Original Report:
Public Health

John Henryism and Perceived Health among Hemodialysis Patients in a Multiracial Brazilian Population: the PROHEMO

Gildete Barreto Lopes, RN, MS, PhD[1,2]; Sherman A. James, PhD[3];
Marcelo Barreto Lopes, MD, MPH, FISN[1,2]; Carolina Cartaxo Penalva, BS[4];
Camila Tavares Joau e Silva, MD[1]; Cacia Mendes Matos, MD, MS, PhD[2,5];
Márcia Tereza Silva Martins, MD, MS[2,6]; Antonio Alberto Lopes, MD, MPH, PhD[1,7]

Purpose: John Henryism (JH) is a strong behavioral predisposition to engage in high-effort coping with difficult socioenvironmental stressors. We investigated associations between JH and perceived general health (GH) among maintenance hemodialysis (MHD) patients in a multiracial Brazilian population.

Design: The 12-item John Henryism Acting Coping (JHAC) Scale was completed by 525 patients enrolled in The Prospective Study of the Prognosis of Hemodialysis Patients (PROHEMO) in Salvador (Bahia) Brazil. JH scores could range from 12 to 60. The low and high JH groups were determined by a median split (<52 vs ≥52). The 36-Item Short Form Health Survey was used to determine GH score (range 0-100; higher means better health). Linear regression with extensive adjustments was used to test associations.

Results: Mean age was 48.3±13.7 years; 38.7% were female; 11.4% were White, 29.1% were Black and 59.4% were mixed race. JH was positively associated with higher GH in the whole sample (adjusted difference [AdjDif]=7.14, 95% CI= 2.98, 11.3) and similarly in men and women. A strong positive association between JH and GH was observed in non-Whites but not in Whites; (AdjDif in Blacks =16.4, 95% CI=8.37, 24.4). Also, a strong positive association between JH and GH was observed for patients aged <60 years (AdjDif =9.04, 95% CI = 4.46, 13.6) but not for older patients.

Conclusions: The results indicate that MHD patients engaged in high-effort coping with socioenvironmental stressors as demonstrated by high JH tend to feel more positively about their overall health. This seems to be especially the case for non-White and younger patients. *Ethn Dis*. 2018;28(4):539-548; doi:10.18865/ed.28.4.539.

Keywords: Coping; John Henryism; General Health; Quality of Life; Hemodialysis; Race

[1] Unit of Clinical Epidemiology and Evidence Based Medicine, Professor Edgard Santos University Hospital, Federal University of Bahia, Salvador, BA, Brazil
[2] Graduate Program of Medicine and Health, School of Medicine, Federal University of Bahia, Salvador, BA, Brazil
[3] Sanford School of Public Policy, Duke University, Durham, NC, United States
[4] Sector of Psychology of the Nephron Clinic, Salvador, BA, Brazil
[5] Institute of Nephrology and Dialysis (INED), Salvador, BA, Brazil
[6] Clinic of Renal Disease and Hypertension (CLINIRIM), Salvador, BA, Brazil
[7] Department of Internal Medicine, Federal University of Bahia, Salvador, BA, Brazil

Address correspondence to Alberto Lopes, Hospital Universitário Professor Edgard Santos, Núcleo de Epidemiologia Clínica e Medicina Baseada em Evidências, Universidade Federal da Bahia; Rua Dr. Augusto Viana, s/n, Canela; Salvador, Bahia, 40110-060, Brazil; 55 71 3283-8142; aaslopes@ufba.br and aaslopesufba@gmail.com

Introduction

According to James,[1-3] John Henryism (JH) is a strong behavioral or personality predisposition to engage in high-effort coping with difficult socio-environmental stressors. The JH construct is based on the late 19th century legend of John Henry, the "steel-driving man" – an African American unskilled laborer who allegedly defeated a mechanical steam drill in an epic contest of "man against machine." However, he died immediately thereafter from complete exhaustion. In 1987, James et al developed a 12-item John Henryism Active-Coping (JHAC) Scale to measure JH, with the items collectively emphasizing three overlapping themes considered inherent in the aforementioned legend: mental and physical vigor, commitment to hard work and determination to succeed.[2] Three illustrative items from the JHAC Scale are: 1) In the past, even when things got really tough, I never lost sight of my goals; 2) I don't let my personal feelings get in the way of doing a job; and 3) Once I make up my mind to do something, I stay with it until the job is completely done. While affirmative responses to questions of this type connote admi-

rable qualities of tenacity and optimism in the face of adversity, over years or decades could increase risk for disease (particular for cardiovascular diseases) in otherwise susceptible individuals. This is known as the John Henryism hypothesis.[1,2,4]

While published tests of the JH hypothesis have produced somewhat mixed results, [5-7] a number of studies[1,2,4,8] have found, in keeping with *a priori* predictions, that among individuals scoring high on JH, those from economically disadvantaged backgrounds were at greater risk of cardiovascular disease than those less disadvantaged. Indeed, the combination of high JH and high socioeconomic status (SES) tended to be associated with the very lowest risk of cardiovascular disease in these studies.[1,2,4,8,9] However, perhaps unsurprisingly, JH has been positively associated with better self-rated health and higher life satisfaction independent of an individual's level of socioeconomic status.[2] This suggests that that high JH connotes relatively better perceived psychological health.

The objective of our present study was to investigate whether John Henryism is associated with better self-perceived health in a sample of end-stage renal disease patients undergoing maintenance hemodialysis (MHD).

While poor perceived general health is known to be strongly associated with long-term clinical outcomes in the general population[10] and in clinical populations, such as end-stage renal disease patients undergoing maintenance hemodialysis (MHD),[11] knowledge about the predictors of self-perceived health in patients with difficult to manage chronic conditions remains limited. As with other challenging chronic conditions, eg, cancer[12] and AIDS,[13] adaptation of end-stage renal disease patients undergoing MHD might be influenced by how well they cope with limitations imposed by the disease and by the treatment itself. The objective of our present study was to investigate whether JH is associated with better self-perceived health in a sample of end-stage renal disease patients undergoing maintenance hemodialysis (MHD). We also investigated associations between sociodemographic characteristics (age, race, gender, economic class, and education), and JH and if the general health reported by MHD patients could be explained by interactions between JH and sociodemographic characteristics.

Methods

Study Design and Setting

Our study was a cross-sectional analysis of baseline data from the Prospective Study of the Prognosis of Chronic Hemodialysis Patients (PROHEMO) based in the city of Salvador (Bahia) Brazil.[14] From a sample of 728 patients, 525 had complete data on both John Henryism and self-reported general health; they constitute the sample of participants for the main analysis of the study. Data were collected from November 2009 through February 2011. The patients were undergoing 4-hour hemodialysis sessions, three times weekly at four dialysis clinics of Salvador. The Institutional Review Board of the Medical School of the Federal University of Bahia approved the study protocol and all patients provided informed consent to participate.

Data Collection and Definitions

The collection of demographic, laboratory, comorbidity and clinical data began as soon as the patients provided informed consent to participate. The data were provided by the patient and the attending nephrologist and supplemented with information extracted from medical records. The trained interviewer classified the patient's race as Black, White, or mixed race.[15] To determine economic class (A, B, C, D, E), the classification system of the Brazilian Institute of Market Research, which is primarily based on possession of consumer goods, was used.[16] Patients belonging to classes D and E were categorized as poor or very poor. Laboratory results were based on regular monthly patient evaluations, and the results closest to the patient's entry in the study

were used. Blood samples were collected before the dialysis session.

Predictors and Outcomes

John Henryism

John Henryism was assessed by the patient's responses to the Portuguese version of the 12-item John Henryism Active Coping (JHAC) Scale. The Portuguese version of the scale was derived through translation and back translation of the English version by the scale's developer (SAJ) and the senior author (AAL) of the current study. The Cronbach alpha, a measure of internal consistency reliability, was .704 for the Portuguese version of the JHAC Scale. This alpha coefficient is comparable to those reported in studies in the United States and Europe.[2,4,8,9] Response options ranged from "completely true" (score = 5) to "completely false" (score = 1). The total JHAC score was determined by summing scores obtained for each of the 12 questions.[4] Total scores can vary from a low of 12 to a high of 60. In our current study, the median score of 52 was used to categorize patients as high or low on John Henryism. This median score is similar to those reported in US community-based studies.[2,17]

Perceived General Health

Perceived General Health (GH) assessed in the present study is part of both the mental and physical dimensions of health-related quality of life.[18] The GH score was determined using the patient's responses for the 5 items of the version 1 of the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36).[19] For item 1, patients were asked to choose one option that represented their general health: excellent, very good, good, fair or poor. For items 2 to 5, the patients were asked to choose the option (definitely true, mostly true, don't know, mostly false and definitely false) that best described their perceived health status in relation to the following health-related statements: item 2) I seem to get sick a little easier than other people; item 3) I am as healthy as anybody I know; item 4) I expected my health to get worse; item 5) My health is excellent. The response for each item was scored. For items 1, 3 and 5, the scores were 100 for definitely true, 75 for mostly true, 50 for don't know, 25 for mostly false and 0 (zero) for definitely false. For items 2 and 4, the scores followed an inverse order. The total general health score was determined by summing up the score for each item and dividing by 5. Total GH scores ranged from 0 to 100, with higher scores indicating better perceived GH.

Statistical Methods

To compare characteristics between patients in high and low John Henryism groups, we used Pearson chi-squared test to evaluate differences in categorical variables in situations where contingency tables with expected values >5 in more than 20% of the cells occurred. The Fisher's exact test could be used to evaluate differences in categorical variables that were not consistent with the use of the Pearson chi-squared test. The t-test was used to evaluate differences in quantitative variables approximating Gauss's distribution. Mann-Whitney test was used to evaluate differences in months on dialysis because the distribution was skewed toward longer duration in dialysis treatment.

We used multivariable linear regression to test for association of John Henryism and each sociodemographic characteristic was associated with general health, taking into account possible effects of several covariates. Multivariable linear regression was also used to investigate associations between JH and GH in sociodemographic subgroups. To estimate the statistical significance of interaction between JH and each sociodemographic characteristics, statistical models containing interaction terms were tested, whereby membership in a high or low category on a given characteristic (coded as 0 or 1) was cross-classified with membership in a high or low category on JH (coded as 0 or 1). Multivariable logistic regression was also used to assess association between each sociodemographic characteristic and JH. As recommended, the covariates included in the multivariable models to adjust for potential confounding were selected based on clinical rationale, independent of their statistical significance.[20,21] Covariates included in the models were age, gender, race, marital status, education, economic class, months of dialysis, dialysis dose by single-pool Kt/V,[22] serum creatinine, serum albumin, hemoglobin, type of vascular access for hemodialysis, heart failure, diabetes, hypertension, cerebrovascular disease, and a group of lower prevalence comorbid conditions (eg, chronic obstructive pulmonary disease [COPD], asthma, virus B infec-

tion, virus C infection, cancer, and peripheral vascular disease) combined into a single category. To handle missing data in the analysis, indicator variables were coded as 1 or 0 to indicate their presence or absence.

Statistical analysis was performed using the IBM SPSS Statistics for Macintosh, Version 25.0 (IBM SPSS, Armonk, NY: IBM Corp.). Differences with two-sided P <.05 are considered statistically significant.

Results

Twenty-nine percent (29.1%) of patients were identified as Black; 59.4% as mixed race; and 11.4% as White. Mean age was 48.3±13.7 years, and lower for Black (47.3±13.1 years) and mixed-race (47.8±13.7 years) than White patients (53.0±14.3 years). The majority of patients were male (61.3%); 61.7% did not graduate from high school; and 48.7% were classified as poor or very poor. The prevalence of comorbidities was generally higher for patients aged ≥60 years vs <60 year: 37.0% vs 14.9% for diabetes; 14.0 vs 9.2% for heart failure; 10.4% vs 4.8% for cerebrovascular disease. Diabetes was more prevalent in Whites (36.7%) than in mixed-race (18.7%) and Black (14.4%) patients. The prevalence of cerebrovascular disease was higher for males than females: 8.1% vs 2.5%. The general health score varied from 0 to 100 and showed similar means for the 525 patients with data on JH (55.22±23.65) and the 203 patients without JH data (55.49±23.84); P=.89 (data not shown).

The median John Henryism (JH) score was 52. Table 1 summarizes patient characteristics by high (>52) and low JH (≤52) categories. The high-JH group was older and contained a slightly higher proportion of non-White patients than was observed for the low-JH group. The distribution of major comorbidity did not show consistent variation by JH categories.

The prevalence of comorbid conditions in the group of other comorbidities in the low and high John Henryism groups were, respectively: 1.5% and 2.7% for asthma, .4% and 1.2% for chronic obstructive pulmonary disease, 1.9% and 1.2% for infectious by virus B, 2.6% and 2.7% for infectious by virus C, 3.0% and 3.5% for cancer, and 2.6% and 4.3% for peripheral vascular disease (data not shown in the Table). These small differences between the low and high JH groups in the distribution of low-prevalence comorbidities did not reach statistical significance (P≥.28).

Table 2 shows the odds ratios of associations between patient characteristics and John Henryism. JH was significantly associated with age and race but not with gender, education and economic class. In the models

Table 1. Selected patients' characteristics by high and low John Henryism

Characteristics	John Henryism		P
	Low (Score ≤52), N=270	High (Score >52), N=255	
Age yr, mean±SD	46.6±13.6	50.1±13.5	.003
% Age ≥ 60 yr	15.6	25.9	.003
% Male	61.1	61.6	.91
% Race			.08
White	14.5	8.3	
Mixed	56.5	62.2	
Black	29.0	29.5	
% < High school	58.7	64.8	.15
% Poor/very poor	49.8	47.6	.63
% Married	45.7	39.0	.12
Months on dialysis, median [IQR]	44.6 [22.2, 88.0]	40.6 [16.0, 81.5]	.15
% Dialysis by catheter	11.9	11.1	.78
Kt/V, mean±SD	1.57±0.36	1.60±0.41	.32
Serum albumin in g/dL, mean±SD	3.73±0.39	3.76±0.38	.37
Serum creatinine in mg/dL, mean±SD	10.9±3.4	10.8±3.7	.67
Blood hemoglobin in mg/dL, mean±SD	10.4±1.8	10.7±1.8	.08
% Hypertension	91.1	92.5	.55
% Diabetic	18.5	20.4	.59
% Heart failure	10.4	9.9	.84
% Cerebrovascular disease	4.5	7.5	.14
% Other comorbidities	10.7	15.3	.12

The percentages of missing values were .6 for education, 9.3% for economic class, .4% for marital status, .4% for vascular access, 3.6% for Kt/V, 2.5% for albumin, .4% for creatinine, 2.5% for hemoglobin, .6% for heart failure.

Other comorbidities include asthma, chronic obstructive pulmonary disease, infections by virus B or virus C, cancer and peripheral vascular disease.

All categorical variables were consistent with the premises of the Pearson chi-squared test. Mann-Whitney test was used to test for differences in months on dialysis. For the other quantitative variable, independent sample t-test was used for comparing differences between the two John Henryism groups.

Table 2. Logistic-regression unadjusted and adjusted odds ratios for associations between patient characteristics and high John Henryism (JH)

			% High JH	Odds ratio (95% CI)	
Characteristics	**Groups**	**N**	**(score >52)**	**Unadjusted**	**Adjusted[a]**
Age	<60 yr	417	45.3	Ref=1	Ref=1
	≥60 yr	108	61.1	1.90 (1.23, 2.92)	2.19 (1.31, 3.65)
Gender	Female	203	48.3	Ref=1	Ref=1
	Male	322	48.8	1.02 (.72, 1.45)	.92 (.61, 1.39)
Race	White	60	35.0	Ref=1	Ref=1
	Mixed	311	51.0	1.92 (1.08, 3.41)	2.38 (1.22, 4.66)
	Black	154	49.0	1.81 (.98, 3.36)	2.30 (1.11, 4.74)
Education	≥ High school	200	44.5	Ref=1	Ref=1
	< High school	322	50.9	1.30 (0.91, 1.85)	1.24 (0.81, 1.92)
Economic Class	> Poor	244	48.8	Ref=1	Ref=1
	Poor/very poor	232	46.6	.92 (.64, 1.31)	.76 (.50, 1.16)

a. Odds ratios in the logistic regression model with inclusion of sociodemographic variables (age, gender, race, marital status, education and economic class months of dialysis, dialysis dose by Kt/V, serum creatinine, serum albumin, hemoglobin, type of vascular access for hemodialysis, hypertension, heart failure, diabetes, chronic obstructive pulmonary disease, cerebrovascular disease and low-prevalence comorbidities (asthma, chronic obstructive pulmonary disease, infections by virus B or virus C, cancer and peripheral vascular disease) as a single group.

adjusted for numerous covariates, the odds for scoring >52 points on JH (ie, high JH) were significantly higher for those aged ≥60 years than for those aged <60 year (OR = 2.19, 95% CI: 1.31, 3.65) and for Black (OR = 2.30, 95% CI: 1.11, 4.74) and mixed race (OR = 2.38, 95% CI: 1.22, 4.66) than for White patients.

As shown in Table 3, gender was the only sociodemographic variable associated with general health. A significantly lower GH score, by approximately six points, was observed for women than for men, both in

Table 3. Unadjusted and adjusted differences in mean general health score by sociodemographic characteristics

		GH Score	Difference in General Health Score , (95% CI)[a]	
Characteristics	**N**	**Mean±SD**	**Unadjusted**	**Adjusted[a]**
Age				
18-59 yr	417	55.6±23.4	Ref=0	Ref=0
≥ 60 yr	108	53.9±24.7	-1.62 (-6.64, 3.40)	.15 (-5.51, 5.81)
Gender				
Female	203	51.5±23.9	Ref=0	Ref=0
Male	322	57.6±23.2	6.02 (1.88, 10.2)	6.29 (1.56, 11.0)
Race				
White	60	56.6±24.5	Ref=0	Ref=0
Mixed	311	55.3±23.3	-1.32 (-7.88, 5.23)	-1.67 (-8.90, 5.56)
Black	154	54.5±24.0	-2.07 (-9.16, 5.01)	-3.34 (-11.2, 4.53)
Education				
≥ high school	200	55.6±23.2	Ref = 0	Ref=0
< high school	322	55.1±24.0	-.53 (-4.72, 3.67)	.74 (-4.20, 5.67)
Economic class				
> Poor	244	56.1±22.9	Ref = 0	Ref=0
Poor/Very Poor	232	55.1±24.6	-1.47 (-5.74, 2.80)	-1.60 (-6.38, 3.19)

a. Difference in the linear regression model with inclusion of sociodemographic variables (age, gender, race, marital status, education and economic class months of dialysis, dialysis dose by Kt/V, serum creatinine, serum albumin, hemoglobin, type of vascular access for hemodialysis, hypertension, heart failure, diabetes, chronic obstructive pulmonary disease, cerebrovascular disease and low-prevalence comorbidities (asthma, chronic obstructive pulmonary disease, infections by virus B or virus C, cancer and peripheral vascular disease) as a single group.

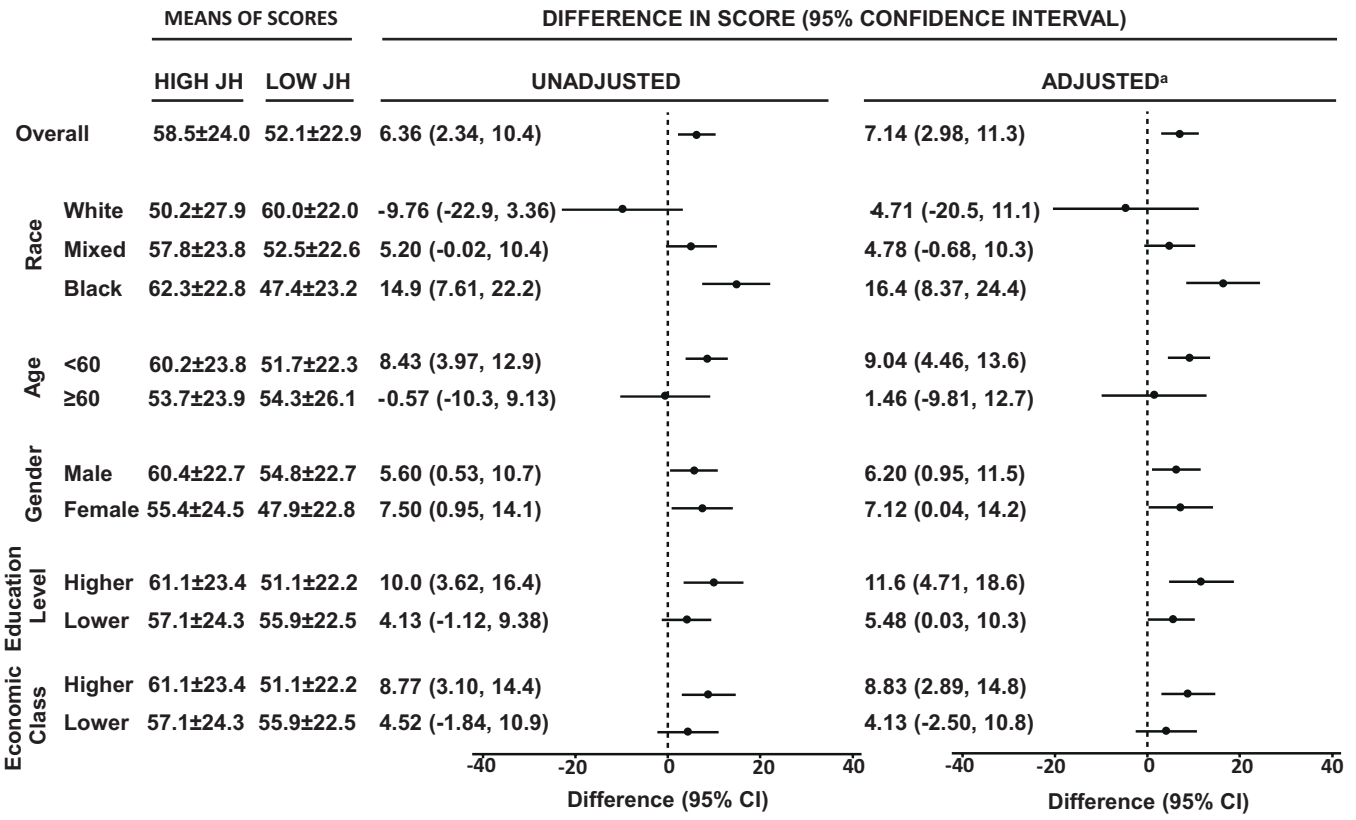

Figure 1. Means and linear regression unadjusted and adjusted differences in general health score by John Henryism category in the total group and by sociodemographic subgroups

P were <.05 for the linear regression coefficients of John Henryism * Black race (White as reference) and John Henryism * age, using age as dichotomous variable (aged <60 years and ≥ 60 years).

JH, John Henryism.

a. Differences were adjusted for age, gender, race, marital status, education, economic class, months of dialysis, dialysis dose by Kt/V, serum creatinine, serum albumin, hemoglobin, type of vascular access for hemodialysis, hypertension, heart failure, diabetes, cerebrovascular disease and a group of low-prevalence comorbidities (chronic obstructive pulmonary disease, asthma, virus B infection, virus C infection, cancer, peripheral vascular disease) as a single category.

the unadjusted difference (men vs women 6.02, 95% CI: 1.88, 10.2) and adjusted models (men vs women 6.29, 95% CI: 1.56, 11.0). Non-statistically significant differences were observed in comparisons between racial groups with a tendency for lower GH scores in mixed race and Black than in White patients.

Figure 1 shows the means of general health scores in patients who reported high and low John Henryism and unadjusted and adjusted linear regression difference in scores between patients with high and low JH in the total sample and by sociodemographic characteristics. The means of GH score was higher by more than six points in the high than in the low John Henryism group (difference = 6.36, 95% CI: 2.34, 10.4) in the whole sample. The difference in GH scores was not reduced with adjustments for sociodemographic factors and comorbidities (difference = 7.14; 95% CI: 2.98, 11.3).

In the analysis stratified by sociodemographic characteristics (Figure 1), statistically significant associations between high JH and greater general health score were observed both among women (adjusted difference = 7.12, 95% CI: .04, 14.2) and men (adjusted difference = 6.20; 95% CI: .95, 11.5). Positive association between JH and GH was observed in non-Whites but not in Whites. Among Blacks, the mean of GH was higher by more than 16 points in patients with high than low John Henryism (adjusted difference = 16.4; 95% CI: 8.37, 24.4). The association between JH and GH followed an inverse direction in Whites. A strong positive association between

JH and GH was observed for patients aged <60 years (adjusted difference =8.77, 95% CI: 4.20, 13.3) but not for older patients. The coefficients of interaction of Black race*JH using White as referent race and age*JH tested in separate models with inclusion of variables listed in Table 1 were statistically significant *(P*<.05).

Discussion

The results of our present study indicate that end-stage renal disease patients undergoing maintenance hemodialysis scoring high on John Henryism (JH) were more likely to report better GH than those scoring low. High JH was associated with better perceived GH for both men and women and across economic classes and education levels (Figure 1). The observed difference in GH score between those with high and low JH was larger than six points, which is considered a clinically significant health-related quality of life difference.[23] However, variations in associations between JH and general health were observed across age and racial groups. As shown, high JH was associated with better GH in non-Whites but not in Whites. Among Blacks the mean general health score was considerably higher for those with high than for those with low JH reaching a very large difference of 16 points in the analysis with extensive adjustments for covariates. High JH was also associated with better perceived GH for patients younger than 60 years but not for older patients. In the covariate-adjusted regression analysis specific for aged <60 years, the mean GH was much higher (difference >8 points) for high-JH patients.

In the whole sample, race was only weakly associated with GH, with a slight tendency for lower GH scores for non-Whites. However, as a result of the race-JH interaction, in the high JH group, Black and mixed-race patients reported better GH than did White patients. By contrast, in the low JH group, higher perceived GH was observed for Whites than for non-Whites. While a trend toward better perceived health was observed for patients aged <60 years than for older patients in the high-JH group, a trend for worse perceived GH was observed for those aged <60 years in the low-JH group. These results indicate that John Henryism is a strong effect modifier of the race and age associations with GH. The effect modifications of JH on association of race and age with GH suggest that younger and non-White MHD patients engaged in high-effort coping with their socioenvironmental stressors as demonstrated by high JH tend to assess their overall health more positively.

Different from age and race, gender was associated with perceived GH in the whole sample and similarly between patients with high and low John Henryism. A lower self-reported GH was observed in women compared with men and was observed in both groups (high and low JH) of patients. These results are in agreement with population studies that show that, in general, women tend to rate their health as poor more often than men.[24] The lower general health score in women than in men in the present study is also in line with the higher burden of symptoms reported by women than in men undergoing hemodialysis.[14,25-27]

It is interesting to note that whereas high JH was associated with better self-reported GH in patients aged <60 years, a high JH was more often reported by older patients. Our cross- sectional study could not assess the reason for the higher JH for older MHD patients. The possibility that the higher JH in older patients is partly explained by selective survivorship is supported by previous studies that showed greater survivorship in patients who demonstrate an active coping style.[28,29] The observed differences in JH by age might also be explained by birth cohort effects; ie, to deal effectively with their life experiences, older patients of our present study may have been determined, active cop-

The results of our present study indicate that end-stage renal disease patients undergoing maintenance hemodialysis scoring high on John Henryism (JH) were more likely to report better GH than those scoring low.

ers from an early age and in ways not required of younger patients. As suggested, the coping skills learned from life experiences from early age would remain as enduring personal characteristic.[30] It is also worth noting that despite the higher prevalence of major comorbidity in older MHD patients, their self-reported health was similar to that of younger patients. This is consistent with data that suggest that people tend to rate their health more favorably as they get older despite progressively worsening physical health.[29] Selective survival is another factor that may contribute to increase the proportion of healthy individuals with chronic conditions at older ages.[31]

The higher JH for non-White than White is in agreement with US population studies wherein African Americans consistently scored higher than Whites on JH.[2,3] According to James,[3] a potential explanation for the higher JH scores among US Blacks than US Whites is that economic hardship for African Americans, unlike that for Whites, contains a racial component which intensifies the socioeconomic adversity they must try to overcome through high-effort coping. This explanation may also account for the higher JH scores observed for non-White Brazilians in the current study given the economic, as well as racial, barriers that Black Brazilians also face.[32]

Limitations of our study should also be acknowledged. The observational design does not permit us to conclude if the observed associations between JH and perceived general health in MHD patients are causal. Also, because the analysis was performed using data collected cross-sectionally, it was not possible to assess the direction of the association between JH and GH. Some constellation of unmeasured or unknown factors may account for the reported associations between JH and perceived health. Longitudinal research employing larger samples and an even broader array of covariates will be necessary to clarify what role JH plays in preserving the psychological wellbeing of patients attempting to manage the burden of end-stage renal disease and the treatment by maintenance hemodialysis. Our findings are consistent, however, with prior research that shows evidence that characteristics such as hope and perseverance play an important role to overcome stressful situations in the course of chronic illness.[33] JH scores may provide a new window for understanding how race and age, among other person-level characteristics, influence a patient's ability to cope with potentially debilitating chronic conditions.

Conclusions

The existing data indicate that the utilization of maintenance hemodialysis (MHD) is increasing in almost all world regions.[34] As shown in previous studies, perceived poor GH has been associated with greater mortality[11,35] and hospitalization[11] in MHD patients. Our findings indicate that the beneficial role of high John Henryism on GH applies similarly to men and women undergoing MHD. The use of the JH active coping scale for the clinical evaluation of MHD patients might be helpful to identify those who need special care to improve outcomes. However, MHD studies developed in different settings are needed to assess the generalizability of JH and investigate association of JH with outcomes, such as self-reported outcomes, mortality and hospitalization. We hope that our study findings will stimulate additional research on John Henryism and the health-related quality of life in MHD patients to aid improving the health care offered to this increasing worldwide population.

Acknowledgments

We are grateful for the support received from the medical directors and staff of the following dialysis units: Clínica NEPHRON of Itapuã, Clínica NEPHRON of Barris, INED and CLINIRIM.

The study was supported by research grants from "The Brazilian National Council for Scientific and Technological Development (CNPq)", grants #484743/2006-6 and #308068/2006-8.

The study protocol was approved by the Institutional Review Board of the Medical School of the Federal University of Bahia in Salvador Brazil and all procedures followed were in accordance with the ethical standards of the IRB and the Helsinki Declaration of 1975, as revised in 2000. All patients provided informed consent to participate.

Conflict of Interest

No conflicts of interest to report.

Author Contributions

Research concept and design: GB Lopes, MB Lopes, Penalva, Silva, Martins, AA Lopes; Acquisition of data: GB Lopes, MB Lopes, Silva, Martins, AA Lopes; Data analysis and interpretation: GB Lopes, James, AA Lopes; Manuscript draft: GB Lopes, James, MB Lopes, Matos, AA Lopes; Statistical expertise: James, MB Lopes, Penalva, AA Lopes; Acquisition of funding: AA Lopes; Administrative: GB Lopes, Silva, Matos, Martins, AA Lopes; Supervision: GB Lopes, MB Lopes, AA Lopes

References

1. James SA, Hartnett SA, Kalsbeek WD. John Henryism and blood pressure differences among black men. *J Behav Med*. 1983;6(3):259-278. https://doi.org/10.1007/BF01315113 PMID:6663614
2. James SA, Strogatz DS, Wing SB, Ramsey DL. Socioeconomic status, John Henryism, and hypertension in blacks and whites. *Am J Epidemiol*. 1987;126(4):664-673. https://doi.org/10.1093/oxfordjournals.aje.a114706 PMID:3631056
3. James SA. John Henryism and the health of African-Americans. *Cult Med Psychiatry*. 1994;18(2):163-182. https://doi.org/10.1007/BF01379448 PMID:7924399
4. James SA, Keenan NL, Strogatz DS, Browning SR, Garrett JM. Socioeconomic status, John Henryism, and blood pressure in black adults. The Pitt County Study. *Am J Epidemiol*. 1992;135(1):59-67. https://doi.org/10.1093/oxfordjournals.aje.a116202 PMID:1736661
5. Subramanyam MA, James SA, Diez-Roux AV, et al. Socioeconomic status, John Henryism and blood pressure among African-Americans in the Jackson Heart Study. *Soc Sci Med*. 2013;93:139-146. https://doi.org/10.1016/j.socscimed.2013.06.016 PMID:23906131
6. Markovic N, Bunker CH, Ukoli FA, Kuller LH. John Henryism and blood pressure among Nigerian civil servants. *J Epidemiol Community Health*. 1998;52(3):186-190. https://doi.org/10.1136/jech.52.3.186 PMID:9616424
7. McKetney EC, Ragland DR. John Henryism, education, and blood pressure in young adults. The CARDIA study. Coronary Artery Risk Development in Young Adults Study. *Am J Epidemiol*. 1996;143(8):787-791. https://doi.org/10.1093/oxfordjournals.aje.a008816 PMID:8610688
8. Mujahid MS, James SA, Kaplan GA, Salonen JT. Socioeconomic position, John Henryism, and incidence of acute myocardial infarction in Finnish men. *Soc Sci Med*. 2017;173:54-62. https://doi.org/10.1016/j.socscimed.2016.11.034 PMID:27923154
9. Duijkers TJ, Drijver M, Kromhout D, James SA. "John Henryism" and blood pressure in a Dutch population. *Psychosom Med*. 1988;50(4):353-359. https://doi.org/10.1097/00006842-198807000-00004 PMID:3413269
10. Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. *J Health Soc Behav*. 1997;38(1):21-37. https://doi.org/10.2307/2955359 PMID:9097506
11. Mapes DL, Lopes AA, Satayathum S, et al. Health-related quality of life as a predictor of mortality and hospitalization: the Dialysis Outcomes and Practice Patterns Study (DOPPS). *Kidney Int*. 2003;64(1):339-349. https://doi.org/10.1046/j.1523-1755.2003.00072.x PMID:12787427
12. Brennan J. Adjustment to cancer - coping or personal transition? *Psychooncology*. 2001;10(1):1-18.https://doi.org/10.1002/1099-1611(200101/02)10:13.0.CO;2-T PMID:11180573
13. Sorensen JL, Costantini MF, London JA. Coping with AIDS: strategies for patients and staff in drug abuse treatment programs. *J Psychoactive Drugs*. 1989;21(4):435-440. https://doi.org/10.1080/02791072.1989.10472190 PMID:2621517
14. Lopes GB, Matos CM, Leite EB, et al. Depression as a potential explanation for gender differences in health-related quality of life among patients on maintenance hemodialysis. *Nephron Clin Pract*. 2010;115(1):c35-c40. https://doi.org/10.1159/000286348 PMID:20173348
15. Krieger H, Morton NE, Mi MP, Azevêdo E, Freire-Maia A, Yasuda N. Racial admixture in north-eastern Brazil. *Ann Hum Genet*. 1965;29(2):113-125. https://doi.org/10.1111/j.1469-1809.1965.tb00507.x PMID:5863835
16. Critério Padrão de Classificação Econômica Brasil/2008. Last accessed September 19, 2017 from http://www.aba.com.br/wp-content/uploads/content/7727632a373615b34f2a5726fcc5c9e2.pdf.
17. Bonham VL, Sellers SL, Neighbors HW. John Henryism and self-reported physical health among high-socioeconomic status African American men. *Am J Public Health*. 2004;94(5):737-738. https://doi.org/10.2105/AJPH.94.5.737 PMID:15117690
18. McHorney CA, Ware JE Jr, Raczek AE. The MOS 36-Item Short-Form Health Survey (SF-36): II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. *Med Care*. 1993;31(3):247-263. https://doi.org/10.1097/00005650-199303000-00006 PMID:8450681
19. Hays RD, Sherbourne CD, Mazel RM. The RAND 36-Item Health Survey 1.0. *Health Econ*. 1993;2(3):217-227. https://doi.org/10.1002/hec.4730020305 PMID:8275167
20. Dales LG, Ury HK. An improper use of statistical significance testing in studying covariables. *Int J Epidemiol*. 1978;7(4):373-375. https://doi.org/10.1093/ije/7.4.373 PMID:744677
21. Greenland S, Neutra R. Control of confounding in the assessment of medical technology. *Int J Epidemiol*. 1980;9(4):361-367. https://doi.org/10.1093/ije/9.4.361 PMID:7203778
22. Daugirdas JT. Second generation logarithmic estimates of single-pool variable volume Kt/V: an analysis of error. *J Am Soc Nephrol*. 1993;4(5):1205-1213. PMID:8305648
23. Samsa G, Edelman D, Rothman ML, Williams GR, Lipscomb J, Matchar D. Determining clinically important differences in health status measures: a general approach with illustration to the Health Utilities Index Mark II. *Pharmacoeconomics*. 1999;15(2):141-155. https://doi.org/10.2165/00019053-199915020-00003 PMID:10351188
24. Benyamini Y, Blumstein T, Lusky A, Modan B. Gender differences in the self-rated health-mortality association: is it poor self-rated health that predicts mortality or excellent self-rated health that predicts survival? *Gerontologist*. 2003;43(3):396-405. https://doi.org/10.1093/geront/43.3.396 PMID:12810904
25. Jassal SV, Karaboyas A, Comment LA, et al. Functional Dependence and Mortality in the International Dialysis Outcomes and Practice Patterns Study (DOPPS). *Am J Kidney Dis*. 2016;67(2):283-292. https://doi.org/10.1053/j.ajkd.2015.09.024 PMID:26612280
26. Silva LF, Lopes GB, Matos CM, et al. Gastrointestinal symptoms and nutritional status in women and men on maintenance hemodialysis. *J Ren Nutr*. 2012;22(3):327-335. https://doi.org/10.1053/j.jrn.2011.07.007 PMID:22071220
27. Lopes AA, Albert JM, Young EW, et al. Screening for depression in hemodialysis patients: associations with diagnosis, treatment, and outcomes in the DOPPS. *Kidney Int*. 2004;66(5):2047-2053. https://doi.org/10.1111/j.1523-1755.2004.00977.x PMID:15496178
28. Svensson T, Inoue M, Sawada N, et al; JPHC Study Group. Coping strategies and risk of cardiovascular disease incidence and mortality: the Japan Public Health Center-based prospective Study. *Eur Heart J*. 2016;37(11):890-899. https://doi.org/10.1093/eurheartj/ehv724 PMID:26746633
29. Idler EL. Age differences in self-assessments of health: age changes, cohort differences, or survivorship? *J Gerontol*. 1993;48(6):S289-S300. https://doi.org/10.1093/geronj/48.6.S289 PMID:8228003
30. McCrae RR. Age differences and changes in the use of coping mechanisms. *J Gerontol*. 1989;44(6):161-169. https://doi.org/10.1093/geronj/44.6.P161 PMID:2809108
31. Markides KS, Machalek R. Selective survival, aging and society. *Arch Gerontol Geriatr*. 1984;3(3):207-222. https://doi.org/10.1016/0167-4943(84)90022-0 PMID:6395820
32. Fernandes F. *O negro no mundo dos brancos.* São Paulo: Difusão Européia; 1972.
33. Seligman ME, Csikszentmihalyi M. Positive psychology. An introduction. *Am Psychol*. 2000;55(1):5-14. https://doi.org/10.1037/0003-066X.55.1.5 PMID:11392865
34. Thomas B, Wulf S, Bikbov B, et al. Maintenance Dialysis throughout the

World in Years 1990 and 2010. *J Am Soc Nephrol*. 2015;26(11):2621-2633. https://doi.org/10.1681/ASN.2014101017 PMID:26209712

35. Feroze U, Noori N, Kovesdy CP, et al. Quality-of-life and mortality in hemodialysis patients: roles of race and nutritional status. *Clin J Am Soc Nephrol*. 2011;6(5):1100-1111. https://doi.org/10.2215/CJN.07690910 PMID:21527646