



Costs of Lifetime Treatment of Acute Coronary Syndrome at Ramathibodi Hospital

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Abstract

Objective: The purpose of this study is to estimate the lifetime cost of acute coronary syndrome (ACS) at Ramathibodi Hospital using both a government and a societal perspective.

Background: ACS has a significant mortality and morbidity burden to the Thai health care system. Therefore it is essential that there is cost-effective analysis of programmes directed at ACS prevention and treatment. This is the first study in Thailand to analyse the cost of treating ACS and also the total lifetime cost of treating ACS which is borne by both health care providers and patients.

Methods: The study had both retrospective and prospective parts. The retrospective used data from the Thai ACS registry of all consecutive patients admitted to Ramathibodi Hospital between August, 2002 and December, 2003. We studied the direct health care costs and indirect costs due to hospitalization, hospital follow up and mortality. Survival parameters were derived using the Kaplan-Meier technique. The second part of the study was a prospective study using data from the Thai ACS registry for all patients who came to Ramathibodi hospital outpatient department for follow up between May, 2005 and October, 2005. In this part we studied the direct non health care costs and indirect costs arising from morbidity. Costs were adjusted to 2005 values using the medical care component of the Thai consumer price index. Finally we developed a calculator to estimate life expectancy and the lifetime medical care costs of ACS.

Results: Median direct health care costs for the first year were calculated at 120,298 baht using the 330 records from 2002-3. Median direct non health care costs for the first year were calculated at 3,215 baht per month using the 193 records from 2005. Median indirect costs for the first year were 30,477 baht, calculated using the records from both 2002-3 and 2005.

Conclusion: The lifetime cost of ACS is considerable compared to other diseases and these results will be very useful for evaluating the effectiveness of health care programmes put in place to control ACS in Thailand.

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Background

Since the Asian economic crisis of 1997, several aspects of public health and the financial system have been reformed by the Thai government in an endeavour to reduce costs and enhance the efficiency of medical treatment (1).

Acute Coronary Syndrome (ACS) is a significant global public health problem including industrialised countries, South East Asia countries as well as Thailand. Hospitalization rates and death rates are high. Also, it is a major cause of chronic illness among the elderly (2-9). Consequently, it is a financial burden on the public health system, starting with the direct costs of medical treatment. This can be seen from the top-ranked prescription of drugs treating heart diseases at Ramathibodi hospital which cost the

health care system an average of 10.3 million Baht per month.

Nevertheless, primary prevention and secondary prevention are critical in terms of patients' and family members' quality of life as well as for social and economic reasons.

On the other hand, the avoidance of risk factors based on evidence from journal articles that this can decrease the risks of ACS or prevent future episodes after the diagnosis of hypertension (10,11) or dyslipidaemia (12-16) is costly especially in non industrialised countries. Furthermore, recent studies such as HOPE (17) and EUROPA (19) have recommended antihypertensive medication from the angiotensin converting enzyme inhibitor (ACE Inhibitor) class of drugs for patients with coronary

artery disease and hypertension, but also in those with ACS but without hypertension. This is expected to decrease the risk of Acute Coronary Syndrome. Other recent studies of statin-like drugs; for example, the Heart Protection Study (19), PROSPER (20), ASCOT-LLA (21) and CARDS (22) suggest the use of statins among ACS patients and people with risk factors even though their blood cholesterol is not high. Similarly, the AFCAPS/TEXCAPS study (23) advises statins be used in people with a low level of HDL cholesterol as primary prevention. These recommendations multiply many times the expenses of secondary prevention (or risk factor avoidance.). As a result, it is even more important to perform analyses of the cost effectiveness of programmes for ACS prevention and treatment in Thailand. Even so, in order to analyse the cost-effectiveness of ACS prevention and treatment, it is necessary to study the actual costs since patients were diagnosed. In Thailand, a study of this type has never been conducted before. Thus, this study's primary aim is to determine the lifetime cost of treatment for Acute Coronary Syndrome.

Methods

Costs and Perspective

We estimated cost from two perspectives:

1. The government perspective: direct health care cost (direct medical cost)
2. A societal perspective: economic cost or burden (direct health care cost, direct non health care cost and indirect cost)

Study Design

We reviewed 330 medical records from the Thai ACS registry of all consecutive patients admitted to Ramathibodi Hospital between August, 2002 and December, 2003 to calculate direct health care costs and indirect costs due to hospitalization, hospital follow up and mortality since first admission until last follow up. After each retrospective records review, we telephoned check the patient's status and colate our data (i.e. - alive, declined to be interviewed, lost to follow up, etc.). To estimate direct health care costs, we cooperated with the policy and planning unit of Ramathibodi Hospital to estimate the cost using the cost accounting method (24). To estimate indirect costs, we used days lost due to hospitalization, hospital follow up and mortality multiplied by the Thailand 2003 GDP per capita per day (25). To calculate

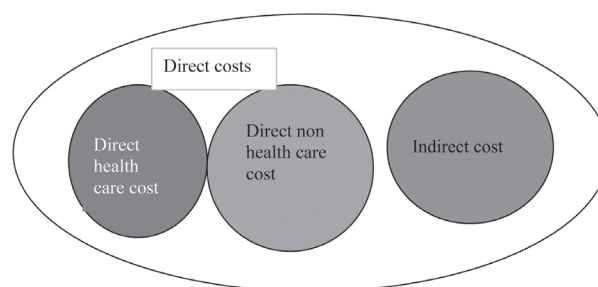
non health care costs (direct non health care costs and other indirect costs for loss of productivity due to illness), because of the long duration since 2002-3 until we began the study, we conducted prospectively 193 interviews of the Thai ACS registry of patients and their relatives who came to the Ramathibodi hospital outpatient department for follow up between May, 2005-October, 2005. We inquired about the costs that they paid during last month to know the cost they paid 1,2,3...to 33 month after acute coronary syndrome. After we had obtained written informed consent, we interviewed them either at the outpatient department (OPD) or by telephone. A human capital approach was deployed to calculate income loss from sick leave and cost of premature death using Thai 2003 GDP per capita (25). All costs were adjusted to 2005 values using the medical care component of the Thai consumer price index (26). Future costs beyond one year were discounted at rate of 3.5%.

Definitions

Government (health care system) perspective: costs were defined as the cost of all medical costs of goods and services that were directly provided by the health care system, called direct health care costs. Certain categories of costs may not be relevant such as patient and care-giver time and travel costs, indirect costs, etc.

Societal perspective: all medical and non-medical costs are relevant include direct health care costs, direct non health care costs and indirect costs. The societal perspective requires valuation of resources using the economic (opportunity) cost approach.

Figure 1. Economic burden of acute coronary syndrome treatment



Economic burden was defined as combination of direct health care costs, direct non health care costs and indirect costs (Figure 1).

Direct health care cost was defined as the cost of goods and services that are directly provided by the health care system such as hospital days, drugs, home nursing etc.

Direct non-health care cost was defined as costs of goods and services used for health care that are not directly provided by the health care system such as caregiver time, transportation etc.

Indirect cost was defined as the value of production lost due to illness, treatment or mortality i.e. salary/income foregone.

Acute Coronary Syndrome was defined using the same definition as codified in the ACS registry by the Heart Association of Thailand. This is composed of ST-elevation myocardial infarction (STEMI), Non ST-elevation (NSTEMI) and unstable angina (UA) with ST-T change (27).

Statistical Analysis

- 1) Analyzing costs using the mean, median, percentiles and standard deviations
- 2) Using descriptive data presented in percent or ratio
- 3) The Kaplan–Meier method was used for the estimation of the probability of death over the 4-year follow-up period

Survival data and life expectancy

We estimated survival rates of patients with ACS from the Thai ACS registry including all patients admitted to Ramathibodi hospital between August 2002 and December 2003. The database consisted of 337 patient records but only 330 records were available for the review. Using STATA we initially applied the non-parametric Kaplan-Meier approach to fit Kaplan-Meier curves and plot graphs of $\log\{-\log[S(t)]\}$ against $\log(\text{time})$ which were generally linear, indicating that a Weibull survival model would adequately fit the data. We consequently used the “streg” module of STATA to perform maximum likelihood estimation for parametric regression of the Weibull survival models.

For the Weibull distribution, the survival function $S(t)$, which describes the probability of survival as a function of age, is

$$S(t) = \exp\{-H(t)\}$$

; and

$$H(t) = \lambda t^\gamma$$

where $H(t)$ is cumulative hazard; α is the scale parameter; t is time in days; and γ is the shape parameter that describes the instantaneous death rate, the hazard rate- $h(t)$, which increases with age if $\gamma > 1$.

In our analysis, depends on the age (year), discharge diagnosis (assigning 1= STEMI, 2= NSTEMI, and 3= UA), presence of complications at first admission (assigning 0=absence and 1= presence), performing cardiac procedures at admission (assigning 0=absence and 1= presence) presence of co-morbidities i.e. diabetes (assigning 0=absence and 1= presence) and cerebrovascular disease (assigning 0=absence and 1= presence). According to these findings the formula can be written as:

$$\lambda = \exp\{(\text{age_coefficient} \times \text{Age}) + (\text{diagnosis_coefficient} \times \text{diagnosis}) + (\text{procedure_coefficient} \times \text{procedure}) + (\text{diabetes_coefficient} \times \text{diabetes}) + (\text{cerebovascular_disease_coefficient} \times \text{cerebovascular_disease}) + \text{cons}\}$$

The transitional probability of dying during the cycle, $tp(c)$, is therefore estimated from the formula ('c'--number of cycle)

$$tp(c) = 1 - \exp\{H(t - c) - H(t)\}$$

Estimated lifetime costs

Lifetime costs were estimated using the method proposed by Lin DY et al. 1997(28). Briefly, the total cost for each patient was identified, including for those who died within the follow-up period and for those who were missing. The study period (4 years) was divided into 4 time intervals; for each interval, the average treatment costs of those who died and were missing during that period was multiplied by the difference in the Kaplan-Meier survival estimate at the beginning and end of the interval. This difference was the probability of dying during the interval. The weighted costs were summed up over

the predicted life expectancy to obtain an average lifetime treatment costs. The results can be estimated using both deterministic and probabilistic estimations with standard error.

Lastly, we developed a “Cost-Calculator” which is a mathematical model for prediction of economic burden of ACS. The model applied to Thai ACS patients aged 55-75 years and adopted both a government and societal perspectives.

Results

The baseline characteristics of the patients are shown in Table I. For the 23-44 months since the first admission until the last follow up, Kaplan-Meier survival curves were calculated for 330 patients (Figure 2). During the first admission the patients were treated with medication only, medication with diagnostic catheterization, medication with percutaneous intervention (PCI) and medication with CABG, in the following percentages; 37.9%, 25.5%, 33.9% and 3.3% respectively. At one year the corresponding percentages were 32.1%, 23.6%, 37.9% and 7% respectively. 38% of patients that survived initial hospitalization were re-hospitalized during the 23-44 months follow up period, the number of readmissions ranged from 1-12 times.

All cardiac procedures during first year are shown in Figure 3

Table I. Baseline characteristics of the patients

Patients, number	330
Mean age ,year (standard deviation)	67(11)
Male sex	182(55%)
Acute coronary syndrome -STEMI	110(33%)
Acute coronary syndrome -NSTEMI	107(32%)
Acute coronary syndrome Unstable Angina	113(34%)
Diabetes mellitus	171(52%)
Hypertension	234(71%)
Dyslipidemia	212(64%)
Smoking	122(37%)
History of cerebrovascular accident	59(18%)
History of peripheral vascular disease	24(7%)
History of coronary artery disease	171(52%)
Congestive cardiac failure	161(49%)
Cardiogenic shock	40(12%)
Mechanical Complication	9(3%)
Major Arrhythmia	49(15%)
Ischemic cerebrovascular accident	10(3%)

Figure 2. Kaplan-Meier survival curves of STEMI, NSTEMI and UA

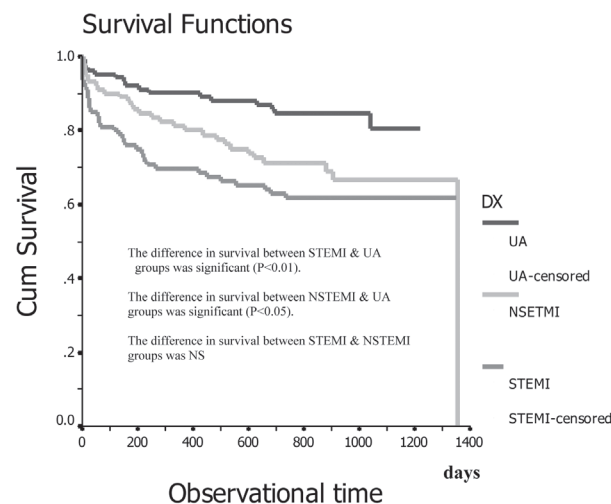
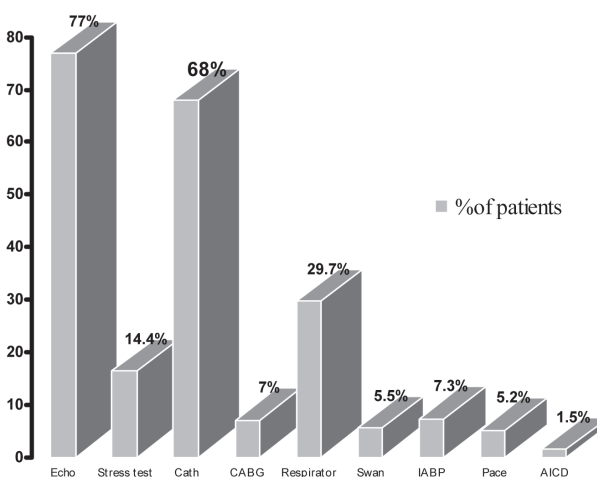


Figure 3. All cardiac procedures during first year



Government perspective

Direct health care cost: Total direct health care cost of the 330 patients during the first admission, first year and all overall was 36,524,923 Baht, 55,159,617 Baht and 62,376,762 Baht respectively. The total costs were mainly due to inpatient care, cardiac catheterization with or without intervention and pharmaceutical costs (Figure 4A, 4B& 4C).

The average direct health care costs of acute coronary syndrome treatment

Figure 4A. Total direct health care costs for 330 patients of the first admission

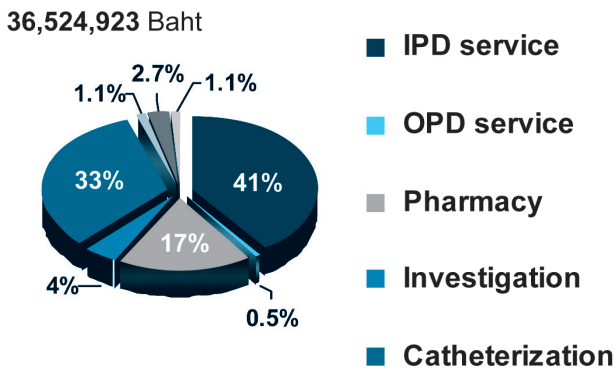


Figure 4B. Total direct health care costs of 330 patients for the first year

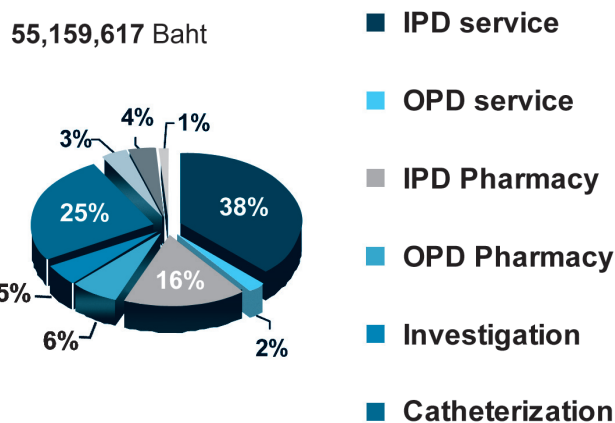
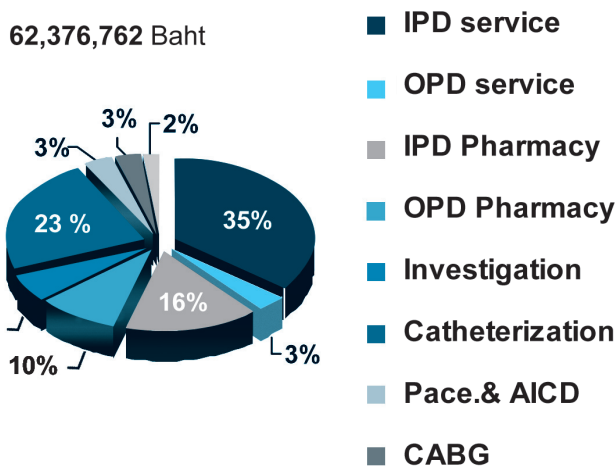


Figure 4C. Total direct health care costs of 330 patients at the final follow up



(Unit cost) during the first admission, first year, and at the final follow up were 110,682 Baht, 167,150 Baht, and 189,020 Baht respectively (Figure 5). The median direct health care costs of ACS were 75,095 Baht, 120,298 Baht and 139,426 Baht for first admission, first year, and at the final follow up (Figure 6). Treatment costs in the second year were lower as most patients returned to stable coronary artery disease. The average direct health care cost of fatal myocardial infarction (MI) was higher than non fatal MI (Figure 7). The direct health care costs of ACS and all subgroups are shown in Table 2.

Figure 5. Average direct health care cost per patient (unit cost) of acute coronary syndrome (Baht)

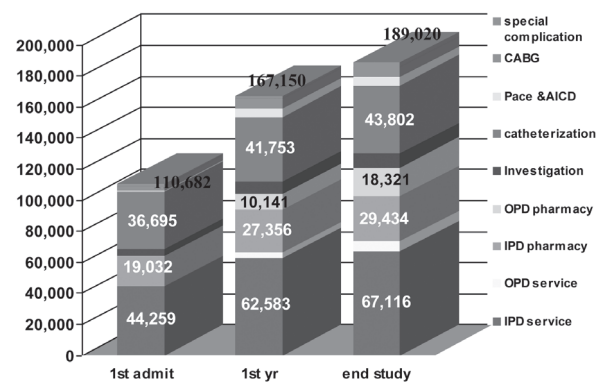


Figure 6. Direct health care costs of ACS per patient (Baht)

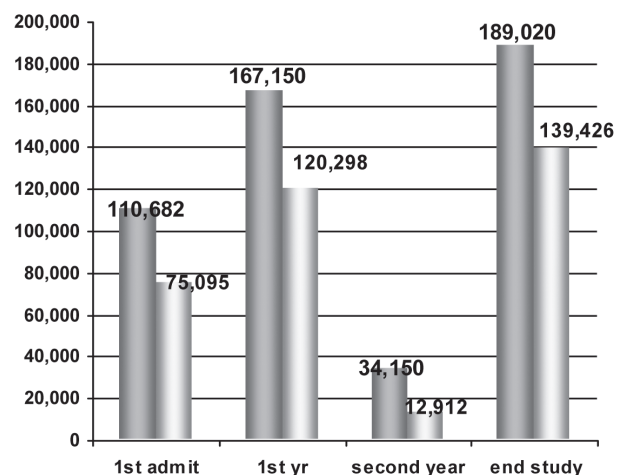
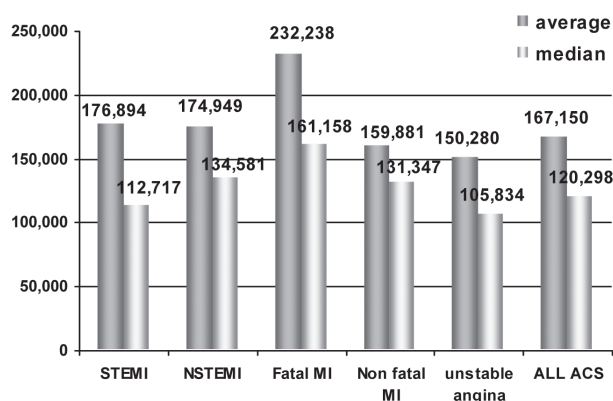


Table 2. Direct health care costs of acute coronary syndrome treatment for the first year and mortality rate at final follow up

Diagnosis (n)	Average (unit cost)	SD	Median	Percentile 25	Percentile 75	Mortality rate at end F/U(%)
All ACS (330)	167,150	156,709	120,298	62,947	216,674	25
STEMI (110)	176,894	179,414	112,717	57,738	235,544	35
NSTEMI (107)	174,949	155,604	134,581	84,785	203,020	27
Fatal MI* (29)	232,238	274,337	161,158	59,461	258,585	100
Non fatal MI (150)	159,881	117,026	131,347	71,512	213,815	0
UA (113)	150,280	132,952	105,834	59,127	185,755	14
ACS no DM (159)	145,012	132,074	100,680	52,422	187,877	21
ACS with DM (171)	187,735	174,854	134,581	75,821	234,677	29
ACS withConservative (111)	119,149	116,999	74,720	47,576	144,534	26
ACS withInvasive (195)	189,368	154,755	151,025	90,281	237,910	17
ACS without statin (26)	101,327	86,522	68,381	50,201	131,191	27
ACS with statin (280)	169,706	149,099	123,414	70,168	219,667	20

*patients that survive initial hospitalization and die within one year

Figure 7. First year average direct health care costs of any type of ACS per patient (Baht)



*patients that survive initial hospitalization and die within one year

Societal perspective

During first 12 months, median cost of medication and hospitalization per month paid by households was 990 baht and the total for the 13th -24th months was 12,810 Baht. From a societal perspective, direct health care costs were the total of government perspective direct health care costs and the cost of medication and hospitalization that was paid by households

Direct health care costs (societal perspective):

Median direct health care costs during first year were 121,288 Baht and for second year was 25,722 Baht. These were direct costs of medical goods and services paid by government and households.

Direct non health care costs:

using the 193 interview records covering 1-33 months after diagnosis of acute coronary syndrome, the median cost per month over the first 12 months was 3,215 Baht, and for second year was 4,650 Baht (Figure 8).

Indirect cost:

using the data from 193 interview records, the median cost of lost productivity due to morbidity per month, excluding costs of hospitalization

Figure 8. Median direct non healthcare costs (Baht)

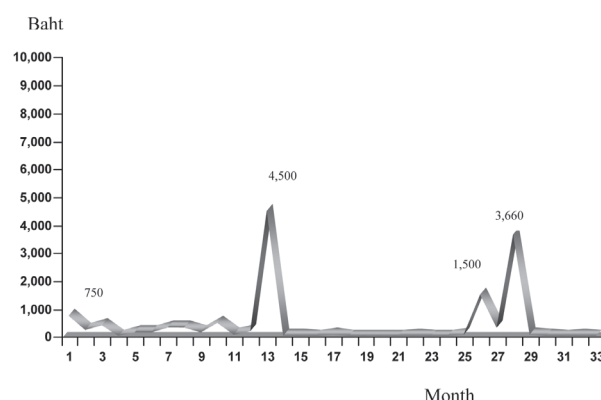


Table 3. Examples of estimated life expectancy and lifetime costs

Diagnosis	Age (year)	DM	history of CVA	Complication*	Cardiac Procedure at admission**	Life expectancy (year)	Lifetime direct health care cost (Government perspective) (Baht)	Lifetime economic burden (societal perspective) (Baht)
STEMI	55	yes	Yes	Yes	Yes	2.63	225,255	4,020,949
STEMI	65	yes	yes	Yes	yes	1.25	181,227	3,045,547
STEMI	75	yes	yes	Yes	yes	0.51	168,517	2,040,344
STEMI	55	yes	no	Yes	yes	6.96	409,903	3,500,175
STEMI	65	yes	no	Yes	yes	4.33	276,901	2,578,947
STEMI	75	yes	no	Yes	yes	2.32	212,532	1,719,754
STEMI	55	yes	no	No	yes	17.80	1,240,268	2,174,273
STEMI	65	yes	no	No	yes	14.10	701,477	841,138
STEMI	75	yes	no	No	yes	8.81	342,767	390,721
STEMI	55	yes	no	No	no	17.82	674,236	1,567,846
STEMI	65	yes	no	No	no	14.12	384,227	503,602
STEMI	75	yes	no	No	no	8.77	180,338	224,108
STEMI	55	no	no	yes	yes	12.18	618,887	2,798,300
STEMI	65	no	no	yes	yes	9.09	398,292	1,695,965
STEMI	75	no	no	yes	yes	6.01	268,526	920,166
STEMI	55	no	no	No	yes	20.82	1,381,031	1,599,749
STEMI	65	no	no	No	yes	14.74	579,814	608,290
STEMI	75	no	no	No	yes	8.91	268,620	295,241
STEMI	55	no	no	No	no	20.80	767,329	904,651
STEMI	65	no	no	No	no	14.74	302,145	335,874
STEMI	75	no	no	No	no	8.91	141,466	164,889
NSTEMI	55	yes	yes	yes	yes	9.57	626,862	3,284,366
NSTEMI	65	yes	yes	yes	yes	6.60	426,557	2,245,402
NSTEMI	75	yes	yes	yes	yes	4.05	295,383	1,450,687
NSTEMI	55	yes	no	yes	yes	15.54	1,359,274	2,823,572
NSTEMI	65	yes	no	yes	yes	12.44	895,094	1,361,066
NSTEMI	75	yes	no	yes	yes	8.19	482,687	610,687
NSTEMI	55	yes	no	No	yes	21.68	2,242,023	2,331,170
NSTEMI	65	yes	no	No	yes	14.75	841,033	866,950
NSTEMI	75	yes	no	No	yes	8.91	380,879	412,915
NSTEMI	55	yes	yes	yes	no	9.78	328,051	2,969,094
NSTEMI	65	yes	yes	yes	no	6.40	218,876	2,084,554
NSTEMI	75	yes	yes	yes	no	3.92	154,068	1,296,593
NSTEMI	55	yes	yes	No	yes	19.37	1,764,894	2,246,355
NSTEMI	55	no	no	yes	yes	19.18	1,765,931	2,301,511
NSTEMI	65	no	no	yes	yes	14.61	835,390	903,937
NSTEMI	75	no	no	yes	yes	8.91	398,801	423,325
NSTEMI	55	no	no	No	no	22.01	1,015,910	1,073,038
NSTEMI	65	no	no	No	yes	14.75	646,415	660,748
UA	55	yes	yes	yes	yes	14.18	890,890	2,692,952
UA	65	yes	no	yes	yes	14.52	872,668	919,920
UA	75	yes	no	No	no	8.91	154,343	185,672
UA	55	yes	no	No	yes	22.00	1,958,810	2,011,575
UA	55	no	no	yes	yes	21.20	1,682,428	1,969,350
UA	65	no	no	yes	yes	14.74	678,906	710,851

* Complication such as congestive cardiac failure (CHF), cardiogenic shock, mechanical complication, major arrhythmia etc.

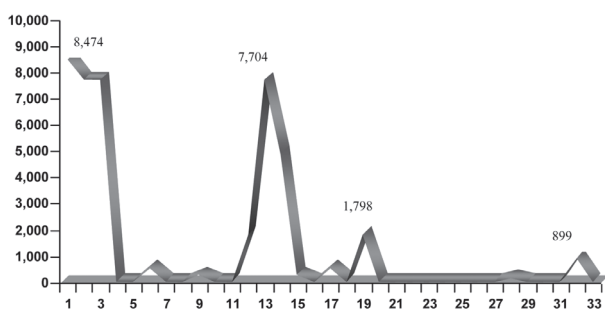
**procedure such as cardiac catheterization, intervention and or CABG etc.

at Ramathibodi and follow up costs, during first year was 26,469 Baht, during second year was 15,157 Baht (Figure 9.)

In the retrospective part of the study using the 330 records; 59 of these patients died in the first year. The number of potentially productive days lost in the first year because of death was 37 up to 365. The total loss due to these was calculated at 4,039,512 baht. Days lost due to admissions and follow up for the 330 patients totaled 5818 days, and this was calculated as lost productivity of 1,457,210 baht.

In the prospective part of the study we analyzed 193 records and the estimated total indirect cost for loss of productivity due to morbidity and mortality in first year was 14,231,633 Baht. Estimated median indirect costs during first year were 30,477 Baht. All indirect costs were calculated based on Thailand GDP per capita, 2003 (25).

Figure 9. Indirect costs due to morbidity during first year (excluding costs due to Ramathibodi hospitalization and follow up) (Baht)



Economic burden of acute coronary syndrome (societal perspective): This is the total of direct health care cost, direct non health care cost and indirect cost from a societal perspective. From the Thai ACS registry of 330 consecutive patients admitted to Ramathibodi Hospital between August, 2002 and December, 2003, the estimated total economic burden and median economic burden of acute coronary syndrome during first year was 70,778,900 and 154,980 Baht. During second year, estimated total economic burden and median economic burden were 24,362,776 and 45,529 Baht (Figures 10A,10B).

Figure 10A. Economic burden of acute coronary syndrome during first year

Total economic burden =70,778,900 Baht

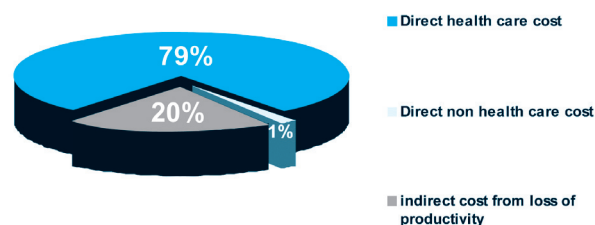
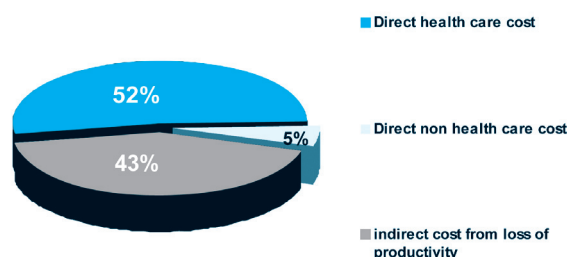


Figure 10B. Economic burden of acute coronary syndrome during second year

Total economic burden =24,362,776 Baht



Many factors affected estimated life expectancy and estimated lifetime costs, such as diagnosis, age, other concurrent diseases, complications, cardiac procedures etc. So we developed a calculator, using the survival function and costs data, on an Excel program to estimate life expectancy and costs. Examples of estimated life expectancy and lifetime costs from the calculator are shown in Table 3.

Discussion

In this study we report survival, life expectancy and costs using a government perspective and an economic burden perspective of acute coronary syndrome (ACS) patients at Ramathibodi Hospital. To the best of our knowledge, these are the first such estimates reported in Thailand. Even in some well known cost studies of coronary artery disease (CAD) in industrialised countries the focus was on direct medical costs only, not estimated true economic cost as in our study (29-32). Therefore the findings from our study are particularly noteworthy. First, despite the current costly

medication and cardiac procedures, more ACS medical costs occurred because of in-patient service costs during hospitalization (4A, 4B & 4C). Second, despite the current high costs of aggressive ACS management, from a lifetime perspective, substantial CAD medical costs are incurred during the post-acute phase, as in this study, 38% of patients that survived initial hospitalization were re-hospitalized during the 23-44 months of follow up. Thus, a patient's burden of CAD continues long after the acute event has resolved. Third, we found there was a substantial economic burden on ACS patients. Costs other than direct health care costs such as indirect costs from loss of productivity due to morbidity or mortality and costs that were directly paid by households were very high and maybe higher than the direct health care costs paid by government (Figure 10A&B). So target for cost saving in new therapies should change from the prevention of costly medication and cardiac procedures in the acute phase to the prevention of hospitalizations or aggravation of the syndrome in the post-acute phase. (For example – cost savings would more readily be made by policy makers in the post treatment phase by looking at strategies for preventing re-hospitalization than in restricting access to costly medications and cardiac procedures in the acute phase).

Lastly, we developed a calculator that can estimate life expectancy and the life time medical care costs of ACS patients. To use the calculator, is very simple, enter the characteristic of the ACS patient, such as diagnosis, age, complication, cardiac procedure etc., and then the calculator will estimate life expectancy and lifetime cost immediately.

Treatment strategy of acute coronary syndrome

Ramathibodi Hospital is a leading medical school in Thailand, so the ACS treatment, as shown in this study, is in the world standard level like the GRACE report, especially medications in four therapeutic classes (ACE inhibitor, aspirin, beta blocker, and lipid lowering) and cardiac procedures with demonstrated survival benefit for ACS patients (33,34). So the estimated medical cost is completely, entire the process of management itself.

CAD Survival and Life Expectancy

GISSI-I, which enrolled 11,712 ACS patients, is the only clinical trial to investigate long-term survival

in an acute MI population (35). Similar to the GISSI-I, and previous observational studies (36), we found a short and long term survival for those patients presenting with unstable angina compared with those presenting with myocardial infarction. In addition, we can estimate life expectancy of unstable angina and MI patients easily by entering the characteristic of the patients into the calculator we developed from our survival probability analysis using the Kaplan-Meier and Markov techniques. Initial ACS status (STEMI, NSTEMI or UA), age, first admission complication (CHF, cardiogenic shock, mechanical complication, and major arrhythmia), DM status and history of stroke were significant predictors of patient life expectancy. For example, a 70 year old NSTEMI patient with CHF had 12 year estimated incremental life expectancy but if he had diabetes the estimated incremental life expectancy was 10 years.

Lifetime medical cost

From a lifetime perspective, despite the current high costs of aggressive ACS management, substantial CAD medical costs are incurred during the post-acute phase as in this study, 38% of patients that survived initial hospitalization were re-hospitalized during the 23-44 months of follow up period. We found that independent factors that affected estimated lifetime medical care cost were diagnosis, age, complication (CHF, cardiogenic shock, major arrhythmia, mechanical complication, stroke), DM status, history of stroke and performing cardiac procedure. In general, NSTEMI patients have higher estimated lifetime medical care costs than STEMI patients because of their longer estimated life expectancy. Diabetes ACS patients have higher estimated lifetime medical care costs than non diabetes patients in general. But in severe complicated cases such as STEMI, diabetes and with a history of stroke have lower estimated lifetime medical care costs than non diabetes patients because of their shorter life expectancy. Patients with cardiac procedures such as cardiac catheterization, intervention and or CABG have higher estimated lifetime medical care costs than patients without the procedures in all situations. But we found that performing cardiac procedures have no significant effect to estimated life expectancy, these may be from the patients we studied were not designed to compare between performing cardiac procedures or not, they all in the Thai ACS registry.

Economic Burden of Illness

Many studies have measured acute CAD medical costs, but few have attempted to estimate post acute costs especially economic cost. Russell used Markov techniques to estimate the incidence-based direct medical costs of CAD in the United States (29) and Kuntz (37) relied on MEDPAR and other data sources to estimate medical costs for AMI patients. Medical cost estimates in both of these studies used data estimated from models and did not measure the actual costs incurred. In our study, we used all data from the hospital, patients and Thai society to estimate the costs in both the government and societal perspectives. These represent the true estimated economic cost and burden of ACS to our patients and Thai society. Similar to estimates reported in the United States (3), the indirect cost from the loss of productivity is considerable part of economic burden and may be more than direct cost that paid by government in years which no event occurs. During the first year of ACS, direct non health care costs and indirect cost were less expensive than direct health care costs. But in the second year, direct non health care costs and indirect costs were comparable to direct health care costs. And from lifetime estimation, estimated lifetime direct non health care and indirect cost were much higher than estimated lifetime direct health care costs. These may be from in the years which no events occurred, direct health care costs were decreased but the patients still suffered from chronic CAD. All of these are economic burden of ACS that continues long since ACS occurred until turned to chronic state of CAD and eventually lifelong. So target for costs saving should change from the prevention of high cost medication and procedures to the prevention of ACS and economic burden of illness by using cost effectiveness medication and procedures.

Limitations

There are some limitations of this study. First, the results are based upon the experience at Ramathibodi Hospital between 2002 and 2005 and may neither be an accurate reflection of the experience of other centers nor of what will occur in the future in a rapidly evolving health care environment. Second, our estimated costs are based on the assumption that all patients were treated by using Thai local made drugs (locally manufactured

generic medications) if possible for that item, so the costs found in this study are lower than actual cost since in real situation some patients were treated by using some or all high cost original drug regimens..

Conclusions

In this first cost study of lifetime ACS treatment in Thailand, we found that the clinical and economic burden of ACS continues long after a patient's acute event has resolved, and that post ACS cardiac event rates and costs may be higher than previously estimated. Despite the high medical costs occurring in both ACS phase and post acute CAD phase, costs other than direct health care cost such as the indirect costs from lost of productivity and the cost that are directly paid by households were very high and may be higher than direct health care cost that paid by government. So target for cost saving when ACS occurred should change from the prevention of costly medication and procedures to the prevention of ACS or aggravation of the syndrome especially in high risk population. And strategy for cost saving should be using cost effective medication and procedures to prevent ACS and economic burden of illness. Thus, cost-effectiveness analysis of programmes for ACS prevention and treatment in Thailand is therefore essential, and the estimated life time cost from our Cost calculator are proper to use for future health economic evaluation of health care programmes to control ACS in Thailand.

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ต้นทุนค่ารักษาโรคหลอดเลือดหัวใจอุดตันฉับพลันของผู้ป่วยของโรงพยาบาลรามธิบดี (คาดคะเนต้นทุนตลอดอายุขัย)

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บทคัดย่อ

วัตถุประสงค์: เพื่อประเมินต้นทุนการรักษาโรคหลอดเลือดหัวใจอุดตันฉับพลันของผู้ป่วยของโรงพยาบาลรามธิบดี ตลอดระยะเวลาการรักษาตั้งแต่ออนในโรงพยาบาลครั้งแรก ตลอดระยะเวลา 1 ปีแรก และตลอดชีวิตของผู้ป่วย โดยใช้ทั้งมุมมองทั้งของรัฐบาล และมุมมองของสังคมโดยรวม

ความเป็นมา: โรคหลอดเลือดหัวใจอุดตันฉับพลัน เป็นสาเหตุการเจ็บป่วยและการตายที่สำคัญของคนไทย และเป็นภาระทางงบประมาณในการดูแลรักษาค่อนข้างมาก ดังนั้นจึงมีความจำเป็นที่จะต้องมีการวิเคราะห์ความคุ้มค่าในการป้องกันและรักษาโรคหลอดเลือดหัวใจอุดตันฉับพลัน การศึกษานี้เป็นการศึกษาแรกในประเทศไทยที่ได้ทำการวิเคราะห์ต้นทุนการรักษาโรคหลอดเลือดหัวใจอุดตันฉับพลันของผู้ป่วยของโรงพยาบาลรามธิบดี ตั้งแต่ออนในโรงพยาบาลครั้งแรก ตลอดระยะเวลา 1 ปีแรก และตลอดชีวิตของผู้ป่วย โดยใช้ทั้งมุมมองทั้งของรัฐบาล และมุมมองของสังคมโดยรวม อันจะเป็นข้อมูลพื้นฐานในการการวิเคราะห์ความคุ้มค่าในการป้องกันและรักษาโรคหลอดเลือดหัวใจอุดตันฉับพลันต่อไป

วิธีการ: ทำการศึกษาแบบย้อนหลังจากเวชระเบียนผู้ป่วย ในทะเบียนคลินิกเนื้อหัวใจขาดเลือดฉับพลัน (Thai ACS registry) ของโรงพยาบาลรามธิบดี ทุกราย ตั้งแต่เดือนสิงหาคม 2545 ถึง เดือน ธันวาคม 2546 จำนวน 330 เวชระเบียน โดยรวบรวมต้นทุนโดยตรงอันเกิดจากการดูแลรักษาของโรงพยาบาลและต้นทุนโดยอ้อมอันเกิดจากการสูญเสียรายได้จากการเจ็บป่วยหรือการเสียชีวิต และได้ทำการศึกษาแบบไปข้างหน้าโดยสอบถามผู้ป่วยในทะเบียนคลินิกเนื้อหัวใจขาดเลือดฉับพลัน ที่มารับการรักษาติดตามอาการที่แผนกผู้ป่วยนอกของโรงพยาบาลรามธิบดี ตั้งแต่เดือน พฤษภาคม 2548 ถึง เดือน ตุลาคม 2548 ทั้งหมด 193 ครั้ง ถึงต้นทุนในการรักษาในฝ่ายของผู้ป่วยทั้งทางตรงและทางอ้อม ต้นทุนถูกปรับค่าให้เป็นต้นทุนในปี 2548 โดยอาศัยดัชนีผู้บริโภคของประเทศไทย (Thai consumer price index) หมวดค่าบริการทางการแพทย์ ในท้ายที่สุดจากการวิเคราะห์อัตราการรอด ผู้วิจัยได้สร้างโปรแกรมการคาดคะเนจำนวนปีที่อยู่รอดและ ต้นทุนค่ารักษาโรคหลอดเลือดหัวใจอุดตันฉับพลันตลอดชีวิตของผู้ป่วย โดยใช้ทั้งมุมมองทั้งของรัฐบาล และมุมมองของสังคมโดยรวม

ผลการศึกษา: ค่ากลาง (median) ของต้นทุนโดยตรงในการรักษาของโรงพยาบาลในปีแรกเท่ากับ 120,298 บาทต่อคน ค่ากลาง (median) ของต้นทุนโดยตรงในการรักษาที่ผู้ป่วยจ่ายในปีแรกเท่ากับ 3,215 บาทต่อคน ค่ากลาง (median) ของต้นทุนโดยอ้อมอันเกิดจากการขาดรายได้อันเนื่องมาจากการเจ็บป่วยหรือการตายในปีแรกเท่ากับ 30,477 บาทต่อคน

สรุป: ต้นทุนการรักษารักษาโรคหลอดเลือดหัวใจอุดตันฉับพลันเมื่อคาดคะเนไปตลอดอายุขัยมีค่าใช้จ่ายที่สูง ผลที่ได้จากการศึกษานี้สามารถนำไปศึกษาหาความคุ้มค่าของยาหรือวิธีการป้องกันรักษาโรคหลอดเลือดหัวใจอุดตันฉับพลันในประเทศไทยต่อไป