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Cardiovascular health and validation of the self-reported score in Brazil: analysis of the National Health Survey

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Abstract *This paper aims to estimate the prevalence of cardiovascular health and the validity of the Brazilian population's self-reported score. This is a cross-sectional, methodological study with 8,943 individual adults and laboratory data from the 2013 National Health Survey. We employed behavioral (body mass index, tobacco use, diet, physical activity, ideal if ≥ 3 ideal factors), biological (tobacco use, dyslipidemia, hypertension, and diabetes, ideal if ≥ 3 ideal factors), and cardiovascular health scores (all factors, ideal if ≥ 4 ideal factors). Prevalence of sensitivity and specificity scores and analyses of the self-reported scores were estimated, considering the scores with measured variables as the gold standard. Approximately 56.7% of individuals had ideal values for the measured cardiovascular health score. Sensitivity was 92% and specificity 30% for the self-reported biological score. Sensitivity and specificity scores were, respectively, 90.6% and 97.2% for self-reported behavior. The self-reported cardiovascular health score had a sensitivity of 92.4% and specificity of 48.5%. A little over half of the population had an ideal cardiovascular health score. The self-reported score showed good sensitivity and lower proportions of specificity.*

Key words *Validation study, Cardiovascular diseases, Self-report, Surveys and questionnaires*

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Introduction

Self-reported measures have been widely used in national health surveys to assess and monitor the occurrence of chronic noncommunicable diseases (NCDs) and their risk factors[1].

This method allows retrieving information with more significant operational and logistical ease, greater agility, and lower cost[1,2]. Therefore, it is often the most essential and convenient tool for monitoring and surveillance of diseases and risk factors on a large scale in the population. However, arguments against the reliability of self-reported data are frequent, and studies of agreement of this information are essential to show how much these measures can and should be considered to avoid classification errors and ensure data quality.

Several studies that assessed the reliability of chronic diseases and their self-reported risk factors, such as body mass index (BMI)[3], physical activity[4,5], diet[6], hypertension[7], and diabetes[8], indicate satisfactory results, with good results in the analyses of reproducibility and validity when the self-reported measures are compared with those measured. It should be added that these studies evaluated factors and diseases in isolation, and further studies are needed to assess the effect of using self-reported measures in constructs that assess cardiovascular health, as proposed by the American Heart Association (AHA)[9].

The ideal cardiovascular health construct adopted by the American Heart Association (AHA) is based mainly on primary prevention as a strategy for the prevention of cardiovascular diseases (CVD). The proposed criterion uses a score composed of seven factors, including four behavioral (tobacco use, physical activity, body mass index (BMI), and diet) and three biological factors (blood pressure, blood glucose, and cholesterol levels)[9]. Several studies have shown that the highest number of factors at an ideal level is associated with a lower risk of cardiovascular events[10-13], which reinforces the importance of these metrics and their use at the individual and population level for proposing actions aimed at the prevention of noncommunicable diseases and conditions, such as cardiovascular diseases, currently the most significant cause of death and DALYs in our country[14].

Noteworthy is that the agreement between the measured and self-reported measures may differ according to sociodemographic, economic, and socio-cultural characteristics such as gender, age, education, and income, limiting the inference of the results in specific groups[4,15-17].

Thus, this study aimed to estimate the prevalence of cardiovascular health in the Brazilian population and analyze the validity of the self-reported cardiovascular health score according to sociodemographic characteristics.

Material and Methods

Study design

This is a cross-sectional and methodological study that used data from the 2013 National Health Survey (PNS), including laboratory data collected in 2014 and 2015, conducted by the Institute of Brazilian Geography and Statistics (IBGE) in partnership with the Ministry of Health[18]. The PNS is a national home-based survey, which uses a three-stage sampling plan by conglomerates: census tracts (primary units); households (secondary units); adults aged 18 years or older (tertiary units). The complete and specific method of this critical population health survey is available in previous publications[19,20].

PNS 2013 had 60,202 interviews, and biological material was collected in a sub-sample for biochemical analysis. The subsample was designed to include 25% of the sample of respondents (around 15,688 individuals). However, the final sample of individuals who had collected biological material was made up of 8,943 individuals. Among the causes of losses were difficulties in locating the household, participants' refusals to collect biological material, lack of knowledge about the project and objectives, time unavailability to meet the research protocol, and inadequate analysis samples.

Noteworthy is that valid answers were required for all the measured and self-reported components of the variables that make up the cardiovascular health score for this study. Thus, the final sample for biological, behavioral, and cardiovascular scores was 6,621, 5,893, and 4,585 individuals, respectively, due to missing measured (anthropometric and laboratory data) and self-reported data.

Cardiovascular health evaluation

The cardiovascular health score proposed by AHA[9] was used to assess cardiovascular health. It should be noted that the score can be grouped

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into behavioral score, biological score, and cardiovascular health score. Each factor can be classified as ideal, intermediate, and poor. The PNS self-reported questions allow classifying ideal and poor/intermediate. Thus, we categorized both measured and self-reported measures for this study. Also, we underscore that the tobacco use factor is repeated in the behavioral and biological scores due to the importance of smoking cessation for health promotion[9].

Chart 1 shows the cutoff points and categorizations used in this study for measured and self-reported measures of biological, behavioral, and cardiovascular scores, as proposed by Lloyd-Jones et al.[9]. In the end, these scores were categorized as ideal, if ≥ 3 factors for biological and behavioral scores, and poor/intermediate, in the case of <3 factors at an ideal level. Concerning the cardiovascular health score, people with values ≥4 factors were classified as having an ideal score, and those with values <4 were included in the poor/intermediate category.

The self-reported information was obtained from the PNS 2013 questionnaire. Tobacco use was assessed with questions: “Do you currently smoke any tobacco product?” “And in the past, did you smoke any tobacco products?” and “P59. When did you stop smoking?”

The diet was evaluated based on four of the five criteria proposed initially: regular consumption of fruits and vegetables, fish, soft drinks and sugar-sweetened drinks, and salt, as described in a previous study[21]. The consumption of whole grains, which is part of the diet indicator in the original score, was not assessed as it was not included in the survey.

The following questions evaluated the consumption of vegetables and fruits: “On how many days of the week do you usually eat lettuce and tomato salad or salad of any other vegetable or raw vegetable?” “In general, how many times a day do you eat this type of salad?”; “How many days of the week do you usually eat fruits?”; and “In general, how many times a day do you eat fruits?”. Fish consumption was assessed by the question, “How many days of the week do you usually eat fish?”. The following questions assessed the consumption of soft drinks and artificial juices: “How many days of the week do you usually drink soft drinks (or artificial juice)?”; and “In general, how many glasses of soft drinks or artificial juice do drink per day?”

Engaging in at least 150 weekly minutes of moderate physical activities or 75 weekly minutes of vigorous leisure activities was assessed by the questions: “How many days per week do you usually engage in physical exercise or sport?”; and “In general, on the day that you engage in exercise or sport, how long does this activity last”. Vigorous activities were considered as running, aerobics, soccer, and basketball.

The self-reported weight and height measures evaluated in this study were informed during the interview by the following questions: “Do you know your weight (even if it is an approximate value)?” “Do you know your height (even if it is an approximate value)?”. The recommendations of the World Health Organization (WHO) were followed for direct measurement of anthropometric parameters[22]. A digital scale with a capacity of 150 kilos and a precision of 100 grams was used for weight measurement, and a portable stadiometer measured height. BMI was calculated using weight and height with the following formula: BMI = weight in kg/ (height in meters * height in meters). The same formula was used with the measurements obtained by the self-reported method and the one measured directly.

The following question was used to assess self-reported hypertension: “Has any doctor ever diagnosed you with hypertension (high blood pressure)?”. Direct blood pressure measurement was performed via the oscillometric method using the automatic device, ensuring that the individual did not smoke, eat, and consume any type of drink, except for water, at least 30 minutes before blood pressure measurement, besides not having exercised in the last hour[22].

Altered cholesterol was assessed using the self-reported method by asking the question, “Has any doctor ever diagnosed you with high cholesterol?”. Peripheral blood was collected with no need for fasting in tubes with gel for direct measurement. The clot was retracted for 30 minutes and subsequently centrifuged, and samples were transported under refrigeration at 2-8ºC, with temperature control in the various stages. Total cholesterol was measured using an automated enzymatic colorimetric method[23].

The following questions were asked to assess diabetes: “Has any doctor ever diagnosed you with diabetes?” and “In the past two weeks, because of diabetes, did you: a. Take oral medications to lower your blood sugar? B. Use insulin?”. The measured criterion for diabetes was glycated hemoglobin, with peripheral blood collection performed at any time of the day, without fasting. The blood was collected in a tube with ethylenediaminetetraacetic acid (EDTA), and the glycated hemoglobin was measured by ion-ex-

Chart 1. Classification of behavioral, biological, and cardiovascular health scores as poor/intermediate and ideal according to self-reported data and measured by the National Health Survey, 2013.

Components and Scores	Self-reported		Measured	
	Poor/intermediate	**Ideal**	**Poor/intermediate**	**Ideal**
Tobacco use	Current smoker or former smoker < 12 months	Never smoked or quit smoking ≥ 12 months	Current smoker or former smoker < 12 months	Never smoked or quit smoking ≥ 12 months
Diet	< 4 components ideal*	4 components ideal*	< 4 components ideal*	4 components ideal*
Physical activity	< 150 min/weekly moderate activities or < 75 min/vigorous weekly leisure activities	≥ 150 min/weekly moderate activities or ≥ 75 min/vigorous weekly leisure activities	< 150 min/weekly moderate activities or < 75 min/vigorous weekly leisure activities	≥ 150 min/weekly moderate activities or ≥ 75 min/vigorous weekly leisure activities
Body Mass Index	BMI≥ 25 Kg/m2 based on self-reported weight and height	BMI<25 Kg/m2 based on self-reported weight and height	BMI ≥ 25 Kg/m2 based on measured weight and height	BMI < 25 Kg/m2 based on measured weight and height
Behavioral score	**Sum of the 4 previous factors Ideal ≥ 3 factors**		**Sum of the 4 previous factors Ideal ≥ 3 factors**	
Blood pressure	Medical diagnosis or medication for high blood pressure	Absence of diagnosis or medication for high blood pressure	SBP ≥ 120 mmHg and DBP ≥ 80 mmHg or use of medication for BP	SBP < 120 mmHg and DBP < 80 mmHg or use of medication for BP
Total cholesterol	Medical diagnosis of increased cholesterol	Absence of medical diagnosis of increased cholesterol	TC ≥ 200 mg/dL	TC < 200 mg/dL
Diabetes	Diabetes diagnosis or medication	Absence of diabetes diagnosis or medication	Glycated hemoglobin ≥ 5.6 or use of medication for diabetes	Glycated hemoglobin ≥ 5.6 or use of medication for diabetes
Biological score	**Sum of the 3 previous factors plus tobacco use Ideal ≥ 3 factors**		**Sum of the 3 previous factors plus tobacco use Ideal ≥ 3 factors**	
Final Cardiovascular Health	**Sum of the 7 factors Ideal ≥ 4 factors**		**Sum of the 7 factors Ideal ≥ 4 factors**	

Note: Classification performed according to American Heart Association (AHA)9 criteria; * Ideal components: 5 servings of fruits and vegetables 5x week; fish consumption twice a week; no soft drink consumption; intake of less than 5g of salt per day. SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; TC: Total cholesterol.

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change high-performance liquid chromatography (HPLC)[23].

Data analysis

Frequencies and means (± SD) of the individuals' sociodemographic variables were presented in the data analysis, and the prevalence and 95% confidence intervals (95% CI) of the individual components, the measured and self-reported behavioral, biological, and cardiovascular health scores were calculated.

The validity of self-reported biological, behavioral, and cardiovascular health scores was assessed using a sensitivity and specificity calculation, with the respective 95% CI, using the measurements measured based on anthropometric and laboratory data as the gold standard. Sensitivity was calculated as (true positives) / (true positives + false negatives) and specificity as (true negatives) / (true negatives + false positives). Also, we calculated the positive predictive values (PPV) – true positives / (true positives + false positives) and negative predictive values (NPV) – true negatives / (true negatives + false negatives) for all scores. All analyses were stratified by gender (male, female), age group (18-49 years, 50-59 years, and 60 years and over) and schooling level (up to 8 years of study; 9-11 years of study; and 12 years of study and over).

The analyses were conducted using the software Stata 14.0 and considered the complex sampling effect and study design.

Ethical considerations

National Research Ethics Commission (CONEP) of the National Health Council (CNS), Ministry of Health, approved the PNS. Adult participation in the research was voluntary, and confidentiality of information was assured. The research participants signed the Informed Consent Term (ICT) and authorized the collection of laboratory tests.

Results

Of the 8,943 individuals who had self-reported, anthropometric, and laboratory data collected, 51.2% (95% CI 51.5-54.3%) were female, and 49.3% (95% CI 47.9-50.7%) reported up to 8 years of study. The mean age of the participants in this study was 43.2 years ± 23.7 SD (data not shown).

The prevalence of the scores and the variables that compose them for self-reported and measured measures are shown in Table 1. Regarding the measured scores, 65.2% (95% CI: 63.7-66.7%), 17.3% (95% CI: 16.0-18.6%), and 56.7% (95% CI: 54.8-58.6%) of the population had ideal values for the biological, behavioral and cardiovascular health scores, respectively. When evaluating self-reported measures, 84.4% of individuals (95% CI: 83.2-85.4%) were classified as having an ideal biological score, 17.9% (95% CI: 16.6-19.3%) as having an ideal behavioral score, and 74.7% (95% CI: 73.0-76.3%) as having an ideal cardiovascular health score.

Regarding the sensitivity analysis of biological, behavioral, and cardiovascular health scores, in general, the values ranged from 72.9% to 98% for the total of individuals and when stratifying by gender, age, and education. On the other hand, more significant variability was observed when assessing all individuals' specificities and stratified by sociodemographic variables, with lower values for the biological score (from 17.1 to 39.6%) and higher values for the behavioral score (from 96.4 to 98.1%). Noteworthy is that, concerning the variables that make up the behavioral score, some data are measured only for the BMI, which allowed their differentiation in the self-reported and measured score. The other variables (physical activity, smoking, and diet) are available only as self-reported in the PNS. Cardiovascular health scores ranged from 36.8 to 59.8% of specificity. The PPVs and NPVs for the cardiovascular health score were 70.1% and 83.0%, respectively. All sensitivity, specificity, PPV, and NPV results are described in Table 2.

Discussion

In the Brazilian population, just over half of the individuals have an ideal cardiovascular health score, considering the objective measures of blood pressure, glycated hemoglobin, and BMI. Studies have shown that individuals with ideal results for this score have a higher risk of developing cardiovascular events[24] and other conditions, such as declining cognitive function[25,26], kidney disease[27], and lower quality of life[28]. This study's findings point to that most Brazilians have metabolic changes and unfavorable lifestyle habits that can adversely influence the rates of morbimortality from chronic diseases.

Regarding the cardiovascular health score, in general, high proportions of sensitivity and

Table 1. Prevalence of cardiovascular health in the Brazilian population comparing individual factors and measured and self-reported scores. PNS 2013.

Cardiovascular health metrics	Self-reported	Measured
	% (95% CI)	% (95% CI)
Biological factors		
Total cholesterol	n = 7.560	n = 8.525
Poor/intermediate	15.5 (14.5-16.5)	32.8 (31.5-34.1)
Ideal	84.5 (83.5-85.5)	67.3 (65.9-68.5)
Diabetes	n = 7.824	n = 8.551
Poor/intermediate	7.5 (6.8-8.3)	24.2 (23.0-25.4)
Ideal	92.5 (91.7-93.2)	75.8 (74.6-77.0)
Blood pressure	n = 8.524	n = 8.857
Poor/intermediate	23.9 (22.8-25.1)	38.8 (37.4-40.2)
Ideal	76.1 (74.9-77.2)	61.2 (59.8-62.6)
Biological score (n = 6,621)		
Poor/intermediate (2-1 factors)	15.7 (14.6-16.8)	34.8 (33.3-36.3)
Ideal (4-3 factors)	84.4 (83.2-85.4)	65.2 (63.7-66.7)
Behavioral factors		
Tobacco use (n = 8,942)		
Poor/intermediate	15.9 (14.9-17.0)	15.9 (14.9-17.0)
Ideal	84.1 (83.0-85.1)	84.1 (83.0-85.1)
Leisure-time physical activity (n = 8,938)		
Poor/intermediate	78.3 (77.0-79.4)	78.3 (77.0-79.4)
Ideal	21.8 (20.6-23.0)	21.8 (20.6-23.0)
Body Mass Index	n = 5,960	n = 8,853
Poor/intermediate	54.6 (52.9-56.3)	57.3 (55.9-58.7)
Ideal	45.4 (43.7-47.1)	42.7 (41.3-44.1)
Diet (n = 8,942)		
Poor/intermediate	80.6 (79.6-81.6)	80.6 (79.6-81.6)
Ideal	19.4 (18.4-20.4)	19.4 (18.4-20.4)
Behavioral score (n = 5,893)		
Poor/intermediate (2-1 factors)	82.1 (80.7-83.4)	82.8 (81.4-84.4)
Ideal (4-3 factors)	17.9 (16.6-19.3)	17.3 (16.0-18.6)
Cardiovascular health score (n = 4,585)		
Poor/intermediate	25.3 (23.7-27.0)	43.3 (41.4-45.2)
Ideal	74.7 (73.0-76.3)	56.7 (54.8-58.6)

low specificities were observed in the validation analyses. This score's lower specificities, which combines the behavioral and biological scores, are mainly due to those found for the biological score. This means that people with ideal health assessed by objective measurements (gold standard) tend to self-classify themselves as healthy. However, the low specificity values reflect the low agreement of measured and self-declared poor/intermediate health. The individuals who declare the cardiovascular health score components as ideal had subclinical laboratory changes or underdiagnosed diseases and conditions that make up the biological score. This gap between measures has been shown in other studies[8,29,30].

As for the behavioral score, there a smaller difference was noted between the measured and self-reported proportions, considering that, among the variables that comprise it – physical activity, diet, tobacco use, and BMI – only the last one was objectively measured in this study, and measures were validated in a study with acceptable results[3].

Concerning the biological score, specifically, the lower sensitivity in individuals with up to eight years of study compared to those with

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Table 2. Analysis of sensitivity, specificity, positive (PPV) and negative (NPV) predictive values of biological, behavioral, and cardiovascular health scores, stratified by gender, age, and education. PNS 2013.

Scores	% Sensitivity (95% CI)	% Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)
Biological score	92 (90.90 - 92.9)	30 (27.6 - 32.4)	73.5 (71.5 – 75.4)	64.6 (60.2 – 68.9)
Gender				
Female	90.8 (89.3 - 92.0)	33.9 (30.8 - 37.2)	68.5 (65.8 – 70.9)	69.4 (63.1 – 75.1)
Male	93.5 (91.8 - 94.8)	25.6 (22.3 - 29.2)	80.8 (78.8 – 82.6)	71.8 (63.6 – 78.8)
Age group				
18-49 years	98.1 (97.4 - 98.6)	17.1 (13.8 - 21.0)	80.8 (78.8 – 82.6)	71.8 (63.6 – 78.8)
50-59 years	87.9 (83.8 - 91.0)	33.7 (29.3 - 38.4)	54.6 (50.6 – 58.6)	75.4 (68.1 – 81.4)
60 years and over	72.9 (69.1 - 76.4)	39.6 (35.8 - 43.5)	53.9 (50.5 – 57.4)	60.2 (55.2 – 64.9)
Schooling (in years of study)				
Up to 8 years	86.4 (84.3 - 88.2)	33.1 (30.2 - 36.1)	61.9 (59.6 – 64.3)	65.8 (61.5 – 69.9)
8-11 years	96.4 (95.1 - 97.3)	24.6 (20.2 - 29.6)	73.5 (65.5 – 80.2)	75.8 (73.07–78.5)
12 years and over	94.9 (92.7 - 96.4)	26.1 (19.8 - 33.7)	82.6 (79.2 – 85.6)	58.1 (46.4 – 68.9)
Total behavioral score	90.6 (87.5 - 92.9)	97.2 (96.5 - 97.7)	87.1 (84.2 – 89.6)	98.0 (97.3 – 98.5)
Gender				
Female	91.6 (87.8 - 94.3)	96.5 (95.5 - 97.3)	83.8 (79.4 – 87.4)	98.3 (97.5 – 98.8)
Male	89.7 (84.7 - 93.2)	97.9 (96.9 - 98.6)	90.4 (86.3 – 93.4)	97.7 (96.5 – 98.5)
Age group				
18-49 years	90.1 (86.1 - 93.1)	97.5 (96.6 - 98.1)	89.5 (86.0 – 92.3)	97.6 (96.6 – 98.4)
50-59 years	93.1 (85.6 - 96.9)	96.7 (94.9 - 97.9)	77.1 (66.9 – 84.8)	99.2 (98.2 – 99.6)
60 years and over	90.9 (84.4 - 94.9)	96.8 (95.2 - 97.9)	85.0 (78.2 – 90.0)	98.2 (96.7 – 98.9)
Schooling (in years of study)				
Up to 8 years	86 (78.8 - 91.1)	98.1 (97.3 - 98.7)	85.8 (80.3 – 89.9)	98.2 (97.1 – 98.9)
8-11 years	89.3 (83.9 - 93.1)	96.4 (95.0 - 97.4)	84.9 (79.7 – 89.0)	97.5 (96.1 – 98.4)
12 years and over	96.1 (92.3 - 98.1)	96.7 (94.7 - 97.9)	90.9 (85.8 – 94.3)	98.6 (97.2 – 99.3)
Cardiovascular health score	92.4 (91.0 - 93.6)	48.5 (45.7 - 51.4)	70.1 (68.1 – 72.1)	83.0 (80.1 – 85.3)
Gender				
Female	92.7 (90.9 - 94.2)	51.9 (48.0 - 55.7)	74.2 (71.6 – 76.7)	82.7 (78.7 – 86.1)
Male	92 (89.7 - 93.9)	45.5 (41.4 - 49.6)	65.8 (62.6 – 68.9)	83.4 (78.8 – 87.1)
Age group				
18-49 years	96.4 (95.1 - 97.4)	36.8 (32.3- 41.5)	77.1 (74.6 – 79.4)	82.4 (76.6 – 86.9)
50-59 years	86.5 (80.4 - 90.9)	54.1 (48.9 - 59.2)	53.2 (48.0 – 58.3)	86.9 (81.0 – 91.2)
60 years and over	79.5 (74.6 - 83.7)	59.8 (55.0 - 64.3)	58.0 (53.2 – 62.7)	80.7 (76.0 – 85.7)
Schooling (in years of study)				
Up to 8 years	87.1 (83.8 - 89.8)	54 (50.3 - 57.6)	58.9 (55.5 – 62.2)	84.7 (80.8 – 87.8)
8-11 years	94.2 (92.0 - 95.8)	41 (35.9 - 46.4)	72.5 (69.1 – 75.8)	81.1 (74.7 – 86.2)
12 years and over	95.5 (93.5 - 97.0)	45.1 (37.8 - 52.6)	81.4 (77.5 – 84.7)	80.2 (72.1 – 86.4)

higher schooling may indicate lesser knowledge about the health situation in less educated people, which was previously observed in a study that analyzed the self-assessment of the health of the Brazilian population[31]. The greatest specificities in this score were found in women and people over 50 years of age, compared to men and younger adults. These findings may reflect women's increased search for health services for prevention and screening[8]. They are also related to the frequent need for periodic monitoring of older individuals by health professionals, contributing to the diagnosis and recognition of diseases by older adults. The severity of diseases tends to be greater with age, which could reduce underdiagnosis through signs and symptoms, while younger individuals, still in the early stages of illness, may not have been diagnosed[15,16]. Therefore, caution is required when interpreting responses in certain population groups, whose sociodemographic conditions may interfere with surveys[16,29,30,32].

In an additional analysis of this study, approximately 20% of the individuals who declared they did not have hypertension and diabetes had alterations in the blood pressure measurement and glycated hemoglobin test (data not shown). Other studies converge towards these findings, resulting in high proportions of the underestimated prevalence of diseases and cardiovascular risk factors[29,30,33].

Thus, self-reported measures can minimize the real burden of disease in the Brazilian population, for reasons related to deficiencies in public policies, financing of the health system, and, consequently, limited access to services, prevention, and screening[8]. It is worth highlighting what self-reported measures also depend on the knowledge of the health situation, the interpretation of the survey questions, and individuals' ability to recall the information[15,29]. On the other hand, the referred morbidity has been used in several national[23,30,34] and international[35,36] studies as an alternative way of estimating the disease burden in populations given the difficulty of carrying out biochemical measurements on a population scale. This study's data show an overestimated prevalence of ideal cardiovascular health in the Brazilian population, and on the other hand, underestimated poor/intermediate health levels. Therefore, it is noteworthy that the burden of disease in self-reported surveys should be interpreted with caution, especially when it comes to constructs of biological data that can change asymptomatically.

Thus, this study's findings also point to the need to discuss barriers to access screening and the importance of health education to prevent cardiovascular diseases and, therefore, premature mortality from these diseases. In the Unified Health System (SUS), Primary Health Care (PHC) would be the most appropriate level of care and with the greatest capillarity to invest in improving the identification and screening of potential at-risk individuals, contributing to comprehensive health.

A limitation of this study was that laboratory tests' performance was not concomitant with the PNS 2013 home interviews. Thus, there may have been changes in some individuals' health status between the interviews and the collection of samples of biological material[20]. Also, the absence of objective physical activity measures, diet, and tobacco use is cited, which required including these variables in the measured and self-reported behavioral scores. On the other hand, this research allowed composing the ideal cardiovascular health score with the measured blood pressure, glycated hemoglobin, cholesterol, weight, and height measurements, showing the importance of using these measurements to estimate population data, since divergences were identified between real and self-declared health conditions.

The National Health Survey is the first representative Brazilian survey to provide self-reported information and objective measures on the population's health status. The clinical and laboratory data provided by PNS 2013 allowed the calculation of the biological score of the AHA criterion of cardiovascular health, and the anthropometric ones, the calculation of BMI, which is one of the variables used in the creation of the behavioral score of that same criterion. The comparative analyses between scores using only the self-reported values and the score containing measured indicators point out the discrepancies between the self-report and the individuals' real health condition due to the existence of undetected subclinical diseases. This study's findings reinforce the importance of investing in national research that carries out more accurate measurements of the population's health status and the need to strengthen health promotion actions in PHC to ensure the identification and monitoring of people potentially at risk of developing cardiovascular diseases.

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Collaborations

AD Moreira, CS Gomes, IE Machado, DC Malta and MS Felisbino-Mendes participated equally in all stages of preparation of the article.

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