Chapter VII

Renal Transplantation: Access and Outcomes

Key Words:
Cadaveric renal transplants
Living related renal transplants
Transplant patient survival
Renal graft survival
Race in transplantation
Cadaveric graft loss
Access to transplantation
Organ allocation
Gender in transplantation

This chapter provides an overview of the trends in access and outcomes of kidney transplantation in the U.S. For the first time, this Annual Data Report (ADR) includes both Medicare and non-Medicare kidney transplants. In 1994 collection of transplant data by both the Health Care Financing Administration (HCFA) and the United Network for Organ Sharing (UNOS) was consolidated into a single expanded data collection by UNOS. This data is shared with HCFA and has recently been made available to the USRDS. The data reported here for 1994 and 1995 come from UNOS. The process of reconciling data that was collected from multiple sources is underway and should be completed by June 1997. At that time, revised reference tables will be made available on the USRDS World Wide Web page. As in the 1996 *ADR*, data on the pediatric transplant population have been incorporated into this section although more detail is provided in chapter VIII. These additions allow a more comprehensive picture of the epidemiology of kidney transplantation in the U.S.

Methods

The materials used in preparing this chapter are derived from Health Care Financing Administration (HCFA) files which include data received from the United Network for Organ Sharing (UNOS). The USRDS patient data files are based on information from the HCFA Medicare data files and the Annual Facility Survey (AFS). Data from UNOS include all transplants (Medicare and non-Medicare). In addition, some of the non-Medicare patients treated by U.S. Department of Veterans Affairs facilities have been included in the database since July, 1990. Taken together, the data sources encompass over 95 percent of all adult and pediatric kidney transplants recipients in the U.S. In order to ensure complete patient and facility information, the data are considered for analysis after a 6-month consolidation period (see Chapter XIII). Because the information from the AFS is not patient-specific, only the data presented for Medicare patients should be regarded as complete. Information concerning transplant *facilities*, however, are complete for all U.S. renal transplant centers through December 31, 1995. Unless noted otherwise, this report is based on an updated census of all renal transplants in the USRDS, which includes 101,429 transplants since 1985. Some of the statistical analyses were limited to the most recent years when it was considered more useful to report only the most recent changes in the relevant facets of transplantation under consideration. Because of the 6-month interval allowed before data analysis, information about patient and graft survival for transplants performed in 1995 are only preliminary. While there are some transplant counts and rates reported here for 1995, data that requires follow-up, such as graft and patient survival, is only reported through 1994. In previous editions of the Annual Data Report, such preliminary data reported by the USRDS were 97-98 percent complete.

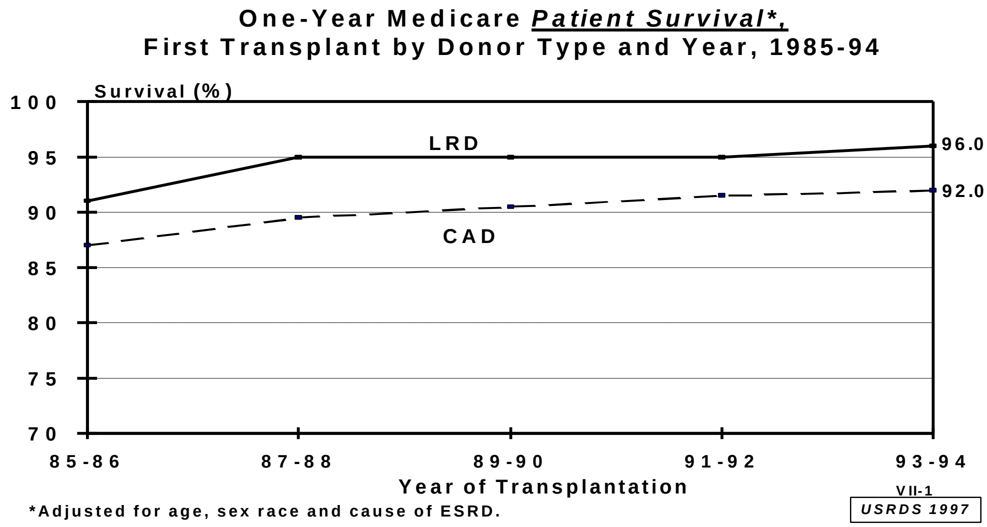

Figure VII-1

Average One-year patient survival, first transplants adjusted for age, sex, race and cause of ESRD by donor type and year, 1985-94.

Throughout the chapter, changes in reported counts or rates are expressed as percentages, not percentage points unless otherwise indicated.

Statistical analysis

Both patient and renal graft survival are calculated using the Kaplan-Meier (KM) product-limit method (Kaplan and Meier, 1 958). The age, sex, race, and primary kidney disease distributions of 1994 incident ESRD patients are used as reference for the standardization of *patient* survival. To improve the stability of adjusted *graft* survival rates, the reference population consists of all Medicare ESRD patients transplanted between 1993 and 1994 (see Chapter XII). Unless noted otherwise, if a figure is group specific, e.g., race-specific, the data in it are adjusted for the 3 remaining covariates, e.g., age, sex,

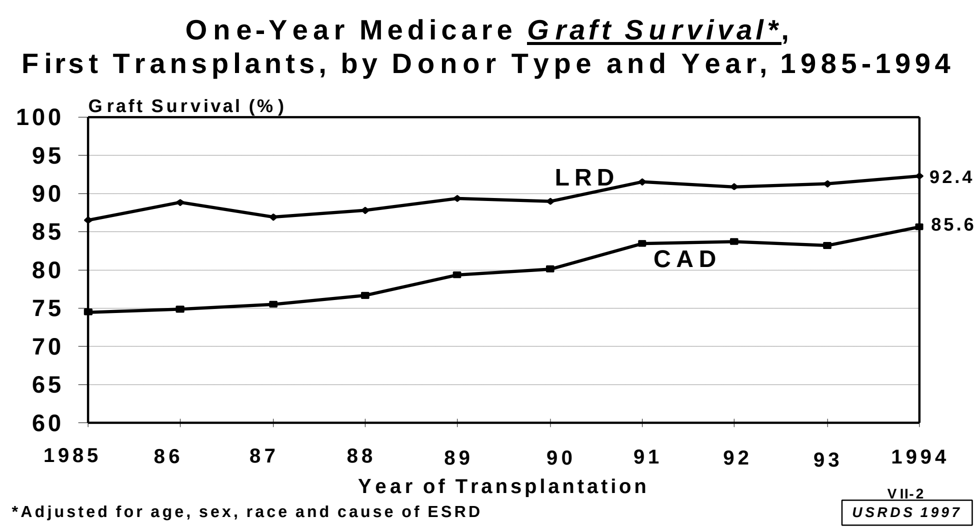

Figure VII-2

One-year graft survival, first transplants adjusted for age, sex, race by donor type and year, 1985-94.

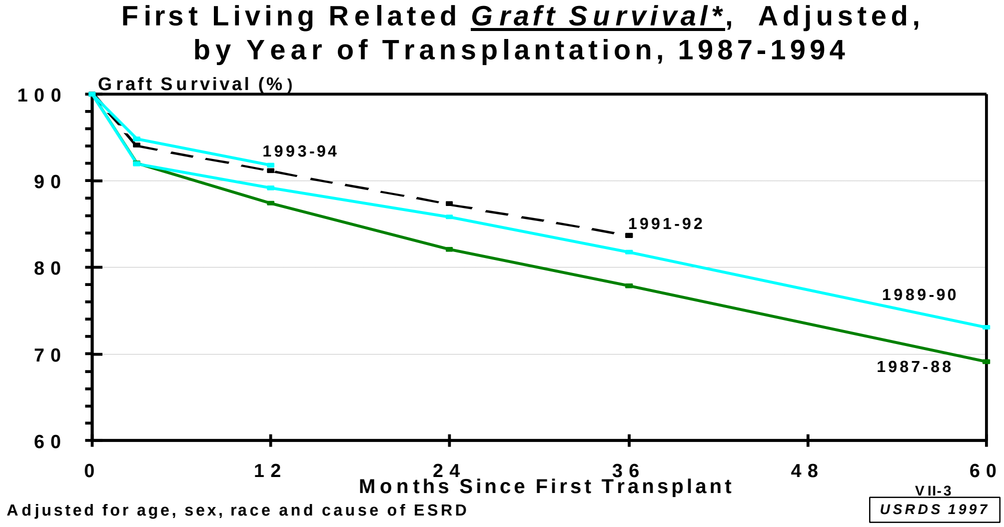

Figure VII-3

Living related kidney graft survival, first transplants, adjusted for age, sex, race and cause of ESRD, 1987-94.

and primary kidney disease. Patient age-group refers to the age at transplantation. Patients older than 65 years represent less than 3 percent of transplant recipients. Therefore, they generally are not included in the statistical analyses, although they deserve special study in the future.

Patient Survival

Figure VII-1 illustrates adjusted one-year *patient* survival rates for recipients whose first transplant was performed between 1985 and 1994. Separate survival curves are shown for CAD and LRD recipients and adjusted for age, sex, race, and primary kidney disease. Throughout the period, recipients of CAD transplants had uniformly lower one-year survival rates than did recipients of LRD transplants. For LRD recipients, patient survival increased from 91 percent in 1985-86 to 96 percent in 1993-94, a 5 percent gain. Patient survival for CAD transplant recipients also improved, from 87 percent in 1985-86 to 92 percent in 1993-94, respectively. The higher mortality rates (lower survival rates) seen in CAD recipients may reflect a higher burden of cumulative immunosuppression and co-morbidities. Studies of cause-specific mortality studies should shed additional insight to the mechanisms underlying the variable mortality rates by organ-donor source.

Kidney Graft Survival

Figure VII-2 show the one-year *graft* survival rates for kidney grafts transplanted between 1985 and 1994. Only first-time transplants are included in this figure. There has been a 15 percent (11 percentage points) increase in CAD graft survival over this period (from 75 percent in 1985 to 86 percent in 1994). There was also a marked but relatively smaller improvement in LRD graft survival which rose from 87 percent in 1985 to 92 percent in 1994, a 6 percent (5 percentage points) increase.

Figures VII-3 and VII-4 show the graft survival rates from 0-60 months by living-related and cadaver donor types, respectively. Combining the results over 2 years (1987-1988, 1989-1990, etc.) improves the stability of the KM product-limit estimator for graft survival. For the allograft survival analysis, the graft failure date was typically, the earliest date of: graft removal, death, or return to dialysis as obtained from the Transplant Followup form. In a small fraction of cases, the graft failure date was obtained from other sources, including the Chronic Renal Disease Medical Evidence Form or the quarterly dialysis billing records (see Chapter XII). Since the length of the followup varied according to year of transplantation, only transplants performed in 1989-90 completed five years of followup whereas those transplanted during 1993-1994 were followed for one year.

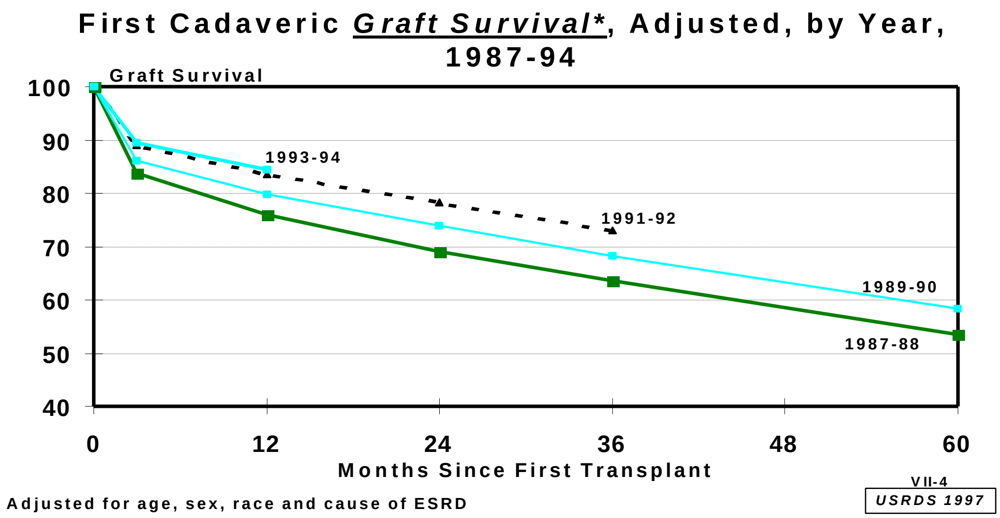

Figure VII-4

Cadaveric donor kidney graft survival, first transplants, adjusted for age, sex, race and cause of ESRD, 1987-94.

Living Related Graft Survival

Figure VII-3 demonstrate first LRD graft survival rates from 1987 to 1994. One-year graft survival improved steadily from 88 percent in 1987-1988 to 93 percent in 1993-1994. Two- and three-year LRD graft survival showed similar trends. Long-term LRD graft survival (five-year-survival) improved from 69 percent for LRD transplants performed in 1986-1987 to 72 percent for those performed in 1989-1990.

Cadaveric Graft Survival

Figure VII-4 shows graft survival rates for first CAD transplantations performed between 1987 and 1994. CAD graft survival improved steadily between the years 1987 to 1994. During this period, the one-year and two-year graft survival improved from 77

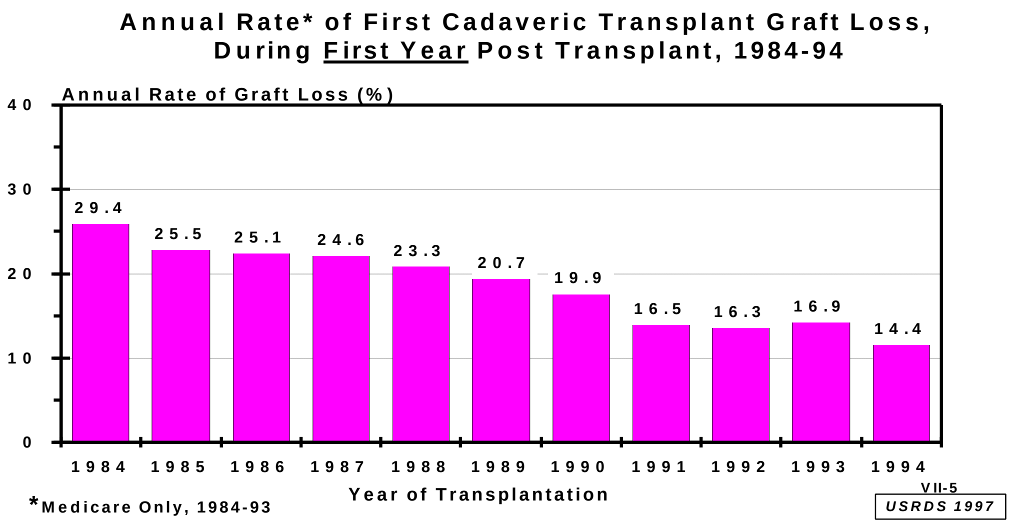

Figure VII-5

Annual rate of graft loss for first cadaveric donor transplants during the first year after transplantation by year, adjusted for age, sex, race and cause of ESRD, 1984-94.

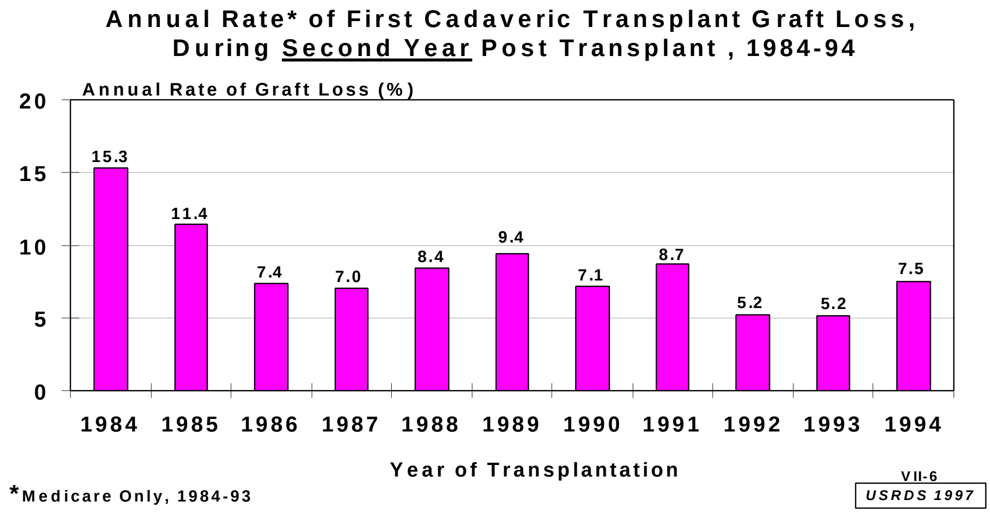

Figure VII-6

Annual rate of graft loss for first cadaveric donor transplants during the second year after transplantation by year, adjusted for age, sex, race and cause of ESRD, 1984-94.

percent to 86 percent and from 70 percent to 78 percent, respectively, and the three-year graft survival also improved from 63 percent to 73 percent. These improvements in CAD graft survival were observed in both diabetic and nondiabetic ESRD patients. Several factors probably contributed to the steady improvement in intermediate graft survival including more experience with the use of cyclosporine as the mainstay of baseline immunosuppression, better treatment and prevention of cardiovascular and infectious complications, improved patient longevity and use of newer immunosuppressive agents such as the monoclonal antibodies (Gaston 1992, Van Buren 1991).

Trend in Cadaveric Graft Loss

Given that the risk of allograft failure is variable over time, the encouraging tends in the outcomes of kidney transplantation are better illustrated when examined in terms of rates of graft loss w thin specific posttransplant intervals. The risk of

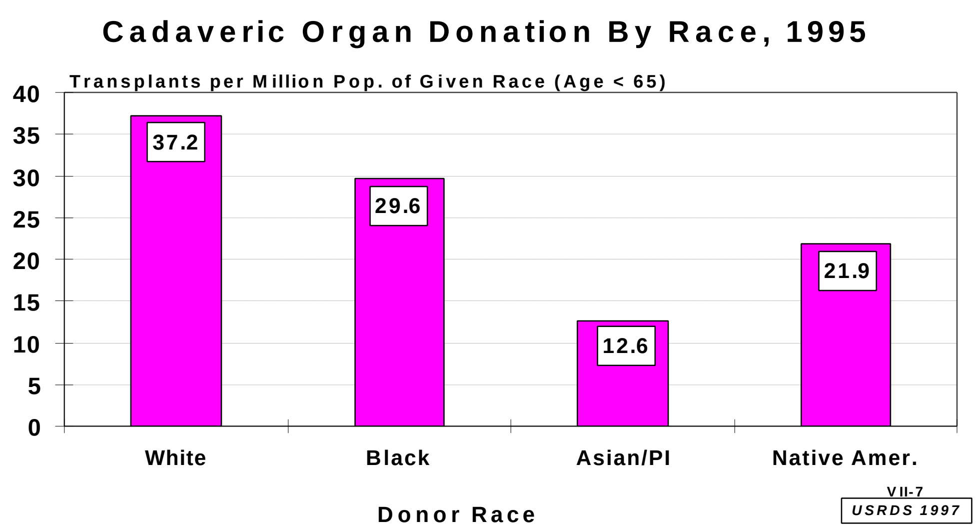

Figure VII-7

Cadaveric organ donation per U.S. population (<65 years old) by donor race in 1995.

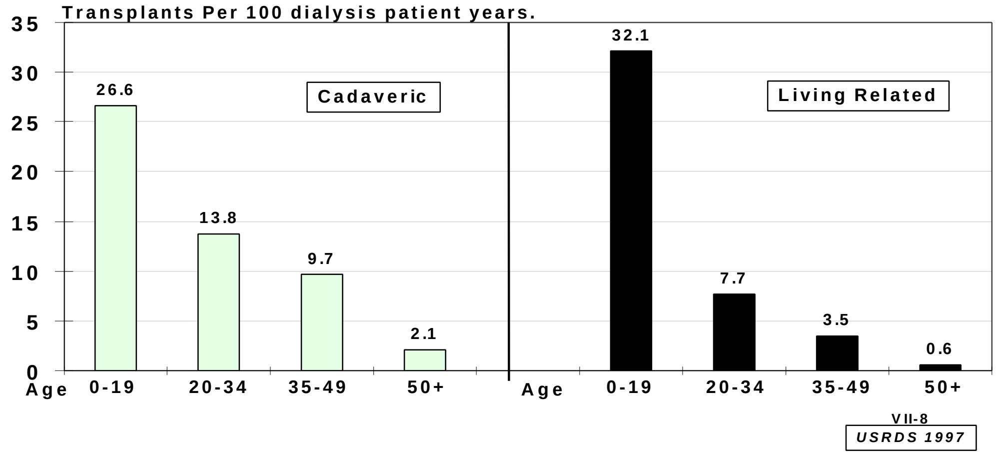

Figure VII-8

First Cadaveric and living related transplantation rate per 100 dialysis patient-years by age, 1995

cadaveric allograft loss during the first two posttransplant years are shown in Figures VII-5 and VII-6. In one decade (1984-1994), annual graft loss rates declined from 29.4 percent to 14.4 percent in the first posttransplant year. Similarly, annual graft loss rates declined from 15.3 percent to 7.5 percent during the second post-transplant period. On the average, the trend in the decline in first-year graft loss rates during this period (1984-1994) has occurred gradually, whereas most of the improvement in second-year survival rates occurred between 1985 and 1986. The slower rates of decline in graft loss rates after 1986 may account for the failure to observe significant improvement in the graft loss rates beyond the second posttransplant year.

Supply of Kidneys for Transplantation

In the last decade, the rate of cadaveric kidney donation has remained remarkably constant. Although the absolute number of cadaveric organ donors has increased slightly, a critical shortage exist because of a relentless growth in the ESRD population (and consequently the wait-listed ESRD population) who are in need of kidney transplantation. (UNOS Update 1996, Ellison 1993). Kidney donation rates vary markedly among race groups. Figure VII-7 shows the CAD kidney donation per million population of the given race (pmp), excluding procured but discarded organs relative to the 1993 U.S. population aged ≤65 years. In 1995, Whites and Blacks have the highest proportion of donated organs transplanted, 37.2 pmp and 29.6 pmp, respectively. Asians and Native Americans had significantly lower donation rates, 12.6 pmp and 21.9 pmp, respectively. The are multiple reasons for the relatively lower rates of CAD kidney donation in non-White groups (Gortmaker 1996). The data presented here may not reflect true procurement kidney rates in each racial group because the fraction of discarded organs (discard rate) may differ by donor race. In 1992 and 1993, discard rate among donors >60 years of age varied from 55 percent for Whites to 52 percent for Blacks and 60 percent for Asians (UNOS Update 1994). Although, it has been suggested that Blacks have a relatively lower rate of kidney donation, the CAD donation rates in Blacks approximated their representation in the U.S. population in 1993 (OPTN Report 1994).

The major growth in kidney transplantation during 1994-95 was due to a sharp increase in the number of living donor procedures. Living unrelated transplantation (LUR) increased by 33 percent between 1993 and 1994 and by 61.8 percent between 1994 and 1995 (see reference table F.1). Although, the LUR growth accounted for most of the growth in living donor transplantation, living related donor transplantation (LRD) also increased by 5 percent between 1993 and 1995, a growth rate twice that of cadaveric donor transplants (CAD) in the same period. Repeat transplantation comprised 10.8 percent of the 11,876 kidney transplant procedures in 1995. The repeat transplant candidates accounted for

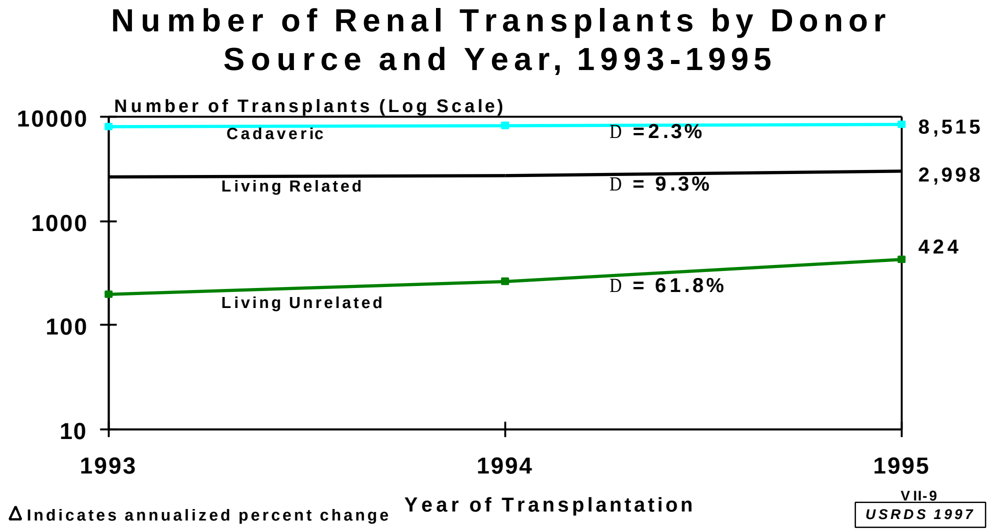

Figure VII-9

Total number of renal transplants by donor source and year, 1993-1995.

12.2 percent and 8.2 percent of CAD and LRD procedures, respectively. These trends suggest that LUR and repeat transplantation will continue to occupy increasingly larger roles in kidney transplantation in the future.

Access to Kidney Transplantation

The proportion of CAD transplant recipients with diabetic-ESRD rose from 14 percent in 1982 to 26 percent in 1993, making this group of patients the fastest growing group of CAD transplant recipients as demonstrated in the 1996 Annual Data Report. There are still profound differences in the access to kidney transplantation in the U.S. (Held 1988, OIG 1991, Gaylin 1993). The enduring partial dependence of access to kidney transplantation on income, race, and other sociodemographic characteristics has important implications for organ allocation and patient recruitment and selection at all levels of the health care system. It calls into question the effectiveness of regulatory instruments specifically designed to reduce

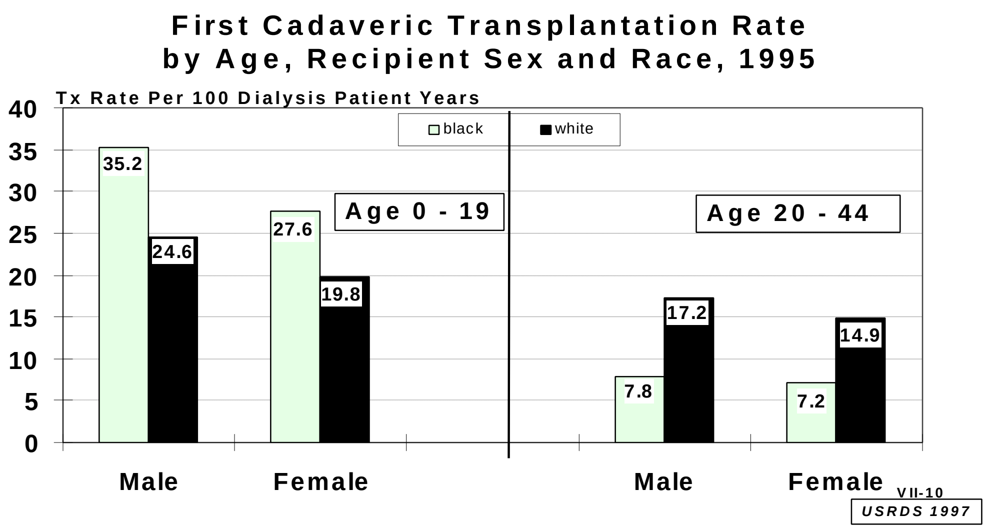

Figure VII-10

First cadaveric transplantation rate per 100 dialysis patient-years by age, recipient sex and race, 1995.

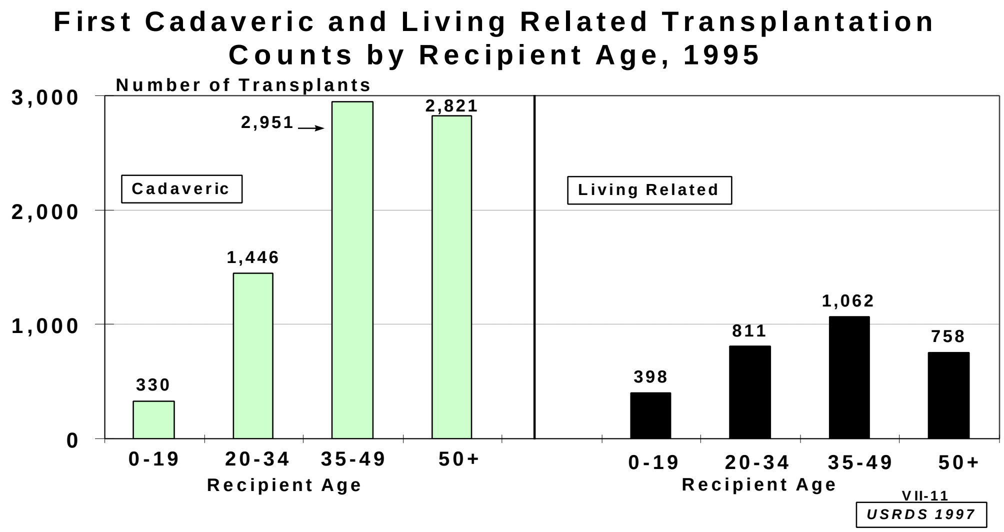

Figure VII-11

First cadaveric and living related transplantation counts by age, 1995.

this apparent imbalance (OIG 1987, OIG 1991). An index of access to transplantation is the transplantation rate which is calculated per 100 dialysis patient years and can be interpreted as the percent of dialysis patients of a particular age-group who received a kidney transplant during that calendar year. Figures VII-8 and VII-9 depict the rates of first LRD and CAD transplantation in 1995 in different demographic groups. The rate of kidney transplantation varies inversely with the recipient age cohort. Disparity in transplantation rate by age group is most striking for LRD for which the rate in the 50+ age group is 0.6/100 dialysis-patient years compared to 32.1/100 dialysis-patient years in the rate in the 0-19-year age group. This difference reveal an emphasis on living related donors in the pediatric ESRD, perhaps in response to a limited supply of cadaver donors and the severe growth and maturational impairment resulting from prolonged waiting times. Figure VII-10 illustrate some of the demographic differences in cadaveric kidney transplantation rates: Blacks have lower transplantation rates than Whites in the adult age groups, whereas White males have higher transplantation rates than females but the gender differences in the rates for Blacks is much smaller. Both medical and non medical reasons have been advanced to explain the lower transplantation rates in Blacks (Kallich 1993, Gaylin 1993, Kjellstrand 1990).

Although transplantation rates are substantially higher in the pediatric age group, most of the kidney transplant procedures are performed in the older age group (Figure VII-11). In 1995, only 4.4 percent and 13.1 percent of primary CAD and LRD transplants , respectively, were performed in pediatric recipients. This numbers reflect both the higher prevalence of ESRD in the adult population and the preference and greater benefits of LRD in pediatric ESRD patients. A comprehensive review of issues related to access to kidney transplantation can be found in other publications (Held 1994, Koyama 1994, Gaston 1993, Sanfilippo 1994).

HLA matching continues to play a major role in kidney allocation and allograft survival, however there remains a lack of consensus on the optimal level of HLA matching that simultaneously satisfy the need for equity and maximum achievable outcomes (Held 1994, Sanfilippo 1994, Gaston 1993). The preponderance of evidence suggests that long term graft survival is substantially improved with better haplotype matching in LRD kidney transplants and with zero-mismatch in CAD kidney transplants. However, for the majority of CAD transplants which have one or more HLA mismatches, the effect of HLA matching on graft survival is relatively small (Koyama 1994, Takemoto 1994, Gaston 1993, Held 1994). Moreover, organ allocation policies that maximize the benefit of HLA matching is likely to raise significant equity problems (Gaston 1993), particularly, with respect to African Americans who are both disproportionately over-represented in the ESRD population and underrepresented in the donor pool. Although, Cross reactive groups (CREG) has been proposed as an alternative matching scheme for cadaver kidney allocation (reference), it is yet to be fully determined how this method would simultaneously satisfy the need for equity and maximum achievable outcomes (Clinical transplants 1995). Beyond the established and widely accepted policy of zero-mismatched cadaveric organ sharing, allocation issues are likely to remain controversial until a surfeit of donors is realized.

Finally, the differential access and outcomes evident in a sophisticated medical procedure such as kidney transplantation probably reflect underlying variabilities in both biologic and socioeconomic factors (Bloembergen 1996, Schroeder 1994, Van Buren 1991, Whelchel 1993). Improved access and optimal outcomes for all w ould require a multi-faceted approach including extended coverage of immunosuppression, increased cadaveric and living organ donation by all and at a minimum, consideration should be given to innovative programs to accomplish these goals.

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