Blood Pressure Control and Cardiovascular Risk Profiles among Post-stroke Survivors: A Cross-sectional Study

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ABSTRACT

INTRODUCTION: Control of modifiable risk factors is important in recurrent stroke prevention strategies. This study aimed to determine the control of blood pressure and other cardiovascular risk profiles among post-stroke patients. Factors associated with uncontrolled blood pressure were also determined. **MATERIAL AND METHODS:** A cross-sectional study was conducted in the outpatient clinics of three hospitals located in the East Coast region of Peninsular Malaysia from May to August 2019. Information on socio-demographic characteristics, clinical profiles, and lifestyle practices were acquired. Univariate and multivariate logistic regression analyses were carried out. Crude odds ratio and adjusted odds ratio (aOR) were reported. **RESULTS:** From a total of 398 stroke patients, majority of the respondents were elderly with first-ever stroke, ischaemic type, and duration of stroke less than 24 months. Uncontrolled blood pressure (52%), overweight and obesity (65%), abdominal obesity (54%), and low physical activity level (65%) were common among the patients. Patients with hypertension (aOR= 3.11, 95% CI: 1.38, 6.99), diabetes mellitus (aOR 1.57, 95% CI: 1.03, 2.38), not taking prescribed medication every day (aOR 2.28, 95% CI: 1.29, 4.01), overweight (aOR 1.75, 95% CI:1.02, 2.99), obesity (aOR 1.99, 95% CI: 1.12, 3.53), and low physical activity level (aOR 2.10, 95% CI: 1.35, 3.27) were at a higher risk of having uncontrolled blood pressure. **CONCLUSION:** Uncontrolled blood pressure and other major cardiovascular risk factors were highly prevalent among post-stroke patients. Increased efforts must be made to optimise the risk profiles management of these high-risk patients to prevent recurrent vascular events in the future.

KEYWORDS: Stroke, Blood pressure, Risk factors, Cross-sectional study, Malaysia

INTRODUCTION

Globally, stroke is the second largest cause of mortality after ischaemic heart disease and the third most common cause of disability.[1] In Malaysia, stroke is the third largest cause of death after ischaemic heart disease and pneumonia.[2] There is no national data on stroke incidence in Malaysia.[3] However, findings from the National Neurology Registry have shown an increment of ischaemic stroke incidence by almost 30% annually, while the incidence of haemorrhagic stroke has increased by almost 19%.[4] Besides, the mean age of stroke onset in Malaysia is between 54.5 to 62.8 years,[3,4] which is more than 10 years younger compared to patients in developed countries (70.6-76.0 years old).[5]

Control of blood pressure is one of the most important and well-established goals in the management of patient after stroke event.[6] The importance of continuous treatment of other modifiable risk factors such as diabetes mellitus, dyslipidaemia, smoking, poor diet and low physical activity to prevent recurrent stroke has also been emphasised.[7] Although there are guidelines for risk factors control for recurrent stroke prevention, available data on the level of risk factors control achieved among stroke survivors after discharge from ward are relatively limited, especially in Asian

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countries.[8] A few cohort studies in European countries and the United States have consistently reported that large proportions of stroke patients did not reach the treatment goals within the duration of follow-up.[9,10] This information is important to identify the gaps in the current treatment practices.

Therefore, the main objective of this study is to examine the prevalence of uncontrolled blood pressure and other cardiovascular risk profiles among stroke survivors attending outpatient clinics. Factors associated with uncontrolled blood pressure among stroke patients were also determined in order to facilitate the development of targeted strategies towards improving the clinical outcomes of patients.

MATERIALS AND METHODS

A cross-sectional and multi-centre study was carried out in the East Coast region of Peninsular Malaysia from May to August 2019. Three hospitals with the highest reported cases were selected, specifically Hospital Sultanah Nur Zahirah, Hospital Tengku Ampuan Afzan, and Hospital Sultan Haji Ahmad Shah. The study was conducted in the outpatient clinics of the selected hospitals across different departments, which included Neurology, Rehabilitation, Physiotherapy, Occupational Therapy, Medical, Surgical, and Otorhinolaryngology. Patients were recruited by purposive sampling during their visit to the outpatient clinics in the selected hospitals. Initially, an appointment list of stroke patients from each department was obtained and screened based on the inclusion and exclusion criteria. The eligible patients were invited to participate in the study during their awaiting time in the outpatient clinics.

The inclusion criteria included adults aged 18 years or older, diagnosed with stroke (haemorrhagic or ischaemic), either first-ever or recurrent stroke, and able to communicate in Bahasa Malaysia. Meanwhile, the exclusion criteria were patients with either Traumatic Intracranial Haemorrhage or Subdural Haemorrhage or Transient Ischaemic Attack, had severe organ failures, suffered from contracture deformity, and had severe language or cognitive impairment and no proxy of the participant available. Proxy of patient is defined as a spouse or first-degree relative who is the main caregiver and familiar with the patient's medical, diet, and lifestyle practices. In this study, stroke survivor is defined as patient who

has survived from the stroke event and without severe complications. The study by Abdul Aziz et al. (2018)[8] showed the prevalence of uncontrolled blood pressure (systolic blood pressure > 140 mmHg) was 27.8%. Using a single proportion formula, with 95% confidence interval, significance level at 0.05, and 20% of attrition rate, an estimated number of 386 respondents were needed.

The dependent variable of this study was blood pressure (BP) status. Uncontrolled blood pressure was defined by either systolic blood pressure (SBP) ≥ 140 mmHg or and diastolic blood pressure (DBP) ≥ 90 mmHg. This study focused on three domains affecting blood pressure status, which were: 1) socio-demographic characteristics (i.e. age, sex, ethnicity, marital status, working status, education level, and household income), 2) clinical profiles (i.e. stroke episodes, types of stroke, duration of stroke, underlying diseases, family history of stroke, traditional medicine and herbs intake, and frequency of prescribed medication intake at home), and 3) nutritional status and lifestyle practices (i.e. body mass index, waist circumference, waist-to-hip ratio, supplements intake, alcohol intake, smoking status, and physical activity levels). According to the 5th edition of Malaysian Clinical Practice Guidelines on Management of Type 2 Diabetes Mellitus, diabetes mellitus is defined as elevated fasting blood glucose above 7.0 mmol/L or HbA1c ≥ 6.3% or previously on oral hypoglycaemic agent or insulin injections.

Data were collected through an interviewer-administered survey, medical record review, and anthropometry measurements. Any underlying diseases were determined from evidence extracted from the medical record. Frequency of taking prescribed medication was coded into always (every day), sometimes (at least once/week), or seldom/never (less than once/month). Physical activity level after the incident of stroke was assessed by the short Malay version of the International Physical Activity Questionnaire (IPAQ), which comprised of seven items with four activity domains (vigorous, moderate, walking and sitting).[11,12] Participants were classified into low, moderate, or high physical activity level based on the scoring protocol available in the IPQ Web site guidelines.[13]

Blood pressure was measured by using the Omron Model HEM-7203 blood pressure monitor following

the manual instruction by the main research assistant. Two readings were obtained with mean value calculated. Weight and height of patients were measured by Tanita Model BC-541 digital weighing scale and Seca 213 portable stadiometer, respectively. An alternative measurement (knee height and mid-upper arm circumference) and predictive equations developed by Suzana and Ng (2003)[14] and Ross Laboratories (2002)[15] were used to estimate the weight and height of the participants who were unable to stand or with balance issue.

Body mass index (BMI) was classified based on Asian cut off points as such: <18.50 kg/m^2 as underweight; 18.50 to 22.99 kg/m^2 as normal; 23.00-27.49 kg/m^2 as overweight and ≥27.50 kg/m^2 as obese.[16] Waist circumference (WC) and hip circumference were measured using standard protocol.[17] The cut-off points for Asian (waist circumference: men ≥90 cm, women ≥80 cm; waist-to-hip ratio: men ≥ 0.95, women ≥ 0.80) were used to determine abdominal obesity among participants.[16,18]

Ethics approval was obtained from the Medical Research and Ethics Committee [NMRR-18-3237-42977(IIR)] and UniSZA Human Research Ethics Committee [UniSZA/UHREC/2019/102]. Written informed consent was obtained from patients who were cognitively intact or from caregivers, for patients who were having communication or cognitive problems.

Data were analysed using IBM SPSS version 25.0 for Windows. Number and proportions were presented for categorical variables. Chi-square test was used to compare the categorical variables. The magnitude of association in univariate and multivariate regression was presented as crude odds ratio (ORs) and adjusted odds ratio (aOR) with 95% confidence interval, respectively. Correlations and multicollinearity between variables were checked. The significance level P-values were set at less than 0.05.

RESULTS

Socio-demographic characteristics, clinical profiles, nutritional status and lifestyle practices of respondents are presented in Table I. A total of 398 respondents were recruited. More than half of them were aged 60 years old and older. There were more

males (56%) and the majority of the respondents were of Malay ethnicity (87%), married (73%), attended secondary education level (55%), were not working (87%), and had a household income less than Malaysian Ringgit (MYR) 2,000 (68%). Majority of the respondents were first-ever stroke survivors (81%), with ischaemic type (71%), and with median duration of stroke at 12 months. Majority of the respondents reported taking the prescribed medication from hospitals every day (82%), while some reported to only take their medications sometimes (18%). About 14 per cent of the respondents practised traditional medicine or herbs at home.

The prevalence of uncontrolled blood pressure was found to be 52 per cent. The mean of SBP and DBP was 140±21 mmHg and 80±11 mmHg, respectively. More than half of the respondents were classified as overweight and obese (65%) and presented with abdominal obesity (54% based on waist circumference and 58% based on waist-to-hip ratio).

About seven per cent of the respondents were active smokers during the survey. Most of the respondents reported not consuming alcohol, while about two per cent of them were drinking occasionally. Majority of the respondents (65%) reported having low physical activity level.

The comparison of socio-demographic characteristics, clinical profiles, nutritional status and lifestyle practices of between groups with normotension and uncontrolled blood pressure are presented in Table II-IV. In a multivariate logistic regression analysis (see Table V), uncontrolled blood pressure was associated with hypertension (aOR 3.11, 95% CI: 1.38, 6.99), diabetes mellitus (aOR 1.57, 95% CI: 1.03, 2.38), not taking prescribed medication every day (aOR 2.28, 95% CI: 1.29, 4.01), overweight (aOR 1.75, 95% CI: 1.02, 2.99), obesity (aOR 1.99, 95% CI: 1.12, 3.53), and low physical activity level (aOR 2.10, 95% CI: 1.35, 3.27).

DISCUSSION

The American Heart Association/American Stroke Association (AHA/ASA) guidelines on stroke recommend that hypertensive stroke patients receive intensive medical and lifestyle modification interventions to achieve a controlled blood pressure at least within 1 year after discharge.[6]

Table I: Socio-demographic characteristics, clinical profiles, nutritional status and lifestyle practices of stroke patients

Variables	All (n=398) n (%)
A) Socio-demographic characteristics	
Age (years)	
20-39	18 (4)
40-59	169 (43)
60-79	203 (51)
≥80	8 (2)
Sex	
Male	223 (56)
Female	175 (44)
Ethnicity	
Malay	345 (87)
Chinese	44 (11)
Indian	9 (2)
Marital status	
Single/ divorced/widowed	106 (27)
Married	292 (73)
Educational levels	
Never attend school	22 (5)
Primary (≤ 6years of school)	115 (29)
Secondary (7-11 years of school)	218 (55)
Tertiary (certificate/diploma/degree)	43 (11)
Working status	
Yes	50 (13)
Household income	
None	119 (30)
≤ MYR 999	43 (11)
MYR 1,000 – 1,999	109 (27)
MYR 2,000 – 2,999	41 (10)
MYR 3,000 – 3,999	26 (7)
MYR 4,000 – 4,999	18 (5)
MYR 5,000 – 5,999	9 (2)
≥MYR 6,000	33 (8)
B) Clinical profiles	
Number episodes of stroke	
First	323 (81)
Recurrent	75 (19)
Types of stroke	
Ischaemic	284 (71)
Haemorrhagic	82 (21)
Undetermined	32 (8)
Duration of stroke	
0-5	142 (36)
6-11	55 (14)
12-17	44 (11)
18-23	31 (8)
>24	126 (31)
Family history of stroke	
Yes	114 (29)
Underlying diseases	
Hypertension	363 (91)
Diabetes mellitus	204 (51)
Dyslipidemia	369 (93)
Atrial fibrillation	19 (5)
Chronic kidney disease	40 (10)
Traditional medicine/ herbs intake	
Yes	55 (14)
Frequency of taking medication	
Always (everyday)	327 (82)
Sometimes (≥once per week)	71 (18)
C) Nutritional status and lifestyle practices	
Body Mass Index	
Underweight (<18.5kg/m^2)	36 (9)
Normal (18.5-22.9kg/m^2)	104 (26)
Overweight (23.0-27.4kg/m^2)	147 (37)
Obese (≥27.5kg/m^2)	111 (28)
Abdominal obesity	
Waist circumference (men≥90cm;women≥80cm)	213 (54)
Waist-to-hip ratio (men≥0.95;women≥0.80)	230 (58)
Smoking status	
Current smoker	28 (7)
Ex-smoker	126 (32)
Never smoke	244 (61)
Dietary supplements	
Yes	112 (28)
Alcohol intake	
Yes	6 (2)
Physical activity	
Low (<600 MET-min/week)	257 (65)
Moderate and high (≥600 MET-min/week)	141 (35)

Abbreviations: MYR, Malaysian ringgit (1 MYR=0.24 United States Dollar); MET, metabolic equivalent of task values; min, minutes

Table II: Comparison of socio-demographic characteristics between groups with normotension and uncontrolled blood pressure

Variables	Normotension (n=191) n (%)	Uncontrolled BP (n=207) n (%)	*P-value
Age (years)			
20-39	8 (4)	10 (5)	0.157
40-59	81 (42)	88 (42)	
60-79	95 (50)	108 (52)	
≥80	7 (4)	1 (1)	
Sex			
Male	113 (59)	110 (53)	0.227
Female	78 (41)	97 (47)	
Ethnicity			
Malay	159 (83)	186 (90)	0.147
Chinese	26 (14)	18 (9)	
Indian	6 (3)	3 (1)	
Marital status			
Single/ divorced/widowed	52 (27)	54 (26)	0.797
Married	139 (73)	153 (74)	
Educational levels			
Never attend school	8 (4)	14 (7)	0.521
Primary (≤ 6years of school)	55 (29)	60 (29)	
Secondary (7-11 years of school)	104 (54)	114 (55)	
Tertiary (certificate/diploma/ degree)	24 (13)	19 (9)	
Working status			
Yes	23 (12)	27 (13)	0.763
Household income			
None	56 (29)	63 (31)	0.823
≤ MYR 999	18 (9)	25 (12)	
MYR 1,000 – 1,999	53 (28)	56 (27)	
MYR 2,000 – 2,999	17 (9)	24 (12)	
MYR 3,000 – 3,999	14 (7)	12 (6)	
MYR 4,000 – 4,999	11 (6)	7 (3)	
MYR 5,000 – 5,999	4 (2)	5 (2)	
≥MYR 6,000	18 (9)	15 (7)	

Abbreviations: BP, blood pressure; MYR, Malaysian ringgit (1 MYR=0.24 United States Dollar)
Note. *Chi-square test is applied with significance level $p < 0.05$.

Table III: Comparison of clinical profiles between groups with normotension and uncontrolled blood pressure

Variables	Normotension (n=191) n (%)	Uncontrolled BP (n=207) n (%)	*P-value
Number episodes of stroke			
First	152 (80)	171 (83)	0.440
Recurrent	39 (20)	36 (17)	
Types of stroke			
Ischaemic	128 (67)	156 (75)	0.144
Haemorrhagic	47 (25)	35 (17)	
Undetermined	16 (8)	16 (8)	
Duration of stroke			
0-5	61 (32)	81 (39)	0.464
6-11	28 (15)	27 (13)	
12-17	25 (13)	19 (9)	
18-23	17 (9)	14 (7)	
>24	60 (31)	66 (32)	
Family history of stroke			
Yes	56 (29)	58 (28)	0.774
Underlying diseases			
Hypertension	166 (87)	197 (95)	**0.004**
Diabetes mellitus	83 (43)	121 (58)	**0.003**
Dyslipidemia	174 (91)	195 (94)	0.234
Atrial fibrillation	13 (7)	6 (3)	0.068
Chronic kidney disease	17 (9)	23 (11)	0.464
Traditional medicine/ herbs intake			
Yes	27 (14)	28 (14)	0.860
Frequency of taking medication			
Always (everyday)	167 (87)	160 (77)	**0.008**
Sometimes (≥once per week)	24 (13)	47 (23)	

Abbreviations: BP, blood pressure
Note. *Chi-square analysis is applied with significance level p < 0.05.

However, this study showed that a large proportion of stroke survivors continued to have poorly controlled blood pressure (52%) at a median duration of 12 months post-discharge. The results are consistent with previous publications reported in the United States (58%), Norway (56%) and Czech Republic (57%).[19-21] However, it is lower than the findings reported in European countries (62%) and Nigeria (60%)[9,22], but higher than previous findings reported in Malaysia (28%).[8] The discrepancy of the study finding may be due to the difference in the operational definition of uncontrolled hypertension among the studies (BP>140/90mmHg versus BP≥ 140/90mmHg) and variation of stroke duration at the time of the survey. The mean and standard deviation of BP of this study, however, is found to be not too different with the study by Abdul Aziz et al. (SBP 140±21 mmHg versus 143±22 mmHg; DBP 80±11 mmHg versus 83±12 mmHg).[8]

One of the possible explanations for uncontrolled blood pressure among stroke survivors in this study was not taking prescribed medication every day at home (aOR 2.28, 95% CI: 1.29, 4.01). Earlier studies have demonstrated that medication adherence is significantly associated with better blood pressure control among post-stroke patients.[19,22] Poor adherence to secondary preventive medication is associated with an increased risk of stroke recurrence.[23] The medication adherence rate among post-stroke patients in Malaysia is unknown although there is evidence on poor antihypertensive medication adherence among hypertensive patients.[24]

A systematic review and meta-analyses of 29 studies have shown that the non-adherence rate to secondary preventive medicine among stroke patients after discharge is 31 per cent.[25] Possible factors associated with non-adherence are the lack of support, concerns about treatment, having a more severe stroke, and higher disability.[25] Future studies may be required to assess medication adherence by using an appropriate tool and understand the reasons associated with medication intake among stroke patients in order to devise strategies for improved adherence.

Table IV: Comparison of nutritional status and lifestyle practices between groups with normotension and uncontrolled blood pressure

Variables	Normotension (n=191) n (%)	Uncontrolled BP (n=207) n (%)	*P*-value
Body Mass Index			
Underweight (<18.5kg/m^2)	20 (10)	16 (7)	0.078
Normal (18.5-22.9kg/m^2)	59 (31)	45 (22)	
Overweight (23.0-27.4kg/m^2)	67 (35)	80 (39)	
Obese (≥27.5kg/m^2)	45 (24)	66 (32)	
Abdominal obesity			
Waist circumference (men≥90cm;women≥80cm)	92 (48)	121 (58)	**0.040**
Waist-to-hip ratio (men≥0.95;women≥0.80)	100 (52)	130 (63)	**0.035**
Smoking status			
Current smoker	113 (59)	131 (63)	0.620
Ex-smoker	65 (34)	61 (30)	
Never smoke	13 (7)	15 (7)	
Dietary supplements			
Yes	59 (31)	53 (26)	0.241
Alcohol intake			
Yes	3 (2)	3 (1)	1.000
Physical activity			
Low (<600 MET-min/week)	110 (58)	147 (71)	**0.005**
Moderate and high (≥600 MET-min/week)	81 (42)	60 (29)	

Abbreviations: BP, blood pressure; MET, metabolic equivalent of task values; min, minutes
Note. *Chi-square analysis is applied with significance level $p < 0.05$.

Besides this, patients with underlying hypertension were found to be more likely to have uncontrolled blood pressure in this study. History of hypertension and a longer duration of hypertension were found to be significantly associated with higher baseline SBP in the Secondary Prevention of Small Subcortical Strokes Study among adults with lacunar stroke less than six months.[26] A retrospective cohort also showed that elderly ischaemic stroke patients with history of hypertension continued to have higher odds of uncontrolled BP at six months after discharge.[27]

Similarly, stroke patients with diabetes mellitus were found to be more likely to have uncontrolled blood pressure, which is consistent with findings in the United States and Norway.[21,28] Previous studies have shown that diabetes mellitus patients with hypertension are more resistant to antihypertensive treatment.[29,30] Possible explanations are the presence of autonomic neuropathy in diabetic patients, which is associated with lesser nocturnal BP decrease and a higher BP variation compared to their counterparts.[31,32] This suggests the need for increased efforts to improve blood pressure management among certain subgroups of patients, especially those with comorbid hypertension and diabetes mellitus.

In accordance with previous findings, higher body mass index was found to be significantly associated with uncontrolled blood pressure among stroke survivors.[21,33] Some studies have found that obesity is associated with left ventricular hypertrophy and it may reduce the cardiovascular benefit of antihypertensive treatment.[34,35] Razmara et al. (2016), however, have reported contradictory findings where obesity is linked to lower odds of uncontrolled blood pressure.[28] The possible explanation of this phenomenon is that obese individuals may receive more aggressive treatment compared to the normal weight individuals.[28]

Table V: Unadjusted and adjusted odds ratios of risk factors for uncontrolled blood pressure (n = 398)

Variables	Crude odds ratio (95% CI)	*P-value	†Adjusted odds ratio (95% CI)	*P-value
Hypertension	2.97 (1.39, 6.36)	**0.005**	3.11 (1.38, 6.99)	**0.006**
Diabetes mellitus	1.83 (1.23, 2.73)	**0.003**	1.57 (1.03, 2.38)	**0.034**
Frequency of taking medication				
Always (everyday)	1.00			
Sometimes (≥once per week)	2.04 (1.19, 3.50)	**0.009**	2.28 (1.29, 4.01)	**0.004**
Body mass index				
Normal (18.5-22.9kg/m^2)	1.00			
Underweight (<18.5kg/m^2)	1.05 (0.49, 2.25)	0.902	0.93 (0.42, 2.03)	0.848
Overweight (23.0-27.4kg/m^2)	1.57 (0.94, 2.60)	0.082	1.75 (1.02, 2.99)	**0.042**
Obese (≥27.5kg/m^2)	1.92 (1.12, 3.31)	**0.018**	1.99 (1.12, 3.53)	**0.018**
Abdominal obesity				
Waist circumference (men≥90cm; women≥80 cm)	1.51 (1.02, 2.25)	**0.040**	1.11 (0.60, 2.05)	0.745
Waist-to-hip ratio (men≥0.95; women≥0.80)	1.54 (1.03, 2.29)	**0.035**	0.99 (0.55, 1.79)	0.975
Physical activity				
Moderate and high (≥600 MET-min/week)	1.00			
Low (<600 MET-min/week)	1.80 (1.19, 2.73)	**0.005**	2.10 (1.35, 3.27)	**0.001**

Abbreviations: MET, metabolic equivalent of task values; min, minutes
*Significance level set at less than 0.05
†Adjusted for waist circumference and waist-to-hip ratio.
Multivariate logistic regression was applied using forward LR.
Multicollinearity and interaction term were checked and not found.
Hosmer-Lemeshow test, (p=0.729), classification table (overall correctly classified percentage= 63.8%), and area under the ROC curve (66.4%) were applied to check the model fitness.

Although weight loss is often linked with improvement in vascular risk factors such as dyslipidaemia, diabetes mellitus and blood pressure[36,37], its influence on stroke recurrence or other clinical outcomes among stroke survivors is less clear.[38] Emerging data have suggested that the prognosis of overweight or obese patients with first-ever stroke are better than underweight and normal weight patients in term of survival rates and stroke recurrence.[39,40] This highlights the need for prospective and interventional studies to provide more evidence for appropriate weight management recommendations among patients after stroke.

Unsurprisingly, many of the stroke survivors reported low physical activity level, which is in line with previous findings.[41,42] Physical inactivity was significantly associated with uncontrolled blood pressure in this study. Although studies that examined the association between physical inactivity and uncontrolled blood pressure among

stroke survivors are limited, there are numerous studies that reported on hypertensive patients.[43,44] Benefits of regular physical activity and exercise among stroke survivors have been shown according to risk factor control, such as hypertension, arterial function, and insulin response.[45-47] However, the effects on recurrence rate are unclear.[45] Despite the health benefits of physical activity, increasing one's physical activity after stroke is challenging. Poor walking ability, impaired sensorimotor function, poor cardiorespiratory fitness, and low mood are among the factors associated with low physical activity level among post-stroke survivors. [48-50]

The current study did not find any significant association between age, sex and ethnicity with uncontrolled blood pressure in both univariate and multivariate analyses. This is consistent with findings in Nigeria[22] and the United States[19,27], yet, contradicted with other studies.[21,26,28,33] A possible explanation may be that there is an improvement in

the blood pressure treatment of patients with a specific age group (e.g. elderly). This study also did not find any relationship between smoking and alcohol consumption with blood pressure status. This is supported by the previous literature.[26,28,33] This is probably due to the successful and intensive quit smoking strategies by healthcare professionals among stroke survivors. This study observed that almost one-third of the respondents reported to quit smoking during the time of survey. Low prevalence of alcohol consumption was also observed among the respondents (2%). This is because most of the respondents are Muslim, whereby alcohol consumption is forbidden according to the religious practice.

There are a few limitations in this study. First, a true cause and effect relationship could not be established in this study due to its cross-sectional and observational study design. Second, this study was unable to review the latest medication prescription (on number and types of antihypertensive medications) taken by respondents, causing difficulties in including these variables in the analysis.

This is because many of the respondents had continued their treatment in the primary care setting and did not bring their follow up book or prescription list during the time of survey. Third, the data collection was confined to outpatient clinics in the hospital setting and covered only two states in Malaysia. To enable better generalisation of the results, future study should include patients who are attending the primary care setting and be carried out in different states of Malaysia in a prospective manner.

CONCLUSION

In summary, uncontrolled blood pressure was highly prevalent among stroke survivors, and that it was associated with the presence of hypertension, diabetes mellitus, frequency of taking prescribed medication, BMI, and low physical activity level. Comprehensive interventions such as intensifying antihypertensive treatment, improving medication adherence, managing overweight and obesity, and promoting physical activity are necessary to achieve better blood pressure control among stroke survivors.

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