Reviews/Analyses

Epidemiology of epilepsy in developing countries

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Epilepsy is an important health problem in developing countries, where its prevalence can be up to 57 per 1000 population. This article reviews the epidemiology of epilepsy in developing countries in terms of its incidence, prevalence, seizure type, mortality data, and etiological factors. The prevalence of epilepsy is particularly high in Latin America and in several African countries, notably Liberia, Nigeria, and the United Republic of Tanzania. Parasitic infections, particularly neurocysticercosis, are important etiological factors for epilepsy in many of these countries. Other reasons for the high prevalence include intracranial infections of bacterial or viral origin, perinatal brain damage, head injuries, toxic agents, and hereditary factors. Many of these factors are, however, preventable or modifiable, and the introduction of appropriate measures to achieve this could lead to a substantial decrease in the incidence of epilepsy in developing countries.

Introduction

In 1978 a WHO Study Group identified epilepsy to be a disorder whose control should receive top priority, in view of its high prevalence in developing countries and potentially severe consequences (*1*). At that time, most of the information available on epilepsy in developing countries had been derived from hospital-based studies, which made extrapolation to the general population highly conjectural. Since then, new data accumulated from different parts of the developing world give a better understanding of the magnitude of the problem, based on community studies of the prevalence and the possible etiological factors. There has also been a shift of emphasis from hospital-based epilepsy management to community-based epilepsy control (*2*). This article reviews the epidemiology of epilepsy in developing countries in the light of these new findings and changing attitudes.

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Definition of epilepsy

The WHO Neurosciences Research Protocol for studying the prevalence of neurological disorders in developing countries, which was developed in collaboration with the Neuroepidemiology Branch of the U.S. National Institute for Neurological Disorders and Stroke (NINDS) (*3*), defines epilepsy as two or more afebrile seizures unrelated to acute metabolic disorders or to withdrawal of drugs or alcohol. Patients who have had a seizure within the last 2–5 years and those on anticonvulsant medication are considered to have active epilepsy.

Incidence and prevalence of epilepsy

Incidence

In industrialized countries, population studies defining epilepsy as recurrent unprovoked seizures have yielded age-adjusted incidences that vary from 28.9 to 53.1 per 100 000 person-years (*4*). Higher incidences occur in children, age being an important factor in determining the incidence. Of the few studies carried out in developing countries, two from the Mariana Islands have reported annual incidences of 30–47.3 per 100 000 population (*5, 6*).

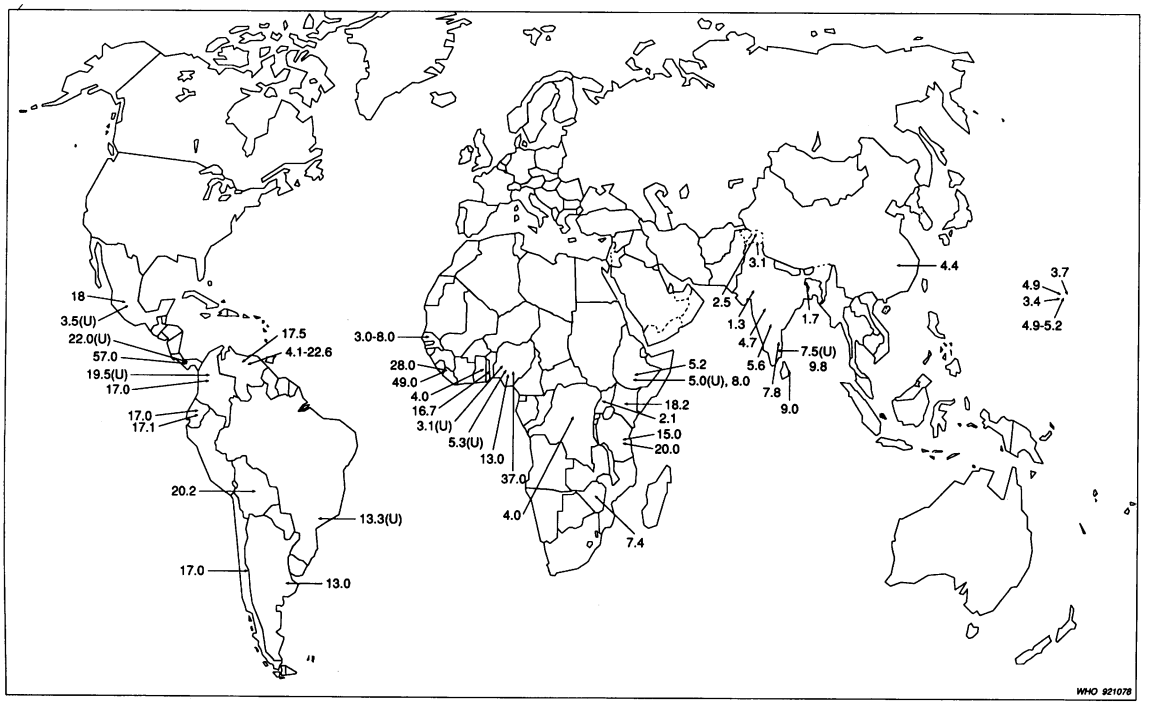
Prevalence

The prevalence of epilepsy in industrialized countries is about 3–9 per 1000 population. Most of the prevalence data available for developing countries (Fig. 1) are based on community surveys of rural populations. Such surveys, in general, have employed a two-phase design, the first phase consisting of screening interviews by field workers and the second phase comprising medical evaluation by neurologists. Common methodological problems of epidemiological studies of epilepsy include deficiencies in the following: differential diagnosis, case ascertainment methods, definition and classification of epilepsy, and selection bias. The possible exclusion of minor seizures, such as absences and partial (temporal lobe) seizures, and underreporting, because of the stigma attached to the disease, were some of the difficulties encountered in one community survey conducted in Sri Lanka (*7*). In some communities, epileptic patients may be expelled from their homes as outcasts, and hence not be available for case ascertainment (*8*). Notwithstanding these shortcomings, this form of survey is the optimum method for detecting all active cases of epilepsy for prevalence studies.

Several studies have reported low prevalences. For example, a house-to-house survey in rural Kashmir, India, found a prevalence of 2.47 per 1000 for active epilepsy (*9*). This arose because mild cases were not identified; also the infant mortality rate was high (104.8 per 1000 live births per year), suggesting that many patients with epilepsy died early in childhood. However, in a community with high infant mortality and morbidity, the prevalence of epilepsy would be expected also to be high. The prevalences for some other regions of India (Baroda, Calcutta, Patiala) are also quite low, and this merits further evaluation.

Prevalences greater than 3–9 per 1000 have been found in several African (*10–13*) and Latin American countries (*14–18*). The rates in some of these studies are not very different from those in industrialized countries (*14*). The prevalence of epilepsy in the Wroughbarh clan of the Grand Bassa County, Liberia, is among the highest in the world (49 per 1000 in one study (*10*) and 28 per 1000 in another (*11*)). Seizure disorders appear to have been introduced to this area approximately 30 years ago, as indicated by the period of onset of epilepsy and by retrospective information gathered from community

Fig. 1. **Map showing the prevalences of epilepsy (per 1000 population) in tropical and subtropical countries.** U = prevalence in urban areas.



elders. An environmental factor, possibly interacting with genes that determine the susceptibility of the host, was postulated to be involved in the etiology (*11*).

Aiyete—a rural community of about 2000 inhabitants, about 100-km south-west of Ibadan, Nigeria—has a high prevalence of active epilepsy (37 per 1000) (*12*). In contrast, in the Nigerian town of Igbo-Ora, which was surveyed using the same WHO protocol that was employed in Aiyete, the prevalence was only 5.3 per 1000 (*19*). The principal reasons for the lower prevalence in Igbo-Ora were held to be the availability of effective primary health care with emphasis on prevention of childhood infectious diseases, improved antenatal care, and a system of health education (*19*).

In the United Republic of Tanzania, a Bantu population of about 10 000 Wapogoro tribesmen in the Mahenge region had 201 diagnosed cases of epilepsy (prevalence, 20 per 1000) (*13, 20*). The causes suggested included asphyxia among newborns caused by poor obstetrics management, syphilis, parasitic infections, meningoencephalitis, and chronic malnutrition. Owing to its marked geographical, cultural and social isolation, the Wapogoro society is traditionally endogamous, and marital union even between first cousins is encouraged. This trend is more pronounced among families with epileptic members, whose low social prestige and poor financial status prevent them from acquiring brides from healthy families. Of the 201 patients, a family history of epilepsy was identified for 154 (76.6%). These findings strongly support a genetic basis for the high prevalence of epilepsy in this tribe.

Studies from Latin American countries, in general, have reported high prevalences, e.g., 22 per 1000 in Panama City (*17*) and 57 per 1000 among the Guaymi Indians in Changuinola, Panama (*18*). The two main risk factors identified in the latter study were a family history of epilepsy and a history of febrile convulsions.

Some of these high prevalences of epilepsy in developing countries probably reflect local or regional characteristics that do not apply to the countries as a whole. It should also be noted that several studies reporting high prevalences used small population samples, some less than 1000 individuals (*12, 17*).

Sex-specific prevalence. Most studies of epilepsy in industrialized countries report that males are more frequently affected than females, although the difference is seldom statistically significant. Results from developing countries are similar, although, some studies in Nigeria (*12, 19*) and Latin America (*15, 21*) have found higher prevalences for females.

Age-specific prevalence. The prevalence of epilepsy increases with age, reaching a peak in the third and fourth decades of life. In Ethiopia (*22*), Nigeria (*12, 19*), and Sri Lanka (*7*) the highest rates occur in the second decade of life; in Guam (*23*) in the third decade; and in Ecuador (*16*) in the fifth decade.

Seizure type

The International League against Epilepsy (ILAE) classifies seizures into two major groups: partial or generalized, according to the presence or absence of localized or focal onset (*24*). Partial seizures originate in a circumscribed area of the cerebral cortex and tend to be due to local causes such as trauma, embolic stroke, or tumour. Complex partial seizures, usually originating in the temporal lobe, may present with a complex variety of symptoms, including prominent psychic sensations such as fear, panic, and dream-like states. Rapid spreading of seizures with focal onset may result in generalized motor seizures. These are classified as partial seizures with secondary generalization. The term primary generalized seizures is reserved for convulsive or nonconvulsive seizures that are bilateral, symmetrical, and without focal onset, presumably arising from deep brain structures. The commonest forms are tonic–clonic (grand mal) seizures, absence (petit mal) seizures, myoclonic seizures, and atonic seizures.

Most studies in industrialized countries have reported a higher proportion of primary generalized seizures. In contrast, in developing countries the trend seems to be a higher frequency of partial seizures, usually secondarily generalized (Table 1). It should be borne in mind, however, that the investigations listed in Table 1 are a mixture of community-based (*9, 19, 25, 30*) and institutional-based studies (*26, 27, 32*).[a] The selection bias in the institutional studies may have influenced the findings; also, some of the studies were based on data from as few as 19 patients. Furthermore, there is a lack of uniformity in the classification of seizure types, particularly in the earlier studies. These methodological differences may explain some of the variations in the frequencies of seizure types between the studies.

The general tendency for a higher frequency of partial seizures in developing countries could be an indication of the high incidence of symptomatic epilepsy in the tropics, caused by cortical damage resulting from secondary factors. Of the generalized seizures, tonic–clonic are by far the commonest.

[a] **Sakamoto, A.C.** [*Clinical study of and prognosis for epileptic fits that began in infancy in the Brazilian population*]. Doctoral thesis, University of São Paulo, 1985 (in Portuguese).

Table 1: **Distribution of seizures, by type, in developing countries**

		Generalized seizures (%)					Partial seizures (%)				
	No. of cases	Tonic–clonic	Absences	Myoclonic	Other	Total	Simple	Complex	PSG[a]	Total	Unclassified
Africa											
Liberia (*25*)	123	37.4	—	—	—	37.4	—	17.9	44.7	62.6	—
Nigeria	—	—	—	—	—	—	—	—	—	—	—
Ibadan (*26*)	155	40.6	—	—	—	40.6	0.7	43.2	15.5	59.4	—
Igbo-Ora (*19*)	101	23.0	3.0	—	—	26.0	4.0	52.0	—	56.0	19.0
Lagos (*27*)	945	17.4	1.2	0.9	2.9	22.8	24.7	32.9	16.7	74.3	3.0
United Republic of Tanzania (*28*)	428	19.6	1.4	0.9	7.9	30.0	18.0	42.1	9.8	70.0	—
Asia											
India											
Bangalore (*29*)	631	42.2	0.6	1.3	—	44.1	2.7	5.4	42.9	51.0	4.9
Bangalore (*29*)	1804	28.2	1.9	1.9	—	32.0	3.4	10.7	42.9	57.0	10.4
Bombay (*30*)	66	42.4	1.5	1.5	—	45.4	1.5	6.0	47.0	54.5	—
Kashmir (*9*)	157	73.3	0.6	1.9	—	79.0	3.2	1.9	6.4	11.5	9.6
Madras (*29*)	1198	32.3	0.7	1.6	—	34.6	6.0	7.9	46.8	60.7	4.7
Varanasi (*31*)	1000	5.4	2.8	1.2	4.2	16.3	46.6	5.8	12.2	64.6	19.1
Sri Lanka[b]	1287	9.2	0.8	14.4	—	24.4	0.4	8.1	62.1	70.6	5.0
Latin America											
Brazil (*14*)	91	57.1	4.4	—	—	61.5	—	—	—	38.5	—
Brazil (*33*)	253[c]	—	—	—	—	10.5	4.0	28.0	10.5	42.5	45.0
Brazil (*32*)	373[d]	—	—	—	—	34.2	0.8	12.0	41.0	53.8	12.0
Colombia (*15*)	168	64.1	8.7	—	—	—	—	—	—	26.7	0.6
Ecuador (*16*)	19	—	—	—	—	73.7	—	—	—	21.1	5.7
Panama (*18*)	19	53.0	11.0	—	—	64.0	5.0	26.0	—	31.0	5.0

[a] PSG = partial seizures, secondarily generalized.
[b] Unpublished data.
[c] Age: 1 month to 13 years.
[d] Age >13 years.

Absences are underrepresented in developing countries, the frequency of these seizures in industrialized countries being approximately 6% (*33*); such seizures, because of the mild nature of their symptomatology, are either not recognized as a form of epilepsy, or there is a genuine, low incidence of this disorder in the tropics. An electroencephalographic study in Nigeria has corroborated the latter explanation (*34*).

Mortality data

Mortality data, based on a single underlying cause of death listed on the death certificate, considerably underestimate the number of deaths among people with epilepsy. Furthermore, the case-fatality ratio for epilepsy is low, so that mortality statistics are not a good indicator of the disease frequency. Also, the accuracy of death certificate diagnosis varies, particularly from one country to another and over long periods of time. Males have a higher age-adjusted mortality rate than females, and developing countries have higher mortality rates than industrialized countries (*35*). In a recent community-based study in rural Ethiopia, 20 of the 316 persons with epilepsy (6.3%) died over a 2-year period (*22*); death was related to epilepsy in nine instances, eight individuals died in status epilepticus, and one person died from severe burns sustained by falling into a domestic fire during a seizure.

Etiological factors

Studies in industrialized countries have recorded a specific etiology for epilepsy in about 60–70% of cases. In developing countries, despite the abundance of potential causes of epilepsy, a known etiology has been reported for less than 40% of cases (Table 2). Clinicians in most developing countries may have ready access to only the most basic investigations, hence the etiological diagnosis is often made on clinical grounds. If such diagnoses were supplemented with those made using the technology available in industrialized countries, the percentage of epilepsy cases with an identifiable etiology would increase considerably.

Parasitic infections

Cysticercosis. Cysticercosis is caused by the larva of the pork tapeworm, *Taenia solium*, and is the most frequent parasitosis of the central nervous system in several countries in Africa, Latin America, and Asia. Seizures are the commonest manifestation of neurocysticercosis (*38, 39*). In Mexico it was the main

Table 2: **Distribution of etiological factors for epilepsy in developing countries**

		Etiological factor (%):[a]										
	No. of cases	PBD	HI	ICI	CC	ICT	CVD	TM	MIS	FS	FH	NK
Africa												
Ghana (*36*)	204	5.4	5.4	2.5	—	0.5	3.4	0.5	—	—	—	82.4
Nigeria (*19*)	101	2.0	5.9	—	—	1.0	2.0	—	—	23.8	5.4	60.4
Nigeria (*27*)	945	3.8	8.4	1.6	—	1.4	1.1	0.8	0.3	16.3	—	66.9
United Republic of Tanzania (*28*)	428	4.4	5.1	6.3	—	2.8	2.6	—	1.6	11.2	—	65.9
Asia												
India (*29*)	3378	3.1	4.8	[3.5][f]		0.1	0.5	—	2.9	—	—	85.1
India (*29*)	1804	1.9	1.7	0.9	0.4	1.9	1.1	—	1.0	—	—	91.6
India (*31*)	1000	2.0	1.4	0.9	—	1.2	1.3	0.1	0.3	1.2	—	78.2
Sri Lanka[b]	1287	1.2	1.7	0.5	—	0.2	0.2	0.2	—	25.0	10.1	—
Latin America												
Brazil [c]	455 [d]	14.0	3.0	5.0	13.0	—	—	—	4.0	—	—	63.0
Brazil (*32*)	147 [e]	11.0	13.0	—	4.0	—	2.5	—	1.5	—	[68.0][f]	
Uruguay (*37*)	500 [d]	8.5	8.0	4.0	—	—	5.0	—	6.5	—	9.0	59

[a] PBD = perinatal brain damage; HI = head injuries; ICI = intracranial infections; CC = cerebral cysticercosis; ICT = intracranial tumour; CVD = cerebrovascular disease; TM = toxic/metabolic including alcohol; MIS = miscellaneous; FS = febrile seizures; FH = family history of epilepsy; and NK = not known.
[b] Unpublished data.
[c] See footnote *a*, p. 249.
[d] Age: 1 month to 15 years.
[e] Age >13 years.
[f] Figures in square brackets denote the sum of the two adjacent etiological factors.

cause of late-onset epilepsy, accounting for half the cases (*40, 41*); in Ecuador, nearly a quarter of all new cases of epilepsy were due to this cause (*42*); and in Brazil, it was the single most frequently identifiable cause of epilepsy.[b] In Africa, neurocysticercosis caused epilepsy among Bantus and Southern Rhodesians (*43, 44*); in northern Togo, the cause of epilepsy in a third of patients aged over 15 years and of two-thirds of those whose epilepsy began after the age of 50 years was attributed to cysticercosis (*45*). In India, 2% of cases of focal epilepsy (*46*) reported in one hospital in New Delhi were due to cysticercosis; it also accounted for 5.1% of 253 patients aged ≥25 years who were evaluated for recent-onset epilepsy (*47*). Cerebral cysticercosis has also been suggested to be the cause of many cases of epilepsy in South India (*48*). In south-east Asia, cysticercosis is the commonest cause of late-onset epilepsy (*49*). In Bali, for example, 8% of the population in one village had epilepsy possibly related to neurocysticercosis (*50*); and this has been identified as a frequent cause of epileptic seizures among the Kapadoku people of Indonesia (*51*) and in New Guinea (*52*); recently, among Nepalese (Gurkhas) in Hong Kong who presented with adult-onset epilepsy, seven out of eight cases had cerebral cysticercosis (*53*). Since no control studies were carried out, some of these findings may reflect local or regional characteristics within countries. However, with the increased availability of computed tomograph (CT) scans and magnetic resonance imaging (MRI) facilities, neurocysticercosis is being recognized more and more frequently in the tropics.

Schistosomiasis. Schistosomiasis, caused by *Schistosoma japonicum*, which is endemic in south-east Asia, causes the majority of cases of cerebral schistosomiasis. Acute schistosomiasis (Katayama fever) may occasionally produce an encephalopathy that manifests as impairment of consciousness, papilloedema, partial and generalized seizures, and focal neurological signs. Chronic forms of cerebral schistosomiasis caused by embolized schistosoma eggs are commonly manifested by epileptic attacks, usually in the form of partial seizures (*54*).

Paragonimiasis. This condition, which is caused by *Paragonimus westermani*, is prevalent in the Far East, south-east Asia, some parts of Africa, and South America. The lung is the primary site of infection but of the other sites, the brain is involved with the highest frequency. Cerebral paragonimiasis is one of the major neurological conditions in endemic areas (*55*). For example, in Korea it accounts for nearly a quarter of "brain tumours" (*56*). Seizures, usually focal motor, are the commonest manifestation (*57*).

Toxoplasmosis. Toxoplasmosis has recently assumed special status because it is a frequent opportunistic infection in patients with acquired immunodeficiency syndrome (AIDS) (*58*). Epilepsy is a well-recognized consequence of toxoplasmosis and occurs in about 25% of affected individuals (*59*). With the increasing incidence of AIDS in the tropics, toxoplasmosis may become a more important cause of epilepsy in developing countries. Approximately 40–60% of patients with congenital toxoplasmosis also have seizures.

African trypanosomiasis. This condition (sleeping sickness), caused by *Trypanosoma brucei*, is widely distributed throughout sub-Saharan Africa. The chronic stage of the disease is characterized by progressive neurological involvement, including generalized and partial seizures. Congenital cases may also occur and manifest as mental retardation and epilepsy.

American trypanosomiasis. This form of trypanosomiasis (Chagas disease) is caused by *T. cruzi* and is a public health problem in rural areas of Central and South America. The heart, oesophagus, and colon are the sites primarily affected. Cerebral involvement secondary to embolization of cardiac blood clots is a cause of late-onset epilepsy with a high frequency of partial seizures having elementary symptomatology (*60*).

Malaria. Malaria is endemic in tropical Africa, America, and Asia, as well as subtropical areas of the Eastern Mediterranean. Epilepsy has long been recognized as one of its late sequelae. Malaria is also a common cause of febrile seizures in the tropics. For example, in Congo, 9.6% of all children admitted to Brazzaville General Hospital in the period 1981–83 presented with seizures (*61*). Status epilepticus occurred in 13.6% of the cases and 67% of these were related to benign malaria; febrile seizures occurred in 73.5% of all cases, and 81% of them were related to malaria. Approximately 60% of all seizure disorders in children aged 1 month to 6 years in one large general hospital in Congo were related to benign or malignant forms of malaria, and seizures were the reason for admission of 10% of all children in this age range (*59*).

Other parasitic diseases. Diseases such as sparganosis, hydatid disease, toxocariasis, and ascariasis may also contribute to the etiology of epilepsy in the tropics.

[b] See footnote *a*, p. 249.

Bacterial infections

Tuberculous meningitis. This form of meningitis can cause epilepsy as a late sequela in 8–14% of patients and is frequently associated with hemiplegia (*62, 63*). Epilepsy is also a common manifestation of intracranial tuberculomas that present as slow-growing, space-occupying lesions (*64*). CT scans often identify small multiple tuberculomas in patients with tuberculous meningitis; these can develop and enlarge after tuberculous meningitis has been successfully treated (*65*). Tuberculomas can also be discovered accidentally in asymptomatic individuals and in children with focal or generalized seizures (*66, 67*). In India, ring or disc-like enhancing lesions, which are thought to be of tuberculous origin, have been identified in CT scans of patients who presented with simple partial epilepsy (*68*).

Pyogenic meningitis. This is common in the tropics, and epidemics of meningococcal meningitis occur from time to time in sub-Saharan Africa and Brazil. In the USA, among 734 survivors of intracranial infections the overall risk for epilepsy was increased sevenfold; for individuals with a diagnosis of brain abscess the risk was more than 40 times greater (*69*). In a study of 185 children who were followed up after bacterial meningitis, 13 developed one or more afebrile seizures after the initial hospitalization (*70*). These findings confirm that intracranial infections are important risk factors for epilepsy. This risk remains elevated for at least 20 years after the infection, although in most instances the onset is within 5 years of the onset of the acute illness (*69*).

Viral infections

Japanese encephalitis. Japanese encephalitis is perhaps the most important and best documented form of epidemic viral encephalitis in developing countries. At present, its incidence appears to be increasing and it is spreading across parts of Bangladesh, India, Myanmar, Nepal, Thailand, and Vietnam (*71*). Neurological sequelae, including intellectual and emotional changes and motor impairment, occur in up to 80% of survivors, especially children (*72*). In an outbreak that affected 128 patients in Bangalore, 1.3% of the 78 survivors developed epilepsy (*73*). In Chiang Mai, Thailand, of 59 children affected by Japanese encephalitis, 57% of the survivors had neurological sequelae—including 20% with epilepsy (*74*).

Perinatal factors

Data from case–control studies prove convincingly that perinatal pathology is a frequent cause of epilepsy. In developed countries, bearing in mind that acquired epilepsy constitutes about 40% of all cases, perinatal pathology should be the cause of about 13–14% of all epilepsies (*75*). The proportions from developing countries (Table 2), which vary from 1% to 14% seem to be an underestimate.

Hypoxaemic-ischaemic encephalopathy is the most frequent type of perinatal pathology that predisposes to epilepsy. The causes of perinatal hypoxia include severe maternal cardiovascular diseases, placental and umbilical cord diseases, prolonged labour, and airway obstruction at birth (*75*). In dystocic deliveries, the excessive reduction of fetal cranial diameters may lead to herniation of hippocampal regions through the incisura tentorium, causing ischaemia, atrophy, and subsequent gliosis of these structures ("mesial sclerosis"), which predisposes to epilepsy (*75*). Prematurity is also an etiological factor for epilepsy because of its strong association with neonatal cerebral lesions.

In many developing countries, most deliveries in rural areas are conducted by traditional birth attendants (*76*). Families are large, in certain areas the rate of twinning is high (*77*), and the incidence of pre-term deliveries is at least twice that in developed countries (*78*). Also, many of the mothers are multiparous, and it is not unusual to find women having babies well into their late forties (*76*). The incidence of brain damage in babies is five times greater if the mother is above 30 years of age (*78*). The mothers may also be malnourished, anaemic, and exposed to a variety of infections that could affect the baby *in utero* or at delivery. All these factors can contribute to perinatal brain damage.

Neonatal bilirubinaemic encephalopathy is a further disorder that can lead to epilepsy (*75*). Although relatively uncommon in developed countries, it is a particular problem in many developing countries; for example, in Nigeria it is the commonest cause of cerebral palsy, accounting for 50% of the cases (*77*); and in Singapore, it is the commonest cause of death in babies under the age of 1 week (*79*). Causative diseases such as glucose-6-phosphate dehydrogenase deficiency (43% of cases in the Singapore study) (*79*) and umbilical cord sepsis probably explain its high incidence in the tropics.

Febrile seizures

Febrile seizures are a common acute neurological disturbance of childhood, affecting about 2–5% of children (*4*). In view of the high frequency of febrile illnesses caused by diseases such as malaria, a higher prevalence of febrile convulsions would be expected in the tropics. The reported frequency of such convulsions varies from 64 per 100 000 in a semi-

urban and rural area of South India (*80*), 2.4 per 1000 in the Parsi community of Bombay (*81*), and 5.4 per 1000 in Ecuador (*16*), to 14% in the Mariana Islands (*5*). Febrile seizures are associated with a six-fold increased risk of subsequent epilepsy. The two conditions are probably not causally related, but rather are an independent outcome of a common underlying factor—either genetically determined or antecedent-localized abnormalities (*82*). It is worthwhile to investigate whether the seizures that accompany fevers such as malaria in the tropics are "febrile seizures" in the sense that the term is used in developed countries or whether they are the result of direct cerebral insult from infection. Also, the toxicity of some of the home remedies, such as cow's urine and herbal medicine used to treat convulsions in the tropics, may contribute to brain damage (*76, 77*).

Head injuries

Head injuries have been reported to be an important cause of epilepsy in adults in certain communities, particularly in Africa (*83, 84*). Such injuries are attributed to fighting and jousting with heavy sticks and knobkerries, a pastime that is both a national sport and a means of settling grievances (*85*). Cranial trauma related to personal attacks or to road traffic accidents is a very common cause of epilepsy in Brazil and Uruguay (*37, 86*). Also, in some tropical countries people climb trees to gather coconuts or tap toddy, and accidental falls may result in head injuries. Traffic accidents associated with poor regulation of motor vehicle transit, lack of seat belts, and lack of helmets for motor-cycle riders are a growing problem in developing countries.

Toxic agents

The neurotoxic potential of some home remedies used in the treatment of convulsions has been mentioned above. Toxicity, mainly from lead, often causes seizures in children. Refining of jeweller's wastes to recover gold and the reconditioning and smelting of lead-containing batteries to obtain scrap lead are the commonest sources of childhood plumbism in Sri Lanka (*87*). Burning lead-containing batteries for cooking purposes or to provide heat have also caused lead poisoning in children in poor communities (*88*).

A condition referred to as "epidemic epilepsy" in the Lakhimpur Kheri district of India has been attributed to the toxicity of the pesticide benzene hexachloride, which is used as a food grain preservative (*89, 90*).

Chloroquine, which is widely used in the tropics to treat malaria and hepatic amoebiasis, has been reported to cause seizures. This could be an idiosyncratic reaction; however, a causal relationship has not been clearly established (*91*).

Alcoholism is another important cause of seizures and also exacerbates primary epilepsy and triggers seizures in epileptic patients (*92*). Consumption of alcohol, illicit liquor in particular, is a growing problem in many developing countries, and its contribution as an etiological agent of epilepsy in the tropics merits further evaluation.

Genetic factors

The risk of epilepsy is increased threefold for individuals with a first-degree relative who has the condition (*93*). Also, a number of diseases that follow Mendelian patterns of inheritance may have seizures as one of their manifestations. In many developing countries, in-breeding is relatively common, and customary; and in some communities, the stigma of epilepsy prevents those affected from finding marriage partners from healthy families (*13*). Such practices are likely to increase the risk of seizure disorders in any offspring. In isolated communities, specific inherited diseases may contribute to the etiology of epilepsy, as in the Grand Bassa County of Liberia (*11*) and among the Wapogoro tribe in the United Republic of Tanzania (*20*).

Conclusions

Although over the past decade there has been significant progress in defining the magnitude of the problem, and identifying the likely etiological factors, our understanding of the epidemiology of epilepsy in developing countries is far from complete. The problem is compounded, particularly in areas where physicians and neurologists do not have ready access to large segments of the population, and where diagnostic methods such as CT scans and electroencephalography (EEG) may not be available. Other difficulties include the following: the diagnosis of epilepsy is not always straightforward and may require EEG confirmation; the classification of epilepsy and epileptic syndromes has become complicated and poorly suited for field studies; the definitions used vary in different studies; and the inclusion criteria are not always clear.

The potential number of etiological factors for epilepsy in developing countries is considerable, and many are preventable. Intracranial infections are of particular importance in this respect. Where simple preventive measures fail, the solution may lie in vaccination, e.g., the control of epidemic meningococcal meningitis. Epilepsy and other long-term sequelae of intracranial infections can be minimized by early

detection and prompt and adequate treatment. Enforcement of strict traffic regulations, such as speed limits and the wearing of helmets by motorcycle riders, and also increasing public awareness, are urgent needs in many developing countries that would slow the rapid increase in the number of head injuries caused by road accidents and the resultant post-traumatic epilepsy. Also, some form of genetic counselling should be made available at least in areas where a specific hereditary predisposition to epilepsy has been established.

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Résumé

Epidémiologie de l'épilepsie dans les pays en développement

L'épilepsie constitue un problème de santé important dans les pays en développement, où elle est à l'origine d'une morbidité élevée et de conséquences potentiellement graves. Sa prévalence est extrêmement variable, allant de 1,3 à 57 pour 1000 habitants. Cette prévalence est généralement faible dans les régions du nord de l'Inde et élevée dans plusieurs pays africains, notamment au Libéria (28/1000, 49/1000), au Nigéria (37/1000) et en République-Unie de Tanzanie (20/1000), ainsi qu'en Amérique latine – Colombie (17/1000 et 19,5/1000), Equateur (17/1000), Panama (22/1000 et 57/1000) et Venezuela (4,1 à 22,6/1000). La plupart des études rapportent un pourcentage plus élevé de crises d'épilepsie partielle, probablement en raison de la forte incidence de l'épilepsie symptomatique provoquée par des facteurs secondaires. A cet égard, les infestations parasitaires et en particulier la cysticercose, en sont l'une des principales causes. Au Mexique, la cysticercose est à l'origjne de la moitié des cas d'épilepsie d'installation tardive et en Equateur, d'un quart de tous les nouveaux cas. Au Brésil, c'est la cause d'épilepsie la plus facile à identifier. D'autres infections, telles que la méningite tuberculeuse et les abcès cérébraux sont également des facteurs déclenchants importants.

Dans de nombreux pays en développement, une forte proportion des accouchements a lieu à domicile, sans l'aide d'une sage-femme qualifiée. Dans certaines régions, les proportions de grossesses multiples et d'accouchements avant terme sont élevées. De nombreuses mères sont également multipares, malnutries, anémiées et exposées à toutes sortes d'infections pouvant toucher leurs enfants *in utero*. L'ictère nucléaire provoqué par un déficit en glucose-6-phosphate-déshydrogénase pose des problèmes particuliers dans certaines régions. Tous ces facteurs peuvent entraîner des lésions cérébrales dans la période périnatale et donc une épilepsie. En raison de la fréquence élevée des maladies fébriles, l'incidence des convulsions fébriles est élevée sous les tropiques; ces dernières peuvent être associées par la suite à un risque six fois plus élevé d'épilepsie.

Les traumatismes crâniens dus à des agressions, à des accidents de la circulation, ou à des chutes sont une autre cause importante d'épilepsie dans les pays en développement. Le potentiel neurotoxique de certains remèdes préparés à domicile et les poisons présents dans l'environnement tels que le plomb et les insecticides doivent également être pris en compte. Dans de nombreux pays, la consanguinité relativement fréquente et la stigmatisation associée à l'épilepsie peuvent empêcher ceux qui en souffrent de trouver un conjoint dans des familles en bonne santé; il peut s'ensuivre un risque augmenté de troubles comitiaux dans leur descendance.

Les facteurs étiologiques potentiels de l'épilepsie dans les pays en développement sont nombreux, même si beaucoup d'entre eux sont évitables. Une détection précoce et un traitement adéquat peuvent réduire le risque d'épilepsie et les autres séquelles à long terme des infections intracrâniennes. L'application d'une réglementation routière stricte, par exemple, limitation de vitesse, port du casque obligatoire pour les motocyclistes, et le fait de faire prendre conscience au public de ces problèmes, ralentirait l'augmentation rapide du nombre de lésions cérébrales dues à des accidents de la route et de l'épilepsie post-traumatique. Certaines formes de conseil génétique devraient être mises à la disposition du public, du moins dans les régions où il existe une prédisposition héréditaire particulière à l'épilepsie.

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