

# Insurance Type and Minority Status Associated with Large Disparities in Prelisting Dialysis among Candidates for Kidney Transplantation

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**Background and objectives:** Disparities in time to placement on the waiting list on the basis of socioeconomic factors decrease access to deceased-donor renal transplantation for some groups of patients with end-stage renal disease. This study was undertaken to determine candidate factors that influence duration of dialysis before placement on the waiting list among candidates for deceased-donor renal transplantation in the United States from January 2001 to December 2004 and the impact of Medicare eligibility rules on access.

**Design, setting, participants, & measurements:** Access to the waiting list was measured as the percentage of all wait-listed candidates in the Scientific Registry of Transplant Recipients database who were listed before dialysis and by the duration of dialysis before placement on the waiting list. Multivariate logistic and linear regressions were used to determine variables that were predictive of preemptive listing and the duration of dialysis before listing.

**Results:** The odds for preemptive placement on the waiting list improved during the course of the study period, whereas the median duration of prelisting dialysis did not. The candidate factors that were associated with low rates of preemptive listing and prolonged exposure to prelisting dialysis included Medicare insurance, minority race/ethnicity, and low educational attainment. In patients who were listed after the age of 64 yr, the adverse effect of Medicare insurance on access largely disappeared.

**Conclusions:** The disparity in dialysis exposure could potentially be diminished by concerted efforts on the part of the nephrology and transplant communities to promote early referral and preemptive placement on the waiting list, by calculating waiting time from the date of initiation of dialysis for patients who are on dialysis at the time of referral, and by relaxing Medicare eligibility requirements.

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The transplant community is entrusted with ensuring a just and equitable system of organ allocation in the United States. Previous studies revealed large disparities in waiting times for some racial and ethnic groups, in part because the previous Organ Procurement and Transplantation Network (OPTN) kidney allocation system was strongly weighted toward HLA matching (1,2). Recent changes in the allocation system that reduce the emphasis on HLA-B similarity as a criterion for allocation have reduced this disparity and contributed to a more equitable distribution of kidneys. Currently, waiting time in the kidney allocation system begins to accrue from the date of placement on the waiting list, most typically after the potential candidate completes his or her evaluation for transplantation. Primary insurance through Medicare, as opposed to private insurance, has been previously recognized as an impediment to referral and listing for deceased-donor transplantation among some popula-

tions, leading to increased duration of dialysis before transplantation (3,4). Other factors, such as race, ethnicity, and educational attainment, have also been identified (4,5). In these previous studies, the primary end points that were used to determine access were rates of placement on the waiting list, defined as the percentage of overall patients who were on dialysis and were placed on the waiting list for transplantation and the percentage of preemptive listings (*i.e.*, the proportion of placement on the waiting list that took place before the initiation of dialysis). Differences in duration of dialysis before registration for placement on the waiting list were not evaluated. With the new OPTN allocation policies decreasing the weight given to HLA matching, waiting time has become a more important determinant for allocation of deceased-donor kidneys. More recent studies have shown that patient and graft survival after transplantation is best among patients with little or no previous maintenance dialysis and worsens progressively with increasing dialysis duration (6–9); therefore, timely referral and placement on the waiting list prevent unnecessary dialysis exposure that increases the risk for death and morbidity before transplantation and reduce subsequent graft and patient survival after transplantation.

More than 40% of patients rely on Medicare as the primary source of insurance for their evaluation for renal transplantation

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(4). Eligibility rules for Medicare change at the age of 65 yr. Generally, patients who are younger than 65 yr and have ESRD must wait 3 mo on dialysis before becoming Medicare eligible. At the age of 65 yr, all citizens qualify for Medicare without a mandatory waiting period. Because citizens who are  $\geq 65$  yr, for practical purposes, have universal insurance, differences in access on the basis of these two age groups provides a unique opportunity to assess the impact of eligibility rules for Medicare on access to transplantation. The purpose of this study was to identify factors in a national cohort of patients that are associated with delayed placement on the waiting list and increased duration of dialysis before placement on the waiting list among candidates for primary deceased-donor kidney transplantation and to determine the impact of eligibility rules for Medicare on access.

## Concise Methods

This study has two sections. In the first section all potential adult ( $\geq 18$  yr) primary deceased-donor renal transplant candidates who were placed on the OPTN waiting list from January 2001 to December 2004 were identified in the Scientific Registry of Transplant Recipients/OPTN database and constituted the primary study population. Patients who were placed on the waiting list and received a living-donor kidney transplant on the same day as their listing were excluded. Patients who were listed for a second transplant of any type were also excluded because these patients comprise a special population that is already engaged with the transplant provider system and because of uncertainty in the data for some patients as to whether the date listed represented the first initiation of dialysis or a subsequent return to dialysis after renal graft failure. Two data fields were used to determine dialysis status at listing: "Date of initiation of dialysis" and "dialysis status at listing, preemptive *versus* on dialysis." The period of 2001 to 2004 was chosen because nearly complete data regarding dialysis status at listing and the date of dialysis initiation existed. The duration of dialysis before listing was determined from the date of first dialysis and the date of listing. For patients for whom the dialysis status at listing and the date of initiation of dialysis were discordant, the dialysis date was used to determine the status of the patient.

The primary insurance at the time of placement on the waiting list was identified from the database. Patients with insurance other than Medicare, Medicaid, or private were classified as other. This group included self-pay, indigent care, pending coverage, Department of Veterans Affairs or other US or state agency coverage, and unknown. Private insurance included patients who were enrolled in health maintenance or preferred provider organizations as well as traditional types of private fee-for-service insurance. Secondary insurance coverage was not included in the analysis. Educational attainment was available for 80% of patients, and those without educational attainment information were coded as unknown. These additional covariates were included in the analysis, and data were available in  $>99\%$  of cases: Gender, race/ethnicity (white, black, Hispanic, or other), age, OPTN region, and cause of ESRD (hypertension, diabetes, polycystic kidney disease, glomerulonephritis, and other).

Two measures of access were used in the study: Percentage of all placements on the waiting list that occurred before initiation of dialysis (*i.e.*, preemptive listing) and the duration of dialysis before placement on the deceased-donor waiting list. Multivariate logistic regression was carried out to determine the independent association of these covariates with the rate of preemptive listing, and multivariate linear regression was used to determine the independent association of these covariates with the duration of dialysis before listing.

The second part of the study investigated the effect of eligibility rules for Medicare on access to transplantation for candidates before and after the

age of 65 yr. All adult primary transplant patients who had completed data regarding dialysis duration and had either private or Medicare as their primary insurance were included in this analysis. Patients with other types of insurance were excluded. Multivariate logistic and linear regression was used to determine the independent effects of the study covariates on preemptive listing and duration of dialysis before listing.

## Statistical Analysis

A two-sided probability of type 1 error ( $\alpha$ ) = 0.05 was considered to be the threshold of statistical significance. All statistical analysis was performed using SPSS 11.0 for Windows (SPSS, Chicago, IL).

## Results

### Part I: Analysis of Primary Deceased-Donor Kidney Transplant Waiting List Placements

Between 2001 and 2004, 76,145 candidates who fulfilled the study criteria as primary registrations were placed on the OPTN deceased-donor kidney transplant waiting list. Of this group, 96 patients were excluded because they were listed on the same day as their living-donor kidney transplant. Seventy patients who were on dialysis at the time of listing lacked dialysis dates and were excluded; 403 patients had discordant data regarding dialysis status and the duration of dialysis before listing and were assigned the status indicated by the date of initiation of dialysis. The final cohort of patients in the study population was 75,979, or 99.8% of the eligible patients who were placed on the waiting list. Of this population, 9979 subsequently received a living-donor kidney  $\geq 1$  d after the date of listing, and an additional 19.7% had a deceased-donor kidney transplant by the study end date.

Table 1 shows the characteristics of the patients who were placed on the waiting list. Nearly two thirds of candidates were between 40 and 64 yr of age. White patients constituted 46.3% the waiting list, followed by black at 29.6% and Hispanics at 15.4%. Other races/ethnicities accounted for 8.7% of the population; 59.1% of candidates were male. At the time of listing, the majority of patients had either Medicare (43.8%) or private insurance (44.9%) as their primary source of payment. Less than 12% of listed patients had other forms of primary insurance. The vast majority of patients for whom the educational status was known had either a high school education or some education after high school. 83% of patients were listed at transplant centers that totaled  $\geq 200$  new candidate registrations during the 4-yr study period.

Table 1 also shows the preemptive listing rate and median duration of dialysis before listing for the covariates of interest. During the 4-yr period, the rate of preemptive listing increased progressively from 17.7% of listings in 2001 to 21.5% of listings in 2004. Although this increase in preemptive listing was highly significant, the median duration of dialysis before listing by year remained essentially unchanged.

With the exception of the 18- to 29-yr age group, as expected, demographic characteristics that were associated with high preemptive listing rates were also associated with shorter median duration of prelisting dialysis. Factors that were significantly associated with variability in preemptive listing were primary insurance, cause of ESRD, race/ethnicity, gender, and educational status.

The lowest percentage of preemptive listings and the longest duration of dialysis before placement on the waiting list occurred among candidates who had Medicare as their primary insurance

Table 1. Characteristics of population placed on the waiting list from 2001 to 2004 and univariate analysis of preemptive listing rate and median duration of dialysis before listing<sup>a</sup>

Population Characteristics ( <i>n</i> = 75,979)	% of Total Population in Subgroup	% of Total Listing that Occurred before Initiation of Dialysis	Duration of Dialysis before Listing (Mo; Median [95% CI])
Age group (yr)			
18–29	8.0	16.6	8.8 (8.4 to 9.2)
30–39	13.8	19.1 <sup>b</sup>	9.8 (9.5 to 10.1)
40–49	22.7	21.3 <sup>b</sup>	9.9 (9.7 to 10.2)
50–64	42.3	19.8 <sup>b</sup>	11.0 (10.8 to 11.2)
≥65	13.2	19.5 <sup>b</sup>	11.7 (11.3 to 12.0)
Race/ethnicity			
white	46.3	28.2	7.1 (6.9 to 7.3)
black	29.6	11.4 <sup>c</sup>	14.8 (14.6 to 15.1)
Hispanic	15.4	10.9 <sup>c</sup>	13.8 (13.5 to 14.1)
other	8.7	19.0 <sup>c</sup>	9.8 (9.4 to 10.2)
Gender			
male	59.1	18.5	10.6 (10.4 to 10.8)
female	40.9	21.5 <sup>d</sup>	10.4 (10.2 to 10.6)
Cause of ESRD			
hypertension	23.5	12.2	13.8 (13.5 to 14.1)
diabetes	25.5	14.4 <sup>e</sup>	11.8 (11.6 to 12.0)
glomerulonephritis	29.5	24.6 <sup>e</sup>	8.0 (7.8 to 8.3)
other	13.6	19.4 <sup>e</sup>	11.0 (10.6 to 11.4)
polycystic kidney disease	7.9	41.9 <sup>e</sup>	3.4 (2.9 to 3.9)
Educational attainment			
junior high school or less	6.7	7.7	15.8 (15.2 to 16.3)
high school	39.2	17.1 <sup>f</sup>	11.6 (11.4 to 11.8)
college	29.9	24.0 <sup>f</sup>	8.6 (8.4 to 8.8)
postgraduate	4.7	33.5 <sup>f</sup>	5.6 (5.1 to 6.1)
unknown	19.5	19.4 <sup>f</sup>	10.6 (10.3 to 10.9)
Primary insurance at listing			
private	44.9	31.6 <sup>g</sup>	5.4 (5.3 to 5.5)
Medicare	43.8	7.9	16.9 (16.7 to 17.1)
Medicaid	7.6	14.2 <sup>g</sup>	10.4 (9.9 to 10.8)
other	3.7	27.0 <sup>g</sup>	7.7 (7.2 to 8.3)
Year of placement on waiting list			
2001	23.4	17.7	10.4 (10.2 to 10.7)
2002	24.3	19.3 <sup>h</sup>	10.5 (10.3 to 10.8)
2003	25.3	20.2 <sup>h</sup>	10.6 (10.3 to 10.8)
2004	27.0	21.5 <sup>h</sup>	10.6 (10.3 to 10.8)
Program listing size (no. of listings during study)			
<50	0.4	16.9 <sup>i</sup>	11.2 (9.6 to 12.8)
50–199	16.3	16.0 <sup>j</sup>	11.5 (11.2 to 11.8)
200–350	24.4	19.6 <sup>k</sup>	10.5 (10.2 to 10.7)
>350	58.9	20.9	10.3 (10.1 to 10.4)

<sup>a</sup>*P* values calculated using two-sided Pearson  $\chi^2$  test.

<sup>b</sup>*P* < 0.001 versus 18- to 29-yr-olds.

<sup>c</sup>*P* < 0.001 versus white patients

<sup>d</sup>*P* < 0.001 versus male patients.

<sup>e</sup>*P* < 0.001 versus hypertension.

<sup>f</sup>*P* < 0.001 versus junior high school or less education.

<sup>g</sup>*P* < 0.001 versus Medicare.

<sup>h</sup>*P* < 0.001 versus 2001.

<sup>i</sup>*P* = 0.089 versus >350 listings.

<sup>j</sup>*P* < 0.001 versus >350 listings.

<sup>k</sup>*P* = 0.001 versus >350 listings.

( $P < 0.01$ ), were of minority race/ethnicity ( $P < 0.01$ ), were male ( $P < 0.01$ ), had hypertension as the cause of ESRD ( $P < 0.01$ ), and had low educational attainment ( $P < 0.01$ ) and among programs that listed  $>50$  but  $<200$  candidates during the study period ( $P < 0.01$ ).

Subgroup analysis showed that even minority kidney transplant candidates with high educational attainment and private insurance fared worse than educated and privately insured white patients (Table 2). Within each race and insurance subgrouping, those with a college education fared better than those without. Within each race and education subgrouping, those with private insurance had more opportunity than those without. Similarly, within each insurance and education subgrouping, white patient had better access than minority patients. A  $>20$ -fold difference in duration of dialysis before placement on the waiting list existed between white patients with high educational attainment and private insurance compared with minority patients with high school or less educational attainment and Medicare. A total of 47.1% of listings were preemptive, and the median prelisting duration of dialysis was 0.9 mo in the former, whereas only 3.8% of listings were preemptive and the median prelisting duration of dialysis was 19.9 mo in the latter.

Tables 3 and 4 show the multivariate logistic regression analysis of the odds for preemptive listing and the multivariate linear regression analysis for duration of dialysis before listing. For both analyses, the most important variables that determined preemptive listing and duration of dialysis before listing were primary insurance, educational attainment, cause of ESRD, race, and program size 50 to 199 listings ( $P < 0.05$  for each variable). Those with a primary cause of ESRD from diabetes, hypertension, or other were less likely to be preemptively placed on the waiting list, but unlike those with the diagnosis of hypertension or other, those with a diagnosis of diabetes had a shorter prelisting dialysis duration ( $-49$  d;  $P < 0.001$ ) than the reference group, glomerulonephritis. Year of placement on the waiting list was significant for 2001 and 2002 for odds for preemptive listing but not for duration of prelisting dialysis. Notably, whereas the rate, independent of

other covariates, of preemptive listing increased 28% during the study interval, the reduction in duration of dialysis before listing was only 5 d, which, even with the inclusion of patients who were listed preemptively, was not statistically significant.

#### Part II: Subgroup Analysis of Insurance and Age

There is a shift in the pattern of insurance coverage at age 65. Whereas the number of kidney transplant registrants who were placed on the waiting list in this sample and were younger than 65 yr and had private insurance (31,741) and Medicare (26,139) were similar, after the age of 65, candidates with Medicare (7122) exceeded those with private insurance (2396) by almost three-fold. Figure 1 shows the frequency distribution of duration of prelisting dialysis on the basis of insurance and age. The dramatic difference in duration of prelisting dialysis on the basis of insurance all but disappears after the age of 65. Figure 2 shows the median duration of prelisting dialysis and rate of preemptive listing on the basis of 5-yr increments in age. At age 65, there is an abrupt drop in the median duration of prelisting dialysis and an abrupt increase in the preemptive listing rate for those with Medicare as their primary insurance.

The multivariate analyses of subgroups on the basis of age at time of placement on the waiting list confirmed this dramatic change in the impact of insurance in the two age cohorts. Before age 65 yr, a large difference existed between private and Medicare insurance in both the odds for preemptive listing (6.83; 95% confidence interval [CI] 6.41 to 7.27) and the mean difference in duration of dialysis before placement on the waiting list (527 fewer days for those with private insurance; 95% CI 511 to 544 d). After age 65 yr, this large difference largely disappeared with the odds for preemptive listing being 1.18 (95% CI 1.05 to 1.33) and the mean difference in duration of dialysis before listing being 46 fewer days (95% CI 14 to 81) for those with private insurance. The impact of minority race/ethnicity and low educational attainment on preemptive listing rates and duration of dialysis before listing

Table 2. Subgroup analysis of percentage of preemptive listing and median duration of dialysis on the basis of race, insurance, and educational status

Educational Attainment	Race and Insurance				P
	White with Private Insurance	Minority with Private Insurance	White with Medicare	Minority with Medicare	
% of preemptive listings					
high school or less	34.4	21.4	11.1	3.8	$<0.001^a$
college or more	47.1	32.7	22.4	7.7	$<0.001^a$
unknown	39.7	23.3	14.7	4.6	$<0.001^a$
P	$<0.001$	$<0.001$	$<0.001$	$<0.001$	
Median duration of dialysis (mo)					
high school or less	4.3	8.7	14.2	19.9	$<0.001^b$
college or more	0.9	5.2	10.5	18.0	$<0.001^b$
unknown	3.0	7.8	13.1	19.4	$<0.001^b$
P	$<0.001$	0.001	NS	0.072	

<sup>a</sup>Pearson  $\chi^2$ .

<sup>b</sup>ANOVA.

Table 3. Multivariate logistic regression analysis of the adjusted OR for preemptive listing<sup>a</sup>

Variable (Reference)	OR (95% CI)	P
Cause of ESRD (glomerulonephritis)		
diabetes	0.62 (0.58 to 0.65)	<0.001
hypertension	0.61 (0.57 to 0.65)	<0.001
other/unknown	0.77 (0.72 to 0.82)	<0.001
polycystic kidney disease	1.76 (1.64 to 1.87)	<0.001
Size of program (>350 listings)		
<50 listings	0.76 (0.56 to 1.04)	NS
50 to 199 listings	0.75 (0.70 to 0.79)	<0.001
200 to 350 listings	0.98 (0.93 to 1.03)	NS
Educational attainment (high school)		
junior high school or less	0.61 (0.54 to 0.68)	<0.001
college	1.20 (1.14 to 1.26)	<0.001
postgraduate	1.65 (1.52 to 1.79)	<0.001
unknown	1.07 (1.02 to 1.13)	0.013
Primary insurance at listing (private)		
Medicare	0.22 (0.21 to 0.23)	<0.001
Medicaid	0.53 (0.49 to 0.58)	<0.001
other	0.87 (0.79 to 0.95)	0.002
Age group (50 to 64 yr)		
18 to 29 yr	0.91 (0.84 to 0.99)	0.026
30 to 39 yr	1.11 (1.04 to 1.18)	0.002
40 to 49 yr	1.10 (1.05 to 1.16)	<0.001
≥65 yr	1.61 (1.51 to 1.71)	<0.001
Race/ethnicity (white)		
black	0.44 (0.42 to 0.47)	<0.001
Hispanic	0.51 (0.47 to 0.54)	<0.001
other	0.65 (0.61 to 0.70)	<0.001
Year of placement on waiting list (2004)		
2001	0.78 (0.74 to 0.83)	<0.001
2002	0.90 (0.85 to 0.95)	<0.001
2003	0.97 (0.92 to 1.02)	NS
Gender (male)		
female	1.25 (1.20 to 1.30)	<0.001

<sup>a</sup>United Network for Organ Sharing (UNOS) region was also in the model as a categorical variable but not included in the table. OR, odds ratio.

was not attenuated in the patients with age >65 yr and remained independently associated with poorer access.

## Discussion

As shown in previous analyses, this study confirms that major disparities on the basis of nonmedical factors persist in the timing of registration on the deceased-donor kidney waiting list. These significant differences are troubling with regard to the equity of allocation of this public resource. It is encouraging that the rate of preemptive listing is increasing slowly over time; however, this has not yet led to a clinically important decrease in the overall duration of dialysis before placement on the waiting list for the majority of candidates. Dialysis exposes patients to an increased risk for mortality and morbidity during the referral and evaluation process, and prolonged dialysis duration worsens patient and graft survival after transplantation. Although the time spent on

the waiting list could be and should be reduced by increasing the number of available donated organs, the most easily modifiable variable in terms of kidney transplant outcomes is dialysis exposure before placement on the waiting list.

Because little or no exposure to dialysis before transplantation is associated with better patient and graft survivals, it is reasonable to postulate that it would improve allograft and patient survival outcomes if most potential candidates for transplantation were referred and considered for placement on the waiting list for transplantation before the need for renal replacement therapy. Late referral to nephrology expertise has been shown to be associated with poorer dialysis outcomes and later transplantation in multiple studies (10–19). The data from this study indicate that only a minority of patients were listed before the need for renal replacement therapy and that patients with Medicare; minority patients; candidates with low educa-

Table 4. Multivariate linear regression analysis of duration of dialysis before listing<sup>a</sup>

Variable (Reference)	Increase or Decrease Days of Dialysis before Listing	95% CI	P
Cause of ESRD (glomerulonephritis)			
diabetes	65	46 to 84	<0.001
hypertension	-85	-104 to -67	<0.001
other/unknown	-76	-102 to -49	<0.001
polycystic kidney disease	26	4 to 48	0.019
Size of program (>350 listings)			
<50 listings	26	-74 to 126	NS
50 to 199 listings	24	5 to 44	0.015
200 to 350 listings	-6	-23 to 11	NS
Educational attainment (high school)			
junior high school or less	46	17 to 74	0.002
college	-34	-50 to -18	<0.001
postgraduate	-73	-105 to -41	<0.001
unknown	3	-15 to 22	NS
Primary insurance at listing (private)			
Medicare	462	447 to 477	<0.001
Medicaid	219	192 to 245	<0.001
other	146	110 to 182	<0.001
Age group (50 to 64 yr)			
18 to 29 yr	-145	-172 to -119	<0.001
30 to 39 yr	-32	-52 to -11	0.003
40 to 49 yr	5	-12 to 22	NS
≥65 yr	-171	-193 to -150	<0.001
Race/ethnicity (white)			
black	233	217 to 250	<0.001
Hispanic	121	100 to 143	<0.001
other	72	47 to 97	<0.001
Year of placement on waiting list (2004)			
2001	9	-9 to 28	NS
2002	6	-13 to 24	NS
2003	-5	-23 to 14	NS
Gender (male)			
female	8	-5 to 22	NS

<sup>a</sup>The constant for the linear regression equation was 331 days (95% CI 304 to 358). A positive value corresponds to the number of additional days of dialysis, and a negative value corresponds to the number of days less of dialysis attributed to that variable. UNOS region was also included in the analysis as a categorical variable but not included in the table.

tional attainment; male patients; patients with ESRD from diabetes, hypertension, or other; and those listed in programs that listed 50 to 199 candidates during the study period had the lowest rate of placement on the waiting list before beginning dialysis. For patients with characteristics predictive of the lowest listing rates before initiation of dialysis (black, Medicare insurance, and low educational attainment), the preemptive listing rate was <5%, whereas for patients with favorable characteristics for predialysis listing (white, high educational attainment, and private insurance), the preemptive listing rate approached 50%. The impact of race persisted even in patients with private insurance and high educational status, suggesting that race-based barriers exist even in this seemingly advantaged population. For most patients with ESRD, it is unneces-

sary to delay transplantation until after the start of dialysis. Although an acceptable rate of placement on the waiting list before dialysis has not been empirically determined, that significant disparities exist on the basis of insurance, education, and race suggests that there exist opportunities to improve preemptive listing rates for those who are disadvantaged by current practices or behaviors. Benchmarks should be established in the nephrology community for acceptable rates of referral for transplantation before dialysis, which could be used in quality improvement initiatives and by regulators as goals to improve the promptness of referral among referring physicians and dialysis facilities.

Of all of the factors studied, insurance type had the largest impact on preemptive listing rate and total duration of prelisting

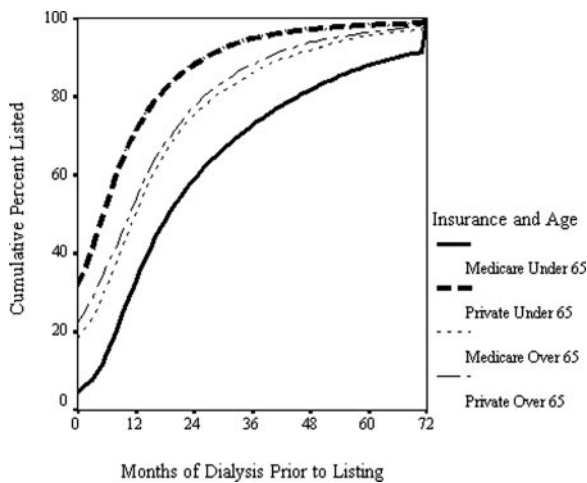


Figure 1. Months of dialysis prior to listing based on insurance and age among patients listed during the study period. The percent at zero months indicates the percent preemptively listed.

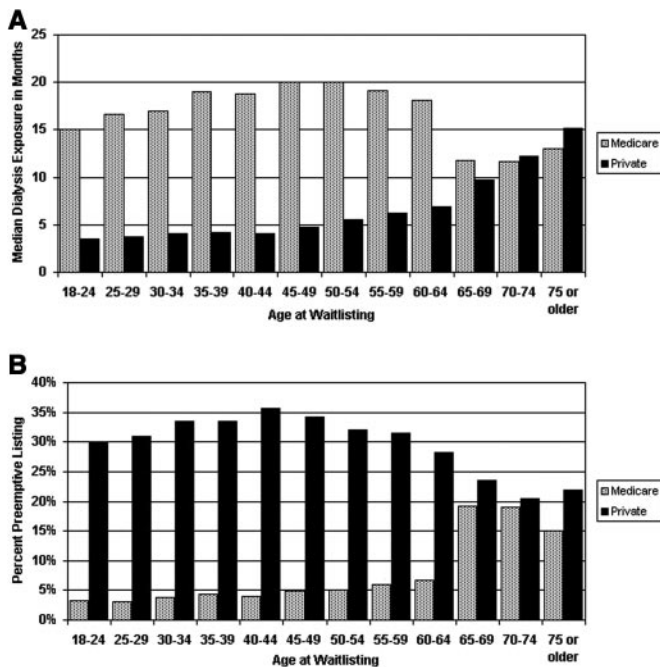


Figure 2. Median duration of dialysis prior to listing (A) and rate of preemptive listing based on age at listing (B).

dialysis. In this study, the private insurance population had the highest preemptive listing rate and shortest duration of dialysis before placement on the waiting list, whereas the Medicare population had the lowest preemptive listing rate and longest duration of prelisting dialysis. More than 85% of adult registrants for the deceased-donor kidney transplant waiting list rely on these two types of insurance, Medicare and private, to cover the cost of evaluation and transplantation. The rules that govern eligibility of Medicare change at the age of 65 yr in the United States. Before age 65, unless previously qualified on the basis of disability, patients who have ESRD that requires in-center hemodialysis

have a mandatory waiting period of 90 d on dialysis, or those who have ESRD and are started on home hemodialysis must wait 30 d on dialysis before they qualify for coverage through Medicare. Although the eligibility requirements for Medicare in patients who are younger than 65 yr allow for the payment of both evaluation and transplantation in patients who have not yet started dialysis, this option seems to be used infrequently in this group of patients on the basis of the very low rates of preemptive listing and suggests that most patients who qualify for Medicare use the former two options to gain coverage. In contrast, after the age of 65 yr, virtually all citizens of the United States qualify for Medicare, and no mandatory waiting period is required before qualification. This change in the eligibility requirements at age 65 seems to exert a profound effect on the time on dialysis before placement on the waiting list for deceased-donor kidneys. The large discrepancy in access to the transplant waiting list before age 65 yr all but disappears in registrants who are  $\geq 65$  yr. The observed effect at age 65 may be reduced by the fact that a small fraction of younger patients may have qualified for Medicare coverage through medical disability. It is possible that these qualifying disabilities contributed to the delay in placement on the waiting list, thereby exaggerating the effect attributed to Medicare coverage in the population that is younger than 65 yr. An important question regarding insurance and access is whether the majority of the delay in access is related directly to insurance or the lack of insurance *per se*, or insurance type selects for behaviors, such as poor initiative to pursue transplant, that lead to delays among the Medicare population. The virtual equalization of access to transplantation after the rule changes at age 65 yr suggests that most of the delay in access is related to insurance or the lack of it and not to behavioral factors selected for by reliance on publicly funded insurance. In addition, the potential effects of secondary coverage on access to transplantation were not explored in this study and might be addressed in future analyses to elucidate further these observations.

Access to the kidney transplant waiting list requires many steps, including identification of progressive renal disease; referral to a transplant center for medical, financial, and psychosocial evaluation of appropriateness for transplantation; approval; and placement on the waiting list. Because our study population includes only candidates who were placed on the waiting list, this population includes only patients who were referred, completed the evaluation process, and were deemed appropriate transplantation candidates. Minority race/ethnicity, which was shown here to be important to timely placement on the waiting list, has been shown also to effect significantly the rates of early identification of renal disease, opportunities for referral, rates of completion of evaluation, and the likelihood of acceptance of patients as candidates for transplantation (3,19–21). The additive impact of these impediments at each step of the process likely profoundly affects disease outcomes in these populations and contributes to the findings reported in these analyses.

This study shows that a significant portion of dialysis duration occurs before and during the referral and evaluation process, before placement on the waiting list. Except for two organ procurement organizations that have participated in an OPTN-alternative system that allows calculation from the date of first dialysis,

the large majority of organ procurement organizations calculate waiting time from the date of placement on the waiting list. Backdating of listing dates to the initiation of dialysis is controversial within the transplant community. Proponents contend that the current system unfairly benefits those with better access to medical care and penalizes those with poorer access to care. Opponents have argued that it would be unfair to move patients who volitionally postponed evaluation for transplantation ahead of others on the waiting list who demonstrated greater initiative. The data from this study suggest that reliance on Medicare insurance before the age of 65 yr and minority status are two of the largest impediments to timely placement on the waiting list, factors largely beyond the control of the potential recipient. Although the transplant community should advocate for rule changes for Medicare eligibility and make efforts to improve timely referral of minorities, it will likely take legislative action to achieve more equitable access. If waiting time remains a significant variable, as it is now, then in future allocation systems for deceased-donor kidneys, rule changes to calculate waiting time from the date of initiation of dialysis for candidates who are already on dialysis at the time of placement on the waiting list would have an immediate effect in ameliorating the medical consequences of a prolonged duration of dialysis before placement on the waiting list for the patients who are most disadvantaged by the current system.

## Disclosures

None.

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