Racial Differences in Choice of Dialysis Modality for Children With End-stage Renal Disease

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ABSTRACT. Objective. Black-white disparities in the use of specific medical and surgical services have been reported in adult populations. Such disparities are not well documented in children. We sought to determine whether racial disparities in the use of medical services exist among children with chronic illness who have similar health insurance, specifically the choice of dialysis modality for individuals with end-stage renal disease.


Setting. Outpatient dialysis facilities throughout the United States.

Patients and Participants. All Medicare-eligible children (age <19 years) undergoing renal replacement therapy in the United States, using data from the Medicare ESRD registry.

Outcome Measures. The odds of receiving hemodialysis versus peritoneal dialysis according to race. Adjustment was made for differences in age, gender, cause, and duration of end-stage renal disease, income, education, and facility characteristics using multiple logistic regression.

Results. In 1990, 870 white and 368 black children received chronic (>1 year) renal replacement therapy in the United States. In bivariate analysis, blacks were two times more likely (odds ratio [OR], 2.2; 95% confidence interval [CI], 1.7, 2.8) more likely than whites to receive hemodialysis versus peritoneal dialysis. After controlling for other patient and facility characteristics in multivariate analysis, black children were still significantly more likely than white children to receive hemodialysis (OR, 2.4; 95% CI, 1.7, 3.5).

Conclusions. Black race is strongly associated with the use of hemodialysis in children. Family, patient, or provider preferences could account for the difference in choice of therapy by race. Pediatrics 1997;99(4). URL: http://www.pediatrics.org/cgi/content/full/99/4/e6; chronic renal failure, children; racial disparities, peritoneal dialysis, health insurance.

ABBREVIATIONS. ESRD, end-stage renal disease; HD, hemodialysis; PD, peritoneal dialysis; RRT, renal replacement therapy.

In 1990, the Council on Ethical and Judicial Affairs of the American Medical Association called for the elimination of racial disparities in medical treatment decisions in the United States.1 They urged physicians to examine their own practices and for the profession to “increase the awareness of racial disparities in medical treatment decisions through broad discussion of the issue.”2 While black-white disparities in treatment options have been previously documented in adults, particularly in nephrology,3 cardiology,4 cardiac surgery,5 obstetrics,6 and general internal medicine,6 this issue has not been explored fully in populations cared for by general or subspecialty pediatricians. Black-white disparities in use of medical services can be confounded by differences in health insurance status making this issue difficult to examine. One population in which primary health insurance differences do not exist is in end-stage renal disease (ESRD) patients covered by Medicare insurance.

Recently, lower rates in initiation of peritoneal dialysis (PD) for black versus white adult patients with ESRD have been reported in a cohort from the Southeastern United States.2 Although transplantation remains the preferred treatment modality for children with ESRD,4 many children with ESRD undergo a period of chronic maintenance dialysis8 before transplantation or after a failed transplant. Unfortunately, because of multiple complicating factors, some children may not be candidates for transplantation, or may spend years waiting for a suitable organ. Although the ideal method of dialysis for the pediatric age group is subject to debate, and few studies have compared the morbidity and mortality of hemodialysis and peritoneal dialysis in an objective and rigorous fashion, home peritoneal dialysis is widely regarded as the optimal form of renal replacement therapy (RRT).10 In a prior observational study in which patients were allowed to choose their own treatment modality, PD was associated with better growth than hemodialysis.11 Improved metabolic control and more liberal diets have also been cited as benefits of PD in observational studies.12 Opportunity for improved school attendance has also been cited as a benefit of PD.10,12 Ultimate rehabilitation may also be more favorable, as children on PD demonstrate improved psychosocial coping skills and less depression.13,14 A recent report from a selected group of pediatric nephrologists9 showed that while 73% of white chil-
METHODS

Study Design

We performed a national cross-sectional study of patients aged 0 to 19 years who had ESRD requiring RRT. Patients were included if they were ≤19 years old, if they were enrolled in the Medicare ESRD program (entitled to Medicare Part A services) at any time between January 1, 1989 and December 31, 1990 and they did not have a functioning transplant during the entire year. Patients were excluded if they did not receive their care at a single facility for more than 6 months, or if they were not on a single dialysis modality for at least 6 months of the year.

Data Sources and Variable Definition

Data from the Medicare ESRD Program Management and Medical Information System (PMMIS), which are assembled and maintained by the Health Care Financing Administration (HCFA), were used to identify all prevalent pediatric patients (age, ≤19 years) enrolled in the United States ESRD program in 1990.

Our analysis used the PMMIS enrollment file containing the beneficiary identification code, date of first ESRD service, date of birth, sex, race (white, black, Asian, Native American, or other), cause of ESRD assigned by the patient’s nephrologist (International Classification of Diseases, Ninth revision, Clinical Modification codes [ICD-9-CM]), date of kidney transplantation, primary treatment facility (providing the majority of ESRD services), treatment facility ownership (for-profit or not-for-profit), facility affiliation (hospital based or free-standing), and facility ESRD network membership. ICD-9-CM codes were grouped into 13 categories consisting of: (1) hypertension (410, 403, 404), (2) diabetes mellitus (250), (3) glomerulonephritis (GN), including categories of nephritis/nephrotic syndrome, rapidly progressive and acute GN (580.9), (4) polycystic kidney disease (753.1), (5) other kidney disease (581, 582, 583), (6) lupus nephritis (659.4, 710), (7) metabolic (including disorders of amino acid transport and carbohydrate transport), (8) unknown cause, (9) other immune-mediated disorders including Henoch-Schonlein purpura, Wegener’s granulomatosis, thrombotic thrombocytopenic purpura, Goodpasture’s syndrome, (10) hemolytic uremic syndrome, (11) congenital anomalies, (12) urologic/obstructive abnormalities, and (13) all other causes (including acute tubular necrosis, AIDS, transplant complications, and so forth). It should be noted that the categories of renal disease available in the database may be more appropriate for adult than pediatric ESRD patients, as causes of ESRD such as diabetes and hypertension, although common in adults, are rarely seen in children.

We also used quarterly dialysis records from the PMMIS containing data on the location and modality of dialysis treatment (in-center hemodialysis [HD], in-center PD, home HD, and home PD). Quarterly records were grouped by patient ID to identify patients who spent at least 6 months during 1990 on a single dialysis modality at a single facility.

The above data files were linked through the beneficiary’s zip code of residence to data from the 1990 national census. From the census, we obtained zip code-specific data on median household income, and race-specific education levels.

Patient age and ESRD duration were categorized as follows: age ≤4 years, >4 to ≤9 years, >9 to ≤14 years, and >14 to ≤19 years; duration ESRD ≤1 year, >1 and ≤2 years, >2 and ≤3 years, and >3 years. Zip code-specific median household incomes were grouped as ≤$20,000, >$20,000 and ≤$40,000, >$40,000 and ≤$60,000, and >$60,000, and were linked to the patient’s beneficiary identification as a marker of economic status. Similarly, the percentage of residents of the same race, residing in the same zip code as the patient who achieved at least a high school education, was used as a measure of educational status.

The ESRD network in which patients received care were grouped geographically into Northeast (networks 1 to 5), South-East (6 to 8), Midwest (9 to 12), Southwest (13 to 15), and West (16 to 18).

Statistical Analysis

We examined the relationship between race and dialysis modality for children with ESRD who were Medicare beneficiaries in 1990. Because patient characteristics other than race (eg, age, duration, assigned cause of ESRD, and socioeconomic factors) and facility traits (eg, hospital-based versus free-standing, for-profit or not-for-profit status) may be associated with dialysis modality choice, we compared the HD group and the PD group with regard to each of these factors. For each independent variable, we constructed 2 × 2 tables of the number of HD or PD patients with that particular trait, to calculate odds ratios and 95% confidence intervals for the association. This permitted us to examine associations among the independent variables to assess for the possibility of confounding. Possible confounders were then adjusted for by using multiple logistic regression analysis to examine the independent association of race with dialysis modality selection. Multivariate analysis was performed using SAS statistical software.15

RESULTS

Characteristics of Patients

There were 2387 children (≤19 years) enrolled in the United States ESRD program in 1990. Dialysis data was available from the quarterly dialysis records on 1404 of these children, adolescents, and young adults. The 983 patients for whom dialysis information was missing were either preemptive transplant patients or patients still in the 3 month waiting period for Medicare eligibility.

Of the 1404 children with dialysis data available, 1256 received their care at a single facility and on a single modality for more than 6 months in 1990. Table 1 shows the demographic characteristics of all patients by racial group. Black children with ESRD were older than whites, and had ESRD for a shorter duration than whites. The mean household incomes of the zip codes in which black children lived were far lower than those of their white counterparts. The number of children who lived in zip codes where fewer than 10% of people of their race achieved greater than a high school education was greater for black children than for white children. Assigned cause of ESRD also differed by race, with blacks over-represented in the glomerulonephritis, lupus, and hypertension groups and whites over-represented in categories of congenital renal anomalies and polycystic kidney disease. There were no differences between black and white children in gender.

Facility characteristics also differed by race of the beneficiary. Whites were more likely than blacks to receive RRT at hospital-based and not-for-profit facilities. As might be expected, a higher percentage of the black patients received care in the Southeastern United States.

Relationship of Race With Dialysis Modality Choice

The Figure shows the relationship from bivariate analysis between race and dialysis modality choice stratified by age. Black children younger than 9 years were more than two times more likely than white children...
children to be on HD rather than PD. Children between the ages of 9 to 14 years were more than four times more likely to be on HD than PD if they were black. In the 14 to 19 year age group, blacks were still 50% more likely to be maintained on HD rather than PD.

Because the association of race and modality choice may be confounded by additional patient characteristics (Table 1) other than age, we also performed multivariate analysis. The results of multivariate analysis of HD versus PD are presented in Table 2. Older age groups were increasingly likely to be on HD over PD as reflected in the bivariate analysis. Patients who had ESRD for longer than 5 years were 50% more likely to be on HD rather than PD. Even after controlling for patient age, gender, duration and assigned cause of ESRD, socioeconomic factors, and facility characteristics, black children with ESRD were almost two and one-half times more likely to be on HD than were white children.

**DISCUSSION**

Our study describes significant differences in dialysis modality choice for children with ESRD by racial group. These disparities persist even after important demographic and socioeconomic differences are taken into account. These findings are consistent with reports of racial differences in RRT in adults, but appear more striking because PD in children is widely regarded, although not proven, to be the preferred form of RRT.

Before our study, racial differences in age were thought to explain the racial discrepancies in modality choice, since older children are more likely to be...
treated with HD, and black children with renal failure are on the whole, older than whites. However, using multivariate techniques, we were able to document that the racial differences in modality choice persisted even after controlling for age. In addition, controlling for differences in clinical characteristics, geography, socioeconomic status, and facility factors potentially associated with the race of the patient, did not lessen the association between black race and the use of HD in children with ESRD.

The observation by Held and colleagues that differences in access to kidney transplantation among different sociodemographic groups exist has led to several studies establishing the fact that access to organ transplantation is not completely separable from the income, race, and other sociodemographic characteristics of the recipient. Prior studies have also highlighted differences in the use of invasive procedures for ischemic heart disease by race. A recent report on ethnic differences in the use of PD for ESRD in adults revealed that ethnic differences in initial PD use could not be explained by many demographic, socioeconomic, or co-morbid factors. The authors suggested that cultural differences in health care beliefs or self-perception might explain varying patient preferences in dialysis modality choice by race. The possibility of systematic bias on the part of providers could not be ruled out as playing a role in the observed association. The consistent finding of an association between treatment decisions and race across these studies across several medical disciplines argues against the association being spurious.

Our study may not be generalizable to a particular segment of children who are not eligible for Medicare. If neither parent has worked and contributed to social security, a child cannot become a Medicare beneficiary. In addition, for the first 18 months of dialysis, a patient’s primary insurance is responsible for payment. After this time period, Medicare becomes the primary health insurer. Patients with Medicare as primary insurance are responsible for approximately 20% of payments, since Medicare covers 80% of outpatient services. However, this is unlikely to have affected our results, since this 80% national zip code-based demographic information to adjust for income and education, important potential socioeconomic confounders in examining the effect of race on choice of therapy.

Our study also has several limitations. Perhaps most importantly, we were unable to capture the effect of prior switches in dialysis modality. For example, if a patient’s initial RRT modality was PD but membrane failure or recurrent peritonitis necessitated conversion to HD before 1990, that patient would be categorized as a HD patient. If these clinical factors are more commonly associated with black race even after adjustment for socioeconomic status, our results would not account for these differences.

We also were unable to adjust for co-existing morbidity, as this may also impact on dialysis modality choice. This is an important factor in adult studies of dialysis modality choice; however, it may not be as crucial in pediatrics, as there are few conditions other than abdominal wall defects and membrane failure that are absolute contraindications to the use of PD in children.

In addition, adjusting for socioeconomic status on the basis of zip code-based census data may not be as desirable as using patient specific income or education. However, recent studies have provided evidence that zip code-based measures of socioeconomic status are robust and reliable proxies for patient socioeconomic conditions.

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Table 2. Association of Patient Characteristics With Dialysis Modality (Hemodialysis vs Peritoneal Dialysis)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Unadjusted Odds Ratio (95% CI)</th>
<th>Adjusted Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>1.0 (reference)</td>
<td>1.0 (reference)</td>
</tr>
<tr>
<td>Black</td>
<td>2.2 (1.7, 2.8)</td>
<td>2.4 (1.7, 3.3)</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤5</td>
<td>1.0 (reference)</td>
<td>1.0 (reference)</td>
</tr>
<tr>
<td>&gt;5–9</td>
<td>1.1 (0.8, 1.5)</td>
<td>0.9 (0.6, 1.3)</td>
</tr>
<tr>
<td>&gt;9–14</td>
<td>2.8 (1.7, 4.6)</td>
<td>1.8 (1.0, 3.4)</td>
</tr>
<tr>
<td>&gt;14–19</td>
<td>5.8 (3.6, 9.2)</td>
<td>3.9 (2.2, 6.9)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1.0 (reference)</td>
<td>1.0 (reference)</td>
</tr>
<tr>
<td>Male</td>
<td>1.0 (0.8, 1.3)</td>
<td>1.1 (0.9, 1.3)</td>
</tr>
<tr>
<td>Duration of ESRD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤1</td>
<td>1.0 (reference)</td>
<td>1.0 (reference)</td>
</tr>
<tr>
<td>&gt;1–2</td>
<td>0.9 (0.6, 1.2)</td>
<td>0.9 (0.6, 1.4)</td>
</tr>
<tr>
<td>&gt;2–5</td>
<td>0.9 (0.7, 1.2)</td>
<td>0.9 (0.6, 1.3)</td>
</tr>
<tr>
<td>&gt;5</td>
<td>1.5 (1.1, 2.1)</td>
<td>1.5 (1.0, 2.2)</td>
</tr>
</tbody>
</table>

* Odds ratio from multiple logistic regression analysis adjusted for all characteristics except the characteristic of interest. Characteristics included age, gender, race, duration of ESRD, cause of ESRD, income, education, facility type, and ownership and geography.
applies for both PD and HD services and we adjusted for duration of ESRD.

In this analysis, although we adjusted for the ESRD network of the provider as a geographic indicator, the distance from a patient’s home to their dialysis center and the modalities offered at that center were not taken into account. Living in a rural or urban center may certainly impact dialysis modality choice, and the geographic distribution of black and white ESRD patients may impact modality choice in ways unmeasured by our study.

A final limitation of this cross-sectional study utilizing existing administrative data, is that individual patient and family preferences and their impact on dialysis modality choice could not be measured. Indeed, there may be distinct advantages for certain patient groups in choosing in-center versus home dialysis treatments. In addition, it is interesting to note that more blacks are treated at free-standing, for-profit facilities. This may reflect more for-profit dialysis facilities locating in urban centers, where larger numbers of black patients live. More information on patient and family preferences and the settings in which dialysis care is provided might enlighten us on why differential access to PD exists by race.

Why do disparities in the use of HD and PD persist in black and white patients? Possible explanations include unmeasured differences in socioeconomic status, differences in co-morbid conditions or modality switches, cultural differences in attitudes toward or preferences for peritoneal and hemodialysis, differences in access to care, or systematic racial bias. Any or all of these factors may contribute to the difference in dialysis modality choice which we observed.

The extent to which subtle provider preconceptions about race affect dialysis modality choice in children is unclear. Determining whether provider bias, patient or family preference, co-morbid conditions or residual socioeconomic or geographic confounders are responsible for the preponderant use of HD in black children with ESRD will require studies which address these possible confounders more precisely, and directly examine the interactions and “participatory decision making”21 between patients and their physicians. Our cross-sectional analysis could lay the groundwork for a prospective study to more precisely clinically, cultural or socioeconomic factors responsible for the discrepancy in access to care for children with ESRD.

**ACKNOWLEDGMENTS**

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