NATIONAL RESPONSE TO NEUROLOGICAL DISEASES IN MALAYSIA: PLANNING FOR THE FUTURE

Jafri Malin Abdullah[1], Ahmad Munnawir Hussin[1], John Tharakan[1], Mohamed Rusli Abdullah[2], Ramli Saad[3], Zaidun Kamari[3], Zabidi Azhar Mohd Hussin[4] and Dzulkifli Abdul Razak[5]

[1]Department of Neurosciences, [2]Department of Community Medicine, [3]Hospital Universiti Sains Malaysia's Administration Office; [4]Department of Pediatric, Universiti Sains Malaysia, Kelantan; [5]Vice Chancellor's Office, Universiti Sains Malaysia, Penang, Malaysia

Abstract. The number of cases of neurological disease is expected to rise in the next 10 years, making this the second leading cause of morbidity and mortality after heart disease in Malaysia. The lack of human resources in the neurological field currently serving the Malaysian population may cause a deficiency in specialized care, especially in rural areas where neurological and neurosurgical care may be lacking. Thus, a resolve was made to increase the numbers of specialists by the Universiti Sains Malaysia (USM) with the help of the Ministry of Health of Malaysia. A study was made to evaluate the number of referral centers needed in strategic parts of Malaysia. Our calculation was based on service demands and operative procedures following the guidelines of the Association of British Neurologists (ABN) where 15 minutes of service time was equivalent to 1 unit. Based on 2 million population covered in the state of Kelantan by this University Hospital, 4.27 neurologists are needed to meet service demands with a consultant to population ratio (CPR) of 1:468,384, compared to 7.46 neurosurgeons, with a CPR of 1:268,097. According to the current service demands, one neurologist has to work more than 407 hours per year and one neurosurgeon 1,219 hours per year in our hospital. Hospitals with a larger catchment area would need to have more neurologists and neurosurgeons for optimal care in their area. Thus, more neurologists and neurosurgeons are needed to be produced, since the existing numbers are too small for quality care in Malaysia.

INTRODUCTION

Neurological and neurosurgical care in less developed countries (LDC'S) is woefully inadequate (World Health Organization, 2001a). While all developed countries (Tower and Feindel, 1980; Guidetti, 1987; Stevens, 1997; Reulen and Marza, 1998) or developing countries (World Health Organization, 2001b) suffer from a shortage of qualified neurological based physicians, the dilemma in LDC is especially severe. A quick resolution using both political and international assistance is needed to tackle this urgent problem. In many African countries, for example, there is one neurosurgeon for every 20,000,000 individuals. These neurological surgeons usually work in poorly equipped urban hospitals and have to cope with an immense workload under extremely unfavorable conditions (World Health Organization, 2001b; Bergen, 2002; Bower and Zenebe, 2005).

LDC'S also face the problem of inadequate funding for equipment and supplies. Tanzania spends approximately US$3.20 per person per year on healthcare (a quarter of

Correspondence: Prof Jafri Malin Abdullah, Department of Neurosciences, School of Medical Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kubang Kerian, Kelantan, Malaysia.
Tel: +609-7664240; Fax: +609-7648613
E-mail: deptneurosciencesppspusm@yahoo.com

the sum that the World Bank estimates as necessary for basic healthcare provision). As for pharmaceuticals, it spends around US$0.40-0.50; this is nowhere near enough to cover even essential Central Nervous System (CNS) drug programs, and certainly not enough for anti-HIV triple therapy (World Health Organization, 2001b).

The World Health Organization (WHO) projections for "disease burden" indicate that heart disease, accidents and violence will account for the majority of non-elective surgeries, including neurosurgery, around the world by 2020. Emergent infectious diseases, most of which are virus based and have no cure, will also cause an increase in neurosurgical and neuromedical interventions needed. AIDS has had, and will continue to have, a profound effect on both surgical practises and the recruitment and training of neuromedical personnel in under-developed countries.

By 2050, the world population is expected to exceed 9.3 billion (as opposed to today's estimated 6 billion). At present, developing regions of Africa, Asia and Latin America account for 96% of the increase in the world's population, and this percentage will increase over the course of the next 25 years.

Vision 2020

The Malaysian government has planned to use telemedicine to reform the country's public healthcare delivery and management service, which is under pressure from rising costs, lack of resources and overworked staff. In June 2000, four pilot programs were launched by the Ministry of Health, Malaysia with a focus on telemedicine applications: Lifetime Health Plan, Mass Customized/ Personalized Health Information and Education, Continuing Medical Education and Teleconsultation. This was implemented in the 8th Malaysian Plan with some success and will be reinforced in the 9th Malaysia Plan from 2006 to 2010.

Most neuromedical and neurosurgical specialists after their postgraduate training pursue careers in urban practice instead of distant rural hospitals in Malaysia. The scope of urban neurologic practice differs from that of community centers, therefore specialist neurological training in Malaysia needs emphasize: (i) an integrated approach to CNS patient care in both urban and rural settings, (ii) greater emphasis on training for ambulatory neurological care, (iii) development of linking departmental with neurological specialists in rural and community hospitals, (iv) optimization of the role of neurotechnology outside teaching centers, and (v) recognition of the need to regionalize some neurologic and neurosurgical care when necessary.

The increased number of neurological cases in rural North East Malaysia as a whole indicates that LDC will achieve development one day and eventually be exposed to "developed" countries diseases and their idiosyncrasies.

The ratio of neurosurgeons and neurologists at this moment indicates an unbalanced situation toward urban cities. More than 6,000 certified and 1,500 uncertified deaths in the year 2002 were caused by neurological diseases, forming the third, fourth and fifth causes of death in government hospitals. Brain tumors, including metastasis were in the top ten causes of death among all cancers. Diseases of the neurological system and sense organs accounted for 6% of all patients seeking treatment at general outpatient departments of public health facilities, specialist clinics and emergency departments, and they are the fifth leading cause of new attendances at Malaysian hospitals. Neurosurgical operations account for 2% of all type of operations done in Malaysian hospitals. Head injuries are the third leading cause of hospitalization in Malaysia, followed by cerebrovascular disease and brain tumors in the CNS disease section (Ministry of Health Malaysia, 2004).

After the School of Medical Sciences was established in 1979, the Hospital Universiti Sains Malaysia was gazetted in 1984 as the only university hospital built in a rural community setting. Its inception during the leadership of the previous Prime Minister of Malaysia, Tun Dr Mahathir Mohamad, has decreased both maternal and infant mortality rates in this state. More than 18 different postgraduate courses are offered. The initiation of a Masters in Surgery (Neurosurgery) program in the year 2000 was meant to decrease dependence on foreign training in the United Kingdom, Australia, USA and Belgium.

In 1988 the Association of British Neurologists (ABN) suggested that the ideal figure for consultant to population ratio (CPR) was one consultant neurologist per 200,000 population, which more or less matched the value proposed in 1986 by the Committee on Neurology of the Royal College of Physicians (Reulen and Marz, 1998). Eighteen years later, this CPR had been proposed for developed countries. Malaysia faces a serious shortage of neurological specialists 49 years after independence from the British.

Thus the aim of this paper was to look at the workload of neuroscience specialists and determine the optimum number of specialists to meet the realistict demands of solving the needs of the country to manage neurological diseases. Conclusions from the results of this paper will be discussed at the national level to improve neurological health care, especially in rural areas.

MATERIALS AND METHODS

Sources of data

The approach to the calculation of workload and specialists needed was to analyze existing data sources and validate information obtained from authorized personnel directly involved in services. The model was extensively based on the service demand and workforce capacity in Hospital Universiti Sains Malaysia (HUSM). The calculation was based on: terms of reference and job description of neurosciences specialists / lecturers, as well as the scope of patient care, including both in- and out-patients. For the neurological in-patients, both surgical and non-surgical times in patient management were considered. The average working hours was calculated as 40 hours/week.

Indications of adequacy of neuroscience specialists

Indicators used to denote the availability of an adequate number of serving neuroscience specialists compared to the workload included the following:

1. Consultant to population ratio (CPR). This ratio varied from place to place and was examined against the background of demand, such as the volume of patient load, complexity of services and type of services offered.

2. Public hospital vacancies. This indicator is different than 1, since adequacy was determined by an appointed committee which based the need on either general principals that covered the board specialties, or other factors, such as financial capacity, organizational planning or political determinants.

3. Waiting time. This was either an adequacy or performance indicator set by the responsible organization, public, or the public's representatives. Waiting time was a complex issue affected by these factors: a) size of the facility; b) efficiency of the staff; c) CPR; d) diagnostic infrastructure and service demand; e) referral patterns; f) organization efficiency; g) quality of supervision of personnel providing services.

4. Perception of adequacy. The perception was based on any one of the indicators, or all of them, without hard evidence.

5. Service demand. Service demand was usually determined by: a) pulation and population growth; b) age structure of the community; c)

prevalence of relevant diseases; d) incidents of neurological-related injuries; e) length of hospital stay; f) health care utilization and health care trends; g) changes in technology and options for service provision; h) linkages and referral patterns.

Service demand was calculated by noting the time needed to manage in-patients and out-patients. Wide variability in the average time spent on in-patients by one consultant in neurology made the calculation tedious and complicated, Therefore the final calculation was based only on out-patient management. Attempts were made to calculate average service time, but were deemed unsatisfactory due to wide standard deviation. The small number of service providers considered in this study could be the main culprit for this. It was therefore decided to adopt the formula by Stevens (1997) whereby clinic units were used instead of continuous average time (Reulen and Marz, 1998). The duration of each unit was suggested by ABN to be 15 minutes for consultants and 20 minutes for trainees or junior doctors running clinics alone or with consultants.

This paper worked out the typical service demand and capacity of service of providers based on routine typical workload experienced by neurosurgeons and neurologists functioning as medical lecturers in a teaching hospital.

A few assumptions were made:

1. The time available on average was the same for all medical lecturers in the specified field.

2. The setting represented the minimal number of required consultants to deal with service needs.

3. The units applied were based on ABN recommendations, which were used as the standard for how much time, on average, was needed to manage patients in the out patient clinic.

4. Distribution of time in an ordinary work day was consistent for the whole year.

5. The number of work weeks took into consideration time used for attending conferences, short courses, and closure of clinics and operation theaters during examination periods and maintainance.

RESULTS

The demand

The total units available per consultant were based on the typical workload shown in Table 1. The typical Malaysian work week is 8 hours daily, 5 days a week. Based on 15 minutes per unit of time as suggested by ABN, one consultant would have 160 units per week available (32 units/day x 5 days). Based on the information in Table 1, a consultant was able to spend only 60% of available units for clinical services. This provides 96 units per week for clinical services (60% x 160 units). In a year, a consultant would have 3,283.2 units of service time available.

There were 102.6 equivalent clinic-years being conducted at HUSM in routine schedule (Table 2). This provided 1,436.4 units for out-patient management based on 3.5 hour clinic sessions for one consultant. The average 3 years outpatient attendance as detailed in Table 3 required a total of 6,128 units. Assuming a consultant spent 1 unit to manage each in-patient, an addition of 1,663 units were required for in-patient management, giving a total of 7,791 units. Since one consultant can provide only 60% of the total available service time, the consultant would be able to provide 3,283.2 units per year. Therefore, to meet service demands for neurology, 2.37 consultants were needed. Taking just out-patient units as an indicator, a total of 6,128 neurology out-patients were required to be managed within 1,436.4 equivalent clinic units per year. This required 4.29 consultants/neurologists.

For neurosurgery clinics, an average of 152 new cases, equivalent to 608 units, were

Table 1
Distribution of work (%) in a typical week based on specialty.

Activities	Neuro-surgeons	Neuro-logists	Neuro-psychologists	Neuro-radiologists	Neuro-pathologists	Neuro-technologists
Clinical	60	60	60	60	60	60
In-patient	20	40	50	50	60	50
Out-patient	10	20	10	10	0	10
Surgery	30	0	0	0	0	0
Administration	10	10	10	10	10	10
Teaching	20	20	20	20	20	5
CME	5	5	5	5	5	5
Others	5	5	5	5	5	20

Table 2
Number of available clinic sessions in a typical teaching/tertiary referral hospital in Malaysia.

Activities	Consultant	Trainee
1. Neurology/Neurosurgery Clinics		
Work week/year (a)	34.2	34.2
Clinic sessions/week (b)	3	3
Equivalent clinics/year (c) [a x b]	102.6	102.6
2. Neurosurgical procedures		
Work week/year (a)	34.2	34.2
Surgeries week (d)	3	3
Equivalent surgeries/year (e)	102.6	102.6
3. No. of out-patient units		
Duration per unit (minute) (f)	15	20
Units per session (3.5 hours) (g)	14	10.5
Units per week (h)	42	31.5
Equivalent units/year [a x a] (i)	1,436.4	1,077.3
4. No. of operative units		
Duration per unit (minute) (j)	15	30
Units per session (8 hours) (k)	32	16
Units per week [k x a] (l)	96	48
Equivalent units per year (m)	3,283.2	1,641.6

needed per year with the addition of 1,835 follow-up units, giving a total of 2,443 units, compared to an available 1,436.4 units, based on 3 clinic sessions per week. This required 1.7 consultants to manage the out patient units. However, in neurosurgery a large proportion of the time is required for surgical procedures. Since each operation required from 16 to 32 units of time, a minimal of 16 units per operative session was used for this calculation.

Based on the current workload, a total of 24,480 operative units were required per year.

Table 3
Out-patient and in-patient attendances, 3 years average duration.

Type of cases	Neurology		Neurosurgery	
	No. of cases	Units	No. of cases	Units
Out-patients				
New case	888	3,552	152	608
F/up	2,576	2,576	1,835	1,835
Total	3,464	6,128	1,987	2,443
In-patient				
Surgical	-	-	1,530	24,480
Non-surgical	1,663	1,663	2,163	2,163
Total	1,663	1,663	3,693	8,283

With the current total of available operative units of 3,283.2, 7.46 consultants/neurosurgeons were required to perform the needed operations. Given a 100% comfort margin, this required an optimum number of 15 neurosurgeons/consultants.

This required number of consultants is similar to the calculation if we take into consideration the total service units required in neurosurgery against the total available service units per consultant/neurosurgeon, which came to 8.86 persons.

Consultant:Population Ratio (CPR)

With the current patient-load, 4.27 consultant neurologists were required to meet the service demands of a population of 2 million. This would provide a ratio of 1 consultant per 468,384 persons. If the standard were to have 1:100,000 CPR, 20 neurologists would be required in HUSM for optimal function.

Based on similar calculations, 7.46 neurosurgeons would be required to give service to a population of 2 million. This would provide a ration of 1 neurosurgeon to 268,097 people. If the standard was to have 1:100,000 CPR, a minimum of 20 neurosurgeons would be required. These calculations of CPR were based on the required number of consultants, not the current number of available consultants.

Workload

Based on a 3-year average patient attendance in the out-patient clinic, and the number of surgeries; the workload would increase by 30% per year, requiring the number of consultants to be increased by 30% per year.

Help from junior doctors

At HUSM, the patient demand is also met by trainees in neurology and neurosurgery. The number of these trainees varies, except for the number of trainee lecturers who do not vary. Other personnel who contribute to service are from the Ministry of Health (MOH). The MOH determines the number of candidates to be released for training in neurosurgery and neurology each year at this hospital.

Service demand-providers balance

At HUSM there are 3 neurosurgeons and 2 neurologists work in patient care. For the neurology services, previous calculations have shown that once consultant time is enough to cover out-patient demand, there should be enough capacity to cover other neurological services. There are currently 2 neurologists serving at HUSM providing an available 2,872.8 equivalent clinic units per year. The total service units required are 6,128 units, with a deficit of 3,255.2 units (6,128-2,872.8

units). This is equivalent to 813.8 hours. One consultant neurologist has to work an excess 406.9 hours per year in the out-patient clinic.

There are currently 3 neurosurgeons working at HUSM. This provides a current capacity of 4,309.2 units. Neurosurgery requirements were based on operative time, which results in a total need of 24,480 units. Since the 3 neurosurgeon are able to provide only 9,849.6 units, there is a deficit of 14,630.4 units. This is equivalent to 3,657.6 hours. Therefore, each neurosurgeon has to perform an extra 1,219.2 hours of surgery per year.

DISCUSSION

The results drawn from this analysis indicate that the minimal requirements for the number of neurologists and neurosurgeons required for a large referral hospital like HUSM does not do justice to the workload caused by elective and emergency neurological care. This is similar to referral hospitals in different regions in West and East Malaysia, which serve a catchments area of 2 to 4 million people. The National Neurosciences Institute, which is the Tuanku Abdul Rahman Institute of Neurosciences in Kuala Lumpur under the Ministry of Health, has a workload three to four times heavier than HUSM.

We did not calculate the number of junior specialists needed, since a uniformity of specialist care with equal experience is needed. A junior specialist in Malaysia may take 10 years before becoming a consultant.

One way for Malaysia to increase it's human resources in both neurology and neurosurgery is to produce, via various mechanisms, such as universities, fellowships and overseas training, enough human resources to accommodate the population growth and the aging population (Watts, 1981; Mosberg, 1992; Friedlich *et al*, 1999).

Universiti Sains Malaysia has embarked on a masters program with a duration of not more than seven years for neurosurgery and a post-masters degree in neurology of not more than five years. The first batch of neurosurgeons graduated on the 6th of August 2005. Furture graduates will contribute to the neurological surgeon resource needs of Malaysia.

Malaysia projects itself as a developed country with a ratio of 1:500,000 for neurologists and a ratio of 1:250,000 for neurosurgeons by 2020. It will be difficult to achieve this CPR, especially in rural hospitals on the East Coast of West Malaysia and in the states of Sabah and Sarawak. Neuro centers for referral in the North, South, West and East of West Malaysia, and specific centers in various areas of Sabah and Sarawak have to be created, before a reasonable human resource to patient ratio can be achieved presumably by the year 2035 in Malaysia. A referral model for neurological diseases similar to that in the United Kingdom and Australia, may have to be adopted (Association of British Neurologists, 1997; Australian Medical Workforce Advisory Committee, 2000).

REFERENCES

Association of British Neurologist. Neurology in the United Kingdom towards 2000 and beyond. ABN London, 1997: 3-31.

Australian Medical Workforce Advisory Committee, The neurosurgery workforce in Australia supply and requirements 1999-2010. AMWAC Report 2000. 3. August 2000: 13-72.

Bergen DC. World Federation of Neurology Task Force on Neurological Services. *J Neurol Sci* 2002; 198: 3-7.

Bower JH, Zenebe G. Neurologic services in the nations of Africa. *Neurology* 2005; 64: 412-5.

Friedlich DL, Feustel PJ, Popp AJ. Workforce demand for neurosurgeon in the United States of America : a 13-year retrospective study. *J Neurosurg* 1999; 90: 993-7.

Guidetti B. European courses of neurosurgery and other training and postgraduate education activities of the European Association of Neurological Societies. *Acta Neurochir* (Wien) 1987; 86: 115-28.

Ministry of Health, Malaysia. Annual report, Ministry of Health 2002. Kuala Lumpur: Malaysian Government Printers, 2004.

Mosberg WHJR. Medical man power needs at home and abroad. *Neurosurgery* 1992; 30: 639-49.

Reulen HJ, Marz U. 5 years' experience with a structures operative training programme for neurosurgical residents. *Acta Neurochir* (Wien) 1998; 140: 1197-203.

Stevens DL. Appendix A: Neurology in the United Kingdom-numbers of clinical neurologists and trainees. *J Neurol Neurosurg Psychiatry* 1997; 63 (suppl 1) 67-72.

Stephens DL. Association of British Neurologist. Neurology in the United Kingdom – numbers of clinical neurologist and trainees. London: ABN London 1996.

Tower DB, Feindel W. Impressions of neurology and neurosurgery in the People's Republic of China. *Ann Neurol* 1980; 7: 395-405.

Watts C. Neurosurgical man power requirements for 1990: an estimate of the graduate medical educational national advisory committee. *Neurosurg* 1981; 8: 277-9.

World Health Organization. Country profiles on mental health resources. 2001a: 405-25.

World Health Organization. Mental health resources in the world. 2001b: 32-3.