# **Do Cardiovascular Risk Factors have an impact on Blood Pressure Control in Hypertensive Patients?**

#### Shahab Rezaeian

Department of Epidemiology & Biostatistics, School of Public Heath, Hamadan University of Medical Sciences, Hamadan, Iran

#### \* Corresponding Author: Shahab Rezaeian

Department of Epidemiology & Biostatistics, School of Public Health, Hamadan University of Medical Sciences, Shaheed Fahmideh Ave. Hamadan 65157838695, Iran Email: shahab\_fs@yahoo.com

#### Abstract

**Background:** Previous studies have shown that hypertensive patients have at least one additional cardiovascular risk factor also blood pressure (BP) control is crucial in the prevention of cardiovascular diseases.

**Objective:** The aim of this study was to investigate the prevalence of cardiovascular risk factors and their association with blood pressure BP control status in hypertensive patients.

**Methods:** In this cross-sectional study 1158 subjects with an established diagnosis of hypertension were included. The data collection was done using family records.

**Results:** The mean age of the patients was 66.0 years and 61.3% were female. The prevalence of obesity, diabetes, smoking and family history of BP were 18.3%, 4.3%, 11.2% and 20.5%, respectively. Overall, control of the hypertension was found in 28.4% of the study population.

After adjustment for baseline variables the likelihood of having well control of BP was 15.24 times greater among the diabetic patients, 2 times greater among the female patients, 0.27 times greater among smokers, 2.12 times greater among obese subjects and 1.8 times greater among patients with family history of BP that these were significant.

**Conclusion:** Analysis showed that cardiovascular risk factors such as advancing age, smoking, diabetes and higher body mass index in hypertensive patients are prevalent. Integrative management of BP as well as co-morbid risk factors should be encouraged.

Key words: Blood pressure control, Hypertensive patients, Cardiovascular risk factors, Propensity score, Iran

## Introduction

Although blood pressure (BP) control is crucial in the prevention of myocardial infarction, stroke, heart failure and renal failure <sup>1-2</sup>, but it was reported to be inadequate on the basis of either the routine clinic BP or home BP measurement.<sup>3,4</sup> According to the previous studies patients with hypertension have had at least one additional cardiovascular risk factor.<sup>5-6</sup> Accordingly, detection of hypertension and BP control are critically important for reducing the risk of these adverse outcomes.

In observational studies, the estimated association between exposure and outcome can be biased because of the imbalance in baseline covariates that may affect the outcome. The propensity score was proposed by Rosenbaum and Rubin as method for control of confounding in observational studies.<sup>7</sup>

The primary objective of this study was to investigate the prevalence of cardiovascular risk factors such as obesity, diabetes mellitus, smoking and family history of BP in hypertensive patients. One of the secondary objectives of the study was to quantify the level of control for BP in the study population and to determine the associated factors as well as adjustment for covariate by propensity score method.

## Methods

We conducted a cross-sectional study including patients diagnosed with hypertension who were treated in normal clinical practice in the primary health care (PHC) setting in the Iranian health system.

Data was collected between April and June 2011 using family records in Sarvabad city, located in the west of Iran. The following information was recorded in the study: age, gender, smoking status, weight, height, diabetes status, family history of BP, systolic and diastolic BP.

Of 1158 family records of hypertensive patients, we included only those if they had been receiving antihypertensive therapy for at least 3 months and had made at least three previous PHC visits. Patients who were diagnosed with hypertension within the previous three months or patients who had incomplete data were excluded from the study. To account for the inclusion criteria, a total of 1112 family records were selected in the study (response rate, 96.0%).

Weight and height were collected in order to calculate body mass index (BMI) and subjects with a BMI of  $\geq$  30 were considered obese. Our definition of uncontrolled BP coincides with the definition used in JNC-7 as a BP of >140/90 mmHg or >130 mmHg systolic and >80 mmHg diastolic with coexisting diabetes.<sup>8</sup> Uncontrolled BP was based on the average of the collected three BP readings.

Values are presented as the mean  $\pm$  standard deviation (SD) for continuous variables, frequencies for categorical variables and 95% confidence interval [CI] estimation. Chi-square and student's t-test were used for statistical analysis for categorical and continuous data respectively. The overall significance level for the study was P < 0.05 using a two-sided test. Also the blood pressure control rate was age, duration of hypertension, the first SBP and DBP

adjusted by propensity score <sup>7</sup> then conditional logistic regression was performed. All analyses were performed using STATA software (version 11; StataCorp, College Station, TX, USA).

#### Results

As stated, there were 1112 family records of hypertensive patients in the study sample. The mean age of the patients was 66.0 ( $\pm$  12.1) years and 61.3% were female. Characteristics of the study sample are given in Table 1. The prevalence of obesity, diabetes, smoking and family history of BP were 18.3% (16.5% in men and 19.4% in women, p=0.2), 4.3% (2.2% in men and 5.6% in women, p=0.005), 11.2% (19.6% in men and 5.9% in women, p<0.001) and 20.5% (21% in men and 20% in women, p=0.6), respectively.

The average number of cardiovascular risk factors was 0.5 ( $\pm$  0.7). Prevalence of cardiovascular risk factors is shown in Figure 1. Among hypertensive patients, 57% had no additional risk factor except for hypertension. On the other hand, 32%, 10% and 1% had one, two or three additional risk factors, respectively. The achievement rate of good (<140/90 mmHg) BP was 51.9% in the patients without additional risk factors. In contrast, BP in those with additional risk factors was less controlled.

Average BP level was 156.6/87.6 mmHg (155.7/87.2 mmHg in men and 157.1/87.8 mmHg in women). Overall, control of the hypertension (both systolic and diastolic pressures) was found in 28.4% [95% CI: 25.8%, 31.1%] of the study population.

The BP control of hypertensive subjects before and after matching by propensity score is shown in Table 2. Before adjustment, among CVD risk factors, there was no significant statistical difference in rate of BP control among subjects with family history of BP. On the other hand, the reported odds ratio for other CVD risk factors is powerless. Surprisingly, after adjustment for baseline variables the likelihood of having well control of BP was 15.24 times greater among the diabetic patients, 2 times greater among the female patients, 0.27 times greater among smokers, 2.12 times greater among obese subjects and 1.8 times greater among patients with family history of BP that these were significant (Table 2).

## Discussion

According to the results of present study, the prevalence of obesity, diabetes, smoking and family history of BP were 18.3%, 4.3%, 11.2% and 20.5%, respectively. We also show that the hypertension was well controlled in just 28.4% of the patients and among our hypertensive patients, 57% had no additional risk factor. This observation is in contrast with the previous studies  $^{5,9}$  that almost 81% of hypertensive patients had at least one additional cardiovascular risk factor in Ohta et al study  $^9$  and Weycker et al have reported that more than 50% of hypertensive patients were complicated with one of the cardiovascular risk factors.<sup>5</sup>

The results of our study showed that the prevalence of CVD risk factors in hypertensive patients is high. These results partially explained the high mortality rates for CVD in Iranian.<sup>10</sup>

In our study, we found that BP control rate was significantly higher in women than men. However, women tended to have more cardiovascular risk factors than men, including obesity and diabetes. Our findings are consistent with results of previous surveys.<sup>11</sup>

In current study, the control rate of BP in diabetes was approximately 2 times greater than non-diabetes and this indicated that diabetes patients had more concerns about their self-care <sup>12</sup>. This finding is in concordance with poor BP control observed in treated hypertensive patients with diabetes in other studies.<sup>13</sup>

Although the previous studies reported that BMI play an important role in management of uncontrolled BP <sup>14-15</sup>, but we found that rate of BP control was approximately 2.12 times greater in obese than non-obese.

Smoking is one of the major risk factors for CVD morbidity and mortality <sup>16-17</sup>; also it is associated with uncontrolled BP and smokers don't have healthy behaviors, as found in other studies.<sup>12, 18-20</sup>

This observational study has several limitations. First, in a cross-sectional study; a sample of reference population in examined at a given point in time, therefore the data do not allow final conclusions about causal relations. Second, no information was available on how BP was measured and recorded which might question the accuracy of the BP readings obtained. Third, only BMI was used to estimate obesity, although waist-hip ratio or other parameters of body fat might have been more useful. Fourth, the main limitation with our study was the possibility of information bias associated with how care of physicians. This limits the generalization of the results to the whole of Iranian patients.

## Conclusion

Analysis showed that BP is not adequately controlled in over 70% of subjects and cardiovascular risk factors such as advancing age, smoking, diabetes and higher body mass index in hypertensive patients are prevalent. Integrative management of BP as well as comorbid risk factors should be encouraged in order to improve BP control among hypertensive patients. On the other hand these factors are the most preventable and modifiable common risk factors. Accordingly clinicians and policymakers should place greater emphasis on reducing their levels in all hypertensive patients.

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Conflict of interest: None declared.

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Variable	Male (n=448)	Female (n=710)	P-value	Total [95%CI]
Age, yr (Mean, SD)	68.5(11.6)	64.1(12.2)	<0.001	66.0[65.1, 66.5]
BMI, (kg/m <sup>2</sup> )	25.8(3.9)	26.0(4.1)	0.4	26.0[25.7, 26.2]
Obesity (BMI $\geq$ 30)	16.5%	19.4%	0.2	18.3%[16.1%, 20.5%]
Diabetes (%)	2.2%	5.6%	0.005	4.3%[3.1%, 5.4%]
Smoker (%)	19.6%	5.9%	<0.001	11.2%[9.4%, 13.0%]
Family history of BP (%)	21.0%	20.0%	0.6	20.5%[18.2%, 22.8%]
Systolic BP(Mean, SD)	155.7(24.4)	157.1(25.7)	0.3	156.6[155.1, 158.1]
Diastolic BP(Mean, SD)	87.2(8.8)	87.8(8.9)	0.2	87.6[87.1, 88.1]
Blood pressure goal (%)	23.9%	31.2%	0.007	28.4%[25.8%, 31.1%]

Table 1: Clinical characteristics of the study participants by gender

**Table 2:** Conditional Logistic Regression Analysis of Factors Associated with Blood

 Pressure Control among Hypertensive Patients

Variable	Before Matching		After Matching*	
	OR	[95% CI]	OR	[95% CI]
Sex	1.44	[1.1, 1.9]	2.0	[1.43, 2.75]
Diabetic	3.42	[1.92, 6.1]	15.24	[3.60, 64.5]
Smoking	0.20	[0.10, 0.38]	0.27	[0.12, 0.70]
Family history of BP	0.90	[0.65, 1.24]	1.80	[1.15, 2.80]
Obesity	2.33	[1.70, 3.20]	2.12	[1.44, 3.13]

\* Matching on age, duration of hypertension, the first SBP and DBP.

OR; odds ratio, CI; confidence interval



Figure 1: Number of cardiovascular risk factor in hypertensive patients