

The following pages provide a focus on selected areas in relation to neurology. The specialists who contributed the reviews are listed in the Project Team and Partners.

◆ Epilepsy is one of the most common serious disorders of the brain, affecting some 50 million people worldwide. It is unique among these disorders in that its symptoms can be completely controlled in the majority of affected individuals by inexpensive medications or cost-effective surgical procedures, and many forms of epilepsy can be prevented by appropriate public health interventions. Epilepsy accounts for 1% of the global burden of disease, determined by the number of productive life-years lost as a result of disability or premature death (50). Among primary disorders of the brain, this burden ranks with depression and other affective disorders, Alzheimer's disease and other dementias, and substance abuse; among all medical conditions, it ranks with breast cancer in women and lung cancer in men.

Approximately one in 10 people can expect to have at least one epileptic seizure during a normal lifespan, but one seizure is not epilepsy. Only a third of the people who experience a seizure have an enduring brain disturbance that causes recurrent seizures and therefore warrants a diagnosis of epilepsy. Despite epilepsy being so common, the reported figures vary widely. The incidence is generally taken to be between 40 and 70 per 100 000 people per year in industrialized countries, with estimates of 100–190 per 100 000 people per year in developing countries (51, 52). The prevalence is between 5 and 40 per 1000 persons (51). Parasitic, viral and bacterial infections have been suggested as important factors in the cause of epilepsy in developing countries (52). Other important causes include brain damage at birth caused by asphyxia, infections, and brain trauma resulting from accidents. Some of the public health policies which may help in modifying these risk factors include better perinatal care, strategies to control head injury, better hygiene to decrease neurocysticercosis, and immunization. In the affluent countries, reduction of stroke by modifying the risk factors may lessen the incidence of epilepsy.

Evidence exists that 60–70% of people with epilepsy could lead normal lives if properly treated with antiepileptic drugs (AEDs) (53). Some of them will need to continue with medication for life but, for others, the antiepileptic medication may eventually be stopped without seizures recurring. For some patients with intractable epilepsy, neurosurgical treatment may be successful.

Of the burden of epilepsy worldwide, 80% is in the developing world, where 80% of people with epilepsy receive no treatment at all (52). In most of these regions, misconceptions, stigma, and discrimination are greater obstacles to the well-being of people with epilepsy than lack of adequate health-care facilities. These problems can be solved relatively inexpensively through education of patients, their families, the general public, health-care providers and government agencies, as well as through improved access to effective treatments. A Global Campaign Against Epilepsy, a joint effort of the International League against Epilepsy (ILAE), the International Bureau for Epilepsy (IBE) and WHO, is currently in progress in order to reduce the treatment gap for epilepsy and promote acceptance of people with this disorder by bringing epilepsy "out of the shadows" (54). The aim of the Campaign is to provide better information about epilepsy and its consequences and to assist governments and those concerned with epilepsy to reduce the burden of the disorder.

Much more basic and clinical research is necessary to develop new approaches for prevention, diagnosis, and treatment, and to devise cost-effective ways to bring currently available approaches to the developing areas of the world where limited resources and tropical conditions remain a major obstacle to adequate health care.

Stroke is the second leading cause of death after ischemic heart disease worldwide, with an estimated 5.5 million subjects dying from stroke every year. Two thirds of these deaths occur in countries with low resources. Approximately 80% of patients survive the acute phase of stroke: 50–75% of the survivors are left with varying degrees of chronic disability, thus making stroke a leading cause of disability in adults.

Hospital care, long-term care, complete or partial working incapacity, and community support – all of these factors cause enormous costs for the patients, their families, communities and the health-care system. There are different estimates of costs of management of stroke per patient in various regions. In Australia, the European Union and North America, the mean total cost of stroke management for the first three months is approximately US\$ 14 000. The average cost per surviving day is US\$ 260 (55). In general, more than 70% of costs are directed for covering hospitalization, less than 20% for rehabilitation, and the rest for chronic care facilities. Lifetime costs per stroke patient range approximately between US\$ 60 000 and US\$ 230 000. These costs should be regarded in the context of the epidemiological data, as the number of stroke survivors in a society translates directly into the actual economic burden of stroke.

Surveys performed before 1990 show that the worldwide crude prevalence rate of stroke in all age groups ranges from 4 to 20 per 1000 population. More recently published data from population-based studies show less variability between geographical regions, with the crude prevalence rate ranging from 5 to 10 per 1000 population (56). Some gender differences can be observed, as the stroke prevalence rate is lower in women than in men. Despite the stable rates, demographic estimates point towards an important increase of the number of strokes in the near future – especially in South America and Asia.

Based on these simple data one can roughly estimate the life-time costs of all strokes as millions of dollars in a medium-sized European country, thus highlighting the importance of stroke as a target for public health campaigns. However, stroke-related costs should not be regarded from a perspective of a high-income country. With the increasing burden of stroke in low-income countries the same magnitude of resources would be required to fulfil the needs of patients and to cover the disability-related loss of productivity.

As prevention is more effective than treatment, primary health care is the most appropriate means of preventing stroke and reducing its public health impact. It is crucial to increase awareness among primary care physicians of modifiable stroke risk factors such as hypertension, diabetes mellitus, tobacco smoking, obesity and excessive alcohol

consumption. This knowledge will allow for institution of primary and secondary prevention measures. It is also of great importance to introduce stroke awareness campaigns for the public, to promote healthy lifestyles and demonstrate the need for risk factor modification. Stroke should be regarded as one of the preventable cardiovascular diseases, and stroke prevention should be a global effort.

Data from the literature shows that organized care in a stroke unit is the most effective way of reducing long-term case fatality, long-term disability and the need for institutionalization (57). The benefits of a stroke unit come from its focus on coordinated multidisciplinary care, nursing integration and early rehabilitation. Specialization of care represented by interest and expertise in stroke rehabilitation, and also education and training of staff, patients and caregivers, are of great importance. Efforts need to be made to popularize and promote stroke unit care, especially in countries with low and medium levels of resources.

Important endeavours have been undertaken recently to improve the knowledge of stroke epidemiology worldwide. The Surveillance and Risk Assessment Division of the Population and Public Health Branch of Health, Canada – a WHO Collaborating Centre for Surveillance of Cardiovascular Diseases – developed a database of worldwide demographic data on cardiovascular and cerebrovascular disease mortality and morbidity. Moreover, the World Federation of Neurology and the International Stroke Society, in collaboration with WHO, have initiated the development of a stroke component of the WHO Global Noncommunicable Disease Infobase, which collects information on stroke prevalence, incidence, mortality and case fatality based on published data. Another WHO-initiated activity is an international stroke surveillance system: the STEPwise approach, which will form a framework for surveillance and data collection in order to achieve comparability of data over time and between different countries (58, 59). All these efforts aim to improve prevention and control of stroke and to facilitate the planning of health services. A joint effort of health-care professionals, nongovernmental organizations and governmental bodies is the key to controlling epidemics of stroke.

◆ Headache disorders are ubiquitous. Their lifetime prevalence in populations in which they have been measured is over 90%. Migraine is most studied, although still not fully in all regions of the world. It mostly affects people of working age but does trouble children as well. European and American studies show that 6–8% of men and 15–18% of women experience migraine every year (60). A similar pattern is seen in Central and South America: in Puerto Rico, for example, 6% of men and 17% of women are affected. Major studies are still to be conducted in India, but anecdotal evidence suggests similar levels of migraine promoted by Indian lifestyle factors. In Japan it is estimated to affect 8.4% of adults. Migraine appears less prevalent, but still common, elsewhere in Asia (3% of men and 10% of women) and in Africa (3–7% in community-based studies). Again in these areas, major studies have yet to be conducted. The higher rates in women everywhere (2–3 times those in men) are hormonally driven.

Tension-type headache (TTH) is the most common headache disorder (61). Most is episodic, and this subtype affects two-thirds of adult males and over 80% of females in developed countries, although few seriously. In its chronic subtype, in contrast, it is present on more days than not and is disabling. Chronic tension-type headache overlaps with and is sometimes indistinguishable from other forms of chronic daily headache, some of which are unrelentingly present throughout every day. Estimates of the prevalence of this group of conditions in Europe and the United States are as high as 1 in 25 of the adult population (62).

Not only is headache painful but, depending on its intensity and other symptoms that may accompany it, it is also disabling. Migraine affects people particularly during their productive years and, in a survey in the United States, 80% of people with migraine reported disability because of it. Extrapolation from migraine prevalence and attack incidence data suggests that 3000 migraine attacks occur every day for each million of the general population so it is unsurprising that, worldwide, migraine is 19th among all causes of years of life lost to disability (YLDs) (63). As well as suffering directly from its symptoms, people with migraine consistently score highly on scales of general physical and mental ill-health. Chronic tension-type headache and other forms of chronic daily headache are associated with long-term morbidity.

Repeated headache attacks, and often the constant fear of the next, damage family life, social life and employment. For example, social activity and work capacity are reduced in almost all migraine sufferers and in 60% of tension-type headache sufferers. The financial cost of headache arises partly from direct treatment costs but much more from loss of work-time and productivity. In the United Kingdom, for example, 25 million workdays or schooldays are lost every

year because of migraine alone. A recent United States study measured indirect costs in a managed-care population at over US\$ 4500 per sufferer per year. Tension-type headache and chronic daily headache may together cause losses of similar magnitude. In the 15 European Union countries prior to enlargement, the annual cost of all headache has been estimated at € 10 000–30 000 million.

Therefore, while headache rarely signals serious underlying illness, it is high among causes of consulting both general practitioners and neurologists. Over a period of five years, one in six patients aged 16–65 years in a large general practice in the United Kingdom consulted because of headache. A survey of neurologists found that up to one third of all their patients consulted for headache – more than for any other single complaint.

Despite headache being a common occurrence, there is good evidence that large numbers of people troubled by it do not receive effective health care. In many countries, headache conditions are not recognized as diseases but only as self-limiting and unimportant symptoms, deserving no allocation at all of resources. A consensus conference organized by the American and International Headache Societies concluded that migraine is underdiagnosed and undertreated throughout the world.

Nevertheless there are effective treatments. It is possible to alleviate much of the symptom burden of headache and thereby mitigate both the humanitarian and the financial costs. Crucially, the common headache disorders require no special investigation and their diagnosis and management call only for skills generally available to physicians. Most headache can be optimally managed in primary care, if the following barriers are removed:

- ◆ lack of knowledge, among health-care providers, of headache disorders and how to treat them;
- ◆ poor awareness among the general public, so that headaches are often trivialized as a minor annoyance and an excuse to avoid responsibility (stigmatization), and among headache sufferers who are unaware that effective treatments exist;
- ◆ failure of governments to acknowledge the burden of headache and to recognize that the costs of treating it are small in comparison with the huge savings that might be made (for example, by reducing lost working days) if resources were allocated to do so appropriately.

The key to successful health care for headache in most areas of the world is therefore education. This is at the heart of the Global Campaign to Reduce the Burden of Headache (64).

◆ Parkinson's disease occurs worldwide: it affects all ethnic groups and socioeconomic classes. Besides the disabling motor symptoms, patients have non-motor symptoms such as anxiety and depression. The Global Parkinson's disease Survey in six countries demonstrated that depression in Parkinson's disease is a significant factor affecting the health-related quality of life (65). Although there is no cure for Parkinson's disease, there have been advances in its management through drugs, rehabilitative measures and surgery. To achieve health for all, it is essential that we have a true appraisal of the epidemiological aspects of Parkinson's disease and resources available in each region.

Most epidemiological studies have shown an estimated incidence ranging from 16 to 19 per 100 000 people per year (66), while estimated crude prevalence is 160 per 100 000 people per year (67). There are regional variations which may, in part, be attributable to different methods of case-finding, diagnostic criteria and the age of the population. There is clearly a need for well-defined epidemiological studies, especially from the developing regions of the world.

Parkinson's disease poses a significant public health burden, which is likely to increase in the coming years. Along with other neurodegenerative diseases such as Alzheimer's disease, Parkinson's disease is expected to surpass cancer as the second most common cause of death by the year 2040. The direct and indirect costs for the care of Parkinsonian patients, including cost of drug treatment (about US\$ 1100 million worldwide) can be substantial (68). The incidence and prevalence of Parkinson's disease increase with advancing age, occurring in about 1% of people over the age of 65 years. With increase in life expectancy, future demographic projections predict a larger population over the age of 60 years in the developing regions, with a corresponding increase in the number of Parkinson patients.

For delivery of neurological care to people with Parkinson's disease, adequate human resources and other facilities are required. These are regrettably deficient, especially in the developing regions. For instance, there are only about 850 neurologists for the care of over 1000 million people in India (1 neurologist for 1.2 million inhabitants). These neurologists are mainly located in the cities, whereas nearly two thirds of India's population reside in rural areas. It is therefore necessary to seek the help of primary care physicians for the care of patients. Medical education should be suitably modified so that graduate physicians are able to recognize primary symptoms of Parkinson's disease and impart education about this illness to patients and their families. They should be able to initiate treatment with the appropriate anti-Parkinsonian drug and refer suitable cases to community hospitals in semi-urban areas or to large urban hospitals. There is also a great need to expand the support services and to have more nurse specialists, social workers, paramedical staff and rehabilitation centres. Various nongovernmental support organizations are working in this area to increase the awareness of this disease and its management.

◆ Dementia is a syndrome characterized by a progressive global deterioration in intellectual function. Alzheimer's disease is the commonest pathology, accounting for 50% to 75% of cases. Recent estimates for numbers of people with dementia worldwide suggest that 18–25 million persons were affected in 2000 and that this number will double to 32–40 million by 2020 (69, 70). It is largely a disease of older persons: only 2% of cases are under 65 years of age. After this age, the prevalence doubles with every five-year increment in age. Prevalence varies very little between developed countries: 1% for 60–64 years, 1.5% for 65–69 years, 3% for 70–74 years, 6% for 75–79 years, 13% for 80–84 years, 24% for 85–89 years, 34% for 90–94 years, and 45% for those aged 95 years or over (70).

Demographic ageing proceeds apace in China, India and Latin America. In the 30 years up to 2020, the oldest sector of the population will have increased by 200% in developing countries compared with 68% in the developed world (2). By 2020, two thirds of all people over 60 (and, presumably, a similar proportion of all those with dementia) will be living in developing countries (69). In the developing world, however, there is more uncertainty as to the frequency of dementia, with few studies and widely varying estimates (71). In general, prevalence and incidence are lower than in the developed countries (71). Early onset cases are again rare, though this may be changing in parts of the world where HIV/AIDS is endemic.

Dementia is one of the major causes of disability in later life. The consensus estimated disability weight for dementia applied in the global burden of disease report was higher than that for almost any other condition with the exception of spinal cord injury and terminal cancer. Among older people, dementia was the most burdensome neuropsychiatric disorder accounting for more than half of all disability-adjusted life years in this domain of morbidity (2).

People with dementia are heavy consumers of health services, but in developed countries most direct costs arise from community and residential care. In the United Kingdom these costs amount to US\$ 8000 million, or US\$ 13 000 per person with dementia (72). The economic burden is unevenly distributed; families from the poorest countries are particularly likely to use expensive private medical services and to be spending more than 10% of per capita GNP on health care (73). Worldwide, family caregivers are the cornerstone of support for people with dementia. They experience significant psychological, practical and economic strain (73, 74). Dementia care is particularly time intensive because of the need for close supervision. Many caregivers need to give up or cut back upon work in order to care. When the full costs of their care inputs were calculated, in the United States they amounted to US\$ 18 000 million annually (75).

Primary prevention should probably focus upon risk factors for vascular disease, including hypertension, smoking, type II diabetes, and hyperlipidaemia. The epidemic of smoking in developing countries and the high and rising prevalence of type II diabetes in Asia are particular causes of concern. More work is needed to identify further modifiable risk factors.

Achieving progress with dementia care has much to do with creating the climate for change. Lack of awareness, widespread among policy-makers, clinicians and the general public, is a key public health problem with important consequences:

- ◆ affected persons do not seek help; even if they do, health-care services tend not to meet their needs;
- ◆ dementia is stigmatized; for example, sufferers can be excluded from residential care and denied admission to hospital facilities;
- ◆ there is no constituency to lobby government or policy-makers;
- ◆ families are the main caregivers, but they lack support or understanding from others.

Population level interventions are needed. National Alzheimer Associations help to raise awareness and create a framework for positive engagement between clinicians, researchers, caregivers and people with dementia.

Primary health-care services have an essential role to play in prevention, detection and management. Clinic-based services providing acute care do not meet this need. For many low-income countries the most cost-effective approach will be community primary care services supporting, educating and advising family caregivers, supplemented by subsidized home nursing or home-care workers. Day care and residential respite care are more expensive, but nevertheless basic to a community's needs, particularly for more advanced dementia. Residential care is unlikely to be a government priority. Even in some of the poorer countries, however, private nursing and residential care homes are opening to meet the new demand (for example, in China and India). If government policies are well formulated, the inevitable shift of resource expenditure towards older people can be predicted and its consequences mitigated (76).

◆ Multiple sclerosis is the most common neurological disorder in younger adults of Caucasian origin. The etiology is still unknown but pathogenetic steps leading to the characteristic histological findings of perivascular inflammation and focal demyelination, as well as astrocyte scarring and axonal loss, have become better understood.

Clinically the disease course is most often relapsing-remitting, with exacerbations lasting on average a few weeks to a few months. In the long run, over decades, this course most often turns (for unknown reasons) into a secondary progression. The cases which remain relapsing-remitting are probably the ones which are benign (10–15%). Another form of the disease is primary progressive, equally frequent in females and males with probably less inflammatory components. In relapsing-remitting and secondary progressive forms the disease is twice as common in females than in males.

The world estimate is 1.11 to 2.5 million cases of multiple sclerosis. High-frequency zones for multiple sclerosis at 50–100 per 100 000 population are Europe, Canada, countries of the former USSR, Israel, northern United States, New Zealand, and south-east Australia. Lowest frequency zones for multiple sclerosis at 5 per 100 000 population are Asia, Africa and South America. In general, multiple sclerosis occurs worldwide with much greater frequency in higher latitudes between 40 and 60 degrees north and south latitude (77, 78).

As long as the etiology of multiple sclerosis remains unknown, a causal therapy or effective prevention is not possible. Introduction of new disease-modifying therapies such as beta-interferon or glatiramer acetate may alter the disease course, especially in the relapsing-remitting form, by reducing the number of attacks by about a third and reducing the accumulation of lesions as seen on MRI, and by influencing the impact of the disease on disability. Rehabilitation still remains the most effective element in the overall management of multiple sclerosis. Clinical as well as basic research are urgently needed in a coordinated fashion in order to find the etiology of this still enigmatic disease, with the goal of finding more effective treatments or preventing it altogether.

Most care for disorders of the nervous system is provided not by neurologists but by general physicians and other primary health-care workers, especially in developing countries where neurologists may be few or nonexistent. Adequate pregraduation training in neurology is needed everywhere so that general physicians can identify and treat disorders of the nervous system, which are major contributors to the global burden of disease.

Undergraduate medical curricula should include the epidemiology and prevention of the neurological disorders that are most prevalent in the region where graduates will practise. Some of the commonest neurological disorders such as stroke and epilepsy are preventable to some degree, for example by adequate treatment of hypertension in the first case and by eradication of neurocysticercosis in the other. The beneficial effects of neurorehabilitation and the careful management of chronic neurological diseases should also be included in pregraduate curricula.

To keep physicians abreast of changing patterns of neurological disorders (such as the increasing incidence of cerebrovascular disease and dementia in developing countries), continuing medical education in neurology should be readily available to all primary care physicians. Particularly in countries where neurospecialists are few, and most care of neurological disorders falls to the primary care physician or other health-care professionals, the educational role of the neurologist should include providing continuing medical education for primary care doctors (79). Continuing medical education for neurologists is widely available in wealthier countries through national and international neurological societies. For neurologists in developing countries, regional neurological societies can offer educational programmes that focus attention on neurological disorders endemic to the area, and foster connections with neurologists in wealthier countries.

Neurologists everywhere are recognized by their expertise in certain areas such as basic neurosciences, the neurological history and examination, and diagnosis and management of neurological disorders. Physicians in some countries may identify themselves as neurologists after minimal specialty training, whereas in other countries several years of postgraduate education, followed by successful completion of a specialty examination, are necessary. Through their national professional organizations, neurologists serve as advisers to national governments in over 70% of countries. Where this is the case, neurology curricula should also include some training in public health and in health-care delivery.

There are no recognized international standards for training in the specialty of neurology or for methods of demonstrating competency in the field. Postgraduate neurology curricula vary widely, some concentrating on clinical training and others stressing knowledge in basic neurosciences. Many of

these differences spring naturally from local needs, and are not necessarily undesirable. There are wide regional differences in the prevalence of various neurological disorders. A core curriculum in neurology should be influenced by local conditions, particularly for training in neuroepidemiology, prevention of neurological disorders, changing patterns of disease, and the cost-effective use of diagnostic and therapeutic resources.

The length of training programmes in neurology varies from place to place. Areas of subspecialty training in neurology include stroke, movement disorders, epilepsy, neurorehabilitation, pain, and clinical neurophysiology, and such programmes are generally available only in the wealthiest countries. They usually require one to two years, but accurate data about the length and content of such programmes are lacking. Whether adequate neurology training might be done in less time in certain countries or regions would be a useful subject for study. Shorter programmes would be less costly and might require fewer faculty members.

The available data demonstrate that in many low-income and middle-income countries there may be no neurologists, or as few as one neurologist for every 2 million people (47). Such countries generally do not have the conventional academic foundations for postgraduate neurology training programmes, and their neurologists receive training elsewhere. For small countries, the model of specialty training abroad may be suitable, as long as the training corresponds to the disease profile and technological milieu of the country where the neurologist will practise. The establishment or improvement of neurology training programmes is desirable in larger countries, however, to produce graduates who will work locally or in the region. The organization and evaluation of new training programmes could be facilitated by international linkages with various nongovernmental organizations.

In some areas the construction of regional training programmes could avoid duplication of costly resources and allow pooling of resources. Modern technology would facilitate the use of long-distance teaching, sharing of teaching materials, and establishment of research ties. In some regions it might be desirable to replace or supplement the traditional four-year postgraduate neurology programme with a shorter training programme for general physicians with a special interest in clinical neurology.

1. WHO – *What it is, what it does*. Geneva, World Health Organization, 1988.
2. Murray CJL, Lopez AD, eds. *The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020*. Cambridge, MA, Harvard School of Public Health on behalf of the World Health Organization and the World Bank, 1996 (Global Burden of Disease and Injury Series, Vol. I).
3. *Atlas of mental health resources in the world*. Geneva, World Health Organization, 2001.
4. Janca A, Prilipko L, Saraceno B. Neurology and public health: a World Health Organization perspective. *Archives of Neurology*, 2000, 57:1786–1788.
5. *World Bank list of economies (July, 2003)*. Washington, DC, World Bank (<http://www.worldbank.org>, accessed February 2004).
6. *The world health report 2003 – Shaping the future*. Geneva, World Health Organization, 2003.
7. Murray TJ. Concepts in undergraduate neurological teaching. *Clinical Neurology and Neurosurgery*, 1976, 79:275–284.
8. Marsland DW, Wood M, Mayo F. The content of family practice. *Journal of Family Practice*, 1976, 3:23–74.
9. Miller JQ. The neurologic content of family practice. Implications for neurologists. *Archives of Neurology*, 1986, 43:286–288.
10. Hopkins A. Lessons for neurologists from the United Kingdom third national morbidity survey. *Journal of Neurology, Neurosurgery and Psychiatry*, 1989, 52:430–433.
11. Papapetropoulos T, Tsiabe E, Pelekoudas V. The neurological content of general practice. *Journal of Neurology, Neurosurgery and Psychiatry*, 1989, 52:434–435.
12. van den Bosch JH, Kardaun JW. [Disease burden of nervous system disorders in the Netherlands]. *Nederlands Tijdschrift voor Geneeskunde*, 1994, 138:1219–1224.
13. Heckmann JG, Duran JC, Galeoto J. [The incidence of neurological disorders in tropical South America. Experience in the Bolivian lowlands]. *Fortschritte der Neurologie-Psychiatrie*, 1997, 65:291–296.
14. Birbeck GL. Barriers to care for patients with neurologic disease in rural Zambia. *Archives of Neurology*, 2000, 57:414–417.
15. Casanova-Sotolongo P, Casanova-Carrillo P, Rodriguez-Costa J. [A neuroepidemiological study in Beira, Mozambique]. *Revista de Neurologia*, 2000, 30:1135–1140.
16. Lavados PM et al. [Neurological diagnostics in primary health care in Santiago, Chile]. *Revista de Neurologia*, 2003, 36:518–522.
17. Lester FT. Neurological diseases in Addis Ababa, Ethiopia. *African Journal of Medicine and Medical Sciences*, 1979, 8:7–11.
18. Morrow JI, Patterson VH. The neurological practice of a district general hospital. *Journal of Neurology, Neurosurgery and Psychiatry*, 1987, 50:1397–1401.
19. Kwasa TO. The pattern of neurological disease at Kenyatta National Hospital. *East African Medical Journal*, 1992, 69:236–239.
20. Playford ED, Crawford P, Monro PS. A survey of neurological disability at a district general hospital. *British Journal of Clinical Practice*, 1994, 48:304–306.
21. Lampl C et al. Hospitalization of patients with neurological disorders and estimation of the need of beds and of the related costs in Austria's non-profit hospitals. *European Journal of Neurology*, 2001, 8:701–706.
22. Rose AS. Graduate training in neurology. *Archives of Neurology*, 1971, 24:165–168.
23. *National disease and therapeutic index specialty profile: neurologists*. Ambler, Pa, IMS America Ltd, 1982.
24. Garrison LP: *Physician requirements – 1990: for neurology*. Hyattsville, MD, Office of Graduate Medical Education, US Department of Health and Human Services, 1982.
25. Kurtzke JF. Neuroepidemiology. *Annals of Neurology*, 1984, 16:265–277.
26. Perkin GD. Pattern of neurological outpatient practice: implications for undergraduate and postgraduate training. *Journal of Royal Society of Medicine*, 1986, 79:655–657.
27. Rajput AH, Uitti RJ. Neurological disorders and services in Saskatchewan – a report based on provincial health care records. *Neuroepidemiology*, 1988, 7:145–151.
28. Hopkins A, Menken M, DeFries G. A record of patient encounters in neurological practice in the United Kingdom. *Journal of Neurology, Neurosurgery and Psychiatry*, 1989, 52:436–438.
29. Perkin GD. An analysis of 7836 successive new outpatient referrals. *Journal of Neurology, Neurosurgery and Psychiatry*, 1989, 52:447–448.
30. Stevens DL. Neurology in Gloucestershire: the clinical workload of an English neurologist. *Journal of Neurology, Neurosurgery and Psychiatry*, 1989, 52:439–46.
31. *UK audit of the care of common neurological disorders*. London, Association of British Neurologists (Services Committee), 1991.
32. Singhal BS, Gursahani RD, Menken M. Practice patterns in neurology in India. *Neuroepidemiology*, 1992, 11:158–162.
33. Boongird P et al. The practice of neurology in Thailand. A different type of medical specialist. *Archives of Neurology*, 1993, 50:311–312.
34. Martin R. [The model of neurological care needs in Valencian community. Commission of the analysis of the quality of SVN]. *Revista de Neurologia*, 1995, 23:1106–1110.
35. Gracia-Naya M, Uson-Martin MM. [Multicentre transverse study of the neurological ambulatory care in the Spanish Health System in Aragon: overall results]. *Revista de Neurologia*, 1997, 25:194–199.
36. Holloway RG et al. US neurologists in the 1990s: trends in practice characteristics. *Neurology*, 1999, 52:1353–1361.
37. Gonzalez Menacho J, Olive Plana JM. [Epidemiology of ambulatory neurological diseases at the Baix Camp]. *Neurologia*, 2001, 16:154–162.
38. Trevisol-Bittencourt PC et al. [The most common conditions in a neurology clinic]. *Arquivos de Neuro-psiquiatria*, 2001, 59:214–218.
39. Herzig R et al. The current availability of neurological inpatient services in post-communist central and eastern European countries. *Neuroepidemiology*, 2003, 22:255–264.
40. Bermejo F et al. [Estimation of the neurological demand in a health-care area of Madrid, Spain (area 11, University Hospital, 12 of October)]. *Neurologia*, 1999, 14:444–451.

41. Carroll C, Zajicek J. Provision of 24-hour acute neurology care by neurologists: manpower requirements in the UK. *Journal of Neurology, Neurosurgery and Psychiatry*, 2004, 75:406–409.
42. Menken M et al. The scope of neurologic practice and care in England, Canada, and the United States. Is there a better way? *Archives of Neurology*, 1989, 46:210–213.
43. Bermejo F. [Demand for neurological services in Spain. Data for a more demanding future]. *Revista de Neurologia*, 1999, 29:673–677.
44. Bartos A et al. Postgraduate Education in Neurology Group at the First European Co-operation Neurology Workshop. Postgraduate education in neurology in Central and Eastern Europe. *European Journal of Neurology*, 2001, 8:551–558.
45. Birbeck GL. A neurologist in Zambia. *Lancet Neurology*, 2002, 1:58–61.
46. Bergen DC. World Federation of Neurology Task Force on Neurological Services. Training and distribution of neurologists worldwide. *Journal of Neurological Sciences*, 2002, 198:3–7.
47. Hooker J et al. Neurology training around the world. *Lancet Neurology*, 2003, 2:572–579.
48. Stevens DL. *Neurology in the United Kingdom: number of clinical neurologists and trainees*. London, Association of British Neurologists, 1996.
49. European Federation of Neurological Societies. *Task force for European subspecialties*. EFNS Newsletter No 3, 2003.
50. Murray CJL, Lopez AD, eds. *Global comparative assessment in the health sector: disease burden, expenditures, and intervention packages* (collected articles from the *Bulletin of the World Health Organization*). Geneva, World Health Organization, 1994.
51. Hauser WA, Hesdorffer DC. *Epilepsy: frequency, causes and consequences*. New York, Demos Press, 1990.
52. Meinardi H et al. on behalf of the ILAE Commission on the Developing World. The treatment gap in epilepsy: the current situation and ways forward. *Epilepsia*, 2001, 42:136–149.
53. Engel J Jr, Pedley TA, eds. *Epilepsy: a comprehensive textbook. Vols. 1, 2 and 3*. Philadelphia, PA, Lippincott-Raven Publishers, 1997: 2976.
54. Reynolds EH, ed. Epilepsy in the world. Launch of the Second Phase of the ILAE/IBE/WHO Global Campaign against Epilepsy. *Epilepsia*, 2002, 43 (Suppl 6):46.
55. Caro JJ, Huybrechts KF, Duchesne I, for the Stroke Economic Analysis Group. Management patterns and costs of acute ischemic stroke: an international study. *Stroke*, 2000, 31:582–590.
56. Feigin VL et al. Stroke epidemiology: a review of population-based studies of incidence, prevalence, and case-fatality in the late 20th century. *Lancet Neurology*, 2003, 2:43–53.
57. Stroke Unit Trialists' Collaboration. Organised inpatient (stroke unit) care for stroke. *Cochrane Database Systematic Review*, 2002, (1):CD000197.
58. Truelsen T, Bonita R, Jamrozik K. Surveillance of stroke: a global perspective. *International Journal of Epidemiology*, 2001, 30 (Suppl. 1):S11–16.
59. Bonita R et al. The global stroke initiative. *Lancet Neurology*, 2004, 3:391–393.
60. Steiner TJ et al. The prevalence and disability burden of adult migraine in England and their relationships to age, gender and ethnicity. *Cephalalgia*, 2003, 23:519–527.
61. Rasmussen BK et al. Epidemiology of headache in a general population – a prevalence study. *Journal of Clinical Epidemiology*, 1991, 44:1147–1157.
62. Scher AI et al. Prevalence of frequent headache in a population sample. *Headache*, 1998, 38: 497–506.
63. *The world health report 2001 – Mental health: new understanding, new hope*. Geneva, World Health Organization, 2001, pp. 22–24.
64. Steiner TJ. Lifting the burden: the global campaign against headache. *Lancet Neurology*, 2004, 3:204–205.
65. Global Parkinson's Disease Survey Steering Committee. Factors impacting on quality of life in Parkinson's disease: results from an international survey. *Movement Disorders*, 2002, 17:60–67.
66. Twelves D, Perkins KSM, Counsell C. Systematic review of incidence studies of Parkinson's disease. *Movement Disorders*, 2003, 8:19–31.
67. Fahn S, Przedborski S. Parkinsonism. In: Rowland LP, ed. *Merritt's textbook of neurology*, 10th edition. Philadelphia, PA, Lippincott Williams & Wilkins, 2000:679–693.
68. Schapira, AHV. Parkinson's disease. *British Medical Journal* 1999, 318:311–314.
69. Prince MJ. The need for research on dementia in developing countries. *Tropical Medicine and Health*, 1997, 2:993–1000.
70. Wimo A et al. The magnitude of dementia occurrence in the world. *Alzheimer's disease and Associated Disorders*, 2004, 17:63–67.
71. The 10/66 Dementia Research Group. Methodological issues in population-based research into dementia in developing countries. A position paper from the 10/66 Dementia Research Group. *International Journal of Geriatric Psychiatry*, 2000, 15:21–30.
72. Bosenquet N, May J, Johnson N. *Alzheimer's disease in the United Kingdom: burden of disease and future care*. London, Imperial College of Science, Technology and Medicine, University of London, 1998 (Health Policy Review Paper 12).
73. The 10/66 Dementia Research Group. Care arrangements for people with dementia in developing countries. *International Journal of Geriatric Psychiatry*, 2004, 19:170–177.
74. Schneider J et al. EURO CARE: a cross-national study of co-resident spouse carers for people with Alzheimer's disease. I: Factors associated with carer burden. *International Journal of Geriatric Psychiatry*, 1999, 14:651–661.
75. Langa KM et al. National estimates of the quantity and cost of informal caregiving for the elderly with dementia. *Journal of General Internal Medicine*, 2001, 16:770–778.
76. Kalache A. Ageing is a Third World problem too. *International Journal of Geriatric Psychiatry*, 1991, 6:617–618.
77. Compston A et al., eds. *McAlpine's multiple sclerosis*, 4th ed. London, Churchill Livingstone, 2004 (in press).
78. Warren S, Warren KG. *Multiple sclerosis*. Geneva, World Health Organization, 2001.
79. Committee on Nervous System Disorders in Developing Countries, Institute of Medicine. *Neurological, psychiatric, and developmental disorders. Meeting the challenge in the developing world*. Washington, DC, National Academy Press, 2001.

Country, territory or area	Name	Country, territory or area	Name
Afghanistan	<i>M.S. Azimi</i>	El Salvador	<i>Carlos Antonio Díaz Manzano</i>
Albania	<i>Jera Kruja</i>	Estonia	<i>Janika Kõrv</i>
Algeria	<i>Mahmoud Aït-Kaci-Ahmed Tazir Meriem</i>	Finland	<i>Juha Korpelainen Jorma Palo</i>
Argentina	<i>Roberto Sica</i>	France	<i>Jean-Marc Léger</i>
Armenia	<i>Vahagn Darbinyan</i>	Gambia	<i>Kathryn Burton</i>
Australia	<i>Geoffrey A. Donnan</i>	Georgia	<i>Shota Bibileishvili George Chakhava</i>
Austria	<i>Franz Gerstenbrand</i>	Germany	<i>Michael Strupp</i>
Bahrain	<i>Adel Al-Jishi</i>	Ghana	<i>Paul Ayisu</i>
Bangladesh	<i>Anisul Haque</i>	Greece	<i>Hellenic Neurological Society</i>
Belarus	<i>Victor V. Yevstigneyev</i>	Guatemala	<i>Luis Fernando Salguero</i>
Belgium	<i>M. Van Zandijcke</i>	Honduras	<i>Reyna Durón Marco Tulio Medina Francisco Ramirez</i>
Benin	<i>Dismand Houinato</i>	Hungary	<i>Imre Szirmai</i>
Brazil	<i>Marco A. Lana-Peixoto</i>	Iceland	<i>Albert Pall Sigurdsson Sigurlavg Sveinbjörnsdottir</i>
Bulgaria	<i>Irena Velcheva</i>	India	<i>M. Gourie-Devi</i>
Burkina Faso	<i>Jean Kabore</i>	Indonesia	<i>Jusuf Misbach</i>
Canada	<i>Morris Freedman Donald W. Paty</i>	Iraq	<i>Sarmed Al-Fahad</i>
Central African Republic	<i>Pascal Mbelesso</i>	Ireland	<i>Michael Hutchinson</i>
China	<i>Wenzhi Wang</i>	Israel	<i>Oded Abransky</i>
China, Hong Kong Special Administrative Region	<i>Richard Kay</i>	Italy	<i>Antonio Federico</i>
Costa Rica	<i>Manuel Carvajal</i>	Japan	<i>Nobuo Yanagisawa</i>
Croatia	<i>Slava Podobnik Sarkanji Vesna Vargek Solter</i>	Jordan	<i>Ashraf Kurdi</i>
Cyprus	<i>Chris Messis</i>	Kazakhstan	<i>Abenov Bulat</i>
Czech Republic	<i>Zdenek Ambler</i>	Kenya	<i>Renato Ruberti</i>
Denmark	<i>Troels W. Kjær</i>	Lao People's Democratic Republic	<i>Vikham Sengkignavong</i>
Djibouti	<i>Abdoulkarim Said</i>	Latvia	<i>Ministry of Health Egils Vitols</i>
Dominican Republic	<i>Juan R. Santoni</i>	Lebanon	<i>Fouad Anton</i>
Ecuador	<i>Fernando Alarcón</i>	Libyan Arab Jamahiriya	<i>Abduraouf G. Aburkes</i>
Egypt	<i>Hassan Hassan ElKalla M. Anwar Etribi</i>		

Country, territory or area	Name	Country, territory or area	Name
Lithuania	<i>Valmantas Budrys</i>	South Africa	<i>R. Eastman J.A. Temlett</i>
Luxembourg	<i>Michel Kruger</i>	Spain	<i>José Luis Molinuevo Guix Jordi Matias-Guiu</i>
Madagascar	<i>Marcellin Andriantseho</i>	Sri Lanka	<i>J.B. Pieris</i>
Malawi	<i>Gretchen L. Birbeck</i>	Sudan	<i>Daoud Mustafa</i>
Mali	<i>Moussa Traoré</i>	Sweden	<i>Sten-Magnus Aquilonius</i>
Mexico	<i>Francisco Rubio Donnadiu</i>	Switzerland	<i>Julien Bogousslavsky Hans Rudolf Stöckli</i>
Mongolia	<i>D. Baasanjav</i>	Syrian Arab Republic	<i>Ahmad Khalifa</i>
Morocco	<i>Mohamed Yahyaoui</i>	Tajikstan	<i>Sherali Radjabaliev</i>
Myanmar	<i>Nyan Tun</i>	Thailand	<i>Rawiphan Witoonpanich</i>
Netherlands	<i>Marianne de Visser</i>	Togo	<i>Eric Grunitzky</i>
New Zealand	<i>Andrew Chancellor</i>	Tunisia	<i>Najoua Miladi</i>
Niger	<i>Sadio Barry</i>	Turkey	<i>Coskun Ozdemir</i>
Nigeria	<i>M.A. Danesi</i>	Ukraine	<i>Oleksandr E. Kutikov</i>
Norway	<i>Johan A. Aarli</i>	United Arab Emirates	<i>Jihad Inshasi Gohar Wajid</i>
Oman	<i>Pratap Chand</i>	United Kingdom	<i>Colin Mumford Graham Venables S.J. Wroe</i>
Pakistan	<i>S.S. Naeem-ul-Hamid</i>	United States of America	<i>Donna C. Bergen Michael F. Finkel Donna M. Honeyman</i>
Philippines	<i>Amado M. San Luis</i>	Uruguay	<i>José Caamaño Alejandro Scramelli</i>
Poland	<i>Urszula Fiszer</i>	Uzbekistan	<i>Karimov Khamid</i>
Portugal	<i>José Lopes Lima</i>	Venezuela, Bolivarian Republic of	<i>Rolando Haack</i>
Puerto Rico	<i>Angel Chinae</i>	Viet Nam	<i>Le Duc Hinh</i>
Qatar	<i>Ahmad Hamad</i>	West Bank and Gaza Strip	<i>Mazen I. El-Hindi</i>
Republic of Korea	<i>Seung Min Kim</i>	Yemen	<i>Hesham Awn</i>
Republic of Moldova	<i>Vitalie Lisnic</i>	Zambia	<i>Gretchen L. Birbeck</i>
Romania	<i>Ovidio Bajenaru</i>		
Russian Federation	<i>Michael Piradov</i>		
Saudi Arabia	<i>Saleh M. Al Deeb Fahmi M. Al-Senani</i>		
Senegal	<i>Ndiaye Mansour</i>		
Serbia and Montenegro	<i>Slobodan Apostolski</i>		
Slovakia	<i>Lubomir Lisy</i>		
Slovenia	<i>Antón Mesec</i>		

