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# Hypertension prevalence, awareness, treatment and its correlates among people 35 years and older: Result from pilot phase of the Azar cohort study

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## Abstract:

**BACKGROUND AND OBJECTIVE:** There is remarkable alteration in hypertension prevalence and awareness, and their correlates among various geographic locations and ethnic groups. The aim of this study was to report hypertension prevalence, awareness, and its correlates as well as hypertension treatment, and control among Azari people aged 35 years and older.

**MATERIALS AND METHODS:** The pilot phase of the Azar Cohort Study; a state level of a nationwide PERSIAN cohort study was conducted in Khameneh city between October 2014 and January 2015. All people 35 years of age and above were invited to take part in this study. A comprehensive range of different biomarkers, lifestyle, socioeconomic factors, and health-related factors was collected. Blood pressure was measured by a trained nurse/midwife. Descriptive statistical methods were used to present general characteristics of the study population as frequency tables. Separate multiple logistic regression models were built to assess the predictors of hypertension prevalence.

**RESULTS:** A total of 1038 people were included in this study. The overall prevalence of hypertension was 22.9%. Awareness of hypertension was 60.5% and in those with known hypertension, 84% were using the antihypertensive medications, of those 68.5% had controlled hypertension. After adjustment; age (odds ratios [OR]<sub>adj</sub> = 1.12 95% confidence interval [CI]: 1.09–1.15), gender (OR<sub>adj</sub> = 1.65 95% CI: 1.08–2.51), obesity OR<sub>adj</sub> = 2.51 (1.40–4.88), waist-to-hip ratio (WHR) (OR<sub>adj</sub> = 1.70 (1.05–2.75), and comorbidities (OR<sub>adj</sub> = 2.51 (1.72–3.66) were independent predictors of hypertension.

**CONCLUSION:** Age, sex, body mass index, WHR, and comorbidities were known as predictors of hypertension in this study, health promotion strategies including lifestyle modification to reduce overweight/obesity and secondary prevention programs for early detection of hypertension in high-risk groups according to age, gender, and disease profile are recommended.

## Keywords:

Awareness, control, PERSIAN cohort, hypertension, prevalence, treatment

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## Introduction

Noncommunicable diseases account for 76% of deaths in Iran and this number is on the rise. Many risk factors associated with noncommunicable diseases are preventable by lifestyle modification.<sup>[1]</sup> Cardiovascular

diseases (CVDs) are the main leading cause of death globally and it is estimated that more than 17 million people die each year. Unfortunately, more than three-quarter of death occurs in low- and middle-income countries where there is no adequate health-care budget to organize prevention

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strategies. In addition, social and economic consequences of CVDs are considerable in these countries.<sup>[2]</sup>

Evidence shows that lifestyle modification such as tobacco cessation, maintain a healthy weight, healthy diet (e.g. adequate consumption of fruit and vegetable, limit sodium intake), sufficient physical activity (PA), lead to a remarkable reduction in the incidence of these diseases.<sup>[3,4]</sup>

Hypertension has been recognized as major risk factors for CVD and mortality.<sup>[5]</sup> It is a global public health concern; it is estimated that approximately 970 million people have hypertension globally mainly living in developing countries. Complication of hypertension accounts for more than 9.4 million deaths annually worldwide.<sup>[6,7]</sup>

Despite progress in increasing detection, awareness, treatment, and control of hypertension many hypertensive people remain undiagnosed for many years. For example, in a study among American's, the prevalence and diagnosis rate of hypertension were 28.7% and 62.9%, respectively.<sup>[8]</sup> In addition, 50%–75% of hypertensive people do not have adequate control of their blood pressure (BP).<sup>[9]</sup>

Consequently, uncontrolled hypertension is the major leading cause of cardiovascular morbidity and mortality.<sup>[10]</sup> Therefore, early detection of hypertension is very important to limit its more cost negative health impact.<sup>[11]</sup> There is a geographical and ethnical variation in hypertension prevalence, awareness, and control.<sup>[12,13]</sup>

In Iran based on the results of a recent systematic review, the overall prevalence of hypertension was 22.1%.<sup>[14]</sup> Hypertension prevalence, treatment, and control have been reported to be varied by geographic location and ethnicity in Iran.<sup>[15]</sup> Results of Golestan cohort study in Northeast of Iran including Turkmen people showed about 42% prevalence of hypertension, hypertension awareness was less among men, and only one-third of treated people had controlled hypertension.<sup>[16]</sup> A national household study in Iran showed that only 34% of people with hypertension were aware of their disease.<sup>[16]</sup> The higher rate of awareness has been reported from large cities such as Tehran and Isfahan (44% and 50%).<sup>[17,18]</sup>

The first step in planning and policy making for the intervention and modification of risk factors of CVDs, such as hypertension in a community, is to determine the prevalence of risk factors in the population. Regarding the importance of hypertension as one of the most important risk factors for CVDs, which is the leading cause of noncommunicable diseases.<sup>[19]</sup> The aim of this study was to investigate hypertension prevalence, awareness, treatment, control and its correlates among Azari people aged

35 years and older in the northwest of Iran participating in the pilot phase of Azar cohort study; a state level of a nationwide cohort study (PERSIAN)<sup>[1]</sup>

## Materials and Methods

The Azar cohort study is a state-level of a nationwide cohort study entitled "Persian Cohort Study" in Iran that has been launched in October 2014 in different geographically regions of Iran mainly aiming to assess a comprehensive range of different biomarkers, lifestyle, socioeconomic factors, and health-related factors of common noncommunicable diseases among Iranian adults. Its methods are described in detail elsewhere.<sup>[1]</sup>

The Azar cohort study has been conducted in Shabestar; a county located in East Azerbaijan province by Tabriz University of Medical Sciences. All people 35–70 years of age are invited to take part in this study if they meet the inclusion criteria (permanent resident of this city, the ability to respond to the questions, Iranian originality). Up to 20,000 people will be recruited in this study which will be sufficient sample for the main outcomes of interest such as CVD, diabetes, and so on. The pilot phase of the Azar cohort study was conducted in Khameneh, one of the cities of the Shabestar County between October 2014 and January 2015.

For the pilot study, all residents of the Khameneh city who were 35-years-old and over were invited by phone to participate in this cohort study. Eligible people were invited to visit the Azar cohort center for the assessment. Information related to demographic, socioeconomic, lifestyle factors, diet, and medical history of diseases was collected through an electronic questionnaire by trained interviewers. Blood, hair, nail, and urine samples were collected from participants for biobank.

Anthropometric measures, including height, weight, hip, and waist circumference, were measured using standard methods by trained staff. To measure the weight of individuals, they were asked to stand on calibrated weighing scales then it was measured with a minimum of clothes and without weighing devices, such as a cellphone or a bag. To measure the height correctly, the participants were asked to stand straight without shoes and hat. Waist circumference was measured on standing participants the middle range between the last rib and the pelvic bone with the minimum of clothing and hip was measured the maximum position with a precision of 0.1 cm. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared and classified into normal BMI ( $18.5 \leq \text{BMI} < 25$ ), overweight (BMI  $\geq 25$ –29.9), and obese (BMI  $\geq 30$ ). Waist-to-hip ratio (WHR) measured for all participants

and WHR  $\geq 0.9$  among men and more or equal than 0.8 for female considered as central obesity.<sup>[20,21]</sup>

BP was measured by a trained nurse/midwife using a Riestter sphygmomanometer-Germany. BP was measured after the participant had rested in a seated position for 15 min using standardized method with cuff size adjusted to arm circumference. The cuff was placed on the arm at the level of the heart. BP was recorded twice, with an approximately 10 min interval for each arm. BP reported as the mean of two measurements taken. Study participants were classified into three groups based on their BP; normal BP (systolic BP [SBP]  $< 120$  mmHg and diastolic BP [DBP]  $< 80$  mmHg), prehypertensive (SBP  $\geq 120$  mmHg but  $< 140$  mmHg or DBP  $\geq 80$  mmHg but  $< 90$  mmHg), and hypertensive (SBP  $\geq 140$  mmHg and/or DBP  $\geq 90$  mmHg and/or self-reported use of antihypertensive medication).

For measuring PA, a questionnaire consists of 23 items based on different activities from sleep/rest to high-intensity activities. The psychometric evaluation of this scale has been reported elsewhere.<sup>[22]</sup> Participants were asked to report their total number of hours spend on their different activities which should be equal 24 h. Examples of activities were given for each category of PA. Then, a PA index (PAI) was generated based on the reported hours in each activity category multiply to the metabolic equivalent task units set for each activity intensity category. Total PA (measured by the PAI) was categorized into quartiles of 18.85–33.08, 33.09–35.25, 35.26–38.13, and 38.14–86.05 MET-hours/day.<sup>[22,23]</sup>

At the time of data gathering, 5 ml blood sample was collected from all participants (1038 samples) by two trained nurses. Lipid profile, including total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), and triacylglycerol, was measured by autoanalyzer. TC  $\geq 200$  mg/dl, triglyceride  $\geq 150$  mg/dl, and low-density lipoprotein  $\geq 130$  mg/dl classified as increased level of plasma lipids. HDL  $\leq 40$  mg/dl for males and  $\leq 50$  mg/dl for females defines as the abnormal level of plasma HDL-C.<sup>[24]</sup>

Comorbidities such as CVDs, thyroid diseases, musculoskeletal disorders, chronic respiratory diseases, cancer, diabetes, chronic renal disease, and psychological disorders were assessed by self-report and/or physical examination and paraclinical results.

Descriptive statistical methods were used to present general characteristics of the study population as frequency tables. Separate multiple logistic regression models were built for each of the dependent variables. Two models were run for each outcome: the first was adjusted for age and sex only, while the second (fully adjusted)

model included age, sex, educational level, marital status, PA, smoking, comorbidities, hyperlipidemia, WHR, and BMI.

Crude and adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were estimated. Unless otherwise indicated, aORs from the fully adjusted models are reported in the text. All analyses were performed using the STATA statistical package Version 14.

## Results

All residents of the Khameneh city who were 35-year-old and over (1236) were invited by phone to participate in this cohort study. A total of 1038 people were included in the pilot phase (952 people 35–70 and 86 people 70+ with the average participation rate of 82%) of Azar cohort study. More than half 569 (55%) were female and 465 (45%) were male. The mean age was  $52.41 \pm 11.67$  years. About 40% of participants were overweight, and 32% of them were obese. Most of the participants (88.1%) were married. A total of 393 (37.86%) people had at least one disease and around of 18% of them were smokers [Table 1].

The mean SBP was  $107.23 \pm 0.52$  standard deviation [SD]. It increased in each 5-year age group from 99.46 in those aged 35–49 to 120.91 in those aged 65+. The mean DBP was  $67.69 \pm 0.27$  SD for those aged 35 years and older. DBP increased overall from 65.62 in the youngest age group to 69.60 in the oldest group [Figure 1].

The overall prevalence of hypertension was 22.9%, this increased as age increased from 4.8% in the younger age group to 55.5 in the oldest group ( $P < 0.001$ ). Hypertension prevalence was higher in women than in men (25.8 vs. 18.7,  $P = 0.006$ ) [Table 2].

Awareness of hypertension was 60.5% (63.64% in men and 57.9% in women), it was highest among participants aged 64+ and lowest among those in the age group 45–54 years of age (67% vs. 38.5%, respectively). Illiterate participants had a lower percentage of awareness compared to other with a different level of education. Those with at least one other medical condition had the higher percentage of hypertension awareness compared to those without any other medical condition (71% illiterate/primary vs. 48.5%). In those with known hypertension, 84% were using the antihypertensive medications, of those 68.5% had controlled hypertension. Controlled hypertension was more frequent in the age group 45–64 years of age (84.9%), and younger and older participants had a lower percentage of controlled hypertension (60% among age group 35–44 and 30% among 65+). The frequency of controlled hypertension was lower among obese participants compared to others.

**Table 1: Demographic, socioeconomic, and health-related factors of study participants**

Variables	Frequency, n (%)
Age groups (years)	
35-44	273 (26.40)
45-54	390 (37.72)
55-64	216 (20.89)
>64	155 (14.99)
Sex	
Male	465 (44.97)
Female	569 (55.03)
Marital status	
Married	912 (88.12)
Single/divorced/widow	123 (11.88)
Educational level	
Illiterate and elementary	399 (38.59)
Secondary and high school	373 (36.07)
University	262 (25.34)
BMI (kg/m <sup>2</sup> )	
Normal	288 (28.02)
Overweight	411 (39.98)
Obese	329 (32.00)
WHR	
Normal	398 (41.98)
Abnormal	550 (58.02)
Hypercholesterolemia (yes)	347 (33.82)
Hypertriglyceridemia (yes)	601 (58.63)
LDL (abnormal)	205 (21.13)
HDL (abnormal)	421 (40.72)
Comorbidity (yes)	393 (37.86)
Smoking (yes)	161 (17.11)
Physical activity (MET-time)	
18.85-33.08	240 (25.29)
33.09-35.25	235 (24.76)
35.26-38.13	239 (25.18)
38.14-86.05	235 (24.76)

WHR=Waist-to-hip ratio, LDL=Low-density lipoprotein, HDL=High-density lipoprotein, MET=Metabolic equivalent task, BMI=Body mass index

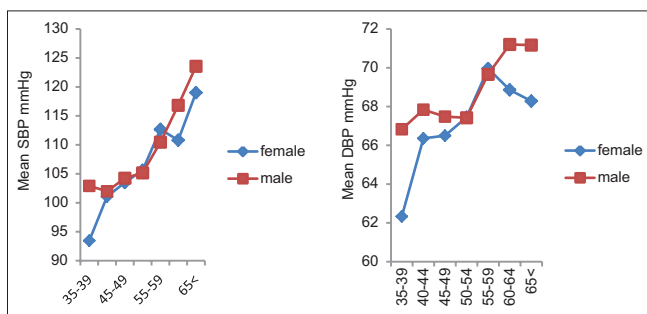


Figure 1: Distribution of weighted mean systolic blood pressure and diastolic blood pressure in the adult population in Khameneh aged 35 years and older by age group and sex

In logistic regression model, in model 1-crude, ORs were calculated, and the results showed that there was a range of factors associated significantly with including age, sex, marital status, education, BMI, WHR, hypertriglyceridemia, and comorbidities. However, after

controlling for other covariates in the final model, age was significantly associated with the higher prevalence of hypertension (OR<sub>adj</sub> = 1.12 95% CI: 1.09–1.15). The prevalence of hypertension was higher among women than men (OR<sub>adj</sub> = 1.65 95% CI: 1.08–2.51). Being overweight and obese were significantly associated with higher prevalence of hypertension OR<sub>adj</sub> = 2.05 (1.14–3.71) and OR<sub>adj</sub> = 2.51 (1.40–4.88), respectively. WHR was also another related factor (OR<sub>adj</sub> = 1.70 (1.05–2.75). Those with comorbidities had a higher prevalence of hypertension (OR<sub>adj</sub> = 2.51 (1.72–3.66) [Table 3].

The association between marital status and educational level was attenuated after adjustment for age and sex. However, the association between hypertriglyceridemia and hypertension remained significant in model 2 [Table 3].

## Discussion

The aim of this study was to report hypertension prevalence, awareness, treatment, and control among Azari people aged 35 years and older in the northwest of Iran participating in the pilot phase of Azar Cohort Study.

The overall prevalence of hypertension was 23% which was higher in older age group (55.5% in participants >65 years of age). There is a variation in the prevalence of hypertension in the world according to the latest report. In 2010, the prevalence of hypertension in high-income countries was 28.5% (27.3%–29.7%) and 31.5% (30.2%–32.9%) in low- and middle-income countries.<sup>[25]</sup>

The overall prevalence of hypertension also varies in different regions of Iran. In a systematic review published in 2008, in Iran.<sup>[14]</sup> The overall prevalence of hypertension in adults in age groups of 30–55 and >55-year-old were around 23% and 50%, respectively. The prevalence of hypertension in our study among participants aged 35–54 years of age (10.4%) was lower than the national estimates. Malekzadeh *et al.* in 2013 reported the overall estimates of 42.7% from the Golestan cohort participants.<sup>[16]</sup> In 2015, a report from southwestern of Iran revealed a prevalence of 17.6%.<sup>[26]</sup> The results of a study in Zanjan province revealed a prevalence of 27.8%.<sup>[27]</sup> These differences in the prevalence of hypertension might be explained by differences in age and ethnicity of these studies.

The prevalence of hypertension was higher among women than men, similar results were reported by other studies.<sup>[14,17,28]</sup> The mean SBP was (107.23 ± 0.52 SD) which increased as the age increased and there was no difference between men and women. Moreover, the mean DBP was (67.69 ± 0.27 SD). It was similar to the other



**Table 2: Sociodemographic, health behavior, and biological characteristics of study participants, by hypertension stages**

Variables	Normotensive, n (%)	Known HTN**, n (%)	Unknown HTN	
			Pre-HTN, n (%)	HTN*, n (%)
Age groups (years)				
35-44	220 (81.18)	10 (3.69)	38 (14.02)	3 (1.11)
45-54	269 (65.15)	47 (12.08)	65 (16.71)	8 (2.06)
55-64	95 (43.39)	71 (33.18)	41 (19.16)	7 (3.27)
>65	39 (25.66)	76 (50.00)	27 (17.76)	10 (6.58)
Sex				
Male	277 (60.09)	74 (16.05)	98 (21.26)	12 (2.60)
Female	346 (61.24)	130 (23.01)	73 (12.92)	16 (2.83)
Marital status				
Married	572 (63.13)	160 (17.66)	152 (16.78)	22 (2.43)
Single/divorced/widow	50 (41.32)	46 (38.02)	19 (15.70)	6 (4.96)
Educational level				
Illiterate and elementary	201 (50.76)	105 (26.52)	73 (18.43)	17 (4.29)
Secondary and high school	245 (66.04)	62 (16.71)	58 (15.63)	6 (1.62)
University	177 (68.34)	37 (14.29)	40 (15.44)	5 (1.93)
BMI (kg/m <sup>2</sup> )				
Normal	199 (70.32)	35 (12.37)	43 (15.19)	6 (2.12)
Overweight	252 (61.95)	75 (18.43)	69 (16.95)	11 (2.70)
Obese	167 (51.23)	91 (27.91)	57 (17.48)	11 (3.37)
WHR				
Normal	300 (75.94)	27 (6.84)	62 (15.52)	6 (1.52)
Abnormal	302 (56.03)	130 (24.12)	92 (17.07)	15 (2.78)
Hypercholesterolemia				
Yes	193 (55.78)	68 (19.65)	75 (21.68)	10 (2.65)
No	428 (63.13)	136 (20.06)	96 (14.16)	18 (2.89)
Hypertriglyceridemia				
Yes	232 (54.85)	101 (23.88)	80 (18.91)	10 (2.36)
No	388 (64.67)	103 (17.17)	91 (15.17)	18 (3.00)
LDL				
Normal	487 (63.74)	149 (19.50)	111 (14.53)	17 (2.23)
Abnormal	100 (48.78)	44 (21.46)	53 (25.85)	8 (3.90)
HDL				
Normal	391 (64.42)	99 (16.31)	100 (16.47)	17 (2.80)
Abnormal	232 (55.37)	105 (25.06)	71 (16.95)	11 (2.63)
Comorbidity				
0	435 (68.29)	71 (11.15)	114 (17.90)	17 (2.67)
1	188 (47.84)	137 (34.86)	57 (14.50)	11 (2.80)
Smoking				
No	407 (64.20)	102 (16.09)	109 (17.19)	16 (2.52)
Yes	199 (65.03)	55 (17.97)	47 (15.36)	5 (1.63)
Physical activity (MET-time)				
18.85-33.08	144 (60.50)	49 (20.59)	41 (17.23)	4 (2.59)
33.09-35.25	155 (66.52)	35 (15.02)	38 (16.31)	5 (2.15)
35.26-38.13	146 (61.34)	40 (16.81)	44 (18.49)	8 (3.36)
38.14-86.05	161 (69.40)	34 (14.66)	33 (14.22)	4 (1.72)

\*\*Participants who have been diagnosed previously with high BP or who were already taking treatment, \*BP  $\geq$  140/90 in participants who have not been diagnosed previously with the high BP and who were not taking treatment. WHR=Waist-to-hip ratio, HDL=High-density lipoprotein, MET=Metabolic equivalent task, BMI=Body mass index, HTN=Hypertension, LDL=Low-density lipoprotein, BP=Blood pressure

studies.<sup>[14,17,29]</sup> The pattern of DBP was different among men and women; it increased sharply among women as the age increase and reached to the highest level in the age group 55–59 years of age, then dropped. However, among men, it increased as age increased and barely decreased in oldest age group. The same results were

reported by Haghdoost *et al.*<sup>[14]</sup> However, in the Irish study,<sup>[29]</sup> DBP decreased overall as the age increased with little changes among women.

Awareness of hypertension was about 61% which was similar to the level of awareness found among adults

**Table 3: Logistic regression models for factors associated with hypertension among study participants**

Variables/ORs	OR <sub>1</sub> (95% CI)	P	OR <sub>2</sub> (95% CI)	P	OR <sub>3</sub> (95% CI)	P
Age (years)	1.09 (1.07-1.10)	<0.0001	1.10 (1.08-1.12)	0.000	1.12 (1.09-1.15)	0.000
Sex (reference male)						
Female	1.51 (1.12-2.04)	0.007	1.93 (1.35-2.76)	0.000	1.65 (1.08-2.51)	0.02
Marital status (reference married)						
Single	2.89 (1.95-4.29)	0.000	0.65 (0.38-1.11)	0.12	0.82 (0.42-1.62)	0.57
Educational level (reference illiterate)						
Secondary and high school	1.21 (0.79-1.84)	0.37	1.35 (0.86-2.12)	0.18	1.26 (0.77-2.06)	0.35
Illiterate and elementary	2.30 (1.55-3.41)	0.000	1.08 (0.68-1.70)	0.72	1.09 (0.66-1.79)	0.72
BMI (kg/m <sup>2</sup> ) (reference normal)						
Overweight	1.59 (1.05-2.39)	0.02	2.79 (1.71-4.55)	0.000	2.05 (1.14-3.71)	0.01
Obese	2.70 (1.80-4.04)	0.000	3.95 (2.40-6.50)	0.000	2.51 (1.40-4.88)	0.002
WHR (reference normal)						
Abnormal	4.09 (2.73-6.13)	0.000	2.56 (1.65-3.95)	0.000	1.70 (1.05-2.75)	0.02
Hypercholesterolemia (reference normal)	0.99 (0.73-1.35)	0.98	0.83 (0.59-1.19)	0.32	0.77 (0.51-1.16)	0.22
Hypertriglyceridemia (reference normal)	1.37 (1.02-1.84)	0.03	1.66 (1.18-2.32)	0.003	1.37 (0.93-2.03)	0.10
Smoking/yes (reference no)	1.07 (0.76-1.51)	0.67	1.15 (0.79-1.68)	0.44	1.29 (0.87-1.93)	0.20
Physical activity (MET-time) (reference 18.85-33.08)						
33.09-35.25	0.72 (0.46-1.14)	0.17	0.75 (0.46-1.24)	0.27	0.86 (0.51-1.45)	0.56
35.26-38.13	0.86 (0.55-1.34)	0.51	1.01 (0.62-1.65)	0.95	1.18 (0.70-1.99)	0.51
38.14-86.05	0.66 (0.41-1.05)	0.08	0.71 (0.42-1.19)	0.19	0.82 (0.47-1.41)	0.47
Comorbidity (yes) (reference no)	3.52 (2.75-5.03)	0.000	2.92 (2.09-4.09)	0.000	2.51 (1.72-3.66)	0.000

OR<sub>1</sub>=Crude OR, OR<sub>2</sub>=Adjusted for age, sex, educational level, marital status, OR<sub>3</sub>=Adjusted for age, sex, educational, marital status, physical activity, comorbidity, hypertriglyceridemia, hypercholesterolemia, WHR, and BMI, CI=Confidence interval, ORs=Odds ratios, WHR=Waist-to-hip ratio, MET=Metabolic equivalent task, BMI=Body mass index

aged 35–84 years in the USA (86%) and England (64%).<sup>[30]</sup> It was higher than that reported from low-middle income countries (37.9%)<sup>[25]</sup> and a study by Malekzadeh *et al.* based on the results of the Golestan Cohort Study which the awareness was 46.2%.<sup>[16]</sup> This might be due to the higher education level of our participants compared to the Golestan Cohort Study. Older age group, those with higher education level and those who had at least one other medical conditions had a higher percentage of awareness which is in line with other studies.<sup>[31]</sup>

In this study, the majority of those who were aware of their hypertension were receiving treatment (84%) and 68.5% of them had controlled hypertension. This was higher than a result of a recent collaborative multinational study including different countries that reported 32.5%<sup>[32]</sup> and was similar to another report from developed countries.<sup>[33]</sup> Uncontrolled hypertension was higher among older age group and obese participants which were in line with other studies.<sup>[34,35]</sup> The high awareness and controlled hypertension might also be explained by the regular follow-up by health centers. In Iran, management of diabetes and hypertension have been a part of the primary health care which are provided by health centers and in rural areas, and small cities have a high coverage, and it has been reported to be an effective program.<sup>[36]</sup>

After adjustment for other variables age, gender, BMI, WHR, and comorbidity were the predictors of hypertension in this study. There are many studies confirmed the relationship between age and gender

with hypertension.<sup>[14,18,27,29]</sup> The association between BMI and hypertension is also mentioned in other studies,<sup>[37]</sup> comorbidity as the significant predictor of hypertension reported in many studies,<sup>[29,38]</sup> this might be partially explained by the higher contact of those with comorbidity with health-care system.

The current study was a population-based study, and participants were more educated than other studies in Iran; therefore, the percentage of awareness and controlled hypertension were higher in this population. Despite its strengths, this study has a limitation. Those (18% of the population) who were not participated in this study might be different with the current participants in terms of the prevalence of hypertension, awareness, and control and also the related factors. At the time of this study, we were not able to obtain the characteristics of nonparticipant people; therefore, further research might be needed to include this group of people to reach a better conclusion.

## Conclusion

Results of this study showed a prevalence of 23% for hypertension, and the awareness was higher than other studies in Iran or developing countries. This might be explained by the difference in the education level of the study participants. Age, sex, BMI, WHR, and comorbidities were known as predictors of hypertension in this study, health promotion strategies including healthy lifestyle modification to reduce overweight/

obesity and also secondary prevention programs for early detection of hypertension in high-risk groups according to age, gender, and disease profile is recommended.

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### Conflicts of interest

There are no conflicts of interest to report.

### References

1. Poustchi H, Eghtesad S, Kamangar F, Etemadi A, Keshtkar AA, Hekmatdoost A, *et al.* Prospective epidemiological research studies in irAN (The PERSIAN cohort): Rationale, objectives and design. *Am J Epidemiol* 2017.
2. Braunwald E, Hollenberg NK. Atlas of Hypertension. California USA: Springer Science & Business Media; 2012.
3. Eyre H, Kahn R, Robertson RM, Clark NG, Doyle C, Hong Y, *et al.* Preventing cancer, cardiovascular disease, and diabetes: A common agenda for the American Cancer Society, the American Diabetes Association, and the American Heart Association. *Stroke* 2004;35:1999-2010.
4. Willett WC, Koplan JP, Nugent R, Dusenbury C, Puska P, Gaziano TA. Prevention of chronic disease by means of diet and lifestyle changes. In: Jamison DT, Breman JG, Measham AR, Alleyne G, Claeson M, Evans DB, *et al.*, editors. Disease Control Priorities in Developing Countries. Washington (DC): World Bank The International Bank for Reconstruction and Development/The World Bank Group; 2006.
5. Pickering GW. The natural history of hypertension. *Br Med Bull* 1952;8:305-9.
6. World Health Organization. A Global Brief on Hypertension: Silent Killer, Global Public Health Crisis. Geneva, Switzerland:World Health Organization; 2013.
7. Bromfield S, Muntner P. High blood pressure: The leading global burden of disease risk factor and the need for worldwide prevention programs. *Curr Hypertens Rep* 2013;15:134-6.
8. Banerjee D, Chung S, Wong EC, Wang EJ, Stafford RS, Palaniappan LP, *et al.* Underdiagnosis of hypertension using electronic health records. *Am J Hypertens* 2012;25:97-102.
9. Rocella EJ, Burt V, Horan MJ, Cutler J. Changes in hypertension awareness, treatment, and control rates 20-year trend data. *Ann Epidemiol* 1993;3:547-9.
10. Wang TJ, Vasan RS. Epidemiology of uncontrolled hypertension in the United States. *Circulation* 2005;112:1651-62.
11. Arredondo A. Hospitalization costs associated with hypertension as a secondary diagnosis. *Am J Hypertens* 2010;23:224.
12. Reynolds K, Gu D, Muntner P, Wu X, Chen J, Huang G, *et al.* Geographic variations in the prevalence, awareness, treatment and control of hypertension in China. *J Hypertens* 2003;21:1273-81.
13. Zhao B, Jose PO, Pu J, Chung S, Ancheta IB, Fortmann SP, *et al.* Racial/ethnic differences in hypertension prevalence, treatment, and control for outpatients in Northern California 2010-2012. *Am J Hypertens* 2015;28:631-9.
14. Haghdoost AA, Sadeghirad B, Rezazadehkermani M. Epidemiology and heterogeneity of hypertension in Iran: A systematic review. *Arch Iran Med* 2008;11:444-52.
15. Ebrahimi M, Mansournia MA, Haghdoost AA, Abazari A, Alaeddini F, Mirzazadeh A, *et al.* Social disparities in prevalence, treatment and control of hypertension in Iran: Second national surveillance of risk factors of noncommunicable diseases, 2006. *J Hypertens* 2010;28:1620-9.
16. Malekzadeh MM, Etemadi A, Kamangar F, Khademi H, Golozar A, Islami F, *et al.* Prevalence, awareness and risk factors of hypertension in a large cohort of Iranian adult population. *J Hypertens* 2013;31:1364-71.
17. Sarraf-Zadegan N, Boshtam M, Mostafavi S, Rafiei M. Prevalence of hypertension and associated risk factors in Isfahan, Islamic republic of Iran. *East Mediterr Health J* 1999;5:992-1001.
18. Azizi F, Ghanbarian A, Madjid M, Rahmani M. Distribution of blood pressure and prevalence of hypertension in Tehran adult population: Tehran lipid and glucose study (TLGS), 1999-2000. *J Hum Hypertens* 2002;16:305-12.
19. Ghorbani R, Askandarian R, Malek M, Rashidy-Pour A. Prevalence of hypertension among the adult population of Semnan province. *Iran J Endocrinol Metab* 2009;10 (5)498-503.
20. Physical Status. The Use and Interpretation of Anthropometry. Technical Report 854. Geneva: WHO; 1995.
21. World Health Organization. Waist Circumference and Waist-Hip Ratio: Report of a WHO Expert Consultation. 8-11 December, 2008. Geneva: World Health Organization; 2011.
22. Mirzaei M, Asghari-Jafarabadi M, Amini-Sani N, Bakhtari-Aghdam F, Dastgiri S. Psychometric evaluation of a self-reported physical activity questionnaire used in the pilot phase of the AZAR cohort study. *Health Promot Perspect* 2016;6:152-8.
23. Aadahl M, Jørgensen T. Validation of a new self-report instrument for measuring physical activity. *Med Sci Sports Exerc* 2003;35:1196-202.
24. Jellinger PS, Smith DA, Mehta AE, Ganda O, Handelsman Y, Rodbard HW, *et al.* American association of clinical endocrinologists' guidelines for management of dyslipidemia and prevention of atherosclerosis: Executive summary. *Endocr Pract* 2012;18:269-93.
25. Mills KT, Bundy JD, Kelly TN, Reed JE, Kearney PM, Reynolds K, *et al.* Global disparities of hypertension prevalence and control: A Systematic analysis of population-based studies from 90 countries. *Circulation* 2016;134:441-50.
26. Yazdanpanah L, Shahbazian H, Shahbazian H, Latifi SM. Prevalence, awareness and risk factors of hypertension in Southwest of Iran. *J Renal Inj Prev.* 2015;4(2):51-6.
27. Kassaei SA, Valizadeh M, Sokhanvar S, MakoieMD RH. Hypertension awareness, treatment, control and prevalence in Zanjan province, Iran. 2010; 11(1):10-16.
28. Shirani S, Gharipour M, Khosravi A, Kelishadi R, Habibi HR, Abdalvand A, *et al.* Gender differences in the prevalence of hypertension in a representative sample of Iranian population: The Isfahan healthy heart program. *Acta Biomed* 2011;82:223-9.
29. Murphy CM, Kearney PM, Shelley EB, Fahey T, Dooley C, Kenny RA, *et al.* Hypertension prevalence, awareness, treatment and control in the over 50s in Ireland: Evidence from the Irish longitudinal study on ageing. *J Public Health (Oxf)* 2016;38:450-8.
30. Ikeda N, Sapienza D, Guerrero R, Aekplakorn W, Naghavi M, Mokdad AH, *et al.* Control of hypertension with medication: A comparative analysis of national surveys in 20 countries. *Bull*

- World Health Organ 2014;92:10-9C.
31. Musinguzi G, Nuwaha F. Prevalence, awareness and control of hypertension in Uganda. *PLoS One* 2013;8:e62236.
  32. Chow CK, Teo KK, Rangarajan S, Islam S, Gupta R, Avezum A, *et al.* Prevalence, awareness, treatment, and control of hypertension in rural and urban communities in high-, middle-, and low-income countries. *JAMA* 2013;310:959-68.
  33. Joffres M, Falaschetti E, Gillespie C, Robitaille C, Loustalot F, Poulter N, *et al.* Hypertension prevalence, awareness, treatment and control in national surveys from England, the USA and Canada, and correlation with stroke and ischaemic heart disease mortality: A cross-sectional study. *BMJ Open* 2013;3:e003423.
  34. Babiker FA, Elkhalfifa LA, Moukhyer ME. Awareness of hypertension and factors associated with uncontrolled hypertension in Sudanese adults. *Cardiovasc J Afr* 2013;24:208-12.
  35. Wang J, Zhang L, Wang F, Liu L, Wang H; China National Survey of Chronic Kidney Disease Working Group, *et al.* Prevalence, awareness, treatment, and control of hypertension in China: Results from a national survey. *Am J Hypertens* 2014;27:1355-61.
  36. Farzadfar F, Murray CJ, Gakidou E, Bossert T, Namdaritabar H, Alikhani S, *et al.* Effectiveness of diabetes and hypertension management by rural primary health-care workers (Behvarz workers) in Iran: A nationally representative observational study. *Lancet* 2012;379:47-54.
  37. Azizi A, Abasi M, Abdoli G. The prevalence of hypertension and its association with age, sex and BMI in a population being educated using community-based medicine in Kermanshah: 2003. *Iran J Endocrinol Metab* 2008;10:323-9.
  38. Higashi T, Wenger NS, Adams JL, Fung C, Roland M, McGlynn EA, *et al.* Relationship between number of medical conditions and quality of care. *N Engl J Med* 2007;356:2496-504.