

COST OF DISORDERS OF THE BRAIN IN SLOVENIA*

STROŠKI MOŽGANSKIH BOLEZNI V SLOVENIJI

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Abstract

Whereas there are many publications on disorders of, for instance, heart or kidney function, there are few, if any, on brain disorders, which are traditionally viewed separately as mental, neurological or neurosurgical disorders. There are, however, marked similarities and shared interests between the fields and, most importantly, basic neuroscience is equally relevant for all clinical problems. The European Brain Council has analysed the burden and the cost of brain disorders in Europe. The aim of the present text is to report data for Slovenia.

Twelve different disorders (or groups of disorders) of brain believed to have the highest cost (addiction, affective disorders, anxiety disorders, brain tumours, dementia, epilepsy, migraine and other headaches, multiple sclerosis, Parkinson's disease, psychotic disorders, stroke, and trauma) were analysed. Epidemiology data for Europe were collected as 12-month prevalence data for disorders by country and stratified according to age, gender, and disorder severity. Because little original data were available for Slovenia, extrapolated data were used. Health economic data (representing direct medical costs, direct non-medical costs, and indirect costs) being transformed into euros for the year 2004 were entered into a health economic model.

The total number of brain disorders in Slovenia amounted to 570,000 in 2004, and when corrected for co-morbidity, 1/5 of the Slovenian population have a brain disorder. In particular, this is 39,000 alcohol dependents and illicit drug dependants, 105,000 affective disorders, 195,000 anxiety disorders, 178,000 migraine, etc. The total cost of all included brain disorders in Slovenia was estimated at 833 million euros, the most costly being affective disorders, dementia, and addiction. It should be mentioned that both the epidemiological data and the resulting cost are significantly underestimated for several disorders, particularly stroke. Direct health care cost mounted to 403 million euros and constituted 48 % of total cost; 6 % of the total cost present drugs for brain disorders. Thus brain disorders in Slovenia constituted 14 % of the total direct health care cost in Slovenia and 9 % of total drug costs. The total cost of brain disorders constituted 2 % of the gross national product of Slovenia.

The preparations for this study have revealed an important lack of epidemiological and health economical data of brain disorders in Slovenia which should serve to promote these studies in future. The estimated costs are nevertheless thought to present a relatively good

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measure of the real picture. The significance of these costs has not really been appreciated so far due to the particularisation of psychiatric, neurological, and neurosurgical disorders into individual compartments. Data should be useful for strategic planning of health care, research, and education.

Key words

neurological disorders; neurosurgical disorders; psychiatric disorders; brain; health costs; cost of illness analysis

Izveček

Mnoge publikacije obravnavajo bolezni srca, ledvic idr., praktično pa ni publikacij o boleznih možganov, ki se tradicionalno delijo po strokah – na duševne in nevrološke ter nevrokirurške bolezni. Omenjene stroke pa vendarle družijo številni skupni problemi in interesi. Posebej pomembno je dejstvo, da so izsledki bazičnih nevroznanosti enako pomembni za vsa našeta klinična področja. Evropski svet za možgane je analiziral breme in stroške iz področja bolezni možganov v Evropi. Namen pričujočega besedila je podati poročilo za Slovenijo.

Dvanajst različnih bolezni (oziroma skupin motenj) možganov, ki so bile ocenjene kot stroškovno najpomembnejše, je bilo analiziranih (bolezni odvisnosti, afektivne motnje, anksioznost, možganski tumorji, demenca, epilepsija, migrena in drugi glavoboli, multipla skleroza, Parkinsonova bolezen, psihoze, možganska kap, poškodbe).

Epidemiološki podatki za Evropo so bili zbrani kot letna prevalenca za posamezno bolezen na državo ter razdeljeni glede na starost, spol in težo prizadetosti. Ker je v Sloveniji publicirano le malo originalnih podatkov, so bili uporabljeni ekstrapolirani podatki. Podatki zdravstvene ekonomike (ki predstavljajo direktne zdravstvene stroške, direktne nezdravstvene stroške in indirektno stroške) so bili spremenjeni v evre za leto 2004 in so bili vneseni v zdravstvenoekonomski model.

Skupno število možganskih motenj v Sloveniji je 570.000 za leto 2004; če upoštevamo komorbidnost, ima petina slovenske populacije vsaj eno možgansko bolezen. Ocenjeno je, da imamo 39.000 odvisnikov od alkohola oziroma drog, 105.000 je prizadetih z afektivnimi motnjami, 195.000 z anksioznostjo, 178.000 z migreno in drugimi glavoboli itd. Celotni stroški vseh analiziranih možganskih bolezni so ocenjeni na 833.000.000 evrov, pri čemer so stroškovno najpomembnejše afektivne motnje, demenca in bolezni odvisnosti. Pomembno je poudariti, da je za nekatere bolezni – še posebej kap – glede na pomanjkljive epidemiološke podatke število teh bolnikov podcenjeno, s čimer so pomembno podcenjeni tudi stroški te bolezni. Od celotnih stroškov je 48 % direktnih zdravstvenih stroškov (403.000.000 evrov) 6 % celotnih stroškov predstavljajo zdravila za možganske motnje. S tem možganske bolezni v Sloveniji predstavljajo 14 % celotnih zdravstvenih stroškov ter 9 % celotnih stroškov za zdravila, pomenijo pa 2 % bruto nacionalnega dohodka Slovenije.

Izvedba študije je pokazala na pomembno pomanjkanje epidemioloških in zdravstveno ekonomskih podatkov za možganske bolezni v Sloveniji. Ocenjeni stroški vendarle po našem mnenju predstavljajo razmeroma dobro izhodišče in vzpodbudo za nadaljnje študije. Dosedanje ocene so bile podane kvečjemu glede na posamične bolezni, oziroma posamične stroke, celota problema bolezni možganov pa nikoli doslej ni bila ustrezno prikazana. S tem področja nevroloških ved ni bilo možno primerjati s stroški za druga področja zdravstva, raziskav in pouka.

Ključne besede

nevrološke bolezni; nevrokirurške bolezni; psihiatrične bolezni; možgani; stroški zdravstva

Introduction

Brain disorders figure amongst the leading causes of disease and disability when psychiatric, neurological and neurosurgical disease are counted together. Yet, the knowledge of the epidemiological and economic impact of brain disorders has been relatively little researched in Europe. Moreover, brain disorders have not been viewed as a whole but rather as separate psychiatric, neurological and neurosurgical diseases. For this purpose they have not received the same attention that has been devoted to heart disease,

cancer or AIDS. While specialisation is still the current state of the art, a number of similarities and shared interests between psychiatry and neurology have developed over the last decades. Most importantly, there is a growing awareness that basic brain research (neuroscience) is equally relevant to neurological, neurosurgical disease and mental disorders. Nevertheless, brain disorders are best viewed together in order to draw attention from politicians and other relevant decision makers.

The European Brain Council (EBC) is an example of this new tendency to keep brain disorders together

with its primary purpose to promote brain research activities. It is a co-ordinating council formed by European organisations in psychiatry, psychology, neurology, neurosurgery, basic neuroscience and industrial research, as well as European patient organisations in psychiatry and neurology. In concordance with its mission, the EBC has, as its first major task, analysed the burden and cost of brain disorders in Europe. Namely, without knowing the size of the problem, it is difficult to make clear recommendations about initiatives in research, teaching and public awareness. Consequently, the »Cost of Disorders of the Brain in Europe« study, published in June 2005, presents the current best possible estimate of the cost of brain disorders in Europe based on the existing literature and information from registries.¹

On the contrary to the »Cost of Disorders of the Brain in Europe« study publications, which have presented findings at the European level, the objective of the present manuscript is to report the specific results for Slovenia.

Methods

The methodology of the European study »Cost of Disorders of the Brain in Europe« that also forms the basis of the current publication has been described in detail previously.¹ In brief, 12 specified areas of brain disorders were selected because they were believed to have the highest cost. Furthermore, a preliminary survey indicated that at least some relevant data were present for these disorders. The following disorders were selected: addiction, affective disorders, anxiety disorders, brain tumours, dementia, epilepsy, migraine and other headaches, multiple sclerosis, Parkinson's disease, psychotic disorders, stroke and trauma. Other disorders that might have been equally costly or relevant were left out because they were too heterogeneous or too little data was available.

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 in the analysis based on a systematic review of published literature for the European region. These epidemiologic reviews have been published elsewhere.²⁻⁹ The main source used for the reviews were electronic databases (Medline and Web of Science) complemented by national registries and the Internet. 12 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.

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 The study used the societal perspective. Therefore, the direct medical, direct non-medical as well as indirect costs were included in the analysis. So-called intangible costs such as suffering, loss of quality of life etc. have not been calculated. All economic data were transformed to Euros for 2004. In order to be able to compare across Europe, the collected cost data were adjusted for the differences in purchasing power. Purchasing power parity currency rates (PPP) were therefore used and all the results were expressed in € PPP.

The epidemiological and health economic data were then entered into a health economic model as indicated in Figure 1 in order to estimate the cost per year of brain disorders in Europe.

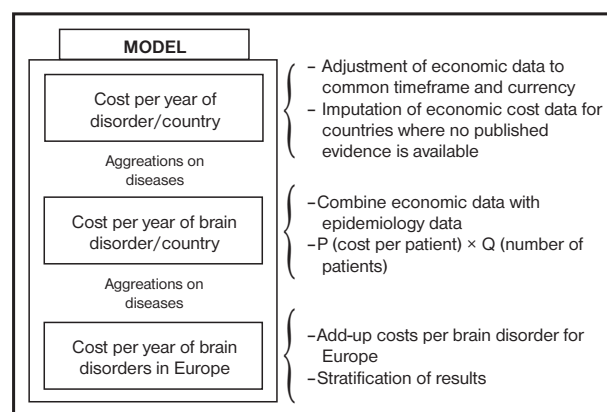


Figure 1. *Health Economic Model.*

Sl. 1. *Zdravstveno ekonomski model.*

Table 1 presents the data on prevalence of brain disorders in Slovenia that were included in the study.¹ On the contrary, for countries in Europe where no cost data were available, including Slovenia, the model was developed to impute cost estimates based on the available input data. An average of the selected economic input data was calculated and formed the basis for imputation. The imputation used different algorithms which were based on indexes from international statistics to eliminate the price level differences across Europe. Direct medical cost were imputed with an index on price level differences in the healthcare sector in Europe, direct non-medical cost data (e.g. transportation, adaptations due to disease, etc.) were imputed with an index on price level differences in the whole economy of European nations (national income), the drug cost as well as the indirect cost data were imputed with an index based on wage level differences in Europe. As a base case, the indexes applied were based on purchasing power parity statistics. The national statistics for Slovenia included in the study is presented in Table 2.

Table 1. *Prevalence of brain disorders in Slovenia.*Razpr. 1. *Razširjenost možganskih bolezni v Sloveniji.*

Brain disorder	Prevalence
Addiction	39,978
Affective disorders ¹	104,839
Anxiety disorders ¹	194,892
Brain tumour	598,000
Dementia ²	18,662
Epilepsy	11,967
Migraine	177,611
Multiple sclerosis	1,655
Parkinson's disease ²	3,791
Psychotic disorders ¹	10,753
Stroke ³	6,062
Trauma ³	3,159
Total	572,967

¹ Prevalence data were based on population aged 18–65.

² Prevalence data were based on population aged 65 or older.

³ Prevalence data were based on population aged 25 or older.

Note: The total number of cases in stroke and trauma are based on incidence data and hence are expected to be underestimated relative to other disorders of the brain.

Table 2. *National statistics for Slovenia included in the study.*Razpr. 2. *Slovenski statistični podatki, ki so bili vključeni v študijo.*

Parameter	Value
Population statistics	1,994,530
GDP/capita (€ PPP)	16,710
Gross wage (€ PPP) ¹	7,203
Health expenditure/ capita (€ PPP)	1,404
Exchange rate (€ PPP)	194.9
Comparative price level ²	0.82

¹ Gross earnings are remuneration (wages and salaries) in cash paid directly to employee, before any deductions for income tax and social security contributions paid by the employee.

² Comparative price levels of final consumption by private households including indirect taxes.

Note: Purchasing power parity (PPP) is an international measure to be able to compare economic data between countries by adjusting for the relative purchasing power in respective countries. Gross domestic product is a measure of the total national income in a country.

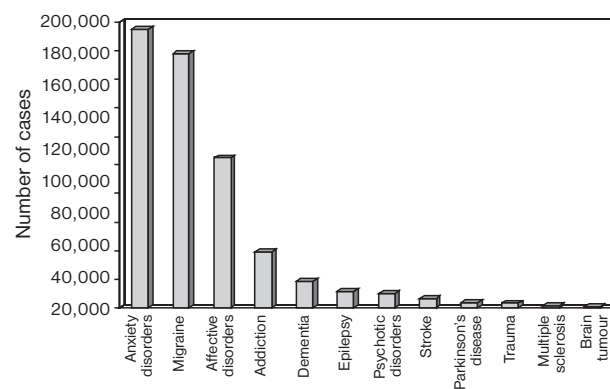
Results

Total prevalence

The total number of people with any brain disorder in Slovenia amounted to approx. 570 000 in 2004, corresponding to almost one third of the total number of Slovenian 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 Slovenian population have a brain disorder.

Number of cases with addiction in Slovenia totalled over 39 000 (including illicit drug dependence and alcohol dependence). If we were to add nicotine dependence to this estimate, the total amount of cases would be 140 000. Affective disorders (depression and bipolar disorder) affected 105 000 cases and anxiety

disorders (panic, phobias, obsessive compulsive disorder (OCD) and generalized anxiety disorder (GAD)) 195 000. The most prevalent neurological disease was migraine, with an estimated 178 000 cases. The distribution of estimated cases with brain disorders in Slovenia across specific disorders are presented in Figure 2. Discrepancies with some available data from »administrative« sources might arise for some of the less prevalent brain disorders, where small numbers present a significant proportion of patients; for multiple sclerosis, for instance, the national registry counts 2500 patients (the resulting prevalence would be higher than for most European countries and has not been obtained by a formal study).

Figure 2. *Estimated number of cases of brain disorders in Slovenia.*

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.

Sl. 2. Ocenjeno število primerov možganskih bolezni v Sloveniji.

Ocena števila kapi in poškodb sloni na podatkih o incidenci, ker ni podatkov o prevalenci. Število primerov odvisnosti ne vsebuje kadilcev.

Cost per patient

Based on a review of economic data in Europe, the cost per case per disorder for 2004 is calculated for Slovenia. Thus, scattered economic studies in Slovenia have not been used directly but have been used together with other European data. From these constituted data, data for Slovenia 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 Slovenia was estimated at 833 million Euros.

Affective disorders were the most costly brain disorders followed by dementia and addiction. Among the neurological disorders stroke was the most costly fol-

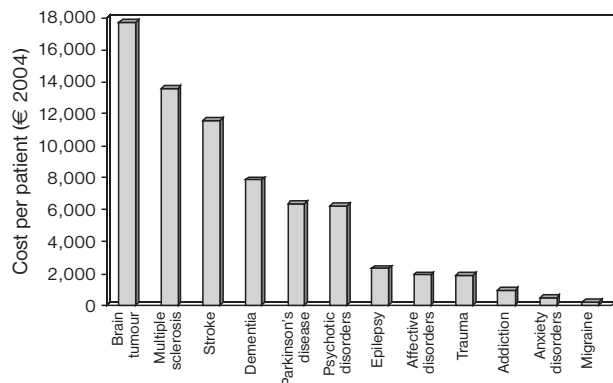


Figure 3. Cost per case of specific brain disorders in Slovenia (in € PPP per patient).

Sl. 3. Stroški na primer določene možganske bolezni v Sloveniji (v EUR/standard kupne moči na bolnika za leto 2004).

lowed by migraine 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.

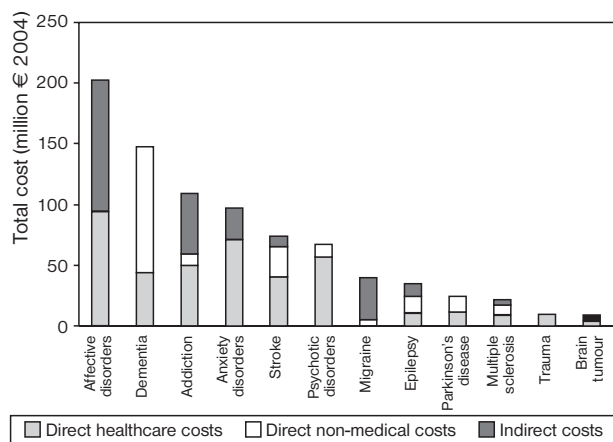


Figure 4. Total cost of brain disorders in Slovenia (€ PPP million, 2004).

Sl. 4. Celotni stroški možganskih bolezni v Sloveniji (v milijonih evrov/standard kupne moči za leto 2004).

Cost of brain disorders per inhabitant

It is of interest how much brain disorders cost each individual citizen in Slovenia. These data are given in Table 3. Taken together, brain disorders cost each citizen of Slovenia € 418 per year.

Cost of brain disorders distributed by resource items

These data are presented in detail in Table 4. Direct health care cost amounted to € 403 million and con-

Table 3. Cost per inhabitant of specific brain disorders in Slovenia (€ PPP, 2004).

Razpr. 3. Stroški možganskih bolezni na prebivalca v Sloveniji (stroški v EUR/standard kupne moči na posameznega bolnika za 2004).

Brain disorder	Direct medical cost	Direct non-medical cost	Indirect cost	Total
All disorders	202	93	122	418
Addiction	25	5	25	55
Affective disorders	47	0	54	101
Anxiety disorders	36	0	13	48
Brain tumour	2	0	2	4
Dementia	22	52	0	74
Epilepsy	5	7	6	18
Migraine	3	0	17	20
MS	4	5	2	11
Parkinson's disease	6	7	0	12
Psychotic disorders	28	5	0	34
Stroke	20	12	4	37
Trauma	5	0	0	5

stituted 48 % of total cost, direct non-medical cost totalled € 186 million, 22 %, and indirect cost € 244 million (29 %) and was mainly consisting 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 6 % of the total cost.

Table 4. Distribution of total cost of brain disorders in Slovenia by resource use components.

Razpr. 4. Razporeditev celotnega stroška možganskih bolezni po komponentah (izraženo v EUR/standard, kupne moči).

Cost	€ PPP million	%
Direct medical costs	403	48 %
Hospitalization	226	27 %
Drugs	51	6 %
Outpatient care	120	14 %
Medical devices	5	1 %
Direct non-medical costs	186	22 %
Social services	146	17 %
Informal care	18	2.2 %
Adaptations	17	2 %
Transportation	6	0.7 %
Total indirect costs	244	29 %
Sick leave	170	20 %
Early retirement	38	5 %
Premature death	37	4 %
Total costs	833	100 %

Brain disorders in Slovenia constituted 14 % of the total direct health care cost in Slovenia. Out of total drug sales in Slovenia, 9 % were used for treatment of brain disorders. The total cost of brain disorders (direct and indirect cost combined) constituted 2 % of the gross national product of Slovenia.

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 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 5. 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 the study.

Table 5. *Cost of brain disorders in Slovenia by disorder area (€ PPP million).*

Razpr. 5. *Stroški možganskih bolezni glede na področje (v milijonih EUR/standard, kupne moči).*

(PPP million)	Direct medical costs	Direct non-medical costs	Indirect costs	Total cost
Neurosurgical disorders	13	1	4	18
Brain tumour	4	1	4	9
Trauma	9			9
Neurological disorders	74	61	58	194
Epilepsy	10	14	12	35
Migraine and other headaches	5		34	39
Multiple sclerosis	8	10	4	21
Parkinson's disease	11	14		25
Stroke	40	24	9	73
Neurological/mental disorder	44	104		148
Dementia	44	104		148
Mental disorders	272	20	182	474
Addiction	50	10	49	109
Affective disorders	94		108	202
Anxiety disorders	71		25	96
Psychotic disorders	57	11		67
All brain disorders	403	186	244	833

Discussion

This is the first publication in Slovenia with the intention to estimate the overall cost of brain disorders in Slovenia. Overall, the study shows that brain disorders are extremely costly and cause a huge burden to the Slovenian society. The total cost of brain disorders was estimated at € PPP 833 million. They consume 2 % of the gross national product and cost each citizen of Slovenia € PPP 418 per year. However, it should be remembered that this is a conservative estimate because not all brain disorders were included in the estimate, not all type of costs were included for some disorders and prevalence estimates for some disorders did not necessarily cover the whole population. Although it largely depends on extrapolated data, it is worthwhile to highlight the extent of the problem.

In contrast to the lively media debate indicating that disorders of the brain are over-treated medically, the drug costs for brain disorders are predicted to constitute only 9 % of the total drug market in Slovenia, and only 6 % of the total cost of brain disorders in Slovenia. 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 authors are generally against attempts to allocate disorders to certain specialities, one might nevertheless point out that the disorders that are traditionally regarded as psychiatric account for ap-

proximately 2/3 of the total costs while disorders traditionally regarded as neurological/neurosurgical account for the last 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 disorders in Slovenia mainly because they are both prevalent and costly per case. This is also in line with the general cost pattern in the rest of the European countries.

Implications for research, health care policy and education

The large costs of brain disorders would be expected to reflect in future research priorities as well in health care policy. Indeed, Slovenian research activities in the area of epidemiology as well in clinical, humanistic (e.g quality of life) and economic outcomes of brain disorders are largely deficient. Furthermore, allocation of funds in health care should consider the large burden brain disorders represent to the society. Nonetheless, the curricula of permanent and continuing education should reflect the above described needs and be able to prepare future as well as current health-care workers to face the huge burden of brain disorders as competent professionals.

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