HU Revista
Artigo Original

Pre-dialysis chronic kidney disease progression over 4 years in the context of the Public Health System in Brazil: is ethnicity a factor?

Progressão da doença renal crônica pré-diálitica ao longo de 4 anos no contexto do Sistema Único de Saúde no Brasil: etnicidade é um fator?

Luciana dos Santos Tirapani Dalamura[1,2]
Lucas Fernandes Suassuna[1]
João Eduardo Cascelli Schelb Scalla Pereira[1]
Rosália Maria Nunes Henriques Huaira[1]
Neimar da Silva Fernandes[1]
Priscylla Aparecida Vieira do Carmo[1,2]
Natália Maria da Silva Fernandes[1,2]

[1]Postgraduate Program in Health, Faculty of Medicine, Federal University of Juiz de Fora, Brazil.

[2]Minas Gerais Institute for Teaching and Research in Nephrology (IMEPEN), Brazil.

✉ **Natália Maria Fernandes**

R. Jamil Altaf, 132, Vale do Ipê, Juiz de Fora, Minas Gerais
CEP: 36035-380
nataliafernandes02@gmail.com

Submetido: 04/05/2021
Aceito: 16/08/2021

RESUMO

Introduction: The prevalence of chronic kidney disease (CKD) significantly increased, and populations with high social vulnerability tend to have worse CKD progression. **Objective:** To evaluate the impact of ethnicity on the control of pre-dialytic CKD in a Brazilian Unified Health System interdisciplinary outpatient clinic. **Material and Methods:** Data of 1,992 CKD patients were retrospectively collected from August/2010 to December/2014. Patients referred by primary health care, >18 years, ≥ two consultations were included. Sociodemographic data were collected upon admission; clinical and laboratory data were obtained at each consultation. Patients were divided into groups according to skin colour (self-identified). A descriptive analysis was performed; variables were compared using ANOVA, chi-square or Mann-Whitney U tests. Variables associated with the delta of the estimated glomerular filtration rate (eGFR) were evaluated using linear regression, adjusting for confounding variables. **Results:** 25.1% were black, 34.4% brown, and 40.5% white. 51.2% had income ≤ two minimum wages, 84.8% had low level education, 14.0% were illiterate. Black patients were younger and had lower education level; they had higher systolic blood pressure, total cholesterol, high-density lipoproteins, intact parathyroid hormone; their haemoglobin and vitamin D were lower. The median annual eGFR loss was 0 (P25 −6.70, P75 +8.76), 36.5% had rapid eGFR loss (>5 ml/min/year). Only use of angiotensin-converting enzyme inhibitors and low proteinuria were determined as significant for the outcome (RR: 0.92, CI: 0.010–0.684, p=0.02; RR: 0.8, CI: 0.998-0.999, p=0.001). **Conclusion:** Ethnicity did not impact CKD progression, even though black patients presented clinical and sociodemographic characteristics associated with worse disease progression.

Palavras-chave: Renal Insufficiency, Chronic; Ethnic Groups; Noncommunicable Diseases; Disease Progression.

ABSTRACT

Introdução: A prevalência de doença renal crônica (DRC) aumentou significativamente, e populações com alta vulnerabilidade social tendem a ter pior progressão. **Objetivo:** Avaliar o impacto da etnicidade no controle da DRC pré-dialítica em um ambulatório interdisciplinar do Sistema Único de Saúde. **Material e Métodos:** Foram coletados dados de 1.992 pacientes com DRC retrospectivamente entre agosto/2010 e dezembro/2014. Foram incluídos pacientes encaminhados pela atenção primária à saúde, > 18 anos, ≥ duas consultas. Dados sociodemográficos foram coletados após a admissão; dados clínicos e laboratoriais foram obtidos em cada consulta. Os pacientes foram divididos em grupos segundo a cor da pele (auto-identificado). Foi realizada uma análise descritiva; as variáveis foram comparadas usando testes ANOVA, chi-quadrado ou Mann-Whitney. Variáveis associadas ao delta da taxa de filtração glomerular estimada (TFGe) foram avaliadas por meio de regressão linear, ajustando-se para confundidores. **Resultados:** 25,1% eram negros, 34,4% pardos e 40,5% brancos. 51,2% tinham renda ≤ dois salários mínimos, 84,8% tinham baixo nível de escolaridade, 14,0% eram analfabetos. Os pacientes negros eram mais jovens e tinham menor nível de escolaridade; apresentaram maior pressão arterial sistólica, colesterol total, lipoproteínas de alta densidade e hormônio paratireoide intacto; e sua hemoglobina e vitamina D eram mais baixas. A mediana da perda anual daTFGe foi de 0 (P25 -6,70, P75 +8,76), 36,5% tiveram perda rápida de TFGe (>5 ml/min/ano). Somente o uso de inibidores de enzimas conversores de angiotensina e baixa proteinúria foram significativamente associados com o desfecho (RR: 0,92, IC: 0,010-0,684, p=0,02; RR: 0,8, IC: 0,998-0,999, p=0,001). **Conclusão:** A etnicidade não impactou na progressão da DRC, embora os pacientes negros apresentassem características clínicas e sociodemográficas associadas à pior progressão da doença.

Key-words: Insuficiência Renal Crônica; Grupos Étnicos; Doenças Não Transmissíveis; Progressão da Doença.

INTRODUCTION

The Brazilian Unified Health System (SUS), proposed by the 1988 Constitution, was established to ensure that all Brazilian citizens receive adequate healthcare. It constitutes a health reform strategy that aims to better monitor, through an integrated approach, the society's health. It was developed based on the following principles: the universality of actions, democratisation of healthcare access, a model of care centred on integrality and equity of actions, decentralisation, social control, and interdisciplinarity. Thus, it comprises strategies that promote social inclusion, based on the National Institute of Social Welfare Medical Assistance (INPS), as opposed to the previous policy, which stated that only those who had labour ties and/or participated in social welfare contributions were entitled to public health services.[1] Recently, the SUS completed 30 years, and a review published in 2018 showed important improvements in health indicators of the population after its implementation in Brazil.[2]

However, several obstacles to the implementation of SUS need to be overcome, mainly related to gender, skin colour, and income factors. Multiple forms of inequalities have been reported in Brazil; however, racial inequality is the main reason for contention as it involves several factors that are characteristic of the Brazilian social structure and whose dynamics resulted in landmark social divides throughout the history of Brazil.[3] In healthcare, these inequalities manifest in various ways, but mainly as a high rate of mortality due to external causes; high maternal and infant mortality; obstetric violence; higher rates of hypertension and type 2 diabetes mellitus (DM); the latter two are known risk factors for the development of chronic kidney disease (CKD).[4-6]

Brazil has a highly heterogenous population, resulting from several migratory events and mixing of ethnicities, thus leading to a great diversity among all the states of the country. Owing to difficulties in classification, the classification of people in Brazil by race/skin colour is subject to criticism. The stratification of individuals as whites and non-whites, based on the North American classification, has advantages in indicating socioeconomic differences because of racial characteristics. However, it does not represent the epidemiological differences well. Moreover, the classic categorisation of individuals into black, brown, and white is not sufficient to explain the ethnic differences throughout the country.[7] For this study, we adopted the classification used by the Brazilian Institute of Geography and Statistics (IBGE), which divides the population into black, brown, white, yellow, and indigenous people, with emphasis on the first three categories.

The International Society of Nephrology estimates that there are approximately 850 million people in the world with renal disease, and about 10%–12% of the general population has CKD.[8] However, data regarding the prevalence of CKD in Brazil are scarce, especially in the field of conservative treatment, in which studies have methodological limitations, and therefore, report variable results.[9-11] In Brazil, the 2019 census showed that 139,691 patients with CKD underwent dialysis;[12] a number that tends to grow due to an aging population and an increase in the prevalence of chronic non-communicable diseases (NCDs).

CKD is more prevalent in the black population due to the involvement of genetic factors, such as the variations in the apolipoprotein 1 gene;[13] in several regions of the world including Brazil, black people are socially vulnerable, which puts them at a greater risk of disease progression than other populations. Therefore, it is necessary to focus on the treatment of black patients with pre-dialytic CKD since they have a high risk of disease progression.[14]

As a strategy to combat the progression of CKD as well as all other morbidities, the SUS follows the health model recommended by the World Health Organization, which defines health as a state of complete physical, mental, and social well-being and not merely the absence of diseases.[15] Despite the initial criticism that labelled this definition as a utopian concept, health is now defined as the product of social relations, with a biopsychosocial perception, that results from the interaction of environmental, sanitary, social, and epidemiological elements. Based on this concept, interdisciplinary care was developed, which has been, for at least the last two decades, identified as beneficial for improving the outcomes of CKD. Studies initially conducted in Canada reported this finding.[16] In Brazil, several studies have demonstrated good results using the interdisciplinary care model.[17,18]

This study aimed to evaluate the impact of ethnicity in the clinical control of pre-dialytic CKD in an SUS interdisciplinary outpatient clinic.

MATERIAL AND METHODS

This longitudinal cohort based retrospective study was conducted in the HIPERDIA Minas Center, in the city of Juiz de Fora, a region of the Zona da Mata of Minas Gerais, from August 2010 to December 2014. An interdisciplinary care model, which includes nurses, social workers, nutritionists, pharmacists, physical educators, physiotherapists, doctors from different specialties, and dentists, was adopted in this study. The following micro-regions delimited by IBGE were included: Juiz de Fora (25 municipalities), Santos Dumont (3 municipalities), and São João Nepomuceno (9 municipalities), with a total of 37 municipalities and a population of 837,991 inhabitants, accounting for 4.07% of the state's population.

Inclusion criteria: CKD patients with

hypertension and/or diabetes, ≥ stage G3b, or patients in initial stages with a decrease of estimated glomerular filtration rate (eGFR) >5 ml/min/year; proteinuria <1.0 g/day and haematuria; proteinuria >1.0 g/day; an annual decrease in eGFR >25%; or patients who exhibited a sudden increase in basal creatinine (>30%) after treatment with renin-angiotensin-aldosterone inhibitors. Patients had to be ≥ 18 years, with at least two consultations at the clinic and referred by a primary health care facility.

Patients aged below 18 years, with less than two outpatient visits, who did not meet any of the high-risk criteria listed above, or who declined to participate in the study were excluded. At the beginning of the outpatient follow-up, all patients were asked to sign an informed consent. The study was approved by the Ethics and Research Committee of the University Hospital of the Federal University of Juiz de Fora (approval number: 203/2011) and conducted in accordance with the principles of the Declaration of Helsinki.

Control indicators: to evaluate blood pressure control, the Brazilian Guideline of Arterial Hypertension was adopted during the study, which recommends a systolic blood pressure (SBP) of ≤140 mmHg and a diastolic blood pressure (DBP) of ≤90 mmHg. To evaluate DM control, a fasting blood sugar level of 126 mg/dL was used as an indicator of DM as haemoglobin A1c (HbA1c) test results were not available during follow-up. The delta of the eGFR was measured during the follow-up, and adjusted annually, to monitor CKD progression. A rapid eGFR loss was defined as an eGFR of >5 ml/min/year.

Regarding the analysed variables and data collection, patients' demographic data were collected upon admission, while the other variables were collected from the medical records at each consultation.

The following demographic variables were analysed: gender, age, skin colour (self-identified), city of origin, location of the basic health unit, marital status, level of education (illiterate, primary, secondary, and higher education), income measured in minimal wages (MW) (<MW, from 1 to 2 MW, from 2 to 3 MW, >3 MW), smoking history, and alcoholism.

All patients were assessed for the presence of hypertension and DM. The clinical variables collected at the beginning and at each consultation, throughout the study, were blood pressure (mmHg), weight (kg), height (cm), and body mass index (BMI).

The following laboratory data were also obtained: creatinine (mg/dL), haemoglobin (g/L), uric acid (mg/dL), total calcium (mg/dL), vitamin B12 (pmol/l), urinary sodium (mEq/l), high-density lipoprotein (HDL) cholesterol (mg/dL), low-density lipoprotein (mg/dL), total cholesterol (mg/dL), glycated haemoglobin (%), triglycerides (mg/dL), potassium (mEq/l), fasting glucose (mg/dL), ferritin (ng/mL), transferrin saturation index (%), serum iron (mg/dL), phosphorus (mg/dL), intact parathyroid hormone (PTHi) (pg/mL), vitamin D (ng/mL), and albumin levels (g/dL), albumin/creatinine ratio (mg/g), proteinuria (mg/24 h), and eGFR, estimated using the CKD-EPI formula.[19]

The use of following medications was noted: angiotensin-converting enzyme (ACE) inhibitors, angiotensin receptor blockers, beta-blockers, statins, acetylsalicylic acid, diuretics, insulin, biguanides, sulfonylureas, and fibrates.

The follow-up time (in months) and the number of consultations during the entire study period were also evaluated. The primary outcome was the delta of the eGFR, which was calculated by subtracting the final eGFR from the initial eGFR and dividing it by 12.

Data analysis

Initially, a descriptive analysis was performed using mean ± standard deviation or percentage according to the characteristic of each variable. Then, all variables were compared between the skin colour groups (white, brown, and black) using analysis of variance, chi-square test, or Mann-Whitney U test. We evaluated the variables associated with the delta of eGFR loss through a linear regression, adjusting for clinically and statistically relevant confounding variables and were included in model was the one that presented normal residual analysis evaluation. The prevalence of missing data was less than 5%, except for HbA1c levels (initial, 26.95%; final, 45.5%), which was excluded from the outcome analysis; therefore, the missing values were not imputated. The software SPSS 17.0, Chicago, IL was used to perform the analysis. A confidence interval of 95% was considered.

RESULTS

A total of 1,992 outpatients with CKD were included in this study, with a mean age of 66.2 ± 13.39 years (median: 67 years). A flowchart of the study process is illustrated in figure 1. The mean time of follow-up was 21.38 ± 14.99 months, 51.5% were female, smoking was registered in 9.9%, obesity was present in 48.2% and physical inactivity in 24.4%, 94% of all patients were hypertensive. According to the distribution of skin color, there was a predominance of the group of patients with self-reported white in relation to those of brown and black (40.5%, 34.4% and 25.1% respectively). The group of white individuals had shorter follow-up, older age, predominance of males and lower systolic and diastolic blood pressures at the beginning of the follow-up. On the other hand, black individuals were predominantly female and had higher systolic blood pressure at the beginning of the study (table 1).

The socioeconomic assessment showed less education for blacks compared to browns and whites,

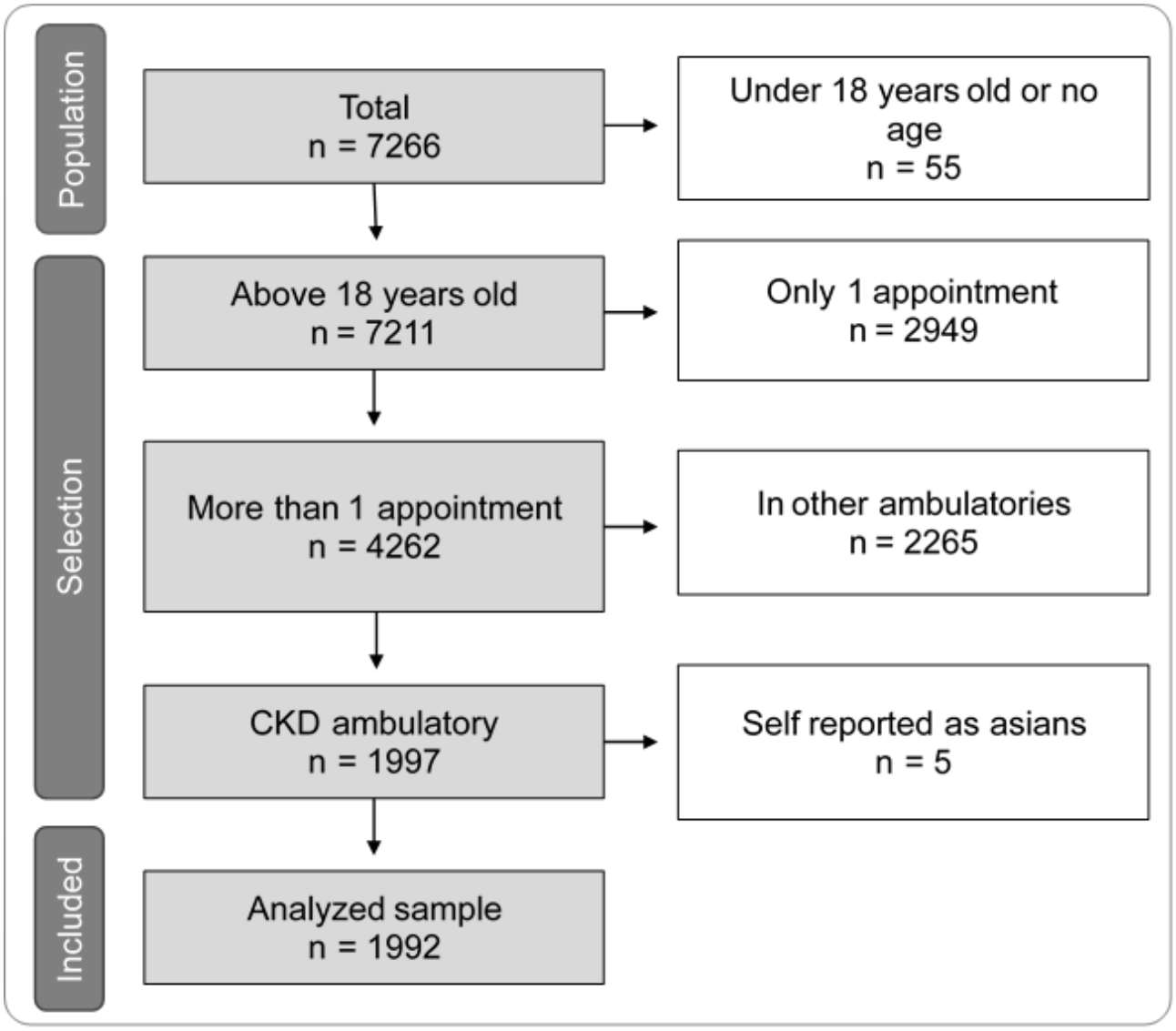

Figure 1: Population inclusion algorithm.

where 18% of blacks were characterized as illiterate compared to 10.9% and 13% for browns and whites respectively. On the other hand, the distribution of income was similar between the groups (figure 2).

As for the class of prescribed drugs, diuretics were the most used, predominating among black patients, when compared to browns and whites. Other drug classes such as angiotensin converting enzyme inhibitors (ACEi), angiotensin receptor blockers (ARB), beta-blockers, statins and acetylsalicylic acid (AAS) also showed high prescription rates, but did not show differences between groups, except for the ACEi that showed a higher percentage of prescription for black patients (table 2).

With respect to target pressure levels achieved during follow-up, we observed that 50.9% of the total population had a target SBP level at the beginning of the study; while 68.5% had a target SBP level at the end of the study. Meanwhile, 71% had achieved target DBP level at the beginning of the study and 84.2% had target DBP level at the end of the study (figure 3).

The patients who had target blood pressure level were compared according to skin colour. At the beginning of the study, 45.9% of the black, 48.8% of the brown, and 55.5% of the white patients achieved the target SBP level (p=0.002). At the end of the study, 65% of black, 68.4% of brown, and 71.2% of white patients achieved the target SBP level (p=0.06). Moreover, 64.2% of black, 72.2% of brown, and 74.8% of white patients achieved their target DBP level at the beginning of the study (p<0.0001). At the end of the study, 79.5% of black, 84.3% of brown, and 87.9% of white patients had achieved their target DBP level (p<0.0001).

When analysing the fasting blood sugar level, 69.8% of the total patients achieved their target blood sugar level (<126 mg/dL) at the beginning of the study; while 72.9% achieved their target blood sugar level at the end of the study (figure 3). However, these data

Table 1: Sociodemographic and clinical characteristics of the study population.

	Total (n=1992)	Black (n=500)	Brown (n=685)	White (n=807)	*p**
Follow-up (years)	21.4±14.9	23.6±15,0	24.5±14,7	17.3±14,3	<0.0001
Age (years)	66.2±13.4	64.3±14.1	66.7±13.1	67±13	<0.0001
Women(%)	51,5	53.6	47.2	46.5	0.03
Alcoholism (%)	15.1	14	16.6	14.4	0.006
Smoking (%)	9.9	11.6	9.9	8.9	0.23
Sedentary (%)	24.4	28.9	27.1	23.9	0.08
Obesity (%)	48.2%	41	37.7	38.1	0.31
Systolic blood pressure (mmHg)					
Initial	146.3±27.3	149.4±30.3	147.1±26.1	143.8±26.4	<0.0001
Final	136.3±24.4	137.8±25.4	136.4±24.5	135.3±23.7	0.2
Diastolic blood pressure (mmHg)					
Initial	87.2±40.8	88.5±16.1	91±64.4	83.4±16	0.0001
Final	81,1±32.0	85.3±48.8	80.9±31.2	78.7±14.7	0.0001

*ANOVA between the black/brown/white groups.

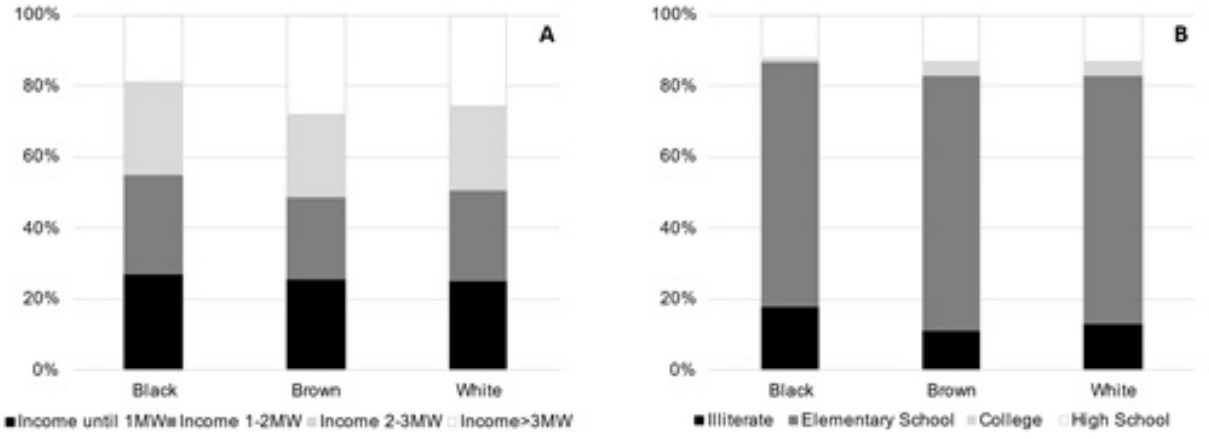

Figure 2: A – Income distribution according to color. MV: minimun vages (p= 0,32); B – Distribution of education level according to color (p<0,001).

were obtained from the general study population that included non-diabetic individuals. When the diabetic patients were evaluated, who accounted for 37.8% of the total population (755), only 41.1% achieved their target blood sugar level at the beginning of the study and 50.8% achieved their target blood sugar level (p<0.0001) at the end of the study. In this subgroup, only 50.7% achieved their target SBP level at the beginning of the study; while 70.6% achieved their target SBP level at the end of the study (p<0.0001). With regard to DBP levels, only 74.9% had levels were within the target at the beginning of the study, while 87.9% were within the target (p=0.001) at the end of the study.

In the general population, when glycaemia was evaluated according to skin colour, results showed that 71.3% of black, 68.6% of brown, and 69.8% of white patients achieved their target blood sugar level at the beginning of the study (p=0.62). At the end of the study, 72.3% of black, 71.4% of brown, and 74.5% of

Table 2: Drug classes used by patients, distributed according to color in general population.

General population (n= 1992)				
	Black (n= 500)	**Brown (n= 685)**	**White (n= 807)**	***p****
ACEI	55.9(280)	51.5(353)	44.8(361)	<0.001
ARB	59.7(299)	63.7(437)	62.1(500)	0.572
Beta blocker	56.1(281)	49.1(337)	49.7(400)	0.074
Statin	61.9(310)	60.8(417)	59.9(482)	0.729
Fibrate	8.2(41)	11.5(79)	11.2(90)	0.204
Acetylsalicylic acid	46.3(232)	48.8(335)	45.7(368)	0.648
Diuretics	86.2(432)	83.8(575)	80.2(646)	0.017
Biguanides	35.3(177)	33.7(231)	33.2(267)	0.536
Sulphonylureas	22.4(112)	23.9(164)	23.5(189)	0.759
Insulins	6.4(32)	7.3(50)	7.8(63)	0.719

Expressed as a percentage and absolute number. ACEI: Angiotensin-converting enzyme inhibitor; ARB: Angiotensin receptor blocker. *ANOVA between the black/brown/white groups.

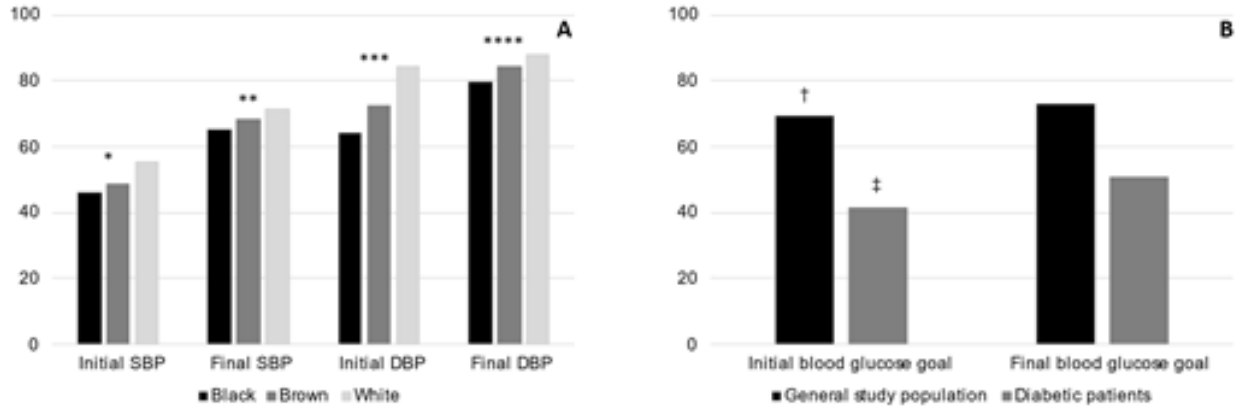

Figure 3: A – Percentage distribution of patients in the pressure targets at the beginning end of the study according to color (SBP: systolic blood plessure; DBP: diastolic blood pressure; *p= 0,002 between diferent color group; **p= 0,06 between diferent color group; ***p= <0,001 between diferent color group; ****p<0,0001 glucose goal – general population; p<0,0001 vc final blood glucose goal – diabetic patients).

white patients achieved their target blood sugar level (p=0.44).

In the laboratory evaluation, black patients had a higher mean total cholesterol both at the beginning of the follow-up and at the end, and a lower average of the vitamin D values at the end of the follow-up when compared to brown and white individuals. The total population had an average eGFR of 36.6 ± 18 mL/min/1.73 m2sc and a final eGFR of 36.6 ± 18 mL/min/1.73 m2sc with no significant difference between groups (table 3). The remaining laboratory variables did not present a statistical difference (table 3).

However, when assessing eGFR variations over the follow-up period, we observed two distinct groups, independent of color. Approximately 36.5% of the total study population had a eGFR loss of 8.39 mL/min/1.73 m2sc, while 63.5% showed a eGFR gain of 8.76 mL/min/1.73 m2sc or no loss of eGFR (figure 4). Regarding the target for control of renal function decay (eGFR delta), the only variables that demonstrated statistical significance for better outcome were use of ACEi and proteinuria <1g (risk ratio [RR]: 0.92, confidence interval [CI]: 0.010–0.684, p= 0.02; RR: 0.8, CI: 0.998–0.999, p= 0.001) (table 4).

Table 3: Laboratory characteristics of the study population.

		Total (n=1992)	Black (n=500)	Brown (n=685)	White (n=807)	p*
Uric acid (mg/dL)	Initial	6.4±1.8	6.7±2	6.4±1.9	6.3±1.8	0.004
	Final	6.3±1.8	6,4±1,9	6,3±1,8	6,3±1,8	0.51
Total cholesterol (mg/dL)	Initial	195.6±53.5	200.6±55.9	195.5±52.3	192.7±53.1	0.03
	Final	184.2±48.6	190.2±50.4	182.3±47.6	182.3±48.2	0.015
HDLc (mg/dL)	Initial	47.0±13.2	49.4±13.9	43.2±13	46.2±12.9	<0.001
	Final	46.8±13.8	49.5±15	46.4±13.7	45.6±13	<0.001
Triglycerides (mg/dL)	Initial	174.1±135.0	162,3±126,1	179,0±141,5	177,2±134,3	0.09
	Final	161.1±108.6	150.3±91.1	168.2±113	161.8±114.4	0.03
GFR mL/min/1.73m2sc	Initial	36.6±18.0	36,9±17,3	36,6±19,2	36,2±17,4	0.78
	Final	36.7±19.9	37,4±19,3	37,1±21,1	35,9±19,2	0.41
Proteinuria (mg/24h) †	Initial	153.1	142.4	146.0	164.5	0.28
	Final	171.0	159.0	160.0	192.0	0.19
25-OH-vitaminD (mg/dL)	Initial	24.0±9.8	23,4±10,1	23,8±9,3	24,6±10,1	0.16
	Final	29.1±10.7	27.3± 11.2	30.2±10.4	29.4±10.8	0.004
PTHi (pg/mL) †	Initial	78.8	84.9	79.3	72.9	0.09
	Final	103.3	110.0	95.8	108.0	0.38
Calcium (mg/dL)	Initial	9.6±0.9	9.5±1.0	9.4±0.9	9.5±0.8	0.048
	Final	9.4±0.8	9.5±0.9	9.4±0.9	9.5±0.7	0.57
Phosphate (mg/dL)	Initial	3.8±0.9	3.8±0.9	3.9±1.1	3.8±1.0	0.552
	Final	3.9±0.9	4.0±1.0	3.9±0.9	4.0±1.0	0.229
Urinary sodium (mEq/L)	Initial	194.4±93.9	195.0±94.3	188.8±89.4	189.1±97.8	0.559
	Final	183.1±94.8	182.3±98.0	186.0±103.3	180.8±82.9	0.770

GFR: Glomerular filtration rate. †Median.* ANOVA between the black/brown/white groups.

DISCUSSION

In this study, we evaluated the impact of ethnicity, controlled for confounding variables, on the clinical control of pre-dialytic CKD in an SUS interdisciplinary outpatient clinic. We observed that socioeconomic variables had no impact on the progression of CKD.

The main limitation of this study is that the HIPERDIA Minas Center is an outpatient secondary care facility, which is accessible to only a restricted portion of the population, and this could have led to a representative bias in the sample. Moreover, there was lack of laboratory test results that could have been used to evaluate the outcome of glycaemic control; glycated haemoglobin test was not performed in all patients, even in those with diabetes.

The interdisciplinary care offered by the centre is based on the SUS principle of full patient care. Its efficacy is supported by several studies, which demonstrated that the use of a global approach results in better outcomes.[20]

Compared with the individuals from the state of Minas Gerais (Brazil),[21] our sample showed

Table 4: Linear regression between socioeconomic and clinical variables (independent) and delta of the GFR at the end of the study (dependent).

Variables	RR	95% CI	*p*
Age	0.923	0,920–1,075	0,909
Female	0.923	0.093–4.898	0.700
ACEI (non-use)	0.923	0.010–0.684	0.021
ARBs (non-use)	0.923	0.017–1.374	0.094
BMI	0.923	0.948–5.457	0.065
Initial systolic pressure	0.970	0.946–1.019	0.351
Initial diastolic pressure	1.009	0.982–1.024	0.774
Proteinuria	0.860	0.998–0.999	0.001
Family income - up to 1 MW earner	1.003	0.402–2.286	0.926
Level of education – illiterate	1.035	0.111–4.454	0.710
Black race/skin colour	1.043	0.724–4.034	0.161

ACEI: Angiotensin-converting enzyme inhibitor; ARBs: Angiotensin receptor blockers; RR: risk ratio; CI: confidence interval; MW, minimum wage; BMI, body mass index.

a discrepancy in the percentage of individuals who identified as black (21.5% vs. 11.3%), this may be the result of a worse progression of CKD in this group.[14] The HIPERDIA centre is a secondary care facility, providing care for more advanced stages of CKD, which may explain the over representation of individuals identified as black. Furthermore, the illiteracy rate in our sample was higher than that of the Brazilian population,[22] and the average age of our sample was also higher than that of the Brazilian population, which may explain this data. The illiteracy rate of all racial groups were similar to that reported in the literature,[22] showing a higher prevalence among black patients than in the other patients.

Unlike the prevalence seen in African Americans,[23,24] the prevalence of obesity among black patients was not high. In the FIBRA study, conducted in Brazil, difference in obesity was also not observed among black, brown, and white elderly participants after adjusting for BMI;[25] this finding is similar to that observed in our sample, which also had a high mean age.

In this study, upon admission, SBP and DBP levels were higher among black patients; this finding is similar to those of the ELSA-Brazil study, which showed a higher prevalence of Systemic Arterial Hypertension (SAH) among black patients, followed by brown and white patients.[26] Worse pressure control was demonstrated in African-Americans compared with white, Asian, and Hispanic population,[27] which can be attributed to the socioeconomic factors and genetic factors.[28,13]

At the beginning of the study, black patients showed higher levels of total cholesterol and HDL but lower levels of triglycerides; this finding is similar to that of the NHANES, which showed that African-Americans had higher levels of HDL and lower levels of triglycerides compared to Caucasians and Mexican Hispanics.[29]

Black people tend to have lower levels of vitamin D; in our study, these levels remained low among the black population at the end of the study. In addition to genetic factors, this could be attributed to the difficulty associated with acquiring medications that are not included in the official list provided by SUS, such as vitamin D supplements. PTHi levels were also higher in this group, which may be related to low levels of vitamin D.

The fasting blood sugar levels for the 37.8% diabetic individuals improved at the end of the study, which was contradictory to the findings of the ELSA-Brazil study,[31] where black individuals had worse glycaemic control.

The medications provided by SUS and prescribed by healthcare professionals were similar among all racial groups, which is inconsistent with the data obtained from the National Health Survey published in 2018;[32] the aforementioned study included the general population and not a population selected from a secondary clinic. It is worth noting that SUS provides a therapeutic arsenal to combat NCDs; among the drugs offered to patients in

our sample, the prevalence of ACE inhibitor and diuretic use was higher among black patients. Since the eGFR was similar among the three racial groups, it is possible to infer that ACE inhibitors are frequently used by black patients because of the high prevalence of hypertension among this population. The same reasoning can explain the high rate of diuretics use; diuretics help to maintain volume control, which is the main cause of hypertension in CKD patients, and an important factor for disease progression.

The mean eGFR was assessed at the beginning and end of the study, and no differences were found between racial groups. In the literature, the main risk factors for CKD progression are age, sex, diabetes, hypertension, anaemia, metabolic-related complications, obesity, and smoking.[33] A strong association between socioeconomic level, race/skin colour, and CKD was also observed in African-Americans.[34] Thus, CKD progression is marked by an interaction between sociodemographic, clinical, environmental, and genetic factors.[35] Another important risk factor of CKD progression is the presence of proteinuria, which can cause renal damage; its reduction can be achieved by the use of ACE inhibitors and is related to the stabilisation of eGFR.[36] In this study, low proteinuria and the use of ACE inhibitors were the only variables that were protective factors for reduced renal function in CKD.

According to the Institute for Applied Economic Research (IPEA), in 2008, the black population represented 67% of the total public served by SUS, and the white 47.2%. Most calls focuses on users with an income range between a quarter and a half minimum wage, distributions that show that the population of more low income and the black population are, in fact, SUS-dependent.[37] In our study, although black patients showed a worse socioeconomic profile at the beginning of the study, these factors did not affect the outcome. The clinical implication of our study is that the interventions implemented in the HIPERDIA outpatient clinic were able to delay the progression of the disease in a similar way among different risk groups, with better outcomes being related to the use of ACE inhibitors and low proteinuria. Ethnicity did not impact CKD progression, even though black patients presented clinical and sociodemographic characteristics associated with worse disease progression.

ACKNOWLEDGEMENTS

The Minas Gerais Institute of Teaching and Research in Nephrology Foundation (IMEPEN), to the Interdisciplinary Center for Teaching and Research in Nephrology (NIEPEN), Federal University of Juiz de Fora, Juiz de Fora (UFJF), Brazil.

To all patients attended at the Minas Gerais Institute of Teaching and Research in Nephrology Foundation (IMEPEN).

CONFLICT OF INTEREST

None of the authors has any conflict of interest.

FUNDING

Coordination for the Improvement of Higher Education Personnel (CAPES) of the Brazil.

REFERENCES

1. Fleury S, Carvalho A. INAMPS. Rio de Janeiro: Fundação Getúlio Vargas; 1998. [citado em 2020 jul 14]. Acessado em: <http://www.fgv.br/cpdoc/acervo/dicionarios/verbete-tematico/instituto-nacional-de-assistencia-medica-da-previdencia-social-inamps>.

2. Castro MC, Massuda A, Almeida G, Menezes-Filho NA, Andrade MV, Noronha KVMS et al. Brazil's unified health system: the first 30 years and prospects for the future. The Lancet. 2019; 394:345-56. http://dx.doi.org/10.1016/S0140-6736(19)31243-7

3. Instituto Brasileiro de Geografia E Estatística (BR). Desigualdades sociais por cor ou raça no Brasil.

4. Instituto de Pesquisa Econômica Aplicada (BR). Atlas da violência. [citado em 2020 jul 16]. Acessado em: <https://www.ipea.gov.br/atlasviolencia/filtros-series/3/violencia-por-raca-e-genero>.

5. Leal MC, Gama SGN, Pereira APE, Pacheco VE, Carmo CN, Santos RV. A cor da dor: iniquidades raciais na atenção pré-natal e ao parto no Brasil. Cad Saúde Pública. 2017; 33 Sup 1:e00078816. doi: 10.1590/0102-311X00078816

6. Ministério da Saúde (BR). Secretaria de Vigilância em Saúde. Indicadores de vigilância em saúde descritos segundo a variável raça/cor, Brasil. Brasília: Ministério da Saúde; 2017.

7. Ministério da Saúde (BR). Manual de doenças mais importantes, por razões étnicas, na população brasileira afro-descendente. Brasília: 2001. [citado em 2020 jul 17]. Acessado em: <http://bvsms.saude.gov.br/bvs/publicacoes/cd06_09.pdf>.

8. Bello AK, Levin A, Lunney M, Osman MA, Ye F, Ashuntantang G et al. Global kidney health atlas: a report by the International Society of Nephrology on the Global Burden of End-stage Kidney Disease and Capacity for Kidney Replacement Therapy and Conservative Care across world countries and regions. Brussels: International Society of Nephrology; 2019.

9. Piccolli AP, Nascimento MM, Riella MC. Prevalence of chronic kidney disease in a population in southern Brazil (pro-renal

study). J Bras Nefrol. 2017; 39(4):384-90. 10.5935/0101-2800.20170070

10. Nascimento MM, Riella M. Raising awareness of chronic kidney disease in a Brazilian urban population. Braz J Med Biol Res. 2009; 42(8):750-5. http://dx.doi.org/10.1590/S0100-879X2009000800010.

11. Bastos RMR, Bastos MG, Ribeiro LC, Bastos RV, Teixeira MTB. Prevalence of chronic kidney disease, stages 3, 4 and 5 in adults. Rev Assoc Med Bras. 2009; 55(1):40-4. PMid:19360276.

12. Sociedade Brasileira de Nefrologia (BR). Censo da Sociedade Brasileira de Nefrologia 2019. [citado em 2020 jul 16]. Acessado em: <https://www.sbn.org.br/>.

13. Dummer PD, Limou S, Rosenberg AZ, Heymann J, Nelson G, Winkler CA et al. APOL1 kidney disease risk variants: an evolving landscape. Semin Nephrol. 2015; 35(3):222-36. doi: 10.1016/j.semnephrol.2015.04.008

14. Hounkpatin HO, Fraser SDS, Honney R, Dreyer G, Brettle A, Roderick PJ. Ethnic minority disparities in progression and mortality of pre-dialysis chronic kidney disease: a systematic scoping review. BMC Nephrology. 2020; 21:217. https://doi.org/10.1186/s12882-020-01852-3

15. Scliar M. História do conceito de saúde. PHYSIS: Rev Saúde Coletiva. 2007; 17(1):29-41.

16. Levin A, Lewis M, Mortiboy P, Faber S, Hare I, Porter EC et al. Multidisciplinary predialysis programs: quantification and limitations of their impact on patient outcomes in two Canadian settings. Am J Kidney Dis. 1997; 29:533-40. 10.1016/s0272-6386(97)90334-6

17. Pereira AC, Carminatti M, Fernandes NMS, Tirapani L dos S, Faria R de S, Gricenkov F et al. Associação entre fatores de risco clínicos e laboratoriais e progressão da doença renal crônica pré-dialítica. Jornal Brasileiro de Nefrologia. 2012; 34:68-75. https://doi.org/10.1590/S0101-28002012000100011

18. Tirapani LS, Pinheiro HS, Mansur HN, Oliveira D, Huaira RMNH, Huaira CC et al. Impacto da vulnerabilidade social nos desfechos de pacientes com doença renal crônica pré-dialítica em um centro interdisciplinar. J Bras Nefrol. 2015; 37(1):19-26. 10.5935/0101-2800.20150004

19. Levey AS, Stevens LA, Schmid CH, Zhang YL, Castro AF, Feldman HI et al. CKD-EPI (chronic kidney disease epidemiology collaboration): a new equation to estimate glomerular filtration rate. Ann Intern Med. 2009; 150:604-12.

20. Bastos MG, Kirsztajn GM. Doença renal crônica: importância do diagnóstico precoce, encaminhamento imediato e abordagem interdisciplinar estruturada para melhora do desfecho em pacientes ainda não submetidos à diálise. J Bras Nefrol. 2011; 33(1):74-87.

21. Instituto Brasileiro de Geografia E Estatística (BR). Pesquisa Nacional por Amostra de Domicílios Contínua Anual (PNAD Contínua) 2019. [citado em 2020 jul 18]. Acessado em: <https://sidra.ibge.gov.br/tabela/6408#notas-tabela>.

22. Instituto Brasileiro de Geografia E Estatística (BR). Pesquisa Nacional por Amostra de Domicílios (PNAD 2004 a 2014). [citado em 2020 jul 17]. Acessado em: <http://tabnet.datasus.gov.br/cgi/tabcgi.exe?pnad/cnv/pnadc.def>.

23. Hill JJ. Obesity: an emerging threat. J Natl Black Nurses Assoc. 2018; 29(2):36-9. PMID: 31022338

24. Olivo RE, Davenport CA, Diamantidis CJ, Bhavsar NA, Tyson CC, Hall R et al. Obesity and synergistic risk factors for chronic kidney disease in African American adults: the Jackson Heart Study. Nephrol Dial Transplant. 2018; 33:992-1001 doi: 10.1093/ndt/gfx230

25. Moretto MC, Fontaine AM, Garcia CAMS, Neri AL, Guariento ME. Associação entre cor/raça, obesidade e diabetes em idosas da comunidade: dados do estudo FIBRA. Cad Saúde Pública; 2016; 32(10):e00081315

26. Chor D, Ribeiro ALP, Carvalho MS, Duncan BB, Lotufo PA, Nobre AA et al. Prevalence, awareness, treatment and influence of socioeconomic variables on control of high blood pressure: results of the ELSA-Brasil study. PLoS ONE. 2015; 10(6):e0127382. doi:10.1371/journal.pone.0127382

27. Yoon SS, Fryar CD, Carroll MD. Hypertension prevalence and control among adults: United States, 2011-2014. United States of America: Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics (NCHS) Data Brief; 2015.

28. Song AY, Crews DC, Ephraim PL, Han D, Greer RC, Boyér LPL et al. Sociodemographic and kidney disease correlates of nutrient intakes among urban African Americans with uncontrolled hypertension. J Ren Nutr. 2019; Sep;29(5):399-406. 10.1053/j.jrn.2018.12.004. Epub 2019 Jan 29.

29. Pu J, Romanelli R, Zhao B, Azar KMJ, Hastings KG, Nimbal V et al. Dyslipidemia in special ethnic populations. Cardiol Clin. 2015; 33(2):325-33. doi:10.1016/j.ccl.2015.01.005.

30. Herrick KA, Storandt RJ, Afful J, Pfeiffer CM, Schleicher RL, Gahche JJ et al. Vitamin D status in the United States, 2011-2014. Am J Clin Nutr. 2019; 110(1): 150-7. doi:10.1093/ajcn/nqz037.

31. Moraes HAB, Mengue SS, Molina MCB, Cade NV. Fatores associados ao controle glicêmico em amostra de indivíduos com diabetes mellitus do estudo longitudinal de saúde do adulto, Brasil, 2008 a 2010. Epidemiol Serv Saude 2020; 29(3):e2018500.

https://doi.org/10.5123/s1679-49742020000300017

32. Drummond ED, Simões TC, Andrade FB. Acesso da população brasileira adulta a medicamentos prescritos. Rev Bras Epidemiol. 2018; 21:1-14. https://doi.org/10.1590/1980-549720180007

33. International Society of Nephrology. KDIGO clinical practice guideline for acute kidney injury. Kidney International Supplements. 2012; 2(1):1-138. doi:10.1038/kisup.2012.2

34. Crews DC, Charles RF, Evans MK, Zonderman, Powe NR. Poverty, race, and CKD in a racially and socioeconomically diverse urban population. Am J Kidney Dis. 2010; 55(6):992-1000. 10.1053/j.ajkd.2009.12.032. Epub 2010 Mar 6.

35. Norris K, Nissenson AR. Race, gender, and socioeconomic disparities in CKD in the United States. J Am Soc Nephrol. 2008; 19(7):1261-70. 10.1681/ASN.2008030276. Epub 2008 Jun 4.

36. Levey AS, de Jong PE, Coresh J, Nahas MEI, Astor BC, Kunihiro M et al. The definition, classification, and prognosis of chronic kidney disease: a KDIGO Controversies Conference report. Kidney International. 2011; 80(1);17-28 10.1038/ki.2010.483.

37. Ministério da Saúde (BR). Secretaria de Gestão Estratégica e Participativa. Departamento de Apoio à Gestão Participativa e ao Controle Social. Política Nacional de Saúde Integral da População Negra : uma política para o SUS. 3. ed. Brasília: Ministério da Saúde; 2017.