

Cost estimates of brain disorders in Belgium

Jean SCHOENEN¹, Franco GIANNI², Luc SCHRETLIN³ and Patrik SOBOCKI^{4,5}

¹Department of Neurology-Headache Research Unit and Research Center for Cellular and Molecular Neurobiology, University of Liège, Liège, Belgium ; ²ANEIDE, CH Dinant, Belgium ; ³UCB, Brussels, Belgium ; ⁴Stockholm Health Economics, Stockholm, Sweden ;

⁵Department of Learning, Informatics, Management and Ethics, Karolinska Institutet, Stockholm, Sweden

Abstract

This article presents the data on cost of the major brain disorders in Belgium which were retrieved from "Cost of Disorders of the Brain in Europe" study sponsored by the European Brain Council and performed by Stockholm Health Economics. The disorders selected were : addiction, depression, anxiety disorders, brain tumours, dementia, epilepsy, migraine and other headaches, multiple sclerosis, Parkinson's disease, psychotic disorders, stroke and trauma. Figures for prevalence of disorders and direct medical, direct non-medical and indirect costs are based on data coming from available electronic data bases, or, when missing for Belgium, best possible estimates or extrapolated data were used. All economic data were transformed to €'s for 2004 and adjusted for purchasing power parity (PPP). The results show that the total number of people with any brain disorder in Belgium amounts to 2,9 million in 2004, the most prevalent being anxiety disorders 1.1 million, migraine 860 000, addiction (any) 800.000 and depression 500.000 cases. The total cost of all included brain disorders in Belgium was estimated at 10.6 billion Euros. Most costly per case are brain tumours, multiple sclerosis, stroke and dementia. Because of their higher prevalence, however, depression, dementia, addiction, anxiety disorders and migraine have the highest total costs. Taken together, brain disorders consume 4% of the gross national product and cost each citizen of Belgium € 1 029 per year. The drug costs for brain disorders constitute only 10% of the total drug market in Belgium, and only 4% of the total cost of brain disorders in Belgium. This should be compared to the cost estimates and to a previous study which showed that brain disorders are responsible for 35% of the total burden of all disorders in Europe. This study suggests therefore that the direct healthcare resources, including expenses for drug therapies, allocated to brain disorders in Belgium are not leveled to the indirect costs and burden of these disorders. A comparison with data available from a direct prospective study in demented Belgian patients suggests that the mathematical estimates presented here reflect quite accurately the real average cost for dementia, although there are large variations depending on disease severity. As, in addition, subjects with brain disorders face collateral costs which have not been taken into account and may vary between countries, it seems worthwhile to conduct, in cooperation with patients

associations, a complementary survey in the Belgian ecosystem to establish the cost profile of representative patients for the major brain disorders. Such a survey is being organized by a task force of the Belgian Brain Council.

Key words : Brain disorders, cost, prevalence, health care resources, pharmacoeconomics.

Introduction

Disorders of the heart, liver, kidneys and other organs are usually grouped according to their site of origin. There are many papers on cardiac disorders and on renal disorders, but few if any on brain disorders. Brain disorders have not been viewed as a whole but rather as psychiatric/mental disorders, neurological disorders, and neurosurgical disorders. While specialisation has come to stay and in many cases further sub specialisation and disorder-related clinics are desirable, a number of similarities and shared interests between psychiatry and neurology have developed over the last decades. Most importantly, basic brain research (neuroscience) is equally relevant to neurological and psychiatric disorders. Finally, brain disorders are best viewed together because politicians and other decision makers prefer to deal with large fields of activity.

The European Brain Council (EBC) is an example of this new tendency to keep brain disorders together for certain activities. It is a co-ordinating council formed by European societies in psychiatry, neurology, neurosurgery, basic neuroscience, as well as European patient organisations in psychiatry and neurology. The brain-related pharmaceutical industry is also represented. The Belgian Brain Council (BBC) was recently created using the same template as the EBC ; it is an incorporated

federation of 17 scientific societies in the basic and clinical neurosciences, 10 patients associations for neuropsychiatric disorders, 12 pharmaceutical companies, a scientific society of pharmacists and the Belgian representative of the European Dana Alliance for the Brain. The EBC has, as its first major task, analysed the burden and cost of brain disorders in Europe. Without knowing the size of the problem, it is difficult to make clear recommendations about initiatives in research, teaching and public awareness.

The "Cost of Disorders of the Brain in Europe" study had as its aim to present best possible estimate of the cost of disorders of the brain in Europe based on the existing literature and the main results were published in June 2005 (1). The aim of the present study is to report data for Belgium and discuss them in relation to the national situation.

Material and methods

The methodology of the European study that forms the basis of the current publication has been described in detail previously (1). In brief, 12 different disorders (or groups of disorders) of the brain were selected because they were believed to have the highest cost and because a preliminary survey indicated that at least some relevant data were present for these disorders. Other disorders that might have been equally costly or relevant were left out because they were too heterogeneous and too little data were available. The disorders selected were : addiction, affective disorders, anxiety disorders, brain tumours, dementia, epilepsy, migraine and other headaches, multiple sclerosis, Parkinson's disease, psychotic disorders, stroke and trauma. A steering committee consisting of Jes Olesen, Hans Ulrich Wittchen, Bengt Jönsson and Patrick Sobocki did this selection and appointed a group of 2-6 neurologists, psychiatrists or neurosurgeons for each of these disorders. These persons were considered to be leading European experts in the epidemiology of the particular disorder. In parallel, the steering committee selected a health economic panel to govern the health economic studies, which were performed by the company Stockholm Health Economics under contract with the EBC. The epidemiology data used were based on a systematic review of published epidemiological data in Europe. These reviews have been published separately (2-9).

The main source used for the reviews were electronic databases (Medline and Web of Science) complemented by national registries and the Internet. Twelve months prevalence data were collected in all disorders by country and stratified according to age, gender and disorder severity where published evidence allowed it. When no data were available in a country, best possible estimates or extrapolated data were used.

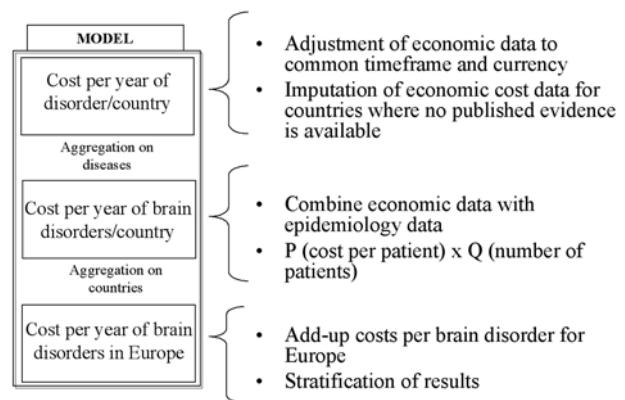


FIG. 1. — Health Economic Model

In parallel, the economists collected all available English language publications from Europe using Medline and HEED (Health Economic Evaluation Database). These data are presented in reviews published separately (10-21). It was attempted to present all relevant costs including both direct medical costs, direct non-medical costs and indirect costs. So-called intangible costs such as suffering, loss of quality of life etc. have not been calculated. All economic data were transformed to €'s for 2004 and adjusted for purchasing power parity (PPP) which is an international measure to be able to compare economic data between countries by adjusting for the relative purchasing power in the respective countries.

The epidemiological and health economic data were then entered into a health economic model as indicated in figure 1. The data presented in this paper are the aggregated results for Belgium which are, thus, in most cases imputed from data observed in other European countries. They were extracted by PS and discussed and confronted with national data by a task force of the BBC.

Results

TOTAL PREVALENCE

The total number of people with any brain disorder in Belgium amounted to 2.9 million in 2004, corresponding to almost one third of the total number of Belgian inhabitants. This figure is an aggregate of the prevalence estimation for each brain disorder included in the study. However, the prevalence estimates in mental disorders, migraine and epilepsy are all based on the European patient populations aged 18-65. The estimate in dementia and Parkinson's disease are limited to the population aged 65 or older, and stroke on the age group 25 years or older. The estimate is in this respect conservative. When correcting for co-morbidity, still one fifth of the Belgian population have a brain disorder.

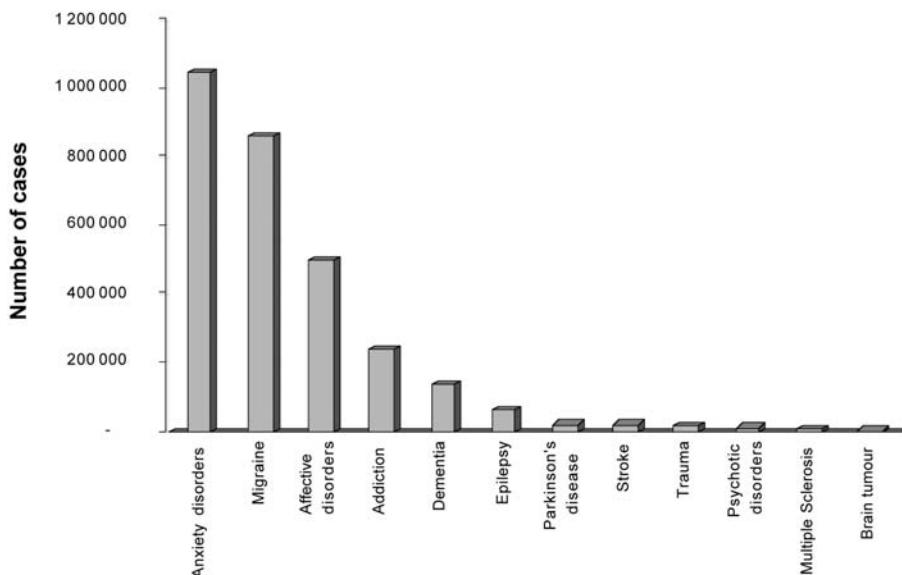


FIG. 2.— Estimated number of cases of brain disorders in Belgium.

Note. The number of cases of stroke and trauma are based on incidence data in the lack of appropriate prevalence data in the literature. Results on addiction omit nicotine dependence.

Number of cases with addiction in Belgium totalled 240.000 (including illicit drug dependence and alcohol dependence). If we were to add nicotine dependence to this estimate, the total amount of cases would be 800.000. Affective disorders (depression and bipolar disorder) affected 500.000 cases and anxiety disorders (panic, phobias, obsessive compulsive disorder (OCD) and generalized anxiety disorder (GAD)) 1.1 million. The most prevalent neurological disease was migraine, with an estimated 860.000 cases. The distribution of estimated cases with brain disorders in Belgium across specific disorders are presented in Figure 2. Among the less prevalent brain disorders multiple sclerosis and brain tumour have an estimated 9.000 and 4.000 cases respectively.

COST PER PATIENT

Based on a review of economic data in Europe, the cost per case per disorder for 2004 is calculated for Belgium. Thus, scattered economic studies in Belgium have not been used directly but have been used together with other European data. From these constituted data, data for Belgium have been imputed. The cost per patient for each of the 12 brain disorders is shown in figure 3. Most costly per case are brain tumours and multiple sclerosis, which have a relatively low prevalence. Anxiety disorders and migraine, on the contrary, have a very low cost per case but are very prevalent.

TOTAL COST OF BRAIN DISORDERS

The total cost of all included brain disorders in Belgium was estimated at 10.6 billion Euros (Fig. 4).

Affective disorders were the most costly brain disorders followed by dementia and addiction. Among the neurological disorders migraine was the most costly followed by stroke and epilepsy. Note that important cost categories are missing for several of the disorders. Indirect costs and direct non-medical costs are, for example not included for psychotic disorders or trauma and direct non-medical costs are not included for anxiety disorders, brain tumours and affective disorders. The cost of stroke is based on incidence because of lack of prevalence data and thus grossly underestimated.

COST OF BRAIN DISORDERS PER INHABITANT

It is of interest how much brain disorders cost each individual citizen in Belgium. These data are given in table 1. Taken together, brain disorders cost each citizen of Belgium € 1 029 per year.

COST OF BRAIN DISORDERS DISTRIBUTED BY RESOURCE ITEMS

These data are presented in detail in table 2 and also as a pie diagram in figure 5. Direct health care cost amounted to € 3.1 billion and constituted 30% of total cost, direct non-medical cost totalled € 2.1 billion, 20%, and indirect cost € 5.4 billion (51%) and was mainly because of production loss due to sick leave. As previously mentioned, important cost categories are missing for several of the disorders. Drug cost due to brain disorders make up 4% of the total cost.

Brain disorders in Belgium constituted 13% of the total direct health care cost in Belgium. Out of total drug sales in Belgium, 10% were used for

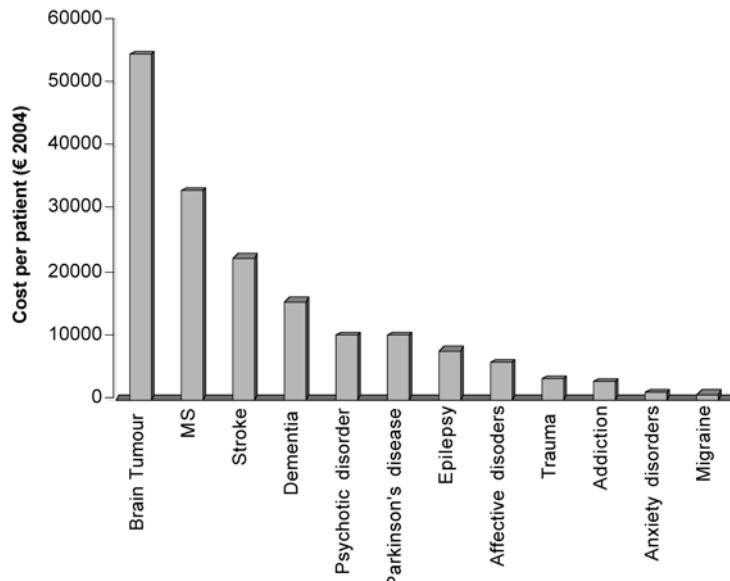


FIG. 3. — Cost per case of specific brain disorders in Belgium (€PPP 2004)

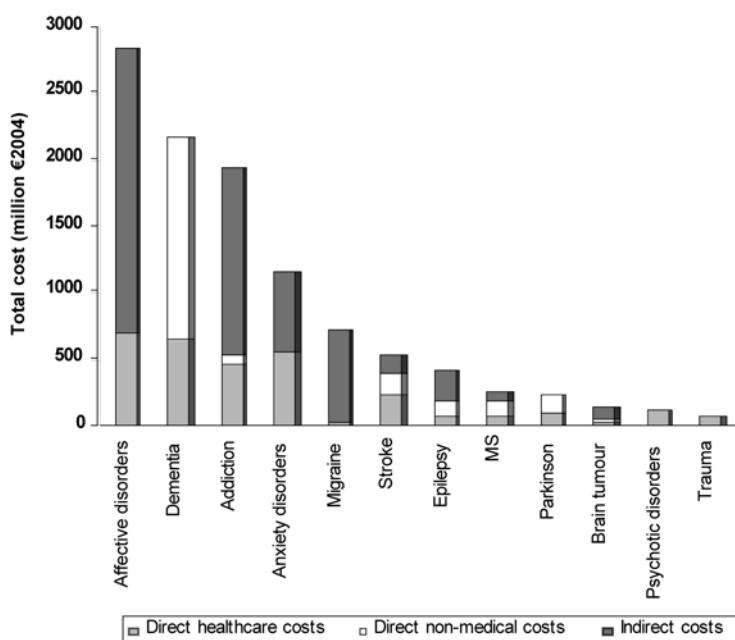


FIG. 4. — Total cost of brain disorders in Belgium (€PPP million, 2004)

treatment of brain disorders. The total cost of brain disorders (direct and indirect combined) constituted 4% of the gross national product of Belgium.

COST OF BRAIN DISORDERS DISTRIBUTED BY MEDICAL SPECIALITY AND DISORDER

Attributing disorders to one speciality is quite artificial. Brain tumour and brain trauma are not only cared for by neurosurgeons but also by neurologists and other specialities. Similarly, stroke, dementia, and most other disorders are cared for by more than one speciality and not least by general practitioners. However, for certain purposes an

attempt to separate into specialities may be useful. We have allocated the different brain disorders to brain specialty in table 3. Dementia has been kept separate, because it is considered to be equally shared between psychiatry and neurology. The biggest neurosurgical disorder, herniated disc, was not included in our study.

Discussion

Overall, this study shows that brain disorders are extremely costly and cause a huge burden to Belgian society. They consume 4% of the gross national product and cost each citizen of Belgium

Table 1

Cost per inhabitant of specific brain disorders in Belgium (€PPP, 2004)

Brain disorder	Direct healthcare	Direct non-medical	Indirect costs	Total
All disorders	304	203	522	1 029
Addiction	46	5	137	188
Affective disorders	68	0	208	275
Anxiety disorders	55	0	56	111
Brain tumour	4	1	10	14
Dementia	64	147	0	210
Epilepsy	7	11	23	41
Migraine	4	0	67	70
MS	7	11	7	25
Parkinson's disease	10	13	0	22
Psychotic disorders	11	2	0	13
Stroke	24	14	13	51
Trauma	7	0	0	7

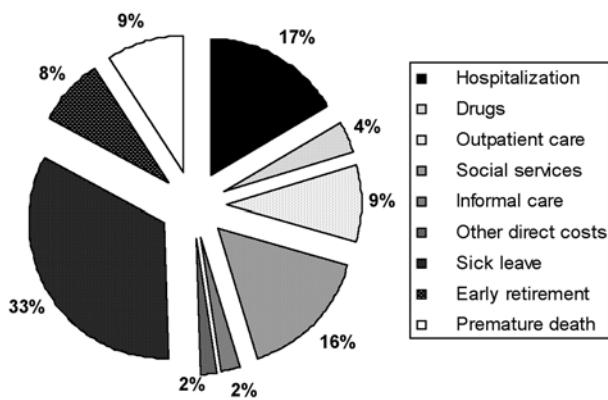


FIG. 5.— Distribution of total cost of brain disorders in Belgium by resource item components.

Note. Direct non-medical costs are missing for the following disorders : affective disorders, anxiety disorders, migraine and trauma. Indirect cost is missing for psychotic disorder. Only indirect costs due sick-leave were included in anxiety disorders.

€ 1.029 per year. In contrast to the lively media debate indicating that disorders of the brain are overtreated medically, the drug costs for brain disorders constitute only 10% of the total drug market in Belgium, and only 4% of the total cost of brain disorders in Belgium. This should be compared to the cost estimates of the present study and to the previous study of the burden of brain disorders in Europe (22), which showed that brain disorders are responsible for 35% of the total burden of all disorders in Europe.

While the present authors are generally against attempts to allocate certain disorders to certain specialities, one might nevertheless point out that the disorders that are traditionally regarded as psychiatric account for approximately $\frac{2}{3}$ of the total costs while disorders traditionally regarded as neurological/neurosurgical account for the last $\frac{1}{3}$ of the cost of brain disorders. Another general trend is that the highly prevalent disorders such as anxiety and migraine are inexpensive per case but, due to their high prevalence, are very costly to society. Affective disorders were the most costly brain dis-

Table 2

Distribution of total cost of brain disorders in Belgium by resource use components

€ million	Cost	%
<i>Direct healthcare costs</i>	3 145	30%
Hospitalization	1 762	17%
Drugs	389	4%
Outpatient care	925	9%
Medical devices	68	1%
<i>Direct non-medical costs</i>	2 102	20%
Social services	1 679	16%
Informal care	231	2%
Adaptations	146	1%
Transportation	46	0%
<i>Total indirect costs</i>	5 390	51%
Sick leave	3 557	33%
Early retirement	848	8%
Premature death	986	9%
Total costs	10 637	100%

orders in Belgium mainly because they are both rather prevalent and costly per case. This is also in line with the general cost pattern in Europe.

METHODOLOGICAL CONSIDERATIONS AND PREVIOUS COST STUDIES

Several Belgian figures shown here are imputed from European data and not directly based on studies performed in Belgium. This is simply due to the fact that cost studies are missing for most brain disorders in Belgium, and for several of them there are even no reliable prevalence or incidence data. Some comparisons can nonetheless be drawn with available figures. For instance, a 1-year prospective study of the economic impact of dementia (NADES) was performed in Belgium by scuvée-Moreau et al (2002). It showed, as expected, that on average the total monthly cost was markedly higher for a demented patient living in an institution (2.301,70 €) than for a patient cared for at home (445,56 €). If one extrapolates these figures to 1 year, the total cost for dementia, assuming a preva-

Table 3

Cost of brain disorders in Belgium by disorder area (€PPP million)

€ million	Healthcare costs	Direct non-medical costs	Indirect costs	Total cost
<i>Neurosurgical disorders</i>	111	9	100	220
Brain tumour	37	9	100	145
Trauma	75			75
<i>Neurological disorders</i>	520	506	1 143	2 169
Epilepsy	72	114	240	426
Migraine and other headaches	38		688	726
Multiple sclerosis	68	115	76	258
Parkinson's disease	99	132		231
Stroke	243	146	139	528
<i>Neurological/mental disorder</i>	660	1 514		2 175
Dementia	660	1 514		2 175
<i>Mental disorders</i>	1 853	72	4 148	6 073
Addiction	477	52	1 419	1 948
Affective disorders	698		2 147	2 845
Anxiety disorders	566		583	1 148
Psychotic disorders	112	21		132
All brain disorders	3 145	2 102	5 390	10 637

lence of 150.000 (Fig. 2), would be 802.008.000 € in case of home care, but 4.143.060.000 € in case of institutional care. These figures can be compared to the 2.200.000.000 € total yearly cost for dementia in Belgium given above (Fig. 4). The comparison between the data coming from the real world of demented patients (Scuvée-Moreau *et al.* 2002) and the figure coming from the mathematical estimates in the present article shows that the latter is almost the arithmetic mean of the costs for the 2 categories of patients, suggesting that it gives a reliable account of total cost of dementia in Belgium. It also illustrates, however, that there can be large differences in direct and indirect costs depending on severity and disease stage for certain disorders.

NEED FOR FUTURE STUDIES

People with brain disorders face additional costs due to, e.g., personal assistance and support, personal injury or property damage, increased fees for medical and other types of insurance... Such costs have not been taken into account, because they are difficult to assess in population studies and because they may greatly vary between countries. For this reason and the abovementioned variability in disease severity, it seems worthwhile to compare the cost estimates coming from epidemiologic prevalence and health expenses data to the real costs encountered in his local ecosystem by a typical Belgian patient for the major brain disorders. Such a survey needs the cooperation of patients' organizations and is about to be organized by a task force of the Belgian Brain Council.

This study has once more underlined that for many brain disorders prevalence and cost data are missing in Belgium, which indicates that more epi-

demiological studies are eagerly needed. Economic considerations are gaining importance in healthcare. Further studies of the economic aspects of brain disorders are needed to allow more efficient use of limited resources. Medical and non-medical interventions, as well as public educational programmes need evaluation.

COMPARISON WITH COST AND BURDEN OF OTHER DISORDERS

We are not aware of other Belgian studies summarising the epidemiology, burden and cost of other major groups of disorders such as heart disorders, cancer or diabetes. Even at the European level and in the USA such data are scarce. Data on diabetes, cancer and heart disorders from foreign sources indicate that brain disorders constitute the most costly group. This is in consonance with the burden of disorders of the brain study (22) showing that, in Europe, brain disorders are responsible for 35% of the total burden of all disorders.

IMPLICATIONS FOR RESEARCH, HEALTH CARE AND TEACHING

Although brain disorders represent by far the most disabling and costly diseases, it is estimated that in Europe only 15% of direct health costs are devoted to them. There is no reason to believe that this is different in Belgium. Huge advances are made since more than a decade in the understanding of the causes of brain disorders and in their treatment. Basic and clinical brain research deserves greater support from policy makers.

In the 5th framework-programme of the EU (1998-2002) 85 million euros were used to fund neuroscience research which represents hardly

0.02% of the estimated cost of brain disorders in Europe. For the 7th framework-programme 500 million euros have been requested by the EBC which would represent 0.13% of the annual cost brain disorders. There is no reason to believe that the situation is different in Belgium. However, precise figures on the global financial resources available for research on the brain and its disorders are missing. Collecting them is the objective of a task force of the BBC.

Another important, and often neglected aspect for the management of brain disorders is that available resources are often underutilized by patients, their doctors and caregivers. Therefore one of the most important tasks, besides prioritizing brain research for public support, is to make effective care available to all who need it, regardless of national and economic boundaries. This needs a comprehensive multilevel strategy including an increase in time devoted to the teaching of basic and clinical neurosciences, in educational programmes for patients and in public resources for the reimbursement of therapies.

REFERENCES

1. ANDLIN-SOBOCKI P., JONSSON B., WITTCHEN H. U., OLESEN J. Cost of disorders of the brain in Europe. *Eur. J. Neurol.*, 2005, **12** (Suppl. 1) : 1-27.
2. ANDLIN-SOBOCKI P. Economic evidence in addiction : a review. *Eur. J. Health Econ.*, 2004, **5** (Suppl. 1) : S5-12.
3. BERG J. Economic evidence in migraine and other headaches : a review. *Eur. J. Health Econ.*, 2004, **5** (Suppl. 1) : S43-54.
4. BERG J. Economic evidence in trauma : a review. *Eur. J. Health Econ.*, 2004, **5** (Suppl. 1) : S84-91.
5. EKMAN M. Economic evidence in brain tumour : a review. *Eur. J. Health Econ.*, 2004, **5** (Suppl. 1) : S25-30.
6. EKMAN M., FORSGREN L. Economic evidence in epilepsy : a review. *Eur. J. Health Econ.*, 2004, **5** (Suppl. 1) : S36-42.
7. EKMAN M. Economic evidence in stroke : a review. *Eur. J. Health Econ.*, 2004, **5** (Suppl. 1) : S74-83.
8. FORSGREN L., BEGHI E., OUN A., SILLANPAA M. The epidemiology of epilepsy in Europe – a systematic review. *Eur. J. Neurol.*, 2005, **12** : 245-253.
9. JONSSON L. Economic evidence in dementia : a review. *Eur. J. Health Econ.*, 2004, **5** (Suppl. 1) : S30-35.
10. KOBELT G. Economic evidence in multiple sclerosis : a review. *Eur. J. Health Econ.*, 2004, **5** (Suppl. 1) : S54-62.
11. LINDGREN P. Economic evidence in Parkinson's disease : a review. *Eur. J. Health Econ.*, 2004, **5** (Suppl. 1) : S63-66.
12. LOTHGREN M. Economic evidence in affective disorders : a review. *Eur. J. Health Econ.*, 2004, **5** (Suppl. 1) : S12-20.
13. LOTHGREN M. Economic evidence in anxiety disorders : a review. *Eur. J. Health Econ.*, 2004, **5** (Suppl. 1) : S20-25.
14. LOTHGREN M. Economic evidence in psychotic disorders : a review. *Eur. J. Health Econ.*, 2004, **5** (Suppl. 1) : S67-74.
15. OLESEN J., LEONARDI M. The burden of brain diseases in Europe. *Eur. J. Neurol.*, 2003, **10** : 471-477.
16. PUGLIATTI M., ROSATI G., CARTON H., RIISE T., DRULOVIC J., VÉCSEI L., MILANOV I. (2005). The burden of multiple sclerosis in Europe : epidemiological review. *Eur. J. Neurol.* In press.
17. SCUVEE-MOREAU J., KURZ X., DRESSE A. National Dementia Economic Study Group. The economic impact of dementia in Belgium : results of the National Dementia Economic Study (NADES). *Acta Neurol. Belg.*, 2002, **102** : 104-113.
18. SERVADEI F., TAGLIAFERRI F., COMPAGNONE C., KORSIC M., KRAUS J. F. (2005). Brain Injury Epidemiology In Europe : Systematic review from recent data. *European Journal of Neurosurgery*. In press.
19. STOVNER L. J., ZWART J.-A., HAGEN K., TERWINDT G. M., PASCUAL J. (2005). Epidemiology of Headache in Europe. *Eur. J. Neurol.* In press.
20. TRUELSEN T., PIECHOWSKI-JOZWIAK B., BONITA R., MATHERS C., BOGOUSSLAVSKY J., BOYSEN G. (2005). Stroke incidence and prevalence in Europe : a review of available data. *Eur. J. Neurol.* In press.
21. VON CAMPENHAUSEN S., BORNSCHEIN B., WICK R., BOTZEL K., SAMPAIO C., POEWE W., OERTEL W., SIEBERT U., BERGER K., DODEL R. Prevalence and incidence of Parkinson's disease in Europe. *Eur. Neuropsychopharmacol.*, 2005, **15** : 473-490.
22. WESTPHAL M., EKMAN M., ANDLIN-SOBOCKI P., LÖNN S., HEESE O. (2005). Brain Tumor Epidemiology in the European Union : A Very Critical Review and Quantified Analysis. *Acta Neurochirurgica*. In press.
23. WITTCHEN H. U., JACOBI F. Size and burden of mental disorders in Europe – a critical review and appraisal of 27 studies. *Eur. Neuropsychopharmacol.*, 2005, **15** : 357-376.

Jean SCHOENEN,
Neurobiology Research Center CNCM,
Axonal regeneration & Cephalic pain,
University Liège,
CHU-Sart Tilman,
B-4000 Liège (Belgium).
E-mail : jschoenen@ulg.ac.be
and

Headache Research Unit,
University Department of Neurology,
Citadelle Hospital,
B-4000 Liège (Belgium).
E-mail : jean.schoenen@chrcitadelle.be