



# Prevalence, Awareness, Treatment, and Control of Hypertension in an Isfahan State Institution Sample

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## Abstract

**Background:** Hypertension is a major risk factor for premature disability and death and is the leading risk factor for global disease burden. The present study aimed to assess the rates of prevalence, awareness, treatment, and control of hypertension in a sample of teachers, staff, and students at Isfahan University of Medical Sciences (IUMS).

**Methods:** This cross-sectional survey was conducted from January to September 2015 on the staff, teachers, and students at IUMS. A total of 1500 subjects were randomly selected and were invited to participate in the survey. Hypertension was defined as an average of 2 blood pressure measurements of at least 140/90 mmHg. The rate of awareness was determined based on self-reports, treatment was defined as the regular use of blood pressure-lowering medications, and control was defined as the maintenance of blood pressure below 140/90 mmHg.

**Results:** The study population comprised 1317 individuals (45.9% female) at a mean age of  $41.4 \pm 9.5$  years. The prevalence rate of hypertension was 17.5% (231 of 1317 participants), and the rate of awareness was 54.5% (126 of 231 hypertensive patients). Seventy-nine (62.7%) patients were undergoing treatment, and 51.9% (41 of 79) controlled their disease. Institutional position ( $p$  value  $< 0.017$ ), age ( $p$  value  $< 0.001$ ), body mass index ( $p$  value  $< 0.001$ ), education level ( $p$  value  $< 0.001$ ), smoking status ( $p$  value  $< 0.001$ ), and history of diabetes mellitus ( $p$  value  $< 0.001$ ) were the most frequent risk factors associated with hypertension.

**Conclusion:** The percentage of the hypertensive subjects who were aware, treated, and controlled was unacceptably low in our sample at IUMS. Hypertension is, therefore, a major health problem in this state institution.

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**Keywords:** Hypertension • Prevalence • Awareness • Therapeutics • Social class

## Introduction

Worldwide, hypertension is one of the most common chronic diseases. It is deemed not only a major risk factor

for premature disability and death but also the leading risk factor for global disease burden.<sup>1</sup> In Western and Asian populations, hypertension is the major cause of stroke, congestive heart failure, and other cardiovascular diseases

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(CVDs)-themselves the leading causes of morbidity and mortality. Cardiovascular morbidity and mortality can be meaningfully diminished after a reduction in blood pressure (BP).<sup>2</sup> The past decade has witnessed rapid economic development in Iran and its resultant impact on lifestyle and diet, both of which may have exerted a great impact on the prevalence and incidence of atherosclerotic diseases. A 25% relative reduction in the prevalence of hypertension in the time period between 2015 and 2025 is one of the objectives in the action plan of the World Health Organization for the prevention and control of noncommunicable diseases (Iso H, Kokubo Y. Global strategies for non-communicable disease in terms of predictive, preventive and personalised medicine. EPMA J 2014;5:A4).

In different studies carried out in the Mediterranean and Middle Eastern countries, the prevalence rate of hypertension has been reported to range from 10% to 17%.<sup>3</sup> In general, 25% to 35% of middle-aged Iranians are hypertensive.<sup>4</sup> Based on previous studies in Iran, the prevalence of hypertension did not change between 2000 and 2007, whereas there was an increase in the control of hypertension among individuals with hypertension.<sup>5</sup> A study demonstrated that despite significant improvement in awareness, treatment, and control of hypertension among hypertensive individuals, only half of them were aware of their high BP, half of these aware patients received treatment, and almost half of these treated patients had an adequately controlled BP.<sup>6,7</sup> In a nationwide survey, the prevalence of hypertension in the Iranian adult population (aged 25-64 y) was 25%; nonetheless, only 34% of these hypertensive patients were aware, 25% were taking antihypertensive medications and of these treated subjects, only 24% controlled their hypertension.<sup>8</sup> Other studies have reported different values apropos the prevalence, awareness, treatment, and control of hypertension.<sup>9-13</sup>

In light of the aforementioned evidence, underscoring the undesirable status of awareness, treatment, and control of hypertension despite recent improvements in Iran, we sought to perform the present study on a small sample of teachers, students, and staff at an Iranian state institution (Isfahan University of Medical Sciences [IUMS]) in order to assess the prevalence, awareness, treatment, and control of hypertension.

## Methods

This cross-sectional survey was conducted from January to September 2015 on teachers, students, and staff at IUMS, Isfahan, Iran. A total of 1500 subjects were randomly selected and were invited to participate in the survey. Of these subjects, 183 individuals were excluded due to incomplete data and unwillingness to participate. The survey was completed by 1317 subjects. The inclusion criteria were comprised of current employment or education at IUMS,

provision of verbal consent for participation, minimum age of 20 years (both males and females), and mental competence. The exclusion criteria consisted of pregnancy, history of heart attack or stroke, and surgery in the preceding 3 months. The study protocol was approved by the Ethics Committee of IUMS.

The questionnaire used in the present study contained information about age, gender, height, weight, education level, marital status, self-reported smoking status, history of diabetes mellitus (DM), family history of hypertension and CVDs, and BP measurement. All the measurements were taken by 2 specially trained nurses. The participants were stratified in 3 age groups: 20 to 39, 40 to 59, and 60 years of age and older. The body mass index (BMI) was estimated through the division of the body weight (kg) by the square of the body height (m<sup>2</sup>) and was categorized as less than 25, between 25 and 29, and equal to or greater than 30 kg/m<sup>2</sup>. Education level was classified as high school diploma and lower, bachelor's degree, master's degree or MD, and PhD or specialty and higher degrees. Marital status was categorized as married, divorced, widowed, and never married.

Blood pressure was measured on the left arm of all the respondents after a rest of 5 minutes in the sitting position at the same time of the day, using a standard sphygmomanometer and cuffs of appropriate sizes. Two consecutive BP measurements were taken with at least a 5-minute interval between them, and the average of these 2 measurements was factored in the analysis. Hypertension was defined as an average systolic BP (SBP) of at least 140 mmHg or an average diastolic BP (DBP) of at least 90 mmHg, or if the participant was already taking antihypertensive medications.<sup>14</sup>

The rates of hypertension prevalence, awareness, treatment, and control were evaluated in the participants.<sup>15-18</sup> Awareness of being hypertensive was defined as a "Yes" answer to the questionnaire's item "Have you ever been told by a doctor or a health professional that you had hypertension, also called 'high blood pressure'?" The respondents who were aware of their hypertension were to answer the next item on the questionnaire "Because of your high blood pressure, are you now taking prescribed medicines?" A "Yes" answer was designated as treatment of hypertension. Additionally, in those taking medications for hypertension, an average SBP below 140 mmHg and an average DBP below 90 mmHg constituted hypertension control. Among the individuals with DM, an average SBP below 130 mmHg and an average DBP below 85 mmHg were taken to represent hypertension control.

All the statistical analyses were done using the SPSS software package for Windows, version 23 (SPSS Inc., Chicago, USA). The continuous variables are presented as means  $\pm$  standard deviations (SDs) and the qualitative variables as numbers (percentages). The  $\chi^2$  test with the Yates correction, where appropriate, was employed to compare



the frequencies. A multivariate logistic regression analysis was also conducted to evaluate the association between the prevalence of hypertension and age (20-39 = 1, 40-59 = 2, and  $\geq 60 = 3$ ), sex (male = 0 and female = 1), BMI ( $< 25 \text{ kg/m}^2 = 1$ ,  $24-29 \text{ kg/m}^2 = 2$ , and  $\geq 30 \text{ kg/m}^2 = 3$ ), education attainment (high school diploma and lower = 1, bachelor's degree = 2, master's degree or MD = 3, and PhD or specialty and higher degrees = 4), marital status (married = 1, divorced = 2, widowed = 3, and never married = 4), and smoking status (nonsmokers = 0 and smokers = 1). All the probability tests used in the current study were 2-tailed and the alpha was set at 5%.

## Results

The response rate in our study was 87.8% (1317 of 1500 subjects). The mean age of the subjects was  $41.4 \pm 9.5$  years. The characteristics of the participants are depicted in Table 1. Those aged between 35 and 49 years accounted for the highest proportion of the study population. Generally, the level of education among the respondents was high, with the majority holding a bachelor's degree. However, 5.8% of the participants had no formal education. The university staff comprised the bulk of the study population (48.7%), and only a small number of the respondents were teachers with PhD or specialty and higher degrees. The overall prevalence rate of overweight and obesity was 30.9% and 7.9%, correspondingly. Most of the subjects (68.2%) were married. The proportion of smokers was 18.1%, and 11.3% of the participants suffered from DM.

The prevalence of hypertension in the whole study population was 17.5% (231 of 1317 subjects). Of these hypertensive individuals, 54.5% (126 of 231) were aware of their hypertension; 62.7% (79 of 126) of the subjects who were aware of their hypertension were taking antihypertensive drug treatment; and 51.9% (41 of 79) of those undergoing treatment had hypertension control. The prevalence of hypertension and the level of awareness, treatment, and control of hypertension by sociodemographic characteristics in the studied subjects are shown in Table 2. As is shown in this table, the prevalence of hypertension in the university staff was significantly higher than that in the teachers or students and the students were more aware of their hypertension. Nonetheless, there were no significant differences between the staff, teachers, and students in the rate of treatment and control of hypertension. The prevalence of hypertension increased with age, with the studied subjects more than 50 years old having a significantly higher prevalence of hypertension than the younger subjects. The prevalence of hypertension significantly increased with a higher BMI and significantly decreased with a higher education level. The divorced and widowed individuals had a significantly higher prevalence of hypertension than

the married and single subjects. The diabetic subjects had a significantly higher prevalence rate of hypertension than those without DM (40.3% vs. 14.4%, respectively). Smoking and family history of hypertension and CVDs were significantly associated with higher prevalence rates of hypertension. The level of awareness was associated with the BMI, institutional position, smoking, and family history of hypertension and CVDs. The overweight and obese subjects were more aware of their hypertensive status than those with a normal BMI. History of DM was the only significant variable associated with the rate of treatment, and the level of hypertension treatment was not significantly different between the respondents in regard to the other studied variables. The rate of controlled hypertension was not significantly different between the participants concerning any of the studied variables.

Table 1. Characteristics of the study participants (N=1317)\*

Gender	
Female	604 (45.9)
Male	713 (54.1)
Age groups (y)	
20-34	333 (25.3)
35-49	685 (52.0)
$\geq 50$	299 (22.7)
Body mass index ( $\text{kg/m}^2$ )	
Normal ( $< 25$ )	806 (61.2)
Overweight (25-29)	407 (30.9)
Obesity ( $\geq 30$ )	104 (7.9)
Institutional position	
Teacher	214 (16.3)
Staff	642 (48.7)
Student	461 (35.0)
Education attainment (y)	
$< 7$ (primary school)	76 (5.8)
7-12 (high school)	187 (14.2)
13-16 (bachelor's degree)	541 (41.1)
17-18 (master's degree or MD)	301 (22.9)
$> 17$ (PhD or medical specialty)	212 (16.4)
Marital status	
Married	898 (68.2)
Divorced/Widowed	73 (5.5)
Never married	346 (26.3)
Smoking	238 (18.1)
History of diabetes mellitus	149 (11.3)
Family history of hypertension	486 (36.9)
Family history of cardiovascular diseases	137 (10.4)

\*Data are presented as n (%)

Table 2. Prevalence, awareness, treatment, and control of hypertension by sociodemographic factors in the study population (N=1317)\*

	Hypertension (n=231)	Awareness (n=126)	Treated (n=79)	Controlled (n=41)
<b>Institutional position</b>				
Teacher	18 (8.4)	5 (27.8)	5 (100)	3 (60.0)
Student	71 (15.4)	45 (63.4)	30 (66.7)	15 (50.0)
Staff	142 (22.1)	76 (53.5)	44 (57.9)	23 (52.3)
P value	< 0.001	0.024	0.134	0.915
<b>Age groups (y)</b>				
20–34	37 (11.1)	19 (51.4)	14 (73.7)	8 (57.1)
35–49	75 (10.9)	47 (60.3)	28 (59.6)	14 (50.0)
≥ 50	119 (39.8)	60 (50.4)	37 (61.7)	19 (51.4)
P value	< 0.001	0.227	0.548	0.905
<b>Gender</b>				
Female	129 (21.4)	62 (48.1)	37 (59.7)	19 (51.4)
Male	108 (15.1)	64 (59.3)	42 (65.6)	22 (52.4)
P value	0.921	0.072	0.455	0.927
<b>Body mass index (kg/m<sup>2</sup>)</b>				
< 25	78 (9.7)	32 (41.0)	19 (59.4)	11 (57.9)
25–29	73 (17.9)	45 (61.6)	24 (53.3)	14 (58.3)
≥ 30	80 (76.9)	49 (61.3)	36 (73.5)	16 (44.4)
P value	< 0.001	0.013	0.118	0.479
<b>Family history of CVD</b>				
	46 (33.6)	31 (67.4)	21 (67.7)	12 (57.1)
P value	< 0.001	0.011	0.895	0.575
<b>Education attainment level (y)</b>				
< 7	50 (65.8)	23 (46.0)	16 (69.6)	7 (43.8)
7–12	87 (46.5)	49 (56.3)	28 (57.1)	12 (42.9)
12–16	61 (11.3)	39 (63.9)	27 (69.2)	16 (59.3)
16–18	25 (8.3)	12 (48.0)	6 (50.0)	4 (66.7)
> 18	8 (3.8)	3 (37.5)	2 (66.7)	2 (100)
P value	< 0.001	0.275	0.615	0.549
<b>Marital status</b>				
Married	146 (16.3)	78 (53.4)	48 (61.5)	28 (58.3)
Never married	56 (16.2)	32 (57.1)	18 (56.3)	8 (44.4)
Divorced/Widowed	29 (39.7)	16 (55.2)	13 (81.3)	5 (38.5)
P value	< 0.001	0.891	0.227	0.343
<b>Smoking</b>				
	179 (75.2)	101 (56.4)	63 (62.4)	35 (55.6)
P value	< 0.001	0.077	0.881	0.197
<b>History of DM</b>				
	60 (40.3)	30 (50.0)	16 (53.3)	6 (37.5)
P value	< 0.001	0.884	0.049	0.197
<b>Family history of HTN</b>				
	144 (29.6)	95 (66.0)	65 (68.4)	32 (49.2)
P value	< 0.001	< 0.001	0.439	0.306

\*Data are presented as n (%).

DM, Diabetes mellitus; HTN, Hypertension; CVD, Cardiovascular disease



Table 3. Factors associated with the prevalence, awareness, treatment, and control of hypertension

	Hypertension		Awareness		Treated		Controlled	
	OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value
<b>Institutional position</b>								
Teacher	Reference	0.017		0.393		0.882		0.275
Student	0.2 (0.04-0.78)	0.006	2.4 (0.55-10.42)	0.238	1.3 (0.88-1.93)	0.634	0.6 (0.16-2.08)	0.366
Staff	1.2 (0.63-2.30)	0.918	1.9 (0.79-4.49)	0.266	0.9 (0.28-2.20)	0.675	0.5 (0.11-1.74)	0.117
<b>Age groups (y)</b>								
20-34	Reference	< 0.001		0.363		0.416		0.831
35-49	5.1 (2.42-10.33)	< 0.001	0.9 (0.38-2.26)	0.965	0.7 (0.19-2.73)	0.642	0.8 (0.17-3.88)	0.792
≥ 50	7.3 (3.95-13.48)	< 0.001	0.7 (0.34-1.23)	0.168	1.6 (0.64-4.24)	0.319	1.3 (0.39-4.13)	0.981
Gender (Female)	1.1 (0.67-1.87)	0.870	0.6 (0.34-1.12)	0.111	1.0 (0.41-2.36)	0.932	1.1 (0.36-3.15)	0.875
<b>BMI (kg/m<sup>2</sup>)</b>								
< 25	Reference	< 0.001		0.070		0.310		0.222
25-29	12.1 (4.91-29.23)	< 0.001	1.9 (0.85-4.36)	0.061	1.3 (0.37-4.55)	0.716	0.3 (0.05-2.10)	0.164
≥ 30	10.8 (4.33-27.58)	< 0.001	0.7 (0.34-1.53)	0.632	2.1 (0.82-5.50)	0.120	0.9 (0.24-3.24)	0.674
<b>Education attainment (y)</b>								
< 7	Reference	< 0.001		0.340		0.178		0.081
7-12	0.1 (0.01-0.39)	< 0.001	1.7 (0.27-11.25)	0.681	0.2 (0.05-1.21)	0.291	0.6 (0.11-44)	0.432
12-16	0.1 (0.03-0.79)	< 0.001	0.9 (0.12-5.82)	0.853	0.5 (0.12-2.02)	0.489	3.1 (0.49-19.78)	0.545
16-18	0.1 (0.00-0.24)	< 0.001	0.7 (0.08-4.83)	0.631	0.2 (0.04-0.97)	0.021	0.6 (0.22-1.36)	0.361
>18	0.4 (0.08-2.07)	0.134	2.2 (0.31-16.36)	0.688	0.3 (0.02-0.87)	0.011	0.3 (0.06-1.82)	0.152
<b>Marital status</b>								
Single	Reference	0.004		0.483		0.137		0.116
Married	0.2 (0.08-0.55)	< 0.001	0.7 (0.32-1.37)	0.266	1.5 (0.56-4.27)	0.392	1.9 (0.52-7.02)	0.392
Widowed/Divorced	0.8 (0.42-1.45)	0.572	1.2 (0.47-3.19)	0.822	0.3 (0.06-1.22)	0.078	3.9 (1.05-18.10)	0.044
Smoking	49.9 (26.08-95.67)	< 0.001	3.1 (1.20-7.84)	0.008	0.9 (0.23-3.16)	0.894	7.7 (1.14-52.29)	0.069
History of DM	4.6 (2.07-9.89)	< 0.001	0.8 (0.42-1.78)	0.899	0.3 (0.11-0.86)	0.023	0.3 (0.07-1.75)	0.239
Family history of HTN	3.3 (1.80-6.11)	< 0.001	4.5 (2.31-8.65)	< 0.001	1.9 (0.65-5.43)	0.239	0.4 (0.09-1.83)	0.153
Family history of CVD	1.1 (0.51-2.53)	0.414	1.8 (0.81-3.91)	0.103	0.6 (0.23-1.65)	0.340	1.3 (0.33-5.01)	0.449

BMI, Body mass index; DM, Diabetes mellitus; HTN, Hypertension; CVD, Cardiovascular disease

The odds ratios of the factors potentially associated with the prevalence of hypertension and the level of awareness, treatment, and control of hypertension in the study population are presented in Table 3. Our logistic regression analysis revealed that institutional position, age, BMI, education attainment, smoking status, and history of DM comprised the risk factors most frequently associated with a diagnosis of hypertension. The subjects younger than 35 years or between 35 and 50 years were less likely than those older than 50 years to be hypertensive (OR: 7.3 [95%CI: 3.95–13.48] and OR: 5.1 [95%CI: 2.42–10.33], respectively). The overweight subjects or the normal-weight subjects were less likely than the obese subjects to be hypertensive. A higher level of education was shown to be associated with potential protection against the incidence of hypertension. Among the hypertensive subjects, the smokers and those with a family history of hypertension were more aware of having hypertension than the others (OR: 3.1 [95%CI: 1.20–7.84] and OR: 4.5 [95%CI: 2.31–8.65], correspondingly); among the subjects aware of their hypertension, a minimum of 16 years of education was significantly associated with a higher likelihood of receiving pharmacological treatment for hypertension (OR: 0.2 [95%CI: 0.04–0.97]); and among those treated with antihypertensive drugs, being divorced and widowed was the only significant variable allied to hypertension control (OR: 3.9 [95%CI: 1.05–18.10]).

## Discussion

In Iran, a great many people are state-employed and it seems necessary that the prevalence of hypertension in this population be determined and compared with that in the general population. We conducted the present study on a large representative sample at a state institution using standard protocols and instruments to explore the prevalence, awareness, treatment, and control of hypertension in this population. We found that the prevalence rate of hypertension among the staff, teachers, and students at IUMS was 17.5%. Of these hypertensive individuals, 54.5% were aware of their hypertension, more than half of the aware subjects were taking antihypertensive drug treatment, and almost half of these on-drug patients had an adequately controlled BP. A higher prevalence rate of hypertension was significantly associated with Institutional position, older age, higher BMI, lower education attainment, smoking, and positive history of DM. Obesity and family history of hypertension were significant factors allied to awareness of having hypertension. Institutional position was the only significant factor linked to receiving pharmacological treatment for hypertension. Our findings showed that the prevalence, awareness, treatment, and control of hypertension in our study subjects, who are in frequent contact with health-care and information centers, were far from satisfactory. In our study, with the exception

of age, the other variables associated with hypertension are modifiable. Given that the population pyramid in Iran predicts the aging of the general population in the near future, policy makers should pay sufficient heed to hypertension control.

In a cross-sectional study with a large sample size, aged 35 to 70 years, from 628 communities in 17 countries with different income levels, Chow et al.<sup>19</sup> reported that 40.8% of all the participants had hypertension. Of these hypertensive patients, 46.5% were aware of the diagnosis; 87.5% of those who were aware of their diagnosis were receiving pharmacological treatment; and 32.5% of the on-drug individuals had hypertension control. The authors also showed that the level of awareness, treatment, and control of hypertension was lower in communities with lower incomes. In the years 1999 to 2004, the overall prevalence of hypertension among American adults was 29.3%.<sup>20</sup> The overall prevalence of hypertension was reported to be 27.9% in the Chinese general population<sup>21</sup> and 30.0% among some Chinese state institutional employees.<sup>22</sup> In a survey in Canada, 82% of the individuals who were aware of their hypertension received treatment.<sup>23</sup> In the China National Nutrition and Health Survey of 2002, the rate of awareness of hypertension was 28% with a treatment rate of 78%.<sup>24</sup> In a survey in the United States among all the studied subjects with hypertension, 82% were aware, 79% were on treatment, and 39% controlled their hypertension.<sup>25</sup> In a study in India, 42.8% of the studied women were aware of their hypertension and the treatment rate was 38.6%.<sup>26</sup> Authors in the first nationally representative study in Iran reported that 25% of adults aged between 25 and 64 years had hypertension, 34% were aware of their diagnosis, 25% were taking prescribed medication, and only almost 6% controlled their hypertension.<sup>8</sup> Another national study reported that 40.5% of people with a low socioeconomic status in Iran had hypertension, in contrast to 16.4% of hypertensive patients with a high socioeconomic status.<sup>27</sup> In some other cities of Iran, the prevalence of hypertension is reported to range between 17% and 22%, with different rates of awareness, treatment, and control of hypertension.<sup>5–8</sup> Shirani et al.<sup>8</sup> in their study on the general population of Isfahan reported that the rate of prevalence, awareness, treatment, and control of hypertension was 17.3%, 40.3%, 35.3%, and 9.1%, respectively. In the present study, the prevalence rate of hypertension among the staff, teachers, and students at IUMS was 17.5%, which was lower than most of the rates in other studies both in other Iranian cities and in other countries. The discrepancies between the findings can be explained by the different samples analyzed in the investigations. Whereas the studied subjects in our investigation were state-employed with relatively easy access to the health-care system, the other relevant studies assessed hypertension in general populations. The rate of awareness in our studied subjects was 54.5%, which is lower than that in developed countries and higher than that in developing countries and the general population in Iran.



Moreover, the treatment rate was 62.7% and the rate of controlled hypertension was 32.5%; both of these figures are similar to those in developed countries and higher than those in the general population of Iran. This can be explained by easier access to medical checkups and antihypertensive drugs among the staff, teachers, and students at IUMS in the current study.

The wide variations in the prevalence, awareness, treatment, and control of hypertension in different communities can be explained by dissimilarities in case ascertainment procedures and in protocols for BP evaluation. Nevertheless, what all these findings reveal is that awareness, treatment, and control of hypertension still remains a major challenge the world over. In our study, although the participants were already within the health-care system, the rates of the prevalence, awareness, treatment, and control of hypertension were far from satisfactory. On the other hand, similar to developing countries, in Iran the burden of stroke, end-stage renal disease, and heart failure secondary to hypertension is growing. Consequently, policy makers and health-care providers should seek to improve programs aimed at the prevention, detection, and treatment of hypertension.

Despite the strengths of the present study, and in particular the high response rate and the use of 2 separate BP measurements, the principal limitation is that we measured BP twice at a single visit, whereas the main guidelines<sup>28</sup> recommend that hypertension be defined based on the average of at least 2 or more BP readings taken at 2 or more visits after an initial screening.

## Conclusion

The findings of the present study revealed that the prevalence rate of hypertension among the staff, teachers, and students at IUMS was 17.5%. Of this total, the rate of awareness, treatment, and control of hypertension was 54.5%, 62.7%, and 61.9%, correspondingly. These findings show that the percentage rates of awareness, treatment, and control of hypertension among the hypertensive subjects at IUMS are unacceptable.

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## References

1. Coffman TM. Under pressure: the search for the essential mecha-

2. Myat A, Redwood SR, Qureshi AC, Spertus JA, Williams B. Resistant hypertension. *BMJ* 2012;345:e7473.
3. Kamran A, Azadbakht L, Mahaki B, Sharifrad G. Psychometric testing of an instrument designed to measure nutritional perceptions of hypertensive patients. *J Educ Health Promot* 2014;3:91.
4. Haghdoost AA, Sadeghirad B, Rezazadehkermani M. Epidemiology and heterogeneity of hypertension in Iran: a systematic review. *Arch Iran Med* 2008;11:444-452.
5. Khosravi A, Mehr GK, Kelishadi R, Shirani S, Gharipour M, Tavassoli A, Noori F, Sarrafzadegan N. 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.
6. Shirani S, Gharipour M, Khosravi A, Kelishadi R, Habibi HR, Abdalvand A, Sarrafzadegan N. Gender differences in the prevalence of hypertension in a representative sample of Iranian population: the Isfahan Healthy Heart Program. *Acta Biomed* 2011;82:223-229.
7. Sarrafzadegan N, Gharipour M, Ramezani MA, Rabiei K, Zolfaghar B, Tavassoli AA, Boshtam M, Zarfeshani S, Khosravi A, Yousefi A. Metabolic syndrome and health-related quality of life in Iranian population. *J Res Med Sci* 2011;16:254-261.
8. Esteghamati A, Meysamie A, Khalilzadeh O, Rashidi A, Haghazali M, Asgari F, Kamgar M, Gouya MM, Abbasi M. 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.
9. Shirani S, Kelishadi R, Sarrafzadegan N, Khosravi A, Sadri G, Amani A, Heidari S, Ramezani MA. Awareness, treatment and control of hypertension, dyslipidaemia and diabetes mellitus in an Iranian population: the IHHP study. *East Mediterr Health J* 2009;15:1455-1463.
10. Prince M, Bryce R, Albanese E, Wimo A, Ribeiro W, Ferri CP. The global prevalence of dementia: a systematic review and metaanalysis. *Alzheimers Dement* 2013;9:63-75.e2.
11. 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;34:45-52.
12. Whelton PK, He J, Muntner P. Prevalence, awareness, treatment and control of hypertension in North America, North Africa and Asia. *J Hum Hypertens* 2004;18:545-551.
13. Fallah Z, Qorbani M, Motlagh ME, Heshmat R, Ardalan G, Kelishadi R. Prevalence of prehypertension and hypertension in a nationally representative sample of Iranian children and adolescents: the CASPIAN-IV study. *Int J Prev Med* 2014;5(Suppl 1):S57-64.
14. No authors listed. 1999 World Health Organization-International Society of Hypertension guidelines for the management of hypertension. Guidelines Subcommittee. *J Hypertens* 1999;17:151-183.
15. Hajjar I, Kotchen TA. Trends in prevalence, awareness, treatment, and control of hypertension in the United States, 1988-2000. *JAMA* 2003;290:199-206.
16. Ong KL, Cheung BM, Man YB, Lau CP, Lam KS. Prevalence, awareness, treatment, and control of hypertension among United States adults 1999-2004. *Hypertension* 2007;49:69-75.
17. Cutler JA, Sorlie PD, Wolz M, Thom T, Fields LE, Roccella EJ. Trends in hypertension prevalence, awareness, treatment, and control rates in United States adults between 1988-1994 and 1999-2004. *Hypertension* 2008;52(5):818-827.
18. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL, Jr, Jones DW, Materson BJ, Oparil S, Wright JT, Jr, Roccella EJ; National Heart, Lung, and Blood Institute Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; National High Blood Pressure Education Program Coordinating Committee. The seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA* 2003;289:2560-2572.

19. Chow CK, Teo KK, Rangarajan S, Islam S, Gupta R, Avezum A, Bahonar A, Chifamba J, Dagenais G, Diaz R, Kazmi K, Lanas F, Wei L, Lopez-Jaramillo P, Fanghong L, Ismail NH, Puoane T, Rosengren A, Szuba A, Temizhan A, Wielgosz A, Yusuf R, Yusufali A, McKee M, Liu L, Mony P, Yusuf S; PURE (Prospective Urban Rural Epidemiology) Study investigators. Prevalence, awareness, treatment, and control of hypertension in rural and urban communities in high-, middle-, and low-income countries. *JAMA* 2013;310:959-968.
20. Teo K, Lear S, Islam S, Mony P, Dehghan M, Li W, Rosengren A, Lopez-Jaramillo P, Diaz R, Oliveira G, Miskan M, Rangarajan S, Iqbal R, Ilow R, Puone T, Bahonar A, Gulec S, Darwish EA, Lanas F, Vijaykumar K, Rahman O, Chifamba J, Hou Y, Li N, Yusuf S; PURE Investigators. Prevalence of a healthy lifestyle among individuals with cardiovascular disease in high-, middle- and low-income countries: The Prospective Urban Rural Epidemiology (PURE) study. *JAMA* 2013;309:1613-1621.
21. Zhao XL, Chen J, Cui YL, Wu F, Hu DY. Current status of primary hypertension in China: an epidemiological study of 12 provinces, 1 autonomous regions, and 1 municipality. *Zhonghua Yi Xue Za Zhi* 2006;86:1148-1152.
22. Xu T, Wang Y, Li W, Chen WW, Zhu M, Hu B, Chen T, Liu B. Survey of prevalence, awareness, treatment, and control of hypertension among Chinese governmental and institutional employees in Beijing. *Clin Cardiol* 2010;33:E66-72.
23. Gee ME, Campbell NR, Gwadry-Sridhar F, Nolan RP, Kaczorowski J, Bienek A, Robitaille C, Joffres M, Dai S, Walker RL; Outcomes Research Task Force of the Canadian Hypertension Education Program. Antihypertensive medication use, adherence, stops, and starts in Canadians with hypertension. *Can J Cardiol* 2012;28:383-389.
24. Wu Y, Huxley R, Li L, Anna V, Xie G, Yao C, Woodward M, Li X, Chalmers J, Gao R, Kong L, Yang X; China NNHS Steering Committee; China NNHS Working Group. Prevalence, awareness, treatment, and control of hypertension in China: data from the China National Nutrition and Health Survey 2002. *Circulation* 2008;118:2679-286.
25. Dickson BK, Blackledge J, Hajjar IM. The impact of lifestyle behavior on hypertension awareness, treatment, and control in a southeastern population. *Am J Med Sci* 2006;332:211-215.
26. Gupta R, Pandey RM, Misra A, Agrawal A, Misra P, Dey S, Rao S, Menon VU, Kamalamma N, Vasantha Devi KP, Revathi K, Vikram NK, Sharma V, Guptha S. High prevalence and low awareness, treatment and control of hypertension in Asian Indian women. *J Hum Hypertens* 2012 Oct;26:585-593.
27. Fateh M, Emamian MH, Asgari F, Alami A, Fotouhi A. Socio-economic inequality in hypertension in Iran. *J Hypertens* 2014 Sep;32:1782-1788.
28. Kjeldsen SE, Farsang C, Sleigh P, Mancia G; World Health Organization; International Society of Hypertension. 1999 WHO/ISH hypertension guidelines--highlights and esh update. *J Hypertens* 2001;19:2285-2288.