

Stroke Burden in Malaysia

Kay Sin Tan^a Narayanaswamy Venketasubramanian^b

^aDivision of Neurology, Department of Medicine, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia;

^bRaffles Neuroscience Centre, Raffles Hospital, Singapore, Singapore

Keywords

Stroke · Burden · Systems of care · Epidemiology · Malaysia

Abstract

Malaysia is located in the heart of South East Asia with two land masses, Peninsular Malaysia and East Malaysia which are separated by the South China Sea. Stroke or cerebrovascular disease is Malaysia's third leading cause of death. There were 47,911 incident cases, 19,928 deaths, 443,995 prevalent cases, and 512,726 DALYs lost due to stroke in 2019. Successive national health and morbidity surveys from 2006 demonstrated a continuous rise in the prevalence of risk factors such as diabetes, hyperlipidaemia, and obesity. These risk factors are implicated in an increase in stroke incidence in those under 65 years of age, the largest increase of 53.3% and 50.4% in men and women, respectively, from the age strata of 35–39 years. The neurologist-to-patient ratio is 1:323,000 with the majority of neurologists working in urban centres. The healthcare system is provided predominantly by the public and private sectors. Concurrent use of traditional and complementary medicine is common and widely accepted. Challenges include delivering adequate care to rural communities, the low overall ischaemic stroke thrombolysis rates, and the high cost of thrombectomy devices for use in large vessel occlusions which have to be borne out-of-pocket by patients and their families. Effort is required to continue improving stroke care services in parallel with pri-

mary and secondary prevention strategies in the future, given the ageing population and the rising number of strokes in young adults nationally. Strategies include careful planning, inter-hospital cooperation, and increased allocation of resources from the government.

© 2022 The Author(s).

Published by S. Karger AG, Basel

Introduction

Malaysia is located in the heart of South East Asia. It has two land masses with thirteen states and three federal territories, separated by the South China Sea into two regions, Peninsular Malaysia and East Malaysia. Malaysia has a population of 32.78 million (2021) with several major racial groups, mainly Malays, Chinese, Indians, and other ethnicities [1].

Healthcare System

Malaysia has a healthcare system with three main providers, namely, the public sector, private sector, and nongovernmental organizations. Nongovernmental organizations provide a very small proportion of subsidized healthcare while heavily subsidized healthcare services are widely available under the public sector, led predominantly by the Ministry of Health, Malaysia. The public

sector services are further stratified into federal, state, and district level. On the other hand, the private sector (hospitals and clinics) caters for a smaller proportion of patient, covered by private insurance or by cash payment in a fee for the service payment model. Investment in health-care as a percentage of gross domestic product (GDP) is 3.76%. In contrast, the UK spends 10% of GDP on health-care. Singapore and Thailand spend 4.5% and 3.8% of GDP, respectively [2, 3]. Organization of stroke services is provided in a similar approach as outlined above with the majority of stroke patients managed in the public sector. Patients admitted with a stroke in Malaysia are also managed by internal medicine physicians and geriatricians due to the very low neurologist-to-patient ratio at 1:323,000 [4].

Stroke Burden and Stroke Epidemiology

Cerebrovascular disease is the 3rd most common cause of death in Malaysia [5]. In 2019, data from Malaysia showed a rising trend with incidence 47,911 (UI 43,757–52,839); deaths 19,928 (95% UI: 15,909–25,000); prevalence 443,995 (95% UI: 414,703–476,838); DALYS 512,726 (95% UI: 420,450–629,695) [6]. Malaysia has a lower age and sex-standardized stroke mortality and DALYs compared to many other countries in South East Asia [7]. At the national level, there was a 4.9% increase in stroke incidence between 2008 and 2016 among men but a 3.8% fall among women; 28-day all-cause mortality fell in both sexes, by 13.1% and 10.6%, respectively [8]. From the data, there are more patients living with stroke-related disabilities [9].

Several studies on the outcome of hospital admissions for acute stroke have shown that 36.2% were discharged independent while 53.1% had functional dependence. Between 2008 and 2015, re-admission rates at 28 days post-discharge range from 11 to 13%, usually for stroke recurrence and infection, with a higher risk among those with intracerebral haemorrhage [10, 11].

Rising Burden of Conventional Risk Factors in Malaysia and Rising Trend of Stroke Incidence in Young Adults

The National Health and Morbidity Survey Malaysia from 2006 to date conducted by the Ministry of Health, Malaysia, is a successive national health survey which has shown a continuous rise in the prevalence of vascular risk

factors in the community, especially diabetes mellitus, hyperlipidaemia, and obesity with a gradual reduction in the prevalence of hypertension [12]. Database on hospital admissions (2008–2016) from Ministry of Health hospitals detected that there was a substantial increase in stroke incidence in those under 65 years of age, the largest increase of 53.3% and 50.4% in men and women, respectively, in the age strata of 35–39 years [8]. A smaller hospital-based study has shown that a large proportion of ischaemic strokes in young adults (under the age of 50) have larger proportions of conventional risk factors in comparison to a similar cohort from Australia [13]. In addition, the same risk factors were consistently implicated in a worldwide rise in ischaemic strokes in young adults [14].

Stroke Units and Acute Stroke Services

No official statistics on the number of stroke units in Malaysia were reported from existing literature. However, most public hospitals have designated general HDU areas for acute stroke admissions while hospitals with acute stroke interventional services (including thrombectomy) have dedicated beds in the neurology ICU/HDU for the care of these patients.

Recently, through a project funded by the pharmaceutical industry, stroke ready hospitals in Malaysia were identified through surveys and voluntary data submission. These data were summarized in a website (<https://mystrokehospital.my>). There were 47 hospitals from private and public sectors listed [15]. However, there was incomplete information on which hospitals offered comprehensive stroke services and which were primary stroke centres offering only intravenous thrombolysis and required inter-hospital transfers for additional procedures. Thus, further clarity for the best access points by the public and by ambulances is required as this information can help minimize pre-hospital delays in order to optimize stroke care delivery and outcomes.

While all of the above strategies are promising for the future development of acute stroke services in Malaysia, more effort is required to improve the quality and quantity of human resources with the provision of adequate training. Stroke units, imaging facilities, and infrastructure for rehabilitation as well as choice of the best acute stroke service model (hub and spoke vs. mothership model) should receive future attention. Given the current state of the economy, resources can be optimized by building upon existing hospitals. In addition, regular au-

dit of stroke care metrics, patient outcomes, and re-admission rates are important measures to follow and improve [16].

Overall, the proportion of intravenous thrombolysis among ischaemic stroke patients for the whole country is very low. A previous survey from the National Stroke Registry showed a nationwide intravenous thrombolysis rate of 0.65% among all ischaemic stroke patients [17]. Most stroke thrombolysis in Malaysia were performed in urban areas. The experience of neurologists in the use of intravenous thrombolysis with the standard rt-PA dosage of 0.9 mg/kg on acute ischaemic stroke patients were reported from Sarawak General Hospital in Kuching, East Malaysia [18], at University of Malaya Medical Centre in Kuala Lumpur [19], and in Hospital Universiti Sains Malaysia in Kubang Kerian, Kelantan, in northeastern Malaysia [20]. The treated patients were observed to have good functional outcomes post-thrombolysis. As acute stroke patients are also managed by internal medicine physicians and geriatricians in public hospitals, a recent comparative study showed no significant differences in complications and functional outcome at 3 months in hospitals with or without neurologists [21]. This observation demonstrated that it will be feasible to run a “hub and spoke model” strategy [22] where intravenous thrombolysis in acute stroke patients with large vessel occlusion can be initiated in primary stroke centres without neurologists.

Going forward, it will be possible for patients to be transferred for thrombectomy in centres with comprehensive facilities, augmented by telemedicine for inter-hospital communication and to facilitate inter-hospital transfers. One such successful model is the Victorian Stroke Telemedicine programme in Australia [23].

On the other hand, due to its high overall cost, bridging therapy (intravenous thrombolysis followed by thrombectomy) is infrequently performed in the majority of hospitals in Malaysia with the exception of large, tertiary-level hospitals and private hospitals with access to trained neuroradiologists and an acute stroke service. This was consistent with an Asia-Pacific survey done in 2016 which showed that the number of patients receiving acute intravenous thrombolysis and thrombectomy was directly related to the respective country’s GDP and reimbursement policies [24]. As thrombectomy devices have to be paid as an out-of-pocket expense, its high cost is a major obstacle for many patients in public and private sectors in Malaysia. These limitations will persist unless there is a national scheme covering all hospitals or adequate insurance to fund or subsidize the cost of these expensive devices.

Post-Stroke Services

In Malaysia, the delivery of post-stroke care can be improved with careful coordination between specialist care and primary healthcare services. One proposal to improve services in Malaysia is through the Integrated Care Pathway for Post Stroke patients (iCaPPS[®]) which was developed by primary care teams to incorporate further rehabilitation and regular screening for post-stroke complications among patients residing at home in communities, using a shared-care approach, especially in areas with limited access to specialist stroke care services. It was found to be cost-effective and to cost less per QALY than conventional care [25].

Stroke Prevention, Rehabilitation, Use of Alternative Therapies, and Patient Support

The National Stroke Association of Malaysia (NASAM) as a stroke support organization has created numerous public awareness campaigns in conjunction with the World Stroke Day as well as holistic, stroke-specific rehabilitation programmes which have helped many stroke survivors. The incremental presence of many NASAM centres throughout Malaysia since its inception in 1996 have helped many patients [26]. NASAM is complementary to the many rehabilitation facilities in existence in many public and private hospitals in Malaysia.

In secondary stroke prevention, prescription profiles from a sample of 14 public hospitals in Malaysia revealed sub-optimal usage of antihypertensive drugs and anticoagulants among ischaemic stroke patients in Malaysia. Internal audits, close supervision, and follow-up of patients can be improved to reduce these inadequacies [27].

As observed in many Asia-Pacific countries, a recent survey in Malaysia validated that stroke patients from outpatient clinics of public hospitals had concurrent traditional and complementary medicine (T & CM) usage in a large proportion of the respondents. These patients widely utilized acupuncture, massage, and traditional Chinese medicines. Overall, the perception towards its use in Malaysia is favourable [28, 29].

While there are adequate stroke service provisions in the cities, there are significant challenges in rural areas. These challenges include access to stroke thrombolysis and rehabilitation facilities. These discrepancies are due to low number and misdistribution of specialists and neurologists as well as allied healthcare personnel [4, 24]. At the same time, raising the knowledge and skills of health-

care workers continues through education and is an important effort. Local annual meetings organized by the Stroke Council under the auspices of the Malaysian Society of Neurosciences as well as regional conferences under the Asia Pacific Stroke Organization (APSO) such as the Asia Pacific Stroke Conference series was successfully held in Kuala Lumpur, Malaysia, in 2015 [30, 31].

The ongoing COVID-19 pandemic has affected many aspects of stroke services which reduced the number of acute stroke-related admissions and thrombolysis rates globally and in Malaysia [30]. In this pandemic, many public hospitals reallocated wards for escalating number of patients affected with COVID-19. Non-COVID-19 patients have been diverted to private hospitals, but the situation has improved with the reduction of cases due to mass vaccination with healthcare services returning to manageable levels. While their pressures and challenges were temporary, the current situation underscores the ongoing need to improve stroke care services in parallel with primary and secondary prevention strategies in the future, given the ageing population and the rising number of strokes in young adults nationally and worldwide [13, 32].

Conclusion

Stroke services have improved steadily in Malaysia over the last 10 years. However, it is also important to improve the quantity and quality of human resources as well

as correcting sub-optimal components within the health-care system to continue improving acute and longer term stroke care. Many facets of stroke care can benefit from careful planning, inter-hospital cooperation, and increased allocation of resources from the government.

Conflict of Interest Statement

Kay Sin Tan has no conflicts of interest to declare. Narayanaswamy Venketasubramanian is an associate editor in Cerebrovascular Diseases.

Funding Sources

There are no funding sources.

Author Contributions

Kay Sin Tan conceptualized, completed, and co-wrote the first draft and revised the subsequent drafts of the paper before approving the final version. Narayanaswamy Venketasubramanian performed critical review, refined the literature search, co-wrote the first draft of the paper, and formatted and approved the final version of the paper.

References

- 1 <https://ourworldindata.org/country/malaysia> (accessed December 2, 2021).
- 2 Sebastian A, Alzain MA, Asweto CO, Mahara G, Guo X, Song M, et al. The Malaysian health-care system: ecology, plans and reforms. *Fam Med Community Health*. 2016;4:19–29.
- 3 World Bank. Available from: <https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS> (accessed December 15, 2021).
- 4 Malaysian National Specialist Register. Available from: <http://www.nsr.org.my>.
- 5 Department of Statistics Malaysia. Available from: <http://www.dosm.gov.my> (accessed December 15, 2021).
- 6 GBD 2019 Stroke Collaborators. Global, regional, and national burden of stroke and its risk factors, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet Neurol*. 2021 Oct;20(10):795–820.
- 7 Venketasubramanian N, Yoon BW, Pandian J, Navarro JC. Stroke epidemiology in South, East, and South-East Asia: a review. *J Stroke*. 2017;19:286–94.
- 8 Hwong WY, Ang SH, Bots ML, Sivasampu S, Selvarajah S, Law WC, et al. Trends of stroke incidence and 28-day all-cause mortality after stroke in Malaysia: a linkage of national data sources. *Glob Heart*. 2021;16:39.
- 9 Nor Azlin MN, Aziz NA, Saperi BS, Aljunid SM. Functional limitation and health-related quality of life, and associated factors among long term stroke survivors in a Malaysian community. *Med J Malaysia*. 2016;71:313–21.
- 10 Chen XW, Shafei MN, Aziz ZA, Sidek NN, Musa KI. Trends in stroke outcomes at hospital discharge in first-ever stroke patients: observations from the Malaysia National Stroke Registry (2009–2017). *J Neurol Sci*. 2019;401:130–5.
- 11 Ang SH, Hwong WY, Bots ML, Sivasampu S, Abdul Aziz AF, Hoo FK, Vaartjes I. Risk of 28-day readmissions among stroke patients in Malaysia (2008–2015): trends, causes and its associated factors. *PLoS One*. 2021
- 12 National Health and Morbidity Surveys, Institute for Public Health, Ministry of Health, Malaysia. Available from: <http://iku.gov.my/nhms> (accessed December 10, 2021).
- 13 Tan KS, Tan CT, Churilov L, Mackay MT, Donnan GA. Risk factors and aetiology of cerebral infarction in young adults: a Comparative Study between Malaysia and Australia. *Int J Stroke*. 2010;5:428–30.
- 14 Jacob MA, Ekker MS, Allarch Y, Cai M, Aarnio K, Arauz A, et al. Global differences in risk factors, etiology and outcome of ischaemic stroke in young adults; a worldwide meta-analysis: the GOAL-initiative. *Neurology*. 2021;98(6):e573–88.
- 15 My Stroke Hospital. Available from: <https://mystrokehospital.my> (accessed December 28, 2021).
- 16 Boulanger JM, Lindsay MP, Gubitz G, Smith EE, Stotts G, Foley N, et al. Canadian Stroke Best Practice Recommendations for Acute Stroke Management: prehospital, emergency department, and acute inpatient stroke care. *Update Int J Stroke*. 2018;13:949–84.

- 17 Aziz ZA, Lee YYL, Sidek NN, Bahari AN, Looi I, Hanip MR, et al. Gender disparities and thrombolysis use among patient with first-ever ischemic stroke in Malaysia. *Neurol Res.* 2016;38:406–13.
- 18 King TL, Tiong LL, Kaman Z, Zaw WM, Aziz ZA, Chung LW. A Hospital-Based Study on ischaemic stroke characteristics, management and outcome in Sarawak: where do we stand? *J Stroke Cerebrovasc Dis.* 2020;29:105012.
- 19 Tai MLS, Goh KJ, Kadir KAA, Zakaria MI, Yap JF, Tan KS. Predictors of functional outcome in patients with stroke thrombolysis in a tertiary hospital in Malaysia. *Singapore Med J.* 2019;60:236–40.
- 20 Wong KY, Baharuddin KA, Mafauzy MM, Halim SA, Chee YC, Sapiai NA, et al. Outcome of acute ischaemic stroke patients after intravenous alteplase in Hospital Universiti Sains Malaysia. *Med J Malaysia.* 2021;76:870–87.
- 21 Chew SH, Looi I, Neoh KK, Ooi J, Cheah WK, Zariah AA. Clinical outcomes of acute stroke thrombolysis in neurologist and non-neurologist centres: a Comparative Study in Malaysia. *Med J Malaysia.* 2021;76(1):12–6.
- 22 Demaerschalk BM, Boyd EL, Barrett KM, Gamble DM, Sonchik S, et al. Comparison of stroke outcomes of hub and spoke hospital treated patients in Mayo Clinic telestroke program. *J Stroke Cerebrovasc Dis.* 2018;27:2940–2.
- 23 Bladin CF, Kim J, Bagot KL, Vu M, Moloczij N, Denisenko S, et al. Improving acute stroke care in regional hospitals: clinical evaluation of the Victorian Stroke Telemedicine program. *Med J Aust.* 2020;212:371–7.
- 24 Suwanwela NC, Pongvarin N, Asian Stroke Advisory Panel. Stroke burden and stroke care system in Asia. *Neurol India.* 2016;64 Suppl:S46–51.
- 25 Abdul Aziz AF, Mohd Nordin NA, Ali MF, Abd Aziz NA, Sulong S, Aljunid SM. The integrated care pathway for post stroke patients (iCaPPS): a shared care approach between stakeholders in areas with limited access to specialist stroke care services. *BMC Health Serv Res.* 2017;17:35.
- 26 National Stroke Association Malaysia (NASAM). Available from: <https://www.nasam.org> (accessed December 10, 2021).
- 27 Hwong WY, Abdul Aziz Z, Sidek NN, Bots ML, Selvarajah S, Kappelle LJ, et al. Prescription of secondary preventive drugs after ischemic stroke: results from the Malaysian National Stroke Registry. *BMC Neurol.* 2017;17:203.
- 28 Ali MF, Abdul Aziz AF, Rashid MR, Che Man Z, Amir AA, Lim YS, et al. Usage of traditional and complementary medicine (T & CM): prevalence, practice and perception among post stroke patients attending conventional stroke rehabilitation in a teaching hospital in Malaysia. *Med J Malaysia.* 2015;70:18–23.
- 29 Kadir AA, Hamid AH, Mohammad M. Pattern of complementary and alternative medicine use among Malaysian stroke survivors: a Hospital-Based Prospective Study. *J Tradit Complement Med.* 2015;5:157–60.
- 30 Malaysian Society of Neurosciences. Available from: <https://www.neuro.org.my> (accessed January 3, 2022).
- 31 The Asia Pacific Stroke Conference (APSC) Kuala Lumpur, Malaysia, October 2–4, 2015: abstracts. *Cerebrovasc Dis.* 2015;40 Suppl 1:1–76
- 32 Nogueira RG, Qureshi MM, Abdalkader M, Martins SO, Yamagami H, Qiu Z, et al. Global impact of covid-19 on stroke care and IV thrombolysis. *Neurology.* 2021;96(23):e2824–38.
- 33 Aziz ZA, Lee YY, Ngah BA, Sidek NN, Looi I, Hanip MR, et al. Acute Stroke Registry Malaysia, 2010–2014: results from the National Neurology Registry. *J Stroke Cerebrovasc Dis.* 2015;24:2701–9.