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OPTN/SRTR 2012 Annual Data Report:

kidney

ABSTRACT : For most end-stage renal disease patients, successful kidney transplant provides substantially longer survival and better quality of life than dialysis, and preemptive transplant is associated with better outcomes than transplants occurring after dialysis initiation. However, kidney transplant numbers in the US have not changed for a decade. Since 2004, the total number of candidates on the waiting list has increased annually. Median time to transplant for wait-listed adult patients increased from 2.7 years in 1998 to 4.2 years in 2008. The discard rate of deceased donor kidneys has also increased, and the annual number of living donor transplants has decreased. The number of pediatric transplants peaked at 899 in 2005, and has remained steady at approximately 750 over the past 3 years; 40.9% of pediatric candidates undergo transplant within 1 year of wait-listing. Graft survival continues to improve for both adult and pediatric recipients. Kidney transplant is one of the most cost-effective surgical interventions; however, average reimbursement for recipients with primary Medicare coverage from transplant through 1 year posttransplant was comparable to the 1-year cost of care for a dialysis patient. Rates of rehospitalization are high in the first year posttransplant; annual costs after the first year are lower.

KEY WORDS End-stage renal disease, kidney transplant, organ allocation, waiting list.

So much of what I talk to people about is the hope that I have because of donation. It gives us something positive to do. Our son is still "out there." It is a thrill that people continue to get to know him. People will never forget him, he will live on in all these people.

donor mom

Introduction

For most end-stage renal disease (ESRD) patients aged younger than 70 years (and for selected patients aged 70 years or older), a successful kidney transplant provides substantially longer survival and better quality of life than dialysis. For patients who undergo transplant, preemptive transplant (before maintenance dialysis begins) is associated with better results than transplant after 6 months of dialysis, and for each additional year of pretransplant dialysis, posttransplant outcomes are worse.

Given these observations, it is striking that in the United States, kidney transplant numbers have changed little over the past decade, and have actually declined slightly in the last 3 years. This chapter's Figures 1-6 show 2012 Organ Procurement and Transplantation Network (OPTN) data on the adult kidney transplant waiting list and kidney transplants in the US. Figures 1.1-1.14 show data on the waiting list and change over time, Figures 2.1-2.7 deceased donation, Figures 3.1-3.6 living donation, Figures 4.1-4.7 and 5.1-5.7 transplant rates and recipient demographics, and Figures 6.1-6.13 transplant outcomes.

Adults

WAITING LIST

Since 2004, the total number of candidates on the waiting list has increased annually (Figure 1.1), mostly due to added inactive candidates. Increased numbers of inactive candidates in part reflect the change in OPTN policy in 2003 permitting inactive candidates to accumulate waiting time points. This policy change eliminated the disincentive to list candidates as inactive. Of candidates who were inactive within 7 days of listing, 72.5% were inactive because of incomplete work-up, 8.8% because of insurance issues, 7.5% because of being too sick, and 4.6% because candidate weight was inappropriate

for transplant (Figure 1.3). In contrast, for candidates who were listed as active but were inactive as of December 31, 2012, 31.1% were inactive because of incomplete work-up and 35.3% because of being too sick. Given the long waiting times for a deceased donor transplant (and the associated morbidity and mortality), some centers list all candidates as inactive because of incomplete work-up and perform the work-up only when the candidates near the top of the list.

From 2002 to 2012, most candidate demographics have changed little (Figures 1.4, 1.5). The only significant trends have been a steady increase in the number of candidates aged 50 years or older (particularly those aged 65 years or older) added to the waiting list, and a steady decrease in the percentage of candidates of white race on the waiting list. Importantly, over the past decade, for all age groups and diagnoses, the number of transplants per 100 active wait-list years has decreased; however, the numbers of candidates with panel-reactive antibodies (PRA) $\geq 20\%$, and particularly $\geq 80\%$, have increased, reflecting OPTN policy changes to give priority to these difficult-to-match candidates (Figure 1.7). The combination of a growing candidate list and decreasing transplant rates has resulted in more than 21,000 candidates being removed from the waiting list in the last 3 years because of death or becoming too sick to undergo transplant (Figure 1.9). This is an area of potential research. Three-year outcomes for candidates listed in 2009 show that 43.0% were still waiting in 2012, 9.3% had died, 8.4% were removed from the list because of being too sick, and 39.3% had undergone transplant (Figure 1.10). The percentage of candidates who underwent transplant after 3 years was highest in the 18-35 year age group; the percentage of candidates removed from the list because of death or being too sick increased with candidate age.

A striking (but not new) observation is the tremendous difference between organ procurement organizations in kidney transplant rates (both living donor and deceased donor) per 100 years on the waiting list (Figure 1.8) and in the percentage of wait-listed patients who undergo deceased donor kidney transplant within 5 years (Figure 1.12). This is also an area of potential research.

Perhaps the best depiction of the current state of kidney transplantation in the US is the median time to transplant for wait-listed adult patients, which increased from 2.7 years in 1998 to 4.2 years in 2008 (Figure 1.11). Given the morbidity and mortality associated with prolonged dialysis (especially for some subgroups, e.g., patients with diabetes or aged older than 60 years), these long waits are associated with only a minority surviving to undergo transplant.

Donation

A concerning observation, especially considering the tremendous shortage of organs, is the increased rate of deceased donor discards by donor type (donation after brain death [DBD], standard criteria donor [SCD], expanded criteria donor [ECD]) (Figures 2.3, 2.4). This could be attributed to increased willingness by organ procurement organizations to procure kidneys from borderline donors in the hope that the kidneys would be usable for transplant; however, this does not explain the increasing rate of SCD kidney discards (Figure 2.4). This question could be investigated further.

Concurrently, the annual number of living donor transplants from relatives steadily decreased (Figure 3.1). This cannot be explained by an increase in spouse, partner, or unrelated donor transplants. Further research could yield insight on this matter. The total annual number of living donor transplants decreased from a peak of 6647 in 2004

to 5622 in 2012 (Figure 3.1). Living donation has been relatively stable among white donors; the decrease has been more pronounced among black, Hispanic, and Asian donors (Figure 3.2). Whether this is due to changing demographics or to other factors has not been determined. Again, further research could yield insight.

In the past decade, living donor death rates have not changed (Figure 3.6), although reported complications have increased. Whether this is a true increase or due to increasing OPTN emphasis on following early donor outcomes is unclear.

TRANSPLANT

As noted above, living donor transplants have decreased, and deceased donor transplants have increased only slightly since 2005 (Figure 4.1). Numbers of transplants have increased only for candidates aged 50 years or older during this interval (Figures 4.2, 4.6). For all subgroups, approximately 14.5% of all transplants are now donation after circulatory death (DCD) transplants. Immunosuppressive medication protocols have changed little recently. Most recipients are treated with tacrolimus and a mycophenolate; 64.2% receive a T-cell depleting agent; and about 30% are steroid-free at transplant and at 1 year posttransplant.

OUTCOMES

On the positive side, for both living and deceased donor transplants, death-censored graft failure in the first 90 days has steadily decreased and continues to decrease (Figure 6.1). Similarly, 6 month and 1-, 3-, 5-, and 10-year graft survival has slowly but steadily improved (Figures 6.3, 6.4). Most of the improvement relates to decreased donor graft loss (graft failure or return to dialysis). Rates of death with function have

changed little; this may represent some improvement in that it is generally believed that patients with more comorbid conditions are undergoing transplant.

Five-year graft survival for deceased donor transplants was 73% in 2012, and was similar for SCDs and DCDs (Figure 6.5). Recipients with glomerulonephritis or cystic disease as primary cause of ESRD had better 5-year outcomes than recipients with diabetes or hypertension (however, data are not controlled for demographic factors such as age and comorbid conditions). Five-year survival for living donor transplants was 84% (Figure 6.6), and was better for recipients with glomerulonephritis or cystic disease than for those with diabetes or hypertension. Graft survival was lower for black recipients than for white recipients or members of others racial groups). Importantly, 5-year graft survival differed little between related and unrelated living donor transplant recipients.

For both living and deceased donor transplants, the half-life of the kidney allograft has slowly but steadily improved, as has the half-life of grafts with 1-year graft survival (Figure 6.7). Of note, the rate of posttransplant diabetes dropped from a peak of 11.4% at 1-year posttransplant in 2005 to 6.1% in 2011 (Figure 6.11). The reasons for this are unclear. The percentage of recipients treated with steroid-free protocols changed little, but possibly recipients treated with steroids receive much lower doses than in 2005 (an area of potential research). Doses (levels) of other immunosuppressive agents may also be lower.

Consistent with the 2011 report, risk of developing posttransplant lymphoproliferative disorders (PTLD) over the first 5 years posttransplant was higher for recipients who are Epstein-Barr virus (EBV) negative at transplant, although the cumulative risk is 1.3% (Figure 6.12).

PUBLIC POLICY CONSIDERATIONS

The total number of kidney transplants in the US has not changed appreciably for a decade, despite increasing numbers of candidates on the waiting list, the knowledge that a successful transplant provides longer life and better quality of life than dialysis, and the fact that transplant (versus dialysis) saves costs for the health care system.

In the early 1990s, the Organ Donation Breakthrough Collaborative was initially associated with a significant increase in the rate of deceased donor transplants; however, since the mid-1990s, although use of ECD and DCD donors has increased, deceased donor kidney transplant rates have not increased. No new public policy initiatives to increase donation have occurred. Instead, the major focus of public policy has been on developing methods of increasing patient survival post-transplant. In accordance with the Final Rule, OPTN has been trying to develop a new allocation system that improves both access to transplant and patient survival. Several deceased donor kidney allocation proposals have been advanced; for each, an underlying theme has been to allocate the best kidneys to the best patients (as defined by the kidney donor risk index and estimated long-term patient survival, respectively). In June 2013, the OPTN Board of Directors approved a new kidney allocation system that was nearly a decade in the making. Although this new allocation policy is expected to improve patient survival and broaden access to transplant, it will not address the shortage of donor kidneys. Clearly, additional efforts are needed to expand the supply of donated organs, and to use donated organs more effectively.

Initiatives in living donation have included the development of nondirected donation, paired exchange, and successful desensitization protocols. Each of these raises associated ethical questions, and importantly, adds substantial work

load to transplant center personnel. Despite these developments, the overall living donation rate decreased 15% from 2004 to 2012.

Is it time to energize another major public policy initiative to increase organ donation? Increased donation rates could possibly decrease mortality on the waiting lists and would save costs for the health care system. The major challenge would be gathering the appropriate government and nongovernment groups into a forum to discuss potential changes.

Children and Adolescents

WAITING LIST

In 2012, just over half of new pediatric candidates added to the kidney transplant waiting list were listed as inactive (Figure 7.1). This number has continued to increase since the policy change in 2003 permitting waiting time to accrue while candidates are listed as inactive. The most common reason for inactive status for new candidates, given for 64.3%, was incomplete work-up (Figure 7.2). Similarly, prevalent wait-listed patients listed as inactive outnumbered those listed as active (Figure 7.1). The most common reasons for inactive status for prevalent candidates included being too sick (25.0%), being too well (24.5%), and incomplete work-up (19.8%) (Figure 7.2). By age, the largest proportion of wait-list candidates were aged 11-17 years (69.0%), followed by those aged 1-5 years (15.9%) (Figure 7.3). While the proportions of white and Asian candidates remained relatively constant, the proportion of Hispanic candidates increased and the proportion of black candidates decreased. Most pediatric candidates on the waiting list (62.6%) had < 1% PRA. The etiology of ESRD remains 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 7.4). Length of time on the waiting list changed remarkably little; 40.9% of candidates waited less than 1 year, 25.3% 1- < 2 years, 16.7% 2- < 4 years, and 17.1% > 4 years (Figure 7.3).

In 2012, 12.8% of pediatric candidates on the kidney transplant waiting list had undergone a previous kidney transplant (Figure 7.5). Of all wait-list candidates in 2012, 2.7% of those aged younger than 6 years, 15.6% of those aged 6-10 years, and 15.4% of those aged 11-17 years were waiting for retransplant. Of pediatric candidates on the waiting list in 2012, 25.8% received a deceased donor kidney by the end of the year, 9.7% received a living donor kidney, 1.3% died, 0.4% were removed from the list because their condition improved, and 0.2% were considered too sick to undergo transplant (Figure 7.6). The rate of deceased donor transplant among pediatric wait-list candidates was 106 per 100 active wait-list years, with similar rates among all age groups (Figure 7.8). However, transplant rates vary significantly by calculated PRA (CPRA); the highest rates are for candidates with < 1% CPRA (198 transplants per 100 active wait-list years) and the lowest for candidates with > 80% CPRA (20 transplants per 100 active wait-list years). In contrast to mortality among patients waiting for other organs, pretransplant mortality among pediatric patients waiting for kidney transplant is low, 1.86 per 100 wait-list years in 2010-2012 (Figure 7.9).

TRANSPLANT

The number of pediatric kidney transplants peaked in 2005 at 899 and remained steady at approximately 750 over the past 3 years (Figure 7.10). In 2012, the number of deceased donor transplants continued to outnumber the number of living donor transplants, 474 to 287, respectively. Retransplant accounted for 9.6% of deceased donor transplants and 7.7%

of living donor transplants among pediatric recipients in 2012 (Figure 7.11). Only 3.2% of pediatric kidney transplants were part of a multi-organ transplant, in contrast to 8.0% of adult transplants (Figure 7.12).

Donation from related living donors declined, while donation from other living donors increased, possibly reflecting increased participation in living donor exchanges (Figure 7.13). The youngest recipients undergo the highest percentage of living donor transplants (Figure 7.13). In 2012, DCD kidneys were used in < 5% of pediatric kidney transplants (Figure 7.14). ECD kidneys are rarely used in pediatric recipients; only 1 case was reported in 2012, and none from 2007-2011.

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. In October 2005, United Network for Organ Sharing (UNOS) implemented a revised allocation policy known as Share 35 that required renal allografts from deceased donors aged less than 35 years to be offered preferentially to patients aged less than 18 years. Figure 7.15 illustrates the increase in deceased donor organs from donors aged less than 35 years following implementation of Share 35.

The number of HLA mismatches increased over time, raising concerns about long-term graft survival. Among deceased donor kidney transplant recipients in 2012, 85% had > 3 HLA mismatches. In contrast, 19.5% of living donor recipients had > 3 HLA mismatches in 2012 (Figure 7.17).

IMMUNOSUPPRESSIVE MEDICATION USE

Trends in maintenance immunosuppressive medications used in children and adolescents are similar to trends for adults. In 2012, 93.8% of pediatric transplant recipients received tacrolimus as part of the initial maintenance immu-

nosuppressive medication regimen, and 93.4% received mycophenolate mofetil (Figure 7.22). In 2011, 5.7% of recipients received mammalian target of rapamycin inhibitors at 1 year posttransplant; corticosteroids were used in 64.5% of transplant recipients at the time of transplant and in 66.3% at 1 year posttransplant. Induction therapy has also changed substantially over time in pediatric kidney transplantation. A decrease in use of interleukin-2 receptor antagonist therapy for induction was accompanied by a corresponding increase in the use of T-cell depleting agents, used in 56.2% of recipients in 2012. The percentage of recipients receiving no induction therapy continued to decline, reaching a low of 12.2% in 2012.

OUTCOMES

Graft survival (survival with a functioning graft) continued to improve over the past decade. Graft failure estimates for deceased donor transplants were 1.8% at 6 months and 2.7% at 1 year for transplants in 2011-2012, 13.8% at 3 years for transplants in 2009-2010, 26.2% at 5 years for transplants in 2007-2008, and 50.8% at 10 years for transplants in 2001-2002 (Figure 7.23). Corresponding graft failure estimates for living donor transplants were 2.5% at 6 months and 2.9% at 1 year for transplants in 2011-2012, 7.7% at 3 years for transplants in 2009-2010, 16.7% at 5 years for transplants in 2007-2008, and 34.7% at 10 years for transplants in 2001-2002 (Figure 7.24). 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 1-year conditional graft half-life was 12.5 years for transplants in 2009-2010; for living donor transplants, the 1-year conditional half-life was 15.3 years for transplants in 2009-2010 (Figure 7.26).

Rehospitalization among transplants in 2007-2012 occurred for 52.8% of patients in the first year after transplant (Figure 7.20).

PTLD is a major concern in pediatric transplantation. The highest risk for PTLD is in EBV-negative recipients of EBV-positive donor kidneys. This occurred in 36.1% of deceased donor transplants and 36.2% of living donor transplants in 2008-2012 (Figure 7.18). The incidence of PTLD among EBV-negative recipients was 4.1% at 5 years posttransplant, compared with 0.6% among EBV-positive recipients (Figure 7.21).

The combination of a cytomegalovirus positive donor and negative recipient occurred in 34.5% of deceased donor kidney transplants and 28.2% of living donor transplants (Figure 7.19).

The incidence of acute rejection among pediatric patients undergoing kidney transplant 2006-2011 increased over time posttransplant (Figure 7.27). At 1 year posttransplant, 14% of deceased donor recipients and 9% of living donor recipients experienced first acute rejection episode.

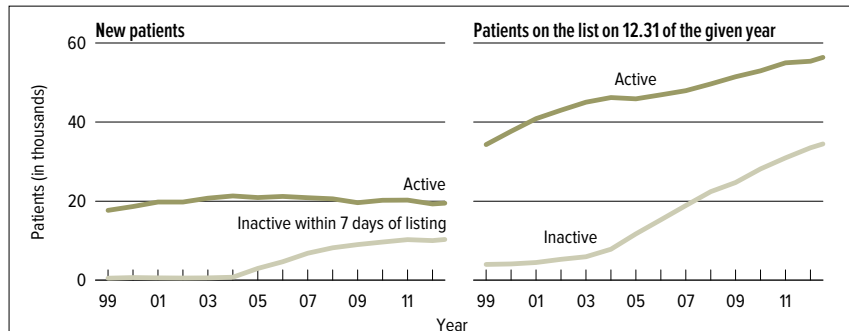
Short-term renal function, measured by estimated glomerular filtration rate (eGFR), improved substantially over the past decade. The proportions of patients with eGFR > 90 mL/min/1.73 m² at discharge increased from 17.1% in 2000 to 34.6% in 2012, at 6 months posttransplant from 10.3% in 2000 to 26.3% in 2012, and at 1 year posttransplant from 6.7% in 2000 to 25.9% in 2011 (Figure 7.28). Almost 70% of recipients in the 2012 cohort had chronic kidney disease stage 1-2 at discharge, with eGFR > 60 mL/min/1.73 m². For the 2011 cohort, this was almost 71% at 6 months and 72% at 12 months posttransplant.

Economics

Kidney transplant remains one of the most cost-effective surgical interventions. However, it is not without considerable direct economic cost. Average reimbursement for kidney

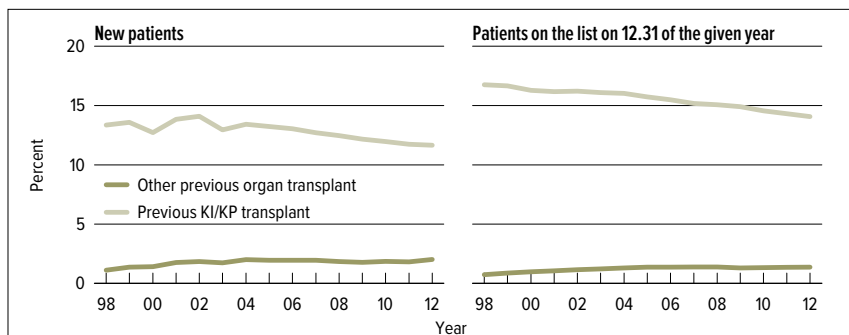
transplant recipients with primary Medicare coverage from transplant through 1 year posttransplant was \$63,432 for Part A and \$19,969 for Part B (Figure 8.5), totaling \$83,401, comparable to the 1-year cost of care for a dialysis patient. Rehospitalization is a primary driver behind inter-patient variation in cost of care. Rates of rehospitalization are relatively high in the first year posttransplant (Figure 8.2) and drop by half in the second year (Figure 8.3). Primary causes of rehospitalization are dominated by transplant complications and infections in both the first and second years posttransplant (Figure 8.4). Annual costs following the first year are dramatically smaller; Medicare Part A and B costs average \$14,427 and \$11,157, respectively during year 2 (Figure 8.6). The total, \$25,584, is expected to remain stable in later years and is approximately one-half to one-third the total annual cost of care for a dialysis patient. Additional costs are not accounted for here, including reimbursement to hospitals for the transplant portion of the Medicare Cost Report and Medicare Part D. Including estimates for these costs raises the average Medicare cost to approximately \$200,000 in the first year posttransplant and approximately \$30,000 in subsequent years. Although kidney transplant is the least expensive per patient of all solid organ transplants, kidney transplant recipients account for 64% of all Medicare Part A and B expenditure following solid organ transplant, or \$2.6 billion, \$26,947 per patient in 2010 (Figure 8.7).

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.



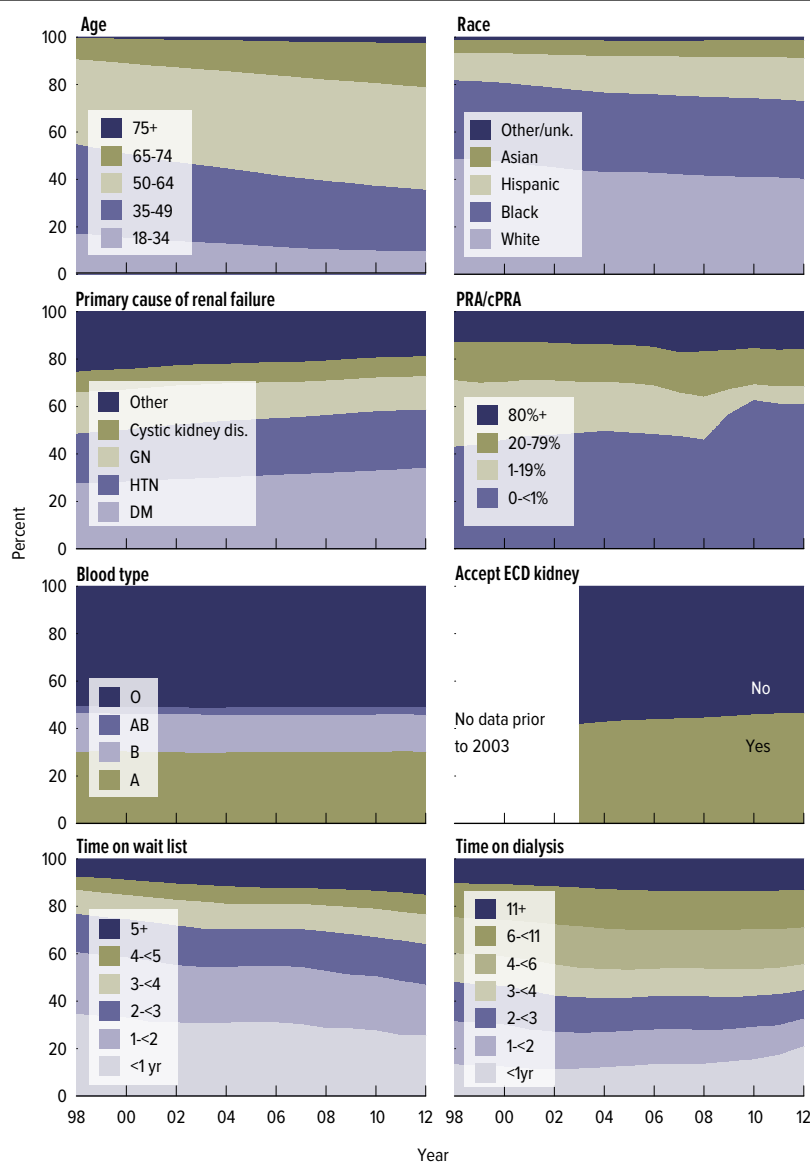
KI 1.2 Prior kidney transplant in patients waiting for a kidney transplant

Prior transplant status of patients waiting for a KI or KP 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 listing, inact. on 12.31	
	N	%	N	%
Candidate work-up incomplete	9,370	72.5	6,052	31.1
Insurance issues	1,076	8.3	1,707	8.8
Too sick	975	7.5	6,876	35.3
Weight inappropriate for tx	589	4.6	1,096	5.6
Too well	384	3.0	951	4.9
Candidate choice	286	2.2	1,059	5.4
Tx pending	104	0.8	45	0.2
Medical non-compliance	75	0.6	662	3.4
Inappropriate substance use	50	0.4	271	1.4
Physician/surgeon unavailable	6	0.0	4	0.0
Unknown	4	0.0	359	1.8
Candidate could not be contacted	3	0.0	374	1.9

KI 1.3 Reasons for inactive status among kidney transplant listings, 2012

Reasons for inactive status of listings in 2012. 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.



KI 1.4 Distribution of adult patients waiting for a kidney transplant

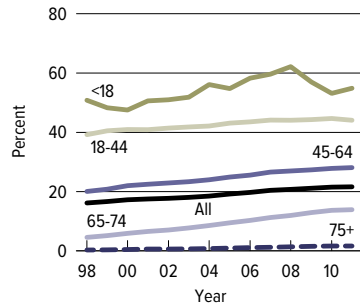
Patients waiting for a transplant any time in the given year. Age determined on the earliest of listing date or December 31 of the given year. Concurrently listed patients are counted once.

		2002		2012	
Level		N	%	N	%
Age	18-34	7,147	14.0	8,811	9.5
	35-49	17,323	34.0	24,799	26.7
	50-64	20,340	39.9	40,523	43.6
	65-74	5,661	11.1	16,779	18.1
	75+	533	1.0	1,973	2.1
Sex	Male	29,334	57.5	55,104	59.3
	Female	21,670	42.5	37,781	40.7
Race	White	21,106	41.4	35,189	37.9
	Black	18,345	36.0	31,607	34.0
	Hispanic	7,406	14.5	17,536	18.9
	Asian	3,445	6.8	7,218	7.8
	Other/unlk.	702	1.4	1,335	1.4
Primary cause of disease	DM	14,501	28.4	31,801	34.2
	HTN	12,362	24.2	23,209	25.0
	GN	8,389	16.4	13,068	14.1
	Cyst. kid	4,265	8.4	7,591	8.2
	Oth/unlk	11,487	22.5	17,216	18.5
Tx hist.	List 1st tx	41,884	82.1	79,376	85.5
	List sub. tx	9,120	17.9	13,509	14.5
Blood type	A	14,211	27.9	26,814	28.9
	B	8,580	16.8	14,832	16.0
	AB	1,375	2.7	2,665	2.9
	O	26,838	52.6	48,574	52.3
PRA & CPRA	<20%	36,494	71.6	79,982	86.1
	≥20%	14,509	28.4	12,903	13.9
	Unknown	1	0.0	0	0.0
Time on list	<1 year	17,542	34.4	26,374	28.4
	1-2	11,825	23.2	19,994	21.5
	2-3	8,318	16.3	15,722	16.9
	3-4	5,221	10.2	10,883	11.7
	4-5	3,131	6.1	7,018	7.6
	5+	4,967	9.7	12,894	13.9
ECD kidney	W/N accept			49,832	53.6
	Will accept			43,053	46.4
Multiple listings	Kidney alone	48,664	95.4	90,808	97.8
	Kid/Pancreas	2,340	4.6	2,077	2.2
Total		51,004	100	92,885	100

KI 1.5 Characteristics of adult patients on the kidney transplant waiting list on December 31, 2002 & December 31, 2012

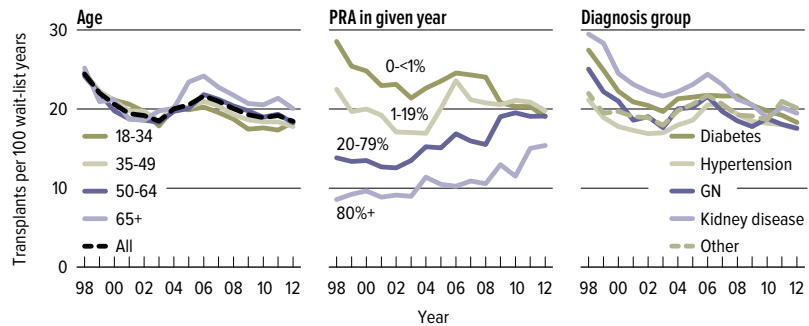
Patients waiting for a transplant on December 31, 2002 and December 31, 2012, regardless of first listing date; active/inactive status is on this date, and multiple listings are not counted.

wait list



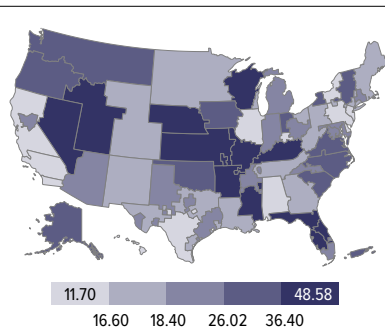
KI 1.6 Prevalent dialysis patients wait-listed for a kidney transplant, by age

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 Deceased donor kidney transplant rates among active adult waiting list candidates

Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of active waiting time in a given year. Age is calculated on the first active listing date in a given year. 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.



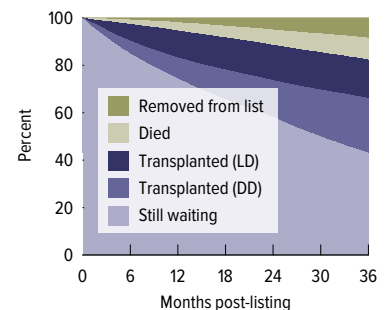
KI 1.8 Deceased donor kidney transplant rates per 100 patient years on the waiting list among active adult candidates, by DSA, 2011-2012

Transplant rates by DSA of the listing center, limited to those with active time on the waiting list in 2011 and 2012; deceased donor transplants only. Maximum time per listing is two years. 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.

	2010	2011	2012
Patients at start of year	81,099	85,948	88,874
Patients added during year	30,564	29,361	30,274
Patients removed during year	25,672	26,399	26,263
Patients at end of year	85,991	88,910	92,885
Removal reason			
Deceased donor transplant	10,826	11,195	11,033
Living donor transplant	5,346	5,009	4,934
Tx (type not specified)	56	49	58
Patient died	5,302	5,440	5,209
Patient refused transplant	339	406	413
Improved, tx not needed	103	138	148
Too sick to transplant	1,533	1,873	2,062
Other	2,167	2,289	2,406

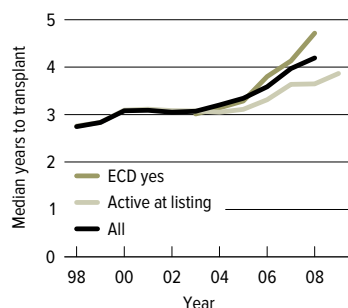
KI 1.9 Kidney transplant waiting list activity among adult patients

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. Patients listed for multi-organ transplants are included. Known deaths following removal for being too ill are counted as deaths.



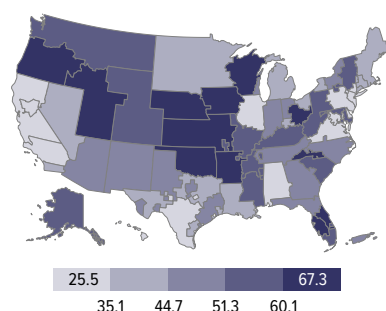
KI 1.10 Three-year outcomes for adult patients waiting for a kidney transplant among new listings in 2009

Adult patients waiting for any kidney transplant and first listed in 2009. 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.



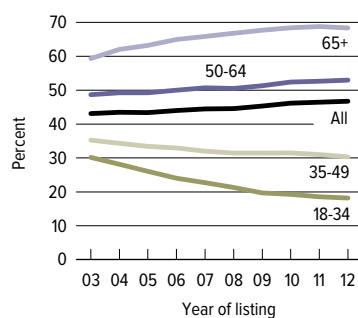
KI 1.11 Median years to kidney transplant for wait-listed adult patients

Patients waiting for a transplant, with observations censored at December 31, 2012; Kaplan-Meier methods used to estimate time to transplant. If an estimate is not plotted, 50% of the cohort listed in that year had not been transplanted at the censoring date. Only the first transplant is counted.



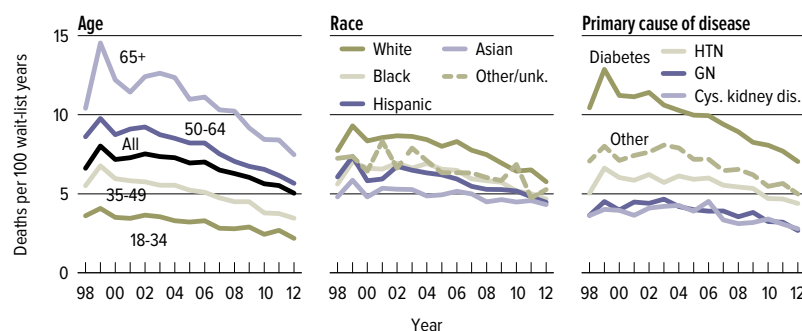
KI 1.12 Percent of adult wait-listed patients, 2007, who received a deceased donor kidney transplant within five years, by DSA

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 1.13 Adult patients willing to accept an ECD kidney, by age

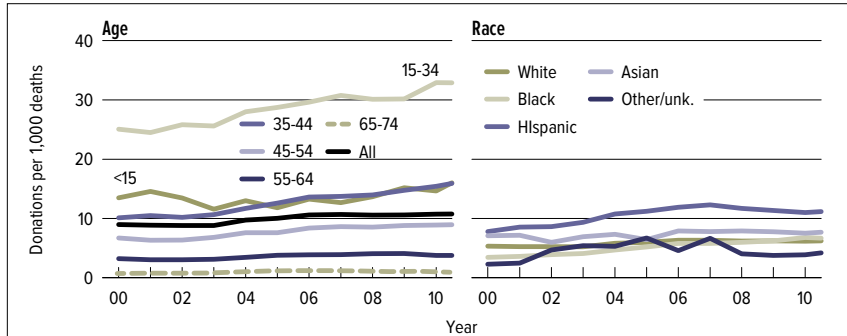
Period-prevalent adult patients waiting for any kidney transplant, 2003 (beginning of ECD program) to 2012. Patients with concurrent listings at more than one center are counted once, from the time of the earliest listing to the time of latest removal. If at least one listing will accept an ECD, patient is considered willing to accept ECD.



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

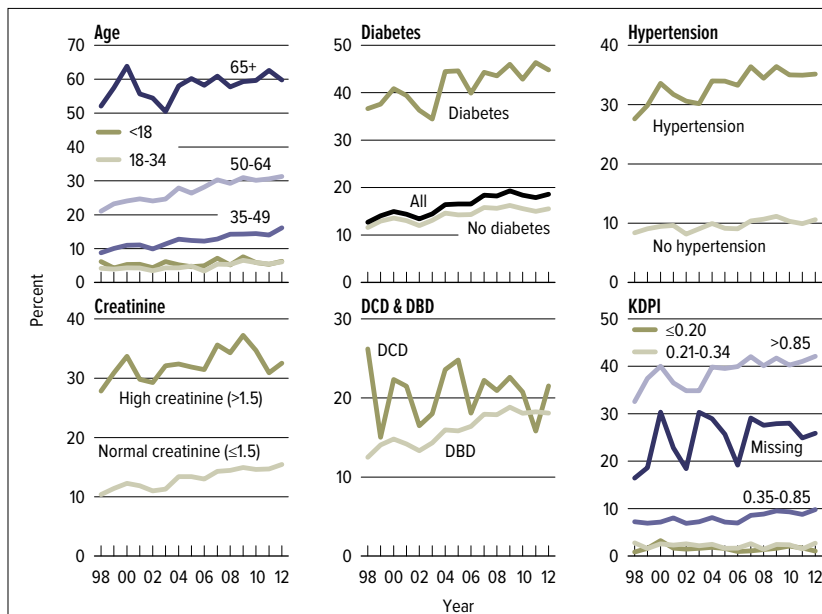
Patients waiting for a transplant. Mortality rates are computed as the number of deaths per 100 patient-years of waiting time in the given year. For rates shown by different characteristics, waiting time is calculated as the total waiting time in the year for patients in that group. Only deaths that 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.

deceased donation



KI 2.1 Deceased donor kidney donation rates

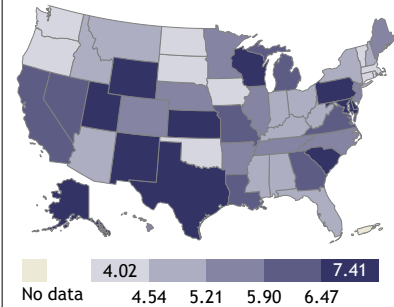
Numerator: Deceased donors age less than 75 with at least one kidney recovered for transplant. Denominator: US deaths per year, age less than 75. (Death data available at <http://www.cdc.gov/nchs/products/nvsr.htm>.) Death data were available only through 2011.



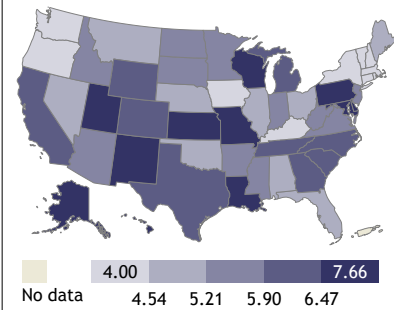
KI 2.3 Discard rates for kidneys recovered for transplant

Percent of kidneys discarded out of all kidneys recovered for transplant. Kidneys are counted individually. The reference population for the KDPI conversion is all deceased donor kidneys recovered for transplant in the US in 2012.

2006–2008



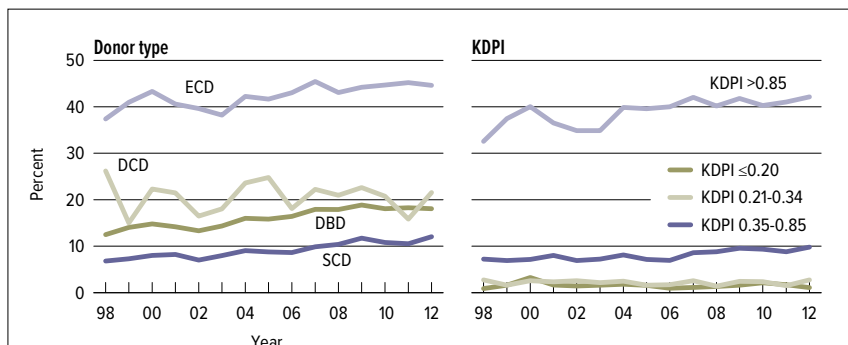
2009–2011



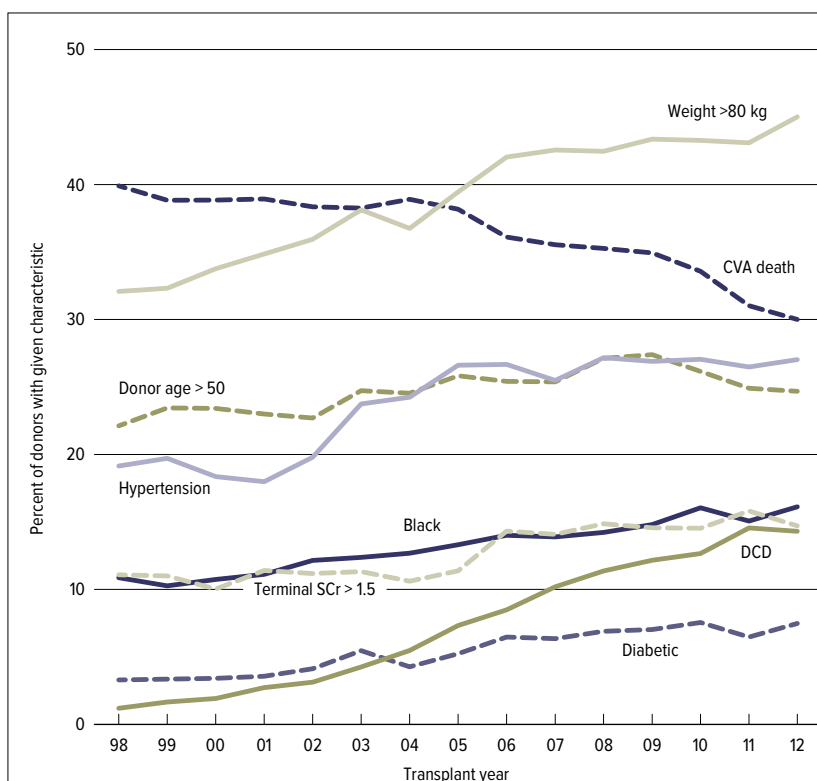
KI 2.2 Deceased donor kidney donation rates (per 1,000 deaths), by state

Numerator: Deceased donors residing in the 50 states whose kidney(s) was/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.

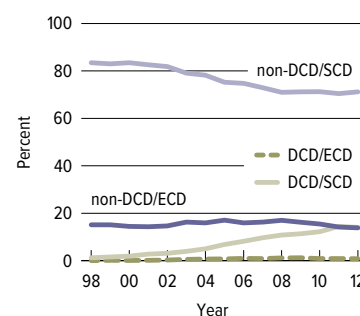
deceased donation

**KI 2.4 Discards by donor type (SCD, ECD, DCD, ECD & DCD)**

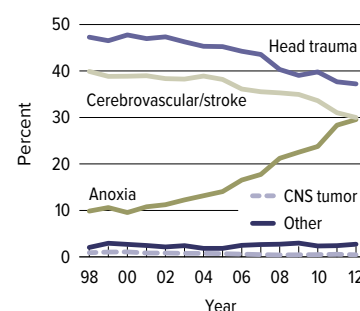
Percent of kidneys discarded out of all kidneys recovered for transplant, by SCD/ECD, DCD/DBD, and KDPI classification of donor. The reference population for the KDRI to KDPI conversion is all deceased donor kidneys recovered for transplant in the US in 2012.

**KI 2.5 Donor-specific components of kidney donor risk index (KDRI) over time**

Donors with at least one kidney transplanted are included. The donor-specific components of KDRI (Kidney Donor Risk Index) are shown, with the exception of donor height and HCV+ status.

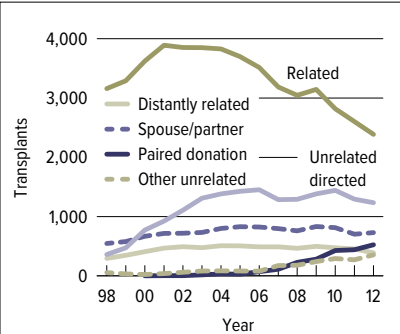
**KI 2.6 DCD with ECD or SCD kidney transplants**

Percent of each kidney type among all deceased-donor kidney-alone transplants.

**KI 2.7 Cause of death among deceased kidney donors**

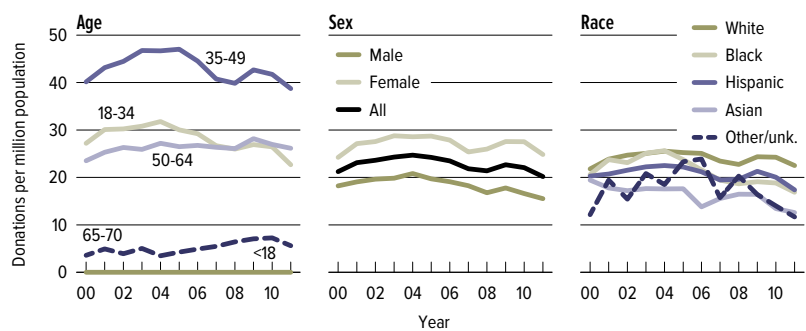
Deceased donors whose kidneys were transplanted. Donors who contributed more than one kidney are counted once. CNS = central nervous system.

live donation



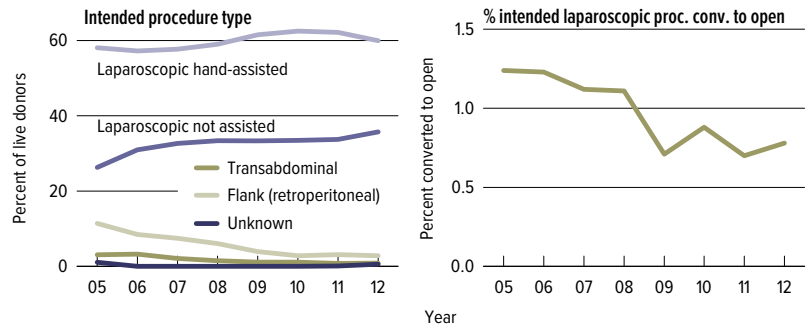
KI 3.1 Kidney transplants from living donors, by donor relation

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



KI 3.2 Living donor kidney donation rates

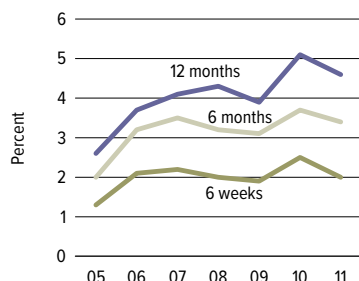
Number of living donors whose kidney was recovered for transplant each year. Denominator: US population age 70 and younger (population data downloaded from http://www.cdc.gov/nchs/nvss/bridged_race/data_documentation.htm#vintage2011).



KI 3.3 Intended kidney transplant procedure type & percent of intended laparoscopic procedures converted to open, 2006–2012

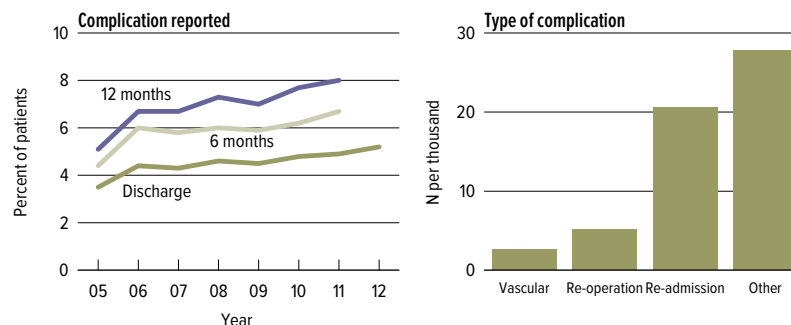
As reported on the OPTN Living Donor Registration form.

live donation



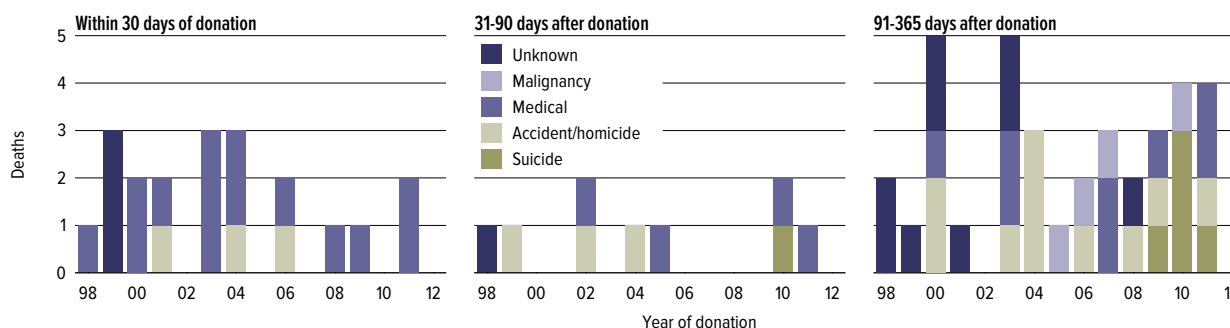
KI 3.4 Readmission to the hospital in the first 6 weeks, 6 months, and 1 year among living kidney donors

Cumulative readmission to the hospital. The six-week time point is recorded at the earliest of discharge or six weeks post-donation.



KI 3.5 Kidney complications among living kidney donors

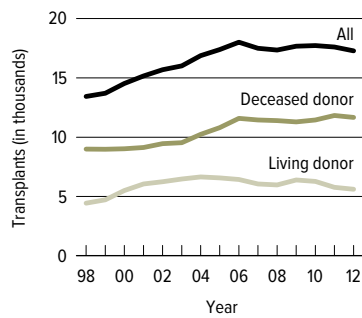
Complications reported on the Living Donor Registration and Living Donor Follow-up forms at each time point. Complications include readmission, re-operation, vascular complications, and other complications requiring intervention. Multiple complications may be reported at any time point. Type of discharge complication is shown among all living donors, 2005-2012.



KI 3.6 Living kidney donor deaths

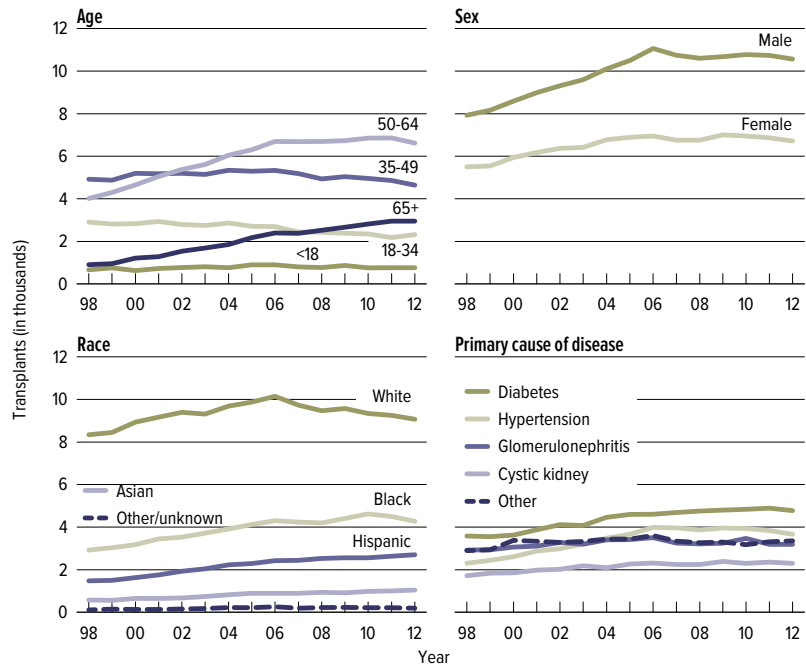
Living kidney donors. Deaths as reported to the OPTN or Social Security Administration. "Donation related" deaths are included in the "Medical" category.

transplant



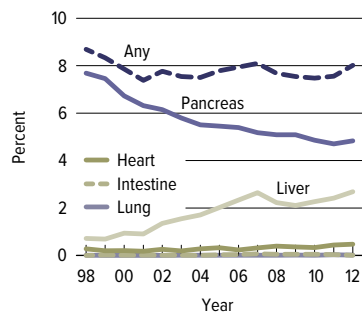
KI 4.1 Total kidney transplants

Patients receiving a transplant, including multi-organ transplants and pediatrics. Retransplants are counted.



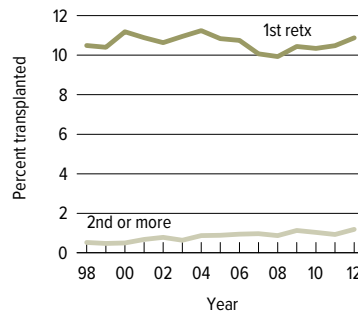
KI 4.2 Kidney transplants

Patients receiving a transplant, including multi-organ transplants and pediatrics. Retransplants are counted.



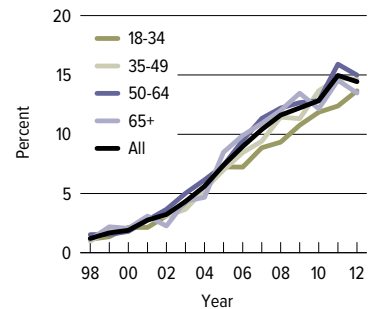
KI 4.3 Kidney transplants that were part of a multi-organ transplant

All adult patients receiving a deceased donor kidney transplant with at least one additional organ. A multi-organ transplant may include more than two different organs in total; if so, each non-kidney organ will be considered separately. Kidney transplants include living donor transplants.



KI 4.4 Retransplants among adult kidney transplant recipients

Patients receiving a kidney retransplant (deceased or living donor) in the given year.



KI 4.5 Use of DCD kidneys among adult kidney-alone transplant recipients, by recipient age

Percent of deceased donor transplants using a DCD donor. DCD = donation after circulatory death.

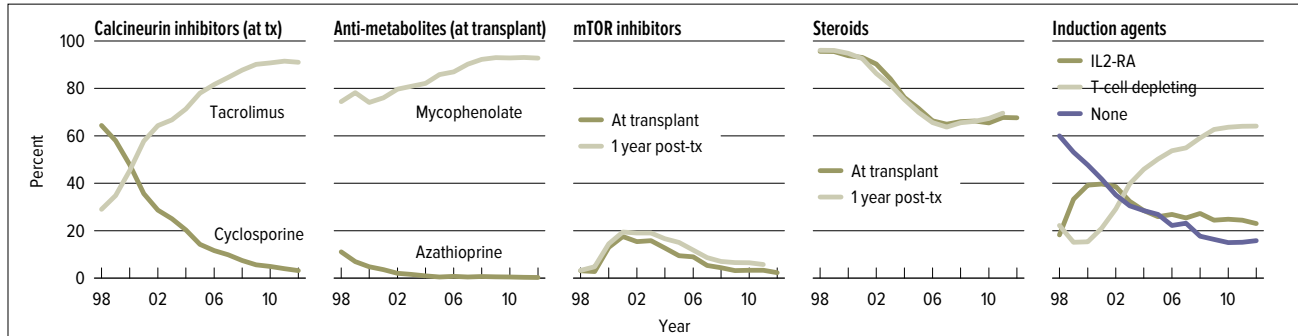
		2002						2012					
		All		Deceased		Living		All		Deceased		Living	
	Level	N	%	N	%	N	%	N	%	N	%	N	%
Age	18-34	2,793	18.7	1,443	15.8	1,350	23.3	2,321	14.0	1,244	11.1	1,077	20.2
	35-49	5,205	34.9	3,193	35.0	2,012	34.7	4,638	28.1	3,104	27.7	1,534	28.8
	50-64	5,382	36.1	3,463	38.0	1,919	33.1	6,616	40.0	4,666	41.7	1,950	36.6
	65+	1,536	10.3	1,019	11.2	517	8.9	2,951	17.9	2,181	19.5	770	14.4
Sex	Female	6,075	40.7	3,660	40.1	2,415	41.7	6,404	38.8	4,404	39.3	2,000	37.5
	Male	8,841	59.3	5,458	59.9	3,383	58.3	10,122	61.2	6,791	60.7	3,331	62.5
Race	White	8,959	60.1	4,957	54.4	4,002	69.0	8,685	52.6	5,135	45.9	3,550	66.6
	Black	3,388	22.7	2,539	27.8	849	14.6	4,157	25.2	3,444	30.8	713	13.4
	Hispanic	1,771	11.9	1,096	12.0	675	11.6	2,496	15.1	1,732	15.5	764	14.3
	Asian	651	4.4	436	4.8	215	3.7	1,009	6.1	754	6.7	255	4.8
	Other/unknown	147	1.0	90	1.0	57	1.0	179	1.1	130	1.2	49	0.9
Primary cause of disease	Diabetes	4,117	27.6	2,741	30.1	1,376	23.7	4,776	28.9	3,644	32.6	1,132	21.2
	Hypertension	2,975	19.9	2,070	22.7	905	15.6	3,656	22.1	2,713	24.2	943	17.7
	Glomerulonephritis	3,107	20.8	1,647	18.1	1,460	25.2	3,067	18.6	1,753	15.7	1,314	24.6
	Cystic kidney disease	1,721	11.5	954	10.5	767	13.2	2,001	12.1	1,164	10.4	837	15.7
	Other/unknown	2,996	20.1	1,706	18.7	1,290	22.2	3,026	18.3	1,921	17.2	1,105	20.7
Blood type	A	5,707	38.3	3,532	38.7	2,175	37.5	6,190	37.5	4,073	36.4	2,117	39.7
	B	1,865	12.5	1,105	12.1	760	13.1	2,166	13.1	1,466	13.1	700	13.1
	AB	695	4.7	475	5.2	220	3.8	859	5.2	632	5.6	227	4.3
	O	6,649	44.6	4,006	43.9	2,643	45.6	7,311	44.2	5,024	44.9	2,287	42.9
PRA/cPRA	<20%	11,959	80.2	6,981	76.6	4,978	85.9	10,531	63.7	6,723	60.1	3,808	71.4
	20%–<80%	1,815	12.2	1,248	13.7	567	9.8	3,363	20.3	2,419	21.6	944	17.7
	≥80%	1,019	6.8	858	9.4	161	2.8	2,172	13.1	1,876	16.8	296	5.6
	Unknown	123	0.8	31	0.3	92	1.6	460	2.8	177	1.6	283	5.3
History of renal replacement therapy	Preemptive transplant	1,809	12.1	573	6.3	1,236	21.3	2,519	15.2	1,041	9.3	1,478	27.7
	<1 year	2,642	17.7	897	9.8	1,745	30.1	2,098	12.7	826	7.4	1,272	23.9
	<3 years	4,593	30.8	2,937	32.2	1,656	28.6	3,837	23.2	2,521	22.5	1,316	24.7
	<5 years	2,553	17.1	2,135	23.4	418	7.2	2,963	17.9	2,554	22.8	409	7.7
	5+ years/unknown	3,319	22.3	2,576	28.3	743	12.8	5,109	30.9	4,253	38.0	856	16.1
Insurance	Private	6,394	42.9	3,047	33.4	3,347	57.7	5,981	36.2	2,872	25.7	3,109	58.3
	Medicare	7,551	50.6	5,473	60.0	2,078	35.8	9,491	57.4	7,531	67.3	1,960	36.8
	Other/unknown	971	6.5	598	6.6	373	6.4	1,054	6.4	792	7.1	262	4.9
HLA mismatches with donor	0	1,679	11.3	1,052	11.5	627	10.8	1,190	7.2	843	7.5	347	6.5
	1	755	5.1	376	4.1	379	6.5	327	2.0	100	0.9	227	4.3
	2	1,704	11.4	699	7.7	1,005	17.3	1,196	7.2	458	4.1	738	13.8
	3	3,222	21.6	1,536	16.8	1,686	29.1	2,752	16.7	1,451	13.0	1,301	24.4
	4	2,804	18.8	2,065	22.6	739	12.7	3,901	23.6	2,990	26.7	911	17.1
	5	2,934	19.7	2,068	22.7	866	14.9	4,568	27.6	3,538	31.6	1,030	19.3
	6	1,740	11.7	1,289	14.1	451	7.8	2,339	14.2	1,723	15.4	616	11.6
	Unk.	78	0.5	33	0.4	45	0.8	253	1.5	92	0.8	161	3.0
Kidney transplant history	First transplant	13,158	88.2	7,986	87.6	5,172	89.2	14,520	87.9	9,764	87.2	4,756	89.2
	Retransplant	1,758	11.8	1,132	12.4	626	10.8	2,006	12.1	1,431	12.8	575	10.8
Prior other organ tx		346	2.3	185	2.0	161	2.8	439	2.7	293	2.6	146	2.7
DCD status *	Non-DCD	.	.	8,824	96.8	.	.	.	.	9,578	85.6	.	.
	DCD	.	.	294	3.2	.	.	.	.	1,617	14.4	.	.
SCD/ECD status *	SCD	.	.	7,763	85.1	.	.	.	.	9,339	83.4	.	.
	ECD	.	.	1,355	14.9	.	.	.	.	1,856	16.6	.	.
Total		14,916	100.0	9,118	100.0	5,798	100.0	16,526	100.0	11,195	100.0	5,331	100.0

* for deceased donor transplant only

K1 4.6 Characteristics of adult kidney transplant recipients, 2002 & 2012

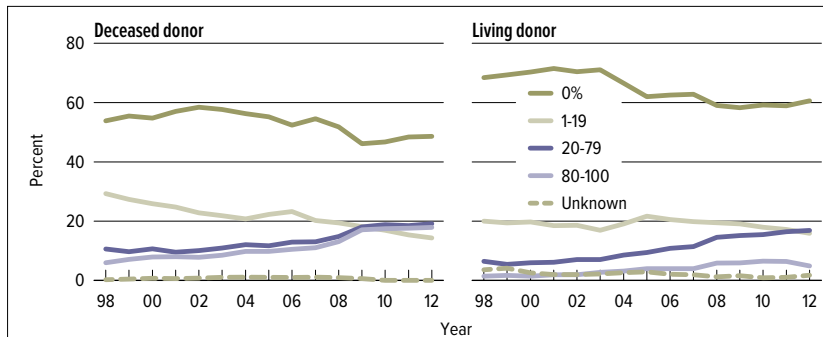
Patients receiving a transplant. Retransplants are counted.

transplant & donor-recipient matching



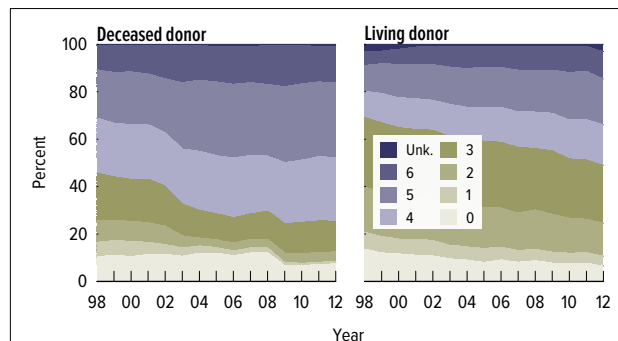
KI 4.7 Immunosuppression use in adult kidney transplant recipients

One-year post-transplant data limited to patients alive with graft function one year post-transplant. Mycophenolate group includes mycophenolate mofetil and mycophenolate sodium.



KI 5.1 PRA at time of kidney transplant in adult recipients

CPRA is used unconditionally from October 1, 2009 on. Between December 1, 2007 - October 1, 2009, CPRA is used if >0; otherwise, the maximum of the most recent PRA values pre-transplant is used. Prior to December 1, 2007, the maximum of the most recent PRA values pre-transplant is used unconditionally. Kidney-alone transplants only.



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 2012.

donor-recipient matching

RECIPIENT	DECEASED DONOR				LIVING DONOR			
	Neg.	Pos.	Unk.	Total	Neg.	Pos.	Unk.	Total
Negative	12.4	18.6	0.1	31.1	23.2	15.8	2.0	41.0
Positive	24.0	43.1	0.2	67.3	20.5	34.4	2.7	57.6
Unknown	0.5	1.1	0.0	1.6	0.4	0.5	0.5	1.4
Total	37.0	62.8	0.3	100	44.2	50.7	5.1	100

KI 5.3 Adult kidney donor-recipient cytomegalovirus (CMV) serology matching, 2008–2012

Adult transplant cohort from 2008–2012. 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
Negative	0.7	9.9	0.0	10.7	1.7	6.8	2.1	10.5
Positive	4.1	67.3	0.2	71.6	5.1	58.3	8.1	71.4
Unknown	1.0	16.6	0.1	17.7	0.4	3.8	13.8	18.1
Total	5.8	93.8	0.4	100	7.2	68.9	23.9	100

KI 5.4 Adult kidney donor-recipient Epstein-Barr virus (EBV) serology matching, 2008–2012

Adult transplant cohort from 2008–2012. 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
Negative	75.4	2.7	0.0	78.2	71.4	1.4	8.1	81.0
Positive	7.7	0.7	0.0	8.5	3.5	0.4	0.6	4.4
Unknown	12.9	0.4	0.0	13.3	6.9	0.1	7.6	14.6
Total	96.0	3.9	0.1	100	81.8	1.9	16.3	100

KI 5.5 Adult kidney donor-recipient hepatitis B core antibody (HBCab) serology matching, 2008–2012

Adult transplant cohort from 2008–2012. 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
Negative	94.7	0.0	0.1	94.8	87.1	0.0	8.3	95.3
Positive	2.5	0.0	0.0	2.5	1.5	0.0	0.1	1.5
Unknown	2.7	0.0	0.0	2.7	2.3	0.0	0.9	3.1
Total	99.9	0.0	0.1	100	90.8	0.0	9.2	100

KI 5.6 Adult kidney donor-recipient hepatitis B surface antigen (HBsAg) serology matching, 2008–2012

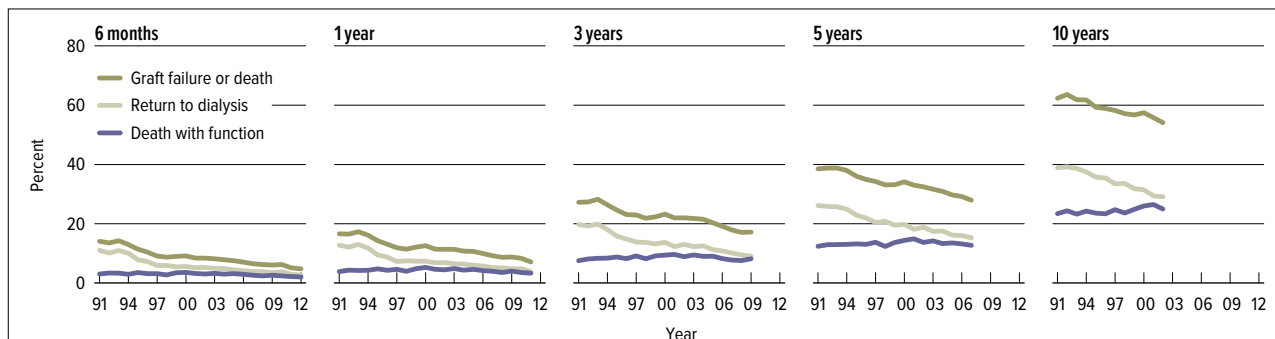
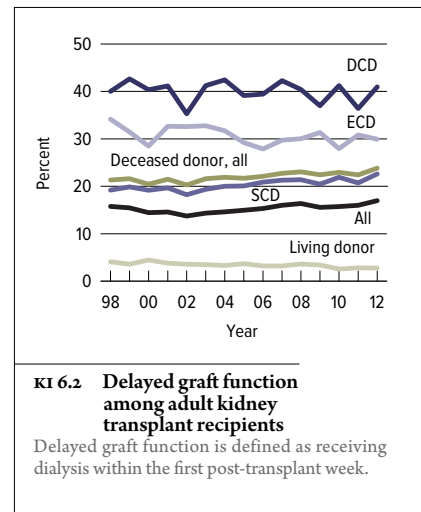
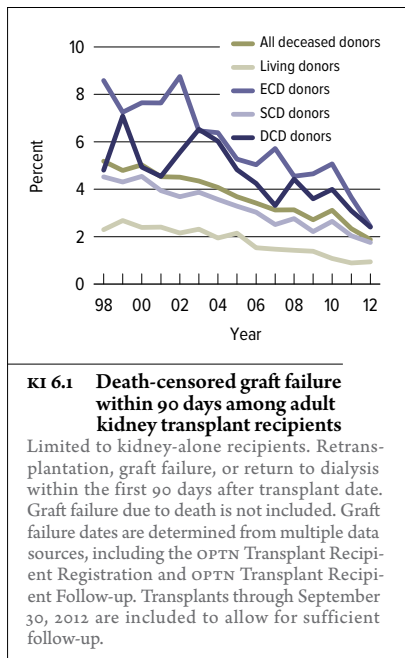
Adult transplant cohort from 2008–2012. Donor serology is reported on the OPTN donor registration forms; recipient serology is reported on the OPTN recipient registration forms. Any evidence for a positive serology is taken to indicate that the person is positive for the given serology; if all fields 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
Negative	90.5	0.2	0.0	90.7	87.3	0.2	6.8	94.2
Positive	4.3	2.0	0.0	6.3	2.1	0.0	0.2	2.3
Unknown	2.9	0.1	0.0	3.0	2.1	0.0	1.4	3.5
Total	97.7	2.3	0.0	100	91.5	0.2	8.3	100

KI 5.7 Adult kidney donor-recipient hepatitis C serology matching, 2008–2012

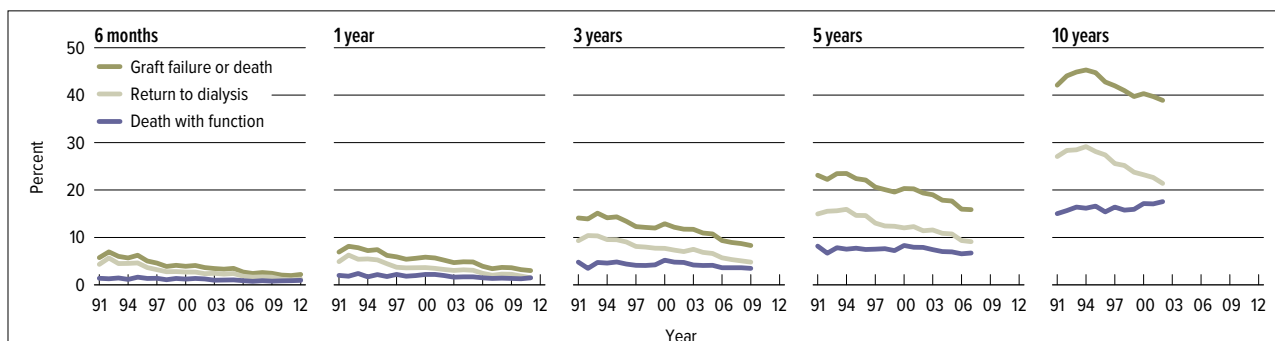
Adult transplant cohort from 2008–2012. Donor serology is reported on the OPTN donor registration forms; recipient serology is reported on the OPTN recipient registration forms. Any evidence for a positive serology is taken to indicate that the person is positive for the given serology; if all fields are unknown, not done, or pending, the person is considered to be “unknown” for that serology; otherwise, serology is assumed negative.

outcomes



KI 6.3 Outcomes among adult kidney transplant recipients: deceased donor

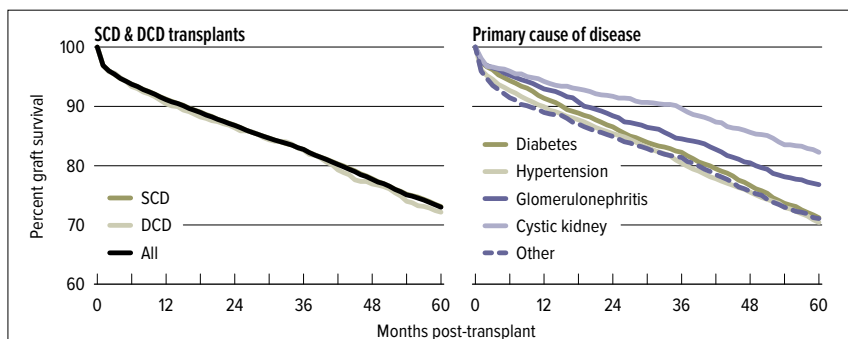
Percent for each outcome is unadjusted, computed using Kaplan-Meier competing risk methods. Death with function defined as no graft failure prior to death; return to dialysis defined as graft failure preceding death.



KI 6.4 Outcomes among adult kidney transplant recipients: living donor

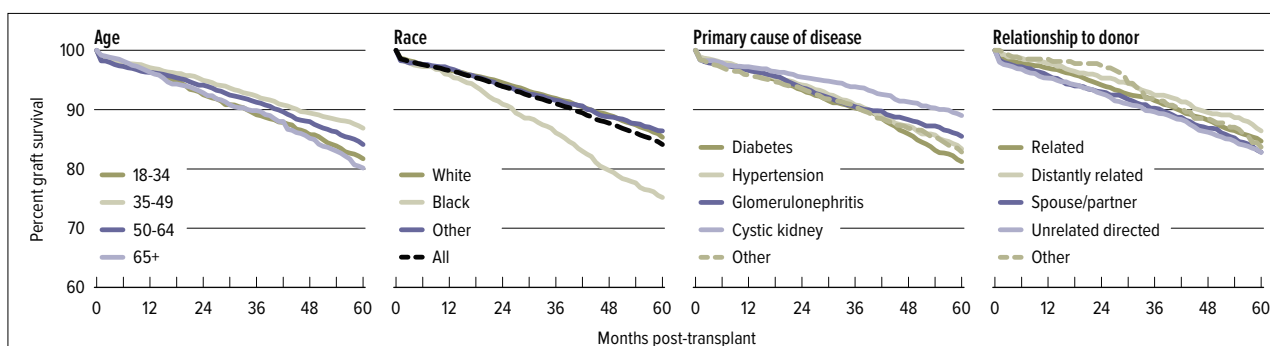
Percent for each outcome is unadjusted, computed using Kaplan-Meier competing risk methods. Death with function defined as no graft failure prior to death; return to dialysis defined as graft failure preceding death.

outcomes



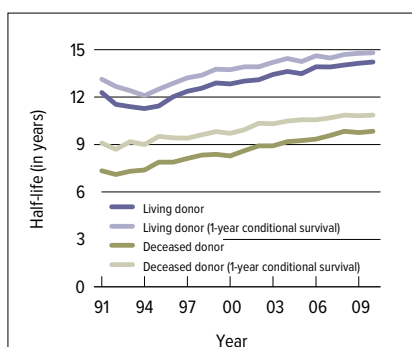
KI 6.5 Graft survival among adult kidney transplant recipients transplanted in 2007: deceased donors

Graft survival estimated using unadjusted Kaplan-Meier methods.



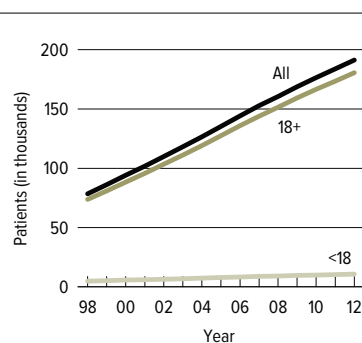
KI 6.6 Graft survival among adult kidney transplant recipients transplanted in 2007: living donors

Graft survival estimated using unadjusted Kaplan-Meier methods.



KI 6.7 Half-lives for adult kidney transplant recipients

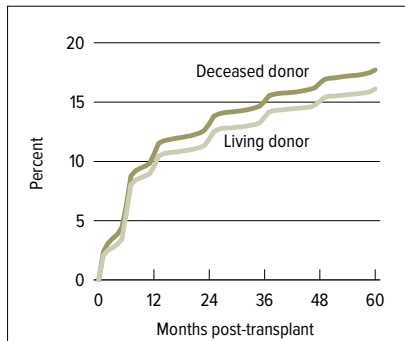
The half-life for a transplant cohort (e.g. 2009 kidney transplants) is the time point in follow-up at which 50% of the transplanted grafts have failed. A conditional half life for a transplant cohort is the same calculation but limited to those who survive with function at least 1 year post-transplant.



KI 6.8 Recipients alive & with a functioning kidney transplant on June 30 of the year

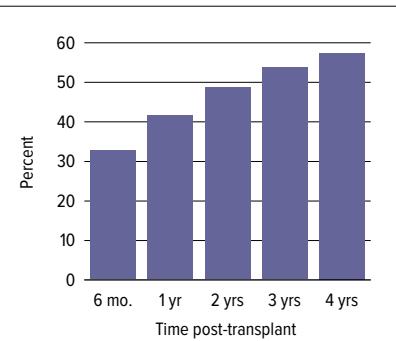
Transplants before June 30 of the year that are still functioning. Patients are assumed alive with function unless a death or graft failure is recorded. A recipient can experience a graft failure and drop from the cohort, then be retransplanted and re-enter the cohort. Age cut is based on age at transplant.

outcomes



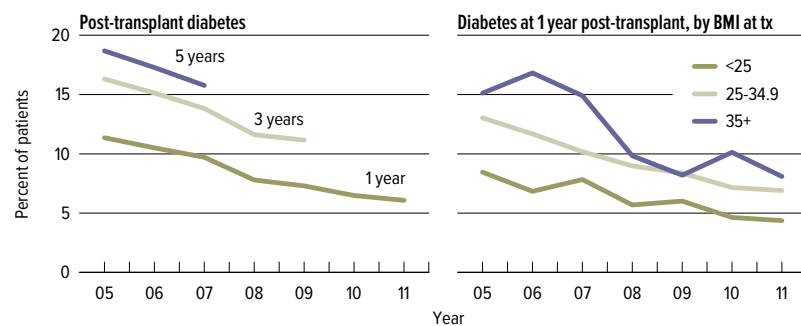
KI 6.9 Incidence of first acute rejection among adult patients receiving a kidney transplant in 2006-2010

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. Cumulative incidence, defined as the probability of acute rejection at any time prior to the given time, is estimated using Kaplan-Meier competing risk methods.



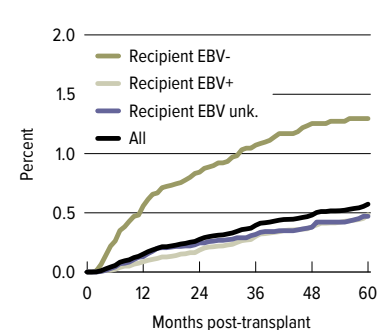
KI 6.10 Reported cumulative incidence of rehospitalizations among adult kidney transplant recipients in 2007-2012

Cumulative rate of rehospitalization; hospitalization identified from follow-up form. Patients required to be alive with graft function at each time period, so denominators reduce over time.



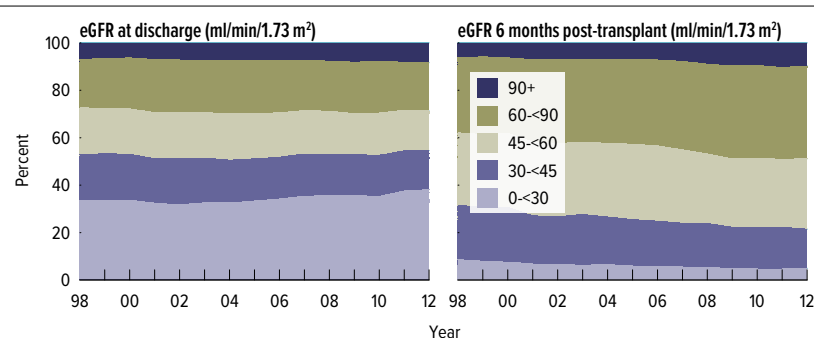
KI 6.11 Post-transplant diabetes among kidney transplant recipients

Percentage of adult deceased kidney recipients who develop diabetes post-transplant out of patients who are diabetes free at transplant.



KI 6.12 Incidence of PTLD among adult patients receiving a kidney transplant in 2006-2010, by recipient Epstein-Barr virus (EBV) status at transplant

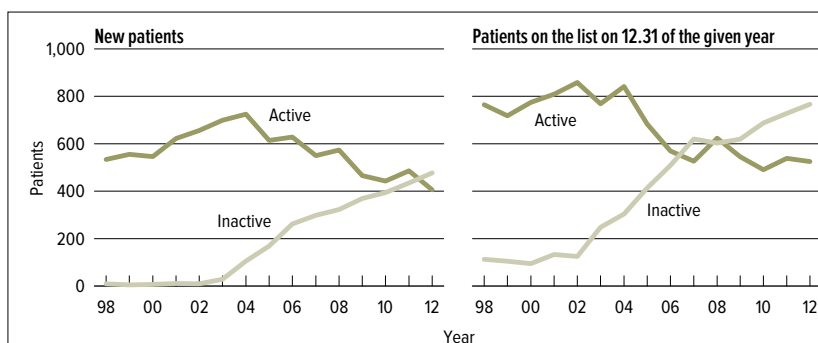
The cumulative incidence, is estimated using Kaplan-Meier competing risks methods. PTLD is identified as either a reported complication or cause of death on the Transplant Recipient Follow-up forms or on the Post-transplant Malignancy form as polymorphic PTLD, monomorphic PTLD, or Hodgkin's Disease. Only the earliest date of PTLD diagnosis is considered.



KI 6.13 Distribution of eGFR at discharge & 6 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.

pediatric transplant



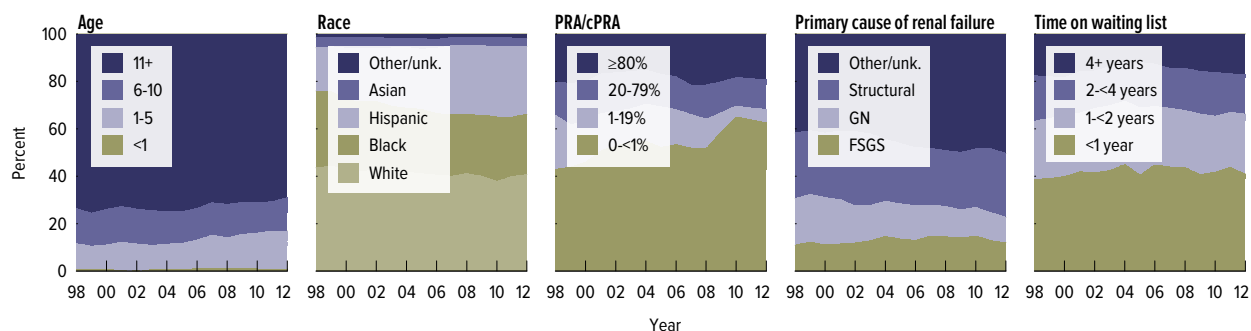
KI 7.1 Pediatric patients waiting for a kidney transplant

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.

Reason for inactive status	Inactive w/i 7 days of listing		Active at listing, inact. on 12.31	
	N	%	N	%
Candidate work-up incomplete	342	64.3	38	19.8
Candidate choice	45	8.5	20	10.4
Too well	42	7.9	47	24.5
Too sick	35	6.6	48	25.0
Tx pending	24	4.5	2	1.0
Insurance issues	21	3.9	10	5.2
Weight inappropriate for tx	17	3.2	1	0.5
Medical non-compliance	4	0.8	15	7.8
Physician/surgeon unavailable	2	0.4	.	.
Unknown	.	.	5	2.6
Candidate could not be contacted	.	.	4	2.1
Inappropriate substance use	.	.	2	1.0

KI 7.2 Reasons for inactive status among pediatric kidney transplant listings, 2012

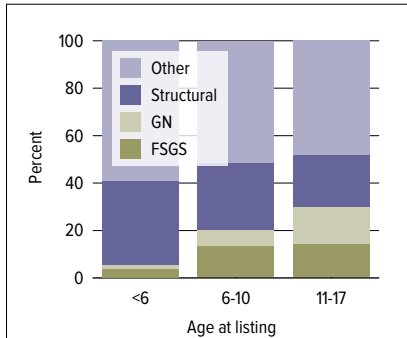
Reasons for inactive status of listings in 2012. Since patients can be concurrently listed at more than one center and have different reasons for going inactive at each center, each listing is counted separately.



KI 7.3 Distribution of pediatric patients waiting for a kidney transplant

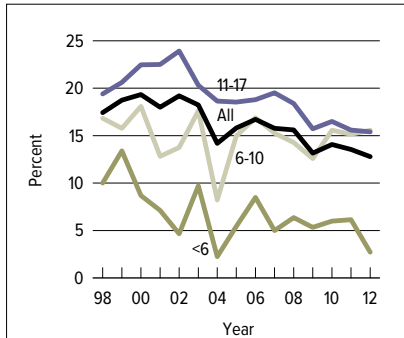
Patients waiting for a transplant any time in the given year. Age determined on the latest of listing date or January 1 of the given year. Concurrently listed patients are counted once. Primary cause of renal failure categorized according groups used by NAPRTCS. FSGS = focal segmental glomerulosclerosis.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

pediatric transplant



KI 7.4 Primary cause of ESRD in pediatric patients waiting for a kidney transplant, 2008–2012, by age

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. Age is computed at earliest listing date. FSGS = focal segmental glomerulosclerosis. GN = glomerulonephritis.



KI 7.5 Prior kidney transplant in pediatric patients waiting for a kidney transplant, by age

Prior transplant is obtained from the OPTN Transplant Candidate Registration form.

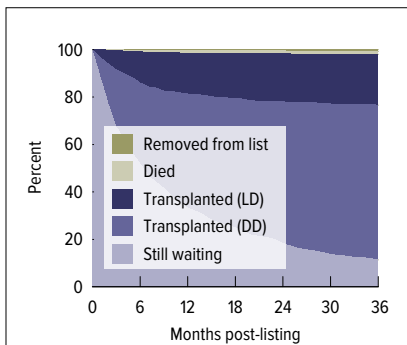
	2010	2011	2012
Patients at start of year	1,172	1,185	1,275
Patients added during year	838	921	883
Patients removed during year	825	831	860
Patients at end of year	1,185	1,275	1,298

Removal reason

Deceased donor transplant	561	559	556
Living donor transplant	199	204	209
Tx (type not specified)	10	8	11
Patient died	31	22	27
Patient refused transplant	2	1	2
Improved, tx not needed	3	9	8
Too sick to transplant	1	1	4
Other	18	27	43

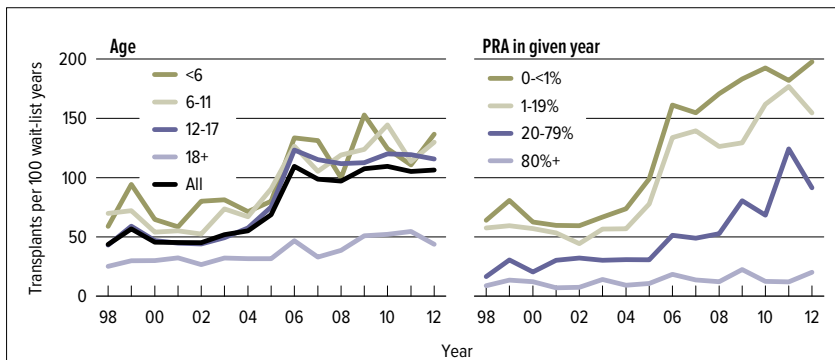
KI 7.6 Kidney transplant waiting list activity among pediatric patients

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. Patients listed for multi-organ transplants are included.



KI 7.7 Three-year outcomes for pediatric patients waiting for a kidney transplant among new listings in 2009

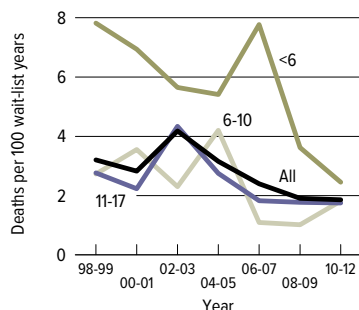
Patients waiting for a transplant and first listed in 2009. Patients with concurrent listings at more than one center are counted once, from the time of the earliest listing to the time of latest removal.



KI 7.8 Deceased donor kidney transplant rates among active pediatric waiting list candidates

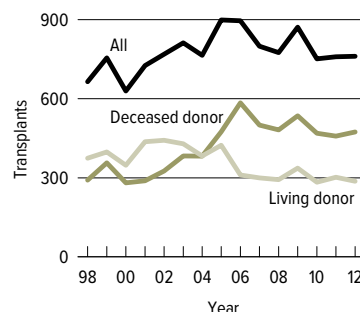
Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of active waiting time in the given year. Age is calculated on the first active listing date in a given year. Age group 18+ includes those listed at age <18, but still on the list in the given year.

pediatric transplant



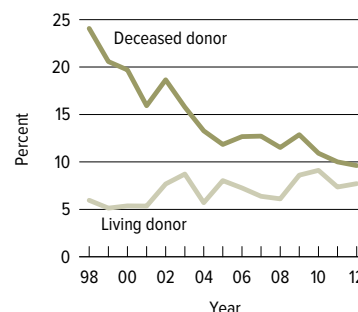
KI 7.9 Pre-transplant mortality rates among pediatric patients wait-listed for a kidney transplant, by age

Patients waiting for a transplant. Mortality rates are computed as the number of deaths per 100 patient-years of waiting time in the given 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.



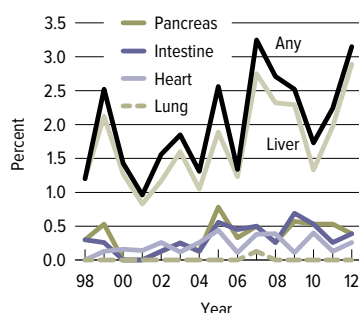
KI 7.10 Pediatric kidney transplants, by donor type

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



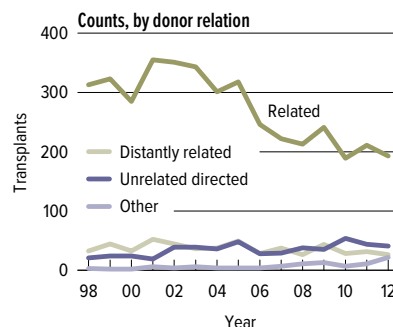
KI 7.11 Retransplants among pediatric kidney transplant recipients

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



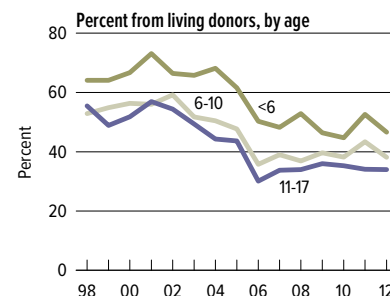
KI 7.12 Pediatric kidney transplants that were part of a multi-organ transplant

Patients receiving a deceased or living donor kidney transplant with at least one additional organ. A multi-organ transplant may include more than two different organs in total; if so, each non-kidney organ will be considered separately.

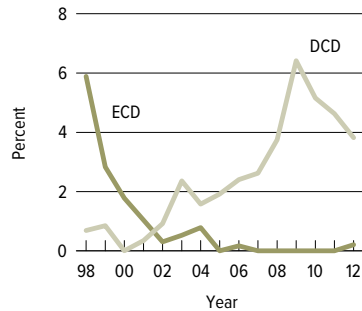


KI 7.13 Pediatric kidney transplants from living donors

Relationship of living donor to recipient is as indicated on the Living Donor Registration form.

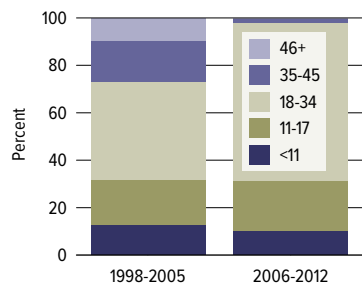


pediatric transplant



KI 7.14 Use of ECD or DCD donors in pediatric kidney transplant recipients

Patients receiving a DCD or ECD kidney transplant.



KI 7.15 Donor age among pediatric kidney transplant recipients before & after Share 35

Patients receiving a deceased donor transplant. Share 35 began in September 2005. Donor age distributions are similar for standard criteria donors (SCD) and donations after circulatory death (DCD).

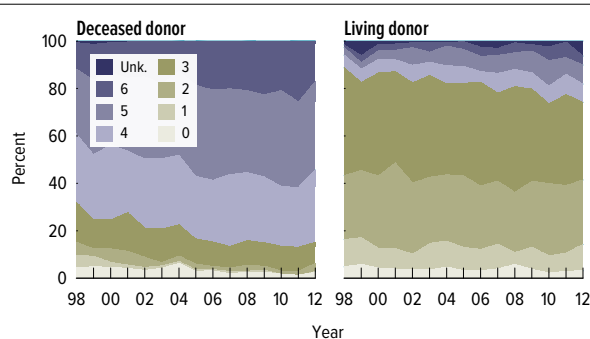
Level	2000–2002				2010–2012			
	All	N	%		All	N	%	
Age								
<1	13	0.6	0	0.0	13	1.1	3	0.1
1–5	400	18.8	128	14.3	272	22.1	518	22.9
6–10	424	20.0	181	20.2	243	19.8	412	18.2
11–17	1,286	60.6	586	65.5	700	57.0	1,329	58.8
Sex								
Female	866	40.8	381	42.6	485	39.5	907	40.1
Male	1,257	59.2	514	57.4	743	60.5	1,355	59.9
Race								
White	1,230	57.9	393	43.9	837	68.2	1,110	49.1
Black	390	18.4	241	26.9	149	12.1	404	17.9
Hispanic	414	19.5	214	23.9	200	16.3	613	27.1
Asian	65	3.1	31	3.5	34	2.8	96	4.2
Other/unk.	24	1.1	16	1.8	8	0.7	39	1.7
Primary cause of disease								
FSGS	226	10.6	122	13.6	104	8.5	283	12.5
GN	389	18.3	169	18.9	220	17.9	244	10.8
Structural	746	35.1	304	34.0	442	36.0	719	31.8
Other cause	762	35.9	300	33.5	462	37.6	1,016	44.9
Blood type								
A	799	37.6	319	35.6	480	39.1	758	33.5
B	245	11.5	96	10.7	149	12.1	279	12.3
AB	92	4.3	40	4.5	52	4.2	77	3.4
O	987	46.5	440	49.2	547	44.5	1,148	50.8
PRA/cPRA								
<20%	1,889	89.0	783	87.5	1,106	90.1	1,941	85.8
20–79%	121	5.7	71	7.9	50	4.1	222	9.8
≥80%	49	2.3	38	4.2	11	0.9	65	2.9
Unknown	64	3.0	3	0.3	61	5.0	34	1.5
History of renal replacement therapy								
Preemp. tx	506	23.8	100	11.2	406	33.1	649	28.7
<1 year	614	28.9	194	21.7	420	34.2	562	24.8
<3 years	677	31.9	383	42.8	294	23.9	642	28.4
<5 years	112	5.3	82	9.2	30	2.4	166	7.3
5+ years	214	10.1	136	15.2	78	6.4	243	10.7
Insurance								
Private	1,079	50.8	320	35.8	759	61.8	919	40.6
Medicaid	442	20.8	255	28.5	187	15.2	536	23.7
Medicare	508	23.9	281	31.4	227	18.5	629	27.8
Oth. public	66	3.1	25	2.8	41	3.3	142	6.3
Other	28	1.3	14	1.6	14	1.1	36	1.6
HLA mismatches with donor								
0	84	4.0	36	4.0	48	3.9	50	2.2
1	110	5.2	14	1.6	96	7.8	77	3.4
2	444	20.9	47	5.3	397	32.3	281	12.4
3	627	29.5	121	13.5	506	41.2	441	19.5
4	334	15.7	259	28.9	75	6.1	445	19.7
5	350	16.5	287	32.1	63	5.1	602	26.6
6	158	7.4	128	14.3	30	2.4	340	15.0
Unknown	16	0.8	3	0.3	13	1.1	26	1.1
Kidney tx history								
First tx	1,907	89.8	754	84.2	1,153	93.9	2,087	92.3
Retrx	216	10.2	141	15.8	75	6.1	175	7.7
Prior other organ tx	25	1.2	12	1.3	13	1.1	25	1.1
DCD status *								
Non-DCD	891	99.6	891	99.6	.	.	1,327	95.5
DCD	4	0.4	4	0.4	.	.	63	4.5
SCD/ECD status *								
SCD	886	99.0	886	99.0	.	.	1,389	99.9
ECD	9	1.0	9	1.0	.	.	1	0.1
DGF								
non-DGF	1,954	92.0	786	87.8	1,168	95.1	2,139	94.6
DGF	169	8.0	109	12.2	60	4.9	123	5.4
ABO								
Comp./Iden.	2,119	99.8	894	99.9	1,225	99.8	2,257	99.8
Incompatible	4	0.2	1	0.1	3	0.2	5	0.2
All patients	2,123	100.0	895	100.0	1,228	100.0	2,262	100.0

* for deceased donor transplant only

KI 7.16 Characteristics of pediatric kidney transplant recipients, 2000–2002 & 2010–2012

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

pediatric transplant



KI 7.17 Total HLA mismatches among pediatric kidney transplant recipients

Donor and recipient antigen matching is based on the OPTN's antigen values and split equivalences policy as of 2012.

RECIPIENT	DECEASED DONOR				LIVING DONOR			
	Neg.	Pos.	Unk.	Total	Neg.	Pos.	Unk.	Total
Negative	4.6	36.1	0.3	41.0	6.9	36.2	8.0	51.1
Positive	5.7	45.9	0.1	51.6	3.7	32.6	4.8	41.1
Unknown	0.8	6.4	0.1	7.3	1.1	4.3	2.5	7.9
Total	11.1	88.4	0.5	100	11.7	73.1	15.2	100

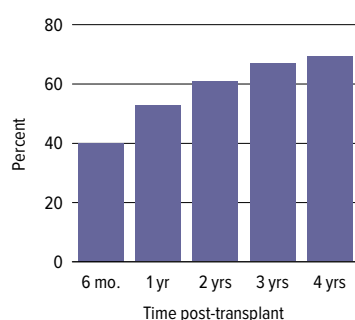
KI 7.18 Kidney donor-recipient Epstein-Barr virus (EBV) serology matching for pediatric transplant recipients, 2008–2012

Pediatric transplant cohort from 2008–2012. Donor EBV serology is reported on the OPTN Donor Registration forms; recipient EBV 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 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.

RECIPIENT	DECEASED DONOR				LIVING DONOR			
	Neg.	Pos.	Unk.	Total	Neg.	Pos.	Unk.	Total
Negative	24.0	34.5	0.1	58.6	33.5	28.2	5.1	66.8
Positive	15.1	23.2	0.1	38.4	6.5	22.0	1.5	30.0
Unknown	1.1	1.8	0.0	3.0	1.3	1.7	0.2	3.2
Total	40.1	59.6	0.3	100	41.3	51.9	6.8	100

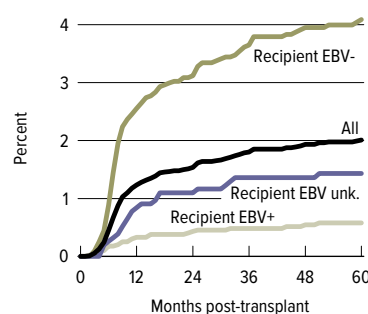
KI 7.19 Kidney donor-recipient cytomegalovirus (CMV) serology matching for pediatric transplant recipients, 2008–2012

Pediatric transplant cohort from 2008–2012. Donor CMV serology is reported on the OPTN Donor Registration forms; recipient CMV 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 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 7.20 Reported cumulative incidence of rehospitalizations among pediatric patients receiving a kidney transplant in 2007–2012

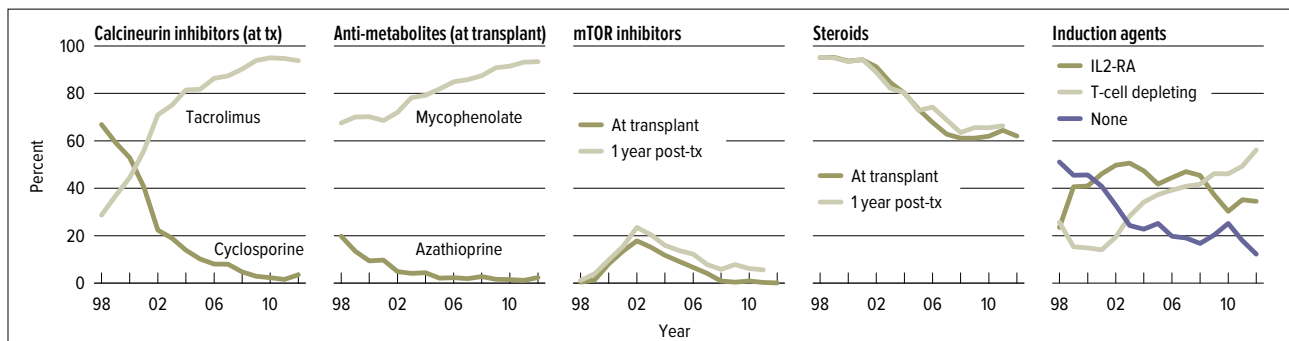
Cumulative incidence of rehospitalization post-transplant; hospitalization identified from the OPTN Transplant Recipient Follow-up form. Patients required to be alive with graft function at each time period, so denominators reduce over time.



KI 7.21 Incidence of PTLD among pediatric patients receiving a kidney transplant, 2000–2010, by recipient Epstein-Barr virus (EBV) status at transplant

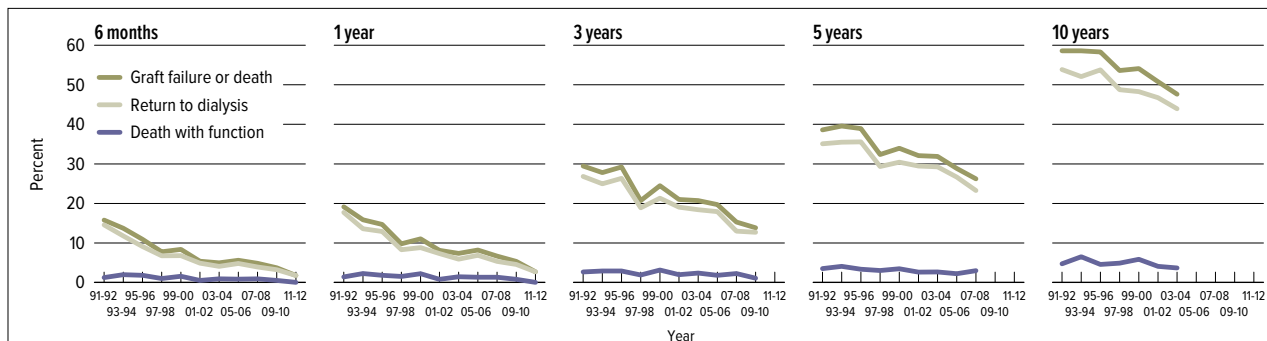
The cumulative incidence is estimated using Kaplan-Meier competing risks methods. PTLD is identified as either a reported complication or cause of death on the Transplant Recipient Follow-up forms or on the Post-transplant Malignancy form as polymorphic PTLD, monomorphic PTLD, or Hodgkin's Disease. Only the earliest date of PTLD diagnosis is considered.

pediatric transplant



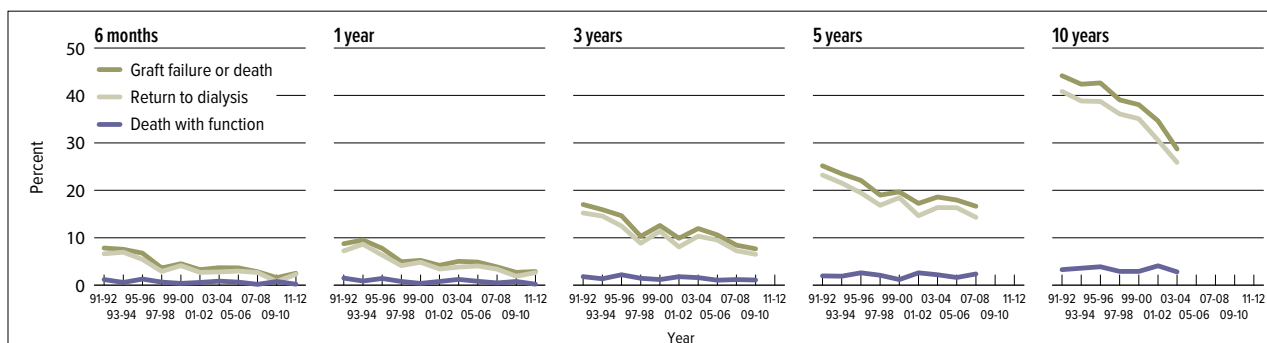
K1 7.22 Immunosuppression use in pediatric kidney transplant recipients

One-year post-transplant data limited to patients alive with graft function one year post-transplant. Mycophenolate group includes mycophenolate mofetil and mycophenolate sodium.



K1 7.23 Outcomes among pediatric kidney-alone transplant recipients: deceased donor

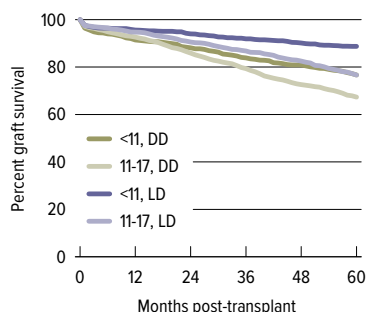
Percent for each outcome is unadjusted, computed using Kaplan-Meier competing risk methods. Death with function defined as no graft failure prior to death; return to dialysis defined as graft failure preceding death.



K1 7.24 Outcomes among pediatric kidney-alone transplant recipients: living donor

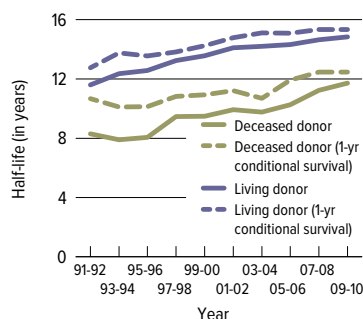
Percent for each outcome is unadjusted, computed using Kaplan-Meier competing risk methods. Death with function defined as no graft failure prior to death; return to dialysis defined as graft failure preceding death.

pediatric transplant



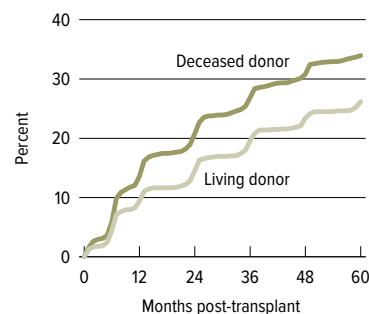
KI 7.25 Graft survival among pediatric kidney transplant recipients transplanted in 2003–2007, by age and donor type

Graft survival estimated using unadjusted Kaplan-Meier Methods. DD=deceased donor transplant; LD=living donor transplant.



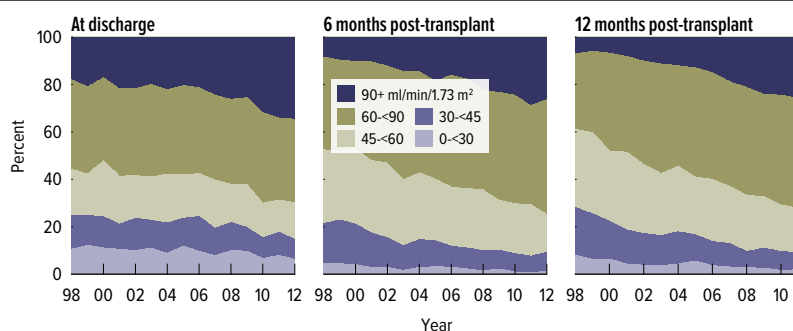
KI 7.26 Half-lives for pediatric kidney transplant recipients

The half-life for a transplant cohort (e.g. 2009 kidney transplants) is the time point at which 50% of the transplanted grafts have failed. A conditional half life for a transplant cohort is the same calculation but limited to those who survive with function at least 1 year post-transplant.



KI 7.27 Incidence of first acute rejection among pediatric patients receiving a kidney transplant in 2006–2011

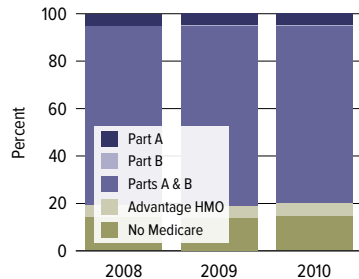
Acute rejection defined as a record of acute or hyperacute rejection, or a record of an anti-rejection drug being administered on either the Transplant Recipient Registration form or the Transplant Recipient Follow-up form. Only the first rejection event is counted. Cumulative incidence is estimated using Kaplan-Meier competing risk methods.



KI 7.28 Distribution of eGFR at discharge & at 6 & 12 months post-transplant among pediatric kidney-alone transplant recipients

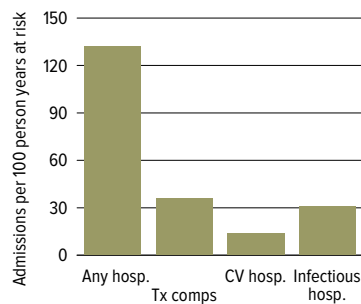
GFR estimated using the bedside Schwartz equation, and computed for patients alive with graft function at the given time point.

Medicare data



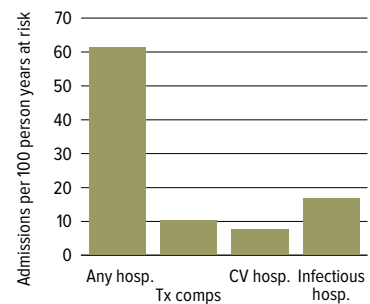
KI 8.1 Medicare coverage among kidney transplant recipients

Coverage at the time of transplant as identified by the Medicare Beneficiary Annual Summary supplied by CMS.



KI 8.2 Rehospitalization rates among kidney transplant recipients in the first post-transplant year

Transplant recipients, 2008, with Medicare as the primary payer at transplant. Rehospitalizations and reasons for rehospitalization determined from Medicare claims. First year rates are based on rehospitalizations occurring from initial discharge to one year later.



KI 8.3 Rehospitalization rates among kidney transplant recipients in the second post-transplant year

Transplant recipients, 2008, with Medicare as the primary payer at transplant. Rehospitalizations and reasons for rehospitalization determined from Medicare claims. Second year rates are based on hospitalizations occurring from initial discharge+1 year to initial discharge+2 years.

Year 1 Cause of hospitalization	Percent of hospitalizations	Year 2 Cause of hospitalization	Percent of hospitalizations
Transplant complication	32.1	Transplant complication	21.8
Other infection	10.4	Other	9.2
Other	8.2	Other infection	9.1
Gastro-intestinal	6.5	Gastro-intestinal	7.5
Metabolic, endocrine, nutritional	5.2	Metabolic, endocrine, nutritional	7.0
Urinary tract infection	4.6	Urinary tract infection	5.8
Genito-urinary and breast	4.1	Respiratory infection	5.2
Electrolyte, acid-base & volume depletion	4.0	Bacteremia, viremia & septicemia	5.1
Bacteremia, viremia and septicemia	3.8	Genito-urinary and breast	4.4
Respiratory infection	3.4	CHF, fluid overload & cardiomyopathy	3.0

KI 8.4 Top ten causes of rehospitalization among kidney recipients transplanted in 2008 with Medicare primary coverage

Transplant recipients, 2008, with Medicare as the primary payer at transplant. Reasons for rehospitalization determined from Medicare claims, denominator for percentages includes only those re-hospitalized.

Medicare data

		# patients	Total costs		PPPY costs	
			Part A	Part B	Part A	Part B
All patients		18,837	1,135,310,769	357,401,120	63,432	19,969
Age	0-11	229	22,220,892	4,537,430	100,209	20,462
	12-17	316	22,649,454	5,922,016	74,961	19,600
	18-34	2,439	133,740,792	47,698,093	56,890	20,289
	35-49	5,167	296,938,347	99,833,315	60,064	20,194
	50-64	6,923	426,677,980	128,799,267	65,013	19,625
	65+	3,763	233,083,304	70,610,999	66,280	20,079
Sex	Male	11,528	696,322,787	217,596,282	63,541	19,856
	Female	7,309	438,987,983	139,804,838	63,260	20,147
Race	White	8,952	535,165,623	163,295,568	62,882	19,187
	Black	5,758	372,705,121	115,979,706	68,676	21,371
	Hispanic	2,857	160,062,784	56,465,170	58,282	20,560
	Asian/Pac. Isl.	972	51,693,735	16,847,714	55,624	18,129
	Other/unk.	298	15,683,507	4,812,962	55,075	16,901
Primary cause of disease	Diabetes	5,423	363,975,149	112,281,926	71,489	22,054
	Hypertension	5,109	292,187,964	96,489,598	60,346	19,928
	GN	3,123	161,068,392	54,527,386	53,566	18,134
	Cystic kidney dis.	1,847	97,726,796	31,525,000	54,614	17,618
	Other/unknown	3,335	220,352,468	62,577,210	69,545	19,750

KI 8.5 Total and per-person per-year (PPPY) Medicare costs (\$) among kidney transplant recipients in the first post-transplant year

Costs among recipients transplanted in 2008 and 2009 who had Medicare as the primary payer at the time of transplant. First year costs include the transplant hospitalization. Costs incurred after a transplant failure are excluded.

		# patients	Total costs		PPPY costs	
			Part A	Part B	Part A	Part B
All patients		8,321	117,269,980	90,690,952	14,427	11,157
Age	0-11	95	1,602,410	1,028,434	17,018	10,922
	12-17	133	2,921,075	1,393,174	22,635	10,795
	18-34	1,121	14,389,113	12,561,407	13,142	11,472
	35-49	2,322	28,738,475	25,871,033	12,618	11,359
	50-64	3,015	43,868,019	31,919,425	14,939	10,870
	65+	1,635	25,750,888	17,917,479	16,131	11,224
Sex	Male	5,101	69,286,158	54,131,145	13,906	10,865
	Female	3,220	47,983,822	36,559,807	15,251	11,620
Race	White	3,959	55,630,442	41,054,375	14,329	10,575
	Black	2,492	38,422,595	29,305,341	15,979	12,187
	Hispanic	1,290	16,827,913	14,957,845	13,219	11,750
	Asian/Pac. Isl.	452	4,780,270	4,303,670	10,772	9,698
	Other/unk.	128	1,608,760	1,069,721	12,873	8,560
Primary cause of disease	Diabetes	2,377	42,539,049	29,203,910	18,413	12,641
	Hypertension	2,262	30,843,121	24,480,898	13,953	11,074
	GN	1,444	16,258,100	14,044,215	11,504	9,937
	Cystic kidney dis.	769	8,039,356	7,313,759	10,667	9,704
	Other/unknown	1,469	19,590,354	15,648,170	13,597	10,861

KI 8.6 Total and per-person per-year (PPPY) Medicare costs (\$) among kidney transplant recipients in the second post-transplant year

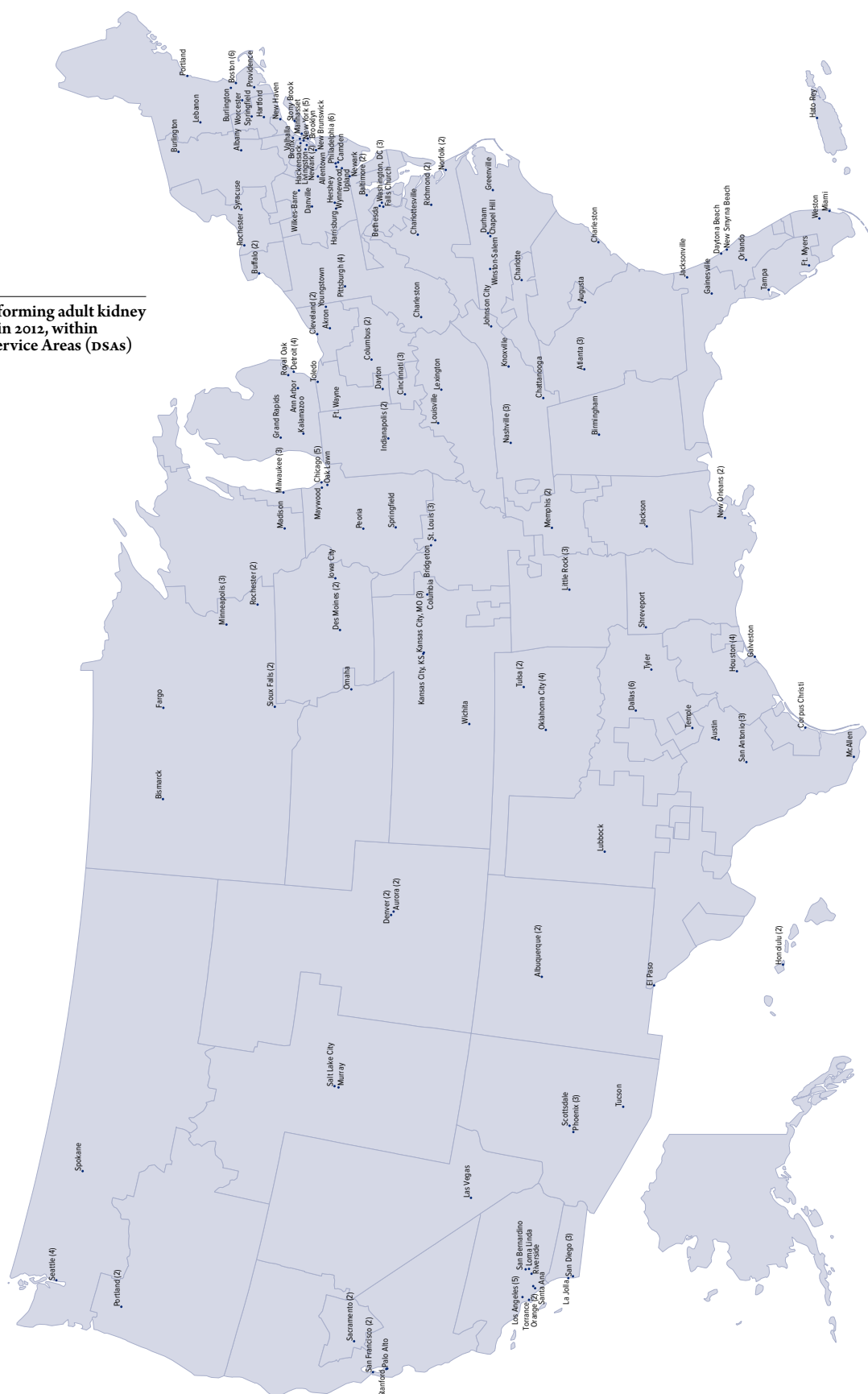
Costs among recipients transplanted in 2008 who had Medicare as the primary payer at the time of transplant. The second post-transplant year runs from 366 to 730 days after transplant. Costs incurred after a transplant failure are excluded.

Medicare data

Total costs		2008 total costs			2009 total costs			2010 total costs		
		# patients	Part A	Part B	# patients	Part A	Part B	# patients	Part A	Part B
All patients		99,971	1,547,762,579	682,146,514	104,651	1,744,164,173	882,140,746	108,706	1,784,809,610	855,769,140
Age	0-11	1,076	22,463,998	6,305,692	1,093	25,227,895	7,768,870	1,103	27,067,787	7,775,029
	12-17	1,721	35,264,896	10,158,522	1,773	39,491,803	12,545,180	1,760	40,100,807	11,608,654
	18-34	15,918	243,598,433	104,852,540	16,146	265,871,313	135,137,427	16,179	269,352,344	125,389,310
	35-49	30,800	430,547,654	204,145,334	31,808	488,263,418	264,570,152	32,464	487,178,033	249,686,042
	50-64	37,806	576,537,107	254,727,944	40,036	643,495,518	326,770,830	42,143	671,708,968	323,055,072
	65+	12,650	239,350,490	101,956,483	13,795	281,814,226	135,348,287	15,057	289,401,671	138,255,032
Sex	Male	59,902	913,770,090	404,850,126	62,596	1,028,797,286	521,789,179	65,058	1,046,148,121	505,361,652
	Female	40,069	633,992,489	277,296,388	42,055	715,366,887	360,351,566	43,648	738,661,489	350,407,488
Race	White	59,025	831,266,321	373,951,586	61,276	930,680,556	476,553,585	63,008	950,210,053	461,653,922
	Black	22,902	434,544,831	178,918,926	24,137	490,920,282	236,353,162	25,458	506,372,240	230,841,310
	Hispanic	12,511	201,362,329	94,413,648	13,297	230,807,718	124,441,914	14,046	232,574,335	120,467,381
	Asian/Pacific Islander	4,382	60,084,669	27,987,005	4,713	68,346,957	35,886,346	4,937	71,206,513	34,262,504
	Other/unk.	1,151	20,504,429	6,875,349	1,228	23,408,660	8,905,739	1,257	24,446,469	8,544,023
Primary cause of disease	Diabetes	27,722	507,437,468	221,814,560	29,102	574,616,094	281,480,112	30,383	584,382,348	277,377,887
	Hypertension	20,948	335,002,311	149,763,459	22,325	385,163,615	203,027,199	23,377	389,431,715	194,967,676
	GN	19,267	254,239,702	116,189,872	19,928	280,997,264	146,555,830	20,652	289,799,569	140,381,018
	Cystic kidney disease	12,279	148,469,802	69,276,723	12,907	170,392,347	90,046,415	13,490	177,844,953	88,068,213
	Other/unknown	19,755	302,613,296	125,101,899	20,389	332,994,854	161,031,189	20,804	343,351,025	154,974,347
Per person per year costs		2008 PPPY costs			2009 PPPY costs			2010 PPPY costs		
		# patients	Part A	Part B	# patients	Part A	Part B	# patients	Part A	Part B
All patients		99,971	17,183	7,573	104,651	18,532	9,373	108,706	18,214	8,733
Age	0-11	1,076	23,158	6,500	1,093	26,062	8,026	1,103	27,363	7,860
	12-17	1,721	22,753	6,554	1,773	25,027	7,950	1,760	25,287	7,320
	18-34	15,918	16,764	7,216	16,146	18,002	9,150	16,179	18,138	8,444
	35-49	30,800	15,348	7,277	31,808	16,896	9,156	32,464	16,469	8,441
	50-64	37,806	16,942	7,486	40,036	17,897	9,088	42,143	17,708	8,516
	65+	12,650	21,878	9,319	13,795	23,583	11,326	15,057	22,172	10,592
Sex	Male	59,902	16,995	7,530	62,596	18,288	9,275	65,058	17,888	8,641
	Female	40,069	17,463	7,638	42,055	18,894	9,517	43,648	18,696	8,869
Race	White	59,025	15,494	6,970	61,276	16,768	8,586	63,008	16,602	8,066
	Black	22,902	21,517	8,860	24,137	23,044	11,094	25,458	22,502	10,258
	Hispanic	12,511	17,896	8,391	13,297	19,235	10,371	14,046	18,328	9,494
	Asian/Pacific Islander	4,382	15,213	7,086	4,713	16,109	8,458	4,937	16,002	7,700
	Other/unk.	1,151	20,012	6,710	1,228	21,895	8,330	1,257	21,921	7,661
Primary cause of disease	Diabetes	27,722	20,468	8,947	29,102	22,137	10,844	30,383	21,551	10,229
	Hypertension	20,948	18,027	8,059	22,325	19,344	10,197	23,377	18,652	9,338
	GN	19,267	14,516	6,634	19,928	15,538	8,104	20,652	15,484	7,501
	Cystic kidney disease	12,279	13,186	6,153	12,907	14,519	7,673	13,490	14,403	7,132
	Other/unknown	19,755	16,883	6,980	20,389	18,070	8,738	20,804	18,135	8,186

K1 8.7 Total calendar-year and per-person per-year (PPPY) Medicare costs (\$) spent on kidney transplant recipients, 2008, 2009, 2010
 Costs paid by Medicare in each calendar year among recipients alive with graft function in the given year, regardless of Medicare eligibility at the time of transplant. Costs incurred after transplant failure are excluded.

KI 9.1 Centers performing adult kidney transplants in 2012, within Donation Service Areas (DSAs)



KI 9.2 Centers performing pediatric kidney transplants in 2012, within Donation Service Areas (DSAs)