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Estimation of the Economic Burden of Cardiovascular Diseases in Iran

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Abstract

Background: Cardiovascular diseases (CVDs) are one of the leading causes of death and disability worldwide and in Iran. These diseases impose a heavy economic burden on the country's health and economic system.

Objectives: The present study aimed to estimate the economic burden of CVDs in Iran.

Methods: This descriptive-analytical study was conducted with data from the year 2024. This study aimed to estimate the economic burden of CVDs in Iran using data from 100 patients referred to public hospitals in Abadan. This cross-sectional study was conducted on 100 patients diagnosed with CVDs who were referred to public hospitals in Abadan, Iran, during 2023. The research sample included cardiovascular patients at Abadan University of Medical Sciences, and the study population encompassed all cardiovascular patients in the country. Cost data were collected from hospital information systems and analyzed using Excel. Direct treatment costs included hospitalization, surgeries, medications, tests, and other medical services. Non-treatment direct costs included travel expenses, lost time, and home nursing care. Indirect costs included losses due to reduced productivity and absenteeism of patients and their caregivers. The overall economic burden of CVDs was estimated based on the per capita cost for each patient and the prevalence of the disease in the country.

Results: The results showed that the average direct treatment costs of CVDs were 7,000,000 Rials, non-treatment direct costs were 650,000 Rials, and indirect costs were 1,300,000 Rials per patient. The overall economic burden of CVDs per patient was estimated to be 8,950,000 Rials. Data analysis showed that direct and indirect costs were higher in older patients and those with more complex diseases. Gender differences in CVD costs were also observed, with costs varying between men and women.

Conclusions: The results of this study indicate the heavy economic burden of CVDs on Iran's health and economic system, highlighting the importance of adopting appropriate measures to reduce this economic burden. These findings can assist policymakers and healthcare managers in designing and implementing better programs for managing CVDs.

Keywords: Cardiovascular Diseases, Economic Burden, Treatment Costs, Iran

1. Background

Non-communicable diseases (NCDs), also known as chronic diseases, are among the leading causes of mortality worldwide. These diseases not only push individuals and families into poverty but also create a more complex situation of illness and poverty. Chronic

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diseases are responsible for 48% of the global burden in terms of disability-adjusted life years, and they also lead to reduced efficiency in work environments (1). Among these diseases, cardiovascular diseases (CVDs) are the leading cause of death and disability both globally and in Iran, accounting for 46% of all deaths in Iran (2, 3). In 2015, these diseases were responsible for 17.7 million deaths worldwide, of which 7.4 million were due to coronary artery disease. According to a report by the World Health Organization (WHO), cardiovascular mortality in Iran has decreased from 471 cases to 350 cases per 100,000 people (4).

Over the past few decades, along with socio-economic changes and the spread of unhealthy lifestyles, risk factors for CVDs such as unhealthy diet, physical inactivity, smoking, high blood pressure, obesity, and diabetes have rapidly increased (5). Evidence shows that CVDs and other NCDs cause catastrophic health expenditures and out-of-pocket payments at the household level, and impose a heavy economic burden on the macroeconomy of low- and middle-income countries (6). In 2009, the direct healthcare costs for coronary artery disease in the European Union were approximately 20 billion euros, and the reduction in productivity due to associated mortality and disability was estimated at 18 billion euros (7). In the United States, in 2010, direct medical costs and productivity losses due to coronary artery disease were estimated at 108.9 billion dollars, and it is predicted that these costs will rise to 218.7 billion dollars by 2030 (8).

Additionally, an estimate of the economic burden of coronary artery disease in Iran in 2015 showed that this disease imposed a significant economic burden, ranging from 4908 to 4715 billion Rials on Iran's economy. The direct healthcare costs were estimated at 3572 billion Rials, and non-treatment direct costs were 933 million Rials (9). Direct healthcare costs refer to costs directly related to the disease, such as costs for diagnosis, treatment, and care (10). Non-treatment direct costs include a combination of costs imposed on the patient and their family, such as travel expenses for treatment, lost time, and home nursing care (11).

Health system policymakers and planners need awareness of disease costs for decision-making regarding optimal resource allocation. The economic burden of disease is used to determine the total cost imposed on a country by an outcome, disease, or incident. Since CVDs are a group of diseases with high costs and heavy economic burdens on society, they account for a significant portion of the growing healthcare costs. Therefore, calculating the economic burden of CVDs is crucial for adopting appropriate measures and strategies to combat these diseases (12).

2. Objectives

Given the importance of the mentioned topics, the presents study aimed to estimate the economic burden of CVDs in Iran by determining the costs of CVDs in the country.

3. Methods

This descriptive-analytical study was conducted with data from the year 2024. The research sample includes cardiovascular patients at Abadan University of Medical Sciences, and the study population encompasses all cardiovascular patients in the country. After collecting cost data and estimating the economic burden of CVDs at the sample level, the per capita cost of the disease for each patient is calculated. Then, the disease prevalence rate in the entire country is extracted based on official reports from the Ministry of Health, and the economic burden for the population (Iran) is estimated considering the per capita cost for each patient and the disease prevalence in the country.

For data collection, the inclusion criterion is having CVD, and only cost information related to this disease will be considered according to the specified items. The exclusion criterion is having CVD accompanied by comorbidities (such as diabetes) and incomplete cost information. To assess the necessity of including each question in the questionnaire [content validity ratio (CVR) and Content Validity Index (CVI)], the clarity of each question, appropriate phrasing of each question, and the comprehensiveness of the entire questionnaire, experts' opinions will be sought. First, experts will be asked about the necessity of each question, and after collecting their opinions, the agreement score of experts regarding the necessity of each question will be calculated. Considering the CVI score and the researchers' opinions, decisions will be made on whether to keep or remove each question. Then, the overall questionnaire Validity Index will be calculated as the average CVR score of the remaining questions in the questionnaire. In the second stage, experts' opinions on the clarity, appropriate phrasing of each question, and the comprehensiveness of the entire questionnaire will

be obtained. Additionally, Cronbach's alpha will be used to assess internal reliability. To this end, the questionnaire will be given to 10 CVD specialists. To examine reliability over time, the test-retest method will also be used for the questionnaire.

The bottom-up approach usually starts with a subgroup of a specified population with the condition of interest and records all costs related to that disease. Then, the costs of this subgroup are used to estimate the total population cost. The top-down approach requires suitable data on healthcare resource utilization and has the advantage of being directly related to the total costs of disease care. As a result, the bottom-up approach is used in this study.

3.1. Indirect Cost Estimation

To estimate the indirect costs associated with CVDs — primarily due to productivity losses from morbidity and premature mortality — we employed the human capital approach, a widely accepted method in health economics for cost-of-illness studies (13-15).

3.2. Productivity Loss Due to Morbidity

Data on average daily wages were extracted from official reports of the Statistical Center of Iran and the Ministry of Cooperatives, Labor, and Social Welfare for the year 2023. Average workdays lost per patient were estimated based on national retrospective studies: Approximately 14 days for hospitalization and 7 additional days for post-discharge recovery and outpatient visits (16, 17). Only patients within the working-age population (18 - 65 years) were included in this component. Productivity loss per day was calculated by dividing the annual income by 250 working days.

3.3. Productivity Loss Due to Premature Mortality

For patients who died prematurely, the years of potential productive life lost (YPPLL) were calculated by subtracting the age at death from the national retirement age (65 years). These years were then multiplied by the average annual income and adjusted using a 3% discount rate, in accordance with the WHO guidelines for economic evaluations (18).

The collected data will be analyzed using Excel software. First, the cost data of cardiovascular patients will be categorized into various groups, including direct treatment costs, non-treatment direct costs, and indirect costs. Then, the costs of each category will be calculated and analyzed separately. Descriptive statistical tests such as mean, standard deviation, and ratios will be used for data analysis. Additionally, inferential statistical tests such as the independent *t*-test and chi-square test will be used to compare costs in the two periods during and post-pandemic. Time series analysis methods will be used to analyze cost trends over time. Finally, considering the per capita cost for each patient and the disease prevalence in the country, the economic burden of CVDs for the population (Iran) will be estimated. The obtained results will be presented in various tables to facilitate better and more precise analysis.

4. Results

Direct treatment costs for CVDs include expenses directly incurred for diagnosing, treating, and caring for patients. These costs include hospitalization, surgeries, medications, tests, and other medical services related to CVDs. Table 1 demonstrates the direct treatment costs.

Non-treatment direct costs include expenses directly imposed on the patient and their family, such as travel expenses for treatment, lost time, and home nursing care. Table 2 demonstrates the non-treatment direct costs.

Indirect costs include losses due to reduced productivity caused by the mortality and disability of CVD patients. These costs encompass economic losses due to absenteeism or reduced performance of patients and their caregivers. Table 3 demonstrates the indirect costs.

The overall economic burden of CVDs includes the total of direct treatment costs, non-treatment direct costs, and indirect costs. Table 4 demonstrates the economic burden of CVDs.

The results also indicate that the costs of CVDs vary based on the age and gender of patients. Direct and indirect costs are higher in older patients due to the need for more care and the complexity of their diseases. Additionally, gender differences in the costs of CVDs have been observed, with costs potentially differing between men and women. Table 5 demonstrates the cost breakdown by age and gender and presents the mean ± standard deviation of direct and indirect costs of CVDs, categorized by age and gender. Including standard

Table 1. Direct Treatment Costs

Cost Type	Average Cost (Rials)
Hospitalization	2,500,000
Surgery	1,800,000
Medications	1,200,000
Tests	900,000
Other medical services	600,000
Total	7,000,000

Table 2. Non-treatment Direct Costs

Cost Type	Average Cost (Rials)
Travel costs	300,000
Lost time costs	200,000
Home nursing care costs	150,000
Total	650,000

Table 3. Indirect Costs

Cost Type	Average Cost (Rials)
Loss due to reduced productivity	800,000
Economic losses due to absenteeism	500,000
Total	1,300,000

deviations provides a clearer picture of cost variability across different demographic groups.

5. Discussion

This study aimed to estimate the economic burden of CVDs in Iran. The results showed that direct treatment costs, non-treatment direct costs, and indirect costs collectively impose a significant economic burden on the country's health and economic system. On average, the overall economic burden of CVDs per patient was estimated to be 8,950,000 Rials. These findings highlight the importance and necessity of adopting appropriate measures to reduce the economic burden of CVDs in Iran.

5.1. Direct Treatment Costs

The results of the present study indicated that direct treatment costs for CVDs, including hospitalization, surgeries, medications, tests, and other medical services, are significantly high. These findings align with studies conducted in the United States, which showed that direct treatment costs for CVDs are projected to increase to $218.7 billion by 2030 (19). Similarly, a study in the European Union estimated the healthcare costs for CVDs to be 20 billion euros (2). These results underscore the importance of focusing on reducing treatment costs and improving management strategies for CVDs.

5.2. Non-treatment Direct Costs

Non-treatment direct costs include expenses directly imposed on the patient and their family, such as travel expenses for treatment, lost time, and home nursing care. The present study results showed that these costs are also significantly high. These findings are consistent with similar studies in other countries. For example, a study in the European Union estimated the reduction in productivity due to mortality and disability related to CVDs to be 18 billion euros (3).

5.3. Indirect Costs

Indirect costs include losses due to reduced productivity caused by the mortality and disability of CVD patients. The results showed that the indirect costs

Table 4. Economic Burden of Cardiovascular Diseases

Cost Type	Average Cost (Rials)
Direct treatment costs	7,000,000
Non-treatment direct costs	650,000
Indirect costs	1,300,000
Total	8,950,000

Table 5. Average Direct and Indirect Costs of Cardiovascular Diseases by Age and Gender (mean ± SD)

Age Group (y)	Average Cost (Rials)	Gender
20 - 30	1,000,000 ± 12,450,000	Male
20 - 30	950,000 ± 11,312000	Female
31 - 40	1,200,000 ± 15,232,000	Male
31 - 40	1,150,000± 10,258000	Female
41 - 50	1,500,000 ± 12,565,000	Male
41 - 50	1,450,000 ± 11,578,000	Female
51 - 60	2,000,000 ± 12,450,000	Male
51 - 60	1,900,000 ± 13,236,000	Female
Above 60	2,500,000 ± 11,698,000	Male
Above 60	2,400,000 ± 16,585,000	Female

for CVD patients average 1,300,000 Rials per patient. These findings align with similar studies in the United States, which showed that economic losses due to reduced productivity caused by CVDs are very high (4).

5.4. Observed Differences in Studies

Studies conducted in other regions have reported differences in the costs and economic burden. For example, a study in China showed that indirect costs of CVDs are significantly lower than direct treatment costs (5). These differences may be due to economic, social, and healthcare system variations in different countries. Additionally, demographic factors such as age and gender can also significantly impact economic costs (6).

5.5. Reasons for Inconsistencies

Inconsistencies in study results can be attributed to various factors. One significant reason is the difference in methods of calculating costs and economic burden. Some studies consider only direct treatment costs, while others include indirect costs as well (13). Furthermore, demographic and economic differences can also impact study results. For instance, in high-income countries, indirect costs such as reduced productivity and absenteeism are more emphasized, while in low- or middle-income countries, direct treatment costs are more emphasized (14).

The results of this study indicate the heavy economic burden of CVDs on Iran's health and economic system, highlighting the importance of adopting appropriate measures to reduce this economic burden. These findings can assist policymakers and healthcare managers in designing and implementing better programs for crisis management and increased efficiency. The study's limitations include restricted access to complete cost data and regional differences in treatment methods. Therefore, it is recommended that more studies be conducted in various regions of Iran to obtain more accurate results.

5.6. Conclusions

The results of this study highlight the heavy economic burden of CVDs on Iran's health and economic system. Direct treatment costs, non-treatment direct costs, and indirect costs collectively impose a significant economic burden on the country. These findings underscore the importance and necessity of

adopting appropriate measures to reduce this economic burden and improve the management of CVDs. Given the high costs and economic and social impacts of CVDs, policymakers and healthcare managers should implement comprehensive and effective programs for managing and preventing these diseases. On the other hand, the study's limitations highlight the need for further research in various regions of Iran to obtain more accurate and comprehensive data. Regional differences in treatment methods and access to complete cost data can affect study results. Therefore, it is recommended that more studies be conducted nationwide to assist policymakers and healthcare managers in making better resource allocation decisions and improving healthcare systems. The results of these studies can contribute to improving the quality of life for CVD patients and reducing the economic burden on Iran's health and economic system.

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Footnotes

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