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The Impact of Poorly Controlled Hypertension on Ambulatory Care Resources in Malaysia

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ABSTRACT

Aim: Since many Malaysians with hypertension have poor control rates of blood pressure, this study wasconducted to determine the impact of uncontrolled hypertension on the utilization of ambulatory care resources.

Setting: The study took place at the Jaya Gading Polyclinic in Kuantan city, Pahang, Malaysia.
Methods: This was a1year follow-up of 600 hypertensive patients who were classified into groups, based on average blood pressure. The monthly direct and indirect costs and the differences in costs were determined.
Main outcome measure: Data analysis using the Mann-Whitney test was performed to compare the direct costswhich were associated with controlled and uncontrolled blood pressure.
Results: The direct costs were significantly higher in the uncontrolled blood pressure groups as compared to the controlled blood pressure groups. Medication costs represented the major portion of the total direct costs in both the controlled and the uncontrolled blood pressure groups.
Conclusion: Poor control of uncomplicated hypertension is associated with the higher utilization of the ambulatory care resources in Malaysia. Aggressive strategies are needed to control hypertension and to reduce the utilization of the ambulatory care resources.

Keywords: Hypertension control, cost, ambulatory care, Malaysia

Key Messages:

Controlling hypertension helps in controlling the budgets which were allocated for hypertension in Malaysia.

There is a need to implement aggressive strategies in order to control hypertension in Malaysia.

Information on the economic burden of hypertension in Malaysia is needed to increase the awareness of the need to control hypertension.

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Adequate control of blood pressure reduces cardiovascular morbidity, mortality and in general, health care costs. In the U.S., inadequate blood pressure control resulted in 39,702 cardiovascular events, 8,374 cardiovascular disease deaths and a direct medical cost of US$ 964 million in 2002 [1]. Patients with uncontrolled blood pressure are associated with the higher utilization of health care resources as compared to patients with controlled blood pressure [2],[3],[4],[5],[6]. Patients with higher blood pressure are also associated with shorter time to the next physician visit, higher number of visits and higher medication costs [7],[8].

Hypertension is highly prevalent and severe in Malaysia, its care is unsatisfactory and its detection and treatment are inadequate. The most recent Malaysian study on the prevalence of hypertension showed that hypertension prevalence is 27.8% and that it increases with age in both genders and in all the ethnic groups. Malaysians with hypertension have low awareness about their hypertension, low treatment and the poor control rates of their blood pressure. Only 34.6% of the study subjects were aware of their hypertension, 32.4% were taking antihypertensive drugs and of these, only 26.6% had controlled blood pressure. Overall, 8.6% of the hypertensives had their blood pressure controlled [9]. Researchers believe that patients with poorly controlled hypertension in Malaysia create an economic burden on the national health care budgets and utilize higher ambulatory care resources as compared to patients with controlled hypertension. To the best of our knowledge, the impact of poorly controlled hypertension on the ambulatory care resources in Malaysia, has not been estimated. In this study, we examined the difference between controlled and poorly controlled hypertension in the 3 stages with regards to ambulatory care cost. This study was conducted to estimate the impact of poorly controlled blood pressure in each stage of uncomplicated hypertension on the utilization of ambulatory care services in Malaysia.

Method

Study design

Data analyses of the 1-year follow-up from 1st January 2007 to 31st December 2007 of hypertensive patients was conducted to determine the direct and indirect costs which were attributable to uncomplicated hypertension among controlled and poorly controlled hypertensive patients. Using the history data of the patients and the blood pressure levels, it was possible to classify all patients into 3 stages of hypertension, based on their average systolic and diastolic blood pressure (i.e., prehypertension, stage 1 and stage 2) according to the JNC 7 classification [10]. After following up the three groups, the patients in each group were classified as having controlled or poorly controlled blood pressure at the end of the prospective year of the study. Controlled blood pressure was defined as a blood pressure of < 140/90 mmHg. Poorly controlled blood pressure was defined as a blood pressure of ≥ 140/90 mmHg [10]. The look-back time horizon was 2 years. The index date was defined as the date on which a patient received his or her first antihypertensive prescription on or after January 1st, 2005. Patients who signed the informed consent sheet (N=600) were included in the study, based on the following criteria: (a) age was 18 years or above as in January 2007, (b) the presence of a diagnosis or a history of uncomplicated hypertension, (c) there was at least one prescription of antihypertensive drugs, (d) the absence of co-morbidities and (e) the informed consent was signed.

Data Collection

The data which were collected in this study were the data which were related to the management of hypertension. The data collected by using the case record form and the standard questionnaire were validated by a numberof experts in the research field. An informed consent form was prepared in English, Bahasa Malaysia, Mandarin and Indian languages in order to allow the participants to make an informed decision on

whether to participate in the study or not. In addition to the main researcher, two senior staff-nurses helped in collecting the data. The staff-nurses were instructed about the purpose and the duration of the study and the data needed for the study and were trained on how to collect the required data. The data collected was stored as binary numbers, normal numbers and dates. Some data were coded when necessary (e.g. drugs names, tests names, etc).

During the first visit, the study subjects were interviewed to collect data regarding their age, sex, and race. Their blood pressure was measured and the average reading was recorded by the two staff-nurses by using a standard mercury sphygmomanometer on the right arm of each participant, in the sitting position, after at least 5-minutes of rest. Three blood pressure readings were taken from the patients during each visit and were averaged to yield one measurement for that visit. All blood pressure measurements taken during the study period were averaged for each patient to yield a mean value for the whole period. The data on new prescriptions of antihypertensive medications, the drug names, dosages, dosing intervals and diagnostic and laboratory tests were also collected. In addition, the main researcher collected similar retrospective data from the patients' medical files. Only visits related to hypertension were studied and the society's perspective was used in this study.

Cost Estimation

The monthly average direct costs were divided into four categories: antihypertensive medications, laboratory and diagnostic tests and the costs of the health professionals and transportations. The means of the costs were calculated according to the blood pressure control status (i.e., controlled and uncontrolled). The utilization rate of the direct costs was calculated as the number of the direct cost component (e.g., drug, laboratory test) per patient, per month.

Calculation of Direct Costs

The health care professional's (i.e., physician, pharmacist and nurse) time which was utilized by the patient, was estimated by using the work sampling technique to calculate their costs. The cost of the health care professional's time was estimated by dividing the daily allowance by the number of working hours to get the cost per hour and then, the cost per minute was estimated to multiply it by the time which was utilized by the patient. The data on the transportation fare to the Jaya Gading Polyclinic was collected by interviewing the patients. The principal source of the direct health care costs was the billing division in the Ministry of Health [11],[12].

The direct medical costs were calculated through the summation of the cost produced by multiplying the quantities of each drug and other ambulatory care services by their unit cost [13]. The transportation cost for each hypertensive patient was calculated by multiplying the transportation fare reported by the patient during the interview, by the number of visits to the polyclinic.

Calculation of Indirect Costs

Estimation of the indirect costs was based on the human capital approach method, which derives the values of the loss of health from the losses in potential earnings. A visit was estimated to take 0.25 (2 hours) working days lost [14]. The cost of productivity which was lost, was calculated by using the following formula [14]:

(Number of days lost for each patient) × (2007 Gross National Product ÷ population and by number of working days per year)

All costs were expressed in Malaysian Ringgit (MYR) (MYR 3.20059 = US dollar 1 for the year 2008).

Data analysis

A variety of descriptive statistics such as mean, standard deviation (SD), median and percentage (%) were calculated to describe some parts of the results. The nonparametric test (i.e., Mann-Whitney test) was used to determine the statistically significant differences between the two groups (i.e., controlled and poorly controlled blood pressure) by using the SPSS™ for Windows version 13.

Sensitivity Analysis

Because there might have been some outliers in the study's population who drove the results, a sensitivity analysis was performed after the exclusion of the patients with the highest and lowest 5% (4) total direct costs and after replacing the drugs costs with maximum values [15] (higher drugs costs) to calculate

the new total direct costs which were used in the sensitivity analysis.

Results

The data from 600 patients were analyzed. The mean age of the patients was 54.67 (±9.75). Of all the patients, 84.5% were ≥ 45 years old and 15.5% were < 45 years old. A majority of patients (84.3%) were Malay, followed by Chinese (13.7%), Indians (1.2) and others (0.8%). The Chinese, Indians and other races were treated as "Others" in the analysis because of their small percentage in the whole sample. Females represented approximately two thirds of the patients (67.7%). The demographic and clinical features of the 600 patients are reported in [Table/Fig 1].

[Table/Fig 1]: Demographic and Clinical Features

		Prehypertension		Stage 1		Stage 2	
		Controlled	Poorly controlled	Controlled	Poorly controlled	Controlled	Poorly controlled
		Number (Percentage %)					
Age	<45	14 (2.3)	14 (2.8)	21 (3.5)	16 (2.6)	16 (2.6)	12 (2.0)
	=45	86 (14.3)	86 (14.3)	79 (13.1)	84 (14.0)	84 (14.0)	88 (14.6)
Sex	Male	25 (4.5)	36 (6.0)	26 (4.3)	39 (6.5)	32 (5.3)	36 (6.0)
	Female	75 (12.5)	64 (10.6)	74 (12.3)	61 (10.1)	68 (11.3)	64 (10.6)
Race	Malay	72 (12.0)	89 (14.8)	83 (13.8)	88 (14.6)	84 (14.0)	90 (15.0)
	Others	28 (4.8)	11 (1.8)	17 (2.8)	12 (2.0)	16 (2.6)	10 (1.6)
		Mean ± SD (Median)					
Age		54.5 ±9.3 (54.5)	55.6 ±8.9 (57.0)	52.3 ±9.0 (51.0)	55.6 ±10.0 (56.0)	53.7 ±10.2 (54.5)	56.1 ±10.4 (56.0)
BMI		27.5 ±4.8 (27.8)	28.8 ±6.4 (27.9)	29.1 ±6.3 (28.4)	27.4 ±5.7 (27.0)	27.4 ±4.6 (28.0)	27.6 ±5.4 (27.1)
SBP		116.2 ±2.2 (116.5)	146.0 ±6.3 (146.3)	116.0 ±3.9 (116.0)	150.3 ±11.1 (150.1)	115.7 ±3.6 (115.4)	157.9 ±12.0 (156.2)
DBP		73.2 ±4.7 (74.7)	89.9 ±5.1 (90.2)	72.1 ±5.3 (72.7)	93.6 ±5.6 (94.2)	71.9 ±5.3 (72.8)	95.9 ±7.1 (96.1)
Visits		16.1 ±10.4 (13.0)	23.5 ±15.1 (18.5)	15.5 ±10.7 (13.5)	17.7 ±12.5 (13.0)	13.3 ±9.4 (11.0)	16.6 ±12.2 (13.5)

The monthly average direct costs per patient increased progressively across the three stages of hypertension [Table/Fig 2]. The average direct costs associated with the poorly controlled blood pressure groups were higher than the average direct costs, which were associated with the controlled blood pressure groups. Medication costs represented the major portion of the total direct costs which were associated with the controlled and the poorly controlled blood pressure groups in the three stages. In the prehypertension stage, the medication costs represented 54.13% and 67.97% of the total direct costs which were attributable to the controlled and the poorly controlled blood pressure groups, respectively. In stage 1, the medication costs represented 55.30% and 67.49% of the total costs and in stage 2, they were (72.55%) and (72.64%), respectively [Table/Fig 4]. The transportation costs came after the medication costs, as the next higher cost utilized by both the groups, followed by the costs of the health professionals and the laboratory tests, respectively.

[Table/Fig 2]: Monthly Direct and Indirect Costs (MYR) for Hypertensive Patients, Stratified by Blood Pressure Control Status

	Prehypertension		Stage 1		Stage 2	
	Controlled	Poorly controlled	Controlled	Poorly controlled	Controlled	Poorly controlled
	Mean ± SD (Median)					
Direct Costs						
Drugs	8.77 ±16.01 (3.35)	16.76 ±24.13 (8.31)	9.64 ±15.17 (3.82)	19.08 ±19.32 (11.47)	19.70 ±68.02 (6.02)	23.30 ±96.01 (9.35)
Tests	0.94±0.94 (0.65)	1.16 ±1.33 (0.77)	0.99 ±1.07 (0.77)	1.46 ±3.82 (0.69)	1.08 ±1.30 (0.77)	1.39 ±3.76 (0.71)
Physician	1.77±0.83 (1.63)	1.84 ±0.72 (1.68)	1.84 ±1.22 (1.61)	2.10 ±2.30 (1.62)	1.70 ±0.74 (1.56)	1.94 ±1.46 (1.72)
Pharmacist	1.42±0.66 (1.31)	1.47 ±0.58 (1.35)	1.48 ±0.97 (1.29)	1.68 ±1.85 (1.30)	1.36 ±0.60 (1.25)	1.56 ±1.17 (1.38)
Nurse	1.00±0.48 (0.95)	1.07 ±0.42 (0.98)	1.07 ±0.71 (0.93)	1.22 ±1.34 (0.94)	0.98 ±0.43 (0.90)	1.13 ±0.85 (1.00)
Transportation	2.26±1.62 (1.70)	2.34 ±1.61 (1.97)	2.39 ±1.47 (2.00)	2.70 ±2.82 (1.82)	2.33 ±1.21 (2.08)	2.62 ±2.20 (2.00)
Total	16.20 ±16.38 (12.19)	24.66 ±24.16 (16.79)	17.43 ±15.50 (11.86)	28.27 ±19.21 (22.31)	27.22 ±68.31 (14.05)	31.70 ±96.06 (18.26)
	Mean ± SD (Median)					
Productivity Lost	5.00 ±3.82 (4.30)	4.61 ±3.59 (4.50)	4.18 ±2.52 (4.12)	6.45 ±4.96 (5.80)	4.80 ±4.34 (3.95)	5.40 ±4.91 (5.10)

The monthly average indirect costs associated with the poorly controlled blood pressure groups in stage 1 and stage 2 were higher than the indirect costs which were associated with the controlled blood pressure groups in the same stages.

However, in the prehypertension stage, the indirect costs were higher in the controlled blood pressure group. The highest indirect cost among all poorly controlled blood pressure groups, was seen in stage 1. The highest indirect cost associated with the controlled blood pressure group was that of the prehypertension stage [Table/Fig 2].

[Table/Fig 3] Percentages of Monthly Direct Costs Categories, Stratified by Blood Pressure Control Status

	Prehypertension		Stage 1		Stage 2	
	Controlled	Poorly controlled	Controlled	Poorly controlled	Controlled	Poorly controlled
Direct Costs						
Drugs	54.30%	67.97%	55.45%	67.49%	72.55%	72.64%
Tests	5.80%	4.70%	5.67%	5.29%	3.96%	4.38%
Physician	10.92%	7.46%	10.55%	7.42%	6.24%	6.14%
Pharmacist	8.76%	5.96%	8.49%	5.94%	4.99%	4.92%
Nurse	6.27%	4.43%	6.13%	4.31%	3.71%	3.66%
Transportation	13.95%	9.48%	13.71%	9.55%	8.55%	8.26%
Total	100%	100%	100%	100%	100%	100%

The monthly average direct costs of hypertensive patients showed significant differences between the controlled and the poorly controlled blood pressure groups in all hypertension stages [Table/Fig 4]. The results of the sensitivity analysis are shown in [Table/Fig 5]. With higher medication costs in both the blood pressure control status groups in each stage, the difference between the direct costs which were associated with the controlled and the poorly controlled blood pressure groups in all stages remained significant ($p < 0.001$). However, the differences in the indirect costs were not significant.

[Table/Fig 4] Differences in Direct and Indirect Costs (MYR) Stratified by Blood Pressure Control Status

	Controlled Mean ± SD (Median)	Poorly controlled Mean ± SD (Median)	Sig. (p)*
Direct Costs			
Prehypertension	16.20 ±16.38 (12.19)	24.66 ±24.16 (16.79)	0.001
Stage 1	17.43 ±15.50 (11.86)	28.27 ±19.21 (22.31)	0.001
Stage 2	27.22 ±68.31 (14.05)	31.70 ±96.06 (18.26)	0.029
Productivity Lost			
Prehypertension	5.00 ±3.82 (4.30)	4.61 ±3.59 (4.50)	0.9
Stage 1	4.18 ±2.52 (4.12)	6.45 ±4.96 (5.80)	0.2
Stage 2	4.80 ±4.34 (3.95)	5.40 ±4.91 (5.10)	0.5

**Mann-Whitney Test*

[Table/Fig 5] Differences in Total Direct Costs (MYR), Sensitivity Analysis

	Controlled Mean ± SD (Median)	Poorly controlled	Sig. p
Prehypertension	110.43 ±6.77 (109.49)	170.16 ±6.94 (169.94)	< **0.001**
Stage 1	77.45 ±3.76 (76.61)	97.59 ± 7.08 (96.10)	< **0.001**
Stage 2	680.39 ±97.56 (670.32)	1635.04 ±97.77 (1643.91)	< **0.001**

**Mann-Whitney Test*

[Table/Fig 6] describes the differences between the total costs (i.e., direct and indirect costs) of all patients who were associated with the controlled and the poorly controlled blood pressure groups at each stage of hypertension. The differences between the two groups were MYR 817.68, MYR 1317.66 and MYR 1581.21 in the prehypertension stage, Stage 1 and Stage 2, respectively.

[Table/Fig 6] Differences in Total Costs (MYR) (Direct and Indirect) between Controlled and Poorly controlled BP

	Controlled BP	Poorly controlled BP	Cost Differences
Prehypertension	2110.40	2928.08	817.68
Stage 1	2160.49	3478.15	1317.66
Stage 2	3192.20	4773.41	1581.21

Discussion

This study categorized hypertensive patients into two groups based on blood pressure control status in the three hypertension stages. The differences in total monthly average costs between the controlled and the poorly controlled blood pressure groups were analyzed and tested for significant differences. The monthly average total direct costs per patient increased progressively across all the hypertension stages. Additionally, the monthly average total direct costs were found to be significantly higher in the poorly controlled blood pressure groups as compared to the controlled blood pressure groups in the three stages. In the prehypertension stage, the monthly average direct costs were MYR 16.20 and MYR 24.66,which were attributable to the controlled and the poorly controlled groups, respectively. In stage 1, the average direct costs were MYR 17.43 and MYR 28.27 and in stage 2, they were MYR 27.22 and MYR 31.70, respectively. The results of the one-way sensitivity analysis, after adjusting the medication costs to recalculate the total direct costs, showed that the cost of controlled blood pressure was significantly lower than the cost of poorly controlled blood pressure under the three stages of hypertension ($p < 0.001$). This implies that when the drug costs increased, the direct cost of the patients with controlled blood pressure remained significantly lower, even when the highest drug cost value was used. In a 19-year follow-up study that included the costs of hospitalization and the costs of major drugs, the mean total costs were US$ 132 500 among patients with normal hypertension, US$ 146 500 among patients with mild hypertension, and US$ 219 300 among patients with severe hypertension [5]. In addition, there was a significant correlation between higher systolic blood pressure and the cost of increased medications [8].

The results of many studies showed that patients with poorly controlled blood pressure were associated with a higher utilization of health care resources [2],[3],[4],[5],[6],[7],[8],[16]. A French study which estimated the cost of treating hypertension in the general practitioners' clinics, found that the average annual cost of patients with controlled blood pressure was 537€ (US$ 784.61) and the cost of patients with poorly controlled blood pressure was 612€ (US$ 894.19) [6]. Paramore et al [8] reported that patients with controlled blood pressure below 130/85 mm Hg accounted for a cost of US$ 325.92. The costs increased to US$ 407.66 for patients in the 130/85 to 139/89 mm Hg controlled group. Patients in the two groups (i.e. poorly controlled hypertension- 140/90 to 159/99 mm Hg and ≥ 160/100 mm Hg) incurred average costs of US$ 430.76 and US$ 577.95, respectively. Their results were significantly different [8]. Furthermore, in a study comparing the cost of health care resources for hypertensive patients taking analgesics stratified by having controlled versus poorly controlled hypertension, the annualized costs for emergency-department visits and hospitalizations for the uncontrolled hypertension group were higher than the costs incurred by the controlled hypertension group by 9.3% and 28.0%, respectively [4].

Medication costs represented a major portion of the total direct costs in all controlled and poorly controlled groups, followed by the transportation costs and the costs for health care professionals and the tests, respectively. Antihypertensive drug costs were frequently referred to as an important cost driver in hypertension treatment, as described by other studies [6],[8],[14],[17],[18],[19]. Medication costs increased with the severity of hypertension, they were higher in patients with poorly controlled blood pressure than in patients with controlled blood pressure and they increased steadily across the hypertension stages.

Additionally, hypertensive patients with poorly controlled blood pressure were associated with a higher number of polyclinic visits as compared to patients with controlled blood pressure in this study. Similar findings were also reported by other studies [3],[7],[8]. The CHOICE study group found that patients with higher blood pressure were associated with a significantly shorter time till the next visit ($p < 0.05$) and that hypertensive patients with poorly controlled blood pressure had office visits about 13 days earlier than those with controlled blood pressure [7]. Moreover, Paramore et al [8] found that the correlation between higher maximum blood pressure and the greater number of physician visits is significant [8].

Indirect costs which were attributable to uncomplicated hypertension which was associated with the poorly controlled blood pressure groups in stage 1 and stage 2 hypertension were higher than the indirect costs which were associated with the controlled blood pressure groups, but the results were not as such in the prehypertension stage. However, the difference was insignificant. Kiiskinen et al. [5] found that patients with severe hypertension lost 2.6 years of work more than did patients with normal hypertension among the males as compared to 2.2years among the females. They concluded that significant losses in terms of years of life lost, years of work lost, and costs are associated with high levels of blood pressure.

Our study results provided estimates of the extra direct and indirect costs incurred by poorly controlled blood pressure, that can be avoided by controlling uncomplicated hypertension in ambulatory care clinics. The data and methodology of this study had some limitations that should be considered when drawing conclusions. The participants of this study were limited to the Malaysian government health care coverage and all of the hypertensive subjects were from the Kuantan city (Jaya Gading area). The health status of the hypertensive subjects may be affected by different factors (e.g., smoking, daily physical activity, etc.).

The results of this study indicate that poorly controlled blood pressure is associated with higher ambulatory care resource utilization. The average direct costs associated with poorly controlled blood pressure were higher than the costs which were associated with controlled blood pressure in the three stages of hypertension. The difference was significant. Furthermore, the differences in the indirect costs between the 3 stages or between the two groups in all the stages of hypertension were not significant.

This study approximated the extra costs due to poorly controlled blood pressure in all stages of hypertension and provided the estimates of the savings that could result from controlling blood pressure. Future studies in Malaysia should consider the impact of poorly controlled complicated hypertension on other resources, such as hospitalizations and emergency department visits.

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