Differentials in risk factors for chronic non-communicable diseases from the race/color standpoint

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Abstract *This article aims to analyze the differences between the prevalence of risk factors of non-communicable chronic disease by race/color. It is a cross-sectional study using data from a telephone survey of 45,448 adults. Prevalence ratios for chronic disease risk factors by race/color were calculated. After adjustments were made for education and income, race/color differences persisted. Among afro-descendant and mulatto women and mulatto men a higher prevalence ratio was identified of physical activity at work and physical activity at home. Afro-descendant women and mulatto men indulged in less physical inactivity. Mulatto men and women showed a lower prevalence of smoking and consumption of 20 cigarettes daily and lower consumption of fruit and vegetables. A higher consumption of full-fat milk with and beans was observed among afro-descendant and mulatto men. Afro-descendant women had a lower prevalence of drinking and driving. Afro-descendant women and men ate more meat with fat and afro-descendant men suffered more from hypertension. Differences in risk factors by race/color can be explained by cultural aspects, by not fully adjustable socioeconomic differences that determine less access to goods and less opportunities for the afro-descendant population.*

Key words *Afro-descendant, Mulatto, Race, Risk factors, Inequalities*

Introduction

Ethnic-racial inequalities are becoming a more relevant topic in national and international scientific production[1]. Different health conditions depending on skin color or race have been described as a public health problem and as an indicator of major social disparities in several countries. The variable "race" can be considered an important predictor of the health status of the population and also a marker for social inequalities and social determinants of health[2].

Despite advances in the income distribution, major social inequalities are still observed inBrazil[3]. Brazil has a very large black population, comprising approximately 82 million brown (mixed) and 15 million black individuals in a population of approximately 191 million people according to the 2010 census[4]. Only recently have some authors begun to investigate the social exclusion of the black population and their health conditions, emphasizing the differences between groups according to race/skin color/ethnicity[5]. The black population in Brazil has worse working conditions, lower wages, increased likelihood of poverty and more restrictions on the access to healthcare services[3,6,7]. Low educational levels and illiteracy affect the black population more than others. In addition, access to higher education is lower among blacks (8.3%) compared to whites (21.3%)[3].

Although the studies on health and skin color inequalities have increased[1,8-12], the lack of equity between races is still rarely explored in the literature, whereas studies addressing differences between classes and regions are more common[13-16]. The studies on racial inequalities and their consequences forhealth have been addressed through the analysis of health information systems[17], municipalsurveys[6,7],and national surveys[10], among others. The majority of these studies have indicated worse health indicators in the brown and black populations[9-11].

Some studies indicate high morbidity and mortality rates in the black population, especially due to violence and homicides, and higher mortality among blacks[18-21].In addition, more cases of violence in public emergency services in Brazil are observed among blacks[22]. Often, these cases occur due to the poor socioeconomic status and low educational level of the victims[17,23,24]. In another line of research, the ethnic differences observed in the studies are often not explained by genetic inheritance. Therefore, socioeconomic, cultural and other factors must explain these differences[2,25].

A higher prevalence of self-reported chronic diseases is also observed in blacks compared to whites[26]. Studies addressing the risk factors for chronic non-communicable diseases are still rare. Since 2006, Brazil has had a national system that monitors the prevalence of risk or protective factors for chronic diseases through telephone interviews (Telephone-Based National Surveillance System of Risk and Protective Factors for Chronic Diseases- *Sistema Nacional de Vigilância de Fatores de Risco ou Proteção para Doenças Crônicas por Inquérito Telefônico* – Vigitel). This system monitors the prevalence of several other risk factors for chronic diseases of the adult population in all 26 Brazilian state capitals and the Federal District. One question addressing the self-reported race/skin color of the interviewee was introduced in 2011, similar to the questionnaire used by the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística* - IBGE)[4], enabling analyses of this issue.

This study aims to analyze the differences between the prevalence of risk factors for chronic non-communicable diseases according to the race (white, black and brown) collected by the Vigitel system.

Methods

This cross-sectional study used data collected by Vigitel in 27 cities in 2012. This study presents estimates of the population that self-reported their race/skin color as white and the population that self-reported their race/skin color as black and brown. The sampling design used to select the sample is presented in detail in another article[27]. Starting in 2012, the availability of the micro data from the 2010 Population Census allowed for updating the estimates of the survey based on the intercensal projections, which considered changes in the population composition, with a higher proportion of elderly and of the population with higher education levels.

In the present study, the population of the Vigitel was adjusted to the 2010 population according to the categories age, educational level, gender and skin color using the rake method. This method uses variables available in the sample and in the population obtained from external sources to adjust the distribution of the telephone-surveyed sample to that of the whole study population . The choice of variables used to construct the weights is important to correct the bias. The following variables were considered

in the weight of the Vigitel sample: gender (male and female), age group (18-24, 25-34, 35-44, 45-54, 55-64 and 65 and older), educational level (no education or incomplete primary education, complete primary education or incomplete secondary education, complete secondary education or incomplete higher education and complete higher education), and skin color (white, black and brown). The details of the weighting adopted by the Vigitel are available in the Vigitel Report 2012[28]. The post-stratification weight of each individual of the Vigitel sample was calculated by this method using a specific routine of the SAS software[29].

The Vigitel questionnaire comprises approximately 94 questions divided into modules: (i) demographic and socioeconomic characteristics; (ii) eating and physical activity patterns; (iii) self-reported weight and height; (iv) tobacco and alcohol use; and (v) self-assessment of health status and self-reported morbidity. The following risk factors were analyzed in the present study: tobacco use, overweight (body mass index $\geq$ 25 kg/m²) and obesity (body mass index $\geq$ 30 kg/m²); consumption of high-fat meats (red meat with visible fat or skin-on chicken); regular consumption of soft drinks or artificial juice (five or more days per week); physical inactivity (individuals who did not practice any physical activity during leisure time in the past three months, individuals who do not perform intense occupational physical efforts, individuals who do not go to work or school by foot or by bike, and individuals who are not responsible for heavy cleaning in their homes); watching TV three or more hours per day (individuals who usually watch three or more hours of television daily); alcohol abuse (four or more doses of alcoholic beverages for women and five or more doses for men on a single occasion in the past 30 days, considering a dose of distilled spirit, a can of beer or a glass of wine as a dose of alcoholic beverage); driving a motor vehicle after consuming any amount of alcohol; health self-assessed as poor; and self-reported morbidity (previous medical diagnosis of hypertension and diabetes).

The protective factors were adherence to the recommended consumption of fruits and vegetables (five or more servings per day, five or more days a week); regular consumption of beans (five or more days a week); recommended physical activity during leisure time [at least 150 minutes per week of mild- or moderate-intensity physical activity (walking, treadmill walking, weight training, water aerobics, fitness, swimming, martial arts and fighting, cycling, volleyball or others) or at least 75 minutes a week of vigorous-intensity physical activity (running, treadmill running, aerobics, football, basketball or tennis) regardless of the number of days of physical activity per week]; occupational physical activity or household physical activity; and performance of screening tests to detect cancer in women (mammography for women aged 50-69 years and Pap smear for women aged 25 to 59 years). These indicators were calculated using the total number of adults interviewed as the denominator, except those indicators specifically related to age and gender.

The prevalence and frequency of the indicators were estimated by gender and self-reported race/skin color (white, black or brown). Prevalence ratios (PRs) of the indicators according to race/skin color (crude) and according to the race/skin color adjusted by educational level were calculated using a Poisson Regression model. This study was approved by the National Commission of Ethics in Human Research (*Comissão Nacional de Ética em Pesquisa em Seres Humanos* - Conep).

Results

The 2012 Vigitel performed 45,448 complete interviews consisting of 17,389 men and 28,059 women. Regarding race/skin color, whites represented 40.9% of the total sample, followed by browns with 38.0% and blacks with 8.5%. A total of 8.0% did not know or did not want to report their race/skin color, while 2.7% and 1.7% were yellow and indigenous, respectively.

Table 1 shows the distribution of the prevalence of the main indicators monitored by the Vigitel by skin color and stratified by gender in the 26 Brazilian capitals and Federal District. Regarding the distribution by gender, changes in the prevalence patterns were observed when skin color was considered for each gender, especially for the following indicators: smoking, smoking 20 or more cigarettes a day , passive smoking at home, consumption of meat with visible fat, practice of household physical activity, alcohol abuse, driving a vehicle after excessive consumption of alcoholic beverages and poor health condition. The variables age and educational level were associated with skin color. The brown and black populations had lower educational levels than the white one. Older people exhibited lower education.

Table 2 shows the PR adjusted for the total population. In the brown population, the ad-

Table 1. Prevalence* of the main risk and protective factors for chronic non-communicable diseases according to skin color and gender in the 26 Brazilian capitals and the Federal District, 2012.

Indicator	Total			Women			Men		
	White	Black	Brown	White	Black	Brown	White	Black	Brown
Smoking	13.13	14.21	11.18	10.35	11.16	8.01	16.59	17.55	14.51
	(11.9-14.3)	(11.5-16.9)	(10.1-12.3)	(9.1-11.6)	(8.3-14.0)	(6.9-9.1)	(14.5-18.7)	(12.9-22.2)	(12.6-16.4)
Being a former smoker	21.31	19.83	20.41	18.19	17.45	18.09	25.19	22.44	22.87
	(20.0-22.6)	(17.3-22.4)	(19.2-21.6)	(16.7-19.7)	(14.5-20.4)	(16.7-19.5)	(23.1-27.3)	(18.2-26.7)	(21.0-24.7)
Smoking 20 or more cigarettes a day	5.10	4.52	3.43	3.67	3.67	2.14	6.86	5.45	4.79
	(4.3-5.9)	(2.8-6.3)	(2.8-4.0)	(2.8-4.5)	(1.5-5.9)	(1.6-2.7)	(5.3-8.4)	(2.7-8.2)	(3.7-5.9)
Passive smoking at home	9.37	11.50	11.11	10.64	11.77	11.88	7.80	11.21	10.30
	(8.4-10.3)	(9.5-13.5)	(10.1-12.1)	(9.3-12.0)	(9.3-14.3)	(10.6-13.2)	(6.5-9.1)	(8.1-14.3)	(8.9-11.7)
Passive smoking at work	8.29	12.69	12.00	4.69	7.05	6.97	12.75	18.88	17.31
	(7.3-9.3)	(10.5-14.9)	(11.0-13.0)	(3.8-5.5)	(5.0-9.1)	(6.0-7.9)	(10.914.6)	(14.9-22.9)	(15.5-19.1)
Overweight	52.71	51.37	50.25	48.26	51.65	48.18	58.22	51.06	52.43
	(51.1-54.3)	(48.3-54.4)	(48.8-51.7)	(46.2-50.3)	(47.9-55.4)	(46.3-50.0)	(55.7-60.7)	(46.1-56.1)	(50.1-54.8)
Obesity	17.56	17.66	17.14	17.65	20.07	17.98	17.44	15.02	16.25
	(16.3-18.8)	(15.5-19.8)	(16.0-18.3)	(16.1-19.2)	(17.0-23.1)	(16.5-19.4)	(15.4-19.3)	(12.0-18.0)	(14.4-18.1)
Regular consumption of fruits and vegetables	38.22	30.11	28.13	44.22	36.28	33.03	30.77	23.36	22.95
	(36.7-39.7)	(27.4-32.8)	(26.9-29.4)	(42.2-46.2)	(32.6-39.9)	(31.3-34.7)	(28.6-33.0)	(19.6-27.1)	(21.1-24.9)
Recommended consumption of fruits and vegetables	25.75	19.76	18.52	30.34	23.99	21.88	20.06	15.12	14.97
	(24.4-27.1)	(17.5-22.1)	(17.4-19.6)	(28.5-32.2)	(20.7-27.3)	(20.4-23.4)	(18.2-21.9)	(12.0-18.2)	(13.3-16.6)
Consumption of meat with visible fat	28.58	39.17	33.27	19.82	27.41	23.78	39.44	52.07	43.27
	(27.1-30.0)	(36.0-42.4)	(31.8-34.7)	(18.2-21.4)	(23.7-31.1)	(22.1-25.4)	(37.0-41.9)	(47.1-57.0)	(40.9-45.6)
Consumption of whole milk	50.53	54.93	58.93	49.21	53.85	57.26	52.15	56.13	60.69
	(48.9-52.1)	(51.8-58.0)	(57.5-60.4)	(47.2-51.3)	(50.0-57.6)	(55.4-59.1)	(49.7-54.7)	(51.1-61.1)	(58.4-63.0)
Consumption of soft drinks five or more days per week	25.49	29.72	25.58	22.53	24.93	22.46	29.16	34.98	28.87
	(24.0-27.0)	(26.7-32.7)	(24.2-26.9)	(20.6-24.4)	(21.5-28.4)	(20.8-24.1)	(26.8-31.5)	(30.1-39.9)	(26.7-31.1)
Consumption of sweets five or more days per week	19.87	19.48	17.17	21.04	19.13	17.79	18.42	19.87	16.53
	(18.6-21.1)	(16.7-22.2)	(16.0-18.3)	(19.4-22.7)	(16.1-22.2)	(16.3-19.3)	(16.4-20.4)	(15.2-24.5)	(14.7-18.3)
Consumption of beans five or more days per week	65.43	73.61		61.24	67.52	62.56	70.61	80.29	76.96
	(64.0-66.9)	(71.2-76.0)	(68.3-70.9)	(59.3-63.2)	(64.1-70.9)	(60.8-64.3)	(68.5-72.7)	(77.0-83.5)	(75.2-78.7)
Practice of 150 min of leisure physical activity	33.93	31.78	34.30	27.43	22.80	25.15	41.97	41.63	43.94
	(32.5-35.4)	(28.8-34.7)	(32.9-35.7)	(25.7-29.1)	(19.8-25.8)	(23.6-26.7)	(39.5-44.4)	(36.7-46.6)	(41.6-46.3)
Practice of physical activity during commuting	13.30	16.92	15.66	14.11	17.27	15.76	12.31	16.55	15.55
	(12.1-14.5)	(14.6-19.3)	(14.5-16.8)	(12.5-15.7)	(14.5-20.0)	(14.3-17.2)	(10.5-14.1)	(12.7-20.4)	(13.8-17.3)
Practice of household physical activity	35.49	38.92	40.04	53.57	61.76	61.90	13.07	13.89	16.99
	(34.0-37.0)	(36.0-41.8)	(38.6-41.5)	(51.6-55.6)	(58.0-65.5)	(60.1-63.7)	(11.5-14.6)	(10.9-16.9)	(15.2-18.7)
Practice of occupational physical activity	37.46	48.93	45.77	30.56	39.46	36.24	46.00	59.31	55.83
	(35.9-39.0)	(45.8-52.0)	(44.3-47.3)	(28.6-32.5)	(35.7-43.2)	(34.4-38.1)	(43.5-48.5)	(54.5-64.2)	(53.5-58.1)
Physical inactivity	16.61	12.89	12.65	16.27	11.12	13.15	17.03	14.83	12.12
	(15.4-17.8)	(10.6-15.2)	(11.8-13.5)	(14.7-17.8)	(8.6-13.6)	(11.9-14.4)	(15.1-19.0)	(10.8-18.9)	(10.8-13.5)

justed PRs of the indicators smoking, smoking 20 or more cigarettes a day, passive smoking at work, consumption of meat with visible fat, consumption of whole milk and consumption of soft drinks five or more days per week were lower than the respective unadjusted PRs. Regarding

Tabela 1. continuation

Indicator	Total			Women			Men		
	White	Black	Brown	White	Black	Brown	White	Black	Brown
Watching TV – 3 hours/day	26.52 (25.1-28.0)	30.37 (27.3-33.5)	26.88 (25.6-28.2)	26.50 (24.7-28.3)	30.21 (26.5-33.9)	26.37 (24.7-28.0)	26.54 (24.2-28.9)	30.54 (25.5-35.6)	27.43 (25.3-29.5)
Alcohol abuse	17.81 (16.5-19.1)	21.73 (19.0-24.5)	18.53 (17.4-19.7)	9.66 (8.5-10.8)	13.08 (10.1-16.1)	10.31 (9.2-11.4)	27.92 (25.6-30.2)	31.21 (26.6-35.8)	27.19 (25.1-29.2)
Driving a vehicle after excessive alcohol consumption	1.63 (1.2-2.1)	1.46 (0.8-2.1)	1.81 (1.5-2.1)	0.33 (0.1-0.5)	0.01	0.16 (0.1-0.3)	3.25 (2.3-4.2)	3.05 (1.6-4.5)	3.54 (2.9-4.2)
Driving after consuming any amount of alcohol	7.47 (6.6-8.3)	6.38 (4.9-7.9)	6.90 (6.2-7.6)	2.55 (1.9-3.2)	1.08 (0.4-1.8)	1.79 (1.3-2.3)	13.57 (11.9-15.2)	12.19 (9.2-15.2)	12.29 (11.0-13.6)
Poor health condition	4.97 (4.1-5.8)	5.95 (4.4-7.5)	5.28 (4.5-6.0)	6.24 (5.1-7.4)	7.38 (5.6-9.2)	6.63 (5.6-7.7)	3.39 (2.1-4.6)	4.38 (1.9-6.9)	3.86 (2.8-4.9)
Self-reported hypertension	25.19 (23.9-26.5)	27.62 (24.9-30.3)	22.20 (21.0-23.4)	27.91 (26.1-29.7)	31.50 (27.9-35.1)	25.54 (24.0-27.1)	21.82 (19.9-23.8)	23.38 (19.3-27.4)	18.68 (16.9-20.4)
Self-reported diabetes	8.22 (7.4-9.1)	8.03 (6.2-9.9)	5.74 (5.1-6.3)	9.22 (8.0-10.4)	7.96 (6.2-9.7)	6.61 (5.8-7.4)	6.99 (5.8-8.2)	8.10 (4.7-11.5)	4.82 (3.9-5.7)
Mammogram in the past two years	78.65 (75.5-81.8)	74.42 (68.8-80.1)	74.90 (71.9-77.9)	78.65 (75.5-81.8)	74.42 (74.4-80.1)	74.90 (71.9-77.9)	-	-	-
Pap smear in the past three years	84.59 (82.8-86.3)	78.53 (75.0-82.1)	80.36 (78.7-82.0)	84.59 (82.8-86.4)	78.53 (75.0-82.1)	80.36 (78.7-82.0)	-	-	-

* Weighted percentage to adjust the sociodemographic distribution of the Vigitel sample to the distribution of the adult population for 2010 according to gender, age, educational level and skin color by the rake method.

the indicators regular and recommended consumption of fruits and vegetables, the adjusted PR was greater than the unadjusted PR.

Table 3 shows the PRs unadjusted and adjusted by educational level and income according to the skin color reported by the women. There were significant differences between the prevalence rates in black or brown individuals and in the white ones. Among black and brown women, significant adjusted PRs (95% confidence interval) were observed for passive smoking at work of 1.41 (1.00-1.99) and 1.40 (1.10-1.77), respectively. Regarding the practice of household physical activity, the adjusted PRs were 1.09 (1.01-1.17) and 1.10 (1.05-1.15); for the practice of occupational physical activity, 1.23 (1.09-1.38) and 1.13 (1.04-1.23);and for physical inactivity,0.76 (0.60-0.97) . Black women had a higher adjusted PR for the consumption of meat with visible fat, 1.26 (1.08-1.47), and a lower adjusted PR for driving a vehicle after excessive alcohol consumption, 0.05 (0.01-0.26). Among the brown women, the adjusted PR for consumption of whole milk was 1.10 (1.04-1.16); for regular consumption of fruits and vegetables, 0.83 (0.77-

0.89); for recommended consumption of fruits and vegetables,0.80 (0.73-0.88);for smoking, 0.74 (0.61-0.89); and for heavy smoking, 0.54 (0.38-0.77). The other indicators showed no differences between the white, black and brown women.

Among the black and brown men, the adjusted PRs were significant for consumption of beans five or more days per week, 1.09 (1.03-1.15) and 1.06 (1.02-1.10), and for practice of occupational physical activity, 1.18 (1.07-1.30) and 1.14 (1.06-1.22). The significant indicators among the brown men included lower PRs for smoking, 0.76 (0.68-0.99);heavy smoking , 0.67 (0.47-0.93); and lower regular consumption of fruits and vegetables, 0.86 (0.77-0.96),and higher PRs for greater consumption of whole milk,1.12 (1.06-1.20), and practice of household physical activity,1.28 (1.09-1.51). Brown men had a lower adjusted PR for physical inactivity, 0.67 (0.47-0.93). Among black men, the indicators were consumption of meat with visible fat, 1.21(1.08-1.36), and higher self-reported hypertension, 1.27 (1.06-1.53). The other indicators showed no variation according to race/color, as shown in Table 4.

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Table 2. Confidence intervals (95%) for prevalence ratios* between the skin colors self-reported by men and women. Data from the 26 Brazilian capitals and Federal District, 2012.

Indicator	White	Black		Brown	
		Unadjusted PR	Adjusted PR**	Unadjusted PR	Adjusted PR**
Smoking	1.00	1.08 (0.88-1.33)	1.00 (0.81-1.23)	0.85 (0.74-0.97)	0.80[a] (0.70-0.92)
Being a former smoker	1.00	0.93 (0.81-1.07)	1.01 (0.88-1.16)	0.96 (0.88-1.04)	1.05 (0.97-1.15)
Smoking 20 or more cigarettes a day	1.00	0.89 (0.59-1.34)	0.80 (0.54-1.21)	0.67 (0.53-0.86)	0.63[a] (0.49-0.82)
Passive smoking at home	1.00	1.23 (1.01-1.50)	1.11 (0.90-1.37)	1.19 (1.04-1.36)	1.09 (0.95-1.25)
Passive smoking at work	1.00	1.53 (1.24-1.89)	1.33[a] (1.07-1.65)	1.45 (1.25-1.68)	1.30[a] (1.11-1.51)
Overweight	1.00	0.97 (0.91-1.04)	1.01 (0.94-1.08)	0.95 (0.91-0.99)	0.99 (0.95-1.03)
Obesity	1.00	1.01 (0.87-1.16)	1.02 (0.88-1.18)	0.98 (0.89-1.08)	1.00 (0.91-1.10)
Regular consumption of fruits and vegetables	1.00	0.79 (0.72-0.87)	0.91 (0.83-1.01)	0.74 (0.69-0.78)	0.83[a] (0.79-0.89)
Recommended consumption of fruits and vegetables	1.00	0.77 (0.68-0.87)	0.89 (0.78-1.01)	0.72 (0.66-0.78)	0.81[a] (0.75-0.88)
Consumption of meat with visible fat	1.00	1.37 (1.24-1.51)	1.25[a] (1.13-1.38)	1.16 (1.09-1.24)	1.08[a] (1.01-1.15)
Consumption of whole milk	1.00	1.09 (1.02-1.16)	1.03 (0.96-1.10)	1.17 (1.12-1.21)	1.11[a] (1.07-1.16)
Consumption of soft drinks five or more days per week	1.00	1.17 (1.04-1.31)	1.05 (0.93-1.18)	1.00 (0.93-1.09)	0.92[a] (0.85-0.99)
Consumption of sweets five or more days per week	1.00	0.98 (0.84-1.14)	1.00 (0.86-1.17)	0.86 (0.79-0.95)	0.87[a] (0.80-0.96)
Consumption of beans five or more days per week	1.00	1.13 (1.08-1.17)	1.08[a] (1.04-1.12)	1.06 (1.03-1.09)	1.03[a] (1.00-1.06)
Practice of 150 min of leisure physical activity	1.00	0.94 (0.85-1.04)	0.97 (0.88-1.07)	1.01 (0.95-1.07)	1.03 (0.97-1.09)
Practice of physical activity during commuting	1.00	1.27 (1.08-1.50)	1.11 (0.94-1.31)	1.18 (1.05-1.32)	1.06 (0.94-1.19)
Practice of household physical activity	1.00	1.10 (1.01-1.19)	1.04 (0.95-1.13)	1.13 (1.07-1.19)	1.09[a] (1.03-1.15)
Practice of occupational physical activity	1.00	1.31 (1.21-1.41)	1.22[a] (1.13-1.31)	1.22 (1.16-1.29)	1.15[a] (1.09-1.22)
Physical inactivity	1.00	0.78 (0.64-0.94)	0.86 (0.71-1.04)	0.76 (0.69-0.84)	0.85[a] (0.76-0.94)
Watching TV – 3 hours/day	1.00	1.15 (1.02-1.29)	1.10 (0.98-1.24)	1.01 (0.94-1.09)	0.99 (0.91-1.06)
Alcohol abuse	1.00	1.22 (1.06-1.41)	1.19 (1.03-1.38)	1.04 (0.95-1.14)	1.01 (0.92-1.11)
Driving after consuming any amount of alcohol	1.00	0.89 (0.52-1.53)	0.97 (0.57-1.65)	1.11 (0.80-1.53)	1.17 (0.84-1.64)
Poor health condition	1.00	1.20 (0.88-1.63)	1.07 (0.78-1.47)	1.06 (0.85-1.33)	1.01 (0.80-1.28)
Self-reported hypertension	1.00	1.10 (0.98-1.23)	1.27[a] (1.14-1.40)	0.88 (0.82-0.95)	1.06 (0.98-1.14)
Self-reported diabetes	1.00	0.98 (0.76-1.26)	1.17 (0.91-1.51)	0.70 (0.60-0.81)	0.89 (0.76-1.03)
Mammogram in the past two years	1.00	0.95 (0.87-1.03)	0.98 (0.89-1.07)	0.95 (0.90-1.01)	0.97 (0.92-1.03)
Pap smear in the past three years	1.00	0.93 (0.88-0.98)	0.96 (0.91-1.01)	0.95 (0.92-0.98)	0.97 (0.94-1.00)

* Weighted percentage to adjust the sociodemographic distribution of the Vigitel sample to the distribution of the adult population for 2010 according to gender, age, educational level and skin color by the rake method. ** Age- and educational level-adjusted PR. [a] Statistically significant value, considering the adjusted PR.

Table 3. Prevalence ratios[*] of the main risk and protective factors for chronic non-communicable diseases among women in the 26 Brazilian capitals and Federal District, 2012.

Indicator	White	Black		Brown	
		Unadjusted PR	Adjusted PR[**]	Unadjusted PR	Adjusted PR[**]
Smoking	1.00	1.08 (0.81-1.43)	1.02 (0.77-1.35)	0.77 (0.65-0.93)	0.74[(a)] (0.61-0.89)
Being a former smoker	1.00	0.96 (0.80-1.16)	1.01 (0.84-1.23)	0.99 (0.89-1.12)	1.06 (0.94-1.20)
Smoking 20 or more cigarettes a day	1.00	1.00 (0.53-1.89)	0.92 (0.49-1.71)	0.58 (0.42-0.82)	0.54[(a)] (0.38-0.77)
Passive smoking at home	1.00	1.11 (0.86-1.42)	1.01 (0.78-1.31)	1.12 (0.94-1.32)	1.03 (0.86-1.22)
Passive smoking at work	1.00	1.50 (1.07-2.11)	1.41 (1.00-1.99)	1.49 (1.18-1.87)	1.40[(a)] (1.10-1.77)
Overweight	1.00	1.07 (0.98-1.17)	1.10 (1.01-1.20)	1.00 (0.94-1.06)	1.04 (0.98-1.10)
Obesity	1.00	1.14 (0.95-1.36)	1.16 (0.97-1.38)	1.02 (0.90-1.15)	1.05 (0.93-1.19)
Regular consumption of fruits and vegetables	1.00	0.82 (0.74-0.92)	0.92 (0.82-1.03)	0.75 (0.70-0.80)	0.83[(a)] (0.77-0.89)
Recommended consumption of fruits and vegetables	1.00	0.79 (0.68-0.92)	0.88 (0.76-1.03)	0.72 (0.66-0.79)	0.80[(a)] (0.73-0.88)
Consumption of meat with visible fat	1.00	1.38 (1.18-1.62)	1.26[(a)] (1.08-1.47)	1.20 (1.08-1.33)	1.10 (0.99-1.23)
Consumption of whole milk	1.00	1.09 (1.01-1.19)	1.03 (0.95-1.12)	1.16 (1.10-1.23)	1.10 (1.04-1.16)
Consumption of soft drinks five or more days per week	1.00	1.11 (0.94-1.30)	1.01 (0.86-1.19)	1.00 (0.89-1.11)	0.91 (0.82-1.02)
Consumption of sweets five or more days per week	1.00	0.91 (0.76-1.09)	0.93 (0.78-1.11)	0.85 (0.75-0.95)	0.86[(a)] (0.77-0.96)
Consumption of beans five or more days per week	1.00	1.10 (1.04-1.17)	1.06 (1.00-1.13)	1.02 (0.98-1.07)	0.99 (0.95-1.03)
Practice of 150 min of leisure physical activity	1.00	0.83 (0.72-0.96)	0.89 (0.77-1.04)	0.92 (0.84-1.00)	0.97 (0.89-1.06)
Practice of physical activity during commuting	1.00	1.22 (1.00-1.49)	1.10 (0.89-1.34)	1.12 (0.96-1.29)	1.01 (0.87-1.17)
Practice of household physical activity	1.00	1.15 (1.07-1.24)	1.09(a) (1.01-1.17)	1.16 (1.10-1.21)	1.10(a) (1.05-1.15)
Practice of occupational physical activity	1.00	1.29 (1.15-1.45)	1.23(a) (1.09-1.38)	1.19 (1.09-1.29)	1.13[(a)] (1.04-1.23)
Physical inactivity	1.00	0.68 (0.54-0.87)	0.76[(a)] (0.60-0.97)	0.81 (0.71-0.92)	0.91 (0.79-1.04)
Watching TV – 3 hours/day	1.00	1.14 (0.99-1.31)	1.13 (0.97-1.30)	1.00 (0.91-1.09)	0.99 (0.89-1.09)
Alcohol abuse	1.00	1.35 (1.05-1.75)	1.33 (1.04-1.72)	1.07 (0.91-1.25)	1.05 (0.89-1.23)
Driving a vehicle after excessive alcohol consumption	1.00	0.04 (0.01-0.22)	0.05(a) (0.01-0.26)	0.50 (0.20-1.21)	0.55 (0.21-1.43)
Driving after consuming any amount of alcohol	1.00	0.42 (0.21-0.84)	0.55 (0.27-1.10)	0.70 (0.48-1.02)	0.86 (0.59-1.27)
Poor health condition	1.00	1.18 (0.87-1.61)	1.11 (0.81-1.52)	1.06 (0.83-1.36)	1.02 (0.79-1.31)
Self-reported hypertension	1.00	1.13 (0.99-1.29)	1.27 (1.13-1.43)	0.92 (0.84-1.00)	1.08 (0.99-1.17)
Self-reported diabetes	1.00	0.86 (0.67-1.11)	0.99 (0.76-1.28)	0.72 (0.60-0.86)	0.87 (0.72-1.04)
Mammogram in the past two years	1.00	0.95 (0.87-1.03)	0.98 (0.89-1.07)	0.95 (0.90-1.01)	0.97 (0.92-1.03)
Pap smear in the past three years	1.00	0.93 (0.88-0.98)	0.96 (0.91-1.01)	0.95 (0.92-0.98)	0.97 (0.94-1.00)

[*]Weighted percentage to adjust the sociodemographic distribution of the Vigitel sample to the distribution of the adult population for 2010 according to gender, age, educational level and skin color by the rake method. [**] Age- and educational level- adjusted PR. [(a)] Statistically significant value, considering the adjusted PR.

Table 4. Prevalence ratios[*] of the main risk and protective factors for chronic non-communicable diseases among men in the 26 Brazilian capitals and Federal District, 2012.

Indicator	White	Black		Brown	
		Unadjusted PR	Adjusted PR[**]	Unadjusted PR	Adjusted PR[**]
Smoking	1.00	1.06 (0.79-1.42)	0.96 (0.72-1.28)	0.87 (0.73-1.05)	0.82[(a)] (0.68-0.99)
Being a former smoker	1.00	0.89 (0.73-1.09)	0.99 (0.81-1.20)	0.91 (0.81-1.02)	1.03 (0.91-1.15)
Smoking 20 or more cigarettes a day	1.00	0.79 (0.46-1.37)	0.71 (0.42-1.21)	0.70 (0.50-0.97)	0.67[(a)] (0.47-0.93)
Passive smoking at home	1.00	1.44 (1.04-1.98)	1.30 (0.94-1.82)	1.32 (1.07-1.64)	1.22 (0.99-1.51)
Passive smoking at work	1.00	1.48 (1.14-1.92)	1.22 (0.94-1.59)	1.36 (1.13-1.63)	1.20 (1.00-1.45)
Overweight	1.00	0.88 (0.79-0.98)	0.92 (0.83-1.03)	0.90 (0.85-0.96)	0.94 (0.88-1.00)
Obesity	1.00	0.86 (0.69-1.08)	0.87 (0.69-1.10)	0.93 (0.80-1.09)	0.95 (0.81-1.11)
Regular consumption of fruits and vegetables	1.00	0.76 (0.64-0.90)	0.92 (0.77-1.10)	0.75 (0.67-0.83)	0.86[(a)] (0.77-0.96)
Recommended consumption of fruits and vegetables	1.00	0.75 (0.60-0.94)	0.91 (0.73-1.15)	0.75 (0.65-0.86)	0.86 (0.74-1.00)
Consumption of meat with visible fat	1.00	1.32 (1.18-1.48)	1.21(a) (1.08-1.36)	1.10 (1.01-1.19)	1.03 (0.95-1.12)
Consumption of whole milk	1.00	1.08 (0.97-1.19)	1.03 (0.93-1.14)	1.16 (1.09-1.24)	1.12[(a)] (1.06-1.20)
Consumption of soft drinks five or more days per week	1.00	1.20 (1.02-1.41)	1.07 (0.91-1.26)	0.99 (0.89-1.11)	0.91 (0.81-1.01)
Consumption of sweets five or more days per week	1.00	1.08 (0.83-1.40)	1.09 (0.84-1.41)	0.90 (0.77-1.05)	0.89 (0.76-1.05)
Consumption of beans five or more days per week	1.00	1.14 (1.08-1.20)	1.09(a) (1.03-1.15)	1.09 (1.05-1.13)	1.06[(a)] (1.02-1.10)
Practice of 150 min of leisure physical activity	1.00	0.99 (0.87-1.13)	1.01 (0.89-1.14)	1.05 (0.97-1.13)	1.05 (0.97-1.13)
Practice of physical activity during commuting	1.00	1.34 (1.02-1.77)	1.14 (0.87-1.48)	1.26 (1.05-1.52)	1.13 (0.93-1.36)
Practice of household physical activity	1.00	1.06 (0.83-1.36)	1.02 (0.79-1.33)	1.30 (1.11-1.52)	1.28[(a)] (1.09-1.51)
Practice of occupational physical activity	1.00	1.29 (1.17-1.42)	1.18[(a)] (1.07-1.30)	1.21 (1.13-1.30)	1.14[(a)] (1.06-1.22)
Physical inactivity	1.00	0.87 (0.65-1.17)	0.94 (0.70-1.27)	0.71 (0.61-0.83)	0.78[(a)] (0.66-0.92)
Watching TV – 3hours/day	1.00	1.15 (0.95-1.39)	1.06 (0.89-1.28)	1.03 (0.92-1.16)	0.98 (0.87-1.11)
Alcohol abuse	1.00	1.12 (0.94-1.32)	1.10 (0.93-1.31)	0.97 (0.87-1.09)	0.96 (0.85-1.07)
Driving a vehicle after excessive alcohol consumption	1.00	0.94 (0.54-1.62)	1.07 (0.62-1.84)	1.09 (0.77-1.54)	1.19 (0.84-1.70)
Driving after consuming any amount of alcohol	1.00	0.90 (0.68-1.18)	1.05 (0.80-1.38)	0.91 (0.77-1.07)	1.01 (0.86-1.18)
Poor health condition	1.00	1.29 (0.66-2.55)	1.05 (0.51-2.13)	1.14 (0.72-1.80)	1.04 (0.63-1.70)
Self-reported hypertension	1.00	1.07 (0.88-1.30)	1.27[(a)] (1.06-1.53)	0.86 (0.75-0.97)	1.04 (0.91-1.18)
Self-reported diabetes	1.00	1.16 (0.74-1.82)	1.49 (0.96-2.30)	0.69 (0.54-0.89)	0.94 (0.72-1.21)

[*] Weighted percentage to adjust the sociodemographic distribution of the Vigitel sample to the distribution of the adult population for 2010 according to gender, age, educational level and skin color by the rake method. [**] Age- and educational level-adjusted PR. [(a)] Statistically significant value, considering the adjusted PR.

Discussion

This is the first Vigitel study that analyzes differences in the risk and protective factors for chronic non-communicable diseases according to race or color. This study demonstrated that the risk and protective factors for chronic non-communicable diseases are different between blacks, browns and whites. After adjusting for socioeconomic and demographic factors, such as educational level and age, the differences between race/color were reduced, but factors such as a lower prevalence of smoking, poor dietary habits, more occupational physical activity, and higher frequency of hypertension persisted among blacks and browns.

The literature describes the importance of methodological adjustments in the analysis of racial inequalities because racial issues are often associated with aspects such as access to information, occupation, goods, services and health as well as the perception of racism suffered by people. Thus, the explanation of such inequalities is still a complex one, and they should not be explained from a biological point of view but rather as a social variable dependent on the historical and cultural context. This social variable is an important determinant of inequality in health among the racial groups[24] . Some authors also indicate that the worse health indicators among the black population may be partly explained by the socioeconomic status, while others consider that racial prejudice could explain these differences[2,24,30].

All these factors may act synergistically, which can negatively intensify the health indicators and increase the inequalities[31,32]. Accordingly, adjusting for socioeconomic variables reduces the excess risk due to social inequalities, although this does not completely eliminate the differences[30]. Thus, even with the adjustments, the racial/ethnic inequalities persist, further showing their complexity. The differences in health behaviors observed in the present study, even after adjusting for socioeconomics variables, may still be attributable to factors that were not properly adjusted and may partially explain them.

Smoking is an important risk factor for chronic diseases[33], and higher prevalence has been reported in populations with lower educational level[34-36]. In contrast, the BRFSS study that addressed the risk factors in adults in the US and analyzed differences between ethnic groups observed that black and Hispanic men were significantly less likely to smoke than white men and

white women in almost all age groups[37]. Differences in smoking habit were large and fairly consistent across the age groups, and the majority remained significant after adjustment for educational level and income. In general, the adjustment for educational level and income increased the racial/ethnic differences in smoking habit. After the adjustment, the black and Hispanic women exhibited approximately from one-quarter to half the odds of smoking compared to white women[37].Similar results were observed in the present study, which identified a lower PR among brown men and brown women, as well as a lower frequency of heavy smoking. Explanations for these differences need to be further explored, and cultural differences between groups should be considered.

There were no differences between races regarding the consumption of alcohol, unlike the BRFSS survey, which showed that younger black individuals (both women and men) were significantly less likely to consume alcohol compared to the same population group with similar age, after adjusting for educational level and income[37] .

The consumption of fruits and vegetables is considered a marker of healthy diet and a protective factor for chronic non-communicable diseases[33]. The present study demonstrated a lower regular consumption of fruits and vegetables among the brown and black populations (both women and men).Other differences in eating pattern were the higher consumption of fatty red meat and beans among black women and the higher consumption of whole milk among brown women. The black and brown men consumed more beans, and brown men consumed more whole milk. Some of these differences can be explained by cultural traditions because the consumption of beans and *feijoada* were popularized by the black population when Brazil was a colony of Portugal. Thus, beans, a staple food in Brazil, are essential for both "rice and beans" and for the national dish *feijoada*[38].

American studies using the same methods used in the present study show that black women are significantly more likely to be physically inactive during leisure than white women after adjusting for educational level and income, while black men and white men are equally likely to be physically inactive[37]. In the present study, black women, brown women, and brown men exhibited a higher PR of occupational and household physical activity, so lower PRs of physical inactivity were observed among black women and men . Leisure physical activity is strongly associated

with high educational level and income[39,40], while the other domains of physical activity (occupational, household and commuting) are more practiced by workers who have lower educational and income[40]. Even after adjusting for age and educational level, black ethnicity remained associated with the practice of household physical activity, perhaps due to associated and unadjusted socioeconomic factors. The fact that blacks are more active in these domains ultimately reduces their sedentariness because this indicator comprises all possible domains of physical activity[39,41].

The analysis of overweight and obesity revealed no differences between the races, but further studies are required. American studies have observed different patterns, where blacks and white men were equally likely to be obese[37,42]. A higher prevalence of overweight and obesity among the black and Mexican populations living in the United States was also observed in other studies[43,44].

Studies on hypertension and race/color differences have been described in national and international studies for decades, indicating high blood pressure rates among blacks[32,45-53]. There is no consensus regarding the causes of increased blood pressure in the black population. Two main explanations have been proposed. One is a genetic predisposition in the black population, and another is related to a greater hardship due to their darker skin, which could cause a more stressful experience among blacks, worse access to health care services, fewer health-promoting practices, and lower access to health care goods and services as a result of lower socioeconomic status, which would trigger high blood pressure[54]. However, there is no consensus in the literature on this difference according to race/color or on the factors that can explain these differences. According to Lessa, "the magnitude of hypertension varies widely depending on the biological-demographic characteristics of populations, their predominant lifestyle, physical and psychosocial environment and also the characteristics of the health care services' organization and the interactions between these factors"[55].

The BRFSS studies also indicate that diabetes is nearly twice as prevalent among African Americans compared to the white population in the United States (16.8% and 8.8%, respectively)[37]. However, these differences on hypertension and diabetes according to race/color were not found in the present study.

Although quality of and access to health care services differ with race[37], the current study showed no differences in the performance of preventive tests in women (mammography in the past two years and Pap smear in the past three years) according to race/color when adjusted for educational level. The self-assessment of health status was also not significantly different according to race/color after adjusting for educational level and income, using data from the National Household Sample Survey[56]. The present study also found no differences.

The difficulty in measuring the race/color and their possible adjustments are among the limitations of this study. The differences identified here are complex, and not all explanations can be considered definitive. According to some authors, concluding that effects are "independent" from race or ethnicity should be done with caution, mainly due to evidence that these differences do not have a genetic basis[2]. They also highlight discrimination on health as the main explanatory mechanism of such differences[2]. In addition, there are limitations in the socioeconomic measures used to adjust for the differences. Limitations in socioeconomic measures might occur when adjusting for educational level because, for example, there is no information about the quality of education. Therefore, there may be residual confounding bias due to unadjusted socioeconomic differences. In other words, the difference identified according to race/ethnicity in our models partly represents the unmeasured socioeconomic factors.

In addition, this study was performed with data obtained from the Vigitel, which interviews adults living in the Brazilian capitals who have a landline telephone. Post-stratification weights of the data were used to reduce possible non-representation bias. In addition, previous validation studies from Vigitel[57] and comparative studies with household surveys are considered appropriate[58], showing that Vigitel is a useful tool in monitoring risk factors for chronic diseases.

Conclusion

This study shows the importance of adjusting for factors such as educational level and age when evaluating differences according to race/color. Without this adjustment, the conclusions may not reflect real ethnic differences but rather the

effects of socioeconomic inequalities. Accordingly, some variables remained different among the races/colors, such as increased blood pressure in black men, which has been classically reported as a variable associated with the black population. In addition some risk factors, such as a lower consumption of fruits and vegetables, higher consumption of fatty red meat and higher frequency of occupational physical activity, are associated with less skilled, manual jobs and are not always considered beneficial to health. This study identified as protective factors a lower prevalence of smoking, a higher consumption of beans, and less inactivity. These differences can be explained by both cultural aspects and differences in access and opportunities.

Affirmative public policies aiming to move toward equity have been proposed by the Ministry of Health. These include "The Health of the Black Population and the SUS", which considers the specific health needs of the black population and the inequalities that affect this population regarding their access to health care services. The approach used in this study is consistent with that document and aims to advance the discussion and academic research on the subject, with the ultimate goal of supporting public policies that promote equity.

Further studies are required because the generated information provides relevant data for developing preventive and interventional measures targeting the reduction of major risk factors for chronic non-communicable diseases specific to the black population. These findings can support policies that reduce social inequalities and meet the real needs of this segment of the population.

Collaborators

DC Malta contributed to the study design, performed literature review and data analysis, drafted the initial version of the manuscript and approved the final version. RTI Bernal contributed to the study design, performed data analysis and statistical data analysis and approved the final version of the manuscript. L Moura contributed to the literature review, provided substantial contributions to the manuscript and approved the final version.

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