A systematic literature review of treatment costs for patients with Acute Myocardial Infarction

Una revisión sistemática de la literatura sobre los costos del tratamiento para pacientes con Infarto Agudo de Miocardio

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Resumen

Objective: To analyze the costs treatment for patients with Acute Myocardial Infarction (AMI) over the period from 2000 to 2016.

Materials and methods: Systematic review of the literature on the costs of treatment for patients with Acute Myocardial Infarction in the period 2000-2016. We selected 30 scientific articles from the database Scielo, Medline, Redalyc, Springer Medizin and Lilacs, which met the inclusion criteria: articles published in Spanish, Portuguese or English from 2000 to 2016. To restrict the search of articles, we use the health descriptors: costs, myocardial infarction and cardiovascular, combining them with the Boolean operators ''AND", ''OR" and ''NOT". Of which, a sample of 11 articles was selected.

Results: It was evidenced that a high percentage (63.6%) came from the Scielo database. According to the country of origin of the articles, it was identified that the highest percentage (36.4%) came from Colombia. Concerning the direct and indirect costs of patients with Acute Myocardial Infarction (AMI) from an international perspective, the total estimated cost for Acute Coronary Syndrome (ACS) in 2011, including direct and indirect costs, is $1.26 million (US dollars are used throughout). In Colombia, the average cost of a case of AMI during the first five years after diagnosis is USD $8,786.9. Ambulatory management costs represent 54%.

Conclusion: The costs of people with Acute Myocardial Infarction in both ambits, the international and national (Colombia) are significantly attributable by surgical interventions, treatment, hospital stay and post-diagnostic outpatient management.

Key words: Costs, myocardial infarction, cardiovascular.

Abstract

Objetivo: Analizar los costos del tratamiento para pacientes con Infarto Agudo de Miocardio (IAM) durante el período 2000 a 2016.

Materiales y métodos: Revisión sistemática de la literatura sobre los costos del tratamiento para pacientes con Infarto Agudo de Miocardio en el período 2000-2016. Seleccionamos 30 artículos científicos de la base de datos Scielo, Medline, Redalyc, Springer Medizin y Lilacs, que cumplieron con los criterios de inclusión: artículos publicados en español, portugués o inglés de 2000 a 2016. Para restringir la búsqueda de artículos, utilizamos los descriptores de salud: costos, infarto de miocardio y cardiovascular, combinándolos con los operadores booleanos ''AND", ''OR" y ''NOT". De los cuales, se seleccionó una muestra de 11 artículos.

Resultados: Se evidenció que un alto porcentaje (63.6%) provino de la base de datos Scielo. De acuerdo con el país de origen de los artículos, se identificó que el porcentaje más alto (36.4%) provino de Colombia. Con respecto a los costos directos e indirectos de los pacientes con Infarto Agudo de Miocardio (IAM) desde una perspectiva internacional, el costo total estimado para el Síndrome Coronario Agudo (SCA) en 2011, incluidos los costos directos e indirectos, es de $ 1.26 millones (se utilizan dólares estadounidenses en todo). En Colombia, el costo promedio de un caso de IAM durante los primeros cinco años después del diagnóstico es de USD $8,786.9. Los costos de manejo ambulatorio representan el 54%.

Conclusión: Los costos de las personas con Infarto Agudo de Miocardio en ambos ámbitos, el internacional y el nacional (Colombia) se pueden atribuir significativamente a las intervenciones quirúrgicas, el tratamiento, la estancia hospitalaria y el tratamiento ambulatorio post-diagnóstico.

Palabras clave: Costos, infarto de miocardio, cardiovascular.

Introducción

Acute Myocardial Infarction (AMI) is the necrosis of myocardial cells as a consequence of prolonged ischemia caused by the sudden reduction of coronary blood supply, which involves one or more areas of the myocardium[1].

According to figures presented by the World Health Organization (WHO), AMI occurs with high prevalence at an early age, precisely when the person is in the process of family structuring and has optimal health status for work performance. It is estimated that by 2020 the prevalence could increase to 11.1 million people per year[2].

In 2006, a total of 146,000 AMIs were estimated for years in the United Kingdom. The incidence is higher in men than in women and increases with age. Likewise, in Scotland and Ireland, incidence rates are higher than in the south of England. In Spain, the incidence of AMI ranges from 135-210 cases per 100,000 inhabitants[3].

On the other hand, AMI is the most important cause of mortality in developed countries, as well as a great number of hospital admissions. In Spain each year there are around 140,000 deaths and 5 million hospitalizations due to the same cause, which corresponds to health care costs of 15% of total expenses, hospital readmissions in the medium term are very frequent in patients who survive AMI; the males, coronary disease background and the number of cardiovascular risk factors are predictive factors of re-entry risk[4,5].

In Spain, the situation is alarming, it is estimated that in 2013 there could be 115,752 cases of AMI (64% in men and 36% women), of which 86.2% would be cases of Acute Myocardial Infarction, of these would have died within the first month 38.7%[6]. Likewise, studies point to the risk factors for Coronary Arteriosclerotic Disease as a direct cause in the exposure of AMI in subjects over 45 years of age. However, in individuals younger than 45 years, the association is more frequent to hypercoagulable phenomena, vasculitis and vasospasm[7, 8].

A study about the prevalence of Acute Myocardial Infarction, carried out in the population of the cardiovascular risk program of a first level health services provider institution in the municipality of Armenia-Quindío during 2014, determined that they consulted 11,765 people and presented 293 cases with a history of Myocardial Infarction, which represented a prevalence of 2.49%. Men corresponded to the highest percentage of people who have suffered a coronary event (57.62%), and at a younger age than women[9].

It should be noted that AMI, because of its great complexity and the economic repercussions, are highly significant, for the individual, his family and for the state or institutions involved. For this reason, it is considered a disease of high direct and indirect cost. Direct costs are those expenses originated by the payment of the work force that directly executes the actions, the consumptions of the materials used, the services and other obligations that can be directly associated to the activity that is executed (the state and institutions involved in the patient-disease process); and indirect costs are expenses that cannot be directly associated with the execution of activities, originate in other organizational areas that support the actions of those who receive it (the individual and his family)[10].

In a study conducted in Colombia on the costs of medical care for Acute Myocardial Infarction, it was evidenced that in the first five years after diagnosis the cost was USD $8,786.9. the cost of outpatient management being the most prevalent (54%); followed by management in the intensive care units (23%); Surgery (8%); the handling in the hemodynamics room and the costs for diagnosis and staging in the emergency room of 9% and Hospitalization 6%[11].

Regarding indirect costs, the information from the San Jorge de Pereira University Hospital (HUSJ) was used, where the corresponding day-bed occupied by a patient with coronary disease was considered, on the total of the service. Costs were identified by indirect labor COP $20,040,789, indirect general expenses COP $27,807,825, administrative expenses COP $25,398,616, logistics COP $23,786,963, for a total of direct costs of COP $97,034,193 [12].

A review of the direct and indirect costs of AMI is relevant considering its scope and economic impact on health institutions. This research is a method to describe the economic impact of the disease in the distribution of the costs of the different types of used resources[13]. Likewise, it is a chronic intransmissible disease that, in general, tends to studied only in terms of its symptomatological, etiological and treatment aspects. Studies of the financial aspects are uncommon in the Literature. By the above, the objective of this study is to analyze the costs treatment for patients with Acute Myocardial Infarction (AMI) over the period from 2000 to 2016.

Materiales y métodos

Systematic review of the literature on the costs of treatment for patients with Acute Myocardial Infarction in the period 2000-2016. We selected 30 scientific articles from the Scielo, Medline, Redalyc, Springer Medizin and Lilacs databases, which met the inclusion criteria: articles published in Spanish, Portuguese or English from 2000 to 2016. To restrict the search for articles, we used the health descriptors: costs, myocardial infarction and cardiovascular, combining them with the Boolean operators ''AND", ''OR" and ''NOT". Of which, a sample of 11 articles was selected.

For the collection of the information, the stages described by Willes for the documentary studies were taken into ac-

count, such as: interpretation, compilation of evidences, recompression of the phenomenon, reflection for the critical action and the social practice of the knowledge and naturalization of the objects of study; for which, the matrix was elaborated with the articles, of which the following information was identified: Database / Country, title, objectives, authors / year and conclusions (See annexes: Table 1)

Database/ Country	Title	Objectives	Authors/Year	Results/Conclusions
Scielo/Chile	Cost / effectiveness of a cardiovascular rehabilitation program for people After Acute Myocardial Infarction: A theoretical analysis	Determine the cost-effectiveness ratio of a theoretical proposal of the Cardiovascular Rehabilitation Program	Gómez, JM et al / 2016	The annual cost of the cardiac rehabilitation center is CLP $ 64,407,065. The Increased Ratio of Cost Effectiveness (ICER), considering a reduction of the late mortality of 25%, is CLP $ 475,209.72 / AVG. Value that being less than the Gross Domestic Product per capita, is considered as a very cost effective intervention
Scielo/Cuba	Institutional cost of Acute Myocardial Infarction at the Institute of Cardiology and Cardiovascular Surgery	Determine the institutional cost of Acute Myocardial Infarction in patients treated at the Cardiology and Cardiovascular Surgery Institute in 2006.	Fernández García, A et al. / 2008	The total cost of the patients care with acute myocardial infarction for the Cardiology and Cardiovascular Surgery Institute was mainly given by the time devoted to patient care, the number of highly qualified professionals and technicians needed in the management of the disease, and the treatments used.
Scielo / Brazil	Cost of the chain of procedures in the treatment of Acute Myocardial Infarction in Brazilian hospitals of excellence and specialized	It presents the methodology and the results of a field survey to evaluate the costs of the chain of procedures for the treatment Of Acute Myocardial Infarction (AMI).	Marqués, R et al. / 2012	Overall, the total costs of the procedures that comprise the «standard treatment» of AMI totaled R $ 12,873.69 if Percutaneous Coronary Intervention (PCI) did not involve stent use. If this becomes necessary, the cost rises to R $ 23,461.87.
Scielo / Colombia	Costs of Chronic Intrasmissible Disease: the Colombian reality	Reflect on the social and economic costs of Chronic No Communicable Disease (CNCD) in Colombia to visualize a load indicator of these pathologies	Gallardo Solarte, K et al. / 2016	Chronic Intrasmissible Diseases represent a burden for the health service system due to very high costs, late intervention and reduced significant benefit for this population and their families.
Medline/ Switzerland	Determinants of Costs and the Length of Stay in Acute Coronary Syndromes: A Real Life Analysis of More Than 10 000 Patients	The aim of this study was to investigate inpatient costs of Acute Coronary Syndromes (ACS) in Switzerland and to assess the main cost drivers associated with this disease	Bramkamp, M et al. / 2007	Mean total costs per patient were 12.101 Euro (median 10.929 Euro; 95% CI: 1.161-27.722 Euro). The length of stay ranged from one to 129 days with a mean of 9.5 days (median 8.0 days; 95% CI: 1-23)
Springer Medizin / Germany	The costs of Myocardial Infarction—a longitudinal analysis using data from a large German health insurance company	The aim of the study was to measure the course of costs after a myocardial infarction	Reinhold, T et al. / 2011	Myocardial Infarction is associated with significant economic costs from the perspective of statutory health insurance. This cost burden particularly occurs within the first 2 weeks following a first myocardial infarction. For this reason, efficient management of the acute event is outstandingly important.
Lilacs/Colombia	Costs of lung cancer care, COPD and AMI attributable to tobacco use in Colombia	The purpose of this article is to present a cost definition exercise applicable to clinical practice in three diseases related to smoking: lung cancer, Acute Myocardial Infarction (AMI) and Chronic Obstructive Pulmonary Disease (COPD).	Pérez, Nicolás et al. / 2007	The average cost of AMI case during the first five years after diagnosis is USD $ 8,786.9. Outpatient management costs represent 54%; management in the ICU, 23%; surgery, 8%; general hospitalization, 6%; management in the catheterization room (for scheduled angioplasty), 5%, and costs for diagnosis and staging in the emergency room, 4%
Scielo/Brazil	Costs of Treatment of Acute Coronary Syndrome from the perspective of the Supplementary Health System	Evaluate costs and time of hospitalization between groups of patients who underwent ACS undergoing angioplasty procedures with or without stent implantation (stent +/- stent-), revascularization (Revasc) and treated only clinically (Clinical) from the perspective of the System Health Care System (SSS).	Teich, V et al. / 2015	The average costs per patient were R $ 18,261.77, R $ 30 611.07, R $ 37 454.94 and R $ 40 883.37 in the Clinical, stent-, stent + and Revasc groups, respectively. The average costs per day of hospitalization were R $ 1987.03, R $ 4024.72, R $ 6033.40 and R $ 2663.82, respectively. The mean hospitalization time was 9.19 days, 7.61 days, 6.19 days and 15.20 days in those same groups. The differences were statistically significant among all groups, except Clinical and stent- and between the stent + and Revasc groups, for cost analysis.
Scielo/ Brazil	Cost Estimate of Acute Coronary Syndrome in Brazil	Estimate the cost of SCA in Brazil and its impact on the Brazilian Health System in 2011, considering direct and indirect costs from the public and private perspective	Teich, V et al. / 2011	The estimate of the direct cost associated with Acute Coronary Syndrome in 2011 under the SUS perspective is R $ 522,286,726, approximately 0.77% of the total SUS budget. For the Supplementary Health System this estimate is R $ 515 138 617. The indirect costs total R $ 2.8 billion, from the perspective of society. The total estimated cost for SCA in 2011, including direct and indirect costs, is R $ 3.8 billion.
Scielo/Colombia	Expenditure by procedure in the specialty of interventional cardiology in patients with Coronary Disease of Social Security, Sectional Valle del Cauca. November 2003-December 2004	Analyze the Expenditures by procedure in the specialty of interventional cardiology in patients with Coronary Disease of Social Security, Valle del Cauca Sectional	Rodríguez, H./ 2006	The ISS paid the IPS who provide interventional cardiology services the sum of COP $ 5 320 786 046 (more than five billion pesos) for the procedures performed, 99.3% of which were performed on patients over 40 years of age. This canceled money corresponded to 39% of the total budget allocated for general hiring in that period.
Redalyc / Colombia	Projection of costs in Colombia for the initial care of Acute Coronary Syndrome.	Make an estimate of the average and total medical cost that the first attention of these acute events means for Colombia.	Castellanos Ramírez, J C. / 2011	General average overall cost was COP $ 7 781 230, medications COP $ 1 948 366 and antiaggregants COP $ 103 572. The cost of SCA care in Colombia has an average position in the referents used, although the presentation is estimated that means a year an important medical cost of close to a quarter of a billion dollars for the country and more than forty million dollars for Bogota

Source: Prepared by the research group.

Resultados

Socio demographic data

From the 11 articles used for the review, a high percentage (63.6%) came from the Scielo database and the remaining 36.4% from the Medline database, Springer Medizin, Lilacs, Redalycs, as shown in Table 2.

Database	N° Reviewed Articles	Percentage
Scielo	7	63,6%
Medline	1	9,1%
Springer Medizin	1	9,1%
Lilacs	1	9,1%
Redalycs	1	9,1%
Total Articles Reviewed	11	100%

Source: Prepared by the research group

According to the country of origin of the articles, it was identified that the highest percentage (36.4%) came from Colombia, followed by Brazil (27.2%) and the remaining (36.4%) from Chile, Cuba, Switzerland and Germany (Table 3).

Country	Reviewed Articles	Percentage
Chile	1	9,1%
Cuba	1	9,1%
Colombia	4	36,4%
Brazil	3	27,2%
Switzerland	1	9,1%
Total	11	100%

Source: Prepared by the research group

Direct and indirect costs of patients with Acute Myocardial Infarction (AMI) from an international perspective

In Brazil, the estimate of the direct cost associated with AMI in 2011 is R $522.286.726 (USD $132.473.649,93 for 2019) approximately 0.77% of the total budget of the single health system (SUS). For the Supplementary Health System this estimate is R $515.138.617 (USD $130.660.592,00 for 2019). Indirect costs total R $2.8billion (USD $710.493.357.124,19 for 2019), from the perspective of society. The total estimated cost for SCA in 2011, including direct and indirect costs, is R $ 3.8billion (USD $964.240.984.668,54 for 2019)[14].

According to time, the highest economic cost occurs particularly within the first two weeks and is totally significant from the perspective of Germany's compulsory health insurance[15]. Among the variables to which this may be due, is given mainly by the time dedicated to patient care, the number of highly qualified professionals and technicians needed in the management of the disease, and the treatments used[16].

Regarding the costs attributable to treatments, specifically those of intervention (surgical) in Brazil, the average cost per patient with AMI was R $18.261,77(USD $4.629,82 for 2019), R $30.611,07(USD $7.760,99 for 2019), R $37.454,94(USD $9.497,11 for 2019) and R $40.883,37 (USD $10.366,60 for 2019) in the Clinical, Stent-, Stent + and Revasc groups, respectively[17]. However, for the procedures that make up the "standard treatment" of the AMI, it amounted to R $12.873,69 (USD $ 3.264,17 for 2019) if the Percutaneous Coronary Intervention (PCI) did not imply the use of a stent. In case this is necessary, the cost rises to R $23.461,87 (USD $ 5.948,95 for 2019), that is, the cost is doubled[18].

On the other hand, the costs attributable to hospitalization in general terms are approximately R $14.708.97 (USD $3.729,47 for 2019) with average hospitalization times of 9.54 days[17]. Likewise, in Switzerland for this same reason, the average total costs per patient were EUR $12.101 euros (USD $12.525,53, 2019) median of EUR $10,929 (USD $12.215,56 for 2019), 95% CI: 1.161 (USD $1.297,67 for 2019)-EUR $27.722 (USD $30.985,43 for 2019), noting that the average hospital stay is 9.5 days (median of 8.0 days, 95% CI: 1-23)[19].

Finally, the yearly costs attributable to cardiac rehabilitation in Chile are CLP $64.407.065 (USD $95.030,28 for 2019). The Incremental Reason for Cost Effectiveness (ICER), considering a reduction in late mortality of 25%, is CLP $475.209,72 (USAD $701,10 for 2019). Value that, being less than the gross domestic product per capita, is considered as a very cost effective intervention[20].

Direct and indirect costs of patients with Acute Myocardial Infarction (AMI) from a national perspective (Colombia)

Today in Colombia, chronic intransmissible diseases, including AMI, represent a burden for the health service system due to very high costs, late intervention and reduced significant benefit for this population and their families[21].

The average cost of AMI case during the first five years after diagnosis is USD $8 786.9 (USD / COP 2006 -2007). Outpatient management costs represent 54%; management in the ICU, 23%; surgery, 8%; general hospitalization, 6%; the management in the catheterization room (for programmed angioplasty), 5%, and the costs for diagnosis and staging in the emergency room, 4%[11].

The cost of acute SCA care in Colombia has an average position in the referents used, although what is presented is estimated to mean an important medical cost of about a quarter of a billion dollars for the country and more than forty million dollars for Bogotá [22].

In other regions of Colombia, as in the case of Valle del Cauca, the Social Insurance Institute (ISS) paid the Healthcare Institutions (IPS) that provide interventional cardiology services (surgical) for the sum of COP $ 5.320.786.046 (more than five billion pesos) (USD $1.642.548,74 for 2019) for the procedures performed. This canceled money corresponded to 39% of the total budget allocated for general contracting[23].

Conclusiones

The treatment costs of people with AMI in Colombia and elsewhere account for a high proportion of the total costs of health institutions and in more specific terms for the state. The major significant components of the total treatment cost are surgical interventions, the treatment pharmacological, the hospital stay and post-diagnostic ambulatory management.

On the other hand, it was evident during the review that little information could be found regarding the indirect costs that the AMI generates at the economic level of the patient and his family. Therefore, one of the recommendations is to conduct research that investigates this problem in order to have a clearer and more complete view of the indirect costs of AMI.

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