

## Prevalence and associated factors of self-reported hypertension among Tehran adults in 2011: a population-based study (Urban HEART-2)

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### Abstract

**Background:** Hypertension is an important public-health challenge worldwide. The prevalence of hypertension greatly varies across countries. The aim of this study was to estimate the prevalence of self-reported hypertension and to determine related factors in a large random sample of Tehran population in 2011.

**Methods:** In this cross sectional study, 69173 individuals aged 25–64 years were selected using multistage cluster random sampling method. All participants were interviewed by trained personnel using standard questionnaires. Weighted prevalence and incidence rates were calculated and principle component analysis (PCA) was used to construct wealth index. Chi-square and odds ratio were used to assess associations in univariate analysis. Logistic Regression model was used in multivariate analysis.

**Results:** The prevalence of self-reported hypertension was 5.27% in total, 3.83% in men and 6.64% in women ( $p < 0.001$ ). The annual incidence rate of self-reported hypertension was 6.87 per 1000; 5.26 in men and 8.43 in women ( $p < 0.001$ ), obviously varied across various districts. In multivariate analysis, age, sex (woman), marital status (single), obesity and smoking were positively associated with prevalence of self-reported hypertension. Education level was negatively associated to hypertension. On the other hand, wealth status was not associated to self-reported hypertension.

**Conclusion:** Our study findings highlighted low awareness rates of hypertension among Tehran adults especially in men and younger people. Hence, we recommend public health strategies to improve health education programs. Moreover, programs to develop the surveillance system and screening programs to early detection of undiagnosed cases are urgently needed particularly in high risk population subgroups.

**Keywords:** Hypertension, Self-reporting, Prevalence, Tehran.

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### Introduction

Hypertension (HTN), known as a global public-health challenge, is a condition in which blood vessels have persistently raised pressure. It may lead to heart attacks,

stroke, kidney failure, blindness, rupture of blood vessels and cognitive impairment (1-5). In 2008, the condition has affected approximately one billion individuals, 40% of adults aged 25 and above across the world

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(1, 3). The highest prevalence of raised blood pressure was reported in the WHO African region with 46% for males and females combined, while the lowest reported in the WHO region of the America with 35% for both males and females. However, the prevalence of hypertension shows a significant variation across countries(6). Awareness of hypertension also varies from 25.2% to 75% [4]. Hypertension accounts for 57 million disability adjusted life years (DALYS) or 3.7% of total DALYS (7). According to the WHO, complications of hypertension account for 9.4 million deaths worldwide every year(8). In Iran, according to a systematic review of 29 studies, the estimated overall prevalence of hypertension in 30 – 55 and >55-year-old population was around 23% and 50%, respectively. This prevalence in men was 1.3% less than that in women and by each year increase in the mean age of subjects, the prevalence increased about 0.5%(8). Other studies on hypertension in Iran have reported the prevalence rates in adults ranged from 21.2% to 41.8%, mostly with higher rates in females, higher age groups, illiterates, poor people and urban residents(9-14).

At the early stages, hypertension is a silent and invisible condition with rare symptoms. Thus, enhancing public awareness and early detection is important to avoid its further stages' complications. Recently, researchers and health specialists increasingly face to obtain information about chronic illnesses conditions and risk factors from self-reports of target populations (15-20), because prevalence rates based on clinically measured blood pressure are often higher than the self-reports' rates(21). While self-reported data is often more economically feasible and readily available compared to clinically measured hypertension, these reports may underestimate clinical prevalence and also may vary in different socio-cultural positions(22) .

The aim of this study was to estimate the prevalence of self-reported hypertension and to assess its associated factors in a rep-

resentative sample of Tehran adults.

## Methods

The second Urban HEART project was a cross-sectional study conducted in Tehran, Iran, in fall 2011. Participants were visited at their house by interviewers who were trained during a two-day workshop prior to data gathering (23).

There were 3 types of questionnaires consisting of 20 parts. The first 14 parts were completed for all selected households, but 3 of these, including demographic, socioeconomic and hypertension data were used for current analysis. All the gathered data were based on the participants' self-reports. Any participant, who was diagnosed as hypertensive patient by a physician or used anti hypertensive drug at the time of the survey, was considered as a hypertension case. The patients whose time of onset of condition was one year or less were considered as new cases and calculated at the annual incidence rates. Body mass index (BMI) was calculated using the formula weight (kg)/height (m<sup>2</sup>). Wealth index was calculated using principle component analysis (PCA) on 14 assets and some other household data including: owning a fridge, a personal computer, a telephone, a mobile phone, a washing machine, a microwave oven, a car, a motorcycle, a kitchen, a bathroom, a toilet, house ownership, number of rooms per capita (less than one vs. one and more), and area of the house (below the median vs. above the median). In principle component analysis, the first component explains the largest proportion of the total variance, so assets that were more unequally distributed across the sample had a higher weight in the first component. The weights (coefficients) for each asset from this first component were used to generate the wealth scores, with higher score indicating higher wealth status and vice versa. Finally, based on quintiles, the scores converted to five ordered categories, from poorest to richest, to determine each household wealth status.

### Sampling method and sample size

A multistage cluster random sampling was used in this study. First stage was stratified by districts. Then 200 clusters were selected randomly in each district and finally eight household were selected in each cluster using systematic random sampling method and all the household persons were selected as primary sampling units. To estimate required sample size for the survey, each district was considered independently to calculate sample size based on Cochran formula as 1535 households in each district. Then, to facilitate the allocation of sample to the mentioned eight-box table that had to be completed for the individual questionnaires and also to reach higher precision, the sample was expanded to 1600 households, regardless the population size in each district. Therefore, we assigned 200 blocks to each district equally. To allocate samples at neighborhood level, method of the probability proportional to size of each district was used. The total sample size was 34116 households covering 118542 individuals from 22 districts and 368 neighborhoods. After excluding participants aged under 25 and over 65 years ( $n = 49369$ ). The analysis was performed on data of the remaining 69173 individuals, who were aged 25–64 years.

### Statistical analysis

Descriptive statistical measures (including measures of central tendency, dispersion, the weighted prevalence and incidence rates) were used to describe the data. Principle component analysis was used to construct the wealth index. Chi-square and Odds ratio were used to assess associations in univariate analysis. In multivariate analysis, Odds Ratios from Logistic Regression model were used as the measures of association between the study variables. All reported p-values are based on two-sided tests and compared to a significance level of 0.05. STATA version 12.0 software was used for all the statistical calculations.

### Results

A total of 69173 subjects consisting 33884 (49%) men and 35289 (51%) women, were included in this analysis. The mean age  $\pm$  standard deviation (SD) of the participants was  $41.5 \pm 11.37$  years. The overall weighted prevalence of self-reported hypertension was 5.27%; significantly higher in women (6.64%) than men (3.83%) ( $p < 0.001$ ). Age group of 25-34 years had the minimum prevalence (0.56%) and age group of 55-64 years had the maximum prevalence (15.32%). Overall trend for prevalence of self-reported hypertension

Table 1. Prevalence rates of Hypertension by sex and age groups.

Age group	Male			Female			Total			p-value
	n	HTN	Weighted Prevalence (%) (95% CI)	n	HTN	Weighted Prevalence (%) (95% CI)	n	HTN	Weighted Prevalence (%) (95% CI)	
25-34	11991	76	0.66 (0.49-0.83)	12267	59	0.45 (0.33 – 0.57)	24258	135	0.56 (0.46 – 0.65)	0.11
35-44	8108	144	1.87 (1.52-2.23)	8668	258	2.87 (2.43 – 3.30)	16776	402	2.39 (2.08 – 2.70)	<0.001
45-54	7822	436	5.51 (4.95-6.10)	8576	835	9.84 (9.01 – 10.67)	16398	1271	7.80 (7.23 – 8.37)	<0.001
55-64	5963	625	10.51 (9.57-11.46)	5778	1160	20.32 (18.79 – 21.85)	11741	1785	15.32 (14.31 – 16.32)	<0.001
Total	33884	1281	3.83 (3.56 – 4.10)	35289	2312	6.64 (6.21 – 7.07)	69173	3593	5.27 (4.96-5.57)	<0.001

Table 2. Weighted incidence rates of hypertension by sex and age groups

Age group	Male			Female			Total			Risk Ratio (95% CI) Female / Male
	At Risk	New case	Incidence (per 1000)	At Risk	New case	Incidence (per 1000)	At Risk	New case	Incidence (per 1000)	
25-34	11915	17	1.56	12208	8	0.63	24123	25	1.09	0.46(0.20 – 1.06)
35-44	7964	35	4.35	8410	56	5.88	16374	91	5.14	1.52(0.99 – 2.31)
45-54	7386	69	7.81	7741	125	14.42	15127	194	11.30	1.73(1.29 – 2.32)
55-64	5338	62	10.50	4618	108	19.57	9956	170	14.94	2.01(1.48– 2.74)
Total	32603	183	5.26	32977	297	8.43	65580	480	6.87	1.61(1.34 – 1.93)

increased considerably as age increased (p for trend<0.001) (Table 1).

The annual weighted incidence rate of self-reported hypertension was 6.87 per 1000; 5.26 in men and 8.43 in women. Age group of 25-34 years had the lowest incidence rate (1.09 per 1000) and age group of 55-64 years had the highest incidence rate (14.94 per 1000). The estimated female to male risk ratio for incidence rate of self-reported hypertension was 1.61 (1.34 – 1.93). Risk ratios and their 95% confidence intervals presented in Table 2 indicates that incidence rates of self-reported hypertension in men was significantly higher than women in age groups of 45-54 and 55-64 years, but no significant difference in age groups of 25-34 and 35-44 years was observed. The overall trend for incidence rates of self-reported hypertension increased considerably as age increased (p for trend<0.001).

Figure 1 indicates that as age increased, prevalence and incidence rates of self-reported hypertension in both sex increased. Moreover, both reported prevalence and incidence rates tend to be higher in women in relation to men as age increased so that in age group of 55-64 years, the two rates have been reached almost twice for females in relation to males.

Table 3 shows the prevalence and inci-

dence rates of self-reported hypertension by district. The two rates obviously vary across the districts. The lowest prevalence occurred in district 17 (2.3%) and the highest in 8 (7.0%). On the other hand, the lowest incidence rate was in district 17 (2.15 per 1000) and the highest in 9 (10.07 per 1000).

In multivariate analysis, the odds of self-reported hypertension in women was 1.62 times that of men. Among all assessed variables in the survey, age had the strongest association to self-reported hypertension so that the odds of self-reported hypertension rapidly increased as age of participants increased (p for trend<0.001). Overall, as the level of education increased, the odds of self-reported hypertension decreased (p for trend<0.001) so that illiterate respondents had more likely than the +17 college group to report hypertension. Compared with married participants, single participants had 33% higher odds of reporting hypertension whereas widow or divorced participants had less likely to report hypertension [OR = 0.46 (0.36 – 0.58)]. The odds of being hypertensive increased with excess of BMI (p for trend<0.001) so that compared with the normal group, over weight and obese participants had more likely to report hypertension (52% and 2.42 times, respectively). Also smokers had 19% more likely to re-

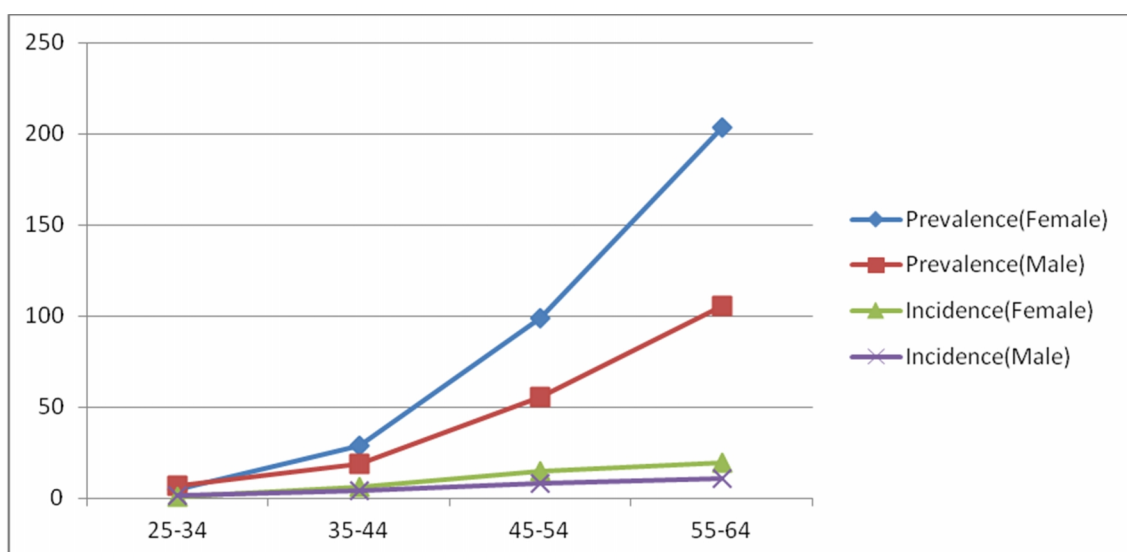


Fig. 1. Prevalence and Incidence rates of self-reported hypertension by sex and age groups (per 1000)

Table 3. Prevalence and Incidence rates of self-reported hypertension by district

District	n	HTN	Weighted Prevalence (%) (95% CI)	At Risk	New Case	Weighted Incidence (per 1000) (95% CI)
1	3200	133	4.16(3.15 – 5.16)	3067	17	5.31(3.20 – 7.11)
2	3295	225	6.83(5.29 – 8.37)	3070	24	7.28(3.71 – 10.86)
3	3042	153	5.03(4.09 – 5.97)	2889	12	3.95(1.20 – 6.69)
4	3301	170	5.15(3.91 – 6.39)	3131	25	7.57(3.58 – 11.57)
5	3363	202	6.01(5.02 – 6.99)	3161	25	7.43(5.28 – 9.59)
6	2955	168	5.69(4.57 – 6.80)	2787	29	9.81(4.49 – 15.14)
7	3068	146	4.76(3.63 – 8.89)	2922	20	6.52(1.80 – 11.24)
8	2993	210	7.02(6.02 – 8.02)	2763	19	6.35(2.46 – 10.24)
9	2979	178	5.98(4.76 – 7.19)	2801	30	10.07(7.04 – 13.10)
10	3011	105	3.49(1.49 – 5.48)	2906	24	7.97(2.04 – 13.90)
11	2962	142	4.80(3.56 – 6.04)	2819	19	6.42(4.13 – 8.71)
12	3166	193	6.10(4.42 – 7.78)	2973	25	7.90(4.60 – 11.19)
13	2764	94	3.40(2.46 – 4.34)	2670	11	3.98(1.94 – 6.03)
14	2971	140	4.71(3.10 – 4.43)	2831	16	5.39(2.44 – 8.31)
15	3408	179	5.25(4.37 – 6.14)	3229	26	7.63(2.79 – 12.46)
16	3055	178	5.83(4.41 – 7.25)	2877	26	8.51(4.02 – 13.0)
17	3261	75	2.30(1.56 – 3.04)	3186	7	2.15(0.37 – 3.93)
18	3683	155	4.21(3.17 – 5.24)	3528	18	4.89(3.40 – 6.38)
19	3201	169	5.28(4.33 – 6.23)	3032	29	9.06(5.68 – 12.44)
20	3424	203	5.93(4.87 – 6.99)	3221	30	8.76(5.31 – 12.22)
21	3503	240	6.85(5.85 – 7.86)	3263	29	8.28(5.65 – 10.91)
22	2569	135	5.26(4.39 – 6.14)	2434	19	7.40(3.89 – 10.91)
Total	69173	3593	5.27(4.96 – 5.57)	65580	480	6.87(6.02 – 7.73)

port hypertension than non-smokers. On the other hand, only wealth status was not associated to self-reported hypertension. The Odds ratios and their confidence intervals are presented in Table 4.

### Discussion

There is a wide range of hypertension prevalence in previous reports. Worldwide estimates for the adult population ranges from 3.4 to 72.5% (4). The present study estimated overall prevalence of self-reported hypertension as 5.27%, which is much lower than the data provided by other clinically assessed (1, 6, 10-13) and even self-reported studies (3, 15, 23-27). This difference is probably due to different study populations, methods and sample sizes. In self-reported studies, moreover, public awareness of hypertension status plays an important role, so that the less public awareness, the more underestimation may occur.

In this study, hypertension was more prevalent in women (6.64%) than in men (3.83%) similar to most previous studies (9, 12, 14, 23, 28-31), although some contradictory results could be observed (6, 10, 13, 32, 33). This can be explained partly by the

fact that women usually used to express more their unwellness and are interested in healthcare services more than men, therefore more likely to have higher awareness of the condition. Also, as we expected, self-reported prevalence of hypertension obviously raised by increasing age in both genders, like most other studies (6, 10-14, 27-30, 32). However with increasing age, a more rapid rise in reported prevalence rates occurred in women compared to men. Furthermore, age and sex patterns of incidence rates of self-reported hypertension were as same as the prevalence rates of self-reported hypertension.

The estimated prevalence and incidence rates of self-reported hypertension by districts ranged from 2.3% to 7.0% and 2.15 to 10.1 respectively. The lowest prevalence and incidence rates of hypertension were reported from district 17 while the highest prevalence and incidence rates of hypertension were reported from districts 8 and 9 respectively. These variations may be explained by different rates of hypertension or different patterns of awareness and reporting the condition among districts residents.

In multivariate analysis using binary logistic regression, we found higher odds of

Table 4. Multivariate analysis results using logistic regression model.

Characteristics	N	HTN	Weighted Prevalence (%) (95% CI)	Odds Ratio (95% CI)	p-value	p-value for trend
Total	69173	3593	5.27(4.96-5.57)			
Sex						
male	33884	1281	3.83(3.56 – 4.10)	1		
Female	35289	2312	6.64(6.21 – 7.07)	1.62(1.48 – 1.77)	<0.001	
Age						
25-34	24258	135	0.56(0.46 – 0.65)	1		
35-44	16776	402	2.39(2.08 – 2.70)	2.86 (2.25 - 3.63)	<0.001	
45-54	16398	1271	7.80(7.23 – 8.37)	8.71(7.10 – 10.75)	<0.001	
55-64	11741	1785	15.32(14.31 – 16.32)	18.22(14.74 – 22.53)	<0.001	<0.001
Marital Status						
Married	50118	3057	6.19(5.79 – 6.59)	1		
Single	3436	428	12.84(11.48 – 14.19)	1.33(1.18 – 1.50)	<0.001	
Widow or Divorced	14497	83	0.57(0.42 – 0.72)	0.46(0.36 – 0.58)	<0.001	
Literacy						
Illiterate	3566	513	14.53(13.02 – 16.04)	1.66(1.26 – 2.19)	<0.001	
1-5 Schooling	5788	558	9.86(8.88 – 10.84)	1.27(0.97 – 1.67)	0.07	
6-8 Schooling	8832	618	7.20(6.49 – 7.92)	1.29(0.99 – 1.68)	0.06	
9-12 Schooling	30392	1341	4.55(4.13 – 4.97)	1.20(0.93 – 1.54)	0.16	<0.001
13-16 Schooling	16850	458	2.77(2.40 – 3.14)	1.04(0.80 – 1.36)	0.75	
College +17	3398	85	2.65(2.07 – 3.23)	1		
BMI						
Under Weight	1677	19	1.21(0.65 – 1.78)	0.64(0.40 – 1.03)	0.065	
Normal Weight	29026	850	2.94(2.70 – 3.19)	1		
Over Weight	25427	1519	6.04(5.62 – 6.45)	1.52(1.38 – 1.66)	<0.001	<0.001
Obese	10067	1095	11.17(10.29 – 12.05)	2.42(2.19 – 2.68)	<0.001	
Smoking						
No Smoker	62996	3258	5.25(4.94 – 5.56)	1		
Smoker	6177	335	5.44(4.80 – 6.07)	1.19(1.04-1.35)	0.01	
Wealth Status						
Poorest	12889	614	4.75(4.24 – 5.26)	1		
Poor	12444	657	5.28(4.79 – 5.76)	0.99(0.86 – 1.14)	0.85	
Moderate	9211	504	5.43(4.85 – 6.02)	1.03(0.87 – 1.21)	0.72	
Rich	16768	923	5.63(5.15 – 6.11)	1.10(0.96 – 1.26)	0.17	0.33
Richest	13306	700	5.51(4.92 – 6.10)	1.13(0.95 – 1.33)	0.16	

reporting hypertension among women versus men after adjustment for other variables. Also, similar to previous studies, increasing age, BMI, low literacy level and smoking were independent risk factors for self-reported hypertension(6, 7, 10-13, 20, 27, 30). Singles had 33% higher odds of reporting hypertension compared to married persons. Odds of reporting hypertension among widows and divorced was nearly half the married participants, which is probably due to different patterns of utilizing medical services or different self-reporting rates among the three groups. Only wealth status was not significantly associated to self-reported hypertension in multivariate analysis.

A major strength of our study is the larger sample size compared to previous studies in Tehran. This can reduce probability of ran-

dom error, and can provide more precise estimates as we can see the narrow confidence intervals for the estimated rates. Moreover, using random sample from each district enabled us to achieve better estimates of the rates disaggregated by districts. Our study is subject to several limitations, too: first, because the study design was a cross-sectional survey, the associations are not proof of causality so reverse causality bias could be there. Second, the nature of self-reporting used in the study can cause underestimation of disease rates because always a large fraction of hypertensive cases in any population are not diagnosed and also some participants are probably reluctant to reveal their disease. Third, it was logistically difficult to measure participants' blood pressure in this survey; hence, we could not present direct es-

timates of the awareness rates of hypertension in the study population.

### Conclusion

Our study findings highlighted low reported rates of hypertension among Tehran adults, which was higher in men and younger people. Hence, we recommend public health strategies to improve health literacy to increase public awareness of hypertension. Moreover, programs to improve the surveillance systems and implementation of community based screening programs to early detection of the cases are urgently needed especially in high risk population subgroups.

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