Risk factors associated with uncontrolled hypertension: findings from the baseline CARMEN survey in Cienfuegos, Cuba

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Objectives **Identifying methods to improve pharmacologic control of elevated blood pressure remains the most urgent challenge in clinical research on hypertension. The probability of having inadequate control varies widely in the population and better understanding of the factors responsible could help to focus treatment strategies.**

Methods **A population-based community survey of 1475 persons aged 25–74 years, in Cienfuegos, Cuba, was used to identify these factors in a low-resource setting.**

Results **While half of women with hypertension were controlled, only one-third of men were receiving successful treatment. Gender differences were not seen, however, among those currently taking medications. The largest burden of hypertension in absolute terms was concentrated in the age range 45–64, emphasizing the heavy burden of uncontrolled high blood pressure that falls on middle-aged men. Race-ethnicity was not a determinant of treatment and control status, nor was inability to obtain medication.**

Conclusions **These findings largely confirm the pattern observed in industrialized countries and demonstrate the near-universal challenge confronting primary-care systems in physician-based control of cardiovascular risk factors.**
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Abbreviations: BMI, Body mass index; *CARMEN*, Spanish acronym for Action Plan for the Multifactorial Reduction of Noncommunicable Diseases; CI, Confidence interval; CVD, Cardiovascular diseases; DBP, Diastolic blood pressure; JNC, Joint National Committee; NHANES, National Health and Nutrition Examination Survey; PAHO, Pan American Health Organization; PDS, Provincial Department of Statistics; PHC, Primary health care; RF, Risk factors; SBP, Systolic blood pressure

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Introduction

Hypertension is the most common cardiovascular condition worldwide and is causally related to approximately 18% of deaths from all causes, as well as the majority of deaths from stroke and ischemic heart diseases, in industrialized nations [1]. Although less well defined, hypertension likewise contributes significantly to the disease burden experienced by developing countries [2,3] with recent estimates suggesting that 13% of all deaths and 54% of strokes could be attributed to this cause in nonindustrialized societies [4]. Despite its public health impact, hypertension control has not received the attention that it deserves in developing countries, in part because of the limited nature of the surveillance data available [5–7]. In the Latin American and Caribbean region, community-based studies of hypertension report prevalence estimates ranging from 15 to 40% of the adult population [5].

Neither advances in knowledge of the disease nor the increasingly effective therapeutic arsenal have guaranteed sustainable control rates at the population level [2,5,8,9]. The limited success in control has been attributed to multiple causes, such as characteristics of patients, access, organization and utilization of health services, problems related to adherence to long-term treatments and doctors' attitudes [10,11]. The challenge of overcoming these multiple obstacles is greater in developing countries, due to the lack of organization and social services and to the poor coverage and quality of the statistical and surveillance systems [2,5,12–17].

Cuba has made a substantial investment in the training of health personnel and has developed a well-organized health system and primary-care network [18–21]. The combination of universal access, an emphasis on primary care, and uniform clinical guidelines have facilitated implementation of a policy where early detection and treatment of hypertension play a central role in controlling cardiovascular diseases (CVD) [18,19].

The city of Cienfuegos is a demonstration area for the CARMEN initiative (Spanish acronym for Action Plan

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for the Multifactorial Reduction of Noncommunicable Diseases) in Cuba. CARMEN is an intervention project developed by the Pan American Health Organization (PAHO) that targets CVD. Utilizing the CARMEN protocol, a baseline survey was undertaken to obtain up-to-date information on the prevalence and control levels of various cardiovascular risk factors (RF) in Cienfuegos [22]. Previous reports based on this survey have demonstrated excellent overall levels of hypertension control [23], although women have significantly better control than men and minimal differences also persist with respect to ethnic origin [24]. The present study attempted to identify the important characteristics of people who did not achieve hypertension control and the factors within the healthcare system that could be contributing to this.

Methods

The study was carried out in the city of Cienfuegos, the capital of Cienfuegos province, on the southern coast of central Cuba. At the time of the survey there were 76 803 inhabitants between the ages of 25 and 74 years. As described in detail elsewhere, this cross-sectional study enrolled a sample of 1475 people, selected randomly and with equal probability [18,23]. The sample population was then stratified by gender and age (25–44, 45–64, 65–74 years). The rate of participation in the clinical examination was 80.2%. Field work and primary data collection were completed during 2001–2002.

The questionnaire component of the survey (available at http://www.paho.org) was adapted from CARMEN [22,25]. The interviewers were selected by the Provincial Department of Statistics (PDS) from a group of survey professionals who had participated in the recent National Census. Initial interviews were conducted at the participants' homes and included a series of questions pertaining to socio-demographics, CVD risk factors, other health conditions, and consumption and availability of prescription drugs. Skin color was recorded by visual inspection by the trained interviewers, similar to the procedure used in the Cuban census of 2001.

Technical personnel were trained and certified for interview and blood pressure measurement. All weight, height and blood pressure measurements were carried out in the physician's office in the local neighborhood following international guidelines [26,27]. Participants' blood pressures were taken three times at one location, at 1-min intervals and under the same conditions. They were measured in the right arm using a calibrated mercury manometer (a column with a graduated scale every 2 mmHg). Before proceeding with the analysis, the distribution of terminal digits was examined (i.e. percentage of readings ending in 0, 2, 4, 6 and 8). Based on criteria adopted ahead of time, 20% was considered 'optimal'; >20 and $\leq 25\%$, 'acceptable'; >25 and <30, 'borderline'; and $>30\%$, 'unacceptable' [28]. No terminal digit occurred in more than 25% of readings, which is taken as evidence of appropriate measurement techniques. The subsequent blood pressure analyses were based on the average of the last two readings.

Participants wore light street clothing. Medication use was verified by a physician who participated in the study by examining the pill bottle. The guidelines for hypertension management that were in effect at the time of the survey were promulgated by the Cuban authorities and followed the US Joint National Committee-6 (JNC-6) [28,29].

Statistical analysis

Hypertension categories used in the analyses were derived from US recommendations (i.e. JNC) [29]. Body mass index (BMI) was calculated as weight in kilograms divided by the height in meters^2. Educational level was dichotomized as <12 grades and ≥ 12 grades (including the previous year). Analyses were carried out using STATA 8.0 (StataCorp LP, College Station, Texas, USA) and accounted for the sampling design.

Blood pressure levels and treatment status were known for all participants. Interviewers classified participants in the following groups based on skin color: 'white' ($n=1045$), 'black' ($n=175$) and '*mulatto*' ($n=255$). Due to the small number of nonwhite participants, blacks and *mulattos* were combined in a single category; blood pressures did not vary between the two groups of nonwhites [24].

Descriptive statistics were used to compare distributions among the hypertension categories. Logistic regression was used to assess the independent contribution of sociodemographic factors to the risk of having uncontrolled hypertension, and the analytic strategy used previously by Hyman and Pavlik [30] was employed. The hypertension categories consisted of the following: participants who were hypertensive but unaware; who knew of their hypertension but did not seek treatment; who were being treated but were not controlled; and those who had hypertension that was controlled with treatment. Subjects who reported that they suffered from hypertension but were not being treated, and whose blood pressure was below 140/90 mmHg, were assigned to the group 'without hypertension'.

The health system in Cuba provides free access to health services; however, there are still potential impediments to adequate treatment, including economic limitations of the country, the availability of medication in the pharmacy, and the purchasing power of the patients. The utilization of health services was examined using the following questions.

Table 1 Prevalence of hypertension, awareness, treatment and control by age and gender (Cienfuegos, Cuba, 2001–2002)

Condition	Groups by age			All
	25–44	45–64	65–74	
Total				
Population (*N*)	719	557	199	1475
With hypertension[a] (*n*)	95	205	108	408
Prevalence[b]	12.5 (8.3–16.8)	35.4 (31.2–39.6)	56.6 (48.1–65.1)	21.4 (17.5–25.3)
Unknown/hypertensive[b]	28.5 (17.5–39.5)	15.7 (9.2–22.1)	22.3 (14.7–29.8)	21.5 (14.7–28.4)
Not treated/know of existing condition[b]	19.0 (11.0–27.0)	18.2 (10.0–26.4)	9.5 (2.6–16.4)	17.3 (12.0–22.6)
Not controlled/treated[b]	14.1 (7.4–20.8)	22.5 (18.0–27.1)	37.1 (27.0–47.1)	21.3 (18.0–24.5)
Controlled/treated[b]	38.4 (29.9–46.9)	43.6 (33.1–54.2)	31.2 (21.3–41.0)	39.9 (33.1–46.6)
Men				
Population (*N*)	311	264	79	654
With hypertension[a] (*n*)	58	97	37	192
Prevalence[b]	17.8 (10.5–25.1)	34.2 (26.6–41.8)	50.7 (37.2–64.2)	23.4 (17.2–29.5)
Unknown/hypertensive[b]	34.3 (21.5–47.1)	26.3 (10.8–41.9)	29.0 (14.8–43.3)	30.7 (20.1–41.4)
Not treated/know of existing condition[b]	22.8 (9.0–36.5)	19.4 (4.1–34.8)	19.3 (5.7–32.9)	21.2 (12.9–29.5)
Not controlled/treated[b]	14.6 (5.3–24.0)	24.7 (15.6–33.7)	22.6 (7.6–37.6)	19.2 (11.5–26.9)
Controlled/treated[b]	28.3 (14.8–41.8)	29.6 (9.9–49.3)	29.0 (12.2–45.9)	28.9 (19.9–37.8)
Women				
Population (*N*)	408	293	120	821
With hypertension[a] (*n*)	37	108	71	216
Prevalence[b]	8.6 (5.9–11.4)	36.2 (32.1–40.2)	58.8 (46.8–70.8)	20.0 (16.9–23.2)
Unknown/hypertensive[b]	19.6 (3.0–36.2)	9.4 (3.6–15.2)	20.1 (12.5–27.6)	14.2 (7.4–21.0)
Not treated/know of existing condition[b]	13.3 (4.8–21.8)	17.4 (9.0–25.8)	6.4 (0.6–12.2)	14.2 (8.9–19.5)
Not controlled/treated[b]	13.3 (4.9–21.7)	21.3 (15.5–27.1)	41.7 (29.8–53.6)	22.9 (18.7–27.1)
Controlled/treated[b]	53.8 (42.3–65.4)	51.9 (42.6–61.2)	31.8 (20.0–43.7)	48.7 (40.5–56.8)

[a] Blood pressure $\geq$ 140/90 mmHg or being treated with antihypertension medication currently.
[b] Percentage (95% confidence interval).

(1) Have you visited a physician at least once in the past 12 months?
(2) Have you had your blood pressure measured at least once:
    (a) in the past 12 months?
    (b) has it been more than 12 months?

Smoking was treated as a confounder of health service utilization and hypertension control.

We estimated the odds ratio associated with hypertension or lack of awareness of hypertension in relation to utilization of health services. Individuals without hypertension were selected as the comparison group, recognizing that the diagnosis of hypertension could change the utilization pattern. Additional multivariate modeling was used to confirm that the relative risk estimates were not altered by the inclusion of other potential confounding variables.

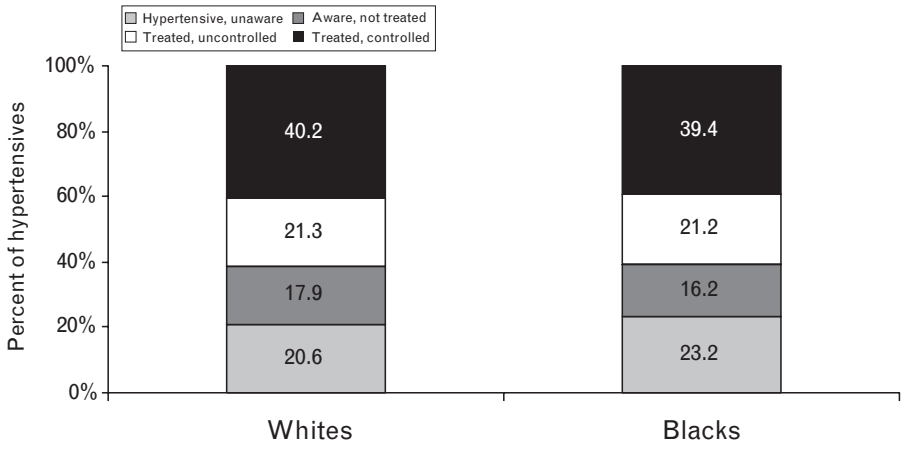
Results

Hypertension prevalence in the study population was 21.4% [95% confidence interval (CI) 17.5–25.3]; 39.9% (95% CI 33.1–46.6) of those individuals with hypertension were found to have their blood pressure controlled (i.e. $<$ 140/90 mmHg). Nearly half of the women had a blood pressure reading below goal, compared to only one in three men. The frequency of undetected hypertension was 21.5%. This condition was most frequent in the age group 25–44 years, particularly among men [34.3% (95% CI 21.5–47.1)]. This age group also had the highest concentration and the greatest frequency of those who knew of their condition and were not receiving treatment, although the prevalence of hypertension was considerably lower in persons aged 25–44 years than among the older age groups. It should be noted that 45% of the adult population of Cienfuegos falls within the 25–44 age range. The 65–74 age group, which has the highest prevalence of hypertension (56.6%), also has a greater proportion of individuals who seek treatment. The frequency of uncontrolled hypertension among those seeking treatment was greater in elderly women (Table 1).

The proportion of people who had sought treatment, but whose pressure was not yet under control, was 21.3% (95% CI 18.0–24.5); only a small difference was observed between men and women. The highest rate of those who were being treated and had their hypertension controlled was observed in the 45–64 age group and reached 51.9% (95% CI 42.6–61.2) in the women of that age group. It should be noted that the greatest absolute number of individuals with hypertension is concentrated in the 45–64 age group (Table 1). Very small differences were observed in the various categories of hypertension analyzed by ethnic group (Fig. 1).

The average blood pressure for each category of uncontrolled hypertension stratified by age group is shown in Table 2. Blood pressure averages for the three categories of uncontrolled hypertension and of each age group were below 160/100 mmHg. As expected, systolic blood pressure (SBP) and diastolic blood pressure (DBP) averages for those who received treatment

Fig. 1



Awareness, treatment and control of hypertension (blood pressure $\geq$140/90 mmHg or taking antihypertension medication) according to ethnicity. Cienfuegos, Cuba, 2001–2002.

were lower than the respective blood pressure averages for those who knew of their condition but did not receive treatment. A considerable proportion of people with hypertension, aged between 65 and 74 years, in the categories of examined hypertension, had confirmed isolated systolic hypertension (SBP $\geq$ 140 mmHg and DBP $<$ 90 mmHg).

Table 3 shows demographic data, access and utilization of the health services and lifestyles which put individuals at risk for hypertension. The individuals that did not have hypertension were younger than those who were classified as hypertensive in the remaining categories. The vast majority of the patients with diagnosed, uncontrolled hypertension claimed to have no difficulty in finding prescribed drugs, and 89% did not have problems paying for them. Of all individuals with uncontrolled hypertension, 85% had visited a physician at least once in the previous 12 months, and 86% had their blood pressure measured during that same time period; however, this was less common in those who did not know of their hypertensive condition (72 and 71%, respectively). A greater proportion of subjects who did not have hypertension visited their physician and had their blood pressure measured than those who did not know of their hypertensive condition. Virtually all patients who had hypertension and were treated, whether controlled or not, had also visited a physician at least once in the 12 months before being interviewed. Individuals with controlled hypertension, compared with those who were undergoing treatment but had not controlled their condition, reported more physical activity (65% versus 36%), a smaller proportion of obesity (26% versus 29%) and a slightly lower BMI (27 versus 28 kg/m^2). Subjects who did not have hypertension had a lower average age and a lower BMI. The proportion of those with obesity in the group without hypertension was notably less than among those who had hypertension.

Table 4 shows the results of the multivariate analysis of predictors in the different hypertension categories. The odds ratio associated with having hypertension and not knowing of your condition was four times greater in those who did not visit their physician at least once in the past 12 months compared to those who had done so. Hypertension was 2.6 times more common in men than in women and almost twice as high in those who had not measured their blood pressure in the previous 12 months. Furthermore, the odds ratio of not having controlled blood pressure while knowing that you are at risk was almost 10 times greater in those who had not had their blood pressure measured in the past 12 months. It was almost three times higher in men than in women, and two times higher in those who had not visited their physician in the previous 12 months, in comparison with those who had.

Discussion

Consistent with other community surveys, a significant proportion of participants in the CARMEN baseline examination in Cienfuegos, Cuba, who were receiving care for hypertension, did not reach the level of blood pressure control recommended by international standards. In addition, many others were identified as having hypertension but did not know of their condition. Men were significantly over-represented in both of these categories. The treatment and control of hypertension can be influenced by factors that have been described in other contexts [31,32] and in Cuba [18,33]. These factors can be grouped as follows: patient-related factors; factors related to physicians' practices; and a combination of both the above, which can be described as factors closely

Table 2 Blood pressure levels in subjects with different categories of uncontrolled hypertension according to age (Cienfuegos, Cuba, 2001–2002)

Group age (years)	Hypertension present but subject is unaware: Average blood pressure	Hypertension present but subject is unaware: SPB ≥ 140 mmHg/DBP < 90 mmHg	Hypertensive condition known but subject does not receive treatment: Average blood pressure	Hypertensive condition known but subject does not receive treatment: SPB ≥ 140 mmHg/DBP < 90 mmHg	Treated, hypertension not controlled: Average blood pressure	Treated, hypertension not controlled: SPB ≥ 140 mmHg/DBP < 90 mmHg
	mmHg SPB (95% CI)/DBP (95% CI)	% (95% CI)	mmHg SPB (95% CI)/DBP (95% CI)	% (95% CI)	mmHg SPB (95% CI)/DBP (95% CI)	% (95% CI)
25–44	137 (132–141)/93 (90–95)	16.2 (2.4–30.1)	142 (138–147)/95 (91–98)	12.0 (5.0–29.1)	140 (130–150)/89 (85–94)	7.4 (2.9–17.8)
45–64	142 (135–148)/90 (88–93)	34.8 (17.2–52.4)	146 (138–154)/94 (89–99)	30.5 (20.8–40.1)	152 (149–155)/94 (90–98)	27.9 (13.7–42.1)
65–74	150 (148–153)/80 (76–84)	76.4 (59.4–93.5)	158 (147–169)/90 (85–94)	40.5 (25.9–55.0)	155 (151–159)/84 (81–87)	60.7 (48.0–73.5)
All subjects	140 (137–144)/90 (88–92)	31.2 (17.8–44.6)	145 (139–151)/94 (92–96)	23.4 (15.6–31.2)	150 (147–152)/90 (88–92)	30.5 (22.5–38.6)

CI, confidence interval; DBP, diastolic blood pressure; SBP, systolic blood pressure.

related to the way in which patients and physicians interact with the healthcare system.

Young and middle-aged men who were unaware of their hypertension reportedly had their blood pressure checked with less regularity than women or older men; this appeared to be a result of not visiting their physician or not receiving a physician visit at their home. Even those young and middle-aged men who were aware of being hypertensive reported a higher frequency of not following treatment regularly, compared to women or older men. This characterization is quite similar to the stereotype of the individual with uncontrolled hypertension [30], and it indicates that the Cuban health system – particularly primary healthcare – has difficulties in reaching young and middle-aged men. Although this group in our study was found to have only moderate hypertension, it accounted for a major proportion of the population.

Those individuals with uncontrolled hypertension may include patients who have blood pressure measurements considered to be mild hypertension. The largest proportion of hypertensive individuals can be found in the 65–74-year-old age group. In addition to stage 1 hypertension, they often have isolated systolic hypertension – both of which are frequently given inadequate attention by physicians and patients [30,32]. Isolated systolic hypertension is still the focus of an international controversy, even though recommendations clearly state that physicians should use SBP as a criterion for diagnosis and treatment [34–35].

Hypertension control for the elderly is a key issue in the current debate in the USA. In one of the most frequently cited studies, 13% of those who did not know their hypertension status and 44% of those with uncontrolled hypertension were 65 years of age or older. In our data, this group's relative risk was moderately high due to uncontrolled hypertension; however, there were only 3% of individuals with hypertension who did not know of their condition and 9% of those who were receiving treatment who were uncontrolled. Hence, the principal challenge for management of the ≥ 65-year-old age group involves coping with a higher prevalence of hypertension and confronting a greater risk of short-term cardiovascular complications. It is also necessary to identify an effective therapeutic regimen for reaching the goal of controlled hypertension, despite the persistent controversy concerning the ease with which one can achieve a SBP level lower than 140 mmHg [34–36].

There is another factor that was not quantified in this study but contributes, in other scenarios, to the high frequency of uncontrolled hypertension. This element could explain, in a context such as the one found in Cuba, how even with broad coverage and access approximately half the individuals with treated but uncontrolled

Table 3 Demographic factors and access and utilization of the health services in accordance with hypertension (Cienfuegos, Cuba, 2001–2002)

Factors	No hypertension	Hypertension not controlled				Treated, hypertension controlled
		Hypertension present but the subject is unaware	Subject has hypertension but does not receive treatment	Treated, hypertension not controlled	Total	
Demographics						
Age (years ± SD)	40.12 ± 0.32	48.25 ± 1.82	47.44 ± 1.13	54.26 ± 1.65	50.04 ± 1.07	49.49 ± 1.40
Males, % (95% CI)	43.1 (39.8–46.3)	69.8 (56.8–82.8)	61.1 (50.7–71.4)	45.9 (32.7–59.2)	59.2 (51.8–66.6)	35.3 (27.3–43.2)
Blacks, % (95% CI)	29.3 (25.7–32.8)	38.7 (27.8–49.6)	35.8 (23.8–47.7)	35.4 (21.9–48.9)	36.7 (30.2–43.3)	34.8 (28.8–40.8)
≥ 12 years of education, % (95% CI)	60.3 (54.2– 66.4)	50.8 (38.3–63.2)	49.6 (32.5–66.8)	40.3 (26.3–54.3)	46.9 (36.7–57.2)	52.3 (44.7–60.0)
Access to health services, % (95% CI)						
Availability of medicine in the pharmacy						
Little or no difficulty				85.9 (77.9–93.8)		79.0 (67.7–90.2)
Considerable difficulty				12.9 (4.3–21.4)		17.7 (6.2–29.1)
Not available				1.3 (0.7–3.3)		3.4 (0.6–6.1)
Ability to pay for medication						
Little or no difficulty				89.3 (83.3–95.3)		92.4 (88.7–96.2)
Considerable difficulty				9.4 (2.2–16.6)		5.4 (0.6–10.2)
Not able to pay				1.3 (−0.7–3.3)		2.2 (0.2–4.5)
Utilization of health services, % (95% CI)						
Visited the doctor ≥ 1 time in the previous 12 months	75.5 (72.5–78.5)	71.9 (62.3–81.6)	85.9 (78.9– 92.9)	98.2 (96.1–100.0)	84.8 (81.5–88.2)	95.0 (92.3–97.7)
Last time that blood pressure was measured						
≤12 months	88.3 (86.3–90.3)	71.0 (62.3–79.7)	90.2 (81.9–98.6)	98.1 (95.4–100.0)	85.7 (81.4–90.1)	99.5 (98.5–100.0)
>12 months	11.7 (9.7–13.7)	5.1 (−1.2–11.4)	4.3 (−2.0–10.7)	0.9 (−0.9–2.8)	3.5 (0.6–6.4)	0.5 (−0.5–1.5)
Lifesyles, % (95% CI)						
Tobacco	33.5 (29.9–37.1)	31.7 (23.9–39.6)	41.2 (29.1–53.3)	26.8 (21.4–32.0)	32.8 (27.9–37.7)	28.2 (20.9–35.5)
Alcohol (moderate or daily)	5.2 (3.7–6.8)	6.5 (0.0–13.0)	6.0 (−0.5–12.5)	4.0 (1.9–5.9)	4.2 (1.1–7.2)	3.9 (1.6–3.2)
Physical activity	28.1 (21.2–35.0)	35.3 (21.9–48.7)	47.6 (35.5–59.8)	36.3 (26.5–46.0)	39.2 (31.4–47.0)	65.1 (54.2–75.9)
Obesity, BMI ≥ 30	8.9 (7.2–10.6)	13.1 (5.1–21.2)	24.8 (13.8–35.8)	29.4 (16.8–42.0)	22.0 (13.3–30.7)	26.3 (18.5–34.0)
BMI (average ± SE)	24.28 ± 0.14	25.62 ± 0.45	27.72 ± 0.63	28.22 ± 0.75	27.21 ± 0.55	27.15 ± 0.55

CI, confidence interval.

Table 4 Results of the multivariate analysis for predictors of hypertension categories (a) hypertension present, but subject is unaware and (b) subject knows their condition but hypertension is uncontrolled (Cienfuegos, Cuba, 2001–2002)

	(a) Hypertension present, but is unknown to the subject[a]		(b) Subject knows of condition but hypertension is not controlled[b]	
Variables	Odds ratio (95% CI)	Value of *P*	Odds ratio (95% CI)	Value of *P*
Age $\geq$ 65 years (versus $<$ 65 years)	1.24 (1.09–1.42)	0.001	1.66 (1.48–1.85)	$<$0.001
Males (versus females)	2.60 (2.37–2.85)	0.000	2.80 (2.59–3.03)	$<$0.001
Black ethnic group (versus white)	1.24 (1.13–1.36)	0.000	1.23 (1.14–1.33)	$<$0.001
Schooling $<$12 grades (versus $\geq$12 grades of schooling	1.13 (1.03–1.24)	0.006	1.48 (1.36–1.60)	$<$0.001
Has not visited the doctor once in the previous 12 months (versus $\geq$1 visit in the previous 12 months)	4.24 (3.77–4.78)	0.000	2.16 (1.86–2.51)	$<$0.001
Last time that blood pressure was measured $>$12 months (versus $\leq$12 months)	1.95 (1.63–2.33)	0.000	9.68 (6.48–14.46)	$<$0.001
Tobacco use (versus no tobacco use)	0.97 (0.89–1.07)	0.598	1.14 (1.06–1.24)	$<$0.001

CI, confidence interval. [a] The model included a total of 1161 people: 1067 people without hypertension and 94 who had hypertension but did not know of their condition. [b] The model included 408 people with hypertension: 70 who knew they had hypertension but did not receive treatment, and 244 with hypertension who received treatment.

hypertension showed mild cases of hypertension, and the rates of control in the elderly were lower. This factor is called 'therapeutic inertia'. Reflecting physicians' practice habits, it is defined as the insufficiency to increase or modify therapy when goals for treatment are not obtained ($<$ 140/90 mmHg) [37]. Therapeutic inertia is a significant barrier not only to better control of hypertension, but also when treating other chronic diseases, such as diabetes and hyperlipidemia [38–42]. The reduction of therapeutic inertia could represent the greatest contribution in the control of hypertension cases, in at least 2/3 of individuals with treated hypertension and in 50% of people with hypertension, a goal that the USA has in place for the year 2010 [37]. The high rate of access to medical care observed in this study, where almost all have visited a physician in the past year and have had their blood pressure measured, the minimal differences in the access to care in relation to education levels and ethnic origin, and the little weight given to both the degree of knowledge and control of blood pressure is consistent with Cuba's universal coverage [18–19].

The results discussed here depict a high level of blood pressure control compared to similar studies conducted elsewhere [43–46]. Our results showed that 40% of all hypertensives in the population sampled had controlled hypertension (i.e. with the denominator as both treated and untreated hypertensives). While this is one of the highest prevalences of controlled hypertension reported in the medical literature, we cannot conclude that this level of accomplishment is directly related to the universal access and free health services which are a hallmark of healthcare in Cuba. For instance, many other developed countries with national health systems or broad systems of health insurance coverage have not been as successful in controlling hypertension (Canada = 17%, England = 10%, Spain = 5%). Similarly, the USA, which does not possess a universal healthcare system, has achieved relatively successful rates of control (29%). This suggests that access is an important factor, in some cases, but not as essential as standard care practices, or, at least, that access by itself does not guarantee hypertension control or quality of care.

The present study has several limitations that need to be mentioned. The sample population was selected from an area that, although representative of Cienfuegos, may not have been a true representation of the Cuban national population. Cienfuegos has been shown to have similar CVD mortality patterns as the rest of Cuba. Taking into account the modest sample size, the statistical estimates of the differences for some subgroups are not particularly large. The information available on social status was very limited. We were unable to collect more data concerning purchasing power, such as wages, material possessions, etc., that could have provided an opportunity to better measure the social status. Absence of other risk-factor data, such as dietary patterns, is also noted. Another limitation is related to the complexity of the blood pressure measurements [47], solved partially through training, certification and supervision. In addition, we know that a single visit to a health clinic is inadequate to establish a diagnosis of hypertension. Individuals could have elevated readings due to anxiety about being in the presence of a physician [48], which may result in falsely elevated blood pressure readings. Therefore, we used the internationally accepted criteria for epidemiological diagnosis of hypertension. We also acknowledge that multiple visits are required to make a clinical diagnosis of hypertension; the screening designation will therefore overstate the number of cases.

Furthermore, we should highlight that the vast majority of the people undergoing treatment who did not reach blood pressure goals only presented with moderate elevations in blood pressure. In fact, nearly half (49%) of all individuals with treated hypertension who did not reach their goal had only one SBP measurement in the interval of 140–149 mmHg, a similar result to that observed in the USA [30]. In the aforementioned group, there could be people who are usually well controlled but that on occasional days possess a SBP value measuring

more than 140 mmHg. Similarly, some subjects labeled by the survey as individuals with untreated hypertension could, in reality, not have had hypertension, and therefore the control rate reported in this type of study could have been falsely reduced. However, it has been indicated that when $\geq$140/90 mmHg is used as the cut-off point for uncontrolled hypertension, the net effect of incorrect classification is small. For example, in NHANES III the prevalence of hypertension diminished by 2% between the first and the second visit to the clinic. Clearly, a net reduction in the number of hypertension cases is going to mean higher rates of control [49].

Although it is obvious that the prevalence of hypertension is sensitive to the methodology used for blood pressure measurement, it has not been observed that treatment rates and control are equally sensitive to the influence of measurement techniques. The analysis of NHANES sensitivity showed that a blood pressure measurement of 1 mmHg greater in all the individuals decreased the treatment and control by 2%. This result demonstrated that a small increase, introduced by average blood pressure measurement techniques, could classify many individuals who are close to the cut-off point of 140/90 mmHg as uncontrolled [49]. For example, auto-notified data are used for measurements related to the access to and the utilization of health services. Blood pressure levels used in this analysis were obtained from personal surveys and not through the medical healthcare providers of the subjects. In addition, this survey did not include an examination of the clinical files of the participants.

In conclusion, this study demonstrated that in spite of universal access to health and drug services, a significant proportion of patients did not meet their target for blood pressure control. In order to achieve a greater reduction in mortality from CVD in Cienfuegos, it is necessary that a greater number of patients control their hypertension. Principal actions to achieve these goals should be directed at the health services (mainly primary healthcare) so that there are more opportunities for all, but especially young and middle-aged male patients, to have contact with health services. Only then can the trajectory for the reduction of mortality from CVD be sustained [18].

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