Beneath this world of stars and flowers
That rolls in visible deity,
I dream another world is ours
And is the soul of all we see.

Agnes Mary Frances Duclaux (Robinson-Darmesteter), “The Idea”
In 2008, the most recent year of available data, 17,413 kidney transplants were performed in the U.S. — slightly fewer than in the previous year, and continuing the decline from a high of 18,059 in 2006. This decline was seen in both deceased and living donor transplants, at 0.6 and 1.2 percent, respectively. It also occurred among both pediatric and adult recipients. The fall in the number of transplants is contemporaneous with a continued decline in the unadjusted rate of new cases of end-stage renal disease, which fell 1.3 percent from a high of 498.1 cases per million population in 2006. The number of patients on the kidney transplant wait list, however, continues to increase sharply, growing 6 percent in 2008, and reaching more than 77,000 at the end of the year. But at the end of 2008, only 66 percent of the total kidney wait list was designated as active, yielding an active list of 51,585 patients.

The use of expanded criteria donors had plateaued at 20 percent in 2005–2007, but increased slightly in 2008 to 22 percent of all deceased donor transplants performed. And the use of kidneys from donations after cardiac death continues to rise; these donations now constitute 12 percent of all donations from deceased donors.

While the total number of transplants from live donors age 20 and older fell 10 percent between 2004 and 2008, reported transplants from kidney paired donation programs increased eight-fold in the same period, reaching 339 reported transplants in 2008. Transplants from paired donations currently make up only 2 percent of transplants performed in the United States. The number of donations from living relations continues to decline, and is now 20 percent lower than that observed in 2004. Donations from spouses or distant relatives have remained fairly constant.

Wait times continue to increase nationwide. For patients entering the wait list in 2005, the most recent year in which 50 percent of wait listed patients had been transplanted, the median time to receive a deceased donor transplant was 3.0 years. Patients with blood type B wait the longest, with a median of 4.0 years for patients listed in 2005, while patients with blood type AB have the shortest waits, with a median of 1.3 years. Unsensitized patients — those with a zero percent panel-reactive antibody (PRA) at the time of listing — have the shortest wait times, a median of 2.5 years in 2005, while those with a PRA of 1–19 and 20–79 percent have median wait times of 2.9 and 4.3 years, respectively. Highly sensitized patients, those with a PRA of 80 percent and above, wait the longest, with median wait times still to be observed for patients listed in 2005. Of those added to the wait list in 2003, 17, 19, and 16 percent of white, African American, and Asian patients, respectively, died within five years awaiting a transplant, and 14, 21, and 25 percent were still waiting for a transplant at the end of that period.

Adjusted one-year survival with a functioning transplant has continued to reach all-time highs, at 91 percent for recipients of first-time, deceased donor transplants and 96 percent for recipients of first-time, living donor transplants in 2007. Attention continues to focus on reducing the incidence of acute rejection and other post-transplant complications, and on improving long-term transplant outcomes. The incidence of reported acute rejection episodes during the first year post-transplant...
has declined more than 50 percent over the past decade, and was reported in 12 percent of deceased
donor recipients and 11 percent of living donor recipients in 2007. New-onset diabetes following
transplant remains common, with over 40 percent of adult recipients having evidence of diabetes
by the end of the third year after transplant. Post-transplant lymphoproliferative disorders are re-
ported in 0.5 percent of adult recipients and 2.0 percent of pediatric recipients through three years
post-transplant. Congestive heart failure remains the leading cause of cardiovascular hospitaliza-
tions during the first two years post-transplant, while urinary tract infections are the leading cause
of infectious hospitalizations during the first two years post-transplant. And among recipients who
die with a functioning transplant, cardiovascular disease continues to be the leading cause of death,
accounting for 30 percent of deaths, followed by infectious causes at 21 percent and malignancies
at 10 percent.

The use of pre-transplant blood transfusions remains common among transplant recipients,
with 15 percent of 2008 recipients receiving at least one such transfusion. Among patients on the
wait-list, the percentage who receive at least one transfusion within the first three years on
the list has remained relatively constant over the past decade, at approximately 28 percent.
The use of transfusions among unsensitized patients is similar to that of patients with low
and mid levels of sensitization, suggesting that transfusion avoidance may need more atten-
tion. There is a positive association between the use of pre-transplant blood transfusion and the odds of elevated PRA at the time of
transplant, and receiving a blood transfusion while on the wait list is
associated with increased rates of death while on the list and with a
reduced likelihood of receiving a transplant.

*Figure 7.1* see page 477 for analytical methods. *Unadjusted incident &
transplant rates: limited to ESRD patients age 20 & older, thus yielding a
computed incident rate higher than the overall rate presented elsewhere
in the Annual Data Report. Wait list counts: patients age 20 & older
listed for a kidney or kidney-pancreas transplant on December 31 of each
year. Wait time: patients age 20 & older entering wait list in the given
year. Transplant counts: patients age 20 & older as known to the USRDS.*
On December 31, 2008, there were 51,585 active patients on the wait list for a kidney or kidney-pancreas transplant, and 25,189 inactive patients. The percentage of new listings willing to accept an ECD kidney averaged 75.8 for patients residing in states represented by the upper quintile. Figures 7.2-3; see page 477 for analytical methods. Patients age 18 & older listed for a kidney or kidney-pancreas transplant on December 31 of each year (7.2); newly listed adults (7.3).

![Wait list counts & multiple listings](image)

![Percent of new listings willing to accept an ECD kidney, by state, 2007-2008](image)

In 1991, just three in ten patients wait-listed for a kidney or kidney-pancreas transplant were age 50 or older. By 2008 this number had doubled, and one in six patients is now 65 or older. Distribution by panel-reactive antibody (PRA) level has also changed; nearly one in two patients now has a PRA of zero, up from 24 percent in 1991. There has been less variation in patient distribution by race; 46 percent of wait-listed patients in 2008 were non-white, compared to 39 percent in 1991. The median wait time for patients listed in 2005, the most recent observation year, was 3.0 years; for those listing in 2010, this is projected to reach 3.6 years. By race, projected times for patients listing in 2010 range from 2.3 years for whites to 3.7 years for African Americans. Wait times continue to be longest for sensitized patients, particularly for those who are highly sensitized. And wait times vary widely by blood type, from a projected 1.9 years for AB patients listing in 2010 to 4.1 years for those with blood type O. Figures 7.4-5; see page 477 for analytical methods. Patients age 18 & older listed for a kidney or kidney-pancreas transplant on December 31 of each year (7.4); patients age 18 & older listed for a first-time, kidney-only transplant in the given year; estimates for PRA of 80 & above are unstable & are therefore omitted (7.5).
Median wait times for adults transplanted in 2008 exceeded three years in Alabama, Hawaii, New Jersey, California, and Illinois, while the nationwide median was 2.1 years. Projected median wait times for listed adults in California and Alabama were 7.2 and 9.3 years, respectively. Figures 7.6–7.7; see page 478 for analytical methods. Patients age 18 & older receiving (7.6) or listed for (7.7) a first-time, deceased-donor, kidney-only transplant in 2008. State is state of transplant center.

Of patients wait-listed in 2007, 12.3 percent had a live-donor transplant within one year, from 24.7 percent of pediatric patients to 8.4 percent of those 65 and older. Within three years of listing in 2005, 79 percent of wait-listed children had a deceased donor transplant, and 34 percent of adults — 27 percent of those with blood type O or B, and 63 percent of those with AB.

Adjusted mortality rates among wait-listed patients are highest in the Gulf Coast states, Montana, West Virginia, and Rhode Island, averaging 9.4 in the upper quintile. For first-time transplant candidates, the probabilities of dying within one or five years of listing reached 0.03 and 0.27, respectively, in 2008. Figures 7.11–7.12; see page 478 for analytical methods. Pts age 18 & older listed for a first-time, kidney-only transplant in 2005; transplanted patients may have subsequent outcomes in the three-year follow-up period.

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Rates of kidney donation from deceased donors remain highest among those age 45–59 and among males, reaching 29.5 and 26.6 per million population, respectively, in 2008. Since 2005, rates by race have been highest in the African American population, reaching 26.1 in 2008, compared to just 9.8–10.1 among Native Americans and Asians.

While deceased donor donation rates have remained quite steady since 2006, rates of donations from living donors have been declining among many groups — 19 percent since 2004 for male donors, and 22 percent for African Americans. Rates by gender are 55 percent greater among women compared to men, at 26.2 and 16.9 per million population, respectively. ♦ Figure 7.13; see page 478 for analytical methods. Donors younger than 70 whose organs are eventually transplanted.

In 2007–2008, the rate of donations from deceased donors was 2.5 per 1,000 deaths overall; rates by state were greatest in Utah, Wisconsin, Delaware, and Alaska. The number of transplants from a kidney paired donation rose from 212 in 2007 to 339 in 2008. Transplants from related donors, in contrast, have fallen 22 percent from their peak in 2001, to 3,045. ♦ Figures 7.14–15; see page 478 for analytical methods. Deaths from July 1, 2007 to July 1, 2008 (7.14); all patients receiving a living donor kidney transplant (7.15).

Twenty-two percent of deceased donor transplants in 2008 were from an expanded criteria donor (ECD); one in eight was a donation after cardiac death (DCD). The Kidney Donor Risk Index (KDRI) is increasingly being used to rate deceased donor quality. As the KDRI score increases, the likelihood of being designated ECD also increases. ♦ Figures 7.16–17; see page 478 for analytical methods. Patients age 18 or older receiving a first-time, kidney-only, deceased donor transplant, 1991–2008 (7.16) & 2008 (7.17).
Since 2000, the overall adjusted transplant rate has fallen 29–30 percent for patients age 18–49; among those 65 and older, in contrast, it has increased nearly 49 percent. By race, the rate continues to fall for whites, remains relatively steady for African Americans, and for Asians has grown 35 percent since 2000.

Deceased donor transplant rates show similar patterns. By age, the rate for patients age 18–34 has fallen 33 percent since 2000, reaching 5.3 per 100 dialysis patient years, while that for patients age 65 and older is now 1.1, almost 54 percent greater than in 2000.

Rates of transplants from living donors peaked at the beginning of the decade, and have since fallen for many patient groups. As with rates overall and for deceased donors, rates by race are now greatest in the Asian population, reaching 2.7 in 2008 — 58 percent higher than in 2000. + FIGURES 7.18–20; see page 478 for analytical methods. Patients age 18 & older. Adj: age/gender/race/primary diagnosis; ref: prevalent dialysis patients, 2008.

By state, the highest overall transplant rates are reported in the Upper Midwest and the northeast states, with rates of 6.8 per 100 patient years or above in Wisconsin, Minnesota, North Dakota, and Vermont. In Minnesota and Vermont, rates of transplants from living donors in 2008 reached 3.8 and 4.2, respectively. + FIGURE 7.20; see page 478 for analytical methods. Patients age 18 & older. Adj: age/gender/race/primary diagnosis; ref: prevalent dialysis patients, 2008. State is state of patient residence.
In 2008, DGF was reported in 3.6 percent of transplants from living donors, compared to 21.3, 29.6, and 40.2 percent of those from SCDS, ECDS, and donations after cardiac death. In 2008, the median length of stay for a transplant hospitalization ranged from five days for adult living donor transplant recipients to nine days for those with delayed graft function. *Figures 7.22–23; see page 478 for analytical methods. Patients age 18 & older with functioning graft at discharge (7.22–23).

Primary non-function — graft failure within seven days of transplant — is now reported in 1.8 and 1.0 percent of deceased and living donor adult transplant recipients, respectively, while the incidence of acute rejection during the first year post-transplant is 11.7 and 11.0 percent. Seventy to 71 percent of reported acute rejections are biopsy-proven. *Figures 7.24–25; see page 478 for analytical methods. *Pts age 18 & older (7.24); first-time, kidney-only tx recipients, 18+, with functioning graft at discharge (7.25).

The distribution of patients by estimated glomerular filtration rate (eGFR) at discharge varies considerably by donor type. In 2008, for example, nearly 48 percent of deceased donor transplant recipients had an eGFR at discharge of less than 30 ml/min/1.73 m², compared to just 12.7 percent of living donor recipients; eGFRs of 60 or above were reported in 20.2 compared to 45.3 percent, respectively.

At one year after transplant, however, the distribution is far more similar across donor types, with an eGFR less than 30 ml/min/1.73 m² found in just 7.3 and 3.3 percent of deceased and living donor recipients transplanted in 2007. Forty-seven and 51 percent of patients had an eGFR of 60 or above. *Figures 7.26–27; see page 478 for analytical methods. Patients age 18 & older, discharged with graft function within 15 days of transplant; eGFR computed using CKD-EPI equation (7.26); patients age 18 & older, alive with graft function 12 months post-transplant; eGFR computed using CKD-EPI equation (7.27).
Eighty-seven percent of patients transplanted in 2008 used tacrolimus as their initial calcineurin inhibitor. Mycophenolate has almost completely replaced azathioprine in new transplant recipients. And use of mTOR inhibitors, both initially and at one year post-transplant, has continued to fall, as has the use of steroids. *Figure 7.28; see page 479 for analytical methods. Patients age 18 & older receiving a first-time, kidney-only transplant (7.30: 2007).

In 2008, nearly 29 percent of transplant patients received IL-2 RA, and 52.3 percent were on a T-cell depleting antibody; just 18.6 percent received no treatment. KDIGO guidelines recommend prophylactic antibiotics in the first three months post-transplant for the prevention of UTI and PCP, and prophylactic antiviral use for the prevention of CMV. *Figures 7.29–30; see page 479 for analytical methods. Patients age 18 & older receiving a first-time, kidney-only transplant (7.30: 2007).

In 2008, influenza vaccination rates in the 12 months post-transplant were 21–23 percent in patients 18–49, and 41 percent in those 65 and older (patients may be vaccinated through non-Medicare programs). Lipid screening rates range from 87 percent in the youngest patients to 94 percent in the oldest. Since 2003, nearly all transplant patients have received a CBC test in the year after transplant. *Figure 7.31; see page 479 for analytical methods. Pts age 18 & older receiving a first-time, kidney-only tx.

In the first six months post-transplant, diuretic use in patients with Part D coverage is more common for deceased donor recipients than for living donor recipients, at 36 compared to 29 percent. Statins are used by 37–39 percent of patients during this period, and insulin by 31–36 percent; 57 and 46 percent of deceased and living donor recipients, respectively, are on an antidiabetic medication. *Figures 7.32–33; see page 479 for analytical methods. Pts age 18 & older receiving a first-time, kidney-only tx.
Long-term transplant outcomes continue to be a focus of attention. Five-year survival with a functioning graft was 69 and 82 percent for recipients of kidneys from deceased and living donors, respectively, in 2003, up from 58 and 75 percent in 1993. Ten-year survival with a functioning graft was 40 and 58 percent in 1998, up from 34 and 52 percent in 1993. Conditional on surviving the first year with a functioning transplant, at 12.6 years 50 percent of deceased donor transplant recipients are projected to have a functioning graft. For recipients of living donor transplants, this projected half-life is 24.8 years. \* Figures 7.34–35; see page 479 for analytical methods. Patients age 18 & older receiving a first-time, kidney-only transplant. Adj (survival): age/gender/race/primary diagnosis. Half-life estimate conditional on first-year graft survival.

In the second year post-transplant, hospitalization rates for adult recipients are 53 percent lower than in the first year, at 68 admissions per 100 patient years. Admissions due to transplant complications fall 70 percent, to 12.3, while cardiovascular and infectious admission rates fall 41 and 49 percent, to 8.9 and 16.7. \* Figure 7.36; see page 479 for analytical methods. First-time, kidney-only tx recipients, age 18 & older, transplanted in 2006; ref: transplant patients, 2005.

In the first year after transplant, 20.1 percent of cardiovascular hospitalizations are due to congestive heart failure; this rises to 23.1 percent in year two. Hospitalizations for coronary atherosclerosis and CVA/TIA also increase, from 7.4 and 5.5 percent, respectively, in year one to 13.8 and 9.8 percent in year two. Urinary tract infection is the most common diagnosis among transplant patients admitted for infection, at 17.3 percent in the first year and 16.3 in the second. \* Figure 7.37; see page 479 for analytical methods. First-time, kidney-only transplant recipients, age 18 & older, with Medicare primary coverage, transplanted in 2004–2008.
POST-TRANSPLANT DIAGNOSES

At 36 months after transplant, the cumulative incidence of post-transplant lymphoproliferative disorder (PTLD) is four times greater among patients younger than 18 than among their adult counterparts, at 1.99 percent compared to 0.5. Adults, in contrast, have a higher incidence of post-transplant diabetes; more than 40 percent of adult recipients develop diabetes during this period, compared to 12.6 percent of pediatric patients.

The reported incidence of malignancies other than PTLD is considerably different between the Medicare and OPTN data, reaching 9.9 compared to 2.4 percent, respectively, at 36 months.

Nearly one in five pediatric transplant recipients has a BK infection by 36 months post transplant, compared to 11.1 percent of adult recipients.

Compared to those with an eGFR of 60–89 ml/min/1.73 m² at one year post-transplant, patients with an eGFR of 15–29 are four times more likely to lose their graft or die with function within the subsequent four-year period.

Graft failure rates fell to 6.5 per 100 patient years in 2008, while rates of a failure necessitating dialysis or retransplantation and of death with function fell to 3.3 and 3.2. Cardiovascular disease and infection are the main cause of death for 30 and 21 percent of adult patients who die with a functioning graft.

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Reported use of pre-transplant blood transfusions among transplant recipients has continued to decline, falling overall from 49 percent in 1991 to 15 percent in 2008. Transfusions are slightly more common among women than men, at 17.1 compared to 13.4 percent. + Figure 7.46; see page 480 for analytical methods. Patients age 18 & older receiving a first-time, kidney-only transplant.

Since 1991, time from first listing to transplant has been increasing for all patients. Those who report a history of transfusion prior to transplant consistently wait longer for a transplant. + Figure 7.47; see page 480 for analytical methods. Patients age 18 & older receiving a first-time, kidney-only, deceased donor transplant.

Use of transfusions among wait-listed patients has remained fairly stable since 1995. Approximately 30 percent of transplant candidates in 2007 had evidence of at least one blood transfusion within three years of being added to the list. Use is greater among patients highly sensitized at the time of transplant (PRA of 80 percent or higher). + Figure 7.48; see page 480 for analytical methods. Patients age 18 & older with Medicare primary coverage & listed for a kidney transplant in the given year.

The distribution of PRA values among patients on the wait list tends toward higher levels of sensitization with longer periods from the date of listing, reflecting the difficulty of finding suitable donors for highly sensitized candidates. + Figure 7.49; see page 480 for analytical methods. Patients age 18 & older listed for a kidney or kidney/pancreas transplant, 1998–2003.

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The distribution of PRA values among patients on the wait list tends toward higher levels of sensitization with longer periods from the date of listing, reflecting the difficulty of finding suitable donors for highly sensitized candidates. + Figure 7.49; see page 480 for analytical methods. Patients age 18 & older listed for a kidney or kidney/pancreas transplant, 1998–2003.
The odds of reporting PRA elevations at the time of transplant are increased in the presence of a pre-transplant transfusion. A reported pre-transplant transfusion is associated more strongly for men than for women with being highly sensitized at the time of transplant. *Figure 7.50; see page 480 for analytical methods. Patients age 18 & older receiving a first-time, kidney-only transplant, 2004–2008.

Receiving a transfusion while on the transplant wait list is associated with nearly a five-fold higher risk of dying while on the wait list within the first five years, and an 11 percent reduction in the likelihood of receiving a transplant within the first five years. *Figure 7.51; see page 480 for analytical methods. Patients age 18 & older, with Medicare primary coverage & listed for a kidney or kidney/pancreas transplant, 2001–2005.
The median wait time for patients listed in 2005, the most recent observation year, was 3.0 years; for those listing in 2010, this is projected to reach 3.6 years. **Figure 7.5**

Within three years of listing in 2005, 79 percent of wait-listed children had a deceased donor transplant, compared to 34 percent of adults. **Figure 7.9**

Since 2005, rates by race of kidney donation from deceased donors have been highest in the African American population, reaching 26.1 per million population in 2008, compared to just 9.8–10.1 among Native Americans and Asians. **Figure 7.15**

Twenty-two percent of deceased donor transplants in 2008 were from an expanded criteria donor; one in eight was a donation after cardiac death. **Figure 7.16**

In 2008, delayed graft function was reported in 3.6 percent of transplants from living donors, compared to 21.3, 29.6, and 40.2 percent of those from standard criteria donors, expanded criteria donors, and donations after cardiac death, respectively. **Figure 7.22**

In the first six months post-transplant, diuretic use in patients with Part D coverage is more common for deceased donor recipients than for living donor recipients, at 50 compared to 29 percent. **Figure 7.32**

Nearly one in five pediatric transplant recipients has a BK infection at 36 months following transplant, compared to 11.1 percent of adult recipients. **Figure 7.41**

The odds of reporting a high PRA level at transplant are increased in the presence of a pre-transplant transfusion. **Figure 7.50**