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The professional practice and training of neurology in the Asian and Oceanian Region: A cross-sectional survey by the Asian and Oceanian Association of Neurology (AOAN)

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ABSTRACT

Objective: To survey AOAN member countries regarding their organizational structure, postgraduate neurology training program, and resources for neurological care provision.
Methodology: A cross-sectional survey using a 36-item questionnaire was conducted among country representatives to AOAN from August 2015 to August 2016.
Results: A total of 18/20 AOAN member countries participated in the survey. All the countries have organized association with regular meetings, election of officers and neurology training program. In 9/18 countries, professionals other than neurologists were eligible for affiliation. In 11/18 countries, prior Internal medicine training (or equivalent postgraduate housemanship) is prerequisite to neurology program. Recertification examination is not a practice, but submission of CME is required in 7/18 countries to maintain membership. 12/18 countries publish peer-reviewed journals with at least 1 issue per year. Subspecialty training is offered in 14/18 countries. The ratio of neurologist to population ranges from 1:14,000 to as low as 1:32 million with 9/18 having < 1 neurologist per 100,000 population. 6/18 countries have at least 1 specialized center solely for neurological diseases. In government-funded hospitals, the lag time to be seen by a neurologist and/or obtain neuroimaging scan ranges from 1 day to 3 months. All except one country have several medical- and lay- advocacy or support groups for different neurological conditions.
Implications: The data generated can be used for benchmarking to improve neurological care, training,

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collaborative work and research in the field of neurosciences among the AOAN member countries. The paper presented several strategies used by the different organizations to increase their number of neurologists and improve the quality of training. Sharing of best practices, academic networking, exchange programs and use of telemedicine have been suggested.

1. Introduction

The World Health Organization (WHO) has predicted that between the year 2000 and 2050, the number of people aged 60 and above is expected to double, and that by year 2050, > 1 in 5 people will be 60 years or older [1]. With increasing life expectancy and advancements in medical care, there will be more elderly who are susceptible to develop chronic illnesses including neurologic diseases such as stroke, dementia and Parkinson's disease. Whereas Asia constitutes > 60% of the world's population, < 20% of neurologists across the globe are in this region [2]. Thus, all measures to lessen the burden of neurologic illness are urgently needed globally and particularly in the Asian and Oceanian Region.

As the official chapter of the World Federation of Neurology (WFN), the Asian and Oceanian Association of Neurology (AOAN) was established in 1961 and has evolved into a regional society with 20 member nations at present. The AOAN continues to promote and foster on an international scale, the advancement, exchange, and dissemination of information and ideas relating to the nervous system in the region. It strives to assist in developing training programs in neurology, promoting research, and facilitating cooperative exchange programs for trainees, neurologists, and neuroscientists in the region. Since 1962, AOAN has held the Asian and Oceanian Congress of Neurology (AOCN) every 4 years. As influenced by the Asia Initiative of the WFN to vitalize the educational activity in the region, the meeting is now held every two years starting with the 14th AOCN meeting in Macau, China in 2014 [3].

This study presents a recent comparative database of the organizational structure, postgraduate neurological training, and the provision of neurological care services in the AOAN countries. It aims to guide AOAN projects, benchmarking and sharing of good practices, and assistance or cooperation among countries to improve the quality neurological care in the region.

2. Methodology

A cross-sectional survey using a 36-item questionnaire was drafted in English and was approved for fielding during the 2014 AOAN meeting in Macau, China. The questionnaires were sent to the national delegates from all 20 member countries of AOAN via electronic mail from August 2015 to January 2016. To encourage survey completion, the collection of survey data was extended until August 2016. Efforts were taken to attain all submissions through repeated follow-up contacts.

The questionnaire is composed of three main sections, exploring: (1) organization of neurologists; (2) postgraduate training in neurology; and (3) neurological services. The limitations of the study are discussed later in this document.

All respondents are board-certified neurologists having important positions in their neurological society and are either appointed or elected to be the country representative to AOAN. Details about the neurologic organization, professional meetings, terms of officers, recertification requirements and scientific publications were done. Also queried is the existence of other nongovernmental organizations such as advocacy or support groups for neurological conditions.

To generally describe how (adult) neurologists in each country are educated, the respondents were surveyed about some aspects of residency training, such as eligibility requirements, average duration of training, number of training institutions, and subspecialty (fellowship) training program/s (if any).

In the assessment of neurological care provision, a number of resources were considered, including: number of specialists (i.e. neurologists (total of adult and pediatric neurologists), neurosurgeons, and neurointerventionalists), specialized inpatient centers and facilities (e.g., stroke units), and general healthcare financing. To be considered a subspecialty training program, there should be at least six months of training after fulfilling a general neurology training program. For the comparative analysis of neurological services, the responding countries were grouped according to income categories using the 2015 gross national income (GNI) per capita as published in the World Bank list of Economies in July 2016. These GNI categories were as follows: high (US $ 12,476 or more), upper-middle (US$ 4036–12,475), lower-middle (US$ 1026–4035), and low-income (US$ 1025 or less) [4]. In order to understand how each country is able to deliver their health care, the total expenditure on health as a percentage of national gross domestic product (GDP) using 2016 World Bank data, as well as the government and private spending on healthcare in a given year, is provided using a graphic presentation.

Because it is difficult to compare the delivery of neurological care among member countries, the data on neuroimaging facilities and waiting times in consultations with neurologists were limited to non-emergent cases in state- or government- funded hospitals with available facility. To be considered a “Specialized Hospital for neurological diseases”, the hospital should be a referral hospital primarily intended to handle neurological illness, having staffs with specialized skills and offering up-to-date investigatory facilities and treatment procedures, and should be a center for neurologic training and research.

In the case of missing or inconsistent data (as some survey questions can be interpreted differently), the delegates were contacted for clarification or standardization of responses. The respondents were made aware of the response of other country representatives thru sharing of tables with the responses.

Additional information and clarifications were gathered from other neurologists during regional conferences during the study period. The comparative data were presented as a poster during the 2016 15th AOCN in Kuala Lumpur, Malaysia.

3. Results

Responses were received from 18 out of 20 member countries of AOAN, representing 90% of the organization. The data from two member countries (i.e. China and Saudi Arabia) were not obtained despite best efforts. Using the WHO grouping by regions, 12 countries (67%) of the respondents belong to the Western Pacific region, 4 countries (22%) from Southeast Asia and 2 (11.1%) from the Eastern Mediterranean region. Based on income categories of the World Bank, majority (8 countries or 44%) are classified as high-income countries, followed by lower-middle (7 countries or 39%) and upper-middle (2 countries or 11%) income countries. Only 1 country was classified as having low-income by GNI. It has to be emphasized that the survey was fielded only to the 20 member countries of AOAN as of 2016 and did not attempt to get all the countries in the Asia and Oceania region.

3.1. Organization of neurologists (Table 1)

All 18 neurological organizations are member societies of the WFN as well as the WHO. The oldest established organizations are from India and the ANZAN (Australia and New Zealand), both founded in the

Table 1
Organization of neurologists in AOAN.

Name of organization per country (year established)	Number of meetings per year	Election of officers	Requirement: CME[a] submission	Official research publication/s (number of issues per year)	Clinical practice guidelines	Number of neurology-related & advocacy organizations
Afghanistan *Afghan Neurological Association* (2013)	Annual	Every 3 years	No	None	Stroke Epilepsy Movement disorder Child neurology	None
Australia and New Zealand *Australian and New Zealand Association of Neurologists* (ANZAN) (1950)	Annual	Annual	Annual submission of CME is required by the RACP	None starting 2016	Stroke Epilepsy Movement disorder Child neurology	≥ 5
Hong Kong *The Hong Kong Neurological Society* (1973)	Annual	Annual	CME every 3 years	None	Stroke, Epilepsy	≥ 7
India *Neurological Society of India* (1950) *Indian Academy of Neurology* (1991)	Annual	Pres-Yearly; Board –q 3 years	No	Annals of Indian Academy of Neurology (4)	Stroke, Vertigo, Epilepsy	≥ 5
Indonesia *Indonesian Neurological Association* (1970)	Semi-annual	Every 4 years	CME every 5 years	Neurona (4)	Stroke, Dementia, Vertigo, Epilepsy, Low Back Pain, Headache, Head Injury	≥ 5
Israel *Israel Neurological Association* (1965)	Annual	Every 3 years	No	Journal of Israel Neurological Association (4)	Stroke Multiple Sclerosis	≥ 7
Japan *Japanese Society of Neurology* (1959) *(formerly integrated with Psychiatry as the Japanese Society of Neurology [1902-] then the Japanese Society of Neurology and Psychiatry [1935-])*	Annual	Every 2 years (President); every 3 years for trustees	CME every 5 years	Neurology and Clinical Neuroscience (6) *Rinsho Shinkeigaku* (Clinical Neurology) (12)	Dementia, Stroke, Headache, Epilepsy, ALS, Parkinson's disease, Multiple Sclerosis, Duchenne Muscular dystrophy, Myasthenia Gravis, GBS/Fisher syndrome, CIDP/MMN, Bacterial meningitis, Herpes Simplex encephalitis, Kii ALS/PDC, Familial Amyloid Polyneuropathy, Genetic diagnosis	≥ 23
South Korea *Korean Neurological Association* (1982)	Semi-annual	Every 2 years	No	Journal of Clinical Neurology (4)	Stroke, movement, epilepsy, dementia, neuromuscular, demyelinating disease	≥ 17
Malaysia *Malaysian Society of Neurosciences* (1989)	Annual	Every 2 years	No	–	Stroke Epilepsy Multiple Sclerosis	≥ 6
Mongolia *Mongolian Neurology Society* (2014) *Monneurology Association (2000)*	Annual	Every 2 years for Pres.; every 3 yrs for board	CME annually	Mongolia Journal of Neurology (2)	Stroke	≥ 4
Pakistan *Pakistan Society of Neurology* (1983)	Semi-annual	Every 2 years	No	Pakistan Journal of Neurological Sciences (4)	Stroke Parkinson's Disease Epilepsy Alzheimer's Disease	≥ 4
Philippines *Philippine Neurological Association* (1973	Semi-annual	Annual	No	Philippine Journal of Neurology (1)	Stroke Dementia Myasthenia Gravis Epilepsy Parkinson's Disease CNS infection-HIV	≥ 7
Singapore *Clinical Neuroscience Society* (2005)	Annual	Annual	No	–	Stroke Alzheimer's disease Parkinson's disease Epilepsy Pain	≥ 10
Sri Lanka *Association of Srilankan Neurologists* (2006)	Annual	Annual	No	Sri Lanka Journal of Neurology (1)	Stroke Epilepsy Movement Disorder	3
Taiwan *Taiwan Neurological Society* (1977)	Annual	Every 2 years	CME every 6 years	Acta Neurologica Taiwanica (1)	Stroke Epilepsy Movement disorder Dementia	≥ 11
Thailand *The Neurological Society of Thailand* (1960)	Semi-annual	Every 2 years	No	Journal of the Neurological Society of Thailand (4)	Stroke Dementia Epilepsy	15

(*continued on next page*)

Table 1 (*continued*)

Name of organization per country (year established)	Number of meetings per year	Election of officers	Requirement: CME[a] submission	Official research publication/s (number of issues per year)	Clinical practice guidelines	Number of neurology-related & advocacy organizations
Vietnam *The Vietnam Neurological Society* (1962)	Annual	Every 5 years	No	Journal of the Neurological Society of Vietnam (3)	No	≥ 4

[a] CME: Continuing Medical Education.

1950's. The neurological organization of Afghanistan is the youngest in the region (established in 2013). The median age of the 17 neurological organizations is 40 years. Two organizations emerged from a wider specialty society: the Indian Academy of Neurology (IAN) from the Neurological Society of India (together with neurosurgeons and neuroscientists); and the Japanese Society of Neurology (JSN), which superseded its century-old joint organization with psychiatry.

At least 9 national associations have memberships that are not limited to neurologists; some included neuroscientists, nurses, paramedical professionals, family physicians, and postgraduate trainees in neurology (i.e. neurology residents). Except for Afghanistan, there are also various local support groups (e.g., lay, medical, mixed) for specific neurologic conditions.

Each organization holds national conferences every year, semi-annual in five countries and less frequent in Vietnam (every 5 years). The selection of executive committees (i.e. organization officers) varies across countries ranging from annual to every 4 years, and in some countries, per position.

Recertification examination is not required in the surveyed countries. However, 6/18 (33%) countries require continuing medical education (CME) units to maintain active membership in the organization.

All countries except Vietnam have produced their local guidelines for stroke. Fewer of these countries also produce practice guidelines for other neurologic diseases, including epilepsy, movement disorder, dementia/Alzheimer's disease, and multiple sclerosis.

12 countries (70%) have peer-reviewed neuroscientific journal/s, including 5 that are currently indexed in PubMed/MEDLINE. Publications of journals range from monthly to yearly issues. The AOAN also co-publishes in an open access quarterly journal *Neurology Asia*, together with the ASEAN Neurological Association (ASNA) and the Asian and Oceanian Child Neurology Association (AOCNA).

3.2. Training in neurology (Table 2)

All responding countries have an accredited local postgraduate neurology residency training. Japan has the highest number of residency slots (across 792 institutions), which far outnumbers that of the other countries. Afghanistan currently has 1 training program which is also combined with psychiatry.

Although the number of years to complete an adult neurology residency is varied, the average duration is 4–5 years. However the length of training may be modified according to the candidate's qualification, such as completion of training in primary care (e.g., Internal Medicine, Pediatrics). The longest number of years needed to become a general neurologist is in Australia and Hong Kong (7 years) while the shortest is in Mongolia (1.5–3 years) and Vietnam (2–3 years). Eleven countries offer a straight neurology residency program where candidates can proceed to neurology right after acquiring basic medical degree. However, the length of rotations in internal medicine and psychiatry ranges from 4 to 9 months and 2–8 months respectively.

In other countries, medical registrars wishing to pursue neurology residency will have to undergo training in internal medicine (i.e. in India, Malaysia, Singapore, Pakistan, and Japan) or basic physician training/postgraduate housemanship (i.e. in Hong Kong, Australia, New Zealand). In India, neurology is regarded as a higher specialty post-doctoral course that is taken through any of 2 pathways (hence 2 distinct institutions): doctorate of medicine (MD) in neurology; or diplomate of national board (DNB) in neurology. Afghanistan has a combined neurology-psychiatry training but will soon start a neurology training program.

Using our criteria of at least 6 months for subspecialty training after a general neurology training, 14/18 countries offer subspecialty training; 81% of these have fellowship programs in stroke and epilepsy. Indonesia and Sri Lanka have subspecialty training programs but the training would last only for 3 months. Other fields of training in some countries include neurophysiology, dementia, and movement disorders. Virtually all these subspecialties are available in high income countries, with Japan having the most number of fellowship programs and positions.

5/18 countries (Hong Kong, Japan, Pakistan, Philippines and Taiwan) have admitted foreign medical graduates in adult neurology training programs.

3.3. Delivery of neurological services (Table 3)

Fig. 1 shows the total health expenditures (as percentage of national GDP) from public and private sectors of each country. The shares of GDP being spent on healthcare ranges from 2.8% in Pakistan to 10.3% in Japan, with 9/18 countries (50%) allocating above the mean of 5.98% (of GDP). The data shows a positive correlation between economic status and healthcare expenditure of each country. Before generalizations on the impact of income classification to the delivery of neurological services can be made, it should be noted that almost half of the responding countries belong to the high-income category based on the national GNIs which, in the case of most Southeast Asian nations (not included in the survey), is quite the opposite.

All responding countries have a publicly-funded healthcare system, which had an average share of 48.5% of the total health expenditure. However, there is a wide discrepancy between countries with regard to shares by the public sector, varying from 20.8% in Afghanistan to as high as 82.9% in New Zealand. As shown in Fig. 1, 11/18 (61%) countries derive majority of their health expenditures from the public (government) sector. On the other hand, countries with greater shares from the private sector (than public/government sector) on national health spending are not purely lower-income nations.

As of August 2016, there are over 19,000 neurologists from the 18 countries surveyed. The average ratio of neurologists per 100,000 population is 1.84, which is higher than the national ratios of 12/18 (67%) countries. Both low- and middle-income countries have < 1 neurologist per 100,000 persons except for Mongolia. Japan accounts for almost half (49%) of the neurologists in the region, followed by South Korea (10.3%), Taiwan (7.6%), India (7.5%), and Indonesia (6.1%). Afghanistan has two neurologists serving a population of 16.1 million.

A similar trend is seen in the reported number of neurosurgeons with an average of 1.11 per 100,000 population. The general trend is that there is a greater proportion of neurologists than neurosurgeons, based on the assumption that there are fewer graduates of

Table 2
Postgraduate neurology education in AOAN countries.

Country	Number of institutions offering adult neurology training[a]	Duration of training to be a general neurologist (after basic medical degree)	Number of institutions offering subspecialty (fellowship) training
Afghanistan	1 (combined with psychiatry residency)	5 years: 2 years IM + 3 years neurology	–
Australia and New Zealand (ANZAN)	46 (40 in Australia; 6 in New Zealand)	7 years: 1 year intern, 3 years basic training + 2 years advanced core training + 1 year of elective (relevant MD or PhD)	Stroke: 6 Epilepsy: 5 Movement disorders: 2 Electrophysiology: 6 Dementia: 1
Hong Kong	13 (9 Fully-accredited; 4 partially-accredited)	7 years: 3 years basic physician training + 4 years dual higher training (Advanced IM/Geriatric Medicine and Neurology)	None
India	22 (15 for MD Neurology; 7 for DNB Neurology)	6 years: 3 years MD degree/DNB in general medicine or pediatric medicine + 3 years neurology	Stroke: 3 Epilepsy: 3 Movement disorders: 2
Indonesia	14	4 years neurology	None (no subspecialty training ≥ 6 mos.)
Israel	18	5 years neurology	Stroke: 3 Epilepsy: 3 Movement disorders: 2
Japan	792 (360 Teaching hospitals; 348 Semi-teaching hospitals; 84 Education-associated institutes)	6 years: 3 years IM training (including 2 years of Early Clinical Medicine Training) + 3 years neurology	Stroke: 768 Epilepsy: 112 Dementia: 387 Movement disorders: > 80 Electrophysiology: > 50 Neuromuscular biopsy: ~10 (all subspecialty societies have their respective fellowships)
South Korea	80	4 years neurology	Stroke: 20 Epilepsy: 20 Dementia: 20 Movement Disorders: 20 Electrophysiology: 20
Malaysia	7	6–7 years: 3–4 years IM + 3 years neurology training	Stroke: 4, Epilepsy: 3 Neuroinflammatory: 2 Movement Disorder: 2 Neuromuscular: 4
Mongolia	3	2 years neurology	Stoke: 2; Neurophysiology: 3
Pakistan	17	5 years: 2 years IM + 3 years neurology	Stroke: 1 Electrophysiology: 1
Philippines	9	3-4 years neurology (3 years if with IM)	Stroke: 4 Epilepsy: 1 Electrophysiology: 4
Singapore	3	7 years: 1 year housemanship + 3 years IM + 3 years neurology	Stroke: 2 Epilepsy: 2 Movement Disorders: 1 Dementia: 1 Electrophysiology: 1
Sri Lanka	4	5.5 years: 2.5 years of general medicine + 3 years of neurology with one year spent overseas)	None (no subspecialty training ≥ 6 mos.)
Taiwan	32	4 years neurology	Stroke: 10 Epilepsy: 9 Dementia: 10 Movement disorders: 9 Electrophysiology: 10
Thailand	11	3 years neurology	Stroke: 4 Epilepsy: 4 Movement disorders: 2 Dementia: 1 Electrophysiology: 1
Vietnam	5	2–3 years neurology	Stroke: 3 Movement disorders: 2 Dementia: 2 Electrophysiology: 2

Abbreviation: MBBS = Bachelor of Medicine and Bachelor of Surgery; MD = Doctor of Medicine; PhD = Doctor of Philosophy; IM = Internal Medicine; DNB = Diplomate of National Board RACP = Royal Australian College of Physicians.
(−) Indicates data is unavailable or inapplicable.
[a] Number of training institutions as of 2014.

neurosurgical residency as well as available training institutions. It is interesting to note, however, that this generality is reverse in 4/18 nations (i.e. Afghanistan, India, Pakistan, and South Korea). For example, Afghanistan has two neurologists as compared to 12 neurosurgeons.

The number of stroke units was queried as this may partly reflect the advancement in stroke care in the region. Although common in the high income countries, stroke units are more abundant in middle income countries like Indonesia, Philippines, Vietnam and Thailand. All except Afghanistan and Mongolia have a neurointerventional service, of which 16/18 (89%) have at least one neurologist performing neurointerventional procedures.

In government-funded hospitals, there is a wide variation in lag times for CT and MRI scans, ranging from < 1 day to several weeks.

Table 3
Resources for Neurological Care in AOAN countries.
Source: Population Reference Bureau, World Population Data Sheet 2015; World Bank. World Bank list of economies 2016.

Country (population[a] in 10^6)	Number of Neurologist[b]: Number of Neuro-surgeons[c]	Ratio of neurologist per population (Number of neurologist per 100,000 population)	Number of neurologists working as neurointerventionalist/total number of neuro-interventionalists[c]	Number of Stroke units[c]	Number of MRI/PET scan units[c]	Lag time for neurologic consultations[**]	Lag time for CT scan[e]/MRI[e]	Specialized hospital/s for neurologic diseases[c]
Low-income[d]								
Afghanistan (32.2 M)	2:12	1:16.1 M (0.006)	0/0	0	9/0	2–3 weeks	1 h/5 h	None
Lower-middle income[d]								
India (1314.1 M)	1300:2500	1:1,010,846 (0.098)	10/20	20	500/10	Few days	Few days/few days	National Institute of Mental Health and Allied Sciences-NIMHANS, Bengaluru (Karnatka) India
Indonesia (255.7 M)	1150:200	1:222,347 (0.45)	25/122	40	11/3	Few days	1–2 weeks/ 4–6 weeks	National Stroke Hospital (Bukittinggi); National Brain Center (Jakarta)
Mongolia (3.0 M)	300:51	1:10,000 (10)	0/0	3	8/0	1 day	(No free CT)	None
Philippines (103.0 M)	425:122	1:242,352 (0.41)	1/7	46	40/5	1–3 days	None	None
Pakistan (200.0 M)	192:250	1:1,041,667 (0.096)	1/4	7	200/3	1 week	None	None
Sri Lanka (20.97 M)	40:22	1:524,250 (0.19)	0/3	6	13/0	1–4 weeks	Up to 4 weeks/ Up to 4 weeks	Institute of Neurology, Colombo
Vietnam (93.4 M)	800:300	1:116,812 (0.86)	10	50	150/5	Few days	Few days	None
Upper-middle income[d]								
Malaysia (30.8 M)	120:100	1:256,666 (0.39)	0/5	8	40/2	4 weeks	4 weeks/ 12 weeks	None
Thailand (67.1 M)	645:540	1:104,031 (0.961)	2/24	50	100/7	1–8 weeks	1–7 days/1 day to 4 weeks	The Bangkok Neurological Hospital The Chiangmai Neurological Hospital The Songkla Neurological Hospital
High income[d]								
Australia (23.9 M)	514:184	1:46,498 (2.15)	5/25	88	349/26	30–90 days	1 day/28 days	None
New Zealand (4.6 M)	46:15	1:100,000 (1.0)	0/10	12	349/26	30–90 days	3 days/45 days	None
Hong Kong (7.3 M)	116:68	1:62,931 (1.59)	5/28	15	34/4	50 days	50 days/ 82 days	None
Israel (8.4 M)	350:50	1:24,000 (4.17)	4/13	15	20/5	8–12 weeks	2–4 weeks/ 4–8 weeks	None
Japan (126.9 M)	9500:9463	1:13,357 (7.49)	61/1074	102	6577/367	0-few days	0-few days/up to 1 week	National Center for Neurology and Psychiatry; National Center for Geriatrics & Gerontology; National Cancer Center; National Cerebral and Cardiovascular Center;Tokyo Metropolitan Neurological Hospital Niigita University Brain Research Institute
South Korea (50.7 M)	1938:3078	1:26,160 (3.82)	30/150	65	600/30	1 day	1 day/2–3 days	None
Singapore (5.5 M)	100:45	1:55,000 (1.81)	0/10	6	15/8	30–60 days	0–14 days/ 14–28 days	National Neuroscience Institute
Taiwan (23.5 M)	1425:300	1:16,491 (6.06)	6/60	52	80/16	Variable	3–7 days/ 3–14 days	None

[a] Population in 2015.
[b] Number of total neurologist includes both adult and pediatric neurologist.
[c] Data or estimates for 2015 from country representatives.
[d] Income classification according to the World Bank list of economies (2016).
[e] Indicates data in government-funded hospitals.
[**] Indicates data in government-funded hospitals.

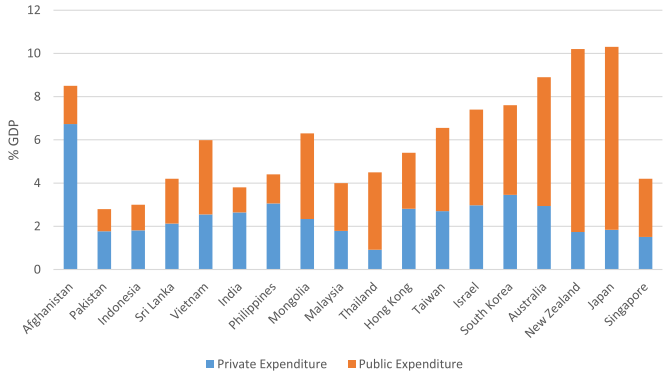

Fig. 1. Comparison of total health expenditure as percentage of Gross Domestic Product (GDP) of 18 countries in Asian and Oceanian region.
GDP = Gross domestic product (2012).
Source: [18].

The waiting times in consultations with neurologists at public (government-funded) hospitals also vary. The promptest notice can be < 1 day to a few days in 5/18 countries, while for other countries it takes longer, ranging from 1 week up to several weeks. The lag times in government-sponsored CT- and MRI- scans range from < 1 day to several weeks, although it generally takes longer for MRI because it is lesser in quantity. The approximate number of neuroimaging (MRI and PET) scans are also shown. Six (6) countries currently have stand-alone hospital/s specializing in neurological diseases.

4. Discussion

The survey reflects the diversity in the delivery of neurological care, as well as neurologic organization and training in the member countries of the Asian and the Oceanian Association of Neurology. The variation can be attributed to the wide range of population, economic status, available neurologic caregivers, infrastructures, as well as the length of existence of the national neurologic associations. These variations and inequities in available neurologic resources, services and training have been reported in previous surveys by the WHO-WFN [5], Steck [6], Janca [7], Poungvarin [8], Lim [9], and Mehndiratta [10]. The difference in the eligibility, program and length of training to become a neurologist are influenced or partly patterned from the neurology programs in the developed countries like the United kingdom [11], United States [12,13] and Europe [14] where past and currents AOAN mentors have trained.

Certain limitations need to be acknowledged prior to the interpretation of findings. The main limitation is that data were derived from the convenient sampling of the member countries of AOAN and the results do not reflect the situation in the other 56 non-member countries/states belonging to the vast Asia and Oceania region. Some of the responses to the survey were best estimates, but all the respondents are respected and leading neurologists in their countries. The data may not truly reflect the overall neurologic care in a country as specialists and services tend to concentrate in urban areas and/or private health facilities. This is the most recent and comparative database of the neurological organizations, resources, and education in the Asia and Oceania region.

The current survey reveals an enormous diversity in the number of neurologist per population in the countries presented. As there is no published ideal ratio applicable to all countries, we have used the ratio of at least 1 neurologist per 100,000 as being acceptable. All of the 8 countries belonging to the high income group had a ratio of > 1 neurologist per 100,000 population with Japan, Taiwan and Israel at the top of the list. Except for Mongolia (1 neurologist per 10,000 population), the lower income countries have low ratio ranging from 1:104,000 to 1:2.3 M population.

Strategies that have been used to increase the number of neurologists and improve the quality of training by the 18 organizations were shared by the respondents. These strategies may not be applicable for all and would depend on the situation and need of each country. Many attributed the increasing number of neurologists in their country during the past decade to an increase in the number of training institutions, especially among the low and middle income countries. The advancement and increasing popularity of the neurosciences as well as promotion of the specialty to the medical students and young doctors attracted many to pursue the specialty. What seems to be perceived in the past as a difficult discipline is now better understood through innovative education and clinical exposure. Others campaigned for the government to increase the number of training positions and have at least one neurologist per major government hospital. For high income countries, accepting overseas trained neurologists who are prepared to work in areas of need has led to the increase in the number of neurologists.

Improvement of neurologic education and training is an attainable goal for better provision of neurologic care. Although the number of neurologists is important, a high quality of neurological training should also be attained. Structuring the basic training programs, proper accreditation, and high quality of certifying exams are key components to ensure quality training. Recertification examination of neurologists is not practiced in the AOAN countries but 7 of the 18 countries require the submission of continuing medical education (CME) units for maintaining membership. Exchange programs and academic partnership would allow trainers and trainees to study with specialists in the top referral centers of the region. For example, Japan, Singapore and Australia have been providing subspecialty training to lower income countries. Collaborative researches especially on prevalent neurologic diseases will help improve education and care in the region. With the availability of online resources, training modules can be utilized to update, improve and circulate information to a wider audience.

Subspecialty training programs are available in 14 of the 18 countries with stroke, epilepsy and movement disorder being the most popular. There is a need to ensure properly trained neurologists to be mentors for the different subspecialties. Fortunately, there are several subspecialty societies in the region that promote advancement in the care for specific neurological illnesses. These organizations include Asia-Pacific Stroke Organization (APSO), Asian Epilepsy Academy (ASEPA), and Asian Society against Dementia (ASAD), Asian Oceanian Myology Center (AOMC) and Pan-Asian Committee for Treatment and Research in Multiple Sclerosis (PACTRIMS). These subspecialties regularly organize conferences and participate as well in the biennial Asian and Oceanian Congress of Neurology (AOCN) organized by the AOAN.

Member countries should learn from good practices not only from high income countries but also from the resourcefulness of other lower income countries. India, for example, has utilized alternative approaches in optimal utilization of rural, community health, and satellite clinics in close interaction with tertiary centers, nongovernmental agencies, and the private sector [15]. There is a need to strengthen the role of primary care physicians, internists, paramedics and nurses in neurologic care particularly in underserved areas. Providing virtual neurological care by utilizing telemedicine should be considered to help offset the lopsided distribution of neurologists and neurosurgeons [16].

The Association of Southeast Asian Nations (ASEAN) is slowly embracing regional integration that includes the practice of medicine which would allow physicians of member countries to practice in any of the 10 ASEAN countries [17]. Since six countries (Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam) out of the 10 ASEAN countries are member countries of the AOAN, standardization or establishing minimal requirements for neurology training will be strategic to ensure a high standard of neurologic care when the ASEAN integration is fully implemented.

Aside from the AOAN, the ASEAN Neurological Association (ASNA) and the Asian Oceanian Child Neurology Association (AOCNA) are two

other independent neurological associations holding biennial conventions working to improve the neurological care and education in the region. Since the goals of the organizations are virtually similar, collaboration and even merging of these organizations especially the AOAN and the ASNA, is worth considering. The annual meetings of the American Academy of Neurology (AAN) and the European Federation of Neurological Societies (EFNS) by well attended by many Asian neurologists which should serve as an inspiration in organizing similar joint conferences to provide our neurologists with more regionally relevant topics while reducing travel expenditures and time out from their countries.

5. Conclusion

We have presented a comparative data related to the organizational structure, postgraduate neurology training programs, and resources for the provision of neurological care in 18 member countries of the AOAN. The data generated can be used for benchmarking purposes. The strategies presented can hopefully assist health professionals, administrators, policy makers, and government of each country in identifying areas of training and neurological care needing reassessment and improvement.

Conflict of interest disclosure

The authors have nothing to report. All the authors have fulfilled appropriate disclosure form as requested.

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