

Direct Medical Cost of Stroke: Findings from a Tertiary Hospital in Malaysia

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SUMMARY

This study aimed to estimate cost of in-patient medical care due to stroke in a tertiary hospital in Malaysia. A retrospective analysis of stroke patients admitted to Universiti Kebangsaan Malaysia Medical Centre (UKMMC) between January 2005 and December 2008 were conducted. Cost evaluation was undertaken from the health provider's perspective using a top-down costing approach. Mean length of stay (LOS) was 6.4 ± 3.1 days and mean cost of care per patient per admission was MYR 3,696.40 \pm 1,842.17 or 16% of per capita GDP of the country. Human resources made up the highest cost component (MYR 1,343.90, SD: 669.8 or 36% of the total cost), followed by medications (MYR 867.30, SD:432.40) and laboratory services (MYR 337.90, SD:168.40). LOS and cost of care varied across different stroke severity levels ($p < 0.01$). A regression analysis shown significant influence of stroke severity on cost of care, with the most severe stroke consumed MYR 1,598.10 higher cost than the mild stroke ($p < 0.001$). Cost of medical care during hospital admission due to stroke is substantial. Health promotion and primary prevention activities need to take priority to minimise stroke admission in future.

KEY WORDS:

Acute stroke, Length of stay, Costing, Economic impact

INTRODUCTION

Stroke remains a significant public health problem worldwide. The past decade witnessed a dramatic increase in the global incidence of first-ever stroke by a three-folds leap from 3.8 million cases in 2000 to approximately nine million cases by the end of 2004¹. Stroke in Malaysia is becoming increasingly prevalent, corresponding linearly with the increased incidence of lifestyle illnesses and ageing population¹. It is now affecting approximately 50,000 people annually, with increase annual hospital admissions of new cases by 12 to 15% between 2003 and 2008².

It is known that stroke carries a huge burden to individual, family and society. Economic reports demonstrated that cost of stroke now accounted for up to 1.6% to 6.9% of the total health care expenditure in many countries³. Various methods have been developed and introduced to measure cost of care

which include the assessment from healthcare providers' or societal perspective or through the measurement of a total cost or cost of a component of care at different stages of stroke. The attempt to compare between countries remains unsuccessful as countries worldwide are different in clinical practice and assessment of unit costs⁴.

Costing of hospitalization due to stroke takes into account all components of care including rehabilitation, nursing and medication costs. Earlier studies had shown that hospital cost for a typical stroke patient accounted to 71% of total stroke care costs, in which approximately 41% was the cost of the initial hospitalization^{5,6}. The total stroke-associated cost is mainly determined by the length of hospital stay, however factors such as gender, age, co-morbid conditions, severity of stroke and family support might had significant contribution to the overall costs of stroke care in any institution^{7,9}.

Investigations into economic impact of stroke are lacking in Malaysia despite increasing hospital admissions due to this disabling condition. The availability of Malaysian cost data is essential for the assessment of cost-effectiveness of stroke-related treatments and future planning of healthcare resources. This study aimed to estimate cost of stroke admission, and to identify important variables that influence the cost in a main tertiary hospital.

MATERIALS AND METHODS

Subjects

This retrospective cross-sectional study used in-patients' data maintained by the Casemix Unit of a tertiary level hospital, the University Kebangsaan Malaysia Medical Centre (UKMMC). Casemix data was preferred than the usual hospital discharge lists because it recorded diagnosis of disease based on the International Classification of Diseases (ICD) coding system, with categorisation of cases according to disease severity.

Sampling method used was universal sampling, in which all patients with ICD-10 code I61 to I69 (cerebrovascular diseases) recorded in the Casemix database were considered for inclusion in the study. Patients who had Transient Ischemic Attack without a progression to stroke, patients below the age of 18 years and those who stayed longer in the

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ward due to conditions not related to the stroke onset such as chronic renal failure and chronic obstructive airway disease were excluded.

Variables retrieved from individual patient's data were the demographics (age and gender), date of admission, date of discharge and stroke clinical profiles (stroke sub-type and severity level) and co-morbidities (disease of circulatory system such as hypertension and cardiac disease, diabetes and other diseases).

Costing evaluation

The cost evaluation was undertaken from the health care provider's perspective and using a top-down costing method.¹⁰ The top down costing method involves analyses of actual hospital expenditure or operational costs at different levels of cost centres; the overhead cost centres, the intermediate cost centres and the final cost centres. In the costing process, the hospital expenditure is first tracked in overhead and intermediate cost centers and then allocated to final cost centres using appropriate allocation factors. In UKMMC, overhead cost centres includes administration, maintenance and utilities, consumables, information technology unit and other services. Intermediate cost centres are pharmacy, radiology, laboratory, physiotherapy, intensive care unit and operating theatres. Final care cost centres are the different wards and clinics where patients received in-patient or out-patient care. In estimating the cost for each cost centre, both capital cost (building, equipment and furniture cost) and recurrent cost (staff salary and recurrent cost except salary) are combined. Information on activities which reflects the workload such as admissions, inpatient days, number of annual test of laboratory and radiology, number of prescription of pharmacy and number of sessions of physiotherapy for both inpatient and outpatient care are gathered to determine appropriate allocation factor. For each final cost centre, the fully allocated costs are then divided by the total units of inpatient days to obtain the cost of providing services on a per-patient per-day of stay basis, referred as unit cost. The unit cost is finally multiplied with the individual patient's length of stay to obtain the cost of care per patient per admission.

In this study, costing evaluation was done for the years 2005 to 2008. As an example, the total hospital expenditure for the year 2005 was MYR 243,517,350.00. After stepping down the cost to the various cost centres, followed by dividing the final allocated costs for medical wards by the total number of inpatient days, the unit cost for medical ward in year 2005 was MYR 522.00. This unit cost was then multiplied with the individual stroke patient's length of stay to obtain the cost of medical care per stroke patient per admission.

Statistical analysis

Statistical analyses were conducted with SPSS version 19.0. Descriptive analyses were used to describe the categorical data of the patients. Comparison of the length of stay and cost of care between subgroups of age and gender, and between subgroups of stroke sub-type and severity level were done with independent t test and analysis of variance (ANOVA), respectively. Variables that shown statistical significance were then inputted into Standard multiple linear regressions to determine influence on length of stay and cost

of care, and to quantify the magnitude of influence. All p values <0.05 were considered significant. The study was approved by the research and ethics review board of University Kebangsaan Malaysia.

RESULTS

The Casemix database recorded 903 stroke patients for the years 2005 to 2008. A total of 813 stroke cases were analysed after excluding cases of TIA, patients below the age of 18 years and cases that stayed longer due to other conditions not related to stroke. Characteristics of the study patients are shown in Table I.

Table II shows the length of stay and cost of care in the study patients. The average length of hospital stay was 6.4±3.1 days, with majority of patients stayed between 4 to 7 days (51.6%) and one-third of them stayed more than 7 days in the hospital. The mean cost of care per patient per admission was MYR 3,696.40 ± 1842.10. The cost was highest for human resources (MYR 1,343.88±669.86 or 36.4% of the total cost), followed by medications (MYR 867.33±432.42 or 23.5 % of the total cost) and laboratory services (MYR 337.85±168.41 or 9.2 % of the total cost).

Table III shows comparison of length of stay and cost of care according to selected demographic variables, stroke subtype and severity level. Patients above the age of 60 years and female patients stayed longer and consumed higher medical resources than their younger and male counterparts, however the differences were not statistically significant. The length of stay was also highest in the hemorrhagic subgroup and severe stroke (p<0.05), with the severe stroke staying an additional 3 days compared to the mild stroke. The mean cost of care per patient per admission did not differ much according to gender and stroke sub-types, however varied noticeably with varying level of severity (p<0.01). The cost increased by 15% when patient suffered from moderately severe stroke and further increased by 52% in the highest level of severity compared to mild stroke.

The results of the standard multiple regression analysis are summarized in Table IV and Table V. Both stroke subtype and level of severity had significant influence on length of stay in these patients. The hemorrhagic stroke and the ischemic stroke stayed 1.0 day (p=0.002) and 0.7 day (p=0.005) respectively and relatively longer than the unspecified stroke. The most severe stroke had the heaviest influence on length of stay ($\beta = 0.382$) and consumed MYR1598.10 (p<0.001) higher resources than the mild stroke.

DISCUSSION

To the best of our knowledge, this study was the first to analyse the cost of in-patient medical care due to stroke in Malaysia.

The mean length of stay for patients in this study was 6.4 days, with one-third of the patients stayed more than a week in the hospital during the stroke onset. The length of stay in this cohort was shorter compared to similar studies done, which reported length of stay of 9 – 33 days^{11,12}. The contradictory results could be explained by a number of

Table I: Characteristics of study patients

Characteristics	Subgroups	N(%)
Age, year (Mean=63.3±13.6)	<60	285 (35.1)
	≥ 60	528 (64.9)
Sex	Male	453 (55.7)
	Female	360 (44.3)
Stroke sub-type	Ischaemic	453 (55.7)
	Hemorrhagic	147 (18.0)
	Unspecified	193 (23.8)
Level of severity	Mild (no complications)	162 (19.9)
	Moderate (with complications)	468 (57.6)
	Severe (with major complications)	181 (22.3)
Main Comorbidities	Diseases of circulatory system, e.g.hypertension and cardiac disease	257 (31.6)
	Diabetes	81 (10)
	Diseases of respiratory system, e.g. chronic obstructive airway diseases	31 (3.8)
	Others (eye and ear, genitourinary)	20 (2.4)

Table II: Length of stay and cost of care per patient per admission in the study patients

Variables	Sub-groups	Mean± SD	%
Length of stay, days	Total	6.4±3.1	-
Length of stay grouping	<3 days	-	15.0
	4-7 days	-	51.6
	> 7 days	-	31.7
Cost per patient, Malaysian Ringgit (MYR)	Total cost	3696.4±1842.1	
Cost per patient by service components, MYR	Administration	243.86±121.55	6.6
	Human resource	1343.88±669.86	36.4
	Utility and maintenance	36.92±18.40	1.0
	Laundry and linen	143.97±71.77	3.9
	Consumables	92.33±46.01	2.5
	Dietetic	99.65±49.67	2.7
	Laboratory services	337.85±168.41	9.2
	Radiology	114.45±57.04	3.1
	Pharmacy (Medications)	867.33±432.42	23.5
	Physiotherapy	66.44±33.12	1.8
	Intensive care	210.42±104.89	5.7
	Other services	132.89±66.24	3.6

Table III: Comparison of length of stay and cost of care per patient per admission by demographic and stroke profile

Variables	Length of stay (Mean ± SD)	p	#Cost/patient, MYR (Mean ± SD)	p
Age group				
<60	6.2±3.3	0.40#	3603.4±1970.8	0.31#
60 and above	6.4±2.9		3746.2±1769.4	
Gender				
Male	6.2±3.1	0.10#	3598.9±1871.9	0.10#
Female	6.5±3.0		3818.6±1799.5	
Stroke subtype				
Hemorrhagic	6.6±3.0	0.03*	3774.2±1780.3	0.15*
Ischaemic	6.4±3.4		3767.6±2034.0	
Unspecified	5.9±2.9		3473.8±1842.7	
Severity level				
Mild	5.2±2.6	0.00*	3099.7±1571.5	0.00*
Moderate	6.2±2.8		3573.7±1729.0	
Severe	8.0±3.4		4697.8±2052.4	

independent t test ; * ANOVA

Table IV: Standard multiple linear regression analysis for length of stay

Variables	Coefficient (SE)	β	p
Constant	4.51 (0.31)		0.000
Severity level			
Moderate (versus mild)	1.13 (0.28)	.178	0.000*
Severe (versus mild)	2.98 (0.35)	.382	0.000*
Stroke subtypes			
Ischemic (versus unspecified)	0.72 (0.26)	.116	0.005*
Hemorrhagic (versus unspecified)	1.08 (0.35)	.130	0.002*

Model R² = 0.10, *p significant at 0.05

Table V: Standard linear regression analysis for cost of care per patient per admission

Variables	Coefficient (SE)	β	p
Constant	3099.71 (141.91)		0.000
Severity level			
Moderate (versus mild)	474.01 (164.74)	.126	0.004*
Severe (versus mild)	1598.10 (203.41)	.345	0.000*

Model $R^2 = 0.08$, *p significant at 0.05

reasons. Both earlier studies were conducted in units where patients received a multi-disciplinary stroke care and in-patient rehabilitation intervention, which in turn lead to the possibility of more intensive and longer in-patient care. The set-up in UKMMC however was different in which, in an absence of stroke unit, stroke patients were admitted to neurology or medical ward mainly for medical treatment and rehabilitation were given mostly as outpatient. The main criterion for discharge according to the clinical pathway for acute stroke practiced in this hospital was stable medical condition, evaluated clinically by the stroke care team. The clinical pathway has also recommended that stroke patients should be hospitalized for duration of no longer than a week to minimize risk of hospital acquired infections among the patients who were mostly elderly. Although it was also suggested in the pathway that stroke patients should be trained for safe transfer prior to discharge, achievement of safe transfer was not an important criterion for discharge from this hospital. Another possible reason for shorter hospital stay among stroke patients in this study was related to hospital charges associated with stroke admission. Public health care services in this country are financed mainly with taxation-based financing system. Although the health care offered in public health institutions are heavily subsidized by the government, and hospital charges are waived for some patients such as those who are civil servants or pensioners, some other patients will have to pay hospital fees on their own. The National Health Account Study¹³ reported that, the out of pocket expenditure on health in this country was as high as 40% of the total health expenditure (THE). Some patients, in an attempt to reduce expenditure caused by the hospital admission might have opted to be discharged earlier. The length of stay in this study varied significantly to stroke-subtypes and levels of severity; with the longest stay noted in hemorrhagic stroke and severe cases. This is in congruent with previous studies^{14,15} which found longer admissions for hemorrhagic stroke, averaging 7.5 to 12 days as compared to ischemic stroke of 5.6 to 10 days. Longer hospital stay in patients with hemorrhagic stroke can be explained by the nature of hemorrhagic stroke being more disabling, commonly due to the development of secondary injuries or delayed stabilization of vital signs namely the blood pressure¹⁶. Severe stroke patients also stayed additional days compared to mild stroke in our cohort. Increased hospital stay as the stroke severity increased has been reported elsewhere¹⁷. The more complex disability among the severe stroke patients may have delayed their achievement of safe transfer, thus prolonged hospital stay.

Although patients in this cohort stayed shorter than patients in other countries, the cost of care incurred, averaged at MYR3,696.40 per patient per admission, was substantial when compared to the per capita Gross Domestic Product

(GDP) of the country and the average annual spending on health per Malaysian. The mean cost of care per patient per admission was 16% of the country's per capita GDP (amounted at MYR 23,700 as per 2010 estimates by International Monetary Fund) and triple to that of the average spending on health per person per year, amounted at MYR 1,296 as documented in a health care review¹⁸. The calculated cost was related to acute care in the medical ward alone. If other associated cost for the care of a stroke patient such as costs for the three-monthly post-discharge follow-up at the neurology clinic and the twice-weekly out-patient rehabilitation were to be included, we hypothesised that the total cost of care for a stroke patient in this country would tripled, thus further increasing the impact to the health expenditure of this country.

Human resources contributed more than one-third of the total cost of medical care. This result was expected considering the fact that stroke is a complex disease requiring care by various health care disciplines. The increasing emphasis on early rehabilitation i.e. within 24 to 48 hours following the diagnosis of stroke has further increased the number of health care professionals who are involved in the acute care of stroke. These include rehabilitation consultants, therapists and medical social workers and other professionals in a multi-disciplinary stroke rehabilitation team.

It is well-documented that stroke patients do not normally admitted due to the stroke insult alone but accompanying co-morbidities that are also established risk factors for the disease such as hypertension, diabetes and cardiac diseases¹. These are evident in this study in which more than 30.0% of the stroke patients had some forms of circulatory disease which include hypertension and cardiac diseases and 10% of the patients had diabetes. Management of these co-morbidities can be resource intensive, both in terms of routine investigations and medications. These, together with the routine blood investigations carried out immediately following stroke admission could have contributed to the relatively significant cost of medications and laboratory tests in this study, i.e. 23.5 % and 9.2 % of the total cost, respectively.

This study also found strong influence of level of severity ($p < 0.01$) on cost among the stroke patients. The severe stroke consumed on an average MYR 1,124 and MYR 1,598 higher resources for each patient per admission than the moderate and the mild stroke respectively. These results strengthen the findings of previous reports⁷⁻⁹ and can be explained by longer hospital stay due to the presence of various co-morbid conditions among these subgroups of stroke patients. The variable, however could only explained 8% of the variance in the cost and factors that contributed to more than 80% of the

cost remained unanswered. On the other hand, although lower cost of admission was noted among male than female patients and in younger patients, the differences were not statistically significant, thus supporting previous claims that age and gender were not an independent determinant for cost of stroke admission^{17,19}.

This study provides the first profile of impact of stroke in terms of health expenditure of the country hospital care. Despite patients staying shorter, the cost to care for these patients is substantial. Efforts must be intensified to reduce the incidence of stroke, concentrating on the aspects of preventive medicine which provides more cost saving opportunities²⁰. In situation where stroke admission is unavoidable, efforts should look into proper managed care, early identification of co-morbid conditions and managing severity to reduce the length of stay subsequently the costs brought about by hospitalizations.

This study is not without limitations. The estimations of cost for some components of care during hospitalization were based on number of visits by the respective health care professionals rather than the actual amount of time spent with the individual patient. This has somewhat affected the accuracy of the cost calculation. The nature of the study being retrospective is also the study limitation. Analyses of costs and contributing factors had to consider only whatever available data from the patients' database and this has limit the depth of the analyses, thus the value of the study findings.

CONCLUSION

Despite its limitation, this study is an important first step in evaluating the economic impact of hospitalisation due to stroke in Malaysia. This study shows that cost of medical care per stroke patient per admission is substantial in the main teaching hospital, UKMMC. Cost of care is significantly influenced by level of severity, rather than age, gender and stroke sub-type. Further studies that evaluate more components of cost, and using both health care providers' and patients' perspective are required to estimate the economic burden of stroke to this country.

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