

Determinants of uncontrolled hypertension in an Iranian population

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Original Article

Abstract

BACKGROUND: Uncontrolled hypertension, a major concern among hypertensive patients, may be caused by various factors such as inadequate knowledge and inappropriate attitude, unhealthy lifestyle, and ineffective treatment. The present study tried to cast light on factors leading to uncontrolled hypertension.

METHODS: In this cross-sectional study, all hypertensive participants of the third phase of the Isfahan Healthy Heart Program were contacted and invited to take part in the study. A questionnaire including knowledge of and attitude toward hypertension and its control and treatment methods, and practice about lifestyle and pharmacological treatment was completed for all patients who consented to participate. The participants' anthropometric indices and blood pressure were then measured. Chi-square and Student's t-tests were used to compare the groups with controlled and uncontrolled blood pressure. The effect of each factor on uncontrolled blood pressure was assessed by employing stepwise logistic regression.

RESULTS: Of 114 participants, 43 (37.12%) and 71 (62.28%) individuals had controlled and uncontrolled blood pressure, respectively. Stepwise logistic regression revealed body mass index > 25 kg/m² to have the greatest effects on uncontrolled blood pressure [Odds ratio (OR) = 13.091, Confidence interval of 95% (95% CI): 1.437-116.352, P = 0.021]. In addition, male gender increased the risk for uncontrolled blood pressure (OR = 8.475, CI95%: 1.276-56.313, P = 0.027), while inappropriate attitude decreased the mentioned risk (OR = 0.047, CI95%: 0.007-0.318, P = 0.002).

CONCLUSION: According to our findings, obesity is the most important cause of uncontrolled blood pressure. Therefore, weight has to be closely monitored and controlled in hypertensive patients.

Keywords: Uncontrolled Hypertension, Obesity, Attitude

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Introduction

Hypertension (HTN) is currently identified as a major risk factor for death and loss of health; accounting for 13% of deaths and 6% of disability worldwide.^{1,2} HTN is the 4th cause of premature death in developed countries and the 7th cause of death in developing countries.³

The seventh report of the Joint National Committee defines HTN as systolic and diastolic blood pressure of higher than 140 and 90 mmHg, respectively.⁴ Despite treatment recommendations, research has shown the high prevalence of

uncontrolled HTN. About 40% of hypertensive Americans are not treated and 2.3% of those under treatment never reach the desirable blood pressure level (< 140/90 mmHg).⁵ Treatment was found to successfully control blood pressure in 37% of hypertensive patients in Saudi Arabia and only 19.88% of those in Romania.^{6,7} This rate has been reported as low as 11.8% in China.⁸ Unfortunately, no more than 6.6% of diagnosed cases of HTN in India have controlled HTN.⁹

Barriers to optimal control of HTN are categorized as either patient-related or physician-

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related.^{10,11} Unawareness about HTN and its pharmacological and non-pharmacological treatments, inappropriate attitude toward the risk and treatment of HTN, and lack of commitment to a healthy lifestyle, use of medicines, and risk factors such as diabetes and obesity may prevent the effective control of blood pressure.¹²

The third national risk factor surveillance in Iran declared the prevalence of HTN as 26.6% which is undoubtedly high.¹³ On the other hand, Khosravi et al. found controlled hypertension in only 15.8% of Iranian hypertensive patients under treatment.¹⁴ Thus, implementation of efficient health and medical policies in the country will require the identification of factors leading to uncontrolled HTN. Since insufficient research has been performed on factors preventing controlled HTN in Iran, the present study sought to shed light on this subject to facilitate the design of more effective blood pressure control methods.

Materials and Methods

In a cross-sectional study, all hypertensive participants of the third phase of the Isfahan Healthy Heart Program (IHHP) were evaluated. The IHHP was a three-phase community-based study in Isfahan and Najafabad as intervention areas and Arak as the reference area.^{15,16} The third phase of the IHHP selected 12000 adults (age > 19 years) from the three mentioned cities (all in central Iran) through multistage random sampling and assessed their knowledge, attitude, and practice toward a healthy lifestyle and risk factors of cardiovascular diseases. The subjects were also examined for the presence of the risk factors and cardiovascular diseases. Blood pressure measurements were conducted while the questionnaires were completed.¹⁷

After extracting patient data from the available files, the individuals were phoned. In case of changed phone numbers, the emergency phone numbers in patient files were contacted. The subjects were excluded after 3 unanswered phone calls. Finally, for the persons who were reached the objectives and methods of the research were explained and they were asked to attend the Isfahan Cardiovascular Research Center (Isfahan, Iran) if they consented to participate.

After referring to the Isfahan Cardiovascular Research Center, the participants signed an informed consent form and completed a questionnaire including demographic characteristics (age, gender, and marital status), socioeconomic status (education and monthly income level, and occupation), history of hyperlipidemia, diabetes, and

cardiovascular diseases, and knowledge, attitude, and practice toward HTN, blood pressure control methods, pharmacological and non-pharmacological treatments of HTN, and lifestyle. The subjects were inquired about their HTN control status, frequency of visits to the physician, the treatment regimen and used/discontinued medications, and non-pharmacological treatments. In order to assess lifestyle, a number of questions regarding diet, salt, fruit, and vegetable intake, physical activity, smoking, and stress management were asked. The participants were then classified as physically active (leisure time physical activity for at least 3 sessions of 30-minute duration per week) or inactive according to their weekly exercise pattern.¹⁸

The next step was to measure blood pressure and anthropometric indices. For each individual, right arm blood pressure was taken 3 times at 10-minute intervals and the mean value was recorded. Height and weight were measured using a Seca scale and a wall mounted measuring tape, respectively. Following the measurement of waist circumference at 2 cm above the iliac crest and hip circumference around the widest portion of the buttocks, waist to hip ratio was calculated. Body mass index (BMI) was also computed as weight divided by height squared.

HTN was confirmed based on the person's declaration of having a history of HTN, use of antihypertensive medications, or systolic/diastolic blood pressure $\geq 140/90$ mmHg. Uncontrolled HTN was defined as systolic blood pressure > 140 mmHg or diastolic blood pressure > 90 mmHg in an individual with the history of HTN despite drug therapy.

Statistical analyses

Data were entered in SPSS for Windows (version 15.0; SPSS Inc., Chicago, IL, USA). After using descriptive analysis (mean and standard deviation or crude and relative frequency), the two groups with controlled and uncontrolled HTN were compared in terms of demographics, socioeconomic status, knowledge, attitude, and practice about definition, control, and treatment of hypertension. Chi-square and Student's independent t-tests were applied to compare qualitative and quantitative variables, respectively. Then, the crude odds ratio (OR) of each variable was determined using logistic regression analysis. In the next stage, adjusted OR for each variable was calculated from stepwise logistic regression. In all analyses, $P < 0.05$ and confidence interval of 95% (95% CI) were considered significant.

Results

A total of 114 individuals participated in the present

study (mean age: 61.10 ± 9.91 years). Controlled and uncontrolled HTN was detected in 43 (37.72%) and 71 (62.28%) subjects, respectively. The mean systolic pressure was 12.89 ± 0.93 cmHg in persons with controlled HTN and 15.17 ± 1.59 mmHg in those with uncontrolled HTN ($P < 0.001$). The corresponding values for diastolic blood pressure were 8.07 ± 0.73 and 8.93 ± 0.69 cmHg, respectively ($P < 0.001$).

There were no statistically significant differences between the two groups with controlled and uncontrolled HTN regarding mean age, sex distribution, marital status, education level, monthly income, insurance coverage, and history of diseases. The groups were only significantly different in terms of mean waist circumference (i.e., the values were significantly lower in subjects with controlled HTN) ($P = 0.013$). Although mean BMI was also lower in the mentioned group, this difference was not statistically significant ($P = 0.063$) (Table 1).

Table 2 compares the knowledge, attitude, and practice of the two groups and shows a significantly

higher frequency of individuals with adequate knowledge about avoiding tobacco products for hypertension treatment in the group with uncontrolled HTN. The frequency of subjects with favorable attitude was also significantly higher in the group with uncontrolled HTN than in those with controlled HTN ($P = 0.002$). The two groups were not significantly different in the frequency of desirable practice about lifestyle and use of medicines.

Table 3 shows the crude effects of all the studied factors (i.e., demographics, history of diseases, lifestyle, overweight or obesity ($BMI > 25 \text{ kg/m}^2$), visits to the physician, and use of medicines) on uncontrolled HTN. As it is seen, only overweight and obesity had a significant effect on the incidence of uncontrolled HTN ($OR = 4.469$; $CI_{95\%}: 1.431-13.955$; $P = 0.010$). Stepwise logistic regression revealed that after adjustments for all variables, being male and $BMI > 25 \text{ kg/m}^2$ increased the chance for uncontrolled HTN. In contrast, inappropriate attitude decreased the chance (Table 4).

Table 1. Demographic and socioeconomic characteristics and risk factors in individuals with controlled and uncontrolled Hypertension (HTN)

Variable	Controlled	Uncontrolled	P
Gender*	43 (37.7)	71 (62.3)	
Male	18 (41.9)	37 (52.1)	0.288
Female	25 (58.1)	34 (47.9)	
Education (year)*			
0-5	26 (60.5)	38 (53.5)	0.556
5-12	11 (25.6)	25 (35.2)	
> 12	6 (14.0)	8 (11.3)	
Marital status*			
Single	5 (11.6)	11 (15.5)	0.565
Married	38 (88.4)	60 (84.5)	
Household's monthly income (Iran Rial)*			
< 300,000 IRR	7 (16.7)	16 (22.9)	0.749
300,00_ 500,000 IRR	19 (45.2)	26 (37.1)	
500,00_ 800,000 IRR	9 (21.4)	18 (25.7)	
> 800,000 IRR	7 (16.7)	10 (14.3)	
Insurance coverage*	34 (79.1)	61 (85.9)	0.342
History of diabetes*	15 (34.9)	27 (38.0)	0.736
History of hyperlipidemia*	22 (51.2)	43 (60.6)	0.326
History of heart attack*	3 (7.0)	4 (5.6)	1.000
History of stroke*	0 (0)	6 (8.5)	0.082
Age (year)**	60.63 ± 12.10	60.75 ± 9.88	0.955
Night sleep (hour)**	5.36 ± 2.91	5.09 ± 3.22	0.718
Body mass index(kg/m^2)**	28.44 ± 4.10	30.05 ± 4.63	0.063
Waist/hip ratio (mean \pm SD)**	0.91 ± 0.09	0.94 ± 0.06	0.064

* N (%); ** Values are n (%) or mean \pm SD

Table 2. The comparison of knowledge, attitude, and practice about lifestyle between the two groups

	Controlled n (%)	Uncontrolled n (%)	P
Knowledge			
What is normal blood pressure?	5 (11.6)	9 (12.7)	0.869
What is hypertension?	15 (34.9)	34 (47.9)	0.174
Are regular blood pressure measurements necessary?	39 (90.7)	69 (97.2)	0.197
Can a person measure his/her blood pressure at home?	42 (97.7)	70 (98.6)	1.000
Does hypertension require pharmacological treatment?	38 (88.4)	68 (95.8)	0.151
Is diet modification necessary to control blood pressure?	41 (95.3)	68 (95.8)	1.000
Is physical activity necessary to control blood pressure?	40 (93.0)	71 (100.0)	0.051
Is avoiding tobacco products necessary to control blood pressure?	36 (83.7)	68 (95.8)	0.027
Is stress management necessary to control blood pressure?	40 (93.0)	70 (98.6)	0.150
Desirable knowledge score	24 (55.8)	46 (64.8)	0.340
Attitude			
Is hypertension a disease?	40 (93.0)	64 (90.1)	0.740
Is hypertension treatable?	36 (83.7)	64 (90.1)	0.311
Do herbal medicines suffice in the treatment of hypertension?	24 (55.8)	45 (63.4)	0.423
If you have hypertension, do you think your blood pressure is controlled?	7 (16.3)	11 (15.5)	0.911
Desirable attitude score	27 (62.8)	62 (87.3)	0.002
lifestyle			
Low-salt food	23 (53.5)	42 (59.2)	0.554
Daily intake of fruits	27 (62.8)	54 (76.1)	0.130
Daily intake of fresh vegetables	17 (39.5)	36 (50.7)	0.247
Not adding table salt	38 (88.4)	63 (88.7)	0.953
Adequate physical activity	22 (51.2)	32 (45.1)	0.528
Current smoker	3 (7.0)	5 (7.0)	1.000
Visits to the physician and pharmacological treatment			
At least one visit to the physician during the past six months	35 (81.4)	61 (85.9)	0.521
Receiving prescriptions from the physician	40 (93.0)	69 (97.2)	0.364
Regular use of the prescribed antihypertensive medicines	36 (90.0)	61 (88.4)	0.798
The physician's emphasis on medicine use during every visit	29 (74.4)	48 (71.6)	0.762
Family support in taking antihypertensive medicines	11 (27.5)	16 (23.2)	0.615
Discontinuation of antihypertensive medicines	4 (10.0)	9 (13.0)	0.637
Side effects of antihypertensive medicines	3 (7.7)	10 (14.7)	0.285
At least one visit to the physician during the past six months	35 (81.4)	61 (85.9)	0.521

Table 3. Crude effect of demographic and socioeconomic characteristics, risk factors, knowledge, attitude, and practice, lifestyle, and pharmacological treatment on blood pressure control

Variable	Odds ratio	Confidence interval	P
Male gender	1.510	0.704-3.245	0.289
Education level lower than high school diploma	1.270	0.411-3.968	0.627
Not being married	1.390	0.449-4.324	0.566
Income level < 500,000 Rials	0.920	0.421-2.024	0.842
No insurance coverage	0.619	0.229-1.672	0.344
History of diabetes	1.145	0.520-2.522	0.736
History of hyperlipidemia	1.466	0.683-3.148	0.327
History of heart attack	0.796	0.168-3.740	0.773
Body mass index > 25 kg/m ²	4.469	1.431-13.955	0.010
Undesirable knowledge	0.686	0.317-1.489	0.341
Undesirable attitude	0.245	0.096-0.623	0.003
Not using low-salt diet	0.794	0.370-1.704	0.554
No daily fruits intake	0.531	0.233-1.211	0.133
No daily fresh vegetables intake	0.636	0.295-1.371	0.248
Immobility (30-minute sessions of physical activity less than 3 times per week)	1.277	0.598-2.727	0.528
Smoking	1.010	0.229-4.456	0.989
No visits to the physician in the past six months	0.717	0.259-1.986	0.522
No prescription from the physician	0.386	0.062-2.412	0.309
Not taking the prescribed antihypertensive medicines regularly	1.180	0.332-4.199	0.798
The physician's lack of attention to emphasizing on regular use of medicines in every visit	1.148	0.470-2.806	0.762
Lack of family support in using antihypertensive medicines	1.256	0.515-3.063	0.616
Discontinuation of antihypertensive medicines	0.741	0.213-2.581	0.637
Side effects of antihypertensive medicines	0.483	0.125-1.875	0.293

Table 4. Factors leading to uncontrolled Hypertension (HTN) after stepwise logistic regression

	Odds ratio	Confidence interval	P
Male gender	8.475	1.276-56.313	0.027
Body mass index > 25 kg/m ²	13.091	1.437-116.352	0.021
Appropriate attitude	0.047	0.007-0.318	0.002

Discussion

The present study indicated that the two groups with controlled and uncontrolled HTN were similar in terms of gender, education and income level, insurance coverage, history of diseases, treatment type, frequency of visits to the physician, and family support. Furthermore, no significant difference in knowledge, attitude, and practice was observed between the two groups (except for appropriate knowledge about smoking which was significantly higher in subjects with uncontrolled HTN). Meanwhile, the frequency of desirable attitude was significantly higher in the group with uncontrolled HTN than in the other group. The mean BMI was also higher, but not significantly, in the mentioned group. After all analyses, BMI > 25 kg/m² and being male were confirmed to have significant effects on increasing the chance for uncontrolled HTN.

Previous studies about the effects of gender on uncontrolled HTN have reported contradictory results. Being female had no impact on BP control in Oman but in Canada women older than 60 years of age were more likely to have uncontrolled hypertension than men.^{19,20} Keyhani et al. evaluated data from the National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey in the United States and found higher frequency of women among subjects with uncontrolled HTN. Moreover, in logistic regression, 65-80 year old women had a lower chance of blood pressure control than their male counterparts.²¹

In contrast, the National Health and Nutrition Examination Survey in the United States rejected any difference in blood pressure control between the two sexes.²² A systematic review on studies about blood pressure control in Africa concluded that women had better controlled HTN than men.²³ Cultural differences might have been responsible for such inconsistencies. In addition, according to recent studies, the higher prevalence of mortality and morbidity due to cardiovascular diseases in women has attracted physicians' attention toward the treatment of female patients.²⁴

BMI > 25 kg/m² was another factor leading to uncontrolled HTN. Various studies have reported similar relations between overweight/obesity and uncontrolled HTN. In a study on hypertensive

African-Belgians, Decoste et al. found uncontrolled HTN to be significantly related with obesity, diabetes, and a sedentary lifestyle.²⁵ Downie et al. identified overweight and obesity as a factor leading to uncontrolled HTN.²⁶ Lloyd-Jones et al. observed the significant effect of BMI > 30 kg/m² (as compared to BMI > 25 kg/m²) on uncontrolled HTN.²⁷ In general, overweight and obesity are currently considered as a major barrier to blood pressure control.^{5,28}

The effect of BMI > 25 kg/m² on uncontrolled HTN in the current study was much stronger than that in similar research. This is extremely important, since our groups had no significant differences in lifestyle, treatment regimen, or demographic and socioeconomic characteristics. Further investigation may help clarify the reason behind this difference. Iranian ethnicity and differences in hormones, enzymes, and genetics may justify the magnitude of the observed relationship. As we did not have genetic information about the participants, future studies with genetic testing are warranted. Once a genetic background for uncontrolled HTN is proven, more effective treatment and preventive measures can be developed.

Overall, based on our findings, blood pressure control policies should mainly focus on men and overweight/obese individuals. Since research has shown the increasing trend of overweight and obesity in Iran, a growing number of cases with treatment-resistant HTN are to be expected in the future. Therefore, the Ministry of Health is recommended to emphasize on the design and implementation of weight control policies through either public education or legislations to control fast foods and food products.

Conclusion

Our findings showed that individuals with controlled and uncontrolled HTN had similar knowledge, attitude, and lifestyle, and followed comparable pharmacological treatments. It is, however, of utmost importance to control blood pressure in men and overweight/obese individuals.

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Conflict of Interests

Authors have no conflict of interests.

References

- World Health Organization. The World Health Report 2002: Reducing Risks, Promoting Healthy Life. Geneva, Switzerland: World Health Organization; 2002.
- World Health Organization. Global Health Risks: Mortality and Burden of Disease Attributable to Selected Major Risks. Geneva, Switzerland: World Health Organization; 2009.
- Talaei M, Sadeghi M, Mohammadifard N, Shokouh P, Oveisgharan S, Sarrafzadegan N. Incident hypertension and its predictors: the Isfahan Cohort Study. *J Hypertens* 2014; 32(1): 30-8.
- Lenfant C, Chobanian AV, Jones DW, Roccella EJ. Seventh report of the Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7): resetting the hypertension sails. *Hypertension* 2003; 41(6): 1178-9.
- Wang TJ, Vasan RS. Epidemiology of uncontrolled hypertension in the United States. *Circulation* 2005; 112(11): 1651-62.
- Saeed AA, Al-Hamdan NA, Bahnassy AA, Abdalla AM, Abbas MA, Abuzaid LZ. Prevalence, Awareness, Treatment, and Control of Hypertension among Saudi Adult Population: A National Survey. *Int J Hypertens* 2011; 2011: 174135.
- Dorobantu M, Darabont RO, Badila E, Ghiorghe S. Prevalence, Awareness, Treatment, and Control of Hypertension in Romania: Results of the SEPHAR Study. *Int J Hypertens* 2010; 2010: 970694.
- Cai L, Liu A, Zhang L, Li S, Wang P. Prevalence, awareness, treatment, and control of hypertension among adults in Beijing, China. *Clin Exp Hypertens* 2012; 34(1): 45-52.
- Kaur P, Rao SR, Radhakrishnan E, Rajasekar D, Gupte MD. Prevalence, awareness, treatment, control and risk factors for hypertension in a rural population in South India. *Int J Public Health* 2012; 57(1): 87-94.
- Hyman DJ, Pavlik VN. Characteristics of patients with uncontrolled hypertension in the United States. *N Engl J Med* 2001; 345(7): 479-86.
- Okonofua EC, Simpson KN, Jesri A, Rehman SU, Durkalski VL, Egan BM. Therapeutic inertia is an impediment to achieving the Healthy People 2010 blood pressure control goals. *Hypertension* 2006; 47(3): 345-51.
- Glynn LG, Murphy AW, Smith SM, Schroeder K, Fahey T. Interventions used to improve control of blood pressure in patients with hypertension. *Cochrane Database Syst Rev* 2010; (3): CD005182.
- Esteghamati A, Meysamie A, Khalilzadeh O, Rashidi A, Haghazali M, Asgari F, et al. Third national Surveillance of Risk Factors of Non-Communicable Diseases (SuRFNCD-2007) in Iran: methods and results on prevalence of diabetes, hypertension, obesity, central obesity, and dyslipidemia. *BMC Public Health* 2009; 9: 167.
- Khosravi A, Mehr GK, Kelishadi R, Shirani S, Gharipour M, Tavassoli A, et al. The impact of a 6-year comprehensive community trial on the awareness, treatment and control rates of hypertension in Iran: experiences from the Isfahan healthy heart program. *BMC Cardiovasc Disord* 2010; 10: 61.
- Sarraf-Zadegan N, Sadri G, Malek AH, Baghaei M, Mohammadi FN, Shahrokhi S, et al. Isfahan Healthy Heart Programme: a comprehensive integrated community-based programme for cardiovascular disease prevention and control. Design, methods and initial experience. *Acta Cardiol* 2003; 58(4): 309-20.
- Sarrafzadegan N, Baghaei A, Sadri G, Kelishadi R, Malekafzali H, Boshtam M, et al. Isfahan healthy heart program: Evaluation of comprehensive, community-based interventions for non-communicable disease prevention. *Prevention and Control* 2006; 2(2): 73-84.
- Sarrafzadegan N, Kelishadi R, Esmailzadeh A, Mohammadifard N, Rabiei K, Roohafza H, et al. Do lifestyle interventions work in developing countries? Findings from the Isfahan Healthy Heart Program in the Islamic Republic of Iran. *Bull World Health Organ* 2009; 87(1): 39-50.
- Rabiei K, Kelishadi R, Sarrafzadegan N, Sadri G, Amani A. Short-term results of community-based interventions for improving physical activity: Isfahan Healthy Heart Programme. *Arch Med Sci* 2010; 6(1): 32-9.
- Al-Saadi R, Al-Shukaili S, Al-Mahrazi S, Al-Busaidi Z. Prevalence of uncontrolled hypertension in primary care settings in Al seeb wilayat, oman. *Sultan Qaboos Univ Med J* 2011; 11(3): 349-56.
- Gee ME, Bienek A, McAlister FA, Robitaille C, Joffres M, Tremblay MS, et al. Factors associated with lack of awareness and uncontrolled high blood pressure among Canadian adults with hypertension. *Can J Cardiol* 2012; 28(3): 375-82.
- Keyhani S, Scobie JV, Hebert PL, McLaughlin MA. Gender disparities in blood pressure control and cardiovascular care in a national sample of

- ambulatory care visits. *Hypertension* 2008; 51(4): 1149-55.
22. Ostchega Y, Dillon CF, Hughes JP, Carroll M, Yoon S. Trends in hypertension prevalence, awareness, treatment, and control in older U.S. adults: data from the National Health and Nutrition Examination Survey 1988 to 2004. *J Am Geriatr Soc* 2007; 55(7): 1056-65.
 23. Kayima J, Wanyenze RK, Katamba A, Leontsini E, Nuwaha F. Hypertension awareness, treatment and control in Africa: a systematic review. *BMC Cardiovasc Disord* 2013; 13: 54.
 24. Rosamond W, Flegal K, Friday G, Furie K, Go A, Greenlund K, et al. Heart disease and stroke statistics-2007 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation* 2007; 115(5): e69-171.
 25. Decoste M, Vanobberghen R, Borgermans L, Devroey D. Uncontrolled hypertension among black Africans in the city of Brussels: a case-control study. *Eur Rev Med Pharmacol Sci* 2013; 17(7): 886-94.
 26. Downie DL, Schmid D, Pleiscia MG, Huston SL, Bostrom S, Yow A, et al. Racial disparities in blood pressure control and treatment differences in a Medicaid population, North Carolina, 2005-2006. *Prev Chronic Dis* 2011; 8(3): A55.
 27. Lloyd-Jones DM, Evans JC, Larson MG, O'Donnell CJ, Roccella EJ, Levy D. Differential control of systolic and diastolic blood pressure: factors associated with lack of blood pressure control in the community. *Hypertension* 2000; 36(4): 594-9.
 28. Kotchen TA. Obesity-related hypertension: epidemiology, pathophysiology, and clinical management. *Am J Hypertens* 2010; 23(11): 1170-8.

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