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Trends in Relative Mortality Between Hispanic and Non-Hispanic Whites Initiating Dialysis: A Retrospective Study of the US Renal Data System

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Abstract

Background—Hispanic patients undergoing long-term dialysis experience better survival compared with non-Hispanic whites. It is unknown whether this association differs by age, has changed over time, or is due to differential access to kidney transplantation.

Study Design—National retrospective cohort study.

Setting & Participants—Using the US Renal Data System, we identified 615,618 white patients 18 years or older who initiated dialysis therapy between January 1, 1995, and December 31, 2007.

Predictors—Hispanic ethnicity (vs non-Hispanic whites), year of end-stage renal disease incidence, age (as potential effect modifier).

Outcomes—All-cause and cause-specific mortality.

Results—We found that Hispanics initiating dialysis therapy experienced lower mortality, but age modified this association ($P < 0.001$). Compared with non-Hispanic whites, mortality in Hispanics was 33% lower at ages 18–39 years (adjusted cause-specific HR [HR_{CS}], 0.67; 95% CI, 0.64–0.71) and 40–59 years (HR_{CS}, 0.67; 95% CI, 0.66–0.68), 19% lower at ages 60–79 years

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SUPPLEMENTARY MATERIAL

Table S1: Characteristics of Hispanic and non-Hispanic whites initiating dialysis, by age group.

Figure S1: Cohort selection flow diagram.

Figure S2: Cumulative incidence plots comparing mortality and transplantation, stratified by age.

Note: The supplementary material accompanying this article (<http://dx.doi.org/10.1053/j.ajkd.2013.02.375>) is available at www.ajkd.org.

(HR_{CS}, 0.81; 95% CI, 0.80–0.82), and 6% lower at 80 years or older (HR_{CS}, 0.94; 95% CI, 0.91–0.97). Accounting for the differential rates of kidney transplantation, the associations were attenuated markedly in the younger age strata; the survival benefit for Hispanics was reduced from 33% to 10% at ages 18–39 years (adjusted subdistribution-specific HR [HR_{sd}], 0.90; 95% CI, 0.85–0.94) and from 33% to 19% among those aged 40–59 years (HR_{sd}, 0.81; 95% CI, 0.80–0.83).

Limitations—Inability to analyze Hispanic subgroups that may experience heterogeneous mortality outcomes.

Conclusions—Overall, Hispanics experienced lower mortality, but differential access to kidney transplantation was responsible for much of the apparent survival benefit noted in younger Hispanics. *Am J Kidney Dis.* 62(2):312–321.

INDEX WORDS

Clinical epidemiology; Hispanic ethnicity; survival; dialysis

More than half the US population growth between 2000 and 2010 resulted from an increase in the Hispanic population, which now represents 16% of the US population. Of these, 63.0% are of Mexican origin, 15.5% come from the Caribbean (principally Puerto Rico, Dominican Republic, and Cuba), and ~13.4% originate from Central (excluding Mexico) and South America.^{1,2} The 2012 Annual Data Report of the US Renal Data System (USRDS) noted that compared with non-Hispanics, Hispanics are almost twice as likely to develop kidney failure, mainly because of the increased prevalence of diabetes mellitus, uncontrolled hypertension, and obesity^{3–7} However, Hispanic patients are not as likely as the general US population to undergo screening for kidney disease risk factors or receive optimal treatment after diagnosis.^{8–11} Furthermore, Hispanics are less likely to receive timely predialysis care by a nephrologist, leading to late initiation of and poor preparation for long-term dialysis treatment.^{12–14}

Despite the higher prevalence of cardiovascular risk factors, barriers to health care, and lower socioeconomic status, previous studies have shown that Hispanic patients undergoing dialysis experience a survival advantage compared with non-Hispanic whites, leading researchers to conclude that a “Hispanic paradox” exists.^{12,15–17} However, it also is known that Hispanic patients with advanced kidney disease experience lower access to kidney transplantation.^{18,19} Therefore, it is important to formally consider differential access to transplantation when studying differences in mortality between Hispanics and non-Hispanics undergoing long-term dialysis. None of the previous studies have conducted analyses that treated kidney transplantation as a competing rather than a censoring event.

We investigated the mortality experience of Hispanic patients undergoing long-term dialysis compared with non-Hispanic whites and specifically examined age as an effect modifier and kidney transplantation as a competing risk. We also examined whether any temporal trends existed in the association between Hispanic ethnicity and mortality.

METHODS

Study Population

From the USRDS, the national registry of individuals with end-stage renal disease (ESRD), we identified all adult (aged 18–100 years) white patients who initiated dialysis therapy between January 1, 1995, and December 31, 2007, and who survived at least 90 days. Patients whose reported race was not white or who had missing ethnicity information were excluded.

Patient Characteristics

All patient characteristics were obtained from the Centers for Medicare & Medicaid Services (CMS) Medical Evidence Report (form CMS-2728-U3). This form is a government document that is completed for every patient initiated on long-term dialysis therapy. In addition to sociodemographic characteristics, information regarding dialysis modality, certain comorbid conditions, and few biometric data are recorded on this form.

Exposure: Hispanic Ethnicity

A patient's Hispanic ethnicity was identified if the provider checked on the Medical Evidence Report the box indicating Hispanic or Latino ethnicity (item 8). Otherwise, the patient was categorized as non-Hispanic.

Outcomes: Mortality and Censoring Events

The outcome for this study was time from the start of dialysis therapy to death from any cause. To ensure proper capture of all patients and outcomes in the USRDS, the study start date for all incident patients was defined as day 91 of ESRD ("90-day rule"). Receipt of a kidney transplant was considered a censoring or competing event, as detailed next. If death and kidney transplantation occurred on the same date, transplantation was used as the outcome. Patients who did not die or receive a kidney transplant were censored on the latter day between the most recent Medicare claim and the last complete period entered in the treatment history file. All patients were administratively censored on December 31, 2008, regardless of the outcome. To account for potential differential loss to follow-up between Hispanics and non-Hispanics in a sensitivity analysis, we conducted the same analyses restricted to person-time spent with Medicare as the primary payer as detailed in the payer history file.

Covariables: Demographic and Health Characteristics

We defined each patient's age at initiation of dialysis therapy (categorized for stratified analyses into 18–39, 40–59, 60–79, and 80 years), sex, dialysis modality (hemodialysis vs peritoneal dialysis), body mass index (categorized into <18.5, 18.5–24.9, 25.0–29.9, 30.0–39.9, and 40.0 kg/m², or missing), estimated glomerular filtration rate, and insurance payer status (group health organization, Medicare primary Part A and B, Medicare primary other, Medicare secondary payer with or without employee group health plan, 90-day waiting period, and other). Selected comorbid conditions included the reported presence of diabetes, history of hypertension, congestive heart failure, atherosclerotic heart disease,

cerebrovascular disease, peripheral vascular disease, chronic obstructive lung disease, cancer, alcohol dependence, drug dependence, and tobacco use. We also generated an indicator of low functional status if the Medical Evidence Report indicated inability to ambulate or transfer.

Statistical Analysis

Differences in patient characteristics between Hispanics and non-Hispanics were assessed by a 2-sample t test for continuous variables and χ^2 test for independence for categorical variables. The primary association of interest was the relationship of all-cause mortality in Hispanics versus non-Hispanic whites. In addition, we sought to determine whether the relationship had changed over time and/or was modified by age. Kidney transplantation was treated as a competing event because patients receiving a kidney transplant have an inherently lower risk for mortality and Hispanics are known to have lower access to kidney transplantation.¹⁸

Cox proportional hazard models were used to estimate unadjusted and adjusted cause-specific hazard ratios (HR_{cs}) and 95% confidence intervals (CIs) of time to death between Hispanics and non-Hispanics. The HR_{cs} is interpreted as the real-world relative hazard of death in the presence of the competing event; patients were censored at the time of kidney transplantation. To further characterize the impact of the competing event, we estimated the subdistribution hazard ratio (HR_{sd}) using the Kaplan-Meier multiple imputation method.²⁰ Censoring times were imputed based on age strata, vintage, and ethnicity. HR_{sd} can be interpreted as the relative hazard of death without censoring the competing event; overall, a better estimate of patient survival, especially if access to kidney transplantation is differential. Each age group was analyzed separately with the same models to estimate HR_{cs} and HR_{sd} .

Based on the statistically significant interaction between age group and Hispanic ethnicity using the likelihood ratio statistic, we stratified the analysis by age group (18–39, 40–59, 60–79, and 80 years). Four models were estimated for all patients as well as within each age group: (1) bivariable models to estimate the unadjusted HR_{cs} between Hispanics and non-Hispanics; (2) adjusted for continuous age, sex, and year at initiation of dialysis therapy; (3) additionally adjusted for all comorbid conditions, dialysis modality, insurance payer status, eGFR, and body mass index; and (4) additionally included a multiplicative interaction term between ethnicity and year of dialysis therapy initiation. Multiple imputation by fully conditional specification was used to handle missing values.²¹ Analyses were explored for violation of proportional hazards by stratification and inspection of Schoenfeld residuals.

Finally, we examined causes of death by specific age groups in Hispanics and non-Hispanics. Primary cause of death for every patient was extracted from the death file in the USRDS, which includes information from the death notification form (CMS-2746-U2). Primary causes of death were grouped into the following categories: cardiac, vascular, infection, withdrawal, and other. Rates of each cause were computed at each age group for Hispanic and non-Hispanic whites separately. Furthermore, we performed χ^2 test to assess

for differences in causes of death in each age group. People with missing or unknown causes of death were excluded from this analysis.

Analyses were conducted using SAS, version 9.3 (SAS Institute Inc), and R statistical software, version 2.14 (The R Foundation for Statistical Computing).

This work was approved by the Institutional Review Board of Stanford University School of Medicine and conducted under a data use agreement between the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) and Dr Winkelmayer. An NIDDK officer reviewed the manuscript for privacy content and approved it prior to submission.

RESULTS

We identified 800,727 white patients aged 18–100 years when they initiated dialysis therapy between January 1, 1995, and December 31, 2007, in the continental United States or Hawaii. Patients were excluded if ethnicity information was not provided on the Medical Evidence Report or they died or received a kidney transplant within 90 days, for a final study cohort of 615,618 (Fig S1, available as online supplementary material). Table 1 compares characteristics between Hispanic and non-Hispanic patients. Hispanics constituted 16.6% ($n = 102,125$) of participants (increasing from 15.7% in 1995 to 18.1% in 2008). Hispanics were younger than non-Hispanics at initiation of dialysis therapy (59.5 ± 14.7 vs 65.8 ± 14.4 years; $P < 0.001$) and were more likely to start treatment using hemodialysis (92.5% vs 89.6%; $P < 0.001$). Hispanics also were found to initiate dialysis therapy at a lower estimated glomerular filtration rate (8.8 ± 4.3 vs 9.6 ± 4.5 mL/min/1.73 m²; $P < 0.001$). For comorbid conditions, Hispanics had more reported diabetes and hypertension, whereas for non-Hispanics, all other comorbid conditions were more prevalent. Regarding distribution of insurance payer status, Hispanics were less likely to have Medicare Parts A and B (41.5% vs 60.5%; $P < 0.001$) and more likely to be listed under the Medicare 90-day waiting period (34.6% vs 19.1%; $P < 0.001$). Table S1 provides age-stratified comparisons of these characteristics.

A total of 404,007 (65.6%) patients died during 1,528,836 person-years of follow-up. Death occurred in 53.3% of Hispanic and 68.1% of non-Hispanic patients. Furthermore, non-Hispanic whites consistently had a higher unadjusted death rate in each age group (Table 2). Hispanics were more likely to be administratively censored (19.4% vs 13.0%), be lost to follow-up (13.9% vs 7.3%), and receive a kidney transplant (13.4% vs 11.7%). However, stratifying by age, Hispanics were less likely to receive a kidney transplant in eligible age strata (Fig S2).

The unadjusted Kaplan-Meier survival on dialysis therapy by ethnicity showed higher survival for Hispanic patients, but the magnitude of the benefit appeared to decrease with older age. In the stratum of patients who were 80 years or older at dialysis therapy initiation, survival appeared comparable (Fig 1). A formal test for effect modification of the association between Hispanic ethnicity and mortality by age was highly significant ($P < 0.001$), confirming the impression gained from examining age-stratified Kaplan-Meier plots.

Stratifying by age, Hispanics maintained lower mortality compared with non-Hispanics at ages 18–39 years (adjusted HR_{CS} [aHR_{CS}], 0.67; 95% CI, 0.64–0.71), 40–59 years (aHR_{CS} , 0.67; 95% CI, 0.66–0.68), 60–79 years (aHR_{CS} , 0.81; 95% CI, 0.80–0.82), and 80 years or older (aHR_{CS} , 0.94; 95% CI, 0.91–0.97). To better illustrate the survival trends, Fig 2 (left column) shows the estimated aHR_{CS} for each age group by year of ESRD incidence. Formal tests for changes in the association between Hispanic ethnicity and mortality over time showed significant increases in the relative mortality benefit in the age strata of 40–59 and 60–79 years (both $P < 0.001$), but not in those younger than 40 years ($P = 0.9$) or 80 years or older ($P = 0.2$).

When accounting for the impact of the competing event, kidney transplantation, Hispanics still maintained lower mortality in each age group, but the associations were much attenuated in the younger age strata (Table 3). The survival benefit for Hispanics was reduced from 33% to 10% at ages 18–39 years (aHR_{sd} , 0.90; 95% CI, 0.85–0.94) and from 33% to 19% for those aged 40–59 years (aHR_{sd} , 0.81; 95% CI, 0.80–0.83). Figure 2 (right column) shows the estimated aHR_{sd} for each age group by year of ESRD incidence. In the 2 older age groups, accounting for competing risks changed the associations only minimally because few patients in these age groups received kidney transplants. A formal test for effect modification of the association between Hispanic ethnicity and mortality by year of ESRD incidence was borderline significant for those aged 18–39 years ($P = 0.03$) and highly significant for those aged 40–59 and 60–79 years (both $P < 0.001$), but remained nonsignificant for patients 80 years or older ($P = 0.2$).

Comparing causes of death, younger but not older Hispanics were less likely to die of cardiac causes and more likely to die of infection or vascular disease in each age subgroup ($P < 0.001$). In addition, older Hispanics were less likely to die after withdrawal from dialysis therapy ($P < 0.001$; Fig 3).

Restricting these analyses to person-time spent with Medicare fee-for-service as primary payer, results were essentially unchanged (not shown).

DISCUSSION

In this study, we found that Hispanic individuals initiating long-term dialysis treatment experienced lower mortality compared with non-Hispanic whites, a finding that persisted after adjustment for sociodemographic characteristics, comorbid conditions, and some biometric data. However, this survival pattern was not consistent across all age categories: the Hispanic survival advantage was attenuated substantially with older age and almost eliminated in the oldest subgroup of patients 80 years or older. Furthermore, conducting analyses that accounted for the competing risk of kidney transplantation, the survival benefits were substantially attenuated in the younger age groups. Focusing on long-term temporal trends, we found that the difference in mortality between Hispanics and non-Hispanic whites has widened over time. Examining cause of death, we found that Hispanics were less likely to die of cardiac causes and more likely to die of infection and vascular events.

Previous observational studies have examined the survival differences by Hispanic ethnicity among CKD^{15,22} and ESRD cohorts.^{4,12,17,23–25} Using data from the ESRD Clinical Performance Measures Project, Frankenfield et al²⁵ studied a cross-sectional sample of prevalent hemodialysis patients in 1998 and found Hispanics to have 24% lower mortality compared with non-Hispanic whites. Another analysis of US patients initiating dialysis therapy in 1996–1997 showed 17% and 30% lower adjusted mortality risks for Hispanics with and without diabetes, respectively. Significant variations in mortality rates among Hispanic racial subgroups also were noted.¹² Similarly, an analysis using data from the US arm of the Dialysis Outcomes & Practice Patterns Study (DOPPS I; 1996–2001) showed an adjusted mortality rate 23% lower compared with non-Hispanics.¹⁷ Although these studies examined nationally representative cohorts, sample sizes and follow-up durations were limited. Only one study focused on incident patients, with the possibility of survivor bias in the other studies of prevalent cohorts. Additionally, 2 of these analyses were restricted to patients receiving hemodialysis only, which thereby reduces their applicability to those treated with peritoneal dialysis. None of the previous analyses considered effect modification by age or the possibility of informative censoring by competing risks.

The finding that the survival benefit for Hispanic patients decreases markedly when the competing risk of kidney transplantation is taken into account is novel and important. It indicates that the apparent survival benefit of Hispanic patients on dialysis therapy is driven by their lower access to kidney transplantation, which has been described previously.^{18,26} In other words, Hispanic patients remain on dialysis therapy longer while otherwise similar non-Hispanic whites leave the cohort through transplantation, thus progressively enriching the cohort with sicker non-Hispanic patients with an inherently worse prognosis. Because access to kidney transplantation varies by age, accounting for it yields more pronounced attenuation of the observed differences in mortality between Hispanics versus non-Hispanics in younger age groups. The increasing mortality difference over time between Hispanics and non-Hispanics is suggestive of reduced access to kidney transplantation for Hispanics, which likely has been exacerbated by the critical shortage of organ donors.

Although less pronounced than previously thought, the phenomenon of improved survival of Hispanic patients on dialysis therapy remains paradoxical. Hispanics have been reported to receive less and lower quality of chronic kidney disease (CKD) care as they approach ESRD, resulting in worsening anemia, increased use of dialysis catheters for vascular access, and late initiation of dialysis therapy, all of which are correlated strongly with mortality while receiving dialysis.^{13,14,27–29} Interestingly, similar paradoxical survival outcomes have been described in other minority populations, such as Asians, Pacific Islanders, and African Americans, despite known disparities in pre-ESRD care.^{30–34}

The survival advantage of Hispanic patients with ESRD has been attributed to better cardiovascular outcomes despite a higher prevalence of diabetes and hypertension.^{12,15,25} The Hispanic cohort in our analysis showed lower prevalences of atherosclerotic disease and heart failure, which other studies also have observed.^{12,15} Additionally, we found that Hispanics were reported to be less likely to die of cardiac causes compared with non-Hispanics younger than 60 years, implying that Hispanics may face a lower cardiovascular burden. Furthermore, when analyzing measures of subclinical cardiovascular disease in the

non-CKD populations, Mexican American males were found to have a narrower carotid intima-media thickness, as well as lower coronary and abdominal aorta calcium scores, compared with age-matched non-Hispanic white men.^{35,36} Extrapolation of these findings to the CKD population recently has been conducted in the Chronic Renal Insufficiency Cohort (CRIC) and Hispanic CRIC (HCRIC) studies. Compared with non-Hispanic whites, Hispanics had a lower prevalence of coronary artery calcification, but after adjusting for sociodemographic factors, this association was no longer significant. Interestingly, in the same study, nearly two-thirds of Hispanics had poorly controlled hypertension and more prevalent left ventricular hypertrophy compared with non-Hispanic whites, a clinically relevant finding because left ventricular hypertrophy is known to be an independent predictor of cardiovascular morbidity and mortality.³⁷ A higher prevalence of left ventricular hypertrophy in Hispanics compared with non-Hispanic whites also has been described in non-CKD populations.^{38,39} Despite these conflicting reports, the lower cardiovascular burden among Hispanics with CKD may be a reflection of less CKD screening and treatment, leading to faster kidney disease progression in a population not yet burdened with advanced cardiovascular disease.

Other possible explanations for this Hispanic survival paradox include migration effects, more specifically, the healthy migrant effect and salmon bias effect. The healthy migrant effect postulates the selection of healthy migrants to the United States, whereas the salmon bias (ie, return migration) effect describes the propensity of older and sicker Hispanic subgroups to return to their native countries when facing a terminal illness.^{40,41} Additionally, the Hispanic paradox has been attributed to cultural characteristics that influence individual health and lifestyle behaviors, family structure, and social networks.^{42,43}

Strengths of our study include the analysis of a large national cohort of patients with ESRD and the comprehensive long-term follow-up for death and transplantation. However, our study has several limitations. First, although the Hispanic population often is thought of as a homogeneous group, Hispanics are a diverse group in terms of nativity status, country of origin, and race, which may have implications for mortality and morbidity outcomes for Hispanic subgroups. For example, in the general population, Hispanics experience lower all-cause age-adjusted death rates than non-Hispanic adults, but, interestingly, this advantage is augmented in foreign-born Hispanic populations, especially Mexican Americans.^{16,42,44,45} Second, differential loss to follow-up was noted in our Hispanic cohort. We performed a sensitivity analysis to compare results in a cohort of patients with Medicare as their primary health care payer; results from this sensitivity analysis did not differ meaningfully from those in the original cohort. Third, comorbidity reporting on the Medical Evidence Report form has not been validated, and prior studies have shown underreporting of comorbid conditions that may have resulted in some nondifferential misclassification.^{46–48} Fourth, although we attempted to capture the presence of comorbid conditions, we were unable to capture disease severity, which may have differed between Hispanics and non-Hispanic whites, partly explaining the survival benefit. Fifth, the accuracy of Hispanic ethnicity in the ESRD Medical Evidence Report has not been validated. Roach et al⁴⁹ compared race categorization from the ESRD Medical Evidence Report (CMS Form 2728) and the Medicare enrollment database. Agreement between the 2 sources ranged from 95.2% for

black race to 62.9% for Asian race. However, Hispanic ethnicity was recorded as a separate ethnic designation in the Medical Evidence Report and as a distinct racial category in Medicare enrollment files (ie, mutually exclusive with white, black, Asian, etc), complicating further validation analysis.⁴⁹ Other validation studies of population-based databases have compared self-identified Hispanics to surname matching. Increased misclassification was noted among English-speaking married and previously married Hispanic women, and a large number of non-Hispanic Filipinos with Spanish surnames were falsely identified as Hispanic.^{50,51} Furthermore, combined surname matching and geocoding did not improve the likelihood of correctly identifying Hispanics.⁵² Hence, dependent on whether reported Hispanic ethnicity was queried directly from patients or presumed by dialysis personnel, some misclassification may be present. However, it is unlikely that misclassification occurred differentially by patients' future risk of dying, therefore biasing any result toward the null. Finally, African Americans and Asians constituted <6% of the Hispanic cohort and therefore were not included in the final study population, limiting generalizability to other racial subgroups.

In summary, we found that Hispanics undergoing dialysis experienced better survival compared with non-Hispanic whites, an observation that persisted after accounting for differences in sociodemographic factors and comorbid conditions. However, the association was attenuated in older age groups and markedly reduced in younger age groups when informative censoring through differential access to kidney transplantation was taken into account. Our analysis also showed less cardiovascular burden, which may partly explain this paradoxical survival advantage. However, future studies are warranted to further understand the mortality outcomes within various Hispanic subgroups. Given that Hispanics represent the largest minority group in the United States and have an increasing incidence and prevalence of ESRD, understanding mortality trends in this ethnic population has important public health and health policy implications. With the substantial increasing number of Hispanics requiring dialysis, improving access to health care is of utmost importance, but will be challenging in a population burdened by linguistic isolation and lower socioeconomic status. More efforts in improving the communication between physicians and patients and providing culturally competent resources are needed in this fast-growing ESRD population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1. Kaplan-Meier plots of mortality in Hispanic and non-Hispanic whites initiating dialysis therapy, by age group.

Figure 2.

Trends in relative mortality between Hispanic and non-Hispanic whites initiating dialysis therapy, by age group. The cause-specific hazard ratio (HR) analyses censor patients for further follow-up at receipt of a kidney transplant, whereas subdistribution HR analyses consider receipt of a kidney transplant as a competing risk. Abbreviation: CI, confidence interval.

Figure 3.

Causes of death, by Hispanic (Hisp) ethnicity and age group. Cardiac, vascular, infection, and withdrawal were the 4 most common causes of death. All remaining causes were collapsed in the other category. Abbreviation: NonHisp, non-Hispanic.

Table 1Characteristics of Hispanic and Non-Hispanic Whites Initiating Dialysis in the United States (1995–2007)^a

Sociodemographic Variables	All Patients (N = 615,618) (100%)	Non-Hispanic (n = 513,493) (83.4%)	Hispanic (n = 102,125) (16.6%)	P
Age at incidence (y)	64.8 ± 14.6	65.8 ± 14.4	59.5 ± 14.7	<0.001
Age categories				<0.001
18–39 y	41,392 (6.7)	30,574 (6.0)	10,818 (10.6)	
40–59 y	156,774 (25.5)	120,359 (23.4)	36,415 (35.7)	
60–79 y	327,575 (53.2)	279,675 (54.5)	47,900 (46.9)	
80y	89,877 (14.6)	82,885 (16.1)	6,992 (6.8)	
Female sex	266,024 (43.2)	220,128 (42.9)	45,896 (44.9)	
Dialysis modality				<0.001
Hemodialysis	554,492 (90.1)	460,003 (89.6)	94,489 (92.5)	
Peritoneal dialysis	60,533 (9.8)	52,950 (10.3)	7,583 (7.4)	
Missing/unknown	593 (0.1)	540 (0.1)	53 (0.1)	
Comorbid conditions				
Diabetes	309,861 (50.3)	245,483 (47.8)	64,378 (63.0)	<0.001
Hypertension	477,112 (77.5)	395,304 (77.0)	81,808 (80.1)	<0.001
Heart failure	211,835 (34.4)	182,234 (35.5)	29,601 (29.0)	<0.001
Atherosclerotic heart disease	188,755 (30.7)	167,783 (32.7)	20,972 (20.5)	<0.001
Cerebrovascular disease	58,024 (9.4)	51,062 (9.9)	6,962 (6.8)	<0.001
Peripheral vascular disease	103,829 (16.9)	90,364 (17.6)	13,465 (13.2)	<0.001
Chronic obstructive lung disease	58,266 (9.5)	54,992 (10.7)	3,274 (3.2)	<0.001
Cancer	41,695 (6.8)	38,961 (7.6)	2,734 (2.7)	<0.001
Alcohol dependence	6,471 (1.1)	5,402 (1.1)	1,069 (1.0)	0.9
Drug dependence	2,494 (0.4)	1,930 (0.4)	564 (0.6)	<0.001
Tobacco use	34,651 (5.6)	32,302 (6.3)	2,349 (2.3)	<0.001
Unable to transfer or ambulate	27,552 (4.5)	23,545 (4.6)	4,007 (3.9)	<0.001
BMI category				<0.001
<18.5 kg/m ²	30,303 (4.9)	25,818 (5.0)	4,485 (4.4)	
18.5–24.9 kg/m ²	218,685 (35.5)	182,896 (35.6)	35,789 (35.0)	
25.0–29.9 kg/m ²	170,001 (27.6)	139,346 (27.1)	30,655 (30.0)	
30.0–39.9 kg/m ²	131,982 (21.4)	110,608 (21.5)	21,374 (20.9)	
40.0 kg/m ²	32,771 (5.3)	28,247 (5.5)	4,524 (4.4)	
Missing	31,876 (5.2)	26,578 (5.2)	5,298 (5.2)	
eGFR (mL/min/1.73 m ²)	9.5 ± 4.5	9.6 ± 4.5	8.8 ± 4.3	<0.001
Missing eGFR	11,193 (1.8)	9,626 (1.9)	1,567 (1.5)	
Payer				<0.001
Medicare primary, Parts A & B	352,879 (57.3)	310,457 (60.5)	42,422 (41.5)	
Medicare primary, other	13,141 (2.1)	9,116 (1.8)	4,025 (3.9)	
Medicare secondary with EGHP	32,116 (5.2)	28,924 (5.6)	3,192 (3.1)	
Medicare secondary, no EGHP	4,875 (0.8)	4,472 (0.9)	403 (0.4)	

Sociodemographic Variables	All Patients (N = 615,618) (100%)	Non-Hispanic (n = 513,493) (83.4%)	Hispanic (n = 102,125) (16.6%)	P
Medicare 90-d waiting period	133,362 (21.7)	98,011 (19.1)	35,351 (34.6)	
Group health organization	50,686 (8.2)	41,553 (8.1)	9,133 (8.9)	
Other/unknown	28,559 (4.6)	20,960 (4.1)	7,599 (7.4)	

Note: Values for categorical variables are given as number (percentage); values for continuous variables, as mean $\pm$ standard deviation.

Abbreviations: BMI, body mass index; eGFR, estimated glomerular filtration rate; EGHP, employergroup health plan.

^a Cell counts less than 10 are suppressed per federal research regulations.

Table 2

Unadjusted Mortality Rates Stratified by Age in Hispanic Compared With Non-Hispanic White Patients

	All Patients (N = 615,618)	Non-Hispanic (n = 513,493)	Hispanic (n = 102,125)
No. of deaths observed	404,007 (65.6)	349,597 (68.1)	54,410 (53.3)
Age category			
18–39 y	8.2	9.5	5.1
40–59 y	16.1	17.8	11.8
60–79 y	30.5	32.0	23.4
80 y	49.6	50.0	45.9

Note: Unadjusted mortality rates per 100 person-years. Number of deaths observed given as number (percentage).

Table 3
Relative Mortality Between Hispanic and Non-Hispanic Whites Undergoing Dialysis in the United States

Age Category	Unadjusted		Adjusted for Age, Sex, Year		Further Adjusted ^a	
	HR _{cs} (95% CI)	HR _{sd} (95% CI)	HR _{cs} (95% CI)	HR _{sd} (95% CI)	HR _{cs} (95% CI)	HR _{sd} (95% CI)
18–39 y	0.52 (0.50–0.55)	0.70 (0.66–0.73)	0.55 (0.52–0.58)	0.73 (0.69–0.77)	0.67 (0.64–0.71)	0.90 (0.85–0.94)
40–59 y	0.64 (0.63–0.65)	0.79 (0.78–0.81)	0.65 (0.64–0.66)	0.80 (0.78–0.81)	0.67 (0.66–0.68)	0.81 (0.80–0.83)
60–79 y	0.73 (0.72–0.74)	0.76 (0.75–0.77)	0.78 (0.77–0.79)	0.82 (0.81–0.83)	0.81 (0.80–0.82)	0.84 (0.83–0.86)
80 y	0.92 (0.90–0.95)	0.92 (0.90–0.95)	0.93 (0.90–0.95)	0.93 (0.90–0.95)	0.94 (0.91–0.97)	0.93 (0.91–0.97)

Abbreviations: CI, confidence interval; HR_{CS}, cause-specific hazard ratio; HR_{SD}, subdistribution hazard ratio.

^a Further adjusted for all comorbid conditions, dialysis modality, payer status, body mass index, and estimated glomerular filtration rate.