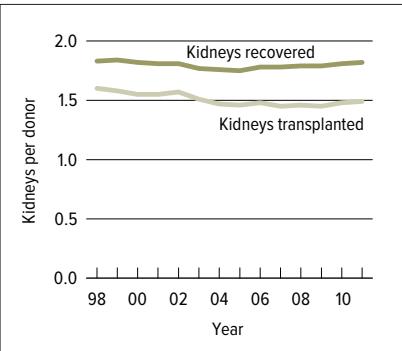
## KI 2.1 Deceased donor kidney donation rates

Numerator: Deceased donors age less than 65 whose kidney(s) were recovered for transplant. Denominator: US deaths per year, age less than 65. (Death data available at <http://www.cdc.gov/nchs/products/nvsr.htm>.) Donors who donated two kidneys are counted twice.



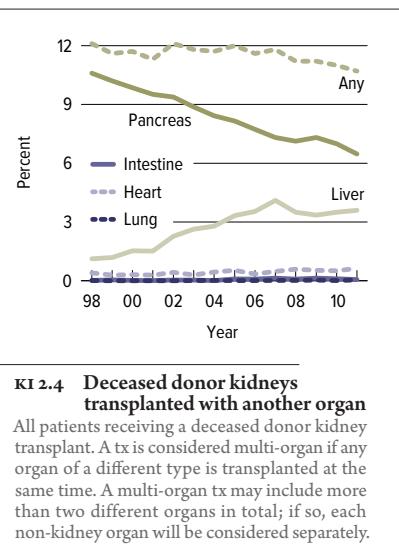
## KI 2.2 Deceased donor kidney donation rates (per 1,000 deaths), by state

Numerator: Deceased donors residing in the 50 states whose kidney(s) were recovered for transplant in the given year range. Denominator: US deaths by state during the given year range (death data available at <http://www.cdc.gov/nchs/products/nvsr.htm>). Rates are calculated within ranges of years for more stable estimates. Donors who donated two kidneys are counted twice.



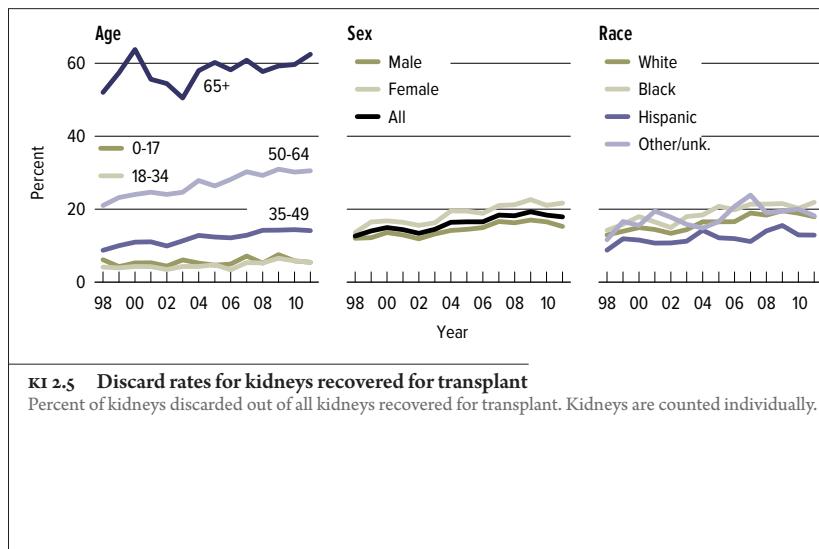
## KI 2.3 Kidneys recovered per donor & kidneys transplanted per donor

Denom.: all deceased donors with at least one organ of any type recovered for tx. Numerator for recovery rate: number of kidneys recovered for tx in the given year; those recovered for other purposes are not included. Numerator for tx rate: all deceased donor kidneys tx'd in given year.



## KI 2.4 Deceased donor kidneys transplanted with another organ

All patients receiving a deceased donor kidney transplant. A tx is considered multi-organ if any organ of a different type is transplanted at the same time. A multi-organ tx may include more than two different organs in total; if so, each non-kidney organ will be considered separately.



## KI 2.5 Discard rates for kidneys recovered for transplant

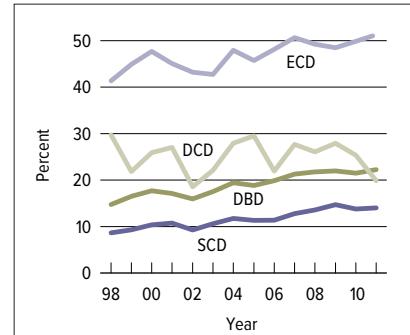
Percent of kidneys discarded out of all kidneys recovered for transplant. Kidneys are counted individually.

# deceased donation

Reasons for discard	Percent	N
Biopsy findings	37.34	966
Other, specify	17.51	453
No recipient located - list exhausted	16.62	430
Poor organ function	9.24	239
Anatomical abnormalities	7.07	183
Diseased organ	3.48	90
Vascular damage	1.70	44
Organ trauma	1.24	32
Positive hepatitis	1.16	30
Too old on ice	1.08	28
Warm ischemic time too long	0.85	22
Too old on pump	0.70	18
Donor medical history	0.66	17
Recipient determined to be unsuitable	0.43	11
Organ not as described	0.27	7
Donor social history	0.23	6
Infection	0.19	5
Ureteral damage	0.15	4
Positive HIV	0.08	2

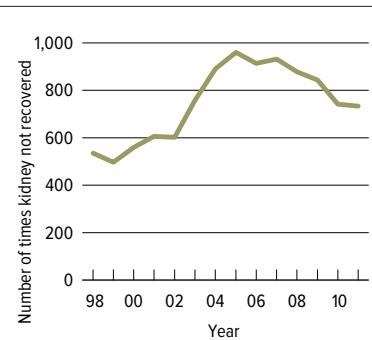
**KI 2.6 Reasons for kidney discards among kidneys removed for transplant but not transplanted, 2011**

Reasons for discard among kidneys recovered for transplant but not transplanted in 2011.



**KI 2.7 Discards by donor type**

Percent of kidneys discarded out of all kidneys recovered for transplant, by SCD/ECD and DCD/DBD classification of donor. Each donor is counted once.



**KI 2.8 Donors whose kidneys were not recovered**

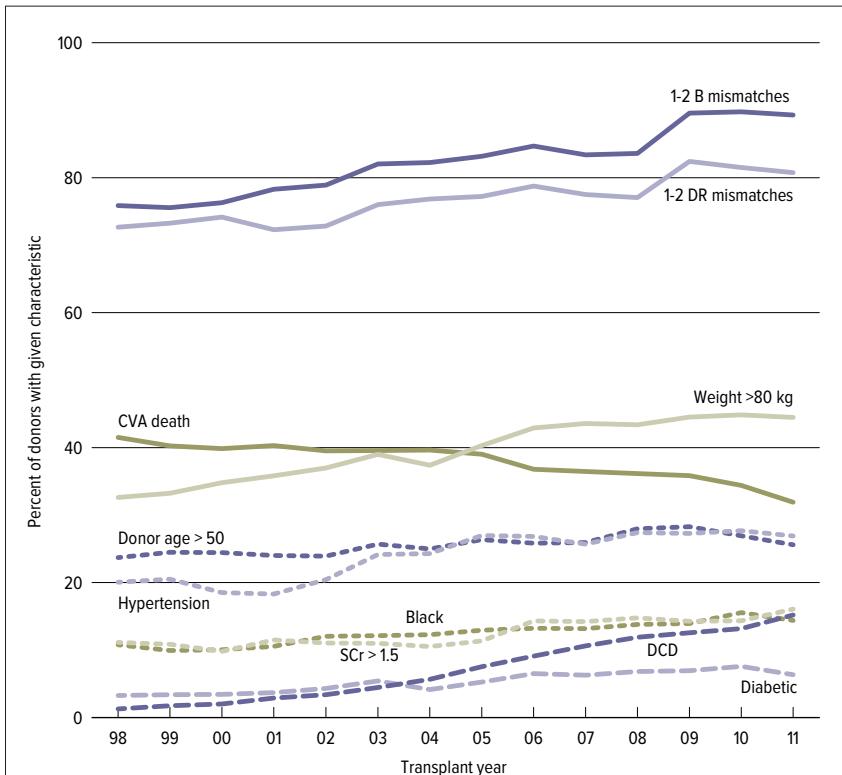
Donors whose kidney(s) were not recovered but at least one other organ was.

# deceased donation

Reasons for non-recovery	Percent	N
Poor organ function	44.28	534
Donor medical history	11.11	134
Other specify	9.29	112
Organ refused by all national programs	6.63	80
Ruled out after evaluation in OR	4.64	56
Diseased organ	4.48	54
Acute/chronic renal failure	3.73	45
Emotional	3.23	39
No recipient located	2.74	33
Organ refused by all regional programs	2.65	32
Donor age	2.32	28
Donor quality	1.24	15
Positive hepatitis	1.16	14
Donor social history	0.83	10
Family conflict	0.50	6
Anatomical abnormalities	0.41	5
Medical examiner restricted	0.33	4
Hemodynamically unstable donor	0.17	2
Surgical damage in OR	0.08	1
Time constraints	0.08	1
Trauma to organ	0.08	1

## KI 2.9 Reasons for kidneys not being recovered at the time of another organ's recovery

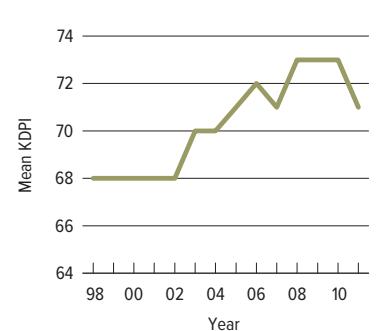
Reasons for non-recovery of kidney, in donors who had at least one other non-renal organ recovered for transplant, 2011. If the same reason was recorded for each kidney, it was only counted once.



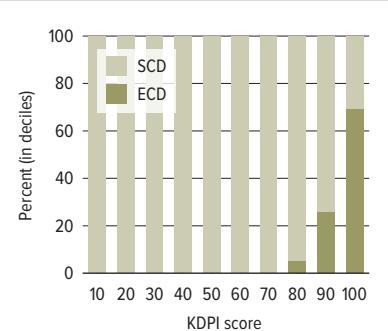
## KI 2.10 Major components of kidney donor risk index (KDRI) over time

Patients receiving a kidney-only, deceased donor transplant. Donors with a missing value for height, weight, or creatinine are excluded. The components of KDRI are donor age, donor race, donor creatinine, donor cause of death, donor height, donor weight, donor history of hypertension, donor history of diabetes, DCD donor, HCV+ donor, HLA-B and DR mismatches with recipient, cold ischemic time of organ, and transplant procedure type (*en bloc*, single, or double). The KDRI is used to calculate the Kidney Donor Profile Index (KDPI), which is the percentile of donors with each KDRI.

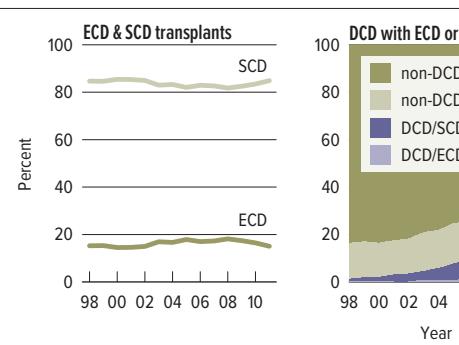
# deceased donation


**KI 2.11 Mean kidney donor profile index (KDPI)**

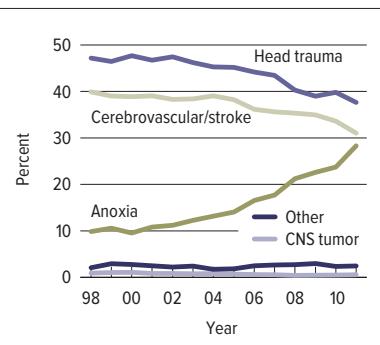
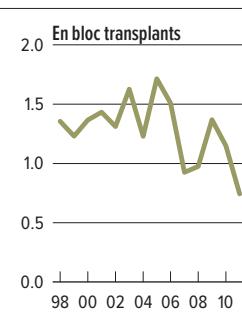
Patients receiving a kidney-only, deceased-donor transplant. Donors with a missing value for height, weight, or creatinine are excluded. KDPI is based on donor factors only; the percentiles are derived by mapping to the 2011 population of kidneys recovered for transplant.


**KI 2.12 Kidney donor profile index (KDPI) scores for ECD & SCD kidneys, 2010**

All deceased donors whose kidney was transplanted in the given year, by SCD/ECD status. Each transplanted kidney is counted separately. Donors with a missing value for height, weight, or creatinine are excluded. KDPI is based on donor factors only; the percentiles are derived by mapping to the 2011 population of kidneys recovered for transplant.

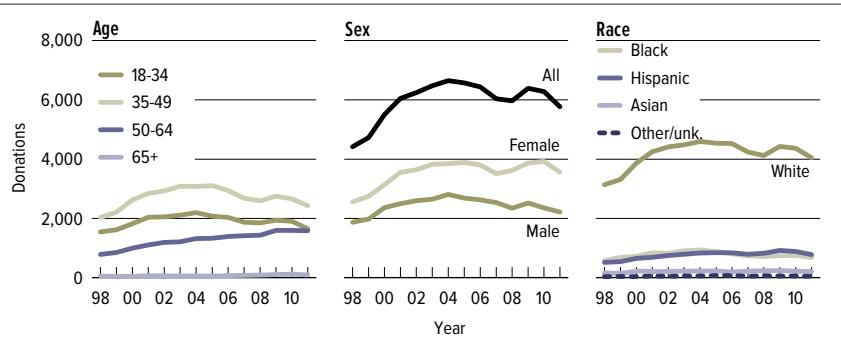

**KI 2.13 ECD, SCD, DCD, & en bloc kidney transplants**

Deceased donor kidney-alone transplants.

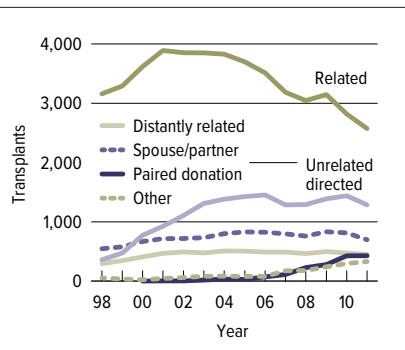

**KI 2.14 Cause of death among deceased kidney donors**

Deceased donors whose kidneys were transplanted. Donors who contributed more than one kidney are counted once. CNS = central nervous system.

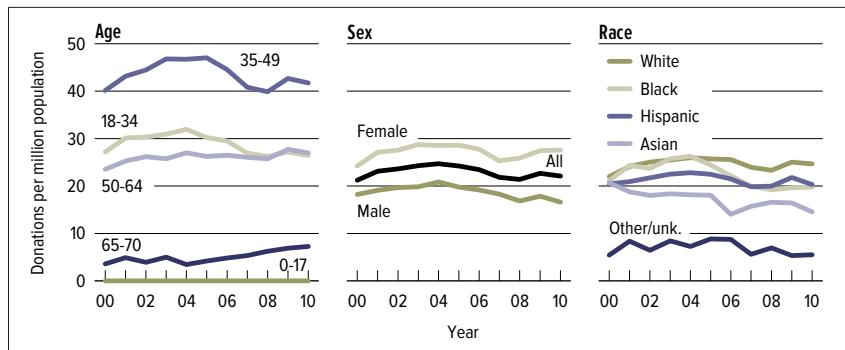
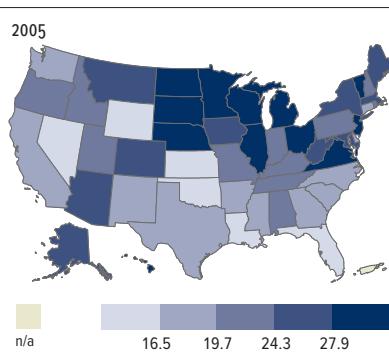
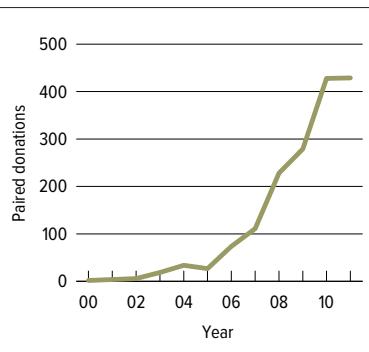
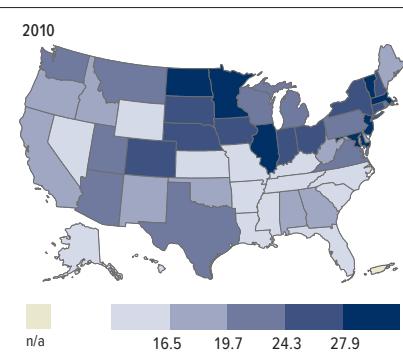
# live donation

**KI 3.1 Kidney donations from living donors**

Number of living donor donations; characteristics recorded on OPTN Living Donor Registration form.

**KI 3.2 Kidney transplants from living donors, by donor relation**

Number of living donor donations; characteristics recorded on OPTN Living Donor Registration form.

**KI 3.3 Living donor kidney donation rates**Number of living donors whose relevant organ was recovered for transplant each year. Denominator: US population age 70 and younger (population data downloaded from <http://www.census.gov/popest/national/asrh/2009-nat-res.html>).**KI 3.4 Living donor kidney donation rates (per million population), by state**Number of living donors residing in the 50 states whose kidney was recovered for transplant in the given year. Denominator: US population age 70 and younger (population data downloaded from [http://www.cdc.gov/nchs/nvss/bridged\\_race/documentation.htm](http://www.cdc.gov/nchs/nvss/bridged_race/documentation.htm)).**KI 3.5 Paired kidney donations**

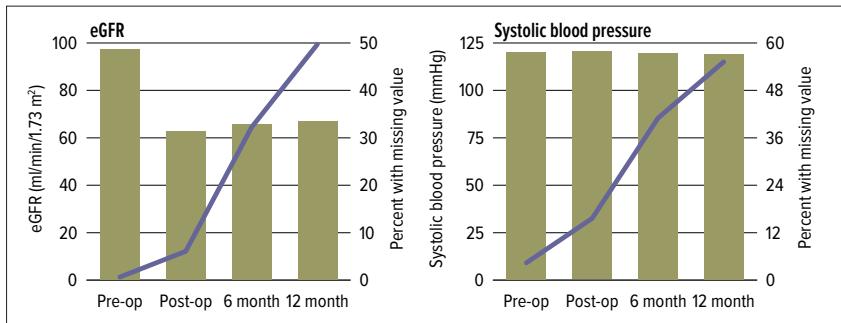
Counts include "domino" donation chains.

# live donation

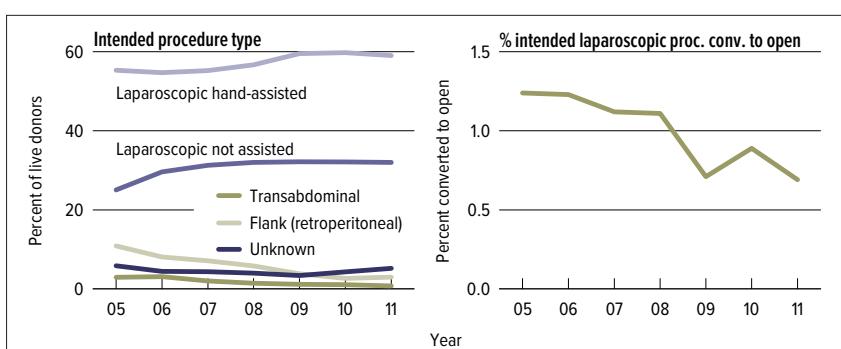
	Deceased donor		Living donor, not paired		Paired	
	N	%	N	%	N	%
<b>PRA/CPRA</b>						
0%	9,190	42.4	6,325	56.5	312	36.3
>0-9%	2,649	12.2	1,427	12.8	69	8.0
10-19%	1,368	6.3	711	6.4	56	6.5
20-29%	1,196	5.5	552	4.9	43	5.0
30-39%	726	3.4	311	2.8	23	2.7
40-49%	694	3.2	291	2.6	26	3.0
50-59%	703	3.2	257	2.3	36	4.2
60-69%	602	2.8	275	2.5	53	6.2
70-74%	298	1.4	133	1.2	18	2.1
75-79%	272	1.3	97	0.9	21	2.4
80-84%	671	3.1	113	1.0	30	3.5
85-89%	657	3.0	117	1.0	37	4.3
90-94%	770	3.6	118	1.1	44	5.1
95%	180	0.8	24	0.2	3	0.3
96%	214	1.0	28	0.3	8	0.9
97%	220	1.0	34	0.3	9	1.0
98%	305	1.4	50	0.4	16	1.9
99%	383	1.8	65	0.6	14	1.6
100%	561	2.6	105	0.9	40	4.7
Unk.	6	0.0	153	1.4	1	0.1
<b>Blood type</b>						
A	7,696	35.5	4,365	39.0	288	33.5
B	2,845	13.1	1,458	13.0	175	20.4
AB	1,179	5.4	420	3.8	45	5.2
O	9,945	45.9	4,943	44.2	351	40.9
<b>Age</b>						
0-17	919	4.2	571	5.1	14	1.6
18-34	2,008	9.3	2,043	18.3	130	15.1
35-49	5,376	24.8	3,237	28.9	284	33.1
50-64	9,137	42.2	3,906	34.9	324	37.7
65+	4,225	19.5	1,429	12.8	107	12.5

**KI 3.6 Characteristics of kidney paired donation (KPD) & non-KPD recipients, 2000–2011 combined**

Patients receiving kidney-alone transplants in 2010 and 2011. PRA is the maximum of computed and measured PRA.

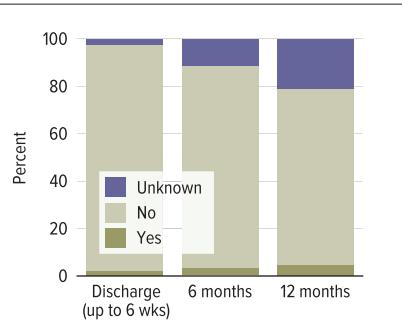

**KI 3.7 Mean pre- & post-operative eGFR & systolic blood pressure among kidney donors, 2009**

eGFR estimated by CKD-EPI formula. (Levey AS et al., Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI). A new equation to estimate glomerular filtration rate. Ann Intern Med., 2009 May 5; 150(9):604-12).


**KI 3.8 Intended kidney transplant procedure type & percent of intended laparoscopic procedures converted to open, 2005–2010**

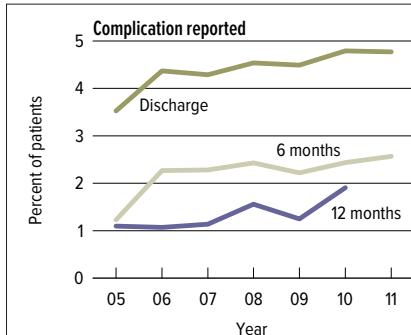
Data sparse prior to 2005.

# live donation



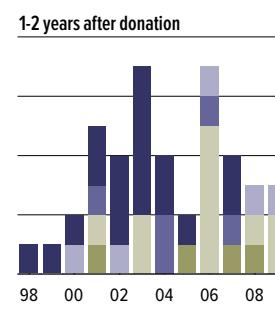
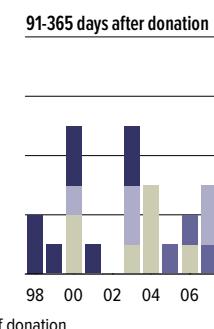
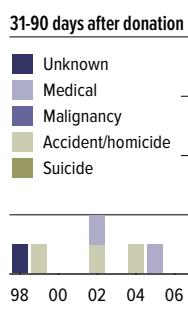
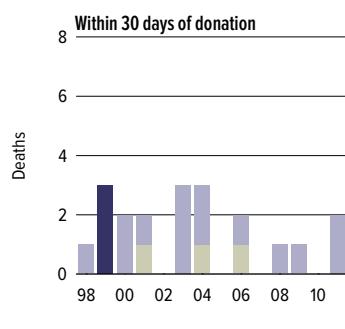
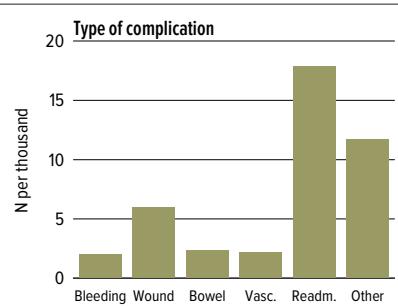
**KI 3.9** Readmission to the hospital in the first year among live kidney donors, 2010

Cumulative readmission to the hospital. "Unknown" means that patient has been lost to follow-up as of this follow-up visit. The six-week time point is recorded at the earliest of discharge or six weeks post-donation.



**KI 3.10 Kidney complications among live kidney donors**

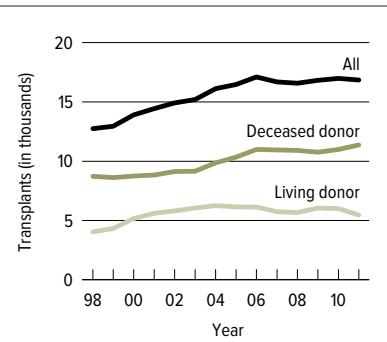
Complications reported on the Living Donor Registration and Living Donor Follow-up forms at each time point. Complications include readmission, re-operation, bleeding, wound healing, bowel obstruction, vascular complications, and other complications requiring intervention. Multiple complications may be reported at any time point. Type of discharge complication is shown among all live donors, 2005–2011.



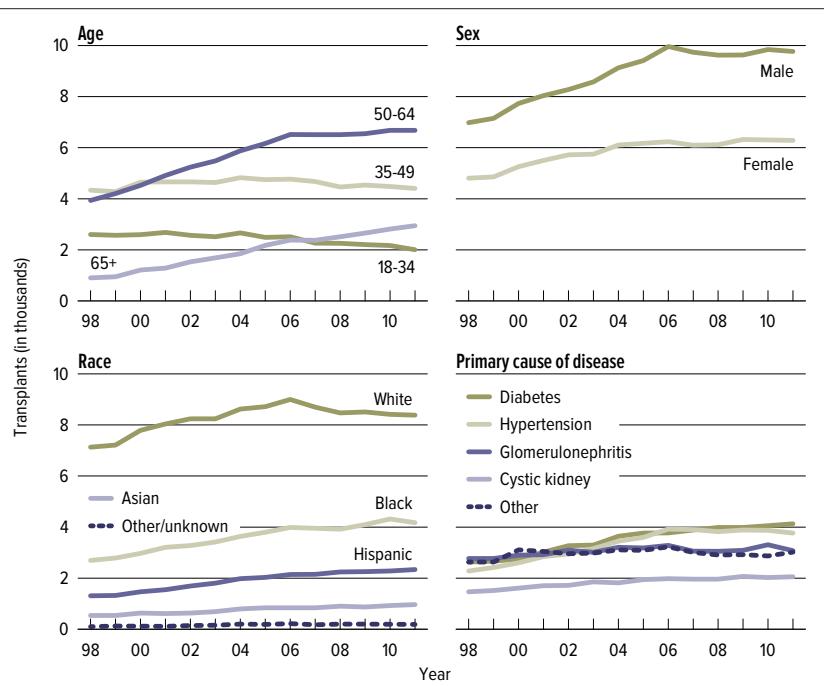
**KI 3.11 Living kidney donor deaths**

Living kidney donors. Deaths as reported to the OPTN or Social Security Administration. "Donation related" deaths are included in the "Medical" category.

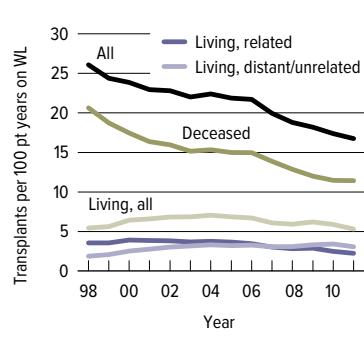
# transplant


**KI 4.1 Total adult kidney transplants (includes kidney-pancreas)**

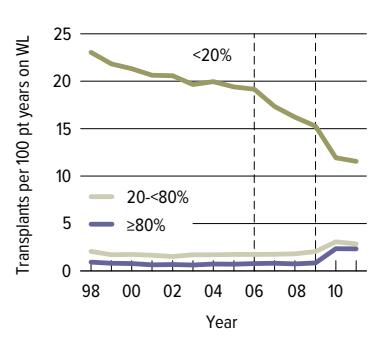
Patients receiving a kidney-alone or simultaneous kidney-pancreas transplant. Retransplants are counted.


**KI 4.2 Adult kidney transplants**

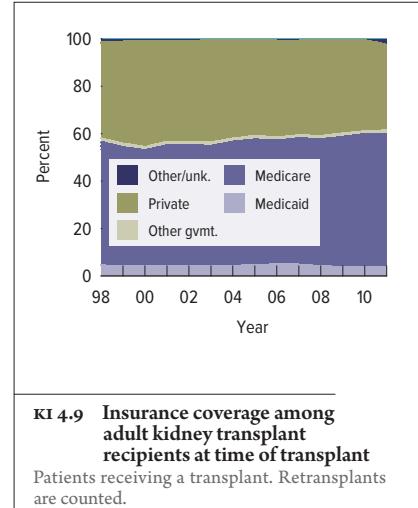
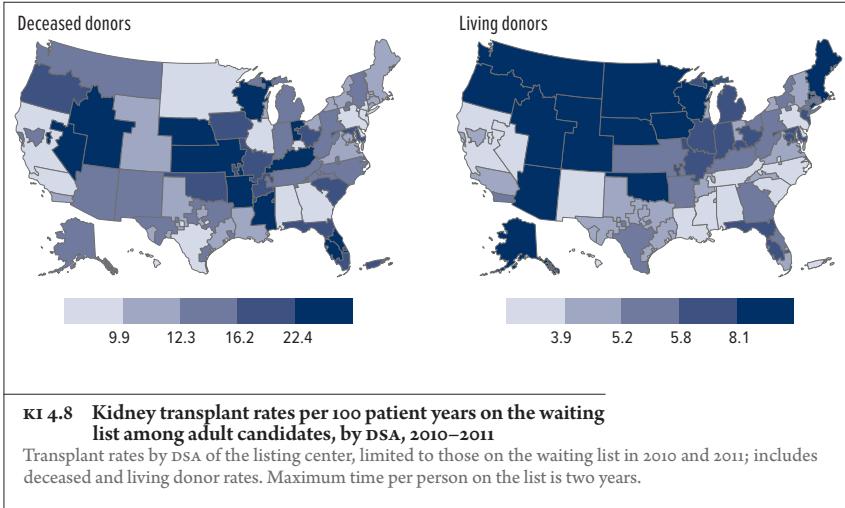
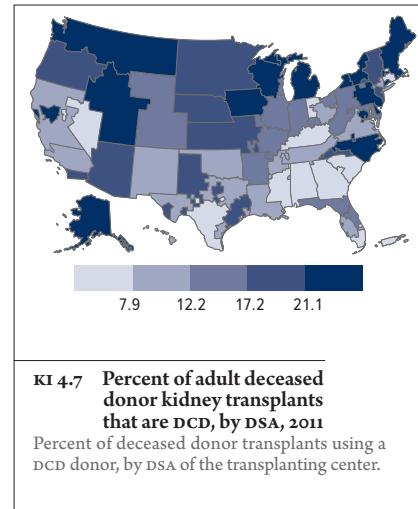
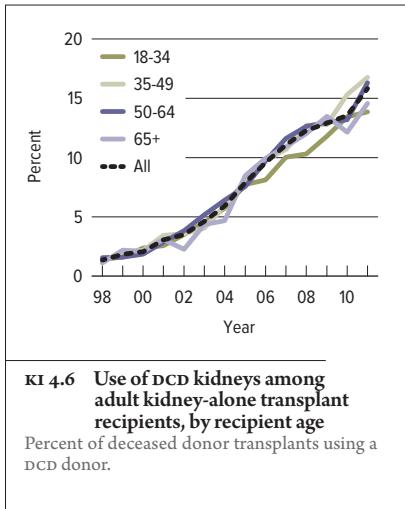
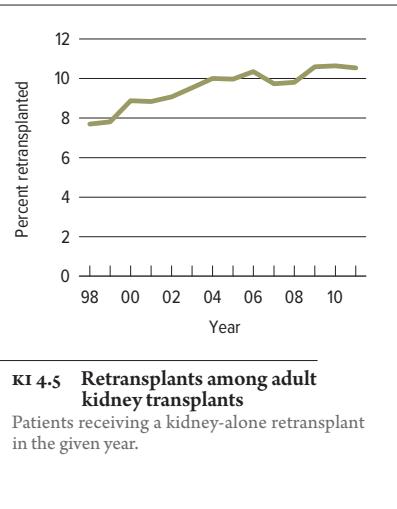
Patients receiving a kidney-alone or simultaneous kidney-pancreas transplant. Retransplants are counted.


**KI 4.3 Kidney transplant rates in adult waiting list candidates**

Patients waiting for a transplant. Transplant rates are computed as the number of transplants per 100 patient-years of waiting time in the given year. All waiting time per patient per listing is counted, and all listings that end in a transplant for the patient are considered transplant events.


**KI 4.4 Kidney transplant rates in adult waiting list candidates, by PRA/CPRA**

Patients waiting for a transplant. Yearly period-prevalent rates for deceased donor transplants are computed as the number of transplants per 100 patient-years of waiting time in the given year. All waiting time per patient per listing is counted, and all listings that end in a transplant for the patient are considered transplant events. PRA/CPRA at the latest of the listing date or Jan. 1 of a given year is used. The most recent PRA is used prior to 2007. If most recent PRA was not provided, peak PRA is reported. Between 2007 and 2009, PRA is used when it is available and CPRA otherwise, because PRA was used in allocation. After 2009, when CPRA started being used in allocation, CPRA is reported.



# transplant

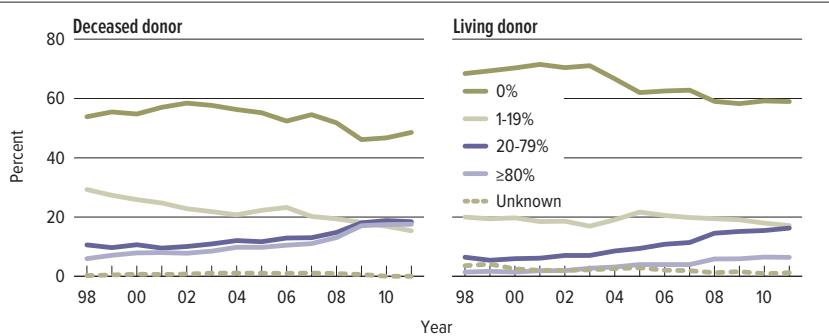
	Level	2001			2011		
		All N	%	Deceased N	%	Living N	%
Age	18-34	2,685	19.8	1,246	15.7	1,439	25.7
	35-49	4,665	34.4	2,669	33.6	1,996	35.6
	50-64	4,913	36.3	3,124	39.3	1,789	31.9
	65+	1,287	9.5	903	11.4	384	6.8
Sex	Female	5,509	40.7	3,160	39.8	2,349	41.9
	Male	8,041	59.3	4,782	60.2	3,259	58.1
Race	White	8,042	59.4	4,216	53.1	3,826	68.2
	Black	3,216	23.7	2,351	29.6	865	15.4
	Hispanic	1,552	11.5	923	11.6	629	11.2
	Asian	622	4.6	390	4.9	232	4.1
	Other/unknown	118	0.9	62	0.8	56	1.0
Primary cause of disease	Diabetes	3,027	22.3	1,735	21.8	1,292	23.0
	Hypertension	2,842	21.0	1,961	24.7	881	15.7
	Glomerulonephritis	2,922	21.6	1,595	20.1	1,327	23.7
	Cystic kidney disease	1,709	12.6	953	12.0	756	13.5
	Other/unknown	3,050	22.5	1,698	21.4	1,352	24.1
Blood type	A	5,186	38.3	3,070	38.7	2,116	37.7
	B	1,660	12.3	959	12.1	701	12.5
	AB	634	4.7	435	5.5	199	3.5
	O	6,070	44.8	3,478	43.8	2,592	46.2
PRA/CPRA	<20%	10,845	80.0	5,999	75.5	4,846	86.4
	20%-<80%	1,596	11.8	1,093	13.8	503	9.0
	≥80%	995	7.3	827	10.4	168	3.0
	Unknown	114	0.8	23	0.3	91	1.6
History of renal replacement therapy	Preemptive transplant	1,594	11.8	404	5.1	1,190	21.2
	<1 year	2,423	17.9	717	9.0	1,706	30.4
	<3 years	4,244	31.3	2,647	33.3	1,597	28.5
	<5 years	2,266	16.7	1,855	23.4	411	7.3
	5+ years/unknown	3,023	22.3	2,319	29.2	704	12.6
Insurance	Private	5,735	42.3	2,510	31.6	3,225	57.5
	Medicare	6,878	50.8	4,912	61.8	1,966	35.1
	Other/unknown	937	6.9	520	6.5	417	7.4
HLA mismatches with donor	0	1,603	11.8	980	12.3	623	11.1
	1	804	5.9	423	5.3	381	6.8
	2	1,716	12.7	698	8.8	1,018	18.2
	3	3,090	22.8	1,514	19.1	1,576	28.1
	4	2,501	18.5	1,777	22.4	724	12.9
	5	2,416	17.8	1,616	20.3	800	14.3
	6	1,328	9.8	904	11.4	424	7.6
	Unk.	92	0.7	30	0.4	62	1.1
Kidney transplant history	First transplant	11,832	87.3	6,846	86.2	4,986	88.9
	Retransplant	1,718	12.7	1,096	13.8	622	11.1
Prior other organ tx		319	2.4	184	2.3	135	2.4
DCD status *	Non-DCD	.	.	7,700	97.0	.	.
	DCD	.	.	242	3.0	.	.
SCD/ECD status *	SCD	.	.	6,685	84.2	.	.
	ECD	.	.	1,257	15.8	.	.
Total		13,550	100.0	7,942	100.0	5,608	100.0
						16,055	100.0
						10,589	100.0
						5,466	100.0

\* for deceased donor transplant only

#### KI 4.10 Characteristics of adult kidney transplant recipients, 2001 & 2011

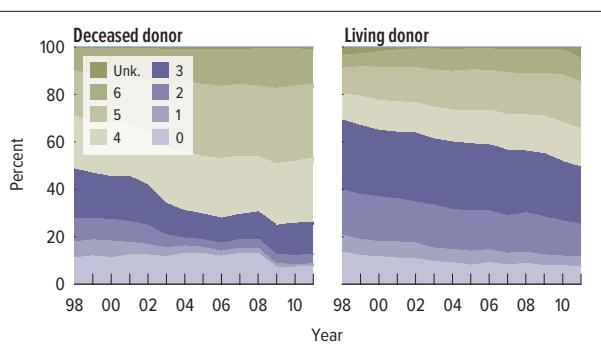
Patients receiving a transplant. Retransplants are counted.

# donor-recipient matching



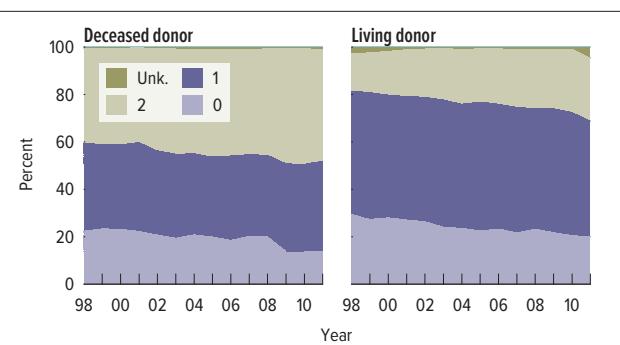
## KI 5.1 PRA at time of kidney transplant in adult recipients

PRA is the maximum of the most recent values recorded at the time of transplant. If “most recent PRA” is not provided, peak PRA is used. CPRA is conditionally incorporated between December 1, 2007 – October 1, 2009 where, if CPRA is >0, the value is included but otherwise is not; from October 1, 2009, CPRA is included unconditionally.



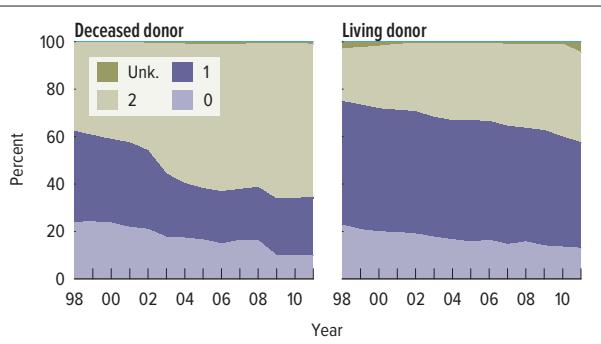
## KI 5.2 Total HLA mismatches among adult kidney transplant recipients

Donor and recipient antigen matching is based on the OPTN’s antigen values and split equivalences policy as of 2011.



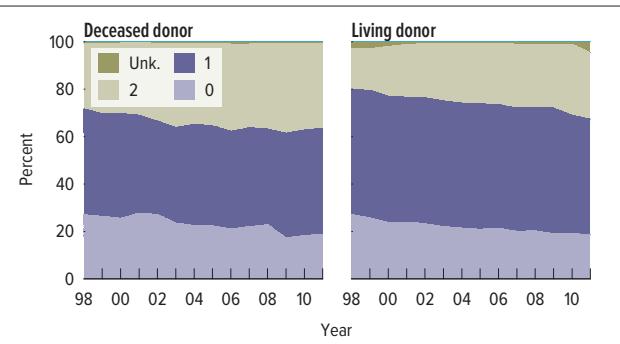
## KI 5.3 HLA-A mismatches among adult kidney transplant recipients

Donor and recipient antigen matching is based on the OPTN’s antigen values and split equivalences policy as of 2011.



## KI 5.4 HLA-B mismatches among adult kidney transplant recipients

Donor and recipient antigen matching is based on the OPTN’s antigen values and split equivalences policy as of 2011.



## KI 5.5 HLA-DR mismatches among adult kidney transplant recipients

Donor and recipient antigen matching is based on the OPTN’s antigen values and split equivalences policy as of 2011.

# donor-recipient matching

RECIPIENT	DECEASED DONOR				LIVING DONOR			
	Neg.	Pos.	Unk.	Total	Neg.	Pos.	Unk.	Total
<b>Negative</b>	11.9	17.8	0.1	29.8	21.8	15.3	3.0	40.1
<b>Positive</b>	23.8	43.6	0.2	67.6	19.6	33.5	4.2	57.3
<b>Unknown</b>	0.9	1.6	0.0	2.5	0.7	0.9	0.9	2.6
<b>Total</b>	36.6	63.0	0.4	100	42.1	49.7	8.1	100

**KI 5.6 Adult kidney donor-recipient cytomegalovirus (CMV) serology matching, 2007–2011**

Adult transplant cohort from 2007–2011. Donor serology is reported on the OPTN Donor Registration forms; recipient serology is reported on the OPTN Recipient Registration forms. Any evidence for a positive serology is taken to indicate that the person is positive for the given serology; if all fields are unknown, not done, or pending the person is considered to be “unknown” for that serology; otherwise, serology is assumed negative.

RECIPIENT	DECEASED DONOR				LIVING DONOR			
	Neg.	Pos.	Unk.	Total	Neg.	Pos.	Unk.	Total
<b>Negative</b>	0.7	10.6	0.5	11.8	1.9	7.0	3.0	11.9
<b>Positive</b>	3.8	60.2	1.7	65.7	4.5	51.5	9.6	65.6
<b>Unknown</b>	1.3	20.4	1.0	22.6	0.5	5.2	16.8	22.5
<b>Total</b>	5.7	91.2	3.1	100	6.9	63.8	29.4	100

**KI 5.7 Adult kidney donor-recipient Epstein-Barr virus (EBV) serology matching, 2007–2011**

Adult transplant cohort from 2007–2011. Donor serology is reported on the OPTN Donor Registration forms; recipient serology is reported on the OPTN Recipient Registration forms. Any evidence for a positive serology is taken to indicate that the person is positive for the given serology; if all fields are unknown, not done, or pending the person is considered to be “unknown” for that serology; otherwise, serology is assumed negative.

RECIPIENT	DECEASED DONOR				LIVING DONOR			
	Neg.	Pos.	Unk.	Total	Neg.	Pos.	Unk.	Total
<b>Negative</b>	72.6	2.9	0.1	75.6	66.9	1.5	10.6	79.0
<b>Positive</b>	7.7	0.9	0.0	8.6	3.3	0.4	0.8	4.5
<b>Unknown</b>	15.2	0.6	0.0	15.8	6.1	0.1	10.4	16.6
<b>Total</b>	95.5	4.4	0.1	100	76.3	2.0	21.8	100

**KI 5.8 Adult kidney donor-recipient hepatitis B core antibody (HBcAb) serology matching, 2007–2011**

Adult transplant cohort from 2007–2011. Donor serology is reported on the OPTN Donor Registration forms; recipient serology is reported on the OPTN Recipient Registration forms. Any evidence for a positive serology is taken to indicate that the person is positive for the given serology; if all fields are unknown, not done, or pending the person is considered to be “unknown” for that serology; otherwise, serology is assumed negative.

RECIPIENT	DECEASED DONOR				LIVING DONOR			
	Neg.	Pos.	Unk.	Total	Neg.	Pos.	Unk.	Total
<b>Negative</b>	93.0	0.0	0.2	93.2	82.9	0.0	11.2	94.1
<b>Positive</b>	2.6	0.0	0.0	2.6	1.4	0.0	0.2	1.5
<b>Unknown</b>	4.2	0.0	0.0	4.2	2.5	0.0	1.9	4.4
<b>Total</b>	99.8	0.0	0.2	100	86.8	0.0	13.3	100

**KI 5.9 Adult kidney donor-recipient hepatitis B surface antigen (HBSAg) serology matching, 2007–2011**

Adult transplant cohort from 2007–2011. Donor serology is reported on the OPTN Donor Registration forms; recipient serology is reported on the OPTN Recipient Registration forms. Any evidence for a positive serology is taken to indicate that the person is positive for the given serology; if all fields are unknown, not done, or pending the person is considered to be “unknown” for that serology; otherwise, serology is assumed negative.

RECIPIENT	DECEASED DONOR				LIVING DONOR			
	Neg.	Pos.	Unk.	Total	Neg.	Pos.	Unk.	Total
<b>Negative</b>	87.7	0.3	0.0	88.0	82.9	0.1	8.8	91.8
<b>Positive</b>	4.7	2.2	0.0	6.8	2.6	0.0	0.2	2.9
<b>Unknown</b>	5.1	0.1	0.0	5.2	3.0	0.0	2.3	5.4
<b>Total</b>	97.4	2.6	0.0	100	88.5	0.1	11.4	100

**KI 5.10 Adult kidney donor-recipient hepatitis C serology matching, 2007–2011**

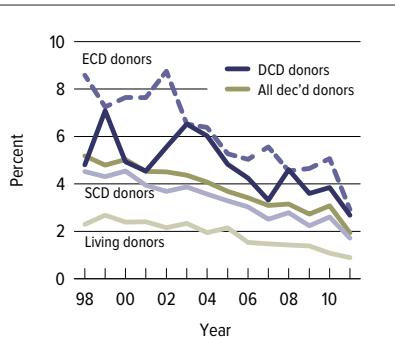
Adult transplant cohort from 2007–2011. Donor serology is reported on the OPTN Donor Registration forms; recipient serology is reported on the OPTN Recipient Registration forms. Any evidence for a positive serology is taken to indicate that the person is positive for the given serology; if all fields are unknown, not done, or pending the person is considered to be “unknown” for that serology; otherwise, serology is assumed negative.

RECIPIENT	DECEASED DONOR				LIVING DONOR			
	Neg.	Pos.	Unk.	Total	Neg.	Pos.	Unk.	Total
<b>Negative</b>	85.9	0.0	0.1	86.0	77.0	0.0	9.3	86.3
<b>Positive</b>	0.7	0.0	0.0	0.7	0.4	0.0	0.1	0.5
<b>Unknown</b>	13.3	0.0	0.0	13.3	3.1	0.0	10.0	13.1
<b>Total</b>	99.9	0.0	0.1	100	80.6	0.0	19.4	100

**KI 5.11 Adult kidney donor-recipient human immunodeficiency virus (HIV) serology matching, 2007–2011**

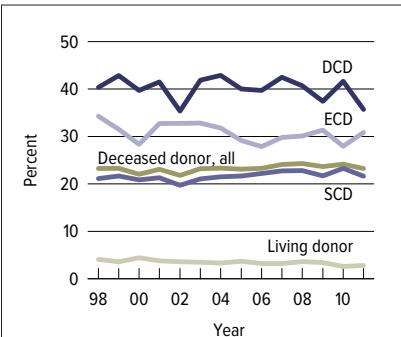
Adult transplant cohort from 2007–2011. Donor serology is reported on the OPTN Donor Registration forms; recipient serology is reported on the OPTN Recipient Registration forms. Any evidence for a positive serology is taken to indicate that the person is positive for the given serology; if all fields are unknown, not done, or pending the person is considered to be “unknown” for that serology; otherwise, serology is assumed negative.

# outcomes



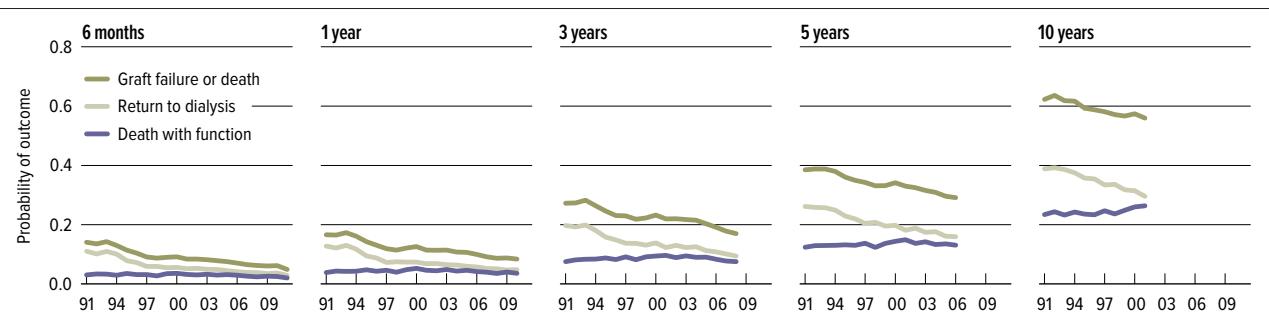
**KI 6.1** Death-censored graft failure within 90 days among adult kidney transplant recipients

Retransplantation, graft failure, or return to dialysis within the first 90 days after transplant date. Graft failure due to death is not included. Graft failure dates are determined from multiple data sources, including the OPTN Transplant Recipient Registration, OPTN Transplant Recipient Follow-up.



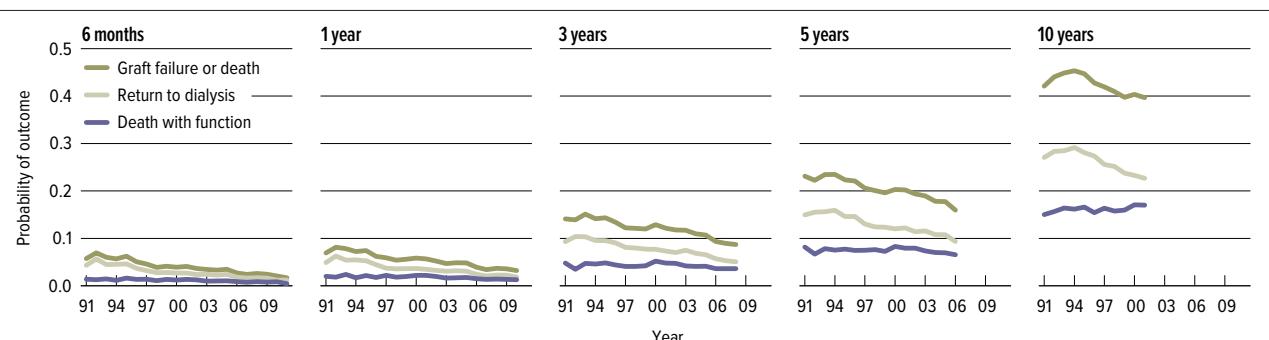
**KI 6.2** Delayed graft function among adult kidney transplant recipients

Delayed graft function is defined as receiving dialysis within the first post-transplant week.



**KI 6.3** Outcomes among adult kidney transplant recipients: deceased donor

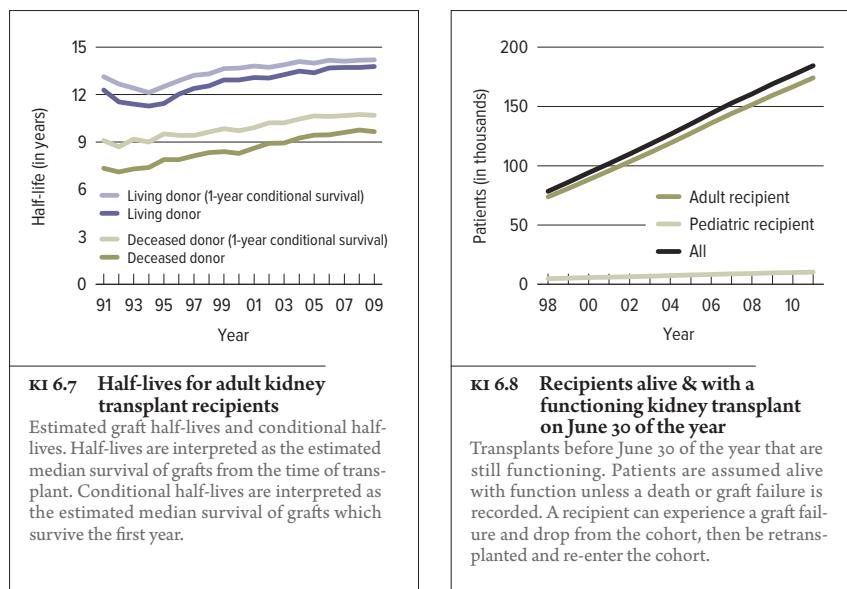
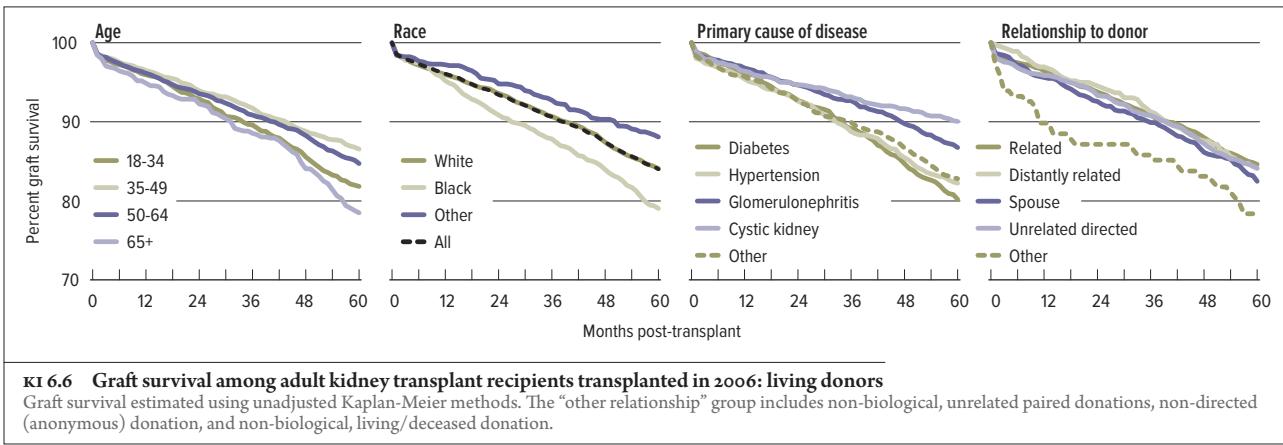
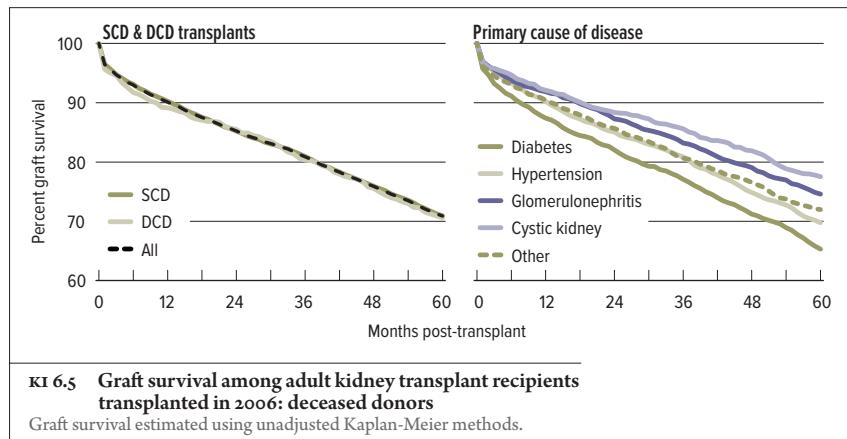
Data are reported as probability of each outcome. Probabilities are unadjusted, computed using Kaplan-Meier competing risk methods. Death with function defined as no graft failure prior to death; return to dialysis defined as graft failure preceding death.



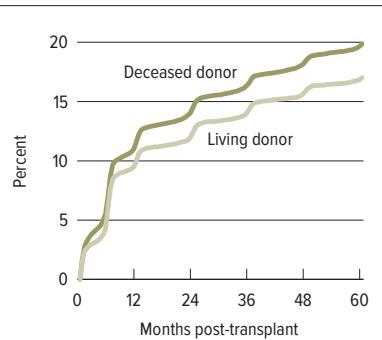
**KI 6.4** Outcomes among adult kidney transplant recipients: living donor

Data are reported as probability of each outcome. Probabilities are unadjusted, computed using Kaplan-Meier competing risk methods. Death with function defined as no graft failure prior to death; return to dialysis defined as graft failure preceding death.

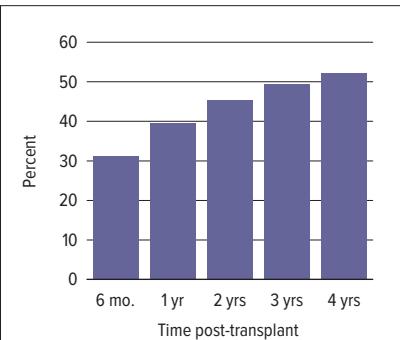
# outcomes



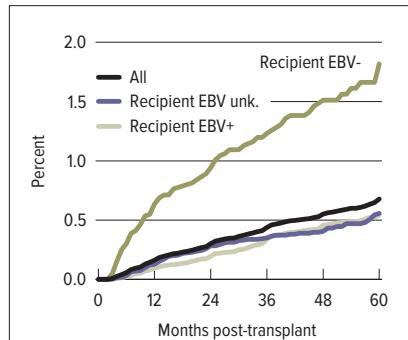
# outcomes


**KI 6.9** Incidence of first acute rejection among adult patients receiving a kidney transplant in 2005–2009

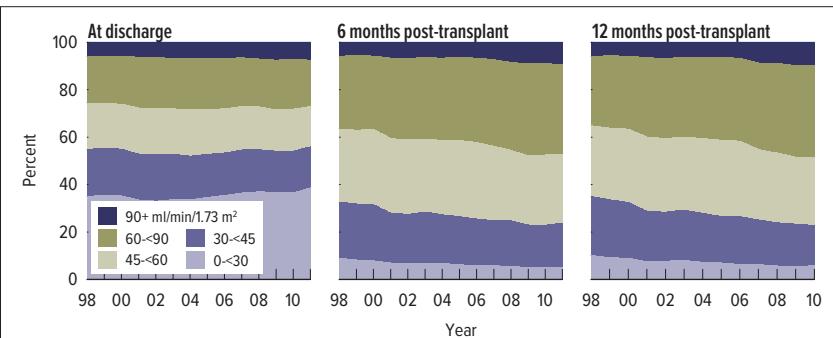
Acute rejection defined as a record of acute or hyperacute rejection, or a record of an anti-rejection drug being administered on either the Transplant Recipient Registration form or the Transplant Recipient Follow-up Form. Only the first rejection event is counted, and patients are followed for acute rejection only until graft failure, death, or loss to follow-up. Cumulative incidence, defined as the probability of acute rejection at any time prior to the given time, is estimated using Kaplan-Meier methods.


**KI 6.10** Reported cumulative incidence of rehospitalizations among adult patients receiving a kidney transplant in 2006–2011

Cumulative incidence of rehospitalization post-transplant; hospitalization identified from the OPTN Transplant Recipient Follow-up form. Patients required to be alive with graft function at each time period, so denominators reduce over time.

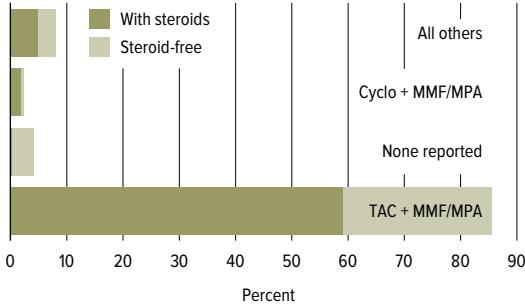

**KI 6.11** Incidence of PTLD among adult patients receiving a kidney transplant in 2005–2009, by recipient Epstein-Barr virus (EBV) status at transplant

The cumulative incidence, defined as the probability of post-transplant lymphoproliferative disorder (PTLD) being diagnosed between the time of transplant and the given time, is estimated using Kaplan-Meier methods. PTLD is identified as either a reported complication or cause of death on the Transplant Recipient Follow-up forms or on the Post-transplant Malignancy form as polymorphic PTLD, monomorphic PTLD, or Hodgkin's Disease. Only the earliest date of PTLD diagnosis is considered, and patients are followed for PTLD until graft failure, death, or loss to follow-up. Patients are censored at graft failure because malignancies are not reliably reported after graft failure.


**KI 6.12** Distribution of eGFR at discharge & at 6 & 12 months post-transplant among adult kidney transplant recipients

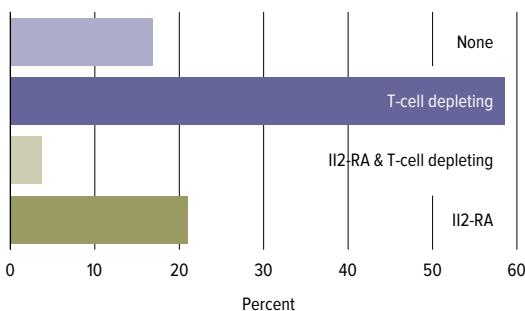
GFR estimated using CKD-EPI equation, and computed for patients alive with graft function at the given time point.

# immunosuppression



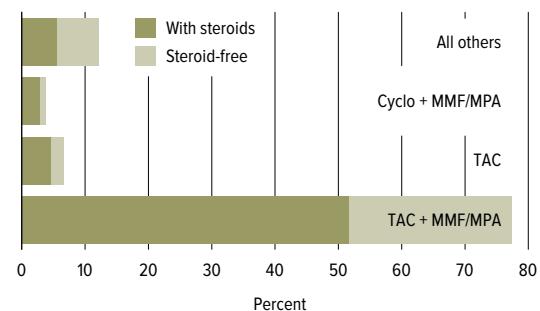
**KI 7.1 Initial immunosuppression regimen in adult kidney transplant recipients, 2011**

Patients transplanted in 2011 and discharged with a functioning graft. Top three baseline immunosuppression regimens are given, plus the “all others” group. Regimens are defined by use of calcineurin inhibitors (TAC=Tacrolimus, Cyclo=Cyclosporine), anti-metabolites (AZA=Azathioprine, MMF/MPA=Mycophenolate), and mTOR inhibitors (mTOR). Data within each regimen are reported separately by steroid use.



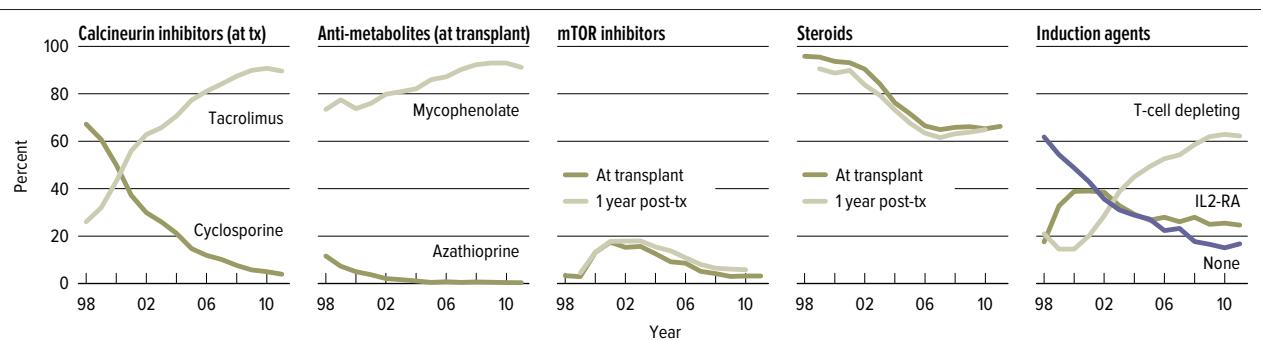
**KI 7.2 Induction agents used at time of kidney transplant, adult recipients, 2011**

Patients transplanted in 2011 and discharged with a functioning graft.



**KI 7.3 Immunosuppression regimen at one year in adult kidney transplant recipients, 2010**

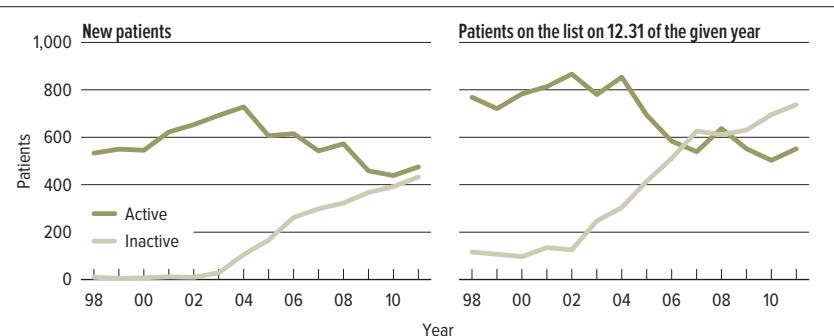
Patients transplanted in 2010 and remaining alive with graft function one year post-transplant. Top three one-year immunosuppression regimens are given, plus the “all others” group. Regimens are defined by use of calcineurin inhibitors (TAC=Tacrolimus, Cyclo=Cyclosporine), anti-metabolites (AZA=Azathioprine, MMF/MPA=Mycophenolate), and mTOR inhibitors (mTOR). Data within each regimen are reported separately by steroid use.



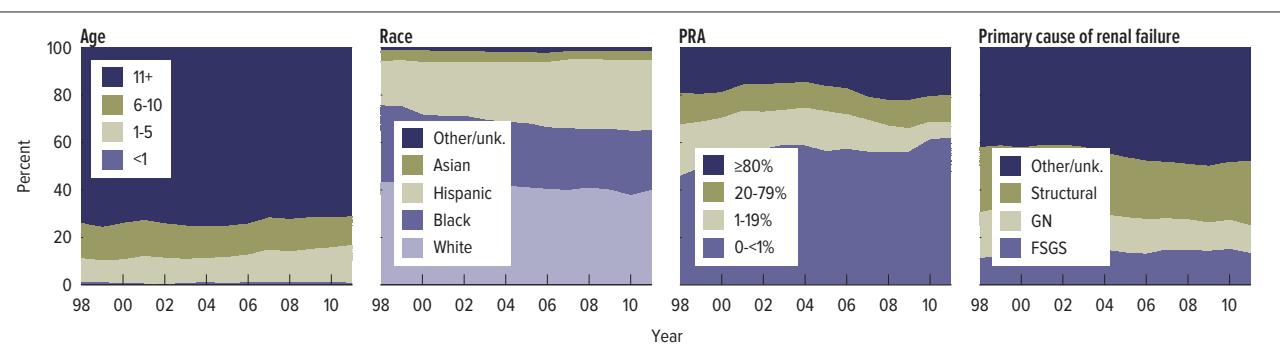
**KI 7.4 Immunosuppression use in adult kidney transplant recipients**

One-year post-transplant data for mTOR inhibitors and steroids limited to patients alive with graft function one year post-transplant. One-year post-transplant data are not reported for 1998 transplant recipients, as follow-up data were very sparse.

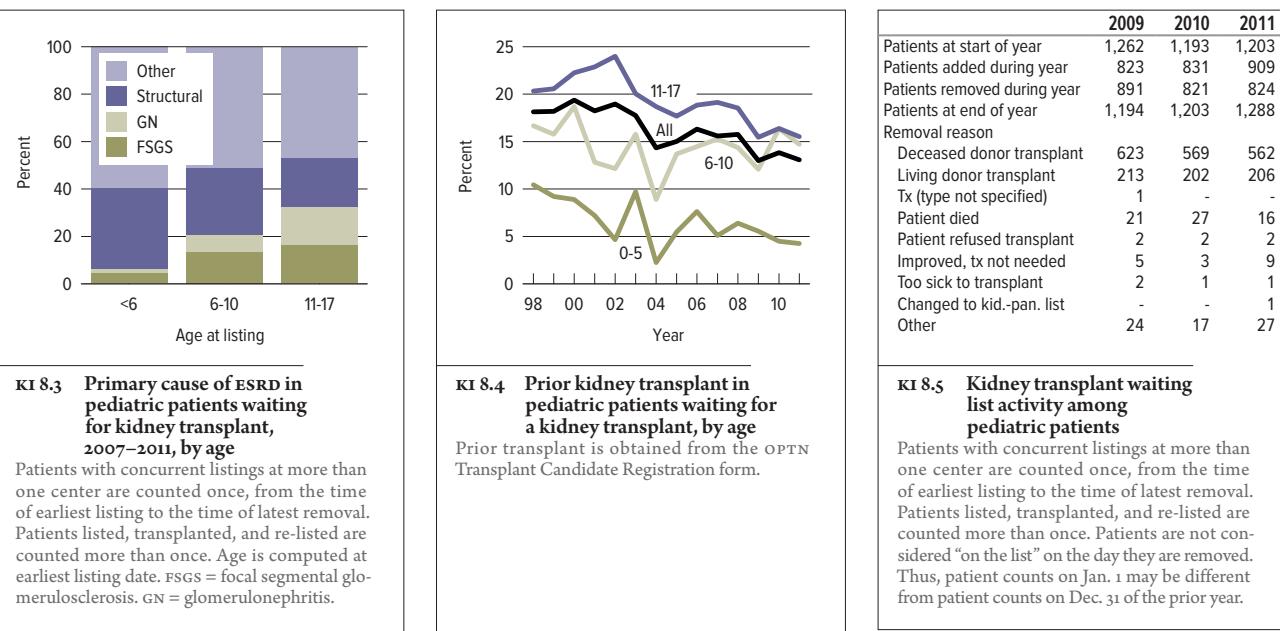
# pediatric transplant


**KI 8.1 Pediatric patients waiting for a kidney transplant**

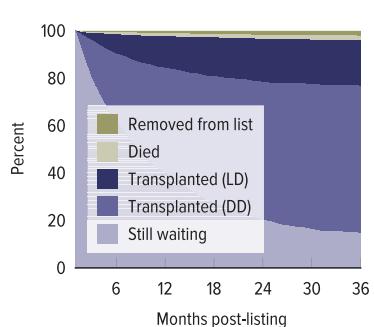
Patients waiting for a transplant. A "new patient" is one who first joins the list during the given year, without having listed in a previous year. However, if a patient has previously been on the list, has been removed for a transplant, and has relisted since that transplant, the patient is considered a "new patient". Patients concurrently listed at multiple centers are counted only once. Those with concurrent listings and active at any program are considered active; those inactive at all programs at which they are listed are considered inactive.


**KI 8.2 Distribution of pediatric patients waiting for a kidney transplant**

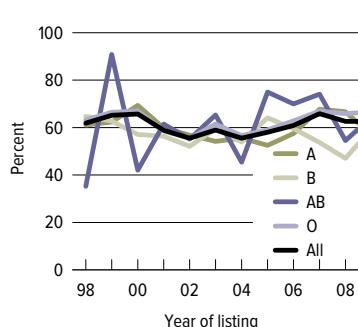
Patients waiting for a transplant any time in the given year. Age determined on the lastest of listing date or January 1 of the given year. Concurrently listed patients are counted once. Primary cause of renal failure categorized according groups used by NAPRTCS. FSGS = focal segmental glomerulosclerosis. GN = glomerulonephritis.



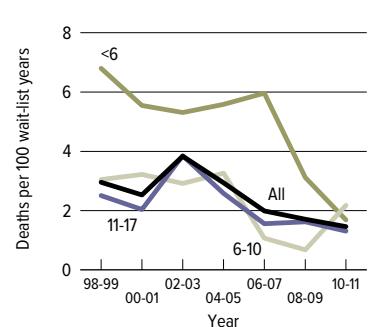
# pediatric transplant


**KI 8.6 Outcomes for pediatric patients waiting for a kidney transplant among new listings in 2008**

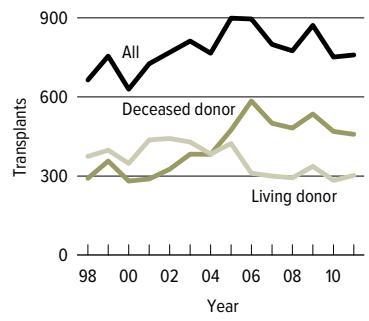
Patients waiting for a transplant and first listed in 2008. Patients with concurrent listings at more than one center are counted once, from the time of earliest listing to the time of latest removal.


**KI 8.7 Pediatric wait-listed patients who receive a deceased donor kidney transplant within three years, by blood type**

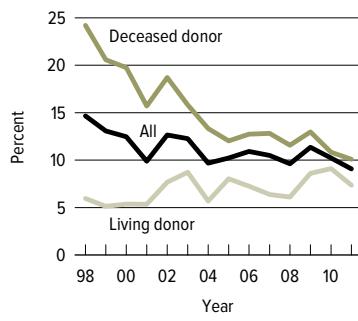
Patients with concurrent listings at more than one center are counted once, from the time of earliest listing to the time of latest removal. Patients listed, transplanted, and re-listed are counted more than once.


**KI 8.8 Pre-transplant mortality rates among pediatric patients wait-listed for a kidney transplant, by age**

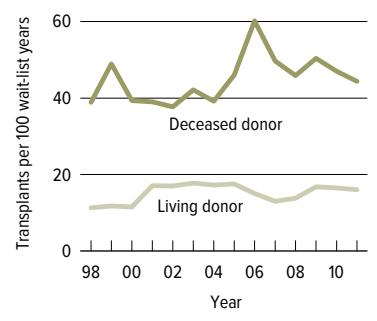
Patients waiting for a transplant. Mortality rates are computed as the number of deaths per 100 patient-years of waiting time in the given 2-year interval. Waiting time is calculated as the total waiting time per age group in the interval. Only deaths that occur prior to removal from the waiting list are counted. Age is calculated on the latest of listing date or January 1 of the given period.


**KI 8.9 Pediatric kidney transplants (includes kidney-pancreas), by donor type**

Patients receiving a kidney-alone or simultaneous kidney-pancreas transplant, by kidney donor type.


**KI 8.10 Percent of pediatric kidney transplants that are retransplants**

Includes patients transplanted after age 17, but listed at age 17 or younger. Retransplanted patients include only those with a prior kidney transplant.


**KI 8.11 Kidney transplant rates in pediatric waiting list candidates**

Patients waiting for transplant. Transplant rates are computed as the number of transplants per 100 patient-years of waiting time in the given year. Patients with concurrent listings at multiple centers are counted once.

# pediatric transplant

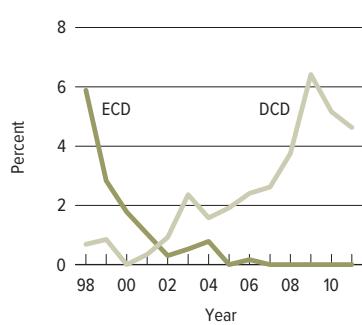
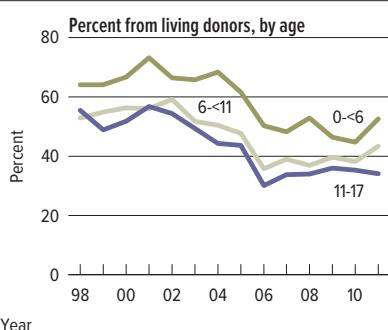
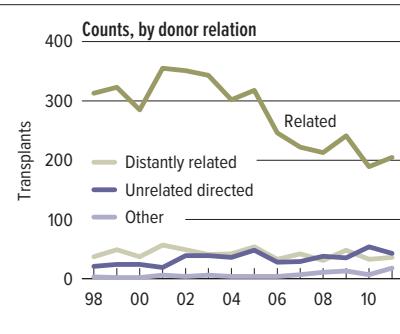
Level	1999–2001						2009–2011						
	All		Deceased		Living		All		Deceased		Living		
	N	%	N	%	N	%	N	%	N	%	N	%	
Age													
<1	17	0.8	2	0.2	15	1.3	5	0.2	2	0.1	3	0.3	
1–5	396	18.8	129	14.0	267	22.6	510	21.5	266	18.4	244	26.5	
6–10	411	19.5	182	19.7	229	19.4	429	18.1	256	17.7	173	18.8	
11–17	1,282	60.9	610	66.1	672	56.8	1,427	60.2	925	63.8	502	54.4	
Sex	Female	885	42.0	403	43.7	482	40.7	954	40.2	596	41.1	358	38.8
	Male	1,221	58.0	520	56.3	701	59.3	1,417	59.8	853	58.9	564	61.2
Race	White	1,250	59.4	431	46.7	819	69.2	1,193	50.3	574	39.6	619	67.1
	Black	391	18.6	249	27.0	142	12.0	438	18.5	350	24.2	88	9.5
	Hispanic	388	18.4	199	21.6	189	16.0	616	26.0	447	30.8	169	18.3
	Asian	55	2.6	30	3.3	25	2.1	87	3.7	56	3.9	31	3.4
	Other/unknown	22	1.0	14	1.5	8	0.7	37	1.6	22	1.5	15	1.6
Primary cause of disease	FSGS	227	10.8	134	14.5	93	7.9	299	12.6	205	14.1	94	10.2
	Glomerulonephritis	386	18.3	162	17.6	224	18.9	270	11.4	175	12.1	95	10.3
	Structural	741	35.2	319	34.6	422	35.7	724	30.5	422	29.1	302	32.8
	Other cause	752	35.7	308	33.4	444	37.5	1,078	45.5	647	44.7	431	46.7
Blood type	A	794	37.7	326	35.3	468	39.6	784	33.1	435	30.0	349	37.9
	B	259	12.3	112	12.1	147	12.4	281	11.9	168	11.6	113	12.3
	AB	79	3.8	30	3.3	49	4.1	75	3.2	48	3.3	27	2.9
	O	974	46.2	455	49.3	519	43.9	1,231	51.9	798	55.1	433	47.0
PRA/CPRA	<20%	1,838	87.3	793	85.9	1,045	88.3	1,908	80.5	1,160	80.1	748	81.1
	20–79%	125	5.9	72	7.8	53	4.5	300	12.7	205	14.1	95	10.3
	≥80%	57	2.7	51	5.5	6	0.5	120	5.1	84	5.8	36	3.9
	Unknown	86	4.1	7	0.8	79	6.7	43	1.8	0	0.0	43	4.7
History of renal replacement therapy	Preemptive tx	512	24.3	119	12.9	393	33.2	612	25.8	279	19.3	333	36.1
	<1 year	645	30.6	212	23.0	433	36.6	615	25.9	370	25.5	245	26.6
	<3 years	620	29.4	362	39.2	258	21.8	700	29.5	499	34.4	201	21.8
	<5 years	126	6.0	93	10.1	33	2.8	155	6.5	121	8.4	34	3.7
	5+ years	203	9.6	137	14.8	66	5.6	289	12.2	180	12.4	109	11.8
Insurance	Private	1,062	50.4	338	36.6	724	61.2	990	41.8	452	31.2	538	58.4
	Medicaid	426	20.2	240	26.0	186	15.7	537	22.6	386	26.6	151	16.4
	Medicare	533	25.3	306	33.2	227	19.2	657	27.7	478	33.0	179	19.4
	Other public	56	2.7	24	2.6	32	2.7	150	6.3	114	7.9	36	3.9
	Other	29	1.4	15	1.6	14	1.2	37	1.6	19	1.3	18	2.0
HLA mismatches with donor	0	97	4.6	42	4.6	55	4.6	55	2.3	28	1.9	27	2.9
	1	138	6.6	26	2.8	112	9.5	79	3.3	4	0.3	75	8.1
	2	421	20.0	44	4.8	377	31.9	284	12.0	24	1.7	260	28.2
	3	591	28.1	124	13.4	467	39.5	485	20.5	146	10.1	339	36.8
	4	323	15.3	259	28.1	64	5.4	450	19.0	380	26.2	70	7.6
	5	324	15.4	283	30.7	41	3.5	617	26.0	534	36.9	83	9.0
	6	167	7.9	134	14.5	33	2.8	374	15.8	332	22.9	42	4.6
	Unknown	45	2.1	11	1.2	34	2.9	27	1.1	1	0.1	26	2.8
Kidney transplant history	First transplant	1,894	89.9	770	83.4	1,124	95.0	2,169	91.5	1,318	91.0	851	92.3
	Retransplant	212	10.1	153	16.6	59	5.0	202	8.5	131	9.0	71	7.7
Prior solid organ tx		28	1.3	14	1.5	14	1.2	24	1.0	17	1.2	7	0.8
DCD status *	Non-DCD	919	99.6	919	99.6	0	0.0	1,370	94.5	1,370	94.5	0	0.0
	DCD	4	0.4	4	0.4	0	0.0	79	5.5	79	5.5	0	0.0
SCD/ECD status *	SCD	905	98.0	905	98.0	0	0.0	1,449	100.0	1,449	100.0	0	0.0
	ECD	18	2.0	18	2.0	0	0.0	0	0.0	0	0.0	0	0.0
All patients		2,106	100.0	923	100.0	1,183	100.0	2,371	100.0	1,449	100.0	922	100.0

\* for deceased donor transplant only

#### KI 8.12 Characteristics of pediatric kidney transplant recipients, 1999–2001 & 2009–2011

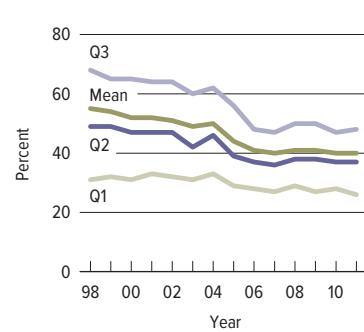
Patients receiving a transplant. Retransplants are counted. PCOD categories follow NAPRTCS recommendations.

# pediatric transplant



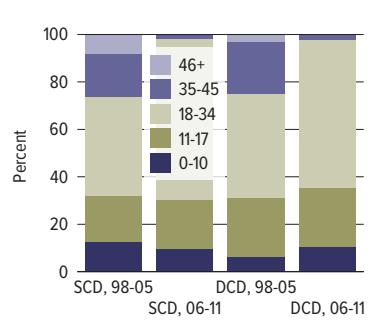
**KI 8.14 Use of ECD or DCD donors in pediatric kidney transplant recipients**

Patients receiving a DCD or ECD kidney transplant.



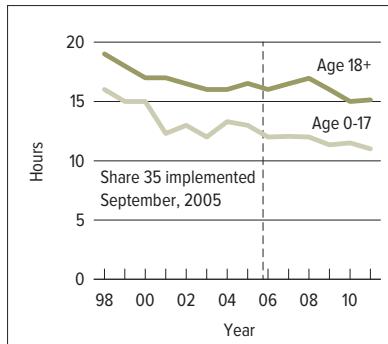
**KI 8.15 Distribution of kidney donor profile index (KDPI) in pediatric recipients of deceased donor kidneys**

Patients receiving a kidney-only, deceased-donor transplant. Those whose transplant organ was missing a value for height, weight, or creatinine are excluded. KDPI is based on donor factors only; the percentiles are derived by mapping to the 2011 population of kidneys recovered for transplant.



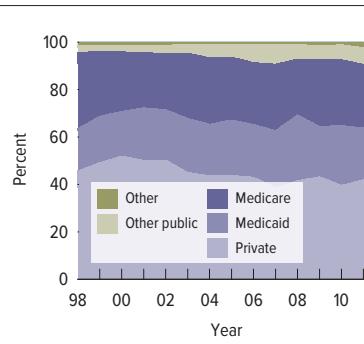
**KI 8.16 Donor age among pediatric kidney transplant recipients, by kidney status, before & after Share 35**

Patients receiving a deceased donor transplant. Share 35 began in September 2005. SCD: standard criteria donor kidneys; DCD: donations after cardiac death. Data for expanded criteria donor (ECD) kidneys are not shown; n=41 ECD kidneys in 1998–2005 and 1 ECD kidney in 2006–2011. Donors of ECD kidneys are age 50+.



**KI 8.17 Median cold ischemia time in adult & pediatric transplant recipients**

Patients receiving a deceased donor transplant. Share 35 began in September, 2005.



**KI 8.18 Insurance coverage among pediatric kidney transplant recipients at time of transplant**

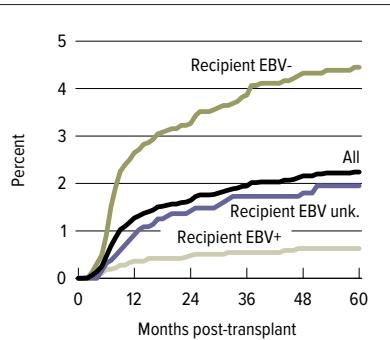
Patients receiving a transplant in given year; reported primary insurance payor at time of transplant. Retransplants are counted.

# pediatric transplant

RECIPIENT	DECEASED DONOR				LIVING DONOR			
	Neg.	Pos.	Unk.	Total	Neg.	Pos.	Unk.	Total
<b>Negative</b>	4.5	32.5	0.9	37.9	5.7	33.5	8.8	47.9
<b>Positive</b>	5.1	44.5	0.9	50.6	3.7	31.2	5.4	40.3
<b>Unknown</b>	1.2	10.0	0.5	11.6	1.0	6.0	4.8	11.8
<b>Total</b>	10.8	87.0	2.3	100	10.4	70.7	18.9	100

**KI 8.19 Kidney donor-recipient Epstein-Barr virus (EBV) serology matching for pediatric transplant recipients, 2007–2011**

Pediatric transplant cohort from 2007–2011. Donor EBV serology is reported on the OPTN Donor Registration form; recipient EBV serology is reported on the OPTN Recipient Registration form. Any evidence for a positive serology is taken to indicate that the person is positive for EBV; if all fields are unknown, not done, or pending the person is considered to be “unknown” for that serology; otherwise, serology is assumed negative.

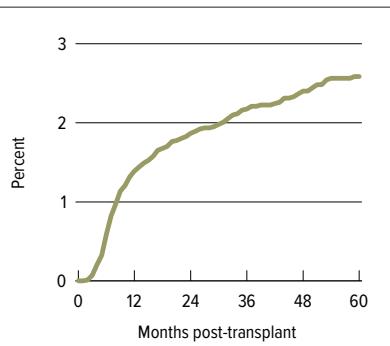

**KI 8.21 Incidence of PTLD among pediatric patients receiving a kidney transplant, 1999–2009**

The cumulative incidence, defined as the probability of post-transplant lymphoproliferative disorder (PTLD) being diagnosed between the time of transplant and the given time, is estimated using Kaplan-Meier methods. PTLD is identified as either a reported complication or cause of death on the Transplant Recipient Follow-up forms or on the Post-transplant Malignancy form as polymorphic PTLD, monomorphic PTLD, or Hodgkin's Disease. Only the earliest date of PTLD diagnosis is considered, and patients are followed for PTLD until graft failure, death, or loss to follow-up. Patients are censored at graft failure because malignancies are not reliably reported after graft failure.

RECIPIENT	DECEASED DONOR				LIVING DONOR			
	Neg.	Pos.	Unk.	Total	Neg.	Pos.	Unk.	Total
<b>Negative</b>	22.4	33.6	0.2	56.2	32.4	26.2	5.4	64.0
<b>Positive</b>	13.9	22.8	0.2	36.9	5.4	21.7	2.0	29.1
<b>Unknown</b>	2.6	4.2	0.0	6.8	2.2	2.8	1.9	6.8
<b>Total</b>	38.9	60.6	0.5	100	40.0	50.7	9.3	100

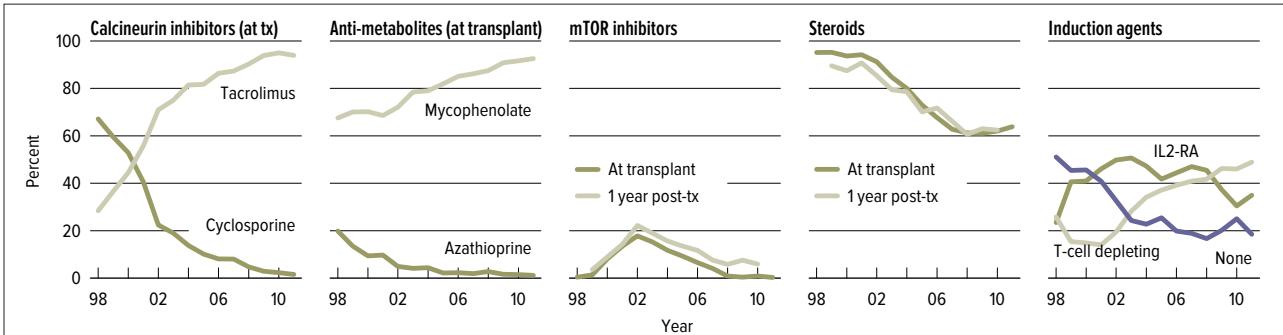
**KI 8.20 Kidney donor-recipient cytomegalovirus (CMV) serology matching for pediatric transplant recipients, 2007–2011**

Pediatric transplant cohort from 2007–2011. Donor CMV serology is reported on the OPTN Donor Registration form; recipient CMV serology is reported on the OPTN Recipient Registration form. Any evidence for a positive serology is taken to indicate that the person is positive for CMV; if all fields are unknown, not done, or pending the person is considered to be “unknown” for that serology; otherwise, serology is assumed negative.

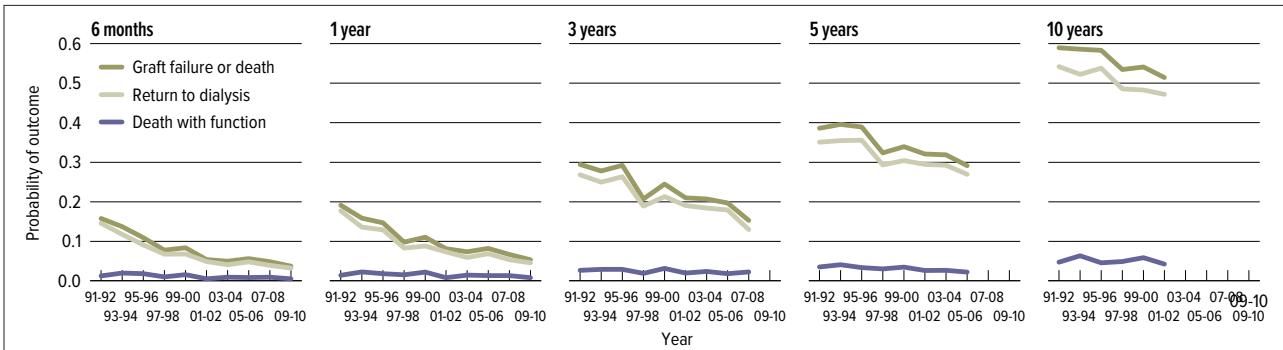

**KI 8.22 Incidence of any malignancy in pediatric patients receiving a kidney transplant in 1999–2009**

The cumulative incidence, defined as the probability of any malignancy being diagnosed between the time of transplant and the given time, is estimated using Kaplan-Meier methods. Malignancies are identified on the Malignancy forms or on the Transplant Recipient Follow-up forms. Causes of graft failure or causes of death attributed to malignancy are included. Only the earliest date of diagnosis is included in the analysis, and patients are followed only until graft failure, death, or loss to follow-up. Patients are censored at graft failure because malignancies are not reliably reported after graft failure.

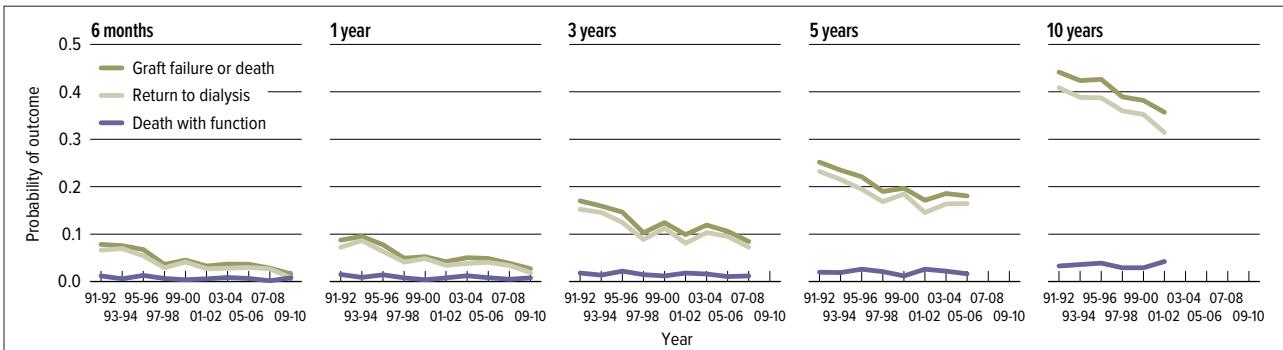
# pediatric transplant


**KI 8.23 Immunosuppression use in pediatric kidney transplant recipients**

One-year post-transplant data for mTOR inhibitors and steroids limited to patients alive with graft function one year post-transplant. One-year post-transplant data are not reported for 1998 transplant recipients, as follow-up data were very sparse.

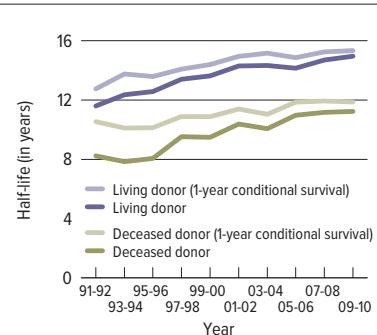

**KI 8.24 Outcomes among pediatric kidney transplant recipients: deceased donor**

Data are reported as probability of each outcome. Probabilities are unadjusted, computed using Kaplan-Meier competing risk methods. Death with function defined as no graft failure prior to death; return to dialysis defined as graft failure preceding death.


**KI 8.25 Outcomes among pediatric kidney transplant recipients: living donor**

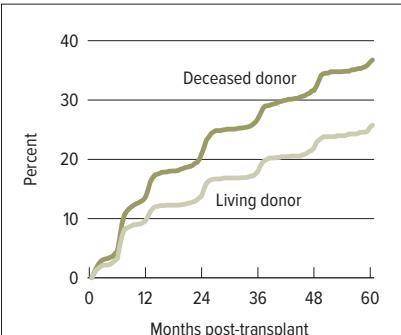
Data are reported as probability of each outcome. Probabilities are unadjusted, computed using Kaplan-Meier competing risk methods. Death with function defined as no graft failure prior to death; return to dialysis defined as graft failure preceding death.

# pediatric transplant



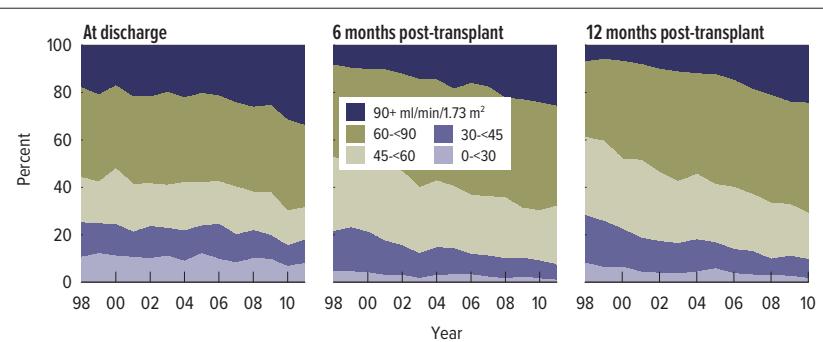
**KI 8.26** Half-lives for pediatric kidney transplant recipients

Estimated graft half-lives and conditional half-lives. Half-lives are interpreted as the estimated median survival of grafts from the time of transplant. Conditional half-lives are interpreted as the estimated median survival of grafts which survive the first year.



**KI 8.27** Incidence of first acute rejection among pediatric patients receiving a kidney transplant in 2005–2010

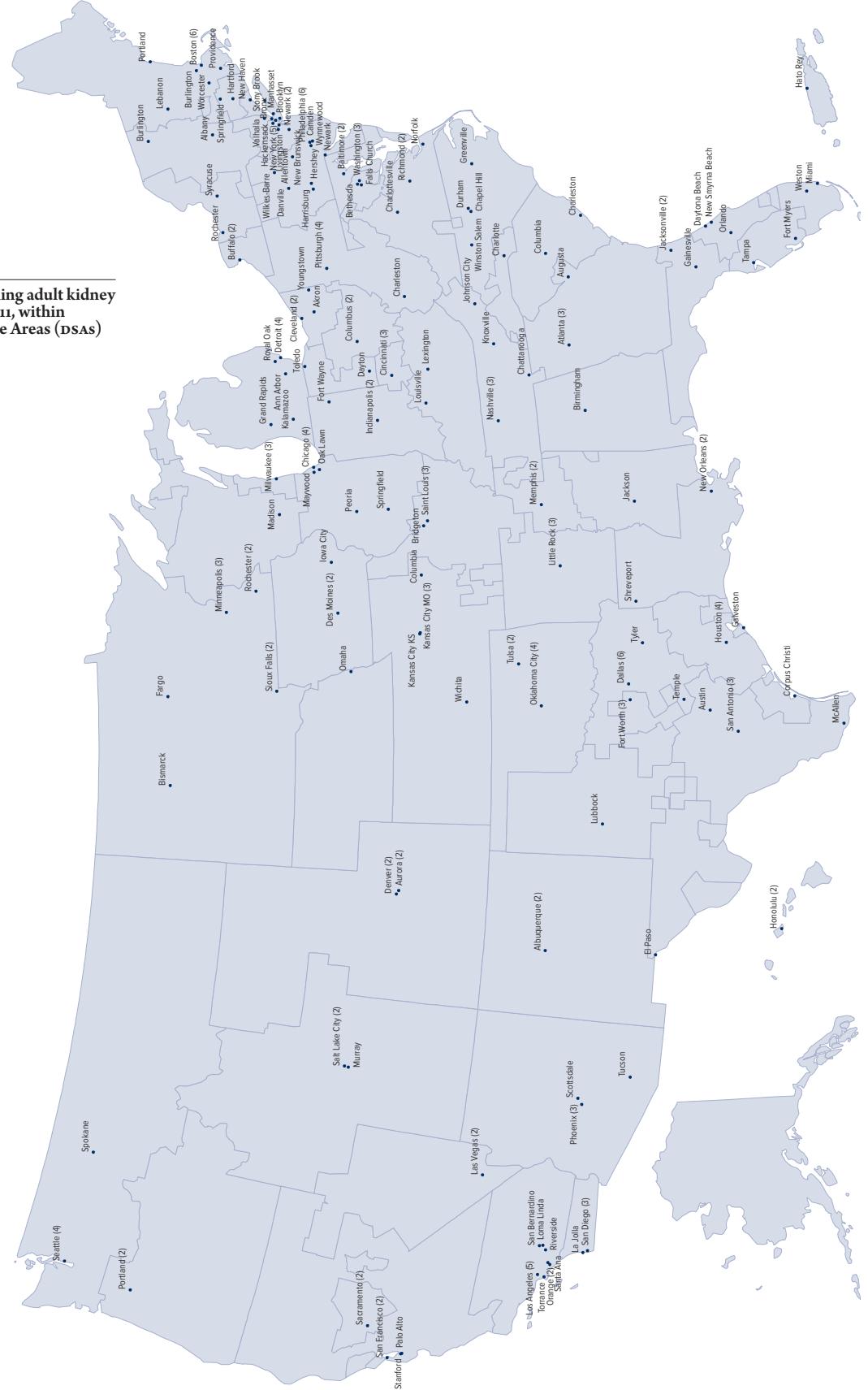
Acute rejection defined as a record of acute or hyperacute rejection, or a record of an anti-rejection drug being administered on either the Transplant Recipient Registration form or the Transplant Recipient Follow-up Form. Only the first rejection event is counted, and patients are followed for acute rejection only until graft failure, death, or loss to follow-up. Cumulative incidence, defined as the probability of acute rejection at any time prior to the given time, is estimated using Kaplan-Meier methods.



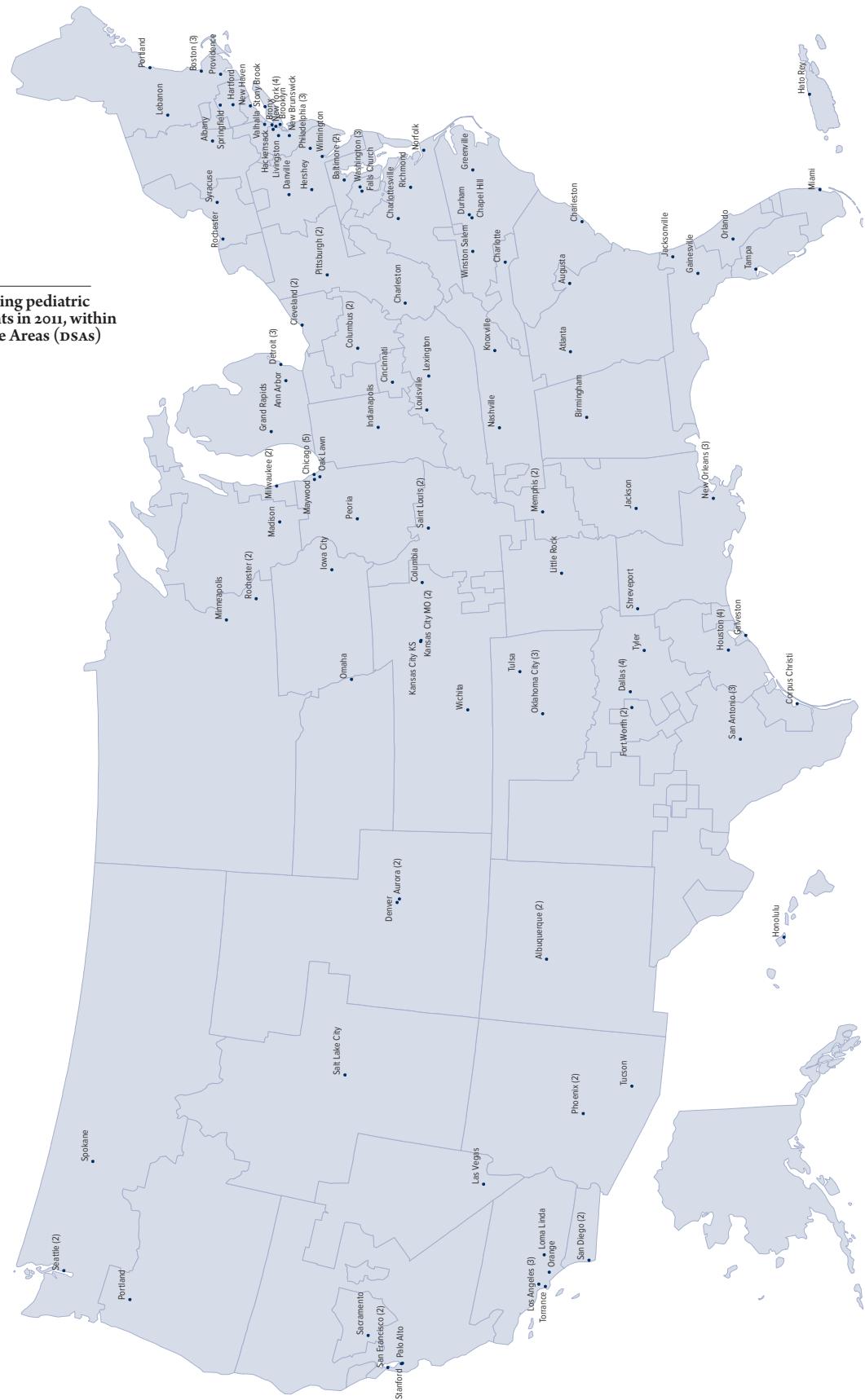
**KI 8.28** Distribution of eGFR, at discharge & at 6 & 12 months post-transplant among pediatric kidney transplant recipients

GFR estimated using the bedside Schwartz equation, and computed for patients alive with graft function at the given time point.

**KI 9.1** Centers performing adult kidney transplants in 2011, within  
Donation Service Areas (DSAs)



KI 9.2 Centers performing pediatric kidney transplants in 2011, within  
Donation Service Areas (DSAs)



**KI 9.3** Centers performing adult kidney transplants in 2011, within OPTN regions

