Original Article

Awareness, Treatment, and Control of Hypertension among 10663 Adults Based on the Baseline Data of the Kherameh Cohort Study

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Abstract

Background: A comprehensive strategy to reduce the complications of hypertension (HTN) should include prevention approaches, such as increasing awareness, early diagnosis, and adequate treatment. The present study aimed to assess awareness, treatment, and control of HTN and their related factors in Kherameh, Iran.

Methods: This cross-sectional study was performed on 10 663 individuals aged between 40 and 70 years using the Kherameh cohort data. HTN was defined as either systolic/diastolic blood pressure ≥140/90 mmHg or taking medications. Logistic regression was used to investigate the relationship between awareness, treatment, and control of HTN and demographic factors, comorbidities, and a family history of diseases.

Results: Out of 10 663 participants, 4719 (44.3%) were men, and the average age of the participants was 51.94±8.27 years. The rates of the prevalence, awareness, treatment, and control of HTN were 27.7% (95% CI, 26.86 to 28.54), 80.3% (95% CI, 79.56 to 81.04), 78% (95% CI, 77.22 to 78.78), and 53.6% (95% CI, 52.66 to 54.54), respectively. Age, gender, body mass index, and cardiovascular disease were associated with all the dependent variables in the regression model. Additionally, occupation, diabetes, chronic diseases, a history of cardiovascular disease in first and second-degree relatives and a history of chronic diseases in second-degree relatives were related to all the dependent variables except for treatment.

Conclusion: A high percentage of the patients were aware of their disease, but a smaller proportion were on medication. Consequently, about half the patients had blood pressure below 140/90 mmHg.

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Introduction

Hypertension (HTN) is a formidable public health challenge worldwide because of its high prevalence and concomitant risks of cardiovascular and kidney diseases.[1] It is identified as the cause of the third highest disability-

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adjusted life years.[2] HTN is closely related to lifestyle, mental health, and quality of life, similar to most chronic diseases, and if not controlled appropriately, it can cause various issues, including disability, reduced productivity, and ultimately diminished mental health.[3] The number of persons living with HTN is increasing and is projected to have risen to about 1.5 billion by 2025.[4] Many studies have shown that urbanization and adaptation to the Western lifestyle, due to economic growth and changes observed with age, have led to an epidemic of noncommunicable chronic diseases, such as HTN.[5, 6] The prevalence of HTN varies across the world considerably: 43.5% in Malaysia,[7] 23.7% in Sri Lanka,[8] 30% in sub-Saharan Africa,[9] and 26.2% in Iran.[5]

The most notable barrier to HTN diagnosis is the lack of awareness of the disease and its complications.[10] Epidemiological studies have revealed the need for raising awareness of one's HTN status, especially in low and middle-income countries where public awareness of the disease is relatively poor.[11] Moreover, while HTN is a preventable disease, antihypertensive drugs are not used often.[10] In a population-based survey in China, 42.6% of the patients were aware of their HTN status, but 34.1% received antihypertensive treatment.[12] In Vietnam, 48.4% were aware of their elevated blood pressure (BP), 29.6% were under treatment, and 10.7% achieved the targeted BP control.[13] In Iran, 49.6% of the patients were aware, 55.7% were treated, and 69.2% were controlled.[14] According to data from the Tehran Cohort Study (TeCS), among hypertensive individuals, 68.2% were aware of hypertension, 53.3% were receiving medication, and 40.4% had adequate BP control.[15]

Although high BP accounts for 50% of heart disease complications, the rate of stroke (33%) and kidney complications (10%–15%) can be reduced by controlling BP.[16] Therefore, a comprehensive strategy to reduce the complications of HTN, including prevention approaches, such as raising awareness, early diagnosis, adequate treatment, and careful BP control, is necessary.[17] This study aimed to assess awareness, treatment, and control of HTN and their related factors based on the baseline data of the Kherameh cohort study.

Methods

This population-based cross-sectional study extracted the required data from the first phase of the Prospective Epidemiological Research Studies in Iran (PERSIAN) cohort study, conducted in Kherameh city. The logic, goals, and design of the PERSIAN cohort study have already been published.[18] This cohort study was designed and conducted in 2014 and included different geographical, ethnic, and climatic groups in 18 centers in 16 provinces of Iran. One

of these provinces was Fars. Kherameh is a city located in southern Fars province with a population of 61 580 people. The Kherameh cohort is part of a large PERSIAN cohort study.

The present study was performed on all individuals (10 663 persons) in the Kherameh cohort study between 2015 and 2016. The main purpose of the Kherameh cohort study was to determine the prevalence and risk factors of noncommunicable diseases at the beginning and follow-up. The main criteria for entering were age between 40 and 70 years, living in Kherameh, and Iranian nationality. The exclusion criteria were absence in clinics for physical examinations, mental retardation, and unwillingness to participate in the study.

In the Kherameh cohort study, participants were firstly invited by public invitation and subsequently through door-to-door visits specifically. The participants filled out informed consent forms; then, trained staff conducted interviews and collected data. After admission, the participants underwent laboratory and physical examinations, including the measurement of height, weight, waist circumference, and BP. BP was measured after a 10-minute rest in the sitting position using a standard calibrated sphygmomanometer (Riester, Germany). Two consecutive measurements were conducted at 15-minute intervals, and the mean was recorded. The individuals were required not to be active, consume food or fluids, and smoke at least half an hour before the measurement. Weight was measured with minimal coverage and without shoes using a SECA scale (made in Germany) with an accuracy of 100 g. Height was also measured using a measuring tape to the nearest 0.1 cm with light clothing and without shoes. Then, body mass index was calculated by dividing weight by height squared. Furthermore, blood glucose and cholesterol tests were performed with the Mindray device (made in Japan) using Pars Azmoon kits. The individuals were required to fast for 12 hours before sampling and not to smoke or drink alcohol.

Physical activity was assessed using a checklist, which included sports, occupation, and the amount of time spent sleeping and eating during the day. Afterward, the metabolic equivalent task index was computed for each activity. Finally, physical activity was divided into 4 groups based on the quartiles: mild, moderate, high, and severe.

Socioeconomic status was considered to comprise homeownership, home size, number of bathrooms within the house, having cars, price of the cars, domestic and international travels, and owning mobile phones, televisions, vacuum cleaners, washing machines, refrigerators, microwaves, and computers. Instead of the statistical analyses of each component of socioeconomic status, exploratory factor analysis was utilized to generate fewer factors. In order to be able to quantitatively enter the socioeconomic status variable into a regression model,

we assigned a coefficient to each factor and added them together. Factors whose constituent variables were more valuable were given a higher coefficient. Additionally, educational level was classified into 5 categories: illiterate, less than 5 years, 6 to 8 years, high school, and university qualifications. First-degree relatives were considered to encompass fathers, mothers, brothers, sisters, sons, and daughters.

According to the guideline for HTN management in Europe, HTN was defined as systolic BP ≥140 mmHg, diastolic BP ≥90 mmHg, or being under treatment for HTN.[19] Dyslipidemia was defined as high levels of cholesterol (≥200 mg /dL) or serum triglyceride (≥150 mg/ dL). Diabetes was defined as the history of known diabetes or fasting blood sugar ≥126 mg /dL.[20] Moreover, awareness of one's HTN status was regarded as the self-report of a previous diagnosis by the health staff. Finally, treatment was regarded as taking antihypertensive medications, and control was defined as BP <140/90 mmHg in a participant receiving treatment for HTN.

The mean and the standard deviation were used to describe quantitative variables, and frequencies and percentages were employed for qualitative ones. A multiple logistic regression model was utilized to determine the relationship between the factors associated with awareness, treatment, and control of HTN. All tests were 2-tailed at a significance level of 0.05 and were conducted using the SPSS software, version 20.

Results

Out of the 10 663 participants, 4719 (44.3%) were male. Additionally, 4416 participants (41.4%) lived in urban areas, 5516 (51.7%) were employed, and 562 (5.3%) had university qualifications (Table 1). Based on the results of the study conducted in this population,[21] 6656 individuals (62.4%; 95% CI, 61.50 to 63.30) were normotensive, while 2953 individuals (27.7%; 95% CI, 26.86 to 28.54) were hypertensive. The mean of systolic and diastolic BP was, respectively, 105.81±10 mmHg and 67.83±7.45 mmHg in the healthy participants and 131.93±20 mmHg and 80.22±11.98 mmHg in the patients.

Among the participants with HTN, 2374 (80.3%) were aware of their disease, and 2304 (97%) of them underwent treatment (78% of all the patients). In addition, 1584 individuals taking antihypertensive drugs (68.7%) had achieved BP control (53.6% of all patients) (Figure 1).

Among the participants who were aware of their disease, 720 (30.3%) had abnormal BP despite taking medications. On the other hand, 70 individuals (2.9%) did not take medications and had abnormal BP (Figure 2).

The results of the multivariate logistic model have been summarized in Table 2. Briefly, the female gender had

higher odds for higher awareness of one's HTN status than the male gender (OR, 1.30, P=0.002) and was associated with better treatment (OR, 2.57, P=0.017) and control (OR, 1.37, P=0.001).

Table 1. Demographic characteristics of the Kherameh population

| Variable	Participants, 10663 (100%)	HTN, 2953 (27.7%)	P
Sex			<0.001
Male	4719 (44.3)	961 (23.2)	
Female	5944 (55.7)	1992 (36.4)	
Age (y)			<0.001
40-49	4639 (43.5)	919 (21.7)	
50-59	3759 (35.3)	1119 (33.4)	
+60	2218 (20.8)	905 (45.9)	
Living Place			0.336
Urban	4416 (41.4)	1226 (30.2)	
Rural	6247 (58.6)	1727 (31.1)	
Literacy			<0.001
Illiterate	5587 (52.4)	1956 (39.3)	
<5 (y)	2676 (25.1)	587 (24)	
6-8 (y)	1136 (10.7)	177 (17)	
High school	702 (6.6)	140 (21.6)	
University	562 (5.3)	93 (18.5)	
Marital Status			<0.001
Married	9492 (89)	2468 (28.9)	
Single	1171 (11)	485 (44.9)	
Employed			<0.001
Yes	5516 (51.7)	1077 (21.9)	
No	5147 (48.3)	1876 (39.9)	
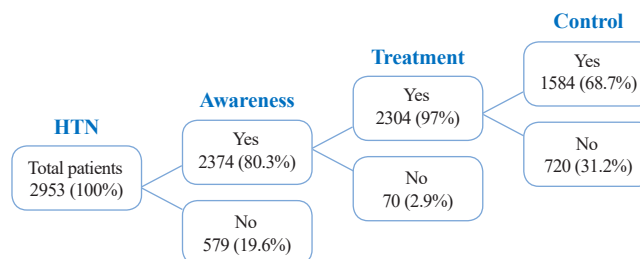
Figure 1. The image depicts the flow diagram of the frequency, awareness, treatment, and control of HTN in the Kherameh population.
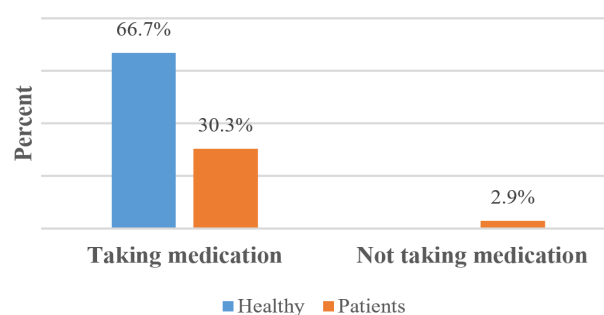HTN, Hypertension

Figure 2. The image illustrates the percentage of individuals receiving treatment and the percentage of control among those aware of their disease (n=2374).

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Table 2. Results of the multiple logistic regression model concerning the factors associated with awareness, treatment, and control of hypertension

Variable	Awareness OR [95% CI] (n=2374)	P	Treatment OR [95% CI] (n=2304)	P	Control OR [95% CI] (n=1584)	P
Gender		0.002		0.017		0.001
Male	1		1		1	
Female	1.30 (1.04-1.63)		2.57 (1.18-5.59)		1.37 (1.01-1.87)	
Age (y)	1.05 (1.04-1.06)	<0.001	1.05 (1.009-1.1)	0.021	1.04 (1.03-1.05)	<0.001
Educational Level		0.039				
Illiterate	1		-	-	-	-
Literate	0.80 (0.65-0.98)		-	-	-	-
Occupation		0.001	-	-		0.002
Jobless	1				1	
Employed	0.67 (0.53-0.84)				0.66 (0.51-0.85)	
Body mass index (kg/m²)	1.09 (1.06-1.11)	<0.001	1.13 (1.03-1.24)	0.006	1.04 (1.02-1.07)	<0.001
Consumption of Alcohol		0.041	-	-		0.014
No	1				1	
Yes	0.68 (0.46-0.99)				0.55 (0.34-0.88)	
Physical Activity			-	-		
Light	1				1	
Moderate	0.84 (0.66-1.08)	0.189			0.88 (0.67-1.16)	0.384
High	0.73 (0.56-0.95)	0.019			0.80 (0.59-1.06)	0.131
Severe	0.66 (0.5-0.87)	0.003			0.66 (0.48-0.91)	0.012
High Cholesterol Level (mg/dL)	-	-	-	-		0.046
No					1	
Yes					0.80 (0.64-0.99)	
Diabetes		<0.001	-	-		<0.001
No	1				1	
Yes	3.29 (2.55-4.24)				2.66 (2.02-3.51)	
Cerebrovascular Disease		<0.001		0.005		<0.001
No	1		1		1	
Yes	4.98 (4.01-6.18)		5.60 (1.67-18.78)		4.07 (3.24-5.12)	
Other Chronic Diseases		<0.001	-	-		<0.001
No	1				1	
Yes	1.50 (1.26-1.79)				1.47 (1.21-1.80)	
History of Cardiovascular Disease in First-Degree Relatives		<0.001	-	-	1	<0.001
No	1				1	
Yes	2.21 (1.79-2.73)				1.93 (1.51-2.46)	
History of Cardiovascular Disease in Second-Degree Relatives		0.001	-	-		0.014
No	1				1	
Yes	1.41 (1.15-1.74)				1.33 (1.06-1.67)	
History of Another Chronic Disease in Second-Degree Relatives		<0.001	-	-		0.001
No	1				1	
Yes	0.50 (0.35-0.72)				0.51 (0.33-0.76)	

Older individuals had better awareness of their HTN status (OR, 1.05, P<0.001), treatment (OR, 1.05, P=0.021), and control (OR, 1.04, P<0.001). BMI and cerebrovascular disease were also directly related to all 3 outcomes. The factors directly related to better awareness of one's HTN status and control were diabetes (OR, 3.29, P<0.001; OR, 2.66, P<0.001), other chronic diseases (OR, 1.50, P<0.001; OR, 1.47, P<0.001), a family history of cardiovascular disease in first-degree relatives (OR, 2.21, P<0.001; OR,1.93, P<0.001), and a family history of cardiovascular disease in second-degree relatives (OR,1.41, P=0.001; OR,1.33, P=0.014). On the other hand, the variables inversely associated with awareness of one's HTN status and control consisted of being employed (OR, 0.67, P=0.001; OR, 0.66, P=0.002), alcohol consumption (OR, 0.68, P=0.041; OR, 0.55, P=0.014), physical activity (OR, 0.66, P=0.003; OR, 0.66, P=0.010), and a history of

another chronic disease in second-degree relatives (OR, 0.50, P<0.001; OR, 0.51, P=0.001). Educational level was correlated with awareness of one's HTN status (OR, 0.80, P=0.039), and a high cholesterol level was associated with control (OR, 0.80, P=0.046).

Discussion

In Iran, HTN has been the second leading cause of morbidity and mortality since 1990.[22, 23] In this country, the prevalence of HTN has been estimated to range from 27.7% to 42.7%.[21, 24] Effective control of patients with HTN requires raising awareness among health professionals and the general public. In our study, the rates of awareness, treatment, and control of HTN in patients were 80.3%, 78%, and 53.6%, respectively.

Unlike other studies, patients were more aware of their disease in the present investigation (80.3%).[25] In addition, 78% of the hypertensive patients and 97% of those who were aware of their disease were treated. In other studies, these rates were found to be 40.9% and 51.9%, respectively.[26, 27]

In the current research, BP was controlled in 53.6% of all patients and 68.7% of those taking drugs. These values are similar to those reported by Gandomkar et al[14] (69.1%) but higher than those obtained by Li.[25] Similar results were also obtained in a survey performed on individuals aged 65 to 94 years in Germany, where 80.2% of the patients knew that they had HTN, and 74.4% of the patients and 92.8% of the informed individuals took antihypertensive drugs.[28] The higher awareness of one's HTN status in the present study might have resulted from better access to health care. Moreover, the fact that more participants followed their treatment plan because more individuals were aware of their disease might explain the better treatment and control of the disease in this study compared with other investigations. In a prior study, poor treatment status was mentioned due to lower socioeconomic status, lower health literacy, and misconceptions about treatment.[29] Given that about half of the patients had abnormal or uncontrolled BP, it can be concluded that poor HTN control was related to individual factors (asymptomatic disease and misconceptions) and health system factors (lack of antihypertensive drugs, long distances to medical centers, high costs of medicines, and shortages of skills and resources).[30]

In the present study, 19.2% of the patients were unaware of their HTN status. Among the hypertensive patients who were aware of their disease and were taking medications, 66.7% had their disease controlled, but 30.3% had abnormal BP. Among those who did not take medications despite being aware of the disease, 2.9% had abnormal BP, in contrast to the results of other investigations. Obtaining precise information regarding each of these subgroups might help researchers not only to determine the reason for

not taking medications or failing to control the disease but also to find practical solutions.

The results of the present study showed that awareness, treatment, and control of HTN were higher among females and older individuals. These findings are consistent with those of other studies and might be due to the fact that these groups often refer to health centers to receive services.[24, 31, 32]

In the present survey, education level was inversely associated with awareness of one's HTN status, in line with the findings of the research by Malekzadeh.[24] However, another study demonstrated that literacy was associated with better treatment.[14] The inverse relationship might be due to the lower utilization of health services by highly educated groups.[33]

In the current study, physical activity was associated with awareness of one's HTN status and control, while Rajati[34] reported that it was only associated with treatment. In addition, a higher body mass index was directly related to all 3 outcomes. The higher level of awareness in obese individuals might result from receiving more attention from the health system.[35]

In agreement with the current study, Zhang[36] indicated that better disease control was inversely related to high cholesterol levels. We found that the individuals who drank alcohol had lower awareness about their HTN status, chiming with the results obtained by Liu et al.[37]

A previous study reported that patients with diabetes had higher awareness of their HTN status,[36] consistent with the results of the current study. That study also showed that individuals with a history of cardiovascular disease had higher awareness of their HTN status and better treatment and control, in agreement with the results of a study performed by Gandmakar et al.[14] Having other chronic diseases was associated with higher awareness of one's HTN status and better control, too. A previous investigation demonstrated that individuals with diabetes, obesity, heart disease, and stroke were more likely to see a doctor and have their BP checked.[28] In the present study, the patients who had a history of cardiovascular disease in their first and second-degree relatives had higher awareness of their HTN status and better control. Nonetheless, the rates of awareness of one's HTN status and control were 50% lower among individuals with a family history of chronic diseases than among those without this condition. Two prior studies showed that individuals with a family history of HTN had higher awareness of their HTN status,[27, 38] implying that a family history of HTN might encourage individuals to check their BP. Physicians might also pay more attention to this group because they are at a higher risk for heart disease.[39]

The salient limitation of the current investigation is its cross-sectional design, rendering it difficult to rule out the inverse causation of variables. Additionally, we did not analyze HTN risk factors, such as stress and dietary habits.

Nevertheless, the strong points of our study are its large sample size, high response rate (99.7%), and precise data collection regarding the potentially relevant demographic and lifestyle factors. Furthermore, our study is among the few studies to have investigated the relationship between a family history of various diseases and HTN.

Conclusion

The results of the present study showed that despite the high level of awareness of one's HTN status, the proportion of patients receiving treatment and having control gradually decreased, such that about half of the patients had abnormal BP. The results, accordingly, indicate the need for planning to raise awareness and improve the control of HTN.

Acknowledgments

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