Jundishapur J Health Sci. 2016 April; 8(2): e32503. doi: 10.17795/jjhs-32503

Published online 2016 January 9. **Research Article**

Analysis of Cardiovascular Diseases Costs and Their Effective Factors in Tabriz Hospitalized Patients, 2015

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Received 2015 August 17; **Revised** 2015 October 31; **Accepted** 2015 November 3.

Abstract

Background: Cardiovascular diseases are the most important chronic diseases with significant negative effects on the individuals' quality of life and communities' economic productivity.

Objectives: The present study aimed to analyze the costs of cardiovascular diseases and identify the related factors in hospitalized patients of Tabriz Shahid Madani hospital in 2015.

Patients and Methods: This paper was a cross-sectional study. Cost information was obtained by a bottom-up approach from the patients and their families' perspective. A number of 285 patients were randomly selected to participate in the study. For data collection, the study deployed a researcher-made questionnaire whose validity and reliability were confirmed by statistical tests. First, the collected data were analyzed using descriptive methods. And then, the researchers used t-test and ANOVA to analyze the relationship between demographic variables and the different types of cost. Tukey test was used to compare differences between groups groups, the researchers used.

Results: The Study findings showed that the total cost of cardiovascular diseases was 13,074,700 Rials (US$462) per patient. The details of the costs of cardiovascular diseases also showed that direct medical costs, direct non-medical costs, and indirect costs were 10,909,100 Rials (US$386), 109'940 Rials (US$38.90), and 1,066,200 Rials (37.73 US$) which were 83.4%, 8.4% and 8.2% of the total costs, respectively. Statistical analyses indicated a significant relationship between gender, marital status, education, job status, location, type of disease, type of admission, and the reason for hospitalization and some types of assessed costs ($P < 0.05$).

Conclusions: The study showed that the costs associated with cardiovascular diseases were not reasonable for many of these patients and their families. This certainly requires more consideration by managers and policy makers in the health care sector and the implementation of effective interventions.

Keywords: Cardiovascular Diseases, Direct and Indirect Costs, Tabriz

1. Background

Today's world has tolerated significant changes such as the occurrence of infectious diseases and the prevalence of chronic diseases, known as the epidemiological transition. Chronic diseases such as cardiovascular diseases not only pervade the developed countries, for example one-third of the American adults, which means nearly 81 million people, who suffer from some form of cardiovascular diseases (1) but also account for about 50% of the total burden of diseases in low- and middle-income countries in 2005. It is predicted that this rate rises in the coming years (2).

Cardiovascular diseases are the most common type of non-communicable diseases and the leading cause of death and disability, especially in low- and middle-income countries such as Iran (3-5). Several studies showed that the risk factors of such diseases are not in a favorable condition in Iran. Note that 3.6%, 21.6%, 15%,61%, 32%, 47.5%, 13.7%, 1.9%, and 87% of the population suffer from diabetes, are smokers, have a family history of heart diseases, have high cholesterol (higher than 200 mg dL), have high triglycerides (higher than 200 mg dL), have high LDL, have high systolic blood pressure (higher than 140 mmHg), diastolic blood pressure (higher than 90 mm Hg), and have no physical mobility, respectively. These risk factors are rising steadily (6).

The negative impact and the costs of these diseases are increasing every day because of the increasing number of patients as a result of an aging population, the decrease in the age of incidence, as well as the development of new therapies (7). According to the World Health Organization (WHO) in 2008, about 80% of the deaths were related to non-communicable diseases that is, about 29 million cases occur in low- and middle-income countries (about 48% of

them occur at a younger age than 70). In the meantime, cardiovascular diseases account for 39% of the cases (8).

In 2004 and 2005, cardiovascular diseases accounted for about 11% of the total expenditure on health, which indicates an 18%increase (9-11). For example one of the common, costly and disabling types of cardiovascular diseases is chronic heart failure (CHF) which afflicts about 2% of the adult population and 6% - 10% of people over 65 in the developed countries (12). It is the cause of staggering costs - about 2% of the budget of the health sector in the UK and more than $ 35 billion of the budget of the United States (13). However, the most common form of cardiovascular diseases, which is the main cause of death in Australia, is coronary heart disease (CHD). Coronary heart disease accounts for about $ 1.81 billion of direct costs which amounts to 30% of the costs related to cardiovascular diseases. The figure is higher than that of any other diseases. Due to the large health and economic impact at the national level, the management and prevention of cardiovascular diseases is Australia's first health priority (9).

Cardiovascular diseases are among the ones that impose various and often extensive costs on patients. It always seems necessary to evaluate the costs imposed on patients in different times and geographic areas. It is necessary to note that the costs imposed by patients, families, and communities are not limited to the bills paid by patients to health care providers but rather various diseases, particularly chronic and debilitating diseases, require vast expenditures (9, 14).

For example, in addition to the costs of prevention, treatment and rehabilitation services known as direct medical costs, there are also other costs including direct non-medical costs (costs of travel, accommodation, food, preparation, etc.), indirect costs (costs of absenteeism, loss of job, and disablement for patients or their families), and intangible costs (costs related to pain, stress, and psychological pressure imposed on patients or their families) (14, 15). Therefore, estimating the costs imposed on the patients requires a comprehensive and scientific point of view in relation to the types of costs. It is only under such conditions that a complete delineation of the financial pressure can be exerted on patients or their families (16).

2. Objectives

According to researchers' best knowledge, no detailed study was conducted on the cost of cardiovascular diseases and their effective factors for patients in Iran. Considering the undeniable importance of costing information in planning and policy making, the present study aimed to analyze the costs of cardiovascular diseases and identify the related factors in hospitalized patients of Tabriz Shahid Madani hospital in 2015.

3. Patients and Methods

This cross-sectional study aimed to analyze the cost-of-illness in cardiovascular diseases. Cost information was obtained with a bottom-up approach from the patients and their families' perspective. A number of 285 patients, determined using Morgan Table were randomly assessed in Apr 2015. The inclusion criteria consisted of subjects having cardiovascular disease at least one year prior to the study; hospitalization in Tabriz Shahid Madani Hospital in the period of data collection; and patients' willingness to take part in the study. The patients were excluded if they did not wish to participate in the study. For data collection, this study deployed a researcher-made questionnaire whose validity and reliability were assessed and confirmed by statistical tests.

To develop this instrument, first the researchers attempted to design the initial questionnaire through an extensive literature review to gain sufficient knowledge of the theoretical framework and recognition of different types of costs for such diseases. Then, all of the components obtained from the literature review were incorporated into the questionnaire. The researchers submitted the questionnaire to 15 experts to evaluate content and face validities. The criteria of inclusion into the expert panel included having sufficient experience in the field besides being specialized in the field of cardiology or holding a PhD in health care management or health economics.

In this part of the study, all of the items were evaluated from experts' perspective in 5 dimensions of relevance, transparency, simplicity, need and measurability each on a four-point scale. According to the statistical principles, the content validity ratio (CVR) was analyzed first. If the hypothesis was confirmed in this index, the scores of the other four indices of content validity index (CVI) were analyzed too. Since 10 of the experts responded, the decision criterion for acceptance was 70% in all these cases. Obviously, if any of the questions did not meet the standards in terms of acceptance score and conditions, they were removed from the final version of the questionnaire (17, 18).

All of the evaluations were performed and they yielded scores of 91% and 94% for CVR and CVI indicators, respectively, hence confirming the content validity of the questionnaire. Also, to confirm the face validity of the questionnaire, the researchers asked for the views of experts and applied their qualitative opinions to all parts of the questionnaire. In addition, to confirm the internal consistency (reliability) of the questionnaire, the researchers conducted a test-retest pilot study with 50 samples and obtained a Cronbach's alpha coefficient of 0.87, which certified the authenticity of the questionnaire. The final questionnaire came out with 14 demographic items on the underlying conditions of the disease and 21 items on the types of costs for patients.

After the completion of random sampling, collected data were first analyzed using descriptive methods and then the results were reported as frequencies (%) for qualitative variables and mean (SD) for quantitative variables. In all types of costs, the calculations were based on the frequency of the related received services and their paid costs (15). The calculated costs were changed to US Dollars

based on the Exchange Rates of Central Bank of the Islamic Republic of Iran (US$ 1 = 28257 Rials on 15 Apr 2015).

In the analytical section, t-test and the two-way or multiway ANOVA were employed to analyze the relationship between demographic variables and the different types of cost. Tukey test was used to compare the groups for significant statistical differences. In all cases, a p value of less than 0.05 was the basis to determine the presence or absence of a significant relationship. All analyses were performed with the SPSS software v19.

To observe research ethics, the participants were free to accept or reject cooperation and subjects signed informed consent letters. The results of the study were published anonymously to respect the privacy of the participants. They were assured that the data and the results would be used only for research purposes.

4. Results

The results of descriptive analyses showed that most respondents were females whose overwhelming majority were over 50 years old, married, housewives, and illiterate. Although the majority of study participants were covered by Iran Health Insurance, only one-third of them had supplementary insurance. Most of these patients lived in East Azerbaijan province and patients residing outside Tabriz were distributed in various geographic distances. Most patients were hospitalized because of high blood pressure and emergency cases for angioplasty (Table 1).

Table 1. Participants' Demographic Data[a]

Variable	Values
Gender	
Male	90 (31.6)
Female	195 (68.4)
Age, y	
Under 50	42 (14.7)
50 to 60	84 (29.5)
60 to 70	87 (30.5)
70 to 80	54 (18.9)
Up to 80	18 (6.3)
Marital status	
Single	6 (2.1)
Married	192 (67.4)
Divorced	6 (2.1)
Widow	81 (28.4)
Level of Education	
Illiterate	169 (59.3)
Primary school	52 (18.2)
Guidance school	27 (9.5)
Diploma	17 (6)
associate degree	8 (2.8)
B.Sc.	8 (2.8)
M.Sc.	2 (0.7)
Religious education	2 (0.7)
Employment Status	
Public service	16 (5.7)
Self-employment	36 (12.7)
Housekeeper	185 (64.9)
Retired	21 (7.4)
Unemployed	10 (3.6)
Daily/seasonal worker	17 (6)
Medical Insurance	
Yes	281 (98.6)
No	4 (1.4)
Insurance Type	
Social security insurance	89 (31.6)
Iran health insurance	108 (38.3)
Military insurance	15 (5.3)
Imam Khomeini relief insurance	12 (4.3)
Iran health insurance (free)	58 (20.6)
Supplemental insurance	
Yes	103 (36.1)
No	182 (63.9)
Habitat	
Tabriz	108 (37.9)
Other cities of East Azerbaijan province	119 (41.8)
Other provinces	49 (17.2)
Other countries	9 (3.2)
Distance from Shahid Madani Hospital	
Lower than 50 km	30 (16.9)
50 to 100 km	68 (38.2)
100 to 200 km	41 (23)
Higher than 200 km	39 (21.9)
Disease type	
Congenital heart disease	9 (3.2)
Hypertension	119 (41.8)
Arrhythmia	54 (18.9)
Heart valve disease	51 (17.9)
Congestive heart failure	8 (2.8)
Chronic ischemic disease	4 (1.4)
Infarction and unstable angina	40 (14.1)
Admission type	
Elective	88 (30.9)
Emergency	197 (69.1)
Reason for hospitalization	
Angioplasty	176 (61.8)
Surgery	43 (15.1)
Angioplasty and surgery	66 (23.1)

[a]Data are presented as No. (%).

Table 2 showed that, on average, the highest level of expenditure by patients under direct medical costs was on angiography, hospitalization and drug supply and the lowest level was on home care, rehabilitation and exercise test. The highest level of expenditure by patients under direct non-medical costs was on travel costs and the lowest level was on home or work environment preparation.

In addition, the level of incurred expenditure due to the absenteeism of patient relatives to take care of the patients under the category of direct non-medical costs was higher than the costs imposed on patients themselves. In general, it can be argued that the cost of angiography was higher than all other fees incurred on patients whereas the cost of preparation was the lowest.

The calculation of incurred costs under each category and the total cost indicated the fact that direct medical costs (= 10,909,100 Rials) impose the highest financial pressure on patients and indirect costs (= 1,066,200 Rials) impose the lowest financial pressure. Cardiovascular diseases in patients under study had an average cost more than 1,300,000 Rials per patient in the previous year (Table 3).

Statistical analyses suggested a statistically significant relationship between gender and the variables of indirect and total costs, between marital status and direct non-medical costs, between educational degree and total costs, between occupational status and indirect costs, between location of residence and the variables of direct non-medical costs and indirect costs, between the type of disease and indirect costs, between the type of admission and direct non-medical costs, also between the reason for hospitalization and the variables of direct medical costs, indirect costs, and total costs (Table 4).

Table 2. A Variety of Services Received by Patients and Their Costs

Type of Service	Average	Minimum Pay		Maximum Pay		Average Fee for Receipt	
	Number of Receipt	US $	Iran Rials	US $	Iran Rials	US $ (Mean, SD)	Iran Rials (Mean, SD)
Supervision by a physician	4.01	0	0	318.50	9,000,000	33.78 (48.25)	954,700 (1,363,580)
Supervision in hospital emergency department	0.29	0	0	318.50	9,000,000	6.48 (26.99)	183,300 (762,920)
Laboratory services	2.40	0	0	424.67	12,000,000	2.41 (42.63)	68,190 (1,204,850)
Electrocardiography	2.59	0	0	176.94	5,000,000	13.36 (18.93)	377,600 (534,970)
Echocardiogram	1.29	0	0	276.03	7,800,000	34.40 (151.83)	972,300 (4,290,270)
Computed Tomography Scan	0.35	0	0	247.72	7,000,000	10.25 (26.38)	289,700 (745,590)
Exercise test	0.16	0	0	141.55	4,000,000	3.04 (12.53)	86,000 (354,160)
Angiography	0.60	0	0	707.78	20,000,000	97.62 (118.57)	2,758,500 (3,350,700)
Other diagnostic services	0.10	0	0	336.19	9,500,000	2.90 (21.86)	82,000 (617,800)
Rehabilitation services	0.16	0	0	254.80	7,200,000	2.02 (21.26)	57,200 (600,810)
Medication	NA	0	0	884.73	25,000,000	75.10 (109.82)	2,122,300 (3,103,350)
Hospitalization (day)	3.22	0	0	3008.10	85,000,000	85.05 (306.58)	2,403,400 (8,663,310)
Other treatments	NA	0	0	22.29	630,000	0.07 (1.32)	2,200 (37,320)
Home care	NA	0	0	53.08	1,500,000	0.28 (35.58)	8,100 (1,005,500)
Procurement of devices	NA	0	0	141.55	4,000,000	1.56 (9.24)	44,100 (261,120)
Travel	NA	0	0	10581.44	299,000,000	32.87 (73.32)	928,900 (2,071,950)
Food	NA	0	0	26.54	750,000	4.29 (19.71)	121,400 (557,150)
Adaptation	NA	0	0	49.54	1,400,000	0.17 (2.93)	4,900 (82,930)
Absence of patient form Job	1.73	0	0	764.41	21,600,000	19.17 (75.71)	541,700 (2,139,600)
Absence of others form Job	1.27	0	0	1734.07	49,000,000	185.65 (114.40)	5,246,000 (3,232,820)
Getting a loan for treatment	NA	0	0	1769.47	50,000,000	86.25 (197.168)	2,437,300 (5,571,380)

Abbreviation: NA, not available.

Table 3. The Costs Imposed on Patients

Type of Cost	Minimum		Maximum		Average Pay	
	US $	Iran Rials	US $	Iran Rials	US $	Iran Rials
Direct medical cost	0	0	3890.0	109,920,000	386.06 (444.40)	10,909,100 (12,557,440)
Direct non-medical cost	0	0	1058.14	29,900,000	38.90 (78.28)	1099400 (2,212,150)
Indirect cost	0	0	1804.86	51,000,000	37.73 (140.67)	1,066,200 (3,975,070)
Total cost	0	0	4049.26	114,420,000	462.70 (500.74)	13,074,700 (14,149,590)

Table 4. Demographic and Background Variables With the Type of Imposed Costs

Demographic and Background Variables	Direct Medical Cost	Direct Non-medical Cost	Indirect Cost	Total Cost
Gender	.340	.558	< .001[a]	.019[b]
Age	.396	.573	.360	.737
Marriage Status	.206	< .001[a]	.069	.349
Level of education	.068	.506	.103	.042[b]
Employment status	.609	.619	< .001[a]	0.134
Medical insurance	.180	.548	.936	.263
Insurance type	.311	.923	.781	.438
Supplemental insurance	.364	.255	.560	.250
Habitat	.447	.002[a]	< .001[a]	.080
Distance from Shahid Madani Hospital	.466	.063	0.773	.411
Disease type	.336	.532	.009[a]	.080
Admission type	.489	.038[b]	.612	.280
Reason for hospitalization	.002[a]	.052	.049[b]	< 0.001[a]

[a] $P < 0.01$ was considered as significant.
[b] $P < 0.05$ was considered as significant.

The results of the post hoc tests showed that the amount of indirect costs and total costs were higher in males than in females, direct non-medical costs were higher in divorced people than in other groups, total costs were higher in people with primary education than the ones with a bachelor's degree, indirect costs were higher in government employees and self-employed people than in housewives, direct non-medical costs were higher in patients referred from other provinces than in patients living in Tabriz or in East Azerbaijan province, indirect costs were higher in patients referred from other countries than those of the other three groups, indirect costs were higher in patients with acute infarctionand unstable angina than in the patients with hypertension, arrhythmia and heart valve disease, direct non-medical costs were higher in patients with elective admission than in the emergency patients, and, after all, direct medical costs, indirect costs, and total costs were higher in patients hospitalized for angioplasty than in the patients without the need for angioplasty or surgery.

Finally, regression analyses revealed no significant relationship between the onset of disease and the variety of costs imposed on the patients.

5. Discussion

This study was conducted to estimate the costs incurred by cardiovascular patients hospitalized at Shahid Madani Hospital of Tabriz and analyze the factors affecting different types of expenditures to provide a clear picture of the type and amount of fees paid by patients and their families.

Under the category of direct medical costs, drug services, supervision by a physician, and electrocardiogram were most frequently received by patients in the order of importance whereas PET scan services, home care, and rehabilitation were least frequently received by patients in the order of importance. In this category, the drug services, supervision by a physician, and electrocardiogram explained the highest expenditures because of repeated and continuous use. Regarding the implementation of the health reform program in Iran and its principle of reducing the amounts that recipients pay, it is necessary to pay more attention to them and adjust the costs especially for low-income strata.

Under the category of non-medical costs, the services related to travel, food and procurement of devices such as wheelchair, walker and etc. were most frequently received by patients; and services related to hotel, care taker and adaptation were the least frequently received. However, the amount of direct non-medical costs for these patients was at a relatively acceptable level.

Under the category of indirect costs, the highest expenditures belonged to the absenteeism of patients' relatives to take care of the patients because most patients included housewives without an official source of income. This requires a greater support of the patients and their families, in the time of taking care of patients, by social insurance institutions. In addition, the situation of these patients and their care conditions did not have a significant impact on the job loss in patients or members of their families.

What is noteworthy about the costs of cardiovascular diseases was that there were no instances of an informal payment to clinical or administrative personnel and health service providers. However, more than one-fourth of the patients had delayed their treatment due to the large geographical distances from Shahid Madani Heart Hospital, and inability to pay for more than half of them. This can be remedied with the help of those in charge of

the health care sector by taking measures such as the creation of an efficient referral system and by strengthening the level and depth of insurance coverage especially for the vulnerable strata of society.

Studies conducted on the costs showed that direct medical costs, amounting to 11,000,000 Rials (US $386), imposed the highest load of expenditure on the patients and their families over the past year. The average annual total costs reached more than 13,000,000 Rials (US $462) per patient. Considering that most patients reported having difficulty paying the costs, healthcare officials can clearly feel the gravity of the situation.

The results of a study conducted by Goss et al. showed that the costs incurred by patients with cardiovascular diseases (CVD) were about $ 3.9 billion in 2003 which will reach $ 22.6 billion in 2033 with a 143% increase (19).

Chronic heart failure (CHF) is one of the most common cardiovascular diseases and afflicts a high percentage of adults in every society. In their study, Stewart et al. stated that CHF was the cause of staggering costs in the year 2002, about 2% of the budget of the health care sector in the UK and more than $ 35 billion of the budget of the United States (13).

In a study in South Korea, Seo et al. estimated the financial burden of rheumatic heart disease (RHD) in 2008 in the country about $ 67 million. The share of indirect costs was estimated about 39% equal to $ 26 million (14).

Another study by Mourad et al. in Sweden showed that the annual costs of acute myocardial infarction (AMI) and angina pectoris (AP) were € 15.989 and € 14.737 per patient, respectively, from the social point of view (16).

Based on the findings of the current study, it is suggested to adjust fees for services frequently received by patients, such as drug services, supervision by a physician, and electrocardiogram and for costly services, such as angiography, as well as better and more comprehensive coverage of services by all types of insurance providers. It is also suggested to identify needy patients and pay special attention to their financial limits and provide cardiovascular patients and their families with economic support from social insurance systems.

The study was conducted at the level of the individual and the family rather than at the level of community or nation due to the lack of basic health information, which was one of its limitations. From the social perspective, it would be possible to gain a more comprehensive picture of the negative financial consequences of diseases on patients and the different sectors of society. Another limitation of this study is the probability of recall bias in respondents because of the difficulty associated with recalling the payments. However, since the study covered only the last year as its time range – the minimum time acceptable in most economic evaluations – the bias was reduced to the lowest possible level. Another noteworthy point in this regard was the lack of similar studies for comparison and discussion; since the researchers found no similar Iranian studies and almost all studies on cardiovascular diseases were conducted outside Iran with a social approach and using extensive data at the national level.

5.1. Conclusion

The current study showed that, despite the support from the health care system and insurance providers, the costs associated with the cardiovascular diseases, especially for outpatient, specialized, and complex services, are not reasonable for many of the patients. It is clear that one of the pillars of health equity is to receive reasonable healthcare fees since the concept of equity in the health system is defined as “payment according to one’s ability and receiving healthcare according to one’s needs”. By providing a clear delineation of the costs paid by the patients and the factors that influence the spectrum of costs, the researchers hope that this study can draw the attention of managers and policy makers more than ever to this issue in order to make appropriate interventions and plans to reduce the financial burden of these diseases and improve the health status of patients.

Acknowledgments

Hereby, authors wish to give their very special thanks to Shahid Madani hospital’s officials for their selfless cooperation as well as to the patients for their helpful contribution and answering the study questionnaire.

Footnotes

Authors’ Contribution: Ali Imani: designing of study, data analyzing; Farid Gharibi: proposal writing, data analyzing, article writing, and correspondence; Ozra dadashi: literature review, proposal writing, Data collection; Mahdiyeh Najafi: literature review, proposal writing, and data collection; Seyed Mahdi Mirbagheri: literature review, data collection, article writing.

Funding/Support: The current study was financially supported by students research committee of Tabriz university of medical sciences, Tabriz, Iran.

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