

Awareness, treatment, and control of hypertension and related factors in adult Iranian Population

Mohsen Mirzaei

Yazd Cardiovascular research Center, Shahid Sadoughi University of Medical Sciences and Health Services

Masoud Mirzaei

Yazd Cardiovascular Research Center, Shahid Sadoughi University of Medical Sciences and Health services

Behnam Bagheri-Fahraji (✉ Behnambagheri222@gmail.com)

Shahid Sadoughi University of Medical Sciences and Health Services <https://orcid.org/0000-0001-8482-0038>

Ali Dehghani

Department of Epidemiology and Biostatistic, Shahid Sadoughi University of Medical Sciences and Health Services

Research article

Keywords: Hypertension, awareness, control, Iran

Posted Date: January 31st, 2020

DOI: <https://doi.org/10.21203/rs.2.22422/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Version of Record: A version of this preprint was published at BMC Public Health on May 12th, 2020. See the published version at <https://doi.org/10.1186/s12889-020-08831-1>.

Abstract

Background

Hypertension, known as the silent killer, is a major risk factor for cardiovascular disease. This study aims to estimate aware, treated, and controlled hypertensive and relevant predictors in an adult Iranian population.

Methods

This cross-sectional study was conducted on 10000 adults aged 20-69 years in Yazd, Iran. They were selected through multi-stage random cluster sampling in 2015-2016. Blood pressure was measured three-time with standard protocol by trained health workers. Those with a positive history of hypertension and using anti-hypertensive drugs, prescribed by a physician, were considered hypertensive. Hypertension was defined as systolic blood pressure ≥ 140 mmHg and/or diastolic BP of ≥ 90 mmHg. Uncontrolled hypertension was defined in accordance with recommended treatment targets by the Joint National Committee (JNC7). Logistic regression was used to assess the predictors of hypertension awareness, treatment and control.

Results

The prevalence of hypertension was 37.3%, and the prevalence of pre-hypertension was 46.4%. 49.7% of People with hypertension were aware of their disease, and 71.5% of them were using antihypertensive drugs prescribed by physicians. Blood pressure was controlled in 38.9% of the treated patients. In the adjusted model, older age, female sex, and history of diabetes mellitus were positively associated with higher awareness. High physical activity, tobacco smoking, and diabetes are the only predictors of treated high blood pressure. Younger age, female sex, and higher education were determinants of controlled hypertension. Having health insurance was significantly correlated with awareness and control of hypertension.

Conclusion

Hypertension is a public health problem in this population, which is not well controlled. Half of the patients were unaware. Intervention for increased screening coverage is needed. It should plan to raise public awareness about hypertension and improve hypertension control under supervision of physicians. Implement a family physician program is recommended in the health system.

Background:

High blood pressure is an important risk factor for cardiovascular disease and causes 7.5 million deaths per year (12.8% of all deaths) annually.^[1] The global burden of disease study suggests that systolic blood pressure is accountable for the highest proportion of lost years of life due to premature death, with 212 million years lost.^[2] The high blood pressure rank in the world increased from the fourth in 1990 to

the second in men and first in women in 2017.^[3] The prevalence of hypertension (HTN) in various regions of the world has been reported from 4–78%. In the Eastern Mediterranean region, it is on average 29.5% and in Iran 22%.^[4–6]

Among the known risk factors for non-communicable diseases, hypertension after high BMI, unhealthy diet, and high blood glucose is the fourth risk factor, which has increased by 6.7% from 2005 to 2016.^[7] Yazd Healthy Heart Project reported the prevalence of HTN 25.6% in Yazd.^[8] The number of people with HTN in low-middle income countries (1.04 billion) is higher than in developed countries (694 million), which shows an increasing trend from 2000 to 2010 (7.7%). However, it decreased by 2.6% in high-income countries.^[9–11]

Despite the high prevalence, studies have shown that in the world, the percentage of unawareness, untreated, and even uncontrolled HTN is significantly high.^[9] In general, 50–75% of patients with hypertension do not receive proper treatment.^[12] In Iran (2011), 43.2% of patients are aware of their illness, 34.8% of hypertensive persons are treated, and 38.6% of them are controlled which vary across provinces.

In Northern Iran, about one-third of the treated patients have controlled hypertension.^[13] In Azar's cohort, 60% of the participants are aware of their illness, and 68% have controlled blood pressure. In Shiraz, 69% have controlled blood pressure.^[13–15] The 2010 study in Yazd showed that the rate of awareness for hypertension was 43.7% of the patients. 77.1% of them were treated, and only 12.4%, who treated, had controlled blood pressure.^[16] This difference between the prevalence, awareness, and control of high blood pressure among countries as well as among different regions of a country in other studies is also reported.^[17] The most important complication of uncontrolled blood pressure is morbidity and mortality of cardiovascular diseases (51% of stroke and 45% of deaths due to myocardial infarction).^[18] Inappropriate management of HTN can be the result of socioeconomic factors such as poor health literacy, lack of access to health care providers due to lack of centers, or inability to pay for health costs, and so on. Identifying these factors may help to design more effective health interventions. The purpose of this study is to estimate the prevalence of awareness, treatment, and control of hypertension and relevant predicting factors in an adult Iranian population.

Methods:

Yazd Health Study (YaHS) is a population-based longitudinal study designed to determine the prevalence of non-communicable diseases and their risk factors in Yazd Greater Area. According to using the cluster random sampling method, 10000 residents of Yazd (20–69 years old) were selected from 200 clusters. Of each age group of ten, five were selected in clusters of 50 (25 men and 25 women). A completed method of study was published elsewhere.^[19] Informed consent was given to participate in the study. According to the protocol, the questionnaire is repeated every five years to provide longitudinal information for determining the risk factors for health and the incidence of disease.

The interviewers completed a valid questionnaire and measured anthropometrics and blood pressure at a home visit. The overall response rate was 98% (n = 9800). Demographic characteristics, history of cardiovascular disease, and the relevant risk factors were recorded. trained people in a sitting position measured physical examination and after rest, using a standard and appropriate cuff size for the participant's arm. [20] The pressure measurement was carried out three times at five-minute intervals by calibrated Reichert electronic sphygmomanometers (Model N-Champion, Reister GMBH, Germany), which were calibrated regularly. The mean of second and third measurements was recorded as blood pressure and used for analysis. People with the following characteristics were classified hypertensive case: a) Self-reported previous diagnosis of hypertension by the physician, and b) systolic BP \geq 140 or diastolic BP \geq 90 mmHg according to the Joint National Committee JNC7 classification. [21]

Awareness of hypertension was defined as a self-reported previous diagnosis of hypertension by a physician among the participants with hypertension. Unawareness of hypertension was defined by blood pressure \geq 140/90 mm Hg without a prior diagnosis by a physician or the use of any antihypertensive drugs.

The participants who were aware of their hypertension, who answered the question: "when was the last time you referred to a doctor for your high blood pressure?", "over the past three months," were categorized in the treated group.

Controlled hypertension was defined for those taking antihypertensive medication for the management of high BP at the time of the interview. It had systolic BP < 140 mm Hg and diastolic BP < 90 mm Hg. Uncontrolled hypertension was defined following recommended treatment targets of systolic BP \geq 140 mmHg and diastolic BP \geq 90 mmHg (Including those who were aware). SBP/DBP goals recommended for Specific disease (diabetes mellitus) was < 130/80 mmHg. [22]

The study was approved by the ethics committee of Shahid Sadoughi University of Medical Science, Yazd, Iran (IR.SSU.MEDICINE.REC.1396.311). The study was explained to all respondents willing to participate. All participants had the right to withdraw from the study at any time. Informed consent was obtained from each participant before data collection. Participants with a new diagnosis of hypertension were advised to refer to their health center or physician for the follow-up.

Descriptive statistics were reported, and age-standardized prevalence rates were calculated using the direct method based on Yazd population in 2011. [23] Awareness, treatment, and control of hypertension were presented as percentages. A chi-square test was used for categorical variables to analyze the differences in demographic variables between the groups. Logistic regression was performed to ascertain the effects of age, gender, education, health insurance, place of residence, BMI & physical activity, smoking and history of diabetes mellitus on the likelihood that participants who are aware of their illness, those who are being treated and whose blood pressure is controlled. The results were presented by the odds ratios and 95% confidence intervals (CI). All statistical analyses were performed using SPSS version 16 software. A p-value of less than 0.05 was considered statistically significant.

Results:

Of the total 9800 participants, 1817 (18.5%) had a history of hypertension, 45.6% of those between 60 and 69 years old. Hypertension was more prevalent in women (21.9 vs. 15.2%, $P < 0.0001$) than men. The age-standardized prevalence of hypertension in this population was 10.5%. The frequency of high blood pressure was higher in people with less education. Hypertension is more common in indigenous population compared to migrants from other provinces (19.5% vs. 13.1%, $P < 0.0001$). A history of two years or more of hypertension has been reported in 72.4% of patients. 28.8% of patients did not refer to the doctor for the treatment of their high blood pressure for four months or more. Socioeconomic factors and family history of common disease associated with self-reported hypertension in Yazd greater area was shown in Table 1.

Table 1
Socioeconomic factors associated with self-reported hypertension in Yazd
Greater Area. 2014–2015

		Num.	Percent
Crude prevalence		1817	18.5
Age-Standardized prevalence		10.5	
Sex			
Men	737	15.2	
Women	1080	21.9	
Age group			
20–29	29	1.5	
30–39	79	4.0	
40–49	270	13.3	
50–59	577	29.5	
60–69	861	45.6	
Education			
primary school and less		881	34.6
high school		484	17.4
diploma and graduate diploma		323	11.3
BSc & MSc. and doctorate		110	7.3
Migration status			
Yazd native		1374	19.1
From within the Yazd province		228	22.2
From other Iranian provinces		161	13.0
from overseas		29	13.8
Duration of hypertension (years)			
< 1		113	6.6
1–2		356	20.9
3–4		370	21.7

	Num.	Percent
5-6	268	15.7
> = 7	595	35.0
Total	1702	100
When was the last time you visited your doctor?		
< 1 month	570	34.0
1-3 months	625	37.3
4-6 months	219	13.1
6-12 months	115	6.9
> 1 year	147	8.8
Total	1676	100
Having health insurance	1733	97.4
positive Family history of hypertension	1247	72.2
positive Family history of CVD	686	39.8
positive Family history of DM	705	39.0

Overall, half of the adults with hypertension were aware of their disease (49.7%). This proportion increased with age, from 11.9% at the age of 20 to 29 years to 67.0% at the age of 60 to 69 years ($P < 0.0001$). Women were more aware of their disease ($P < 0.0001$). Hypertension was more common in overweight and obese patients, less educated, those with low physical activity and patients with a positive family history of cardiovascular disease and diabetes ($P < 0.0001$). 71.3% of the aware patients (33.0% of all participants with high blood pressure) were referred to physicians during the past 3 months. Younger and more educated people are less likely to go to treatment by physicians, compared to older people and illiterate, ($P < 0.05$). The control of hypertension among males was significantly lower than females; also, uncontrolled hypertension increased with age ($P < 0.0001$). There was no significant difference in terms of the treatment and control of hypertension between those with and without health insurance, physical activity, place of residence, or abnormal BMI (Table 2). Figure 1 shows a summary finding of prevalence, its unawareness and uncontrolled of hypertension among adult participants.

Table 2. Prevalence of awareness, treatment, and control of hypertension in Yazd adult residents aged 20-69 years (Total hypertensive n= 3655)

	Awareness	Treated*	Controlled*
	Num. (%)	Num. (%)	Num. (%)
Crude prevalence	1817 (49.7)	1209 (71.5)	731 (40.2)
Age groups			
20-29	29 (11.9)	9 (52.9)	20 (69.0)
30-39	79 (19.2)	37 (56.1)	40 (50.6)
40-49	270 (37.7)	172 (71.1)	106 (39.3)
50-59	577 (58.0)	384 (70.8)	253 (43.8)
60-69	861 (67.0)	606 (73.5)	311 (36.1)
P value	< 0.0001	0.015	< 0.0001
Sex			
Male	737 (39.1)	408 (70.7)	255 (34.6)
Female	1080 (61)	729 (72.0)	476 (44.1)
P value	< 0.0001	Not Significant	< 0.0001
Education			
Primary school and less	881 (61.3)	625 (74.3)	325 (36.9)
High school	484 (46.6)	315 (70.6)	200 (41.3)
Diploma & Graduate Diploma	323 (40.6)	189 (65.2)	151 (46.7)
BSc ,MSc. and Doctorate	110 (31.5)	69 (69.0)	47 (42.7)
P value	< 0.0001	0.024	0.016
Place of residence			
Urban (Yazd)	1601 (49.1)	1057 (70.9)	636 (39.7)
Urban (New Cities) or Semi-Urban	129 (59.2)	90 (75.6)	58 (45.0)
Rural	87 (50.3)	62 (74.7)	37 (42.5)
P value	0.015	Not Significant	Not Significant
Health insurance			
Yes	1733 (50.4)	1148 (71.0)	699 (40.3)
No	46 (31.1)	35 (83.3)	12 (26.1)
P value	< 0.0001	Not Significant	Not Significant

BMI (kg/m ²)			
Underweight	9 (25.7)	7 (87.5)	6 (66.7)
Normal	291 (39.5)	184 (70.8)	122 (41.9)
Overweight	731 (49.6)	489 (71.7)	290 (39.7)
Obesity	766 (58.4)	515 (70.8)	310 (40.5)
P value	< 0.0001	Not Significant	Not Significant
Physical activity			
Low	1157 (55)	747 (69.9)	478 (41.3)
Moderate	576 (44.4)	410 (74.7)	221 (38.4)
High	84 (32.8)	52 (70.3)	32 (38.1)
P value	< 0.0001	Not Significant	Not Significant
Family history of hypertension			
Yes	1247 (80.2)	871 (72.4)	488 (39.1)
No	480 (50.1)	308 (68.6)	200 (41.7)
P value	< 0.0001	Not Significant	Not Significant
Family history of CVD			
Yes	686 (58.0)	472 (73.4)	319 (46.5)
No	1038 (46.5)	680 (70.6)	376 (36.2)
P value	< 0.0001	Not Significant	< 0.0001
Current tobacco use			
Yes	191 (34.6)	104 (61.9)	73 (38.20)
No	1604 (52.4)	1095 (72.7)	647 (40.3)
P value	< 0.0001	0.003	Not Significant
A positive history of DM			
Yes	705 (75.2)	510 (75.3)	293 (41.6)
No	1103 (40.9)	692 (68.7)	433 (39.3)
P value	< 0.0001	0.002	Not Significant

* Frequency in those who are aware of their hypertension

Bivariate logistic regression analysis ascertained the effects of predictors of awareness, treatment, and control of hypertension. Age, sex, BMI, physical activity, insurance, and diabetes history are able to predict changes in awareness. ($\chi^2 (9) = 776.154, p < 0.0001$). It correctly classified 69.7% of cases. The logistic regression model was statistically significant for treatment ($\chi^2 = 40.748, p = 0.001$) with correct classification of 71.6% cases. Physical activity, smoking, and a history of diabetes can predict changes in treatment. The model for control of hypertension classified 62.4% of cases, correctly. Age, sex, and insurance are predictors of change to control hypertension ($\chi^2 (9) = 66.724, p < 0.0001$). Table 3 shows the contribution of each independent variable to the model and its statistical significance.

Table 3

Factors related to awareness, treatment, and control of hypertension in Yazd Greater Area population 20–69 years

	Aware	Treated	Controlled
	OR(95%CI)	OR(95%CI)	OR(95%CI)
Age groups			
20–29	Ref.	Ref.	Ref.
30–39	1.46 (0.90–2.39)	1.44 (0.46–4.51)	0.32 (0.12–0.87)
40–49	3.24 (2.05–5.10)	2.49 (0.85–7.26)	0.22 (0.08–0.55)
50–59	6.22 (3.97–9.75)	2.35 (0.82–6.74)	0.27 (0.11–0.67)
60–69	9.01 (5.73–14.17)	2.65 (0.92–7.59)	0.19 (0.07–0.48)
Sex			
Male	Ref.	Ref.	Ref.
Female	1.98 (1.68–2.34)	0.87 (0.67–1.11)	1.65 (1.32–2.08)
Education			
Primary school and less	Ref.	Ref.	Ref.
High school	0.98 (0.81–1.19)	0.91 (0.69–1.21)	1.23 (0.96–1.58)
Diploma and Graduate Diploma	1.22 (0.98–1.52)	0.68 (0.49–0.93)	1.66 (1.24–2.22)
BSc, MSc. and Doctorate	1.06 (0.78–1.44)	0.88 (0.54–1.44)	1.40 (0.89–2.18)
Place of residence			
Urban	1.15 (0.79–1.67)	1.16 (0.67–1.98)	1.08 (0.67–1.74)
Rural	Ref.	Ref.	Ref.
BMI (kg/m²)			
Normal	Ref.	Ref.	Ref.
Underweight	1.23 (0.52–2.94)	0.28 (0.03–2.42)	0.43 (0.09–1.86)
Overweight	1.50 (0.63–3.55)	0.27 (0.03–2.31)	0.39 (0.09–1.69)
Obesity	1.95 (0.82–4.62)	0.28 (0.03–2.38)	0.37 (0.08–1.59)
Physical Activity			
Low	1.17 (1.00–1.37)	0.76 (0.60–0.96)	1.19 (0.96–1.47)

	Aware	Treated	Controlled
Moderate/ High	Ref.	Ref.	Ref.
Insurance			
Yes	. 1.62 (1.04–2.52)	0.53 (0.23–1.24)	2.38 (1.10–5.15)
No	Ref.	Ref.	Ref.
Current tobacco use			
Yes	1.18 (0.94–1.48)	1.64 (1.13–2.37)	0.93 (0.86–1.32)
No	Ref.	Ref.	Ref.
A positive history of DM			
Yes	2.72 (2.26–3.27)	1.32 (1.05–1.67)	1.20 (0.97–1.48)
No	Ref.	Ref.	
Constant	0.035	5.56	1.75

Discussion:

The prevalence of hypertension is high among the Yazd adult population with inappropriate awareness and controlled hypertension rates. Less than half of aware patients, who were treated, had controlled blood pressure.

The results indicate that Yazd is among the areas with high blood pressure prevalence compared to similar studies in Iran and the world.^[12] The prevalence of hypertension in the world has also been reported 28.8% in high and 31.5% in low-income countries^[24], indicating a worsening situation in Yazd. This might be justified by the different prevalence of risk factors due to ethnicity and lifestyle changes, or different age groups in the study.

Almost 50% of Yazdi adults are aware of their hypertension, which is lower than in high-income countries (67%) but higher than low/middle-income countries (37.9%).^[24] In different countries this awareness has been reported from 25 to 75%.^[25] Awareness in Yazd is lower compared to most studies in Iran (69.2% in Isfahan,^[9] 60.5% in Tabriz,^[12] and 57% in Kerman^[26]). It is slightly higher than Golestan's (46.2%) and a previous study in Yazd (43.7%).^[12, 16] Over the past decade, the 5% awareness increase in Yazd was not satisfactory, considering increased access to health centers and increase in the number of health insured.

The study shows that about three-quarters of patients (71.5%), who were aware of their disease, had visited by the physician during the past three months. Although the treated hypertension in Yazd is higher than the world average (36.9%),^[24] it is more inadequate than other studies in Iran.^[9, 12] The availability and affordability (low cost) of health care services have made this index more favorable in Iran than in

the world - even in high-income countries (55.6%).^[16, 24] Un-prescribed drug use and differences in the definition of treated people may be other reasons for this difference.

Despite treatment, only 39% had controlled hypertension, which is close to the worldwide statistics (37.1%), although it was better in high-income countries (50.4%) in 2010.^[24] Although the difference between treated and controlled hypertension was reported in all studies, Isfahan (59.1%) and Tabriz (68.5%) in Iran reported a better-controlled situation^[9, 12] suggesting worse control of hypertension in Yazd. A comparison of blood pressure control status in Yazd in this study with the previous study shows threefold growth. Since awareness and treatment of the disease have not changed, improved quality of treatment by physicians has been effective. Misuse of medication or lack of regular patient care, as well as inadequate medication administration, can be a cause of the disease poor control.

After adjustment, patients with older age, history of diabetes, female sex, and health insured were more likely to aware of their hypertension. More elderly referrals to physicians and health centers for treatment and periodic care justify older people's awareness of their blood pressure compared to younger adults. In this study, less awareness of men than women can be due to lower access to health centers, employment and less attention to their health. This association between age and sex has been confirmed in other studies.^[9, 12, 16] However, the odds ratios between sex-age groups in geographic regions vary depending on the level of education, availability, and cost of health services.

In this study, adult education did not correlate with their awareness, which is consistent with the findings of Katibeh et al. findings in Yazd.^[27] However, most studies have reported a relationship between their education and awareness of hypertension.^[28, 29] Also, there was no relationship between high education and treated hypertension, as well as the control of hypertension. Higher education in people has no effect on the management of the disease, unlike the results of others, so it requires further investigation. Individuals' health literacy appears to be more important than education for health care.

Although health insurance was not associated with patients being treated, insurance was a predictor of hypertension awareness and control. The positive effect of health insurance was also reported in other studies.^[30] This can be due to the reduced cost of receiving services in continuing care.

In our study, having a history of diabetes is a predictor for awareness and treatment of hypertension. Others have confirmed that having another medical condition (diabetes, hyperlipidemia, etc.) is associated with the awareness and treatment of hypertension.^[9, 29, 31] It will cause people to go to health centers; as a result, hypertension will be diagnosed sooner, and medication will be started. However, having diabetes was not a predictor for blood pressure control. Different goals in defining blood pressure control and various guidelines in diabetic patients have made blood pressure control more difficult in this group.^[32]

Strengths And Limitations

The strengths of this study are the large sample size with random multi-stage cluster sampling from different urban and rural areas, 95% participation rate, and, most importantly the three measurements of blood pressure at home according to the standard protocol by trained health care providers. Investigating the relationship between tobacco smoking, obesity, physical activity, and diabetes history with hypertension awareness and control are among the other advantages of this study. This study, however, had some limitations. This cross-sectional study and cannot investigate the causality. Hypertensive risk factors such as stress, dietary habits, and alcohol use have not been analyzed. Tobacco smoking, physical activity, and diabetes were self-reported which may produce bias. This study was not considered the relationship between economic factors and health services utilization with awareness and control of hypertension.

Conclusion:

Hypertension is a public health problem in Yazd, which is not well controlled. Half of the patients were undiagnosed, and more than half of known cases of hypertension were not controlled. It can lead to high-cost cardiovascular complications. This study represents a warning message for cardiovascular health in Yazdi adults. Health policymakers must consider new strategies for prevention. Intervention for increased screening coverage is needed, especially for men. Public awareness should be raised about hypertension and improved hypertension control under supervision of physicians should be promoted. Implementation of family physician program for health insured persons may accelerate reaching to these goals.

Abbreviations

BP: Blood Pressure

JNC: Joint National Committee

HTN: Hypertension

BMI: Body Mass Index

CI: Confidence Interval

WHO: World Health Organization

Declarations

Ethics approval and consent to participate

All procedures performed in this study were approved by the ethics committee of Shahid Sadoughi University of Medical Science, Yazd, Iran (IR.SSU.MEDICINE.REC.1396.311). During the training of interviewers, principal investigator emphasis was placed on the importance of obtaining informed

consent that informed that participants can choose not to answer any questions. Written informed consent was obtained from all participants.

Consent for publication

Not applicable.

Availability of data and material

The data collected by Yazd Health Study are not open access but can be shared under conditions of collaboration and endowment. Data are available from the authors upon reasonable request and with permission of principal investigator. For further information, please visit YaHS website at www.yahs.ir / yahs.ssu.ac.ir

Competing interests

The authors declare that they have no competing interests.

Funding

This study was funded by Shahid Sadoughi University of Medical Sciences. Funding bodies had no role in data collection, analysis, and interpretation of data and in writing the manuscript.

Authors' contributions

The conception of research idea was conducted by Mohsen Mirzaei (MM1) and Masoud Mirzaei (MM2) designed the study. Conducted the study under the supervision of MM2 and AD. MM1 and BB analyzed the data and wrote the draught of the manuscript. AD reviewed and critically revised the manuscript. All authors read and approved the final manuscript. MM2 finalized the manuscript.

Acknowledgments

We express our gratitude to all those who helped us in this study, especially the good people of Yazd, the health workers.

References

1. Mouhtadi BB, Kanaan RMN, Iskandarani M, Rahal MK, Halat DH. Prevalence, awareness, treatment, control and risk factors associated with hypertension in Lebanese adults: A cross-sectional study. *Global cardiology science & practice*. 2018;2018(1):6. Doi:10.21542/gcsp.2018.6
2. Forouzanfar MH, Afshin A, Alexander LT, Anderson HR, Bhutta ZA, Biryukov S, et al. Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *The Lancet*. 2016;388(10053):1659-724. DOI:10.1016/S0140-6736(16)31679-8

3. Gakidou E, Afshin A, Abajobir AA, Abate KH, Abbafati C, Abbas KM, et al. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *The Lancet*. 2017;390(10100):1345-422. DOI:10.1016/S0140-6736(17)32366-8
4. Salem H, Hasan DM, Eameash A, El-Mageed HA, Hasan S, Ali R. Worldwide prevalence of hypertension: A pooled meta-analysis of 1670 studies in 71 countries with 29.5 million participants. *Journal of the American College of Cardiology*. 2018;71(11 Supplement): A1819. DOI: 10.1016/S0735-1097(18)32360-X
5. Tailakh A, Evangelista LS, Menten JC, Pike NA, Phillips LR, Morisky DE. Hypertension prevalence, awareness, and control in Arab countries: A systematic review. *Nursing & health sciences*. 2014;16(1):126-30. Doi.org/10.1111/nhs.12060
6. Mirzaei M, Moayedallaie S, Jabbari L, Mohammadi M. Prevalence of hypertension in Iran 1980–2012: a systematic review. *The Journal of Tehran University Heart Center*. 2016;11(4):159-167
7. (GBD) IGBod. [22.11.2017]. Available from: <http://www.healthdata.org/iran>.
8. Kazemi T, Hajhosseini M, Mashreghimoghadam H, Azdaki N, Ziaee M. Prevalence and determinants of hypertension among Iranian adults, Birjand, Iran. *International journal of preventive medicine*. 2017;8:36. Doi: 10.4103/ijpvm.IJPVM_103_16
9. Eghbali M, Khosravi A, Feizi A, Mansouri A, Mahaki B, Sarrafzadegan N. Prevalence, awareness, treatment, control, and risk factors of hypertension among adults: a cross-sectional study in Iran. *Epidemiology and health*. 2018;40:e2018020. DOI: <https://doi.org/10.4178/epih.e2018020>
10. Feng XL, Pang M, Beard J. Health system strengthening and hypertension awareness, treatment and control: data from the China Health and Retirement Longitudinal Study. *Bulletin of the World Health Organization*. 2013;92:29-41. DOI:10.2471/BLT.13.124495
11. Bloch MJ. The worldwide prevalence of hypertension exceeds 1.3 billion. *Journal of the American Society of Hypertension: JASH*. 2016;10(10):753-54 Doi: 10.1016/j.jash.2016.08.006.
12. Ghorbani Z, Shamshirgaran SM, Ghaffari S, Sarbakhsh P, Najafipour F, Aminisani N. Hypertension prevalence, awareness, treatment and its correlates among people 35 years and older: Result from the pilot phase of the Azar cohort study. *Journal of education and health promotion*. 2018;7. 45. Doi:10.4103/jehp.jehp_118_17
13. Esteghamati A, Etemad K, Koohpayehzadeh J, Abbasi M, Meysamie A, Khajeh E, et al. Awareness, treatment and control of pre-hypertension and hypertension among adults in Iran. *Arch Iran Med*. 2016 Jul;19(7):456-64. Doi: 0161907/AIM.003.
14. Shirani S, Kelishadi R, Sarrafzadegan N, Khosravi A, Sadri G, Amani A, et al. Awareness, treatment and control of hypertension, dyslipidemia and diabetes mellitus in an Iranian population: the IHHP study. *EMHJ* 2009,15(6),1455-1463
15. Gandomkar A, Poustchi H, Malekzadeh F, Malekzadeh MM, Moini M, Moghadami M, et al. Prevalence, Awareness, Treatment, Control, and Correlates of Hypertension in the Pars Cohort Study. *Archives of Iranian Medicine (AIM)*. 2018;21(8):335-343

16. Kalani Z, Abdi H, Shahbazi L, Salimi T, Amini Poor M. Hypertension in the Yazd adult population. *Payesh*. 2011; 10 (1) :101-107
17. Mohamed SF MM, Wamai R, Wekesah F, Haregu T, Juma P, et al. Prevalence, awareness, treatment, and control of hypertension and their determinants: results from a national survey in Kenya. *BMC Public Health*. 2018;18(Suppl 3):1219. DOI:10.1186/s12889-018-6052-y
18. Tesfaye B, Haile D, Lake B, Belachew T, Tesfaye T, Abera H. Uncontrolled hypertension and associated factors among adult hypertensive patients on follow-up at Jimma University Teaching and Specialized Hospital: a cross-sectional study. *Research Reports in Clinical Cardiology*. 2017;8:21-9. Doi:10.2147/RRCC.S132126
19. Mirzaei M, Salehi-Abargouei A, Mirzaei M, Mohsenpour MA. Cohort Profile: The Yazd Health Study (YaHS): a population-based study of adults aged 20–70 years (study design and baseline population data). *International journal of epidemiology*. 2017;47(3):697-8h. DOI:10.1093/ije/dyx231
20. Ogedegbe G, Pickering T. Principles and techniques of blood pressure measurement. *Cardiology clinics*. 2010;28(4):571-86. Doi: 10.1016/j.ccl.2010.07.006
21. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo Jr JL, et al. 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(19):2560-71. Doi:10.1001/jama.289.19.2560
22. Tran TM, Giang NM. Changes in blood pressure classification, blood pressure goals and pharmacological treatment of essential hypertension in medical guidelines from 2003 to 2013. *IJC Metabolic & Endocrine*. 2014;2:1-10. Doi:10.1016/j.ijcme.2014.01.001
23. amar.ostanyazd.ir. [December 2016]. Available from: <http://amar.ostanyazd.ir/documents/6892/14359981>.
24. 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(6):441-50. Doi:10.1161/CIRCULATIONAHA.115.018912
25. Devi P, Rao M, Sigamani A, Faruqui A, Jose M, Gupta R, et al. Prevalence, risk factors and awareness of hypertension in India: a systematic review. *Journal of human hypertension*. 2013;27(5):281-7 Doi: 10.1038/jhh.2012.33
26. Najafipour H, Nasri HR, Afshari M, Moazenzadeh M, Shokoohi M, Foroud A, et al. Hypertension: diagnosis, control status and its predictors in general population aged between 15 and 75 years: a community-based study in southeastern Iran. *International journal of public health*. 2014;59(6):999-1009. Doi:10.1007/s00038-014-0602-6
27. Katibeh M, Sanjari Moghaddam A, Yaseri M, Neupane D, Kallestrup P, Ahmadi H. Hypertension and associated factors in the Islamic Republic of Iran: a population-based study. *East Mediterr Health J*. 2019;25.
28. Olives C, Myerson R, Mokdad AH, Murray CJ, Lim SS. Prevalence, awareness, treatment, and control of hypertension in United States counties, 2001–2009. *PloS one*. 2013;8(4):e60308. Doi:10.1371/journal.pone.0060308

29. 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. *Journal of hypertension*. 2013;31(7):1364-71. Doi: 10.1097/HJH.0b013e3283613053
30. Maimaris W, Paty J, Perel P, Legido-Quigley H, Balabanova D, Nieuwlaat R, et al. The influence of health systems on hypertension awareness, treatment, and control: a systematic literature review. *PLoS medicine*. 2013;10(7):e1001490. Doi:10.1371/journal.pmed.1001490
31. Ware LJ, Chidumwa G, Charlton K, Schutte AE, Kowal P. Predictors of hypertension awareness, treatment and control in South Africa: results from the WHO-SAGE population survey (Wave 2). *Journal of human hypertension*. 2019;33(2):157-166. Doi: 10.1038/s41371-018-0125-3
32. Grossman A, Grossman E. Blood pressure control in type 2 diabetic patients. *Cardiovascular diabetology*. 2017;16(1):3. Doi:10.1186/s12933-016-0485-3

Figures

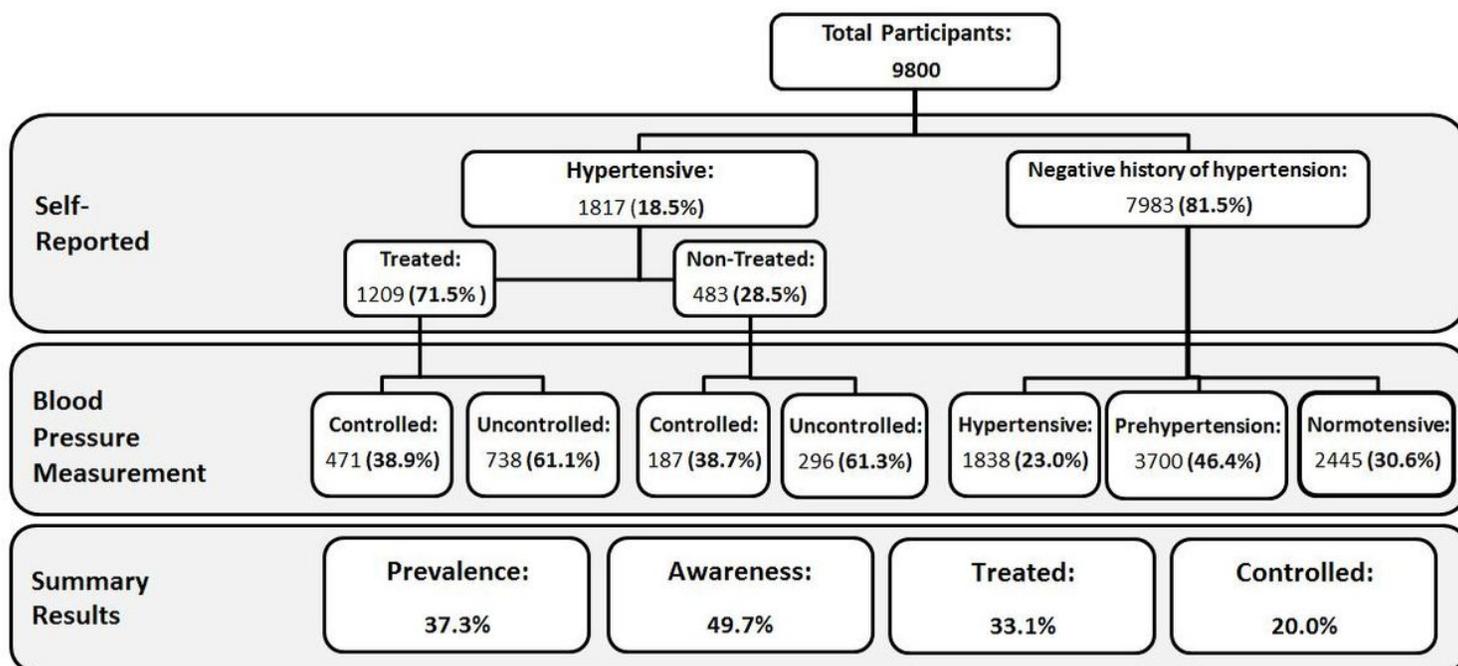


Figure 1

Hypertension, its awareness, and control among adults 20–69 years in Yazd Greater Area- Iran