

ORIGINAL ARTICLE

DEVELOPING THE COST FOR UNCOMPLICATED ACUTE ST ELEVATED MYOCARDIAL INFARCTION (STEMI PRIMARY PERCUTANEOUS CORONARY INTERVENTION) USING STEP DOWN AND ACTIVITY BASED COSTING AT UKMMC.

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ABSTRACT

- Background:** Cardiovascular disease is the number one cause of death globally and is projected to remain the leading cause of death. If the trend is allowed to continue, by 2015 an estimated 20 million people will die from cardiovascular disease (mainly because of myocardial infarction and strokes). The number of cardiovascular disease cases in Malaysia has increased to 14% in five years from 96,000 cases in 1995 to 110,000 cases in 2000.
- Methods:** The cost to treat patients admitted to Universiti Kebangsaan Malaysia Medical Center (UKMMC) Malaysia, diagnosed with Acute Uncomplicated ST Elevated Myocardial Infarction (STEMI) was calculated by using two different methodologies, namely step down costing methodology and activity based costing using clinical pathway.
- Results:** Cost for each stay per day at the cardiology ward using the step down methodology is RM596.42. The treatment cost is estimated from RM1, 789.26 to RM 4,771.36. The average cost per episode for STEMI care with the average length of stay for 5.6 days is RM3, 340(SD ±596.42. The cost of coronary PCI procedure in step costing is RM 13,950.00. Hence, the total cost incurs for STEMI with PCI is RM 17,290.00(SD ±596.42) by using step down method. (an average cost per episode is RM3,340, plus the cost of coronary procedure of RM 13,950.00 . However by using the ABC the cost of STEMI (PCI) with an average length of stay for 5.6 days is RM 20,431.39. The study showed the ABC method was higher by 15.3% than the step down costing.
- Conclusion:** The cost in managing STEMI (PCI) with the average length of stay of 5.6 days was calculated by using two different methodologies, namely step down costing methodology and activity based costing. Cost of treatment calculated by using activity based costing are higher because all resources used are incorporated in detail. The ABC method was higher by 15.3% than the step down costing. The difference is within 80-20 rules and the biggest percentage of cost in both methods is procedure or PCI cost.
- Keywords:** Treatment cost of STEMI, step down costing, activity based costing, clinical pathway.

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INTRODUCTION

Cardiovascular disease is the number one cause of death globally and is projected to remain the leading cause of death. An estimated 17.5 million people died from cardiovascular disease in 2005, representing 30% of all global death. 7.6 million of these cases were due to heart attack and 5.7 million were due to stroke. About 80% of these cases occurred in low and middle income countries. If this trend is allowed to continue, by 2015 an estimated 20 million people will die from cardiovascular disease (mainly from myocardial infarction and strokes)¹

Myocardial infarction is a leading cause of morbidity and mortality in the United States. Approximately 1.3 million cases of non fatal myocardial infarction are reported each year, for an annual incidence rate of approximately 600 cases per 100,000 people. The proportion of patients diagnosed with non ST Elevation Myocardial Infarction compared with ST Elevation Myocardial Infarction has progressively increased².

The number of cardiovascular disease cases in Malaysia has increased to 14% in five years from 96,000 cases in 1995 to 110,000 cases in 2000. It is the leading cause of death in the country claiming a third of all its patients. In 2001, approximately 20 percent of all death at the Ministry of Health hospitals was due to myocardial infarction and strokes. Two thirds of these deaths were due to myocardial infarction and the rest were strokes³. In 2004, 14.45% of both heart disease and disease of pulmonary circulation became the second cause of death at the Ministry of Health hospitals.”

Managing cardiovascular disease in hospitals is expensive in term of treatment cost. Study conducted by Herrey et al⁵ in Ireland hospital showed that the average cost of treatment for myocardial infarction is 3,976 pound sterling with average length of stay is 7.9 days. In that study, the average cost of treatment per day was estimated as 501 pound sterling per day. Fifty percent of hospital cost was due to ward service. From the total treatment cost, cost for procedure is 35% and pharmacy is 7%⁵. This average cost of treatment of STEMI in Ireland is lower than average cost of treatment of STEMI in France in 1999 that 5,566 pound sterling⁶. But this average cost in Ireland is similar to the treatment cost of STEMI in Belgium Hospital in 1998, which was calculated to be 3,675

pound sterling⁷. Treatment cost of STEMI nowadays has increased significantly, because of increasing role of surgical 1992 to 1994 showed that average cost of STEMI was 2,333 pound sterling⁸. Study in Mater Ireland hospital from Spain in 1995 found average cost of STEMI was 2,445 pound sterling⁹.

A cardiology inpatient care based on step down costing, shows an estimated cost of treatment for STEMI without co morbidity and complication (IR-DRG 05331) of RM 3,699 (1056.9USD) with an average length of stay of 5.5 days¹⁰. However, there is no study yet on the differences of costs between step down costing method and activity based costing method for cost treatment of STEMI at UKMMC.

There are two different methods that can be used to estimate the cost of treatment in hospitals. These are: step down costing method and activity based costing (ABC). Step down costing involves breaking down departments or divisions expenditures to obtain operation-level cost. There are two different methods of “step down” costing; they are “per-diems” costing and “case mix” costing. Per-diems costs are calculated by dividing the total acute inpatient costs of providing care by the number of patient days to give an “average” cost per patient per day. The case mix costing method goes further than the per diems costing by dividing patients into more homogeneous groups (called case-mix groups) that are clinically meaningful and that can be expected to use similar amounts of hospital resources^{11, 12}.

Step down Costing method has limitation that no adjustments are made for differences in patient characteristics that are likely to affect resource utilization (i.e. Case-mix), rendering it less accurate. However, as described in Mugford et al¹⁵, it does offer reliable mean estimates. Step down costing is easier to carry out for a number of reasons (i.e. less data intensive, fewer research skill needed, data can be collected from routine sources) and thus it is more popular^{13,14}.

UKMMC is the first hospital that has implemented case-mix system in Malaysia since 2002. UKMMC has been routinely conducting the case-mix based step down costing for its case-mix system.

Activity based costing or ABC is a method for developing cost estimates in which the calculation is sub divided into discrete,

quantifiable activities or a work unit. Activity based costing in hospital means that measuring cost of every resource used by a specific patient¹⁴. ABC has some disadvantages such as requires more intensive primary data collection, slow and more expensive, need properly trained staff, not necessary accurate (operators may change their behavior), difficult to estimate, and require expensive and specialized software for data collection, but it gives data on inter-patient variation^{11,15}.

The method of costing using ABC can be calculated by using clinical pathway. Clinical pathway is an interdisciplinary plan of care that outlines the optimal sequencing and timing of intervention for patients with a particular diagnosis, procedure or symptom. UKMMC has developed clinical pathway of STEMI (thrombolysis pathway and primary percutaneous coronary intervention pathway) with a collaborative effort among cardiologist, community health and emergency department at UKMMC. Clinical pathways are a necessary part of process costing, analyzing and optimizing. The economical data associated with clinical pathway provides the basis for an efficient controlling. Therefore the clinical pathway costing can be used as the de facto activity based costing.

This study aims to compare step down costing method and ABC (using clinical pathway) method in developing cost of treatment for uncomplicated acute STEMI (PCI) at UKMMC.

METHODS

For the purpose of this study, we had calculated the cost of treatment of 31 patients admitted, with diagnosed Acute Uncomplicated ST Elevated Myocardial Infarction (STEMI) at the Universiti Kebangsaan Malaysia Medical Center (UKMMC) and underwent percutaneous coronary intervention (PCI) procedure. To receive treatment, these patients were admitted to the Coronary Care Unit (CCU), Coronary Rehabilitation Ward (CRW) and Cardiology Ward.

To develop the cost of treatment by using the step down methodology (case-mix costing), for all patients admitted to the above mentioned wards, in year 2009. Whereas, for the development of cost of treatment using the activity based costing, we randomly selected 31 patients admitted to the cardiology

department between February 2009 till October 2009.

The instrument used in calculating cost using step down costing method was template of step down costing, including the hospital basic data, and documentation from the ward. The instrument for activity based costing was general format of clinical pathways of STEMI (PCI pathway).

All available data was gathered, updated continuously and added into database. A statistical software, "Statistical package for Social Science" (SPSS) 17.0 was used. Statistical tests applied with the degree of significance $p < 0.05$.

The cost of treatment for step down costing was calculated by using Clinical Cost Modeling (CCM) Software version 2.1. CCM software performs costing calculation after the basic cost data is put in according to predefined format. Output windows in the CCM software will show cost per day in respective ward. Cost of treatment per day in medical ward was chosen as the cost of treatment for STEMI. Cost per day in medical ward then multiplied by the respective patient's length of stay in medical ward to obtain the cost of treatment for that episode of care. Cost of PCI was added with total cost in medical ward as obtained before.

Cost calculation using activity based costing method was completed in two phases. In phase one, we calculated the capital and recurrent cost using step down method to determine cost of building, cost of utilities, cost of maintenance and cost of administration per day in medical ward. After that, this calculated cost is multiplied by patient length of stay (LOS) in medical ward to determine cost per episode of disease.

In the second phase, we calculated cost per activity using clinical pathways template to determine cost of treatment per episode of disease per patient. Cost calculated during the second phase is the staff salary, cost of consumables, cost of drugs, cost of procedure, and cost of investigation. The total cost is calculated by adding up both cost from phase one and phase two.

The mean cost from step down costing is then compared with activity based costing. The cost difference between both methods was taken as a result of study.

RESULTS

By using the step down methodology, the cost per day in managing STEMI using Clinical Cost Modeling (CCM) software is RM 596.42(170.4USD). Each of the patients of STEMI remains in ward for more than one day; therefore the cost per day of treatment at the medical ward is then multiplied with the actual length of stay (LOS) in order to determine the actual cost of treatment for that episode of care for STEMI. The minimum cost per episode of care for STEMI was RM 1,789.26(511.2USD) and maximum cost per episode of care was RM 4,771.36(1363.2USD). Mean cost was RM 3,340 (954.3USD (SD ±596.42 (170.4USD)) with average length of stay 5.6 days at UKMMC without cost of PCI. In order to get the actual cost, the procedure cost should be added to medical ward cost. Patient has to pay

for the procedure and the cost is RM 13,950.00(3985.7USD).Therefore, the total cost of treatment of STEMI using the step down (case-mix) methodology was calculated to be RM 17,290.00(4940USD) (SD±596.42) (954.3USD). (Average cost of episode RM 3,340(SD ±596.42) plus cost of PCI procedure RM 13,950.00).

There is no precedence for calculating the cost of coronary related procedure (PCI) in Malaysia. When we calculated the cost of treatment using the activity based costing (using clinical pathway), the average cost of treatment was RM 20,431.39(5837.5USD). The highest percentage was cost of procedure. The detail of the cost component is shown in the Table 1.The study showed the difference is 15.4%.

Table 1 Cost composition of STEMI (Primary PCI) using activity based costing method

Item Cost	Average Cost
Cost of Medical Ward(episode)	1033.85
Emergency Department	159.42
Activities in CCU, CRW, Ward:	
• Activity	23.21
• Observation	211.64
• Investigation	284.66
• Treatment	101.60
• Hygiene	3.35
• Education	56.40
• Physiotherapy Activities	36.68
• Diet	102.08
• Elimination(waste)	2.00
Procedure (PCI)	18,416.50
Total	20,431.39

DISCUSSION

According to James Vertres and Leon Paff step down costing method to estimates inpatient cost included eight steps. First study organization’s chart or account, second define cost centers, third grouped cost centers in to first-tier or overhead cost centers, second-tier or intermediate cost centers, third-tier or final care cost centers, fourth identify total cost of each overhead, intermediate and final cost center, fifth decide on units to distribute cost or to allocate cost, sixth allocate the cost of overhead cost centers to intermediate and final care cost centers, seventh allocate the costs of intermediate to final cost centers and eighth related cost to case-mix group to determine cost per day¹⁶.

Now, the process to calculate cost per day in any ward in hospital become much easier by using Clinical Cost Modelling Software. Clinical Cost Modelling Software created based on three different conventional costing approach in hospital setting, namely step down (step down), activity based costing and case mix costing. It is much easier to use because user only needs to collect several data on hospital’s performance, financial data and basic data that can be obtained from the hospital’s annual report¹⁷.

Cost in medical department for every admission of patients suffered with STEMI was RM 3,340 (SD 596.42) with average length of stay of 5.6 days (SD=1day). This result was almost similar with finding of

Amrizal et al 2005, mean cost of STEMI without comorbidity and complication (IR-DRG 05331) was RM 3,699(1056USD) with length of stay 5.5 days.

This study found that average cost of STEMI with PCI procedure is RM RM 13,950.00(3985.7USD). Percentage of ABC cost components are procedure (69%), drugs (21%), overhead cost (5%), investigation cost (3%), and salary (2%). According to Burnelli et al 1996 percentage of cost component in STEMI were interventional cardiology (25.7%), share facility (24.5%), drugs (19.8%), salary (13.9%) and laboratory (5.6%)¹⁸.

This study found that the cost of STEMI developed using the ABC was higher (15.4%) as compared to step down costing method. Cost of treatment calculated by using activity based costing are higher because all resources used are incorporated in detail. These resources include; over head cost, salary, consumables, equipment, drugs, investigation, procedure and many more. Compared to step down costing, activity based costing was more time consuming and more people are involved. In this study, the data was collected from cardiologist, nurses, physiotherapist, pharmacist, dietitian, cathlab managers, hematology and pathology managers, radiology managers, general store chief unit, equipment suppliers, finance staff, engineering staff and human resources staff. However, activity based costing can describe the real cost in each activity of treatment. It also provides data on cost component that contribute to the increased cost of treatment.

CONCLUSION

Step down Costing was calculated by using Clinical Cost Modeling (CCM) Software version 2.1. Financial data collected and running through the software are basic hospital utilization data, hospital performance, and some financial data. From the study the cost of Uncomplicated Acute ST Elevation Myocardial Infarction per episode of care was RM 3340(954USD) (SD=596.42). Total cost after added to the procedure cost was RM 17,290.00(4940USD) (SD ±596.42 (170.4USD)). Cost of treatment by activity based costing used clinical pathways of Uncomplicated Acute ST Elevation Myocardial Infarction as guide line. By this method it is found that cost of treatment per episode of care was RM 20,431.39(5837.5USD). The study concluded the activity based costing method was higher

than step down costing method with approximately 15.4%.

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