



Direct Costs of Hypertension Treatment in Iran

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Abstract

Background: Hypertension is a common public health problem with potentially serious consequences. We aimed to explore the direct costs of hypertension treatment in Iran.

Methods: Literature review and STEPS survey were used to estimate the incidence and prevalence of hypertension for Iranian males and females and the proportion of its treatment coverage in 2020. A standard national protocol for hypertension treatment was used to estimate the required medical services including visits, medications, and lab tests. The cost of each service and the total cost of the disease were identified using the national reference costs.

Results: About 23.39 million people suffer from moderate systolic blood pressure (BP of 120 to 139 mm/Hg) and a further 14.6 million people had severe BP (≥ 140 mm/Hg). Nearby 39.8% of these patients, receive BP treatment. The direct costs of hypertension treatment were 19,006.08 billion IR Rials (USD 87.54 million), of which 16.60% and 83.40% of the costs were related to new and prior cases, respectively. The costs of patient visits, medications, and lab tests were 56%, 35.51%, and 8.49% of the total costs, respectively.

Conclusion: The prevalence and economic burden of hypertension are relatively high in Iran. Early detection and treatment of hypertension might have a significant effect on reducing its complications and costs.

Keywords: Direct costs; Hypertension; Iran; Non-communicable diseases

Introduction

Non-communicable diseases (NCDs) are currently a major health issue with huge health and economic impact worldwide (1). In 2016, approximately 72% of all deaths were due to chronic non-communicable diseases worldwide (2). In addition, NCDs were responsible for more than 60% of Disability-adjusted life years (DALYs) and 80% of Years of healthy life lost due to disability (YLD) (2, 3). NCDs have therefore, a great impact on economic development and growth (4).

Hypertension (HTN) is a common non-communicable disease (5), and one of the most common cardiovascular and respiratory disorders that lead to high mortality worldwide (6). HTN is a major risk factor for a wide range of non-communicable diseases, especially stroke, heart disease, chronic kidney disease (7). The population fraction attributed to hypertension for ischemic heart disease, ischemic and hemorrhagic stroke, and chronic kidney disease is estimated at 54.5, 50, 58.3, and 59%, respectively (8). HTN is recognized as a major risk factor for mortality



and is a growing global public health problem that imposes a heavy economic burden on society (9, 10).

The prevalence of hypertension worldwide was 26.4% in 2000 and it is projected to reach 29.2% by 2025 (11), and also it is currently higher in LMICs than in high-income countries (12). The regions with the highest prevalence of hypertension include sub-Saharan Africa, South Asia, and Central and Eastern Europe, which mainly include LMICs (13). In high-income areas, the number of people with high blood pressure is expected to increase by 70 million from 2000 to 2025, while in low-income areas, the number of people with high blood pressure is expected to increase by more than 500 million in the same period (14, 15).

In 2010, hypertension has caused 9.4 million deaths and seven percent of disability-adjusted life-years worldwide and in ranking the burden of diseases based on DALYs, it has changed from the fourth rank in 1990 to the first rank in 2010 among 20 risk factors (5). In the 2015 Global Burden of Disease Report, systolic hypertension among the risk factors had the highest burden, even higher than smoking and obesity (16).

In Iran, as a middle-income country, along with economic growth and lifestyle changes, the incidence of hypertension has increased in recent years and has become a major problem. As emphasized in the 2016 Global Burden of Disease, In Iran, since 2005, the DALYs rank of hypertension have risen from tenth to sixth place (2). This growing challenge is a threat to the socio-economic development and health of millions of people. Therefore, estimating the costs of hypertension is necessary both as a motivation for health system decision-makers and as a source of primary information for planning and prioritizing resources to making appropriate and cost-effective decisions to maintain people's health and reducing the costs (17, 18).

Due to the lack of sufficient information about the direct costs of hypertension treatment in Iran, as well as the interest and needs of health policymakers and decision-makers to assess potential costs and understand the economic costs of hypertension, therefore, we aimed to estimate the direct costs of hypertension in Iran in 2020.

Methods

A standard method named the cost of illness approach was used to calculate the direct cost of hypertension. The costs were calculated in four steps.

First, we estimated the number of prior and new cases of hypertension by age and sex, as well as the stage of the disease. Then the age and sex-specific incidence and prevalence rate of hypertension in each age and sex group were identified. Age and sex-specific incidence and prevalence rates were extracted from previous studies as well as STEPS surveys (19-21). Iran's population by age and sex in 2020 was also extracted from the website of the Statistics Center of Iran (22).

In the second step, based on the STEPS survey, the percentage of health care coverage for people with hypertension was extracted, in other words, the percentage of patients that were identified and treated was extracted by age and sex (23). In the third step, according to a standard national protocol developed by the Tehran University of Medical Sciences, the various services that patients at different levels of blood pressure should receive were determined. Medical services included visits, medications, and lab tests (24).

The required medical services for newly affected people or incidence included physician visits, a set of lab tests after definitive diagnosis of hypertension, medications, and re-lab tests one or two weeks after starting medication use (Fig.1).

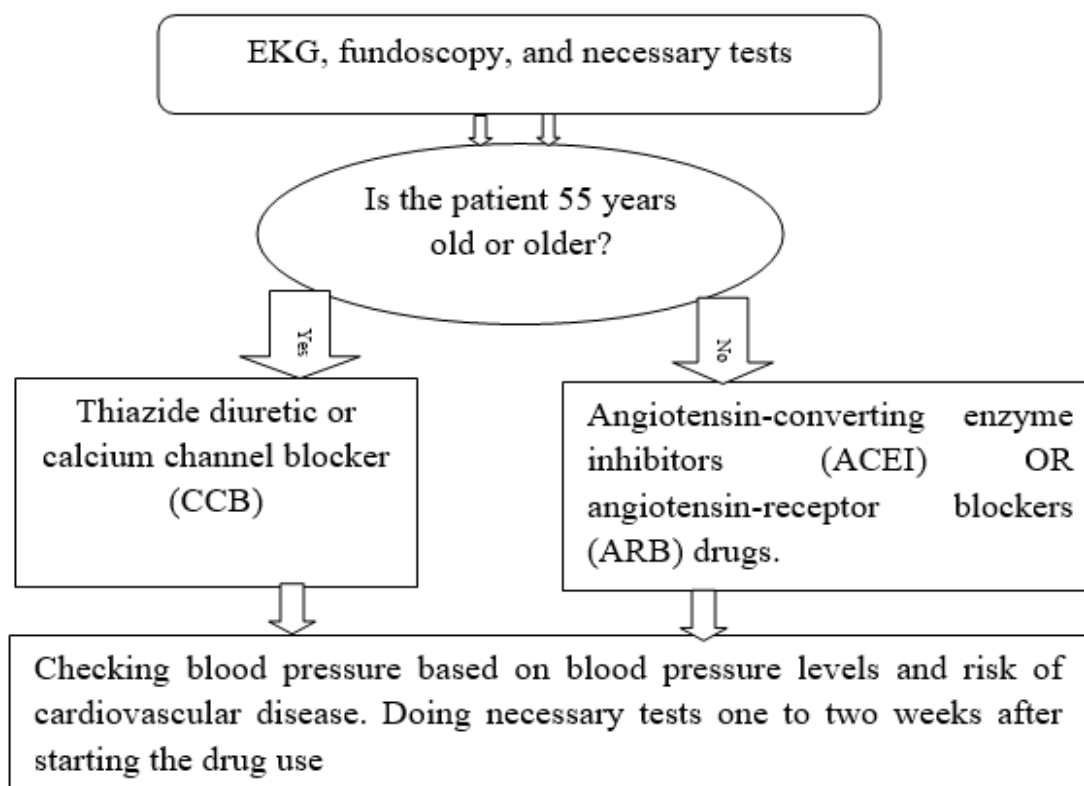


Fig.1: The process of necessary measures after the definitive diagnosis of hypertension for the first time

Services needed by patients who already had the disease (prior cases) also included daily medications, physician Visits based on the level of cardiovascular risks, including age and blood pressure levels, and routine lab tests every 6 months. According to the protocol, antihypertensive medications are very diverse and numerous for prior cases, so by reviewing the literature (25) the most common medications prescribed to patients were identified, which were atenolol, captopril, and Diuretics (thiazides). In addition, for 60% of patients, only one type of medication that is atenolol or captopril has been prescribed and for the other 40%, the combination of medications (2 medications or more) has been prescribed. Finally, in the last step, to calculate the total direct costs of hypertension, first, the total cost is calculated separately for each service and then the total cost of services is added together. To calculate the total cost of each service, the total number of services used was multiplied by the price of each service. The total number of services

used is calculated by multiplying the number of patients by the average number of times the service is used per year. The average price of each service is derived from national reference costs and market prices(26, 27). To convert the IR Rials into the US Dollar, the average exchange rate of the Central Bank system for 2020 has been used (1USD = 217,109 IR Rials) (28).

Results

Based on the prevalence of hypertension in different age and sex groups, the population of people with systolic blood pressure between 120 and 140 mm was 23,388,410 and the number of people with more than 140 mm Hg was 14,666,474. However, not all the patients with high blood pressure receive health care. According to the distribution of high blood pressure coverage, based on the STEPS surveys, 4,733,030 people with systolic blood pressure between 120

and 140 mm Hg and 4,249,177 patients with systolic blood pressure more than 140 mm Hg receive medical services. Table 1 shows the number

of prior and new high blood pressure cases at different levels based on age and sex.

Table 1: Number of prior and new cases of high blood pressure by age and sex in 2020

Number of prior patients						
Gender	Males		Females		Both sex	
Range of blood pressure	120-140	≥140	120-140	≥140	120-140	≥140
Age group(yr)						
20-24	1,512,729	176,844	768,628	38,024	2281357	214,868
25-29	1,732,980	800,900	1,192,957	725,933	2925937	1,526,833
30-34	2,084,786		1,653,902		3738688	
35-39	2,058,062	1,025,324	1,526,464	1,504,941	3584526	2,530,265
40-44	1,870,304		1,301,858		3172162	
45-49	1,177,344	1,675,332	1,098,584	1,483,525	2275928	3,158,857
50-54	917,190		967,020		1884210	
55-59	765,856	1,101,404	707,784	1,362,123	1473640	2,463,527
60-64	691,580		592,040		1283620	
65-69	358,662	442,244	409,680	268,637	768342	710,881
≥70		780,000		1,120,190		1,900,190
Total	13,169,493	6,002,048	10,218,917	6,503,373	23,388,410	12,505,421
Number of new patients						
Range of blood pressure	Males		Females		Both sex	
Age group(yr)	≥140		≥140		≥140	
15-24	107,673		51,604		159,277	
25-34	99,372		43,199		142,571	
35-44	281,274		154,142		435,416	
45-54	215,430		178,364		393,794	
55-64	191,007		186,447		377,454	
65-74	125,902		308,329		434,231	
≥75	88,920		129,390		218,310	
Total	1,109,578		1,051,475		2,161,053	

Table 2 shows the costs of different services in hypertension treatment in prior males and females patients. Due to the fact that the number of visits varies at different levels of blood pressure and in different age groups, the cost of the visit was calculated in three separate groups. In

prior cases, considering that 60% of patients used one type of medication, patients were divided into two groups including single and combination drug therapy, and cost calculations were performed.

Table 2: Number of patients and costs of different services in prior patients, which have received medical care, based on gender

<i>Type of service</i>		<i>Number of patients</i>	<i>Average annual cost per patient(IRR)</i>	<i>Total annual cost (billion IRR)</i>	<i>Total annual cost (million USD)</i>
Males					
Visit	BP \geq 140 mm Hg and aged \geq 45 years old	1,489,100	2,076,000	3,091.37	14.24
	BP \geq 140 mm Hg and aged <45 years old	152,123	1,038,000	157.90	0.73
	BP 120 -139 at all ages	1,954,095	346,000	676.12	3.11
Medications	Single medication treatment	984,734	1,021,087	1,005.50	4.63
	Combination treatment	656,49	1,888,875	1,240.03	5.71
Lab tests		1,641,224	185,601	304.61	1.40
Females					
Visit	BP \geq 140 mm Hg and aged \geq 55 years old	1,594,883	2,076,000	3,310.98	15.25
	BP \geq 140 mm Hg and aged <55 years old	1,013,070	1,038,000	1,051.57	4.84
	BP 120 -139 at all ages	2,778,935	346,000	961.51	4.43
Medications	Single medication treatment	1,564,772	1,021,087	1,597.77	7.36
	Combination treatment	1,043,181	1,888,875	1,970.44	9.08
Lab tests		2,607,953	185,601	484.04	2.23

The total cost of prior cases in males and females were 6,475.53 billion IR Rials (USD 19.48 million) and 9,376.30 billion IR Rials (USD 43.19 million) respectively. The cost of visits, lab tests, and medications for males and females with high blood pressure in new cases are calculated in Table 3.

The total cost of new cases in males and females with hypertension were 1,181.83 billion IR Rials (USD 5.44 million), and 1,972.41 billion IR Rials (USD 9.08 million) respectively. In Table 4 the total direct costs of hypertension treatment by new and prior cases and medical services are summarized.

Table 3: Costs of different services for new cases of hypertension in men and women which have received medical care

<i>Type of Service</i>		<i>Number of patients</i>	<i>Average annual cost per patient(IRR)</i>	<i>Total annual cost (billion IRR)</i>	<i>Total annual cost (million USD)</i>
Males					
Visit	<45 years old	36,078	1,038,000	37.45	0.17
	≥45 years old	237,560	2,076,000	493.17	2.27
Medications	<55 years old	90,798	1,518,400	137.87	0.64
	≥55 years old	182,841	1,153,400	210.89	0.97
Lab tests	Before starting treatment	273,638	1,012,508	277.06	1.28
	After starting treatment	273,638	92,800.50	25.39	0.12
Females					
Visit	<55 years old	113,347	1,038,000	117.56	0.54
	≥55 years old	359,277	2,076,000	745.86	3.44
Medications	<55 years old	113,347	1,518,400	172.11	0.79
	≥55 years old	359,277	1,153,400	414.39	1.91
Lab tests	Before starting treatment	472,625	1,012,508	478.54	2.20
	After starting treatment	472,625	92,800.50	43.86	0.20

Table 4: The total cost of different services in both sexes and both new and prior cases, which have received medical care

<i>Cost item</i>	<i>Amount in million USD</i>	<i>Percent of total</i>
Prior cases	Visit costs	42.60
	Medication costs	26.78
	Lab tests costs	3.63
	TOTAL	73.01
New cases	Visit costs	6.42
	Medication costs	4.31
	Lab tests costs	3.80
	TOTAL	14.53
All cases	Visit costs	49.02
	Medication costs	31.09
	Lab tests costs	7.43
	TOTAL	87.54

In the tables above, the calculations were related to the costs of patients identified and treated, to

perform the sensitivity analysis, a 20% change in visit and medication costs was performed, which

resulted in a change of $\pm 12.61\%$ (USD 9.80 million) and $\pm 7.27\%$ (USD 5.93 million) in the total direct costs of hypertension, respectively. In addition, a change in the coverage of hypertension treatment to 100% was performed, which caused

an increase of 196% in the total direct costs of hypertension. Therefore, if all people suspected or suffering from high blood pressure receive medical services, the costs will increase by USD 171.96 million, which is provided in Table 5.

Table 5: Total costs of medical services in both sexes and both new and prior cases assuming all patients are treated

<i>Cost item</i>	<i>Amount in million USD</i>	<i>Percent of total</i>
Prior cases	Visit costs	129.33
	Medication costs	78.81
	Lab tests costs	10.69
	TOTAL	218.83
New cases	Visit costs	16.29
	Medication costs	13.38
	Lab tests costs	11
	TOTAL	40.67
All cases	Visit costs	145.62
	Medication costs	92.19
	Lab tests costs	21.69
	TOTAL	259.50

Discussion

The direct costs of hypertension treatment were analyzed using the cost of illness method. Generally, the financial cost of blood pressure in this study includes physician visits, medications, and lab tests. On the grounds that the coverage of hypertension treatment in Iran was very low and about 25-39.8% of patients (23, 29), the total direct costs of hypertension were 19,006.08 billion IR Rials (USD 87.54 million), which was 16.6% for new cases and 83.40% for prior cases. The costs of visits, medication, and lab tests accounted for 56, 35.51, and 8.49 percent of total costs, respectively. Of course, as shown in Table 5, if all people with high blood pressure, get medical services, the total cost of treating high blood pressure would be USD 259.50 million, which would almost triple.

The results show that most of the direct costs of hypertension are related to visit costs. However, some studies in other countries have shown that medication costs have been the highest (30, 31). In the present study, the services required by patients with prehypertension were also calculated,

which often require only non-pharmacological care, including physician visits, and only certain groups of patients need medication. Therefore, the population consuming the medication are less and its costs is less than physician visit.

According to the results of a study in 2008, approximately 25% or 6.6 million Iranians, aged 25-64 yr had high blood pressure. Also, 46% or 12 million Iranians between the ages of 25 and 64 had prehypertension (29). Therefore, the number of people who should be visited and cared for is more than the number of people who take the medication. In accordance with the results of the present study, although the newly infected population is about 8% of the total patients, about 16.6% of the total costs are included. One of the reasons is that the average annual cost of each new patient was 4,226,716 IR Rials (USD 19.47) and for prior cases was 1,764,804 IR Rials (USD 8.13).

Hypertension is an independent risk factor for cardiovascular disease, including stroke, ischemic heart disease, congestive heart failure, and chronic kidney disease, and it is associated with increased mortality (32). In 2016 in Iran ischemic

heart disease, stroke, hypertension, chronic kidney disease, and other cardiovascular diseases were among the most important causes of death (2). The WHO estimated in 2002 that half of all cardiovascular diseases were owing to high blood pressure (33). High blood pressure was the cause of 49% of coronary heart disease and 62% of stroke (34). In 2005, the global burden of hypertension was estimated to increase from about \$ 0.9 billion in 2000 to about \$ 1.4 billion by 2010, and to \$ 1.6 billion in 2025 (11, 35), thus, by preventing or treating hypertension, a large number of cardiovascular diseases and as result, a lot of costs can be prevented.

The costs of treating hypertension alone accounted for 12.1% of the costs associated with hypertension (36). Another study estimated that the costs of treating hypertension accounted for about 21% of the total costs associated with hypertension, cardiovascular complications 27%, and other diseases 52% (37). Hypertension due to its complications, result in increasing mortality and reducing life expectancy, and puts a high economic burden by increasing out-of-pocket and catastrophic costs. Therefore, if the risk factors and various health programs remain unchanged, the economic effects of the expected epidemiological changes will be greater (38).

Hypertension treatment is cost-effective (39-42). Therefore, the treatment of people with hypertension, although imposes many costs on the health system, but to avoid further costs they must be treated. One of the most important problems for the prevention and controlling of hypertension is the Unawareness of the people and the ignoring of hypertension. According to an Iranian study, 34% of people are aware of their blood pressure (29). Therefore, the need for early public measures to inform people, prevention of hypertension by regular screening in the country's health networks, and providing healthcare is obvious.

Strengths and limitations

This is the first study estimating the direct costs of hypertension for the entire population of Iran, and in this study, the costs of medication, visits, and lab tests for males and females in prior and new cases were calculated separately. Its limitations are the point estimation of direct costs of hypertension without considering its complications, and assuming that outpatient treatment does not require travel to other cities and that absence from work is not necessary or that it is very rare and negligible, therefore, it was not calculated. Also in this study, costs were estimated based on literature review and the use of hypertension treatment guidelines.

Conclusion

Although direct costs of hypertension are not catastrophic per patient, the prevalence of hypertension in the community is high, and the costs of the complications of hypertension are significant, but due to the asymptomatic of hypertension and ignorance of its complications, less attention is paid and the treatment coverage of hypertension is much less. Therefore, if the government covers all patients through public information including informing patients about the disease, and encouraging patients to seek treatment through training and financing of long-term care can prevent the complications associated with hypertension, as a result, reducing the costs associated with hypertension.

Furthermore, in developing countries such as Iran, in addition to focusing on infectious diseases, we need to understand the importance of problems such as high blood pressure and address them through various policies and programs. Strategies such as running screening programs, building parks and trails, involving local authorities in awareness-raising campaigns, focusing on medication availability, etc. should be on the agenda to reduce the disease as well as its economic burden.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interests

The authors declare that they have no competing interests

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