

## Costs of Disorders of the Brain in Europe

### Executive summary

Key words: brain disorder, cost, cost of illness, economic burden, Europe, mental disorder, neurology, neurosurgery

**Background:** Brain disorders (psychiatric, neurological and neurosurgical diseases together) figure amongst the leading causes of disease and disability. Yet, the knowledge of the epidemiological and economic impact of brain disorders has been relatively little researched in Europe. WHO data suggest, however, that brain disorders cause 35% of the burden of all diseases in Europe.

**Objectives:** The present study aims at estimating the economic cost of disorders of the brain in Europe based on the published epidemiological and economic evidence. A secondary objective was to identify gaps in both epidemiological and economic evidence on brain disorders thus providing focus for future research efforts.

**Methods:** A model was developed to combine epidemiological and economic data on brain disorders in Europe (EU member countries, Iceland, Norway and Switzerland) and thus estimate their total cost. More specifically, it consisted of the following steps in which we: (i) transformed and converted available economic data to a defined time period as well as currency (€2004); (ii) adjusted country specific economic data for purchasing power and relative size of economy; (iii) imputed data for countries where no data are available; (iv) combined epidemiology and economic data to estimate the total cost of a defined disease; (v) added the cost of all selected disorders to arrive at the total cost for Europe. The model was populated with data collected from extensive literature reviews in the epidemiology and economic burden of brain disorders in Europe, conducted by 12 groups of European epidemiologists and health economists.

The cost data were calculated as cost per patient, and epidemiological data were primarily reported as 12-month prevalence estimates. National and international statistics for the model were retrieved from the OECD (Organization for Economic Co-operation and Development) and Eurostat databases. The aggregated annual cost estimates were presented in Euros for 2004.

**Results:** There are an estimated 127 million Europeans currently living with a brain disorder out of a population of 466 million. The total annual cost of brain disorders in Europe was estimated to €386 billion in 2004. Direct medical expenditures alone totaled €135 billion, comprising inpatient stays (€78 billion), outpatient visits (€45 billion) and drug costs (€13 billion). Attributable indirect costs resulting from lost workdays and productivity loss because of permanent disability caused by brain disorders and mortality were €179 billion, of which the mental disorders are the most prevalent. Direct non-medical costs (social services, informal care and other direct costs) totaled €72 billion.

Mental disorders amounted to €240 billion and hence constitute 62% of the total cost (excluding dementia), followed by neurological diseases (excluding dementia) totaling €84 billion (22%). Neurosurgical diseases made up a smaller fraction of the total cost of brain disorders in Europe, reaching a cost of €8 billion. The average cost of brain disorders in Europe was €829 per inhabitant (based on a total number of inhabitants in Europe of 466 million). However, the cost per inhabitant is different between European countries, and in general, cost of brain disorders per inhabitant is higher in Western European countries compared with the EU admission countries. Because of scarcity of

data, our total cost results only partially includes direct non-medical cost (e.g. community care and informal care) and indirect costs, and omits completely intangible costs. We have for example shown that the cost of dementia increase with 25% when including informal care and the cost of multiple sclerosis increases with at least 50% when including intangible costs.

**Discussion:** The scarcity of both epidemiologic and health economic data in several countries and for specific brain disorders have led to conservative inclusions of cost items and population age groups. Together with the restriction of the present study to the most prevalent brain disorders, this leads to the conclusion, that the true economic cost of disorders of the brain is substantially higher than our estimate of 386 billion Euros, perhaps in the range 500–700 billion Euros. Brain disorders are, thus, substantially more costly than other important fields of medicine such as heart disease, cancer and diabetes. However, the burden of brain disorders is seldom taken together, but rather reported by each single diagnosis. If training efforts, research funding and health care resources could be allocated according to this new knowledge, a very considerable increase in funding of brain related activities should take place. Our cost estimations are the best possible based on the economic and epidemiological data available in Europe today. However, our study has identified major shortcomings both in the epidemiological and economic evidence on brain disorders in Europe, in particular in the EU admission countries. More research of a systematic, prospective, collaborative nature is needed in order to accurately estimate the cost of disorders of the brain in Europe.

**Conclusion:** Based on extensive literature reviews, the present study provides best possible estimates of the cost of disorders of the brain in Europe in 2004. In 28 countries with a population of 466 million, 127 million were affected by at least one brain disorder. The total annual cost was €386 billion (386 000 000 000). Brain research funding, health care resource allocation and teaching at medical schools are proportionately much smaller. The huge cost and burden of brain disorders calls for increased efforts in research, health care and teaching.