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Cost of stroke from patients' perspective: A real-world evidence study in Vietnam

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ABSTRACT

Introduction: Stroke is the second leading cause of death worldwide, accounting for 10% of all deaths and 17 million new cases annually. Its impact on society is enormous, not only due to the disease burden but also because of the associated medical costs. Studies on the cost of stroke in Vietnam have been limited so far. The aim of this study is to evaluate stroke-related costs from the patients' perspective in Vietnam using hospital data. Methods: A cross-sectional study using a randomized sample of stroke patients from a hospital in Ho Chi Minh City (115-bed hospital) was conducted to evaluate the cost of stroke. Patients who were hospitalized for stroke at the studied hospital, had complete medical records, and agreed to participate in the study were selected. Patients who were foreigners, did not complete their treatment at the research hospital, or died during treatment were excluded from the study. The costs of stroke considered both direct (medical and nonmedical) and indirect expenses. Results: Based on the study sample of 273 patients with ratio of men: women of 1.315:1, mean age of 62.97± 14.3; approximately 85% with ischemic stroke and 15% with hemorrhagic stroke. The mean total cost per stroke patient was VND 8,112,458.7 ± 285.499,16; 77% of which was due to direct cost (VND 6,307,554.5) and the rest (23%) was due to indirect cost (VND 1,804,904.2). In the structure of direct cost, the medical costs were 1,22 times higher than non-medical costs (3,470,583.8 vs 2,836,970.7 VND; respectively). Discussions: This study was conducted on a small scale, involving only one hospital and a limited study period, which led to constraints in sample size. The study demonstrated the treatment costs for stroke inpatients and highlighted the variations in different types of stroke-related expenses. These findings can assist medical centers and physicians in making informed clinical decisions. Additionally, the results provide a basis for shaping policy decisions and developing national medical programs. Conclusions: With an average hospital stay of 6.17 ± 0.18 days, direct medical costs constituted the largest portion of the total expenses. Given the increasing incidence of stroke in Vietnam, healthcare policies aimed at reducing the financial burden on stroke patients should be considered.

Keywords: *cost, cost of illness, inpatient treatment, stroke*

1. INTRODUCTION

Stroke, also known as cerebrovascular accident , is the second leading cause of death worldwide with 10% of all deaths and 17 million new cases per year [1, 2]. The lower middle income countries take a large mortality of stroke, at 85%, such as Vietnam [3]. Stroke is less common in people under 40 years old [4]. The incident rate of stroke in man is higher but adverse effects are more serious in women [5]. Stroke is classified into 2 major categories: ischemic and hemorrhagic. Ischemic strokes (IS) account for 80% of all strokes and 15% to 20% other cases were hemorrhagic strokes (HS). Due to dangerous complications and high risks, treatments and supportive services are necessary to improve stroke patients' health. Therefore, the impact of stroke on society is large not only because of the disease burden but also the medical cost. Many studies about cost of stroke

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were performed in South Africa, Netherlands, Singapore, South Korea, Vietnam…. In Vietnam, there are not many studies on cost of treatment for stroke until now. A study was done in Ho Chi Minh city (HCMC) 115 People hospital in 2009, which revealed that the mean cost per patient of IS and HS were VND 6,427,000 and VND 7,659,000 respectively [6]. This study aims to assess the cost of stroke for inpatients who were treated in HCMC 115 People hospital with the most updated data.

2. METHODS

2.1. Study design

A cross-sectional study has been conducted in department of cerebrovascular diseases, HCMC 115 People hospital from March to April 2016. Total cost included direct cost (medical, non-medical) and indirect cost. Medical direct costs were retrieved from medical payment receipt of patients, nonmedical and indirect costs were retrieved from surveying patients with questionnaire.

2.2. Sample

This study included patients who were hospitalized with primary diagnosis stroke (I60-64) in researched hospital with full medical records and agreed to participate in the study. Patients who were foreigners or did not finish the treatment course or died within the course were eliminated from this study. Sample size was calculated using the formula:

$$n = \left(\frac{z_{(1-\alpha)/2}\sigma}{e}\right)^2$$

In which, n is the sample size; α=0,05; $z_{\alpha/2}$ is inferred from Student's t-distribution (1.96); σ is standard deviation from pilot study with 30 patients (3,993,627.6 VND); e is the width of the range estimation (500,000 VND) [7]. The sample size of the study after calculating was 245 patients.

2.3. Sampling

With 20% non-response rate, the needed sample size should be 300. With the study period of 2 months (44 working days), an average sample per day was 300/44 = 7 patients. Every day at the Department of cerebrovascular diseases, HCMC 115 People Hospital has an average of 25 cases released from the hospital. During the study period, out-of-hospital discharge cases were numbered and made a pre-planned list, based on which the researcher will randomly select 7 patients to conduct surveys. The survey process is carried out at the hospital room and from 9am to 12pm daily. Samples included in the study must be consistent with selection criteria and exclusion criteria.

2.4. Statistical analysis

Data were analyzed by using relevant statistical test with 95% confidence interval by IBM SPSS 22.0.

3. RESULTS

3.1. Characteristics of sample study

The characteristics of study sample (n=273) is presented in Table 1.

In terms of gender distribution, men accounted for a higher proportion than women (56.8% vs. 43.2%). The average age of the patients was 62.97 years, ranging from 25 to 99 years, with 40% of the patients falling in the 60-79 age range. Over 37% of participants lived in Ho Chi Minh City. The average monthly income of the patients was VND 1,945,970.7, with values ranging from VND 0 to VND 30,000,000. Approximately 85% of the study sample was diagnosed with ischemic stroke (IS), while the remaining were hemorrhagic stroke (HS) cases. A significant majority (nearly 80%) experienced their first stroke incident. According to the NIH Stroke Scale (NIHSS), 56.6% of the patients had moderate strokes, and 36.1% had minor strokes, with a mean NIHSS score of 7.16.

Table 1. The characteristics of sample stuty

	Characteristic	N	%	% accumulation
Sex	Men	155	5.,8%	56.8%
	Women	118	43.2%	100%
Age group	0-19	0	0%	0%
	20-39	14	5.1%	5.1%
	40-59	102	37.4%	42.5%
	60-79	114	41.8%	84.3%
	80+	43	15.8%	100%

	Characteristic	N	%	% accumulation
Living	Urban HCMC	61	22.3%	22.3%
	Extramural HCMC	41	15%	37.3%
	Nearby provinces HCMC	108	39.6%	76.9%
	Others	63	23.1%	100%
Stroke	Ischemic	232	85%	85.0%
	Hemorrhagic	41	15%	100%
Recurrence	1	217	79.5%	79.5%
	2	44	16.1%	95.6%
	3	8	2.9%	98.5%
	4	3	1.1%	99.6%
	5	1	0.4%	100%
The severity follow NIHSS	No stroke symptoms	0	0%	0.0%
	Minor stroke(1-4)	79	36.1%	36.1%
	Moderate stroke(5-15)	124	56.6%	92.7%
	Moderate to severe stroke (16-20)	14	6.4%	99.1%
	Severe (21-42)	2	0.9%	100%
Health insurance	No insurance	106	38.8%	38.8%
	Self-insurance	84	30.8%	69.6%
	Government insurance	44	16.1%	85.7%
	Company insurance	8	2.9%	88.6%
	Elderly insurance	31	11.4%	100%

			N	Min	Max	Mean	SD	SE
Age			273	25	99	62,97	14,3	0.87
The average income/ month			87	500,000	30,000,000	1,945,970,7	4,049,335.3	245,076.9
The length of hospital stay	Total		273	2	22	6.17	2.9	0.18
	Stroke	IS	232	2	22	5.88	2.8	0.18
		HS	41	3	18	7.83	3.1	0.50
	The severity	Minor	79	2	13	4.96	2.4	0.27
		Moderate	124	2	17	6.10	2.6	0.23
		Moderate to severe	14	4	14	8.79	2.9	0.81
		Severe	2	8	10	9.00	1.0	1.00
NIHSS score	Total		219	1	22	7.16	4.6	0.31
	IS		198	1	22	6.99	4.5	0.32
	HS		21	1	20	8.71	5.1	1.11
The number of main caregivers	Total		273	1	7	1.90	0.9	0.07
	Stroke	IS	232	1	7	1.90	1.0	0.07
		HS	41	1	4	1.88	0.8	0.12
	The severity	Minor	79	1	4	1.67	0.7	0.08
		Moderate	124	1	7	2.02	1.1	0.09
		Moderate to severe	14	1	5	2.43	1.1	0.30
		Severe	2	2	3	2.50	0.5	0.50

Nearly two-thirds of the patients used health insurance, and 30.8% were self-insured. Elderly insurance, which covers 100% of treatment costs, accounted for over 11% of the cases. The average hospital stay was 6.17 days, ranging from 2 to 22 days, with longer stays for HS

patients (7.83 days) compared to IS patients (5.88 days). Hospital stay duration increased with stroke severity, ranging from 4.96 days for minor strokes to 9 days for severe strokes. On average, each patient had 1.9 caregivers, with this number ranging from 1.67 caregivers for minor stroke cases to 2.5 caregivers for severe strokes. This number was consistent between IS and HS patients.

3.2. Total treatment costs

The mean value of total costs for treatment in stroke inpatients was VND 8,112,458.7 ± 4,718,872.5 per patient. Direct costs which included medical and non-medical direct costs were the highest proportion with above 77%. The indirect cost took about 22% (Figure 1). The mean total cost for HS patients was higher than IS patients (VND 9,380,330.4 and VND 7,888,395.1; accordingly) (Figure 2).

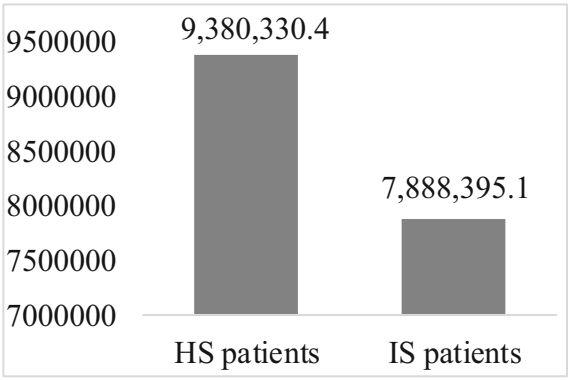

Figure 1. The structure of total cost

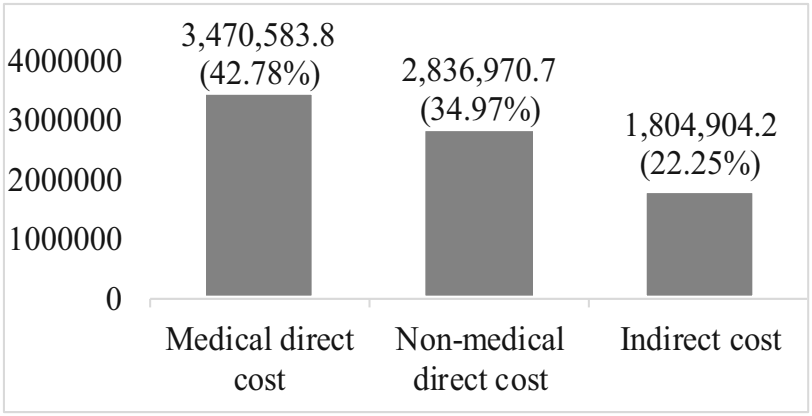

Figure 2. The mean total costs follow categories of stroke

3.2.1. Direct costs

This study estimated the cost of stroke care, which related to treatment directly, to be around VND 6,307,554.5 per patient. Above 55% of this total direct cost was for medical direct cost and the remaining proportion (45%) was for non-medical direct cost (Figure 3).

3.2.2. Medical direct costs

This study estimated the cost of stroke care, which related to healthcare services directly, to be around VND 3,470,583.8 per patient. The medical direct costs included costs of healthcare services, drugs and emergency service with the values per patient of VND 2,115,264.2; VND 744,672.1 and VND 610,647.5, respectively (Figure 4). Costs of healthcare services comprised the highest proportion from total medical direct costs with 60.95%.

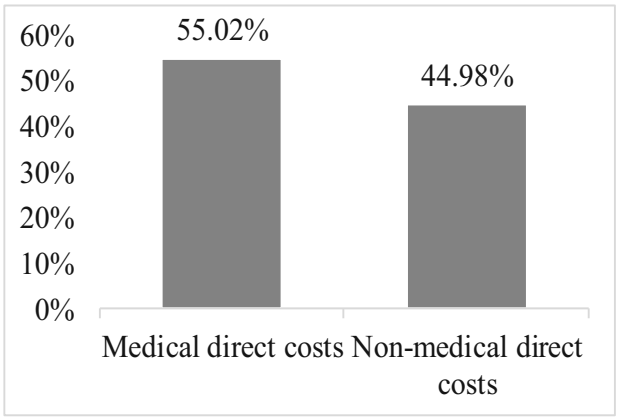

Figure 3. The structure of direct cost

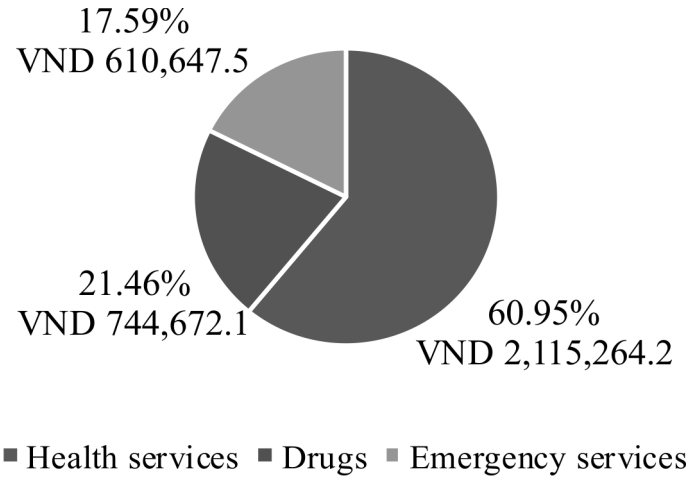

Figure 4. Components of medical direct costs

According to payers, the mean values of medical direct costs of patients and health insurance organization were VND 1,856,629.7 and VND 1,613,954.1 per patient, respectively. Patients paid higher cost for healthcare services and emergency services than health insurance organizations. In contrast, drug costs were paid more by health insurance organizations than by patients (Figure 5).

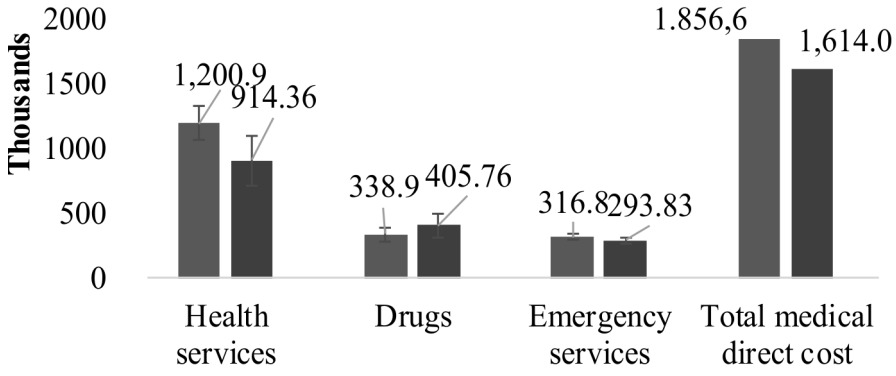

Figure 5. The medical direct costs follow payers and components

3.2.3. Non-medical direct costs

The non-medical direct costs were calculated from costs of transportation, meals, accommodation and hired caregivers. The costs of transportation accounted for the highest value of total non-medical direct cost with VND 1,528,699.6 per patient. Second coming was the mean value of costs for meals with VND 1,292,007.3 per patient (Figure 6).

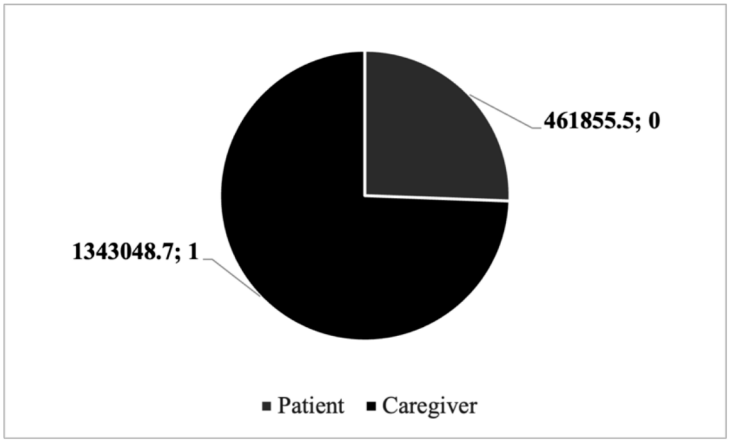

Figure 6. Components of non-medical direct costs

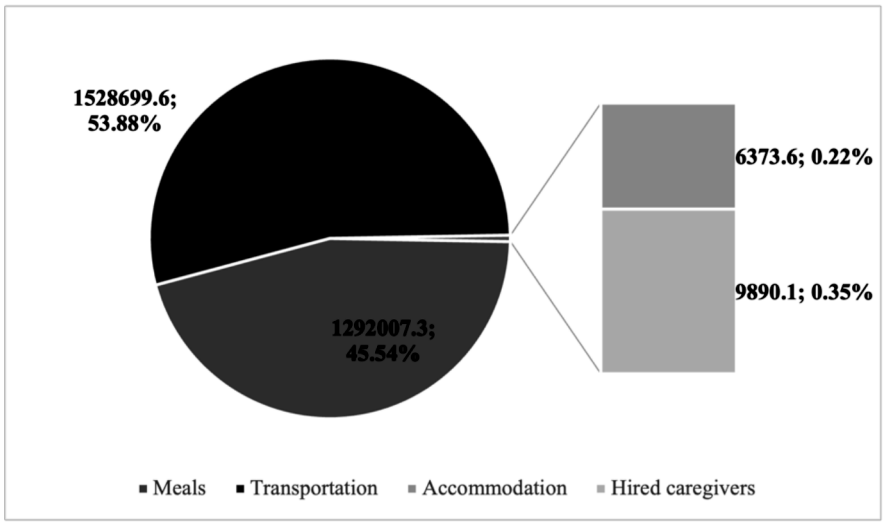

Figure 7. Components of indirect costs

3.2.4. Indirect costs

This study found that the mean of indirect costs was VND 1,804,904.2 per patient, in which costs related to productivity losses for treatments of stroke of both patient and family were VND 461,855.5 and VND 1,343,048.7, respectively (Figure 7).

3.3. Compare treatment cost with GDP and OOP

Based on the 2013 general health review report, the topic of average household medical out-of-pocket payments (OOP) in 2010 was 243,000 VND/monthnor 2,916,000 VND/year [8]. At the time of the survey, each stroke patient on average experienced no more than one relapse each year. Therefore, the cost of treating a stroke in 1 year is equivalent to the cost of treating a stroke. The study compares the cost of stroke treatment with OOP/year after converting OOP and the cost of treatment for the same year 2016 based on the consumer price index of Vietnam (Figure 8).

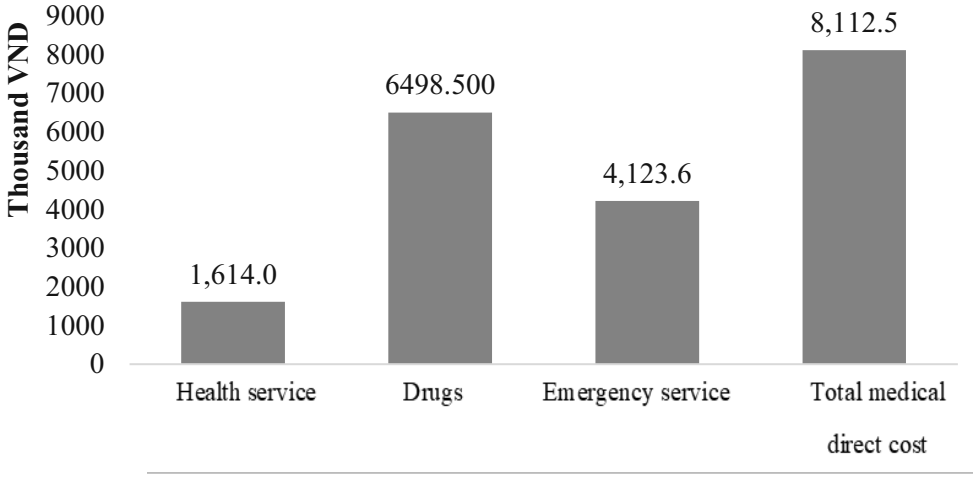

Figure 8. Compare the cost of treating stroke with OOP/year

According to a diagram, the total cost of stroke treatment that an average patient has to pay if not using health insurance will be 2.7 times the average level of health care for the household per year (8.1 and 2.9 million VND, respectively). However, when there is support from health insurance, each stroke patient only has to pay 6.5 million VND, 1.5 times more than OOP per year, the cost of the health insurance agency is 1.6 million VND average per patient. Therefore, despite support from the health insurance agency, stroke treatment is still beyond the ability of each household to pay. This shows that the cost burden of stroke is not small for both patients and families, especially for low-middle-income countries like Vietnam. Thus, it is necessary to have other policies and support resources to reduce the burden on the patients.

3.4. Related factors to treatment costs

The results of the analysis of factors affecting the cost of treating inpatient stroke at HCMC People's Hospital 115 are presented in Table 2.

Table 2. The level affects the cost of treatment in groups

Group	Characteristic	Mean (SD)	Mean difference (95% CI)/r pearson	p
Gender	Men (155) vs Women (118)	7.82 (0.33) vs 8.49 (0.50)	-658,253 (-1,839,969; 523,462)	0.27
Age	20-39 (n=14) vs 60-79 (n=114)	11.4 (1.2) vs 7.7 (0.4)	3,669,911 (251,315; 7,088,507)	0.03
	20-39 (n=14) vs 80+ (n=43)	11.4 (1.2) vs 7.5 (0.7)	3,880,183 (165,699; 7,594,666)	0.037
Type stroke	Ischemic (n=232) vs Hemorrhagic (41)	7.9 (0.3) vs 9.4 (0.9)	-1,491,935 (-3,058,603; 74.732)	0.062
The severity by NIHSS	Minor stroke (n=79) vs Moderate to severe stroke (n=14)	6.8 (0.4) vs 11.5 (1.2)	-4.670.550 (-7.752.698; -1.588.402)	0.001
	Moderate stroke (n=124) vs Moderate to severe stroke (n=14)	7.9 (0.4) vs 11.5 (1.2)	-3.599.167,9 (-6.595.944; -602.392)	0.011
The length of hospital stay			0,472	0.000
The number of main caregivers			0,224	0.000

In regard to genders, the cost of treatment for women is higher than that of men (8.49 ± 0.50; 7.82 ± 0.33 million VND; p = 0.27), the study recorded the difference between the cost of treatment in both men and women groups is not statistically significant. The age group, the research recorded a statistically significant difference between groups 20-39 with group 60-79 with mean difference of 3,669,911 (95% CI: 251,315 - 7,088,507; p = 0,03); between group 20-39 with group 80+ with the mean difference of 3,880,183 (95% CI: 165,699 - 7,594,666; p = 0.037). The difference in the cost of treatment between Ischemic and Hemorrhagic groups was not statistically significant (7.9 ± 0.3 compared to 9.4 ± 0.9 million VND; p = 0.062 > 0.05). Meanwhile, the cost of treating stroke increased with the severity of the disease and significant differences were observed in patients with mild stroke compared to severe stroke with mean difference of VND -4.670.550 (95% CI: -7.752.698; -1.588.402; p=0.001) and in patients with moderate stroke vs Moderate to severe stroke with mean difference of -3.599.167,9 (95% CI: -6.595.944; -602.392; p=0.011). The study recorded that the treatment cost is positively correlated with the number of days of stay (r = 0.472; p = 0.000) and the number of caregivers (r = 0.224; p = 0.000). In summary, of the 8 factors investigating the effect on treatment costs, the topic noted that there are 4 related factors including age group, number of days of residence, severity, and number of caregivers.

4. DISCUSSIONS

In 2016, according to statistics the average treatment cost per patient in the highest stroke in Sweden is 78,807.4 USD/person and the lowest is in India with an average cost of 59.0 USD/person [9, 10]. In general, the cost of stroke treatment is higher in European countries including Ireland, Italy, France and Sweden. This may be explained by the fact that Europe belongs to a group of areas with a high incidence of disease and a well-developed health care system. Vietnam, with an average treatment cost of USD 361.4, is generally lower than other countries.

Each country has a different level of development, investment in the health care system is different, so for an objective and more comprehensive assessment of the cost of treating stroke in countries, it is necessary to compare. The average ratio of treatment costs per person to the average GDP per capita. Sweden has the highest cost of stroke treatment in GDP per capita with 143.32%, followed by Italy with 39.34% and France with 30.36%, while the Netherlands has the proportion of treatment costs according to GDP per capita is the lowest (0.17%). The study noted the

proportion of stroke treatment costs per capita GDP in Vietnam reached 21.45%, only after France, Italy and Sweden. While the average cost of treatment is lower than in other countries, but is a low to moderate income country, the cost of treating stroke also accounts for a significant portion of GDP. In general, when assessing treatment costs in proportion to per capita GDP in each country, high rates are no longer concentrated in European countries. This can be explained by the high level of development in countries in this region, leading to a high value of GDP per capita, resulting in a different rate than when comparing cost by value.

In Vietnam, the mean total cost for HS patients was higher than IS patients (VND 9.380.330 and VND 7.888.395, respectively). This result was similar to the study which were performed in cerebrovascular disease department in HCMC 115 People hospital in 2009 (VND 6,427,000 in IS and VND 7,659,000 in HS)[] and the study of Hyun-Jin Kim in Korean in 2010 (USD 1.87 billion for HS and USD 1.66 billion for IS)[].

The total cost for stroke inpatients in this study was VND 8,112,458.7 per patient, including VND 6,307,554.5 of direct cost and VND 1,804,904.2 of indirect cost. The mean value of medical direct costs was VND 3,470,583.8 which is lower than the results of Ngo TTD et al study 2009 (VND 5,293,000). In Ngo TTD et al study medical direct costs in 2009 composed of bed days (30.2%), drugs (18.3%) and subclinical services (35.9%) []. These results were different to finding costs in this study with 18.34%; 21.46% and 42.61%, respectively. Besides, this study included costs for emergency services in medical direct costs with 17.59%. This difference can be made by the change of price over time or new therapies or support of national health program. The mean non-medical direct cost was VND 2,836,970.7 per patient that is near 5 times higher than that from study in 2009. In Ngo TTD et al study (2009), non-medical direct costs just included costs for meals, transportation of caregivers during hospital stay and implements but not concerned the costs of transportation for admission and discharge from hospital, accommodation and hired caregivers[]. That led to the change because the costs of transportation for admission and discharge from hospital were the highest value with 49.2% of total non-medical direct costs in this study. Indirect costs accounted for 22.25%, including 74.41% in caregivers and only 25.59% in patients. These results were suitable to the survey because of the majority of jobless participants around the study time. Health insurance organizations paid averagely VND 1,613,954.1 per patient. Patients who had health insurance could reduce over 50% of costs of healthcare services for treatment in hospital. Therefore, using health insurance is an effective way to reduce financial burden for stroke patients.

While this study was limited by a small sample size and short study period, the results provide valuable references for future research. The study outlines stroke treatment costs and their variations, aiding medical centers and physicians in clinical decision-making. Additionally, these findings form the foundation for policy-making and national health programs. However, it should be noted that the study's reliance on data from a single hospital restricts the generalizability of its findings to other settings. Future research should aim to incorporate data from multiple hospitals across different regions to provide a more comprehensive analysis of stroke-related costs in Vietnam.

Furthermore, while indirect costs, particularly productivity losses, were identified, a more detailed exploration of their long-term impacts on households is essential. Productivity losses due to stroke can have sustained effects on both patients and caregivers, contributing to extended financial strain. Expanding research to include these long-term impacts could provide deeper insights into the true cost burden of stroke on families.

To further reduce the financial burden of stroke, it would be beneficial to explore alternative healthcare models, such as telemedicine or community-based care. These interventions could potentially lower treatment costs by minimizing hospital stays, increasing access to care, and promoting early intervention, especially in remote or underserved areas. Telemedicine, for instance, allows for continuous monitoring and consultation without requiring costly inpatient care, while community health workers could assist with rehabilitation and post-stroke management, reducing long-term care expenses.

5. CONCLUSIONS

With hospital stay length of 6.17 ± 0.18 days, the mean total cost of stroke was VND 8,112,458.7 ± 4.718.872,5 per patient which medical direct costs were the majority part of total cost (42.78%). With the increased incidence of stroke in Vietnam, the healthcare policy reducing the cost burden for stroke patients should be considered.

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Chi phí của đột quỵ từ góc nhìn của bệnh nhân: Một nghiên cứu bằng chứng thực tế tại Việt Nam

Lê Thị Ngọc Thanh, Nguyễn Huy Thắng, Tiêu Từ Mẫn, Phạm Lương Sơn và Nguyễn Thị Tố Nga

TÓM TẮT

Giới thiệu: Đột quỵ là nguyên nhân gây tử vong đứng thứ hai trên thế giới, chiếm 10% tổng số ca tử vong với 17 triệu ca mắc mới mỗi năm. Tác động của đột quỵ đối với xã hội rất lớn không chỉ do gánh nặng bệnh tật mà còn do chi phí y tế. Các nghiên cứu về chi phí của đột quỵ tại Việt Nam cho đến nay còn hạn chế. Mục tiêu của nghiên cứu này là đánh giá chi phí của đột quỵ từ góc độ của bệnh nhân tại Việt Nam dựa trên dữ liệu bệnh viện. Phương pháp: Nghiên cứu cắt ngang với mẫu ngẫu nhiên của bệnh nhân đột quỵ tại Bệnh viện Nhân dân 115, TP.HCM đã được thực hiện để đánh giá chi phí đột quỵ. Các bệnh nhân được chọn là những người nhập viện vì đột quỵ tại bệnh viện nghiên cứu, có hồ sơ y tế đầy đủ và đồng ý tham gia nghiên cứu. Những bệnh nhân là người nước ngoài, không hoàn thành liệu trình điều trị tại bệnh viện hoặc tử vong trong quá trình điều trị bị loại khỏi nghiên cứu này. Chi phí đột quỵ bao gồm cả chi phí trực tiếp (y tế, phi y tế) và chi phí gián tiếp. Kết quả: Mẫu nghiên cứu gồm 273 bệnh nhân với tỷ lệ nam: nữ là 1.315:1, độ tuổi trung bình 62.97 ± 14.3; khoảng 85% mắc đột quỵ nhồi máu não và 15% mắc đột quỵ xuất huyết. Chi phí trung bình cho mỗi bệnh nhân đột quỵ là 8,112,458.7 ± 285,499.16 VND; trong đó 77% là chi phí trực tiếp

(6,307,554.5 VND) và 23% còn lại là chi phí gián tiếp (1,804,904.2 VND). Trong cơ cấu chi phí trực tiếp, chi phí y tế cao hơn 1.22 lần so với chi phí phi y tế (3,470,583.8 VND so với 2,836,970.7 VND; tương ứng). Thảo luận: Nghiên cứu này được thực hiện ở quy mô nhỏ với 1 bệnh viện và thời gian nghiên cứu giới hạn, dẫn đến hạn chế về cỡ mẫu. Nghiên cứu đã chỉ ra chi phí điều trị bệnh nhân nội trú đột quỵ và sự khác biệt về các loại chi phí trong điều trị đột quỵ, nhằm hỗ trợ các trung tâm y tế và bác sĩ trong việc ra quyết định lâm sàng. Ngoài ra, kết quả này cũng là cơ sở để thiết lập các chính sách y tế hoặc chương trình y tế quốc gia. Kết luận: Với thời gian nằm viện trung bình là 6.17 ± 0.18 ngày, chi phí y tế trực tiếp chiếm phần lớn trong tổng chi phí. Với tỷ lệ mắc đột quỵ ngày càng gia tăng ở Việt Nam, các chính sách y tế nhằm giảm gánh nặng chi phí cho bệnh nhân đột quỵ cần được xem xét.

Từ khóa: *chi phí, chi phí bệnh tật, điều trị nội trú, đột quỵ*

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