Transplantation

Educational Level as a Determinant of Access to and Outcomes After Kidney Transplantation in the United States

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Background: Disparities in access to kidney transplantation exist, yet few studies investigated educational level as a determinant of access to and outcomes after kidney transplantation.

Study Design: Prospective cohort study.

Settings & Participants: Nationally representative sample of incident US dialysis patients, in which 3,245 patients reported their educational level.

Predictor: Educational level, categorized as some high school, high school graduate, some college, and college graduate.

Outcomes & Measurements: Access to kidney transplantation was defined as time from first dialysis treatment to: (1) the day of being wait-listed and (2) first kidney transplantation. Outcomes after kidney transplantation were: (3) all-cause mortality and graft failure ([4] all-cause and [5] death censored). Using Cox regression, we studied the relationship between predialysis educational level and access to and outcomes after kidney transplantation.

Results: During follow-up, 692 patients were wait-listed and 670 underwent kidney transplantation. Of those, 164 died and 241 lost their allograft (121 from nondeath causes). After multivariate adjustment, college graduates experienced 3 times greater rates of wait-listing (hazard ratio, 2.81; 95% confidence interval, 2.21 to 3.58) or kidney transplantation (hazard ratio, 3.06; 95% confidence interval, 2.38 to 3.92) compared with patients without a high school degree (*P* for trend across educational level for both outcomes < 0.001). Although mortality was not associated with educational level, increased rates of death-censored allograft loss were observed with less education (*P* for trend = 0.03).

Limitations: Not a randomized study.

Conclusion: The latter finding is novel and important and requires confirmation. Its possible mechanisms (eg, adherence to immunosuppressants) warrant additional study.

Am J Kidney Dis 51:811-818. © 2008 by the National Kidney Foundation, Inc.

INDEX WORDS: Socioeconomic status; wait-list; renal allograft; patient survival.

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The number of patients treated for end-stage renal disease doubled during the last decade in both the United States[1] and Europe.[2] It is well known that kidney transplantation is the preferred treatment option compared with hemodialysis or peritoneal dialysis. Patients receiving a kidney transplant show decreased mortality,[3] show improved quality of life and psychological well-being,[4] and consume fewer health resources compared with similar patients receiving dialysis.[5] Unfortunately, the demand far exceeds the supply of transplantable organs; thus, both waiting times for transplantation and the burden of comorbid disease in patients seeking transplantation have increased.

Previous studies showed that disparities in access to kidney transplantation exist. These disparities mainly were attributed to race or ethnic background,[6] sex,[7,8] nephrologist care[9] and refer-

ral,[10] and socioeconomic status (SES), factors not supposed to influence organ allocation. In the United States, differences in access to transplantation were shown for several minority groups, such as blacks, Hispanics, Native Americans, or Asians, but also for women, the poor, and patients with otherwise low SES. In very few studies, all 3 classically defining indicators of SES, which are income, occupation, and education, were available for analysis.

Although some studies investigated the relationship between SES and access to transplantation, only a few indicated that such aspects of SES as low income and poverty status may be associated with greater mortality and graft failure, respectively.[11,12] Conversely, studies of educational level and access to and outcomes after kidney transplantation were scarce. In the present study, we hypothesized that a low level of education is a predictor of decreased access to kidney transplantation, as well as earlier graft failure and greater patient mortality. We tested these hypotheses in a large and nationally representative sample of incident US dialysis patients.

METHODS

Study Population and Follow-up

The Dialysis Morbidity and Mortality Study (DMMS) Wave 2 was a special study conducted by the US Renal Data System (USRDS). During a predefined time window in 1996 and 1997, all patients who began peritoneal dialysis therapy and a random 20% sample of all incident hemodialysis patients were prospectively enrolled for study (total N = 4,024). Data for medical conditions were obtained by using a questionnaire at each dialysis facility. Data for medical history and demographics were obtained from patient records. Baseline data were collected at approximately 60 days after the first dialysis treatment. Patient follow-up was available through the USRDS core data set; all records can be linked to any given patient by using a unique identifier assigned by the USRDS. For this study, we used year 2004 USRDS files. No personally identifiable data were used in any analyses.

From the overall DMMS Wave 2 sample, we excluded patients who did not have a USRDS-assigned identifier, patients for whom information was not available for the main exposure variable (ie, education), and patients who were not truly incident, evident from receipt of maintenance dialysis or kidney transplantation before the DMMS Wave 2 enrollment period. We also excluded patients who were positive for human immunodeficiency virus or had received a diagnosis of acquired immunodeficiency syndrome at initiation of maintenance dialysis therapy.

Main Exposures

The main exposure variable, educational level, was obtained from the patient questionnaire portion of DMMS Wave 2. The 4 response categories were less than 12 years of high-school, high school graduate, some college, and college graduate.

Other Patient Characteristics

We identified several demographic characteristics for each patient. These included age at first dialysis (continuous), sex (female, male), race (white, black, other), and Hispanic ethnicity (yes/no), and we also ascertained the presence of several comorbidities (all yes/no). Comorbid conditions were abstracted from the medical evidence form (Centers for Medicare & Medicaid Services Form 2728) and included diabetes, hypertension, coronary heart disease, congestive heart failure, peripheral artery disease or amputation, cerebrovascular disease, chronic obstructive lung disease, history of cardiac arrest, and any cancer. We also ascertained the initial dialysis modality chosen (center hemodialysis, continuous ambulatory peritoneal dialysis, other).

Outcomes

This study considered 5 different outcomes: (1) a patient's first date of being wait-listed for kidney transplantation, and (2) the actual date of the first transplantation. The former was ascertained from the FIRST_SE variable in the PATIENTS file of the USRDS. The latter was ascertained using the TDATE variable in the TX (transplantation) file. For those who received a transplant, the outcomes studied were: (3) all-cause mortality, (4) graft failure from any cause (return to dialysis, retransplantation, or death), and (5) death-censored graft loss. The latter was defined similar to the previous outcome, but patients were censored at death. The RXHIST file in the USRDS data that gives a detailed account of patient treatment history was used to determine the graft failure date.

Statistical Analyses

SAS, version 9.1 (SAS Institute, Cary, NC), was used to perform all statistical analyses. We conducted trend tests for differences in baseline characteristics across levels of education by using linear and logistic regression for continuous and categorical variables, respectively. Educational level was used as an ordinal variable. All 5 study outcomes were evaluated by using time-to-event analyses. For models evaluating access to transplantation, the index date was the date of first dialysis treatment, and outcome dates were the first date on the wait-list and date of receipt of a first kidney transplant. Time from first day of dialysis to the date of first wait-listing was restricted to patients who had not been added to the wait list electively (ie, before the first dialysis treatment). Analyses of outcomes after transplantation were restricted to patients who had received a transplant, and the day of that transplantation served as the index date. Patients were censored at the end of follow-up in the available USRDS files (September 30, 2004). We built univariate and multivariate Cox proportional hazards models to study crude and adjusted associations between educational level, coded