Special Articles

EFFECT OF THE OWNERSHIP OF DIALYSIS FACILITIES ON PATIENTS' SURVIVAL AND REFERRAL FOR TRANSPLANTATION

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ABSTRACT

Background More than 200,000 patients with end-stage renal disease undergo dialysis in the United States each year, about two thirds in for-profit centers. Economic pressures, such as the decline in inflation-adjusted Medicare payments for dialysis, may compromise the quality of care. Facilities may also be reluctant to refer patients to be evaluated for transplantation because of the loss of revenues from dialysis after patients receive transplants. It is unknown whether for-profit facilities respond more aggressively than not-for-profit facilities to these financial pressures. Therefore, we examined the effect of for-profit ownership of dialysis facilities on patients' survival and referral for possible transplantation.

Methods We used data from the U.S. Renal Data System to assemble a nationally representative cohort of patients with end-stage renal disease of recent onset. We followed patients for a minimum of three years and a maximum of six years, until death, placement on the waiting list for a renal transplant, or loss to follow-up, or until May 31, 1996. We used proportional-hazards models to assess the effect of the profit status of the dialysis facility on patients' outcomes and adjusted for differences in sociodemographic, clinical, and facility-level characteristics.

Results Of the 3681 patients who were eligible for inclusion, we included 3569 in the analysis of mortality and 3441 in the analysis of the waiting list. The crude mortality rate per 100 person-years of end-stage renal disease was 21.2 for patients treated in for-profit facilities and 17.1 for patients treated in not-for-profit centers (adjusted relative hazard, 1.20; 95 percent confidence interval, 1.02 to 1.42). The likelihood of being placed on the waiting list for a renal transplant was lower for patients treated at for-profit centers (adjusted relative hazard, 0.74; 95 percent confidence interval, 0.56 to 0.98).

Conclusions In the United States, for-profit ownership of dialysis facilities, as compared with not-for-profit ownership, is associated with increased mortality and decreased rates of placement on the waiting list for a renal transplant. (N Engl J Med 1999;341: 1653-60.)

THERE has been much concern that the growth of for-profit ownership of health care organizations may compromise the quality of care provided to patients. As compared with not-for-profit entities, for-profit firms may be under more pressure to generate income, a situation that may lead to greater cost cutting and a resistance to providing less lucrative services.[1-3] Moreover, some observers have speculated that the behavior of for-profit firms may be influenced by their proximity to not-for-profit organizations, because not-for-profit facilities may set community standards.[4]

In the United States, the care of patients with end-stage renal disease (ESRD) is a $15.6 billion industry.[5] The more than 200,000 patients who undergo dialysis annually receive care in hospital-based and free-standing centers, which may be organized as either for-profit or not-for-profit entities. In 1997, 68 percent of patients were treated in free-standing for-profit centers.[5] Medicare pays facilities a fixed amount for each dialysis treatment; this amount has not increased since 1973.[6] The declining inflation-adjusted value of this reimbursement has aroused concern that attempts by dialysis providers to maintain income by cost containment may compromise the quality of care and lead to increased mortality among patients.[6]

There is also concern about whether patients with ESRD are being appropriately referred to regional centers for evaluation regarding possible transplantation. Despite the proven benefits of transplantation over dialysis,[6-9] anecdotal reports in the medical literature and the news media suggest that dialysis providers may be reluctant to refer patients for whom transplantation may be appropriate, because transplantation removes a constant stream of revenue from the facility.[10-12] If for-profit dialysis facilities respond more aggressively than not-for-profit entities to the economic pressures created by Medicare's system of

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reimbursement for treatment of ESRD, patients treated in for-profit centers may have higher mortality and lower rates of referral for transplantation.

METHODS

Study Design

We conducted a longitudinal cohort study using national data to assess whether survival and rates of referral for renal transplantation differed between adult patients with ESRD who were treated in free-standing for-profit dialysis facilities and similar patients who were treated in free-standing not-for-profit dialysis facilities. We selected patients from two nationally representative cohorts of patients with newly diagnosed or preexisting ESRD that were assembled by the U.S. Renal Data System.[13] One cohort, Case-Mix Adequacy, comprised 7096 patients who received hemodialysis in centers on December 31, 1990. The Dialysis Morbidity and Mortality Study Wave 1 was a cohort of 5534 patients who underwent hemodialysis on December 31, 1993. In the assembling of each patient cohort, facilities were systematically sampled at a national level to ensure representativeness with regard to the ESRD Network, distance from the network office, and size.[13] ESRD Networks are region-specific organizations designated by the Health Care Financing Administration to oversee improvement in the quality of care provided to patients with ESRD. Because the dates on which patients were referred to a regional center for transplantation evaluation were unavailable, we used the date of first placement on the renal-transplant waiting list as a proxy.

Study Patients

Patients from the U.S. Renal Data System cohorts were candidates for our analysis if they were older than 20 years and had ESRD of recent onset (a first dialysis treatment in 1990 for the Case-Mix Adequacy cohort and a first dialysis treatment in 1993 for the Dialysis Morbidity and Mortality Study Wave 1 cohort). As a result, 3681 adult patients with newly diagnosed ESRD were eligible. To use only reliable data, we excluded patients who had been followed for fewer than 90 days and patients for whom data were missing for more than half the clinical variables.[14] In the analysis of the waiting list for a renal transplant, we also excluded recipients of living-donor transplants, whose names may not have appeared on the waiting list for a cadaveric transplant, and patients who received a transplant but for whom we could not identify a preceding date of placement on the waiting list.

Collection of Data

Medical-records abstracters used standardized forms (nearly identical for both cohorts) to obtain demographic and clinical data.[13] We linked the data abstracted from patients' charts to a longitudinal history file from the U.S. Renal Data System that documented changes in dialysis providers and treatment methods. We also used data from the U.S. Renal Data System on ownership, structure, and ZIP Code of each facility. Data on median household income from the 1990 Census were assigned to patients on the basis of their ZIP Codes. Similarly, Census data and the ZIP Code of the facility were used to identify whether each treating facility was within a metropolitan area. Finally, we obtained from the U.S. Renal Data System the date when each patient's name was first placed on the waiting list of the United Network for Organ Sharing for a renal transplant. A study has reported a 95 percent rate of matching between patients on the waiting list and in Medicare files of patients with ESRD (the primary source from which U.S. Renal Data System data are drawn).[15]

Clinical and Demographic Characteristics of the Patients

We adjusted for the effect of the following sociodemographic factors on survival and access to the transplant waiting list: age at onset of ESRD, median household income as determined on the basis of the ZIP Code, race, sex, whether the patient had graduated from high school, employment status in first year with ESRD, marital status, primary cause of ESRD, year of onset of ESRD, whether the patient lived in a nursing home, geographic region, and whether treatment was in a Census-defined metropolitan area.

We also evaluated the effect of 14 clinical factors that were assessed at the onset of ESRD. These factors were body-mass index, serum albumin concentration, tobacco use, and the presence or absence of 11 conditions (cancer, cardiomegaly, cerebrovascular disease, congestive heart failure, coronary artery disease, dependence on others for assistance with activities of daily living, diabetes mellitus, hypertension, left ventricular hypertrophy, peripheral vascular disease, and pulmonary disease).

Facilities

We categorized dialysis facilities as free-standing for-profit, free-standing not-for-profit, or other (hospital-based facilities, transplantation centers, and government facilities) as these classifications were assigned by the Health Care Financing Administration. Less than 2 percent of "other" facilities were designated as for-profit. We present data on outcomes of treatment in all three types of facility, because patients may switch from one provider to another over time. However, our analysis focused on treatment in free-standing for-profit and not-for-profit facilities, which are most comparable with regard to structure, operations, and reimbursement.

We conducted cross-sectional analyses of characteristics of the patients and facilities by identifying each patient's primary dialysis provider during his or her first year with ESRD, which we considered to be the facility that provided the greatest number of treatments for the patient during that year. To assess the effect of the ownership of facilities on patients' survival, we used longitudinal data to identify changes in patients' providers and included the type of facility as a time-dependent covariate. However, because long-term decisions regarding treatment are most often made early in the course of ESRD, and because Medicare requires that dialysis providers prepare annual care plans in which each patient's suitability for renal transplantation is documented,[16] we assigned each patient to the first-year primary provider when we evaluated placement on the waiting list.

We also evaluated the effect of facility volume (the average number of patients treated per year) and occupancy (the number of patients per dialysis machine). Straight-line distances from each facility to the nearest transplantation center were triangulated with the use of latitude and longitude coordinates of ZIP Codes for the facility and the transplantation center (Power ZipFind, Bridger Systems, Bozeman, Mont.).

Local Dialysis Markets

We used the U.S. Renal Data System Annual Facility Survey to characterize each county that had a dialysis center. Counties were designated as for-profit only (containing only free-standing for-profit facilities), not-for-profit only (containing only free-standing not-for-profit or other facilities), and mixed (containing free-standing for-profit facilities as well as free-standing not-for-profit facilities, hospital-based facilities, or both).

Statistical Analysis

Because of the large amounts of data abstracted from medical records, information on a few variables was missing for some patients. In terms of the 12 sociodemographic variables, data on at least 11 variables were available for 93 percent of the patients, and data on 2 or 3 variables were missing for 6 percent of the patients. In regard to the 14 clinical variables, we had data on at least 13 variables for 79 percent of the patients, and we lacked data on 2 or 3 variables for 17 percent of the patients. These patterns were similar for patients treated in for-profit facilities and patients treated in not-for-profit facilities. To avoid having to exclude patients for whom only minimal information was missing, we included a category of "missing" for each variable in the multivariate model.

We assessed bivariate associations of base-line characteristics with the type of facility, using t-tests to evaluate differences between means and chi-square statistics to evaluate differences in proportions.[17] Two-tailed P values of 0.05 or less were considered to indicate statistical significance.

All patients were followed from the onset of ESRD for a minimum of three years and a maximum of six years — until death, loss to follow-up, or May 31, 1996 (the end of the observation period). Proportional-hazards models were used to evaluate the unadjusted and adjusted effects of facility ownership on mortality and placement on the waiting list for a renal transplant.[18] In the models of mortality, patients were removed from the analysis at the time of transplantation. We converted continuous data to categorical variables because of nonlinear associations with outcomes. To ensure robustness, we tested many models with alternative categorizations to identify and minimize residual confounding. We used backward stepwise techniques and sequentially excluded nonpredictive covariates with a significance level of $P>0.05$ to create parsimonious models.[19]

To adjust for the possibility that the observed effects were due to the results at a few of the facilities from which patients were sampled, we calculated robust variances that corrected for clustering according to facility.[20] For all multivariate models, the assumption of the proportionality of hazards was verified graphically.[19] We tested for interactions between ownership and variables pertaining to patients' demographic characteristics and to the facilities. Analyses were performed with the use of Stata 5.0 software (Stata Corporation, College Station, Tex.).

RESULTS

Representativeness of the Study Population

Of the 3681 patients who were eligible for inclusion in our study, 70 patients were excluded because of insufficient follow-up, and 42 were excluded because data were missing on more than 7 of the 14 clinical variables. As a result, 3569 patients (97 percent of the eligible patients) were included in the study cohort for the analysis of mortality. After excluding an additional 79 patients who had received transplants from living donors and 49 patients whose first waiting-list dates could not be identified, the analysis of placement on the waiting list involved 3441 patients (93 percent of the eligible patients). Patients who were excluded from either analytic cohort were more often white, were older, and had higher incomes than those who were included. Patients who were excluded did not differ significantly from patients who were included in terms of the type of facility or region of the country.

The 3569 patients were representative of patients with ESRD nationally in terms of age, sex, race, and primary cause of disease.[5] In addition, the proportions of patients in our sample who were treated in the various types of facility are similar to those for the entire U.S. population of patients undergoing dialysis.[5] Figure 1A shows the percentage of patients treated in the three types of facility, classified according to county type, for the study population and for the 124,394 patients in the United States who underwent dialysis in 1990. The 3569 patients in our sample were treated by 950 primary providers of dialysis during their first year with ESRD (a median of 3 patients sampled from each facility). The 950 facilities were similar in terms of type of facility and type of county to the 2183 facilities that were in operation in 1990 (Fig. 1B) and the 2536 facilities that were functioning in 1993 (data not shown).

Characteristics of the Patients

The base-line characteristics of the patients according to the ownership status of the primary provider of care in the first year are shown in Table 1. Patients treated in not-for-profit facilities were younger, were more often male, and had lower incomes than those treated in for-profit facilities. Despite small differences in the geographic distribution of patients, approximately 85 percent of all patients were treated in metropolitan areas. The proportions of patients with various clinical conditions and characteristics were similar in both facility types, except for smoking, which was more common in patients in not-for-profit facilities, and diabetes mellitus, which was more common in patients in for-profit facilities.

Effects of Type of Ownership of the Dialysis Facility on Mortality

The crude mortality rate per 100 person-years with ESRD was 21.2 for patients treated in for-profit facilities, as compared with 17.1 for those treated in not-for-profit facilities (Table 2). In the unadjusted hazards analysis the mortality rate among patients treated in for-profit facilities was higher than that among patients treated in not-for-profit facilities (relative hazard, 1.28; 95 percent confidence interval, 1.10 to 1.50). In the adjusted analysis, the volume and occupancy of the facility, urban location, and distance from a transplantation center were not independently predictive of survival. However, treatment in a for-profit facility continued to be associated with higher mortality than treatment in a not-for-profit facility, even after adjustment for the effects of many other independently predictive covariates (relative hazard, 1.20; 95 percent confidence interval, 1.02 to 1.42) (Table 2).

Effects of Type of Ownership on Placement on the Waiting List

In the unadjusted analysis, treatment in a for-profit facility was associated with a reduction of approximately one third in the rate of placement on the waiting list for a renal transplant (relative hazard, 0.68; 95 percent confidence interval, 0.52 to 0.90) and a 26 percent reduction in fully adjusted multivariate models (relative hazard, 0.74; 95 percent confidence interval, 0.56 to 0.98) (Table 3).

Effect of Proximity to a Not-for-Profit Facility on Outcomes in For-Profit Facilities

Of the 2168 patients treated in for-profit facilities during the first year with ESRD, 1350 were in mixed

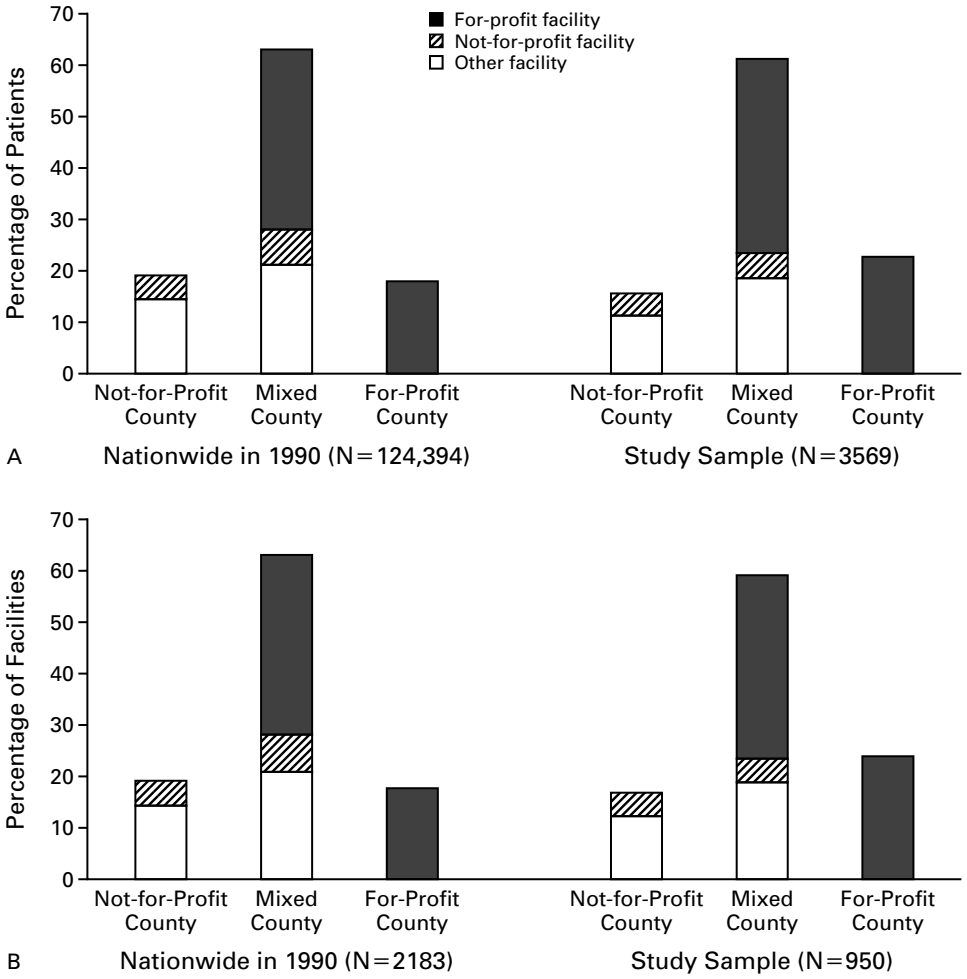

Figure 1. Patients and Dialysis Facilities in the Study Sample and in the United States in 1990, According to Ownership Status of Facilities.

Panel A shows the distribution of patients who underwent dialysis, and Panel B shows the distribution of facilities in which they were treated, according to the type of county. "Mixed" counties contained both for-profit and not-for-profit facilities. Patients are classified according to the primary provider of dialysis during their first year with end-stage renal disease.

counties, and 818 were in counties with only free-standing, for-profit facilities. As compared with patients treated in for-profit facilities in mixed counties, patients treated in for-profit facilities in counties with only for-profit facilities were more often white (66 percent vs. 62 percent, $P<0.001$), had lower median household incomes (65 percent vs. 44 percent had incomes of less than $27,000, $P<0.001$), and were less likely to have a high-school education (48 percent vs. 59 percent, $P<0.001$). There were no significant differences between the two groups with regard to the other sociodemographic factors or any of the clinical factors (data not shown).

Outcomes did not differ significantly between patients treated in for-profit facilities in mixed counties and patients treated in all not-for-profit facilities (Table 4). However, patients in for-profit facilities in for-profit-only counties had higher mortality (relative hazard, 1.29; 95 percent confidence interval, 1.08 to 1.55) and lower rates of placement on a waiting list for a renal transplant (relative hazard, 0.56; 95 percent confidence interval, 0.39 to 0.79) than patients treated in not-for-profit facilities.

DISCUSSION

Although previous studies have investigated whether the type of ownership of a dialysis facility affects the delivery of care, they used facility- and state-level data that did not contain detailed information about the health status of patients.[21-28] In our patient-level analysis, we found that patients treated in for-profit facilities rather than not-for-profit facilities had a 20

TABLE 1. BASE-LINE CHARACTERISTICS OF THE 3569 PATIENTS ACCORDING TO THE OWNERSHIP STATUS OF THE DIALYSIS FACILITY.*

CHARACTERISTIC	FREE-STANDING NOT-FOR-PROFIT FACILITY (N=336)	FREE-STANDING FOR-PROFIT FACILITY (N=2168)	OTHER FACILITY (N=1065)
Sociodemographic factors			
Study and year of onset of ESRD — no. (%)†			
Case-Mix Adequacy, 1990	189/336 (56)	1068/2168 (49)	549/1065 (52)
DMMS Wave 1, 1993	147/336 (44)	1100/2168 (51)	516/1065 (48)
Age at onset of ESRD — no. (%)†			
20–35 yr	30/336 (9)	133/2168 (6)	93/1065 (9)
36–50 yr	56/336 (17)	304/2168 (14)	169/1065 (16)
51–65 yr	97/336 (29)	568/2168 (26)	350/1065 (33)
>65 yr	153/336 (46)	1163/2168 (54)	453/1065 (43)
Race — no. (%)			
White	200/336 (60)	1372/2168 (63)	722/1065 (68)
Black	122/336 (36)	695/2168 (32)	303/1065 (28)
Other	14/336 (4)	101/2168 (5)	40/1065 (4)
Female sex — no. (%)‡	134/336 (40)	1057/2168 (49)	513/1065 (48)
High-school graduate — no. (%)	162/290 (56)	983/1798 (55)	476/825 (58)
Household income — no. (%)§			
≤$21,000	110/326 (34)	531/2078 (26)	258/1036 (25)
$21,000–$27,000	73/326 (22)	539/2078 (26)	273/1036 (26)
$27,001–$35,000	64/326 (20)	536/2078 (26)	266/1036 (26)
>$35,000	79/326 (24)	472/2078 (23)	239/1036 (23)
Marital status — no. (%)¶			
Married	176/331 (53)	1207/2136 (57)	570/1032 (55)
Single or divorced	99/331 (30)	456/2136 (21)	255/1032 (25)
Widowed	56/331 (17)	473/2136 (22)	207/1032 (20)
Employment status during first year with ESRD — no. (%)			
Full time	25/312 (8)	140/2047 (7)	87/985 (9)
Part time	10/312 (3)	68/2047 (3)	41/985 (4)
Not working	277/312 (89)	1839/2047 (90)	857/985 (87)
Residence in nursing home — no. (%)†	11/330 (3)	133/2142 (6)	61/1041 (6)
Cause of ESRD — no. (%)			
Glomerulonephritis	39/336 (12)	238/2168 (11)	135/1065 (13)
Hypertension	92/336 (27)	713/2168 (33)	286/1065 (27)
Diabetes mellitus	141/336 (42)	850/2168 (39)	410/1065 (38)
Other	64/336 (19)	367/2168 (17)	234/1065 (22)
Region — no. (%)‖			
Northeast (ESRD networks 1–5)	69/336 (21)	501/2168 (23)	431/1002 (43)
Southeast (ESRD networks 6–8, 13, 14)	110/336 (33)	900/2168 (42)	107/1002 (11)
Midwest (ESRD networks 9–12)	82/336 (24)	287/2168 (13)	310/1002 (31)
West (ESRD networks 15–18)	75/336 (22)	480/2168 (22)	154/1002 (15)
Treatment in metropolitan area — no. (%)†	268/336 (80)	1804/2168 (83)	858/1065 (81)
Clinical factors			
Current smoker — no. (%)†	58/283 (20)	287/1838 (16)	139/889 (16)
Body-mass index	24.3±5.0	24.4±5.3	24.5±5.3
Cancer — no. (%)	32/333 (10)	262/2141 (12)	102/1051 (10)
Cardiomegaly — no. (%)	130/297 (44)	804/1880 (43)	426/929 (46)
Cerebrovascular disease — no. (%)	64/333 (19)	400/2118 (19)	179/1046 (17)
Chronic obstructive pulmonary disease — no. (%)	58/335 (17)	300/2130 (14)	134/1046 (13)
Congestive heart failure — no. (%)	152/329 (46)	1052/2127 (49)	510/1040 (49)
Coronary artery disease — no. (%)	167/332 (50)	1158/2137 (54)	516/1052 (50)
Dependence on help for activities of daily living — no. (%)	49/329 (15)	328/2145 (15)	153/1042 (15)
Diabetes mellitus that is not the cause of ESRD — no. (%)‡	24/334 (7)	285/2155 (13)	135/1059 (13)
Hypertension that is not the cause of ESRD — no. (%)	158/323 (49)	952/2095 (45)	517/1021 (51)
Left ventricular hypertrophy — no. (%)	119/289 (41)	700/1856 (38)	359/899 (40)
Peripheral vascular disease — no. (%)	85/335 (25)	611/2139 (29)	296/1053 (28)
Serum albumin — g/dl	3.54±0.47	3.54±0.48	3.54±0.51

*The 3569 patients are those included in the mortality analysis. The patients are categorized according to the primary provider of dialysis during their first year with end-stage renal disease (ESRD). The percentages reflect proportions among patients for whom data were available. The significance testing was based on a comparison of patients in free-standing not-for-profit and for-profit facilities only. The body-mass index was calculated as the weight in kilograms divided by the square of the height in meters. DMMS denotes Dialysis Morbidity and Mortality Study. Plus–minus values are means ±SD.

†$P<0.05$. ‡$P<0.005$. §$P=0.005$. ¶$P=0.001$. ‖$P<0.001$.

TABLE 2. MORTALITY AMONG PATIENTS UNDERGOING DIALYSIS, ACCORDING TO THE OWNERSHIP STATUS OF THE FACILITY.*

FACILITY TYPE†	FOLLOW-UP	CRUDE MORTALITY RATE‡	UNADJUSTED RELATIVE HAZARD (95% CI)	ADJUSTED RELATIVE HAZARD (95% CI)§
	person-yr			
Free-standing not-for-profit	1039	17.1	1.00	1.00
Free-standing for-profit	5726	21.2	1.28 (1.10–1.50)	1.20 (1.02–1.42)
Other	2721	18.5	1.14 (0.97–1.36)	1.00 (0.83–1.20)

*CI denotes confidence interval. Free-standing not-for-profit facilities were the reference group.

†Switching between providers over time has been accounted for.

‡The crude mortality rates are per 100 person-years of end-stage renal disease (ESRD).

§The relative hazard has been adjusted for age, race, educational level, year of onset of ESRD, primary cause of ESRD, whether the patient resided in a nursing home, whether the patient was a current smoker, body-mass index, dependence on others for assistance with activities of daily living, the serum albumin concentration, and the presence or absence of cancer, cardiomegaly, cerebrovascular disease, coronary artery disease, congestive heart failure, chronic obstructive pulmonary disease, diabetes mellitus, hypertension, and peripheral vascular disease.

TABLE 3. RATE OF PLACEMENT ON THE WAITING LIST FOR A RENAL TRANSPLANT, ACCORDING TO THE OWNERSHIP STATUS OF THE FACILITY.*

FACILITY TYPE†	FOLLOW-UP	CRUDE INCIDENCE RATE‡	UNADJUSTED RELATIVE HAZARD (95% CI)	ADJUSTED RELATIVE HAZARD (95% CI)§
	person-yr			
Free-standing not-for-profit	847	7.2	1.00	1.00
Free-standing for-profit	5244	4.9	0.68 (0.52–0.90)	0.74 (0.56–0.98)
Other	2525	7.2	1.00 (0.74–1.33)	1.04 (0.79–1.38)

*CI denotes confidence interval. Free-standing not-for-profit facilities were the reference group.

†The facility type is that assigned as the primary provider of dialysis during the first year of end-stage renal disease (ESRD).

‡The crude incidence rates are per 100 person-years of ESRD.

§The relative hazard has been adjusted for age, race, sex, educational level, median household income, employment status, marital status, year of onset of ESRD, serum albumin concentration, distance to the nearest transplantation center, and the presence or absence of cancer, cardiomegaly, congestive heart failure, chronic obstructive pulmonary disease, and peripheral vascular disease.

percent higher mortality rate and a 26 percent lower rate of placement on the waiting list for a transplant. Moreover, the rapid growth in the number of for-profit facilities due to new construction and conversions of not-for-profit facilities to for-profit facilities has outpaced the growth rate of the population of patients undergoing dialysis. As a result, between 1990 and 1997, the proportion of patients receiving treatment in for-profit facilities increased from 53 percent to 68 percent, while the number of patients undergoing dialysis in the United States increased from 125,000 to more than 200,000.[5]

Thus, given that approximately 140,000 patients underwent dialysis in for-profit facilities in 1997, the increase in the absolute mortality rate from 17.1 to 21.2 per 100 person-years suggests that a considerable number of deaths of patients with ESRD may have been associated with treatment in for-profit facilities. In addition, we found that the association between for-profit ownership and poor outcomes was less marked in counties where for-profit facilities operated in proximity to not-for-profit facilities. Survival and rates of placement on a waiting list for a renal transplant among patients treated in other, predominantly not-for-profit, facilities (hospital-based centers, transplantation centers, and government centers) were similar to those among patients in free-standing not-for-profit facilities.

Our findings suggest that decisions and recommendations made by physicians for the treatment of patients with ESRD may differ between for-profit and not-for-profit facilities. In particular, the poorer outcomes at for-profit facilities may result from a more aggressive response to incentives to economize at for-profit facilities, as compared with not-for-profit facilities. For-profit facilities use less labor and equipment per treatment, which suggests a lower average cost per dialysis session.[25] For-profit facilities also are more likely to engage in several cost-saving practices that have been associated with poorer patient survival,[29-31] such as the provision of lower doses of dialysis and the reuse of dialyzers.[29,32]

Poor outcomes may also be attributable to the lower levels of staffing in for-profit facilities,[33,34] particularly because patients with ESRD identify the staff of the dialysis center as their primary health care providers.[35,36] Similarly, these staffing patterns could cause the disparities found in rates of placement on the waiting list if lower rates of staffing result in insufficient attention to the education of patients regarding the selection of a mode of treatment or to coordination of the process by which patients are evaluated for transplantation. Moreover, for-profit providers may fail to refer some patients for evaluation for transplantation who are appropriate if they are more sensitive than not-for-profit providers to incentives to generate income by maintaining a greater volume of patients.

In addition, the differing effects of for-profit ownership in mixed counties and in counties that have only for-profit facilities support the hypothesis that for-profit facilities may deliver better care when competing for patients with nearby not-for-profit facilities.[4] However, our study cannot rule out the possi-

TABLE 4. THE RISK OF DEATH AND LIKELIHOOD OF PLACEMENT ON THE WAITING LIST FOR A RENAL TRANSPLANT AMONG PATIENTS UNDERGOING DIALYSIS, ACCORDING TO THE OWNERSHIP STATUS OF THE FACILITY AND THE TYPE OF COUNTY.*

TYPE OF FREE-STANDING FACILITY	TYPE OF COUNTY	MORTALITY†		PLACEMENT ON THE WAITING LIST‡	
		FOLLOW-UP	ADJUSTED RELATIVE HAZARD (95% CI)	FOLLOW-UP	ADJUSTED RELATIVE HAZARD (95% CI)
		person-yr		person-yr	
Not-for-profit	Not-for-profit or mixed	1039	1.00	847	1.00
For-profit	Mixed	3659	1.15 (0.97–1.37)	3267	0.86 (0.65–1.16)
For-profit	For-profit	2068	1.29 (1.08–1.55)	1977	0.56 (0.39–0.79)

*The facility type is that identified as the primary provider of dialysis during the first year of end-stage renal disease (ESRD). "Mixed" counties contained both for-profit and not-for-profit facilities. CI denotes confidence interval. Not-for-profit facilities were the reference group.

†Switching between providers over time has been adjusted for. The relative hazard has been adjusted for the covariates that are listed in a footnote to Table 2.

‡The relative hazard has been adjusted for the covariates listed in a footnote to Table 3.

bility that competition with other for-profit facilities also results in improved outcomes in for-profit centers, because we were unable to determine whether neighboring for-profit dialysis facilities were operated by the same or different owners. Our sample size limited our ability to evaluate whether proximity to for-profit facilities altered clinical outcomes for patients treated in not-for-profit facilities.

We found geographic differences in the distribution of patients treated in for-profit as compared with not-for-profit facilities (Table 1). As a result, the ownership-related differences in outcomes that we found could be due to an association between for-profit ownership and location in a community with a lower quality of care. However, such an association must be independent of geographic differences in patients' sociodemographic and clinical characteristics, for which we were able to adjust. Moreover, the geographic variables we evaluated — metropolitan location and region — did not significantly confound our analysis. Nevertheless, this potential explanation and the factors that influence facilities in deciding to locate in certain areas should be explored further when suitable methods are available to define dialysis markets with greater precision.

Although our study was prospective, our sample was nationally representative, and we carried out extensive adjustment for patient characteristics, several limitations remain. First, our categorization of facilities according to ownership status oversimplified the complexities of organizational structure. For example, we were unable to consider several other factors that may be related to the quality of care at a dialysis facility, such as its profitability, its affiliation with a chain or with an academic medical center, and the financial incentives faced by individual providers within a practice.

Second, because the actual date of referral by the dialysis facility for evaluation for possible transplantation was unavailable, we used the date of placement on the waiting list as a proxy. However, this use of a proxy is not likely to have biased our results, since we have no reason to believe that transplantation centers preferentially list patients referred from either for-profit or not-for-profit facilities as a result of factors not captured in our analysis. Third, because our data are observational, we cannot rule out entirely the possibility of residual confounding, despite our adjustment for numerous characteristics of the patients and facilities. However, in our study we document an association between for-profit ownership and a lower quality of care, using two independent outcomes. In addition, the results were consistent in unadjusted analyses and in numerous multivariate models in which alternative categorizations of key variables were used.

In summary, our study suggests that, on average, patients treated in for-profit dialysis facilities have higher mortality rates and are less likely to be placed on the waiting list for a renal transplant than are patients who are treated in not-for-profit facilities. Because these effects may be due to a greater emphasis on income generation at for-profit facilities, our results arouse concern about the current system of payment for dialysis services that rewards efforts by the facility to control costs and maintain patient volume but does not provide incentives to maximize clinical outcomes. Greater oversight or competing incentives to improve quality may be necessary to ensure that cost containment is not so extensive that it affects patient outcomes adversely. For example,

results from the ESRD Core Indicators Project, a recent quality-improvement effort sponsored by the Health Care Financing Administration, suggest that feedback to providers of care to patients with ESRD on clinical performance measures can lead to improvement in the adequacy of dialysis.[37] In addition, when evaluating the effect of conversions of not-for-profit facilities to for-profit facilities in the dialysis industry and in other types of health care organizations, policy makers should consider the finding that proximity to not-for-profit facilities is associated with improved outcomes for patients in nearby for-profit facilities.

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