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Survival Advantage for Adult Hispanic Hemodialysis Patients? Findings from the End-Stage Renal Disease Clinical Performance Measures Project

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Abstract. One-year follow-up mortality in Hispanic and non-Hispanic patients and its association with intermediate outcomes of dialytic care were examined utilizing the Center for Medicare & Medicaid Services' (CMS) ESRD Clinical Performance Measures (CPM) Project and administrative data. Demographic and clinical information was collected on a national random sample of adult in-center hemodialysis (HD) patients for the period of October through December, 1998. Patients were categorized as Hispanic, non-Hispanic White, or non-Hispanic Black. Of 8336 patients 994 (12%) were identified as Hispanic, 3618 (43%) as non-Hispanic White, and 3111 (37%) as non-Hispanic Black. The adjusted 12-mo mortality risk (99% CI) for Hispanics was 0.76 (0.60 to 0.96; $P < 0.01$) and for non-Hispanic Blacks 0.66 (0.56 to 0.78, $P < 0.001$) compared with non-Hispanic Whites (referent). Similar 12-mo mortality risks were noted in the groups with diabetes mellitus or hypertension as the causes of ESRD and among patients ≥65 yr. After controlling for demographic and geographic variables, Hispanics compared with the referent group, non-Hispanic Whites, were more likely to have a mean serum albumin ≥4.0/3.7 g/dL (BCG/BCP) (1.5 [1.2 to 1.7]; $P < 0.001$) and as likely to have a mean Kt/V ≥1.2, mean hemoglobin ≥11 g/dL, and an arteriovenous fistula as their vascular access. These data suggest that adult Hispanic HD patients have a 12-mo survival intermediate to non-Hispanic Blacks and non-Hispanic Whites and experience equivalent or better intermediate outcomes of dialytic care compared with non-Hispanic Whites. *dfrankenfield@cms.hhs.gov*

The Centers for Medicare & Medicaid Services (CMS) End-Stage Renal Disease (ESRD) Clinical Performance Measures (CPM) Project annually profiles certain intermediate outcomes of care for nationally representative samples of adult (≥ 18 yr) in-center hemodialysis and adult peritoneal dialysis patients in the United States. This project assists dialysis care providers in identifying opportunities to improve care that may be due to actionable practice differences (1,2).

One of the goals of the federal government's initiative *Healthy People 2010* is to eliminate health disparities among different segments of the population (3). Hispanics are almost twice as likely to die from diabetes mellitus and have higher rates of hypertension and obesity compared with non-Hispanic Whites (3). These disparities, with the potential implication for more complex management of ESRD for these patients, were the impetus to examine the mortality experience of Hispanic hemodialysis patients in the United States and its association with intermediate outcomes of dialytic care.

The few published studies of the mortality experience of Hispanic hemodialysis patients have been from small regional samples (4,5). The results presented herein provide the first report of the 12-mo follow-up mortality experience of Hispanics from a large, nationally representative, random sample of in-center hemodialysis patients in the United States and examines its association with key intermediate outcomes of dialytic care captured in this data set.

Materials and Methods

Study Design and Sample Selection

Detailed information about CMS's ESRD CPM Project has previously been published (6). In brief, a random sample, stratified by the 18 ESRD Networks (regional organizations contracted by CMS to perform quality oversight activities to assure the appropriateness of services and protection for dialysis patients) of Medicare-eligible adult in-center hemodialysis patients was selected from an end-of-year ESRD patient census for 1998. Patients were eligible for inclusion in the sample if they were at least 18 yr old as of October 1, 1998, and were receiving in-center hemodialysis and alive on December 31, 1998. Clinical information was obtained on the selected patients for October through December 1998.

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Data Collection

In May 1999, the ESRD Networks sent a three-page data collection form to all facilities with one or more patients selected for the sample. Available patient information included gender, age, race (White, Black, Asian/Pacific Islander, American Indian/Alaska Native, and Other/Unknown), the primary cause of ESRD, and years on dialysis therapy. A separate question was placed on the data collection form to ascertain Hispanic status: "Is patient Hispanic?" with response categories of "Yes," "No," and "Unknown." If the response to this question was "Yes," the patient was placed in the Hispanic category. If the response was "No" or "Unknown," the patient was considered to be non-Hispanic and was placed in one of the racial categories listed above. All racial/ethnic designations were reported by a staff person at the facility responsible for completing the data collection form. The designations may not have been uniformly reported by or reviewed with the patient.

Patient data were abstracted from medical records by the dialysis facility staff for each month of the study period and included the patient's height, first documented pre- and post-dialysis blood urea nitrogen concentration (BUN) and pre- and post-dialysis patient weights, delivered dialysis session length, dialyzer code (used to determine dialyzer KUf), blood pump flow rate 60 min during the session the BUN were drawn, type of vascular access, hemoglobin, prescribed weekly Epoetin alfa dose at the time the hemoglobin was drawn, transferrin saturation, serum ferritin concentration, iron prescription practice, and serum albumin with the laboratory method used to determine the serum albumin (bromcresol green [BCG] or bromcresol purple [BCP]).

Completed forms were returned to the appropriate ESRD Network office, where data were reviewed and entered into a computerized database (7). The data were forwarded to CMS for aggregation and analysis.

Dates of death were obtained from CMS's enrollment database and subsequently linked to the clinical information in the CPM data file. We included all deaths occurring during the 12 mo after the study period (January 1, 1999, through December 31, 1999).

Data Analyses

The Hispanic group was compared to other non-Hispanic racial groups, similar to group classifications in numerous other health outcome studies (4,5,8–18). Due to small numbers in certain racial groups, ethnic analysis was restricted to Hispanic, non-Hispanic White (hereafter referred to as White), and non-Hispanic Black (Black) groups. Associations of group classification with the clinical data were tested by χ^2, two-tailed *t* test, and hierarchical ANOVA analyses. A two-tailed $P < 0.05$ was considered to be significant. Multivariable logistic regression analyses to control for demographic and geographic variables were conducted on the following four intermediate outcomes: mean Kt/V $\geq$ 1.2, mean hemoglobin $\geq$ 11 g/dL, mean serum albumin $\geq$ 4.0/3.7 g/dl (BCG/BCP), and presence of an arteriovenous (AV) fistula as the vascular access. Variables entered into the separate models with ethnicity (White = referent group) included gender, age, years on dialysis, cause of ESRD (diabetes mellitus *versus* other causes combined), mean postdialysis body mass index (BMI, kg/m^2), and ESRD Network (referent group was the Network 9th in rank for each intermediate outcome).

All factors found to be significantly associated with 1-yr mortality in bivariate analyses or considered conceptually important were entered simultaneously into a Cox proportional hazards model. Variables entered into the initial adjusted model included ethnicity (White = referent group), gender, age group (18 to 44 yr [referent], 45 to 64 yr, and 65+ yrs), diabetes as the cause of ESRD *versus* other causes combined, years on dialysis (<0.5 yr, 0.5 to 0.9 yr, 1.0 to 1.9 yr, 2.0+ yrs [referent]), mean postdialysis BMI, presence of an amputation(s), mean Kt/V $\geq$ 1.2 (0,1), presence of catheter access, mean hemoglobin $\geq$ 11 g/dL (0,1), mean serum albumin $\geq$ 4.0/3.7 g/dL (0,1) and ESRD Network. Network 4 was selected as the referent as the percent of patients that died during the 12-mo follow-up period in this region was nearly identical to the national average in this sample. Interaction terms were tested and placed into the models if significant.

Both forward stepwise and backward stepwise modeling techniques were employed, utilizing the likelihood ratio statistic. Due to the multiple comparisons made, only predictors with a $P < 0.01$ were retained in the final adjusted model predicting 12-mo mortality. The mortality analysis was conducted on the full sample of patients and separately for the subset of patients with diabetes mellitus as the cause of their ERSD (DM+), for the subset of patients with hypertension as the cause of their ESRD, and among patients aged 65 yr or older. The data analyses were conducted utilizing Epi Info version 6.04a and SPSS for Windows, version 10.0 (19).

Results

Of 8838 patients, 8336 (94%) met the inclusion criteria for the sample for analysis. Information on Hispanic ethnicity was provided for 8220 (98.6%) of 8336, and racial designations were provided for 8302 (99.6%) of 8336 patients in the sample. Ethnicity of 994 patients (12%) was identified as Hispanic, 3618 (43%) as White, and 3111 (37%) as Black. Hispanic patients were more prevalent in California, Texas, the Southwest, and New Jersey/Puerto Rico (Figure 1). This distribution closely parallels that of Hispanics in the general population (20). This Hispanic subgroup was composed of the following racial categories: 55% White, 3% Black, and 42% Other/Unknown. Whites were older than Hispanics or Blacks (63.6 $\pm$ 14.9 yr *versus* 58.5 $\pm$ 14.9 yr and 57.1 $\pm$ 14.8 yr, respectively; $P < 0.001$; Table 1). Hispanics were more likely to have diabetes mellitus as the cause of ESRD, compared with Whites or Blacks (55% *versus* 38% and 40%; $P < 0.001$) and to have an amputation (10% *versus* 7% and 8%; $P < 0.05$).

Unadjusted and adjusted odds ratios (95% CI) for ethnicity predicting selected intermediate outcomes of interest are pre-

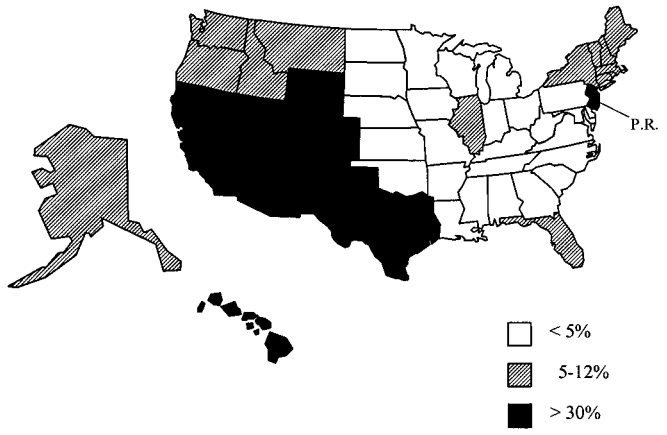

Figure 1. Distribution by Network of adult Hispanic ESRD patients in the United States.

Table 1. Patient characteristics

Characteristic	Hispanic *n* (%)	Non-Hispanic White *n* (%)	Non-Hispanic Black *n* (%)
Total	994 (100)	3618 (100)	3111 (100)
Gender[a]			
male	538 (54)	2038 (56)	1558 (50)
female	456 (46)	1580 (44)	1553 (50)
Age (yr)			
mean (± SD)[a]	58.5 (14.9)	63.6 (14.9)	57.1 (14.8)
median	61.0	66.0	58.0
18 to 44	174 (18)	461 (13)	679 (22)
45 to 64	417 (42)	1177 (33)	1328 (43)
65+	403 (41)	1979 (55)	1104 (36)
Cause of ESRD[a]			
diabetes mellitus	544 (55)	1355 (38)	1225 (40)
hypertension	159 (16)	743 (21)	1127 (36)
glomerulonephritis	132 (13)	451 (13)	347 (11)
other/unknown	157 (16)	1058 (29)	395 (13)
Duration of dialysis (yr)			
mean (± SD)[a]	3.3 (3.4)	3.0 (3.7)	3.8 (3.8)
median	2.2	1.8	2.6
<0.5	122 (12)	539 (15)	310 (10)
0.5 to 0.9	138 (14)	595 (16)	386 (12)
1 to 1.9	206 (21)	825 (23)	582 (19)
2.0+	528 (53)	1659 (46)	1832 (59)
Post-dialysis BMI (kg/m^2)			
mean (± SD)[a]	26.0 (5.9)	25.7 (6.6)	26.7 (6.9)
median	25.0	24.5	25.5
Patients with amputation(s)[b]	98 (10)	259 (7)	243 (8)

[a] $P < 0.001$.
[b] $P < 0.05$.

sented in Table 2. After controlling for gender, age, years on dialysis, postdialysis BMI, cause of ESRD, and Network region in multivariable logistic regression analyses, Hispanics were more likely than the referent group (Whites) to have a mean serum albumin ≥ 4.0/3.7 g/dL (BCG/BCP) (OR [95% CI], 1.5 [1.2 to 1.7]; $P < 0.001$). Hispanics did not differ significantly from Whites in attaining a mean Kt/V ≥ 1.2, a mean hemoglobin ≥ 11 g/dL, or having an AV fistula as their vascular access after controlling for demographic and geographic variables.

Eighteen percent of Hispanic patients compared with 24% of Whites and 14% of Blacks died during the 12-mo following the study period ($P < 0.001$). Within the subset of patients with diabetes mellitus as the cause of ESRD, 21% of Hispanics, 28% of Whites, and 18% of Blacks died during the follow-up period ($P < 0.001$). Within the subset of patients with hypertension as the cause of ESRD, 18% of Hispanics, 27% of Whites, and 14% of Blacks died during the follow-up period ($P < 0.001$). Among patients 65 yr or older, 28% of Hispanics, 32% of Whites, and 23% of Blacks died during the follow-up period ($P < 0.001$).

Hispanics had an intermediate unadjusted 12-mo mortality risk compared with Blacks and Whites (referent group). The unadjusted 12-mo mortality risk (99% CI) for all Hispanics was 0.70 (0.57 to 0.87; $P < 0.001$) and for Blacks was 0.56 (0.48 to 0.65; $P < 0.001$). Within the subset of patients with diabetes mellitus as the cause of ESRD, the unadjusted 12-mo mortality risk for Hispanics was 0.71 (0.54 to 0.93; $P < 0.01$) and for Blacks was 0.59 (0.47 to 0.73; $P < 0.001$) compared with Whites, the referent group. Within the group of patients with hypertension as the cause of ESRD, Hispanics and Blacks had an unadjusted mortality risk of 0.65 (0.39 to 1.09; $P = 0.0309$) and 0.49 (0.37 to 0.64; $P < 0.001$), respectively, compared with Whites. Among patients 65 yr or older, the unadjusted 12-mo mortality risk for Hispanics was 0.87 (0.67 to 1.13; $P = 0.1689$) and for Blacks was 0.68 (0.56 to 0.83; $P < 0.001$) compared with Whites.

In the final model adjusted for patient characteristics, geographic region, and clinical parameters, Hispanics had a 12-mo mortality risk of 0.76 (0.60 to 0.96; $P < 0.01$) compared with White patients, the referent group (Table 3). Blacks had an adjusted 12-mo mortality risk of 0.66 (0.56 to 0.78; $P < 0.001$). There was no significant survival advantage for Hispanic patients compared with Black patients (1.15 [0.90 to 1.47]; $P = 0.1427$). Within the subset of patients with diabetes mellitus as the cause of ESRD, Hispanics had an adjusted

Table 2. Unadjusted and adjusted odds ratios (95% CI) of ethnicity predicting selected intermediate outcomes

	Unadjusted	Adjusted[a]
Non-Hispanic White = referent group		
Mean Kt/V ≥1.2		
Hispanic	1.2 (1.0 to 1.5)[d]	1.2 (0.96 to 1.5)
Non-Hispanic Black	0.81 (0.72 to 0.92)[b]	0.74 (0.64 to 0.86)[b]
Mean hemoglobin ≥ 11 g/d		
Hispanic	1.03 (0.89 to 1.2)	0.99 (0.84 to 1.2)
Non-Hispanic Black	0.85 (0.77 to 0.94)[c]	0.90 (0.81 to 1.0)
Mean serum albumin ≥4.0/3.7 g/d (BCG/BCP)		
Hispanic	1.4 (1.2 to 1.6)[b]	1.5 (1.2 to 1.7)[b]
Non-Hispanic Black	1.4 (1.2 to 1.5)[b]	1.2 (1.0 to 1.3)[c]
AV fistula use		
Hispanic	0.93 (0.80 to 1.1)	0.91 (0.76 to 1.1)
Non-Hispanic Black	0.67 (0.59 to 0.74)[b]	0.67 (0.59 to 0.76)[b]

[a] Adjusted for gender, age, years on dialysis, post-dialysis BMI, cause of ESRD (diabetes mellitus *versus* other causes combined), and ESRD Network (Network ranked 9th for each intermediate outcome was the referent Network).
[b] $P < 0.001$.
[c] $P < 0.01$.
[d] $P < 0.05$.

12-mo mortality risk of 0.67 (0.50 to 0.90; $P < 0.001$); Blacks 0.59 (0.47 to 0.74; $P < 0.001$). Among patients with hypertension as the cause of ESRD, Hispanics had an adjusted 12-mo mortality risk of 0.86 (0.50 to 1.48; $P = 0.4827$); Blacks 0.67 (0.49 to 0.90; $P < 0.001$). Within the subset of patients ≥ 65 yr of age, Hispanics had an adjusted 12-mo mortality risk of 0.92 (0.69 to 1.23; $P = 0.4584$); Blacks 0.70 (0.57 to 0.87; $P < 0.001$).

Although there was regional variation in the percent of patients who experienced 12-mo mortality, ranging from 15% to 23% among the 18 Networks ($P < 0.05$), in the Cox proportional hazards models adjusted for patient characteristics and clinical variables, the Network variable did not remain as a significant predictor of 12-mo mortality with either the forward or backward stepwise modeling techniques. Due to the significant regional variation in the distribution of Hispanic patients, the Network variable was forced into the models. Forcing this regional variable did not alter the final model for either the entire sample or the subsamples; Network area did not remain as a significant predictor of 12-mo mortality in the multivariable final models.

Discussion

US Census 2000 data indicate that Hispanics comprised 12.5% of the US population and that this group is the fastest growing minority group in the U.S., increasing by 57.9% from 1990 to 2000 compared with an increase of 13.2% for the total population over the same time period (20). Within the Hispanic group, Mexican-Americans increased by 52.9%, Puerto Ricans by 24.9%, and Cuban-Americans by 18.9%. The growth of the Hispanic group is attributed to both immigration and high birth rates (21,22). The Hispanic group is projected to become the largest minority group in the United States by 2009 (23). In 2000, 50% of Hispanics lived in California and Texas. The subgroups of Hispanics had distinct geographic distribution patterns, with Mexican-Americans primarily in California, Texas, the Southwest, and Illinois, Puerto Ricans in New York, Florida, New Jersey, and Pennsylvania, and Cuban-Americans in Florida (20).

Patient ethnicity has been a required data field on CMS's Medical Evidence Form (Form 2728) since 1995. Data from the United States Renal Data System's most recent Annual Data Report indicate that the number of Hispanic patients receiving in-center hemodialysis has approximately doubled from 1995 to 1999 (24). With the rapidly increasing numbers of Hispanics in the general population, the high prevalence of diabetes in this population and the increased incidence of ESRD among Hispanics, one can expect that the percent of Hispanic patients treated for ESRD will continue to increase.

Classification methods for ethnicity have been inconsistent, and confusion exists over the definitions of race, ethnicity, and country of origin. A separate question on Hispanic origin was first included on the 1970 federal census, but this question was asked only of a 5% sample of households (20). In 1980 and 1990, respondents were asked if they were of "Spanish/Hispanic origin or descent," and if so, to specify Mexican, Puerto Rican, Cuban, or "other Spanish/Hispanic." In 2000, those respondents who identified themselves as Spanish/Hispanic/Latino (beginning with the 2000 federal census, the terms "Hispanic" and "Latino" could be used interchangeably) could further identify themselves as Mexican-American/Chicano, Puerto Rican, Cuban, or "other Spanish/Hispanic/Latino." In contrast to these classifications, CMS's Medical Evidence Form offers only Hispanic-Mexican, Hispanic-Other, and Non-Hispanic as categories for the required ethnicity field.

For this study, dialysis facility staff designated ethnicity. The ESRD CPM data collection form asks if the patient is Hispanic (Yes, No, or Unknown). Although ethnicity informa-

Table 3. Final adjusted Cox proportional hazards model predicting 12-month follow-up mortality

Patient Characteristic[d]	All Hazard Ratio (99% CI)	Diabetes Mellitus as Cause of ESRD Hazard Ratio (99% CI)	Hypertension as Cause of ESRD Hazard Ratio (99% CI)	≥ 65 yr Hazard Ratio (99% CI)
Ethnicity				
Hispanic	0.76 (0.60 to 0.96)[f]	0.67 (0.50 to 0.90)[e]	0.86 (0.50 to 1.48)	0.92 (0.69 to 1.23)
Non-Hispanic Black	0.66 (0.56 to 0.78)[e]	0.59 (0.47 to 0.74)[e]	0.67 (0.49 to 0.90)[e]	0.70 (0.57 to 0.87)[e]
Age group (yr)				
45 to 64	2.03 (1.47 to 2.79)[e]	1.66 (1.01 to 2.73)[f]	2.76 (1.28 to 5.97)[e]	NE
65+	3.86 (2.84 to 5.24)[e]	2.92 (1.80 to 4.73)[e]	5.17 (2.45 to 10.92)[e]	NE
Age (yr)	NE[a]	NE	NE	1.04 (1.02 to 1.05)[e]
Diabetes mellitus as cause of ESRD	1.36 (1.17 to 1.59)[e]	NA	NA	1.38 (1.14 to 1.68)[e]
Presence of amputation	1.53 (1.23 to 1.91)[e]	1.53 (1.18 to 1.97)[e]	NS[b]	1.50 (1.13 to 1.99)[e]
Duration of dialysis (yr)				
<0.5	0.57 (0.45 to 0.72)[e]	0.48 (0.34 to 0.68)[e]	0.57 (0.35 to 0.92)[f]	0.58 (0.44 to 0.77)[e]
0.5 to 0.9	0.71 (0.57 to 0.88)[e]	0.69 (0.51 to 0.94)[f]	0.64 (0.41 to 0.99)[f]	0.73 (0.56 to 0.95)[f]
1.0 to 1.9	0.88 (0.74 to 1.06)	0.76 (0.59 to 0.99)[f]	0.84 (0.59 to 1.20)	0.80 (0.64 to .99)[f]
Mean post-dialysis BMI (kg/m^2)	0.97 (0.96 to 0.99)[e]	0.980 (0.964 to 0.997)[f]	0.97 (0.95 to 0.99)[f]	0.98 (0.96 to 0.99)[f]
Mean hemoglobin 11 g/d	0.71 (0.62 to 0.82)[e]	0.66 (0.54 to 0.82)[e]	0.72 (0.54 to 0.95)[f]	0.73 (0.61 to 0.87)[e]
Mean serum albumin ≥ 4.0/3.7 g/d (BCG/BCP)[c]	0.58 (0.49 to 0.70)[e]	0.64 (0.50 to 0.83)[e]	0.57 (0.41 to 0.78)[e]	0.62 (0.50 to 0.77)[e]
Catheter access	1.71 (1.46 to 2.01)[e]	1.74 (1.38 to 2.20)[e]	1.71 (1.25 to 2.35)[e]	1.53 (1.25 to 1.86)[e]

[a] NE, factor not entered into the model.
[b] NS, not significant.
[c] BCG, bromcresol green laboratory method, BCP, bromcresol purple laboratory method. Factors entered into the model but found to be not significant; gender, mean Kt/V ≥ 1.2, and ESRD Network.
[d] Referent groups: Non-Hispanic White for ethnicity; 18 to 44 yr for age; 2+ yr for duration of dialysis.
[e] $P < 0.001$.
[f] $P < 0.01$.

tion may not have been reported by or reviewed with the patient, these patients are seen in these facilities over a prolonged period of time. The staff have likely had enough personal contact with both patients and their families to have ascertained the patient's ethnicity and did not base the classification solely on either appearance or Spanish surname. However, we acknowledge that there is likely some misclassification inherent in this method of ascertainment and that some patients who were Hispanic were not identified as such, and *vice versa*. We do not believe that there was a systematic bias of misclassification of patients into either the Hispanic or non-Hispanic ethnic categories but that, in some instances, they may have been placed into ethnic categories due to staff perceptions. As possible ethnic group misclassification may have occurred in both directions, it is likely that any misclassification of ethnicity that occurred was non-differential, which may have decreased our ability to detect differences in survival risk between Hispanics and Blacks. Non-differential misclassification of ethnicity should not, however, reverse the rank order of mortality risk we noted.

As reported by other investigators (4,9), diabetes mellitus was the principal cause of ESRD for Hispanic patients in the sample. Perhaps due to the high percentage of Hispanics with diabetes mellitus as their cause of ESRD, Hispanics in our sample were more likely to have an amputation compared with Whites and Blacks. Other investigators have reported that, in adjusted multivariable analyses of cross-sectional data, Hispanics were more likely to have a late initiation of dialysis compared with Blacks and Whites (OR: 1.47, 1.01, and 1.00, respectively) and have suggested the need for additional studies to determine if late initiation of dialysis resulted in adverse outcomes (10). Although we were unable to examine the effect of late initiation of dialysis on intermediate outcomes or survival, our data show that Hispanics generally experienced equivalent or better intermediate outcomes compared with their non-Hispanic counterparts. Their better dialysis adequacy values, measured by either Kt/V or URR, may be partially explained by their smaller body size. Similar proportions of Hispanic and White patients met different targets for hemoglobin values. A smaller proportion of Black patients met these same targets, despite similar Epoetin dosing across all ethnic groups, a finding that has been observed by others (25). Both Hispanics and Blacks were more likely to meet different serum albumin targets compared with Whites. Hispanics and Whites

were more likely than Blacks to have an AV fistula as their vascular access.

Several studies have shown similar or lower mortality rates for Hispanics for diseases or conditions other than ESRD compared with Whites (11–15,26,27). Within the ESRD population, we found that both Hispanic and Black hemodialysis patients had a 12-mo survival advantage compared with White patients, both in the univariate analyses and after controlling for patient characteristics, geographic region, and clinical variables.

Several hypotheses have been proposed for the survival advantage noted for Hispanic patients, in general, and within the ESRD population. This apparent survival advantage has been labeled by some as the "Hispanic paradox" (16–18,26). Despite lower incomes and educational levels, more limited access to health care, and a greater proportion without health insurance, Hispanics in the United States tend to have better than expected health and survival outcomes, particularly in older age groups. Hypotheses to explain this paradox include the presence of social and cultural factors promoting health including extended families, a strong ethnic identity, religiosity, acculturation, migration effects, and misclassification bias (16,23,26).

The "healthy migrant" effect postulates that people who immigrate into the United States are healthier and stronger; thus, the Hispanic ethnic group, with high levels of immigration, would include a larger proportion of healthy people (16,26). The "salmon bias," or the return of retired or ill people to their land of nativity, could possibly result in a biased lower estimate of Hispanic mortality in the United States (16,28). More recently, Abraido-Lanza *et al.* (17), analyzing National Longitudinal Mortality Study data, found that neither Puerto Ricans nor Cubans were susceptible to the "salmon bias" and that these ethnic subgroups had lower mortality rates than non-Hispanic Whites. Puerto Ricans were not susceptible because their deaths in Puerto Rico would be reported in US national statistics, and Cubans were not susceptible because they face barriers in returning to their land of birth. Additionally, US-born Hispanics, who would not be susceptible to either the "salmon bias" or to the "healthy migrant" effect, had improved survival compared with US-born non-Hispanic Whites.

In regard to the ESRD population, Eggers (29) has suggested that perhaps unmeasured severity differences between racial groups or increased voluntary withdrawal from dialysis by White patients might account for the lower survival rate noted for White ESRD patients. Medina *et al.* (5), in a prospective study of 638 patients with diabetes-related ESRD in 32 dialysis centers in Texas, found that non-Hispanic White patients were not sicker than Hispanics at the onset of ESRD, yet they experienced shorter survival. These investigators found insignificant differences in voluntary withdrawal from dialysis by ethnicity or significantly higher transplantation rates for non-Hispanic Whites. Examining the association of URR with survival, Owen *et al.* (30) found differential survival among race/gender groups. Specifically, these investigators found that Blacks received lower doses of dialysis but had higher survival rates compared with White patients. Owen speculated that Blacks, who had greater weights, body surface areas, serum albumin levels, and serum creatinine concentrations compared with Whites, had a better nutritional status, and that nutrition was a more powerful predictor of death than dialysis dose. Hispanic patients are intermediate to non-Hispanic Blacks and non-Hispanic Whites in regard to these nutritional parameters; hence, one can hypothesize that mortality rates would be intermediate to these two other groups. Further study is needed to more fully understand what factors are contributing to lower survival rates for White ESRD patients.

In addition to the possible misclassification bias described above, there were other limitations to this analysis. As this was a cross-sectional study design, no causal associations may be determined. Other investigators have shown differential health outcomes for the subgroups within the Hispanic category and have described the need for further research to account for Hispanic national origin and acculturation (14,16,17,31). We were unable to perform this type of analysis because we did not have Hispanic subgroup information available. In this study, there is likely heterogeneity not only within the group designated as Hispanic, but also within the non-Hispanic White and non-Hispanic Black groups. Despite this limitation, we followed the convention of numerous other health outcomes studies comparing Hispanics to these other two racial/ethnic groups.

Our data indicate that adult Hispanic in-center hemodialysis patients are not disadvantaged when compared with Whites or Blacks for 12-mo follow-up survival or several important intermediate outcomes of dialysis care. Hispanics had an intermediate 12-mo survival experience compared with Blacks and Whites, with Black patients most likely to survive over the 12-mo follow-up period. Hispanics experienced equivalent or better intermediate outcomes for dialysis adequacy, vascular access, anemia management, and serum albumin compared with their non-Hispanic counterparts.

Given the rapidly increasing number of Hispanics in the general population, their younger age, the high prevalence of diabetes mellitus, and the increased incidence of ESRD in this ethnic group, it is likely that the percentage of Hispanics with treated ESRD will dramatically increase in the coming years. Continued surveillance of intermediate outcomes and the subsequent morbidity and mortality experience of this group should be conducted to ensure that there is no disparity in either care or outcomes for this segment of the population. Future research should examine the health outcomes and survival of the different Hispanic subgroups to determine if certain groups are at higher risk for poor outcomes. Given the high prevalence of diabetes mellitus and hypertension in this group, attention should be given to preventive measures to delay end organ damage and the need for dialysis therapy.

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