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Ideal Cardiovascular Health in the southern cone of Latin America

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ABSTRACT

Objective: The American Heart Association developed the concept of 'Ideal Cardiovascular Health', which is based on the presence of ideal levels across seven health factors. The goal of this study is to assess the prevalence of Ideal Cardiovascular Health in the Southern Cone of Latin America.

Study design: We conducted a cross-sectional analysis as part of CESCAS I cohort.

Methods: This report included 5458 participants aged between 35 and 75 years who were selected using stratified multistage probability sampling in Argentina, Chile and Uruguay. Interviews included demographic information, the International Physical Activity Questionnaire, and a food frequency questionnaire on dietary habits. Participants were classified as current, former or non-smokers. Weight, height and blood pressure were measured by trained personnel, and fasting cholesterol and glucose plasma levels were measured.

Results: Only 0.1% (95% confidence interval [CI]: 0.0–0.2) met the seven criteria that define the Ideal Cardiovascular Health. The least prevalent healthy behaviour was having a healthy diet: 0.5% (95% CI: 0.3–0.7), while the least prevalent health factor was having blood pressure < 120/80 mmHg: 23.6% (95% CI: 22.1–25.0).

Conclusions: The prevalence of Ideal Cardiovascular Health is very low in a representative sample of population from the Southern Cone of Latin America, and the levels of healthy lifestyle behaviours are even lower than ideal biochemical parameters. These results highlight the challenge of developing strategies to improve the levels of Ideal Cardiovascular Health at primary prevention levels.

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Introduction

Cardiovascular conditions are the leading cause of morbidity and mortality worldwide, with ischaemic heart disease as the leading cause of premature mortality and disability-adjusted life years (DALYs).[1] Several studies have identified the same risk factors for myocardial infarction or stroke across different populations, though different regions present a different prevalence and disease burden.[2,3] For a long time, initiatives have focused on measuring the extent of the problem and lowering risk factors.

To improve cardiovascular health, it is necessary to promote healthy lifestyles and to take a more positive approach. This is why the American Heart Association's (AHA) Strategic Impact Goal Through 2020[4] created the Ideal Cardiovascular Health construct as a way to emphasise primary prevention. AHA defines Ideal Cardiovascular Health as the simultaneous presence of four favourable cardiovascular behaviours (non-smoking, body mass index (BMI) < 25 kg/m2, physical activity at target level and a diet consistent with current guideline recommendations) and three ideal health factors (untreated total cholesterol <200 mg/dL, untreated blood pressure <120/<80 mmHg and untreated fasting glucose <100 mg/dL).

Since the introduction of this construct, many US studies have reported on the prevalence,[5,6] and association with cardiovascular disease[7,8] and other risk factors or conditions like cancer,[9] subclinical vascular disease,[10,11] disability,[12,13] and mortality.[14,15]

Several other studies have described the levels of Ideal Cardiovascular Health in European[16–19] and Asian[20–24] countries, but there are no reports from South America.

The aim of this study is to assess the prevalence of Ideal Cardiovascular Health in an adult population from the Southern Cone.

Methods

This report is part of the CESCAS I study (Detection and follow-up of cardiovascular disease and risk factors in the Southern Cone of Latin America). CESCAS I methodology has been described earlier.[25,26] Below, we present a summary of aspects of CESCAS I (study design, sampling methods and measurements techniques) that are relevant to this analysis.

CESCAS I is a prospective cohort study with participants from four small and medium-size cities: two Argentine cities (Bariloche and Marcos Paz), one Chilean city (Temuco) and one Uruguayan city (Pando—Barros Blancos). Cohort recruitment involved a first cross-sectional stage between 2011 and 2012. Participants from all four cities were selected through a four-stage stratified sampling method. In the first stage, census radii were randomly selected, stratified by socio-economic level. In the second stage, a number of blocks proportional to the radius size were randomly selected. In the third stage, a systematic random sampling to select households within each block was performed. All household members aged between 35 and 74 years were included in the final sampling frame. Finally, during the fourth stage, only one member per household, stratified by gender (50% women and 50% men) and age category (35–44, 45–54, 55–64, and 65–44 years), was randomly selected to be included in the study. The overall response rate was 73.4%, and the response rates were similar in men and women and across different locations.

Inclusion criteria: (i) aged between 35 and 74 years; (ii) living as a permanent resident of the city for at least 6 months per year; (iii) being able to respond autonomously to the questionnaires; and (iv) being willing to sign an informed consent to participate in the study.

Each site sent a letter to all subjects identified during the sampling process inviting them to take part in the study. An interviewer contacted candidates and arranged a home visit. During this visit, the interviewer explained the details of the study. Those who agreed to participate in the study signed an informed consent form.

Study participants responded to questionnaires administered by a trained interviewer. Interviewers scheduled a visit to the clinic to obtain physical measurements and overnight fasting blood samples.

Questionnaires gathered information on participants' demographics, socio-economic level, healthcare utilisation and personal and family history of cardiovascular disease and risk factors.

Dietary habits were assessed with a 126-item food frequency questionnaire (FFQ), which recall food consumed in the last year. This questionnaire was adapted from the National Cancer Institute's Diet History Questionnaire and has been validated for its use in Argentina, Chile and Uruguay.[27] First, we excluded participants with reported extreme energy intake (defined as ≤300 kcal/d or ≥7000 kcal/d). All variables were energy-adjusted and referred to a diet of 2000 kcal/d. Then, we categorised the achievement of the four components of an ideal diet as follows:

- ≥4.5 cups/d of fruits and vegetables (approximately ≥400 g/d; fruits included whole fruits; vegetables included orange and green leafy vegetables, tomatoes and other vegetables excluding root and starchy vegetables);
- ≥two 3.5 oz servings/wk of fish (approximately ≥200 g/wk of fish and seafood);
- less than 1500 mg of sodium/day (estimated according to nutrient intake—as per FFQ—without including salt added at the table or while cooking); and
- ≤36 oz/wk of sugar-sweetened beverages (approximately ≤36 oz/wk, including soda, juice and flavoured water with sugar).

Physical activity was evaluated using the transcultural adaptation of the International Physical Activity Questionnaire (IPAQ)[28] used in the Hispanic Community Health Study / Study of Latinos (HCHS/SOL Study).[29,30] The IPAQ includes questions on frequency and duration of moderate and vigorous intensity activities over the last 7 days in three domains: work, leisure time and active transportation. Recorded activities were converted into metabolic equivalents and then into min/week of moderate or vigorous intensity physical activity.

Information about current and former cigarette smoking, age of onset, years of smoking and number of cigarettes smoked per day were evaluated using the Global Adult Tobacco Survey.[31]

Weight was measured with a standing scale supported on a steady surface with participants wearing only underwear (without shoes). Height was measured without shoes on the Frankfort plane positioned at a 90° angle against a metric tape mounted on a wall. Two measurements were performed. The resulting average was used to calculate BMI.

According to AHA recommendations, trained personnel measured blood pressure three times at 30-s intervals[32] using the standard mercury sphygmomanometer with the corresponding cuff size. We used the mean of all three measurements.

Fasting blood samples were obtained in order to determine cholesterol and fasting glucose levels. Blood specimens were processed at the examination centre and shipped to the central laboratory at Hospital Italiano of Buenos Aires where the specimens were stored at −80 °C until laboratory assays could be done.

Ideal Cardiovascular Health was defined as the simultaneous presence of four ideal health behaviours and three ideal health factors in absence of clinical cardiovascular disease (specifically, coronary disease, stroke or cardiac failure). Each component was analysed using specific criteria based on the following categories: ideal, intermediate, and poor cardiovascular health (Table 1). The AHA index was generated based on health behaviours and health factors. The ideal health behaviours index corresponds to the number of ideal behaviours present (score 0 to 4), and the ideal health factors index corresponds to the number of health factors present plus 'not smoking' (score 0 to 4). Both indexes considered smoking, following AHA's explicit recommendations.

The sample size for the main CESCAS study was calculated considering a 5% level of significance and 85% power, a minimum prevalence of 5% and a design effect of 1.5. This sample size was sufficient for this analysis since for a prevalence of 1% the power is still greater than 80%.

We calculated weighted prevalences and their 95% confidence interval (CI). Descriptive analysis is presented in tables stratified by sex, age and site. Additionally, we conducted a sensitivity analysis to compare all results between included and excluded participants.

Results

Out of the 7524 participants of CESCAS' main study, 5458 participants (3214 women and 2244 men) were included in this report with all measurements needed. Mean age was 54.8 ± 10.8 years, and 34.7% of the population has completed secondary school education or higher. There were 2066 participants excluded from analysis due to missing data (96% due to missing FFQ data and 4% due to missing laboratory tests). Characteristics of excluded participants are similar to those included in the analysis. Table 2 presents demographic and clinical characteristics by site and for both included and excluded participants.

Table 3 shows the distribution of components classified into ideal, intermediate and poor cardiovascular health categories across the whole sample and stratified by sex, age and educational level. As regards to ideal health behaviours, having a healthy diet was the least prevalent behaviour, with 0.5% (95% CI: 0.3–0.7); while non-smoking, i.e. they either never smoked or had quit for more than 12 months, got the best results with 61.4% (95% CI: 59.8–63.0). For ideal health factors, the best indicator was ideal level of fasting plasma glucose with a prevalence of 68.8% (95% CI: 67.4–70.3), while blood pressure was the worst factor, since only 23.6% (95% CI: 22.1–25.0) presented ideal levels of systolic or diastolic blood pressure. There is greater prevalence of Ideal Cardiovascular Health in women, specifically with regard to smoking status (65.6%, 95% CI: 63.5–67.7), BMI (24.6%, 95% CI: 22.8–26.5), blood pressure (30.1%, 95% CI: 28.0–32.3) and fasting plasma glucose (72.5%, 95% CI: 70.7–74.4). There is a consistent tendency among younger participants: most of them tend to show a higher prevalence of Ideal Cardiovascular Health for total cholesterol, blood pressure and fasting glucose. People aged between 45 and 64 years have the lowest prevalence of ideal smoking status, i.e. they never smoked or had quit more than 12 months ago. In the case of ideal BMI, people aged between 35 and 44 years have the highest prevalence. Participants with less educational level have consistently less prevalence of ideal health behaviours and factors except for smoking status.

Table 1 – Definitions of ideal, intermediate and poor cardiovascular health for each metric.

Metric	Definitions		
	Ideal health	Intermediate health	Poor health
Smoking status	Never smoker or quit >12 month	Former smoker ≤12 month	Current smoker
Body mass index	<25 kg/m^2	25–29.9 kg/m^2	≥30 kg/m^2
Physical activity	≥150 min/wk of moderate intensity or ≥75 min/wk of vigorous intensity or ≥150 min/wk of moderate-vigorous intensity combination	1–149 min/wk of moderate intensity or 1–74 min/wk of vigorous intensity or 1–149 min/wk of moderate-vigorous intensity combination	None or not meet the criteria for ideal or intermediate health
Healthy diet	4 components	2–3 components	0–1 components
Total cholesterol	<200 mg/dL untreated	200-239 mg/dL or treated to goal	≥240 mg/dL
Blood pressure	SBP <120 mmHg and DBP <80 mmHg untreated	SBP 120–139 mmHg and DBP 80–89 mmHg or treated to goal	SBP ≥140 mmHg or DBP ≥90 mmHg
Fasting plasma glucose	<100 mg/dL untreated	100-125 mg/dL or treated to goal	≥126 mg/dL

DBP, diastolic blood pressure; SBP, systolic blood pressure.

Table 2 – Sample sociodemographic and clinical characteristics.

Characteristic [a]n (%); [b]mean (95% CI)	City				Total included (n = 5458)	Total excluded (n = 2066)
	Marcos paz (n = 1563)	Bariloche (n = 1740)	Temuco (n = 893)	Pando-Barros Blancos (n = 1262)		
Age strata (years)[a]						
34–44	356 (22.8%)	389 (22.4%)	183 (20.5%)	272 (21.6%)	1200 (22.0%)	516 (24.98%)
45–54	424 (27.1%)	521 (29.9%)	240 (26.9%)	322 (25.5%)	1507 (27.6%)	565 (27.35%)
55–64	448 (28.7%)	527 (30.3%)	249 (27.9%)	344 (27.3%)	1568 (28.7%)	546 (26.43%)
65–74	335 (21.4%)	303 (17.4%)	221 (24.8%)	324 (25.7%)	1183 (21.7%)	439 (21.25%)
Sex[a]						
Female	937 (60.0%)	1046 (60.1%)	473 (53.0%)	758 (60.1%)	3214 (58.9%)	1145 (55.42%)
Males	626 (40.0%)	694 (39.9%)	420 (47.0%)	504 (39.9%)	2244 (41.1%)	921 (44.58%)
Educational level[a]						
Secondary incomplete or minor	338 (21.6%)	652 (37.5%)	572 (64.0%)	330 (26.2%)	1892 (34.7%)	1257 (60.84%)
Secondary completed or major	1225 (78.4%)	1088 (62.5%)	321 (36.0%)	932 (73.8%)	3566 (65.3%)	809 (39.16%)
Body mass index[b]	29.9 (29.6, 30.3)	28.4 (28.1, 28.6)	29.0 (28.6, 29.3)	28.6 (28.3, 29.0)	28.8 (28.6, 28.9)	29.0 (28.8, 29.3)
Systolic blood pressure[b]	128.1 (127.0, 129.1)	127.3 (126.4, 128.1)	125.9 (124.6, 127.3)	129.7 (128.6, 130.9)	127.4 (126.8, 128.0)	126.5 (125.5, 127.4)
Diastolic blood pressure[b]	81.1 (80.5, 81.8)	85.3 (84.7, 85.8)	80.7 (79.9, 81.5)	81.6 (81.0, 82.3)	82.6 (82.3, 83.0)	81.8 (81.1, 82.4)
Total cholesterol[b]	203.7 (201.3, 206.0)	197.1 (195.0, 199.2)	201.1 (198.3, 204.0)	208.9 (206.3, 211.5)	201.4 (200.0, 202.7)	202.4 (200.2, 204.6)
LDL cholesterol[b]	128.6 (126.6, 130.6)	122.5 (120.8, 124.3)	124.6 (122.2, 126.9)	133.3 (131.1, 135.5)	125.9 (124.8, 127.0)	126.6 (124.8, 128.5)
HDL cholesterol[b]	44.9 (44.2, 45.6)	45.8 (45.1, 46.4)	44.5 (43.7, 45.4)	48.6 (47.9, 49.3)	45.8 (45.4, 46.2)	45.4 (44.8, 46.1)
Triglycerides[b]	159.0 (152.0, 166.0)	149.8 (143.7, 156.0)	171.8 (162.7, 180.8)	140.4 (133.7, 147.1)	156.1 (152.1, 160.1)	163.7 (155.2, 172.2)
Glycaemia[b]	102.0 (100.1, 103.9)	93.6 (92.5, 94.7)	100.7 (98.6, 102.8)	95.7 (94.3, 97.2)	97.2 (96.4, 98.1)	99.5 (98.0, 101.0)

CI, confidence interval; DBP, diastolic blood pressure; SBP, systolic blood pressure; HDL, High-density lipoprotein; LDL, Low-density lipoprotein.
[a] n and percentage is presented.
[b] mean and corresponding 95% confidence interval is presented.

Only one participant, i.e. 0.1% (95% CI: 0.0–0.2), was classified as having ideal levels in all seven criteria of Ideal Cardiovascular Health. The proportion of participants who met five or more criteria was 8.5%, with three (29.5%) and two (22.3%) being the more frequent scenarios. With regard to healthy behaviours, a greater proportion of participants met only two criteria, one or none (91.2%), as opposed to health factors, where the majority met two, three or four criteria (68.6%). Older subjects had a tendency to meet less health factors than younger subjects. Table 4 shows both the Ideal Health Behaviours Index and the Ideal Health Factors Index by sex, age and educational level.

The sensitivity analysis showed that the prevalence in all Ideal Cardiovascular Health criteria were similar between participants included and excluded from analysis.

Discussion

This study shows a very low prevalence of Ideal Cardiovascular Health. Only 0.1% of the study population met the seven components of the definition (i.e. only one subject in the sample). Results were similar for all four health behaviours, and only 6.8% participants met the four health factors included in the definition of Ideal Cardiovascular Health.

To interpret these results, it is necessary to understand some characteristics of the study population as well as the context of cardiovascular health in the Southern Cone of Latin America. The sampling frame considered adults aged between 35 and 74 years, when risk factors are most frequent. In Latin America, the most prevalent cardiovascular risk factors are overweight, obesity, hypertension and dyslipidemia.[26] In addition to this, previous studies have revealed a poor level of knowledge and control of these risk factors. For example, it has been reported that only 57.1% of hypertensive patients in Latin America are aware of their condition, 52.8% receive treatment, and only 18.8% have their blood pressure under control.[33]

The prevalence trends for age strata and education levels are as expected with less ideal total cholesterol, blood pressure and fasting glucose in higher aged strata, and, with the exception of smoking status, there was significantly lower prevalence of all ideal cardiovascular criteria in participants who had not completed secondary education or less. This is consistent with the higher prevalence of risk factors in the population with less education[34] and can be explained by less knowledge about healthy lifestyle and access to health services. Additionally, if diet is the component with the worst results, the availability and affordability of healthy foods can be an important influencing factor.[35]

Even though ideal health behaviours and factors are rare in the study population, the figures of this first Latin American report are similar to those obtained by studies conducted in other regions. The first reports from the US, prepared shortly after AHA's introduction of the concept of Ideal Cardiovascular Health, also showed a very low prevalence. An analysis of the data presented in the community-based Heart Strategies Concentrating on Risk Evaluation (Heart SCORE) study conducted in Allegheny County found that only 0.1% of the population met the seven criteria, only 2% met the four factors of ideal cardiovascular behaviour and 1.4% had Ideal Cardiovascular Health factors. In that study, the average age of the sample was slightly higher than in our population (59 vs. 54

Table 3 – Weighted prevalence of ideal, intermediate and poor cardiovascular health by sex, age groups and educational level [% (95% CI)].

	Total	Sex		Age (years)				Educational level	
		Males (N = 2244)	Females (N = 3214)	35–44 (N = 1200)	45–54 (N = 1507)	55–64 (N = 1568)	65–74 (N = 1183)	Secondary incomplete or minor (N = 1257)	Secondary complete or major (N = 809)
Smoking status									
Ideal	61.4 (59.8, 63.0)	56.7 (54.2, 59.1)	65.6 (63.5, 67.7)	61.7 (58.4, 64.9)	55.3 (52.5, 58.2)	65.1 (62.4, 67.8)	68.1 (65.1, 71.0)	62.5 (60.6, 64.4)	60.1 (57.4, 62.7)
Intermediate	9.2 (8.3, 10.1)	10.5 (9.0, 11.9)	8.0 (6.9, 9.1)	5.7 (4.1, 7.3)	7.9 (6.3, 9.5)	10.7 (9.0, 12.5)	18.4 (16.0, 20.9)	9.8 (8.7, 10.9)	8.4 (6.9, 9.8)
Poor	29.4 (27.9, 31.0)	32.9 (30.5, 35.2)	26.4 (24.4, 28.4)	32.6 (29.5, 35.8)	36.8 (34.0, 39.6)	24.1 (21.8, 26.5)	13.5 (11.3, 15.7)	27.7 (25.9, 29.5)	31.6 (29.0, 34.1)
BMI									
Ideal	22.6 (21.2, 23.9)	20.3 (18.3, 22.2)	24.6 (22.8, 26.5)	27.5 (24.6, 30.3)	22.0 (19.7, 24.3)	18.6 (16.5, 20.7)	17.4 (15.0, 19.8)	20.6 (19.0, 22.1)	25.1 (22.8, 27.3)
Intermediate	42.1 (40.4, 43.7)	48.7 (46.2, 51.1)	36.2 (34.1, 38.3)	41.5 (38.2, 44.7)	43.2 (40.3, 46.1)	41.9 (39.1, 44.7)	41.5 (38.3, 44.6)	39.6 (37.6, 41.5)	45.1 (42.5, 47.8)
Poor	35.3 (33.8, 36.9)	31.1 (28.9, 33.3)	39.1 (37.1, 41.2)	31.1 (28.0, 34.1)	34.8 (32.1, 37.5)	39.5 (36.8, 42.2)	41.1 (38.0, 44.2)	39.9 (38.0, 41.8)	29.8 (27.4, 32.3)
Physical activity									
Ideal	50.5 (48.8, 52.1)	50.2 (47.8, 52.6)	50.7 (48.5, 52.8)	55.1 (51.8, 58.3)	47.9 (45.0, 50.8)	49.5 (46.7, 52.3)	45.5 (42.3, 48.6)	48.8 (46.4, 50.3)	53.0 (50.3, 55.7)
Intermediate	17.2 (16.1, 18.5)	16.6 (14.9, 18.4)	17.8 (16.2, 19.4)	13.6 (11.4, 15.8)	17.3 (15.1, 19.5)	19.3 (17.1, 21.5)	23.7 (21.0, 26.5)	17.6 (16.2, 19.1)	16.8 (14.9, 18.8)
Poor	32.3 (30.7, 33.8)	33.1 (30.8, 35.5)	31.5 (29.4, 33.6)	31.3 (28.2, 34.5)	34.8 (32.0, 37.6)	31.2 (28.6, 33.8)	30.8 (27.8, 33.7)	34.0 (32.1, 35.9)	30.1 (27.6, 32.7)
Diet									
Ideal	0.5 (0.3, 0.7)	0.4 (0.1, 0.7)	0.6 (0.2, 0.9)	0.2 (0.0, 0.6)	0.2 (0.0, 0.5)	1.0 (0.4, 1.7)	0.8 (0.2, 1.4)	0.3 (0.1, 0.5)	0.7 (0.2, 1.1)
Intermediate	36.9 (35.3, 38.5)	29.3 (27.1, 31.5)	43.6 (41.5, 45.8)	30.8 (27.7, 34.0)	35.2 (32.4, 38.0)	43.0 (40.2, 45.7)	46.7 (43.5, 49.9)	33.5 (31.7, 35.4)	41.1 (38.4, 43.7)
Poor	62.6 (61.0, 64.2)	70.3 (68.1, 72.5)	55.8 (53.7, 58.0)	68.9 (65.8, 72.1)	64.6 (61.8, 67.4)	56.0 (53.2, 58.8)	52.5 (49.3, 55.7)	66.2 (64.3, 68.0)	58.2 (55.6, 60.9)
Total cholesterol									
Ideal	42.5 (40.9, 44.1)	42.2 (39.7, 44.6)	42.8 (40.6, 45.0)	55.9 (52.6, 59.2)	42.1 (39.2, 45.0)	29.1 (26.6, 31.7)	29.6 (26.7, 32.5)	41.1 (39.2, 43.1)	44.2 (41.5, 46.9)
Intermediate	40.6 (39.0, 42.2)	40.2 (37.8, 42.6)	41.0 (38.9, 43.1)	33.2 (30.1, 36.4)	40.0 (37.2, 42.8)	47.3 (44.5, 50.1)	50.8 (47.6, 54.0)	41.5 (39.5, 43.4)	39.6 (37.0, 42.2)
Poor	16.9 (15.7, 18.0)	17.6 (15.8, 19.5)	16.2 (14.8, 17.7)	10.9 (8.9, 12.9)	17.9 (15.7, 20.1)	23.6 (21.2, 26.0)	19.6 (17.0, 22.1)	17.4 (16.0, 18.8)	16.2 (14.4, 18.1)
Blood pressure									
Ideal	23.6 (22.1, 25.0)	16.1 (14.2, 18.0)	30.1 (28.0, 32.3)	38.8 (35.6, 42.0)	23.3 (20.8, 25.7)	10.4 (8.7, 12.0)	5.8 (4.3, 7.2)	19.1 (17.5, 20.8)	29.0 (26.5, 31.6)
Intermediate	42.9 (41.3, 44.5)	43.6 (41.2, 46.0)	42.4 (40.3, 44.5)	40.6 (37.4, 43.9)	45.4 (42.5, 48.3)	44.3 (41.5, 47.1)	41.4 (38.3, 44.5)	41.9 (39.9, 43.8)	44.2 (41.6, 46.9)
Poor	33.5 (32.0, 35.0)	40.3 (38.0, 42.7)	27.5 (25.7, 29.3)	20.6 (17.9, 23.2)	31.4 (28.7, 34.0)	45.4 (42.6, 48.1)	52.8 (49.7, 56.0)	39.0 (37.1, 40.9)	26.7 (24.5, 29.0)
Fasting plasma glucose									
Ideal	68.8 (67.4, 70.3)	64.7 (62.5, 67.0)	72.5 (70.7, 74.4)	82.1 (79.5, 84.6)	71.5 (68.9, 74.2)	56.7 (53.9, 59.5)	47.8 (44.6, 51.0)	65.5 (63.6, 67.3)	73.0 (70.7, 75.3)
Intermediate	25.4 (24.0, 26.7)	28.9 (26.7, 31.0)	22.3 (20.5, 24.0)	16.1 (13.7, 18.6)	23.5 (21.0, 26.0)	33.5 (30.8, 36.1)	40.7 (37.5, 43.9)	27.5 (25.8, 29.3)	22.7 (20.5, 24.9)
Poor	5.8 (5.1, 6.4)	6.4 (5.3, 7.4)	5.2 (4.4, 6.1)	1.8 (1.0, 2.6)	5.0 (3.7, 6.2)	9.9 (8.2, 11.6)	11.5 (9.4, 13.5)	7.0 (6.1, 7.9)	4.3 (3.3, 5.3)

BMI, body mass index; CI, confidence interval.

Table 4 – Proportion of participants in each strata of health index by sex, age groups and site [% (95% CI)].

	Total	Sex		Age strata (years)				Educational level	
		Males (N = 2244)	Females (N = 3214)	35–44 (N = 1200)	45–54 (N = 1507)	55–64 (N = 1568)	65–74 (N = 1183)	Secondary incomplete or minor (N = 1257)	Secondary complete or major (N = 809)
Health behaviour index									
0	18.6 (17.3, 19.9)	21.4 (19.4, 23.4)	16.1 (14.5, 17.8)	15.0 (12.5, 17.4)	21.2 (18.8, 23.6)	18.3 (16.1, 20.4)	23.1 (20.4, 25.8)	19.0 (17.4, 20.5)	18.2 (16.1, 20.3)
1	36.5 (34.9, 38.1)	36.4 (34.0, 38.8)	36.6 (34.5, 38.7)	36.7 (33.5, 40.0)	38.8 (36.0, 41.6)	36.2 (33.5, 38.9)	31.4 (28.4, 34.4)	37.2 (35.3, 39.2)	35.6 (33.0, 38.2)
2	36.1 (34.6, 37.6)	35.0 (32.7, 37.3)	37.0 (35.0, 39.1)	37.3 (34.2, 40.5)	33.1 (30.4, 35.8)	38.4 (35.7, 41.1)	35.7 (32.7, 38.8)	36.5 (34.6, 38.4)	35.6 (33.0, 38.1)
3	8.7 (7.8, 9.6)	7.1 (5.9, 8.4)	10.1 (8.8, 11.3)	10.8 (8.9, 12.7)	6.9 (5.5, 8.3)	7.1 (5.6, 8.5)	9.8 (7.9, 11.7)	7.3 (6.3, 8.3)	10.4 (8.9, 12.0)
4	0.1 (0.0, 0.2)	0.0 (0.0, 0.0)	0.1 (0.0, 0.4)	0.2 (0.0, 0.5)	0.0 (0.0, 0.0)	0.1 (0.0, 0.2)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.2 (0.0, 0.5)
Health factor index									
0	11.6 (10.7, 12.6)	13.7 (12.1, 15.3)	9.8 (8.6, 11.1)	6.0 (4.4, 7.6)	10.5 (8.7, 12.3)	16.2 (14.1, 18.4)	21.6 (18.9, 24.3)	13.1 (11.8, 14.4)	9.9 (8.4, 11.4)
1	19.7 (18.5, 21.0)	22.1 (20.1, 24.1)	17.7 (16.1, 19.3)	11.8 (9.6, 14.0)	23.0 (20.6, 25.5)	25.8 (23.3, 28.3)	23.5 (20.8, 26.3)	21.0 (19.4, 22.6)	18.2 (16.2, 20.2)
2	35.9 (34.4, 37.5)	38.4 (35.9, 40.8)	33.8 (31.8, 35.8)	33.8 (30.7, 37.0)	35.1 (32.3, 37.9)	39.4 (36.6, 42.2)	37.7 (34.6, 40.9)	36.2 (34.3, 38.1)	35.6 (33.0, 38.2)
3	25.9 (24.4, 27.3)	22.3 (20.2, 24.4)	29.0 (27.0, 31.0)	34.4 (31.2, 37.5)	26.4 (23.8, 28.9)	17.3 (15.1, 19.4)	16.0 (13.7, 18.3)	23.9 (22.2, 25.7)	28.2 (25.7, 30.7)
4	6.8 (5.9, 7.7)	3.6 (2.7, 4.5)	9.7 (8.2, 11.2)	13.9 (11.7, 16.2)	5.0 (3.7, 6.3)	1.3 (0.7, 1.8)	1.1 (0.5, 1.7)	5.8 (4.8, 6.8)	8.1 (6.5, 9.7)
Total									
7	0.1 (0.0, 0.2)	0.0 (0.0, 0.0)	0.1 (0.0, 0.4)	0.2 (0.0, 0.5)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.1 (0.0, 0.4)

CI, confidence interval.

years), and 44% of their study population was made up of African Americans, who had significantly fewer components of the definition of Ideal Cardiovascular Health.[5] In another study conducted in New Ulm, Minnesota, the proportion of people who met the seven criteria was 1%, and, similar to our findings, women presented higher levels of cardiovascular health than men, except for physical activity, which differed from our study. The fact that this study was conducted on a rural population may account for the differences found, at least to a certain extent—though the level of Ideal Cardiovascular Health was also extremely low.[6]

Another study conducted in Southeast China reported that only 1.1% of participants met the seven criteria. Advanced age, being a man and living in rural areas were significantly related with lower likelihood of having Ideal Cardiovascular Health. The main difference in that study, as compared to ours, is that it included people from 19 years of age onwards. This shows that Ideal Cardiovascular Health levels are also very low among young people.[24]

One analysis carried out as part of the Atherosclerosis Risk in Communities Study (conducted in different USA cities) presented very interesting results. This analysis assessed the extent to which the fulfilment of Ideal Cardiovascular Health criteria is associated with the development of incidental cancer. The study found that the more ideal cardiovascular health criteria are met, the lower the incidence of cancer. In their study population, 2.7% met six or seven criteria, and they had a 51% lower risk of incidental cancer than those with scores of 0. This shows that in addition to predicting the development of cardiovascular diseases, AHA factors can predict the development of other non-communicable chronic diseases like cancer.[9]

In this context, and considering that components of Ideal Cardiovascular Health have a protective effect on cardiovascular health and some of them on chronic disease in general, our findings are particularly alarming and evidence the difficulties and challenges faced by policymakers and all involved in primary prevention where strategies are needed, both at individual and the population levels. At individual level, healthy lifestyle and risk factors education can be the critical aspect to be considered, but at population levels, all strategies addressed to influence the tobacco, nutritional and physical activity environment are needed. Policies about smoke-free tobacco environment have been implemented in the sites in this study, but more regulation about tobacco marketing[36] and, therefore, complete implementation of the WHO Framework Convention on Tobacco Control[37] can be key. On the other hand, the availability of healthy factors such as fruits and vegetables,[35] marketing, taxes and food labelling can influence positively the nutritional environment,[38] and implementing of strategies to increase walkability and favour the active transportation can be examples for improvement of the physical activity environment.[39,40]

One of the strengths of the CESCAS study is its statistical power and the representativeness of the sample, which is the result of a rigorous population sampling process. In addition to this, it was planned to preserve data reliability by the standardisation of measurement procedures, the training received by both interviewers and personnel in charge of recording physical measurements and the biochemical procedures used. Nonetheless, this report has some limitations. One of them is

related to some measurements: whole fibre consumption could not be included in the domain of healthy dietary habits because FFQ did not collect specific data, and the instrument used to collect data on energy expenditure to determine the levels of physical activity did not consider household activities. This may result in an underestimation of the level of physical activity in which this dimension may be more relevant. Low response rate to the food frequency questionnaire (77%) is another limitation. If lack of response is associated to worse dietary habits, our results may be even more alarming.

In conclusion, the prevalence of Ideal Cardiovascular Health is very low in our population, with healthy lifestyles being less frequent than ideal health factors. Considering these components have a protective effect on cardiovascular health, our findings are particularly alarming and evidence the difficulties and challenges faced by primary prevention in healthcare systems and especially by policymakers and all involved in primary prevention. To improve the levels of Ideal Cardiovascular Health in the Southern Cone of Latin America, our results pose a challenge: the need to promote the development of effective strategies considering the imperative of health in all policies.

Author statements

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Ethical approval

The study conforms to the ethical guidelines of the 1975 Declaration of Helsinki and the protocol was approved by the followings Institutional Review Boards (IRB):

- *Comité de Ética de Protocolos de Investigación del Hospital Italiano de Buenos Aires* for Argentinians sites.
- *Comité Ética Científica Araucanía Sur* for the Chilean site.
- *Comité de Ética para Proyectos de Investigación—Facultad de Medicina—Universidad de la República* for the Uruguayan site
- Tulane University Human Research Protection Office.

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Competing interests

The authors declare there is no conflict of interest.

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