Chapter VII

Renal Transplantation: Access and Outcomes

The universal acceptance of kidney transplantation as the most superior form of renal replacement therapy (RRT) derives primarily from its improved physical, psychosocial and economic rehabilitation potentials (Chapman 1989, Evans 1985). In the last decade it was demonstrated that recipients of living-related donor kidney transplants have improved longevity (Weller 1982, Garcia-Garca 1985) but it has only recently been well established that recipients of kidney recipients from cadaveric donors also have better survival than comparable dialysis patients (Port 1993, Ojo 1994). The continued growth of the ESRD population medically suitable for kidney transplantation has occurred simultaneously with a remarkably stable supply of organs available for transplantation (see chapter IV). This has produced an ever growing waiting list that is expected to exceed 30,000 in 1995 (UNOS 1994). This critical shortage of cadaveric organs and public policy relevant to its equitable distribution is a dominant issue in solid organ transplantation today.

Methods

The materials used in preparing this section of the Annual Data Report were derived form the USRDS patient database. The database was synthesized from the HCFA Annual Facility Survey (AFS) and Medicare patient data files which contains information on all Medicare eligible ESRD patients (93% of patients in the United States - see Chapter XI for more details). The Facility Survey covers all kidney transplants performed per year, including those not eligible for Medicare benefits. Non-Medicare patients treated by the United States Department of Veterans Affairs (DVA) facilities have been included in the database since July, 1990. In order to ensure complete patient and facility information, a period of at least 6 months is allowed to elapse before the data are considered for analysis (see Chapter XIV). Because the information from the Facility Survey are not patient-specific, the materials presented here should be regarded as complete only for all Medicare patients. Information about transplant facilities are however complete for all United States renal transplant centers through December 31, 1993. Unless noted otherwise, this report is based on an updated census of all renal transplants in the USRDS, which includes 112,000 transplants for patients alive at any time since 1977, and 91,000 between 1983 and 1993. For most statistical analyses the year 1983 was chosen as the starting point for the analysis since facets of transplantation changed with the introduction of cyclosporine in late 1983. In addition, the reporting of data to HCFA improved substantially in that year. Because of the six month allowable interval before data are considered for analysis, information about patient and graft survival for transplants performed in 1993 are only preliminary. Over the previous years, such preliminary data reported from the USRDS were usually 97% to 98% complete.

Statistical analysis

Patient survival and renal graft survival are calculated by the product-limit method of Kaplan-Meier (KM) (Kaplan and Meier). The age, sex, race, and primary disease distributions of 1991 incident ESRD patients are used as the reference groups for the standardization of patient survival. For graft survival rates, the reference population consists of all ESRD patients transplanted between 1989 and 1991. We used a three-year reference period for adjustment of graft survival to improve the stability of estimates (see Chapter XIV). If a table or figure is group specific, e.g. primary disease specific, it was adjusted for the three remaining covariates, in this example age, race, and sex. Patient age-group refers to the age

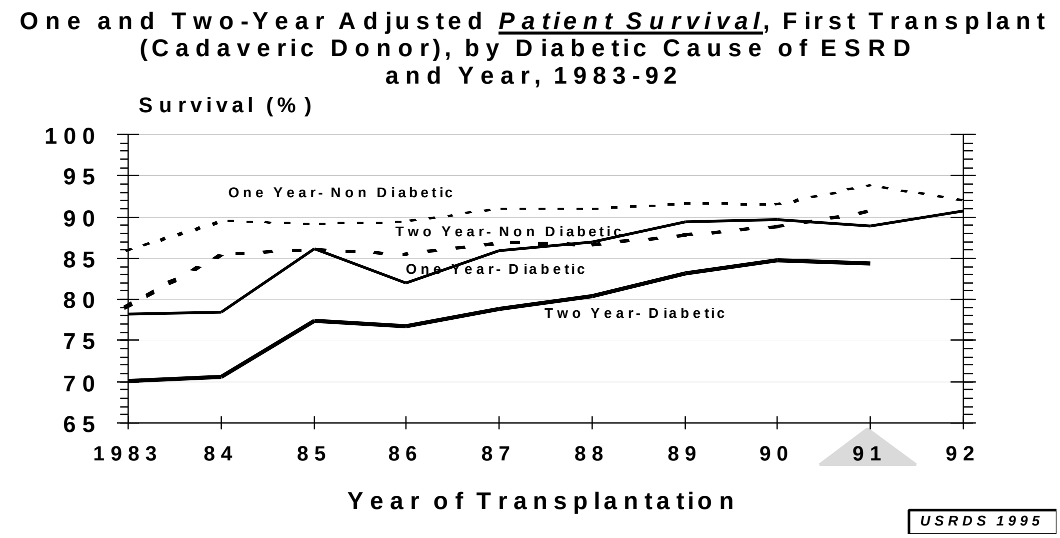


Figure VII-1

One and two-year Kaplan-Meier patient survival (percent) for ESRD patients receiving a first cadaveric transplant by diagnosis and year of transplant, 1983-92. Adjusted for age, race and sex to the distributions of the 1991 ESRD incident population. Medicare patients only. Source: Reference Tables E.58-E.59.

at transplantation. As the number of older transplanted patients is limited, most analyses presented here use two age group cohorts: 20-44 years and 45-64 years. Younger transplant patients are considered separately in a chapter on Pediatric ESRD (chapter VIII). Patients older than 65 years represent less than 1% of recipients and are not included the statistical analyses. Life expectancy was calculated as the reciprocal of the death rate.

Patient Survival

Figure VII-1 presents the adjusted one- and two-year patient survival for recipients of a first cadaveric kidney graft during 1983-92 by year of transplantation for two major aggregations of diseases leading to chronic renal failure. Primary diseases were collapsed into two groups, diabetic and non-diabetic, because the trends in patient survival for non-diabetic disease groups were found to be similar (Reference Tables E.58 and E.59). Patients with and without diabetic ESRD demonstrate distinct improvements in one- and two-year survival over this entire time period. Differences between one and two-year patient survival are consistently smaller among non-diabetics. The difference in one-year patient survival between diabetics and non-diabetics decreased over time from 8 percentage points in 1983 (78% vs. 86%) to 1% (92.0% vs. 90.8) in 1992. For diabetics, patient survival was uniformly lower than for non-diabetics between 1983 and 1991. However, the continuing improvement in one and two-year patient survival noted in all primary disease groups has been greater for diabetics than for non-diabetics.

Shown in Figure VII-2 is the one-year adjusted patient survival for two age groups (20-44 years, 45-64 years) by kidney donor source (living related, cadaveric), for adults whose first transplant was performed between 1983 and 1992. As expected, recipients of cadaveric transplants have consistently lower one-year survival than do LRD recipients of the same age-group cohort. One-year patient survival for the two living-related transplant recipient cohorts (LRD 20-44 years and LRD 45-64 years) fluctuated in a non-specific pattern by year of transplantation (likely due to the small number of recipients in the 45-64 years cohort). Overall one-year patient survival was consistently higher for younger cadaveric transplant recipients (20-44 years) compared to older cadaveric transplant recipients (45-64 years).

Notwithstanding the donor source of the kidney transplant, both young and older cohorts showed a noticeable trend towards improved one-year patient survival between 1983 and 1992. Cadaveric transplant recipients showed the most impressive gain in patient survival by 6 and 9 percentage points for the two age groups between 1983 and 1992.

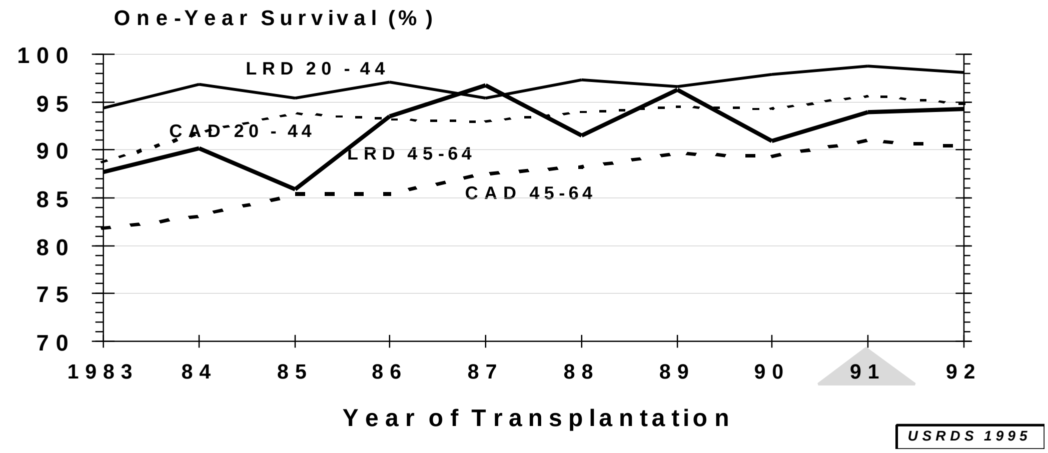


Figure VII-2

One-year Kaplan-Meier patient survival (percent) for ESRD patients receiving a first transplant by donor type (living related, cadaver) and age, adjusted for race, sex and primary disease to the distributions of the 1991 ESRD incident population, 1983-92. Medicare patients only. Average n per year: LRD 20-44, 1058; CAD 20-44, 2821; LRD 45+, 331; CAD 45+, 2112. Source: Reference Tables E.58 and E.70.

Kidney Graft Survival

In contrast to Annual Data Reports before 1994, this chapter shows graft survival rates that are adjusted for differences in patient age, sex, race and primary disease distribution. In most cases, the graft failure date was derived primarily from the Transplant Follow-up Form as the earliest of the date of graft nephrectomy, death or return to dialysis. In a small fraction of cases, the graft failure date was derived from other sources, including the Chronic

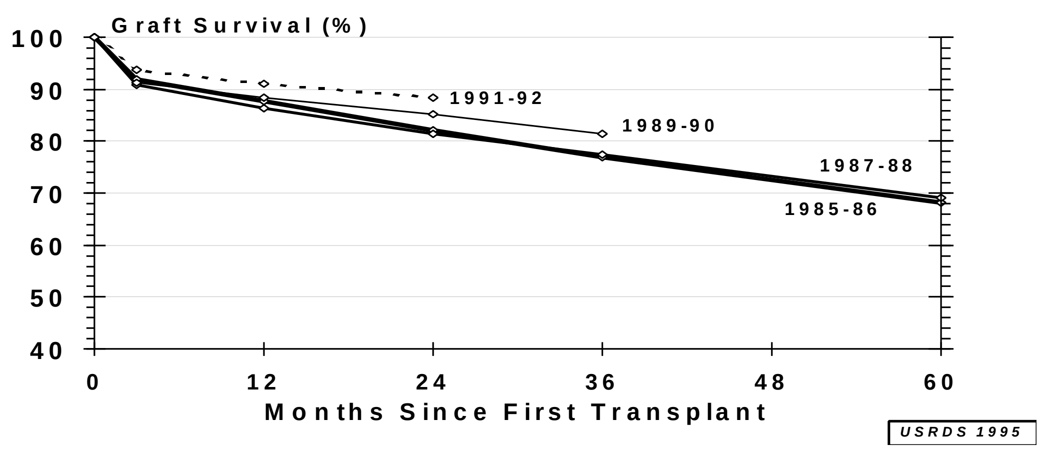


Figure VII-3

Kaplan-Meier kidney graft survival (percent), first living related transplant recipients, by time since transplant and year of transplantation, 1985-92. Adjusted for age, race, sex and primary disease to the distributions of the 1989-91 transplant recipients. Annual Kaplan-Meier graft survival estimates are averaged over each two-year period. Patients in Puerto Rico and U.S. Territories are included. Medicare patients only. Source: Reference Tables G.35-G.39.

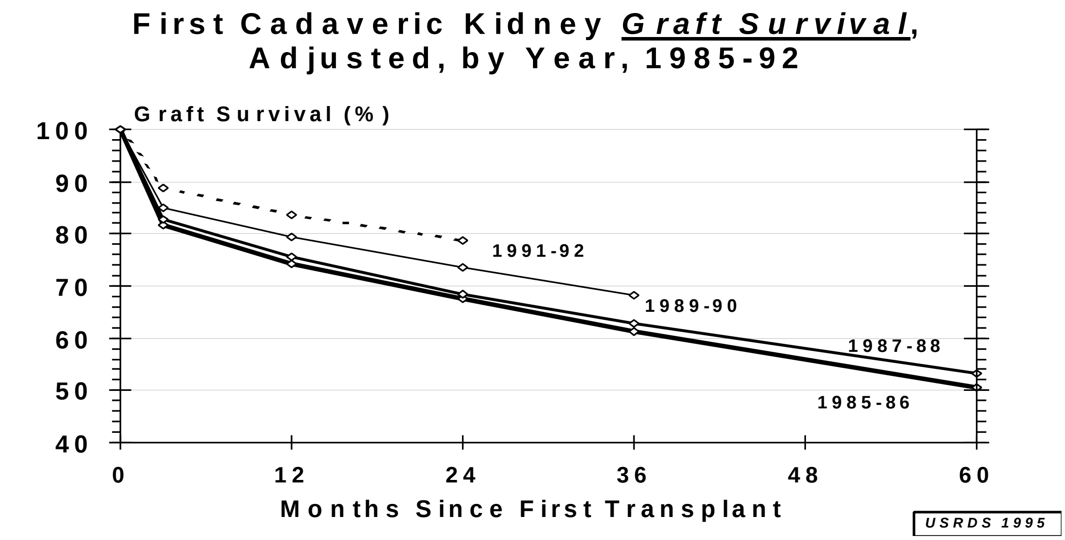


Figure VII-4

Kaplan-Meier kidney graft survival (percent), first cadaveric transplant recipients, by time since transplant and year of transplantation, 1985-92. Adjusted for age, race, sex and primary disease to the distributions of the 1989-91 transplant recipients. Annual Kaplan-Meier graft survival estimates are averaged over each two-year period. Patients in Puerto Rico and U.S. Territories are included. Medicare patients only. Source: Reference Tables G.17-G.21.

Renal Disease Medical Evidence Form or the quarterly billing dialysis records (see Chapter XIV).

Living Related Graft Survival

Adjusted Kaplan-Meier (KM) graft survival rates up to five years post-transplant for living related donor transplants are shown in Figure VII-3. Transplants performed between 1985 and 1992 were used for this analysis. Thus transplants performed prior to January 1989 had five years of follow-up and those performed during 1992 had one year of follow-up. To improve stability of the product-limit estimator of graft survival, results have been averaged in two-year groups (1985-86, 1987-88, etc.). Early post-transplant graft survival (3 months) changed little between 1985 and 1990 (91% to 92%), whereas one-year graft survival improved steadily during the study period from 87% in 1985/86 to 91% in 1991/92. Similar trends are shown for the two and three-year graft survival. The long term (five-year) graft survival improved from 68% for transplants performed in 1985-86 to 69% for transplants performed in 1987-88. The improvement in one-year graft survival between 1985 and 1992 (14%) is larger than the gain in five-year graft survival between 1985 and 1988 (8%). The sustained improvement in both short and long-term graft survival has been accomplished despite a substantial relative increase in the proportion of diabetic kidney transplant recipients (Basadonna 1992) which has been adjusted for in the current analysis.

Cadaveric Graft Survival

Adjusted and two-year averaged graft survival curves for first cadaveric donor transplants performed between 1985 and 1992 are shown in Figure VII-4. Follow-up extended up to five years post-transplantation. Adjusted cadaveric graft survival improved steadily between 1985 and 1992. During the decade adjusted one year graft survival improved from 74% to 84%, two-year survival improved from 68% to 79% and during the third post-transplant year, graft survival rose from 61% to 68% during a four-year interval. The steady continuing increase in the graft survival noted above was observed among both diabetic and non-diabetic recipients. In 1992, the adjusted one-year cadaveric graft survival was similar for diabetics and non-diabetics (Figure VII-5). The proportion of transplant recipients with diabetic-ESRD increased from 14.5% in 1982 to 24.5% in 1993, thus making patients with diabetic primary disease the fastest growing group of kidney transplant recipients (Reference Table F.8). Attention has not been drawn to the fact that graft survival analysis may be biased against diabetics because of graft loss from premature death resulting from cardiovascular and infectious complications (Basadonna 1992). As is tradition, death with graft function has been treated as graft loss in graft survival analysis; therefore a higher

One and Two-Year First Cadaveric Graft Survival, Adjusted, by Diagnosis and Year, 1983-92

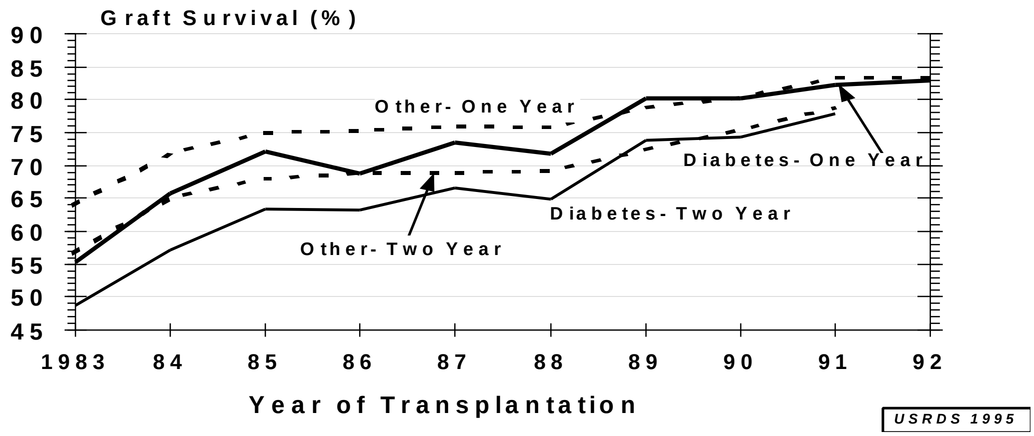


Figure VII-5

One and two-year Kaplan-Meier graft survival (percent), first cadaveric transplant recipients by diagnosis(diabetes and non diabetes) and year of transplantation, 1983-92. Adjusted for age, race and sex to the distributions of the ESRD population incident in the years 1989-91. Patients in Puerto Rico and U.S. Territories are included. Medicare patients only. Source: Reference Tables G.18-G.19.

death rates in diabetics would bias graft survival estimates in favor of non-diabetics. Notwithstanding this possible source of bias, Figure VII-5 shows that both diabetics and non-diabetics have experienced a progressive increase in one and two-year graft survival. Since 1989 diabetic recipients and recipients in other primary disease groups have enjoyed similar improvements in one and two-year graft survival.

Figures VII-3 to VII-5 clearly indicate that the graft survival has improved steadily and consistently after the introduction of cyclosporine in 1983. This improvement has not reach a plateau and is observable for all patient groups both for the short (one-year survival) and the longer-term. Although the initial improvement in 1984 through 1987 may be partly due to cyclosporine, additional factors including improved patient survival, reduction in cardiovascular and infectious complications, greater selection of patients and introduction of monoclonal antibodies have likely contributed to the more recent improvement (Gaston 1992, Van Buren 1991).

Trends in Cadaveric Graft Loss

The post-transplant period is characterized by lack of uniformity in the risk of graft loss, with the risk being highest during the first three months after transplantation (Figure VII-4) and decreasing thereafter monotonically with time.

A more detailed examination of the trends in graft survival at different post-transplantation intervals is instructive in understanding the factors associated with improvement in outcome. Graphical representation of adjusted graft loss rates at four separate consecutive post-transplant intervals are shown in Figures VII-6 and VII-7.

Figure VII-6 shows the average monthly rate of graft loss during the initial three post-transplant months for first cadaveric transplants performed between 1983 and 1992. The pattern of early graft loss shows a dramatic 25% reduction in monthly rate of graft loss between 1983 and 1984 (from 9.8% per month to 7.5% per month). This precipitous reduction in graft loss coincides with and may be directly attributable to the FDA approval of cyclosporine for maintenance immunosuppression in late 1983. During the period between 1984 and 1990, the monthly rate of graft loss declined slowly to a cumulative total reduction of 30% (from 7.5% per month in 1984 to 5.2% per month in 1990). The gradual decline during this period is associated with universal spread of cyclosporine into most transplant programs as marked by a significant proportional increase in patients on triple maintenance therapy (Ojo 1995) coupled with better understanding of its

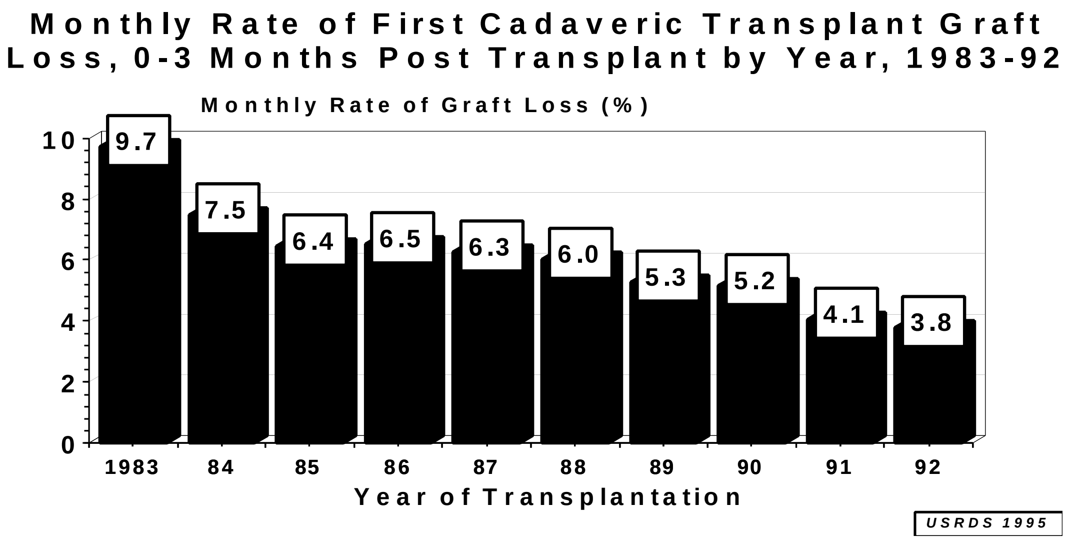


Figure VII-6

Monthly Rate of first cadaveric graft loss (percent) for 0-3 months, by time since first transplant, and year of transplantation, 1983-92. Adjusted for age, race, sex and primary disease causing ESRD to the distributions of the ESRD population incident in the years 1989-91. Patients in Puerto Rico and the U.S. Territories are included. Medicare patients only. Source: Reference Tables G.17.

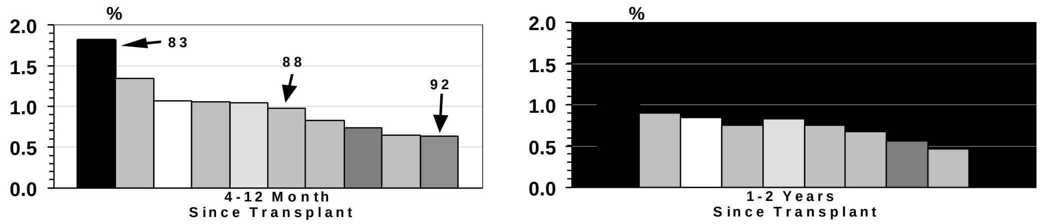
pharmacokinetics. Between 1991 and 1992, the monthly rate of graft loss during the first three post-transplant months declined from 4.1% to 3.8% (7%) In the aggregate, there has been a three-fold reduction in the monthly risk of graft loss in the early post-transplant period (0-3 months) between 1983 and 1992. This trend has led a to substantial improvement in short-term graft survival.

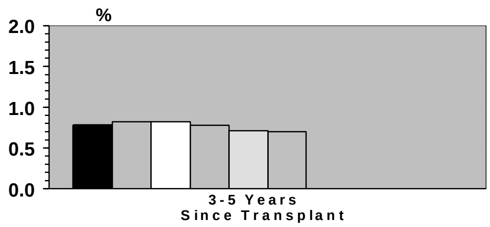
Figure VII-7 is a composite of the monthly rate of graft loss during three separate and consecutive post-transplant periods (4-12 months, 1-2 years and 3-5 years). During the initial 4-12 months post-transplant, the monthly rate of graft loss declined from 1.8% to 1.1% (39%) between 1983 and 1985. Thereafter, the decline in monthly graft loss rates has been relatively small although it appears to show a consistent improvement. Unlike the earlier period, the monthly rate of graft loss during one to two years after transplantation is characterized by a gradual and consistent decline since 1983. Nonetheless, the rate in 1991 (0.5% per month) is 50% lower than the rate in 1983 (1.0% per month). The monthly rate of graft loss during year three through five varied between 0.8% and 0.7% with no sustained decline. The table in Figure VII-7 summarizes the trends in monthly rate of graft loss over time and suggests that the improvement in short and long term graft survival in the last decade is largely due to a sustained reduction in the rate of graft loss predominantly during the first two post-transplant years.

Kidney Transplantation and HLA Antigen Matching

The central focus of HLA antigen matching in kidney transplantation derives from its impact on the access and outcome of kidney transplantation. Consequently, HLA antigen matching is pertinent to the formulation of public policy aimed at promoting fair and equitable allocation of available organs. A substantial body of knowledge has accumulated during the last three decades on the impact of HLA antigen matching on graft survival and the access of special populations to kidney transplantation (Kallich 1993, OIG 1991). Controversies resulting

Monthly Rate of First Cadaveric Transplant Graft Loss by Year and Time Since Transplant, 1983-92





	4-12 Month	1-2 Year	3-5 Year
83	1.8	1.0	0.8
84	1.3	0.9	0.8
85	1.1	0.8	0.8
86	1.1	0.8	0.8
87	1.0	0.8	0.7
88	1.0	0.7	0.7
89	0.8	0.7	
90	0.7	0.6	
91	0.6	0.5	
92	0.6		

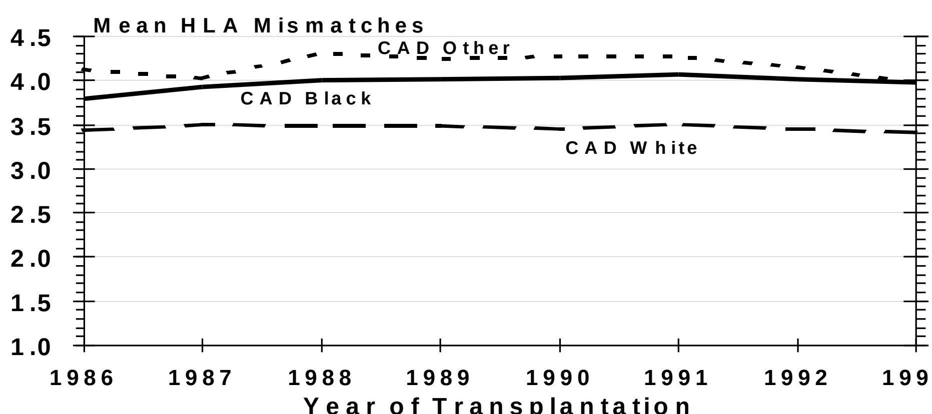
USRDS 1995

Figure VII-7

Monthly Rate of first cadaveric graft loss (percent) for 3-60 months, by time since first transplantation and year of transplantation, 1983-92. Adjusted for age, race, sex and primary disease causing ESRD to the distributions of the ESRD population incident in the years 1989-91. Patients in Puerto Rico and the U.S. Territories are included. Medicare patients only. Source: Reference Tables G.17-G.21.

from the lack of consensus on this subject have fueled several important publications and public pronouncements in the last two years (Held 1994, Sanfilippo 1994, Gaston 1993). The overwhelming preponderance of evidence suggests that HLA antigen matching is incontestably beneficial and has long term benefits for graft survival in living-related donor and well matched (zero mismatch) cadaveric kidney transplantation. However, for the overwhelming majority of cadaveric (CAD) transplants who have one or more mismatches, the effect of HLA antigen matching on improving graft survival is relatively

Mean HLA A, B, DR Mismatches for First Cadaveric Transplants, by Recipient Race and Year, 1986-93



USRDS 1995

Figure VII-8

Mean number of total HLA A, B, DR mismatches (0-6 possible), by donor type and transplant number, 1986-93. Patients in Puerto Rico and the U.S. Territories are included. Medicare patient transplants only. Source: Reference Table F.23.

small (Koyama 1994, Takemoto 1994, Held 1994, Gaston 1993). It is widely accepted, with notable exceptions, that efforts to improve HLA matching beyond the currently mandated national sharing of zero antigen mismatched kidneys would cause a shift in the allocation system which would be less favorable to minority population groups (Blacks and others) that are disproportionately affected by end-stage renal disease (Gaston 1993).

Figure VII-8 describes the average number of HLA mismatches at the A, B and DR loci in three racial groups of first cadaveric transplant recipients between 1986 and 1993. White recipients have a mean mismatch of 3.5 which is consistently lower then the mean mismatch of 3.8 to 4.0 in Blacks and 4.1 in other racial groups. The trend in the number of mismatches varied slightly between 1987 and 1993. The UNOS policy of national sharing of six antigen matched kidneys beginning from 1987 had little impact on the trend of mean number of mismatches over time because perfectly-matched kidneys represent a very small fraction (vide infra) of all cadaveric transplants. Repeat CAD transplants have 0.5 lower average mismatches than first transplants, again with no discernible trend over time (not shown).

Strict implementation of the UNOS-mandated national six-antigen matched kidney has resulted in a gradual increase in the fraction of 0-HLA mismatched kidneys transplanted between 1988 and 1993 as shown in Figure VII-9. Compared to 1987 when 0-HLA mismatched kidneys accounted for only 2.1% of all CAD transplants, there has been a greater than two-fold increase by 1993. Most likely, this trend represents broader implementation of the UNOS mandate rather than an absolute increase in the available number of 0-mismatch kidneys. The more recent mandate for national sharing of 0-HLA mismatched kidneys will likely increase this fraction of CAD transplants in the future.

The distribution of haplotype match in Blacks and Whites among first living-related donor (LRD) recipients is shown in Figure VII-10. Between 1986 and 1993, HLA-identical transplants accounted for 20 to 26% of first LRD transplants in Whites. Among Blacks, the proportion of LRD transplants that were HLA-identical was 25% in 1986 but declined to 12% in 1993. This trend was matched by a slight increase in the proportion of haplo-dissimilar donors. Since HLA-identical and haplo-dissimilar donors are by definition siblings and non-parental donors, this trend may represent either improved methods of haplotype typing in Blacks or a slight shift towards second degree related donors among Blacks. The proportions of haplotype matches have been remarkably constant among White recipients of first LRD transplants.

ABO Blood Type and Renal

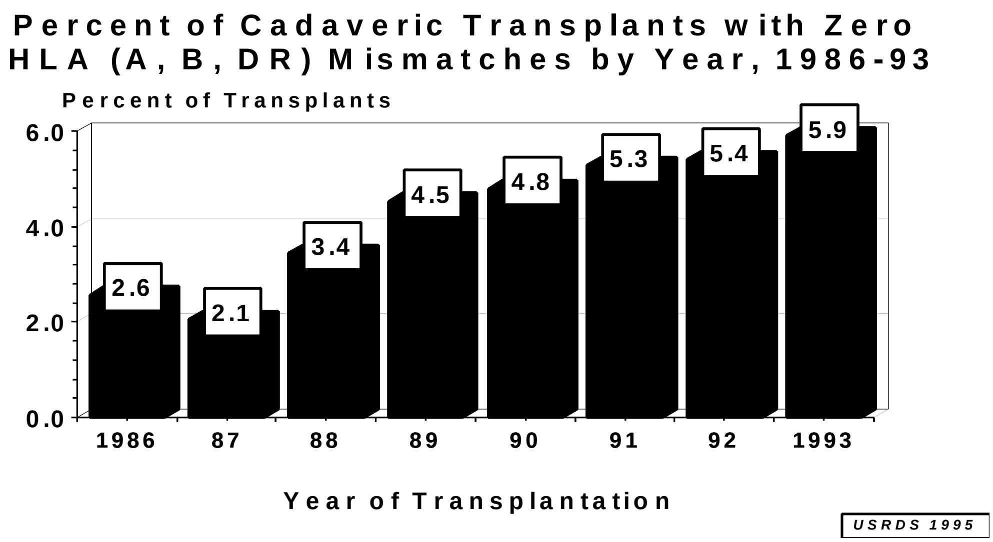


Figure VII-9

Percent of cadaveric transplants with 0 HLA (A, B, DR) mismatches by year, 1986-93. Patients in Puerto Rico and the U.S. Territories are included. Medicare patients only. Source: Reference Table F.23.

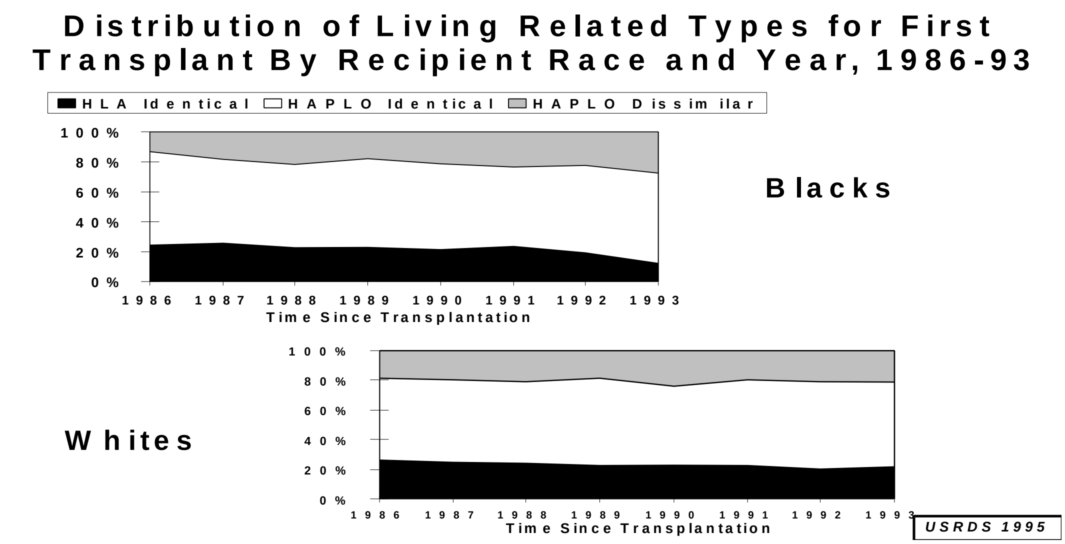


Figure VII-10

Distribution of living related types for first transplants by recipient race and year of transplant, 1986-93. Patients in Puerto Rico and the U.S. Territories are included. Medicare patient transplants only. Source: Reference Tables F.24 and F.25.

Transplantation

Differences between the "ABO" blood type in the distribution of the cadaveric organ donor pool and the pool of potential recipients on the waiting lists have led to variability in the rate of kidney transplantation by blood group types among wait-listed ESRD patients. This also has consequences for different race groups of ESRD patients on the wait-list. In the past, blood type "O" wait-listed patients have had the longest waiting time. However the discrepancy in waiting times between blood type "O" and other phenotypes (Port 1991) may have diminished since the implementation of the UNOS policy in 1987 which prohibited transplantation across "ABO" blood types except for six-antigen and phenotype matches.

More recently, Blacks with blood type "B" and Whites with blood type "O" or "B" have the longest waiting time (Kallich 1993, Whelchel 1993). Figure VII-11 shows the distribution by blood type and recipient race relative to the proportion of all "ABO" blood phenotype donors for all CAD transplants performed in 1992. Blood type "O" donors constituted 50% of all donors, followed by blood type "A" donors (37%). Blood type "B" donors accounted for 10% and type "AB" for 2% of all CAD donors in 1993. The distribution of CAD recipient blood types in all race groups paralleled that of the overall donor population. Examination of recipient blood type within race groups showed that blood group "B" and "AB" phenotypes constituted 13% of White recipients but twice as many Asian recipients (27%) and more than 20% of black recipients.

Figure VII-12 shows the trend in the proportion of blood type "O" cadaveric kidneys going to non-type "O" recipients. As noted above, UNOS policy prohibiting transplantation across blood type phenotypes except for six-antigen matches came into effect in 1987. The impact of this policy on organ distribution can be seen by the sharp decrease (52%) in across blood group "O" phenotype transplantation between 1987 and 1988. Since 1988, blood type O CAD organs going to non-"O" phenotype has remained low suggesting a high degree of compliance with UNOS policy. The remaining small fraction of blood type "O" CAD organs transplanted into non-O blood phenotype recipients may represent to a large extent six-antigen matched transplantation as required by a concurrent UNOS policy.

Supply of Kidneys for Transplantation

The supply of cadaveric kidneys has remained remarkably constant since 1988 (UNOS Update 1994, Ellison, 1993). The lack of a significant increase in the total donation rate has been accompanied by an increasing demand (chapter IV). The organ donation rate varies somewhat between race groups. Figure VII-13 represents the rate of cadaveric organs donated and actually transplanted from a race group relative to that racial group's representation in the

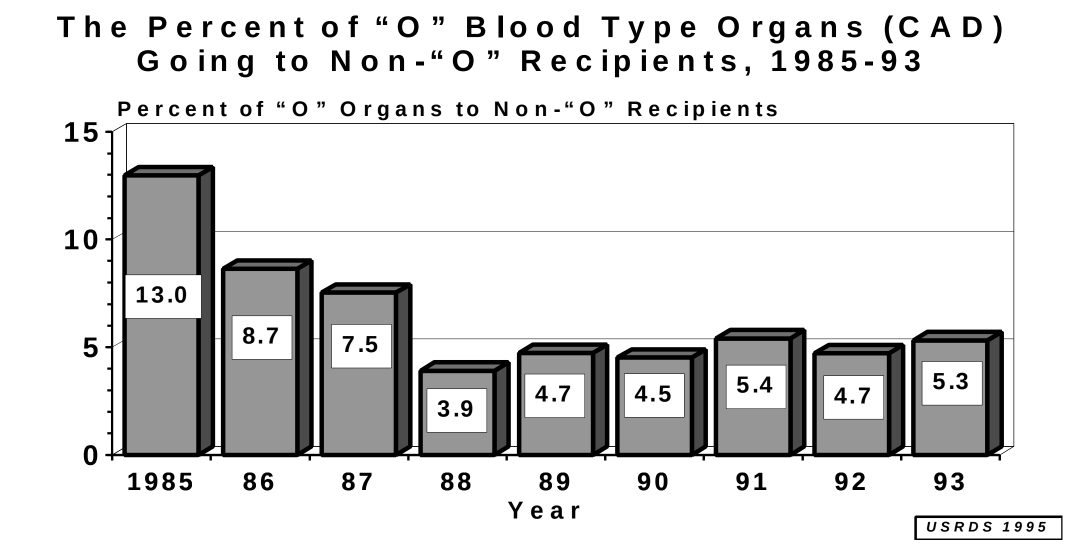


Figure VII-12

Figure VII-12. Percent of "O" blood type organs from cadaveric donors going to non-"O" recipients. Patients in Puerto Rico and the U.S. Territories are included. Medicare patients only. Source: Special Analysis.

The distribution of patient ABO blood types for cadaveric transplant recipients by race, 1992. Patients in Puerto Rico and the U.S. Territories are included. Medicare patients only. Source: Reference Table F.41 and Special Analysis.

U.S. population in 1993 (rate per million population - pmp). Whites have the highest rate of donated organs that were transplanted during 1992 and 1993 combined. The average annual rate of transplanted organs was 27.5 pmp for Whites and 23.5 pmp for Blacks. The rate was substantially lower for Asians and Native Americans than for Blacks and Whites. Reasons for low rate of CAD organs from Asians and Native Americans for Blacks are not known. It should be emphasized that the data presented in Figure VII-13 may not accurately reflect the rate of CAD organ donation per million population in each racial group. The discard rate was as high as 10% in 1993 and it is not known whether the discard rate differs by donor race. However, among older donors (>60 years), the discard rate in 1992 and 1993 was 55% for Whites, 52% for Blacks and 60% for Asians (UNOS). Although the rate of transplanted CAD organs from black donors is slightly lower than that of Whites (27.5 pmp vs. 23.5 pmp), recent data from the Organ Procurement and Transplant Network (OPTN 1994 Annual Report) indicate that the actual rate of CAD kidney donation for Blacks and Whites may currently be similar to their representation in the general US population (OPTN 1994 Annual Report).

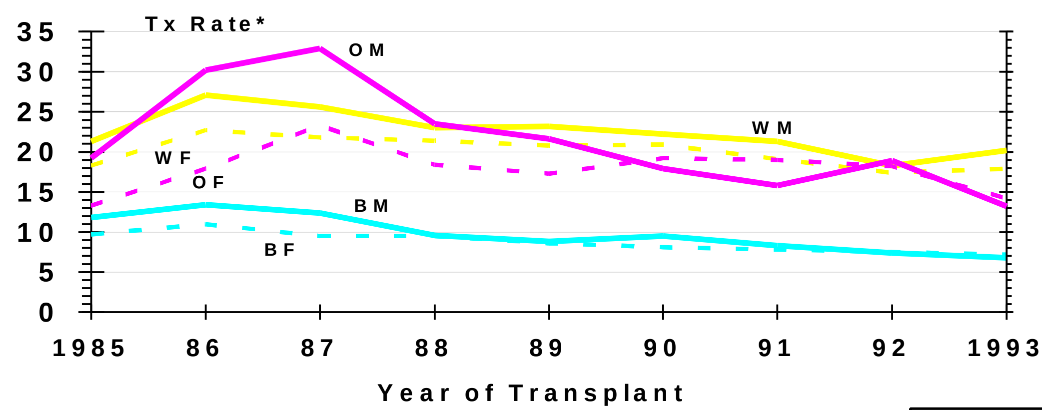
Access to Kidney Transplantation

The observation by Held and colleagues (1988) of differences in access to kidney transplantation among different sociodemographic groups has kindled the interest of several investigators, policy makers, and the general public on how cadaveric organ allocation policy is functioning (OIG 1991, Gaylin 1993). It has been established that access to kidney transplantation is not completely separable from the income, race and other sociodemographic characteristics of the recipients. Organ allocation that is partly dependent on sociodemographic characteristics has serious implications for federal regulatory agencies, societal values and tenets of medical practice (OIG 1987). Central to the issue of organ allocation is the apparent disparity in access to waiting list and transplantation rates between Black and White ESRD patients.

A corollary issue is the outcome of kidney transplantation (graft survival) in these two race groups, which constitute more than 90% of kidney transplant recipients. Graft survival impacts access to transplantation because previously transplanted patients comprise 26% of the national CAD waiting list (OPTN 1993 Annual Report). Figure VII-14 depicts the relationship between age and rate of CAD transplantation between 1984 and 1993. The transplantation rate 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 cadaveric transplant during that calendar year.

Throughout the period under study, the rate of kidney transplantation varies inversely with the recipient age cohort. The overall rate of CAD transplantation relative to person-years on dialysis (see Chapter 14 for statistical methods) showed an increase between 1984 and 1986 and a subsequent decline by approximately 33% (9 to 6 per 100 patient years). The rate of cadaveric transplantation among all age groups under 50 years (0-19 years, 20-29 years and 30-49 years) declined steadily from a peak in 1986. The largest decline occurred in the 0-19 years age group. The rate among patients who were 50 years or older showed a smaller reduction since 1986. These trends are predominantly due to a fairly constant number of donor organs and an increasing pool of dialysis patients. For the oldest age group the dialysis pool had the greatest growth and likely included the largest proportion of patients with serious comorbid conditions (Gaylin 1993).

First Cadaveric Transplantation Rate (Age 20-44) by Year, Recipient Sex and Race, 1985-93



* Per 100 dialysis patient years.

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Donor Race

Figure VII-15

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First cadaveric transplantation rate (per 100 dialysis patient years), by recipient race and sex, ages 20-44, 1985-93. Patients in Puerto Rico and the U.S. Territories are included. Medicare patients only. Note: W=White, B=Black, O=Other; M=Male, F=Female. Same as Figure VII-16 with the exception of age groups. Source: Special analysis.

Figure VII-13

Number of cadaveric organs transplanted per million U.S. population by race, averaged over the years 1992-93. Populations of Puerto Rico and U.S. Territories are not included in the denominator. Source: Reference Tables F.27, J.7, and special analysis.

First Cadaveric Transplantation Rate (Age 45-64) by Year, Recipient Sex and Race, 1985-93

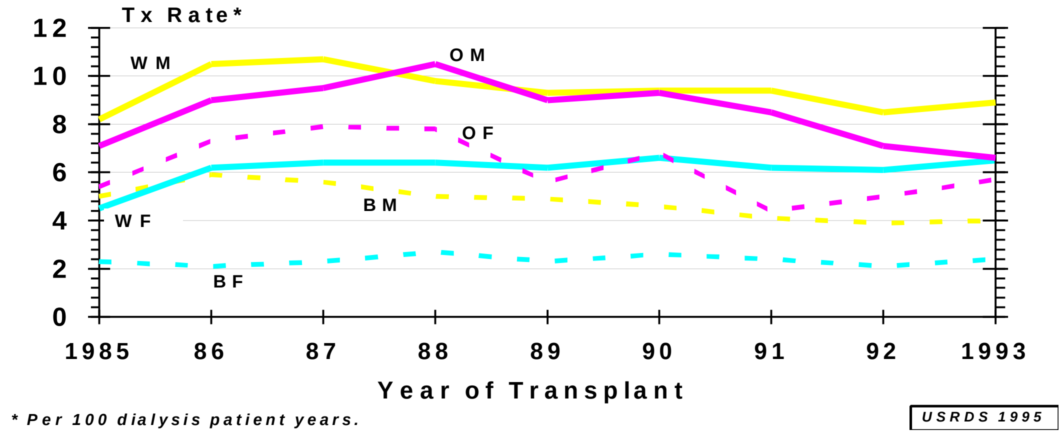

Figure VII-16

First cadaveric transplantation rate (per 100 dialysis patient years), by recipient race and sex, ages 45-64, 1983-91. Patients in Puerto Rico and the U.S. Territories are included. Medicare patients only. Note: W=White, B=Black, O=Other; M=Male, F=Female. Same as Figure VII-15 with the exception of age groups. Source: Special analysis.

Cadaveric transplantation rate per 100 dialysis patient years at risk by year of transplant and age at transplant, 1984-93. Patients in Puerto Rico and the U.S. Territories are included. Medicare patients only. Source: Special Analysis.

A more detailed illustration of the rate of first cadaveric transplantation by race and gender categories is shown in Figure VII-15 for recipients aged 20-44 years and in Figures VII-16 for recipients in the 45-64 year age group. The trends in the rate of first CAD transplantation among the various sociodemographic groups between 1985 and 1993 can be summarized as follows:

In the younger age group (20-44 years), Black males and females had the same rate of transplantation (approximately 10 per 100 dialysis patient years) which remained stable since 1988. Rates for Blacks were consistently half that of

Living Related Transplantation Rate (Age 20-44) by Year, Recipient Sex and Race, 1985-92

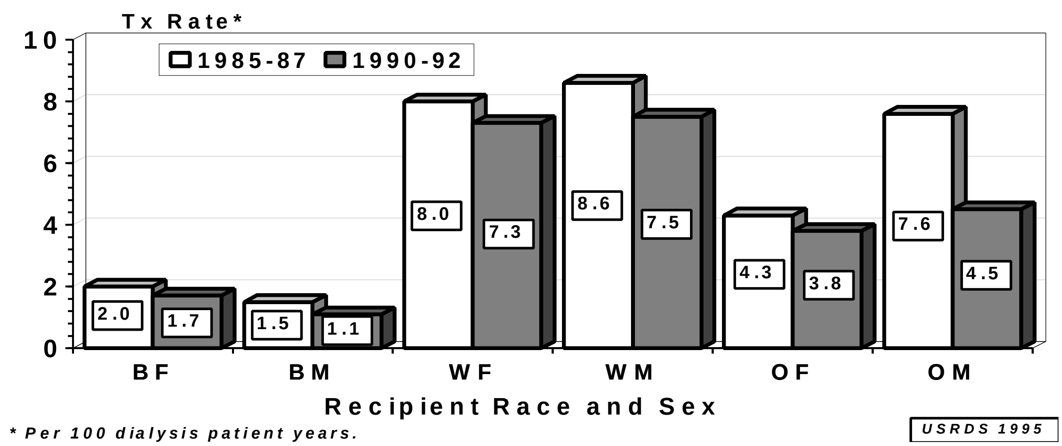

Figure VII-17

Living related transplantation rate (per 100 dialysis patient years), by recipient race and sex, ages 20-44, 1985-92. Patients in Puerto Rico and the U.S. Territories are included. Medicare patients only. Note: W=White, B=Black, O=Other; M=Male, F=Female. Same as Figure VII-1 with the exception of age groups. Source: Special analysis.

Whites. For Whites, there appears to be a gradual decline. White and Other (Asians, Native Americans and Hispanics) females in the 20-44 age group have a consistently lower rate of transplantation than do their male counterparts. The rate of transplantation for these latter race and gender groups fluctuated slightly but showed no consistent pattern between 1988 and 1993.

In the older age group (45-64 years), females in each race group also had lower rates of transplantation compared to their male counterparts. Black females had the lowest rate of transplantation among all groups, at all times between 1985 and 1993 (nearly 2 per 100 dialysis patient years). Whites have the largest gender disparity in the rate of transplantation with White males having 2.5 to 5 per 100 dialysis patient years more than White females compared. The difference between genders appeared to have decreased slightly since 1986.

The rates of first LRD transplantation in two eras (1985-87 and 1990-92) are depicted for race and gender categories for two age groups in Figures VII-17 and 18, respectively. In both age groups, the LRD transplant experience was similar to that of CAD transplantation with females in each race group having lower rates compared to their male counterparts. Similarly, Blacks had substantially lower rates (four to seven-fold less likely) compared to Whites. Other race had a rate approximately half-way between those for Blacks and Whites. The rates of transplantation remained relatively stable for all groups except among the Other race group where males experienced a sharp decline in their rate between the two three-year periods considered.

The variable rates of transplantation among race, age and gender groups described in the preceding figures reflect the combined impact of organ allocation policy, distribution of disease burden, and perhaps differences in graft survival and the willingness to donate both cadaveric and living-related organs. A comprehensive analysis of these issues can be found in recent publications (Held 1994, Koyama 1994, Gaston 1993, Sanfilippo 1994). In an atmosphere where these issues dominate public debates and scientific writings on solid organ transplantation, two important observation must be kept in focus. Firstly, CAD donation in Blacks cannot meet organ requirements in this race because it suffers ESRD at rates that several fold higher than other race groups. Current levels of CAD organ donation in Blacks and Whites approximate their respective representation in the general population (OPTN 1994 Annual Report) and thus, the expectation of an increased minority organ donation may be unrealistic without an overall effort to increase the organ supply. Secondly, an allocation policy that emphasizes maximal matching is likely to have a limited impact on graft survival but will divert a substantial number of organs from Blacks and other minority groups who are disproportionately affected by ESRD. A fruitful additional strategy to address

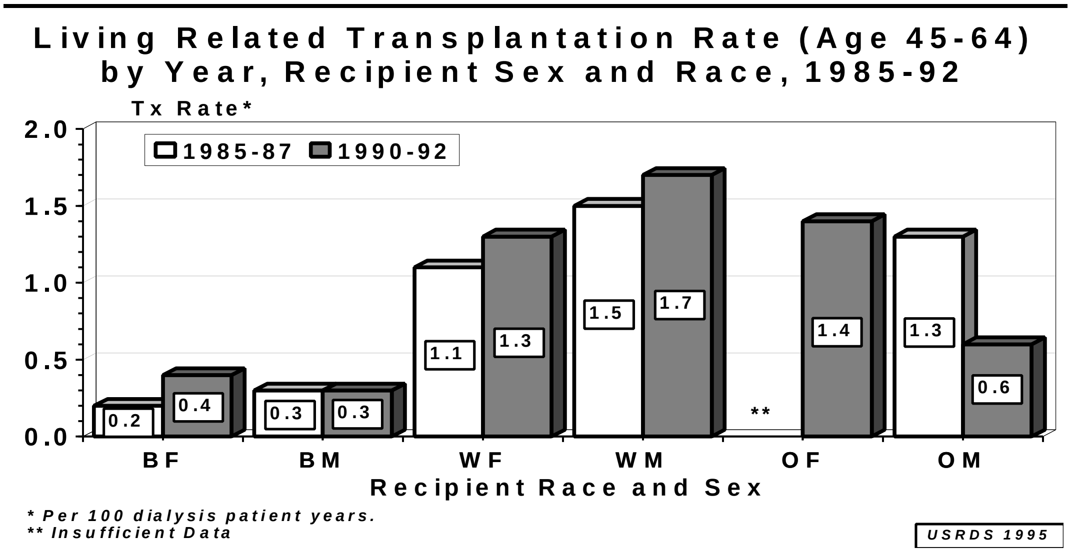

Figure VII-18

Living related transplantation rate (per 100 dialysis patient years), by recipient race and sex, ages 45-64, 1985-92. Patients in Puerto Rico and the U.S. Territories are included. Medicare patients only. Note: W=White, B=Black, O=Other; M=Male, F=Female. Same as Figure VII-17 with the exception of age groups. Source: Special analysis.

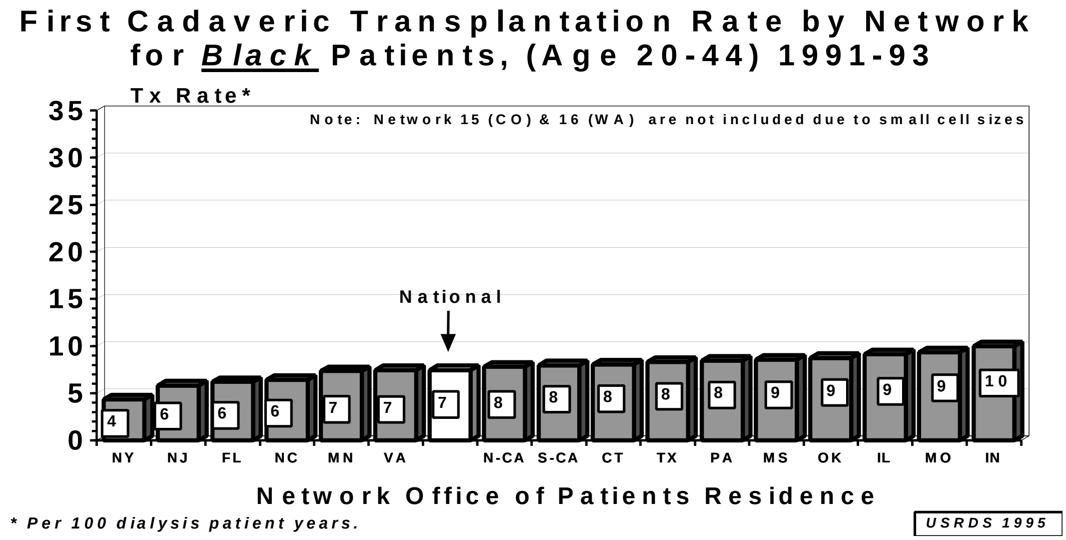

Figure VII-19

First cadaveric transplantation rate per 100 dialysis patient years, for black patients, ages 20-44, by Network, 1991-93. See Figure II-6 for Network key. Medicare patients only, includes transplants in Puerto Rico and U.S. Territories. Integers do not show decimal values which have been used in the ordering of Networks. Source: Reference Tables F.57 and F.58.

critical organ supply is an aggressive promotion of living organ donation from suitable relatives of potential recipients (Ojo 1993).

Transplantation Rates by Network

The probability of receiving a kidney transplant also varies by the ESRD Network of residence for ESRD patients. Using the event "wait-listing" during the first year of ESRD incidence as a measure of access, Kallich (1993) found that the probability of being wait-listed varies widely according to geographic area of the residence of the ESRD patient. At the low end, only 6.5% of incident Black ESRD

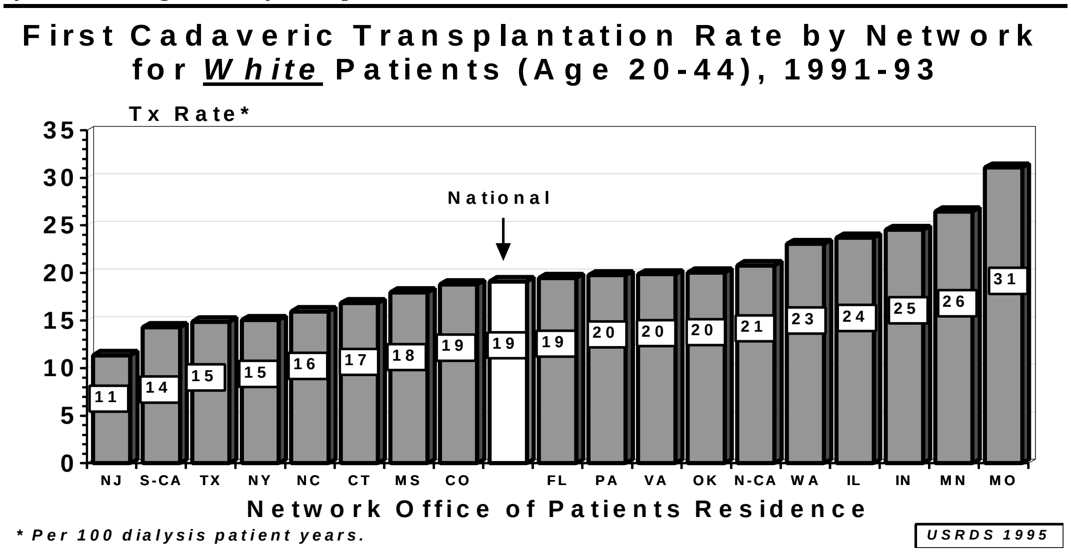

Figure VII-20

First cadaveric transplantation rate per 100 dialysis patient years, for white patients, ages 20-44, by Network, 1991-93. See Figure II-6 for Network key. Medicare patients only, includes transplants in Puerto Rico and U.S. Territories. Integers do not show decimal values which have been used in the ordering of Networks. Source: Reference Tables F.57 and F.58.

patients were wait-listed during the first year of ESRD compared to 19.4% in another Network. The variability between Networks in access to waiting list also differs by the race of the ESRD beneficiary.

Figure VII-19 and VII-20 illustrate the variability in the rate of first cadaveric transplantation among the 18 ESRD Networks in Blacks and Whites, respectively. The age cohort (20-44 years) was chosen for illustration because the largest fraction of transplants occur in this age group. The denominator for calculating the transplantation rate is the person-years (scaled to 100) of dialysis experience of ESRD patients residing in each Network. For the years 1992 and 1993, the average national annual transplantation rate was 7 and 19 transplants/100 dialysis-patient years in Blacks and Whites, respectively with a spread by a factor of 2.5 to 2.8.

An interesting observation is that the three Networks with offices located in New York, New Jersey and North Carolina are among the regions with lowest transplant rates for both Blacks and Whites. Similarly, the three Networks with highest transplantation rates in Blacks (offices located in Illinois, Missouri and Indiana) are also among the Networks with the highest transplantation rates in Whites. Thus, the annual rate of cadaveric transplantation in each Network appear to reflect the volume of transplant activities occurring in each particular Network. These rates do not represent the probability of receiving a transplant given the patient's Network or residence because of referrals to neighboring Networks. Consequently, the data presented in Figures VII-19 and VII-20 do not impugn the performance of any particular ESRD Network with respect to transplant-related activities because the transplant rates may be driven by several factors unrelated to geographic location such as the fraction of ESRD patients who travel across Networks to receive transplants in centers located in the neighboring Network(s) or the location of transplant programs within Networks. If nothing else, the data presented in Figures VII-19 - 20 serve as guide to further evaluate the utilization of transplantation as a preferred form of renal replacement therapy.

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