



# GHEC

Global Health Education Consortium

## **Global Burden of Neurological Disorders**

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**June 2009**

Prepared as part of an education project of the  
Global Health Education Consortium  
and collaborating partners

# Learning objectives

1. Discuss the epidemiology and treatment gaps in developing countries of neurological priority conditions.
2. Consider the cost-effectiveness of neurological treatments.
3. Review neurological services available worldwide and ways to expand the neurological workforce and neurological care.

# Epidemiologic transition

- Economic development leads to alterations in mortality and disease patterns
- Causes of death evolves from infectious diseases to non-communicable diseases in an increasingly aging population

# Global Burden of Disease study

- The Global Burden of Disease (GBD) study began in 1993 as a joint effort by the World Health Organization, World Bank, and the Harvard School of Public Health to assess the burden of disease for the year 1990
- Updated projections for 2002-2030 were published in 2005

[http://www.who.int/topics/global\\_burden\\_of\\_disease/en/](http://www.who.int/topics/global_burden_of_disease/en/)

# Global Burden of Disease study

- Group I: communicable diseases, maternal causes, conditions arising in the perinatal period, and nutritional conditions
- Group II: non-communicable diseases
- Group III: intentional and unintentional injuries

# Global Burden of Disease study

- Previous to the GBD study, population studies using only mortality data underestimated the burden of disease by not accounting for the impact of chronic diseases
- Using a new metric, the disability adjusted life years (DALY), the GBD study incorporated early mortality and morbidity of nonfatal chronic diseases in the assessment of health status

- Measures health gap between current and ideal health status
- $DALY = YLL + YLD$ 
  - YLL = years of life lost from premature mortality
  - YLD = years of healthy life lost from disability, weighted by severity of disability

Two additional adjustments for DALY calculations were age weighting and discounting of future life. Age weighting gives greater value to years lived in young adulthood, with value peaking at age 25, and less to years lived in beginning and end of life. Discounting (at a rate of 3%) gives greater value to health benefits obtained in the present compared to health benefits in the future. Standard life expectancy was taken to be 82.5 years for women and 80 years for men.

Though controversial, the DALY has become a widely used metric of burden of disease. For more discussion on DALYs, please see GHEC module #21 “Global burden of disease: Magnitude and measures.”

# DALY- disability weights

| Disability class | Disability Weights | Indicator Conditions  |
|------------------|--------------------|---|
| 1                | 0.00-0.02          | Vitiligo, weight for height < 2 SD                                  |
| 2                | 0.02-0.12          | Diarrhea, severe sore throat, severe anemia                         |
| 3                | 0.12-0.24          | Radius fracture, erectile dysfunction, rheumatoid arthritis, angina |
| 4                | 0.24-0.36          | Below knee amputation, deafness                                     |
| 5                | 0.36-0.50          | Rectovaginal fistula, mild mental retardation, Down syndrome        |
| 6                | 0.50-0.70          | Major depression, blindness, paraplegia                             |
| 7                | 0.70-1.00          | Active psychosis, dementia, severe migraine, quadriplegia           |

*Murray and Lopez. The Global Burden of Disease. Geneva, Switzerland: World Health Organization, 1996.*



## Note on DALY – Disability Weights

These disability weights were derived using the person trade-off method. Health workers were asked to make a judgment on how many years lived with a particular disability they would trade for a period of perfect health. These twenty two indicator conditions were weighted between 0 (perfect health) and 1 (death), representing severities of disability. For example, two years of life with a disability weight of 0.5 would be equivalent to one year of perfect health.

For more discussion on the disability adjusted life year, please see the module, “Global burden of disease: Magnitude and measures.”

# Disability weights for selected neurological conditions

| Condition   | Average disability weight<br>(varies with age, treatment) |
|---|---|
| Diabetic neuropathy                                     | 0.072   |
| Epilepsy  | 0.113   |
| Stroke: long term survivor                              | 0.266   |
| Parkinson's disease                                     | 0.351   |
| Poliomyelitis   | 0.369   |
| Meningitis: with motor deficit, with mental retardation | 0.381, 0.459  |
| Multiple sclerosis                                      | 0.411   |
| Malaria with neurological sequelae                      | 0.471   |
| Dementia  | 0.666   |

[http://www.who.int/healthinfo/global\\_burden\\_disease/GBD2004\\_DisabilityWeights.pdf](http://www.who.int/healthinfo/global_burden_disease/GBD2004_DisabilityWeights.pdf)

# **DALY- Disability adjusted life year**

One DALY = one lost year of healthy life as a result of disease or injury

One year of life without disability

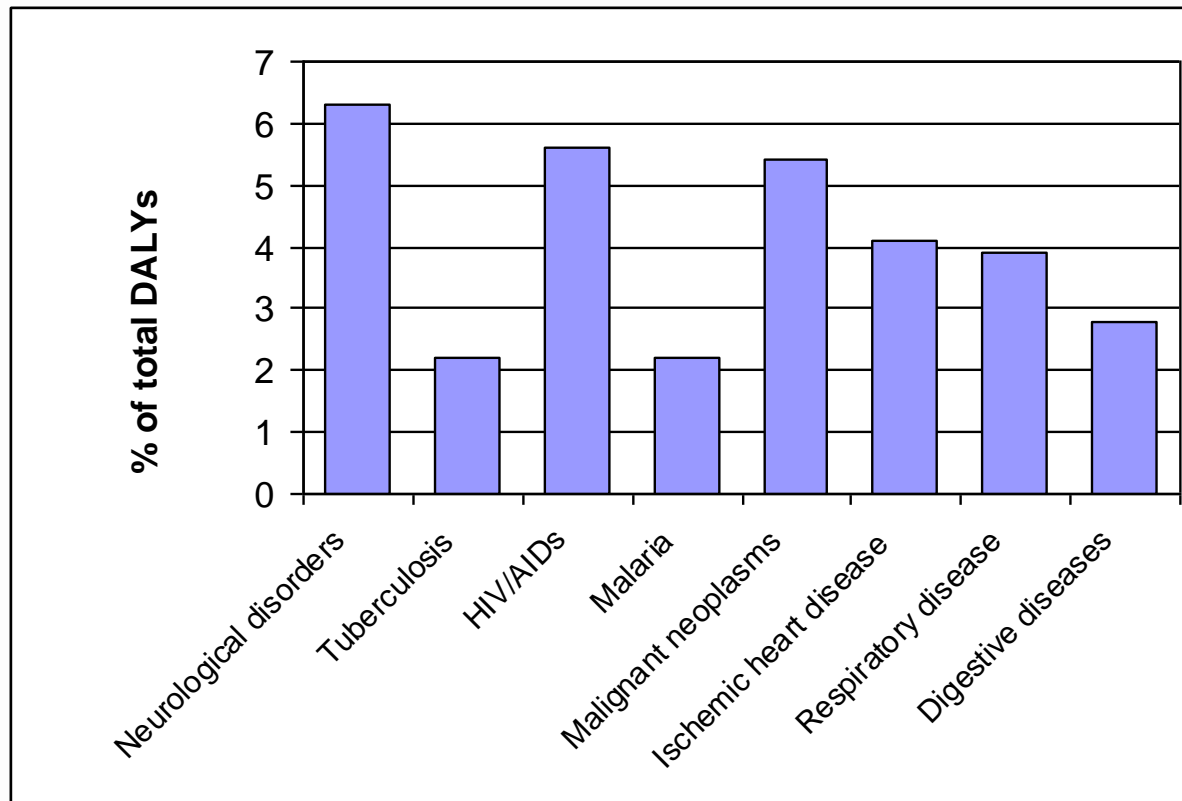
or

Two years of life with 50% disability

# Global Burden of Disease study

Many previously unrecognized neurological disorders, *which cause significant disability but not mortality*, emerged as priority health problems

# Global Burden of Disease: Neurological disorders 2005



Neurological disorders = 6.3% of the global burden of disease by DALYs, or *more than.....*

- HIV/AIDS
- ischemic heart disease
- respiratory disease

Neurological Disorders: Public Health Challenges. Geneva, Switzerland: World Health Organization, 2006

# Notes on: Global Burden of Disease: Neurological disorders

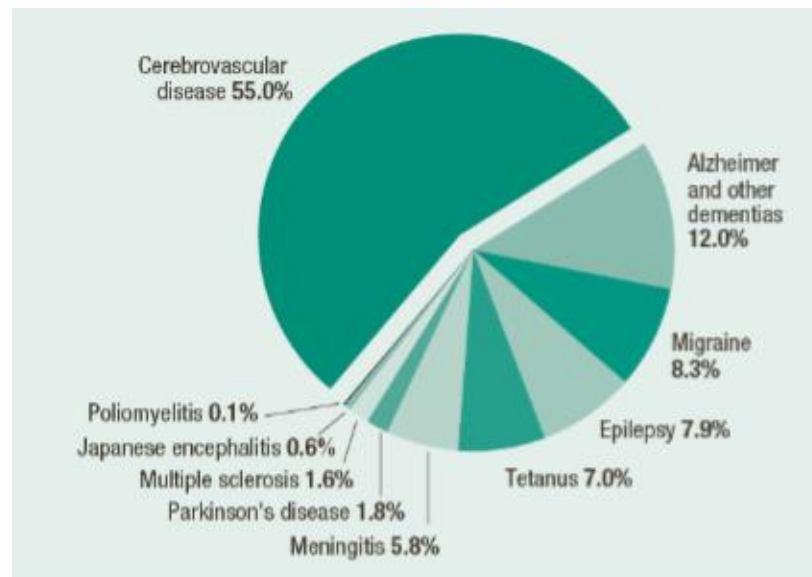
## Neurological disorders for GBD included

1. disorders grouped into a primary neuropsychiatric cause category (epilepsy, dementias, parkinson's disease, multiple sclerosis, migraine)
2. disorders with neurologic sequelae grouped in other cause categories (cerebrovascular disease, poliomyelitis, tetanus, meningitis, Japanese encephalitis).

Some categories of disease which can cause substantial neurological sequelae were not included under neurological disorders. This is discussed in more detail later in the module.

# Neurological burden of disease

DALYs for individual neurological disorders as percent of total



- Major contributors to the neurological burden are non-communicable diseases
  - Cerebrovascular disease
  - Dementias
  - Migraine
  - Epilepsy
- These diseases account for 83% of the neurological burden

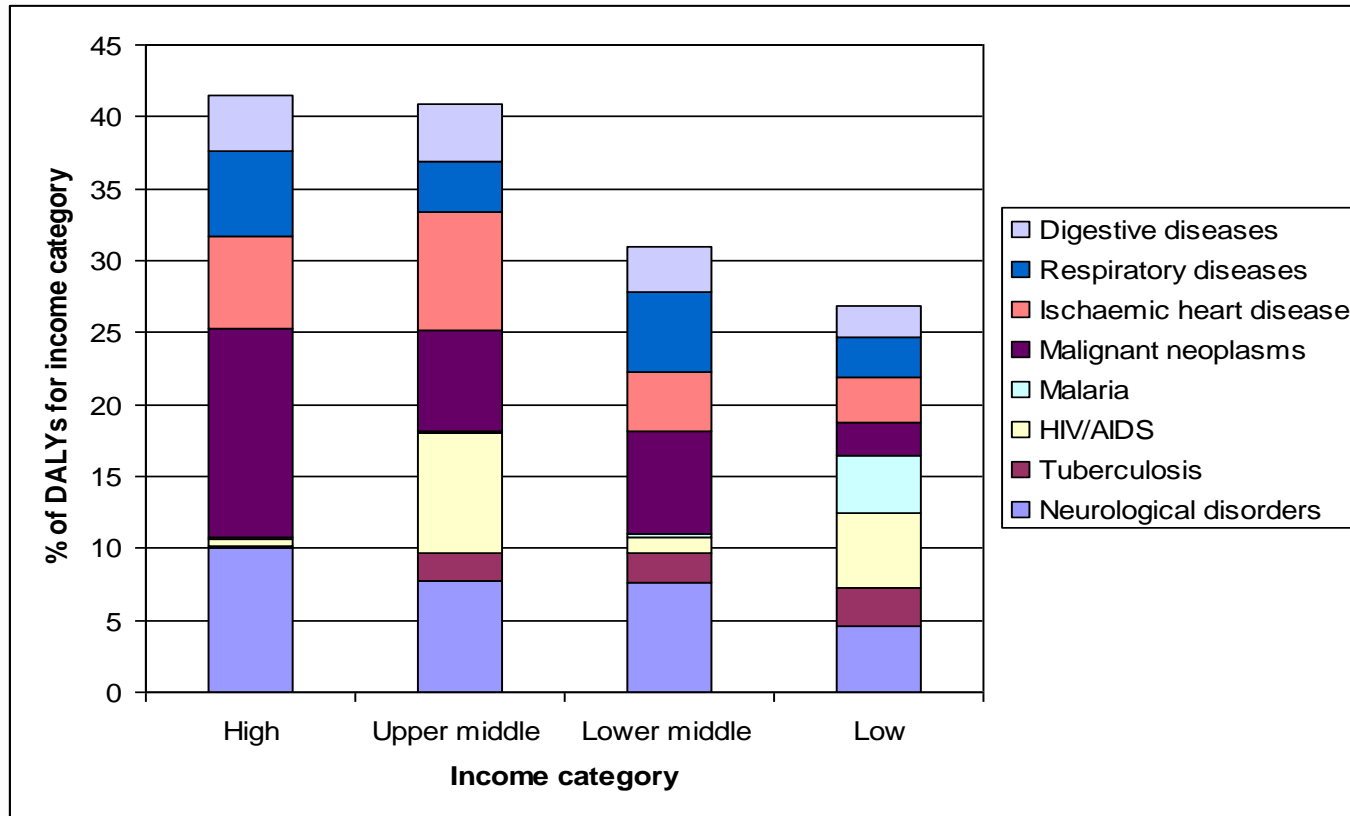
*Neurological Disorders: Public Health Challenges. Geneva, Switzerland: World Health Organization, 2006*

# **Global Burden of Disease: Neurological disorders 2005**

- The GBD study brought attention to the fact that neurological disorders affect both developing and developed countries
- In particular, lower income countries suffer the double burden of communicable and non-communicable diseases



# Neurological disorders across World Bank income categories



World Health Organization, Burden of Disease Statistics.

[http://www.who.int/healthinfo/global\\_burden\\_disease/estimates\\_regional/en/index.html](http://www.who.int/healthinfo/global_burden_disease/estimates_regional/en/index.html)

.Assessed 6/30/2009

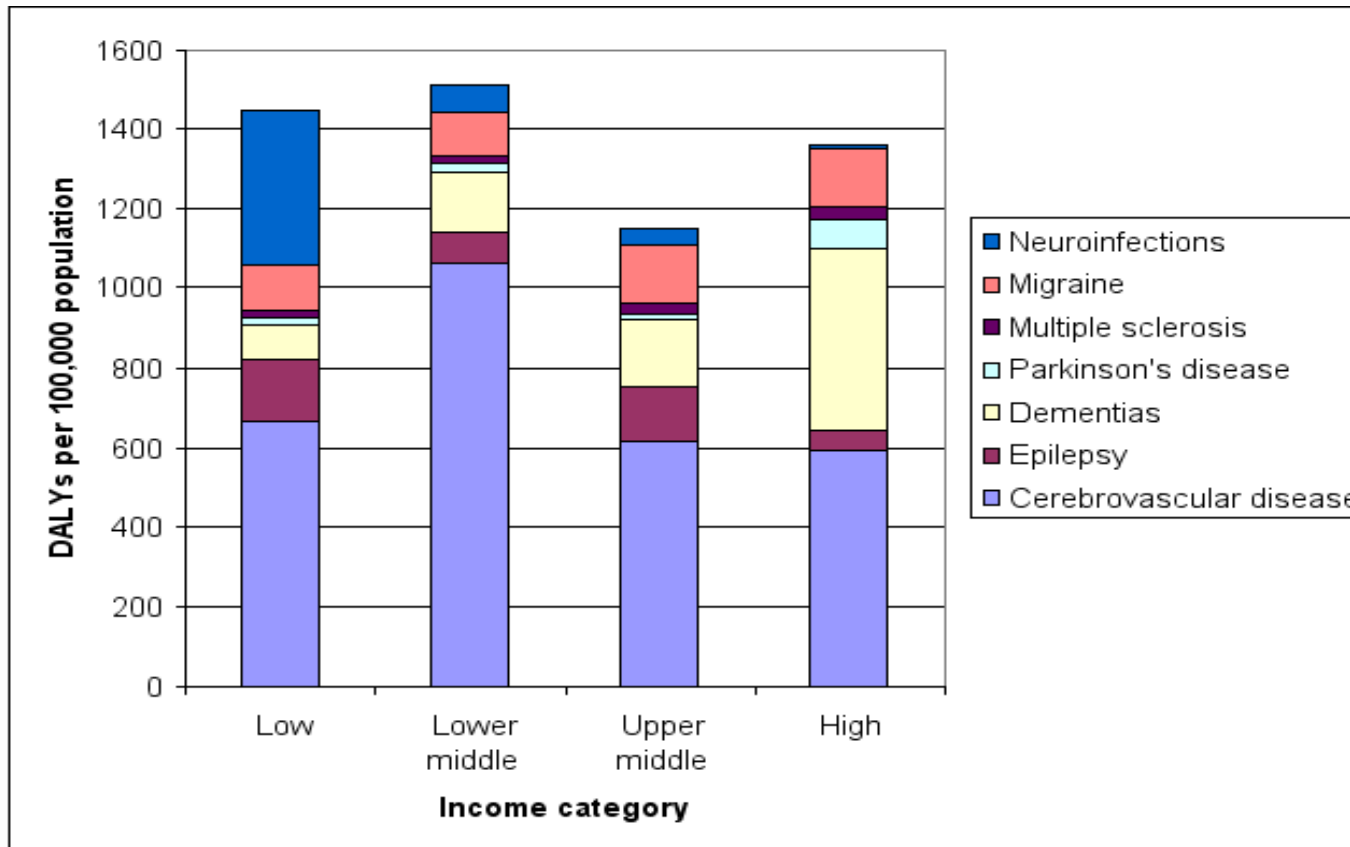
## Notes on Neurological disorders across World Bank income categories

This graph compares the burden of neurological disorders with the same disease categories in slide 12, but stratifies the burden by high income, upper middle income, lower middle income, and low income countries. In this graph, the burden of disease is represented as a percentage of total DALYs for that income category. Even in low income countries, the burden of neurological disorders is 4.6%, comparable to malaria (4.0%), HIV/AIDs (5.2%), and tuberculosis (2.7%) in those regions. This graph was compiled from publicly available WHO GBD statistics for 2004. (*World Health Organization, Burden of Disease Statistics.*

[http://www.who.int/healthinfo/global\\_burden\\_disease/estimates\\_regional/en/index.html](http://www.who.int/healthinfo/global_burden_disease/estimates_regional/en/index.html). Assessed 6/30/2009).

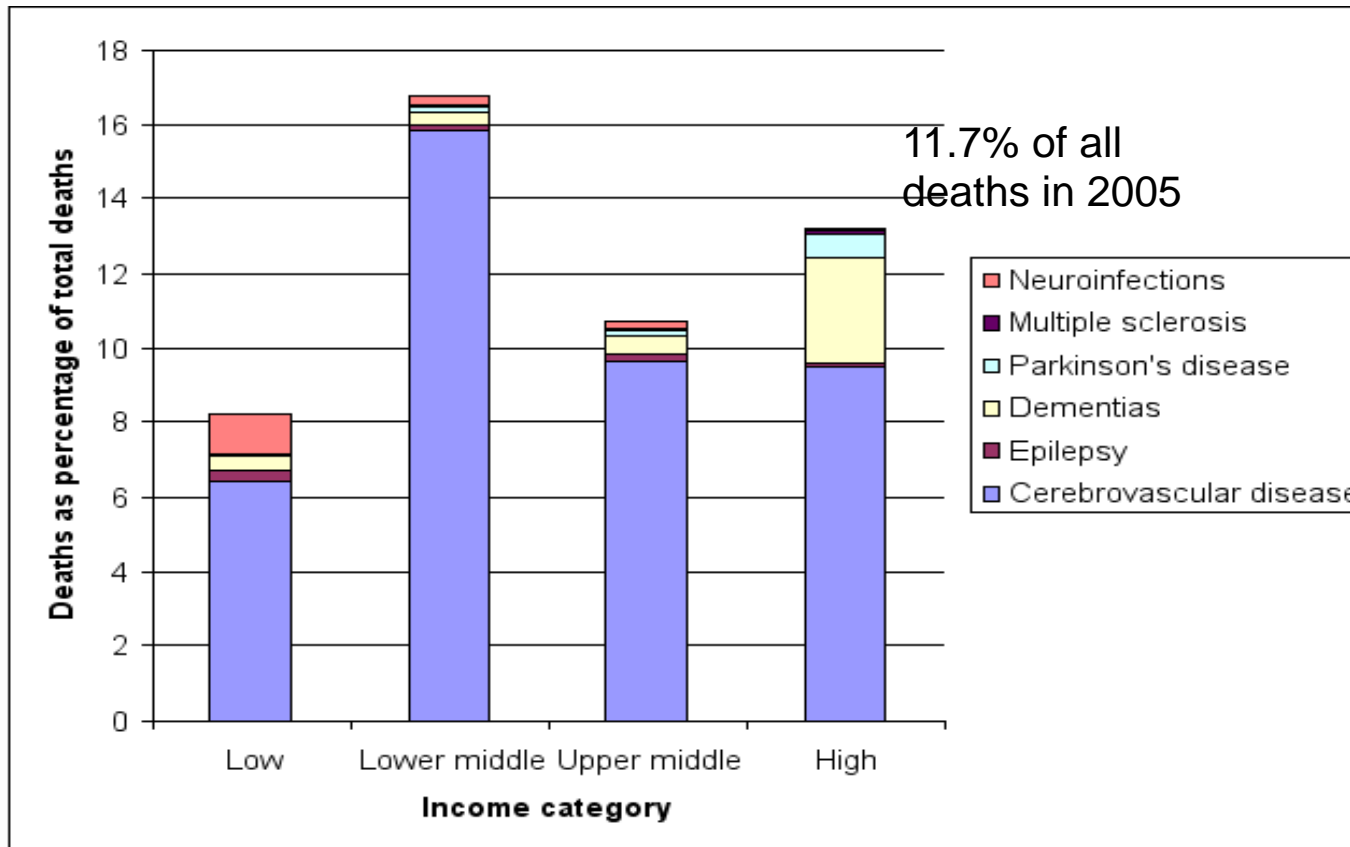
Neurological diseases included in this graph were cerebrovascular disease, dementias, migraines, epilepsy, tetanus, meningitis, parkinson's disease, multiple sclerosis, Japanese encephalitis, and poliomyelitis.

# Neurological burden of disease across World Bank income categories



Neurological Disorders: Public Health Challenges. Geneva, Switzerland: World Health Organization, 2006

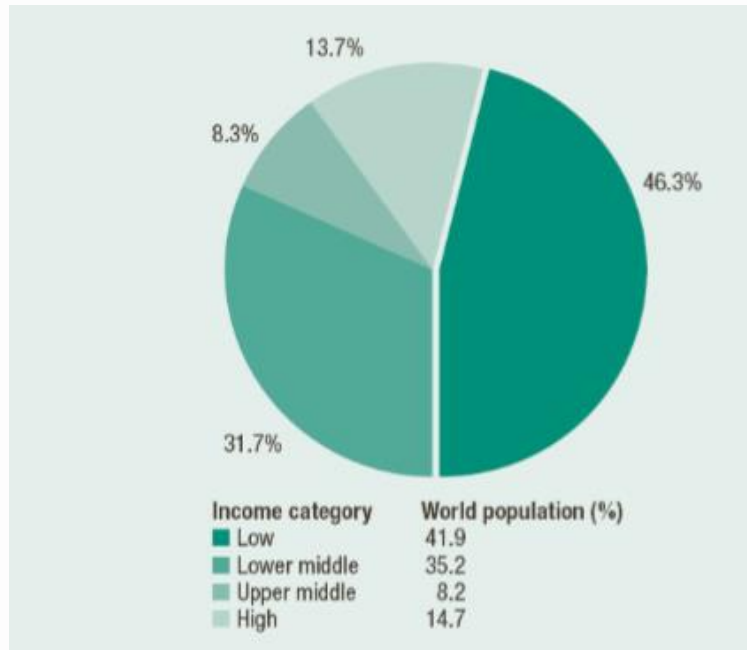
# Neurological mortality across World Bank income categories



*Neurological Disorders: Public Health Challenges. Geneva, Switzerland: World Health Organization, 2006*

# Neurological morbidity across World Bank income categories

YLDs associated with neurological disorders as percent of total



78% of YLDs\* due to neurological disorders occur in lower income countries

*\*YLDs = years of healthy life lost with disability*

Neurological Disorders: Public Health Challenges. Geneva, Switzerland: World Health Organization, 2006

## **Notes on Neurological morbidity across World Bank income categories**

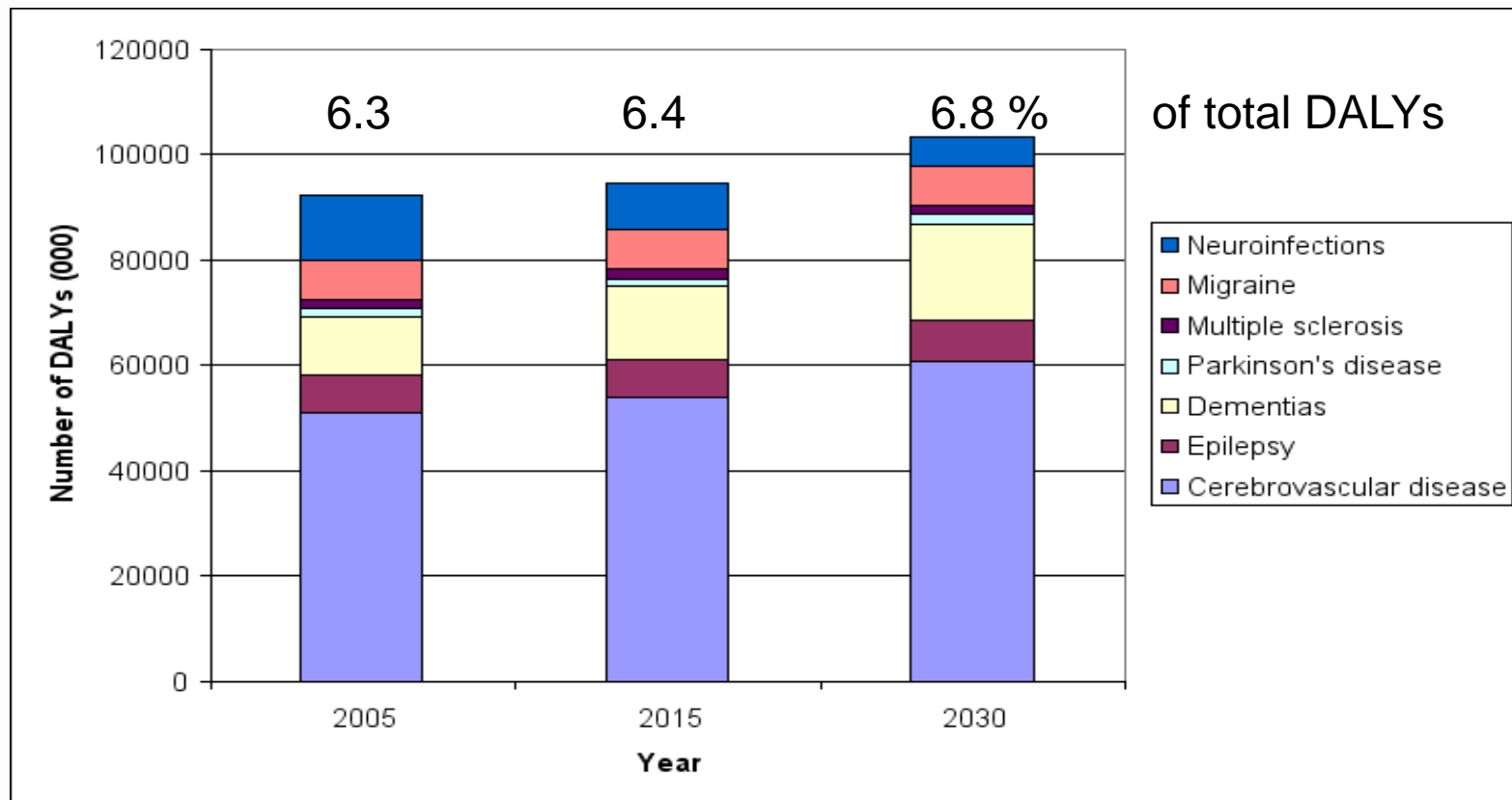
Calculation of years of healthy life lost (YLDs) included nutritional deficiencies/neuropathies and neurological injuries. These were not included in estimates of mortality and DALYs, as mortality is attributed to one underlying cause, whereas YLDs are separately estimated for each neurological sequelae. For example, take the case of a person who sustains a spinal cord injury/paraparesis from a car accident who dies of cancer ten years later, The mortality would be attributable to cancer, but YLDs can be separately calculated for the ten years lived with the neurological sequelae of paraparesis.

Neurological disorders accounted for approximately 14% of total years of health life lost (YLDs) in 2005. Nutritional deficiencies/neuropathies and neurological injuries accounted for half of this YLD burden.

# Global Burden of Disease: Neurological disorders 2005 to 2030

- The neurological disease burden will continue to increase. DALYs for neurological disorders are projected to increase 12% from 2005 to 2030
  - 62% increase in neurodegenerative diseases (dementias, Parkinson's disease)
  - 20% increase in cerebrovascular diseases
  - 57% decrease in neuro-infectious diseases

# Neurological burden of disease: Projections from 2005 to 2030



*Neurological Disorders: Public Health Challenges. Geneva, Switzerland: World Health Organization, 2006.*



# Neurological sequelae of other diseases and conditions

- Some diseases and conditions, which are not primary neurological diseases or infections, can cause substantial neurological sequelae
  - Not included in the analysis of neurological burden/DALYs
  - Include HIV/AIDs, tuberculosis, parasitic diseases (schistosomiasis, cysticercosis), measles, birth asphyxia, birth trauma, and malnutrition
  - Many occur more commonly in lower income countries

# Malnutrition: examples of neurological manifestations

- Affects more than 800 million people in the world
- Neurological manifestations from both nutritional deficiencies and toxic exposures
- Nutrient deficiencies (some examples)
  - B1 (thiamine): *polyneuropathy, visual disturbances, cardiovascular complications*
  - B3 (niacin): *diarrhea, dermatitis, dementia*
  - B6 (pyridoxine): *seizures*
  - B12 (cobalamine): *anemia, glossitis, myeloneuropathy, confusion/dementia*
  - Folate: *peripheral neuropathy, neural tube defects, anemia*
  - Iodine: *mental retardation, hypothyroidism*

*Neurological Disorders: Public Health Challenges. Geneva, Switzerland: World Health Organization, 2006.*

# Malnutrition: examples of neurological manifestations

- Toxic exposures: scarce food sources can lead to consumption of plants that contain neuro-toxic substances
  - Cassava based diets
    - leads to excessive exposure to cyanide
    - progressive syndrome of painful polyneuropathy, ataxia, and blurry vision (from optic atrophy)
    - has also been associated with spastic paraparesis (increased tone and weakness of limbs with preserved sensation)
    - outbreaks have been reported in Africa (Nigeria, Democratic Republic of Congo, Cameroon)
  - Grass pea (*Lathrus sativa*)
    - thought to be due to an excito-toxic amino acid
    - leads to an acute to subacute onset of spastic paraparesis
    - continues to be a public health problem in Bangladesh, India, and Ethiopia

*Neurological Disorders: Public Health Challenges. Geneva, Switzerland: World Health Organization, 2006.*

# Disease Control Priorities Project

- The Disease Control Priorities Project (DCPP) examines emerging and current public health problems in low and middle income countries
- DCPP assesses the public health significance and cost-effectiveness of interventions of priority conditions

<http://www.dcp2.org/main/Home.html>

# Neurological Priority Conditions

From: *Disease Control Priorities in Developing Countries*, 2nd edition (DCP-2), 2006

- Alzheimer's disease and other dementias
- Parkinson's disease
- Epilepsy
- Stroke

*Chandra V et al. "Neurological Disorders." 2006. Disease Control Priorities in Developing Countries (2<sup>nd</sup> edition), ed., New York: Oxford University Press.*

- By 2040, 71% (58 million) of dementia cases will be in the developing world
- Growth projections for dementia are highest in China and southeast Asia, with a 300% increase between 2001 and 2040, compared to a 100% increase in developed countries
- Most common types are Alzheimer's and vascular dementia
- Risk factors include age, low education, and vascular factors (hypertension, hyperlipidemia, diabetes)
- Dementias are likely underdiagnosed in many developing countries, misclassified as "normal aging"

*Kalaria RN et al. "Alzheimer's disease and vascular dementia in developing countries: prevalence, management, and risk factors." Lancet Neurology 2008; 7: 812-826.*

## Notes on Dementias

- Potentially reversible causes of dementia include hypothyroidism, B12 deficiency, and neurosyphilis.
- Risk of Alzheimer's disease, the most common type of dementia, increases with age. The neurodegeneration that occurs in Alzheimer's is due to abnormal accumulation of proteins inside and outside neuronal cells (neurofibrillary tangles and amyloid plaques). A clinical diagnosis of Alzheimer's requires that the cognitive changes lead to impairment in social or occupational functioning, in contrast to cognitive changes that occur with "normal" aging. While at present clinical and imaging features can lead to a probable diagnosis of Alzheimer's, a definitive diagnosis can only be made pathologically upon death.
- Research efforts have been focused on developing therapies to interfere with the abnormal protein deposition that occurs in Alzheimer's. Recent studies also suggest that cardiovascular disease (hypertension, hyperlipidemia) and diabetes may affect the development and course of Alzheimer's disease.

- Anticholinesterase inhibitors and memantine improve cognitive performance in short term, but likely not cost-effective interventions on large scale
- Caregiving in developing countries is provided mainly at home by family. Around 20% of people with dementia live alone or with a spouse only
- Dementia care and services should include reducing caregiver burden through support and training

One must recognize the assumptions made in the analysis that anticholinesterase inhibitors for dementia are not cost-effective. Calculations were made with the assumption that there were no benefits to the patient in disability or mortality, but that there were decreased caregiver hours based on improvement in a patient's cognitive function. The cost per hour of caregiver time saved was \$13 across low and middle income countries, which would be more than the wage rate in these regions for hired caregivers (\$1-\$1.50).



# Parkinson's disease

- Prevalence
  - 1-2 per 1000 persons
  - 1% of people over age 65

*Neurological Disorders: Public Health Challenges. Geneva, Switzerland: World Health Organization, 2006.*

# Parkinson's disease

- Early studies had shown ethnic variation in prevalence.
  - China was reported to have the lowest worldwide, *but.....*
  - 1997-98 comprehensive cross-sectional prevalence study in rural and urban communities in China found prevalence of Parkinson's disease for people > 55 similar to that in developed countries
- Underdiagnosis may contribute to wide regional variability

Zhang ZX et al. "Parkinson's disease in China: prevalence in Beijing, Xian, and Shanghai." *Lancet* 2005; 365:595-597.

# Parkinson's disease – treatment

- Medications
  - Motor symptoms: mainstay of therapy are levodopa-carbidopa and dopamine agonists
  - Non-motor symptoms: medications targeting autonomic, sleep and cognitive disturbances
- Surgical interventions for advanced disease
  - Ablative procedures
  - Deep brain stimulation

# Parkinson's disease – treatment gap

- Availability of drugs is highly variable
  - 12.5% in Africa
  - 79.1% in Europe
- Surgical interventions not widely available in developing countries

*Neurological Disorders: Public Health Challenges. Geneva, Switzerland: World Health Organization, 2006.*

# Parkinson's disease – treatment gap

- Underdiagnosis, as illustrated in cross-sectional prevalence study in China
  - 48% of people were diagnosed with Parkinson's disease for the first time by study investigators (68% rural, 37% urban)
  - Only 37% received levodopa treatment prior to the study

# Epilepsy

- Prevalence
  - 8 per 1000 in high income countries
  - 9.5 per 1000 in low income countries, with some reports as high as 20 to 30 per 1000

*Neurological Disorders: Public Health Challenges. Geneva, Switzerland: World Health Organization, 2006.*

# Epilepsy

- Consequences
  - Injuries from seizures, asphyxia, sudden death
  - In developing countries, additional concerns include
    - Burns from falling into cooking fires
    - Social stigma
      - In some cultures, epilepsy is thought to be
        - » due to possession by demons or spirits
        - » contagious
      - Studies looking at social consequences of epilepsy have shown decreased school attendance, employment rates, and marriage rates

# Epilepsy

- Causes
  - Trauma, central nervous system infections, cerebrovascular disorders, perinatal risk factors, tumors, and congenital/genetic
  - Etiology of 40-50% of cases remain unknown
- Trauma and infections are two preventable causes
  - More common in developing countries
  - May account for increased prevalence in developing countries

*Atlas Epilepsy Care in the World 2005. Geneva, Switzerland: World Health Organization, 2005.*



# Epilepsy – treatment

- Anti-epileptic medications
  - Phenobarbital is the most commonly prescribed in low income countries
    - At a typical dose, Phenobarbital costs less than \$5 per person annually
  - Phenytoin, carbamazepine and valproic acid are other first line agents
  - Newer anti-epileptic agents available, but are more expensive
  - Costs and availability vary across countries

# Epilepsy – treatment

- If properly treated, up to 70% of people with epilepsy can become seizure free with medical therapy
- For refractory epilepsy, epilepsy surgery may be beneficial

# Epilepsy – treatment gap

- 80% of the global burden lies in developing countries
  - Estimated that more than 80% of people in developing countries with epilepsy do not receive treatment
  - Many are never diagnosed
  - Availability of medications variable and erratic
- Epilepsy surgery for refractory epilepsy is not available in more than 50% of countries

# Stroke

- By 2015, 90% of the 50 million DALYs attributed to stroke will be in low and middle income countries
- Between 2002 and 2030, stroke mortality will increase faster in low and middle income countries than in high income countries

*Strong K, Mathers C and R Bonita. "Preventing stroke: saving lives around the world." Lancet Neurology 2007; 6:182-187.*

# Stroke

- Two-thirds of stroke burden occurs in people under age of 70
- 80% of strokes are ischemic and 20% are hemorrhagic. The proportion of hemorrhagic strokes is much higher in some countries such as China and Japan
- Transient ischemic attack (TIA) is associated with a high early risk of stroke

# Stroke – primary prevention

- Risk factors include modifiable factors such as.....

Obesity

Tobacco use

Poor diet

Hypertension

Hypercholesterolemia

Physical inactivity

# Stroke – primary prevention

- Over 60% of stroke mortality in low-income and middle-income countries is due to joint effects of tobacco use, poor diet, and hypertension
- Low-income and middle-income countries also suffer from preventable risk factors rarely encountered in high-income countries
  - For example, rheumatic heart disease increases risk for embolic strokes

# Stroke – treatment

- Acute treatments:
  - In ischemic stroke, aspirin and thrombolysis
    - prevents early stroke recurrence
    - increases disability-free survival
  - Treatment in stroke units leads to
    - 17% relative risk reduction in one year mortality
    - decrease in disability and institutionalization
    - absolute treatment effect similar to thrombolysis



# Stroke – treatment

- Secondary prevention
  - Antiplatelet agents
  - Lowering of blood pressure and cholesterol
  - Diabetes control
  - Anticoagulation for atrial fibrillation
  - Surgical treatment for significant ipsilateral carotid stenosis

# Stroke – treatment gap

- Treatment gap exists in all aspects of stroke care: prevention, diagnosis, treatment, and rehabilitation
- Computed tomography to distinguish between ischemic and hemorrhagic stroke is not widely available
- Out-of-hospital treatment of stroke is an accepted practice in many developing countries. Even with in-hospital treatment, stroke teams and units are rarely available

# Stroke – treatment gap

- TIAs are underrecognized and not treated as neurological emergencies requiring the same evaluation and treatment as stroke
- Simple, cost-effective interventions such as antiplatelet agents are not administered in a systematic manner
- Surgical interventions are available in only a few centers

# Headache disorders

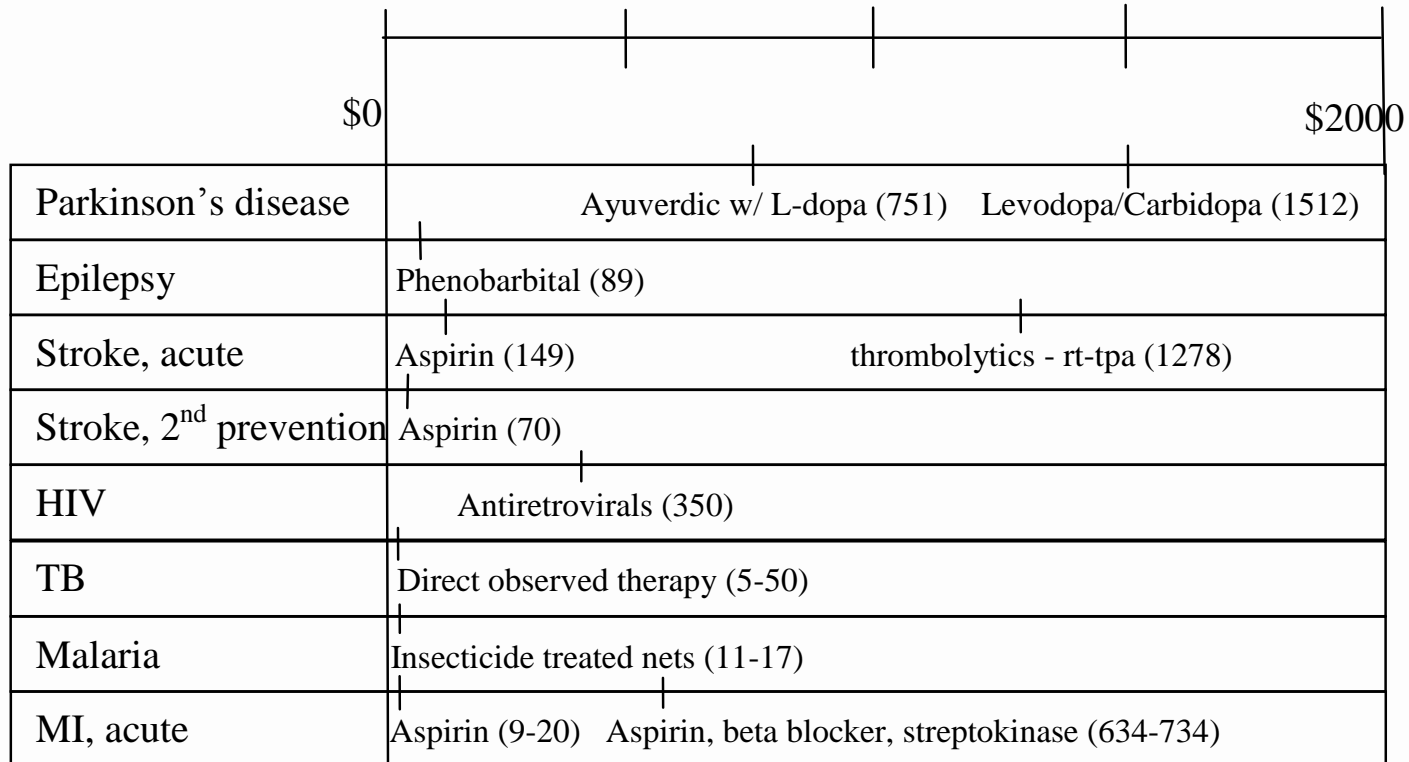
- Data were not widely available to study headache disorders in DCP-2, but headaches are widespread and widely undertreated
- Migraines alone account for 0.5% of the global burden of disease

*Neurological Disorders: Public Health Challenges. Geneva, Switzerland: World Health Organization, 2006.*

# Headache disorders

- Primary headache disorders include migraine, tension headaches, and cluster headaches
- Secondary headache disorders associated with a variety of underlying etiologies, including infections, tumors, vascular disorders, and trauma
- Effective treatment of headache is available, but grossly underutilized

Cost per DALY gained



*Disease Control Priorities in Developing Countries (2<sup>nd</sup> edition), ed., New York: Oxford University Press, 2006.*

Incremental cost effective ratios were obtained by calculating the DALYs gained by a population with the treatment or intervention (DALYs lost without treatment compared with DALYs lost with treatment), and then dividing by the treatment cost. Incremental cost effective ratios for several common global health interventions are included for comparison. Aspirin and phenobarbital are highly cost-effective interventions for stroke and epilepsy, respectively. Ayuverdic preparations containing L-Dopa is more cost-effective than commercial preparations of levodopa/carbidopa.

# Neurological resources

*Despite the high global burden of neurological disorders*

- Access to neurological care is highly variable and poor in many parts of the world.
- The vast majority of global health dollars continues to be allocated towards infectious disease research and treatment.

# Neurological resources

Median number per 100,000 population

| Region           | Beds       | Neurologists | Neuro-nurses | Neuro-surgeons | Neuro-pediatricians |
|------------------|------------|--------------|--------------|----------------|---------------------|
| Africa           | 0.3        | 0.03         | 0            | 0.01           | 0                   |
| Americas         | 1.7        | 0.89         | 0.14         | 0.76           | 0.12                |
| E. Mediterranean | 1.5        | 0.32         | 0.13         | 0.37           | 0.06                |
| Europe           | 17.1       | 4.84         | 2.43         | 1.02           | 0.47                |
| SE Asia          | 0.3        | 0.07         | 0.005        | 0.03           | 0.003               |
| W. Pacific       | 2.6        | 0.77         | 0.32         | 0.39           | 0.08                |
| <b>World</b>     | <b>3.6</b> | <b>0.91</b>  | <b>0.11</b>  | <b>0.56</b>    | <b>0.1</b>          |

Janca A et al. "WHO/WFN Survey of neurological services: A worldwide perspective." *Journal of the Neurological Sciences* 2006; 247:29-34.



**Notes on Neurological resources** -- Many parts of the world suffer from a shortage of health service providers (doctors, nurses, midwives, therapists). For more discussion on the health workforce, please see GHEC module #69 “Human Resources for Health: A Worldwide Crisis.”

Between 2001-2003, the World Health Organization (WHO) and World Federation of Neurology (WFN) conducted a survey of neurological services involving 109 countries. Part of the survey evaluated neurological services available in primary care, as emergency care and follow-up treatment. Worldwide, about three quarters of countries reported both access to emergency care and follow-up treatment. This was lowest in Africa and the Western Pacific, where about one fourth of countries did not have emergency care and one third did not have follow-up treatment. The table depicted in this slide addresses the availability of neurological beds and providers, with a paucity of service providers in Africa and Southeast Asia.

## Percentage of countries in region

| Region (n=number of countries providing data) | Pediatric neurology | Neurological rehabilitation | Neuroradiology | Stroke units |
|---|---------------------|-----------------------------|----------------|--------------|
| Africa (16)                                   | 37.5                | 18.8                        | 18.8           | 31.3         |
| Americas (14)                                 | 100                 | 78.6                        | 92.9           | 64.3         |
| E. Mediterranean (18)                         | 68.4                | 73.7                        | 84.2           | 26.3         |
| Europe (42)                                   | 95.2                | 88.1                        | 85.7           | 83.3         |
| Southeast Asia (6)                            | 66.7                | 83.3                        | 100            | 83.3         |
| Western Pacific (9)                           | 88.9                | 77.8                        | 88.9           | 77.8         |
| <b>World</b>                                  | <b>80.6</b>         | <b>73.2</b>                 | <b>77.8</b>    | <b>62</b>    |

Janca A et al. "WHO/WFN Survey of neurological services: A worldwide perspective." *Journal of the Neurological Sciences* 2006; 247:29-34.

Despite a paucity of neurological service providers in Southeast Asia, the region reported a high percentage of countries with neurological rehabilitation, neuroradiology, and stroke units. (However, note that only 6 countries in Southeast Asia responded to this part of the survey). Again Africa has a paucity of these neurological specialty services, with more than 80% of African countries without neurological rehabilitation or neuroradiology.

# Expanding neurological care

With a global shortage of neurologists, improving neurological care around the world will require innovative strategies for improving neurological care within existing health structures/primary care networks.

# Expanding neurological care: training primary health workers

*Where there is no neurologist: Manual for paramedical professionals in developing countries*, by Gretchen Birbeck

- Based on success of a one week intensive training session in Chikankata, Zambia, this is incorporated into training of all clinical officers in Zambia.
- Manual is available free online at <http://www.wfneurology.org/africanExperience.php>

*Epilepsy: A Manual for Medical and Clinical officers in Africa*, by P.A. Dekker

- Manual is available free online at [http://www.who.int/mental\\_health/resources/epilepsy/en/index.html](http://www.who.int/mental_health/resources/epilepsy/en/index.html)

# Expanding neurological care: community-based interventions

- Global campaign against epilepsy
  - Joint project of World Health organization (WHO), International League Against Epilepsy (ILAE), and the International Bureau for Epilepsy (IBE)
  - Demonstration projects in developing countries that includes incorporation of epilepsy care at the primary care level

- Community-based intervention trial in rural China using phenobarbital for epilepsy
  - 2455 patients with epilepsy identified at primary care level
    - Treated by local physicians provided special training over 1-5 days with protocol in screening, treatment, and follow-up
    - Neurologist confirmed diagnosis
  - After two year of treatment, 25% of patients were seizure free and 72% had a decrease in seizure frequency by at least half

*Wang WZ et al. Efficacy assessment of phenobarbital in epilepsy: a large community-based intervention trial in rural China. Lancet Neurology 2006 5:46-52.*

Similar WHO/ILAE/IBE demonstration projects against epilepsy have been undertaken in different regions, including Argentina, Brazil, Zimbabwe, and Senegal. In Cameroon, an intervention program also demonstrated the efficacy of nurse-led care for epilepsy in a rural health district, using structured management protocols (Kengne A, et al. Nurse-led care for epilepsy at primary level in a rural health district in Cameroon. *Epilepsia* 2008; 49: 1639-1641). Over a 22 month duration, 224 patients were treated; 158 of these patients were new to the clinic during this time period. Data derived from 186 patients (83%), who attended more than one clinic visit, showed mean monthly seizure frequency decreased by 75%. Interventions programs collaborating with traditional healers are also under study (Kendall-Taylor, et al. Traditional healers and epilepsy treatment on the Kenyan coast. *Epilepsia* 2008; 49: 1638-1639).

## Expanding neurological care: community based interventions

- Cardiovascular preventive care at primary care level
  - Primary prevention: population studies have estimated that each 10mmHg lower systolic pressure results in one to two fifth reduction in cardiovascular disease
  - Secondary prevention: blood pressure lowering after TIA or stroke leads to 30-40% decrease in risk of recurrent stroke or cardiovascular events
- In Japan, educational campaigns and treatment of high blood pressure have lowered stroke rates by more than 70%

## Expanding neurological care: community based interventions

- WHO cardiovascular disease risk (CVD) management package
  - Guides healthcare providers to assess and manage cardiovascular risk factors in low and middle income countries
  - Risk assessment and risk management algorithms, lifestyle counseling and drug treatment protocols, referral pathways
  - Scenarios for different levels of resource availability

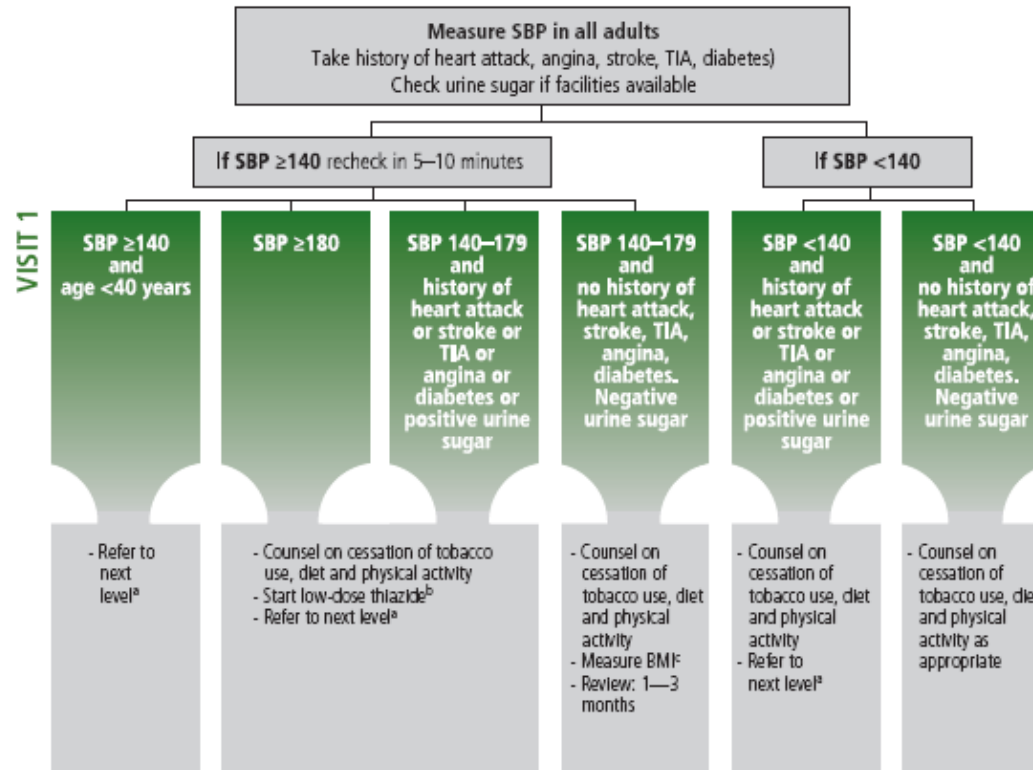
*Integrated Management of Cardiovascular Risk: report of a WHO meeting, Geneva 9-12 July 2002.  
WHO CVD-Risk Management Package for low- and medium- resource settings. Geneva, Switzerland: WHO 2002.*



# WHO CVD risk management package

- Scenario one: non physician health worker
- Scenario two: medical doctor or specially trained nurse
- Scenario three: medical doctor with access to full specialty care

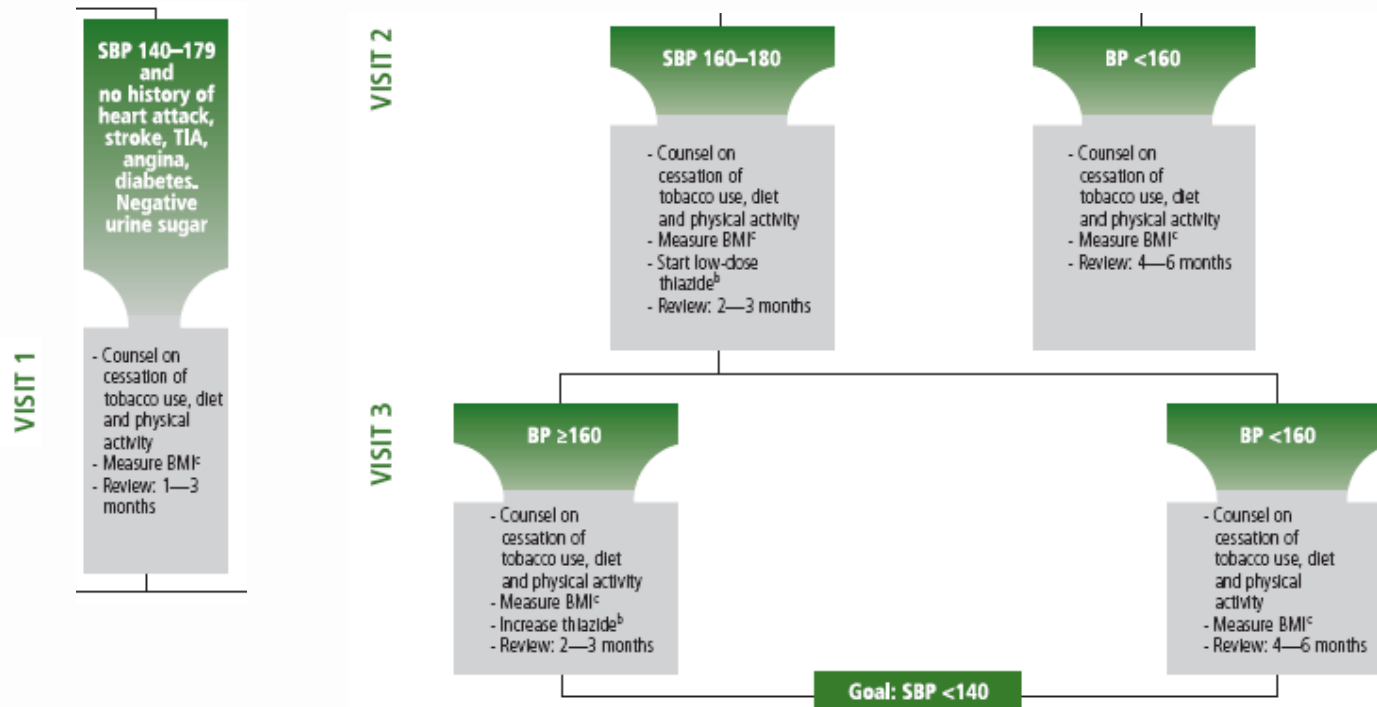
# WHO CVD risk management package: Scenario I (non physician health worker)



WHO CVD-Risk Management Package for low- and medium- resource settings.  
Geneva, Switzerland: WHO 2002.

For example, a patient with a systolic blood pressure (SBP) of 160 and no history of cardiovascular symptoms/events (heart attack, stroke, TIA, angina) or diabetes would receive counseling on lifestyle modifications and follow-up. In contrast, a patient with the same SBP of 160, but with a history of cardiovascular symptoms/events or diabetes, would be started on a blood pressure medication (thiazide) and referred to the next level, in addition to receiving counseling.

# WHO CVD risk management package: Scenario I (non physician health worker)



WHO CVD-Risk Management Package for low- and medium- resource settings.  
Geneva, Switzerland: WHO 2002.

If the patient with no history of cardiovascular symptoms/events at the second visit continues to have an elevated systolic blood pressure above 160, the patient will be started on a blood pressure medication.

# WHO CVD risk management package

- Reliability of applying package in typical primary care setting
  - Over 80% agreement between non-physician health workers and “expert” physicians with regard to
    - Medical history
    - Health behavior
    - Treatment decisions (algorithm-based)

*Abegunde DO et al. Can non-physician healthcare workers assess and manage cardiovascular risk in primary care? Bulletin of the World Health Organization 2007 85:432-440.*

# WHO CVD risk management package

- Community intervention trial to assess feasibility, conducted in eight health posts in rural and urban India
  - Of 1010 adults (age>30) screened, 279 identified by health workers with hypertension
    - 74.5% seen by doctor
    - Significant decrease in mean SBP by 8.8mmHg at follow-up
    - Increased adherence of anti-hypertensive medications in intervention compared to control area

*Kar SS et al. Cardiovascular disease risk management in a primary health care setting of rural India. Indian Heart J 2008 60:19-25.*

# Expanding neurological care: summary

- Models of basic neurological care at the primary care level have been shown to be effective
- Increasing neurological capacity should involve multi-tiered approach of
  - Training primary health workers
  - Developing subspecialty care

## Quiz

- Now we invite you to take the module quiz and test your recent learning.
- This module quiz includes 8 multiple choice questions with feedback
- Note your answers on a piece of paper and then compare them with the slides following the quiz
- After completing your quiz, come back for the summary of this module presentation.

1. Of the following conditions, which has the lowest disability class/weight?

- A Dementia
- B Angina
- C Psychosis
- D Severe migraine
- E Quadriplegia

2. Compared to neurological disorders, which of the following diseases constituted a larger burden of disease by DALYs in 2005?

- A HIV/AIDs
- B Tuberculosis
- C Malaria
- D Malignancies
- E None of the above



3. Which income category countries have the highest neurological burden as measure by DALYs?

- A Low income countries
- B Lower middle income countries
- C Upper middle income countries
- D High income countries

4. The burden of disease will continue to rise except for which of the following neurological disorders?

- A Parkinson's disease
- B Epilepsy
- C Neuro-infections
- D Dementias
- E Cerebrovascular diseases

5. Which region has the highest growth projections for dementia?

- A United States
- B Western Europe
- C China and southeast Asia
- D Africa
- E Latin America

6. What percentage of people with epilepsy can become seizure free with proper treatment?

- A 20%
- B 50%
- C 70%
- D 100%

7. What percentage of people with epilepsy live in developing countries?

- A 20%
- B 40%
- C 60%
- D 80%

8. Which of the following are not considered cost effective interventions in DCP-2, Diseases Control Priorities in Developing Countries, second edition?

- A Ayurvedic preparations containing L-dopa
- B Aspirin for acute stroke
- C Aspirin for secondary prevention of stroke
- D Anticholinesterase inhibitors for dementia
- E Phenobarbital for epilepsy

**Now, compare your answers with those  
in the following slides**

1. Of the following conditions, which has the lowest disability class/weight?

B Angina -- **Correct.** -- Angina is ranked in disability class 3, with disability weight between 0.12-0.24. Dementia, active psychosis, severe migraine, and quadriplegia are all ranked in the highest disability class 7, with disability weights of 0.70-1.00. Seven of the top ten indicator conditions are neuro-psychiatric conditions.

2. Compared to neurological disorders, which of the following diseases constituted a larger burden of disease by DALYs in 2005?

E None of the above -- **Correct.** -- Neurological disorders constituted 6.3% of the global burden of disease in 2005. HIV/AIDs and malignant neoplasms constituted slightly more than 5%. Tuberculosis and malaria constituted slightly more than 2%.

3. Which income category countries have the highest neurological burden as measure by DALYs?

B Lower middle income countries -- **Correct.** -- Burden is highest in lower middle income countries, followed by low, high, and upper middle income countries. Mortality is also highest in lower middle income countries, accounting for more than 16% of total deaths, compared to 13% in high income countries. This increased burden in lower middle income countries is partly due to a high stroke burden, and the double burden of neuro-infectious diseases and non-communicable diseases.

4. The burden of disease will continue to rise except for which of the following neurological disorders?

C            Neuro-infections -- **Correct.** -- Between 2005 and 2030, DALYs for neurological disorders are projected to increase 12%, due exclusively to non-communicable diseases. Neurodegenerative disorders represent the largest increase, with dementias rising by 66% and Parkinson's disease rising by 25%. Cerebrovascular disease will rise by 20%. Epilepsy will rise slightly by 2%. In contrast, there will be a 57% decrease in neuro-infections (polio, tetanus, meningitis, encephalitis).

5. Which region has the highest growth projections for dementia?

C            China and southeast Asia -- **Correct.** -- Highest growth projections for dementia are in China and southeast Asia, with a 300% increase between 2001 and 2040, compared to a 100% increase in developed countries.

6. What percentage of people with epilepsy can become seizure free with proper treatment?

C            70% -- **Correct.** -- 70% of people with epilepsy can become seizure free with proper anti-epileptic treatment. First line anti-epileptic medications are Phenobarbital, phenytoin, carbamazepine, and valproic acid. Availability and cost of each of these agents is variable across developing countries.

7. What percentage of people with epilepsy live in developing countries?

D 80% -- **Correct** -- 80% of people with epilepsy live in developing countries. Of these, more than 80% are not treated. Preventable causes of epilepsy which are more common in developing countries compared to developed countries include traumas and infections.

8. Which of the following are not considered cost effective interventions in DCP-2, Diseases Control Priorities in Developing Countries, second edition?

D Anticholinesterase inhibitors for dementia -- **Correct.** -- Aspirin and Phenobarbital are highly cost-effective interventions, all less than \$150/DALY gained. Ayurvedic preparations containing L-DOPA cost \$751/DALY gained, and is more cost-effective than commercial preparations of levodopa/carbidopa. Anticholinesterase inhibitors are not deemed to be cost-effective, but was made with the assumption that there was no benefit to the patient in disability or mortality and only decreases caregiver time.

## Summary of key points

- Neurological diseases constitute a significant amount of the global burden of disease and is highest in lower income countries.
- Priority conditions include neuro-degenerative disorders, epilepsy, and cerebrovascular disease.
- Large treatment gaps exist despite availability of cost-effective treatments for some neurological conditions.
- Increasing the resources for neurological care will require innovative health system initiatives.



## **Papers: Epilepsy**

- Chisholm D. “Cost-effectiveness of First-line Antiepileptic Drug Treatments in the Developing World: A Population-level Analysis.” *Epilepsia* 2005; 46: 751-759.
- Kengne A et al. “Nurse-led care for epilepsy at primary level in a rural health district in Cameroon.” *Epilepsia* 2008; 49:1639-1641
- Scott RA, Lhatoo SD and J Sander. “The treatment of epilepsy in developing countries: where do we go from here?” *Bulletin of the World Health Organization* 2001; 79: 344-351.
- Wang WZ et al. Efficacy assessment of phenobarbital in epilepsy: a large community-based intervention trial in rural China. *Lancet Neurology* 2006 5:46-52.

## **Neurodegenerative diseases**

- Kalaria RN et al. “Alzheimer’s disease and vascular dementia in developing countries: prevalence, management, and risk factors.” *Lancet Neurology* 2008; 7: 812-826.
- Zhang ZX et al. “Parkinson’s disease in China: prevalence in Beijing, Xian, and Shanghai.” *Lancet* 2005; 365:595-597.

## Stroke

- Feigin VL et al. “Worldwide stroke incidence and early case fatality reported in 56 population-based studies: a systematic review.” *Lancet Neurology* 2009; 8:355-369.
- Johnston SC, Mendis S and C Mathers. “Global variation in stroke burden and mortality: estimates from monitoring, surveillance, and modeling.” *Lancet Neurology* 2009; 8: 345-354.
- Strong K, Mathers C and R Bonita. “Preventing stroke: saving lives around the world.” *Lancet Neurology* 2007; 6:182-187.

## Neurological Workforce

- Janca A et al. “WHO/WFN Survey of neurological services: A worldwide perspective.” *Journal of the Neurological Sciences* 2006; 247:29-34.

## Books: Available for Download online (see web links below)

- *Neurological Disorders: Public Health Challenges*. Geneva, Switzerland: World Health Organization, 2006.
- *Disease Control Priorities in Developing Countries* (2nd edition), ed. New York: Oxford University Press, 2006.

## Web Links: General

- Global burden of Disease.  
[http://www.who.int/topics/global\\_burden\\_of\\_disease/en/](http://www.who.int/topics/global_burden_of_disease/en/). General information and publications on GBD study. Includes publicly available regional and country data on disease and injury.
- Neurological Disorders: Public Health Challenges.  
[http://www.who.int/mental\\_health/neurology/neurodiso/en/index.html](http://www.who.int/mental_health/neurology/neurodiso/en/index.html). Published by the WHO in 2006, this book discusses the public health importance of common neurological disorders.
- Disease Control Priorities Project. <http://www.dcp2.org/main/Home.html>. Search under disease/condition for “Neurological Disorders” to access chapter on neurological disorders.
- World Federation of Neurology: the African Experience.  
<http://www.wfneurology.org/africanExperience.php>. “Where there is no neurologist: manual for paramedical professionals in developing countries” can be downloaded as pdf..

## Epilepsy

- Global Campaign against Epilepsy: Out of the shadows.  
[http://www.who.int/mental\\_health/management/globalepilepsycampaign/en/index.html](http://www.who.int/mental_health/management/globalepilepsycampaign/en/index.html). Includes reports on the campaign, an atlas of epilepsy care around the world in 2005, and other publications including “Epilepsy: A Manual for Medical and Clinical officers in Africa”
- International League Against Epilepsy. <http://www.ilae-epilepsy.org>. Association of physicians and healthcare professionals working towards quality epilepsy care. Includes information on the global campaign against epilepsy.

## Cardiovascular/Stroke

- Integrated Management of Cardiovascular Risk: report of a WHO meeting, Geneva 9-12 July 2002.  
[http://www.who.int/cardiovascular\\_diseases/priorities/management/package/en/](http://www.who.int/cardiovascular_diseases/priorities/management/package/en/). Report that includes discussion on the background, rationale and development of the CVD Risk Management Package.

## Web Links

- WHO CVD-Risk Management Package.  
[http://www.who.int/cardiovascular\\_diseases/resources/pub0401/en/](http://www.who.int/cardiovascular_diseases/resources/pub0401/en/). Core module for CVD management for low and middle income countries.

## **Credits**

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June 2009

The Global Health Education Consortium gratefully acknowledges the support provided for developing these teaching modules from:

***Margaret Kendrick Blodgett Foundation***

***The Josiah Macy, Jr. Foundation***

**Arnold P. Gold Foundation**



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