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OPTN/SRTR 2016 Annual Data Report: Kidney

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Abstract

Data from 2016 show ongoing positive trends in short- and long-term allograft survival, and a decrease in the number of active listed candidates for the first time in more than a decade, with a concomitant increase in deceased donor kidney transplants. Transplant rates that had changed dramatically for some groups after implementation of the new kidney allocation system in 2014 are stabilizing, allowing for evaluation of new steady states and trends. Many challenges remain in adult kidney transplantation, including stagnant rates of living donor transplant, geographic disparities in access to transplant, racial disparities in living donor transplant, and overall a continuing demand for kidneys that far outpaces the supply. For pediatric recipients, a decline in the proportion of living donor transplants is of concern. In 2016, only 34.2% of pediatric transplants were from living donors, compared with 47.2% in 2005. The number of related donors decreased dramatically over the past decade, and the number of unrelated directed transplants performed in pediatric candidates remained low (50).

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1 Introduction

The 2016 Annual Data Report kidney chapter provides a second year of data following implementation of the new kidney allocation system (KAS) in December 2014. Examination of 2015 data revealed “bolus effects,” or rapid changes in transplant rates before they leveled out at a new steady state. We can now begin to assess both intended and potential unintended consequences of the new policy. These data also show where the new KAS achieved its aims, for example in increasing deceased donor transplant rates among racial minorities, and where the kidney transplant community should continue its efforts beyond the KAS to achieve equity, such as increasing access to transplant for blood group B candidates and reducing the ongoing marked disparity for black patients in access to living donor transplant and allograft survival.

The 2016 data show other encouraging trends and concerns that warrant further investigation. For the first time in more than a decade, the number of candidates, both active and inactive, on the deceased donor waiting list declined, and the number of deceased donor transplants increased notably. Both short- and long-term unadjusted allograft survival continued to improve, although the short-term effect of KAS may not have stabilized, and long-term effects are unknown. However, the number of living donor transplants remained flat. Geographic variation in access to transplant remained high, and fewer candidates were willing to accept kidneys with a high kidney donor profile index (KDPI) score despite an aging waitlist population with more years on dialysis and higher prevalence of comorbid conditions. The potential long-term graft survival benefits of longevity matching with kidney donor risk index (KDRI) and expected posttransplant survival scores will be difficult to assess for several years. In summary, the 2016 data show both progress and ongoing challenges for the transplant community in providing this life-saving treatment to patients with end-stage kidney disease.

2 Adult Kidney Transplant

2.1 Waiting List

Perhaps the most striking trend apparent in the 2016 waitlist data is the decrease in listed candidates for the second year in a row, after a peak of nearly 100,000 in 2014 (Figure KI 2). Unlike in 2015, numbers of both active and inactive candidates decreased. In total, 30,869 adult candidates were added to and 33,291 removed from the list, and deceased donor transplants increased from 12,279 in 2015 to 13,501 in 2016 (Table KI 5, Table KI 6). The number of new inactive listings declined for the second year in a row, likely due to the new KAS, which eliminated the utility of newly listing as inactive for candidates already on dialysis undergoing pretransplant workup (Figure KI 1). Credit given for time on dialysis may also explain the ongoing increase in numbers of adult patients removed from the list due to being too sick to undergo transplant, 4411 in 2016 versus 3325 in 2014. Unfortunately, more than one-fourth of the 33,291 adult patients removed from the list were removed due to death or deteriorating medical condition, reflecting the ongoing organ shortage despite gains in numbers of deceased donor transplants (Table KI 6). Removals for other reasons also increased, and given that more than 13.4% of waitlist removals were for

other reasons, a closer examination of how reporting categories are used may be warranted to ensure that clinically relevant trends are not missed.

The kidney transplant waiting list continued to age, with ongoing increases in the proportions of candidates aged 50–74 years (Figure KI 3). While overall the racial composition of the list changed little, the trend toward increasing proportions of Hispanic candidates continued, from 15.7% in 2005 to 19.4% in 2016 (Figure KI 4). Proportions of waitlisted candidates with calculated panel-reactive antibodies (cPRA) 98%–100% declined from 9.4% in 2013 to 8.2% in 2016, likely reflecting increases in transplants for these candidates due to the new KAS (Figure KI 7). The proportion of candidates with diabetes as a cause of kidney disease increased to 36.2% of waitlisted candidates (Figure KI 5). Time on the waiting list and on dialysis also continued to increase; more than 20% of listed candidates had been on dialysis for at least 6 years from their most recent listing (Figure KI 8). Considering that more listed candidates are older, have diabetes, and have longer dialysis duration, perhaps the most concerning recent waitlist trend is a decrease for the second year in a row in the proportion willing to accept a high-KDPI kidney, down from 49.9% in 2014 to 45.7% in 2016 (Figure KI 9). Counter-intuitively, this decline was more dramatic among candidates aged 65 years or older (Figure KI 19).

Deceased donor transplant rates, or transplants per 100 waitlist-years, changed dramatically for some groups after KAS implementation. After an initially large increase in 2015 for candidates aged 18–34 years, the rate increased again in 2016, but to a degree similar to increases for all other age groups (Figure KI 11). The rate for candidates with cPRA 98%–100% was essentially equal to the rate in 2015, when a dramatic increase followed KAS implementation (Figure KI 13). Transplant rates remained higher for candidates with blood type AB (Figure KI 14). Interestingly, the rate for candidates listed for less than 1 year soared after 2014, perhaps reflecting many more transplants in newly listed candidates who had been on dialysis for many years (Figure KI 15).

Cumulatively, for candidates listed in 2013, fewer than 50% were still waiting in 2016; 20% underwent deceased donor transplant, 15% underwent living donor transplant, 8% died, and 11% were removed from the list for other reasons (Figure KI 16). These competing risks reflect the difficulty of calculating a national median time to transplant, as half of newly listed candidates in 2005 had not undergone transplant by 2016 (Figure KI 17). Geographic variability in access to transplant remained high, making national averages for waitlist outcomes less relevant than from region to region. The percentage of patients who underwent deceased donor kidney transplant within 5 years varied from 9.1% to 84.3% across donation service areas (DSAs) (Figure KI 18); waitlist mortality rates also varied, ranging from 0 to 12.7 per 100 patient-years across DSAs (Figure KI 23). Overall and by age, race, and diagnosis, mortality rates for listed patients decreased over the past 10 years (Figure KI 20, Figure KI 21, Figure KI 22). However, given recent increases in removals from the waiting list for reasons other than death or transplant, it is notable that deaths within 6 months of removal have also declined since 2014, suggesting that, at the very least, transplant programs are not compensating for changed waitlist demographics post-KAS by more rapidly delisting candidates at higher mortality risk.

2.2 Deceased Donation

Overall, the demographics of deceased kidney donors remained stable, with a slight decline over 10 years in the proportions in the youngest and oldest age groups, and an increase in the proportion aged 18–34 years (Figure KI 25, Figure KI 26). Donation rates continued to vary greatly by state, from 6.9 to 32.2 per 1000 deaths (Figure KI 27). The previously noted trend of a slow 10-year increase in discard rates continued across age group, comorbidity, cause of death, donor type, and KDPI. Implementation of the new KAS raised concerns about increasing discard rates in the setting of increased geographic sharing of kidneys and longer cold ischemia time. While the current discard trend preceded the new KAS, the rate of increase appears to have worsened post-KAS in some groups (Figure KI 28, Figure KI 29, Figure KI 30, Figure KI 31, Figure KI 32, Figure KI 33). In particular, discards of kidneys recovered from donors aged 65 years or older, from donors with diabetes, and with KDPI above 85% increased more rapidly in the 2 years since KAS implementation.

The discard rate for biopsied kidneys remained markedly higher than the rate for non-biopsied kidneys; nearly one-third of biopsied kidneys were discarded in 2016, despite declines in the KDRI of biopsied kidneys over the past 10 years, from 1.61 in 2005 to 1.45 in 2016 (Figure KI 32, Figure KI 38). This suggests that kidneys discarded based on biopsy could likely have benefitted listed candidates. Of similar concern is a trend toward decreasing KDRI of discarded kidneys (Figure KI 37). This may be an unintended consequence of the clinical use of KDPI rather than KDRI; KDPI assigns a percentile score of 0–100 based on the previous years' recovered kidney donors (for the purpose of transplant) and can result in "drift." Specifically, if recovery practice nationwide becomes more conservative in a single year, the definition of a KDPI > 85 kidney will be more conservative the next year (i.e., have a relatively lower KDRI than the prior year). The meaning of a KDPI > 85 kidney is redefined each year and always tends in the direction of the previous year, driving an ongoing process.

2.3 Living Donation

The total number of living donor transplants, in adults and children, has remained flat since 2011, and represents a declining proportion of all kidney transplants (Figure KI 48). Unrelated donations continued to make up a greater proportion of living donor kidney transplants; paired donations increased from 27 in 2005 to 642 in 2016 (Figure KI 40). White donors continued to donate most living donor kidneys (70%); proportions of black living donors declined from 13.4% in 2005 to 9.6% in 2016 (Figure KI 43). The extent of this decrease due to medical contraindications or psychosocial barriers needs further study. In addition, the proportion of donors aged 50 years or older increased (Figure KI 41), possibly due to concern that the long-term risks for younger donors may be greater than for older donors. More comprehensive follow-up of these living donors, along with appropriate controls as proposed by SRTR's Living Donor Collective (see Kasiske et al, The Living Donor Collective: A scientific registry for living donors. *Am J Transplant*. In press. DOI: 10.1111/ajt.14365) will provide better insights into the short- and long-term risks of donation, especially given improvements in surgical techniques and the near elimination of retroperitoneal nephrectomy (Figure KI 44). Readmission after donor nephrectomy within the first year remains uncommon, at 5.3% with complications reported in 9%; However,

readmission rates at 12 months are unknown for nearly one-fifth of donors (Figure KI 45), illustrating the need to better ascertain living donor outcomes.

2.4 Kidney Transplants

Encouragingly, after at least a decade of stasis in numbers of transplants despite an expanding waiting list, the total number of kidney transplants rose notably in 2015 and 2016. This increase is entirely attributable to an increase in deceased donor transplants, as living donor transplants did not increase (Figure KI 48). The increase in transplants occurred across most levels of age, sex, racial/ethnic, and diagnosis groups (Figure KI 49, Figure KI 50, Figure KI 51, Figure KI 52). Also encouraging are apparently accelerated gains in numbers of transplants in black and Hispanic patients since 2014 (Figure KI 51). These gains appear to be related to intentional KAS policies aimed at reducing racial disparities in access to deceased donor transplant, such as credit given for time on dialysis before listing. However, disparity in access to living donation persists; only 12.3% of living donor kidney transplants were performed in black recipients, compared with 65.1% in white recipients (Table KI 8). Meanwhile, white candidates made up only 36.4% of the waiting list, and black candidates 33.2% (Table KI 2).

Nearly half of deceased donor recipients in 2016 had been on dialysis for at least 5 years; the proportion of deceased donor recipients who had waited more than 5 years was only 19.2%, likely reflecting the credit given for time on dialysis under the new KAS (Table KI 9, Table KI 10). Consistent with the higher rate of discards for kidneys with KDPI above 85%, the proportion of transplants using high-KDPI kidneys declined from 10.7% in 2005 to 7.9% in 2016 (Figure KI 53). This trend again suggests that kidneys that could benefit some candidates may be unnecessarily discarded.

Nearly 70% of deceased donor recipients in 2016 were on Medicare, compared with only 37.8% of living donor recipients. Conversely, 21.9% of deceased donor recipients had private insurance, compared with 55.6% of living donor recipients. A small but similar proportion of deceased and living donor recipients were covered by Medicaid, 6.5% and 4.1%, respectively (Table KI 8).

Nearly 75% of transplant recipients underwent immunosuppression induction with T-cell depleting agents in 2016, and IL2 receptor antagonists (IL-2-RA) or no induction became increasingly uncommon (Figure KI 54). Similarly, tacrolimus remained the calcineurin inhibitor of choice over cyclosporine, prescribed for only 1.7% of recipients (Figure KI 55). Ten years ago, mTOR inhibitors were more commonly used, but only 1.9% of recipients were prescribed them at transplant in 2016, increasing to 4.3% at 1 year posttransplant (Figure KI 57). Mycophenolate use continued to increase, to 95.2% in 2016 (Figure KI 56). Steroid use also continued to increase. After a nadir of 63.8% recipients using steroids at 1 year posttransplant in 2007, 71.8% were using steroids in 2016 (Figure KI 58).

Due to the new KAS, the proportion of deceased donor transplants among candidates with cPRA 98%–100% increased dramatically in 2015, to 14.6%. In 2016, the proportion decreased to 11.8%, still well above the 2014 proportion of 4.8% (Figure KI 59). Monthly data from the OPTN 2-year KAS report shows minimal fluctuation during 2016, suggesting

that a steady state may have been reached for this group (see https://www.transplantpro.org/wp-content/uploads/sites/3/KAS_First-two-years_041917.pdf).

Transplants were performed at a variety of transplant programs; 5% of kidney transplants occurred at programs that performed at least 245 transplants, and 5% at programs that performed 2 or fewer. The 75th and 95th percentile program volumes increased over time, while numbers of transplants performed at programs of median or smaller size remained relatively stable (Figure KI 62). More than half of all transplants occurred at programs in the 75th or higher percentile, with 18% occurring at programs in the 95th percentile and 41% occurring at programs in the 75th to 95th percentile (Figure KI 63).

2.5 Outcomes

In mid-2016, 210,615 recipients were alive with a functioning graft, nearly twice as many as in 2005 (Figure KI 79). The longstanding improvement in unadjusted short- and long-term deceased donor graft survival continued in 2016; 6-month all-cause and death-censored graft failure for deceased donor recipients in 2015 was nearly half what it was 10 years ago. All-cause graft failure declined from 7.5% in 2005 to 4.8% in 2015, with a similar decline in 6-month death-censored graft failure from 4.3% to 2.6% over the same period. Long-term failure rates improved; 10-year all-cause graft failure for recipients in 2006 declined to 51.6% from 57.2% 8 years earlier, and 10-year death-censored graft failure declined from 33.7% to 26.2% (Figure KI 64, Figure KI 65). Similarly positive trends continued for living donor recipients, with 6-month and 10-year all-cause graft failure only 1.3% and 34.2% (Figure KI 67). Censoring for death, nearly 82% of living donor kidneys transplanted in 2006 were still functioning in 2016 (Figure KI 68).

Five-year graft survival among recipients who underwent deceased donor transplant in 2011 was lower for those with diabetes and hypertension as cause of kidney failure than for those with cystic disease or glomerulonephritis (Figure KI 70). Graft survival did not differ for donation-after-circulatory-death versus donation-after-brain-death kidneys (Figure KI 72). While graft survival for KDPI 35%–85% and > 85% was notably lower than for KDPI = 20% and 21%–34% (63.9% for KDPI > 85%, 82.7% for KDPI = 20%), graft survival differed little between the two lowest KDPI groups (82.7% and 81.1% for KDPI = 20% and 21%–34%, respectively) (Figure KI 71). Observed 5-year graft survival was lower for biopsied than for non-biopsied kidneys (71.2% versus 79.7%), suggesting that biopsies are more often performed when kidneys are medically likely to be of lower quality (Figure KI 73). Given that the 5-year survival for biopsied vs. non-biopsied kidneys was nearly equivalent to calculated survival for KDPI 35–85% vs. KDPI 21–34%, this again raises concern that biopsy may not add to available clinical information with regard to predicting subsequent graft failure rates. While still better than deceased donor graft survival, 5-year living donor graft survival was lower for black recipients than for any other racial/ethnic group, at 82.0% compared with 92.3% for Asian, 89.9% for Hispanic, and 85.7% for white recipients (Figure KI 75).

Posttransplant diabetes continued to decline, especially among recipients with the highest body mass index (BMI); 1-year incidence in recipients with BMI = 35 kg/m² was essentially the same as for recipients with BMI 25–34 kg/m² (Figure KI 81, Figure KI 82). This trend is

particularly encouraging given the increased use of tacrolimus in lieu of cyclosporine for immunosuppression. Incidence of posttransplant lymphoproliferative disorder (PTLD) remained low overall at 0.6% at 5 years posttransplant. However, 5-year incidence was substantially higher for recipients who were Epstein-Barr virus (EBV) negative, albeit still low at 1.6% (Figure KI 83).

Patient survival closely mirrored graft survival. Five-year deceased donor recipient survival was lowest for patients with diabetes (Figure KI 85) and for those who received a high-KDPI or biopsied kidney (Figure KI 86, Figure KI 87). Patient and living donor graft survival were lowest for recipients aged 65 years or older. The next worse graft survival was for recipients aged 18–34 years (Figure KI 74), but not surprisingly patient survival was highest for these recipients after both living and deceased donor transplant (Figure KI 84, Figure KI 88).

3 Pediatric Kidney Transplant

3.1 Waiting List

In 2016, 917 pediatric candidates were added to the kidney transplant waiting list, 522 (57%) as inactive (Figure KI 91). The number of prevalent pediatric candidates (listed at age < 18 years and on the list on December 31 of the given year) has been steadily increasing and reached 1,494 on December 31, 2016 (Figure KI 92). The most common reason for inactive status among newly listed candidates in 2016 was incomplete work-up (52.1%), followed by living donor candidate status (16.8%), and too well to need transplant (11.6%) (Table KI 13). Over the past decade, the age of pediatric candidates on the list at year-end shifted, with an increase in those aged 1–5 years (14.9% to 24.6%) and a decrease in those aged 11–17 years (66.3% to 54.3%) (Table KI 14). Proportions of candidates with congenital anomalies of the kidney and urinary tract (CAKUT) as primary cause of disease increased from 27.8% in 2006 to 37.3% in 2016, and proportions with glomerulonephritis decreased from 12.3% to 7.1%. Most candidates (65.7%) had a cPRA of less than 1% (Table KI 15). The proportion of pediatric candidates waiting for retransplant decreased from 26.4% on December 31, 2006, to 15.0% on December 31, 2016. Multi-organ listing was uncommon; only 2.4% of pediatric candidates were awaiting multi-organ transplant on December 31, 2016 (Table KI 16). The leading cause of end-stage kidney disease changed with age; CAKUT was most common in children aged younger than 6 years, while focal segmental glomerulosclerosis and glomerulonephritis were more common in older children (Figure KI 98).

Of the 972 pediatric candidates removed from the waiting list in 2016, 598 (61.5%) received a deceased donor kidney, 273 (28.1%) received a living donor kidney, 27 (2.8%) died, 23 (2.4%) were considered too sick to undergo transplant, and 7 (0.7%) were removed from the list because their condition improved (Table KI 17, Table KI 18). Among patients newly listed in 2013, 57.4% underwent deceased donor transplant within 3 years, 22.5% underwent living donor transplant, 16.5% were still waiting, 2.3% were removed from the list for other reasons, and 1.2% died (Figure KI 99). The rate of deceased donor transplant in 2016 among pediatric waitlisted candidates was 106.8 per 100 active waitlist years, up from 98.3 in 2015 (Figure KI 100), compared with 20.7 for adult candidates (Figure KI 11). One aim of the

KAS was to maintain the high level of access to transplant for pediatric candidates that was present pre-KAS. Transplant rates varied by age. In 2016, transplant rates were highest for candidates aged 11–17 years (120.7 per 100 active waitlist years), followed by candidates aged 6–10 years (105.3). Mirroring 2015, transplant rates among pediatric candidates were lowest for children aged younger than 6 years (98.4 per 100 active waitlist years). Rates also varied by cPRA (Figure KI 101), further demonstrating the effects of new priority for highly sensitized candidates under the KAS. For pediatric candidates with cPRA greater than 98%, the transplant rate increased from 6.9 per 100 active waitlist years in 2014 to 25.9 in 2016. Transplant rates for pediatric candidates with cPRA 80%–97% declined from 63.7 in 2014 to 18.2 in 2015, and increased to 34.9 in 2016. In contrast to mortality among candidates waiting for other organs, pretransplant mortality among pediatric candidates waiting for kidney transplant was low: 1.4 per 100 waitlist years in 2015–2016 (Figure KI 102).

3.2 Transplant

The number of total pediatric kidney transplants decreased from a peak of 899 in 2005 to 731 in 2016 (Figure KI 103). The decline in the proportion of living donor kidney transplants in pediatric recipients is of concern. In 2016, only 34.2% of pediatric transplants were from living donors, compared with 47.2% in 2005. Similar to adults, the number of related donors decreased dramatically over the past decade. The number of unrelated directed transplants performed in pediatric candidates remained low (50 in 2016) (Figure KI 104). Children aged younger than 6 years made up the largest group of living donor kidney recipients (44.3%) (Figure KI 105).

In 2016, 30 programs were performing only pediatric kidney transplants, compared with 130 performing only adult transplants and 58 performing transplants in both adults and children (Figure KI 106). In 2016, 14.2% of transplants in candidates aged 0–14 years were performed at programs with volumes of 5 or fewer pediatric transplants in that year (Figure KI 107). A higher proportion of living donor transplants were in recipients aged 1–5 years; this group accounted for 28.5% of pediatric living donor transplants and 18.5% of pediatric deceased donor transplants, compared with 17.8% and 19.4%, respectively, for recipients aged 6–10 years. While most pediatric transplants were in recipients aged 11–17 years (59.0%), deceased donor transplants were more common than living donor transplants (62.0% vs. 53.3%) (Table KI 19). The racial distribution differed for deceased and living donor transplant recipients. A higher proportion of living donor than deceased donor recipients were white (69.6% vs. 39.8%) and a higher proportion of deceased donor recipients than living donor recipients were black (23.7% vs. 9.2%) and Hispanic (27.9% vs. 16.1%). Private insurance was more common among living donor recipients and Medicare/Medicaid among deceased donor recipients. Most deceased donor recipients (66.3%) underwent transplant with a kidney from a donor with KDPI = 20%. The number of HLA mismatches was higher among deceased donor recipients than among living donor recipients; 83.6% of deceased donor recipients and 23.2% of living donor recipients had more than three HLA mismatches in 2012–2016 (Figure KI 114).

The combination of a donor who was positive for cytomegalovirus and a pediatric recipient who was negative occurred in 22.7% of deceased donor transplants and in 19.5% of living

donor transplants (Table KI 22, Table KI 23). The combination of a donor who was positive for EBV and a recipient who was negative occurred in 36.9% of deceased donor transplants and in 46.0% of living donor transplants.

3.3 Immunosuppressive Medication Use

Trends in immunosuppressive medications used in children and adolescents were similar to trends for adults. In 2016, use of T-cell depleting agents continued to increase, reaching 65.1%; IL-2-RA therapy use remained steady at 34.7%. The percentage of recipients receiving no induction therapy continued to decline, reaching a low of 5.2% in 2016 (Figure KI 108). In 2016, tacrolimus was used as part of the initial maintenance immunosuppressive medication regimen in 97.1% of pediatric transplant recipients and mycophenolate in 96.5% (Figure KI 109, Figure KI 110). Mammalian target of rapamycin inhibitors were used in 5.6% of 2015 pediatric recipients at 1 year posttransplant (Figure KI 111). Corticosteroids were used in 61.6% of 2016 pediatric recipients at the time of transplant and in 62.4% of 2015 recipients at 1 year posttransplant (Figure KI 112). T-cell depleting agents were more common with increasing cPRA and IL-2-RA use more common with decreasing cPRA (Figure KI 113).

3.4 Outcomes

All-cause graft failure after deceased donor transplant in pediatric recipients was 2.6% at 6 months and 3.3% at 1 year for transplants in 2014–2015, 10.8% at 3 years for transplants in 2012–2013, 18.2% at 5 years for transplants in 2010–2011, and 45.8% at 10 years for transplants in 2006–2007 (Figure KI 117). Corresponding graft failure after living donor transplant was 2.5% at 6 months and 3.3% at 1 year for transplants in 2014–2015, 4.9% at 3 years for transplants in 2012–2013, 11.5% at 5 years for transplants in 2010–2011, and 30.5% at 10 years for transplants in 2006–2007 (Figure KI 120). For the cohort of recipients who underwent transplant in 2007–2011, graft survival was highest for living donor recipients aged younger than 11 years (91.1% at 5 years) and lowest for deceased donor recipients aged 11–17 years (74.5% at 5 years) (Figure KI 123). Over the past 6 years, the incidence of acute rejection in the first year remained relatively stable between 11.4% and 12%. In the youngest age group (< 6 years), incidence of reported acute rejection in the first posttransplant year increased over time from 9.3% in 2010–2011 to 11.9% in 2014–2015, the highest incidence by age (Figure KI 124). Short-term renal function, measured by estimated glomerular filtration rate (eGFR), improved substantially over the past decade. The proportion of recipients with eGFR 90 mL/min/1.73 m² or higher at discharge increased from 20.6% in 2005 to 35.9% in 2016, and at 1 year posttransplant from 13.0% to 27.7% (Figure KI 115, Figure KI 116). Of recipients in the 2015 cohort, 74.7% had chronic kidney disease stage 1–2 at 1 year posttransplant, with eGFR 60 mL/min/1.73 m² or higher. Incidence of PTLD among EBV-negative recipients was 2.9% at 5 years posttransplant, compared with 0.7% among EBV-positive recipients (Figure KI 125). Overall 5-year patient survival among pediatric kidney transplant recipients in 2007–2011 was 98.0% (Figure KI 126).

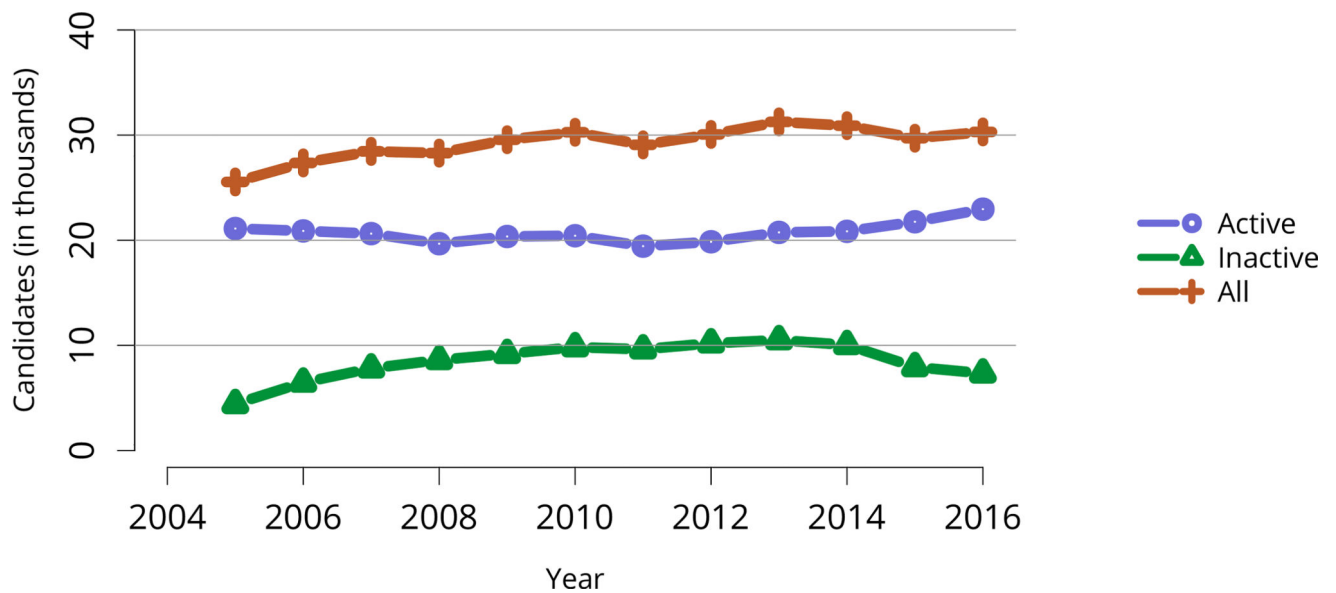


Figure KI 1. New adult candidates added to the kidney transplant waiting list

A new candidate is one who first joined the list during the given year, without having been listed in a previous year. Previously listed candidates who underwent transplant and subsequently relisted are considered new. Candidates concurrently listed at multiple centers are counted once. Active and inactive patients are included; active status is determined on day 7 after first listing. Includes kidney and kidney-pancreas listings.

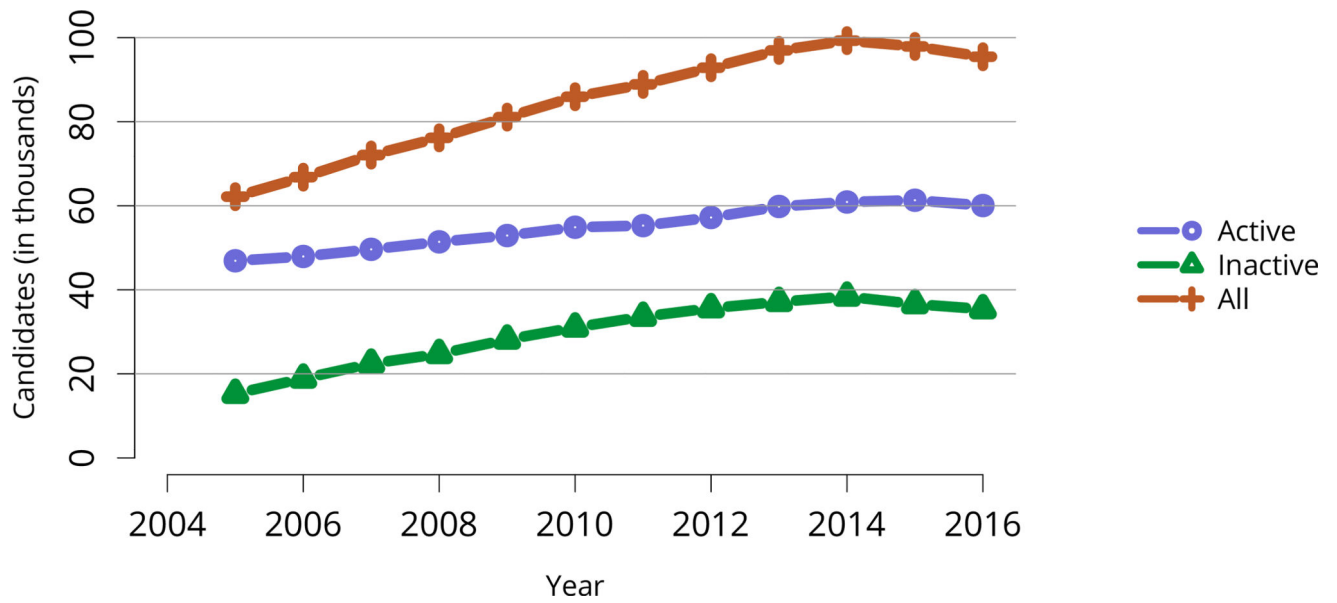


Figure KI 2. Adults listed for kidney transplant on December 31 each year
Candidates concurrently listed at multiple centers are counted once. Those with concurrent listings and active at any program are considered active. Includes kidney and kidney-pancreas listings.

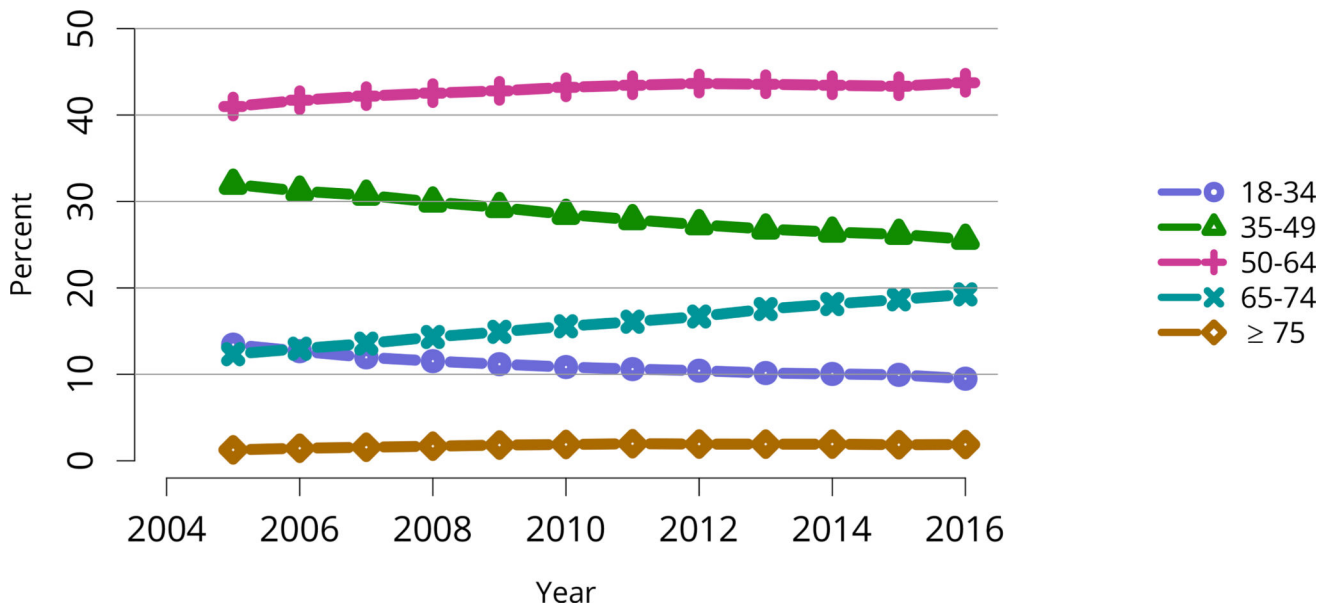


Figure KI 3. Distribution of adults waiting for kidney transplant by age
 Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Age is determined at the later of listing date or January 1 of the given year. Active and inactive candidates are included.

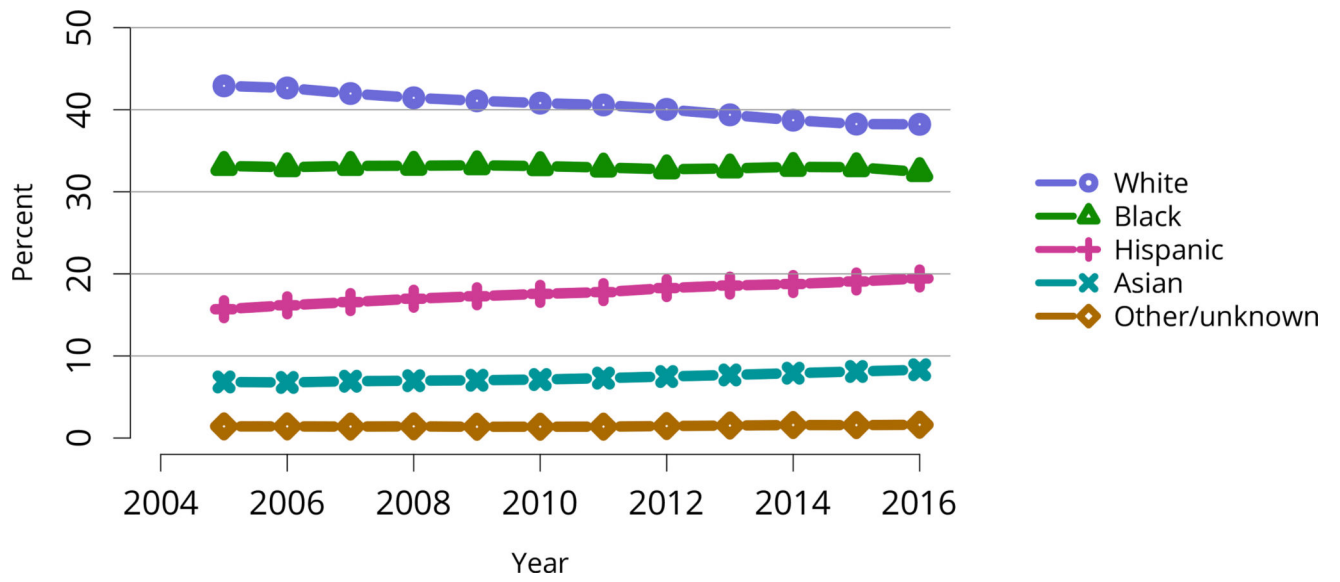


Figure KI 4. Distribution of adults waiting for kidney transplant by race
Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Active and inactive candidates are included.

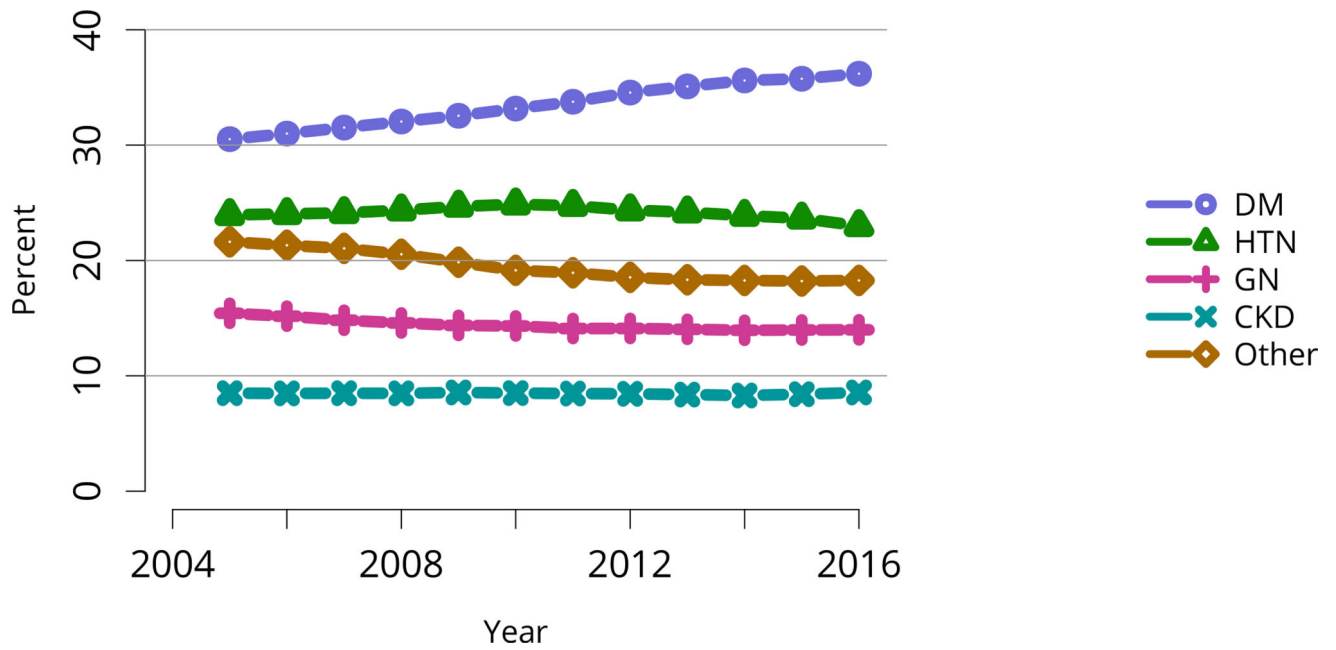


Figure KI 5. Distribution of adults waiting for kidney transplant by diagnosis
 Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Active and inactive candidates are included. CKD, cystic kidney disease; DM, diabetes. HTN, hypertension. GN, glomerulonephritis.

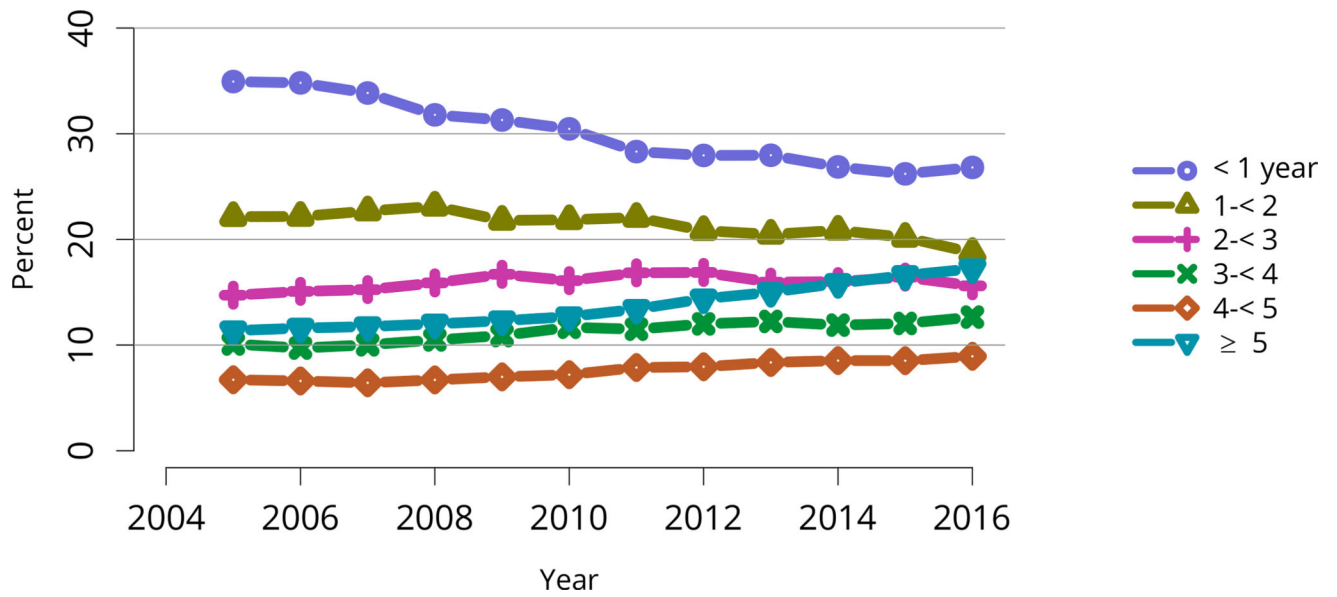


Figure KI 6. Distribution of adults waiting for kidney transplant by waiting time
 Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Time on the waiting list is determined at the earlier of December 31 or removal from the waiting list. Active and inactive candidates are included.

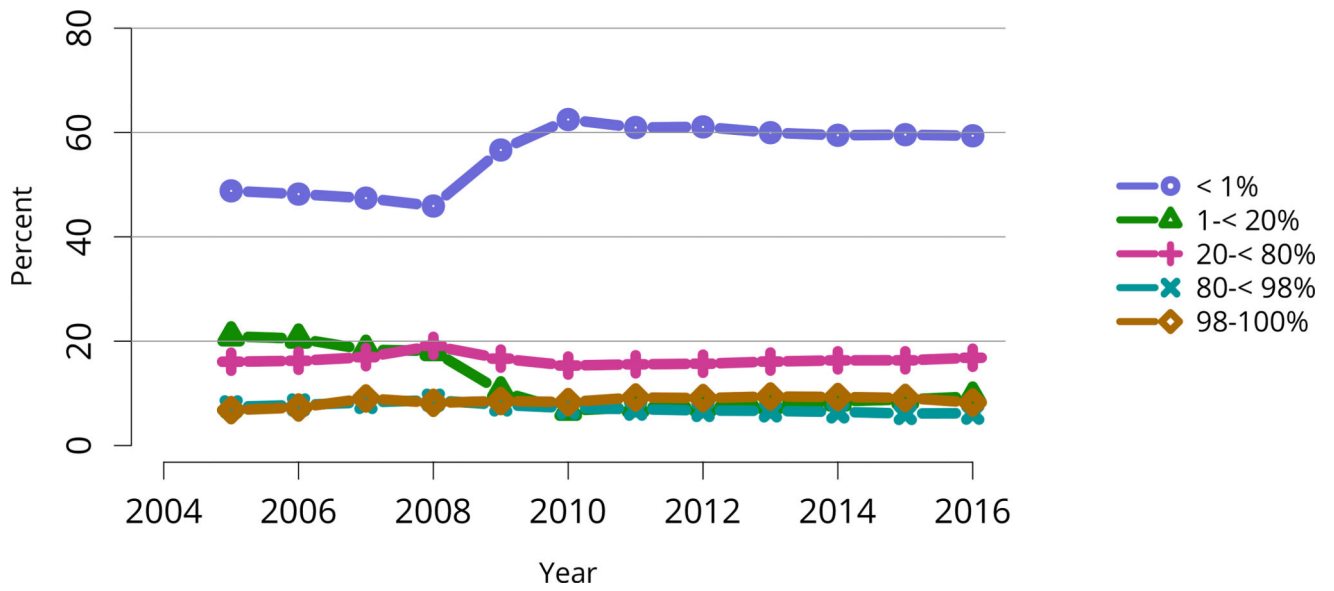


Figure KI 7. Distribution of adults waiting for kidney transplant by C/PRA
 Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. From December 5, 2007, through September 30, 2009, CPRA was used if greater than 0; otherwise, the maximum pretransplant PRA was used. Before December 5, 2007, the maximum pretransplant PRA was used unconditionally. CPRA is used after September 30, 2009. C/PRA is the highest value during the year. Active and inactive candidates are included.

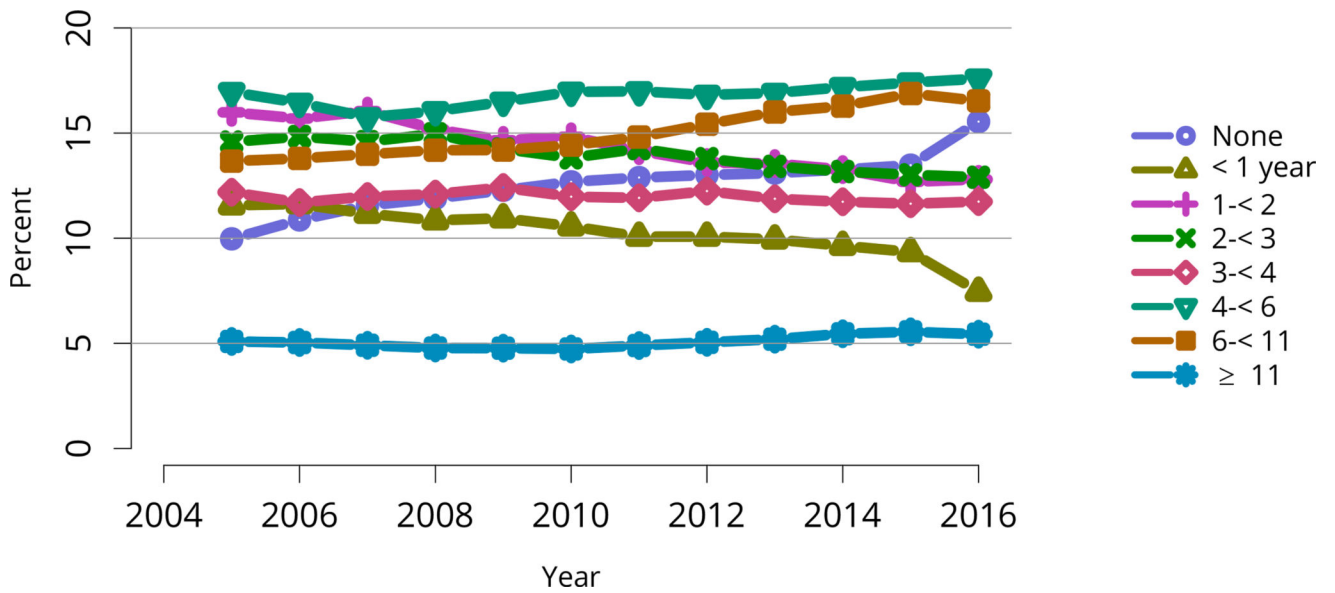


Figure KI 8. Distribution of adults waiting for kidney transplant by time on dialysis
 Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Time on dialysis begins at the more recent of first ESRD service date and most recent graft failure, and ends at the earlier of December 31 or removal from the waiting list. Active and inactive candidates are included.

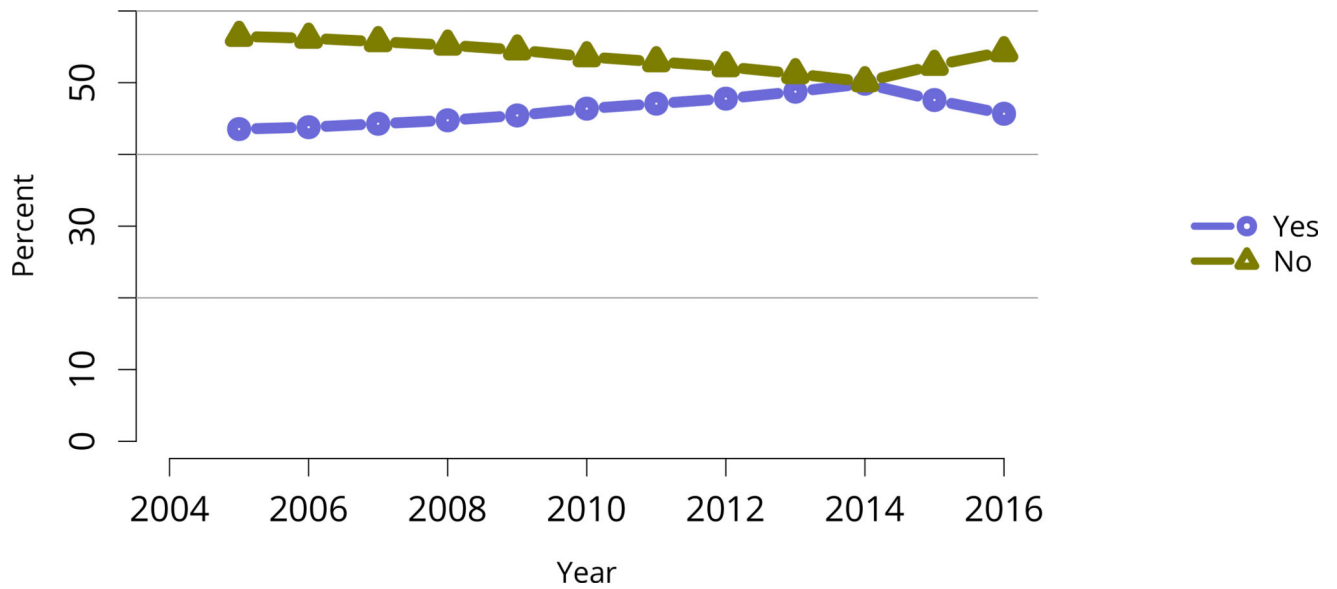


Figure KI 9. Distribution of adults waiting for kidney transplant by willingness to accept ECD or KDPI > 85% kidney

Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Active and inactive candidates are included. Willingness to accept ECD at time of listing or willingness to accept a local non-zero HLA mismatch KDPI >85% kidney for at least one day during the year, beginning in 2014. ECD, expanded criteria donor.

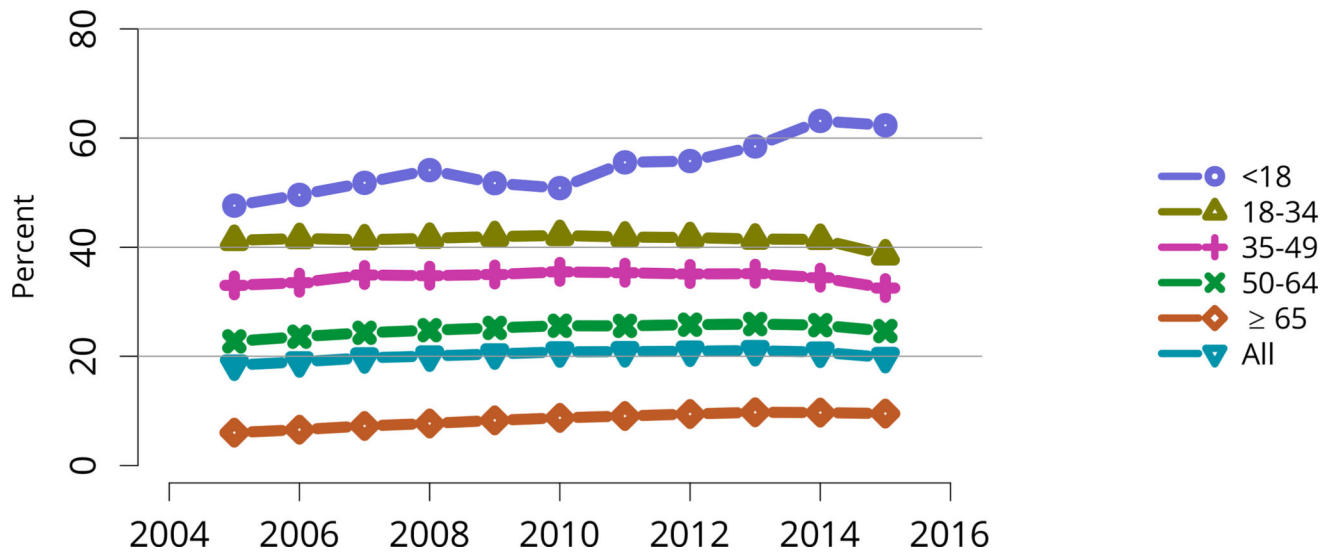


Figure KI 10. Prevalent dialysis patients waitlisted for kidney transplant by age
 Estimated percentage of prevalent dialysis patients waitlisted for kidney or kidney-pancreas transplant. Percentage calculated as the sum of point prevalent waitlist candidates divided by the sum of point prevalent dialysis patients on December 31 of each year. Dialysis data from the Consolidated Renal Operations in a Web-enabled Network (CROWN) dataset. Age calculated on December 31 of given year.

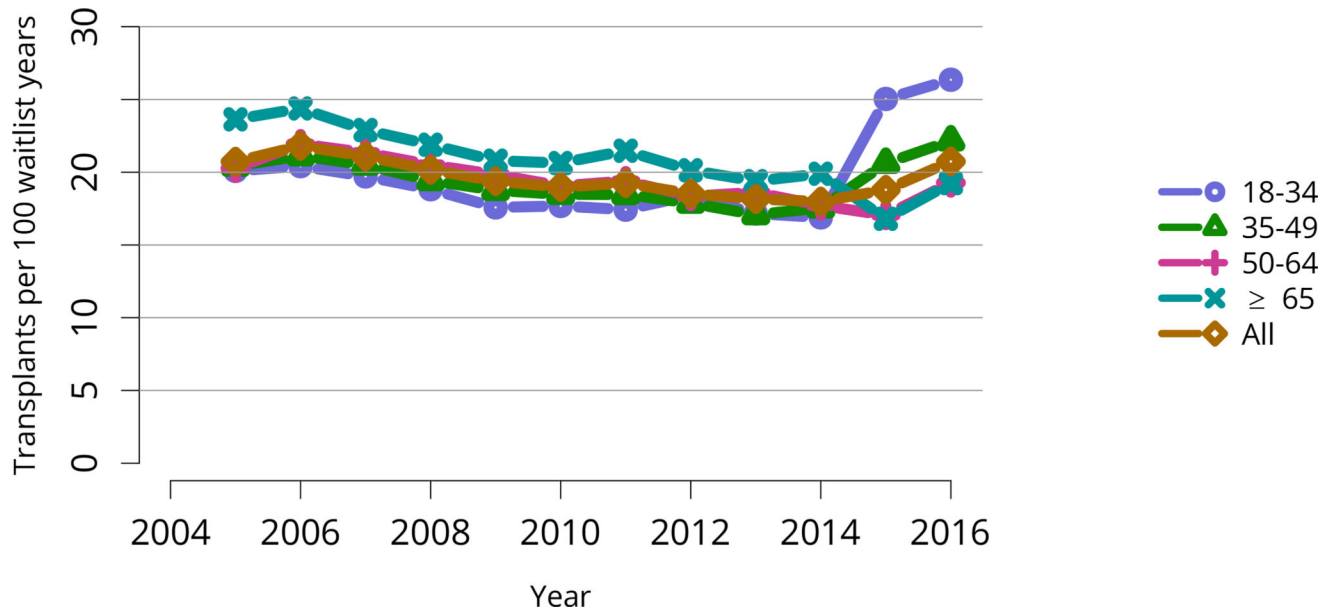


Figure KI 11. Deceased donor kidney transplant rates among active adult waitlist candidates by age

Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of active wait time in a given year. Individual listings are counted separately. Age is determined at the later of listing date or January 1 of the given year. Rates with less than 10 patient-years of exposure are not shown.

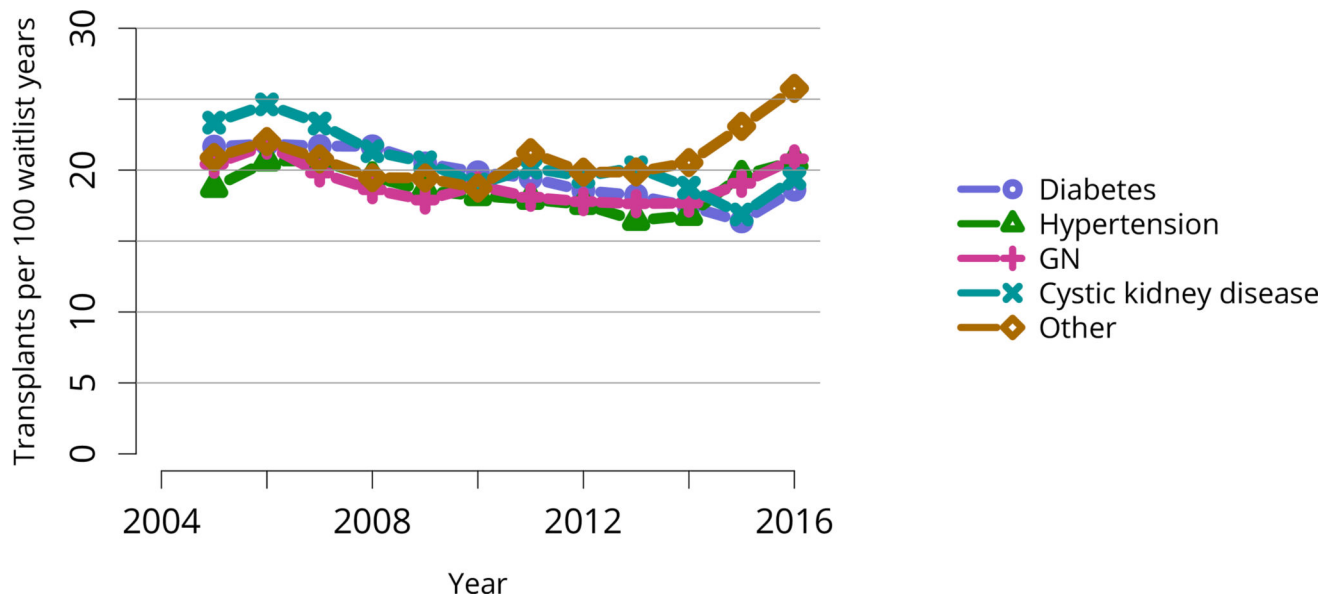


Figure KI 12. Deceased donor kidney transplant rates among active adult waitlist candidates by diagnosis

Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of active wait time in a given year. Individual listings are counted separately. Rates with less than 10 patient-years of exposure are not shown. GN, glomerulonephritis.

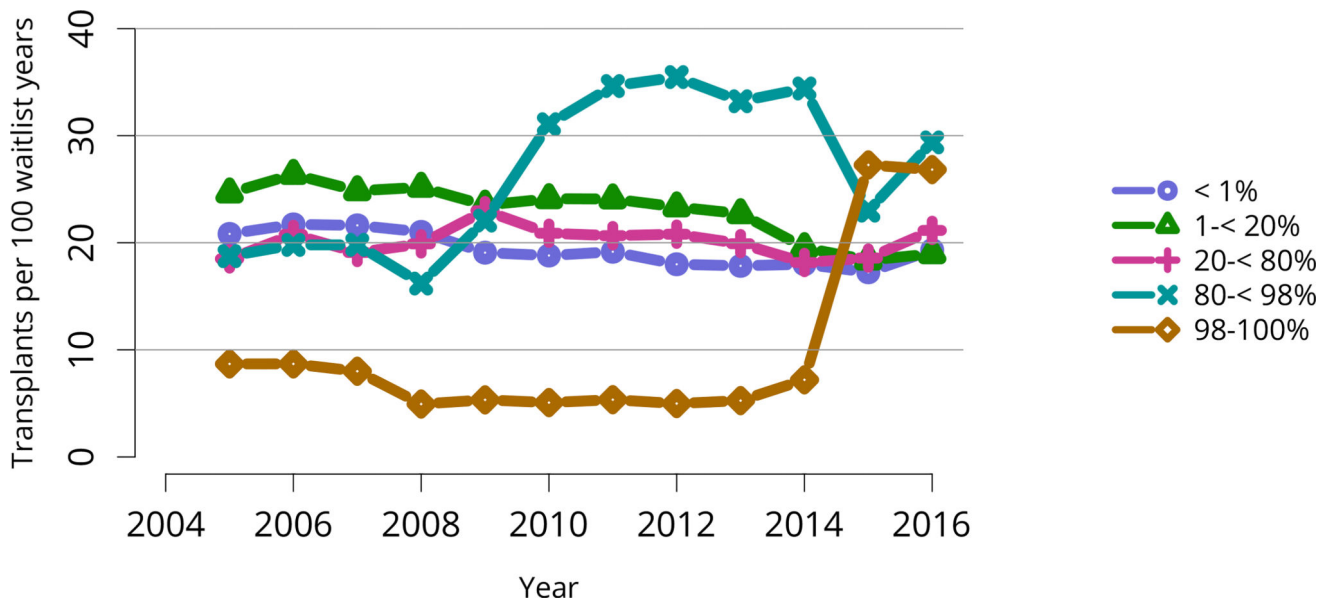


Figure KI 13. Deceased donor kidney transplant rates among active adult waitlist candidates by C/PRA

Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of active wait time in a given year. Individual listings are counted separately. From December 5, 2007, through September 30, 2009, CPRA was used if greater than 0; otherwise, the maximum pretransplant PRA was used. Before December 5, 2007, the maximum pretransplant PRA was used unconditionally. CPRA is used after September 30, 2009. Rates with less than 10 patient-years of exposure are not shown.

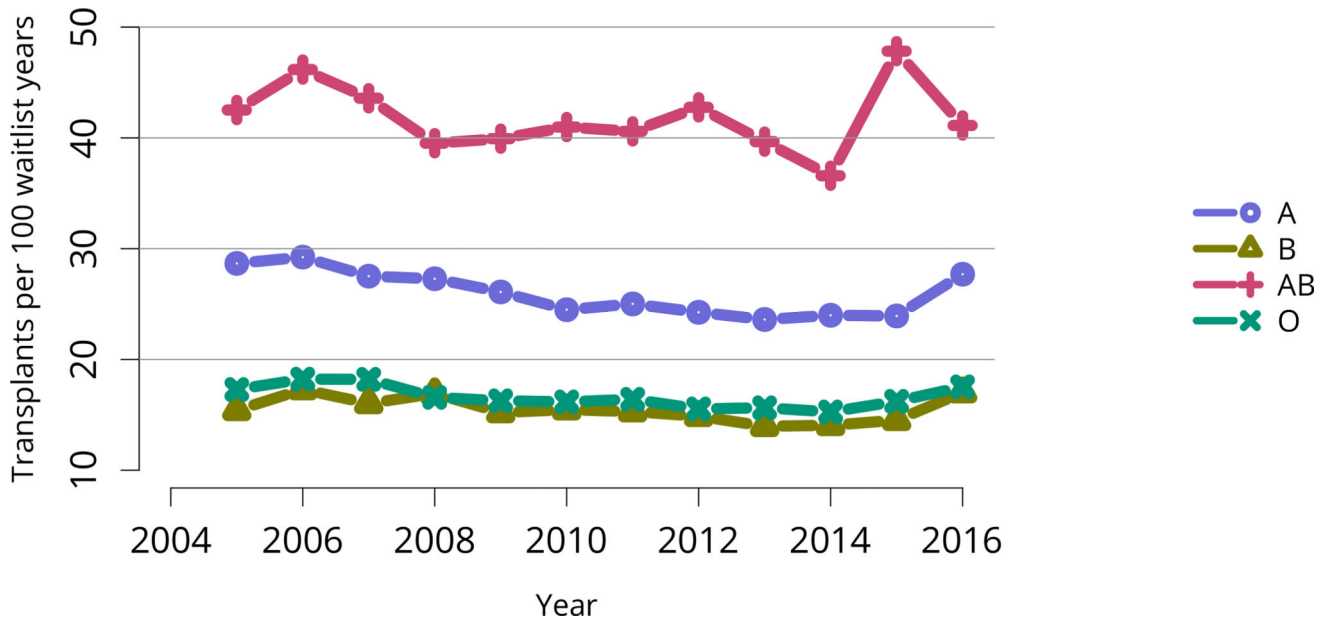


Figure KI 14. Deceased donor kidney transplant rates among active adult waitlist candidates by blood type

Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of active wait time in a given year. Individual listings are counted separately. Rates with less than 10 patient-years of exposure are not shown.

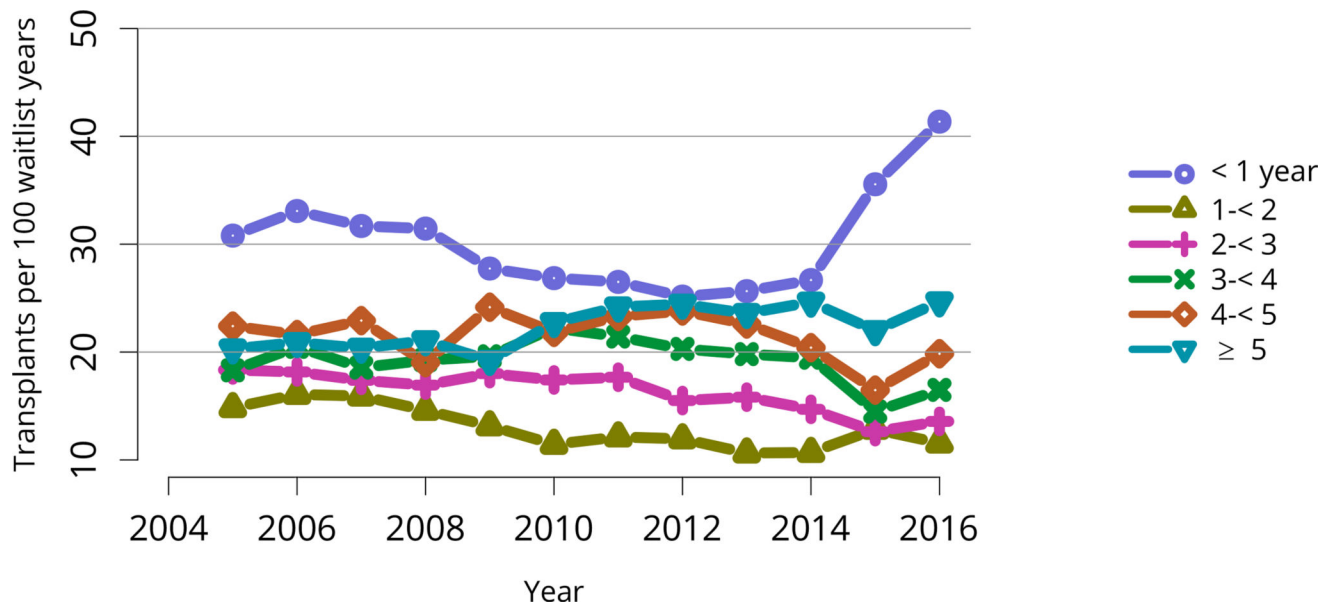


Figure KI 15. Deceased donor kidney transplant rates among active adult waitlist candidates by time on the waitlist

Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of active wait time in a given year. Individual listings are counted separately. Rates with less than 10 patient-years of exposure are not shown.

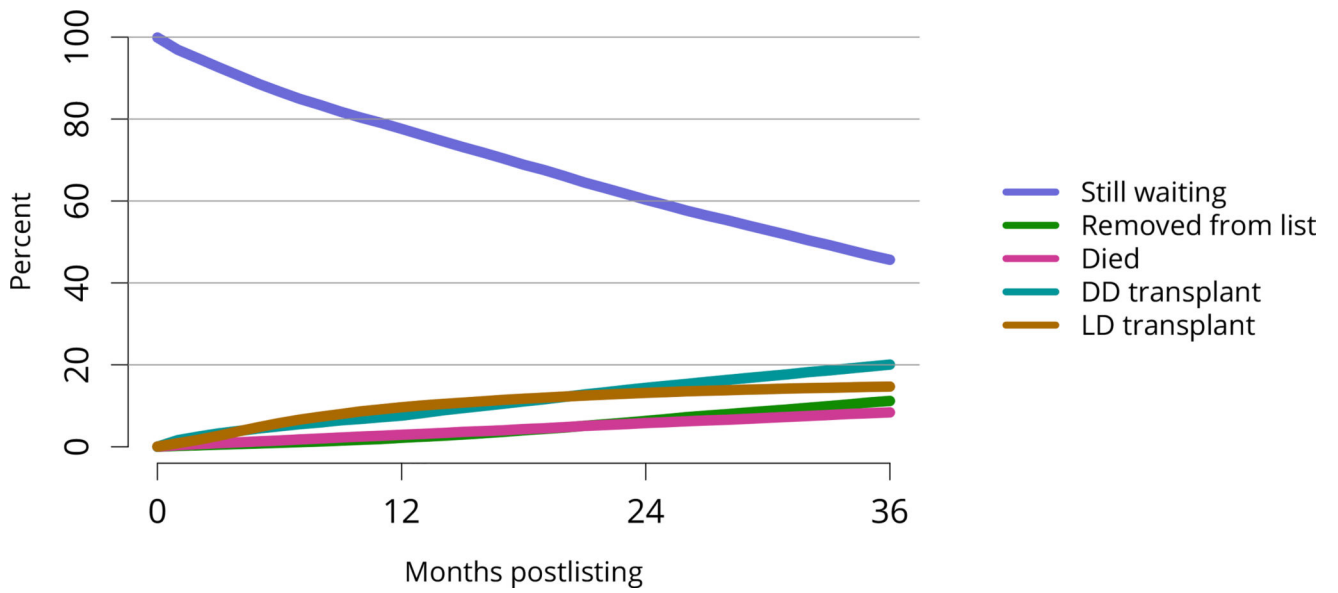


Figure KI 16. Three-year outcomes for adults waiting for kidney transplant, new listings in 2013
 Adults waiting for any kidney transplant and first listed in 2013. Candidates concurrently listed at more than one center are counted once, from the time of earliest listing to the time of latest removal. Removed from list includes all reasons except transplant and death. DD, deceased donor; LD, living donor.

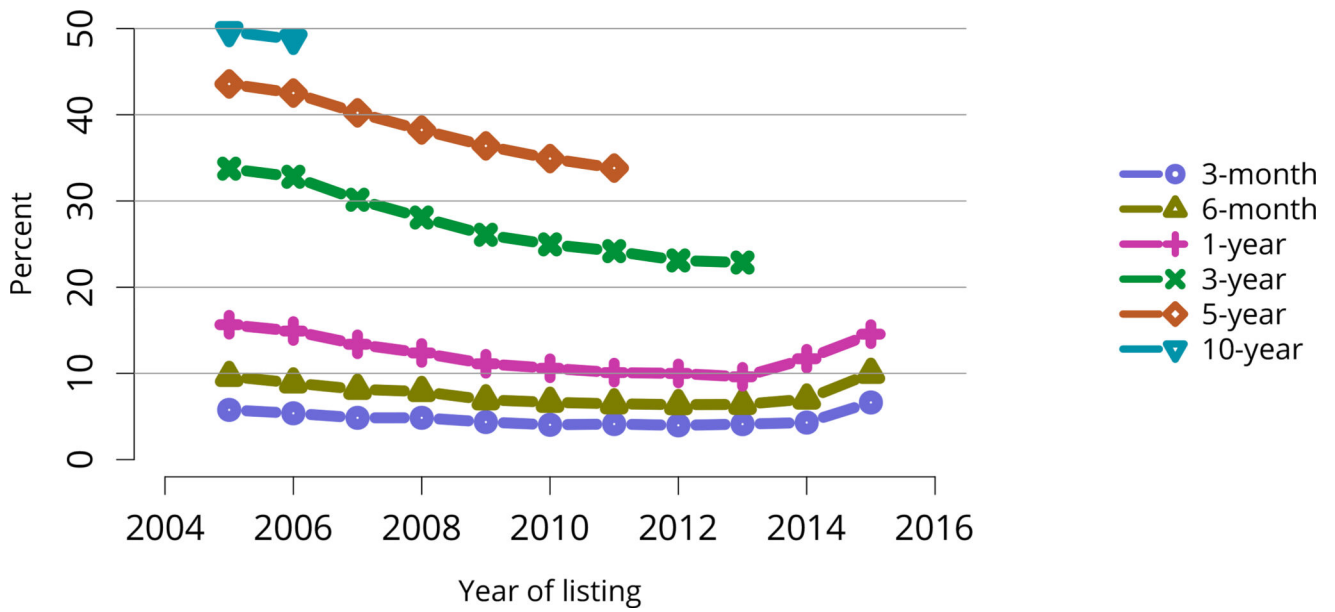


Figure KI 17. Percentage of adults who underwent deceased donor kidney transplant within a given time period of listing

Candidates concurrently listed at more than one center are counted once, from the time of earliest listing to the time of latest removal.

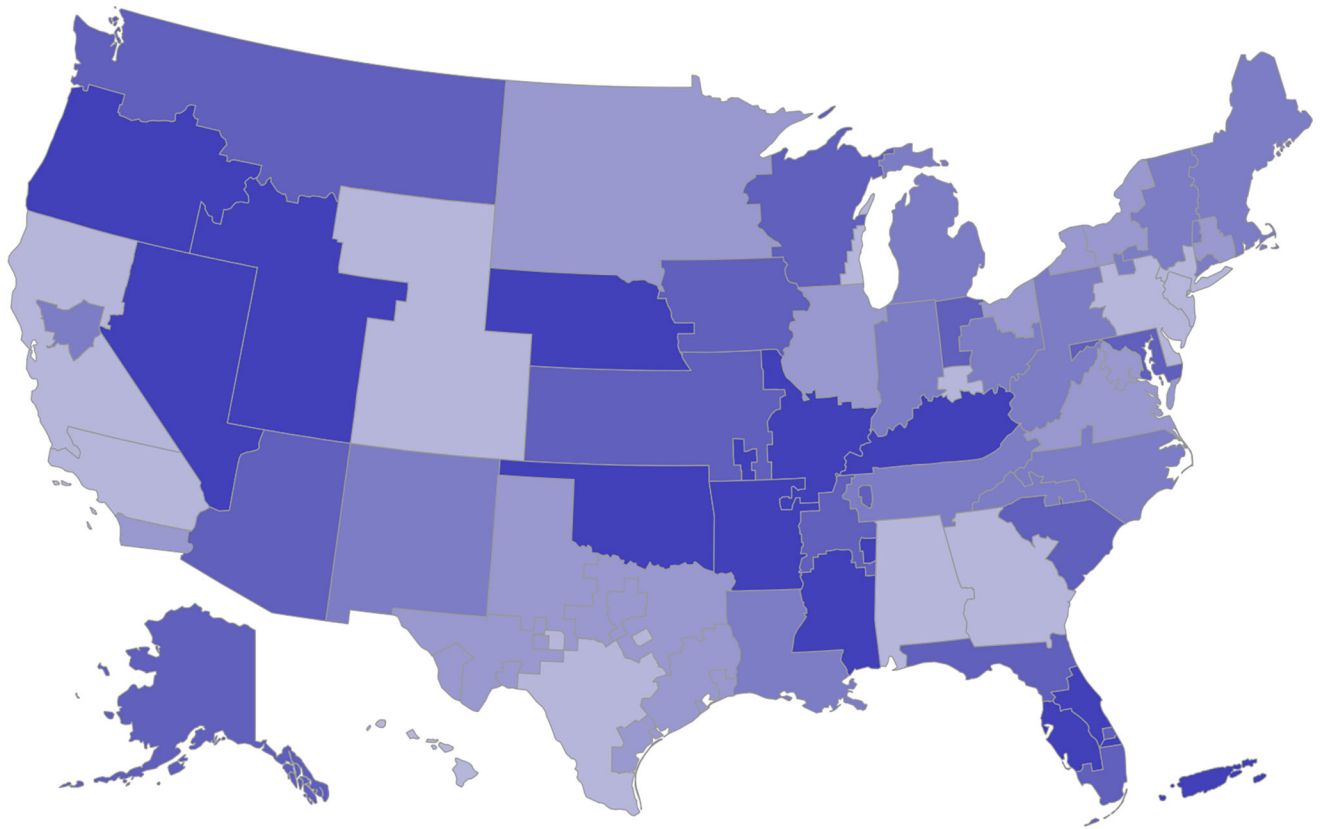


Figure KI 18. Percentage of adults who underwent deceased donor kidney transplant within 5 years of listing in 2011 by DSA
 Candidates listed concurrently in a single DSA are counted once in that DSA, from the time of earliest listing to the time of latest removal; candidates listed in multiple DSAs are counted separately per DSA.

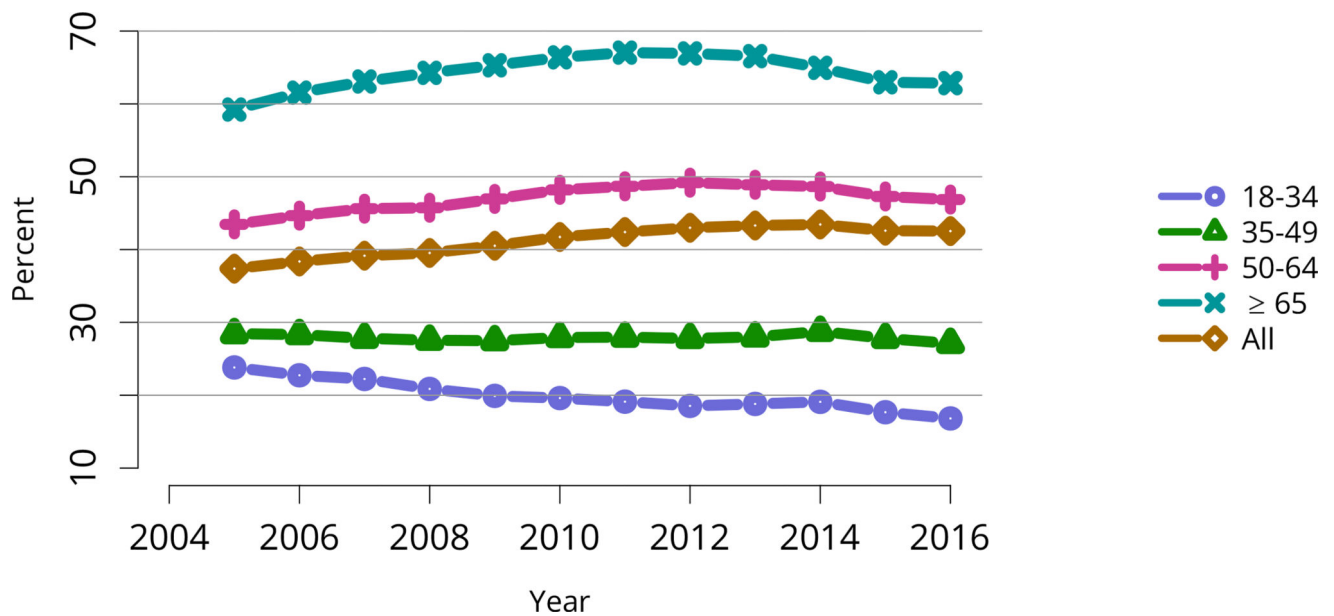


Figure KI 19. Adults willing to accept a kidney designated ECD or KDPI > 85% by age
 Adults waiting for kidney transplant on December 31 of the given year. Candidates concurrently listed at more than one center are counted once, from the time of earliest listing to the time of latest removal. Willingness to accept ECD at time of listing or willingness to accept a local non-zero HLA mismatch KDPI >85% kidney for at least one day during the year, beginning in 2014. ECD, expanded criteria donor.

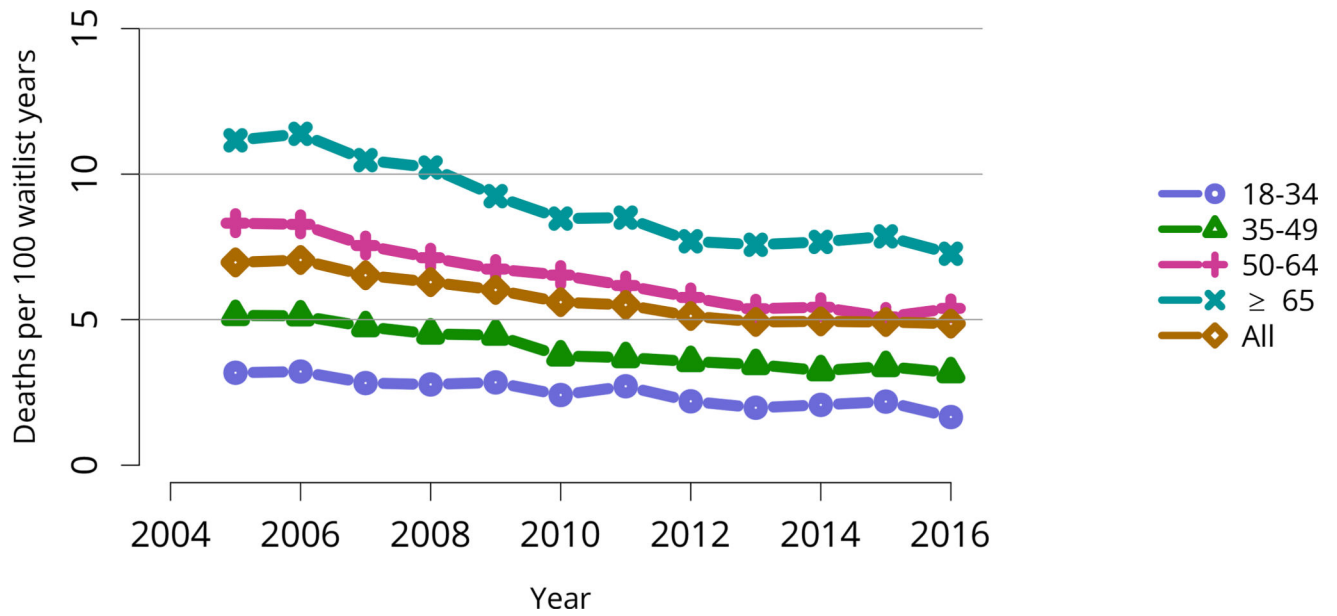


Figure KI 20. Pretransplant mortality rates among adults waitlisted for kidney transplant by age Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Individual listings are counted separately. Rates with less than 10 patient-years of exposure are not shown. Age is determined at the later of listing date or January 1 of the given year.

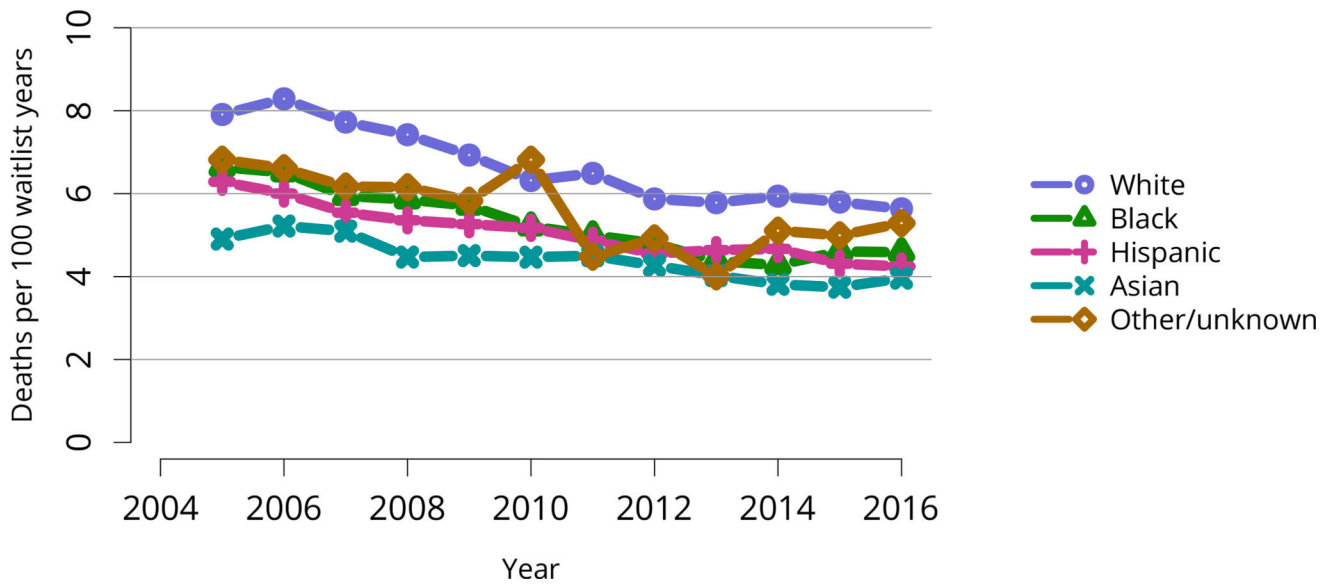


Figure KI 21. Pretransplant mortality rates among adults waitlisted for kidney transplant by race

Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Individual listings are counted separately. Rates with less than 10 patient-years of exposure are not shown.

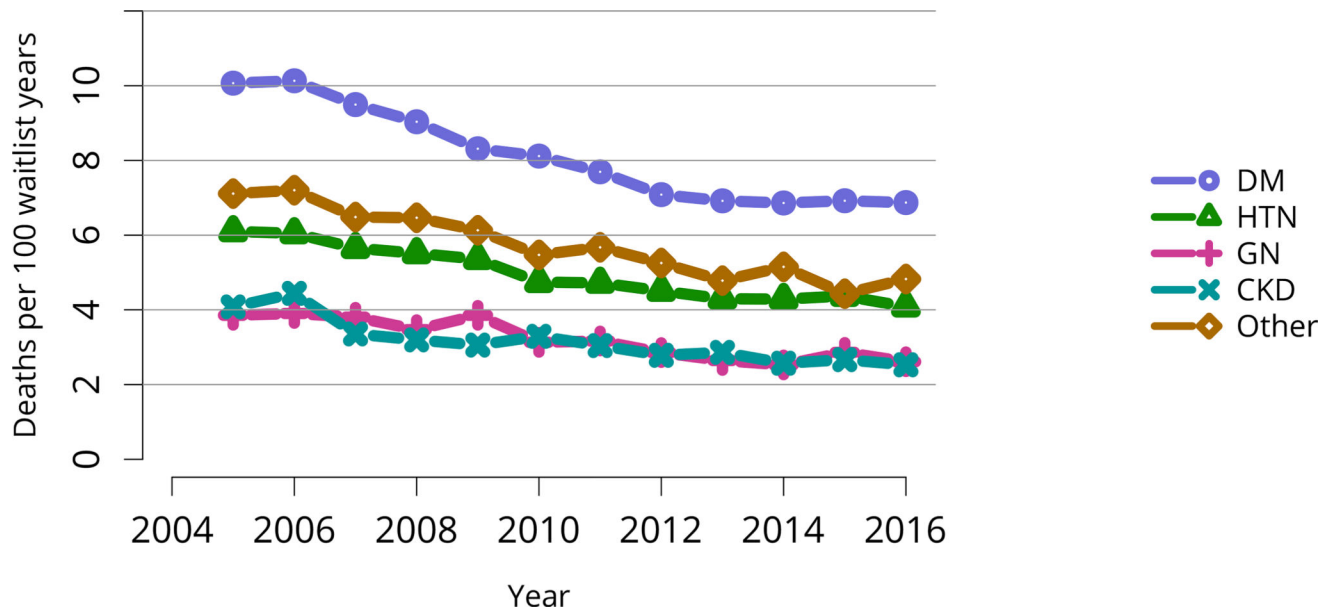


Figure KI 22. Pretransplant mortality rates among adults waitlisted for kidney transplant by diagnosis

Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Individual listings are counted separately. Rates with less than 10 patient-years of exposure are not shown. CKD, cystic kidney disease; DM, diabetes. HTN, hypertension. GN, glomerulonephritis.

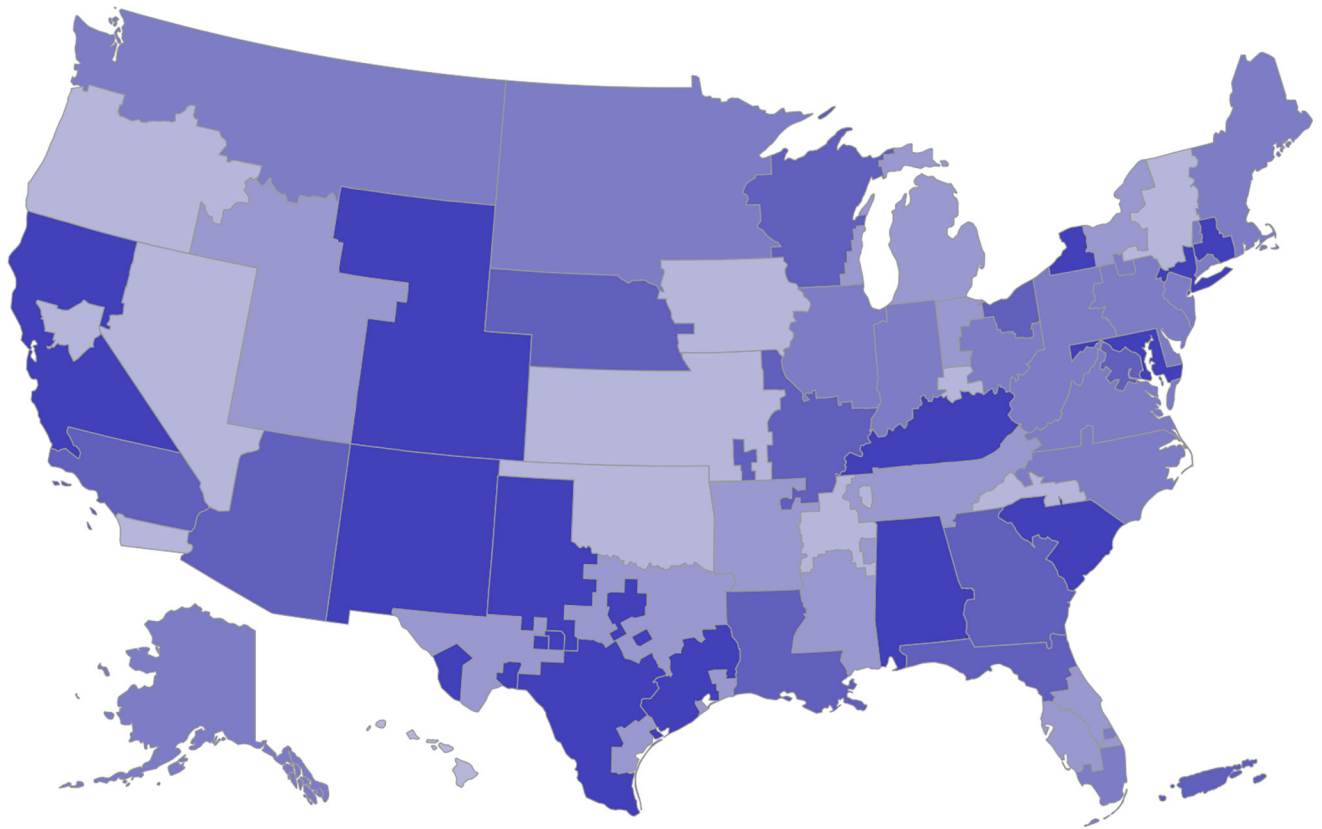


Figure KI 23. Pretransplant mortality rates among adults waitlisted for kidney transplant in 2016, by DSA

Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Patients censored at waitlist removal. Individual listings are counted separately. Rates with less than 10 patient-years of exposure are not shown.

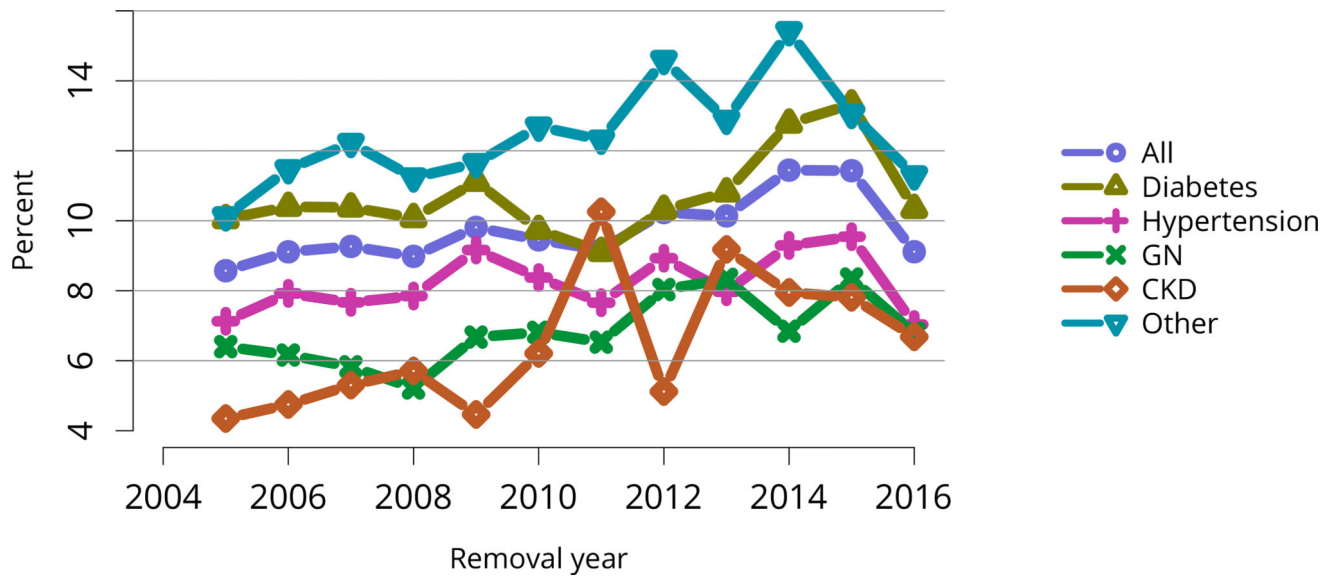


Figure KI 24. Deaths within six months after removal among adult kidney waitlist candidates
Denominator includes only candidates removed from the waiting list for reasons other than transplant or death while on the list.

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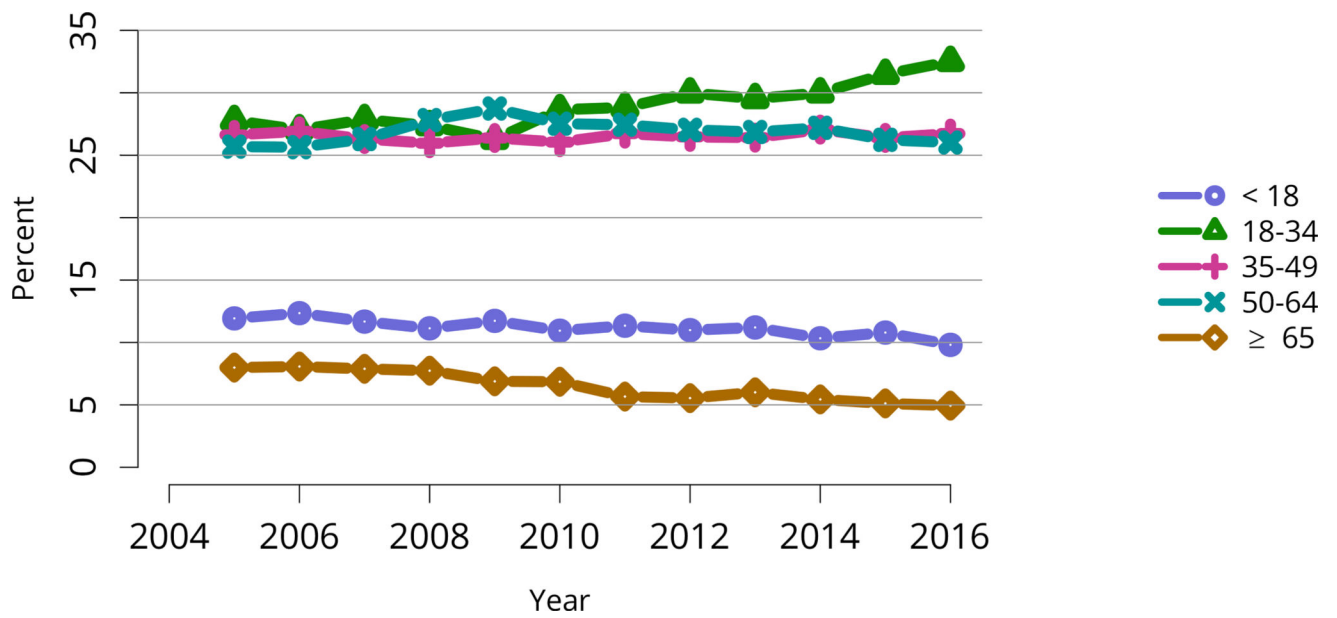


Figure KI 25. Deceased kidney donors by age
 Deceased donors with at least one kidney recovered for transplant. Donors whose kidneys were recovered en-bloc are counted once, and donors whose kidneys were recovered separately are counted twice.

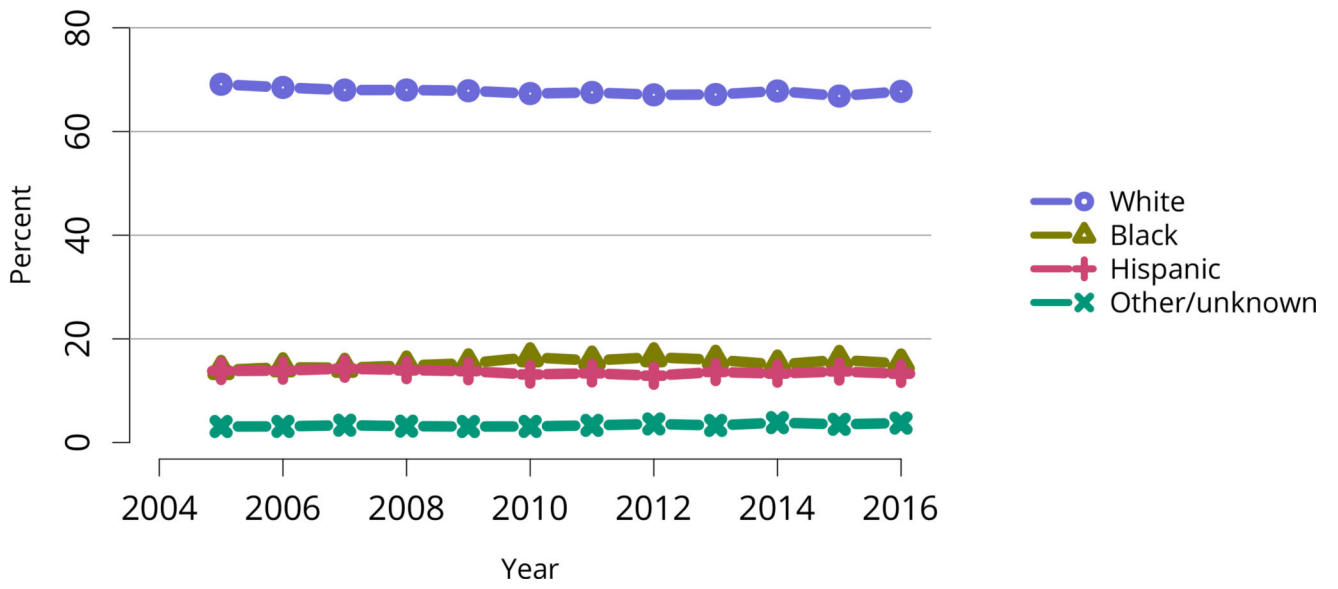


Figure KI 26. Deceased kidney donors by race

Deceased donors with at least one kidney recovered for transplant. Donors whose kidneys were recovered en-bloc are counted once, and donors whose kidneys were recovered separately are counted twice.

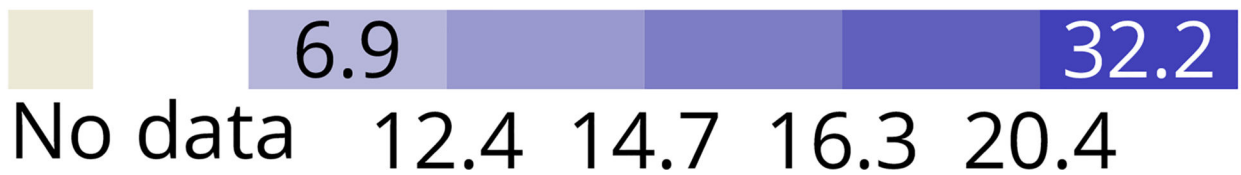
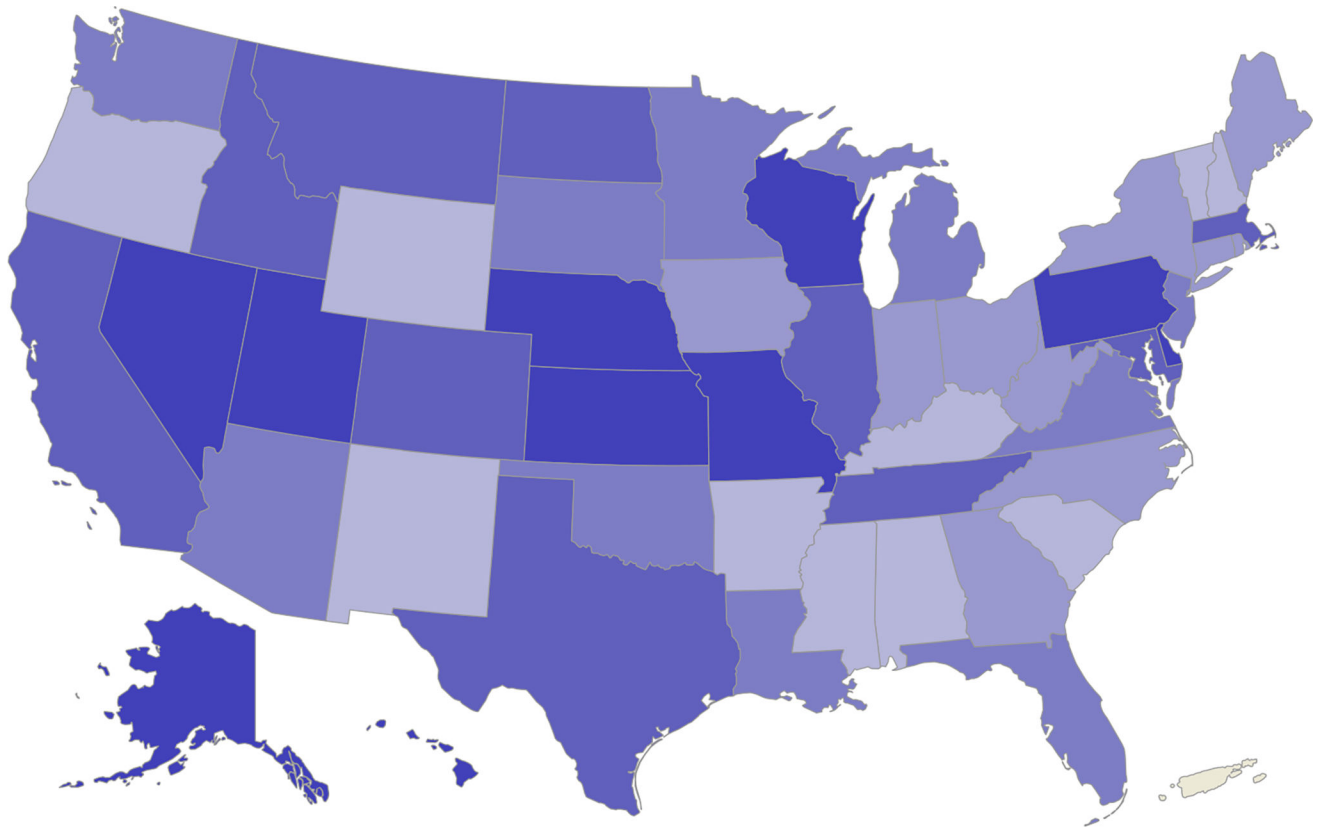


Figure KI 27. Deceased donor kidney donation rates (per 1000 deaths) by state, 2013–2015
 Numerator: Deceased donors aged < 70 years, by state of death, whose kidneys were recovered for transplant from 2013 through 2015. Denominator: US deaths aged < 70 years, by state of death, from 2013 through 2015. State death data by age obtained through agreement with NAPHSIS (<https://www.naphsis.org/research-requests>). Donors whose kidneys were recovered en-bloc are counted once, and donors whose kidneys were recovered separately are counted twice.

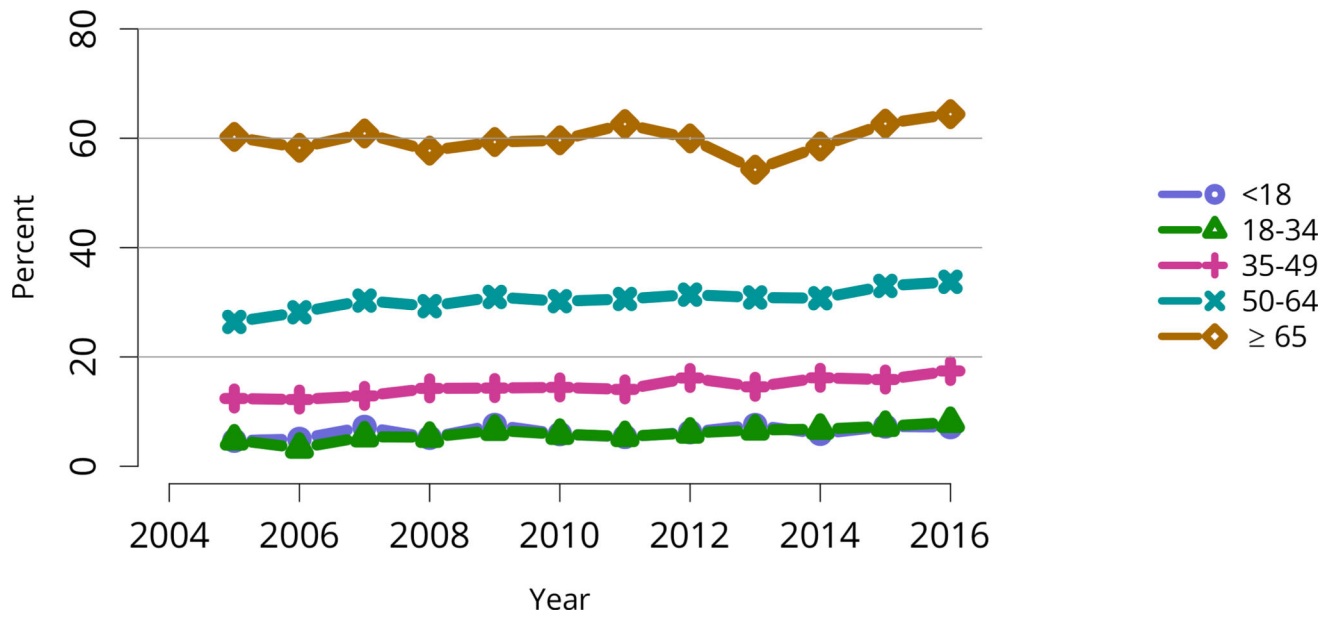


Figure KI 28. Rates of kidneys recovered for transplant and not transplanted by age
 Percentages of kidneys not transplanted out of all kidneys recovered for transplant. Kidneys recovered en-bloc are counted once, and kidneys recovered separately are counted twice.

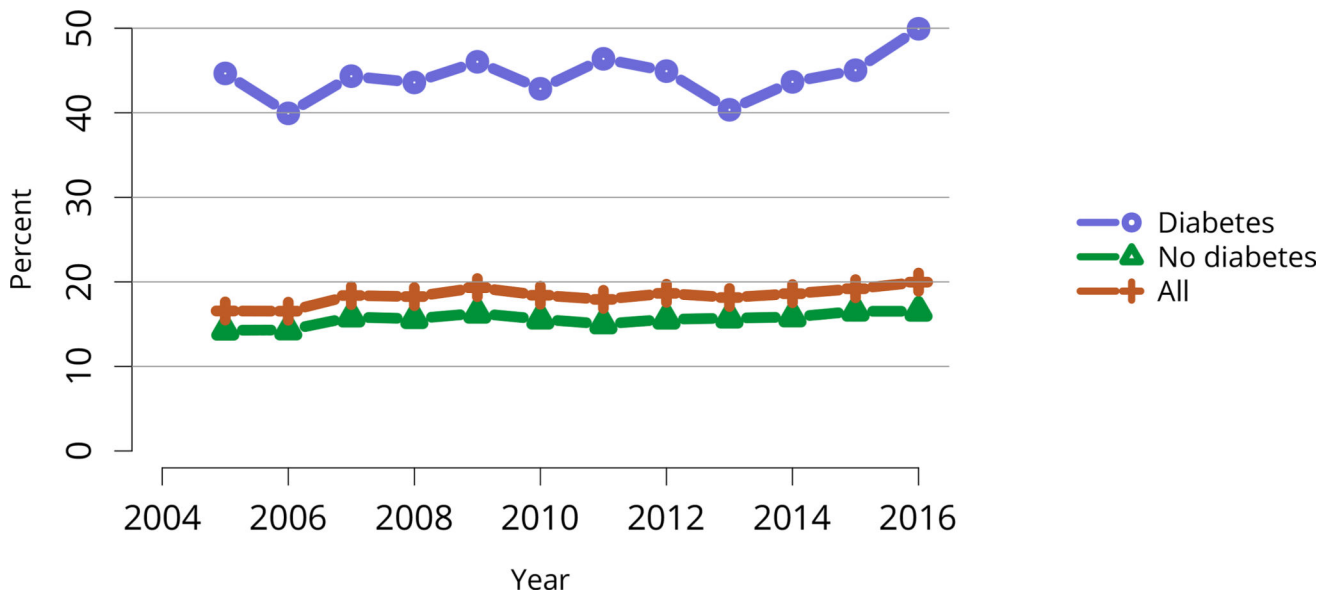


Figure KI 29. Rates of kidneys recovered for transplant and not transplanted by diabetes status
 Percentages of kidneys not transplanted out of all kidneys recovered for transplant. Kidneys recovered en-bloc are counted once, and kidneys recovered separately are counted twice.

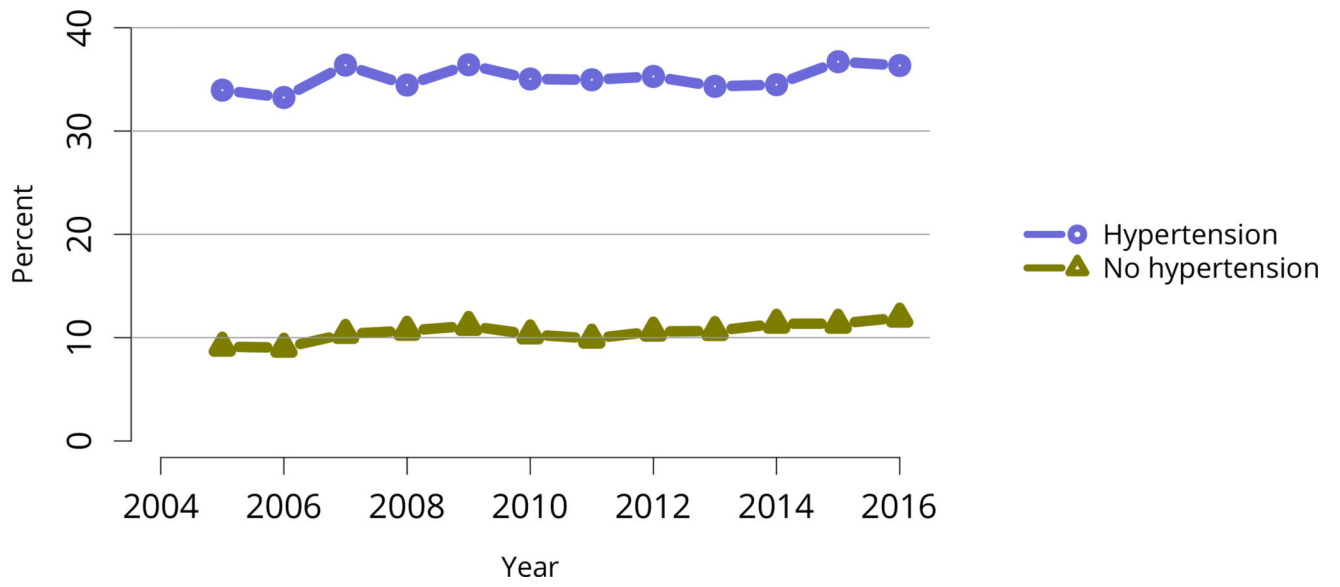


Figure KI 30. Rates of kidneys recovered for transplant and not transplanted by hypertension status

Percentages of kidneys not transplanted out of all kidneys recovered for transplant. Kidneys recovered en-bloc are counted once, and kidneys recovered separately are counted twice.

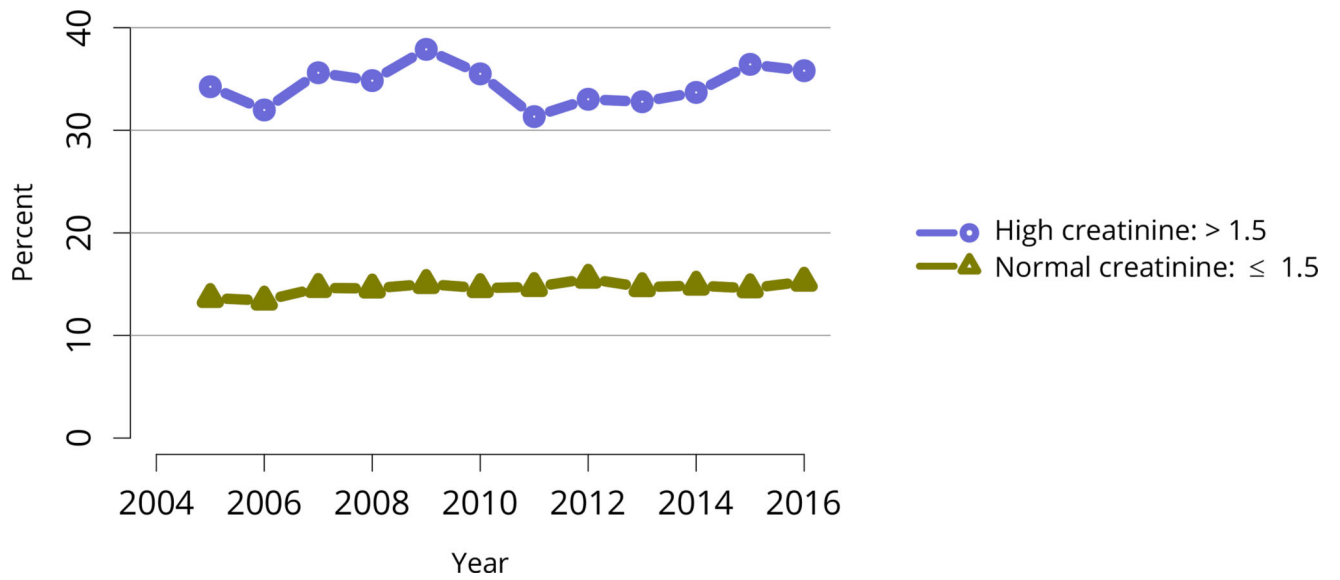


Figure KI 31. Rates of kidneys recovered for transplant and not transplanted by terminal creatinine
Percentages of kidneys not transplanted out of all kidneys recovered for transplant. Kidneys recovered en-bloc are counted once, and kidneys recovered separately are counted twice.

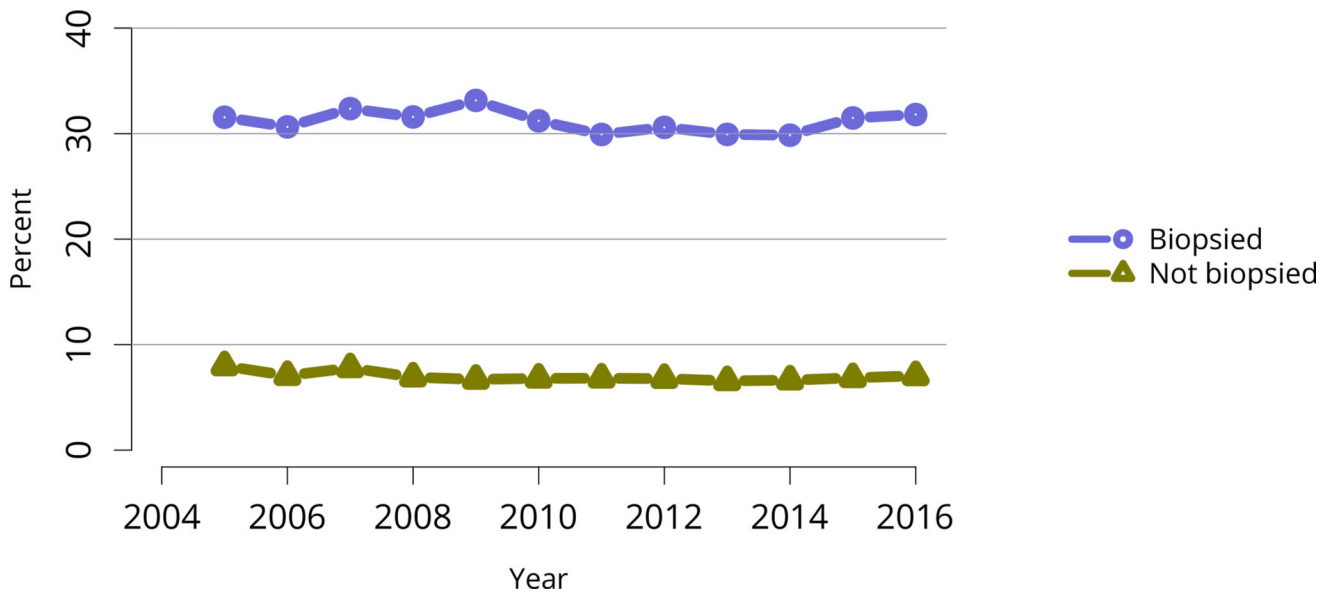


Figure KI 32. Rates of kidneys recovered for transplant and not transplanted by biopsy status
 Percentages of kidneys not transplanted out of all kidneys recovered for transplant. Kidneys recovered en-bloc are counted once, and kidneys recovered separately are counted twice.

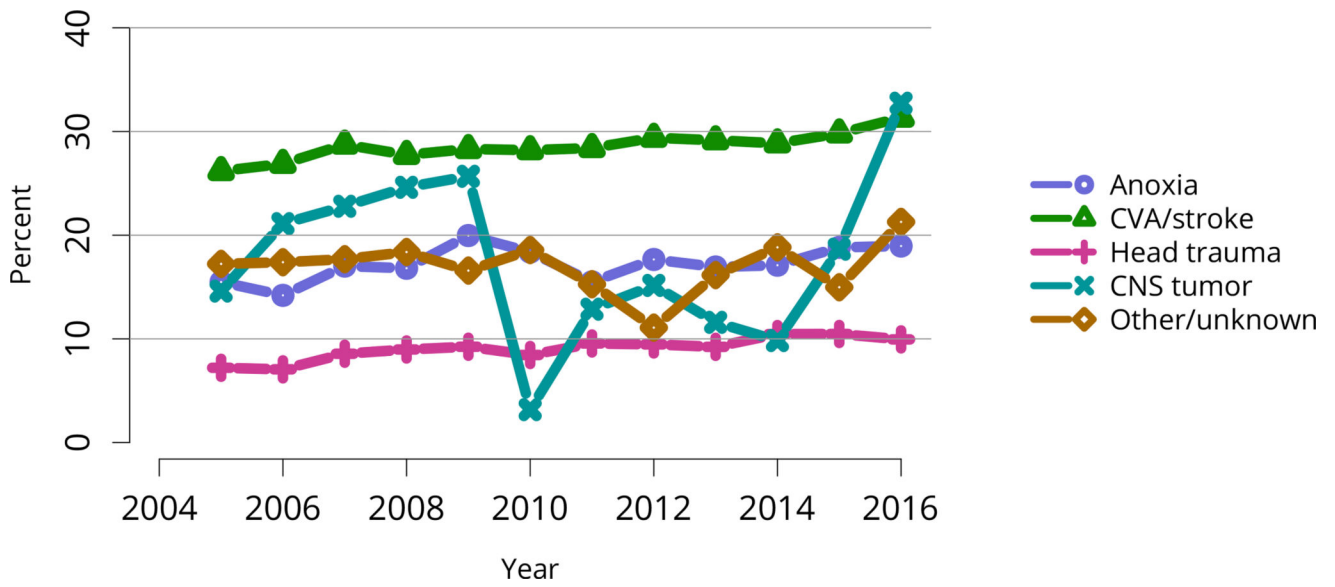


Figure KI 33. Rates of kidneys recovered for transplant and not transplanted by cause of death
 Percentages of kidneys not transplanted out of all kidneys recovered for transplant. Kidneys recovered en-bloc are counted once, and kidneys recovered separately are counted twice. CNS, central nervous system; CVA, cerebrovascular accident.

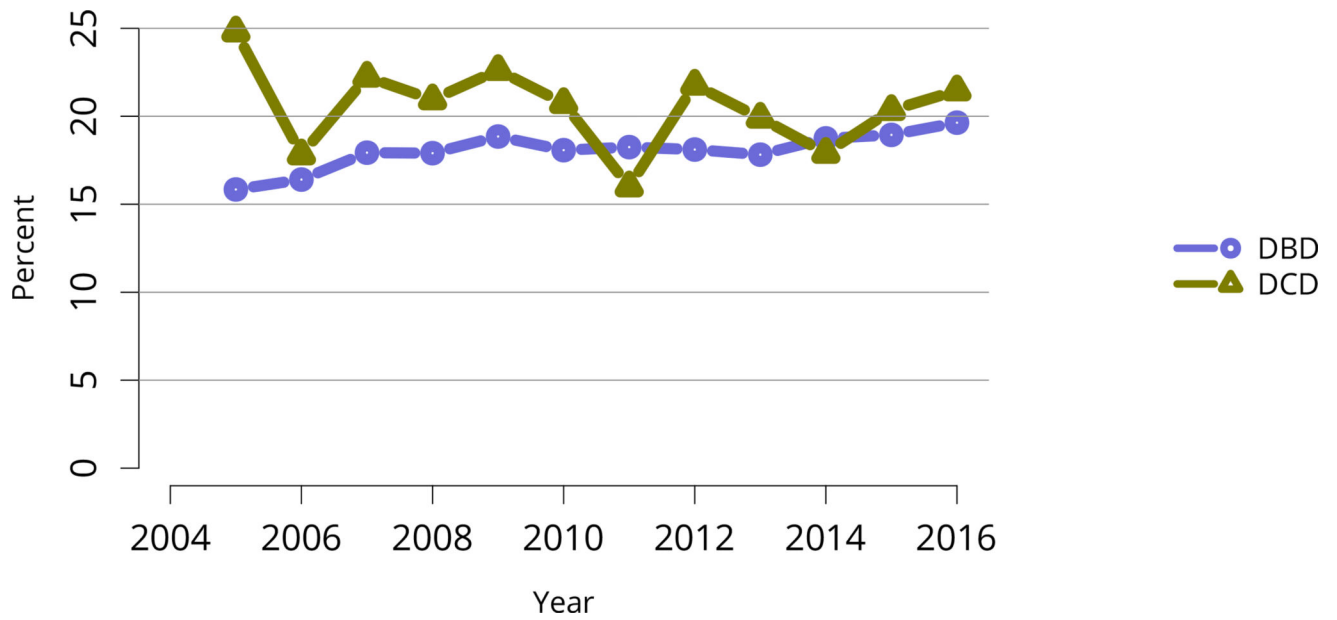


Figure KI 34. Rates of kidneys recovered for transplant and not transplanted by DCD status
Percentages of kidneys not transplanted out of all kidneys recovered for transplant. Kidneys recovered en-bloc are counted once, and kidneys recovered separately are counted twice. DBD, donation after brain death; DCD, donation after circulatory death.

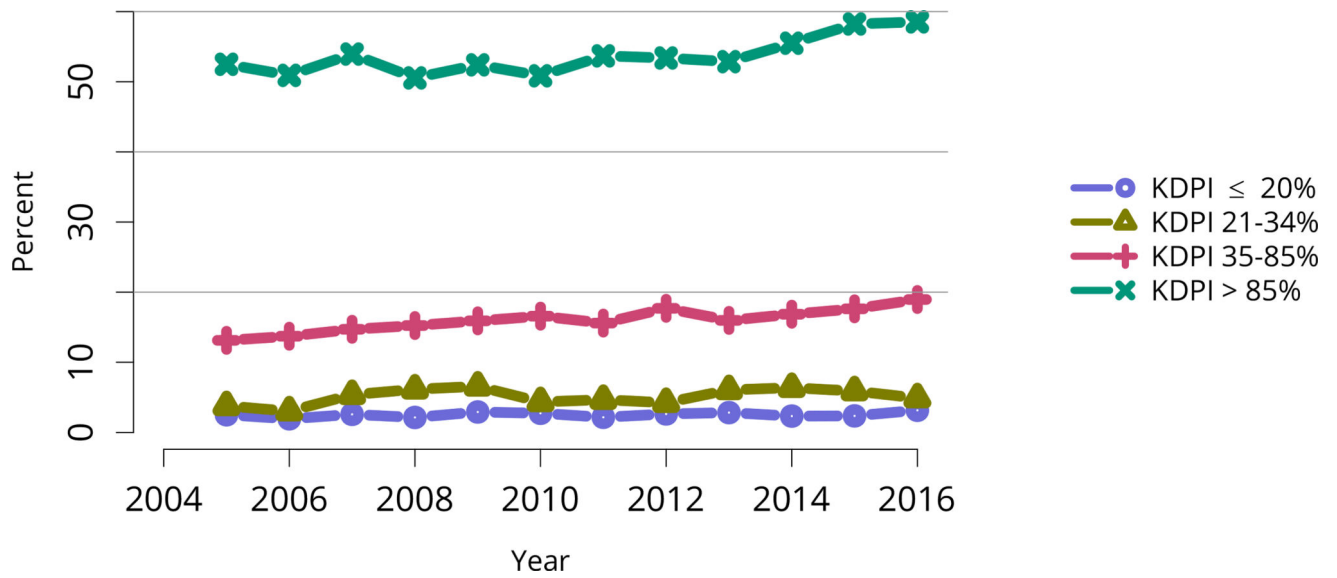


Figure KI 35. Rates of kidneys recovered for transplant and not transplanted by KDPI
Percentages of kidneys not transplanted out of all kidneys recovered for transplant, by KDPI classification. The reference population for the KDRI to KDPI conversion is all deceased donor kidneys recovered for transplant in the US in 2016. Kidneys recovered en-bloc are counted once. KDPI, kidney donor profile index; KDRI, kidney donor risk index.

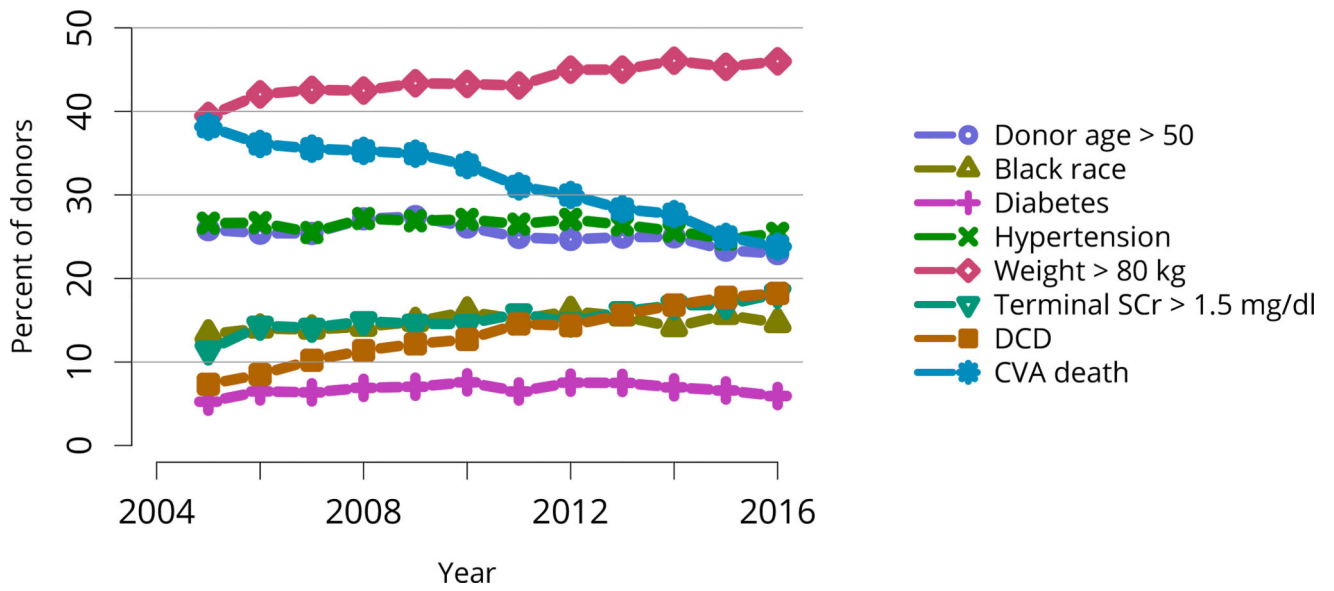


Figure KI 36. Donor-specific components of the kidney donor risk index
 Donors with at least one transplanted kidney. The donor-specific components of the kidney donor risk index are shown, except for donor height and hepatitis C virus status. CVA, cerebrovascular accident; DCD, donation after circulatory death; SCr, serum creatinine.

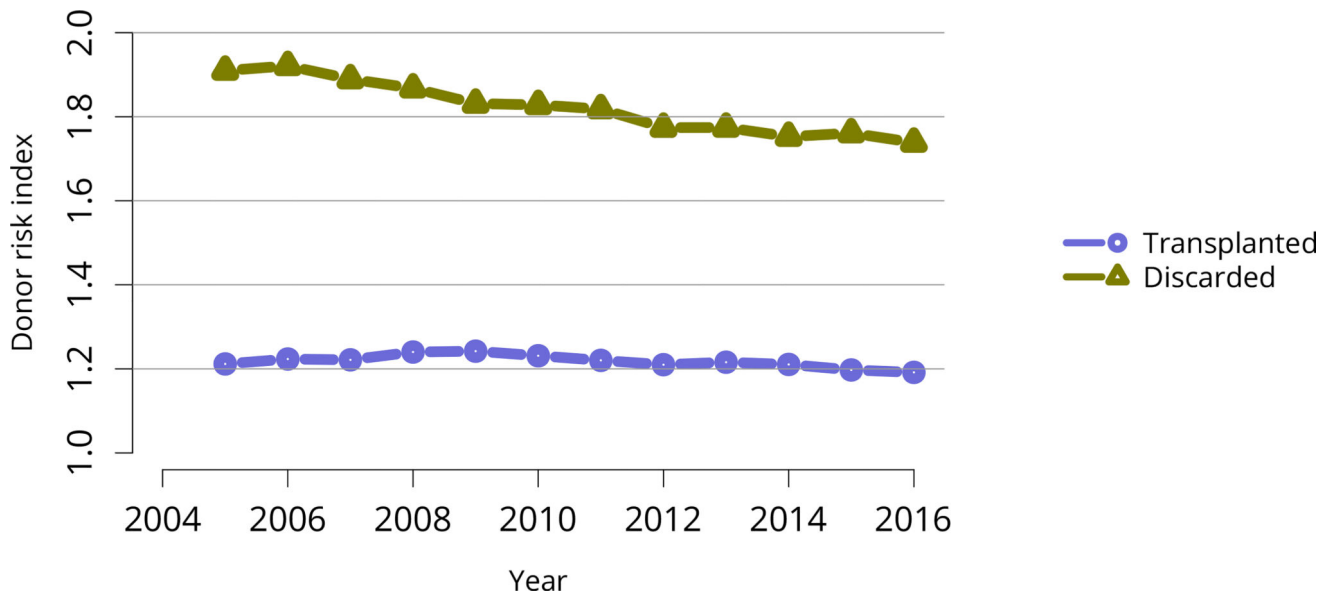


Figure KI 37. Average kidney donor risk index
Kidneys recovered for transplant. Kidney donor risk index is computed using only donor-specific components.

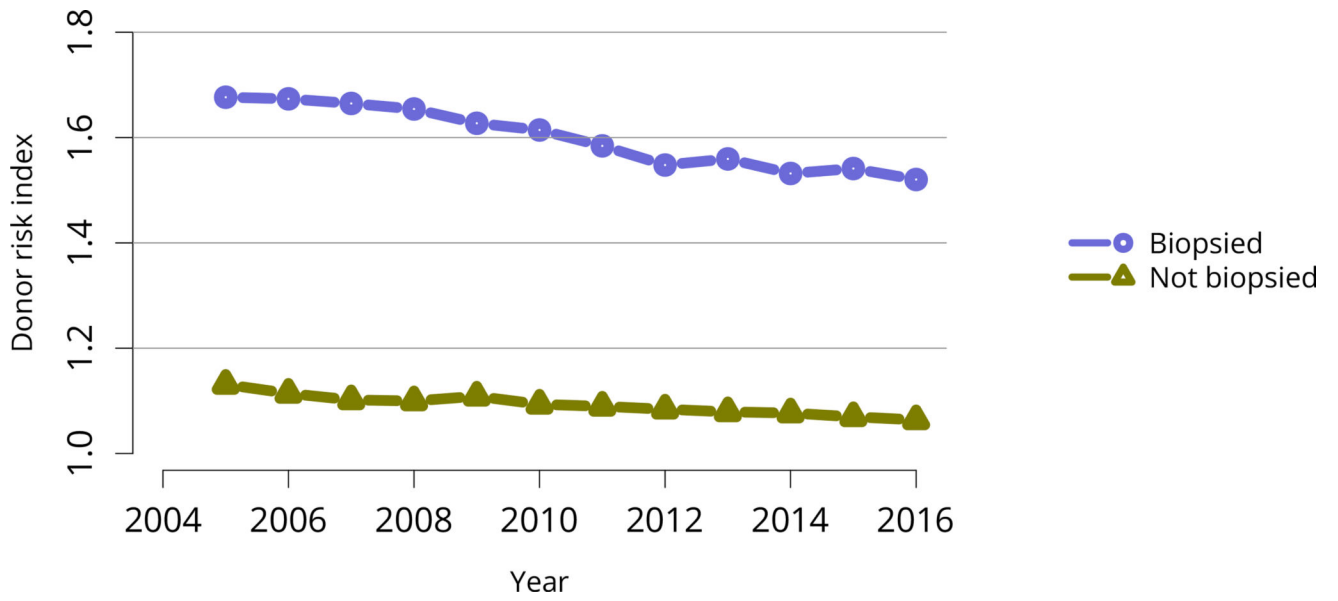


Figure KI 38. Average kidney donor risk index by biopsy status
Kidneys recovered for transplant. Kidney donor risk index is computed using only donorspecific components, and is not converted to KDPI.

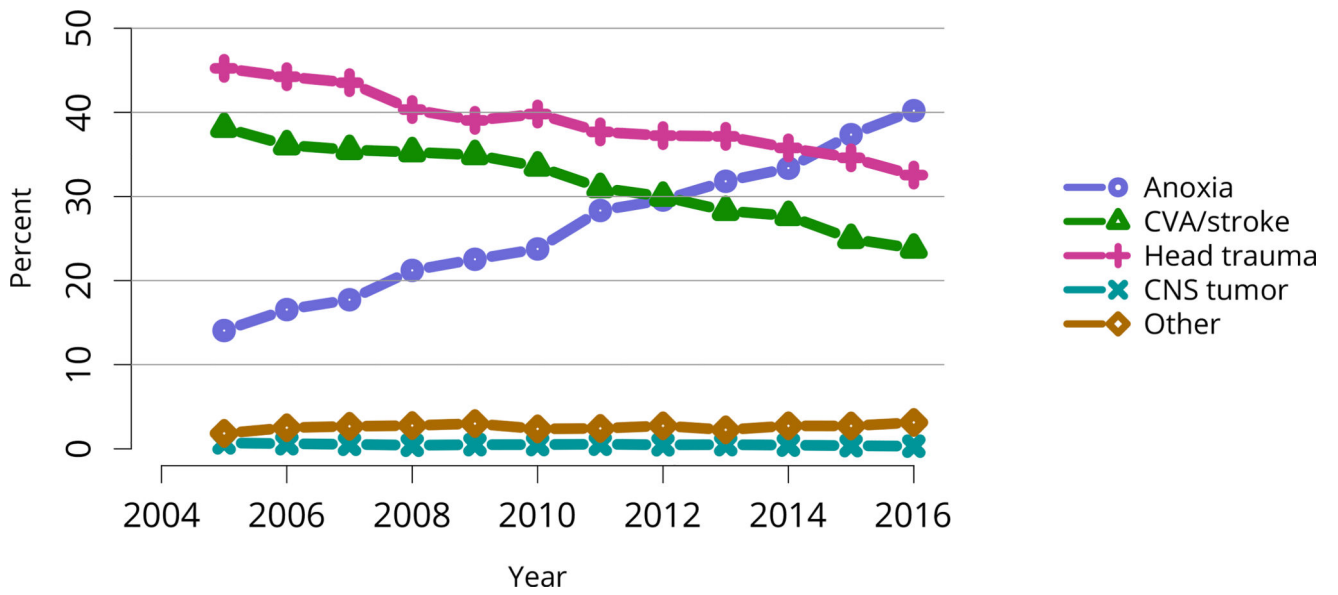


Figure KI 39. Cause of death among deceased kidney donors
Deceased donors whose kidneys were transplanted. Each donor is counted once. CNS, central nervous system; CVA, cerebrovascular accident.

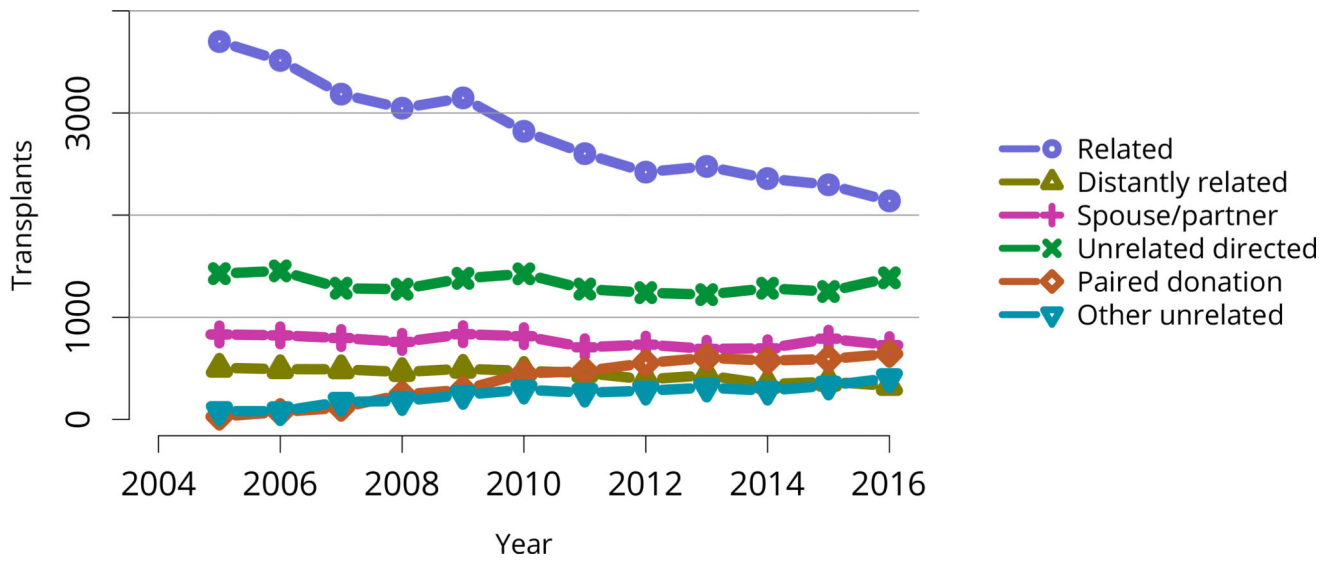


Figure KI 40. Kidney transplants from living donors by donor relation
As reported on the OPTN Living Donor Registration Form.

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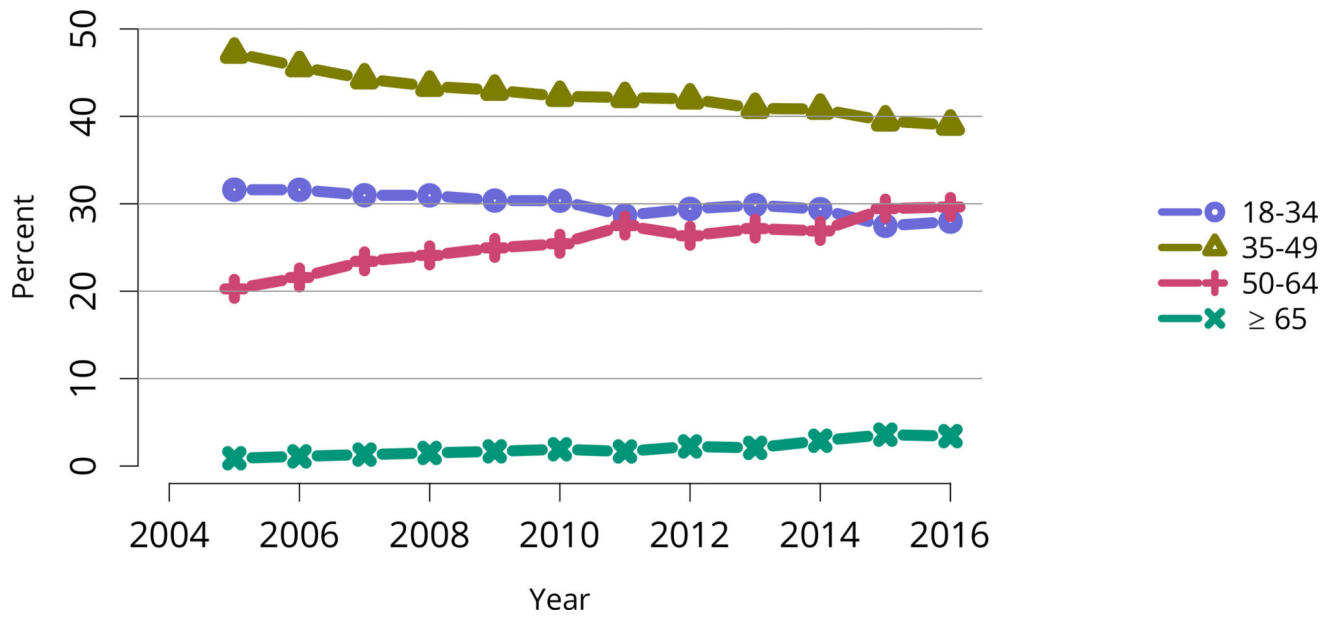


Figure KI 41. Living kidney donors by age
As reported on the OPTN Living Donor Registration Form.

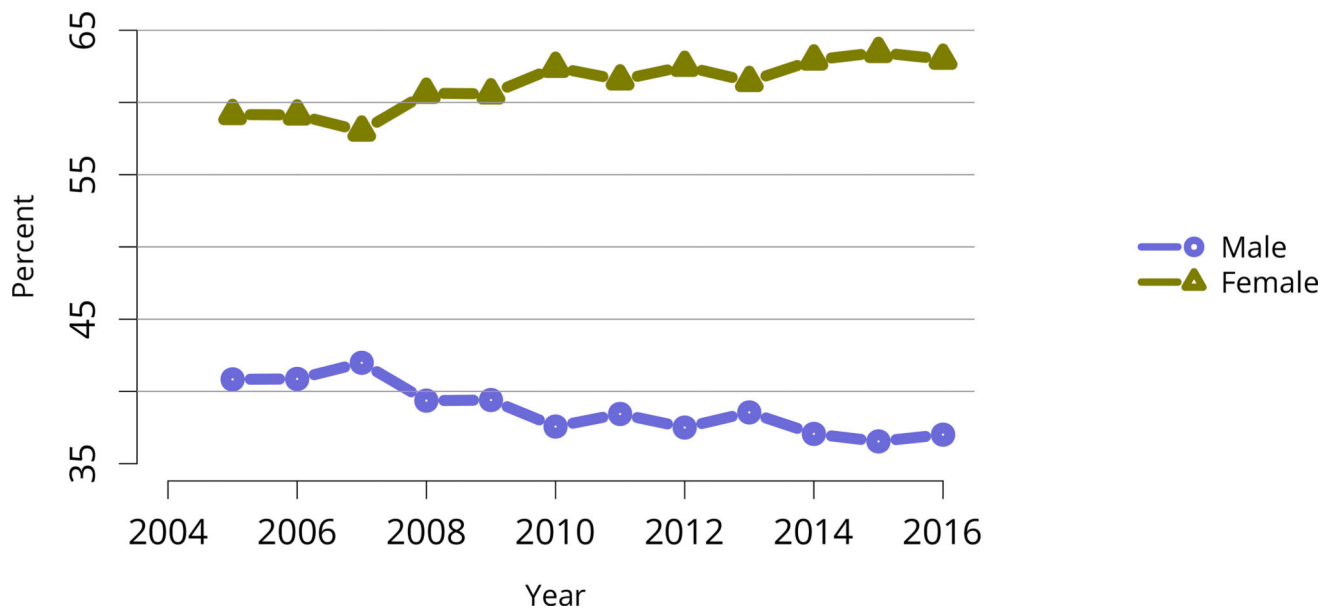


Figure KI 42. Living kidney donors by sex
As reported on the OPTN Living Donor Registration Form.

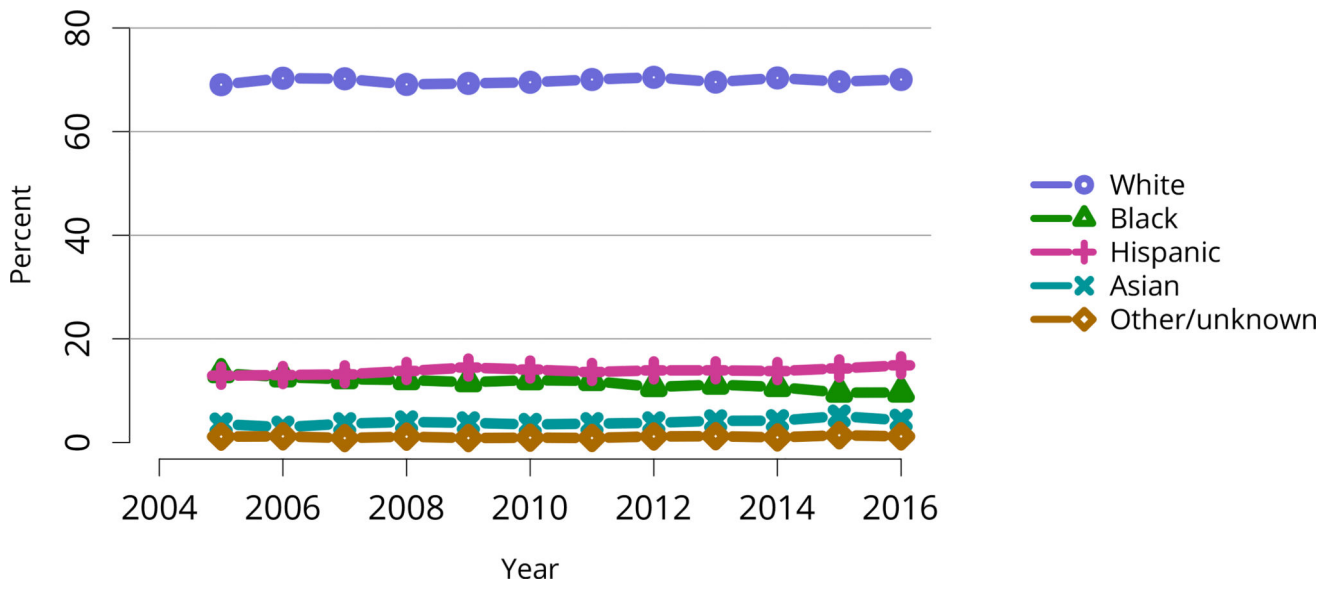


Figure KI 43. Living kidney donors by race
As reported on the OPTN Living Donor Registration Form.

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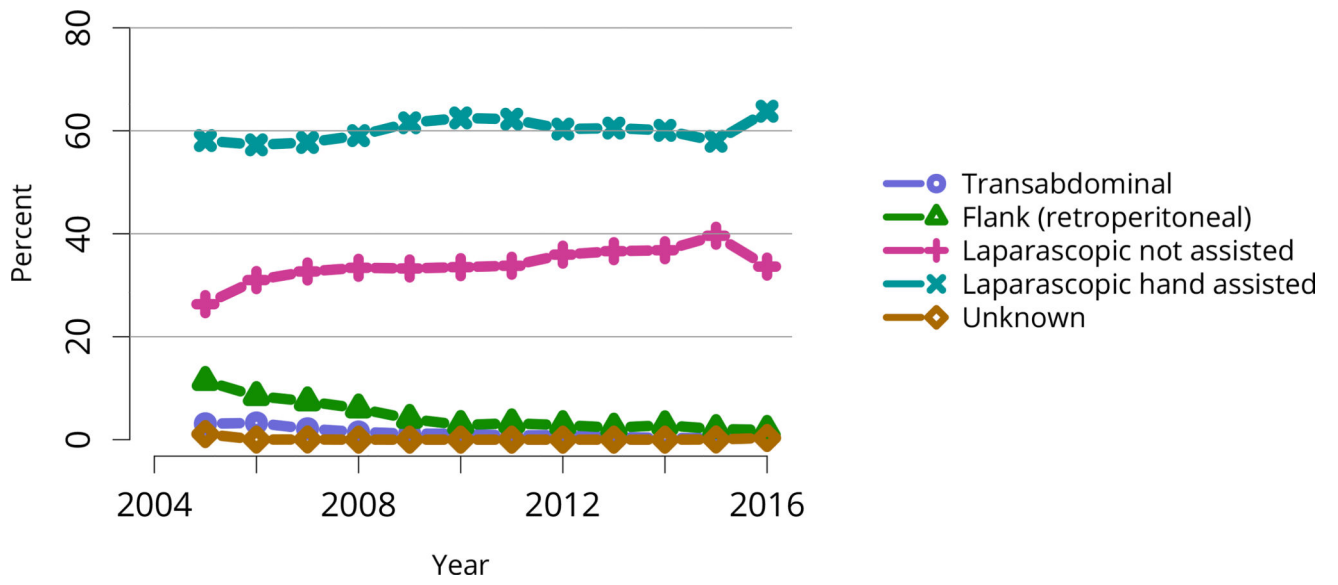


Figure KI 44. Intended living kidney donor procedure type
As reported on the OPTN Living Donor Registration Form.

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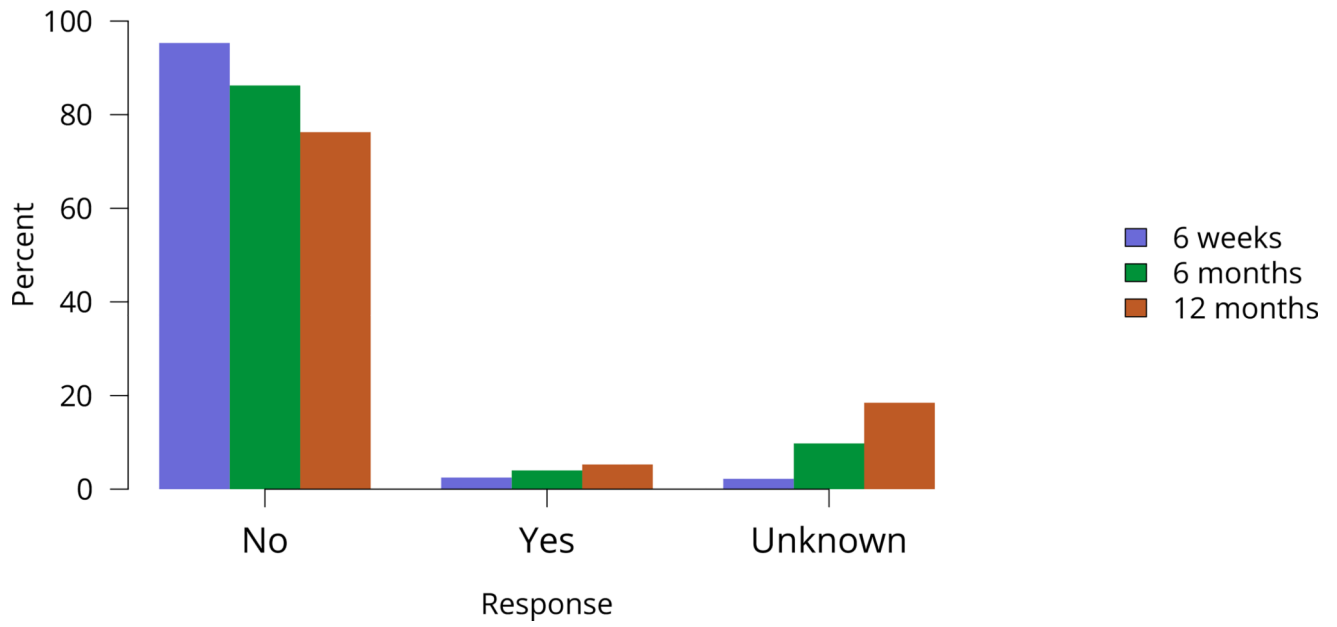


Figure KI 45. Rehospitalization in the first 6 weeks, 6 months, and 1 year among living kidney donors, 2011–2015
Cumulative hospital readmission. The 6-week time point is recorded at the earliest of discharge or 6 weeks after donation.

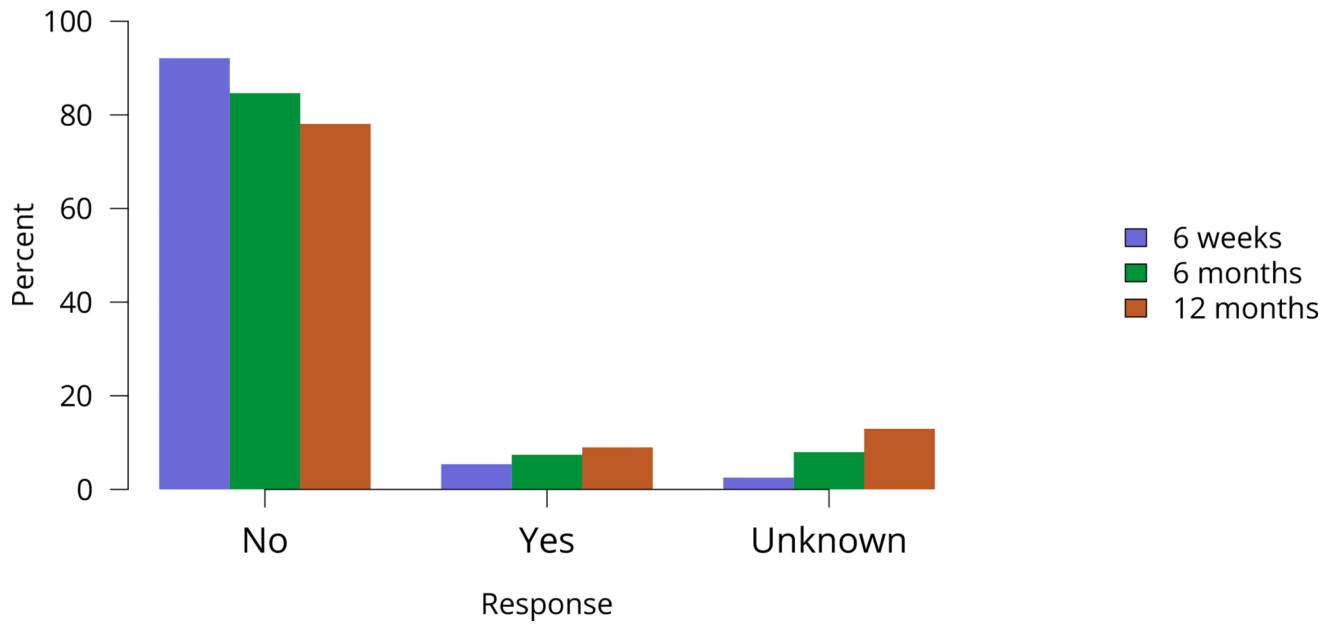


Figure KI 46. Kidney complications among living kidney donors, 2011–2015

Complications reported on the OPTN 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.

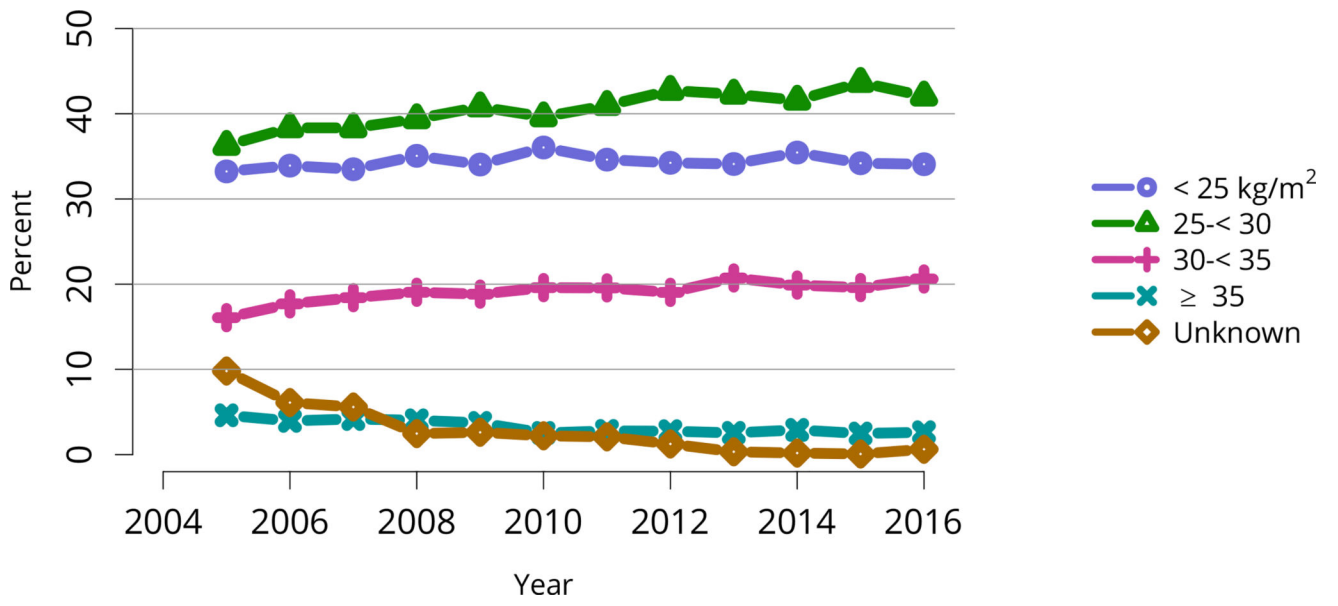


Figure KI 47. BMI among living kidney donors
Donor height and weight reported on the OPTN Living Donor Registration Form.

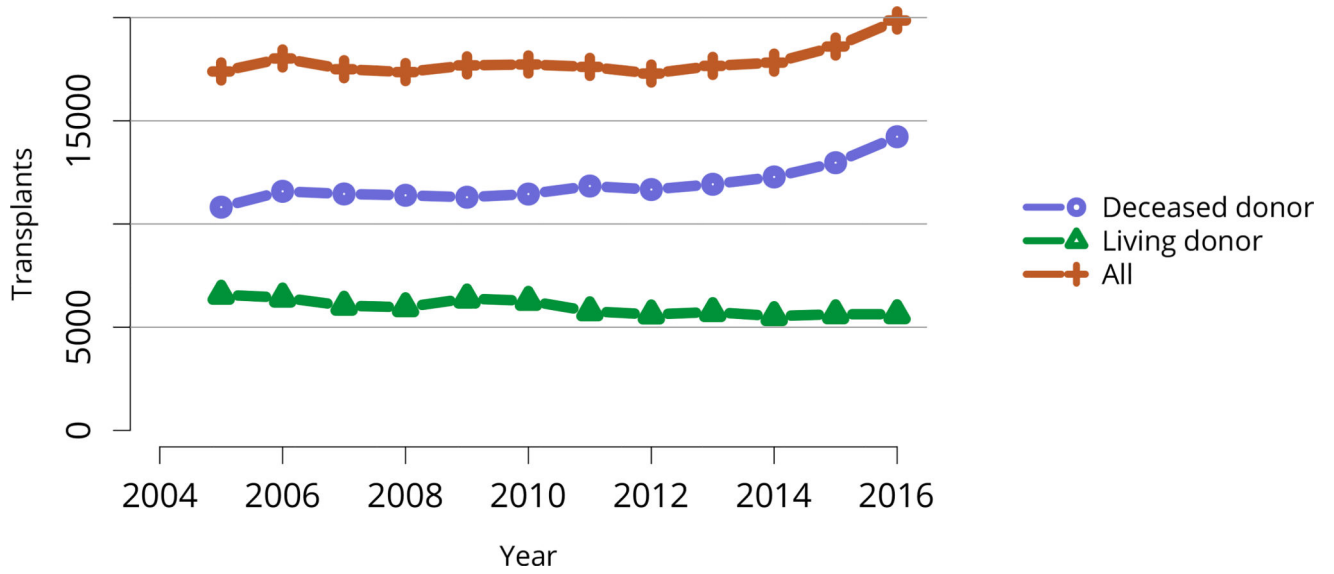


Figure KI 48. Total kidney transplants
All kidney transplant recipients, including adult and pediatric, retransplant, and multi-organ recipients.

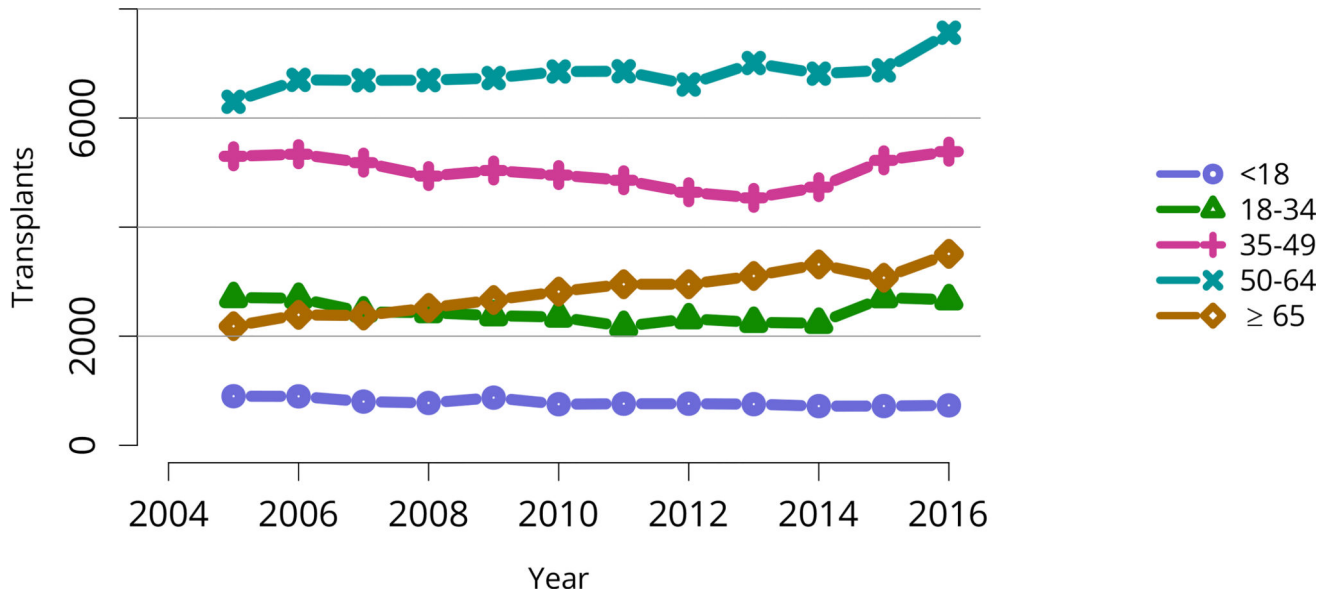


Figure KI 49. Total kidney transplants by age
 All kidney transplant recipients, including adult and pediatric, retransplant, and multi-organ recipients.

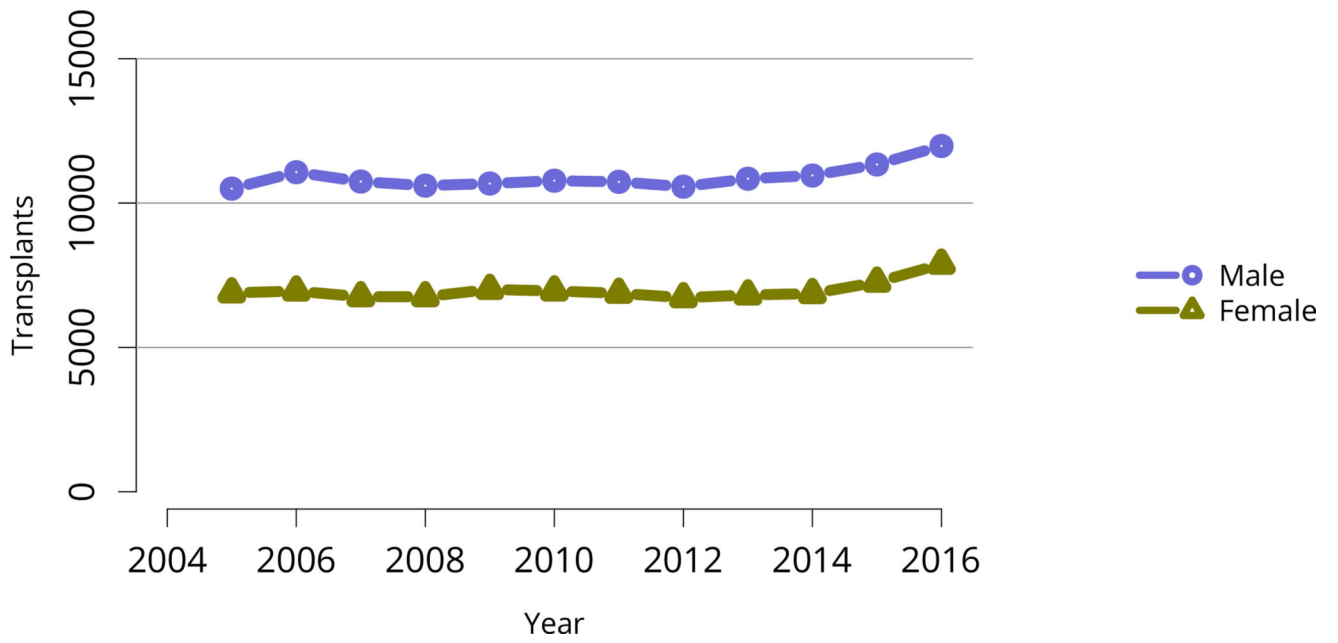


Figure KI 50. Total kidney transplants by sex
All kidney transplant recipients, including adult and pediatric, retransplant, and multi-organ recipients.

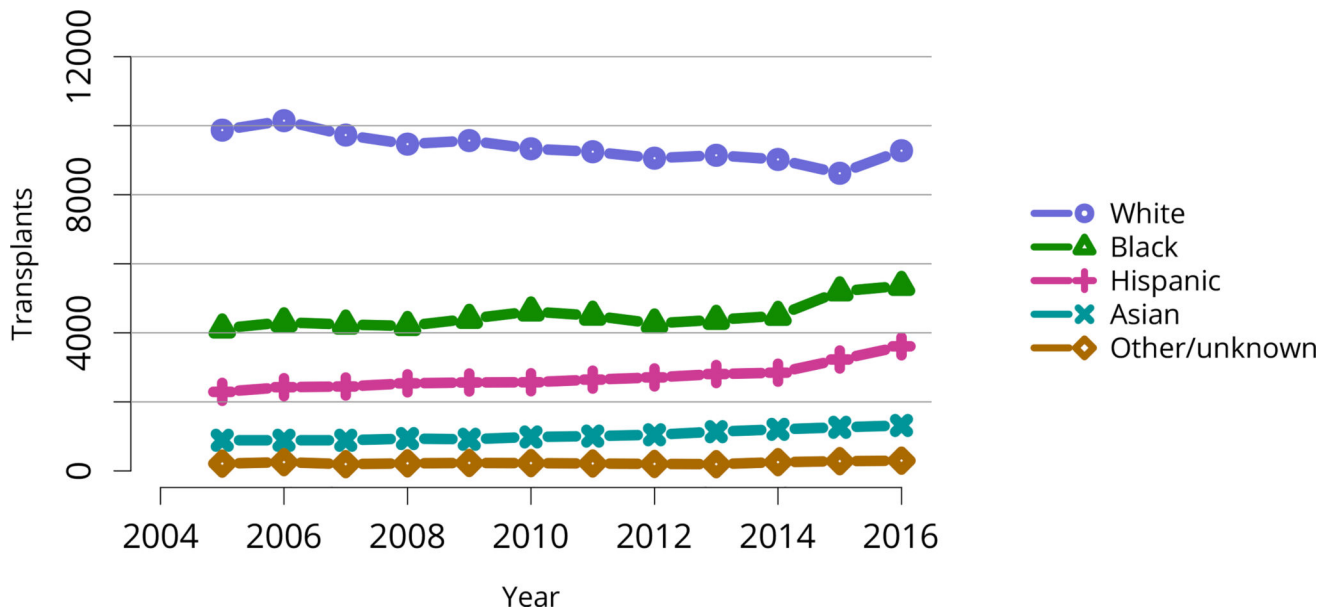


Figure KI 51. Total kidney transplants by race
All kidney transplant recipients, including adult and pediatric, retransplant, and multi-organ recipients.

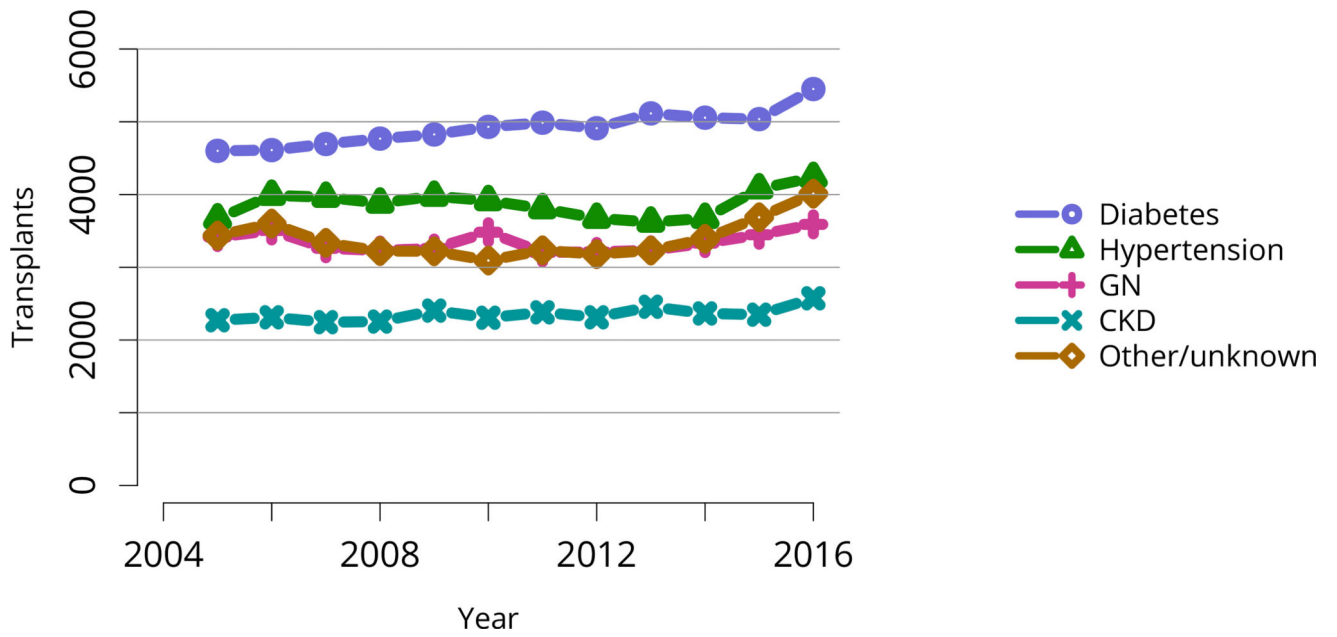


Figure KI 52. Total kidney transplants by diagnosis
All kidney transplant recipients, including adult and pediatric, retransplant, and multi-organ recipients. GN, glomerulonephritis; CKD, cystic kidney disease.

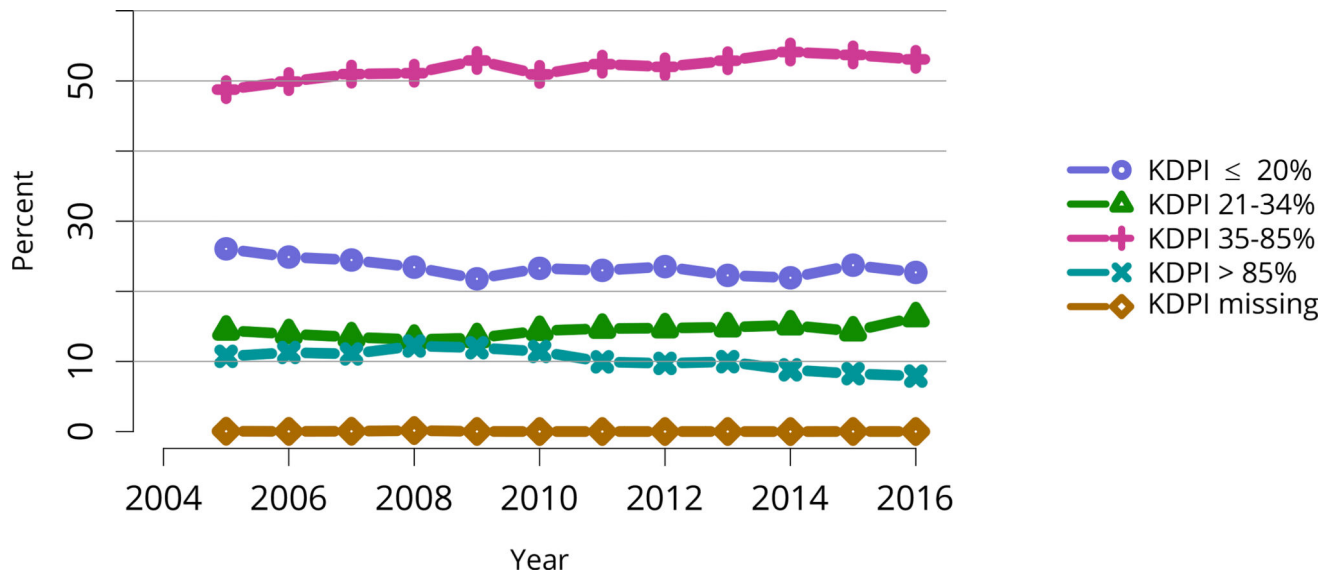


Figure KI 53. Kidney transplants by kidney donor profile index (KDPI)
 All adult recipients of deceased donor kidneys, including multi-organ transplants. The reference population for the KDRI to KDPI conversion is all deceased donor kidneys recovered for transplant in the US in 2016. Kidneys recovered en-bloc are counted once. KDPI, kidney donor profile index; KDRI, kidney donor risk index.

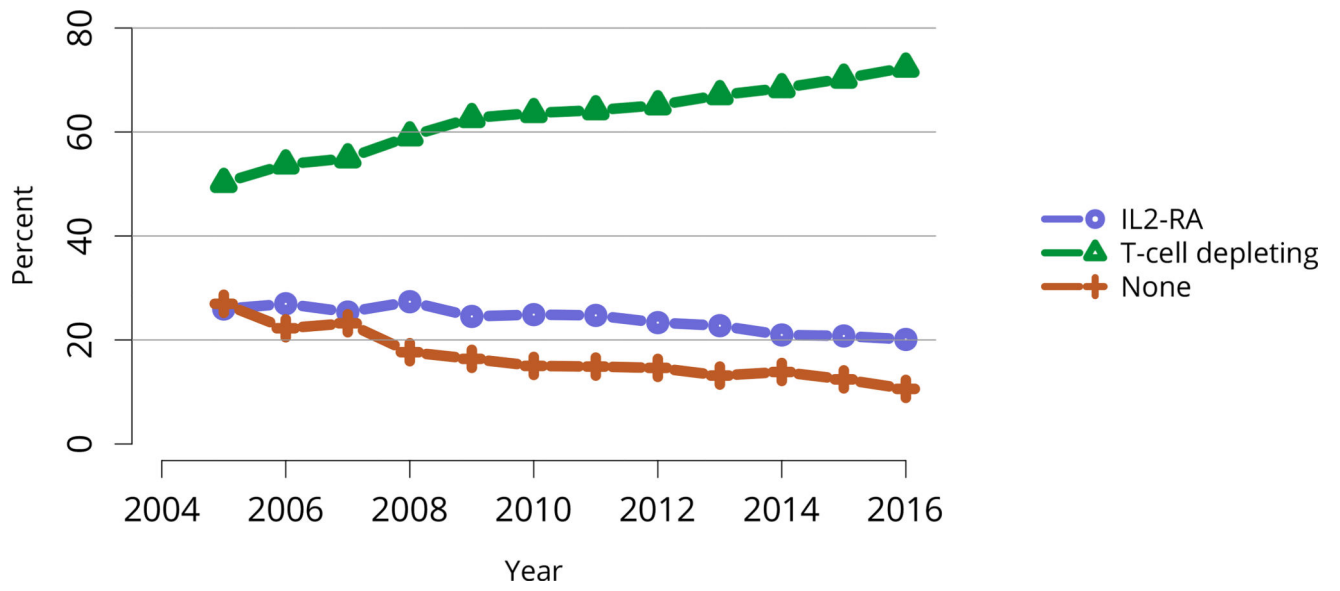


Figure KI 54. Induction agent use in adult kidney transplant recipients
Immunosuppression at transplant reported to the OPTN. IL2-RA, interleukin-2 receptor antagonist.

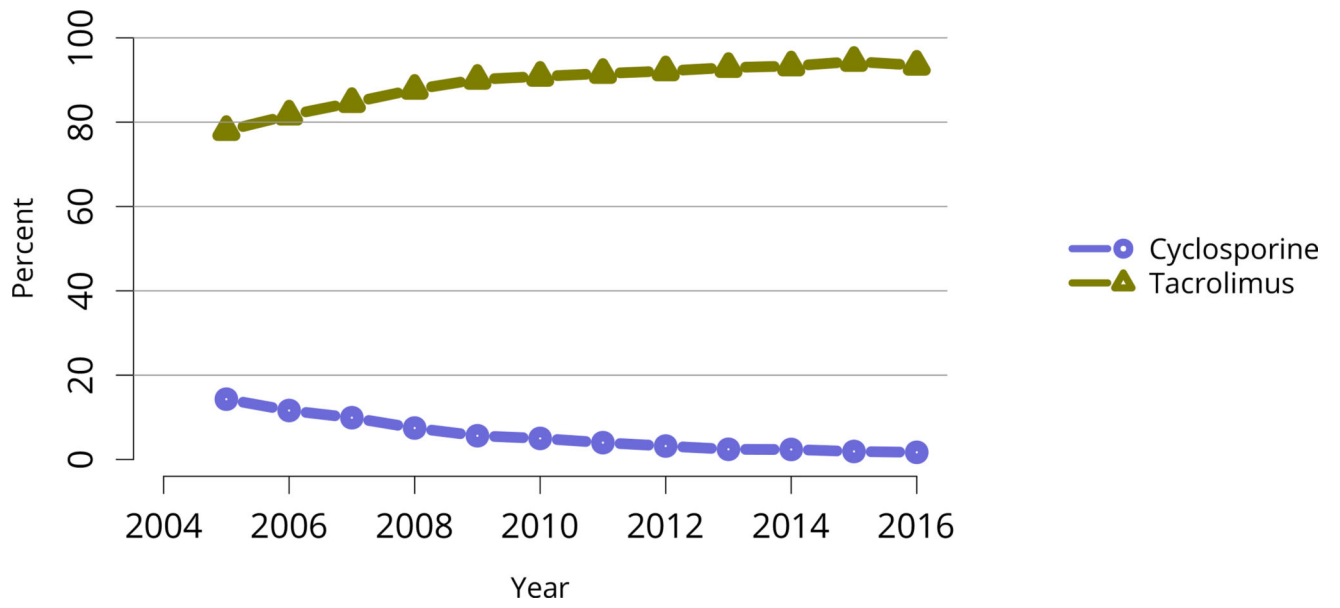


Figure KI 55. Calcineurin inhibitor use in adult kidney transplant recipients
Immunosuppression at transplant reported to the OPTN.

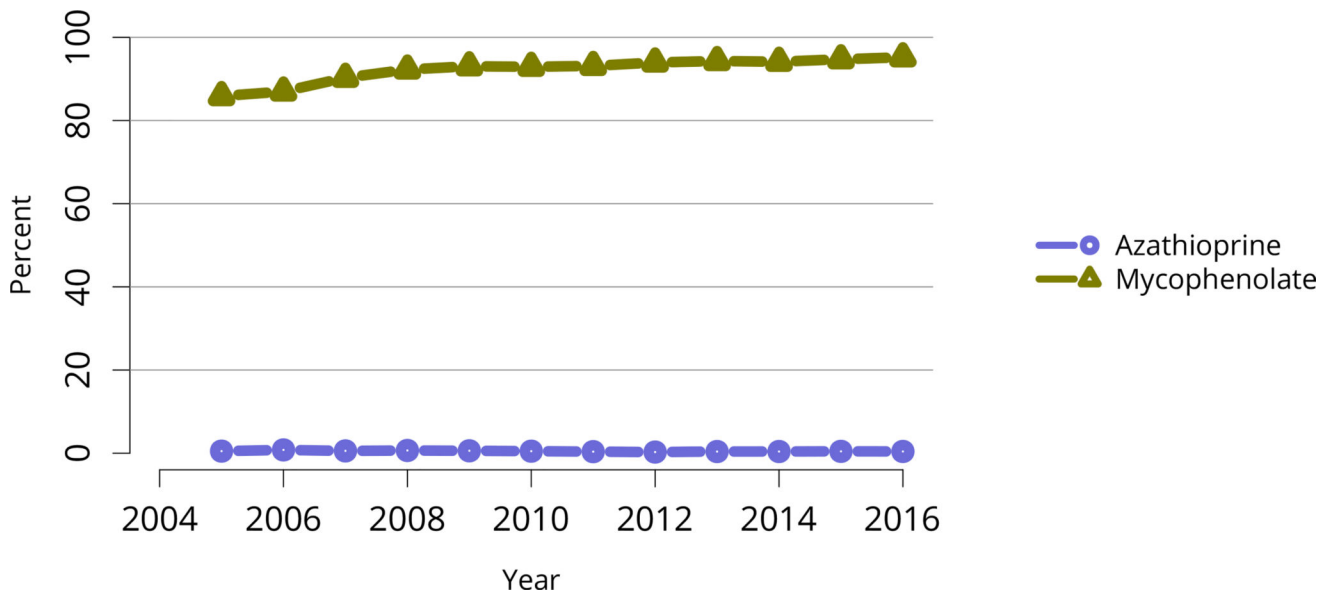


Figure KI 56. Anti-metabolite use in adult kidney transplant recipients
Immunosuppression at transplant reported to the OPTN. Mycophenolate includes mycophenolate mofetil and mycophenolate sodium.

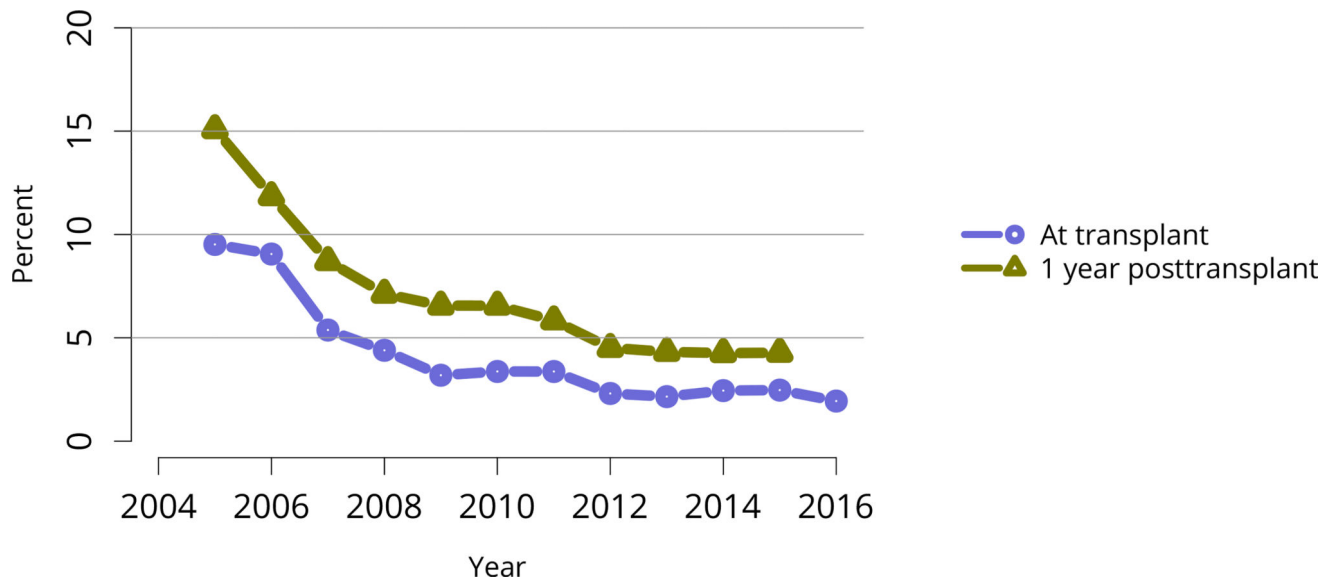


Figure KI 57. mTOR inhibitor use in adult kidney transplant recipients
Immunosuppression at transplant reported to the OPTN. One-year posttransplant data are limited to patients alive with graft function at 1 year posttransplant. mTOR, mammalian target of rapamycin.

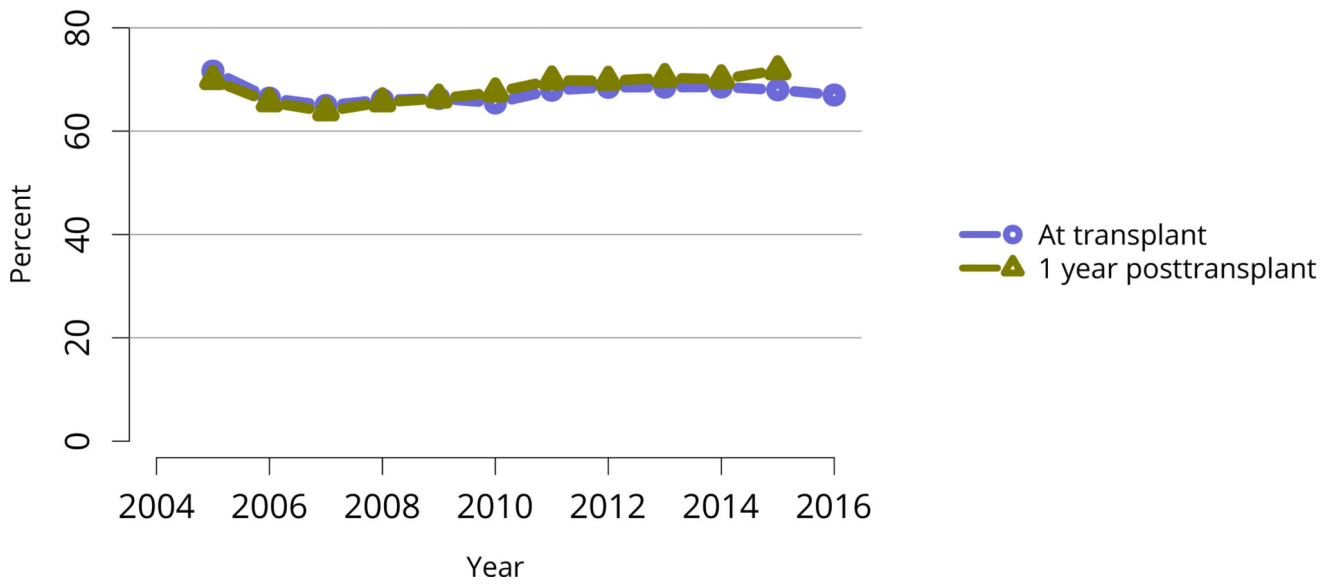


Figure KI 58. Steroid use in adult kidney transplant recipients
Immunosuppression at transplant reported to the OPTN. One-year posttransplant data are limited to patients alive with graft function at 1 year posttransplant.

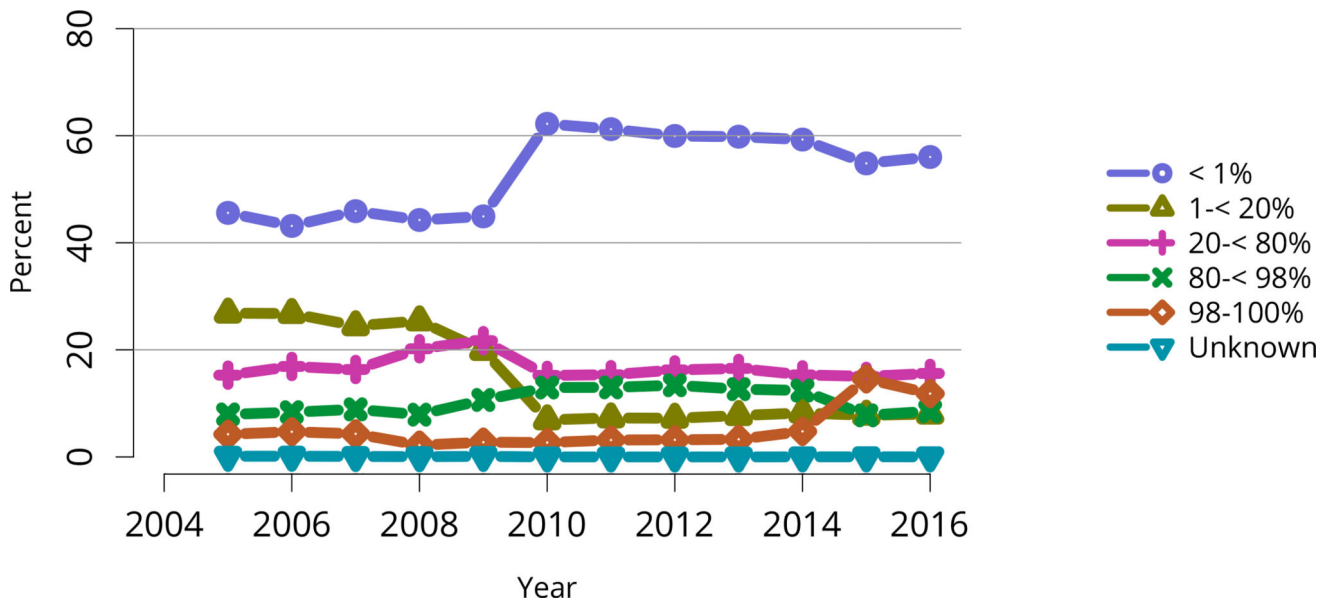


Figure KI 59. C/PRA at time of kidney transplant in adult deceased donor recipients

From December 5, 2007, through September 30, 2009, CPRA was used if greater than 0; otherwise, the maximum pretransplant PRA was used. Before December 5, 2007, the maximum pretransplant PRA was used unconditionally. CPRA is used after September 30, 2009, unless it is missing; if it is missing, the maximum pretransplant PRA is used. Kidney-alone transplants only.

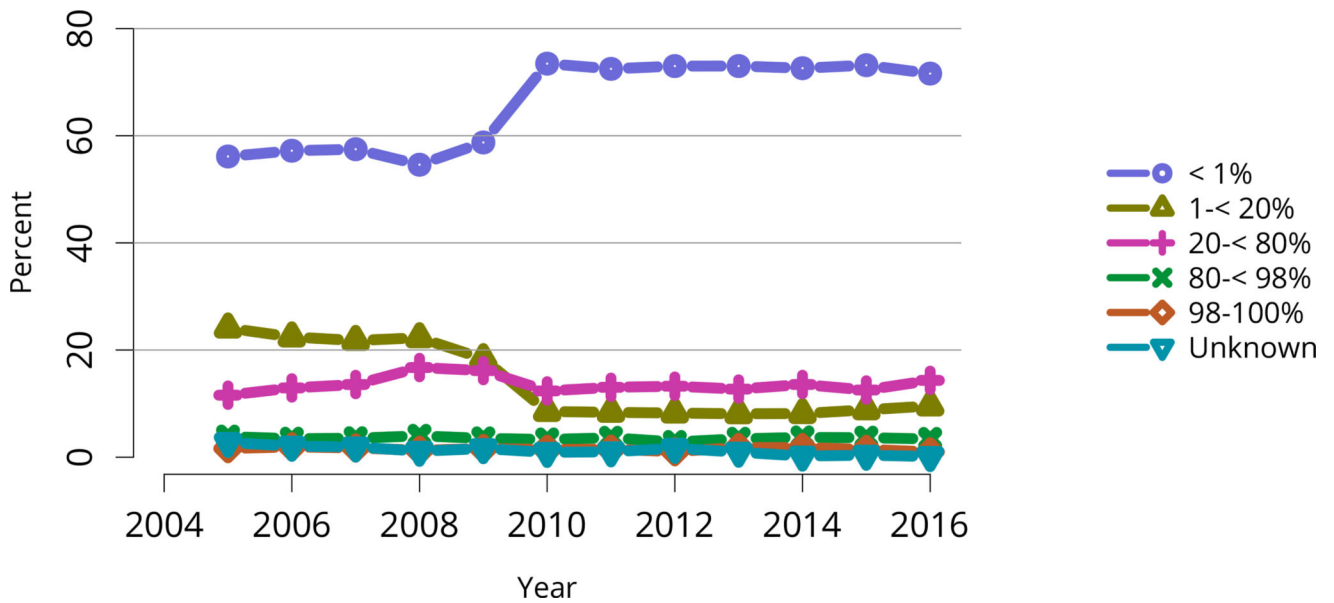


Figure KI 60. C/PRA at time of kidney transplant in adult living donor recipients
 From December 5, 2007, through September 30, 2009, CPRA was used if greater than 0; otherwise, the maximum pretransplant PRA was used. Before December 5, 2007, the maximum pretransplant PRA was used unconditionally. CPRA is used after September 30, 2009, unless it is missing; if it is missing, the maximum pretransplant PRA is used. Kidney-alone transplants only.

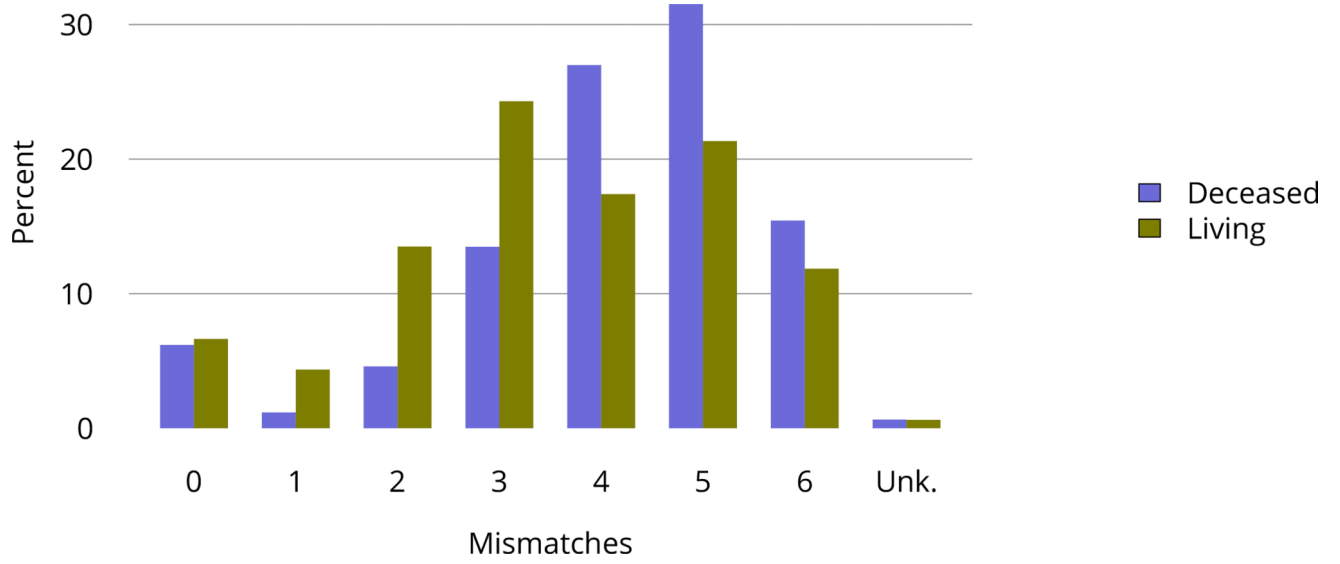


Figure KI 61. Total HLA A, B, and DR mismatches among adult kidney transplant recipients, 2012–2016

Donor and recipient antigen matching is based on OPTN antigen values and split equivalences policy as of 2016.

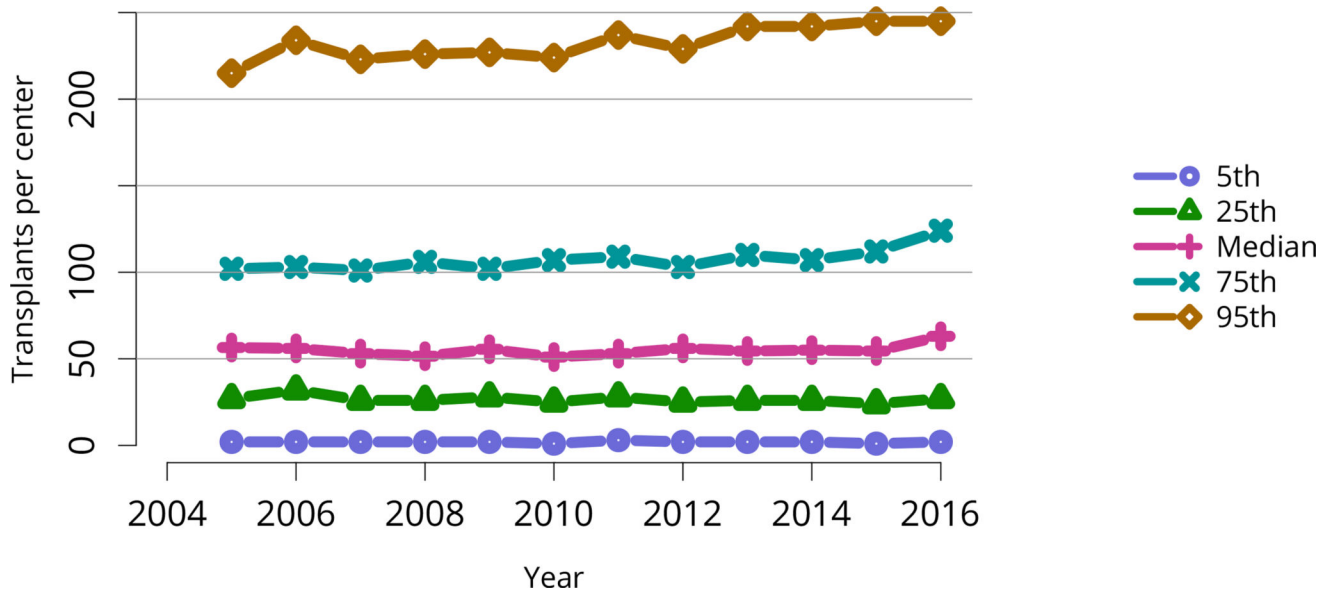


Figure KI 62. Annual adult kidney transplant center volumes, by percentile
Annual volume data are limited to recipients aged 18 or older.

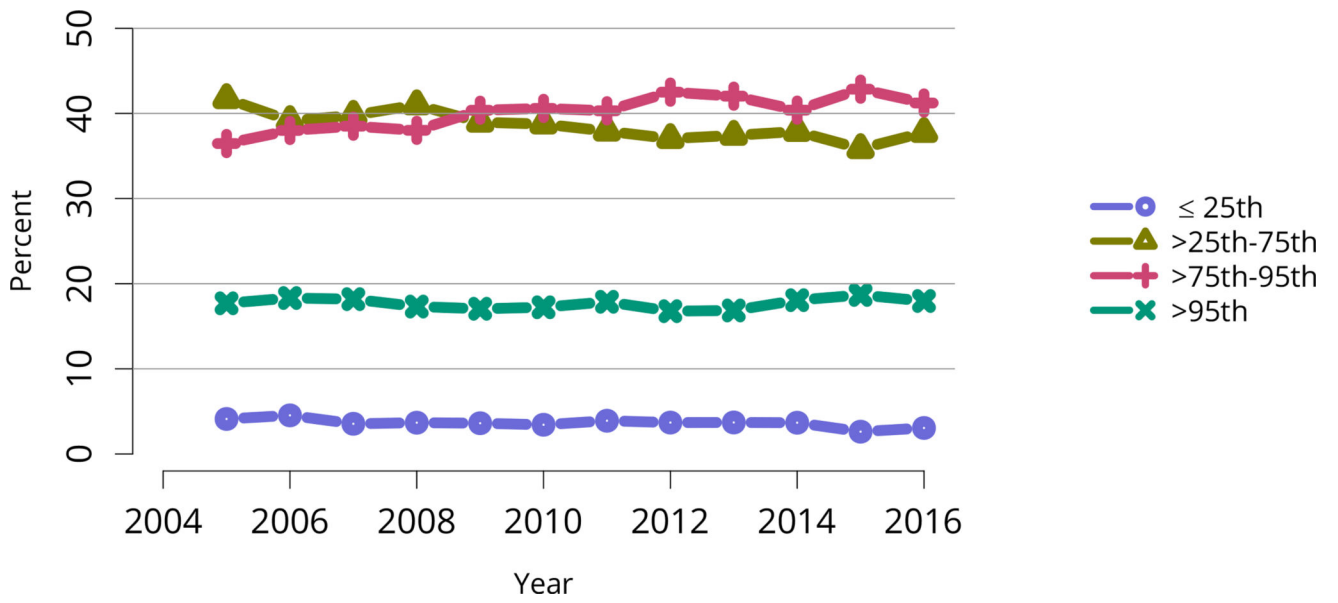


Figure KI 63. Distribution of adult kidney transplants by percentile of center volume
Percentiles are based on annual volume data among recipients aged 18 or older.

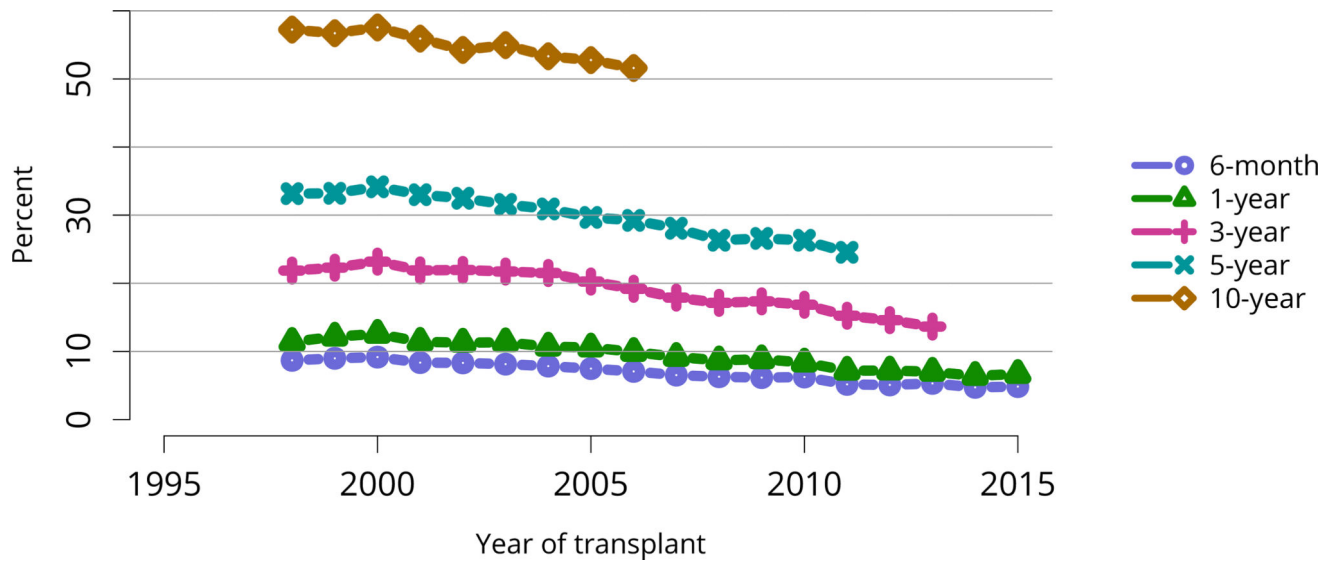


Figure KI 64. Graft failure among adult deceased donor kidney transplant recipients
 Estimates are unadjusted, computed using Kaplan-Meier competing risk methods. Recipients are followed to the earliest of kidney graft failure; kidney retransplant; return to dialysis; death; or 6 months, 1, 3, 5, or 10 years posttransplant. All-cause graft failure (GF) is defined as any of the prior outcomes prior to 6 months, 1, 3, 5, or 10 years, respectively.

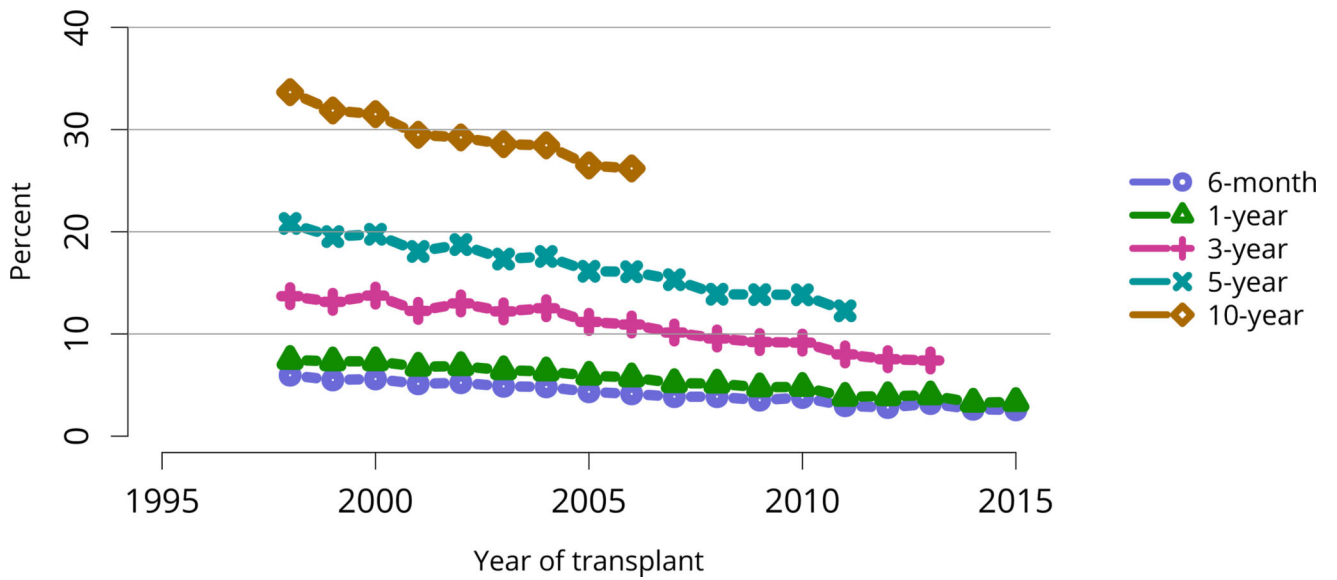


Figure KI 65. Death-censored graft failure among adult deceased donor kidney transplant recipients

Estimates are unadjusted, computed using Kaplan-Meier competing risk methods.

Recipients are followed to the earliest of kidney graft failure; kidney retransplant; return to dialysis; death; or 6 months, 1, 3, 5, or 10 years posttransplant. Death-censored graft failure (DCGF) is defined as a return to dialysis, reported graft failure, or kidney retransplant.

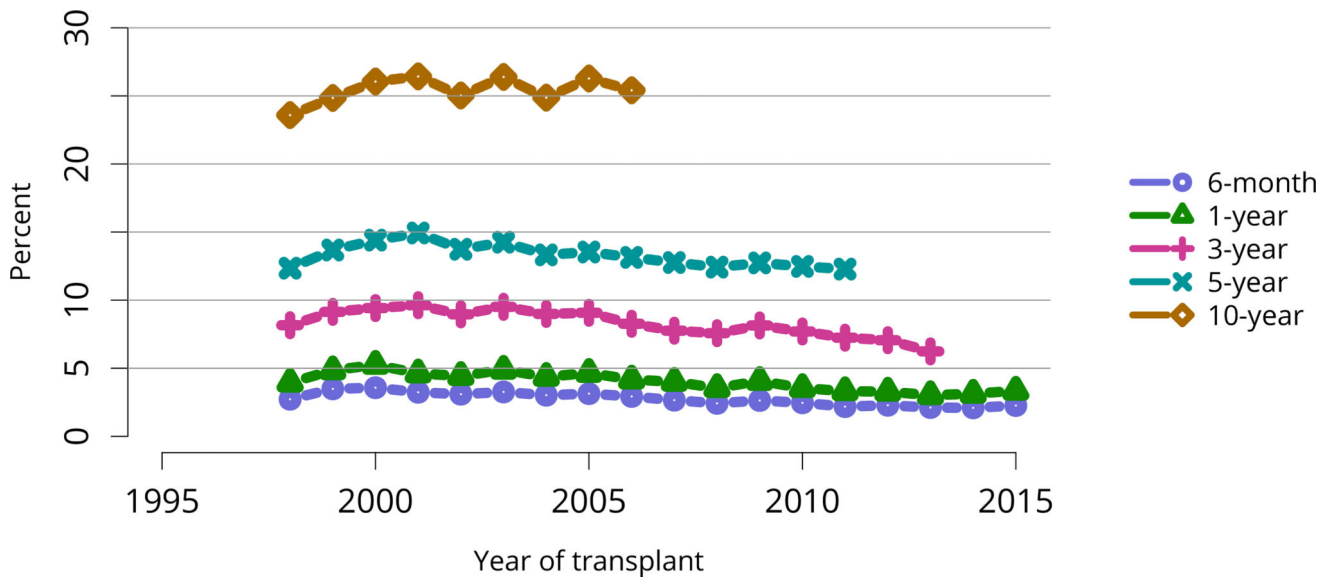


Figure KI 66. Death with function among adult deceased donor kidney transplant recipients
 Estimates are unadjusted, computed using KaplanMeier competing risk methods. Recipients are followed to the earliest of kidney graft failure; kidney retransplant; return to dialysis; death; or 6 months, 1, 3, 5, or 10 years posttransplant. Death with function (DWF) is defined as death without prior graft failure, return to dialysis, or retransplant.

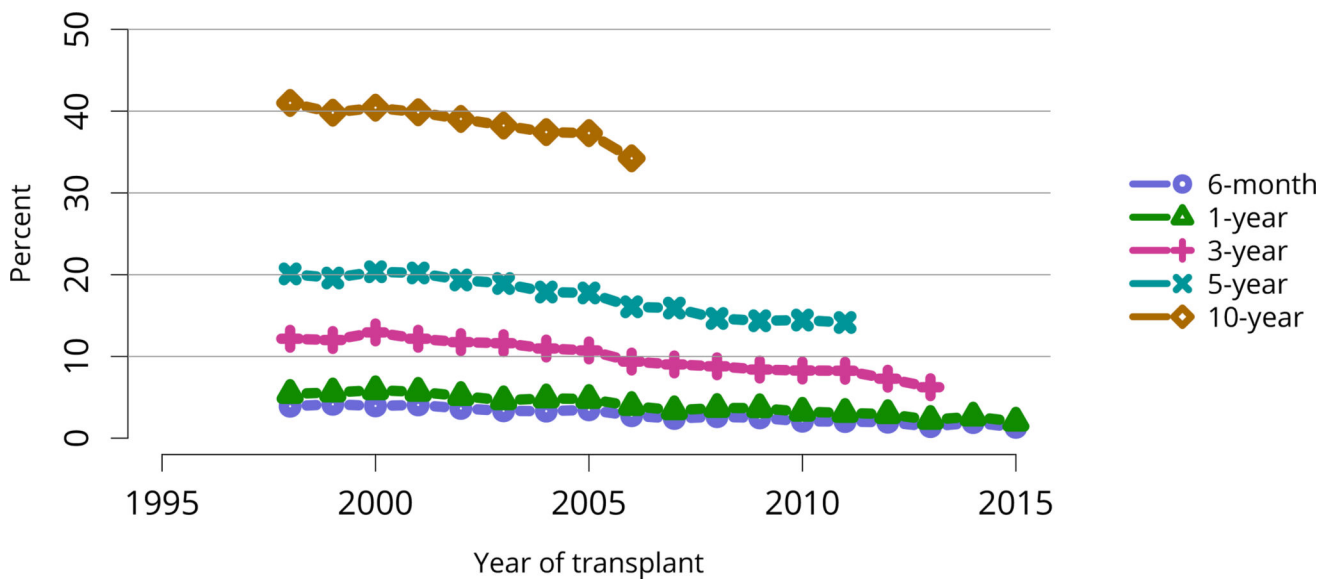


Figure KI 67. Graft failure among adult living donor kidney transplant recipients
 Estimates are unadjusted, computed using Kaplan-Meier competing risk methods. Recipients are followed to the earliest of kidney graft failure; kidney retransplant; return to dialysis; death; or 6 months, 1, 3, 5, or 10 years posttransplant. All-cause graft failure (GF) is defined as any of the prior outcomes prior to 6 months, 1, 3, 5, or 10 years, respectively.

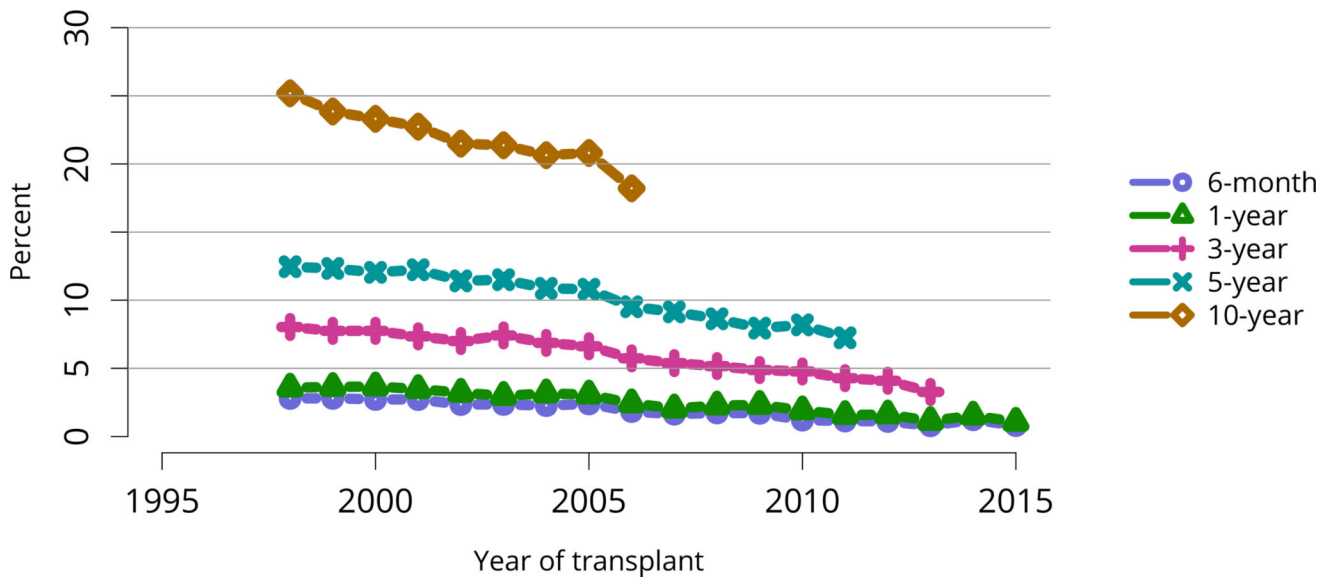


Figure KI 68. Death-censored graft failure among adult living donor kidney transplant recipients

Estimates are unadjusted, computed using Kaplan-Meier competing risk methods.

Recipients are followed to the earliest of kidney graft failure; kidney retransplant; return to dialysis; death; or 6 months, 1, 3, 5, or 10 years posttransplant. Death-censored graft failure (DCGF) is defined as a return to dialysis, reported graft failure, or kidney retransplant.

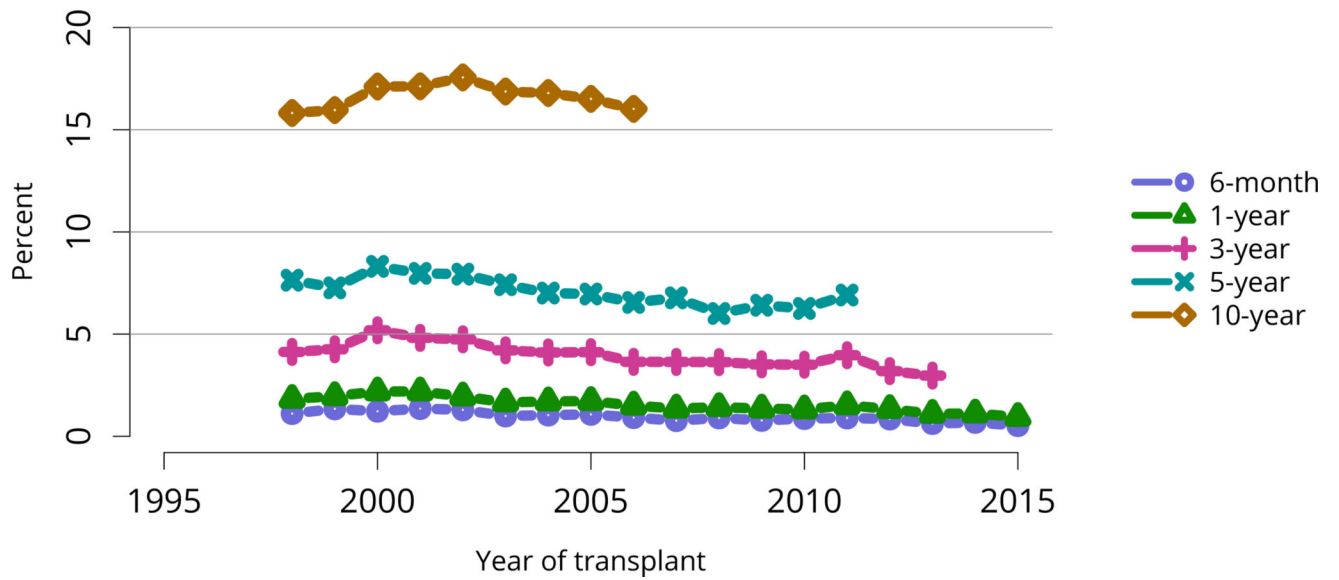


Figure KI 69. Death with function among adult living donor kidney transplant recipients
 Estimates are unadjusted, computed using Kaplan-Meier competing risk methods. Recipients are followed to the earliest of kidney graft failure; kidney retransplant; return to dialysis; death; or 6 months, 1, 3, 5, or 10 years posttransplant. Death with function (DWF) is defined as death without prior graft failure, return to dialysis, or retransplant.

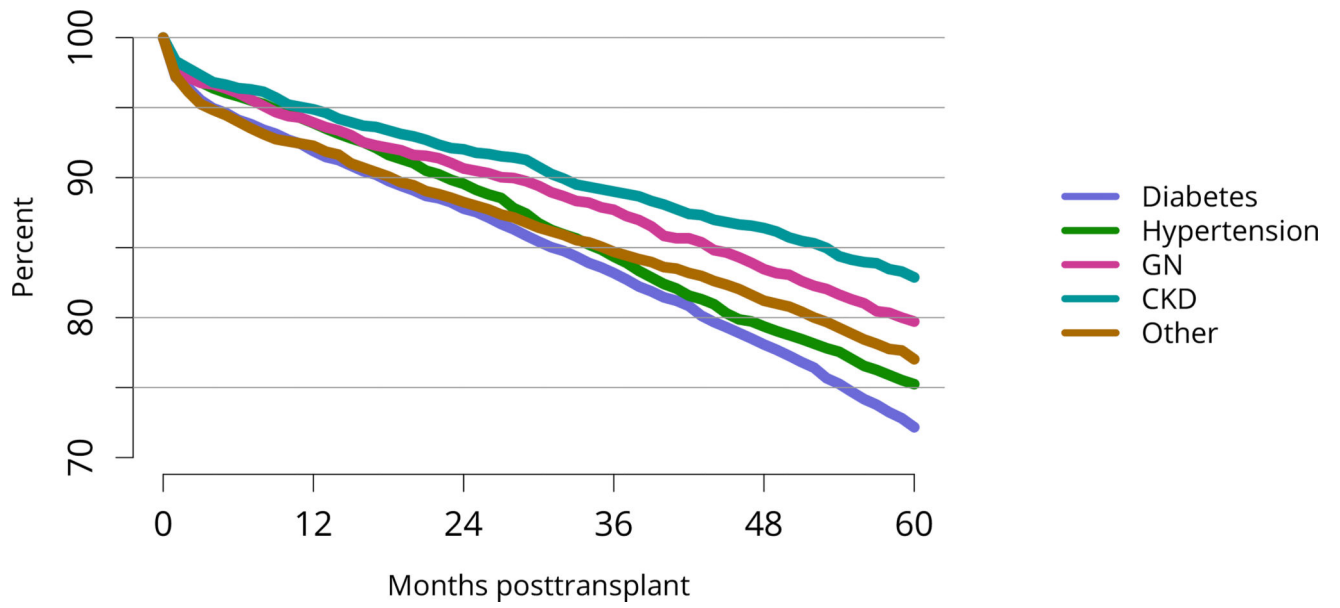


Figure KI 70. Graft survival among adult deceased donor kidney transplant recipients, 2011, by diagnosis
Graft survival estimated using unadjusted Kaplan-Meier methods. CKD, cystic kidney disease; GN, glomerulonephritis.

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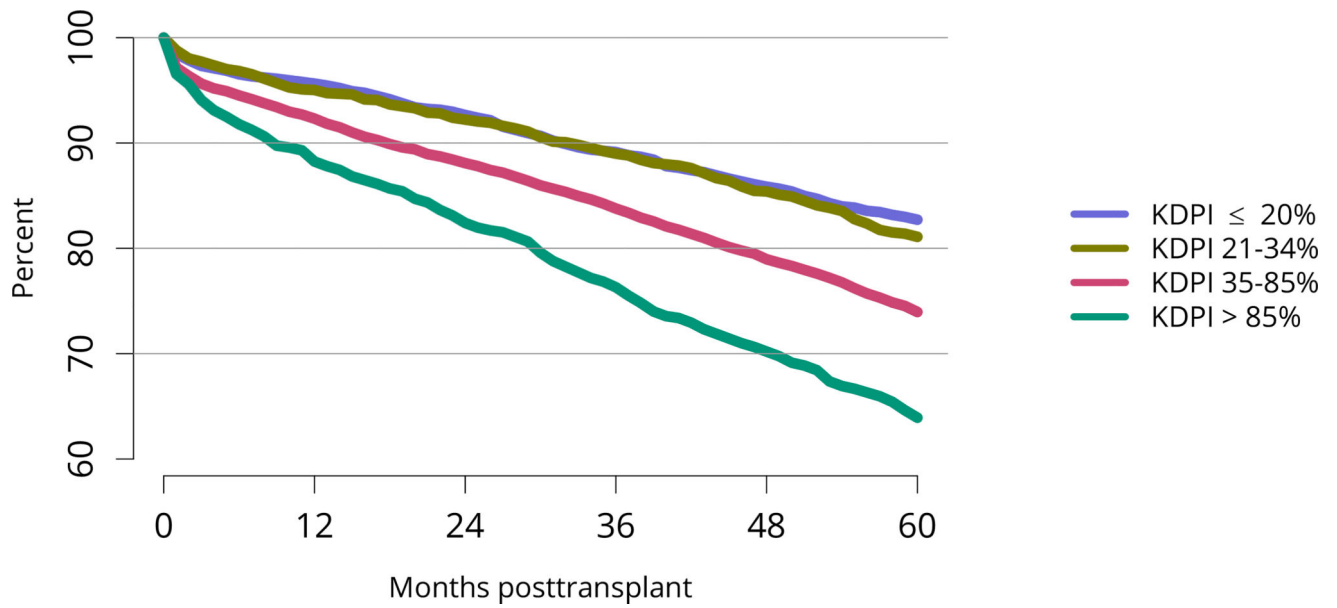


Figure KI 71. Graft survival among adult deceased donor kidney transplant recipients, 2011, by KDPI

Graft survival estimated using unadjusted Kaplan-Meier methods. The reference population for the KDRI to KDPI conversion is all deceased donor kidneys recovered for transplant in the US in 2016. KDPI, kidney donor profile index.

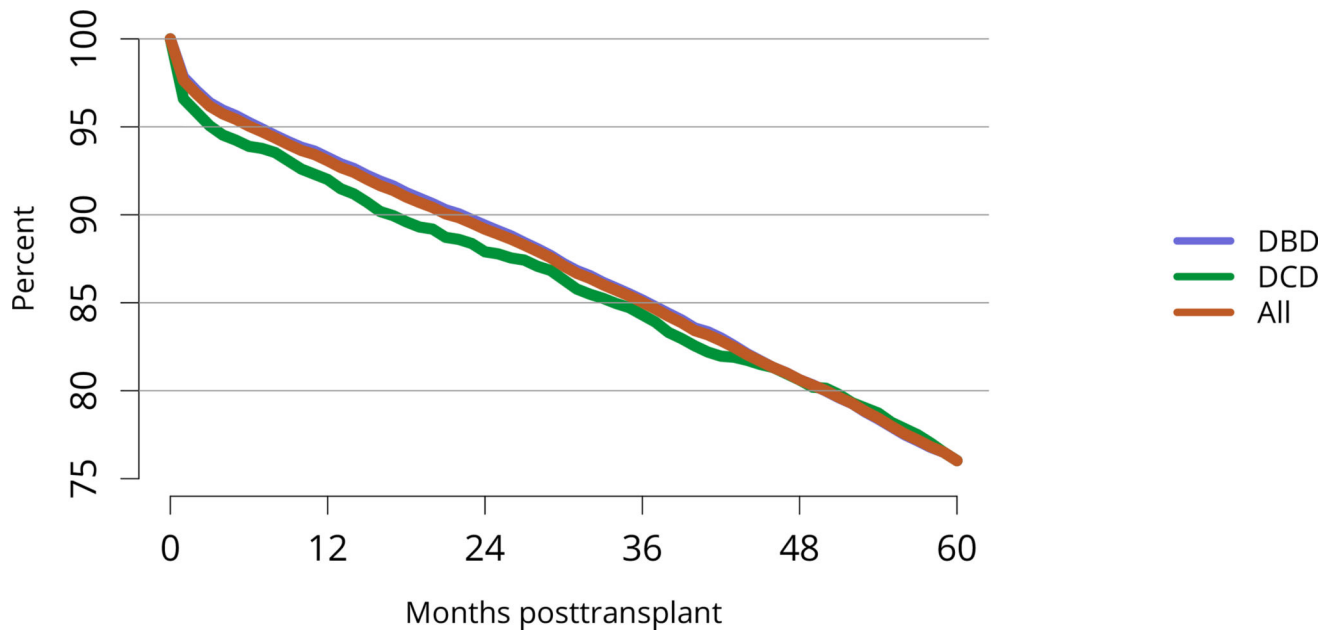


Figure KI 72. Graft survival among adult deceased donor kidney transplant recipients, 2011, by DCD status

Graft survival estimated using unadjusted Kaplan-Meier methods. DCD, donation after circulatory death; DBD, donation after brain death.

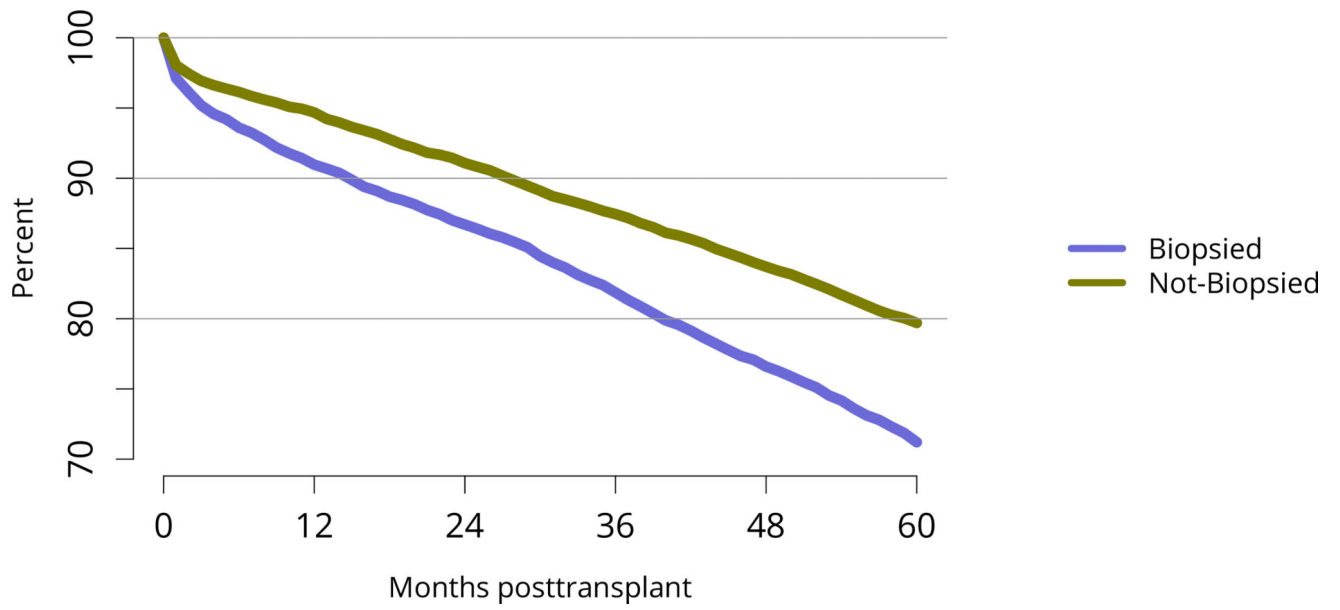


Figure KI 73. Graft survival among adult deceased donor kidney transplant recipients, 2011, by biopsy status
Graft survival estimated using unadjusted Kaplan-Meier methods.

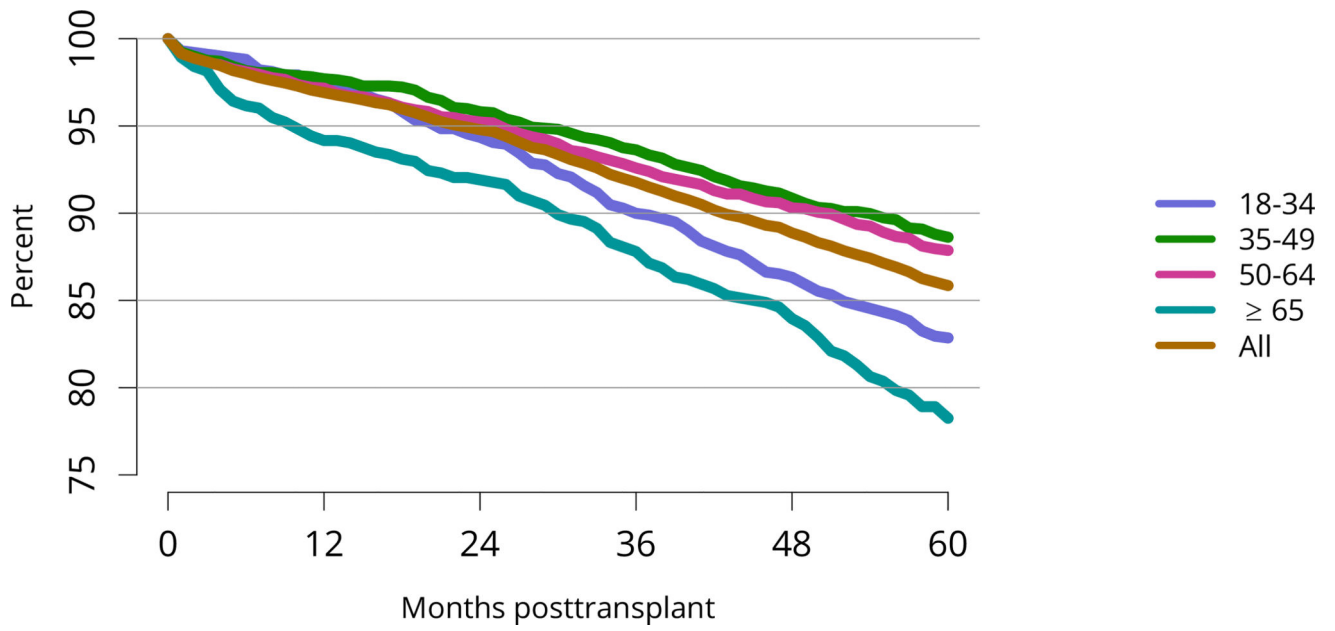


Figure KI 74. Graft survival among adult living donor kidney transplant recipients, 2011, by age
Graft survival estimated using unadjusted KaplanMeier methods.

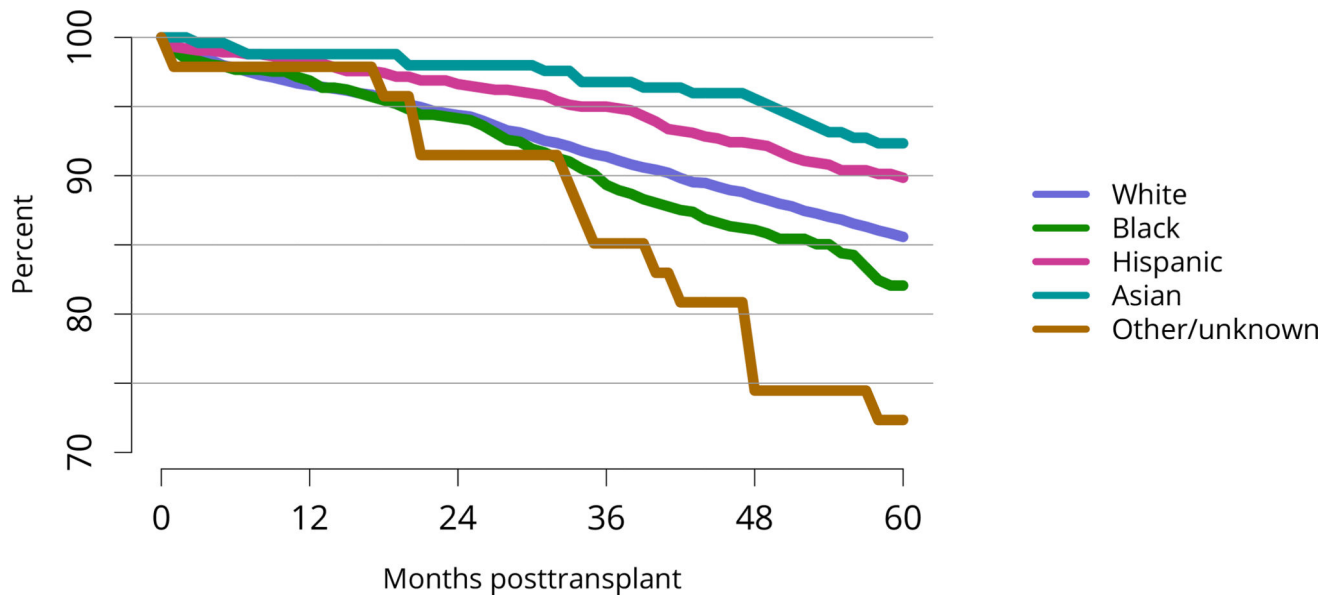


Figure KI 75. Graft survival among adult living donor kidney transplant recipients, 2011, by race
Graft survival estimated using unadjusted KaplanMeier methods.

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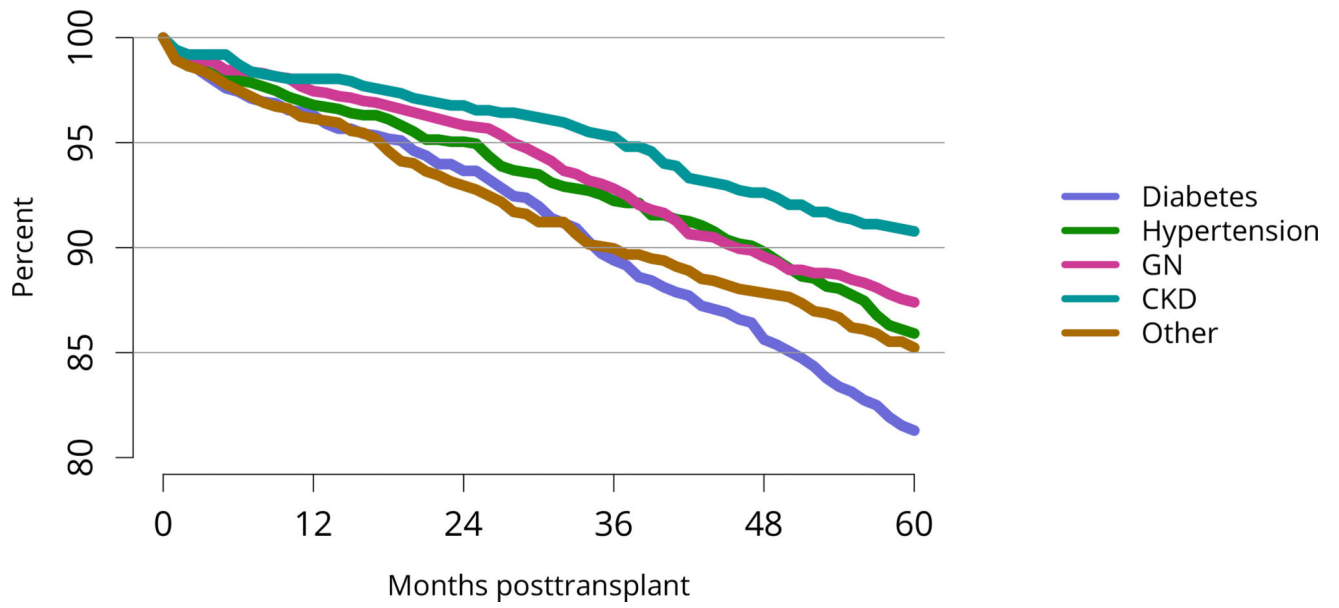


Figure KI 76. Graft survival among adult living donor kidney transplant recipients, 2011, by diagnosis
Graft survival estimated using unadjusted Kaplan-Meier methods. CKD, cystic kidney disease; GN, glomerulonephritis.

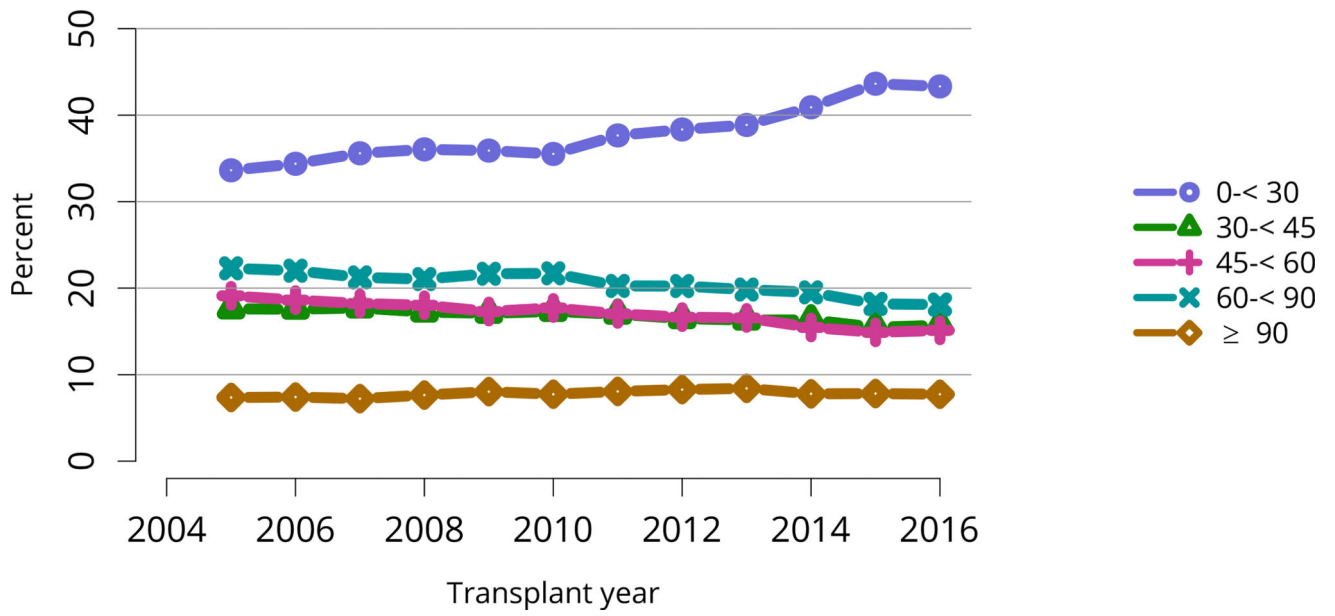


Figure KI 77. Distribution of eGFR at discharge among adult kidney transplant recipients
GFR (mL/min/1.73 m²) estimated using the Chronic Kidney Disease Epidemiology
Collaboration equation, and computed for patients alive with graft function at discharge.

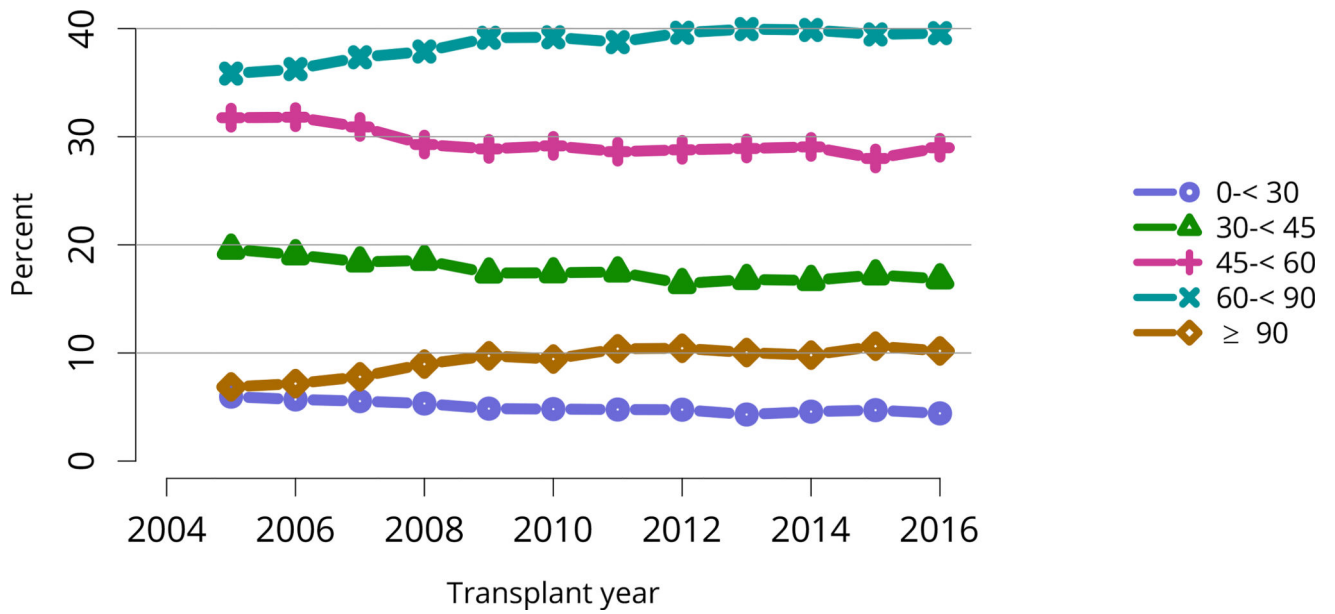


Figure KI 78. Distribution of eGFR at 6 months posttransplant among adult kidney transplant recipients

GFR (mL/min/1.73 m²) estimated using the Chronic Kidney Disease Epidemiology Collaboration equation, and computed for patients alive with graft function at 6 months posttransplant.

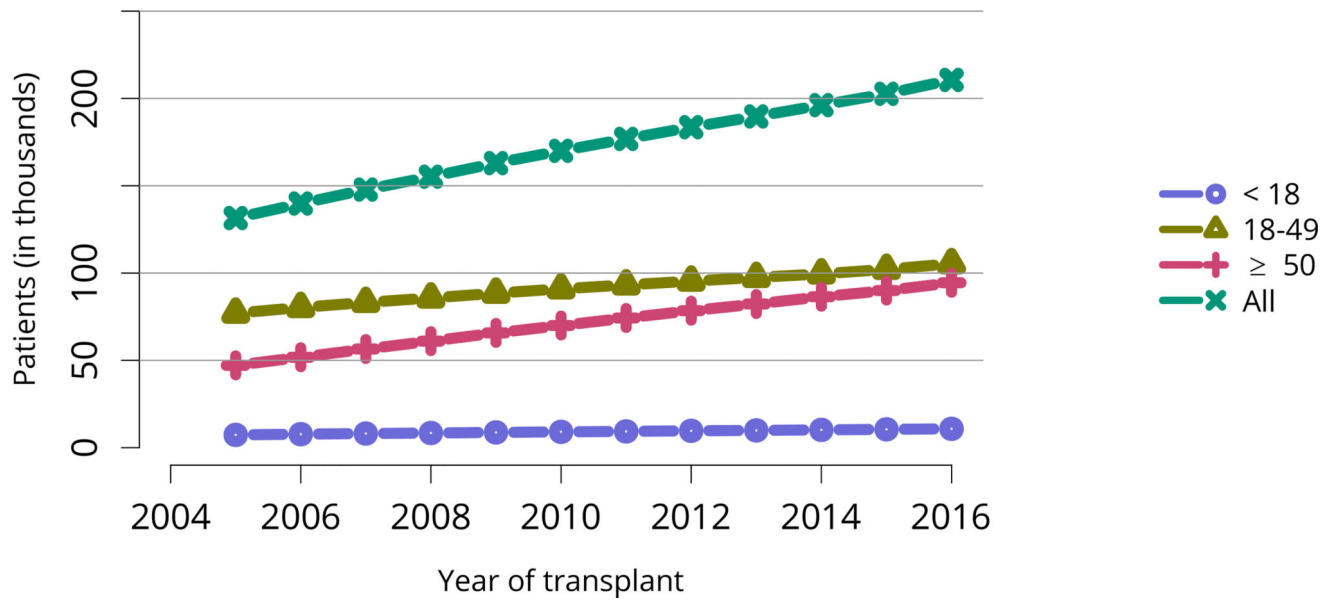


Figure KI 79. Recipients alive with a functioning kidney graft on June 30 of the year, by age at transplant

Recipients are assumed to be alive with function unless a death or graft failure is recorded. A recipient may experience a graft failure and be removed from the cohort, undergo retransplant, and reenter the cohort.

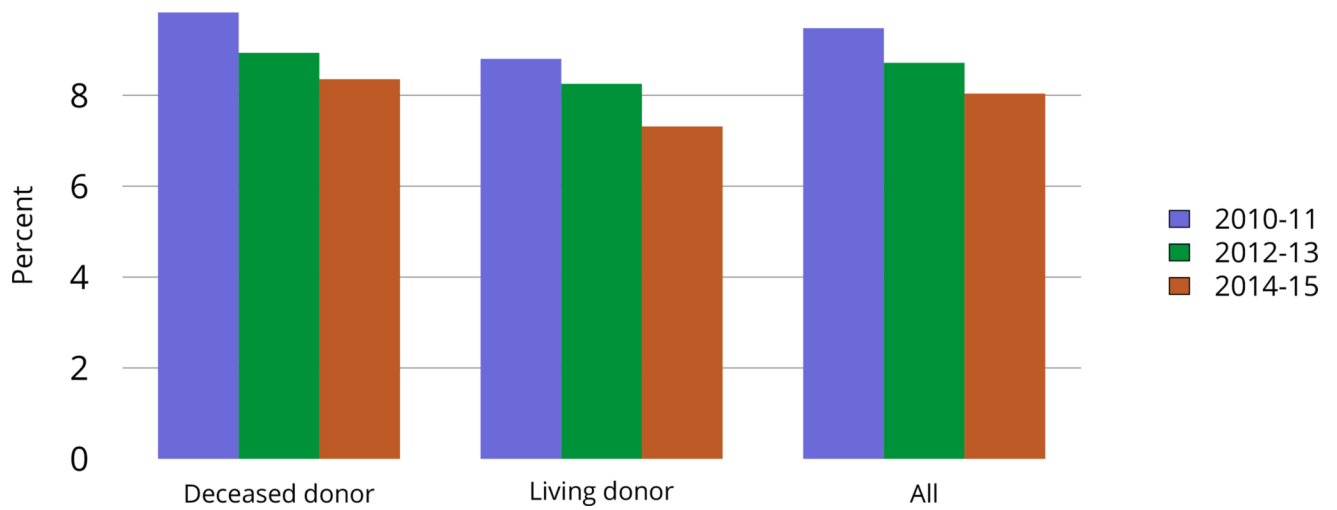


Figure KI 80. Incidence of acute rejection by 1 year posttransplant among adult kidney transplant recipients by donor type

Acute rejection is defined as a record of acute or hyperacute rejection, as reported on the OPTN Transplant Recipient Registration or Transplant Recipient Follow-up Form. Only the first rejection event is counted. Cumulative incidence is estimated using the Kaplan-Meier competing risk method.

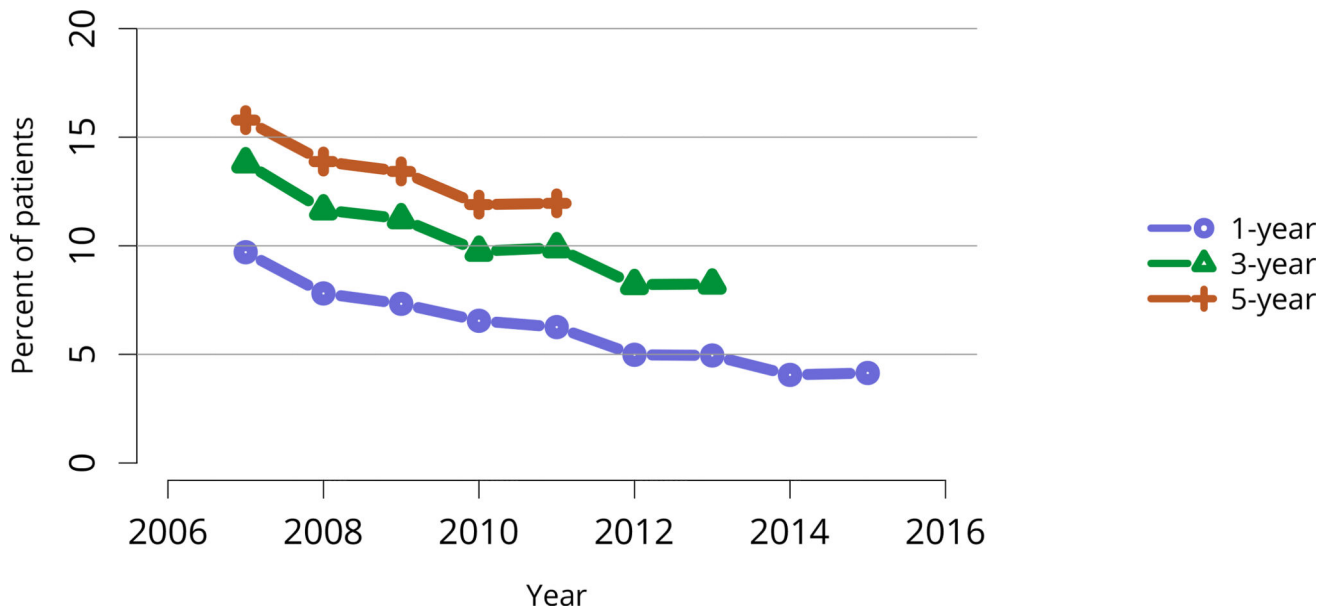


Figure KI 81. Posttransplant diabetes among adult kidney transplant recipients
Percentage of adult deceased donor kidney recipients who were nondiabetic at transplant and developed diabetes posttransplant. Posttransplant diabetes is reported on the Transplant Recipient Follow-up Form. Death and graft failure are treated as competing events.

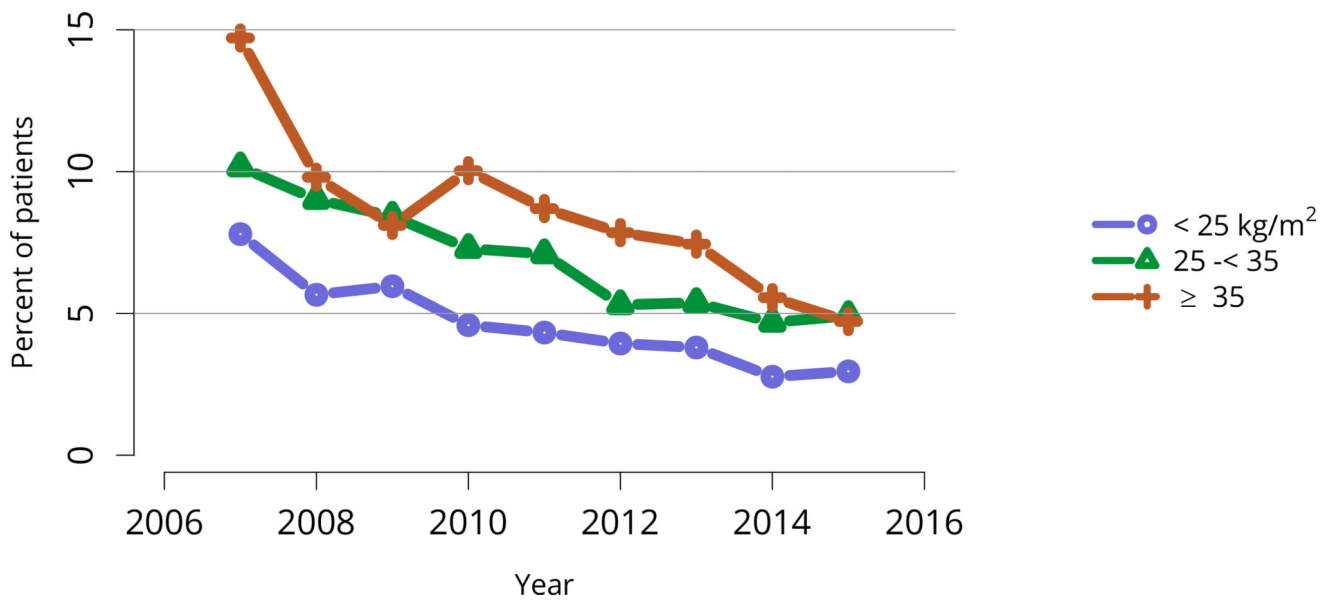


Figure KI 82. Posttransplant diabetes within 1 year among adult kidney transplant recipients by BMI at transplant
 Percentage of adult deceased donor kidney recipients who were nondiabetic at transplant and developed diabetes posttransplant. Posttransplant diabetes is reported on the Transplant Recipient Follow-up Form. Death and graft failure are treated as competing events.

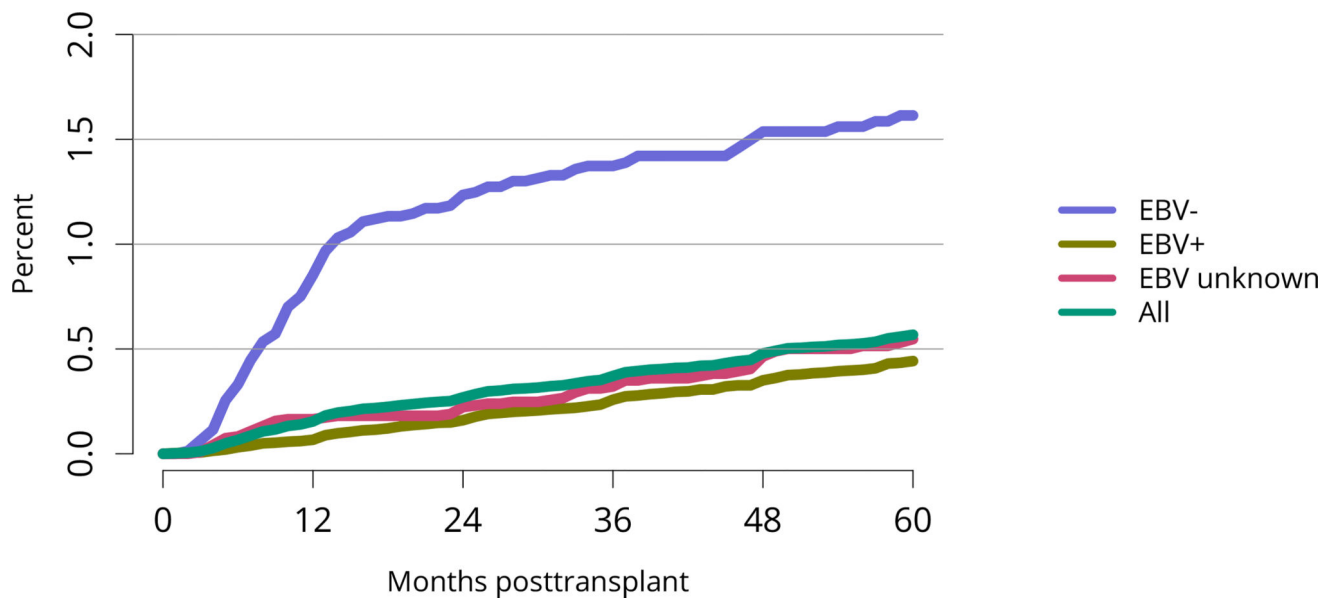


Figure KI 83. Incidence of PTLD among adult kidney transplant recipients by recipient EBV status at transplant, 2010–2014

Cumulative incidence is estimated using the Kaplan-Meier competing risk method. PTLD is identified as a reported complication or cause of death on the OPTN Transplant Recipient Follow-up Form or the Posttransplant Malignancy Form as polymorphic PTLD, monomorphic PTLD, or Hodgkin disease. Only the earliest date of PTLD diagnosis is considered. EBV, Epstein-Barr virus; PTLD, posttransplant lymphoproliferative disorder.

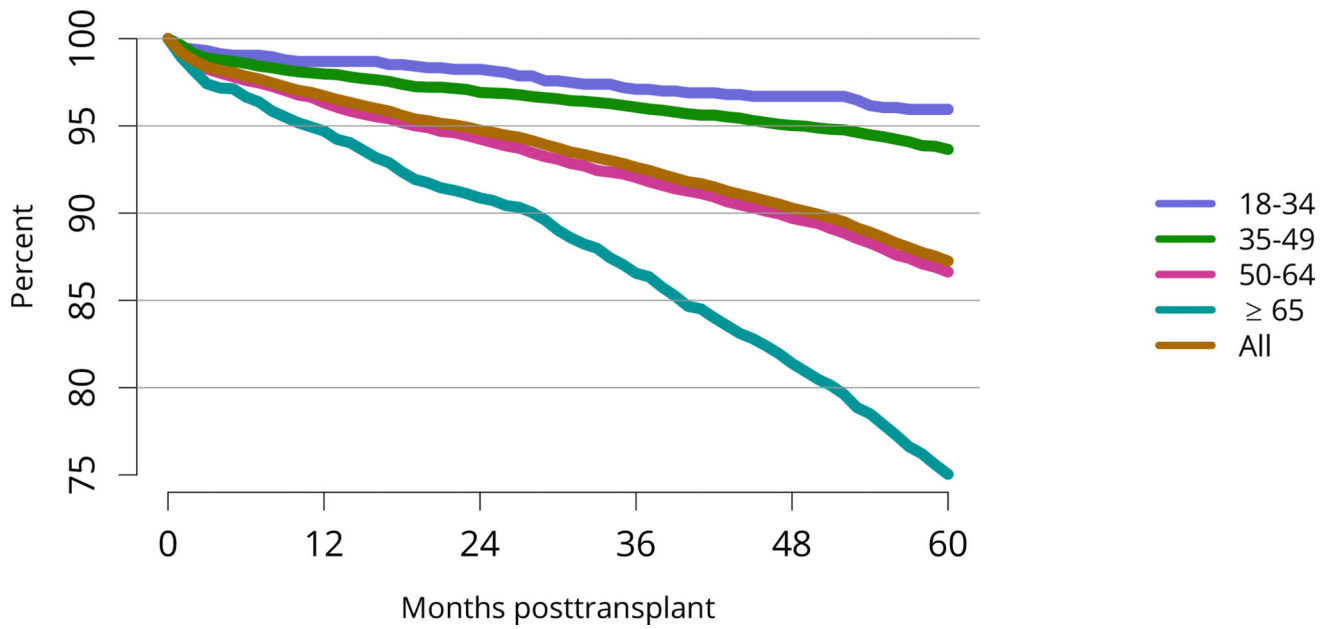


Figure KI 84. Patient survival among adult deceased donor kidney transplant recipients, 2011, by age

Patient survival estimated using unadjusted Kaplan-Meier methods. For recipients of more than one transplant during the period, only the first is considered.

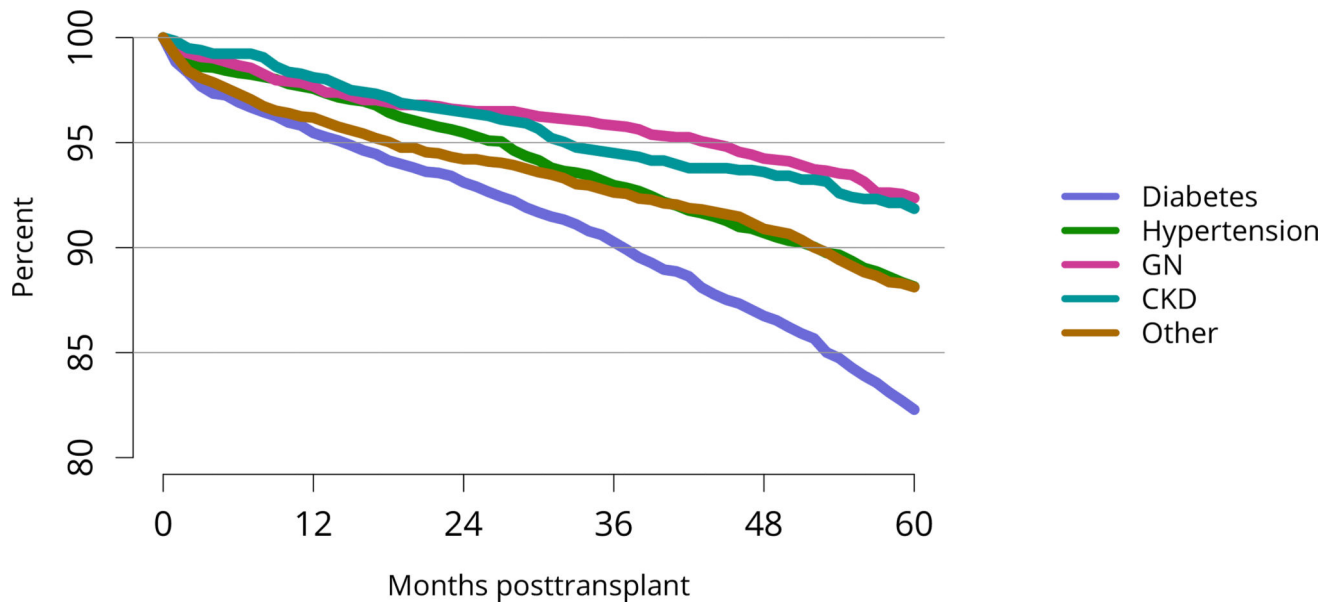


Figure KI 85. Patient survival among adult deceased donor kidney transplant recipients, 2011, by diagnosis
 Patient survival estimated using unadjusted Kaplan-Meier methods. For recipients of more than one transplant during the period, only the first is considered. CKD, cystic kidney disease; GN, glomerulonephritis.

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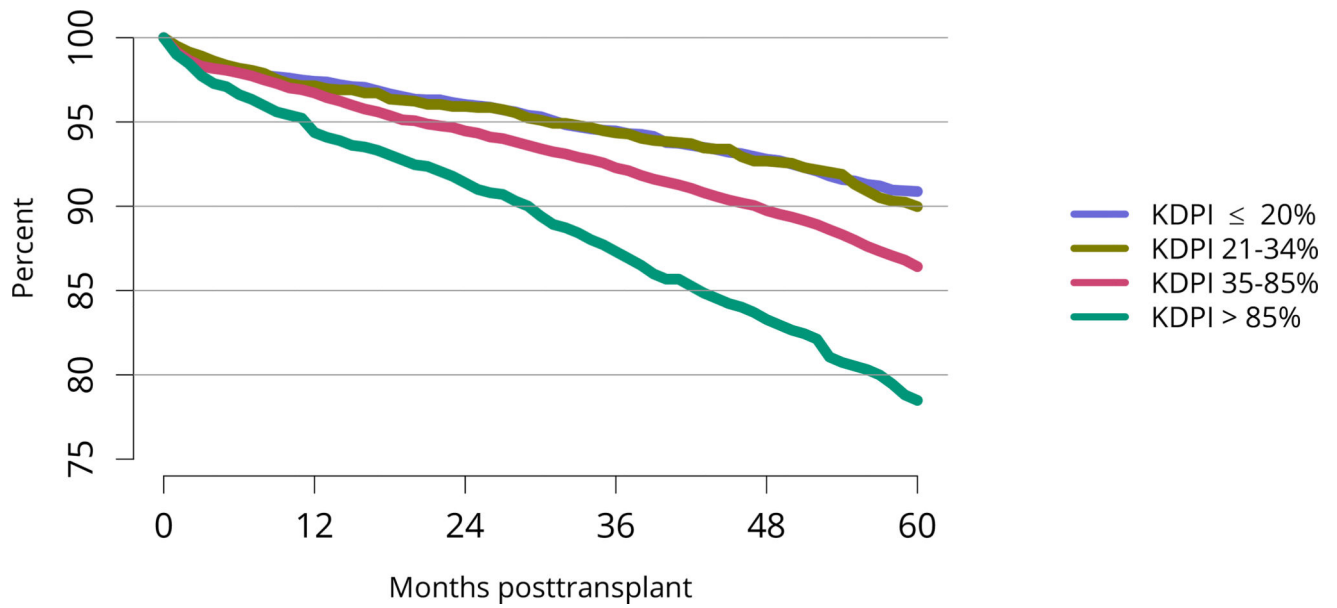


Figure KI 86. Patient survival among adult deceased donor kidney transplant recipients, 2011, by KDPI

Patient survival estimated using unadjusted Kaplan-Meier methods. For recipients of more than one transplant during the period, only the first is considered. The reference population for the KDRI to KDPI conversion is all deceased donor kidneys recovered for transplant in the US in 2016. KDPI, kidney donor profile index.

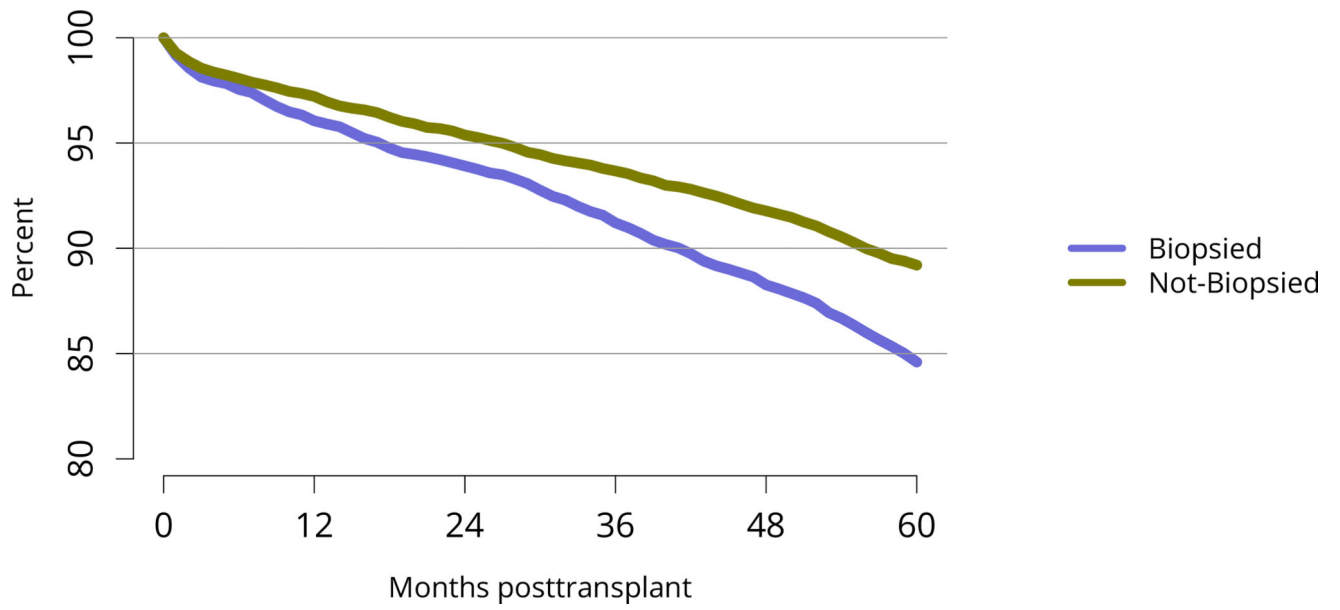


Figure KI 87. Patient survival among adult deceased donor kidney transplant recipients, 2011, by biopsy status
Patient survival estimated using unadjusted Kaplan-Meier methods. For recipients of more than one transplant during the period, only the first is considered.

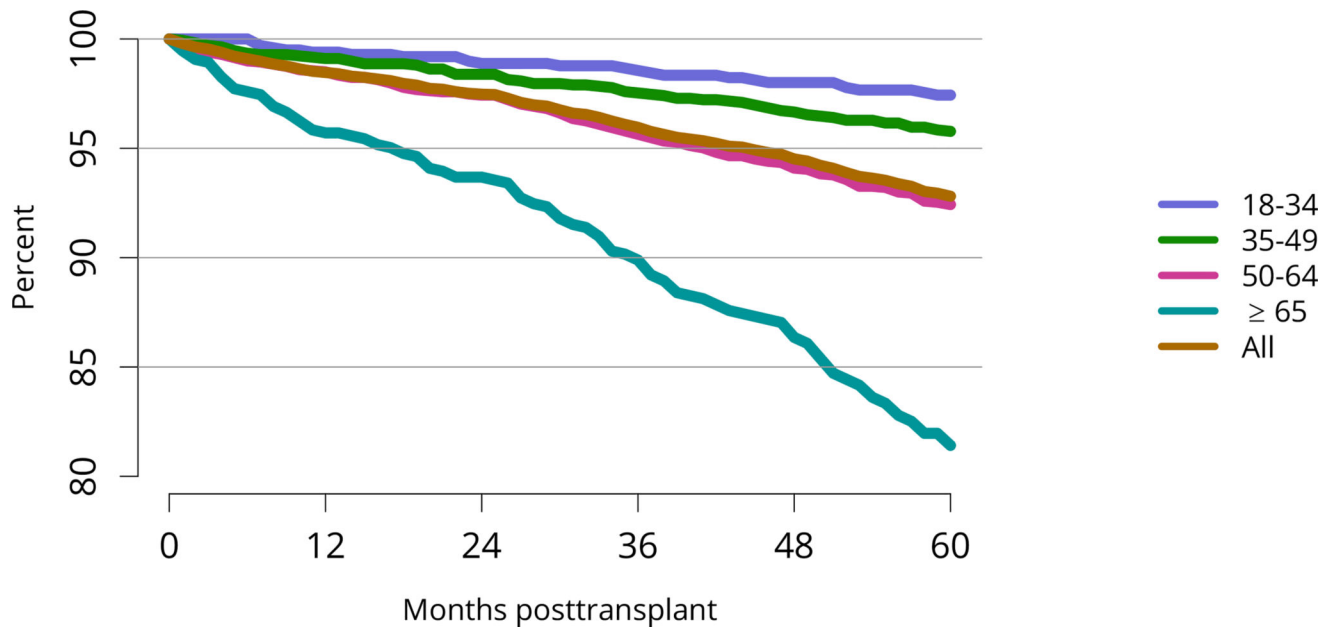


Figure KI 88. Patient survival among adult living donor kidney transplant recipients, 2011, by age

Patient survival estimated using unadjusted KaplanMeier methods. For recipients of more than one transplant during the period, only the first is considered.

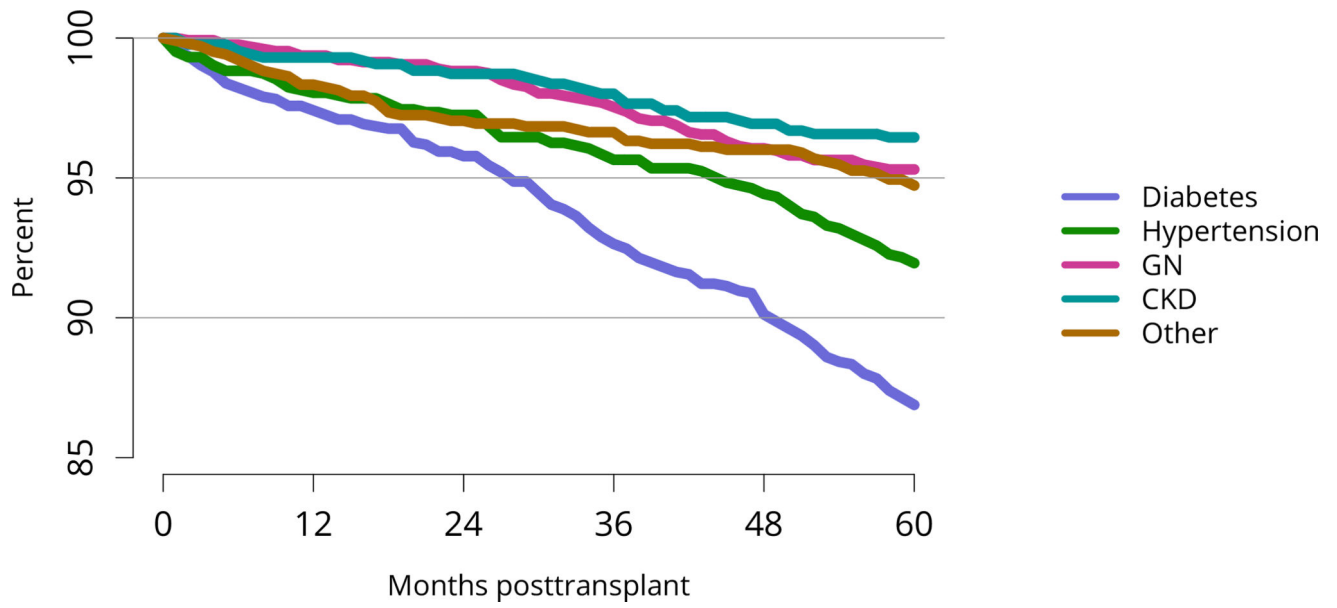


Figure KI 89. Patient survival among adult living donor kidney transplant recipients, 2011, by diagnosis
 Patient survival estimated using unadjusted Kaplan-Meier methods. For recipients of more than one transplant during the period, only the first is considered. CKD, cystic kidney disease; GN, glomerulonephritis.

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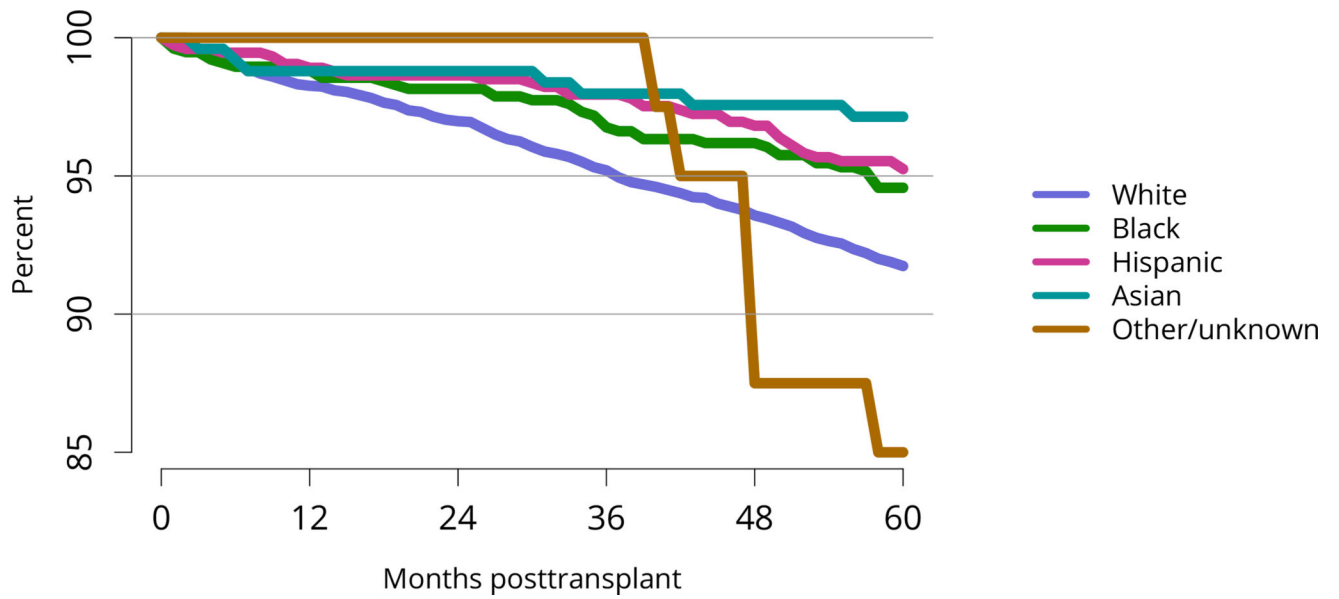


Figure KI 90. Patient survival among adult living donor kidney transplant recipients, 2011, by race
Patient survival estimated using unadjusted Kaplan-Meier methods. For recipients of more than one transplant during the period, only the first is considered.

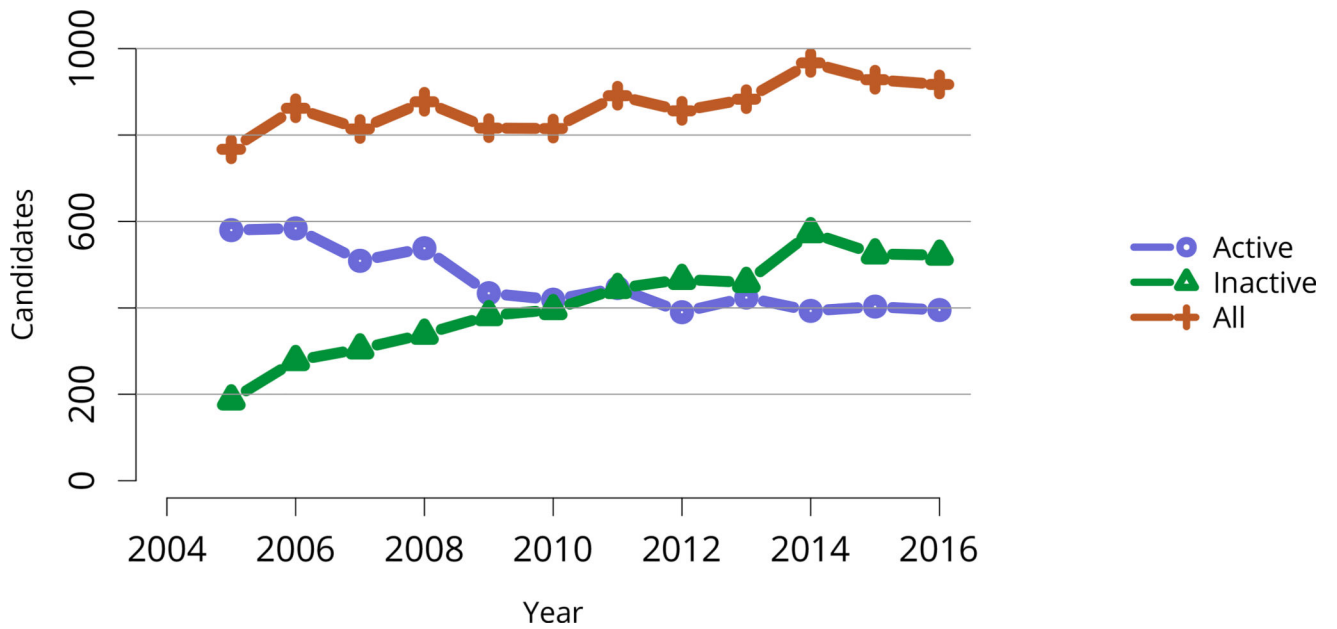


Figure KI 91. New pediatric candidates added to the kidney transplant waiting list

A new candidate is one who first joined the list during the given year, without having been listed in a previous year. Previously listed candidates who underwent transplant and subsequently relisted are considered new. Candidates concurrently listed at multiple centers are counted once. Active and inactive patients are included. Age determined at listing.

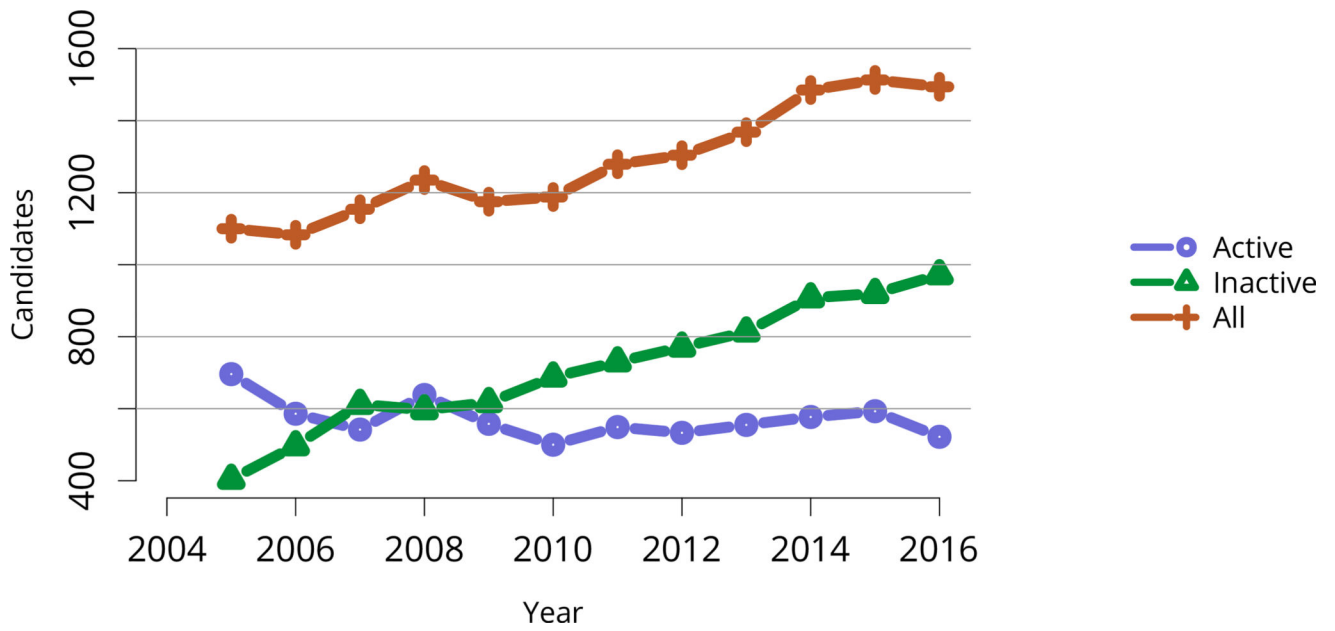


Figure KI 92. Pediatric candidates listed for kidney transplant on December 31 each year
Candidates concurrently listed at multiple centers are counted once. Those with concurrent listings and active at any program are considered active. Active status is determined on day 7 after first listing; age determined at first listing.

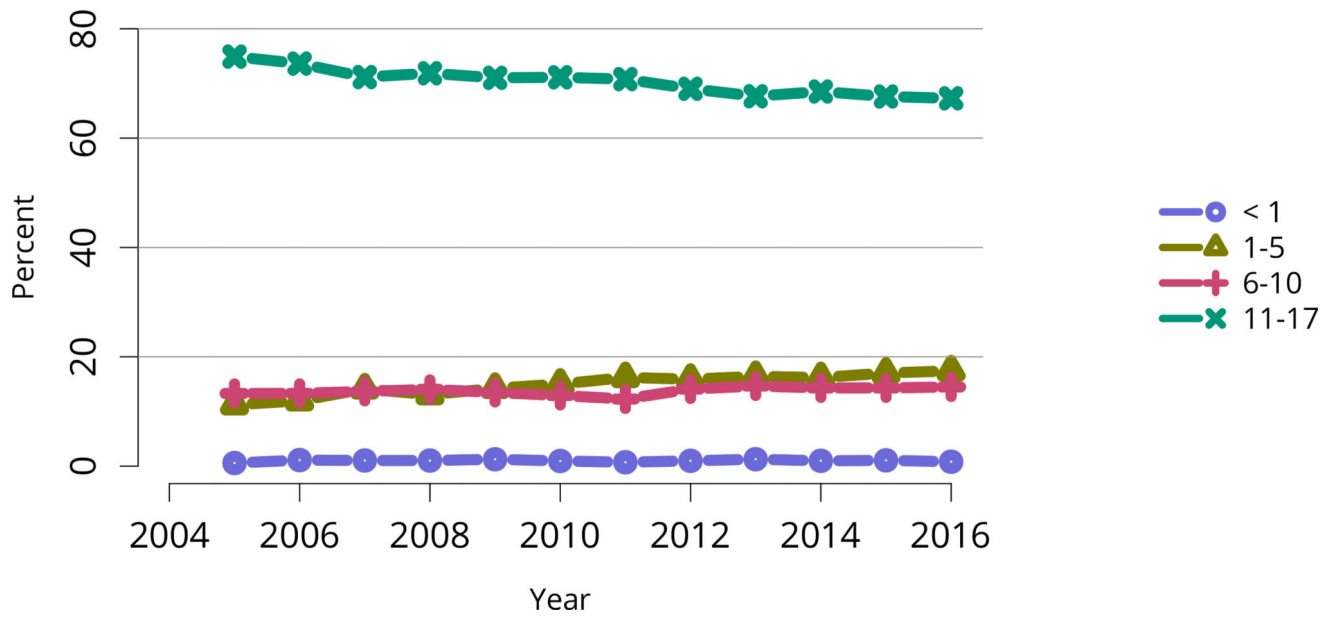


Figure KI 93. Distribution of pediatric candidates waiting for kidney transplant by age
 Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Age is determined at the later of listing date or January 1 of the given year. Active and inactive candidates are included.

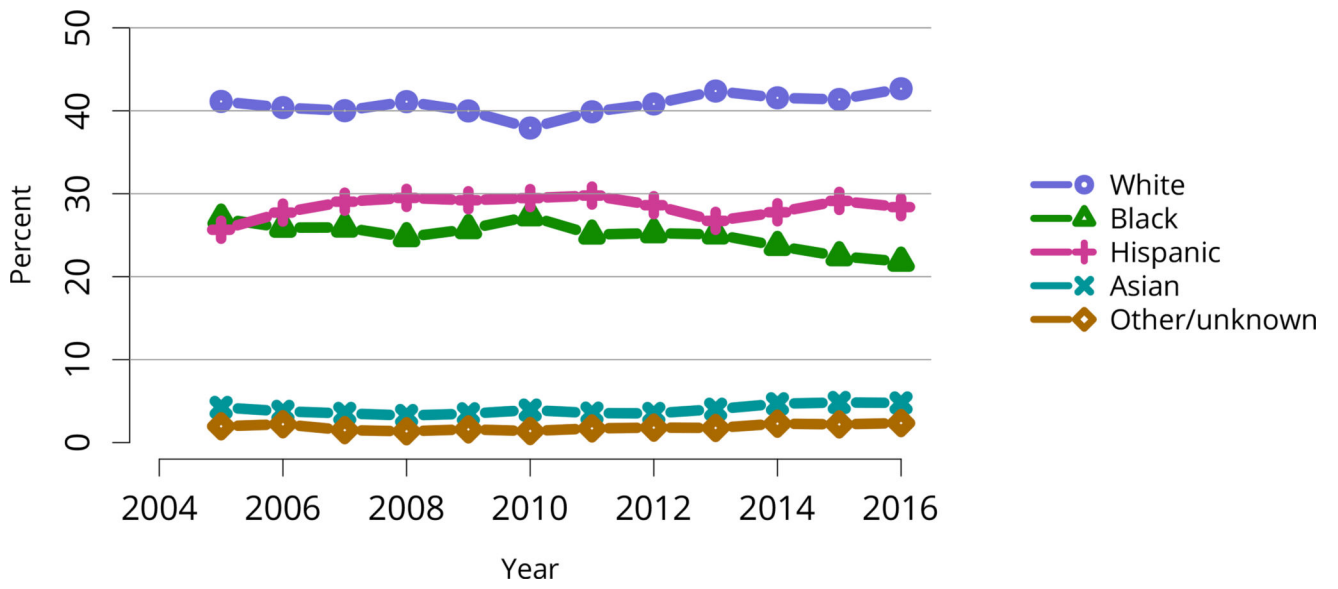


Figure KI 94. Distribution of pediatric candidates waiting for kidney transplant by race
 Candidates waiting for transplant any time in the given year. Candidates listed concurrently at multiple centers are counted once. Active and inactive candidates are included.

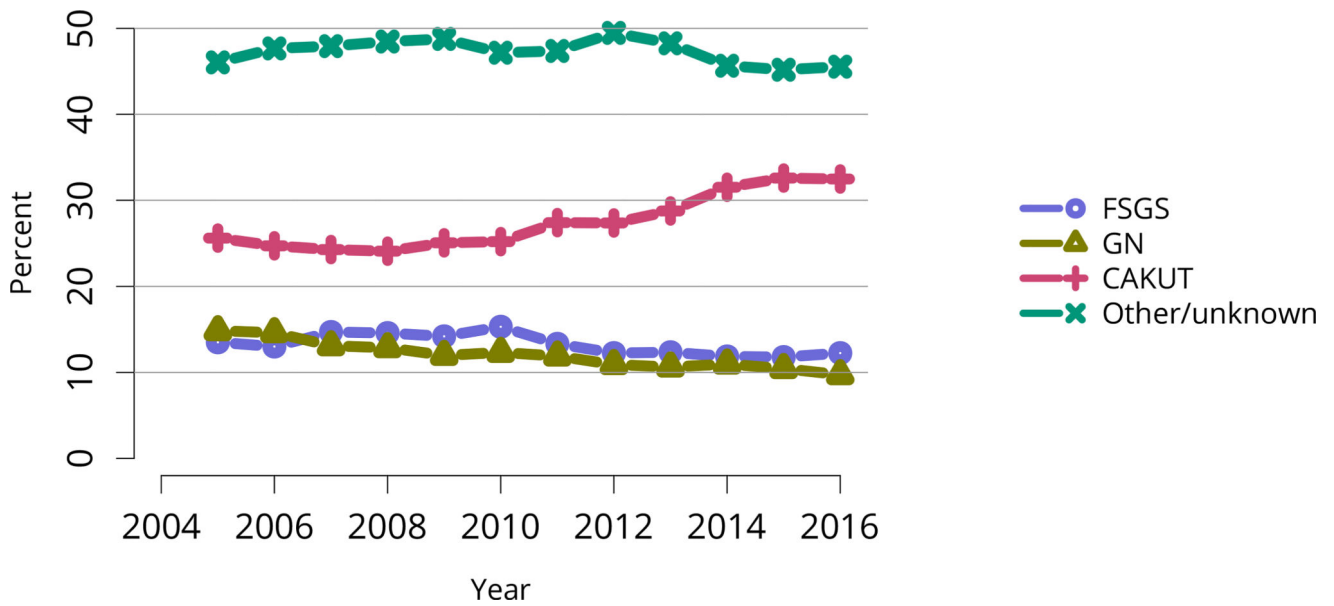


Figure KI 95. Distribution of pediatric candidates waiting for kidney transplant by diagnosis
 Candidates waiting for transplant any time in the given year. Candidates listed concurrently at multiple centers are counted once. Diagnosis categories follow North American Pediatric Renal Trials and Collaborative Studies recommendations. Active and inactive candidates are included. FSGS, focal segmental glomerulosclerosis; GN, glomerulonephritis; CAKUT, congenital anomalies of the kidney and urinary tract.

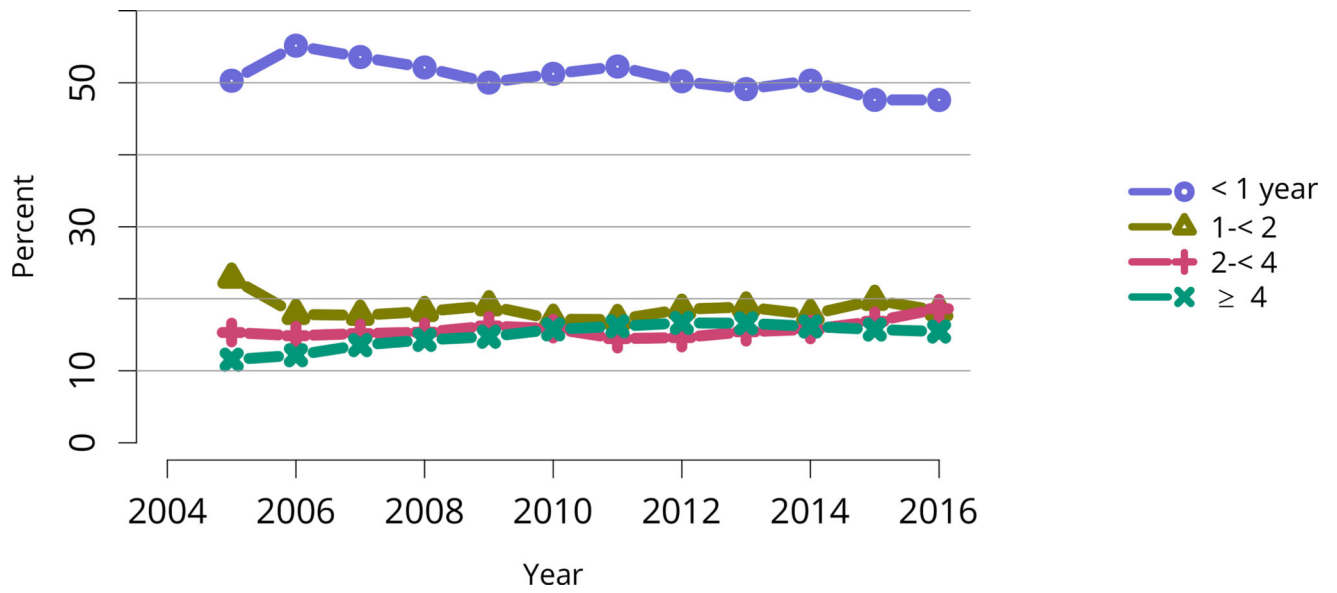


Figure KI 96. Distribution of pediatric candidates waiting for kidney transplant by waiting time
 Candidates waiting for transplant any time in the given year. Candidates listed concurrently at multiple centers are counted once. Time on the waiting list is determined at the earlier of December 31 or removal from the waiting list. Active and inactive candidates are included.

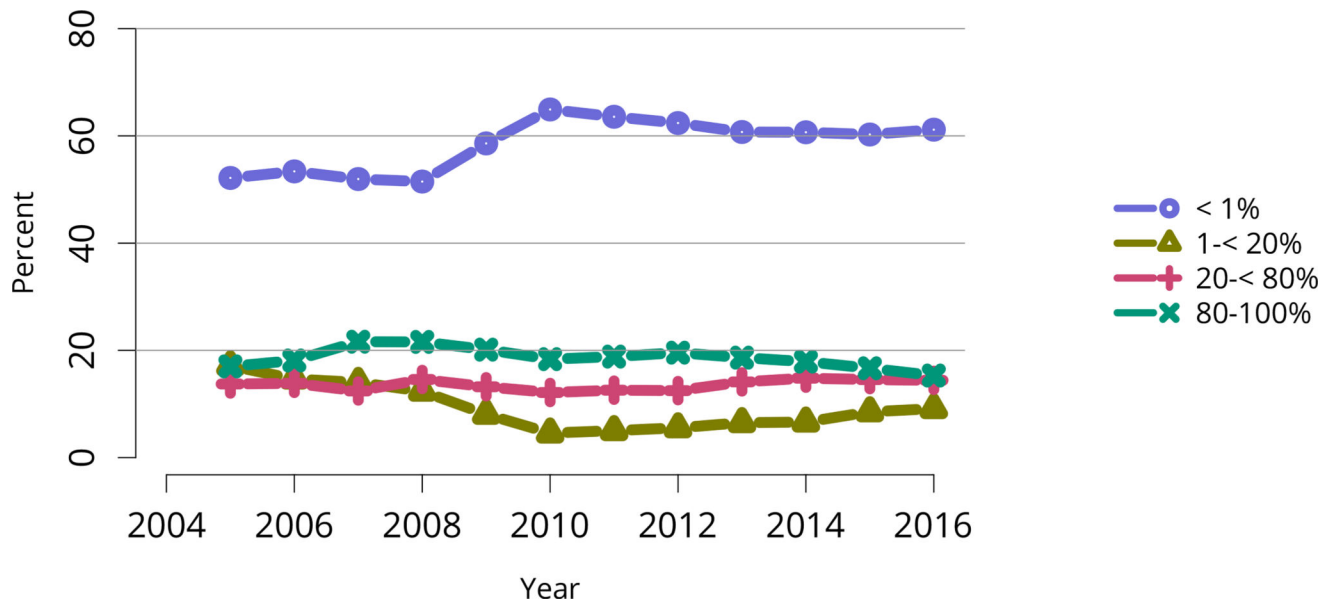


Figure KI 97. Distribution of pediatric candidates waiting for kidney transplant by C/PRA
 Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. From December 5, 2007, through September 30, 2009, CPRA was used if greater than 0; otherwise, the maximum pretransplant PRA was used. Before December 5, 2007, the maximum pretransplant PRA was used unconditionally. CPRA is used after September 30, 2009. C/PRA is the highest value during the year. Active and inactive candidates are included.

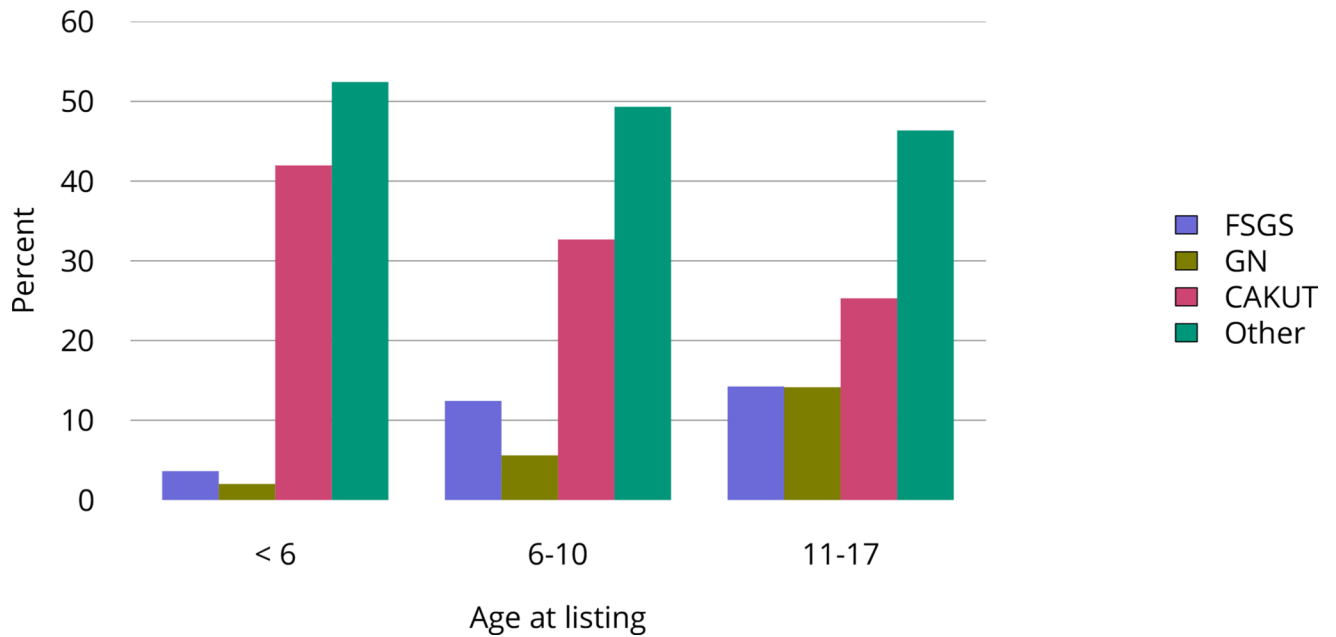


Figure KI 98. Primary cause of ESRD in pediatric candidates waiting for kidney transplant by age, 2011–2015

Candidates who joined the list 2011–2015. Candidates concurrently listed at more than one center are counted once. Patients who were listed, underwent transplant, and were relisted during the time period are counted more than once. Age is computed at earliest listing date. FSGS, focal segmental glomerulosclerosis; GN, glomerulonephritis; CAKUT, congenital anomalies of the kidney and urinary tract.

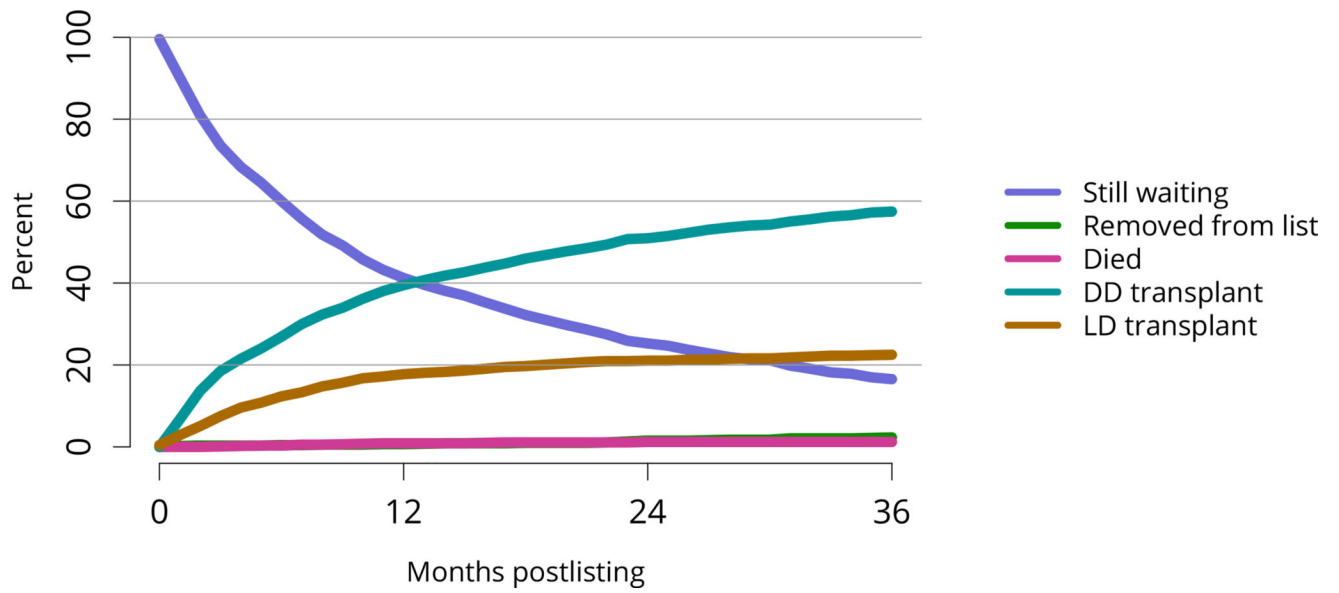


Figure KI 99. Three-year outcomes for newly listed pediatric candidates waiting for kidney transplant, 2013

Pediatric candidates who joined the waitlist in 2013. Candidates concurrently listed at more than one center are counted once, from the time of earliest listing to the time of latest removal. DD, deceased donor; LD, living donor.

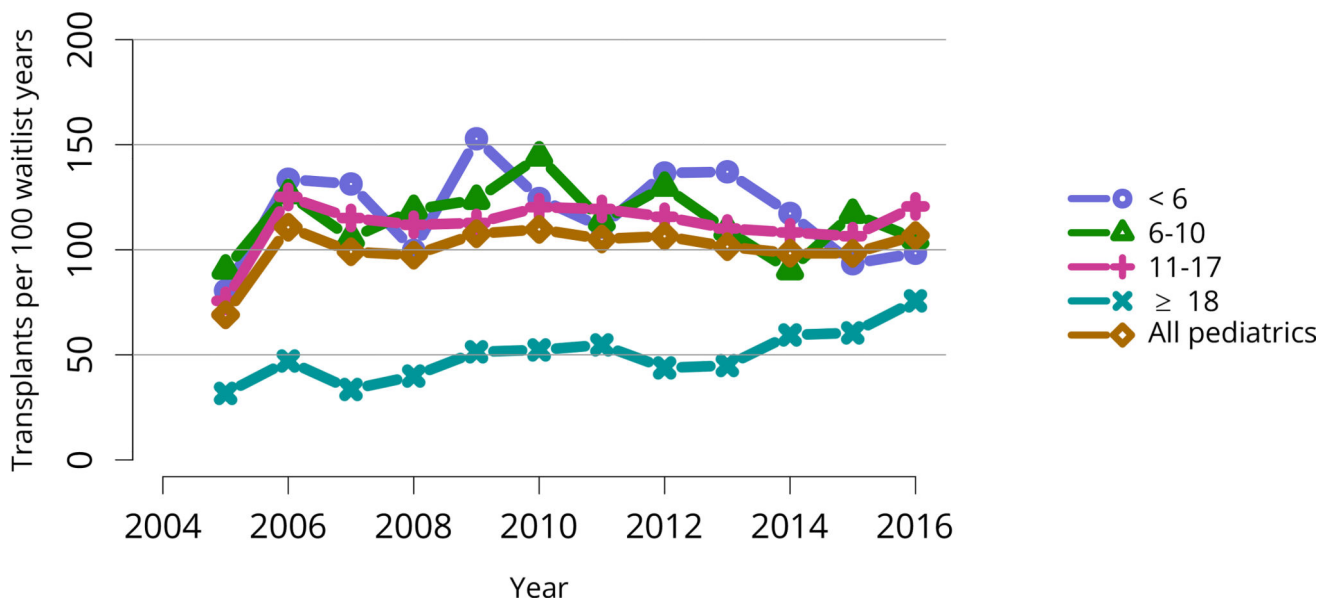


Figure KI 100. Deceased donor kidney transplant rates among active pediatric waitlist candidates by age

Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of active waiting in a given year. Individual listings are counted separately. Age is determined at the later of listing date or January 1 of the given year. Rates with less than 10 patient-years of exposure are not shown. The age category 18 years or older includes candidates listed when pediatrics but still on the list in the given year.

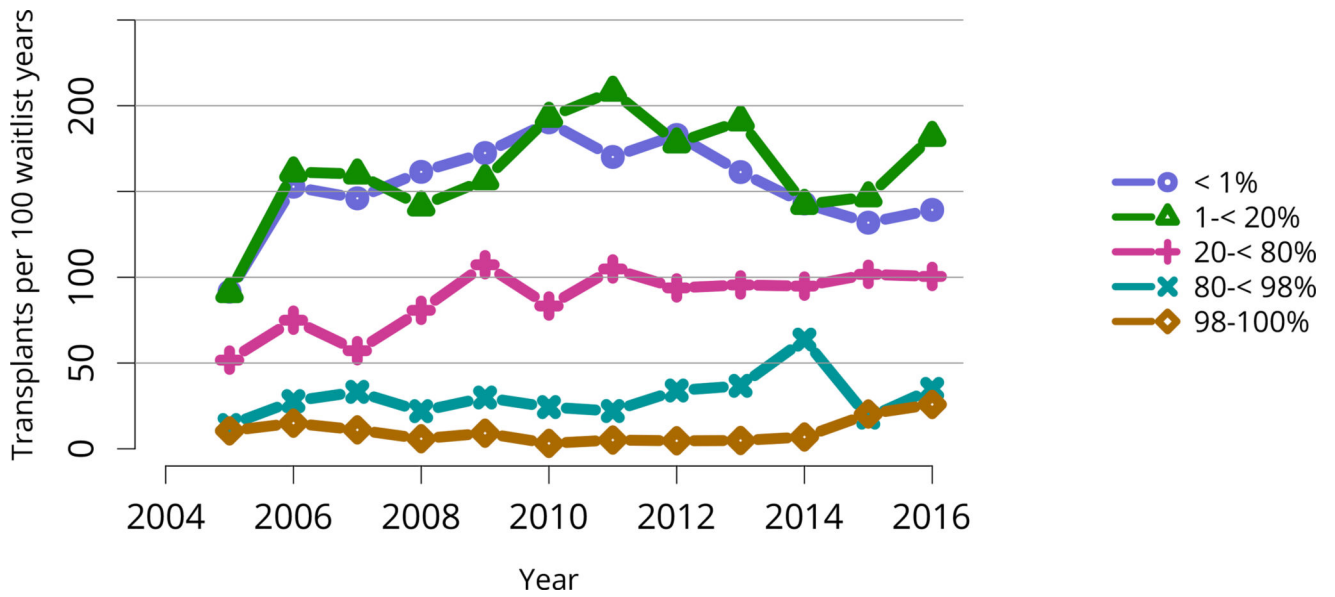


Figure KI 101. Deceased donor kidney transplant rates among active pediatric waitlist candidates by C/PRA

Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of active waiting in a given year. Individual listings are counted separately. Rates with less than 10 patient-years of exposure are not shown.

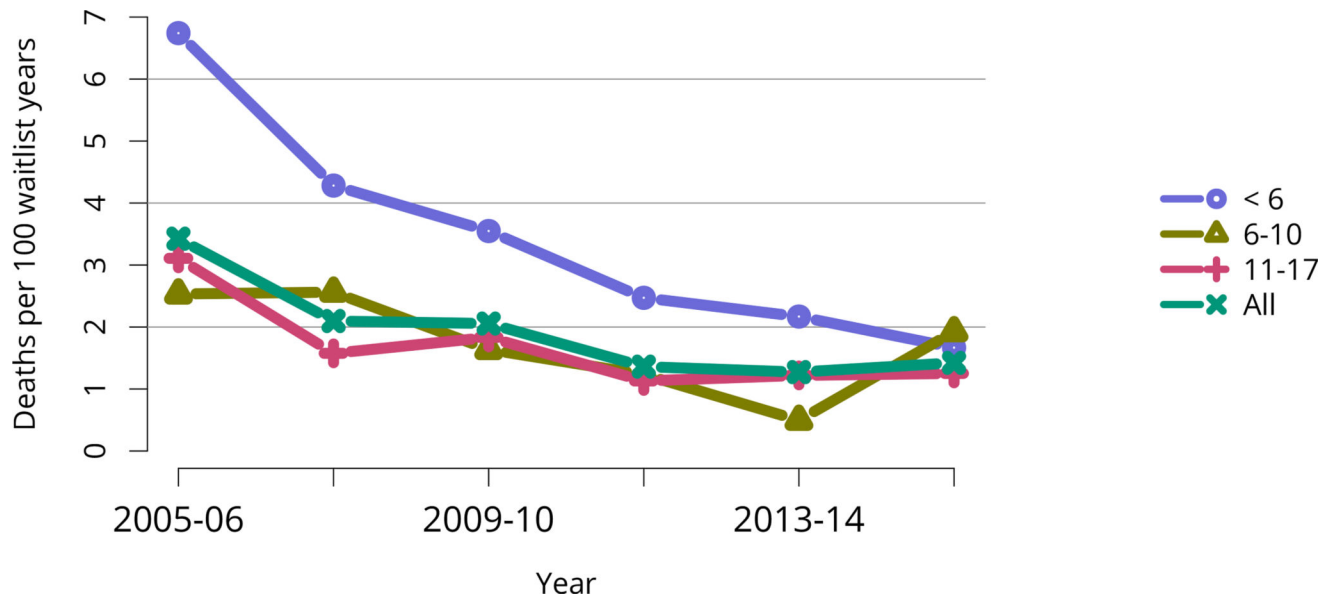


Figure KI 102. Pretransplant mortality rates among pediatric waitlisted for kidney transplant by age

Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Individual listings are counted separately. Age is determined at the later of listing date or January 1 of the given year. Rates with less than 10 patient-years of exposure are not shown.

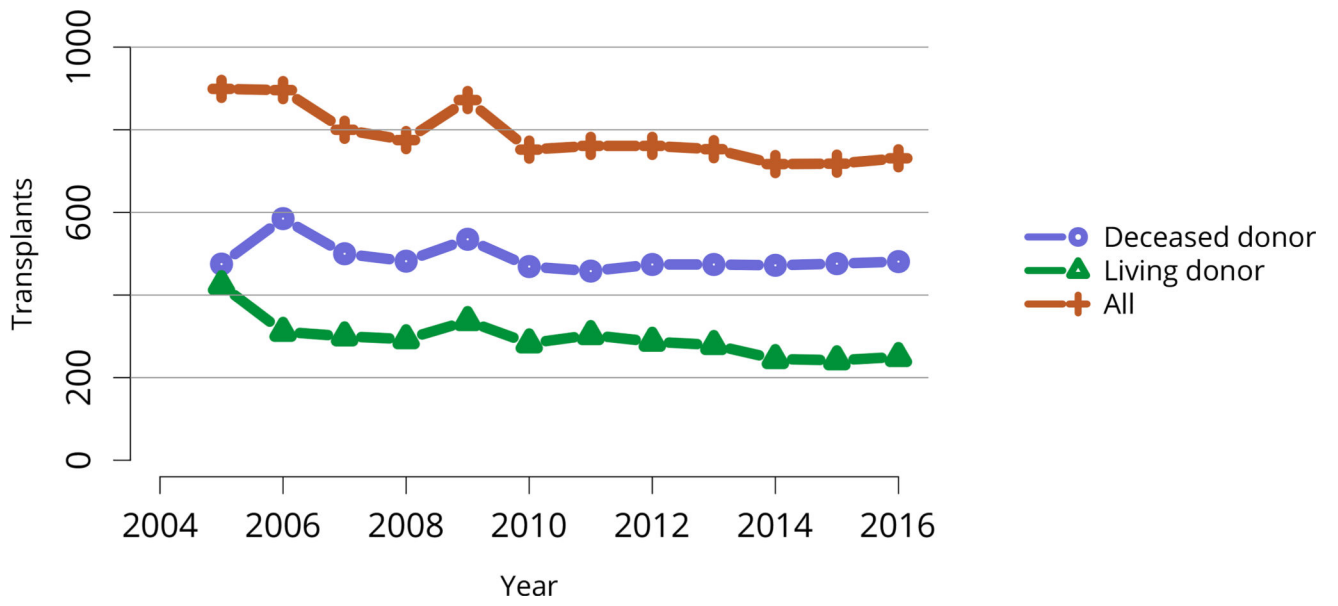


Figure KI 103. Pediatric kidney transplants by donor type
 All pediatric kidney transplant recipients, including retransplant, and multi-organ recipients.

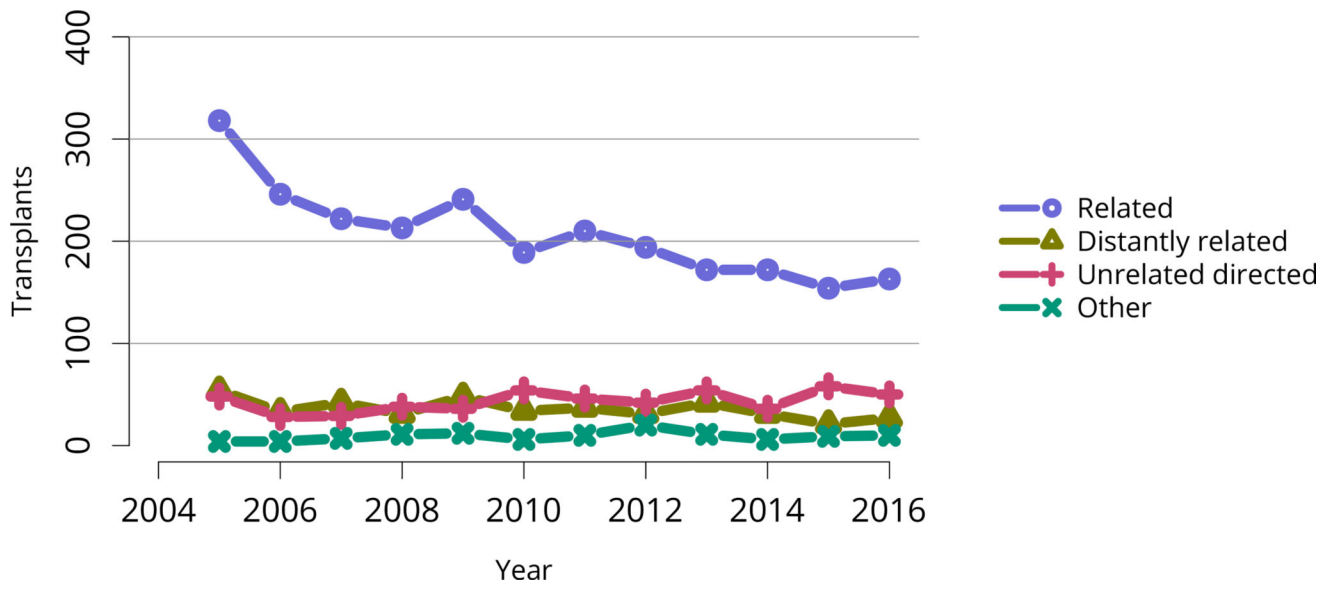


Figure KI 104. Pediatric kidney transplants from living donors by relation
Relationship of living donor to recipient is as indicated on the OPTN Living Donor Registration Form.

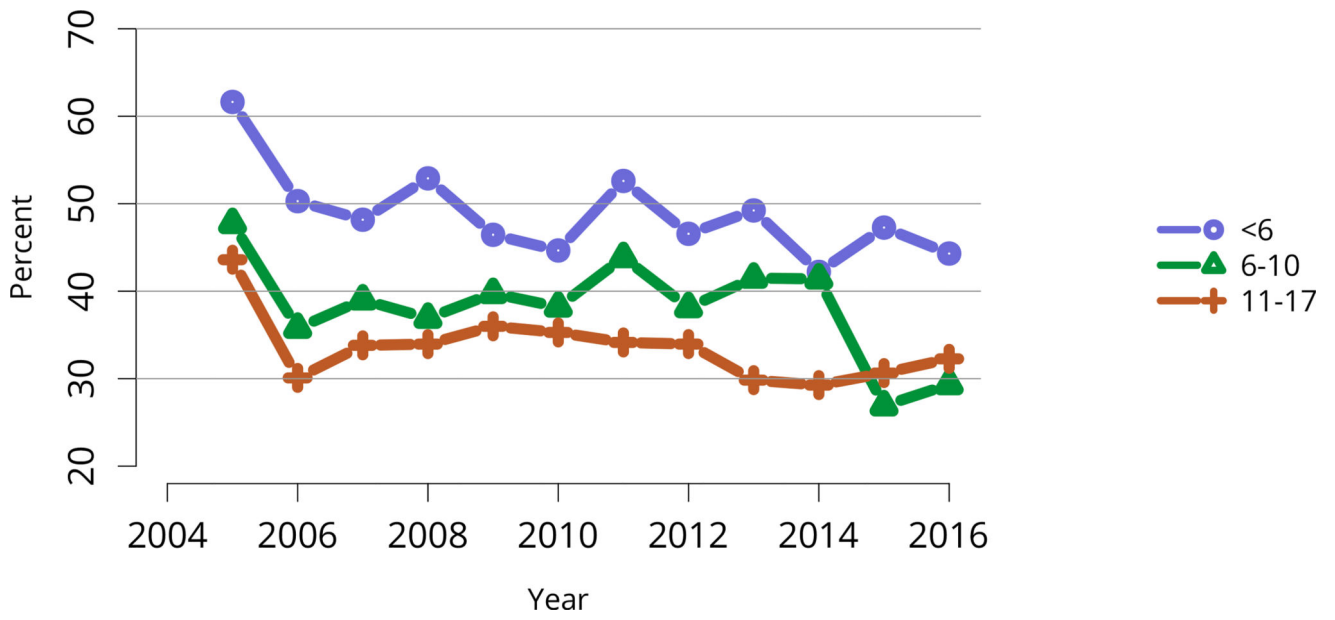


Figure KI 105. Percent of pediatric kidney transplants from living donors by recipient age
All pediatric living kidney transplant recipients, including retransplant, and multi-organ recipients.

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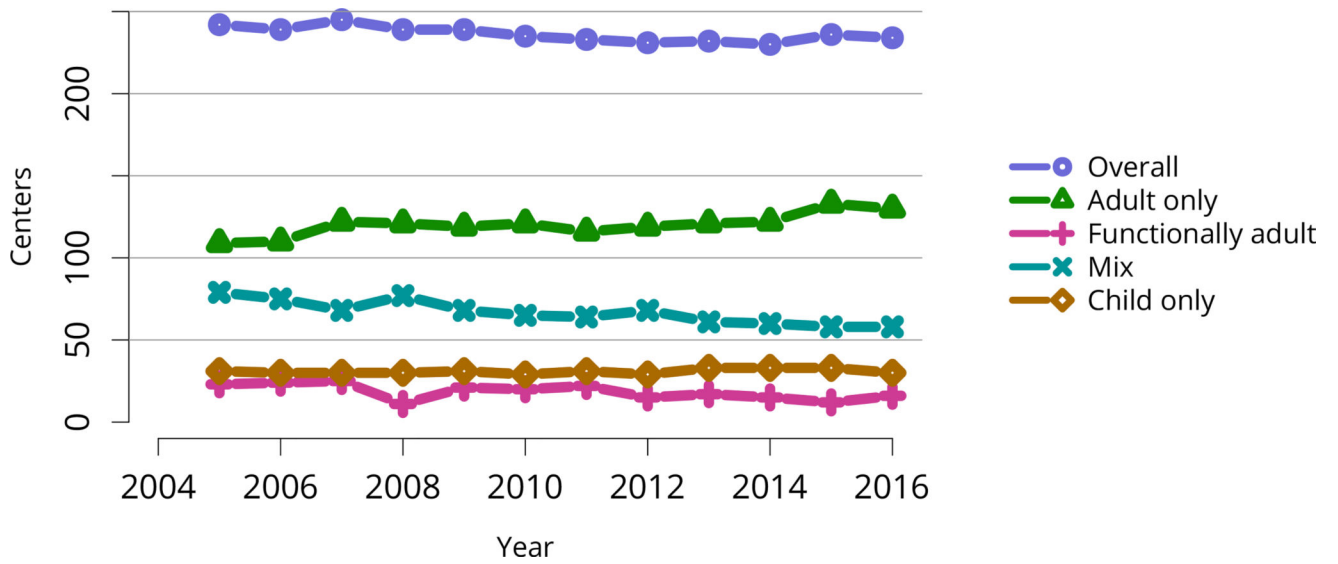


Figure KI 106. Number of centers performing pediatric and adult kidney transplants by center's age mix

Adult centers transplanted only recipients aged 18 years or older. Functionally adult centers transplant 80% adults or more, and the remainder were children aged 15–17 years. Mixed included adults and children of any age groups. Child only centers transplanted recipients aged 0–17 years, and small number of adults up to age 21 years.

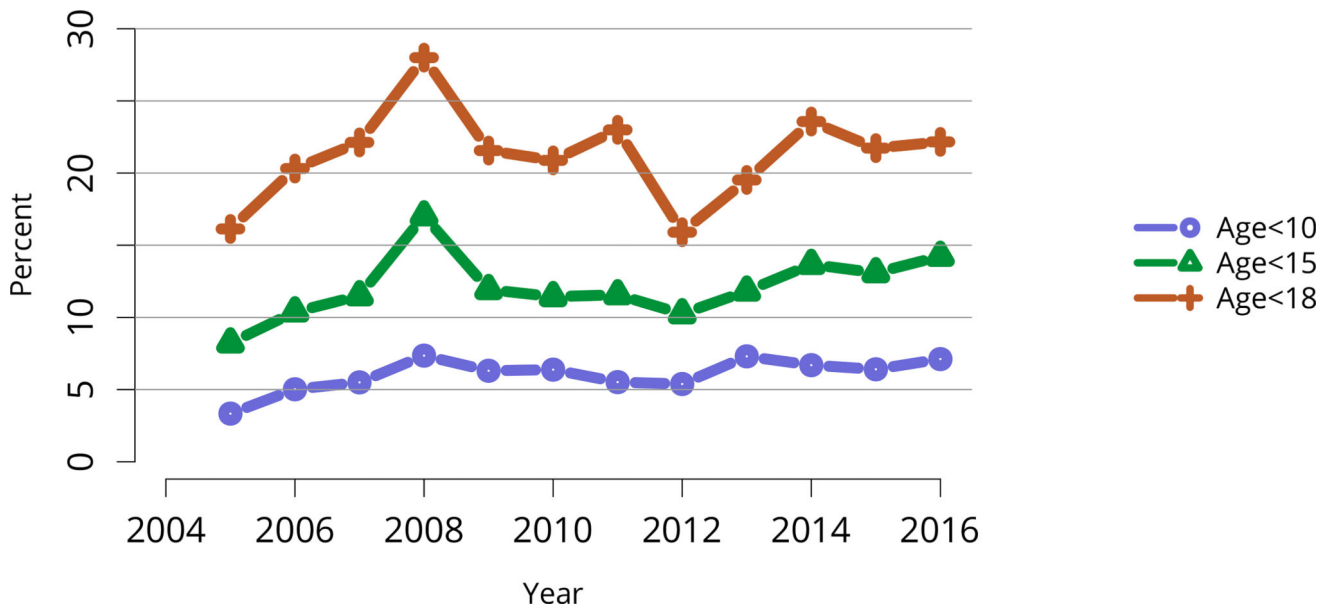


Figure KI 107. Pediatric kidney recipients at programs that perform 5 or fewer pediatric transplants annually
Age groups are cumulative.

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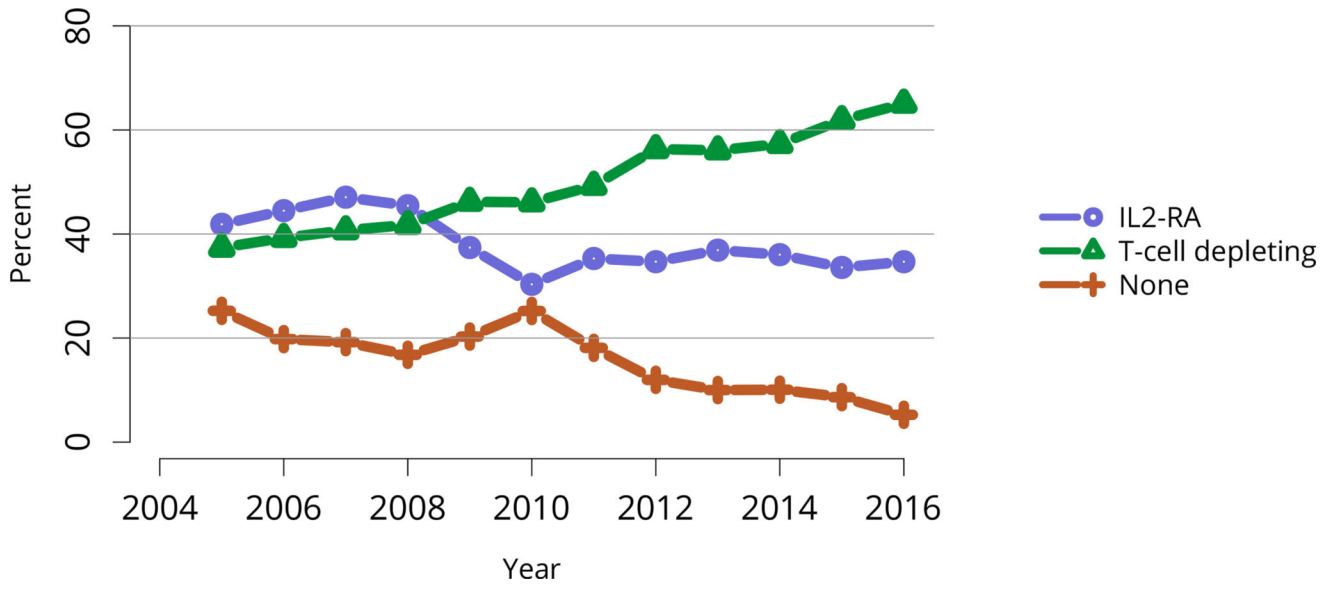


Figure KI 108. Induction agent use in pediatric kidney transplant recipients
Immunosuppression at transplant reported to the OPTN. IL2-RA, interleukin-2 receptor antagonist.

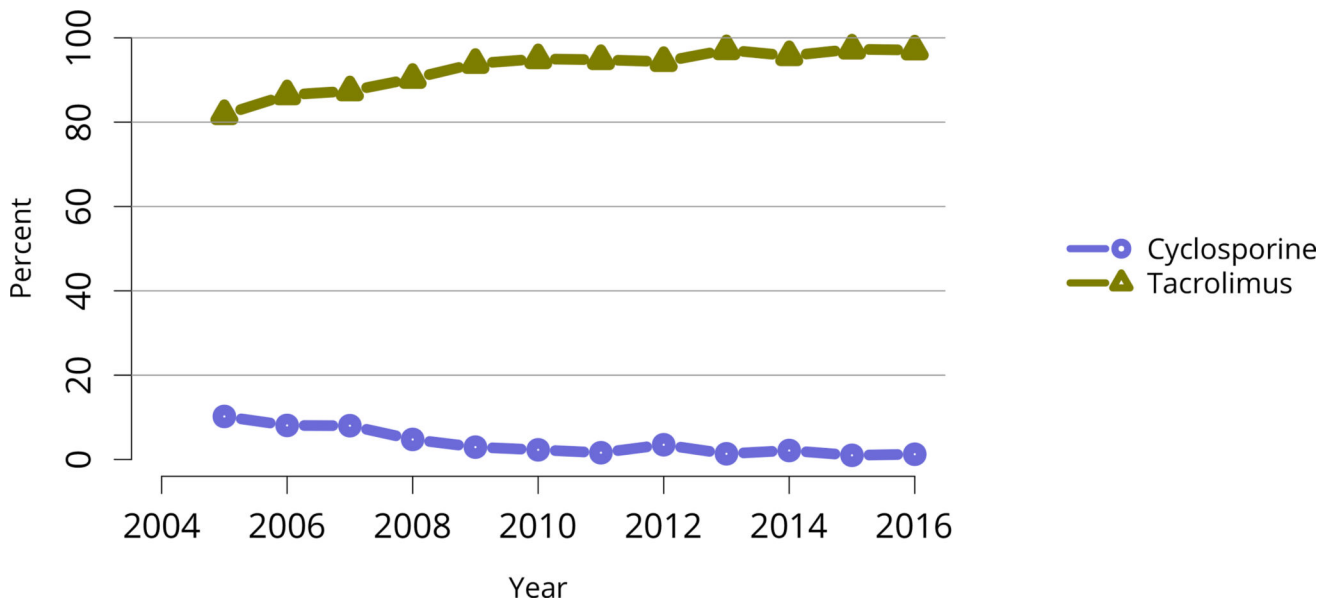


Figure KI 109. Calcineurin inhibitor use in pediatric kidney transplant recipients
Immunosuppression at transplant reported to the OPTN.

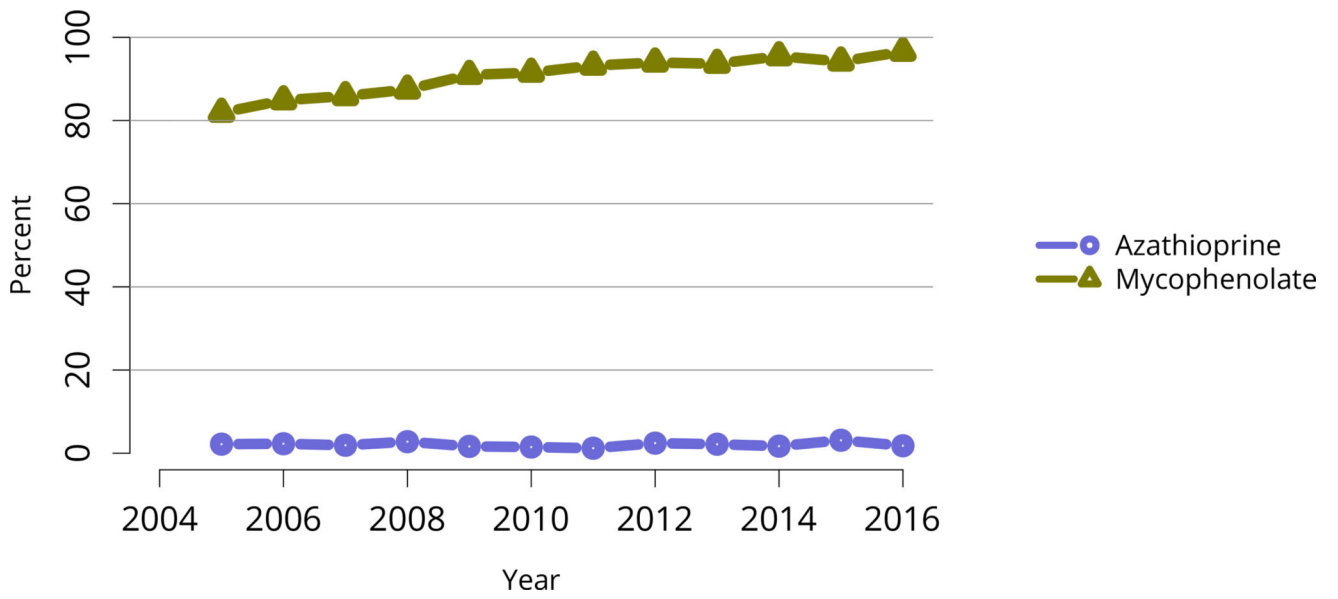


Figure KI 110. Anti-metabolite use in pediatric kidney transplant recipients
Immunosuppression at transplant reported to the OPTN. Mycophenolate includes mycophenolate mofetil and mycophenolate sodium.

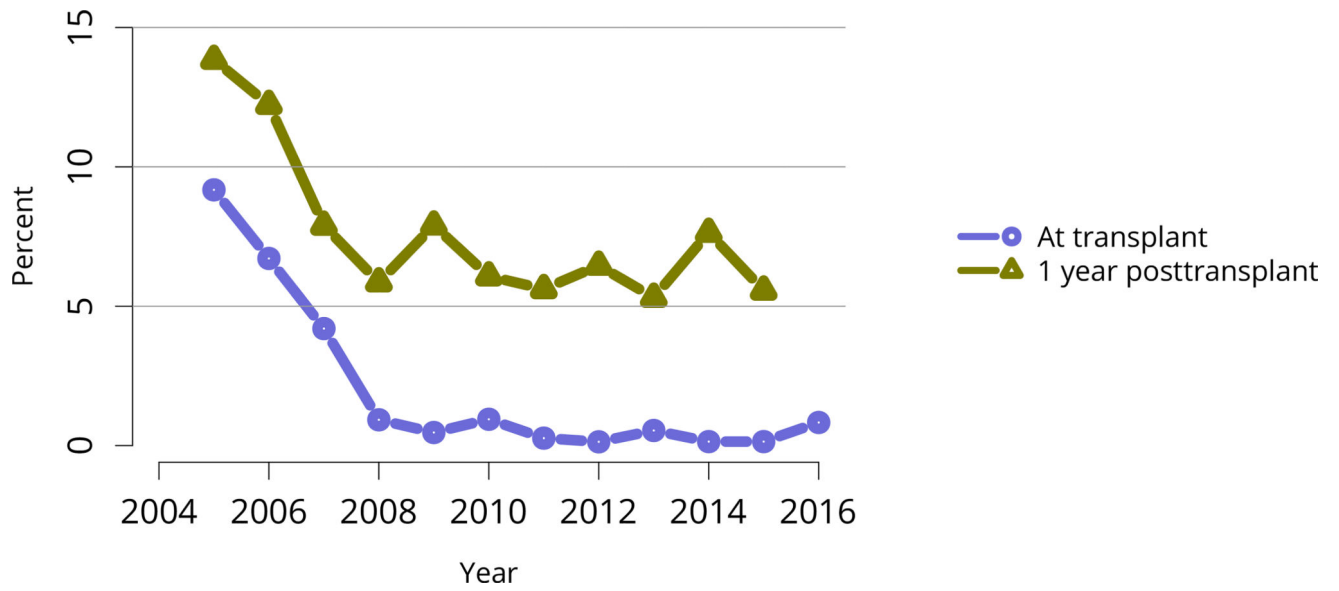


Figure KI 111. mTOR inhibitor use in pediatric kidney transplant recipients

Immunosuppression at transplant reported to the OPTN. One-year posttransplant data are limited to patients alive with graft function at 1 year posttransplant. mTOR, mammalian target of rapamycin.

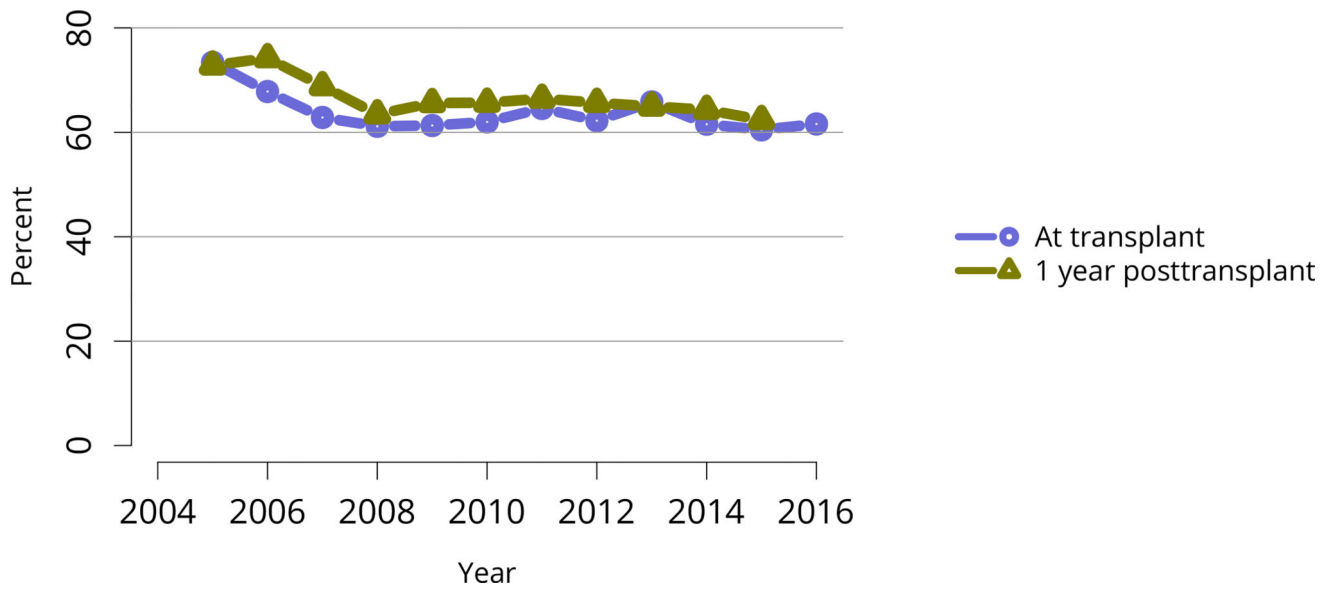


Figure KI 112. Steroid use in pediatric kidney transplant recipients
Immunosuppression at transplant reported to the OPTN. One-year posttransplant data are limited to patients alive with graft function at 1 year posttransplant.

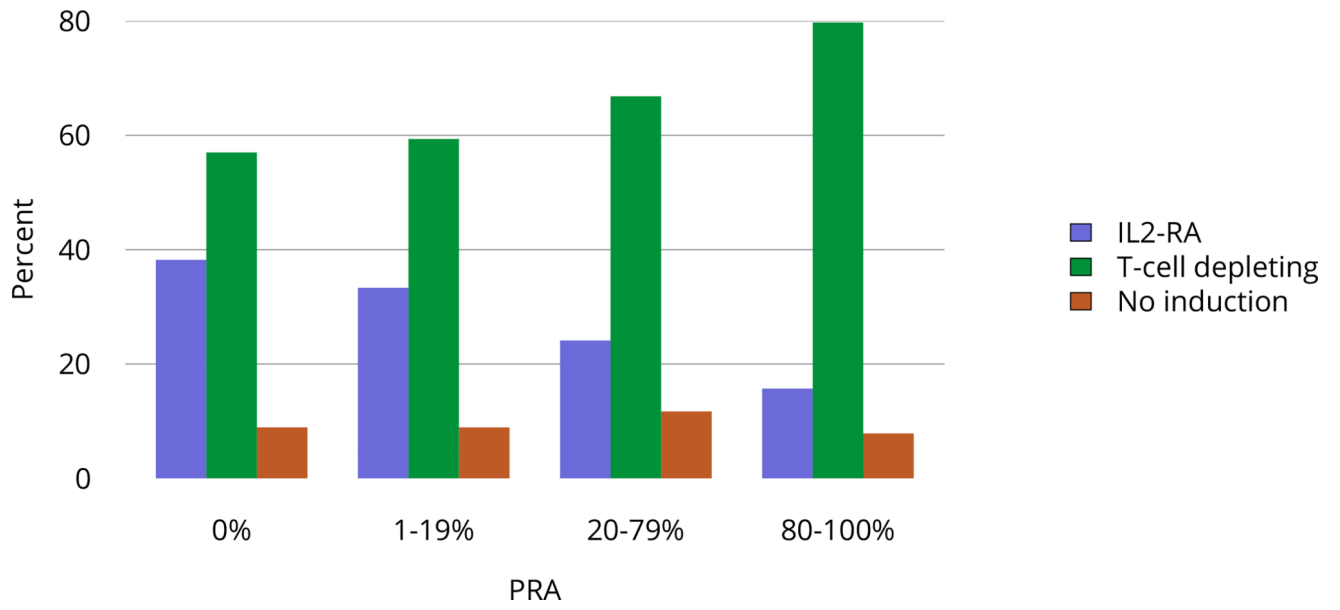


Figure KI 113. Induction use by C/PRA among pediatric kidney transplant recipients, 2012–2016
IL2-RA, interleukin-2 receptor antagonist.

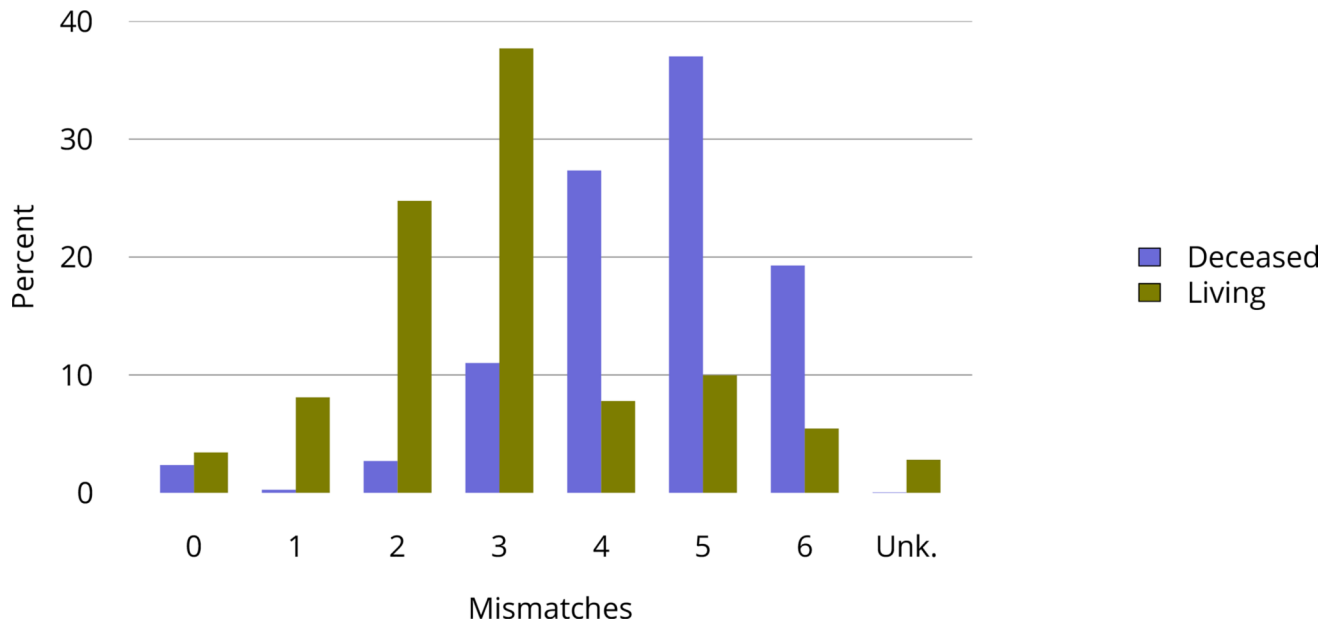


Figure KI 114. Total HLA A, B, and DR mismatches among pediatric kidney transplant recipients, 2012–2016
Donor and recipient antigen matching is based on OPTN antigen values and split equivalences policy as of 2016.

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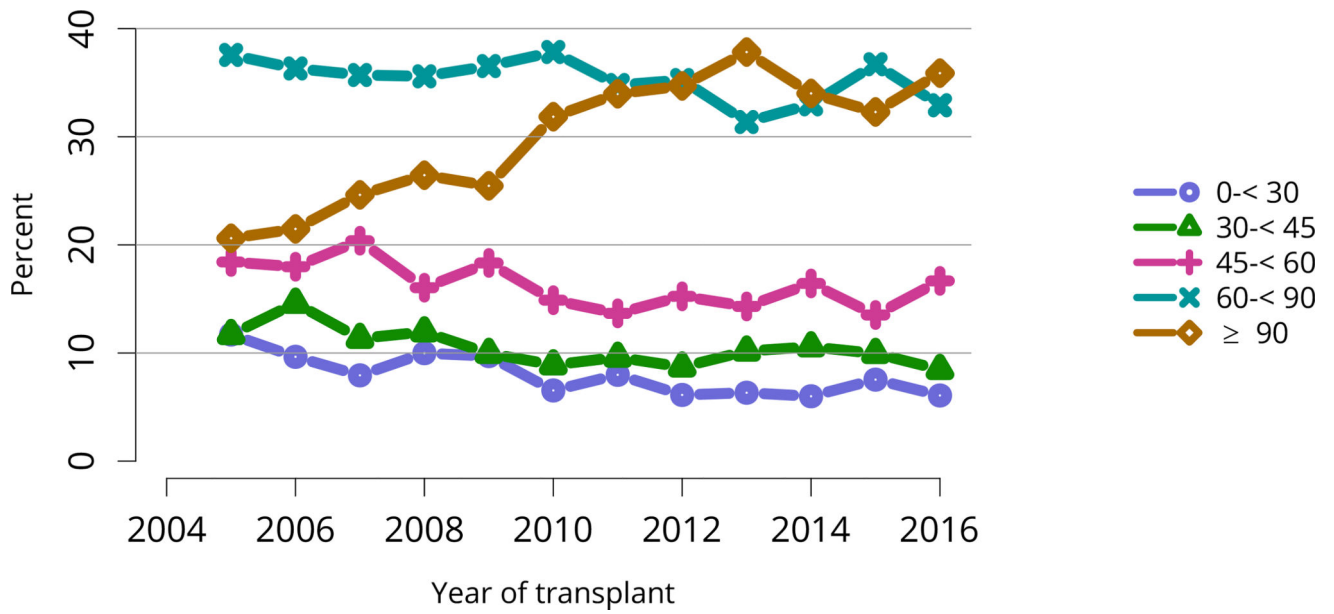


Figure KI 115. Distribution of eGFR at discharge among pediatric kidney-alone transplant recipients

GFR (mL/min/1.73 m²) estimated using the bedside Schwartz equation, and computed for patients alive with graft function at discharge. Equation: eGFR = 0.413*Height(cm)/Creatinine (mg/dL).

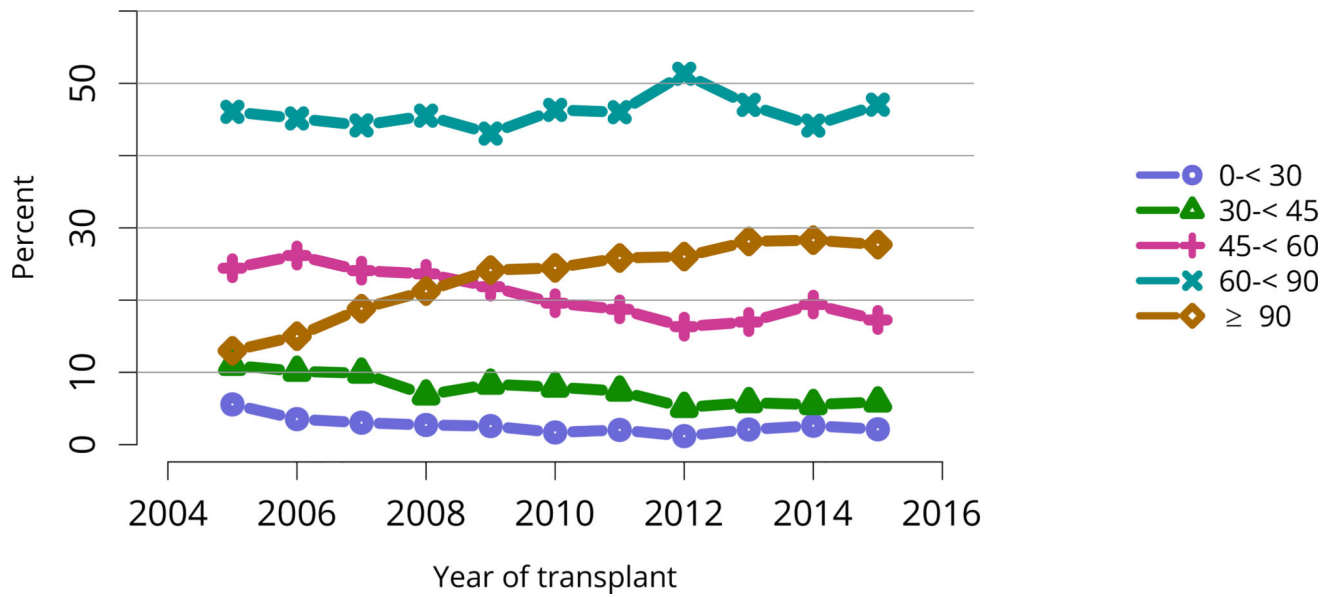


Figure KI 116. Distribution of eGFR at 12 months posttransplant among pediatric kidney-alone transplant recipients

GFR ($\text{mL}/\text{min}/1.73 \text{ m}^2$) estimated using the bedside Schwartz equation, and computed for patients alive with graft function at 12 months posttransplant. Equation: $\text{eGFR} = 0.413 \cdot \text{Height}(\text{cm}) / \text{Creatinine}(\text{mg}/\text{dL})$.

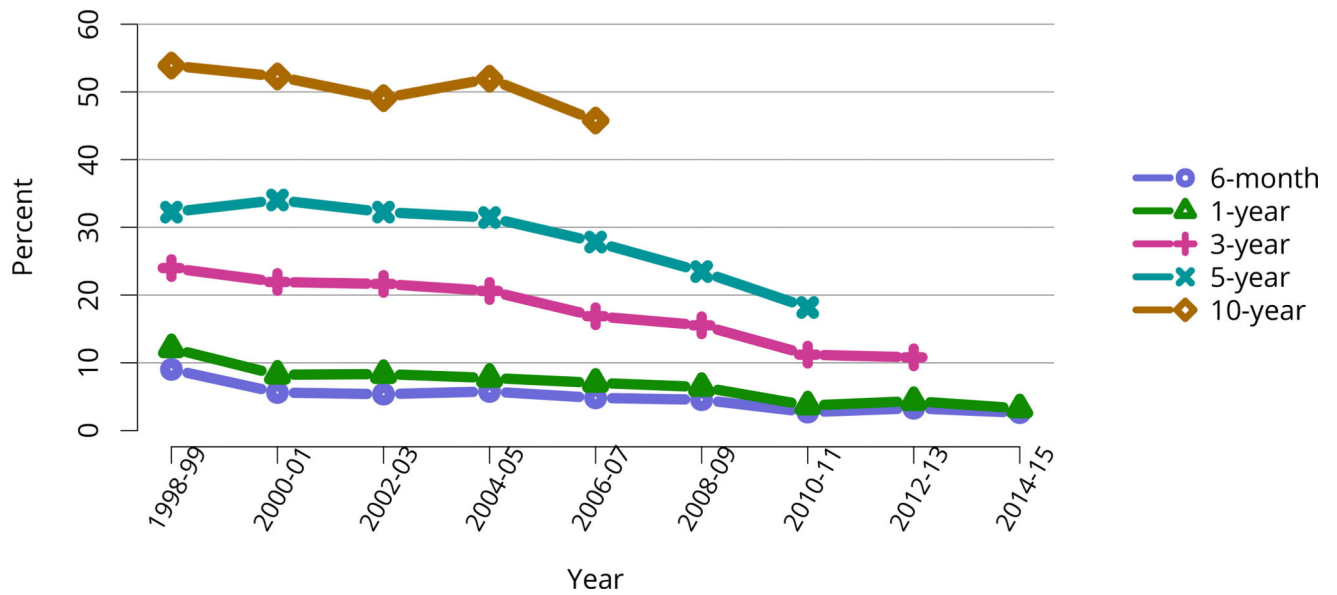


Figure KI 117. Graft failure among pediatric deceased donor kidney-alone transplant recipients
 Estimates are unadjusted, computed using KaplanMeier competing risk methods. Recipients are followed to the earliest of kidney graft failure; kidney retransplant; return to dialysis; death; or 6 months, 1, 3, 5, or 10 years posttransplant. All-cause graft failure (GF) is defined as any of the prior outcomes prior to 6 months, 1, 3, 5, or 10 years, respectively.

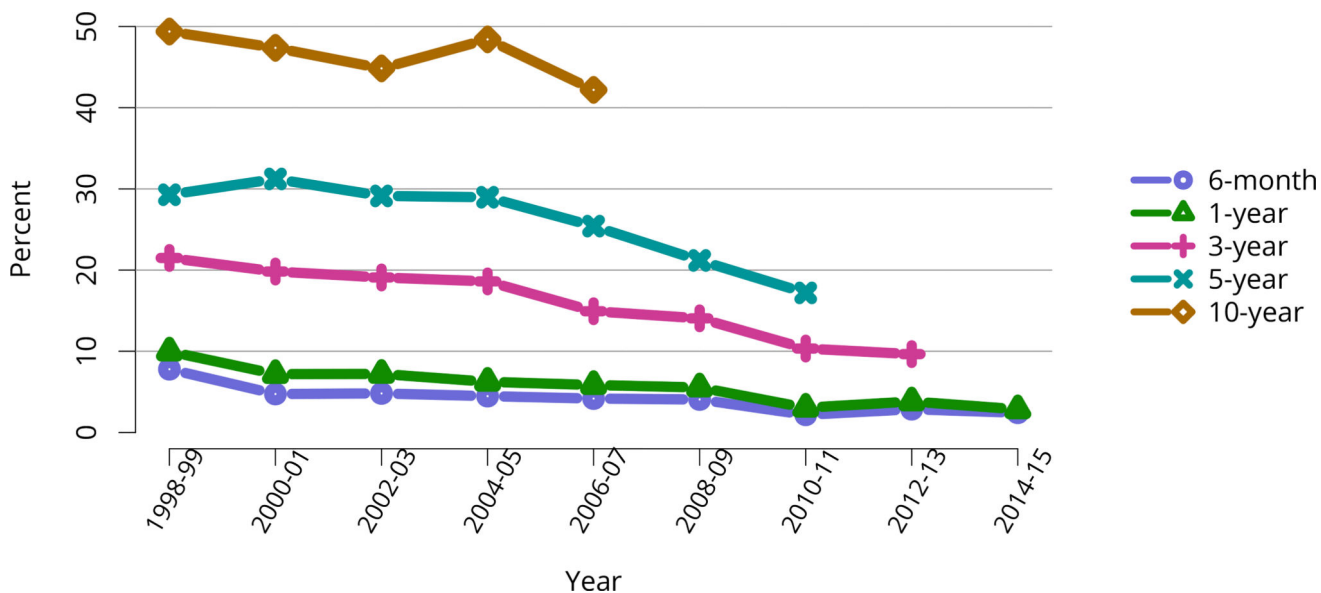


Figure KI 118. Death-censored graft failure among pediatric deceased donor kidney-alone transplant recipients

Estimates are unadjusted, computed using Kaplan-Meier competing risk methods. Recipients are followed to the earliest of kidney graft failure; kidney retransplant; return to dialysis; death; or 6 months, 1, 3, 5, or 10 years posttransplant. Death-censored graft failure (DCGF) is defined as a return to dialysis, reported graft failure, or kidney retransplant.

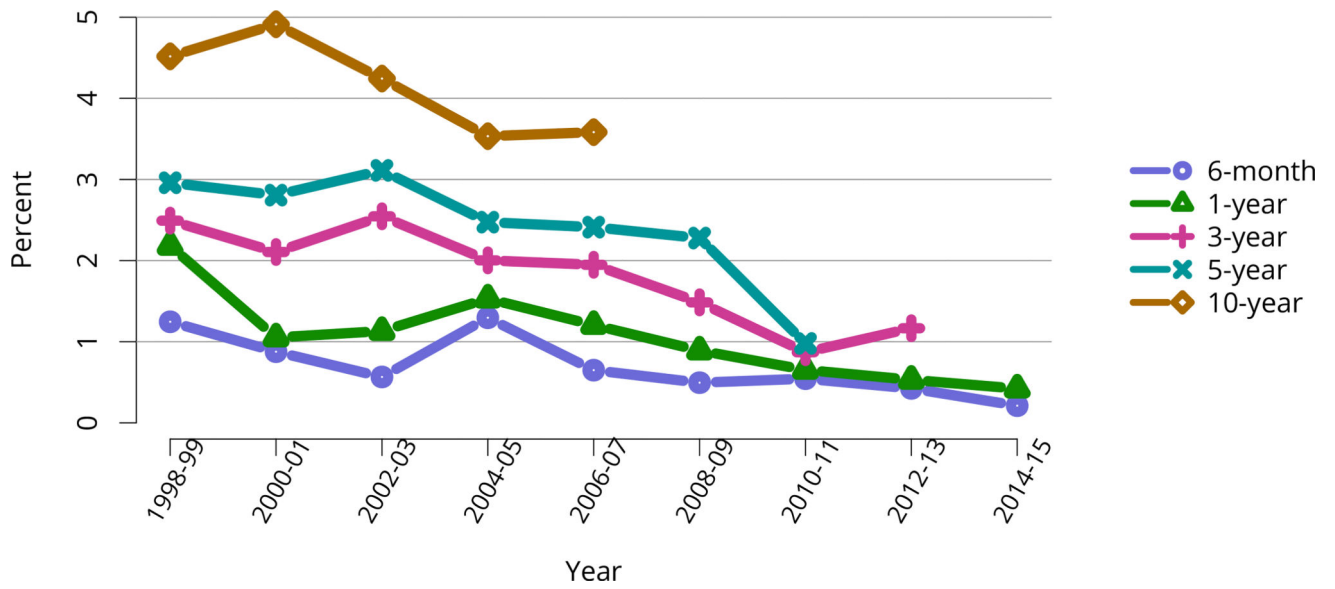


Figure KI 119. Death with function among pediatric deceased donor kidney-alone transplant recipients

Estimates are unadjusted, computed using Kaplan-Meier competing risk methods.

Recipients are followed to the earliest of kidney graft failure; kidney retransplant; return to dialysis; death; or 6 months, 1, 3, 5, or 10 years posttransplant. Death with function (DWF) is defined as death without prior graft failure, return to dialysis, or retransplant.

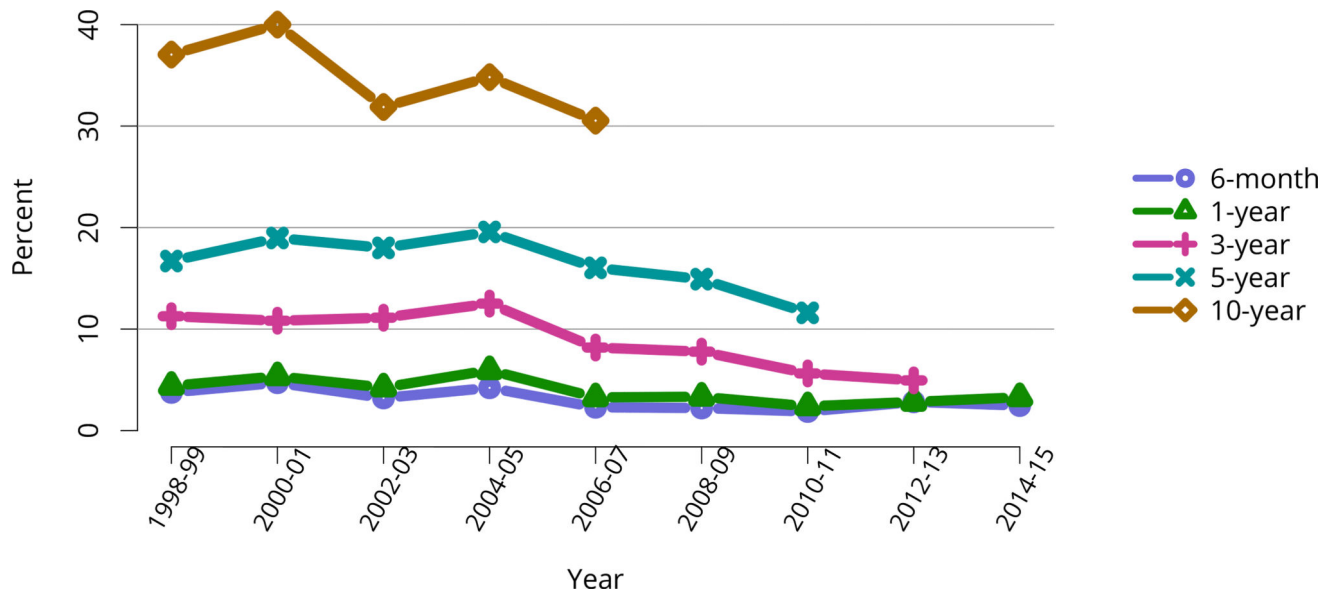


Figure KI 120. Graft failure among pediatric living donor kidney-alone transplant recipients
 Estimates are unadjusted, computed using KaplanMeier competing risk methods. Recipients are followed to the earliest of kidney graft failure; kidney retransplant; return to dialysis; death; or 6 months, 1, 3, 5, or 10 years posttransplant. All-cause graft failure (GF) is defined as any of the prior outcomes prior to 6 months, 1, 3, 5, or 10 years, respectively.

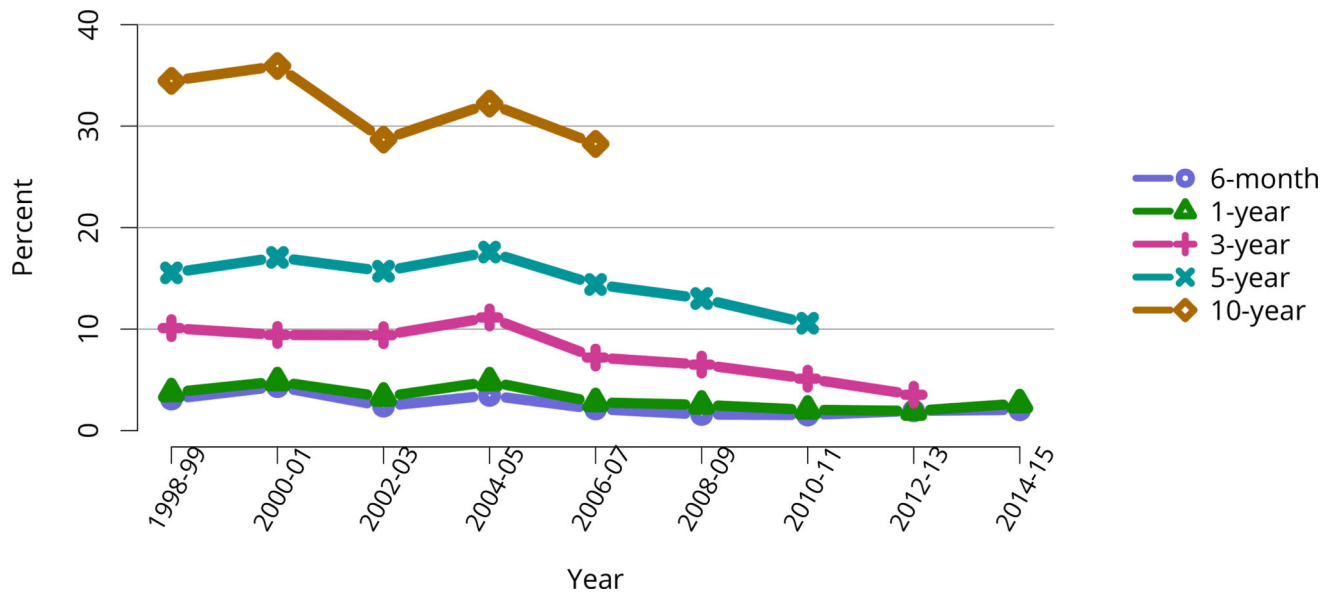


Figure KI 121. Death-censored graft failure among pediatric living donor kidney-alone transplant recipients

Estimates are unadjusted, computed using Kaplan-Meier competing risk methods.

Recipients are followed to the earliest of kidney graft failure; kidney retransplant; return to dialysis; death; or 6 months, 1, 3, 5, or 10 years posttransplant. Death-censored graft failure (DCGF) is defined as a return to dialysis, reported graft failure, or kidney retransplant.

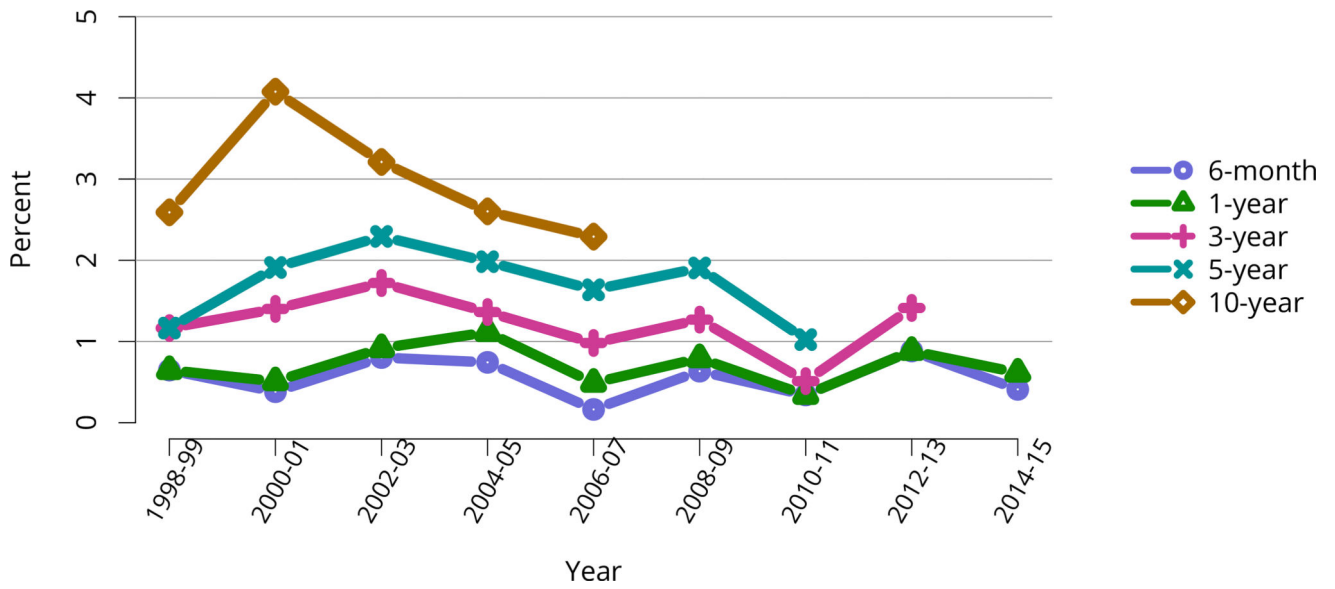


Figure KI 122. Death with function among pediatric living donor kidneyalone transplant recipients

Estimates are unadjusted, computed using Kaplan-Meier competing risk methods.

Recipients are followed to the earliest of kidney graft failure; kidney retransplant; return to dialysis; death; or 6 months, 1, 3, 5, or 10 years posttransplant. Death with function (DWF) is defined as death without prior graft failure, return to dialysis, or retransplant.

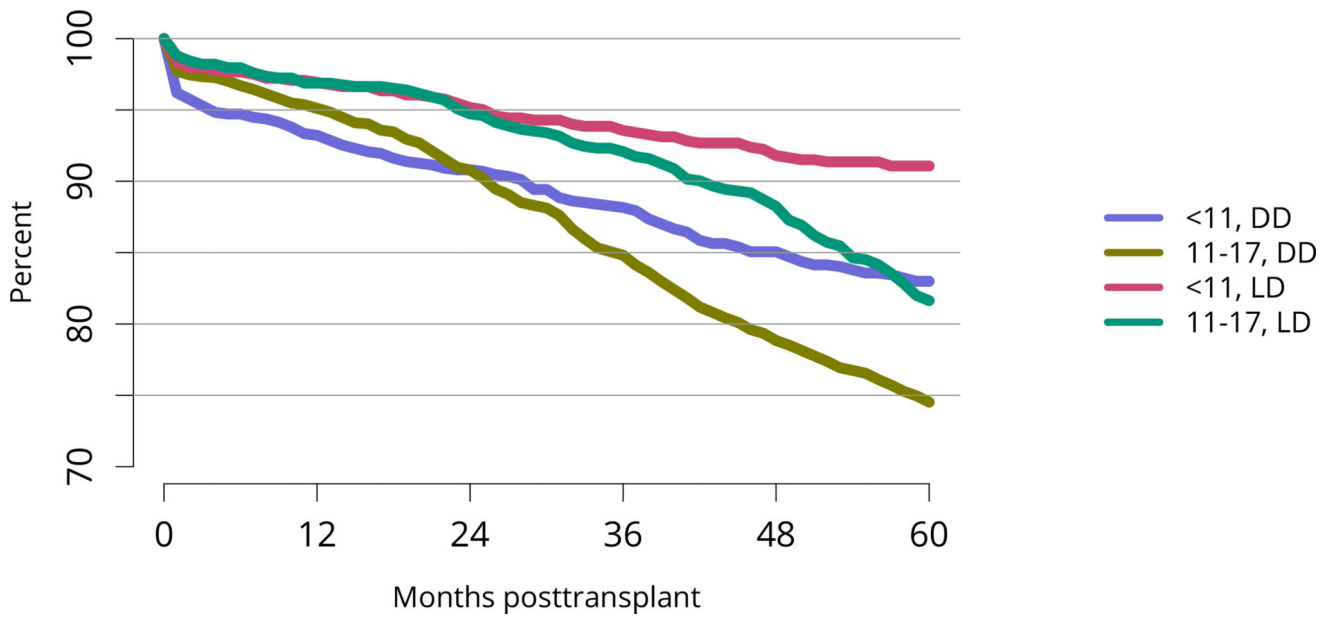


Figure KI 123. Graft survival among pediatric kidney transplant recipients by age and donor type, 2007–2011
Graft survival estimated using unadjusted Kaplan-Meier methods. DD, deceased donor; LD, living donor.

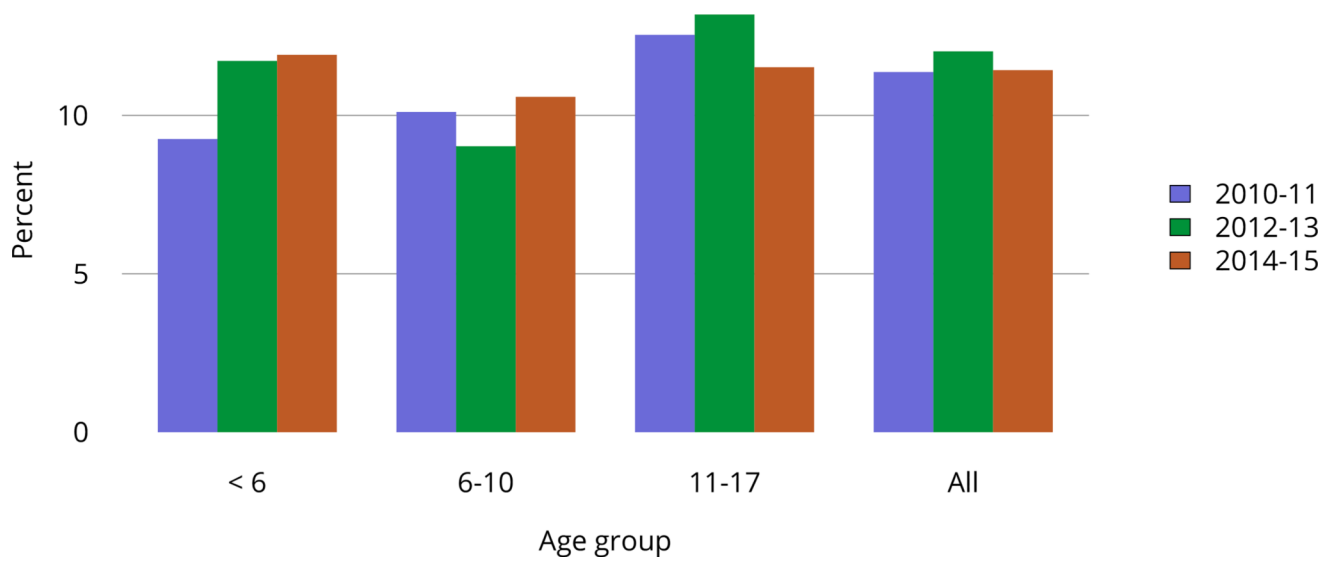


Figure KI 124. Incidence of acute rejection by 1 year posttransplant among pediatric kidney transplant recipients by age

Acute rejection is defined as a record of acute or hyperacute rejection, as reported on the OPTN Transplant Recipient Registration Form or Transplant Recipient Followup Form. Only the first rejection event is counted. Cumulative incidence is estimated using the Kaplan-Meier competing risk method.

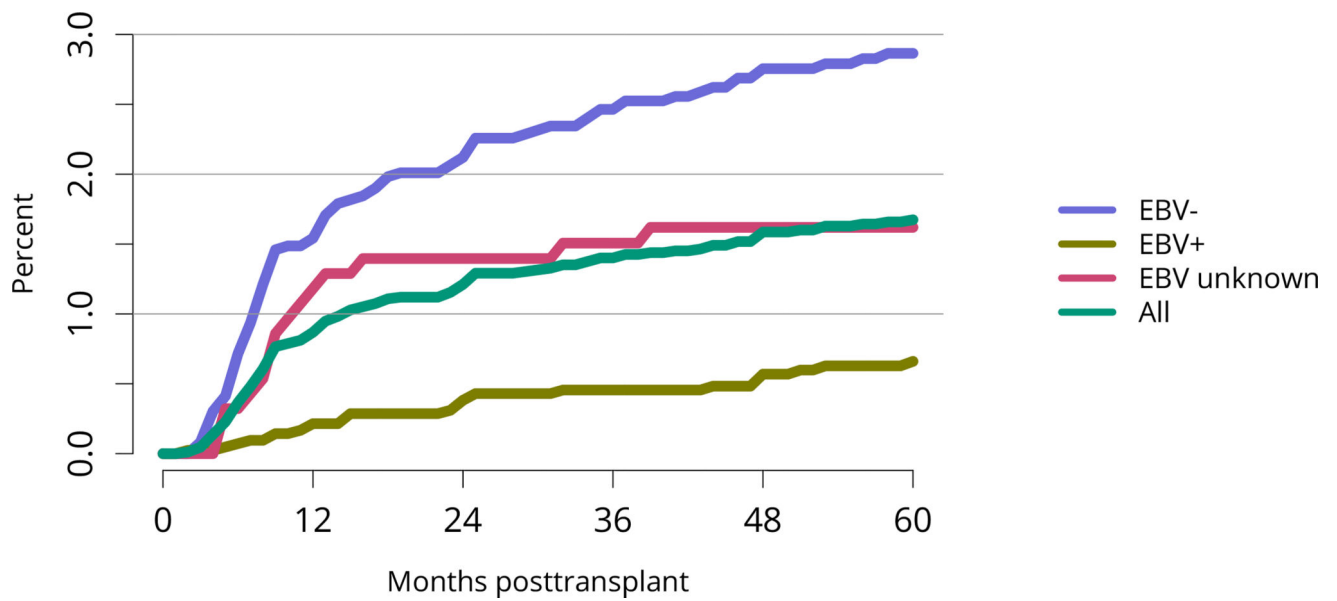


Figure KI 125. Incidence of PTLD among pediatric kidney transplant recipients by recipient EBV status at transplant, 2004–2014

Cumulative incidence is estimated using the Kaplan-Meier competing risk method.

Posttransplant lymphoproliferative disorder (PTLD) is identified as a reported complication or cause of death on the OPTN Transplant Recipient Follow-up Form or on the Posttransplant Malignancy Form as polymorphic PTLD, monomorphic PTLD, or Hodgkin disease. Only the earliest date of PTLD diagnosis is considered. EBV, Epstein-Barr virus.

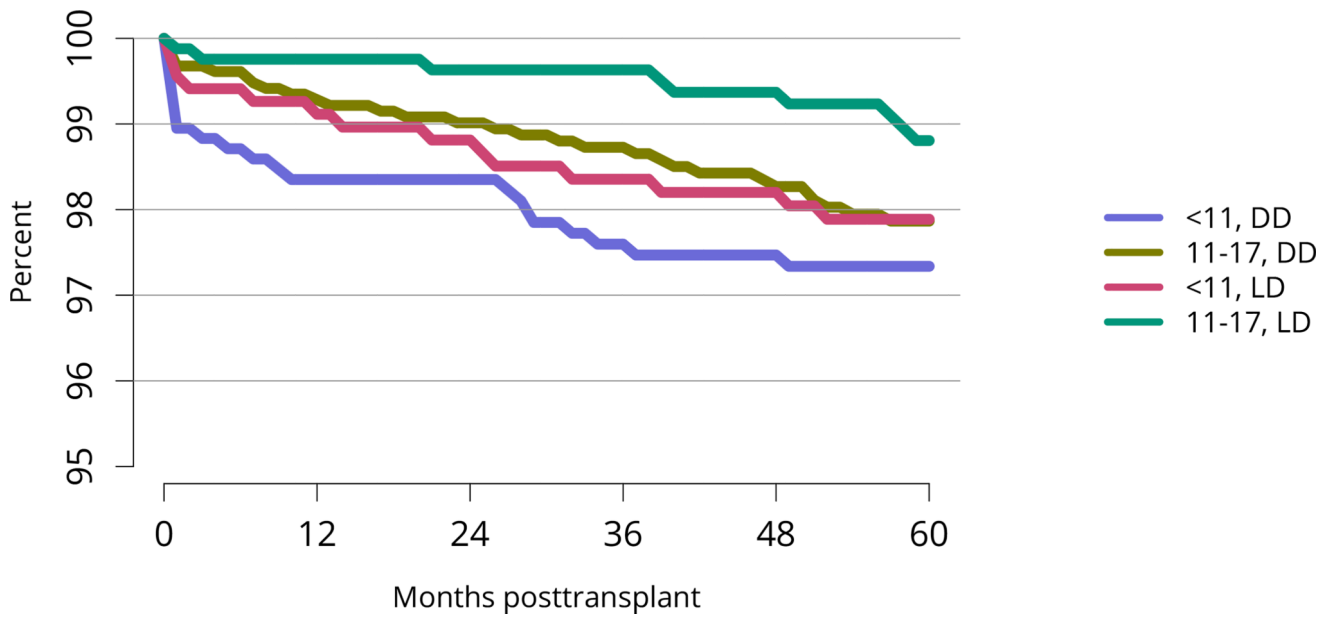


Figure KI 126. Patient survival among pediatric kidney transplant recipients, 2007–2011, by age and donor type

Recipient survival estimated using unadjusted Kaplan-Meier methods. DD, deceased donor; LD, living donor.

Table KI 1
Reasons for inactive status among new adult kidney transplant listings, 2016

Candidates first listed as inactive. Each listing is counted separately.

Reasons for inactive status	N	Percent
Candidate work-up incomplete	5707	68.2%
Insurance issues	732	8.7%
Too sick	565	6.8%
Too well	459	5.5%
Weight inappropriate	274	3.3%
Candidate for LD transplant only	205	2.5%
Candidate choice	203	2.4%
Transplant pending	134	1.6%
Unknown	34	0.4%
Medical non-compliance	30	0.4%
Inappropriate substance abuse	17	0.2%
Candidate could not be contacted	5	0.1%
Physician/surgeon unavailable	1	0.0%

LD, living donor.

Table KI 2

Demographic characteristics of adults on the kidney transplant waiting list on December 31, 2006, December 31, 2011 and December 31, 2016

Candidates waiting for transplant on December 31, 2006, December 31, 2011, and December 31, 2016, regardless of first listing date; multiple listings are collapsed.

Characteristic	2006		2011		2016	
	N	Percent	N	Percent	N	Percent
Age						
18–34 years	7749	11.6%	8692	9.8%	8018	8.4%
35–49 years	20,636	30.9%	24,356	27.4%	23,691	24.8%
50–64 years	28,230	42.2%	38,731	43.6%	42,254	44.3%
65 years	10,203	15.3%	17,105	19.2%	21,493	22.5%
Sex						
Female	27,997	41.9%	36,343	40.9%	37,384	39.2%
Male	38,821	58.1%	52,541	59.1%	58,072	60.8%
Race/ethnicity						
White	26,299	39.4%	33,991	38.2%	34,745	36.4%
Black	23,357	35.0%	30,329	34.1%	31,692	33.2%
Hispanic	11,415	17.1%	16,480	18.5%	18,990	19.9%
Asian	4795	7.2%	6811	7.7%	8505	8.9%
Other/unknown	952	1.4%	1273	1.4%	1524	1.6%
All candidates	66,818	100.0%	88,884	100.0%	95,456	100.0%

Table KI 3

Clinical characteristics of adults on the kidney transplant waiting list on December 31, 2006, December 31, 2011 and December 31, 2016

Candidates waiting for transplant on December 31, 2006, December 31, 2011, and December 31, 2016, regardless of first listing date; multiple listings are collapsed.

Characteristic	2006		2011		2016	
	N	Percent	N	Percent	N	Percent
Diagnosis						
Diabetes	20,636	30.9%	30,133	33.9%	34,811	36.5%
Hypertension	16,648	24.9%	22,362	25.2%	22,301	23.4%
GN	10,059	15.1%	12,572	14.1%	13,320	14.0%
CKD	5489	8.2%	7366	8.3%	8106	8.5%
Other	13,986	20.9%	16,451	18.5%	16,918	17.7%
Diabetes*	26,343	39.4%	38,620	43.4%	43,883	46.0%
Blood type						
A	18,925	28.3%	25,777	29.0%	26,931	28.2%
B	10,885	16.3%	14,166	15.9%	15,644	16.4%
AB	1904	2.8%	2581	2.9%	2573	2.7%
O	35,104	52.5%	46,360	52.2%	50,308	52.7%
CPRA						
< 1%	31,929	47.8%	49,823	56.1%	58,590	61.4%
1-< 20%	12,982	19.4%	9148	10.3%	8932	9.4%
20-< 80%	10,125	15.2%	13,673	15.4%	14,918	15.6%
80-< 98%	5250	7.9%	5846	6.6%	5533	5.8%
98-100%	5188	7.8%	8421	9.5%	7155	7.5%
Unknown	1344	2.0%	1973	2.2%	328	0.3%
All candidates	66,818	100.0%	88,884	100.0%	95,456	100.0%

CKD, cystic kidney disease; GN, glomerulonephritis.

* Diabetes status based on diagnosis and comorbid conditions.

Table KI 4
Listing characteristics of adults on the kidney transplant waiting list on December 31, 2006, December 31, 2011 and December 31, 2016

Candidates waiting for transplant on December 31, 2006, December 31, 2011, and December 31, 2016, regardless of first listing date; and multiple listings are collapsed.

Characteristic	2006		2011		2016	
	N	Percent	N	Percent	N	Percent
Transplant history						
First	55,812	83.5%	75,496	84.9%	83,505	87.5%
Retransplant	11,006	16.5%	13,388	15.1%	11,951	12.5%
Wait time						
< 1 year	23,062	34.5%	25,472	28.7%	25,134	26.3%
1-< 2 years	15,202	22.8%	20,426	23.0%	18,818	19.7%
2-< 3 years	10,144	15.2%	14,900	16.8%	15,415	16.1%
3-< 4 years	6393	9.6%	9867	11.1%	12,160	12.7%
4-< 5 years	4367	6.5%	6729	7.6%	8347	8.7%
5 years	7650	11.4%	11,490	12.9%	15,582	16.3%
Will accept KDPI* > 85%	29,294	43.8%	41,859	47.1%	45,219	47.4%
Tx type						
Kidney alone	64,124	96.0%	86,052	96.8%	92,621	97.0%
Kidney-pancreas	2297	3.4%	2081	2.3%	1720	1.8%
Kidney-liver	325	0.5%	635	0.7%	909	1.0%
Kidney-heart	58	0.1%	107	0.1%	191	0.2%
Other	14	0.0%	9	0.0%	15	0.0%
All candidates	66,818	100.0%	88,884	100.0%	95,456	100.0%

KDPI, kidney donor profile index.

* Prior to 2014, includes willingness to accept expanded criteria donor (ECD) kidney. KDPI >=85% is local non-zero HLA mismatch only.

Table KI 5
Kidney transplant waitlist activity among adults

Candidates concurrently listed at more than one center are counted once, from the time of earliest listing to the time of latest removal. Candidates who are listed, undergo transplant, and are relisted are counted more than once. Candidates are not considered to be on the list on the day they are removed; counts on January 1 may differ from counts on December 31 of the prior year. Candidates listed for multi-organ transplants are included.

Waiting list state	2014	2015	2016
Patients at start of year	96,920	99,239	97,878
Patients added during year	31,267	30,221	30,869
Patients removed during year	28,893	31,538	33,291
Patients at end of year	99,294	97,922	95,456

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Table KI 6
Removal reason among adult kidney transplant candidates

Removal reason as reported to the OPTN. Candidates with death dates that precede removal dates are assumed to have died waiting.

Removal reason	2014	2015	2016
Deceased donor transplant	11,589	12,279	13,501
Living donor transplant	5084	5331	5335
Transplant outside US	46	50	77
Patient died	4953	4976	4830
Patient refused transplant	474	524	479
Improved, transplant not needed	194	211	195
Too sick for transplant	3325	4099	4411
Other	3228	4068	4463

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Table KI 7
Living kidney donor deaths, 2012–2016, by number of days after donation

Living kidney donors. Numbers of deaths reported to OPTN or the Social Security Administration. Donation-related deaths are included in the Medical category.

Cause	0–30 days	31–90 days	91–365 days
Suicide	1	0	1
Accident/homicide	0	0	7
Overdose	0	0	1
Medical	3	0	0
Cancer	0	0	0
Unknown	0	1	1
TOTAL	4	1	10

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Table KI 8
Demographic characteristics of adult kidney transplant recipients, 2016

Adult kidney transplant recipients, including retransplants.

Characteristic	Deceased		Living		All	
	N	Percent	N	Percent	N	Percent
<i>Age</i>						
18–34 years	1721	12.5%	948	17.6%	2669	14.0%
35–49 years	3842	27.9%	1542	28.7%	5384	28.1%
50–64 years	5552	40.4%	2013	37.4%	7565	39.5%
65 years	2633	19.2%	877	16.3%	3510	18.4%
<i>Sex</i>						
Female	5546	40.3%	2012	37.4%	7558	39.5%
Male	8202	59.7%	3368	62.6%	11,570	60.5%
<i>Race/ethnicity</i>						
White	5406	39.3%	3505	65.1%	8911	46.6%
Black	4576	33.3%	660	12.3%	5236	27.4%
Hispanic	2561	18.6%	858	15.9%	3419	17.9%
Asian	985	7.2%	297	5.5%	1282	6.7%
Other/unknown	220	1.6%	60	1.1%	280	1.5%
<i>Insurance</i>						
Private	3005	21.9%	2989	55.6%	5994	31.3%
Medicare	9452	68.8%	2032	37.8%	11,484	60.0%
Medicaid	897	6.5%	223	4.1%	1120	5.9%
Other government	243	1.8%	72	1.3%	315	1.6%
Unknown	151	1.1%	64	1.2%	215	1.1%
All recipients	13,748	100.0%	5380	100.0%	19,128	100.0%

Table KI 9
Clinical characteristics of adult kidney transplant recipients, 2016

Adult kidney transplant recipients, including retransplants.

Characteristic	Deceased		Living		All	
	N	Percent	N	Percent	N	Percent
Diagnosis						
Diabetes	4240	30.8%	1209	22.5%	5449	28.5%
Hypertension	3363	24.5%	865	16.1%	4228	22.1%
GN	2188	15.9%	1279	23.8%	3467	18.1%
CKD	1278	9.3%	969	18.0%	2247	11.7%
Other	2679	19.5%	1058	19.7%	3737	19.5%
Blood type						
A	4942	35.9%	2073	38.5%	7015	36.7%
B	1914	13.9%	696	12.9%	2610	13.6%
AB	638	4.6%	221	4.1%	859	4.5%
O	6254	45.5%	2390	44.4%	8644	45.2%
Dialysis time						
None	1555	11.3%	1906	35.4%	3461	18.1%
< 1 year	858	6.2%	1023	19.0%	1881	9.8%
< 3 years	2493	18.1%	1342	24.9%	3835	20.0%
< 5 years	2657	19.3%	385	7.2%	3042	15.9%
5 years	6185	45.0%	724	13.5%	6909	36.1%
CPRA						
< 1%	8075	58.7%	3852	71.6%	11,927	62.4%
1–< 20%	1084	7.9%	514	9.6%	1598	8.4%
20–< 80%	2067	15.0%	771	14.3%	2838	14.8%
80–< 98%	1081	7.9%	183	3.4%	1,264	6.6%
98–100%	1439	10.5%	53	1.0%	1,492	7.8%
Unknown	2	0.0%	7	0.1%	9	0.0%
All recipients	13,748	100.0%	5380	100.0%	19,128	100.0%

CKD, cystic kidney disease; GN, glomerulonephritis.

Table KI 10
Transplant characteristics of adult kidney transplant recipients, 2016

Adult kidney transplant recipients, including retransplants.

Characteristic	Deceased		Living		All	
	N	Percent	N	Percent	N	Percent
Wait time						
< 1 year	124	0.9%	100	1.9%	224	1.2%
< 3 years	5301	38.6%	3361	62.5%	8662	45.3%
< 5 years	3838	27.9%	1505	28.0%	5343	27.9%
5 years	2634	19.2%	311	5.8%	2945	15.4%
Unknown	1851	13.5%	103	1.9%	1954	10.2%
KDPI						
20%	3120	22.7%				
21–34%	2244	16.3%				
35–85%	7296	53.1%				
> 85%	1087	7.9%				
Unknown	1	0.0%				
DCD status						
DBD	11,204	81.5%				
DCD	2544	18.5%				
Transplant history						
First	11,921	86.7%	4816	89.5%	16,737	87.5%
Retransplant	1827	13.3%	564	10.5%	2391	12.5%
All recipients	13,748	100.0%	5380	100.0%	19,128	100.0%

DBD, donation after brain death; DCD, donation after circulatory death; KDPI, kidney donor profile index. DCD status and KDPI scores apply to deceased donor transplants only.

Table KI 11
Adult deceased donor kidney donor-recipient serology matching, 2012–2016

Donor serology is reported on the OPTN Donor Registration Form and recipient serology on the OPTN Transplant Recipient Registration Form. There may be multiple fields per serology. Any evidence for a positive serology is treated as positive for that serology. If all fields are unknown, incomplete, or pending, the person is categorized as unknown for that serology; otherwise, serology is assumed negative.

Donor	Recipient	CMV	EBV	HB core	HB surf. ant.	HCV	HIV
D–	R–	7.6%	0.7%	80.6%	96.7%	91.3%	92.0%
D–	R+	15.2%	5.8%	8.1%	1.9%	4.1%	1.0%
D–	R unk	16.4%	0.8%	7.7%	1.3%	1.8%	5.8%
D+	R–	10.7%	8.1%	2.7%	0.0%	0.3%	0.0%
D+	R+	24.9%	75.6%	0.6%	0.0%	2.5%	0.0%
D+	R unk	24.8%	9.0%	0.2%	0.0%	0.0%	0.0%
D unk	R–	0.1%	0.0%	0.0%	0.1%	0.0%	1.2%
D unk	R+	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
D unk	R unk	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%

CMV, cytomegalovirus; EBV, Epstein-Barr virus; HB, hepatitis B; HCV, hepatitis C virus; HIV, human immunodeficiency virus.

Table KI 12
Adult living donor kidney donor-recipient serology matching, 2012–2016

Donor serology is reported on the OPTN Donor Registration Form and recipient serology on the OPTN Transplant Recipient Registration Form. There may be multiple fields per serology. Any evidence for a positive serology is treated as positive for that serology. If all fields are unknown, incomplete, or pending, the person is categorized as unknown for that serology; otherwise, serology is assumed negative.

Donor	Recipient	CMV	EBV	HB core	HB surf. ant.	HCV	HIV
D-	R-	15.1%	2.0%	80.1%	93.2%	94.0%	55.9%
D-	R+	13.0%	6.7%	3.6%	1.2%	2.0%	0.3%
D-	R unk	17.7%	0.5%	8.6%	1.3%	1.6%	1.8%
D+	R-	10.3%	7.1%	1.5%	0.4%	0.4%	0.0%
D+	R+	21.7%	72.0%	0.4%	0.0%	0.0%	0.0%
D+	R unk	19.6%	4.7%	0.1%	0.0%	0.0%	0.0%
D unk	R-	0.6%	0.7%	3.5%	3.6%	1.9%	38.9%
D unk	R+	1.0%	2.7%	0.2%	0.1%	0.0%	0.2%
D unk	R unk	1.1%	3.6%	2.1%	0.1%	0.2%	2.9%

CMV, cytomegalovirus; EBV, Epstein-Barr virus; HB, hepatitis B; HCV, hepatitis C virus; HIV, human immunodeficiency virus.

Table KI 13
Reasons for inactive status among new pediatric kidney transplant listings, 2016

Candidates first listed as inactive. Each listing is counted separately.

Reasons for inactive status	N	Percent
Candidate work-up incomplete	282	52.1%
Candidate for LD transplant only	91	16.8%
Too well	63	11.6%
Too sick	37	6.8%
Candidate choice	29	5.4%
Insurance issues	15	2.8%
Medical non-compliance	10	1.8%
Weight inappropriate	9	1.7%
Transplant pending	4	0.7%
Candidate could not be contacted	1	0.2%

LD, living donor.

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Table KI 14

Demographic characteristics of pediatric candidates on the kidney transplant waiting list on December 31, 2006, December 31, 2011, and December 31, 2016

Candidates aged younger than 18 years waiting for transplant on December 31 of given year, regardless of first listing date; multiple listings are collapsed. Age calculated at snapshot.

Characteristic	2006		2011		2016	
	N	Percent	N	Percent	N	Percent
Age						
< 1 year	4	0.5%	0	0.0%	1	0.1%
1–5 years	109	14.9%	181	21.8%	241	24.6%
6–10 years	133	18.2%	151	18.2%	206	21.0%
11–17 years	484	66.3%	497	60.0%	533	54.3%
Sex						
Female	290	39.7%	329	39.7%	384	39.1%
Male	440	60.3%	500	60.3%	597	60.9%
Race/ethnicity						
White	287	39.3%	344	41.5%	410	41.8%
Black	179	24.5%	180	21.7%	201	20.5%
Hispanic	232	31.8%	263	31.7%	291	29.7%
Asian	22	3.0%	30	3.6%	56	5.7%
Other/unknown	10	1.4%	12	1.4%	23	2.3%
All candidates	730	100.0%	829	100.0%	981	100.0%

Table KI 15
Clinical characteristics of pediatric candidates on the kidney transplant waiting list on December 31, 2006, December 31, 2011, and December 31, 2016

Candidates aged younger than 18 years waiting for transplant on December 31, 2006, December 31, 2011, and December 31, 2016, regardless of first listing date; multiple listings are collapsed.

Characteristic	2006		2011		2016	
	N	Percent	N	Percent	N	Percent
Diagnosis						
FSGS	79	10.8%	80	9.7%	97	9.9%
GN	90	12.3%	74	8.9%	70	7.1%
CAKUT	203	27.8%	268	32.3%	366	37.3%
Other	358	49.0%	407	49.1%	448	45.7%
Blood type						
A	215	29.5%	258	31.1%	279	28.4%
B	97	13.3%	132	15.9%	166	16.9%
AB	19	2.6%	29	3.5%	23	2.3%
O	399	54.7%	410	49.5%	513	52.3%
CPRA						
< 1%	406	55.6%	550	66.3%	645	65.7%
1–< 20%	93	12.7%	32	3.9%	92	9.4%
20–< 80%	91	12.5%	93	11.2%	143	14.6%
80–< 98%	53	7.3%	64	7.7%	39	4.0%
98–100%	53	7.3%	79	9.5%	60	6.1%
Unknown	34	4.7%	11	1.3%	2	0.2%
All candidates	730	100.0%	829	100.0%	981	100.0%

FSGS, focal segmental glomerulosclerosis; GN, glomerulonephritis; CAKUT, congenital anomalies of the kidney and urinary tract.

Table KI 16
Listing characteristics of pediatric candidates on the kidney transplant waiting list on December 31, 2006, December 31, 2011, and December 31, 2016

Candidates aged younger than 18 years waiting for transplant on December 31, 2006, December 31, 2011, and December 31, 2016, regardless of first listing date; multiple listings are collapsed.

Characteristic	2006		2011		2016	
	N	Percent	N	Percent	N	Percent
Transplant history						
First	537	73.6%	633	76.4%	834	85.0%
Retransplant	193	26.4%	196	23.6%	147	15.0%
Wait time						
< 1 year	432	59.2%	482	58.1%	510	52.0%
1-< 2 years	164	22.5%	166	20.0%	210	21.4%
2-< 3 years	68	9.3%	68	8.2%	118	12.0%
3-< 4 years	40	5.5%	45	5.4%	68	6.9%
4-< 5 years	15	2.1%	28	3.4%	34	3.5%
5 years	11	1.5%	40	4.8%	41	4.2%
Tx type						
Kidney alone	712	97.5%	799	96.4%	956	97.5%
Kidney-liver	12	1.6%	21	2.5%	21	2.1%
Kidney-heart	3	0.4%	4	0.5%	1	0.1%
Other	3	0.4%	4	0.5%	2	0.2%
All candidates	730	100.0%	829	100.0%	981	100.0%

Table KI 17
Kidney transplant waitlist activity among pediatric candidates

Candidates concurrently listed at more than one center are counted once, from the time of earliest listing to the time of latest removal. Candidates who are listed, undergo transplant, and are relisted are counted more than once. Candidates are not considered to be on the list on the day they are removed; counts on January 1 may differ from counts on December 31 of the prior year. Candidates listed for multi-organ transplants are included.

Waiting list state	2014	2015	2016
Patients at start of year	1365	1482	1513
Patients added during year	1002	976	953
Patients removed during year	882	945	972
Patients at end of year	1485	1513	1494

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Table KI 18
Removal reason among pediatric kidney transplant candidates

Removal reason as reported to the OPTN. Candidates with death dates that precede removal dates are assumed to have died waiting.

Removal reason	2014	2015	2016
Deceased donor transplant	575	586	598
Living donor transplant	238	261	273
Transplant outside US	0	1	0
Patient died	22	20	27
Patient refused transplant	2	2	1
Improved, transplant not needed	2	8	7
Too sick for transplant	8	12	23
Other	35	55	43

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Table KI 19
Demographic characteristics of pediatric kidney transplant recipients, 2014–2016

Kidney transplant recipients, including retransplants.

Characteristic	Deceased		Living		All	
	N	Percent	N	Percent	N	Percent
Age						
< 1 year	2	0.1%	3	0.4%	5	0.2%
1–5 years	264	18.5%	210	28.5%	474	21.9%
6–10 years	277	19.4%	131	17.8%	408	18.8%
11–17 years	886	62.0%	393	53.3%	1279	59.0%
Sex						
Female	602	42.1%	298	40.4%	900	41.6%
Male	827	57.9%	439	59.6%	1266	58.4%
Race/ethnicity						
White	569	39.8%	513	69.6%	1082	50.0%
Black	338	23.7%	68	9.2%	406	18.7%
Hispanic	399	27.9%	119	16.1%	518	23.9%
Asian	81	5.7%	23	3.1%	104	4.8%
Other/unknown	42	2.9%	14	1.9%	56	2.6%
Insurance						
Private	402	28.1%	419	56.9%	821	37.9%
Medicare	427	29.9%	142	19.3%	569	26.3%
Medicaid	486	34.0%	130	17.6%	616	28.4%
Other government	93	6.5%	32	4.3%	125	5.8%
Unknown	21	1.5%	14	1.9%	35	1.6%
All recipients	1429	100.0%	737	100.0%	2166	100.0%

Table KI 20
Clinical characteristics of pediatric kidney transplant recipients, 2014–2016

Kidney transplant recipients, including retransplants. Diagnosis categories follow North American Pediatric Renal Trials and Collaborative Studies recommendations.

Characteristic	Deceased		Living		All	
	N	Percent	N	Percent	N	Percent
Diagnosis						
FSGS	177	12.4%	73	9.9%	250	11.5%
GN	167	11.7%	65	8.8%	232	10.7%
CAKUT	507	35.5%	264	35.8%	771	35.6%
Other	578	40.4%	335	45.5%	913	42.2%
Blood type						
A	468	32.8%	267	36.2%	735	33.9%
B	182	12.7%	103	14.0%	285	13.2%
AB	60	4.2%	36	4.9%	96	4.4%
O	719	50.3%	331	44.9%	1050	48.5%
Dialysis time						
None	347	24.3%	303	41.1%	650	30.0%
< 1 year	283	19.8%	203	27.5%	486	22.4%
< 3 years	492	34.4%	156	21.2%	648	29.9%
< 5 years	147	10.3%	16	2.2%	163	7.5%
5 years	160	11.2%	59	8.0%	219	10.1%
CPRA						
< 1%	1054	73.8%	554	75.2%	1608	74.2%
1–< 20%	129	9.0%	68	9.2%	197	9.1%
20–< 80%	176	12.3%	84	11.4%	260	12.0%
80–< 98%	43	3.0%	16	2.2%	59	2.7%
98–100%	27	1.9%	9	1.2%	36	1.7%
Unknown	0	0.0%	6	0.8%	6	0.3%
All recipients	1429	100.0%	737	100.0%	2166	100.0%

FSGS, focal segmental glomerulosclerosis; GN, glomerulonephritis; CAKUT, congenital anomalies of the kidney and urinary tract.

Table KI 21
Transplant characteristics of pediatric kidney transplant recipients, 2014–2016

Kidney transplant recipients, including retransplants.

Characteristic	Deceased		Living		All	
	N	Percent	N	Percent	N	Percent
Wait time						
< 1 year	8	0.6%	79	10.7%	87	4.0%
< 3 years	991	69.3%	549	74.5%	1540	71.1%
< 5 years	353	24.7%	99	13.4%	452	20.9%
5 years	57	4.0%	8	1.1%	65	3.0%
Unknown	20	1.4%	2	0.3%	22	1.0%
KDPI						
20%	947	66.3%				
21–34%	334	23.4%				
35–85%	145	10.1%				
> 85%	3	0.2%				
DCD status						
DBD	1376	96.3%				
DCD	53	3.7%				
DGF						
None	1310	91.7%	710	96.3%	2020	93.3%
Yes	119	8.3%	27	3.7%	146	6.7%
Tx type						
Kidney only	1378	96.4%	737	100.0%	2115	97.6%
Kidney-liver	43	3.0%	0	0.0%	43	2.0%
Other	8	0.6%	0	0.0%	8	0.4%
Transplant history						
First	1302	91.1%	681	92.4%	1983	91.6%
Retransplant	127	8.9%	56	7.6%	183	8.4%
All recipients	1429	100.0%	737	100.0%	2166	100.0%

DBD, donation after brain death; DCD, donation after circulatory death; DGF, delayed graft function; KDPI, kidney donor profile index; DCD status and KDPI scores apply to deceased donor transplants only.

Table KI 22
Pediatric deceased donor kidney donor-recipient serology matching, 2012–2016

Donor serology is reported on the OPTN Donor Registration Form and recipient serology on the OPTN Transplant Recipient Registration Form. There may be multiple fields per serology. Any evidence for a positive serology is treated as positive for that serology. If all fields are unknown, incomplete, or pending, the person is categorized as unknown for that serology; otherwise, serology is assumed negative.

Donor	Recipient	CMV	EBV
D–	R–	16.0%	4.7%
D–	R+	10.3%	7.2%
D–	R unk	14.4%	0.3%
D+	R–	22.7%	36.9%
D+	R+	12.7%	47.4%
D+	R unk	23.0%	3.4%
D unk	R–	0.3%	0.0%
D unk	R+	0.3%	0.1%
D unk	R unk	0.3%	0.0%

CMV, cytomegalovirus; EBV, Epstein-Barr virus.

Table KI 23
Pediatric living donor kidney donor-recipient serology matching, 2012–2016

Donor serology is reported on the OPTN Donor Registration Form and recipient serology on the OPTN Transplant Recipient Registration Form. There may be multiple fields per serology. Any evidence for a positive serology is treated as positive for that serology. If all fields are unknown, incomplete, or pending, the person is categorized as unknown for that serology; otherwise, serology is assumed negative.

Donor	Recipient	CMV	EBV
D–	R–	21.5%	7.8%
D–	R+	4.8%	2.5%
D–	R unk	18.7%	0.5%
D+	R–	19.5%	46.0%
D+	R+	13.5%	34.9%
D+	R unk	18.9%	3.7%
D unk	R–	2.1%	2.8%
D unk	R+	0.5%	1.3%
D unk	R unk	0.6%	0.6%

CMV, cytomegalovirus; EBV, Epstein-Barr virus.