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Original Investigation

Association of Ethnicity and Survival in Peritoneal Dialysis: A Cohort Study of Incident Patients in Brazil

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Background: There are no available epidemiologic studies about the impact of ethnicity on outcomes of patients treated with peritoneal dialysis (PD) in South America. This study aims to assess the effect of ethnicity on the mortality of incident PD patients in Brazil.

Study Design: Prospective observational cohort study of incident patients treated with PD.

Settings & Participants: Patients 18 years or older who started PD therapy between December 2004 and October 2007 in 114 Brazilian dialysis centers.

Predictors: Self-reported ethnicity defined by the Brazilian Institute of Geography and Statistics as black and brown versus white patients and baseline demographic, socioeconomic, clinical, and laboratory data were collected at baseline.

Outcome: Mortality, using cumulative mortality curves in which kidney transplantation and transfer to hemodialysis therapy were treated as competing end points. Multivariate Cox proportional hazards analysis was used to adjust for gradually more potential explanatory variables, censored for kidney transplantation and transfer to hemodialysis therapy. Analyses were performed for all patients, as well as stratified for elderly (aged ≥65 years) and nonelderly patients.

Results: 1,370 patients were white, 516 were brown, and 273 were black. The competing-risk model showed higher mortality in white patients compared with black and brown patients. With white patients as the reference, Cox proportional hazards analysis showed a crude HR for mortality of 0.77 (95% CI, 0.56-1.05) for black and 0.74 (95% CI, 0.59-0.94) for brown patients. After adjusting for potential explanatory factors, HRs were 0.67 (95% CI, 0.48-0.95) and 0.77 (95% CI, 0.43-1.01), respectively. The same results were observed in elderly and nonelderly patients.

Limitations: Ethnicity was self-determined and some misclassification might have occurred.

Conclusions: Black and brown Brazilian incident PD patients have a lower mortality risk compared with white patients.

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INDEX WORDS: Ethnicity; race; peritoneal dialysis; survival.

Editorial, p. 10

End-stage renal disease (ESRD) is a serious public health issue in developed and developing countries. The scale and patterns of kidney disease vary from country to country; to some degree, these differences could be the result of regional racial and ethnic composition.[1,2] However, in some continents, data are still scarce.

Racial and ethnic differences in the outcomes of patients with ESRD have been widely described in certain parts of the world. Data from the United States have shown increased mortality for Caucasian compared to non-Caucasian dialysis patients on hemodialysis (HD) and peritoneal dialysis (PD) therapy,[3-5] although this is mainly in patients older than 50 years.[6] Evaluating the influence of race on survival in PD patients in the United States, Korbet et al[7] showed that white patients experienced worse survival compared with black patients. In Canada, Hispanic, black, and Asian patients on HD and PD therapy have significantly better survival than non-Hispanic Caucasian patients.[8] In Europe, non-Caucasian HD patients also were found to have better survival compared with Caucasian dialysis patients,[9] and a similar result was observed in a nationwide study from the United Kingdom.[10] Furthermore, immigrant dialysis patients in the Netherlands were found to have better

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survival compared with native Dutch dialysis patients.[11] In contrast, the indigenous dialysis population in Australia and New Zealand presented an increased mortality risk compared with white dialysis patients.[12] Data for the survival of patients with ESRD in South and Latin America have not been described systematically for different ethnic groups.

The population in Brazil, one of the largest countries in South America, is one of the most heterogeneous populations in the world[13] as a result of 5 centuries of admixture between its ancestral roots (autochthonous Amerindians, white Europeans, and sub-Saharan Africans). In the past 2 centuries, Asians also have contributed to this miscegenation.[14-18] The ancestrally admixed population (referred to as "brown" in Brazil), which corresponds to 42.6%[19] of the Brazilian general population,[19] certainly places Brazil among the most ethnically admixed countries. The heterogeneity and admixture of the Brazilian population also may have relevant implications for the design and interpretation of studies performed with Brazilians.[17,18]

The prevalence of ESRD in Brazil was 483 patients per million inhabitants[20] in 2010, and black and brown patients seem to face a higher risk of ESRD than white patients.[21] Brazil has a public and private hybrid health care system,[22] which provides universal access to renal replacement therapy, and a group of patients start PD as first treatment.

In order to understand the impact of ethnicity in the mortality of PD patients in Brazil, it is of utmost importance to include the predominant ethnicities, including those categorized as brown. The results presented here, based in a large PD database, are to our knowledge the first time that such an assessment of the ethnicity of incident PD patients is reported from South America. The aim of this study is to assess the impact of ethnicity on the survival of incident PD patients in Brazil.

METHODS

Patients

We analyzed data from the Brazilian Peritoneal Dialysis Multicenter Study (BRAZPD), a prospective observational cohort study of PD patients enrolled throughout Brazil in 114 dialysis centers, treating more than 10 patients each.[23] It is important to note that 60% of the total Brazilian PD population in 2007 was included in the BRAZPD cohort.[20] For this specific analysis, we included patients who were 18 years or older and started PD therapy between December 2004 and October 2007 either as first renal replacement therapy or after HD. Patients were excluded when data for ethnicity and/or age were lacking. Baseline was defined as 3 months after the initiation of PD therapy. The study was approved by the medical ethical committees of all participating centers. All patients signed the informed consent form before inclusion.

Data Collection Procedures

Details regarding data collection procedures have been published elsewhere.[23] For this particular study, we used the following demographic and clinical data at baseline: age, sex, ethnicity, geographic region of the dialysis center, family income (self-report; 0-2, 3-5, and >5 times the minimum monthly national salary), educational level (self-report; illiteracy, elementary school, secondary school, and college),[24] distance from dialysis center (<25, 25-50, and >50 km), cause of ESRD, whether a patient underwent previous HD treatment, PD modality (continuous ambulatory PD or automated PD), PD indication (medical, patient's choice, or only option), duration of predialysis care, comorbid conditions, body mass index, blood pressure, and laboratory parameters (urea, creatinine, calcium, phosphate, potassium, alanine aminotransferase, glucose, and hemoglobin). Ethnicity was self-categorized and based on categories defined by the Brazilian Institute of Geography and Statistics (white, black, brown, yellow, and indigenous). Brown people result from the mixture between white and black, white and indigenous, or black and indigenous. The term brown is culturally accepted in Brazil.[19]

Assessment of comorbid conditions was based on the *International Classification of Diseases, Tenth Revision*.[25] Laboratorial data were collected at baseline and, if not available, at 2 or 4 months after the start of PD therapy therapy. Quality of life (QoL) data were collected 6 months after the start of PD therapy. QoL was assessed using the Mental and Physical Component Summary scores of the 36-Item Short Form Health Survey questionnaire.[26]

Patients were followed up until October 2007. Dropout, mortality rate, and causes of death were classified according to the Brazilian government.[27]

Statistical Analysis

Patient characteristics are described as mean ± standard deviation or percentage. Differences in baseline characteristics among white, black, and brown patients were analyzed with analysis of variance, Kruskal-Wallis (for alanine aminotransferase level), and χ^2 tests. Patients were followed up until death, transfer to HD therapy, kidney transplantation, or the end of the study period in October 2007, whichever came first. In order to determine the influence of ethnicity on mortality, we used cumulative mortality curves in which kidney transplantation and transfer to HD therapy were treated as competing end points.[28] Multivariate Cox proportional hazards analyses were used to adjust gradually for more potential explanatory variables; first for demographic variables, followed by additional adjustment for socioeconomic, clinical, QoL, hemoglobin level, and creatinine level variables that presented clinical and/or statistical significance in univariate analysis. Analyses also were performed stratifying for elderly (aged ≥65 years) and nonelderly patients (aged <65 years). All analyses were carried out with SPSS, version 17.0, for Windows statistical software (SPSS Inc), and $P < 0.05$ was considered as statistically significant.

The percentage of missing data was <10%, except for QoL (27%), body mass index (15%), blood pressure (15%), glucose level (18%), and creatinine level (10%). In order to create complete data sets for multivariate Cox analysis, missing values for variables included in the Cox model (age, sex, level of education, family income, geographic region of the dialysis center, cause of ESRD, comorbid conditions, QoL, first therapy, creatinine level, and hemoglobin level) were imputed with multiple imputation techniques (5 repetitions). With multiple imputation techniques, missing data are imputed by a value that is predicted using the patient's available characteristics, under the condition of missing "at random."[29] Sensitivity analysis was performed with and without imputation for missing data.

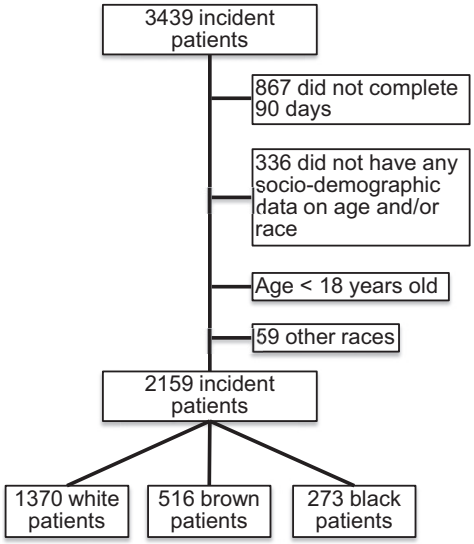

Figure 1. Flow chart of the study.

RESULTS

Study Participants

In BRAZPD, 3,439 incident PD patients were included by October 2007. From this cohort, 867 patients did not complete 90 days of PD therapy by the end of the study. Further, 336 patients were excluded because they did not have sociodemographic data for age and/or race and 18 patients were younger than 18 years. Due to limited numbers (n = 59), yellow and indigenous patients (self-identified; brown, yellow, black, and white terminology is culturally accepted in Brazil) were excluded from the analysis. A total of 2,159 incident patients were included in the study: 1,370 patients were white, 516 were brown, and 273 were black (Fig 1).

Of 867 patients who did not complete 90 days by the end of the study, 73 died, 13 underwent kidney transplantation, 31 were transferred to HD therapy, 4 had recovery of kidney function, 4 were lost to follow-up, and 742 simply had not received 90 days of PD therapy by the end of the study period. No differences were found in sociodemographic characteristics between this group of 867 patients and the 2,159 patients included in the study.

Sixty-seven percent of the incident PD patients had had HD as their first dialysis therapy. No statistical differences in baseline characteristics were observed between this group and those who had PD as their first renal replacement therapy.

Demographic and clinical characteristics of white, brown, and black patients are listed in Table 1. White PD patients were older than black and brown patients. Black and brown patients had lower family incomes compared with white patients, and there were more illiterates among them than in the white group. Both white and brown patients more often had predialysis care than black patients. However, more black than brown and white patients initiated dialysis with HD as their first therapy. White patients had more diabetic kidney disease and black patients had more hypertensive nephropathy. White patients also had more diabetes mellitus than black and brown patients and had more congestive heart failure. Black patients had more vascular peripheral disease compared with white and brown patients. Body mass index was lower in brown patients compared with black and white patients.

Brown and black patients had significantly better Mental and Physical Component Summary scores compared with white patients (Table 1).

The percentage of black patients was higher in the Southeast region, whereas the percentage of brown patients was higher in the Southeast and Northeast, and for white patients, it was higher in the South and Southeast regions of the country (Table 1).

Table 2 lists laboratory data at baseline for white, black, and brown patients. Compared with white patients, black patients were found to have significantly higher creatinine levels and lower hemoglobin levels.

Follow-up and Outcomes

Mean follow-up in the study was 12.9 months, with 10.4 months for black, 12.5 months for brown, and 13.0 months for white patients. There were 309 (22.6%) deaths in the white, 45 (16.4%) deaths in the black, and 91 (17.6%) deaths in the brown patient groups. The mortality rate was 244.7 deaths/1,000 patient-years for white patients, 188.6 deaths/1,000 patient-years for black patients, and 184.2 deaths/1,000 patient-years for brown patients (Table 3). The competing-risk model comparing the cumulative mortality of white, black, and brown patients shows lower mortality for black and brown patients compared with white patients (Fig 2).

As listed in Table 3, cardiovascular disease was the most important cause of death among black and white patients, whereas in brown patients, it was sepsis. The incidence rate for cardiovascular mortality was 95.0 events/1,000 patient-years for white patients, 71.2 events/1,000 patient-years for black patients, and 38.4 events/1,000 patient-years for brown patients. Compared with white patients, black patients were less likely to die because of sepsis, whereas brown patients had similar incidence rates for mortality due to sepsis (incidence rates: 65.7 events/1,000 patient-years for white patients, 66.8 events/1,000 patient-years for brown patients, and 37.7 events/1,000 patient-years for black patients). The incidence rate for transplantation was higher in brown patients (24.2 events/1,000 patient-years) than in black

Table 1. Demographic and Clinical Characteristics at Baseline

Variable	Black (n = 273)	Brown (n = 516)	White (n = 1,370)	*P*[a]
Age (y)	57.0 ± 15.5	52.5 ± 17.4	59.8 ± 16.0	<0.001
Female sex	63.7	54.8	52.2	0.002
Education				<0.001
Illiterate	23.1	13.0	8.6	
Elementary school	60.1	55.0	56.2	
Secondary school	12.8	25.2	26.6	
College	4.0	6.8	8.5	
Low family income[b]	56.8	44.2	29.0	<0.001
Distance to center <25 km	56.0	53.7	60.3	0.02
Predialysis care >6 mo	41.0	57.0	56.8	<0.001
HD as first RRT	76.6	68.8	65.5	0.001
PD indication: only option	31.5	19.6	15.3	<0.001
PD type				<0.001
APD	46.9	38.8	54.7	
CAPD	53.1	61.2	45.3	
Geographic region				<0.001
South	8.8	6.4	23.1	
Southeast	65.9	38.8	62.5	
Midwest	4.4	2.7	2.7	
Northeast	19.1	33.5	10.8	
North	1.8	18.6	0.9	
Cause of ESRD				<0.001
Diabetic nephropathy	34.1	34.9	38.2	
Hypertensive nephropathy	32.6	18.0	21.3	
Chronic glomerulonephritis	8.8	12.2	10.9	
Unknown	13.6	19.2	12.7	
Other	11.0	15.7	16.9	
Comorbid conditions	3.3	5.2	1.8	
Systemic hypertension	78.6	80.1	79.5	0.1
Congestive heart failure	20.9	19.4	26.9	0.001
Peripheral vascular disease	31.5	20.5	25.2	0.003
Left ventricular hypertrophy	43.2	36.4	39.1	0.1
Diabetes	39.2	36.0	44.0	0.005
Malignancies	2.2	2.3	4.0	0.08
None	3.3	5.2	1.8	<0.001
Blood pressure (mm Hg)				
Systolic	139 ± 30	140 ± 27	137 ± 27.	0.07
Diastolic	84 ± 17	85 ± 15	82 ± 16	0.04
BMI (kg/m^2)	24.8 ± 5.1	23.7 ± 4.9	24.9 ± 4.9	<0.001
SF-36				
PCS score	39.9 ± 10.5	41.6 ± 10.6	38.1 ± 10.5	<0.001
MCS score	42.8 ± 5.1	43.2 ± 9.5	40.5 ± 10.0	<0.001

Note: Values for categorical variables are given as percentages; values for continuous variables, as mean ± standard deviation.

Abbreviations: APD, automated peritoneal dialysis; BMI, body mass index; CAPD, continuous ambulatory peritoneal dialysis; CKD, chronic kidney disease; ESRD, end-stage renal disease; HD, hemodialysis; MCS, Mental Component Summary; PCS, Physical Component Summary; PD, peritoneal dialysis; SF-36, 36-Item Short Form Health Survey.

[a] *P* value refers to comparison among the 3 groups by analysis of variance or χ^2.

[b] Up to 2 times minimum national salary.

(16.7 events/1,000 patient-years) and white patients (19.0 events/1,000 patient-years). Black and brown patients were more likely to transfer to HD therapy compared with white patients. The incidence rate for transfer to HD therapy was 96.4 events/1,000 patient-years in black patients, 93.1 events/1,000 patient-years in brown patients, and 83.9 events/1,000 patient-years in white patients (Table 3). The main cause in all groups for transfer

Table 2. Laboratory Characteristics at Baseline

	Black (n = 273)	Brown (n = 516)	White (n = 1,370)	P[a]
Urea (mmol/L)	35.5 ± 14.2	37.0 ± 14.8	35.7 ± 15.7	0.2
Creatinine (μmol/L)	751.4 ± 371.2	680.7 ± 327.0	645.3 ± 353.6	<0.001[b]
Potassium (mmol/L)	4.8 ± 1.0	4.4 ± 1.0	4.4 ± 1.5	0.5
ALT (U/L)	20.9 ± 16.8	28 ± 119.0	20.4 ± 13.8	0.07
Calcium (mmol/L)	2.1 ± 1.1	2.2 ± 0.4	2.0 ± 0.5	0.2
Phosphate (mmol/L)	1.5 ± 0.4	1.4 ± 0.4	1.6 ± 0.5	0.001[a]
Hemoglobin (g/L)	10.9 ± 2.2	11.3 ± 2.5	11.3 ± 2.2	0.03[b,c]
Glucose (mmol/L)	6.5 ± 4.0	6.6 ± 4.6	7.0 ± 4.7	0.1

Note: Values are given as mean ± standard deviation.
Abbreviation: ALT, alanine aminotransferase.
[a]*P* value refers to comparison among the 3 groups by analysis of variance.
[b]Post hoc test refers to difference between brown versus white.
[c]Post hoc test refers to difference between black versus white.

to HD therapy was peritonitis (35% in white, 22% in brown, and 26% in black patients).

With white patients as the reference group, Cox proportional hazards analysis showed a crude hazard ratio (HR) for mortality of 0.77 (95% confidence interval [CI], 0.56-1.05) for black patients and 0.74 (95% CI, 0.59-0.94) for brown patients (Table 4, model 1). After adjusting for age, these HRs increased but remained lower than 1.0 for black (HR, 0.84; 95% CI, 0.61-1.15) and brown (HR, 0.91; 95% CI, 0.71-1.15) patients (Table 4, model 2). After further adjustment for demographic, socioeconomic, clinical, QoL, and laboratory variables as potential explanatory factors, HRs decreased to 0.67 (95% CI, 0.48-0.95) and 0.77 (95% CI, 0.43-1.01), respectively, for black and brown patients (Table 4, model 6). The Cox proportional hazards analysis was repeated stratified for elderly (aged ≥65 years) and nonelderly (aged <65 years) patients, and no differences were observed (data not shown).

There is no difference between results in sensitivity analyses performed with and without imputation for missing data.

Table 3. Incidence Rates for Outcomes

	Black (n = 273)	Brown (n = 516)	White (n = 1370)
Death	188.6 (45)	184.2 (91)	244.7 (309)
Cardiovascular	71.2 (17)	38.4 (19)	95.0 (120)
Sepsis	37.7 (9)	66.8 (33)	65.7 (83)
Kidney transplantation	16.7 (4)	24.2 (12)	19.0 (24)
Transfer to hemodialysis	96.4 (23)	93.1 (46)	83.9 (106)

Note: Values given as incidence rates per 1,000 patient-years (number of events).

DISCUSSION

In this large cohort of incident PD patients in Brazil, BRAZPD, we observed lower mortality rates for both black and brown patients compared with white patients. These survival advantages remained after adjusting for several potential explanatory variables, with black patients having 33% and brown patients having 23% lower mortality compared with white patients.

The lower mortality in the black population is comparable to findings of other studies of dialysis patients.[5-10] In a study including only PD patients (n = 233) from the United States, a somewhat stronger effect was observed (whites compared with blacks: HR, 2.35).[7] In the United Kingdom, the adjusted HR for mortality for black compared with white PD patients was 0.62.[10] In contrast, a nationwide study from the Netherlands did not find lower mortality for black compared with white PD patients. However, the number of black patients was small (n = 45 [2%]) in this study.[30] Like most North American and Canadian studies,[3-5,8] black patients in the present study had higher survival compared with white patients, even after adjustments. Nevertheless, this study presents an important racial difference in comparison to studies performed in the United States and Canada, namely, the presence of the admixed population. Moreover, it also is difficult to compare results because each study is adjusted for different factors[5-8] and some studies lack power and find a large result that is not statistically significant. Comparisons to studies performed in a racial minority in Europe[9,10] also are difficult because the majority of the Brazilian population is mixed, making this study a reflection of the geographic behavior of the entire Brazilian population.[31]

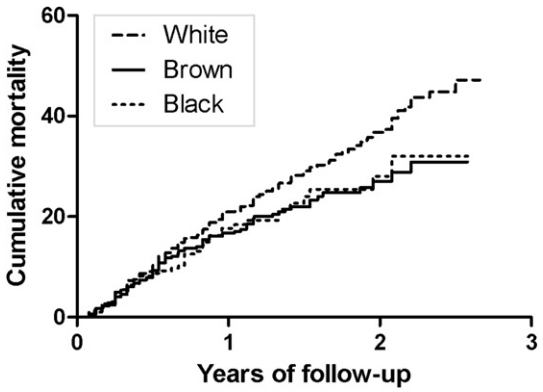

Figure 2. Cumulative mortality curves for white, black, and brown patients treated with peritoneal dialysis, taking into account transfer to hemodialysis therapy and kidney transplantation as competing end points.

Similar to other studies,[32] in our sample, the population on dialysis therapy is over-represented in terms of black patients (13%) compared to the general population (6.9%),[21] suggesting a higher prevalence of ESRD in this population.[21] The brown population is under-represented (24%) compared to the general population (42.6%).[19] This might be related to the fact that the majority of patients included in this study were from the Southeast and South regions of the country, where the brown population is less prevalent than in other regions.[31] The majority of the brown population on dialysis therapy lives in the North and Northeast regions, where there are few dialysis centers and late referral to nephrologists is most common. This might result in selection bias for the brown population.[31]

In a recent analysis of US data, Kucirka et al[6] showed that the survival advantage for black compared with white dialysis patients applies to only patients older than 50 years. They speculated that this finding was a result of differences in insurance coverage, comorbid conditions, and access to organ transplantation. This finding could not be replicated in our study, which may be related to differences in health care systems between the United States and Brazil. In the United States, all adults older than 65 years are eligible for Medicare, but patients at a young age are more likely to be uninsured or have Medicaid insurance,[6] whereas in Brazil, there is a universal health care system for patients of all ages.[22]

Although health care in Brazil is universal, blacks were found to have late referral to predialysis care more often compared with white and brown patients. This might be related to their lower socioeconomic status.[33] Low socioeconomic status incorporates important determinants of health: health care access, environmental exposure, health behavior, and low health literacy,[34] all of which contribute to health care disparities directly and indirectly.[35] Socioeconomic status was lower in black and brown patients; however, adjustments for these factors did not affect results.

Other factors that should be considered are the differences in comorbid conditions and QoL. White patients had more diabetes and cardiac failure at baseline than brown and black patients, factors associated with mortality.[36] On the other hand, QoL was better in black and brown patients compared with white patients in our study, which is in disagreement with Kutner et al,[37] who observed that black PD patients had the lowest satisfaction with care scores after adjustment.[38] However, adjustment for these factors did not change results, which is in agreement with a study by van den Beukel et al.[30]

Table 4. HRs for Mortality for Black and Brown Patients Versus White Patients

Model	Black	Brown	Variables Tested
1. Unadjusted	0.77 (0.56-1.05)	0.74 (0.59-0.94)	Unadjusted
2. Adjusted for age	0.84 (0.61-1.15)	0.91 (0.71-1.15)	Model 1 plus age
3. Sociodemographic	0.70 (0.50-0.98)	0.72 (0.55-0.96)	Model 2 plus sex, level of education, income, geographic region
4. Comorbid conditions and ESRD cause	0.69 (0.50-0.97)	0.71 (0.54-0.94)	Model 3 plus CVD,[a] DM, PVD, malignancy, cause of ESRD
5. First dialysis therapy, QoL	0.69 (0.49-0.97)	0.78 (0.58-1.02)	Model 4 plus first dialysis therapy (HD or PD), QoL (PCS and MCS scores)
6. Laboratory investigations	0.67 (0.48-0.95)	0.77 (0.43-1.01)	Model 5 plus creatinine and hemoglobin levels

Note: With gradually more extensive multivariate models for the association between ethnicity and mortality. Associations given as HR (95% confidence interval).

Abbreviations: CVD, cardiovascular disease; DM, diabetes mellitus; ESRD, end-stage renal disease; HD, hemodialysis; HR, hazard ratio; MCS, Mental Component Summary; PCS, Physical Component Summary; PD, peritoneal dialysis; PVD, peripheral vascular disease; QoL, quality of life.

[a]CVD is defined as *International Classification of Disease, Tenth Revision.*

Our results show significantly higher serum creatinine levels in black and brown patients compared with white patients. This may reflect differences in muscle mass and metabolism between whites and nonwhites.[39,40] This is in agreement with Hsu et al,[41] who found that blacks have higher serum creatinine concentrations than whites at dialysis therapy initiation and higher serum creatinine levels are independent predictors of reduced mortality. Higher serum creatinine levels for black and brown patients might affect the time of starting dialysis therapy and hence outcomes on dialysis therapy. However, in our study, adjustment for this variable did not have an impact on results.

Much deliberation, discussion, and debate have resulted from the terms race and ethnicity being used in epidemiologic and public health studies. Many of the methods used to evaluate race and ethnicity do not use an objective measurable characteristic, and there is not adequate evidence that present racial classifications accurately capture biological or genetic similarities; thus, accurate categorization is challenging.[42] In this study, ethnicity was self-determined, and it is possible that some misclassification might have occurred. Other important variables such as genetic components were not available. Other variables related to survival were not available, such as Kt/V, residual kidney function, and inflammation. Another limitation of this study is that patients were lost to follow-up after they switched to HD therapy, which might have occurred for several reasons, not only for failed PD therapy. This loss to follow-up was more frequent for black and brown patients than for white patients. This observation is in agreement with a study from the United States by Kim et al.[43] However, the authors did not observe differences in mortality rates of black patients who were transferred to HD therapy and those who continued on PD therapy.[43] Unfortunately, it is not possible to verify if this also holds for the BRAZPD population.

Our study, similar to most studies comparing the survival of black and white dialysis patients elsewhere, demonstrates better survival for black patients compared with white patients in a large incident PD population. The novel observation is that brown patients have better survival compared with white patients and similar to black patients. The clinical and environmental factors alone are insufficient to fully explain the striking and consistent survival advantage that is observed in black and brown Brazilian PD patients. We may add as a final suggestion that collaborative studies among different areas of the world, evaluating both phenotypes and genotypes in dialysis patients, may shed light in the comprehension of the different race outcomes reported to date.

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