The association between skin color/race and health indicators in elderly Brazilians: a study based on the *Brazilian National Household Sample Survey* (2008)

Associação da cor/raça aos indicadores de saúde para idosos no Brasil: um estudo baseado na *Pesquisa Nacional por Amostra de Domicílios* (2008)

Asociación de raza/color con los indicadores de salud para ancianos en Brasil: un estudio basado en el *Estudio Nacional por Muestra de Domicilios* (2008)

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Abstract

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This study analyzed racial inequalities in health in 18,684 elderly Brazilians 65 years or older, interviewed in the National Household Sample Survey *in 2008 (PNAD 2008), and who reported their color/race as white, brown, or black. Associations were estimated between self-rated health status, functional incapacity, and number of chronic conditions according to crude and adjusted regression analyses (α = 0.01). The majority of the elderly were white (56.2%). In the adjusted analysis, brown color/races was associated with worse self-rated health status (OR = 1.11; 95%CI: 1.03-1.18) and black color/race was associated with more chronic diseases (PR = 1.07; 95%CI: 1.02-1.13). Brown color/race appeared as a protective factor against functional incapacity. When brown and black elderly were combined in one category ("black"), "black" elderly continued to show worse self-rated health status (OR = 1.09; 95%CI: 1.02-1.16) and lower odds of functional incapacity (OR = 0.83; 95%CI: 0.76-0.92). "Black" color/race lost the association with number of chronic diseases. Color/race explained part of the health inequalities in elderly Brazilians, but other socioeconomic variables had a more striking effect.*

Ethnicity and Health; Health Inequalities; Aged

Resumo

Analisaram-se as desigualdades raciais na saúde de 18.684 idosos brasileiros com 65 anos ou mais, incluídos na Pesquisa Nacional por Amostra de Domicílios *2008 (PNAD 2008), que autorreferiram sua cor/raça como branca, parda ou preta. Estimaram-se associações da cor/raça com autoavaliação do estado de saúde, incapacidade funcional e com o número de doenças crônicas em análises de regressão brutas e ajustadas (α = 0,01). Predominaram idosos brancos (56,2%). Na análise ajustada, a cor/raça parda associou-se positivamente com pior estado de saúde autorreferido (RC = 1,11; IC95%: 1,03-1,18) e a preta com o maior número de doenças crônicas (RP = 1,07; IC95%: 1,02-1,13). A cor/raça parda foi fator protetor para incapacidade funcional. Unindo-se pardos e pretos (negros), manteve-se a maior chance de os negros autorreferirem pior estado de saúde (RC = 1,09; IC95%: 1,02-1,16) e menor chance de incapacidade funcional (RC = 0,83; IC95%: 0,76-0,92). A cor/raça negra perdeu associação com o número de doenças crônicas. A cor/raça explicou parte das desigualdades em saúde dos idosos, mas outras variáveis socioeconômicas tiveram efeito mais marcante.*

Origem Étnica e Saúde; Desigualdades em Saúde; Idoso

Introduction

The racial composition of the growing Brazilian elderly population has changed in recent years [1]. In the first decade of the 21st century, the Brazilian population 65 years or older increased by 29.5%, from 9.9 million (5.8%) in 2000 to 14.0 million (7.4%) in 2010 [1]. In 2000, the white elderly population (61.7%) predominated over brown elderly (29.5%) and black elderly (6.9%), while by 2010 the proportion of white elderly had decreased (56.8%), with an increase in browns (33.8%) and blacks (7.7%) [1].

However, recent economic, political, and health changes in the country [2] have failed to eliminate the inequalities in living and health conditions between racial groups among elderly Brazilians [2,3]. The impact of these changes has not been uniform [4]. The presence of racial inequalities among the elderly suggests the complex interaction between color/race and markers of social position [5,6] and reflects the unequal distribution of risk factors, protective factors, and health problems that accumulate over the course of various life cycles and into old age [6,7]. Brown and black elderly thus continue to experience lack of equality, worse socioeconomic situations [2,8], and greater health needs [9].

Although various studies indicate that the aging process does not occur homogeneously between persons of different social and racial gradients [2,4,8,9,10,11], doubts persist as to whether health inequalities can be attributed directly to color/race, independently of individual and contextual socioeconomic inequalities [3,11,12,13].

Worldwide, health status assessment in the elderly is frequently based on indicators of health conditions and physical mobility and autonomy [6,9,10,14,15]. The most widely used indicators include global self-related health status, number of chronic diseases or conditions, and functional capacity [6,9,14,15]. The first indicates elders' subjective and integrated dimensions of their own health. Functional status reveals the functional dimension of performing daily tasks, and number of chronic diseases represents the medical and objective dimension of the presence of deviations from normal physiological function [9,16,17].

The association between brown and black color/race and worse health conditions and functional decline in elderly Brazilians has received little research attention [7,9,12], and the results of this association are controversial and conflicting [15,16]. This has limited the current understanding of the impacts of racial inequalities in this phase of life [7,12]. In Brazil, various studies based on data from the *National Household Sample Survey* (PNAD) have explored the influence of gender, income, schooling, age bracket, and social housing context on the health of elderly [14,18,19], but the association between health-disease and functional incapacity indicators and the color/race variable has not been explored [1,19].

This study aimed to analyze the associations between color/race and health indicators in elderly Brazilians, using data from the health supplement of PNAD for 2008.

Methods

This cross-sectional study analyzed the relationship between color/race and health indicators in elderly Brazilians included in the PNAD database [20], conducted in 2008 by the Brazilian Institute of Geography and Statistics (IBGE).

PNAD is a nationwide population-based household survey that aims to obtain representative information on the Brazilian population concerning socio-demographic, educational, housing, work, and income characteristics. The 2008 edition included a health supplement with information on the sample's health conditions and physical mobility [20].

The PNAD uses a complex probabilistic sample of households from all regions of Brazil, obtained in three selection stages [20]. The first stage involves the selection of municipalities (counties), which are classified as self-representative, with 100% probability of belonging to the sample, and non-self-representative, where the probability of belonging to the sample is proportional to the resident population. In the second stage, census tracts are selected, where the probability of inclusion is proportional to the number of households in the tract. In the last stage, households are sampled in each census tract, collecting information on the households and all their individual residents [20].

The data covered 391,868 persons and 150,591 households distributed in all States of Brazil. This analysis used the elderly population 65 years or older (n = 28,437). The inclusion criterion was self-reported color/race [1,20,21], removing the elderly whose color/race was reported by third parties in order to reduce the odds of information and classification bias in this variable and prevalence bias in the target racial groups [1,3]. After removing the elderly whose color/race was reported by others (n = 8,752), "yellow" color/race (i.e., Asian or Asian-descent) (n = 153), indigenous (n = 69), missing (n = 15), and those with no information on per capita family income (n = 764), the final study population included 18,684 elderly.

Study variables

The study outcomes were two health indicators – global self-rated health (GSRH) and number of chronic diseases and conditions – and an indicator of physical mobility and autonomy – functional capacity.

GSRH has five response categories: very good, good, fair, bad, and very bad. The number of chronic diseases and conditions was calculated by adding all those included in the PNAD: arthritis/rheumatism, cancer, diabetes, hypertension, depression, spinal column disease/back pain, bronchitis/asthma, tuberculosis, heart disease, chronic kidney disease, cirrhosis, and tendinitis/tenosynovitis.

Functional incapacity was defined as the degree of difficulty in performing the activity of daily living (ADL) "eating, bathing, and toileting". In the PNAD, this indicator has four categories: no difficulty, major difficulty, minor difficulty, and unable to perform. In the current study, this indicator was organized in three categories; none, some (combining minor and major difficulty), and total functional incapacity.

The main explanatory variable was self-reported color/race of the elderly, categorized as white, black, and brown. In the PNAD, interviewees are asked to report their skin color as a proxy for race. The color/race item thus shows which which racial group the individuals identify [3,22].

For this study, the socioeconomic, demographic, and health covariates were: sex (male or female); age (in complete years grouped in three age brackets: 65 to 69, 70 to 79, and ≥ 80 years); schooling (in years, grouped in three strata: 0, 1 to 8, and ≥ 9 years of schooling); workforce status in the reference week (in the workforce versus not in the workforce); role in the family (in three categories: reference person, spouse, and other); number of residents in the household (grouped in three categories: 1, 2, and ≥ 3 persons); location of the household (urban versus rural); major geographic region of Brazil, in five categories (North, Northeast, Central, Southeast, and South); private health plan (yes or no), and per capita household income quintile [in five strata: 1st (lowest), 2nd, 3rd, 4th, and 5th (lowest)], where median income was R$: 207.00 in the 1st quintile and R$ 1,572.00 in the 5th quintile.

Analysis

The study estimated prevalence rates and 95% confidence intervals (95%CI) for the socioeconomic, demographic, and health variables according to color/race, considering the sampling design.

Differences in distribution of socioeconomic, demographic, and health variables in the color/race categories were estimated by the Pearson chi-square test.

Two final regression models were constructed for each outcome. First, color/race was divided into three categories: white, brown, and black. The associations were then tested by combining brown and black into one category ("blacks").

To estimate the associations between color/race and the outcomes self-rated health status and functional incapacity, ordinal logistic regression analyses (proportional odds type model) were used to obtain odds ratios (OR) and respective 95%CI [23,24]. For the number of chronic conditions, prevalence ratios (PR) and 95%CI were estimated by Poisson regression. The proportional odds type model of ordinal logistic regression was used because the model considers the ordinal polychotomous nature of the study outcome and indicates the likelihood or accumulated odds ratio between the ordinal outcome categories [23,24]. Meanwhile, Poisson regression models have been used as a good alternative for obtaining adequate PR estimates, even in cross-sectional studies, when the outcome is frequent [25,26].

Variables associated with the outcome with p < 0.20 were selected as potential confounders. Only the variables with p < 0.01 were kept in the multivariate model.

All the analyses used Stata version 10.0 (Stata Corp., College Station, USA), with the *svy* command (with weighting factors, strata, and primary sampling units) which incorporates the effect of the complex sampling design [21] in PNAD 2008 in the analyses. The Wald t test was used to test the models' fit. For the number of chronic conditions, the determination coefficient was estimated (pseudo R2). For the other outcomes, the observed and estimated values were compared for the outcome categories, calculating the percentage of agreement.

Results

Among the 18,684 elderly in this study, median age was 72 years (68-77). Some 56.2% (95%CI: 55.1-57.2) of the elderly identified themselves as white, 36.3% as brown (95%CI: 35.3-37.3), and 7.5% as black (95%CI: 7.1-8.0). Among the elderly analyzed, 7.5% (95%CI: 7.0-8.0) rated their health status as very good, 74.4% (95%CI: 73.7-75.2) had at least one chronic disease, and 14.9% (95%CI: 14.2-15.6) reported functional incapacity.

For the three racial groups, all the socioeconomic, demographic, and health variables

showed statistically significant differences (p < 0.001), considering design effect (Table 1).

Women predominated in the three racial groups. Some 40.6% of the brown elderly and 38.1% of the blacks were young elderly (65-69 years) and 17.1% of the whites were among the oldest old (≥ 80 years). Some 50.8% of the brown elderly and 50.6% of the black elderly had no schooling. Only 7.4% of the brown elderly and 7.2% of the blacks reported ≥ 9 years of schooling. The data showed that 27.9% of the brown elderly, 25% of the blacks, and 12.6% of the whites belonged to the lowest income quintile. Some 30% of the white elderly belonged to the highest income quintile, compared to 10.2% of the browns and 8.8% of blacks. The proportion of elderly in the country's rural area was higher among browns (24.9%) and lower among whites (14.5%). Nearly 77% of the white elderly lived in the South and Southeast of Brazil, while 55% of the brown elderly and 37% of the blacks lived in the North and Northeast. Exclusive reliance on the Brazilian Unified National Health System (SUS) included 85% of the black elderly, 83.8% of the browns, and 62.7% of the whites (Table 1).

Self-rated health status in elderly Brazilians differed significantly in the racial groups analyzed here (p < 0.001). Prevalence of very good self-rated health was higher among whites, while bad and very bad self-rated health was higher in browns and blacks (Table 1).

Very good self-rated health in elderly Brazilians in 2008 was also more common in women, elders in the workforce, reference persons in the

Table 1

Socioeconomic, demographic, and health characteristics of Brazilian elderly ≥ 65 years (N = 18,684) that reported their own color/race. *National Household Sample Survey* (PNAD), 2008.

Variables	White (n = 9,825) Total [% * (95%CI)]	Brown (n = 7,384) Total [% * (95%CI)]	Black (n = 1,475) Total [% * (95%CI)]	p-value (χ^2)
Sex				
Male	39.0 (38.1-39.9)	42.5 (41.3-43.8)	38.0 (35.5-40.6)	0.0001
Female	61.0 (60.1-61.9)	57.5 (56.2-58.7)	62.0 (59.4-64.5)	
Age bracket (years)				
65-69	35.4 (34.4-36.5)	40.6 (39.3-41.9)	38.1 (35.5-40.7)	0.0001
70-79	47.5 (46.4-48.6)	45.5 (44.3-46.8)	45.6 (42.8-48.3)	
≥ 80	17.1 (16.2-18.0)	13.9 (13.0-14.8)	16.3 (14.3-18.6)	
Schooling (years)				
0	25.6 (24.5-26.8)	50.8 (49.3-52.3)	50.6 (47.8-53.4)	0.0001
1-8	55.2 (54.0-56.4)	41.8 (40.4-43.3)	42.2 (39.4-45.1)	
≥9	19.2 (18.1-20.3)	7.4 (6.7-8.1)	7.2 (5.8-8.7)	
Household income quintile				
1st (lowest)	12.6 (11.8-13.4)	27.9 (26.6-29.2)	25.0 (22.8-27.5)	0.0001
2nd	23.2 (22.2-24.3)	31.6 (30.3-32.9)	32.4 (29.7-35.1)	
3rd	11.9 (11.2-12.7)	13.7 (12.8-14.7)	16.9 (14.7-19.4)	
4th	23.6 (22.6-24.6)	16.6 (15.6-17.6)	16.9 (14.7-19.2)	
5th (highest)	28.7 (27.4-30.1)	10.2 (9.4-11.1)	8.8 (7.3-10.5)	
Workforce status				
In the workforce	20.9 (19.9-21.9)	26.3 (24.9-27.7)	22.1 (19.8-24.5)	0.0001
Not in the workforce	79.1 (78.1-80.1)	73.7 (72.2-75.1)	77.9 (75.5-80.2)	
Role in family				
Reference person	71.2 (70.3-72.0)	72.3 (71.2-73.3)	74.6 (72.2-76.8)	0.0008
Spouse	21.1 (20.3-21.9)	19.8 (18.9-20.7)	16.3 (14.3-18.4)	
Other	7.7 (7.2-8.4)	7.9 (7.2-8.6)	9.1 (7.7-10.9)	

(continues)

Table 1 (continued)

Variables	White (n = 9,825) Total [% * (95%CI)]	Brown (n = 7,384) Total [% * (95%CI)]	Black (n = 1,475) Total [% * (95%CI)]	p-value (χ²)
Number of residents in household				
1	21.9 (21.0-22.8)	18.2 (17.2-19.3)	22.9 (20.6-25.4)	0.0001
2	42.4 (41.1-43.6)	31.1 (29.7-32.4)	33.1 (30.3-35.9)	
≥ 3	35.7 (34.6-36.9)	50.7 (49.2-52.2)	44.0 (41.3-46.9)	
Household location				
Urban	85.5 (84.2-86.7)	75.1(73.2-76.9)	81.0 (78.6-83.2)	0.0001
Rural	14.5 (13.3-15.8)	24.9 (23.1-26.8)	19.0 (16.8-21.4)	
Region of Brazil				
North	2.2 (1.9-2.5)	9.5 (8.7-10.4)	4.4 (3.8-5.1)	0.0001
Northeast	15.9 (15.0-16.8)	45.5 (43.8-47.0)	32.6 (30.8-34.5)	
Central	5.1 (4.7-5.6)	7.4 (6.9-8.0)	6.8 (6.1-7.6)	
Southeast	52.5 (51.3-53.7)	31.4 (30.0-32.8)	49.0 (47.2-50.8)	
South	24.3 (23.2-25.3)	6.2 (5.6-6.9)	7.2 (6.5-7.9)	
Private health plan				
No	62.7 (61.3-64.1)	83.8 (82.7-84.8)	85.0 (82.8-86.9)	0.0001
Yes	37.3 (35.9-38.7)	16.2 (15.2-17.3)	15.0 (13.1-17.2)	
Self-rated health status				
Very good	9.3 (8.6-10.0)	5.1 (4.6-5.7)	5.6 (4.4-7.2)	0.0001
Good	37.8 (36.7-38.9)	30.9 (29.7-32.1)	34.7 (31.9-37.6)	
Fair	40.9 (39.8-42.1)	48.7 (47.3-50.0)	43.4 (40.4-46.5)	
Bad	9.5 (8.9-10.2)	12.1 (11.2-13.0)	12.3 (10.6-14.3)	
Very bad	2.5 (2.1-2.8)	3.2 (2.8-3.8)	4.0 (3.0-5.2)	
Number of chronic conditions				
0	25.1 (24.0-26.1)	27.1 (26.0-28.4)	21.4 (19.4-23.7)	0.0001
1	31.6 (30.6-32.7)	33.1 (31.9-34.2)	34.3 (31.9-36.8)	
2	23.5 (22.5-24.5)	23.4 (22.3-24.4)	24.4 (22.1-26.8)	
≥ 3	19.8 (18.9-20.8)	16.4 (15.4-17.4)	19.9 (17.7-22.2)	
Functional incapacity (in activities of daily living)				
None	85.3 (84.4-86.1)	85.5 (84.5-86.4)	82.1 (79.8-84.2)	0.0175
Some	13.8 (13.0-14.6)	13.3 (12.5-14.3)	17.0 (14.9-19.3)	
Total	0.9 (0.8-1.2)	1.2 (0.9-1.5)	0.9 (0.5-1.6)	

95%CI: 95% confidence interval.

* Estimates for all elderly whites, all elderly browns, and all elderly blacks, respectively.

household, those with private health plans, residents of urban areas, and those from the South and Southeast. Very good self-rated health decreased with age and with the number of household members, while increasing with income and schooling (Table 2).

In the crude analysis, brown and black elderly had higher odds of worse self-rated health. The odds of bad self-rated health were 54% greater in browns (OR = 1.54; 95%CI: 1.44-1.64) and 39% greater in blacks (OR = 1.39; 95%CI: 1.24-1.57) than in whites. After adjusting for confounding, the odds ratios were attenuated, but brown color/race remained directly associated with the odds of very bad self-reported health. Brown elderly had 11% higher odds of worse self-reported health (OR = 1.11; 95%CI: 1.03-1.18) than whites (Table 2).

Prevalence of chronic conditions in elderly Brazilians differed significantly between racial

Table 2

Prevalence and odds ratios for very good, good, fair, bad, and very bad self-rated health in Brazilian elderly ≥ 65 years (N = 18,684) that reported their own color/race. *National Household Sample Survey* (PNAD), 2008.

Variables	%					Crude analysis	Adjusted analysis
	Very good	Good	Fair	Bad	Very bad	OR (95%CI)	OR (95%CI)
Color/Race							
White	9.3	37.8	40.9	9.5	2.5	1.00	1.00
Brown	5.1	30.9	48.7	12.1	3.2	1.54 (1.44-1.64) *	1.11 (1.03-1.18) *
Black	5.6	34.7	43.4	12.3	4.0	1.39 (1.24-1.57) *	1.04 (0.92-1.17)
Sex							
Female	7.5	35.8	43.5	10.4	2.8	1.00	1.00
Male	7.4	34.0	44.6	11.0	3.0	1.07 (1.01-1.13) **	1.25 (1.16-1.33) *
Age bracket (years)							
65-69	8.1	38.0	42.6	8.8	2.5	1.00	1.00
70-79	7.2	33.8	45.2	10.9	2.9	1.22 (1.14-1.30)	1.15 (1.08-1.23) *
≥ 80	6.9	31.9	43.5	14.1	3.6	1.41 (1.29-1.55) *	1.27 (1.15-1.39) *
Schooling (years)							
≥ 9	18.4	47.3	29.2	4.3	0.8	1.00	1.00
1-8	7.0	36.4	45.0	8.8	2.8	2.62 (2.38-2.89) *	1.93 (1.73-2.14) *
0	4.0	28.5	48.1	15.7	3.7	4.36 (3.92-4.84) *	2.56 (2.26-2.89) *
Workforce status							
In the workforce	9.7	38.4	43.0	7.6	1.3	1.00	1.00
Not in the workforce	6.8	34.1	44.2	11.6	3.3	1.43 (1.34-1.53) *	1.55 (1.44-1.66) *
Household income quintile							
1st (lowest)	3.4	28.9	49.1	14.7	3.9	1.00	1.00
2nd	4.5	29.8	47.6	14.0	4.1	0.93 (0.85-1.01)	0.97 (0.89-1.05)
3rd	5.9	33.4	47.2	11.2	2.3	0.71 (0.64-0.79) *	0.84 (0.76-0.94) *
4th	7.5	39.7	42.1	8.3	2.4	0.53 (0.48-0.58) *	0.70 (0.64-0.77) *
5th (highest)	16.3	44.1	34.0	4.5	1.1	0.28 (0.26-0.31) *	0.51 (0.45-0.58) *
Role in family							
Reference person	8.1	35.5	43.5	10.1	2.8	1.00	1.00
Spouse	6.0	33.2	46.1	11.8	2.9	1.20 (1.12-1.29) *	1.30 (1.20-1.41) *
Other	6.4	35.5	42.6	12.4	3.1	1.13 (1.01-1.26) *	1.03 (0.91-1.15)
Number of residents in household							
1	9.4	37.0	41.2	9.6	2.8	1.00	-
2	7.4	35.4	43.9	10.6	2.7	1.15 (1.06-1.26) *	-
≥ 3	6.7	33.7	45.3	11.2	3.1	1.28 (1.18-1.38) *	-
Household location							
Urban	8.2	35.9	42.7	10.2	3.0	1.00	-
Rural	4.3	31.4	49.5	12.7	2.1	1.36 (1.25-1.47) *	-
Region of Brazil							
North	4.4	30.1	50.4	12.7	2.4	1.00	1.00
Northeast	4.8	29.5	48.2	14.1	3.4	1.06 (0.95-1.19)	1.03 (0.91-1.17)
Central	7.3	33.3	45.3	11.7	2.4	0.81 (0.71-0.92) **	0.93 (0.80-1.07)
Southeast	9.4	38.4	40.8	8.6	2.8	0.61 (0.54-0.68) *	0.80 (0.70-0.90) *
South	7.9	37.6	42.6	9.3	2.6	0.67 (0.59-0.76) *	0.88 (0.76-1.02)
Private health plan							
Yes	12.2	41.6	37.7	6.5	2.0	1.00	1.00
No	5.7	32.5	46.3	12.3	3.2	1.95 (1.81-2.10) *	1.09 (1.01-1.20) **

95%CI: 95% confidence interval; OR: odds ratio.

* p-value ≤ 0.001;

** p-value ≤ 0.05.

groups (p < 0.001) (Table 1). Prevalence was higher in blacks (78.6%; 95%CI: 76.4-80.6) than whites (74.9%; 95%CI: 73.9-76.0) and browns (72.9%; 95%CI: 71.6-74.0) (Table 3). It was higher in women, elders outside the workforce, with less schooling, spouses, urban residents, in the South and Southeast, and those with private health plans. Prevalence of chronic diseases increased directly with age and household income and decreased with number of household members. In the crude analysis, black color/race did not differ significantly (p = 0.266) and brown color/race was inversely associated with the outcome, with 8% lower prevalence of chronic diseases than whites (PR = 0.92; 95%CI: 0.89-0.95). After adjusting for confounding, black elderly showed 7% higher prevalence of chronic diseases than whites (PR = 1.07; 95%CI: 1.02-1.13) (Table 3).

Prevalence rates of functional incapacity in elderly Brazilians differed significantly between racial groups (p = 0.0175). Prevalence of any functional incapacity was greater in black elderly (17%) than in whites (13.8%) and browns (13.3%) (Table 1).

Prevalence of preserved functional status in elderly Brazilians in 2008 was higher in men, elders in the workforce, spouses, urban residents, in the Southeast region, and in those with private health plans. The proportion of preserved functional capacity decreased with schooling and with increasing age, while increasing with household income. In the crude analysis, the odds of elderly rating their functional status in the functional decline categories were directly associated with black color/race (p < 0.001). The odds of functional decline were 26% greater in black elderly than in whites (OR = 1.26; 95%CI: 1.07-1.47). There was no significant difference for browns as compared to whites (p = 0.741). After adjusting for confounding, the odds ratio for black color/race changed and lost the association with worse functional status (OR = 0.97; 95%CI: 0.82-1.15). Brown elders showed 20% lower likelihood (OR = 0.80; 95%CI: 0.73-0.89) of evolving on the functional incapacity scales when compared to whites (Table 4).

When analyzing the black and brown categories jointly (hereinafter designated as "black", i.e., in quotes), there was a loss of statistically significant difference in prevalence rates for functional incapacity between whites and the combined "black" category (p = 0.612). For the other outcomes, the same p-value remained (< 0.001).

The crude analysis showed that the odds of "black" elders reporting worse self-rated health were 51% greater (OR = 1.51; 95%CI: 1.42-1.61) than for whites. In the adjusted analysis, these odds were attenuated to 9% (OR = 1.09; 95%CI: 1.02-1.16). For the number of chronic conditions, "black" color/race showed a protective effect, with 6% lower prevalence (PR = 0.94; 95%CI: 0.91-0.97) than in whites. In the adjusted analysis, there was no statistically significant association with the outcome (p = 0.132). For functional incapacity, only the adjusted analysis showed an association with "black" color/race: the odds of "blacks" reporting functional decline were 17% lower than for whites (Table 5).

All the models showed good fit (p < 0.001). However, for number of chronic conditions, the model explained 5.6% of the variance in the outcome when two or three racial categories were used. For self-rated health status and functional incapacity, agreement between the observed and predicted values was 27.9% and 52.4%, respectively, independently of considering two or three racial categories.

Discussion

The results of this analysis suggest the presence of racial inequalities in health and socioeconomic and demographic conditions in elderly Brazilians ≥ 65 years in 2008. Brown and black elderly compared to white elderly predominate in the younger age brackets (65-69 years), those relying exclusively on the SUS, with less schooling, in the lowest income quintile, and in regions of the country with worse social and health indicators.

Elderly in the sample showed important differences in the estimates for risk and protective factors, revealing that aging among browns and blacks occurs in a context of significant inequalities. These inequalities result from denial of social rights throughout life, with repercussions on overall living conditions in old age [5,6].

In other countries, the estimates of black elderly with worse socioeconomic status are similar to those observed in this study, indicating the overlapping of blacks among poor elderly and those with less schooling [6,27,28].

In the current study, brown and black elderly showed the worst outcomes for the target health indicators, both when compared to elderly in general in our own study and in relation to estimates by Lima-Costa et al. [14] for the total Brazilian population, using the PNAD data from 1998, 2003, and 2008.

Color/race was directly associated with indicators that are widely used in health surveys in Brazil and elsewhere in the world to evaluate and monitor health in the elderly [6,10,14,15], especially in browns for worse global self-rated health status and in blacks for more chronic conditions. For maintenance of functional capacity, brown

Table 3

Prevalence of chronic conditions and prevalence ratios for number of chronic conditions in Brazilian elderly ≥ 65 years
(N = 18,684) that reported their own color/race. *National Household Sample Survey* (PNAD), 2008.

Variables	% *	Crude analysis PR (95%CI)	Adjusted analysis PR (95%CI)
Color/Race			
White	74.9	1.00	1.00
Brown	72.9	0.92 (0.89-0.95) **	1.01 (0.98-1.05)
Black	78.6	1.03 (0.98-1.08)	1.07 (1.02-1.13) **
Sex			
Female	79.3	1.00	1.00
Male	67.1	0.75 (0.73-0.77) **	0.79 (0.76-0.81) **
Age bracket (years)			
65-69	72.3	1.00	1.00
70-79	75.3	1.08 (1.05-1.11) **	1.05 (1.02-1.08) **
≥ 80	76.9	1.11 (1.06-1.15) **	1.05 (1.01-1.10) ***
Schooling (years)			
≥ 9	70.3	1.00	1.00
1-8	75.8	1.16 (1.11-1.22) **	1.19 (1.13-1.25) **
0	74.1	1.11 (1.06-1.16) **	1.23 (1.16-1.30) **
Workforce status			
In the workforce	66.0	1.00	1.00
Not in the workforce	77.0	1.34 (1.29-1.39) **	1.21 (1.17-1.26) **
Household income quintile			
1st (lowest)	72.1	1.00	1.00
2nd	75.3	1.07 (1.03-1.12) **	1.03 (0.98-1.07)
3rd	76.4	1.13 (1.07-1.19) **	1.07 (1.02-1.13) ***
4th	75.0	1.12 (1.07-1.17) **	1.04 (0.99-1.09)
5th (highest)	73.6	1.06 (1.01-1.11) ***	1.00 (0.95-1.06)
Role in family			
Reference person	73.2	1.00	-
Spouse	77.8	1.12 (1.08-1.16) **	-
Other	76.6	1.09 (1.04-1.15) **	-
Number of residents in household			
1	75.8	1.00	1.00
2	74.9	1.01 (0.97-1.05)	1.05 (1.01-1.09) ***
≥ 3	73.3	0.95 (0.91-0.98) ***	1.02 (0.98-1.06)
Household location			
Urban	75.7	1.00	1.00
Rural	68.9	0.80 (0.77-0.84) **	0.90 (0.86-0.94) **
Region of Brazil			
North	72.1	1.00	1.00
Northeast	70.2	0.94 (0.88-1.01)	0.94 (0.88-1.00)
Central	75.6	1.15 (1.07-1.23) **	1.11 (1.04-1.20) ***
Southeast	76.1	1.16 (1.09-1.24) **	1.10 (1.03-1.17) **
South	77.4	1.26 (1.17-1.35) **	1.23 (1.15-1.32) **
Private health plan			
No	73.3	1.00	1.00
Yes	77.4	1.11 (1.08-1.15) **	1.10 (1.06-1.15) **

95%CI: 95% confidence interval; PR: prevalence ratio.

* Socioeconomic, demographic, and health characteristics of elderly that reported one or more chronic conditions,
n = 13,927;

** p-value ≤ 0.001;

*** p-value ≤ 0.05.

Table 4

Prevalence and odds ratios for loss of functional capacity and autonomy (none, some, and total) in Brazilian elderly ≥ 65 years (N = 18,684) that reported their own color/race. *National Household Sample Survey* (PNAD), 2008.

Variables	None	% Some	Total	Crude analysis OR (95%CI)	Adjusted analysis OR (95%CI)
Color/race					
White	85.3	13.8	0.9	1.00	1.00
Brown	85.5	13.3	1.2	0.98 (0.90-1.08)	0.80 (0.73-0.89) *
Black	82.1	17.0	0.9	1.26 (1.07-1.47) *	0.97 (0.82-1.15)
Sex					
Female	83.6	15.3	1.1	1.00	1.00
Male	87.4	11.7	0.9	0.74 (0.67-0.81) *	0.84 (0.76-0.93) *
Age bracket (years)					
65-69	90.4	9.2	0.4	1.00	1.00
70-79	85.0	14.1	0.9	1.65 (1.49-1.84) *	1.49 (1.34-1.66) *
≥ 80	73.0	24.3	2.7	3.51 (3.10-3.97) *	2.80 (2.46-3.19) *
Schooling (years)					
≥ 9	92.8	6.7	0.5	1.00	1.00
1-8	86.9	12.3	0.8	1.94 (1.61-2.32) *	1.42 (1.17-1.72) *
0	79.7	18.7	1.6	3.28 (2.73-3.94) *	2.03 (1.65-2.50) *
Workforce status					
In the workforce	93.7	6.1	0.2	1.00	1.00
Not in the workforce	82.5	16.2	1.3	3.15 (2.73-3.63) *	2.63 (2.27-3.04) *
Income quintile					
1st (lowest)	80.1	18.4	1.5	1.00	1.00
2nd	81.4	17.4	1.2	0.92 (0.81-1.03)	0.85 (0.75-0.97) **
3rd	85.7	13.3	1.0	0.67 (0.57-0.78) *	0.73 (0.62-0.86) *
4th	87.7	11.6	0.7	0.56 (0.49-0.65) *	0.63 (0.54-0.73) *
5th (highest)	91.7	7.6	0.7	0.36 (0.31-0.43) *	0.48 (0.40-0.59) *
Role in family					
Reference person	85.8	13.4	0.8	1.00	1.00
Spouse	86.1	12.9	1.0	0.98 (0.88-1.08)	0.97 (0.86-1.10)
Other	76.3	20.8	2.9	1.91 (1.66-2.19) *	1.41 (1.22-1.64) *
Number of residents in household					
1	84.5	14.7	0.8	1.00	-
2	85.5	13.6	0.9	0.92 (0.82-1.04)	-
≥ 3	85.1	13.7	1.2	0.96 (0.85-1.08)	-
Household location					
Urban	85.2	13.8	1.0	1.00	-
Rural	84.6	14.3	1.1	1.05 (0.91-1.21)	-
Region of Brazil					
North	85.6	13.5	0.9	1.00	-
Northeast	83.1	15.3	1.6	1.22 (1.01-1.47) **	-
Central	84.1	14.8	1.1	1.12 (0.90-1.41)	-
Southeast	86.7	12.5	0.8	0.91 (0.76-1.09)	-
South	84.4	14.9	0.7	1.10 (0.90-1.33)	-
Private health plan					
Yes	89.4	9.8	0.8	1.00	1.00
No	83.5	15.4	1.1	1.66 (1.49-1.86) *	1.20 (1.05-1.37) *

95%CI: 95% confidence interval; OR: odds ratio.

* p-value ≤ 0.001;

** p-value ≤ 0.05.

Table 5

Odds ratios for very good, good, fair, bad, and very bad self-rated health, prevalence ratios for number of chronic conditions, and odds ratios for loss of functional capacity and autonomy (none, some, and total) in Brazilian elderly ≥ 65 years (N = 18,684) that reported their own color/race. *National Household Sample Survey* (PNAD), 2008.

Variables	Self-rated health status		Number of chronic conditions		Functional incapacity (activities of daily living)	
	Crude analysis OR (95%CI)	Adjusted analysis * OR (95%CI)	Crude analysis PR (95%CI)	Adjusted analysis ** PR (95%CI)	Crude analysis OR (95%CI)	Adjusted analysis *** OR (95%CI)
Color/Race						
White	1.00	1.00	1.00	1.00	1.00	1.00
"Black" #	1.51 (1.42-1.61) ##	1.09 (1.02-1.16) ###	0.94 (0.91-0.97) ##	1.02 (0.99-1.06)	1.03 (0.94-1.12)	0.83 (0.76-0.92) ##

95%CI: 95% confidence interval; OR: odds ratio; PR: prevalence ratio.

* Final multivariate model containing the following variables: color/race, sex, age bracket, schooling, workforce status, household income quintile, role in family, household location, region of Brazil, and private health plan;

** Final multivariate model containing the following variables: color/race, sex, age bracket, schooling, workforce status, household income quintile, household location, region of Brazil, and private health plan;

*** Final multivariate model containing the following variables: color/race, sex, age bracket, schooling, workforce status, household income quintile, role in family, and private health plan;

"Black" (in quotes) refers to the combined categories of black and brown color/race as reported by the elderly;

p-value ≤ 0.001;

p-value ≤ 0.05.

color/race appeared a as potential protective factor. In brown elderly, the odds of worse self-rated health were independent of differences in socioeconomic and demographic factors. After multivariate analysis, the higher likelihood of chronic diseases in the black elderly suggests that the effect of black color/race is influenced by the factors considered in the model.

The effects of color/race on the health of the elderly Brazilian population still show differences between studies [9,15,29]. Some authors indicate that health inequalities cannot be attributed directly to color/race, independently of socioeconomic differences between individuals and context [3,12,13]. Meanwhile, other studies contend that the color/race variable influences various levels of exposure to different individual and contextual health risks throughout life [5,12]. It assumes the role of a sociopolitical variable, acting through interactive and complex mechanisms according to the context in which individuals live [7,12]. However, regardless of whether the color/race variable has a direct effect or a joint effect together with socioeconomic factors, the current study's evaluation of health indicators showed that color/race cannot be ruled out in the production of health inequalities in this sample of elderly Brazilians.

In the current analysis, prevalence of very good or good self-rated health was 23.6% less common in brown elderly than in whites. In a population-based study of 1,432 elderly in Campinas, São Paulo State, prevalence of excellent or very good self-rated health in non-whites was similar, namely 25.8% less common than in whites [15].

Studies in other countries also indicate an association between color/race and worse self-rated health in the elderly, independently of socioeconomic and demographic factors [10,17]. Still, in some studies of elderly Brazilians, this association is either questioned or not observed after adjusting for socioeconomic and health variables [15,30]. The current study showed a direct association between color/race and worse self-rated health status. Adjustment for confounding decreased the size of the association but did not eliminate the statistically significant effect among browns. Brown elderly had 11% higher odds of worse self-rated health status than white elderly.

A population-based study of 1,940 elderly in the city of São Paulo using hierarchical ordinal logistic analysis also showed that blacks and browns reported worse health status (OR = 1.27; p < 0.01) than whites [9]. After adjusting for gender and age, a cross-sectional population-based study in Campinas showed that non-white elderly had 29% lower odds of excellent or very good self-rated health. As in our results, this suggests that non-white elderly rated their own health more negatively [15].

One possible explanation for this result is that blacks display cultural and psychosocial variations in their conceptualization of this health indicator, or even that they are more pessimistic than whites about their own health [10,29]. When they consider their lifetime experiences with worse living conditions, material deprivation, or social racism, they tend to perceive their own health more negatively [7,27]. In other words, the direct effects of race on self-rated health may result indirectly from individual and contextual socioeconomic disadvantages for blacks [10,29].

Meanwhile, studies that fail to observe an association between self-reported color/race and self-rated health in the elderly assume that low income and schooling are more determinant of health status than cultural values associated with race [15,30]. Among Brazilians 20 years or older, some studies have observed that such factors play a more relevant role in self-reported health status than non-white color/race [31,32].

Numerous studies have shown that chronic conditions have become more common in the elderly [27,33,34], increasing the demand for medical and social services [27,33,34]. Among elderly Brazilians, the prevalence of at least one chronic disease also increased according to socioeconomic variables [34,35]. For the racial groups in this population, such prevalence rates are still unknown. The current study showed a high prevalence of chronic diseases in the three racial groups, but prevalence in black elderly was higher than in the other groups (Table 3).

In other countries, the color/race variable shows a direct and independent association with the number of chronic conditions in the elderly [22,27]. In Brazil, this association has not only been questioned [3,13], but it has not been studied with data from the PNAD. Our study shows that black elderly experience more chronic diseases, even after adjusting for confounding factors. Other Brazilian studies have also found racial differences in the presence of chronic comorbidities and adjusted estimates with a similar magnitude for black color/race in the adult population in the PNAD surveys for 2003 [33] (PR = 1.04; 95%CI: 1.01-1.07) and 2008 [34] (PR = 1.06; 95%CI: 1.05-1.08).

Studies have attributed this fact to unequal exposure to risk factors between racial groups throughout life cycles [6,7] whereby individual and contextual characteristics influence the adoption of healthy or harmful behaviors [36]. These factors vary between racial groups and favor the occurrence of racial differences in estimates of chronic diseases [27,36]. Blacks may thus experience more chronic diseases in old age because this condition is associated with more vulnerable social groups [9,27,33,34,35,36].

Similar to other work, the current study assesses functional incapacity of elderly according to activities of daily living [6,9,29,37]. In some studies, the explanatory role of color/race in the functional decline of elderly is controversial. In the United States, race explains functional decline in the elderly, even after adjusting for socioeconomic variables [29,38]. However, in England and Brazil this association has still not been observed [6,9,16]. Our findings agree with studies indicating the protective effect of brown and black color/race in maintaining functional status in the elderly. A study of elderly in the city of São Paulo showed that blacks and browns had 26% lower odds of reporting functional decline [9]. A study with the PNAD data for 2003 showed that black and brown elderly had lower odds (0.28, 0.18 to 0.07) of evolving in the three levels of disability [16]. And a study of non-white English elderly showed 36% lower odds of functional limitations [6].

According to some authors, the fact that the association between color/race and functional decline does not occur in the expected direction is due to the shorter life expectancy among blacks and browns with worse socioeconomic status [11,39,40]. This would lead the current group of elderly blacks to have lower odds of functional decline due to unequal survival between racial groups. This phenomenon was also demonstrated in a longitudinal population-based study of 2,969 elderly in the United States [11]. The authors cited survival bias to explain the loss of association between race and functional decline after adjusting for socioeconomic factors in both sexes [11].

In Brazil, the standard racial classification combines phenotype and socioeconomic characteristics [22,41]. Studies have recognized that the racial categories are not homogeneous, that individuals do not always belong definitively to the same racial groups [41], and that there are differences between the classificatory system adopted by the IBGE and that defended by the Brazilian black movement [3,22,42]. The divergence results from the IBGE's use of the "brown" (or mixed-race) category, potentially belonging to either the group of whites or that of blacks. This racial instability is one limitation to racial self-classification in Brazil [3,42]. The Brazilian black movement claims the inclusion of both browns and blacks in the same category of "blacks". Although the black/white binary classification has become widely accepted by the media, it is not unanimous among policymakers and researchers [3,22,42].

In our study, the adjusted analysis showed that when blacks and browns were analyzed jointly, "black" color/race remained associated with worse self-reported health status and

maintenance of functional status, but with lower association than for browns in the two health outcomes. Still, for the number of chronic conditions, the direct association between "black" (black + brown) color/race was not maintained, as observed previously in blacks (not including browns). Thus, the dichotomous black/white analysis appears not to modify the analysis of differential health characteristics between white, brown, and black elderly Brazilians, but it does appear to produce an absence of clear distinctions between various racial groups of elderly Brazilians or even disguise inequalities among these groups [22,42].

The study's limitations include the intrinsic cross-sectional design, which prevents verifying temporal associations or direction in the associations observed with some of the socioeconomic and demographic variables included in the models. However, to study the association between the target outcomes and color/race, the cross-sectional design does not alter the study's validity, since racial classification remains more stable throughout life.

Importantly, in the analysis of data from the PNAD data, prevalence and survival bias may occur, since the elderly with worse socioeconomic status experience shorter survival [9,11,35,39,40]. This would lead to a selection bias of the elderly in the more vulnerable racial groups. Another potential limitation is the influence of the large sample size, making some minimal differences statistically significant, thus requiring that these race differentials be evaluated for their relevance and the sociopolitical significance of the race issue in the Brazilian context [13,22].

According to some authors, the significant associations found in this study may result from confounding factors not measured in the models [3,13]. Furthermore, the observed association between the racial categories and the health outcomes may be influenced by limitations in the terms, concepts, and methods, often cited as capable of weakening and underestimating the results of studies with a racial focus [3,12,13].

However, such limitations should not discourage reflection on racial inequalities in health, since this study's results were obtained from a representative and probabilistic sample of the elderly population from all regions of Brazil. This sample is sufficient to allow precise estimates for this population [14]. The current study only included elderly that reported their color/race according to the categories recommended by IBGE [1], thus reducing the impact of information bias on the classification of racial categories.

In addition, the statistical analysis of the outcomes was adjusted for the main factors commonly associated with health indicators in the elderly, using a narrower level of significance ($\alpha = 0.01$) in order to obtain more precise estimates. Despite such care, estimates of the models' fit indicated that the target variables explain little of the variation in each outcome, suggesting that other factors should be considered in explaining these outcomes.

Importantly, this study used both objective and subjective health indicators simultaneously. These measures suggest varied impacts from color/race on the three health dimensions that were evaluated, indicating that this variable's effect on one dimension may not necessarily appear in another [14].

The results thus suggest the presence of racial inequalities in health and overall living conditions in elderly Brazilians. They indicate that black and brown elderly form a vulnerable group and experience aging with overlapping risks. Despite controversies on the racial issue in Brazil, the color/race variable partially explained the health of the elderly. However, other socioeconomic inequalities – related to schooling, work status, and income – had a greater effect on the health of the elderly in the sample. Even so, these racial inequalities pose a challenge for health systems, based on principles of equity and included in a context of rapid demographic and epidemiological transition, thus supporting this variable's use in analyses on the health of elderly Brazilians.

Resumen

Se analizaron las desigualdades raciales en la salud de 18.684 ancianos brasileños con ≥ 65 años, incluidos en el Estudio Nacional por Muestra de Domicilios *2008 (PNAD 2008), que autodefinieron su raza/color del siguiente modo: blanco, mestizo y negro. El trabajo calcula las asociaciones de raza/color con la autoevaluación del estado de salud, incapacidad funcional y con el número de enfermedades crónicas, utilizando análisis de regresión no ajustados y ajustados (α = 0,01). Predominaron los ancianos blancos (56,2%). En el análisis ajustado, la raza/color mestizo se asocia con un peor estado de salud autodefinido (OR = 1,11; IC95%: 1,03-1,18) y los negros con el mayor número de condiciones crónicas (RP = 1,07; IC95%: 1,02-1,13). La raza/color mestizo fue un factor protector para la incapacidad funcional. Si se unen mestizos y negros, aún sigue siendo mayor la posibilidad de que los negros autodefinan un peor estado de salud (OR = 1,09; IC95%: 1,02-1,16) y sigue existiendo una menor posibilidad de incapacidad funcional (OR = 0,83; IC95%: 0,76-0,92). El color/raza negra perdió su asociación con el número de condiciones crónicas. Otras variables socioeconómicas poseían efectos más marcados en la salud de los ancianos pertenecientes a uno de los grupos expuestos.*

Origen Étnico y Salud; Desigualdades en la Salud; Anciano

Contributors

B. L. C. A. Oliveira conceived the study, reviewed the literature, participated in the data analysis and interpretation, and wrote the manuscript. E. B. A. F. Thomaz conducted the analyses, interpreted the data, and wrote the manuscript. R. A. Silva conceived the study, interpreted the data, and wrote the manuscript.

Acknowledgments

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