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Risk factors for cardiovascular disease in the elderly in Latin America and the Caribbean

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Summary
Introduction: The Latin America and Caribbean (LAC) regions are undergoing a transition from infectious to chronic non-communicable disease, together with and linked to a rapid aging of the population. Although cardiovascular disease is a principal cause of ill-health and death, few data are available among the elderly.
Materials and methods: We evaluated people aged 60 and over, living in seven urban centers in LAC: Buenos Aires, Bridgetown, Havana, Mexico City, Montevideo, Santiago, and Sao Paulo, who participated in the 'Salud, Bienestar, y Envejecimiento' study (SABE), conducted in 1999 and 2000. We calculated the prevalence of self-reported cardiovascular disease (CVD), and examined its association with established risk factors, using odds ratios (ORs) and their population attributable risks (PARs).
Results: The overall prevalence of CVD was 20.3% (95% CI 18.9—21.6). Rates varied across the region: lowest in Mexico City (10.0%) and Bridgetown (11.1%), intermediate in Buenos Aires (19.6%), Sao Paulo (19.8%), Montevideo (23.8%) and Havana (24.1%), and highest in Santiago (32.2%). CVD prevalence increased by 11% with every additional five-years of age, and was higher in women than men (21.2% vs. 18.9%).

Factors related to higher CVD prevalence included hypertension (odds ratio = 2.67), diabetes (OR = 1.42), obesity (OR = 1.19), and smoking (OR = 1.31),

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while regular exercise (OR = 0.66), adequate nutrition (OR = 0.70), and regular alcohol consumption (OR = 0.79) were related to lower CVD prevalence ($p = 0.01$ for BMI, $p = 0.02$ for alcohol consumption, and $p < 0.001$ for all other risk factors). Collectively, these seven modifiable risk factors accounted for 69.7% of the PAR.
Discussion: Established and modifiable risk factors underpin CVD prevalence in LAC. Public health programmes, including reliable measures of their effectiveness are needed to reduce the burden of CVD in the region.

Introduction

The mean age of national populations in the Latin America and Caribbean (LAC) regions continues to increase, reflecting the decline in fertility, and delayed adult mortality [1]. Population aging represents a public health success story, and simultaneously creates new health care challenges. The elderly experience disproportionate levels of chronic disease and disability, which reduce quality of life, and increase the demand for health and social services. In recent decades the speed of population aging in many less-developed countries has been dramatic [2], and is likely to exceed the wealth accumulation needed to cope with the increased economic burden on society [3].

The 'epidemiological transition' [4] has led to chronic non communicable diseases (NCDs) being the principal causes of ill health and death in LAC [5]. In spite of this important disease burden, there is still a lack of objective data about cardiovascular risk factors, incidence and prevalence rates, clinical outcomes, and the impact on society of cardiovascular disease (CVD) among the elderly in the region. The Salud, Bienestar, y Envejecimiento en America Latina y el Caribe study (The SABE study) [2] was conducted in elderly populations of seven urban centers in the LAC region, and provides data about CVD and many anticipated risk factors.

In this review of cardiovascular disease in the LAC region we summarize information from the SABE study, presenting demographic characteristics, and the prevalence of cardiovascular disease based on self-reported diagnosis having been made by a healthcare professional. We evaluate the strength of association between CVD and lifestyle risk factors such as self-reported diabetes and hypertension, obesity, tobacco smoking, physical activity, alcohol consumption, and whether participants considered themselves well nourished.

Methods

SABE was a cross-sectional survey of health and well-being among people born in 1939 or earlier (60 years or older in 1999) from seven urban centers in Latin America and the Caribbean: Buenos Aires, Argentina; Bridgetown, Barbados; Havana, Cuba; Mexico City, Mexico; Montevideo, Uruguay; Santiago, Chile and Sao Paulo, Brazil [6].

Detailed information about study methods has been provided elsewhere [7]. Briefly, the study participants were selected from the population of non-institutionalized elderly in the participating cities. The samples in all countries were selected using a multistage clustered design with two stages in Barbados and Brazil and three stages in all other countries. In every country the primary sampling unit was a cluster of independent households, selected from the geographical city or urban limits according to the norms of the national statistical offices in these countries.

Principal investigators from each participating country were trained in the study methods to ensure standardization, and study participants completed a common questionnaire administered in Spanish, Portuguese or English as appropriate. Anthropometric evaluations were conducted in six of the centers (not in Argentina).

Data management took place at a central site to ensure consistency of the collected information. The final public release data are a set of standardized and comparable datasets with minimal national idiosyncrasies. The data, first released to the public for statistical reporting and analysis in January 2005, are archived at the National Archive of Computerized Data on Aging (NACDA) and can be downloaded for free [8].

Participants were classified with cardiovascular disease if they had been diagnosed at any time by a doctor or nurse with a heart attack, coronary heart disease, angina, congestive heart failure, or other heart problem.

We defined smoking as current or past smoking of cigarettes, cigars or pipes. We defined regular exercise as vigorous physical activity (such as playing sports, dancing, or heavy housework) three or more times in a week, and we used self-reported nutritional status (adequate or not-adequate) as a proxy for a healthy diet. To assess the role of alcohol consumption we used the average number of days per week that participants drank beer, wine, or spirits. We then stratified higher alcohol use as consumption on five or more days per week (following a common World Health Organization stratification) [9]. We used the 15-item Geriatric Depression Scale (GDS) to measure depression [10]. During tabulations we considered a score of more than 5 to be suggestive of depression, and used the original GDS scores in statistical modeling.

Statistical methods

We present selected characteristics of our survey population, stratifying the dataset by participating city. We present the self-reported prevalence of cardiovascular disease by participating city, by gender, and by age (in five-year age groups). We then smoothed the CVD prevalence using a locally-weighted algorithm (known as lowess smoothing) and graphed these smoothed data by year of age and by participating city.

We tabulated the prevalence of seven known and modifiable predictors of cardiovascular disease (diabetes, hypertension, obesity, smoking, exercise, nutritional status, alcohol consumption) by CVD status, by gender, and by participating city. We investigated formal associations with CVD status using several logistic regression models and report the odds of CVD in each city, compared to the average for the LAC region. We then added each modifiable predictor to this model, and present the strength of association as odds ratios with associated 95% confidence intervals by participating city. We finally constructed a single multivariate logistic model, including all seven modifiable risk factors. We investigated the cumulative effect of risk factors using odds ratios derived by adding the respective model coefficients from the multivariate model.

We also present the population attributable risk (PAR) for cardiovascular disease — the proportion of CVD cases in the study population that may be prevented if the risk factor were totally eliminated. We calculated the PAR adjusted for age, gender, and all other modifiable risk factors. For protective factors (exercise, nutrition, alcohol consumption) the PAR was calculated using the group without the exposure.

We weighted all analyses to account for the clustered study design and levels of non-response, and pre-adjusted all regression models for age and gender. We used Stata for all analyses (Version 9, StataCorp LP, College Station, Texas, US), assuming statistical significance at $p \leqslant 0.05$, but present confidence intervals and p-values at all times to clarify the exact strength of statistical relationships.

Results

Data were collected between 1999 and 2000, and completed questionnaires were obtained from 10,597 participants. Response rates were 63% in Buenos Aires and 65% in Montevideo, 80% in Bridgetown, 84% in Santiago, 85% in Sao Paulo and Mexico City, and 95% in Havana [11].

Table 1 presents data on selected characteristics of the elderly population participating in the SABE study. The age-sex distributions were similar in all countries; the overall mean age was 70.6 years (standard deviation 0.12 years) and 60% of participants were women. The mean duration of education ranged from 3.4 years in Sao Paulo to 7.2 years in Buenos Aires and Havana. Ninety-five percent of participants interviewed in the Latin American and Cuban centers had been married, compared to 80% in Bridgetown, which also had the highest percentage of participants living alone. There was considerable variation in self-reported health status, and countries could be broadly stratified into those reporting better health (Argentina, Uruguay, Barbados, mean health status score 3.25, 95% confidence interval 3.19—3.31) or worse health (Cuba, Chile, Mexico, mean score 3.73, 95% CI 3.68—3.77), with Brazil reporting an intermediate health status score (3.44, 95% CI 3.37—3.50).

Cardiovascular prevalence

Table 2 and Fig. 1 present cardiovascular disease prevalence. Regional prevalence increased from 16% among 60—64 year olds to between 23% and 24% among the oldest-old (aged 75 and over). Throughout the region, cardiovascular disease prevalence increased at an average rate of 11% for every additional five years of age (OR 1.11, 95% CI 1.07—1.14, $p < 0.001$), and was 15% higher in women compared to men (OR 1.15, 95% CI 1.03—1.29, $p = 0.02$).

Table 1 Selected characteristics of the elderly in seven urban centers in Latin America and the Caribbean

Characteristic	Country							
	Argentina $N = 1043$	Barbados $N = 1508$	Brazil $N = 2143$	Chile $N = 1301$	Cuba $N = 1905$	Mexico $N = 1247$	Uruguay $N = 1450$	All[a] $N = 10,597$
Age (mean, SE)	70.7 (0.49)	72.4 (0.24)	69.4 (0.40)	70.3 (0.32)	71.1 (0.21)	69.7 (0.26)	70.9 (0.22)	70.6 (0.12)
Age (%)								
Young-old (60–74 years)	72.4	62.6	77.9	72.3	69.1	76.0	69.9	71.6
Oldest-old (75+ years)	27.6	37.4	22.1	27.7	30.9	24.0	30.1	28.4
Sex (% female)	61.7	60.3	58.6	59.8	59.1	56.4	63.7	59.8
Years of education (mean, SE)	7.2 (0.65)	5.3 (0.13)	3.4 (0.23)	6.1 (0.49)	7.2 (0.12)	4.7 (0.27)	6.0 (0.84)	5.6 (0.16)
Marital status (% married)	94.6	80.3	95.1	93.2	96.9	95.9	96.5	93.3
Living alone (%)	19.7	22.1	13.2	—	10.8	11.2	18.4	15.5
Self-reported health status[b]								
Excellent/very good	19.9	15.6	11.0	6.0	5.5	7.0	17.1	11.4
Good	45.2	36.2	36.6	32.1	31.9	23.6	44.0	35.6
Fair/poor	34.9	48.2	52.4	61.9	62.7	69.4	38.9	53.0

[a] Equal weighting given to each country.
[b] Not answered by proxy respondents (Argentina $n = 40$, Barbados $n = 37$, Brazil $n = 249$, Chile $n = 102$, Cuba $n = 176$, Mexico $n = 70$).

Table 2 Self-reported cardiovascular disease in seven urban centers in Latin America and the Caribbean

Characteristic	Country							
	Argentina *N* = 1043	Barbados *N* = 1508	Brazil *N* = 2143	Chile *N* = 1301	Cuba *N* = 1905	Mexico *N* = 1247	Uruguay *N* = 1450	All *N* = 10,597
Prevalence of cardiovascular disease (%)								
Men								
60—64	18.7	11.7	15.2	21.4	14.7	9.5	10.3	14.6
65—69	23.2	7.3	20.0	33.4	22.2	9.0	26.5	20.3
70—74	23.1	16.5	26.6	38.0	20.0	4.2	23.8	21.7
75—79	21.5	12.8	24.1	29.0	21.4	16.4	29.1	22.0
80+	14.0	10.2	25.7	15.0	21.8	17.7	23.5	18.4
Overall	*21.0*	*11.6*	*20.5*	*27.8*	*19.3*	*9.8*	*22.7*	*18.9*
Women								
60—64	17.0	5.2	14.2	31.8	26.3	5.4	17.6	17.3
65—69	15.6	7.0	17.7	35.2	24.3	10.2	25.0	19.6
70—74	21.1	9.9	21.6	32.5	28.9	16.3	18.6	21.3
75—79	16.5	16.9	23.4	41.6	30.1	13.2	30.6	25.5
80+	27.4	15.7	25.0	38.8	29.0	8.7	36.1	25.6
Overall	*19.1*	*10.8*	*18.9*	*35.3*	*27.4*	*10.1*	*24.5*	*21.2*
All								
60—64	17.6	7.8	14.6	27.1	21.2	7.4	15.1	16.1
65—69	18.7	7.1	18.7	34.5	23.4	9.7	25.6	19.9
70—74	21.9	12.6	23.7	34.6	25.1	10.9	20.6	21.5
75—79	18.6	15.2	23.7	36.8	27.0	14.5	30.1	24.1
80+	23.3	13.8	25.2	31.4	26.5	11.8	31.9	23.2
Overall	*19.8*	*11.1*	*19.6*	*32.2*	*24.1*	*10.0*	*23.8*	*20.3*

There were important regional variations in the reported prevalence of CVD. Chile, Cuba, and Uruguay had rates that were significantly higher than the regional average (Chile two times higher, Cuba and Uruguay 1.3 times higher, $p < 0.001$ for all countries). Barbados and Mexico had rates that were half the regional average ($p < 0.001$ in both countries). Argentina, and Brazil were similar to the regional average (Argentina $p = 0.06$, Brazil $p = 0.29$) (Fig. 1 and Table 4, column 1).

Risk factors

Tables 3 and 4 present information on established and modifiable factors known to influence the onset of cardiovascular disease. The prevalence of diabetes varied widely across the urban centers. Rates ranged from 12.4% (95% CI 9.3—16.2) in Argentina to 21.7% (95% CI 19.4—24.2) in Barbados, with an overall prevalence of 16.6% (95% CI 15.7—17.6) across the region. Diabetes prevalence was higher in women than in men (OR 1.32, 95% CI 1.15—1.51, $p < 0.001$) and was higher in participants with coincident CVD (OR 1.42, 95% Cl 1.24—1.61, $p < 0.001$). Hypertension was widely prevalent throughout the region, ranging from 42.8% (95% CI 40.0—45.7) in Mexico to 53.7% (95% CI 50.9—56.4) in Brazil. Across the region, the overall rate was 48.0% (95% CI 46.7—49.2), was higher in women than in men (OR 1.58, 95% Cl 1.45—1.73, $p < 0.001$), and was associated with coincident CVD (OR 2.67, 95% Cl 2.36—3.04, $p < 0.001$). Obesity, measured using the body mass index (BMI) was strongly gender specific, with obesity 2.7 times more likely in women compared to men (OR 2.75, 95% Cl 2.43—3.10, $p < 0.001$). Obesity was associated with CVD, although the association was not strong (OR 1.19, 95% Cl 1.05—1.35, $p = 0.01$).

We investigated the role of several lifestyle factors (smoking tobacco, alcohol consumption, regular exercise, and nutritional status). Across the region, smoking was associated with a 31% higher CVD prevalence (OR 1.31, 95% CI 1.16—1.49, $p < 0.001$), while regular exercise was associated with a 59% lower CVD prevalence (OR 0.63, 95% CI 0.54—0.73, $p < 0.001$). Adequate nutritional status was associated with a 43% lower CVD prevalence (OR 0.70, 95% CI 0.60—0.81, $p < 0.001$). Regular alcohol consumption was associated with a 26% lower CVD prevalence (OR = 0.79, 95% CI 0.65—0.97, $p = 0.02$).

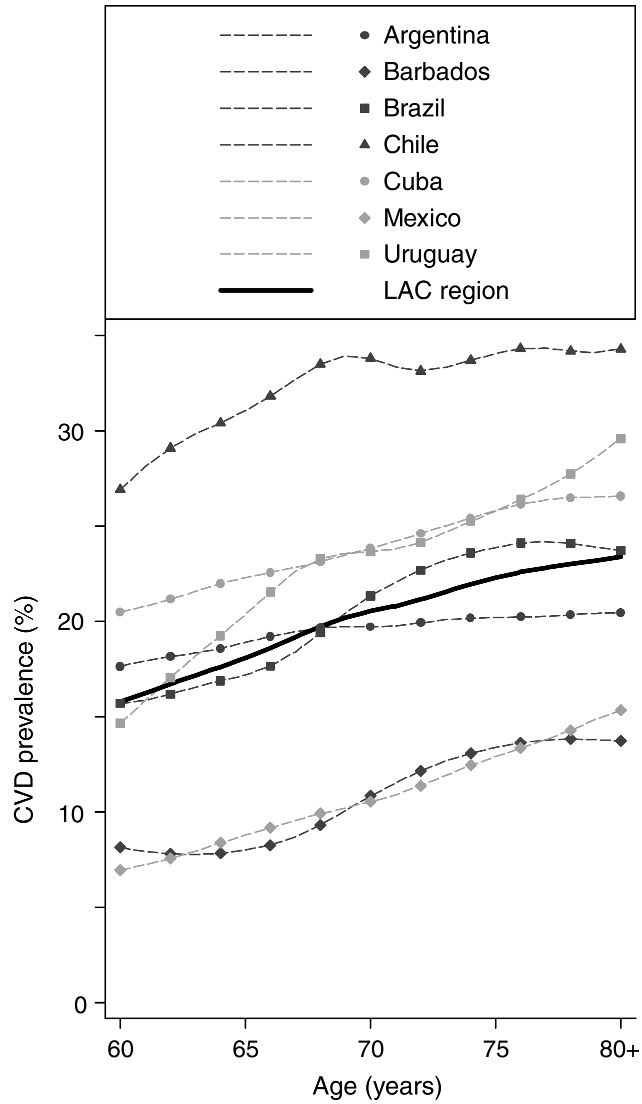

Figure 1 Prevalence of cardiovascular disease (CVD) in seven urban centers in Latin America and the Caribbean (Smoothed percentage).

We used years of education and depression as two individual components of a 'psychosocial' determinant of cardiovascular disease. CVD prevalence increased by 1% for each additional year of education ($p = 0.01$). Depression was strongly and consistently associated with CVD prevalence; across all countries the odds of reporting CVD was 1.6 times higher (95% CI 1.49–1.79) for every 5-point increase in the GDS score (which has a possible range of 0–15). We had no information on whether the reported symptoms of depression pre-dated CVD onset.

Table 5 presents information on the strength of association of the seven modifiable risk factors with CVD prevalence, after adjusting for age, gender, and all other factors. All factors except obesity and nutritional status remained important predictors ($p = 0.002$ or stronger in all cases, obesity $p = 0.30$, nutritional status $p = 0.23$). The cumulative effect of these risk factors increased the odds of CVD by over 8 times (OR 8.54, 95% CI 2.48–29.45), and together they accounted for 69.7% of the PAR of cardiovascular disease.

Lifestyle risk factors alone (exercise, adequate nutrition, smoking, and alcohol consumption) were important determinants of CVD risk. A non-smoker who exercised and reported an adequate nutritional status had an odds ratio of 0.60 95% Cl (0.40–0.79) compared to a current or former smoker with a poor lifestyle. These three factors accounted for one quarter of the PAR of CVD (24.4%, 95% CI 14.8–32.9). Hypertension and diabetes increased the odds of CVD three-fold (OR 3.52, 95% CI 2.46–5.05), and these two conditions

Table 3 Cardiovascular risk factors among men and women in seven urban centers in Latin America and the Caribbean

Characteristic			Country							
			Argentina[a] *N* = 1043	Barbados *N* = 1508	Brazil *N* = 2143	Chile *N* = 1301	Cuba *N* = 1905	Mexico *N* = 1247	Uruguay *N* = 1450	All *N* = 10,597
Prevalence of diabetes (%)	Men	CVD	20.7	19.2	22.7	11.8	11.5	28.2	18.0	17.8
		Non-CVD	12.2	18.4	15.5	12.1	6.3	21.8	10.9	13.9
	Women	CVD	17.0	27.9	23.1	18.4	29.3	21.1	19.3	22.6
		Non-CVD	10.0	23.4	17.8	11.8	16.5	20.8	12.9	16.8
	Overall		*12.4*	*21.7*	*18.0*	*13.3*	*14.8*	*21.6*	*13.7*	*16.6*
Prevalence of hypertension (%)	Men	CVD	67.6	52.4	71.1	62.4	54.5	57.4	58.3	61.7
		Non-CVD	42.0	36.3	43.9	38.3	31.4	32.3	31.2	36.5
	Women	CVD	67.1	71.0	77.0	60.1	73.7	70.1	69.2	69.8
		Non-CVD	47.2	51.3	51.9	53.3	40.8	46.4	43.2	47.7
	Overall		*49.7*	*47.5*	*53.7*	*51.4*	*44.1*	*42.8*	*45.2*	*48.0*
BMI (obese, %BMI ⩾ 30)	Men	CVD	–	9.8	12.8	21.0	8.5	15.1	16.5	15.5
		Non-CVD	–	11.8	8.1	26.7	5.1	16.5	17.8	14.9
	Women	CVD	–	27.6	29.2	31.5	22.4	31.2	42.0	33.1
		Non-CVD	–	29.7	23.7	32.1	15.7	30.2	39.0	30.2
	Overall		–	*22.3*	*18.2*	*29.2*	*12.7*	*24.2*	*31.7*	*22.1*
Smoking (%)	Men	CVD	79.0	53.3	74.8	61.5	78.6	86.0	72.2	72.0
		Non-CVD	70.9	52.2	73.6	65.6	77.4	69.3	75.7	69.5
	Women	CVD	26.8	8.2	30.6	40.7	38.7	26.1	24.9	31.3
		Non-CVD	23.5	8.9	29.0	32.7	35.8	21.5	25.2	25.2
	Overall		*42.7*	*26.1*	*47.9*	*47.1*	*53.4*	*43.3*	*43.3*	*44.0*
Regular exercise (%)	Men	CVD	6.4	38.1	29.4	28.3	24.5	50.3	16.5	26.1
		Non-CVD	18.2	49.0	29.6	26.3	31.5	42.2	22.2	32.4
	Women	CVD	8.0	18.7	13.1	15.5	17.2	21.6	5.6	13.7
		Non-CVD	13.9	42.6	27.0	17.8	19.0	24.2	13.8	23.7
	Overall		*13.9*	*42.9*	*26.6*	*21.0*	*23.3*	*32.2*	*15.1*	*25.4*
Adequate nutritional status (%)	Men	CVD	97.5	98.1	94.7	90.3	73.9	85.9	95.0	90.1
		Non-CVD	97.2	96.0	95.9	93.1	72.6	85.1	94.1	89.8
	Women	CVD	93.4	95.1	87.3	85.1	68.8	76.3	91.5	83.8
		Non-CVD	96.3	97.4	91.8	92.2	76.8	80.4	94.8	89.8
	Overall		*96.3*	*96.8*	*92.9*	*90.6*	*73.9*	*82.1*	*94.1*	*89.0*
Regular alcohol consumption (%)	Men	CVD	37.1	12.6	11.5	9.6	3.4	8.8	24.9	14.2
		Non-CVD	39.6	11.7	16.0	17.0	8.4	3.8	36.9	17.0
	Women	CVD	12.7	0.7	0.6	5.5	0.4	–	5.0	3.4
		Non-CVD	13.5	3.0	2.2	3.1	1.4	1.2	9.8	4.4
	Overall		*23.1*	*6.3*	*7.3*	*8.4*	*3.7*	*2.5*	*17.8*	*9.1*

[a] Height and weight not collected.

accounted for almost half of the PAR of CVD (42.4%, 95% CI 38.4–46.1).

Risk in men and women

Overall, CVD prevalence was slightly higher in women than in men (18.9% in men, 21.2% in women, $p = 0.02$). There were important differences in the risk profile of men and women in the region. Women reported statistically significantly higher rates of hypertension (52.4% vs. 41.4%), diabetes (18.0% vs. 14.6%) and obesity (31.6% vs. 14.8%) ($p < 0.001$ in all cases). They also reported lower levels of regular exercise (21.6% vs. 31.1%, $p < 0.001$), and fewer reported regular alcohol consumption (4.2% vs. 16.4%, $p < 0.001$). Many more men were current or former smokers (26.5% vs. 70.1%, $p < 0.001$). The risk-profile amongst women accounted for a higher PAR for cardiovascular disease; 76.6% (95% CI 60.8–86.1) in women and 63.8% (95% CI 48.0–74.7) in men.

Risk and age

There were also important age-related risk differences within our elderly population. Using a common age stratification (young-old between 60 and 74, oldest-old aged 75 and over), there were similar proportions of participants with hypertension

Table 4 Cardiovascular risk factors among men and women in seven urban centers in Latin America and the Caribbean

Country	CVD[a]		Diabetes (Yes vs. No)		Hypertension (Yes vs. No)		BMI (Obese vs. Not obese)	
	OR	*P*-value	OR	*P*-value	OR	*P*-value	OR	*P*-value
Argentina	1.04 (0.92–1.17)	0.54	1.87 (1.33–2.64)	<0.001	2.48 (1.90–3.23)	<0.001	–[b]	–
Barbados	0.51 (0.44–0.59)	<0.001	1.19 (0.79–1.81)	0.40	2.12 (1.46–3.09)	<0.001	0.90 (0.58–1.39)	0.63
Brazil	1.07 (0.95–1.22)	0.27	1.46 (1.11–1.92)	0.01	3.03 (2.30–3.98)	<0.001	1.36 (0.98–1.90)	0.07
Chile	2.06 (1.63–2.60)	<0.001	1.44 (1.00–2.06)	0.05	1.77 (1.29–2.43)	<0.001	0.97 (0.76–1.24)	0.78
Cuba	1.35 (1.20–1.53)	<0.001	2.17 (1.65–2.85)	<0.001	3.78 (2.98–4.80)	<0.001	1.86 (1.35–2.55)	<0.001
Mexico	0.48 (0.40–0.58)	<0.001	1.19 (0.79–1.78)	0.41	2.71 (1.79–4.10)	<0.001	1.05 (0.65–1.69)	0.85
Uruguay	1.31 (1.11–1.53)	0.001	1.68 (1.43–1.96)	<0.001	3.08 (2.51–3.79)	<0.001	1.08 (0.91–1.28)	0.40
All	1	–	*1.42 (1.24–1.61)*	*<0.001*	*2.67 (2.36–3.04)*	*<0.001*	*1.19 (1.05–1.35)*	*0.01*

Country	Smoking (Yes vs. No)		Regular exercise (No vs. Yes)		Well nourished (No vs. Yes)		Regular alcohol consumption (No vs. Yes)	
	OR	*P*-value	OR	*P*-value	OR	*P*-value	OR	*P*-value
Argentina	1.49 (1.11–2.00)	0.007	0.45 (0.27–0.75)	0.003	0.66 (0.32–1.36)	0.26	0.99 (0.70–1.39)	0.95
Barbados	1.16 (0.79–1.70)	0.45	0.48 (0.32–0.71)	<0.001	0.86 (0.32–2.32)	0.76	0.92 (0.44–1.91)	0.82
Brazil	1.22 (0.92–1.62)	0.16	0.68 (0.46–1.00)	0.05	0.67 (0.43–1.05)	0.08	0.71 (0.39–1.28)	0.26
Chile	1.16 (0.81–1.68)	0.42	0.96 (0.67–1.36)	0.80	0.55 (0.37–0.81)	0.003	0.76 (0.36–1.60)	0.47
Cuba	1.04 (0.83–1.30)	0.74	0.80 (0.59–1.09)	0.15	0.78 (0.61–1.00)	0.05	0.32 (0.13–0.79)	0.01
Mexico	1.68 (1.12–2.50)	0.01	1.18 (0.74–1.88)	0.48	0.86 (0.53–1.40)	0.55	1.76 (0.43–7.10)	0.43
Uruguay	1.02 (0.80–1.30)	0.87	0.54 (0.44–0.67)	<0.001	0.73 (0.59–0.90)	0.004	0.56 (0.42–0.75)	<0.001
All	*1.31 (1.16–1.49)*	*<0.001*	*0.63 (0.54–0.73)*	*<0.001*	*0.70 (0.60–0.81)*	*<0.001*	*0.79 (0.65–0.97)*	*0.02*

Odd ratios represent the increased odds for a 5-point increase in the Geriatric Depression Scale score (the range of possible scores for the GDS is 0–15).

[a] Odds Ratios are compared to the mean CVD levels in the LAC region.

[b] Height and weight not collected.

Table 5 Multivariate logistic model of modifiable cardiovascular risk factors among men and women in seven urban centers in Latin America and the Caribbean

Risk factor	Prevalence		Multivariate logistic regression model[a]	
	No CVD	CVD	OR (95% CI)	PAR (95% CI)
Diabetes	15.6	20.8	1.34 (1.18–1.53)	5.4 (2.8–8.0)
Hypertension	43.2	66.7	2.47 (2.22–2.75)	39.5 (35.5–43.3)
BMI[b]	24.2	27.4	1.07 (0.94–1.23)	1.8 (0–5.4)
Current and former smoking	43.3	46.6	1.20 (1.07–1.34)	7.4 (2.6–12.0)
Regular exercise[c]	27.3	18.3	0.79 (0.69–0.90)	17.2 (7.7–25.7)
Well nourished[c]	89.8	86.2	0.91 (0.77–1.07)	1.3 (0–3.7)
Regular alcohol consumption[c]	9.5	7.4	0.73 (0.59–0.89)	25.5 (10.0–38.3)
Diabetes and hypertension	–	–	3.52 (2.46–5.05)	42.4 (38.4–46.1)
Lifestyle risk factors[d]	–	–	2.43 (1.17–5.08)	43.7 (29.4–55.1)
All modifiable[b]	–	–	8.54 (2.48–29.45)	69.7 (59.9–77.1)
All modifiable + (education and depression)[b]	–	–	12.48 (3.27–47.68)	72.2 (63.2–79.0)

[a] Regression models adjusted for age, sex, city of residence, years of education, and all modifiable risk factors (diabetes, hypertension, smoking, exercise, nutrition, alcohol consumption).
[b] BMI OR and PAR calculated for 6-nation sample (excluding Argentina).
[c] Protective factors, PARs are provided for the group without these factors.
[d] Lifestyle risk factors are exercise, adequate nutrition, smoking, and alcohol consumption.

(46.6% vs. 48.5%, $p = 0.10$) and diabetes (16.2% vs. 16.8%, $p = 0.39$). There was less obesity among the oldest-old (19.6% vs. 26.8%, $p < 0.001$), fewer current or former smokers (36.1% vs. 47.2%, $p < 0.001$), and fewer people reported taking regular exercise (16.3% vs. 29.1%, $p < 0.001$). The PAR for cardiovascular disease was dominated by hypertension (43.0%), alcohol consumption (32.2%) and smoking (10.2%) among the young-old, and by hypertension (31.9%), regular exercise (33.6%), and alcohol consumption (36.7%) among the oldest-old.

Discussion

In spite of the high prevalence of ill-health related to CVD, and its well-established increased prevalence with older age, there have been few data available from the LAC region documenting CVD prevalence and related risk factors among the elderly. The SABE study provides an early opportunity to evaluate CVD in the elderly populations of seven urban centers in the region. We report an overall prevalence of CVD of 20.3% (95% CI 18.9–21.6) among people aged 60 years and older. Compared to this regional rate, the elderly populations of Bridgetown and Mexico City had half the CVD prevalence, the elderly living in Havana and Montevideo had a 30% higher CVD prevalence, and those from Santiago had a more than twice the CVD prevalence.

We report that seven modifiable risk factors accounted for almost 70% of the PAR of cardiovascular disease. Four of these promoted CVD (hypertension, diabetes, smoking, and obesity), and three provided protection against CVD (regular exercise, being well nourished, and regular alcohol consumption).

This risk factor profile in the LAC region shows many similarities with other developing and developed economies; the same cardiovascular risk factors have been well documented in populations from all continents. In a major case-control study of risk factors for myocardial infarction among almost 30,000 people in 52 countries, nine potentially modifiable factors were identified: the seven factors identified in our study, along with lipids and a psychosocial profile [12,13]. Although not assessed in this study, it is likely that there are locally relevant causes of cardiovascular disease in the LAC region, notably two infectious agents — Chagas disease and rheumatic fever. The regional burden of Chagas disease is high, 20 million people are currently infected by *Trypanosome cruzi*, and 100 million are exposed to infection by the parasite [14].

Hypertension was the strongest single determinant of cardiovascular disease, raising the odds of CVD 2.5 times, and accounting for 40% of the PAR. Hypertension is a major preventable risk factor for CVD in the region, affecting 48% of the elderly in this survey, and is estimated to affect between 8% and 30% of all ages throughout the LAC region [15]. In Barbados, hypertension was undiagnosed in almost 40% of those affected and remained uncontrolled in a third of diagnosed hypertensives on treatment, who were also at a

60% increased risk of premature cardiovascular death [16]. Prospective cohort data from Mexico also highlighted the association between hypertension and mortality [17].

Diabetes was also strongly related to CVD outcomes. Current projections are for the prevalence of diabetes to increase further in the first three decades of this century, with the greatest disease burden in middle income developing countries [18]. Morbidity related to glucose intolerance begins at levels well below the diagnostic cutpoints for diabetes [19,20], which has implications for the ultimate burden associated with this important CVD risk factor.

The relatively modest association that we report between BMI as a measure of obesity and CVD is in line with other reports [21], suggesting its limited utility in predicting CVD risk [22]. Its utility may be particularly limited among the elderly. After adjusting for gender, the prevalence of obesity among the oldest-old (those aged 75 years and older) is 67% lower than among the young-old (ages 60 to 74) (OR 0.59, 95% Cl 0.50–0.71, $p < 0.001$), which could reflect selective mortality among our participants, or a reduction in muscle mass with age, or a combination of the two.

Public health strategies

The already high and still increasing burden of CVD across the developing world requires a concerted and comprehensive public-health response. This response should involve governments, non-governmental organizations, academic and research institutions, and the general public. Action must be at all levels of healthcare provision, from health promotion to primary, secondary and tertiary care [23].

There is a continuing need for surveillance and population-based studies to provide a solid evidence-base for guiding preventive interventions and control strategies [24]. Risk factor prevalence should be periodically documented in our populations, and a widely accepted surveillance model has been developed by the World Health Organization (The STEPwise risk factor surveillance methodology — the so-called STEPS survey) [25]. The STEPS survey involves the collection of physical measurements (such as blood pressure and anthropometry) and biochemical measurements (blood glucose, total and HDL cholesterol, and triglycerides). These objective disease indicators would be a marked improvement on the currently available surveys (such as SABE) that are restricted to self-reports of disease status.

Two complementary strategies should then be considered: at the level of the community and the individual. Community-wide interventions address primary prevention, and might include taxing tobacco products, health education, and the promotion of physical activity. The WHO Global Strategy on Diet, Physical Activity and Health is a comprehensive primary prevention strategy, aimed at controlling chronic diseases [26]. Policies for treating the individual include treating known CVD risk factors such as hypertension and high cholesterol, and programs for smoking cessation, as well as evidence-based guidelines for the treatment of overt CVD. Principles for developing strategies for treating individuals have been recently published by the World Heart Federation [27,28]. Efforts at these two levels can reverse or prevent the increasing CVD trend. Over the past three decades, mortality from cardiovascular diseases has declined by about 60% in the USA and Canada [5,29,30]. It has been suggested that in these countries with a substantial decline in cardiovascular mortality, about three quarters of the decline can be attributed to a reduction in event rates (through the improvement of risk factor profiles) and the remaining quarter to improvements in case fatality (mainly attributable to medications) [13,31].

The commonality of CVD risk factors around the world means that public health lessons learned in other settings may be appropriate for the LAC region. Public health responses must still be tailored to local conditions to account for the relative importance of these risk factors, and the resources available to mount a public health response.

The epidemic of CVD is shifting from the developed to developing nations, and it is now estimated that 80% of the global CVD burden is among developing nations [12]. The burden of premature disability and mortality from cardiovascular disease, measured using disability adjusted life years (DALYs) is important. It accounts for over 8% of total disease burden in the LAC region, and ischemic heart disease is in the top ten causes of DALYs in all developing regions [32]. Moreover, the ratio of death from cardiovascular diseases to death from infectious and parasitic diseases is expected to rise in Latin American countries from 1.1 to 4.75 during the period 1985–2015 [33]. Research and health policy should address the impact and challenges of non-communicable diseases right away — the epidemiological transition is underway, and targeted interventions today are likely to reduce future disease burden and related costs.

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