Self-declared ethnicity associated with risk factors of cardiovascular diseases in an urban sample of the Brazilian population: The role of educational status in the association

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The incidence of cardiovascular diseases (CVDs) does not follow the same pattern among different ethnic groups, in the same way the socioeconomic status of an individual may be related to which ethnic group he/she belongs. Studies show that low socioeconomic status is associated with factors such as poor nutrition, and stress which increases the chances of developing CVD [1].

Brazil is a country with a highly admixture population and the three main ancestral populations are European, African and Amerindian, reflecting the history of the country's colonization [2]. The three main self-reported ethnicities are White, Mulatto (mixed ethnicity) and Black. Thus, the aim of this study was to access the association between risk factors for CVD with self-reported ethnicity, and understand the influence of socioeconomic factors on these associations in a representative sample of the urban Brazilian population.

We analyzed self-reported data of 2531 individuals aged 17–88 year from 72 urban regions of Brazil. Ethnicity/color was self-reported as White, Black, Mulattoes (mixed ethnicity) or others. The variables analyzed in this study were the following risk factors for CVDs: arterial hypertension, hypercholesterolemia and stroke. The covariates in this study are alcohol consumption, smoking habits, physical activity, family income and educational level. Income and educational levels were divided into several categories. However, such parameterization divided the sample into many different classes, unreliable estimates for the effects and making the interpretation of the results difficult, we represented these covariates in two ways, categorically and continuously. These variables were all self-reported.

We performed logistic regressions to assess the association between arterial hypertension, hypercholesterolemia and stroke with self-reported ethnicity. The logistic regression models were fitted using these risk factors as a dependent variable adjusting for possible confounders of the association. For the variable stroke, another regression was performed by adding hypertension as a confounder of the association. The analyses were performed using the glm function available in the R Statistical Software [3]. Results with p-value < 0.05 were considered significant.

The study population comprised 51.56% of White individuals, 10.27% Black, 36.31% Mulattoes, and 1.86% other ethnicities. Table 1 shows the distribution of the proportion of cardiovascular risk factors and general characteristics of the studied sample between the different ethnicities. In this table, we can observe significant differences between ethnic groups regarding educational level, specifically for individuals with a university degree.

We can see in our data that educational level and economic status were significantly different between ethnic groups. Blacks and Mulattoes are more likely to have no formal education than Whites, and in all income levels above 1 MW (minimal wage), Whites had a greater chance, and the odds increased with socioeconomic status (unpublished results).

The analysis of the association between hypertension and self-reported ethnicity was significant in both logistic regression models. In the first model, Black individuals showed 39% higher risk of having hypertension than White individuals (Table 2). For the second model, the odds ratio (OR) was similar. The association between ethnicity and hypercholesterolemia was also significant in both models, individuals of Black ethnicity had a 43% lower risk than White (Table 2).

Similarly to our results, studies comparing cardiovascular risk factors by ethnicity among adults and young, found that Black individuals were more likely to have uncontrolled blood pressure than Whites [4,5]. For hypercholesterolemia, the opposite occurred, White individuals had a higher risk than Blacks, in agreement with the literature [6].

The association between stroke and ethnicity was analyzed in the second model. Stroke was significantly associated with the Mulatto ethnic group, producing a risk estimative of approximately 3.4 times higher of being affected by a stroke when compared with Whites. The models for stroke adjusted by hypertension presented similar results suggesting that the observed association was not solely explained by different prevalences of hypertension in different ethnicities (Table 2).

A study conducted by Kleindorfer et al. [7] showed that Blacks had higher stroke incidence than Whites and, considering a long follow-up period, found a decrease in incidence among Whites, but not among Blacks, suggesting that racial disparity in stroke incidence is worsening.

We also observed that individuals with high school had a lower cardiovascular risk than individuals with no formal education. The analysis of educational status as a continuous variable showed a 13% decrease in risk with each increase in educational level suggesting a protector role of education in blood pressure. This may be because individuals with high educational levels may be more exposed to messages about health, and consequently increase health knowledge, improve health behaviors [8], have improved employment opportunities, working conditions, health care, income, and being less likely to suffer complications of a chronic disease [1,9].

On the other hand, hypercholesterolemia and educational level are inversely related, and our results demonstrated a 19% increase in this risk factor with each increase in educational level. Other results are presented in Table 2.

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Table 1
Characteristics of the Brazilian population stratified by ethnicity.

	Black (n = 260)	White (n = 1305)	Mulatto (n = 919)	Others (n = 47)	p-Value
Age, years	40.07 ± 14.50	41.85 ± 15.28	39.89 ± 14.43	39.51 ± 16.23	<0.05
Gender %					
Male	51.92	47.51	50.05	55.32	>0.05
Female	48.08	52.49	49.95	44.68	
Educational level %					
No formal education	7.31	3.45	6.64	2.13	<0.05
Primary	56.92	38.85	49.51	44.68	
High school	27.31	38.47	36.34	31.91	
University degree	8.46	19.23	7.51	21.28	
Income %					
Up to 1 MW	16.92	6.90	13.28	10.64	<0.05
1 to 5 MW	66.54	52.41	61.59	59.57	
5 to 10 MW	11.92	23.37	17.74	14.89	
10 to 20 MW	3.85	11.34	5.44	10.64	
Above 20 MW	0.77	5.98	1.96	4.26	
Metabolic risk factors %					
Arterial hypertension	35.00	29.66	28.50	23.40	>0.05
Stroke	2.31	0.77	2.72	0.00	<0.05
Hypercholesterolemia	9.62	16.86	14.36	17.02	<0.05
Behavior risk factors%					
Smoking habits	26.92	23.22	24.81	21.28	>0.05
Sedentary lifestyle	80.77	78.01	81.83	76.60	>0.05
Alcohol consumption	41.54	35.56	37.76	40.43	>0.05

In this study, Black individuals were associated with hypertension and Mulattoes were associated with stroke. These two ethnic groups were also associated with lower education, and these two risk factors were also associated with lower education. Considering the common association of the factors existing in the model of education and model of self-reported ethnicity, data suggest that part of the observed differences in health between different ethnic groups are also a consequence of the observed socioeconomic difference between these groups. Nonetheless, the associations persist even after adjusting for this potential confounder also suggesting residual risk due to ethnicity per se.

Ethnic differences are evident in arterial hypertension, hypercholesterolemia and stroke prevalence in the Brazilian urban population. This may reflect greater susceptibility of particular groups to CVD. However, social and economic differences are also evident among ethnic groups

Table 2
Multiple logistic regression analysis of risk factors associated with hypertension, hypercholesterolemia and stroke in adult individual of Brazilian population sample.

Risk factors	Odds ratios (95% confidence intervals)			
	Hypertension	Hypercholesterolemia	Stroke1	Stroke2[h]
Ethnicity[a] (vs. Whites)				
Blacks	1.39 (1.018–1.901)*	0.57 (0.356–0.905)*		
Mulattoes	1.02 (0.831–1.258)	0.96 (0.741–1.240)	_	_
Income[b] (vs. up to 1 MW)				
1 to 5 MW	1.14 (0.836–1.571)	1.17 (0.782–1.748)	_	_
5 to10 MW	0.83 (0.641–1.071)	0.91 (0.660–1.244)		
10 to 20 MW	1.14 (0.780–1.682)	0.90 (0.563–1.441)		
Above 20 MW	0.78 (0.443–1.387)	0.80 (0.400–1.602)		
Educational level[c] (vs. no formal education)				
Primary	0.82 (0.542–1.252)	0.63 (0.396–1.009)	_	_
High school	0.75 (0.597–0.934)*	1.32 (0.992–1.759)		
University degree	1.18 (0.857–1.634)	1.38 (0.946–2.013)		
Behavior risk factor [d]				
Sedentary lifestyle (vs. Physically active)	1.03 (0.813–1.306)	1.05 (0.788–1.409)	_	_
Smoking habits (vs. no smoking)	0.82 (0.654–1.024)	0.76 (0.564–1.024)		
Alcohol consumption (vs. less or no consumption)	0.95 (0.771–1.164)	0.86 (0.655–1.121)		
Model 2 with income and educational level as continuous variables.				
Ethnicity[e] (vs. Whites)				
Blacks	1.41 (1.037–1.932)*	0.57 (0.361–0.914)*	2.83 (0.989–8.098)	2.60 (0.897–7.517)
Mulattoes	1.02 (0.828–1.252)	0.96 (0.746–1.245)	3.37 (1.570–7.244)†	3.47 (1.607–7.491)†
Income[f]	0.97 (0.864–1.090)	0.94 (0.816–1.084)	0.69 (0.429–1.104)	0.69 (0.422–1.130)
Educational level[g]	0.87 (0.745–0.997)*	1.19 (1.006–1.415)*	0.68 (0.408–1.131)	0.73 (0.439–1.216)

† p-Value < 0.01.
* p-Value < 0.05.
[a] Adjusted by gender, age, smoking habits, alcohol consumption, sedentary lifestyle, educational level and income.
[b] Adjusted by gender, age, smoking habits, alcohol consumption, sedentary lifestyle, educational level and ethnicity.
[c] Adjusted by gender, age, smoking habits, alcohol consumption, sedentary lifestyle, income and ethnicity.
[d] Adjusted by gender, age, educational level, income and ethnicity.
[e] Adjusted by gender, age, smoking habits, alcohol consumption, sedentary lifestyle, educational level and income.
[f] Adjusted by gender, age, smoking habits, alcohol consumption, sedentary lifestyle, educational level and ethnicity.
[g] Adjusted by gender, age, smoking habits, alcohol consumption, sedentary lifestyle, income and ethnicity.
[h] Adjusted by hypertension.

and are also related to these risk factors, suggesting that ethnic differences may, in part, be reflecting much, but not all, of the socioeconomic differences existent.

Authors contributions: Santos H.C. — performed the data analysis and interpretation, and wrote the manuscript.

Fragoso M.T. — provided statistical support for the data analysis and interpretation.

Machado-Coelho G.L., do Nascimento R.M., Mill J.G. and Krieger J.E. — participated in data collection.

Pereira A.C. — participated in the concept and design of the study, provided support for data analysis and interpretation, and revised the manuscript.

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Who reviews the reviewers?

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I am a regular reviewer for several publishers in Cardiology.

I believe I am effective as a reviewer.

In many cases, I have reviewed clinical studies based on “statistics” only. Over the years, I have found the statistical interpretations of the authors to often be determinant for the possible publication of a given article. This is particularly so in studies where the number of observations is too small to allow them to be regarded as acceptable in themselves.

Sincerely believe that “authors should not know who will be the reviewers”, and that “reviewers should not know who the authors are”. In other words, a “rigorous double-blind” approach is needed. In this way, any “vested interests” would be avoided entirely. Both I and many other colleagues support this approach.

Many anecdotal manuscripts are accepted for publication despite the fact that they involve only a small number of assessments and are based on the “p-value” as the only element supporting significance. In contrast, valuable, original and rigorous clinical documents are often rejected simply because the reviewers consider the supporting statistics to be incorrect.

How can we be sure that this is the case if we do not have the original database?

I know that “nothing is more open to manipulation than statistics”. By changing just one number, the “p-value” might become significant, and a clinical work therefore may be assumed to have been “well done”.

In my experience, we possibly have reached a point where what matters is “publication for the sake of publication”, and having a paper accepted in a Journal with a high impact factor.

I find this to be unethical.

I think there are many “vested interests” when it comes to accepting or not accepting a given article for publication.

In effect, a reviewer may know who the author is, and the latter may be either a friend or foe.

The outcome is clear and obvious: rejection or acceptance depending of the degree of friendship.

And when it comes to open-access journals, publication is always sure, provided of course that the authors pay for having the article appear in print.

Maybe I belong to the “old school”. Maybe!

However, ethics, objectivity and “love of teaching” should be the guiding principles of any professional. In my opinion, it is not only a matter of statistical support, but also of ethics.

And I feel that this also applies to open-access journals, where often little can be done unless of course the authors agree to pay for publication.

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