

HYPERTENSION AMONG HISPANIC ELDERS OF A CARIBBEAN ORIGIN IN MASSACHUSETTS

Objectives: We determined the prevalence and associated risk factors of hypertension in Hispanic elders, ages 60–92 years, living in Massachusetts.

Design: Cross-sectional study.

Setting: State of Massachusetts.

Subjects: A representative sample of 597 Hispanics of Caribbean origin (77% Puerto Ricans and 23% Dominicans) and 243 non-Hispanic Whites from the same neighborhoods.

Measures: Blood pressure, income, health behaviors, chronic conditions, body mass index (BMI), and waist circumference.

Results: Hypertension was prevalent in all groups: 66% for Puerto Rican and 73% Dominican men, 69% for non-Hispanic White men; and 75%, 76%, and 74% for women in these groups, respectively. Twenty-one percent of Puerto Rican and 15% of Dominican women had systolic hypertension, compared to 9% for non-Hispanic White women ($P < .01$ and $P < .05$, respectively). The prevalence of systolic hypertension was 14% and 21% for Puerto Rican and Dominican men, compared to 13% for non-Hispanic White men (not significant). Puerto Rican women with hypertension were less likely to have their blood pressure under control than were non-Hispanic White women. Puerto Rican and Dominican elders remained more than 2.6 times more likely to have systolic hypertension than non-Hispanic White elders after adjusting potential confounders.

Conclusion: Hypertension is prevalent in this population and systolic hypertension is more prevalent among Hispanic vs non-Hispanic White elders. Investigation of genetic or other factors associated with this apparent excess risk of systolic hypertension among elderly Hispanics, particularly among women, is warranted. (*Ethn Dis.* 2002;12:499–507)

Key Words: Hypertension, Systolic Hypertension, Ethnicity, Elderly, Prevalence, Hispanic, Puerto Ricans, Dominicans

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INTRODUCTION

The United States is a diverse nation composed of individuals from many cultures. In the past 2 decades, the country has experienced a marked increase in the number of Hispanics. The 1990 Census reported that, of the US population, 9% were of Hispanic origin, a 53% increase since 1980.¹ The latest report from the US Census Bureau revealed that, in 2000, Hispanics accounted for 12.6% of the population, a 58% increase since 1990.² Despite shared ancestry and a common language, the Hispanic population is not homogeneous. In Massachusetts, there were an estimated 428,000 Hispanics in the year 2000, mostly of Puerto Rican and Dominican origin.^{1,2}

Hypertension has long been recognized as a leading health concern for the US population. Data from the Third National Health and Nutrition Examination Survey (NHANES III, 1988–1994) suggest that more than 43 million people (24% of American adults) have hypertension.³ African Americans have been shown to have higher average blood pressure than non-Hispanic Whites.⁴ Some studies have shown lower age-adjusted prevalence of hypertension for Hispanic Americans than for non-Hispanic Whites.^{5,6} A more recent analysis using NHANES III data confirmed those ethnic differences; African

Americans had higher diastolic (DBP) and systolic blood pressure (SBP), as well as higher prevalence of hypertension than did non-Hispanic Whites or Mexican Americans.⁷ However, other studies have shown that the prevalence of hypertension among Hispanic Americans may fall between that of African Americans and non-Hispanic Whites.^{8,9} It has been suggested that the prevalence of hypertension among Hispanic Americans may rise with acculturation, as these individuals assume more of the high-risk cultural and dietary habits of non-Hispanic Whites.¹⁰

Most of the existing data on hypertension in Hispanics is from Mexican Americans, who may differ from other Hispanic ethnic groups. Hispanic groups in the United States are of diverse ethnic and cultural backgrounds, as well as racial characteristics.¹⁰ Genetic admixtures of Mexican Americans differ from that of Puerto Ricans. For Mexican Americans, the proportionate genetic contributions from European, Native American and African ancestries are estimated to be 61%, 31%, and 8%, respectively, while for Puerto Ricans those contributions are estimated at 45%, 18%, and 37%, respectively.¹¹

Few studies are available on hypertension among elderly Hispanics of Caribbean origin living in the United States. This study was designed to determine the prevalence of hypertension among Caribbean Hispanics in Massachusetts and to identify factors associated with hypertension in this population. In addition, we examine the status of treatment and control of hypertension among these Hispanic and neighborhood-based non-Hispanic White elders.

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The latest report from the US Census Bureau revealed that, in 2000, Hispanics accounted for 12.6% of the population, a 58% increase since 1990.²

METHODS

Subjects

Study subjects were from the Massachusetts Hispanic Elderly Study (MAHES), a statewide survey representative of the state population of Hispanics, aged 60 and older, conducted between 1993 and 1997. The design and sampling for this study have been described elsewhere.¹² In brief, with a 2-stage cluster sampling technique and using 1990 Census data, we first allowed Massachusetts counties to fall randomly into the sample, proportionate to the size of its Hispanic population of 55 or more years of age. Within selected counties, we sampled Census blocks that contained 2 or more Hispanics 55 years of age and older. Through door-to-door enumeration we located both the Hispanic sample and a comparison group of non-Hispanic White elders in the same Census blocks. We investigated a total sample of 1,030 subjects, ages 60 to 92 years. Hispanic subjects were classified according to their national origin as Puerto Rican, Dominican, and Other Hispanic. This last group included elders from the rest of Latin America (South and Central America and Mexico) and the Caribbean (Cuba).

For this analysis, we included 457 Hispanics originally from Puerto Rico and 140 from the Dominican Republic, along with 243 non-Hispanic Whites, for a total study sample of 840 elders. The remaining sample was composed of the Other Hispanics, who constituted a

heterogeneous group from which no meaningful conclusions could be drawn. Because the non-Hispanic Whites were from the same neighborhoods where the Hispanics were identified, the socioeconomic indicators for this comparison group were closer to those of the population of Hispanics than would have been seen with a random sample of non-Hispanic Whites. No subject was excluded for health reasons. The study was conducted with the approval of the New England Medical Center Human Investigation Review Committee in Boston.

Blood Pressure Measurement and Definitions of Hypertension

At the time of the home interview for the MAHES study, a total of 4 measures of blood pressure, 2 readings at 2 separate times, were taken using a digital blood pressure meter (UA-701, A & D Medical Division, 1555 McCandless Drive, Milpitas, CA 95035, USA) validated in our metabolic center. The first set of readings was collected approximately midway through the interview, and the second set near the end of the interview, with the subjects in a sitting position after about 15 minutes of resting. Blood pressure readings were examined for possible tendencies toward readings of zero or 5 or to be 140/90 mm Hg or 160/95 mm Hg, and no obvious tendency was seen. The mean of the 2 sets of blood pressure measurements were computed as continuous measures of diastolic and systolic blood pressures (DBP and SBP). There were no significant differences between measurements at time 1 vs 2, by paired *t* test, examined separately by sex and ethnic group.

Subjects who were using antihypertensive medication or those with high blood pressure, based on the average of the measurements taken during the home interviews, were classified as having hypertension. Following current recommendations,⁶ high blood pressure

was defined as greater than 140/90 mm Hg. Stage categorization was based on the following criteria: 140–159 mm Hg SBP and 90–99 mm Hg DBP=stage 1; SBP \geq 160 or DBP \geq 100=stage 2. Subjects using antihypertensive medications were included in the stage 2 category, as done in similar studies.¹³ Blood pressure was defined as “high-normal” when measurements were between 130–140 for systolic, or 85–90, for DBP. Systolic hypertension was defined as SBP 160 mm Hg or greater. When a subject’s SBP and DBP fell into different categories, the higher category was applied.⁶

At the time of the interview and following the methodology used by Burt,³ treatment of hypertension was defined as use of a prescription medication for management of high blood pressure. For the subgroup of individuals being treated with antihypertensive medications, we also calculated the proportion who had their blood pressure under control. Control of hypertension was defined as pharmacological treatment of hypertension associated with SBP<140 mm Hg and DBP<90 mm Hg.

Anthropometric Measurement

Body weight was measured using a balance scale (Seca Corporation, Columbia, Md) with a capacity of 150 kg and graduation of 500 g, calibrated regularly with known weights. Height was measured with a Harpenden pocket stadiometer (Holtain Ltd, Crymch, United Kingdom). Both height and weight measures were utilized to compute BMI (kg/m²). For subjects who were unable to stand, or with stooped posture, height was estimated from knee height using an equation developed for this Hispanic population¹⁴ and a published equation for non-Hispanic Whites.¹⁵ Waist circumference (WC) was measured to the nearest tenth of a centimeter with a non-stretchable measuring tape held at the level of the smallest area of the waist.

Lifestyle Factors

During the MAHES interview, individuals were asked about their current

and past use of alcohol and tobacco. Based on the answers by subjects, categorical variables, indicating former, current, and never use were created for alcohol and for tobacco use. Physical activity was estimated with a modified version of the Harvard Alumni Physical Activity Questionnaire.¹⁶ Subjects were asked how many hours per day (mean of regular weekday and regular weekend day) they usually spent sleeping, or sitting (sedentary) and engaging in light, moderate, and heavy (vigorous) activities, with interviewer probing to ensure that the total hours equaled to 24. The time spent in each of these categories was multiplied by the weighting coefficients 1.0, 1.1, 1.5, 2.4 and 5.0, respectively and summed to create a physical activity score.^{17,18}

Socio-Demographic Data

Socio-demographic information was also collected by questionnaire. Ethnicity was classified based on subject identification about their ethnic background. Based on their responses, we identified those of Puerto Rican and Dominican origin, and the non-Hispanic White elders.

An income/poverty ratio was calculated based on 2 components. With a series of specific questions, all subjects were asked to estimate their total household income in the year preceding the interview. The denominator was a poverty threshold, specified by the US Census Bureau, which varied with the number of persons in the family, the age of the reference person, and the month/year in which the family was interviewed.¹⁹ A cutoff of 1.0 was used to classify those above or below this poverty threshold.

Questions concerning health insurance coverage were asked during the interview. In general, 3 types of health insurance coverage were used: Medicare, Mass Health (the state-run health insurance principally targeted to low-income residents in Massachusetts), and private health insurance coverage.

Table 1. Subject characteristics

Charcteristics	Hispanic		Non-Hispanic Whites
	Puerto Rican	Dominican	
Men (N)	188	44	99
Age (yrs), mean ± SD	68.8 ± 7.6	68.1 ± 6.7†	71.5 ± 7.8
Years of education, mean ± SD	5.2 ± 4.3‡	6.1 ± 5.1‡	11.6 ± 4.2
Mean income/poverty ratio, mean ± SD	1.16 ± 0.77‡	1.05 ± 0.34‡	2.17 ± 3.24
Living below the poverty threshold (%)	50.5‡	45.5‡	22.2
Health insurance coverage (%)			
—Medicare	65.8	44.2*	73.1
—Mass Health	79.6‡	78.6‡	26.4
—Private hospital coverage	8.6‡	16.3‡	49.5
—Private medical office coverage	8.1‡	11.6‡	43.5
Women (N)	269	96	144
Age (yrs), mean ± SD	69.3 ± 7.3‡	69.0 ± 6.9‡	72.8 ± 7.9
Years of education, mean ± SD	4.2 ± 3.9‡	4.3 ± 3.2‡	11.5 ± 3.3
Mean income/poverty ratio, mean ± SD	1.05 ± 0.64‡	0.91 ± 0.43‡	1.78 ± 1.56
Living below the poverty threshold (%)	65.4‡	72.9‡	25.7
Health insurance coverage (%)			
—Medicare	64.6†	48.4‡	85.2
—Mass Health	84.2‡	78.5‡	35.0
—Private hospital coverage	9.9‡	4.4‡	52.9
—Private medical office coverage	9.2‡	3.3‡	47.1

* *P*<.05; † *P*<.01; ‡ *P*<.001 for Puerto Rican or Dominican vs non-Hispanic White, adjusted for age, using logistic regression or general linear models in SAS, where appropriate.

Statistical Analysis

Comparisons across ethnic groups were tested using general linear models (GLM) for continuous variables, and logistic regression models for dichotomous outcome variables, with adjustment for age and sex, when appropriate. SAS (version 8.0, SAS Institute, Cary, NC) was used for all analyses. The level of significance was set at 0.05.

The presence of hypertension, systolic hypertension, use of antihypertensive medication and control of hypertensive condition were each regressed on ethnicity, subjects' age, gender, poverty status (income/poverty threshold ratio), years of education, physical activity score, smoking, alcohol use, and BMI. We also repeated these analyses substituting waist circumference for BMI. We ran models first for presence of hypertension on all subjects, and repeated these for the subset of subjects not using antihypertensive medication. We also ran models for the presence of systolic hypertension. Finally, among subjects with hypertension, we examined the use

of anti-hypertensive medication and control of hypertensive condition. The age at which the subject had been diagnosed with hypertension was added to the models for use of prescription medication and control of hypertensive condition. For each of the models, we tested interactions between sex and ethnicity (Puerto Ricans or Dominicans vs non-Hispanic Whites) and between sex and other independent variables. None of those interactions were significant, and they were dropped from final models.

RESULTS

More than 65% of Puerto Rican and 73% of Dominican women lived below the poverty threshold, compared with 26% of non-Hispanic White women (Table 1). Similarly, more than 50% of Puerto Rican and 45% of Dominican men lived in poverty, compared with 22% of non-Hispanic White men. The education levels of these Hispanic elders

were also significantly lower (mean=4–6 years of school completed) relative to the non-Hispanic White elders (11–12 years).

Puerto Rican and Dominican women had significantly lower coverage rates by Medicare than did non-Hispanic White women (65% and 48%, respectively, vs 85%). Among men, Medicare coverage for Dominicans (44%) but not Puerto Ricans (66%) was significantly lower than that for non-Hispanic Whites (73%). Mass Health (the state Medicaid program) covered about 80% of Puerto Ricans and Dominicans, compared with only about 30% of non-Hispanic Whites. In contrast, approximately 50% of non-Hispanic Whites were covered by private health insurance, compared to fewer than 10% of Puerto Ricans, 20% of Dominican men, and 5% of Dominican women.

The prevalence of smoking differed by ethnic group (Table 2). Significantly more Puerto Rican men (56%) than non-Hispanic White men (38%) reported being past smokers. Conversely, the prevalence of current smoking in non-Hispanic White men (33%) was significantly higher than for Puerto Rican (22%) or Dominican (18%) men. Among women, the prevalence of past smoking did not differ significantly across groups. However, significantly more non-Hispanic White women reported current smoking (29% vs 13% for Puerto Rican and 5% for Dominican women, respectively).

Among men, 63% of Puerto Ricans reported past alcohol use, significantly more than non-Hispanic White men (40%). However, more non-Hispanic White men (47%) reported that they were current drinkers, significantly higher than for Puerto Ricans (29%) or Dominicans (32%). In women, both past and current alcohol use were significantly less prevalent among Puerto Ricans and Dominicans than non-Hispanic Whites (20%–23% vs 36% for past and 13% vs 35% for current alcohol use). There were no significant dif-

ferences across ethnic groups in anthropometric measures.

Hypertension Prevalence

No differences were observed in mean systolic and DBP between Puerto Rican men and non-Hispanic White men (Table 2). However blood pressures of Dominican men were significantly higher than those of non-Hispanic White men (145 vs 137 mm Hg for systolic and 83 vs 76 mm Hg for diastolic measures). Puerto Rican women had significantly higher SBP than non-Hispanic White women (141 vs 135 mm Hg). Hispanic men reported significantly older average age at diagnosis with hypertension (56 years for Puerto Ricans and 60 years for Dominicans) compared to non-Hispanic White men (54 years). There were no significant differences in age at diagnosis for women.

The prevalence of hypertension ranged from 66% for Puerto Rican men to 76% for Dominican women but did not differ significantly across ethnicity and gender (Table 3). However, Hispanic men were significantly more likely to be in the high-normal category (13% of Puerto Rican and 18% of Dominican men) compared to non-Hispanic White men (4%). No significant difference was found in prevalence of high-normal blood pressure across ethnic groups of women. The prevalence of systolic hypertension was similar across groups of men, but significantly higher for Puerto Rican women (21%) compared with non-Hispanic White women (9%).

Treatment and Control of Hypertension

Similar proportions of Hispanic and non-Hispanic White men (76%–80%) and women (78%–81%) received treatment for their hypertension (Table 4). However, of those receiving treatment, significantly fewer Puerto Rican women had their blood pressure under control (31% vs 46% for non-Hispanic White women). Although Dominican men ap-

peared to be least under control, this did not differ significantly across ethnicity among men.

Factors Associated with Hypertension, Systolic Hypertension, Use of Medication and Control of Hypertension

The results of the logistic regression models of hypertension (yes/no), systolic hypertension (yes/no), antihypertensive medication use (yes/no), and control of hypertensive condition (yes/no) on ethnicity, gender, age, BMI, and other socioeconomic and health-related behaviors are presented in Table 5. The prevalence of hypertension among Hispanics (either Puerto Ricans or Dominicans) did not differ significantly from that of non-Hispanic Whites after adjusting for other potentially confounding or explanatory factors, with inclusion of all anti-hypertensive medication users. Women were more likely to have hypertension than were men. BMI and age were positively associated with presence of hypertension. Previous alcohol use increased the likelihood of having hypertension by 80% but current alcohol use and cigarette smoking were not significantly associated with having hypertension. Among the subjects who did not use antihypertensive medication, Dominicans were more likely to have hypertension and the likelihood of having hypertension with past alcohol use increased by more than 100%. Waist circumference, when substituted for BMI in these models, showed similar patterns of association with hypertension.

Although there was no significant difference in prevalence of general hypertension between Hispanics (either Puerto Ricans or Dominicans) and non-Hispanic Whites, Hispanics were more than 2.6 times more likely to have systolic hypertension after adjusting for other confounding variables. Systolic hypertension was also 45% more likely for each decade of age, but was not sig-

Table 2. Lifestyle, anthropometric and blood pressure measurements

Characteristics	Hispanic		
	Puerto Rican	Dominican	Non-Hispanic White
Men (N)	188	44	99
Smoking (%)			
—Former smoker	55.9†	36.4	38.1
—Current smoker	21.8*	18.2*	33.0
—Never smoked	22.3	45.5*	28.9
Alcohol use (%)			
—Former user	63.3‡	46.3	40.4
—Current user	29.0‡	31.7*	46.8
—Never use	7.7	22.0	12.8
BMI, mean ± SD§	27.3 ± 4.5	26.3 ± 4.1	27.4 ± 4.8
Waist circumference (cm), mean ± SD	99.7 ± 11.4	97.4 ± 10.2	101.7 ± 13.9
Physical activity score, mean ± SD	29.2 ± 3.1	30.2 ± 2.9	29.8 ± 3.5
SBP (mm Hg), mean ± SD	137.0 ± 20.7	145.4 ± 20.4*	137.3 ± 22.4
DBP (mm Hg), mean ± SD	77.8 ± 12.1	83.1 ± 11.1†	76.4 ± 10.5
Age at diagnosis of hypertension, mean ± SD	55.9 ± 16.8*	59.7 ± 13.3†	53.5 ± 16.4
Women (N)	269	96	144
Smoking (%)			
—Former smoker	33.8	24.0	29.2
—Current smoker	13.4‡	5.2‡	28.5
—Never smoked	52.8*	70.8‡	42.4
Alcohol use (%)			
—Former user	22.6†	19.8*	35.9
—Current user	12.5‡	12.5‡	25.2
—Never use	64.9‡	67.7‡	28.9
BMI, mean ± SD	28.5 ± 5.8	29.1 ± 5.6	29.6 ± 6.7
Waist circumference (cm), mean ± SD	96.1 ± 12.9	97.1 ± 11.7	94.6 ± 15.3
Physical activity score, mean ± SD	28.7 ± 2.7	29.2 ± 3.2	29.2 ± 3.2
SBP (mm Hg), mean ± SD	141.3 ± 20.4†	140.4 ± 20.1	135.4 ± 16.9
DBP (mm Hg), mean ± SD	76.9 ± 11.5	77.3 ± 11.1	75.6 ± 12.3
Age at diagnosis, mean ± SD	57.1 ± 12.3	55.7 ± 12.1	58.1 ± 13.7

* $P < .05$; † $P < .01$; ‡ $P < .001$ for Puerto Rican or Dominican vs non-Hispanic White, adjusted for age, using logistic regression or general linear models in SAS, where appropriate.

§ BMI=body mass index.

nificantly associated with behavioral risk factors.

After adjusting for other factors, use of antihypertensive medication among subjects with hypertension was negatively associated with physical activity and with age at diagnosis. Current smokers were also significantly less likely to be using medication. However, those with lower income (income/poverty ≤ 1) were more likely than those with relatively higher income to take medication for their hypertension. Among subjects who had received treatment for their hypertension, those who had already stopped smoking were more likely to have their hypertension under control. Also, later age at diagnosis was signifi-

cantly associated with controlled blood pressure.

DISCUSSION

Previous studies have suggested that hypertension may be more prevalent among non-Hispanic Whites and African Americans than among Hispanics. The Hispanic Health and Nutrition Examination Survey (HHANES), conducted in the early 1980s, reported that the prevalence of hypertension among Mexican Americans, Cubans, and Puerto Ricans were lower than those of non-Hispanic Whites and African Americans.^{5,20} However, other studies in

San Antonio, Texas²¹ and in Orange County, California²² found similar levels of hypertension among Hispanics and non-Hispanic Whites, and one study found that Hispanics were more likely to have high blood pressure than non-Hispanic Whites, but less likely than African Americans.⁸

The results from this community-based study of Hispanics of Caribbean origin suggest that the overall prevalence of hypertension among these Hispanic elders is similar to that of non-Hispanic White elders living in the same neighborhoods. The prevalence rates for these groups were higher than those reported for the US population of elders, aged 60 and over.³ This may represent a contin-

Table 3. Classification of blood pressure and the prevalence of hypertension and systolic hypertension

HBP Categories	Hispanic		
	Puerto Rican	Dominican	Non-Hispanic White
Men (N)	188	44	99
Normal	20.7	9.1	27.3
High normal	13.3*	18.2†	4.0
Hypertension‡	66.0	72.7	68.7
—Stage 1	14.4	15.9	12.1
—Stage 2 or treated	51.6	56.8	56.6
Systolic hypertension§	13.8	20.5	13.2
Women (N)	269	96	144
Normal	16.4	13.5	16.7
High normal	8.9	10.4	9.0
Hypertension‡	74.7	76.0	74.3
—Stage 1	10.8	15.6	15.3
—Stage 2 or treated	63.9	60.4	59.0
Systolic hypertension§	20.5†	14.6	9.0

* $P < 0.05$; † $P < 0.01$ for Puerto Ricans or Dominicans vs non-Hispanic White, adjusted for age, using logistic regression models in SAS.

‡ Hypertension was defined as higher than 140 mm Hg SBP or 90 mm Hg DBP or using anti-hypertensive medication; 140–159 mm Hg SBP and 90–99 mm Hg DBP=stage 1 and $SBP \geq 160$ or $DBP \geq 100$ =stage 2. Subjects using anti-hypertensive medications were included in stage 2. When SBP and DBP fell into different categories, the higher category applied.

§ Systolic hypertension=SBP 160 mm Hg or greater.

uation of an increase in prevalence of hypertension among Hispanics through decades of acculturation, and it parallels increases that have been observed for obesity, diabetes, and heart disease in the aging Hispanic population.²³ It may also relate to the poorer economic and education status of this population, which affects lifestyle and health behavior. This apparent increasing prevalence of hypertension in Hispanics is in sharp contrast to the persistent decrease in the general US population.^{3,24,25}

Since strong evidence of the benefits of controlling systolic hypertension in older persons emerged from the Systolic Hypertension in the Elderly Program (SHEP)²⁶ and other clinical trials reported in the early 1990s,^{27,28} SBP has been recognized as a better predictor than DBP of congenital heart disease (CHD) events, cardiovascular disease (CVD), heart failure, stroke, end-stage renal disease, and all-cause mortality. The value of SBP in risk prediction is even more convincingly demonstrated

Table 4. Treatment and control among those with hypertension

	Hispanic		
	Puerto Rican	Dominican	Non-Hispanic White
Men			
Treated (%)*	76.9	75.9	79.7
Controlled (%)‡	46.7	31.8	43.1
Women			
Treated (%)*	80.9	77.6	81.0
Controlled (%)‡	38.9†	48.1	56.8

* Treated=using anti-hypertensive medication.

† $P < .01$ relative to non-Hispanic White, adjusted for age, using logistic regression in SAS.

‡ Controlled=SBP<140 mm Hg and DBP<90 mm Hg.

in 12-year data from >316, 000 men screened for the Multiple Risk Factor Intervention Trial (MRFIT).²⁹ In this large cohort study, coronary heart disease death rates were almost linearly related to SBP at all levels of blood pressure. In MRFIT, increased CVD risk in those with SBP <140 mm Hg was found only when DBP exceeded 100 mm Hg.²⁹ This study also identified SBP as a more precise risk indicator of kidney failure than DBP.³⁰ It has been suggested that SBP may, therefore, be more useful than DBP in the classification and staging of hypertension.³¹ Systolic hypertension is the hypertensive subtype most prevalent among the US adult population after their 6th decade of life.³² We found that these Hispanic elders of Caribbean origin, particularly the women, were more likely to have systolic hypertension relative to non-Hispanic Whites.

Most previous studies have shown low hypertension awareness rates among Hispanics. In one widely cited study on hypertension in Puerto Ricans in the United States, almost 50% of Puerto Ricans with hypertension were unaware of their condition,³³ whereas 56% to 81% non-Hispanic Whites with hypertension who were 50 years and older in NHANES III were aware of their condition.³⁴ We found that more than 75% elderly Puerto Ricans and Dominicans in our study were being treated, and thus were aware of their hypertensive condition.

Among the general US population studied in the NHANES II and III, a longitudinal trend toward greater awareness of hypertension (from 51% to 73%) was observed.³⁴ This trend, along with the advanced age of our sample, may explain why more of our subjects were aware of their hypertension than has been seen in previous studies of Hispanics. It is also possible that the type of health care in the state of Massachusetts contributes to higher treatment levels. Individuals with low incomes are eligible for Mass Health, the state Medicaid program, which covers most

Table 5. Factors associated with hypertension, systolic hypertension, use of medication, and control†

Characteristics	Hypertension (All subjects, N=840) OR (95% CI)	Hypertension (Non medication users only, N=313) OR (95% CI)	Systolic hypertension (All subjects, N=840) OR (95% CI)	Medication use (With Hypertension, N=605) OR (95% CI)	Controlled§ (Medication users only, N=453) OR (95% CI)
Puerto Rican vs non-Hispanic White	1.19 (0.71–1.99)	1.35 (0.61–2.98)	2.65 (1.36–5.18)†	0.45 (0.19–1.04)	0.84 (0.43–1.64)
Dominican vs non-Hispanic White	1.63 (0.87–3.08)	2.81 (1.08–7.35)*	2.69 (1.24–5.86)*	0.35 (0.13–0.93)*	0.79 (0.36–1.75)
Gender: female vs male	1.67 (1.13–2.48)*	1.82 (0.99–3.34)	0.71 (0.44–1.15)	0.67 (0.37–1.23)	1.15 (0.71–1.87)
Age (/10 y)	1.31 (1.01–1.69)*	1.33 (0.89–1.97)	1.45 (1.07–1.96)*	1.48 (0.97–2.28)	0.81 (0.59–1.11)
Education (y)	1.01 (0.97–1.06)	0.99 (0.93–1.06)	1.02 (0.97–1.07)	1.03 (0.96–1.10)	1.05 (1.00–1.11)
Body mass index (kg/m ²)	1.07 (1.04–1.11)*	1.06 (1.01–1.11)*	1.02 (0.98–1.05)	1.01 (0.96–1.07)	1.01 (0.97–1.05)
Physical activity score	0.95 (0.90–1.01)	1.05 (0.96–1.14)	0.99 (0.92–1.06)	0.87 (0.79–0.95)*	0.98 (0.90–1.06)
Former drinker vs never	1.83 (1.16–2.89)*	2.06 (1.01–4.20)*	1.27 (0.77–2.12)	0.92 (0.47–1.82)	0.85 (0.51–1.42)
Current drinker vs never	1.30 (0.80–2.11)	2.07 (0.96–4.46)	0.85 (0.45–1.59)	0.86 (0.40–1.88)	0.83 (0.44–1.54)
Former smoker vs never	1.37 (0.92–2.05)	1.85 (1.00–3.42)	1.20 (0.75–1.92)	0.59 (0.32–1.07)	1.71 (1.07–2.73)*
Current smoker vs never	0.92 (0.57–1.49)	1.98 (0.97–4.06)	1.64 (0.90–2.99)	0.34 (0.15–0.75)*	1.05 (0.53–2.08)
In poverty vs not¶	0.87 (0.60–1.25)	0.72 (0.41–1.26)	0.79 (0.51–1.22)	2.25 (1.24–4.09)*	1.50 (0.94–2.41)
Age at diagnosis (/10 y)				0.97 (0.97–0.99)*	1.01 (1.01–1.02)*

OR=odds ratio; CI=confidential interval.

* P<.05.

† P<.01.

‡ All dependent variables are dichotomous (yes vs no).

§ SBP<140 mm Hg and DBP<90 mm Hg.

|| Models replacing BMI with waist circumference were also tested with the following results for waist circumference for each model as presented above: 1.03 (1.02–1.05)*, 1.02 (1.01–1.04)*, 1.00 (0.99–1.02), 1.01 (0.99–1.03) and 1.00 (0.98–1.02).

¶ Living in poverty=ratio of income/poverty line <1.0.

healthcare services and medications without co-payment. Hispanic elders in our study were mostly of low-income, and were covered by Mass Health.

Large trials of patients older than 60 years have shown that antihypertensive drug treatment reduces stroke, CHD, CVD, heart failure, and mortality.^{35,36} However, compliance with treatment remains a challenge among patients with hypertension. Systolic hypertension is the most poorly controlled type of hypertension.^{32,37} Control of hypertension remains low although there have been improvements over time, from about

10% in the 1980s to close to 30% in the mid 1990s.³⁴ A 1980s study on hypertension in Puerto Ricans in the South Bronx, New York City, found that 58% of hypertensive Hispanic patients were taking antihypertensive medication and, of this group, only 22% achieved control.³³ In HHANES (1982–84), only 12% of Puerto Rican men with hypertension reported having achieved controlled blood pressure.⁵ In contrast, in our study, we found that 24%–37% of Hispanics with hypertension had achieved control. It is possible that the Mass Health System, by providing free access to medication is contributing to better control of hypertension among low income population, than is seen elsewhere.

Although alcohol consumption is associated with hypertension, the specific mechanism remains controversial. One hypothesis is that alcohol acts on the central nervous system modifying neural control of the pressor system.³⁸ A review of 30 cross-sectional epidemiological studies³⁹ found evidence that 3 drinks per day elevated BP 3–4/1–2 mm Hg,

and 6 drinks per day elevated BP 5–6/2–4 mm Hg. Our results showed that alcohol use was associated with 30%–100% greater likelihood of general hypertension but was not associated with systolic hypertension.

Many studies have shown an association of smoking with hypertension.⁶ Although there was a tendency toward higher blood pressures among smokers in this population, it did not reach statistical significance. However, we found that current smokers were less likely to take medication for their hypertensive condition, suggesting a more general pattern of lower health motivation or awareness among smokers than among non-smokers with hypertension. Age at diagnosis was negatively associated with use of antihypertensive medication, and positively with control of hypertensive condition. Together, these age associations suggest that those diagnosed at older ages may have milder conditions that demand less use of medication and are easier to control.

Hypertension is an important factor in the pathogenesis of atherosclerosis. A

This apparent increasing prevalence of hypertension in Hispanics is in sharp contrast to the persistent decrease in the general US population.^{3,24,25}

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decline in the prevalence of hypertension has been observed since the 1960s for the general population. Results from this study suggest that the prevalence of hypertension, particularly systolic hypertension, among this group of Hispanic elders is high. Despite increased national emphasis on identification and treatment of hypertension in older persons, sub-sets of the population may be in need of greater attention. As in other studies, we found that obesity and alcohol use were significantly associated with general hypertension in this Hispanic population. These modifiable risk factors offer important opportunities for primary and secondary prevention of hypertension in this group. However, they were not significantly associated with systolic hypertension. The persistence or greater likelihood of systolic hypertension among Hispanics compared to non-Hispanic Whites after control of potential confounders suggests that either genetic or other environmental factors need further investigation. The lower control rate among Puerto Rican women with hypertension, despite greater reported use of medication, also suggests that further efforts are needed to monitor and improve the treatment of this population in order to achieve greater blood pressure control.

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