ORIGINAL ARTICLE

Prevalence, Awareness, Treatment, and Control of Hypertension in the Southern Cone of Latin America

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BACKGROUND
Hypertension is the leading global preventable risk factor for premature death. While hypertension prevalence has been declining in high-income countries, it has increased continuously in low- and middle-income countries.

METHODS
We conducted a cross-sectional survey in 7,524 women and men aged 35–74 years from randomly selected samples in 4 cities (Bariloche and Marcos Paz, Argentina; Temuco, Chile; and Pando-Barros Blancos, Uruguay) in 2010–2011. Three blood pressure (BP) measurements were obtained by trained observers using a standard mercury sphygmomanometer. Hypertension was defined as a mean systolic BP ≥140 mm Hg and/or diastolic BP ≥90 mm Hg and/or use of antihypertensive medications.

RESULTS
An estimated 42.5% of the study population (46.6% of men and 38.7% of women) had hypertension and an estimated 32.5% (36.0% of men and 29.4% of women) had prehypertension. Approximately 63.0% of

adults with hypertension (52.5% of men and 74.3% of women) were aware of their disease condition, 48.7% (36.1% of men and 62.1% of women) were taking prescribed medications to lower their BP, and only 21.1% of all hypertensive patients (13.8% of men and 28.9% of women) and 43.3% of treated hypertensive patients (38.1% of men and 46.5% of women) achieved BP control.

CONCLUSIONS
This study indicates that the prevalence of hypertension is high while awareness, treatment, and control are low in the general population in the Southern Cone of Latin America. These data call for bold actions at regional and national levels to implement effective, practical, and sustainable intervention programs aimed to improve hypertension prevention, detection, and control.

Keywords: blood pressure; cross-sectional survey; hypertension control; hypertension; Latin America; prevalence; risk factors.

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Hypertension is the leading global risk factor for cardiovascular disease (CVD) and premature death.[1–3] It was estimated that high blood pressure (BP) contributed to 9.4 million deaths (17.8% of global total) in 2010 with 80% of the attributable burden occurring in low- and middle-income countries.[2] About 54% of stroke and 47% of ischemic heart disease were attributable to high BP worldwide.[3] While the prevalence of hypertension has been declining in high-income countries,[4] it has been increasing in low- and middle-income countries.[5]

Previous studies indicated that hypertension was common and has contributed to a large burden of CVD in Latin America.[6–8] Unfortunately, most data on the prevalence of hypertension in Latin America were self-reported.[7]

The Cardiovascular Risk Factor Multiple Evaluation in Latin America (CARMELA) study reported that hypertension prevalence ranged from 9% to 29% among the general populations aged 25–64 years in 7 South and North American cities between 2003 and 2005.[6] Updated information on the prevalence and control of hypertension is essential for public health priority setting and resource allocation. This information is especially important for low- and middle-income countries because the prevalence of hypertension is high and increasing while the awareness, treatment, and control are low in these populations.[9–11]

The Centro de Excelencia en Salud Cardiovascular para América del Sur (CESCAS) I study is a population-based study aimed to examine CVD and risk factors in the general

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population from 4 representative cities in the Southern Cone of Latin America.[12] Specifically, the objective of the present report is to provide current and reliable data on the prevalence, awareness, treatment, and control of hypertension in the general adult population in this region.

METHODS

Study participants

The details of study design and sampling method of the CESCAS I study have been published elsewhere.[13] Briefly, 7,524 women and men, aged 35–74 years old, were recruited between February 2010 and December 2011 from randomly selected samples in 4 small to mid-sized cities in the Southern Cone of Latin America: 2 cities located in Argentina (Bariloche and Marcos Paz), 1 in Chile (Temuco), and 1 in Uruguay (Pando-Barros Blancos). These study locations were selected based on population characteristics reflecting country averages.

A 4-stage stratified sampling method was used to select a representative sample of the general population of these countries. In the first stage, census radii were randomly selected from each of the 4 locations, stratified by socioeconomic level. In the second stage, a number of blocks proportional to the radius size were randomly selected. In the third stage, households within each block were selected by systematic random sampling. All members between 35 and 74 years in the selected households were listed to create the study sampling frame. In the final stage of sampling, 1 listed member per household was randomly selected to be included in the study. Of the 10,254 individuals randomly selected, 550 were never found at their homes and 1,394 refused to participate. Of those 8,310 who completed the home surveys, 855 did not attend the clinical examination. Thus, the final sample for this analysis includes 7,524 participants (3,165 men and 4,359 women). The overall response rate was 73.4% and the response rates were similar in men and women and across different regions.

The institutional review board at each participating university approved the study. Informed consent was obtained from each participant before data collection.

Data collection

Study data were collected at a home visit and a clinical visit. At the home visit, information on demographic characteristics, personal history of major CVD and risk factors, treatment of hypertension, diabetes, and dyslipidemia, lifestyle risk factors was recorded.[14] Nutrition information was collected using a semi-quantitative, self-administered food frequency questionnaire adapted from the NCI Dietary History Questionnaire and validated in Argentina, Chile, and Uruguay.[15]

At the clinical examination, BP measurements were obtained by trained and certified observers using standard protocols and techniques.[16] Three BP measurements were obtained with the participant in the seated position after 5 minutes of rest using a standard mercury sphygmomanometer, and the mean of 3 readings was used for analysis. Participants were advised to avoid cigarette smoking, alcohol, caffeinated beverages, and exercise for at least 30 minutes before their BP measurement. Body weight, height, and waist circumference were measured twice during the examination according to a standard protocol.[12,13] BP was categorized into normal (systolic BP <120 mm Hg and diastolic BP <80 mm Hg), prehypertension (systolic BP 120–139 mm Hg or diastolic BP 80–89 mm Hg), stage-1 hypertension (systolic BP 140–159 mm Hg or diastolic BP 90–99 mm Hg), and stage-2 hypertension (systolic BP ≥160 mm Hg or diastolic BP ≥100 mm Hg or self-reported use of antihypertensive medications within 2 weeks of the interview). Awareness was defined as a self-reported prior diagnosis of hypertension by a health care professional among individuals with hypertension; treatment as use of antihypertensive medication for management of high BP at the time of the interview; and control as an average systolic BP <140 mm Hg and diastolic BP <90 mm Hg among treated hypertensives. Obesity was defined as a body mass index ≥30 kg/m^2 and overweight as body mass index ≥25 and <30 kg/m^2. Central obesity was defined as waist circumference ≥102 cm for men or ≥88 cm for women.[17]

Overnight fasting blood specimens were obtained for measurement of lipids, creatinine, and glucose. The fasting time was verified before the blood specimen was taken. Participants who had not fasted for at least 10 hours did not have their blood drawn. Blood specimens were processed at the examination center and shipped to a central clinical laboratory in Buenos Aires where the specimens were stored at −80 °C until laboratory assays could be done. Blood glucose, total cholesterol, high-density lipoprotein cholesterol, triglycerides, and creatinine were measured using standard methods with commercially available reagents. Low-density lipoprotein cholesterol was calculated using the Friedewald equation for participants with triglycerides <400 mg/dl.[18]

Statistical analysis

The CESCAS I study was designed to provide precise estimates of the prevalence of hypertension and proportions of awareness, treatment, and control by sex and region (Marcos Paz and Bariloche, Argentina; Temuco, Chile; and Pando-Barros Blancos, Uruguay) in 4 age groups: 35–44, 45–54, 55–64, and 65–74 years old. Sample sizes were estimated to meet generally recommended requirements for precision in a complex survey.[19] All calculations were weighted to represent the general adult population aged 35–74 years in the study sites. Weights were calculated on the basis of data from the 2010 Population Census and the CESCAS I study sampling scheme, and took into account several features of the survey, including oversampling for specific age groups, nonresponse, and other demographic differences between the sample and the total population.

Mean BP level and hypertension prevalence estimates were calculated for the overall population and by the 4 age groups. Additionally, age-standardized prevalence estimates were calculated for men and women, and the 4 study sites, after age-standardization to the overall 2010 population

distribution in the Southern Cone of Latin America. SEs were calculated by a technique appropriate for the complex survey design. Multivariable logistic regression analysis was used to explore the association between hypertension prevalence and risk factors. All data analyses were done with SUDAAN (version 10.0; Research Triangle Institute, Research Triangle Park, NC) and STATA 12.0 (StataCorp LP, College Station, TX).

RESULTS

Mean BP levels

The estimated mean systolic and diastolic BP in the general population from 4 representative cities in the Southern Cone of Latin America were 127.8 mm Hg (95% confidence interval (CI) 127.4, 128.3) and 82.5 mm Hg (95% CI 82.2, 82.8), respectively (Table 1). Men had higher BP than women (130.7 vs. 125.3 mm Hg for systolic BP and 84.8 vs. 80.4 mm Hg for diastolic BP). Mean systolic BP increased continuously with age in both men and women. Mean diastolic BP increased with age in both men and women until age 65 years and became flat in women or decreased in men after then. BP did not vary significantly among the 4 populations, except diastolic BP in Bariloche (Argentina), which was significantly higher compared to the other sites. In addition, we observed a BP gradient by educational levels where systolic and diastolic values were higher in less educated individuals.

Prevalence of hypertension

Overall, an estimated 42.5% (95% CI 41.3, 43.7) of the study population (46.6% of men and 38.7% of women) had hypertension. Prevalence of hypertension increased with age and was higher in men than in in women across all age groups, except in ages 65–74 years, where women had a higher prevalence (Figure 1). Age-standardized prevalence of hypertension was similar among the 4 geographic regions, except for a higher prevalence in Bariloche in men. Estimated percentages of adults within different BP categories according to JNC-7 guidelines are presented in Table 2. Only 25.0% of individuals (17.5% of men and 31.9% of women) had normal BP, a substantial 32.5% (36.0% of men and 29.4% of women) had prehypertension, 15.8% (21.4% of men and 10.8% of women) had stage-1 hypertension, and 26.7% (25.2% of men and 27.9% of women) had stage-2 hypertension. While stage-1 or -2 hypertension was more common in the elderly, prehypertension was more common in young- and middle-age groups. Compared to men, women had a higher prevalence of stage-2 hypertension, particularly in the age group 65–74 years (61.3% vs. 51.9%).

Awareness, treatment, and control of hypertension

Overall, 63.0% of adults with hypertension (52.5% of men and 74.3% of women) were aware of their condition, 48.7% (36.1% of men and 62.1% of women) were taking prescribed medications to lower their BP, and only 21.1% of all hypertensive patients (13.8% of men and 28.9% of women) and 43.3% of treated hypertensive patients (38.1% of men and 46.5% of

women) achieved BP control (Table 3). The awareness and treatment of hypertension increased with age in both men and women. However, the percentage of controlled hypertension, particularly among those treated, was lower in older age groups. The proportions of awareness, treatment, and control were similar among the 4 geographic regions, except for Bariloche, where lower rates were observed compared to the other sites. The awareness, treatment, and control did not differ by education level.

Overall, 64.9% (95% CI 62.2, 67.5) of treated hypertensives were taking 1 medication, 26.7% (24.2, 29.2) were taking 2 medications, and 8.4% (7.0, 9.9) were taking 3 or more medications (Figure 2). No significant differences were observed between controlled and uncontrolled hypertensives in the number of antihypertensive medication used: 1 (66.1% vs. 64.0%), 2 (26.7% vs. 26.7%), or 3 or more (7.2% vs. 9.4%). Likewise, no differences were observed by sex in medication use. Older subjects were more likely to take 2 or 3 or more medications compared to younger subjects, particularly in those aged 55–64 years, where 25.9% (95% CI 21.9, 29.9) were prescribed with ≥3 medications. Participants from Marcos Paz and Bariloche in Argentina were less often on ≥3 medications in comparison to participants from Temuco, Chile and Pando-Barros Blancos, Uruguay.

The common antihypertensive medication classes used in the 3 countries were angiotensin-converting enzyme inhibitors (75.5% overall, 71.5% in Argentina, 76.0% in Chile, and 79.5% in Uruguay), followed by diuretics (21.1% overall, 11.4% in Argentina, 27.6% in Chile, and 17.9% in Uruguay), beta blockers (15.8% overall, 19.9% in Argentina, 12.0% in Chile, and 19.8% in Uruguay), and calcium channel blockers (9.1% overall, 7.8% in Argentina, 6.8% in Chile, and 16.6% in Uruguay).

Risk factors for hypertension prevalence

Multivariate logistic regression revealed that male gender, older age, parental history of hypertension, lower education, heavy alcohol drinking, diabetes, overweight, obesity, central obesity, and serum total cholesterol were significantly associated with prevalent hypertension (Table 4).

DISCUSSION

In this population-based survey, we documented a high prevalence of hypertension and the low proportions of hypertension awareness, treatment, and control in a representative sample of general populations in 4 cities of the Southern Cone of Latin America. The overall prevalence of hypertension was 42.5% in the study population, while only 63.0% of hypertensive patients were aware, 48.7% were treated, and 21.1% were controlled. These data indicate that hypertension is a major public health challenge in Argentina, Chile, and Uruguay.

The prevalence of hypertension increased with age and was higher in men across all age groups, except in those aged 65–74 years, where it was higher in women. A higher prevalence of hypertension in women after age 65 years has been observed in most prevalence studies and is consistent with the increased risk of CVD in postmenopausal women.[20,21]

Table 1. Age-specific and age-standardized mean BP levels (95% confidence interval) in adults aged 35–74 years in the Southern Cone of Latin America

|	Overall			Men			Women		
	No.	Systolic BP	Diastolic BP	No.	Systolic BP	Diastolic BP	No.	Systolic BP	Diastolic BP
Overall	7,520	127.8 (127.4, 128.3)	82.5 (82.2, 82.8)	3,164	130.7 (130.0, 131.4)	84.8 (84.3, 85.2)	4,356	125.3 (124.7, 125.9)	80.4 (80.0, 80.8)
Age groups, years									
35–44	1,712	119.0 (118.2, 119.8)	80.2 (79.6, 80.8)	705	123.2 (122.0, 124.4)	83.2 (82.3, 84.2)	1,007	115.0 (114.0, 116.1)	77.3 (76.5, 78.1)
45–54	2,072	125.9 (125.0, 126.8)	83.3 (82.7, 83.9)	832	128.6 (127.3, 129.8)	85.4 (84.6, 86.3)	1,240	123.5 (122.3, 124.7)	81.4 (80.6, 82.1)
55–64	2,114	134.4 (133.5, 135.3)	84.4 (83.9, 85.0)	935	136.8 (135.5, 138.2)	86.8 (86.0, 87.6)	1,179	132.2 (131.0, 133.4)	82.4 (81.7, 83.0)
65–74	1,622	141.7 (140.6, 142.9)	83.0 (82.4, 83.6)	692	142.4 (140.7, 144.1)	83.7 (82.8, 84.6)	930	141.2 (139.7, 142.8)	82.5 (81.6, 83.3)
P values for differences		<0.0001	<0.0001		<0.0001	<0.0001		<0.0001	<0.0001
Locations									
Marcos Paz, Argentina	1,989	128.7 (127.9, 129.6)	81.1 (80.6, 81.7)	792	130.1 (128.8, 131.3)	83.4 (82.6, 84.3)	1,197	127.3 (126.2, 128.5)	78.8 (78.1, 79.4)
Bariloche, Argentina	1,997	127.8 (127.1, 128.6)	85.3 (84.8, 85.8)	797	129.7 (128.7, 130.8)	87.8 (87.1, 88.6)	1,200	126.0 (125.1, 127.0)	82.9 (82.3, 83.5)
Temuco, Chile	1,950	127.2 (126.4, 128.0)	81.4 (80.9, 81.9)	923	130.9 (129.8, 132.1)	83.5 (82.7, 84.3)	1,027	123.9 (122.9, 125.0)	79.5 (78.8, 80.2)
Barros Blancos, Uruguay	1,584	129.2 (128.3, 130.2)	81.5 (81.0, 82.1)	652	131.7 (130.3, 133.1)	83.5 (82.6, 84.4)	932	126.9 (125.7, 128.1)	79.7 (78.9, 80.4)
P values for differences		0.01	<0.0001		0.14	<0.0001		0.001	<0.0001
Education level									
Primary school	3407	129.5 (128.7, 130.3)	83.1 (82.6, 83.6)	1381	131.8 (130.6, 132.9)	84.9 (84.1, 85.6)	2026	127.5 (126.5, 128.5)	81.6 (80.9, 82.2)
Secondary school	2789	127.6 (126.9, 128.4)	82.6 (82.1, 83.1)	1200	130.3 (129.3, 131.4)	84.9 (84.2, 85.6)	1589	125.2 (124.2, 126.2)	80.5 (79.9, 81.1)
University	1317	125.4 (124.4, 126.4)	81.5 (80.8, 82.1)	581	129.4 (127.9, 130.8)	84.4 (83.4, 85.3)	736	121.6 (120.3, 122.9)	78.7 (77.9, 79.6)
P values for differences		<0.0001	0.003		0.02	0.72		<0.0001	<0.0001

Abbreviation: BP, blood pressure.
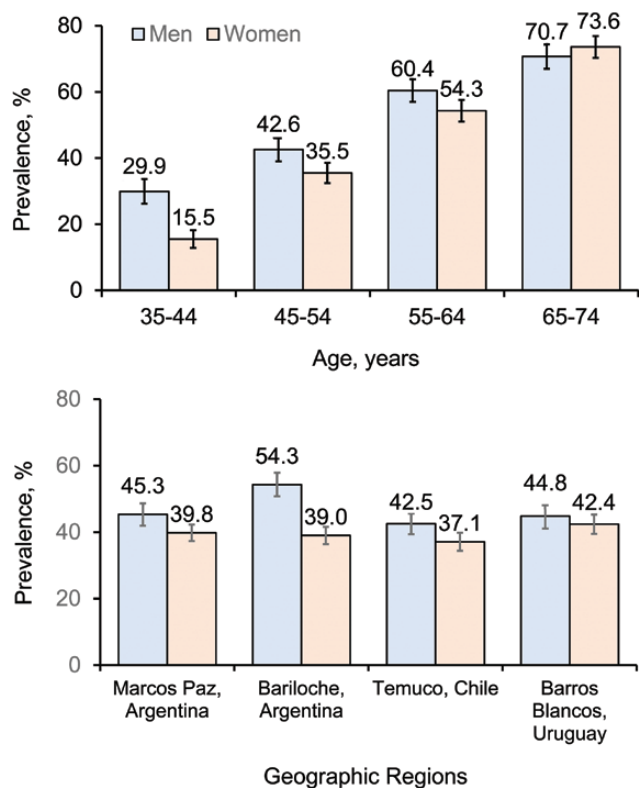
Figure 1. Age-specific prevalence (upper panel) and age-standardized prevalence (lower panel) of hypertension in men and women in the Southern Cone of Latin America.

In addition, hypertension awareness, treatment, and control were also higher in older age groups. However, younger age groups had better BP control among hypertensive individuals who received antihypertensive treatment. More older hypertensive individuals took ≥3 antihypertensive medications due to higher average BP levels. Participants with hypertension from Marcos Paz and Bariloche in Argentina were more likely to take only 1 medication compared to those from Chile and Uruguay. Nevertheless, hypertension control rates were similar in Marcos Paz, Chile, and Uruguay but were lower in Bariloche. In addition, the prevalence of hypertension was higher and the control rate was lower among individuals with lower education levels. Metabolic risk factors, such as obesity, central obesity, diabetes, and hypercholesterolemia were common and associated with hypertension prevalence in our study.[12] A high prevalence of obesity and central obesity may explain the higher prevalence of hypertension in the Southern Cone of Latin America compared to other Latin American countries.[6]

Hypertension surveillance in Latin America is still problematic due to significant methodological limitations in published studies along with scarce and poor quality of data.[22] Most recent publications on hypertension surveys from 35 countries in Latin America and the Caribbean did not meet the basic methodological criteria to be considered useful for surveillance purposes.[7] In addition, although national surveys on cardiovascular risk factors in the Southern Cone have recently become available, these surveys are limited in their ability to provide valid information because they were based on either mostly self-reported data or small and probably biased subsamples with measured BP data.[23]

The CARMELA study, a cross-sectional survey assessing cardiovascular risk factors in adult populations aged 25–64 years from 7 cities in South and North America, showed considerable variation in hypertension prevalence, awareness, treatment, and control.[6] For example, hypertension prevalence ranged from 9% in Quito to 29% in Buenos Aires, undiagnosed hypertension ranged from 24% in Mexico City to 47% in Lima, and treated and controlled hypertension ranged from 12% (Lima) to 41% (Mexico City).[6] Because of different age ranges between the CARMELA study and ours, these prevalences cannot be compared directly. However, age-specific data showed that hypertension prevalences were similar in men but slightly higher in women in our study. The age-specific proportion of controlled hypertension was similar in our study compared to those in the CARMELA study (18% in Buenos Aires and 20.3% in Santiago).[6] Since the CARMELA study was performed 10 years ago, these results indicate that hypertension prevalence and control have improved very little in Latin America.

More recently, the Prospective Urban Rural Epidemiological (PURE) study reported that the prevalence of hypertension was 50.9% in Argentina, 52.6% in Brazil, and 46.6% in Chile among participants aged 35–70 years.[11] In addition, the PURE study reported the proportions of awareness, treatment, and control were 57.1%, 52.8%, and 18.8%, respectively, among hypertensive patients in the 3 South American countries.[11] The higher prevalence of hypertension in the PURE study compared to ours may be due to the differences in BP measurement methods. The PURE study obtained 2 BP measurements using an automated digital device while we obtained 3 BP readings using a standard mercury sphygmomanometer. Our study showed slightly higher hypertension awareness and control compared to the PURE study.

The prevalence of hypertension has been stable or has reduced while awareness, treatment, and control of hypertension have improved in high-income countries over past decades.[20,21] For example, the prevalence of hypertension was 30.5% among men and 28.5% among women in the US in 2009–2010, which was similar compared to 29.1% among men and 29.7% among women in 1999–2000.[23] The hypertension awareness rate was 69.7% among men and 80.7% among women in 2009–2010, increasing from 63.3% among men and 61.0% among women from 1999–2000. The hypertension control rate was 40.3% for men and 56.3% for women in 2009–2010, increasing from 28.3% for men and 27.6% for women in 1999–2000.[23] Our study showed that the hypertension control rate was much lower in Latin Americans.

Our study is one of the first studies in the Southern Cone of Latin America to systematically examine CVD risk factors, including hypertension, in a representative sample of the general population. Physical and biochemical risk factors were measured using standard methods, which can reduce potential bias due to self-reported data. In addition, a stringent quality control procedure was implemented in all stages of the study. This study provides the most recent and reliable

Table 2. Age-standardized and age-specific prevalence (95% confidence interval) of BP categories in adults aged 35–74 years in the Southern Cone of Latin America

	Overall				Men				Women			
	Normal	Prehypertension	Stage-1 hypertension	Stage-2 hypertension	Normal	Prehypertension	Stage-1 hypertension	Stage-2 hypertension	Normal	Prehypertension	Stage-1 hypertension	Stage-2 hypertension
Overall	25.0 (23.8, 26.1)	32.5 (31.3, 33.8)	15.8 (14.8, 16.8)	26.7 (25.7, 27.7)	17.5 (15.9, 19.0)	36.0 (34.1, 37.9)	21.4 (19.7, 23.0)	25.2 (23.7, 26.7)	31.9 (30.2, 33.5)	29.4 (27.7, 31.1)	10.8 (9.7, 11.9)	27.9 (26.5, 29.3)
Age groups, years												
35–44	40.4 (37.7, 43.1)	37.1 (34.5, 39.8)	14.4 (12.4, 16.3)	8.1 (6.6, 9.6)	25.8 (22.2, 29.3)	44.3 (40.3, 48.3)	21.3 (18.0, 24.6)	8.6 (6.4, 10.9)	54.1 (50.4, 57.8)	30.4 (27.0, 33.8)	7.9 (5.9, 9.8)	7.7 (5.7, 9.6)
45–54	26.5 (24.3, 28.7)	34.7 (32.3, 37.0)	16.4 (14.6, 18.2)	22.4 (20.4, 24.5)	20.2 (17.2, 23.2)	37.2 (33.6, 40.8)	21.5 (18.5, 24.5)	21.1 (18.1, 24.1)	32.1 (29.0, 35.2)	32.4 (29.3, 35.4)	11.9 (9.9, 13.9)	23.6 (20.8, 26.4)
55–64	11.6 (10.1, 13.2)	31.2 (28.9, 33.5)	17.6 (15.8, 19.5)	39.5 (37.2, 41.9)	8.7 (6.8, 10.6)	30.9 (27.6, 34.2)	23.0 (20.0, 26.0)	37.4 (34.0, 40.8)	14.3 (12.0, 16.6)	31.4 (28.3, 34.6)	12.8 (10.7, 15.0)	41.4 (38.1, 44.7)
65–74	7.5 (6.0, 8.9)	20.2 (18.0, 22.3)	15.1 (13.2, 17.0)	57.3 (54.6, 60.0)	6.7 (4.7, 8.7)	22.6 (19.2, 26.0)	18.8 (15.7, 21.9)	51.9 (47.9, 56.0)	8.0 (6.0, 10.1)	18.3 (15.5, 21.2)	12.3 (9.9, 14.7)	61.3 (57.8, 64.9)
P values for differences	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Locations												
Marcos Paz, Argentina	27.7 (25.6, 29.8)	29.7 (27.5, 31.9)	13.2 (11.6, 14.8)	29.4 (27.5, 31.3)	23.0 (19.8, 26.2)	31.7 (28.2, 35.2)	17.6 (14.8, 20.4)	27.7 (24.7, 30.6)	32.6 (30.0, 35.2)	27.6 (25.0, 30.2)	8.9 (7.3, 10.5)	30.9 (28.5, 33.3)
Bariloche, Argentina	19.4 (17.5, 21.2)	34.3 (32.0, 36.5)	22.5 (20.5, 24.4)	23.9 (22.2, 25.6)	11.2 (8.8, 13.6)	34.5 (31.0, 37.9)	29.9 (26.5, 33.2)	24.4 (21.7, 27.1)	27.0 (24.4, 29.5)	34.0 (31.2, 36.8)	15.7 (13.6, 17.8)	23.3 (21.3, 25.4)
Temuco, Chile	27.7 (25.7, 29.7)	32.6 (30.5, 34.8)	13.1 (11.6, 14.6)	26.6 (24.8, 28.4)	19.6 (16.9, 22.3)	37.9 (34.7, 41.2)	18.2 (15.6, 20.8)	24.3 (21.7, 26.8)	34.9 (32.0, 37.7)	28.0 (25.2, 30.9)	8.7 (7.0, 10.4)	28.4 (25.9, 30.9)
Barros Blancos, Uruguay	24.6 (22.3, 26.8)	31.8 (29.3, 34.3)	13.9 (12.0, 15.7)	29.8 (27.7, 31.8)	18.7 (15.5, 22.0)	36.4 (32.6, 40.3)	18.0 (14.9, 21.1)	26.8 (23.7, 29.9)	30.3 (27.2, 33.4)	27.4 (24.3, 30.4)	10.0 (8.0, 12.0)	32.4 (29.7, 35.0)
P values for differences	<0.0001	0.02	<0.0001	<0.0001	<0.0001	0.03	<0.0001	0.29	0.0003	0.001	<0.0001	<0.0001
Education level												
Primary school	22.1 (20.1, 24.1)	31.9 (29.7, 34.1)	18.4 (16.6, 20.3)	27.6 (26.0, 29.3)	16.9 (14.2, 19.7)	34.0 (30.6, 37.3)	25.3 (22.2, 28.3)	23.8 (21.5, 26.1)	26.7 (23.9, 29.6)	30.0 (27.1, 32.8)	12.4 (10.4, 14.5)	30.8 (28.5, 33.1)
Secondary school	24.8 (23.0, 26.6)	33.2 (31.2, 35.2)	15.0 (13.5, 16.4)	27.0 (25.3, 28.8)	17.1 (14.7, 19.4)	36.8 (33.8, 39.8)	19.8 (17.4, 22.3)	26.3 (23.8, 28.8)	31.9 (29.4, 34.5)	29.8 (27.2, 32.5)	10.5 (8.8, 12.1)	27.7 (25.4, 30.1)
University	28.9 (26.3, 31.5)	33.7 (30.9, 36.4)	13.7 (11.7, 15.7)	23.8 (21.5, 26.1)	19.0 (15.6, 22.3)	36.9 (32.8, 41.0)	18.9 (15.5, 22.2)	25.2 (21.8, 28.7)	38.3 (34.7, 41.9)	30.4 (26.7, 34.1)	8.9 (6.6, 11.1)	22.4 (19.4, 25.5)
P values for differences	0.0002	0.23	0.0008	0.05	0.46	0.22	0.003	0.49	<0.0001	0.75	0.08	0.0006

BP categories: normal, systolic BP <120 mm Hg, and diastolic BP <80 mm Hg; prehypertension, systolic BP 120–139 mm Hg or diastolic BP 80–89 mm Hg; stage-1 hypertension, systolic BP 140–159 mm Hg or diastolic BP 90–99 mm Hg; and stage-2 hypertension, systolic BP ≥160 mm Hg or diastolic BP ≥100 mm Hg or self-reported use of antihypertensive medications within 2 weeks of the interview. Abbreviation: BP, blood pressure.

Table 3. Awareness, treatment, and control of hypertension in adults aged 35–74 years in the Southern Cone of Latin America

	Overall				Men				Women			
	Awareness	Treatment	Control[a]	Control[b]	Awareness	Treatment	Control[a]	Control[b]	Awareness	Treatment	Control[a]	Control[b]
Overall	63.0 (61.1, 65.0)	48.7 (46.7, 50.7)	21.1 (19.5, 22.7)	43.3 (40.7, 46.0)	52.5 (49.6, 55.4)	36.1 (33.5, 38.8)	13.8 (11.9, 15.6)	38.1 (33.9, 42.3)	74.3 (71.9, 76.7)	62.1 (59.5, 64.8)	28.9 (26.4, 31.4)	46.5 (43.2, 49.9)
Age groups, years												
35–44	41.8 (36.1, 47.5)	21.3 (16.6, 26.0)	11.3 (7.7, 14.9)	53.0 (40.8, 65.3)	34.0 (27.1, 41.0)	12.9 (8.2, 17.6)	7.3 (3.5, 11.0)	56.3 (37.2, 75.4)	55.7 (46.5, 65.0)	36.5 (27.4, 45.5)	18.6 (11.3, 25.8)	50.9 (35.1, 66.7)
45–54	59.9 (56.1, 63.8)	42.7 (38.7, 46.6)	20.3 (17.0, 23.5)	47.5 (41.4, 53.7)	47.9 (42.3, 53.6)	29.9 (24.8, 35.1)	11.4 (7.8, 15.0)	38.0 (27.9, 48.0)	72.8 (68.1, 77.5)	56.3 (50.9, 61.7)	29.8 (24.6, 35.1)	53.0 (45.4, 60.5)
55–64	69.6 (66.7, 72.5)	57.3 (54.2, 60.5)	25.3 (22.5, 28.2)	44.2 (40.0, 48.4)	61.8 (57.5, 66.1)	45.7 (41.2, 50.1)	17.0 (13.5, 20.5)	37.2 (30.8, 43.7)	77.4 (73.7, 81.0)	69.0 (64.9, 73.0)	33.6 (29.3, 38.0)	48.8 (43.3, 54.2)
65–74	77.9 (75.3, 80.5)	70.0 (67.1, 72.9)	25.6 (22.9, 28.3)	36.6 (33.0, 40.2)	71.1 (66.9, 75.4)	63.2 (58.6, 67.8)	21.5 (17.6, 25.3)	34.0 (28.3, 39.6)	82.8 (79.6, 86.0)	75.0 (71.3, 78.7)	28.6 (24.9, 32.4)	38.2 (33.6, 42.9)
P values for differences	<0.0001	<0.0001	<0.0001	0.001	<0.0001	<0.0001	<0.0001	0.23	<0.0001	<0.0001	0.008	0.002
Locations												
Marcos Paz, Argentina	62.5 (59.0, 66.0)	53.0 (49.4, 56.5)	23.9 (21.0, 26.8)	45.2 (40.7, 49.7)	54.5 (49.1, 59.9)	44.0 (38.7, 49.3)	17.4 (13.4, 21.4)	39.5 (31.9, 47.0)	71.5 (67.5, 75.6)	63.1 (58.7, 67.4)	31.3 (27.2, 35.4)	49.6 (44.2, 55.1)
Bariloche, Argentina	52.2 (48.8, 55.6)	37.6 (34.5, 40.7)	11.4 (9.5, 13.3)	30.3 (25.8, 34.7)	44.3 (39.5, 49.1)	29.1 (25.0, 33.2)	8.2 (5.8, 10.5)	28.0 (20.9, 35.1)	62.3 (57.9, 66.7)	48.5 (44.0, 52.9)	15.5 (12.4, 18.6)	32.0 (26.3, 37.7)
Temuco, Chile	68.6 (65.1, 72.2)	52.7 (49.0, 56.3)	25.3 (22.2, 28.4)	48.0 (43.4, 52.7)	57.8 (52.5, 63.1)	37.1 (32.2, 41.9)	16.6 (12.9, 20.2)	44.7 (37.0, 52.3)	79.3 (75.0, 83.5)	68.0 (63.2, 72.8)	33.9 (29.2, 38.6)	49.8 (44.0, 55.7)
Pando-Barros Blancos, Uruguay	68.7 (65.2, 72.3)	56.1 (52.5, 59.8)	26.3 (23.2, 29.4)	46.9 (42.3, 51.4)	54.8 (49.1, 60.5)	43.3 (37.8, 48.9)	15.9 (12.0, 19.9)	36.8 (28.9, 44.6)	82.0 (78.3, 85.7)	68.3 (63.8, 72.7)	36.1 (31.7, 40.6)	52.9 (47.5, 58.4)
P values for differences	<0.0001	<0.0001	<0.0001	<0.0001	0.001	<0.0001	<0.0001	0.02	<0.0001	<0.0001	<0.0001	<0.0001
Education level												
Primary school	64.8 (62.2, 67.5)	51.1 (48.4, 53.8)	20.8 (18.6, 22.9)	40.6 (37.1, 44.2)	51.7 (47.6, 55.8)	36.0 (32.2, 39.7)	11.5 (9.1, 13.8)	31.9 (26.3, 37.5)	76.3 (73.1, 79.5)	64.4 (60.8, 67.9)	28.9 (25.6, 32.2)	44.9 (40.5, 49.3)
Secondary school	61.8 (58.5, 65.1)	46.9 (43.6, 50.2)	20.9 (18.3, 23.5)	44.6 (40.0, 49.2)	51.8 (47.0, 56.6)	35.2 (30.9, 39.5)	13.8 (10.8, 16.9)	39.3 (32.3, 46.3)	73.4 (69.3, 77.5)	60.5 (55.8, 65.1)	29.1 (24.9, 33.4)	48.2 (42.2, 54.2)
University	61.6 (56.4, 66.8)	47.0 (41.9, 52.2)	22.1 (17.9, 26.2)	46.9 (39.9, 53.9)	55.5 (48.4, 62.6)	38.2 (31.6, 44.7)	17.7 (12.7, 22.7)	46.3 (36.1, 56.5)	70.3 (63.0, 77.6)	59.7 (52.1, 67.3)	28.4 (21.4, 35.4)	47.6 (37.9, 57.2)
P values for differences	0.29	0.11	0.86	0.18	0.63	0.76	0.07	0.04	0.25	0.32	0.98	0.66

Values are percentage (95% confidence interval). Awareness was defined as self-report of a prior diagnosis of hypertension by a health care professional. Treatment was defined as self-reported use of antihypertensive medications within 2 weeks of the interview. Abbreviation: BP, blood pressure.

[a]Control was defined as systolic BP <140 mm Hg and diastolic BP <90 mm Hg among all hypertensive patients.

[b]Control was defined as systolic BP <140 mm Hg and diastolic BP <90 mm Hg among hypertensive patients on antihypertensive medications.
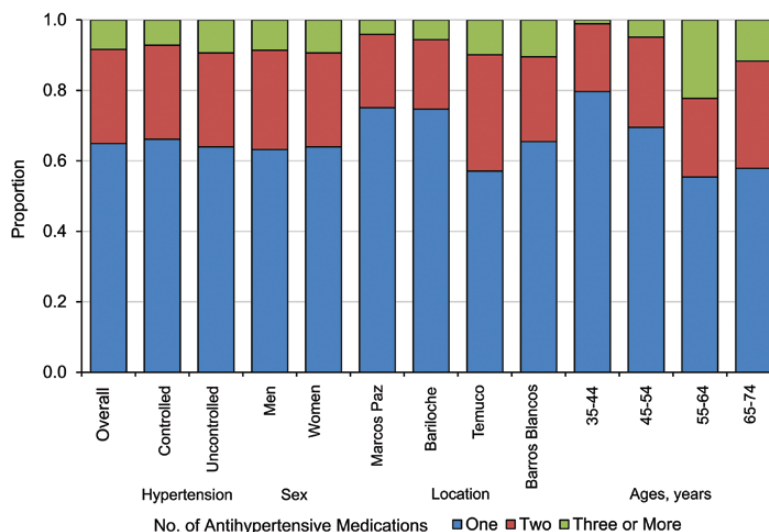
Figure 2. Proportions of treated hypertensive individuals according to number of antihypertensive medications in the Southern Cone of Latin America.

Table 4. Multiple-adjusted odds ratios of hypertension associated with risk factors in adults aged 35–74 years in the Southern Cone of Latin America

	Hypertension	
Risk factors	Odds ratio (95% CI)	P value
Male sex	1.85 (1.59, 2.17)	<0.001
Age, 10.8 years	2.30 (2.14, 2.47)	<0.001
Parental history of hypertension	1.70 (1.50, 1.94)	<0.001
Education level		
Secondary vs. primary	0.85 (0.74, 0.99)	0.03
University vs. primary	0.67 (0.56, 0.81)	<0.001
Current smoking	0.66 (0.56, 0.77)	<0.001
Heavy drinking	1.42 (1.08, 1.88)	0.01
Diabetes	1.56 (1.27, 1.91)	<0.001
Overweight	1.68 (1.39, 2.02)	<0.001
Obesity	2.76 (2.20, 3.46)	<0.001
Central obesity	1.41 (1.18, 1.70)	<0.001
Low physical activity (<600 MET-hours/week)	1.01 (0.87, 1.16)	0.94
Low fruit/vegetable intake (<5 servings/day)	1.06 (0.89, 1.26)	0.53
Total cholesterol, 42.9 mg/dl	1.71 (1.39, 2.12)	<0.001
LDL cholesterol, 35.7 mg/dl	0.67 (0.55, 0.81)	<0.001
HDL cholesterol, 12.9, mg/dl	0.92 (0.84, 1.00)	0.04

Education: ≤7 year, 8–12 years, >12 years. Hypertension: systolic blood pressure ≥140 mm Hg and/or diastolic blood pressure ≥90 mm Hg and/or use of antihypertensive medication. Overweight: body mass index ≥25 and <30 kg/m²; obesity: body mass index ≥30 kg/m²; central obesity: waist circumference ≥102 for men and ≥88 cm for women. Diabetes: fasting glucose ≥126 mg/dl or self-reported history of diabetes. Heavy alcohol drinker: ≥5 drinks in men and ≥4 drinks in women on the same occasion on 5 or more days per month. Abbreviations: CI, confidence interval; HDL, high-density lipoprotein; LDL, low-density lipoprotein; MET, metabolic equivalent.

data on hypertension prevalence and control in the general adult population in the Southern Cone of Latin America.

A major limitation of this study is that the sampling frame in each country is not nationally representative. While study samples were randomly selected from each city included, caution is needed to extrapolate our findings to the overall country or region. Nevertheless, the prevalence of hypertension reported in our study is consistent with the results shown in national surveys of the Southern Cone, which suggests no major biases due to the selection of cities included in the CESCAS I study.[24–26]

Reducing premature mortality caused by noncommunicable diseases by 25% by 2025, as stated by the World Health Assembly, will depend to a large extent on the global actions to reduce BP-related mortality.[27,28] The target agreed upon by the Pan American Health Organization for 2019 is to achieve a hypertension control rate of 35% in the general population.[29] To achieve this target, the proportion of awareness, treatment, and control among hypertensives should be well above 70%. Our study indicates that the prevalence of hypertension is high while awareness, treatment, and control are low in the general population of the Southern Cone. These data call for bold actions at regional and national levels to implement effective, practical, and sustainable intervention programs aimed to improve hypertension prevention, detection, and control in the Southern Cone of Latin America.[30]

DISCLOSURE

The authors declared no conflict of interest.

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