

Hypertension in Rural Haitians: Its Relation to Weight*

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Abstract

Being overweight is a risk factor for hypertension, but there has been little study of the extent of this risk where obesity is rare. While providing medical services, clinical personnel recorded the ages, weights, blood pressures (BP) and diagnoses of 396 Haitian adults; as well, descriptive and analytical statistics were generated to explain associations among these recorded factors. Elevated BP was found in 39% of men and 45.6% of women. It was noted that 30.1% of men and 12.4% of women were underweight, whereas none of the men and 3.2% of the women were overweight. Regression models showed significant contributions from age and weight in predicting BP, but only accounted for 11–32% of the variation. Although age and weight are useful in predicting BP, there are unmeasured factors that account for most of the variation, which require future research.

Introduction

One of the first interventions that a physician recommends to an overweight hypertensive patient is weight reduction because of the association between obesity and high blood pressure (BP). However, hypertension has been shown to have multifactorial causes, and in some populations, weight gain may be a minor risk factor in comparison to others.

In 1997, a team of American clinicians traveled to Haiti to provide medical care to people living in and around the rural town of Léon in the Grande-Anse province. Many of the clinically malnourished and underweight patients encountered there had elevated BP readings. This observation, plus the rarity of obesity in this community, suggested that weight might play a minor role in the etiology of hypertension in these people. An understanding of the extent to which weight is a risk for BP elevation would be relevant in planning hypertension treatment for Haitian-Americans who have been able to increase their caloric intake. If weight does play a relatively minor role in the etiology of their hypertension, then focusing on this too much could divert attention from other more effective medical interventions.

* The views presented here are those of the author and do not necessarily represent those of the U.S. Department of Health and Human Services, the U.S. Department of Defense, or any of their components.

Background and Public Health Significance

The published literature on hypertension in Haitians is sparse. Most studies of high BP in Black populations come from the United States and Africa. Preston et al. (1996) published a small study of 88 Haitian patients seen in a multi-specialty clinic in Miami. They found 87.5% to be hypertensive (BP greater than or equal to 140 millimetres mercury (mm Hg) systolic or 90 mm Hg diastolic, or taking antihypertensives), and 52% to be obese (based on weight and height). In a study of African-American men from a county in the southern United States, Curtis et al. (1998) found a positive correlation between baseline obesity and hypertension, and between hypertension and weight gain during the study in men who were not obese at baseline. Rosenberg et al. (1999) used logistic regression to examine the relationship of body mass index (BMI) to hypertension in college-educated African-American women. Overweight women had a 2.7-fold greater risk of hypertension, and severely overweight women (BMI 32.3 or above) had a 4.9-fold greater risk compared to women of normal weight. The regression models showed further that about 25% of the prevalence was explained by the differences in proportions of moderately and severely overweight women.

Lluberas et al. (2000) found a 27% prevalence of hypertension among 233 Haitian adults seen in a rural mission clinic (26% for women, 31% for men). The average BP was 131/79, without a significant gender difference. There was a significant age difference between hypertensive (59 years) and non-hypertensive men (47.1 years). The hypertensive men were said to be leaner, but weights and BMIs were not reported. Shipp (2001) found a 24% prevalence of hypertension among 382 adults who were accompanying sick people to a clinic in Port-au-Prince.

In 826 patients seeking medical care at the Léon dispensary over a one-week period in 1997, malnutrition and high BP were among the top five most frequent problems, exceeded only by nonspecific musculoskeletal complaints, gastroesophageal symptoms and intestinal parasites. Of the 55% of adult patients who had BP recorded, 36% had a systolic BP greater than 140 mm Hg, and 33% had a diastolic BP greater than 90 mm Hg. Fifty-seven per cent of these patients met a case definition for malnutrition based on clinical impression and a weight below the fifth percentile for their gender. However, this was a biased estimate, since weights were not measured on all patients.

A second medical team returned to Haiti in 1998. Based on earlier observations, the team wished to define better the prevalence of high BP and malnutrition in this population in order to guide its community-oriented primary care planning efforts. Thus, a clinical protocol was developed that included taking BP and weight measurements on all patients over 18 years of age. A bilingual (English and French) medical record was created for purposes of clinical care. The data included age, gender, BP, weight, height and up to four diagnoses. This was used to estimate the frequencies of high BP, clinical malnutrition and other medical conditions.

The 1998 data again showed a number of people who had elevated BP (some severely so) despite being underweight. Since weight is associated with elevated BP in other populations (including those of African descent), but had not been studied in Haitians specifically, this study was initiated to determine whether this association holds for Haitians, too. Since this study was done in a primary care clinic setting, it was more representative of the general population than a subspecialty clinic would be. Thus, hypotheses can be generated to clarify risk factors for hypertension, and to provide a basis for estimating the burden of disease and prioritizing the delivery of targeted health services for rural Haitian people.

Materials

The study population consisted of 396 adult patients who came to the Léon dispensary for any medical complaint during a one-week period in March 1998, when a team of American clinicians provided direct primary care. This dispensary served residents of both the town and outlying areas within several days walking distance, and was normally staffed by Haitian nurses.

Methods

This study was a secondary data analysis of medical records. As such, the design was reviewed by

the Institutional Review Board at the Uniformed Services University of Health Sciences, Bethesda, Maryland, and approved as an exempt study.

In this study, the case definition of high BP was the World Health Organization (2003) criterion of greater than or equal to either 140 mm Hg systolic or 90 mm Hg diastolic. The case definition of underweight was a weight below the fifth percentile for male or female 18-year-olds. This reflected the percentile criteria used to define "underweight" on the 2000 growth charts of the National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (2000). This percentile had been chosen previously by the team in order to prioritize limited treatment resources to the most severely affected. The case definition of overweight was a weight at or above the 95th percentile, consistent with the Centers for Disease Control and Prevention (CDC) definitions.

Data from the clinical encounters were entered into a Statistical Package for the Social Sciences (SPSS) database. Each adult patient's age, sex, systolic and diastolic BP, weight and diagnoses were entered along with a study identification number. No personal identifiers were included. Data entry was then verified and corrected by manually comparing the database with the original records.

Age was recorded in years. Nurses used aneroid cuffs to take BP readings. Systolic and diastolic BPs were recorded in mm Hg. When more than one BP was in the record, the first one was entered into the study database for consistency. Systolic and diastolic BP were recoded into a single categorical variable for high and normal BP. Nurses recorded weights in kilograms; the weights were recoded into fifth and 95th percentile bands based on NCHS growth charts (Hamill et al. 1979). Diagnoses were transcribed into the database in the order in which they appeared in the records, using the phrasing employed by the clinician as much as possible. When a specific diagnosis was not recorded, the presenting symptoms were substituted. Diagnoses were then converted into codes from the International Classification of Diseases, Ninth Revision (Hart and Hopkins 2004).

Statistical analysis was done by means of SPSS-12 and SAS-9.1 software. Descriptive statistics (means and standard deviations) are presented for the various study factors. Pearson correlation coefficients were calculated for continuous variables. For contingency tables, continuity adjusted chi-squares were used. All analyses were two-sided, with significance defined at the $p < 0.05$ level.

Results

During one week, 396 adult patients were seen, of whom 36.9% were men and 63.1% were women. Ages of 18 or over were recorded for 387 patients (ranges 18–91 for men, 18–87 for women). The other nine patients had no age recorded, but were judged to be adults on the basis of the clinical presentations in their medical records. Mean ages for men and women are found in Table 1.

Table 1. Mean age, BP and weight of patients by gender, with corresponding standard errors: Léon, Haiti, 1998

	Women		Men	
	M	SE	M	SE
Age (years)	45.9	1.0	45.6	1.4
Systolic BP (mm Hg)	138.0	2.1	133.5	2.2
Diastolic BP (mm Hg)	84.7	1.1	82.0	1.1
Weight (kg)	55.3	0.7	58.4	0.7

M Mean

SE Standard error

Systolic BP was obtained for all 146 (100%) of the men and 247 (98.8%) of the women. Diastolic BP was obtained for all as well, save one woman who had only a systolic BP recorded.

Table 1 presents mean systolic and diastolic measurements. Forty-three per cent of the patients had elevated BP, with no significant gender difference (see Table 2).

Table 2. Number and per cent distribution of hypertensive, underweight and overweight patients by gender: Léon, Haiti, 1998

	All Patients		Women		Men		<i>p</i>
	Number	%	Number	%	Number	%	
All patients	396	100.0	250	100.0	146	100.0	
Hypertensive	171	43.2	114	45.6	57	39.0	0.20
Not hypertensive							
Normotensive	222	56.1	133	53.2	89	61.0	
Unknown	3	0.8	3	1.2	0	0.0	
Underweight	75	18.9	31	12.4	44	30.1	< 0.0001
Not underweight							
Normal weight	296	74.7	199	79.6	97	66.4	
Overweight	8	2.0	8	3.2	0	0.0	
Unknown	17	4.3	12	4.8	5	3.4	

Weight was recorded for 141 (96.6%) of the men and 238 (95.2%) of the women. Mean weights are in Table 1. The mean weight for men was just above the 10th percentile. The mean weight for women (none of whom were pregnant) was below the 50th percentile. The per cent distributions of underweight, normal weight and overweight patients are in Table 2. About 30% of the men and 12% of the women were underweight – a highly significant gender difference. No men and about 3% of the women were overweight.

Elevated BP was noted in about 41% of the underweight men and 39% of the underweight women. Although the idea for this study came from these patients, no significant positive or negative association between underweight and elevated BP was noted for either gender (Table 3).

Table 3. Association between weight and BP by gender: Léon, Haiti, 1998

	Women			Men		
	Underweight	Not Underweight	<i>p</i>	Underweight	Not Underweight	<i>p</i>
All patients	100.0	100.0	0.47	100.0	100.0	0.99
High BP	38.7	47.6		40.9	39.2	
Normal BP	61.3	52.5		59.1	60.8	

Age was positively correlated with systolic and diastolic BP in both men and women. Weight was positively correlated with both systolic and diastolic BP in men, but only with systolic BP in women. There was no significant correlation between age and weight (Table 4).

Multiple linear regression models were constructed for each sex using systolic and diastolic BP as dependent variables and age and weight as independent variables, using stepwise selection (probability of *F* to enter = 0.05; probability of *F* for removal 0.10). Intercepts, regression coefficients for weight and age, correlation coefficients and coefficients of determination are presented in Table 5. Analysis of variance showed all four models to be highly significant. Frequency plots of standardized residuals and normal P-P plots showed the residuals to be normally distributed.

Table 4. Correlations among age, weight and BP by gender: Léon, Haiti, 1998

	Women		Men	
	<i>R</i>	<i>p</i>	<i>R</i>	<i>p</i>
Age – weight	-0.05	<i>ns</i>	-0.03	<i>ns</i>
Age – systolic BP	0.54	< 0.001	0.28	0.001
Age – diastolic BP	0.40	< 0.001	0.18	0.03
Weight – systolic BP	0.14	0.03	0.22	0.01
Weight – diastolic BP	0.00	<i>ns</i>	0.29	0.001

ns Nonsignificant*R* Correlation coefficient**Table 5. Linear regression models for systolic and diastolic BP by gender: Léon, Haiti, 1998**

	Women					
	Intercept	Beta (weight)	Beta (age)	<i>R</i>	Adjusted <i>R</i> ²	<i>p</i>
Systolic BP	57	0.51	1.14	0.57	0.32	< 0.001
Diastolic BP	54	0.44	0.20	0.42	0.17	< 0.001
	Men					
	Intercept	Beta (weight)	Beta (age)	<i>R</i>	Adjusted <i>R</i> ²	<i>p</i>
Systolic BP	68	0.76	0.47	0.37	0.12	< 0.001
Diastolic BP	47	0.49	0.15	0.35	0.11	< 0.001

R Correlation coefficient*R*² Coefficient of determination

Discussion

This preliminary work has shown that hypertension is a significant problem for the people of this area of rural Haiti, as it is for many populations of African descent. The prevalence of elevated BP was high for both women (39%) and men (45.6%). This is similar to the prevalences reported by the Centers for Disease Control and Prevention (2005) among American non-Hispanic Black women (40.4%) and men (43.4%) between 1999 and 2002.

The impetus for this study was the observed high prevalence of elevated BP in this adult clinic population, even though obesity was rare, and even in the presence of clinical malnutrition. Thus, the high prevalence of hypertension stood out even more starkly than it does in developed countries where obesity is a significant confounding factor even among ethnic Haitians.

The next question was whether weight was still a risk factor for hypertension in such a population. Since BP is known to rise with age and weight in other populations, bivariate correlations were set up, which showed similar relationships in this Haitian population except for diastolic BP in women.

For those who like to quantify risk factors, linear regression analysis is attractive. In these equations, both age and weight contributed significantly to the prediction of systolic and diastolic BP, even for diastolic BP in women. However, the coefficients of determination were discouraging, ranging from 11–32%. Thus, age and weight accounted for only a small portion of the variability in BP in this population, implying that there are other unmeasured risk factors that would need to be taken into account in constructing a more complete regression model.

While examining the associations between weight and BP is interesting, and certainly more powerful statistically because of the continuous nature of the variables, the real clinical question is whether hypertension itself is associated with weight in Haiti. Because these data show positive correlations between BP and weight, it is reasonable to think that a larger sample size might define better a similar categorical relationship for hypertension. It is impossible to draw conclusions about the relationship of obesity to hypertension in this population, since there were so few overweight women and no overweight men.

Other Possible Causes of Hypertension

There are undoubtedly other factors influencing the prevalence of hypertension (such as renal or cardiac disease, family history, diet, consumption of raw sea salt available in the local market) for which data were not collected. Some possibilities for these factors in African-descended populations come from the literature, albeit not for Haitians specifically.

Fraser (1986) noted that African-Americans do not excrete a sodium load as rapidly as Americans of European descent. He also noted that there may be African subpopulations that are more prone to develop hypertension than others in response to dietary salt. He also cited non-African populations with high prevalences of hypertension, and related that to salt consumption as well. One Solomon Islands tribe stood out from their neighbours in having a higher prevalence of hypertension, associated with a unique custom of boiling their food in seawater. A confederation of Turkish tribes with a high age-related incidence of hypertension also showed higher than usual sodium excretion for both genders, presumably due to high salt consumption. This is of interest in Haiti, since raw sea salt was available in large quantities on market day in the town of Léon where the clinic was located.

Ducorps et al. (1996) found an overall hypertension prevalence of 66.4% among 550 diabetic patients at a hospital in Cameroon. They contrasted this with previous studies in Africa that showed prevalences between 2.5–30% in more general populations. Svetkey et al. (1991) studied hypertensive American patients with clinical features suggesting a renovascular cause. Renal artery stenosis was found in 19% of Black subjects; renovascular hypertension was diagnosed in 9% of these subjects. However, this did not differ significantly from results seen in White patients. Seedat (1996) reported an age-adjusted hypertension prevalence of 25% among urban Zulus in South Africa, but also noted that the mean arterial pressures in this group were lower than those seen in Black populations of the West Indies and United States. He attributed this difference to the “New World” groups having lived “Western lifestyles” over 300 years, and goes on to discuss other etiologic factors such as limitations in intracellular sodium-potassium exchange, slower sodium excretion rates and defects in the renin-aldosterone pathway in Black populations. He noted no differences in daily sodium intake between South African Black populations and Western populations, but suggested a potassium-deficient diet as one causative factor for hypertension.

Limitations

The sample for this current study was not randomly drawn from the population. Self-selection bias is likely in a clinic population, which might yield an overestimate of the real population prevalence of BP or weight abnormalities. Especially in 1998, the local people were aware that the team offered some treatment for both hypertension and malnutrition. Also, some patients who might have come to the clinic due to the novelty of visiting American clinicians might not ordinarily have sought medical care, especially if they lived a great distance from the clinic. The extent of these factors or how they might have affected the composition of the study population is not certain. However, since the majority of patients were presenting with symptoms of musculoskeletal pain and dyspepsia, and had high BP noted incidentally, it is reasonable to assume that these data may approximate the true population prevalence of hypertension. These prevalences are relevant to other volunteer organizations that provide medical care in developing countries, in that their clinic populations are also likely to be self-selected, and therefore to exhibit the same type of bias among the patients they actually treat.

This medical mission was not conceived for research purposes. Therefore, the measurements were

subject to issues of reliability and accuracy inherent to a clinical setting in a developing country. These might have included variations in BP measurement techniques among nurses and the absence of external calibration of the BP cuffs. Standard cuffs were used for all patients, even at the extremes of weight, which could have introduced an unknown degree of systematic error to these measurements. There is diagnostic inaccuracy inherent in using only one BP screening as the basis for diagnosing hypertension. The usually-accepted diagnostic criterion for hypertension is three elevated BP readings taken at different times. Thus, it is recognized that elevated screening BP readings are not strictly equivalent to a diagnosis of hypertension. For this reason, the team's treatment efforts were targeted to the above-160/100 group, in order to best utilize limited medication supplies. Although BMIs calculated from both weight and height would have been better than weight alone, heights were recorded on very few patients because of the large numbers needing to be seen in a short time. Thus, this study was limited to defining underweight in terms of weight percentiles alone. There was a small number of adults (less than 5% of the total) missing either BP or weight.

Adult Haitian norms for BP and weight may differ from US norms. However, no literature exists to validate this as a significant concern. Neither the CDC nor the WHO advocates different norms for specific ethnic groups, nor are such norms available.

Conclusions

In this population of self-selected rural Haitian patients with undifferentiated complaints, age and weight were positively associated with both systolic and diastolic hypertension, but correlations were weak. Linear regression models showed that age and weight account for a significant but small amount of the variability in BP.

Thus, the hypothesis generated by this study is that there are other determinants of BP elevation in rural Haitians that account for the largest part of the etiology. Possibilities for future research include: dietary factors, especially sodium and potassium intake; diabetes mellitus and other diagnoses that might be associated with hypertension; cardiac pathology, such as aortic stenosis or coarctation; renal dysfunction, especially due to tropical diseases; and closer investigation of the renin-angiotensin-aldosterone system. Although there are practical limitations to studying many of these factors in a rural mountain setting in a developing country, some of them can be assessed through anthropological techniques (dietary customs and food availability), dietetic surveys (to estimate sodium and potassium intake), physical examination (cardiac auscultation and differential BP) or systematic recording of target diagnoses using objective case definitions. It may be possible to investigate other factors with some technological investment (e.g., serum/urine electrolytes and glucose screening). Other biochemical studies are possible, but would require collection of body fluid specimens that would need to pass through international barriers to be delivered to a reference laboratory.

Although these findings can only be extrapolated strictly to similar populations of self-selected clinic patients in Haiti, this has practical value to medical non-governmental organizations that serve precisely this type of population. Since most of the hypertensive patients were not presenting with a chief complaint of hypertension, it is reasonable to test hypotheses generated by this study in the general Haitian population. A prospective community outreach approach would be much more effective for drawing inferences about this population.

References

- Centers for Disease Control and Prevention. 2000. "Use and Interpretation of the CDC Growth Charts: An Instructional Guide." Retrieved August 2, 2006. <<http://www.cdc.gov/nccdphp/dnpa/growthcharts/00binaries/growthchart.pdf>>.
- Centers for Disease Control and Prevention. 2005. "Quick-Stats: Percentage of Persons Aged \geq 20 Years with Hypertension, by Race/Ethnicity—United States, 1999–2002." *Morbidity & Mortality Weekly Report* 55(33): 826.
- Curtis, A.B., D.S. Strogatz, S.A. James and T.E. Raghunathan. 1998. "The Contribution of Baseline Weight and Weight Gain to BP Change in African Americans: The Pitt County Study." *Annals of Epidemiology* 8: 497–503.

- Ducorps, M., B. Bauduceau, H. Mayaudon, E. Sonnet, L. Groussin and C. Castagne. 1996. "Prevalence of Hypertension in a Black African Diabetic Population." Translated from French. *Archives des Maladies du Coeur & des Vaisseaux* 89(8): 1069–73.
- Fraser, G.E. 1986. "The Epidemiology of Hypertension." *Preventive Cardiology* 10: 127–47.
- Hamill, P.V., T.A. Drizd, C.L. Johnson, R.B. Reed, A.F. Roche and W.M. Moore. 1979. "Physical Growth: National Center for Health Statistics Percentiles." *American Journal of Clinical Nutrition* 32: 607–29.
- Hart, A.C. and C.A. Hopkins. 2004. *International Classification of Diseases, Ninth Revision, Clinical Modification*, 6th ed. Ingenix, Inc.
- Lluberás, G., L.A.M. Parrish and C.M. Kling. 2000. "Hypertension Prevalence in a Rural Haitian Missionary Clinic." *The Nurse Practitioner* 25(11): 59–61.
- Preston, R.A., B.J. Materson, M.A. Yoham and H. Anapol. 1996. "Hypertension in Haitians: Results of a Pilot Survey of a Public Teaching Hospital Multispecialty Clinic." *Journal of Human Hypertension* 10: 743–5.
- Rosenberg, L., J.R. Palmer, L.L. Adams-Campbell and R.S. Rao. 1999. "Obesity and Hypertension among College-Educated Black Women in the United States." *Journal of Human Hypertension* 13(4): 237–41.
- Seedat, Y.K. 1996. "Ethnicity, Hypertension, Coronary Heart Disease and Renal Diseases in South Africa." *Ethnicity & Health* 1(4): 349–57.
- Shipp, M.L. 2001. "Awareness Status and Prevalence of Hypertension in a Group of Urban Haitians: Findings of a Population-Based Survey." *Ethnicity & Disease* 11(3): 419–30.
- Svetkey, L.P., S. Kadir, N.R. Dunnick, S.R. Smith, C.B. Dunham, M. Lambert et al. 1991. "Similar Prevalence of Renovascular Hypertension in Selected Blacks and Whites." *Hypertension* 17(5): 678–83.
- World Health Organization, International Society of Hypertension Writing Group. 2003. "2003 World Health Organization (WHO)/International Society of Hypertension (ISH) Statement on Management of Hypertension." *Journal of Hypertension* 21: 1983–92.

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