

Cost of Disorders of the Brain in Europe 2010

Gustavsson et al. *Cost of disorders of the brain in Europe 2010*.
Eur. Neuropsych. (2011) 21, 718-779

Steering Committee

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Acknowledgements

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Background

Previous report

Cost of the disorders of the brain in Europe 2005

- Report included 27 European countries and 12 diagnostic groups
- Cost was estimated at €386 billion in 2004
- Number of persons affected: 127 million European adults

Need for revision

EBC 2005 cost estimates

- Covered only 12 major disorders of the brain
- Lack of epidemiologic and/or economic data

EBC 2010 study

- Growth of evidence – possibility to include more disorders of the brain / extensions to previously studied disorders
- Addition of two European countries (Bulgaria & Romania)

Aim of study

To estimate:

1. The number of persons with defined disorders of the brain in Europe in 2010
2. The total cost per person per year related to each disease by specifying direct and indirect costs
3. The total cost per disorder and country
4. The total cost of brain disorders in all of Europe

Methods

Update on disorders included in 2005

Addiction

Mood disorders

Anxiety disorders

Multiple sclerosis

Brain tumour

Parkinson's disease

Dementia

Psychotic disorders

Epilepsy

Stroke

Migraine

Traumatic Brain Injury

Extension of disorders included in 2005

Anxiety disorders: PTSD

Traumatic Brain Injury: Moderate and Severe cases
Prevalent cases

Stroke: Prevalent cases

Medication Overuse
Headache: Tension Type
Other

Disorders of the brain added in the 2010 study

Child/adolescent disorders

Eating disorders

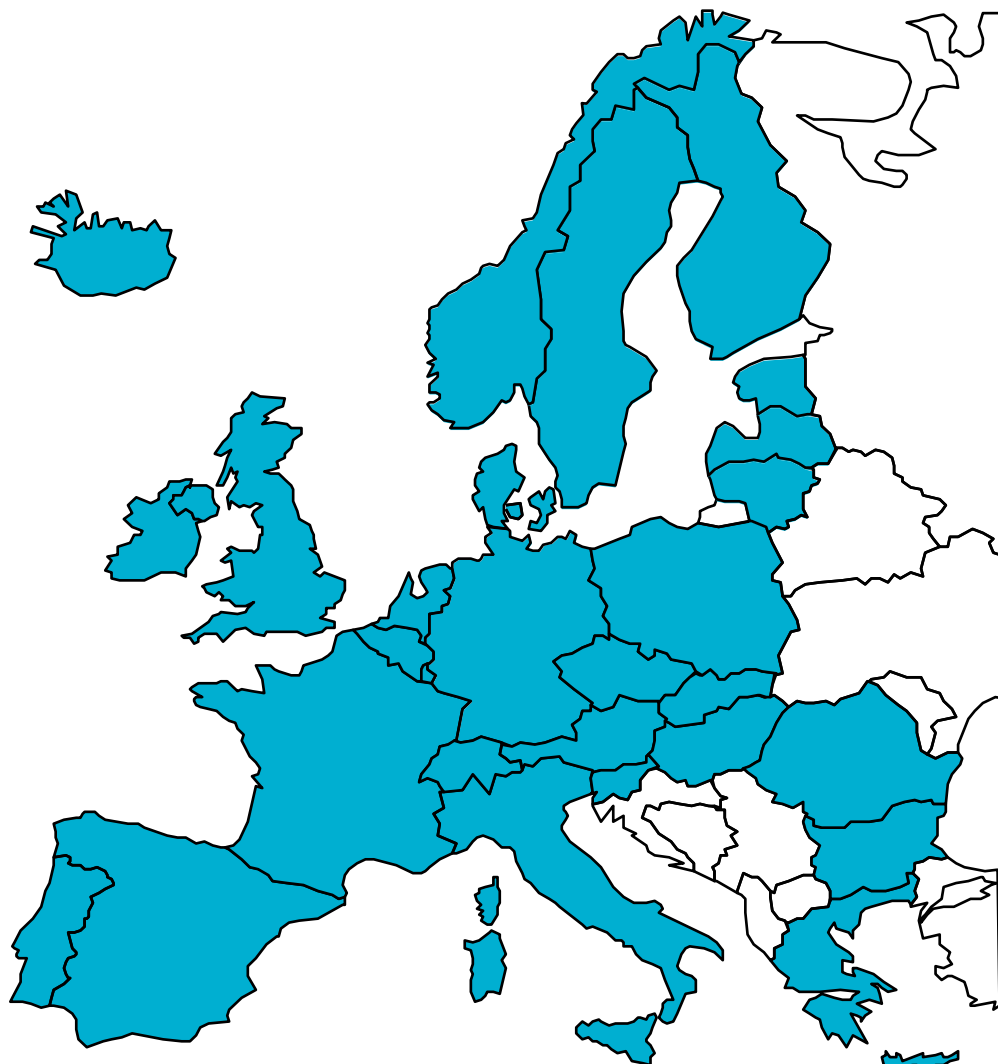
Intellectual disability disorders

Personality disorders

Sleep disorders

Somatoform disorders

Geographical scope



EU member
countries
(EU-27) plus
Iceland, Norway,
and Switzerland

Cost-of-illness methodology

- Societal perspective
- Cost is presented in 3 main categories:
 - Direct health care cost
 - Direct non-medical cost
 - Indirect cost

Cost-of-illness methodology

Bottom-up

Cost information collected for individual patients

Prevalence-based

Number of patients in a 12 month period

Total Cost

Annual cost per subject **X** Number of patients in a given
year

European Cost-of-illness Model

Input Data

For countries where data was available

- Cost per subject with a disorder
- 12-month prevalence of the disorder

Cost per
brain disorder
per country



Cost of all
brain
disorders per
country



Cost of all
brain
disorders in
Europe

Cost per subject with a disorder

Literature review (PubMed)

- Search strings - combination of disorder and cost terms, and relevant countries
- All hits with an English abstract were reviewed
- Articles with potentially useful information were retrieved as full texts

Cost per subject with a disorder

Literature review (PubMed)

Inclusion criteria

Data on costs / resource use – cost-of-illness studies

Relevant diagnosis

Data for any of the 30 relevant countries

Written in English, French, German, Italian or Spanish

Robust methodology

Published on January 1st 2004 or later

Cost components included in the 2010 study

For most disorders:

direct healthcare, direct non-medical cost, and indirect cost

- Indirect cost only applicable to working population (18 – 65 years old) unless estimates were presented as an average of the total population with the disorder
- Direct cost was adjusted for the treated vs. untreated population where estimates referred to a subset of the total population

12-month prevalence for each disorder

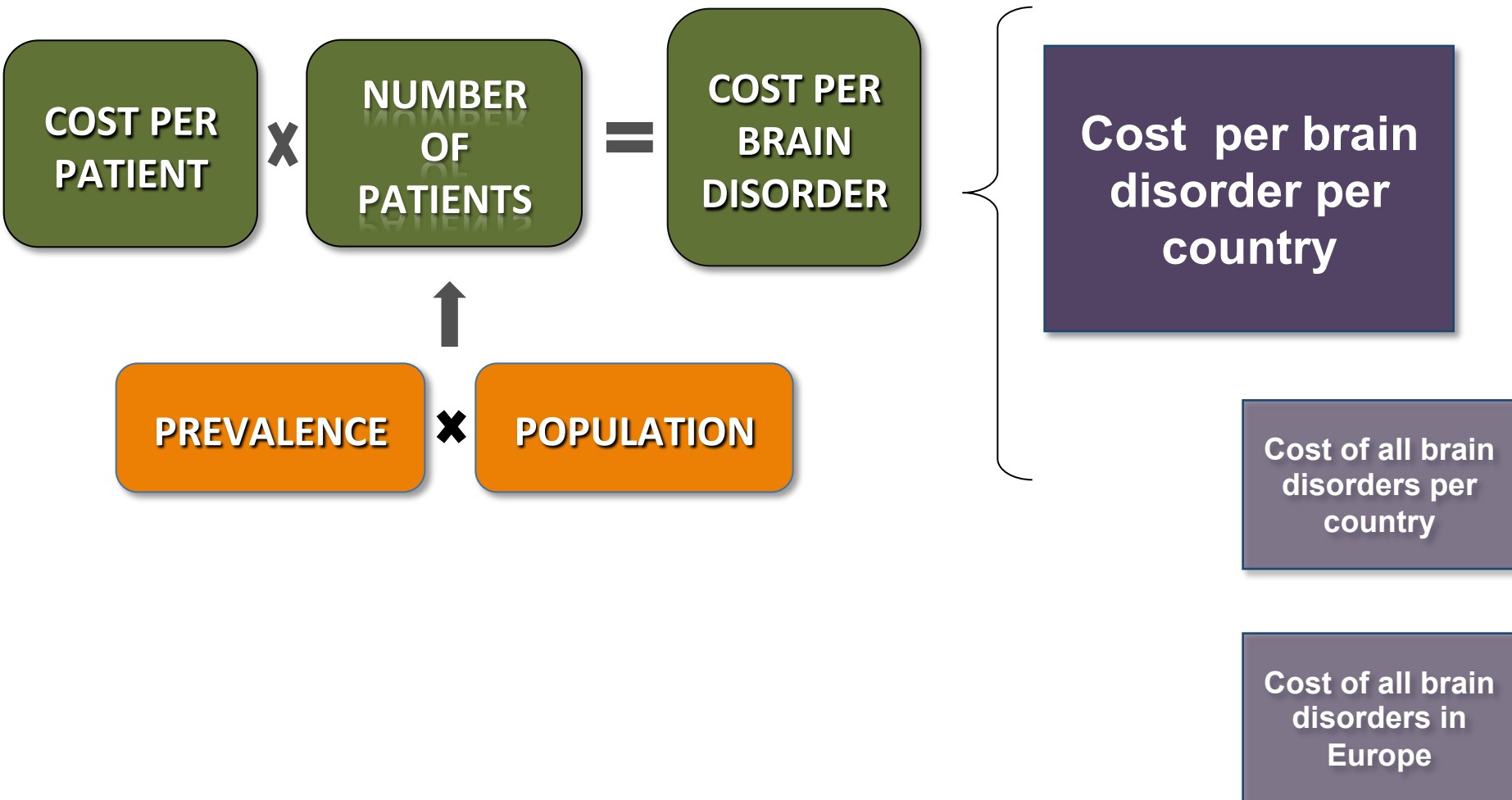
Literature review (PubMed)

- Performed by disorder specific epidemiologic panels

Country-specific surveys

- Best-estimate provided by experts

European Cost-of-illness Model



European Cost-of-illness Model

Cost per subject

- adjusted to € 2010 using the Consumer Price Index (Eurostat)
- converted to real € using nominal exchange rates (European Central Bank) adjusted for comparative price levels (PPP - Eurostat)

Population data retrieved from Eurostat

Cost per brain disorder per country

Cost of all brain disorders per country

Cost of all brain disorders in Europe

European Cost-of-illness Model

For countries with missing prevalence and/or cost data

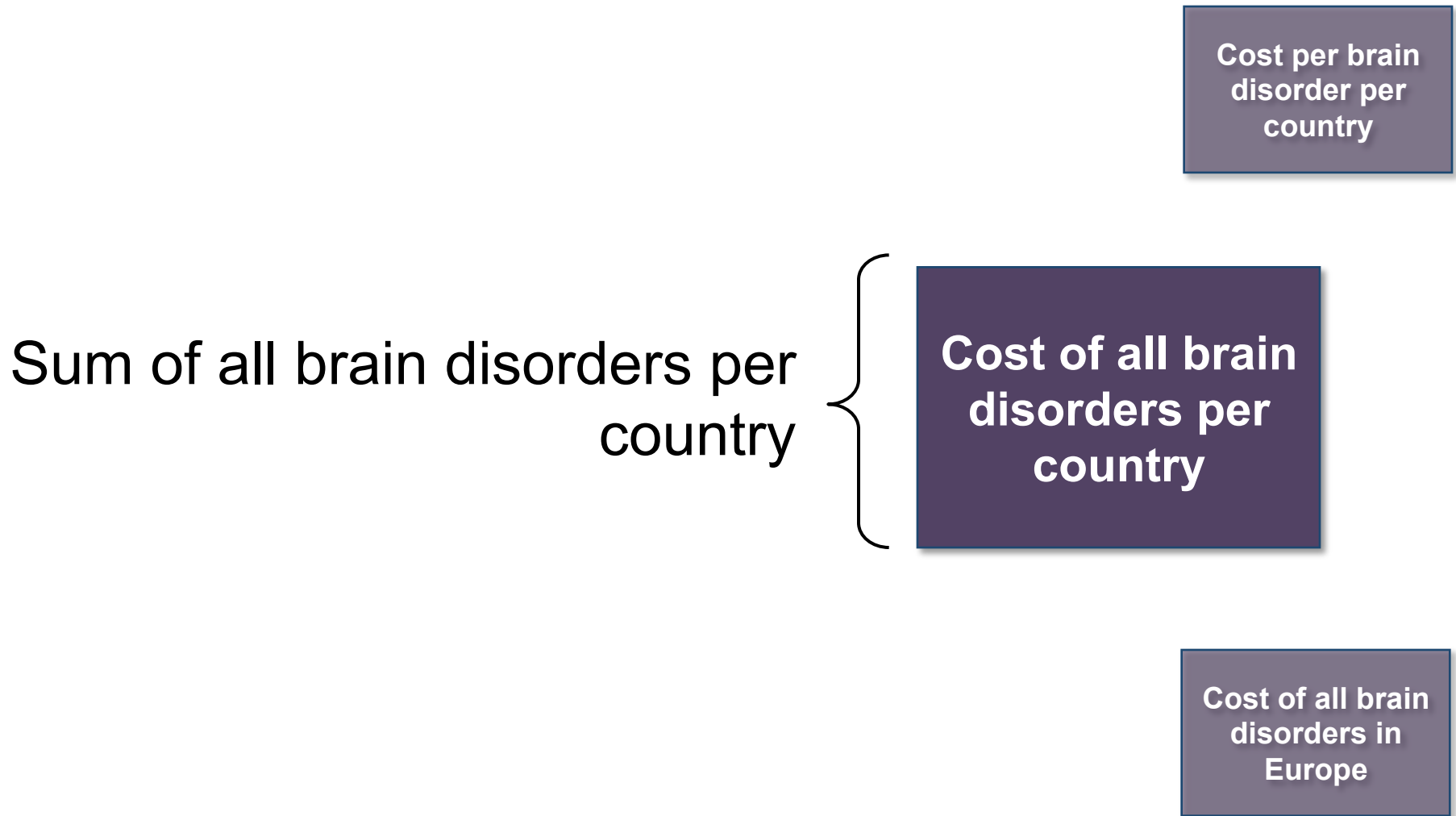
- median prevalence ratio
- median cost per subject
adjusted for income, healthcare expenditure and wage level differences across countries

Cost per brain disorder per country

Cost of all brain disorders per country

Cost of all brain disorders in Europe

European Cost-of-illness Model



European Cost-of-illness Model

Cost per brain
disorder per
country

Cost of all brain
disorders per
country

**Total cost of disorders of the
brain in Europe 2010**



**Cost of all brain
disorders in
Europe 2010**

Validation of results

- Comparison with EBC 2005

- External data
 - Administrative databases
 - Other European reviews
 - Studies from the United States (for some disorders)

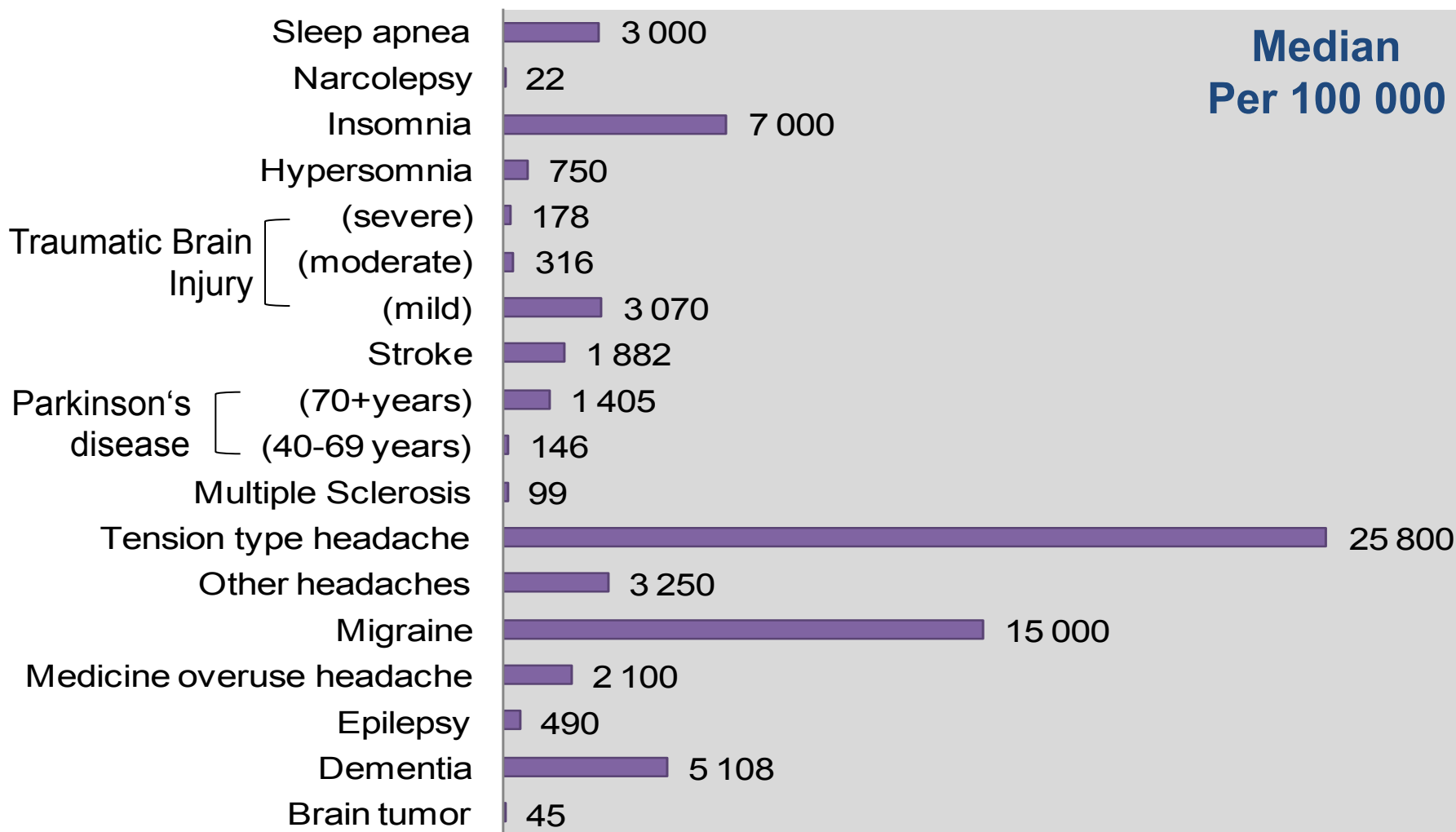
Epidemiology

Epidemiology

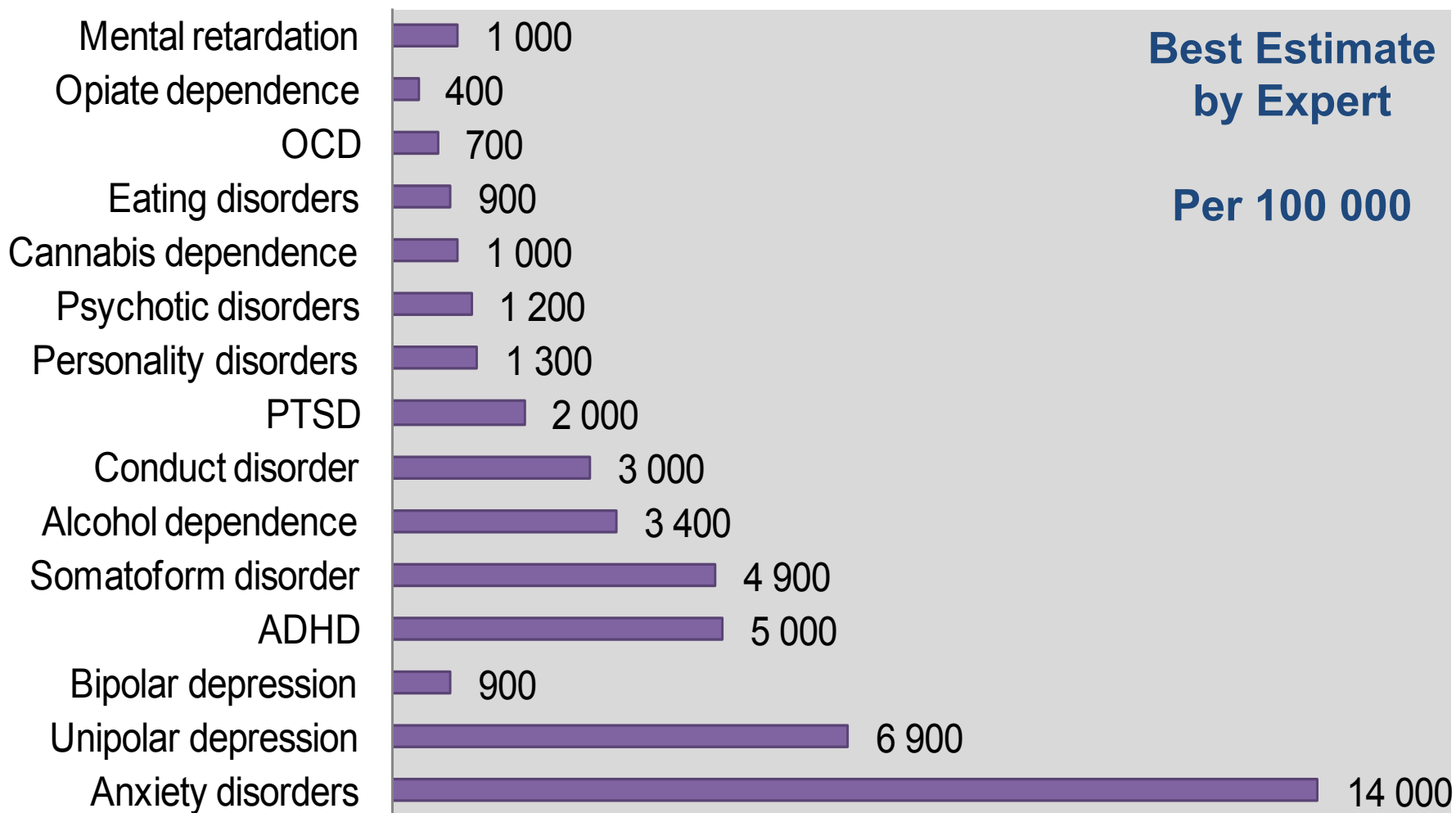
Aggregated 12-month prevalence rates

- age-group-specific prevalence: calibrated age specific diagnostic prevalence to reflect the total population of all ages
- adjusting for comorbidity: assumptions based on theoretical and restricted empirical grounds to avoid double counting

Neurologic disorders – 12 month prevalence



Mental disorders – 12 month prevalence



Results

Number of diagnoses

- EBC 2005 – 127 million
- EBC 2010 – 380 million
 - 12 previously studied disorders including extensions:
299 million
 - New disorders of the brain: 81 million

Number of diagnoses – difference with EBC 2005

- Increase in underlying population
 - Population under 18 and over 65 was included
 - Per country increase of population
 - New countries were added

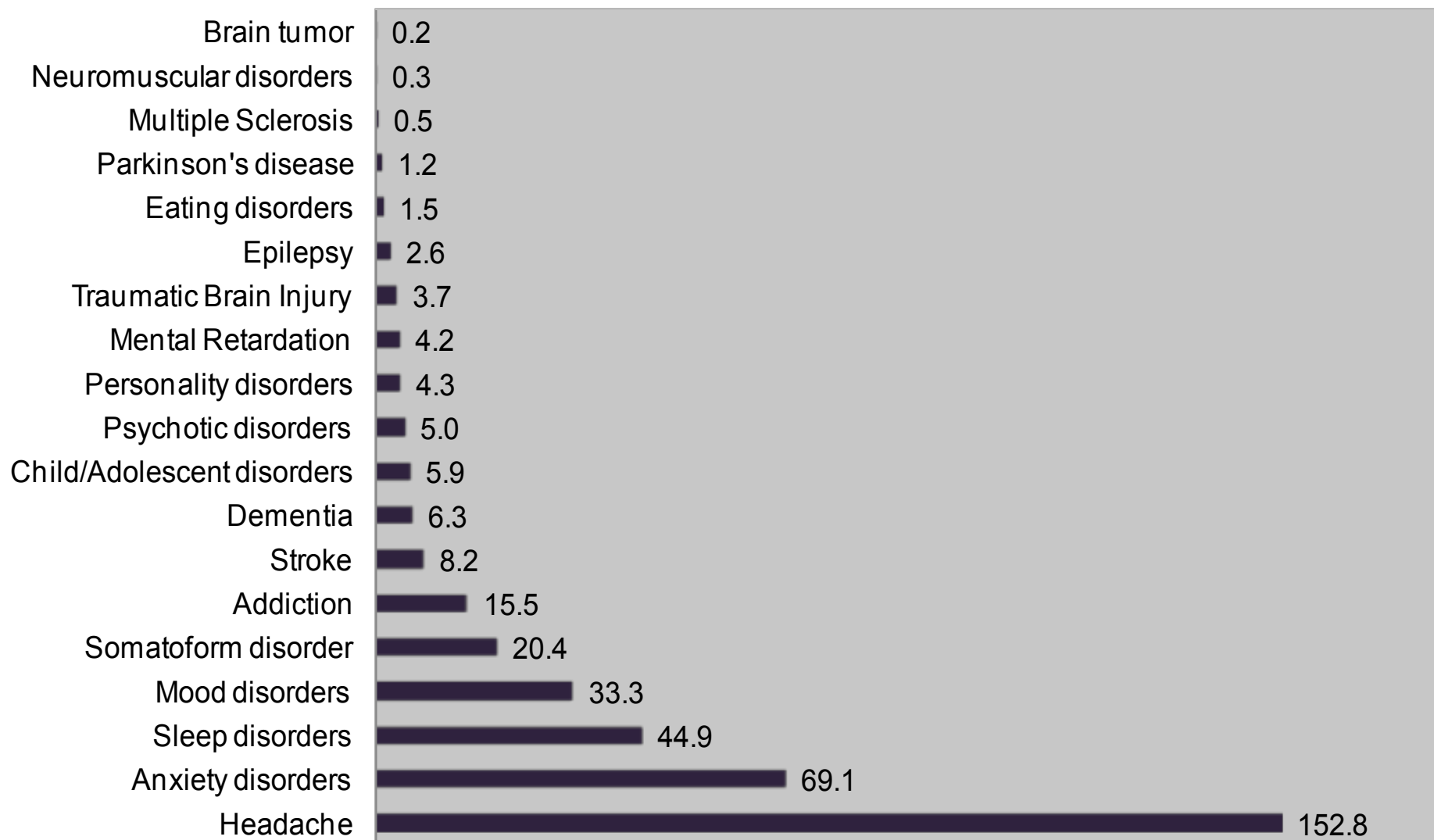
- Disorder extensions and new disorders
 - Additional sub-groups for disorders studied previously
 - Results for 7 new disorders

Number of diagnoses – difference with EBC 2005

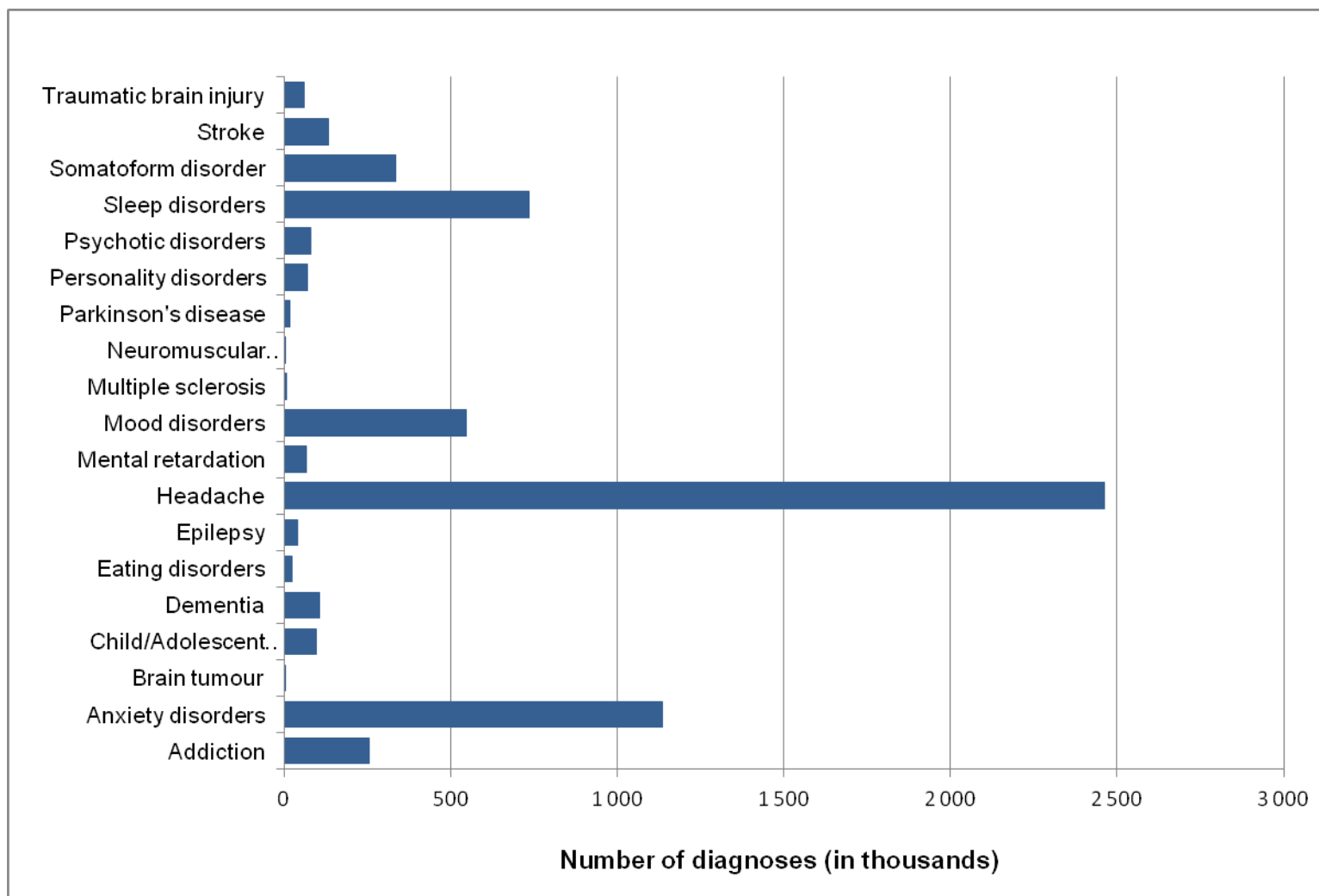
New evidence for the prevalence of some disorders

- *Addiction*
 - higher prevalence for alcohol addiction but lower for cannabis addiction
- *Brain tumors*
 - higher prevalence due to inclusion of benign brain tumors
- *Migrainious headaches*
 - new evidence in the literature suggesting higher prevalence compared to 2005
- *Multiple Sclerosis*
 - change in diagnostic criteria resulted in earlier detection of the disease and therefore to higher prevalence

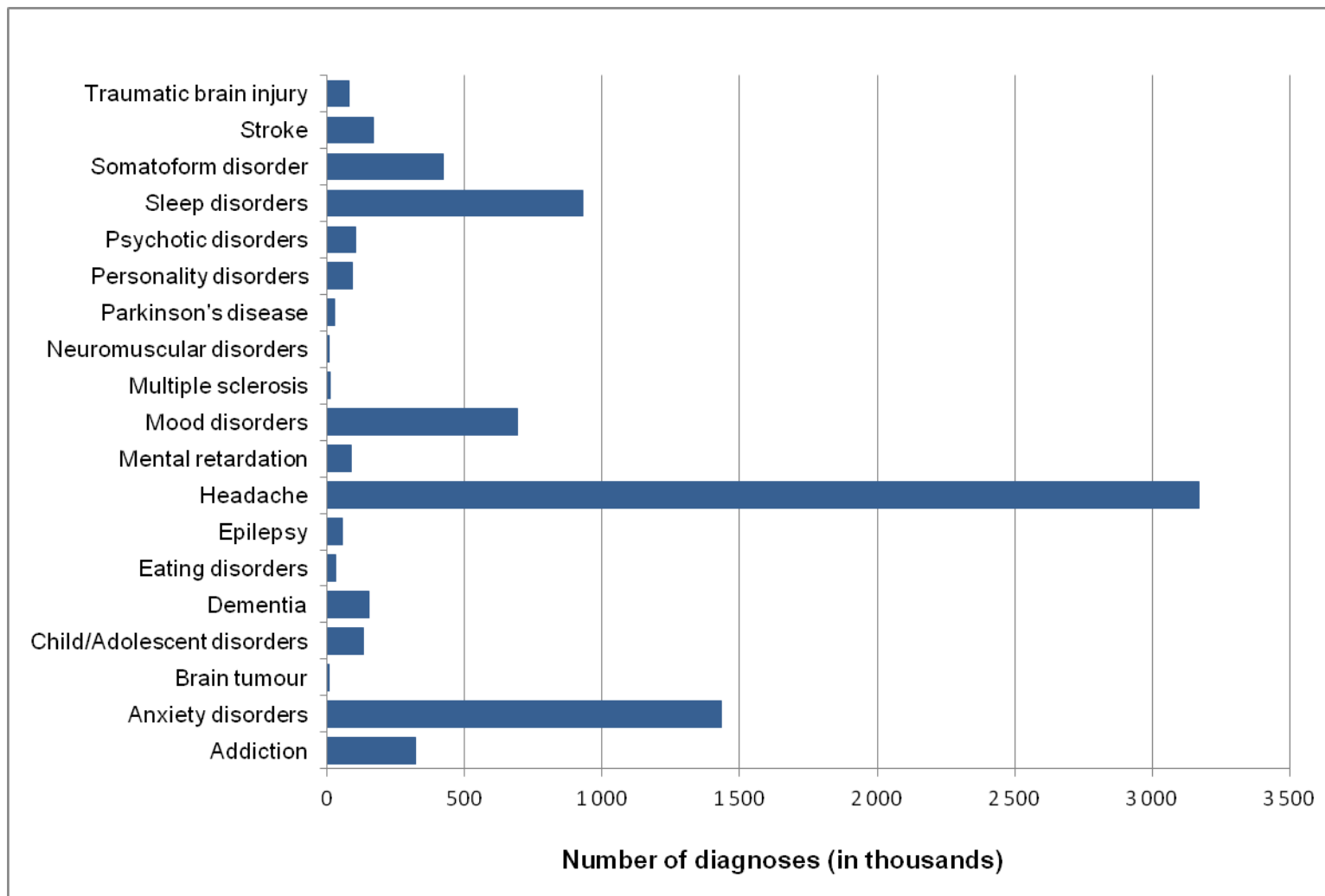
Number of diagnoses with disorders of the brain in Europe, in Million



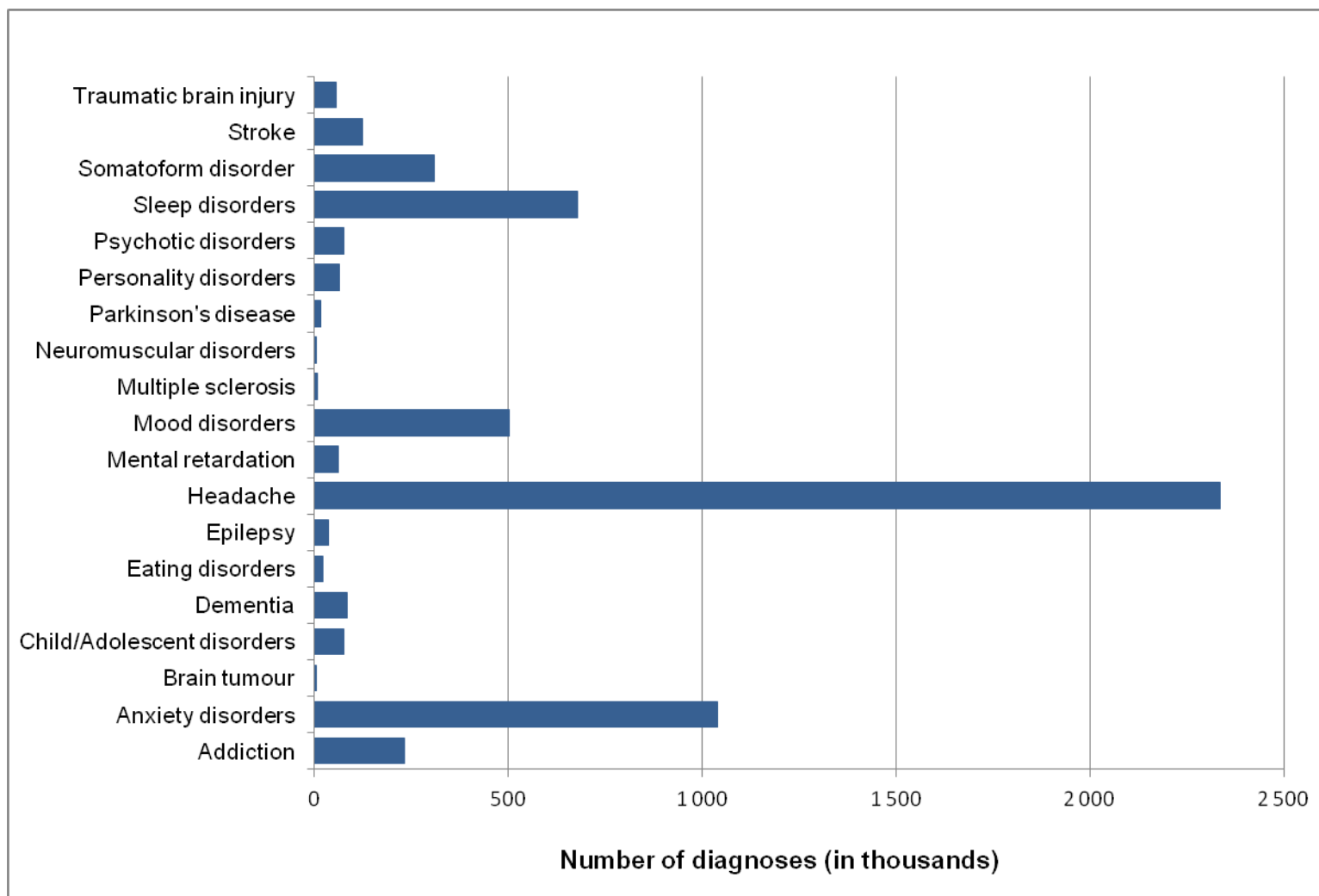
Number of diagnoses – Austria



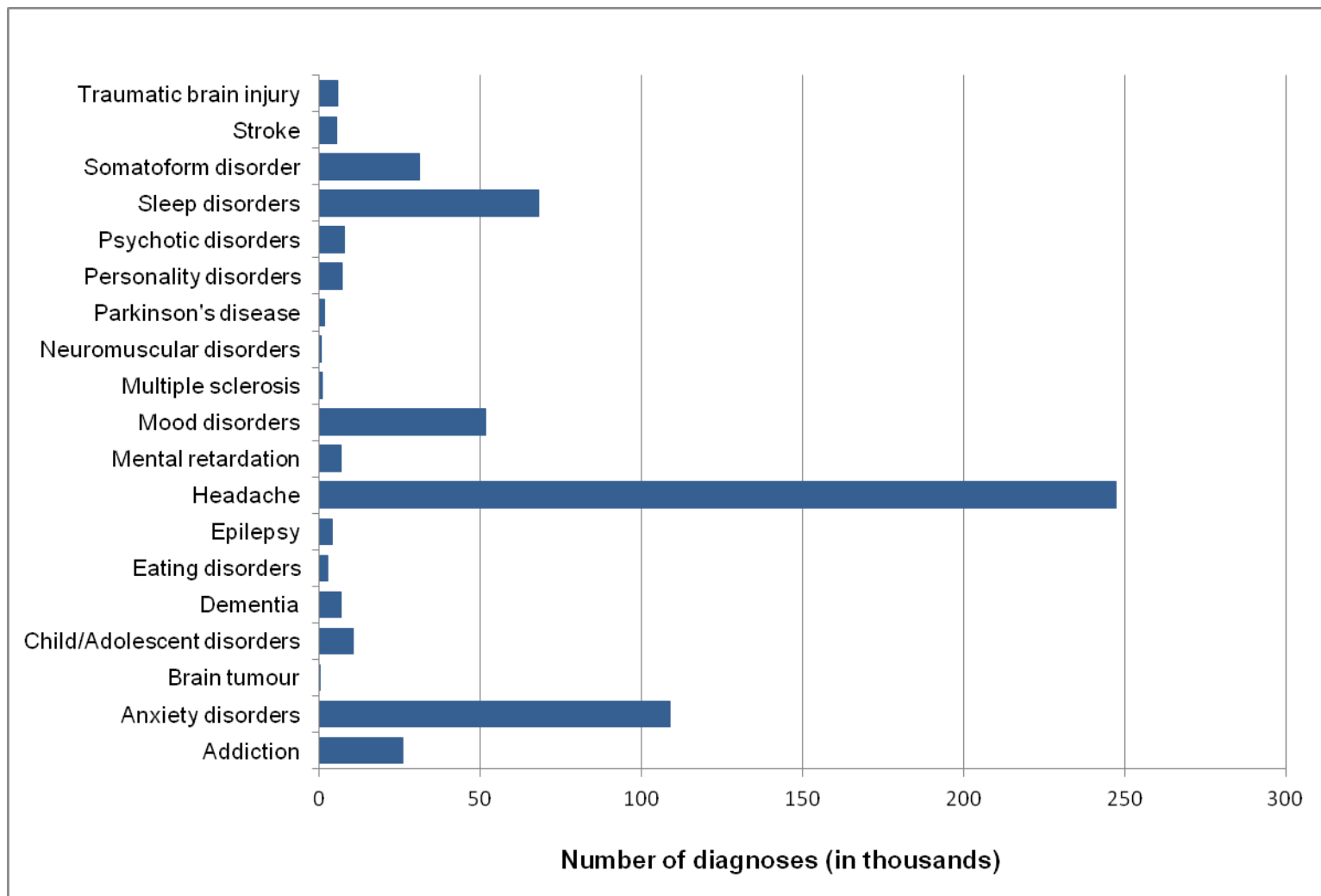
Number of diagnoses – Belgium



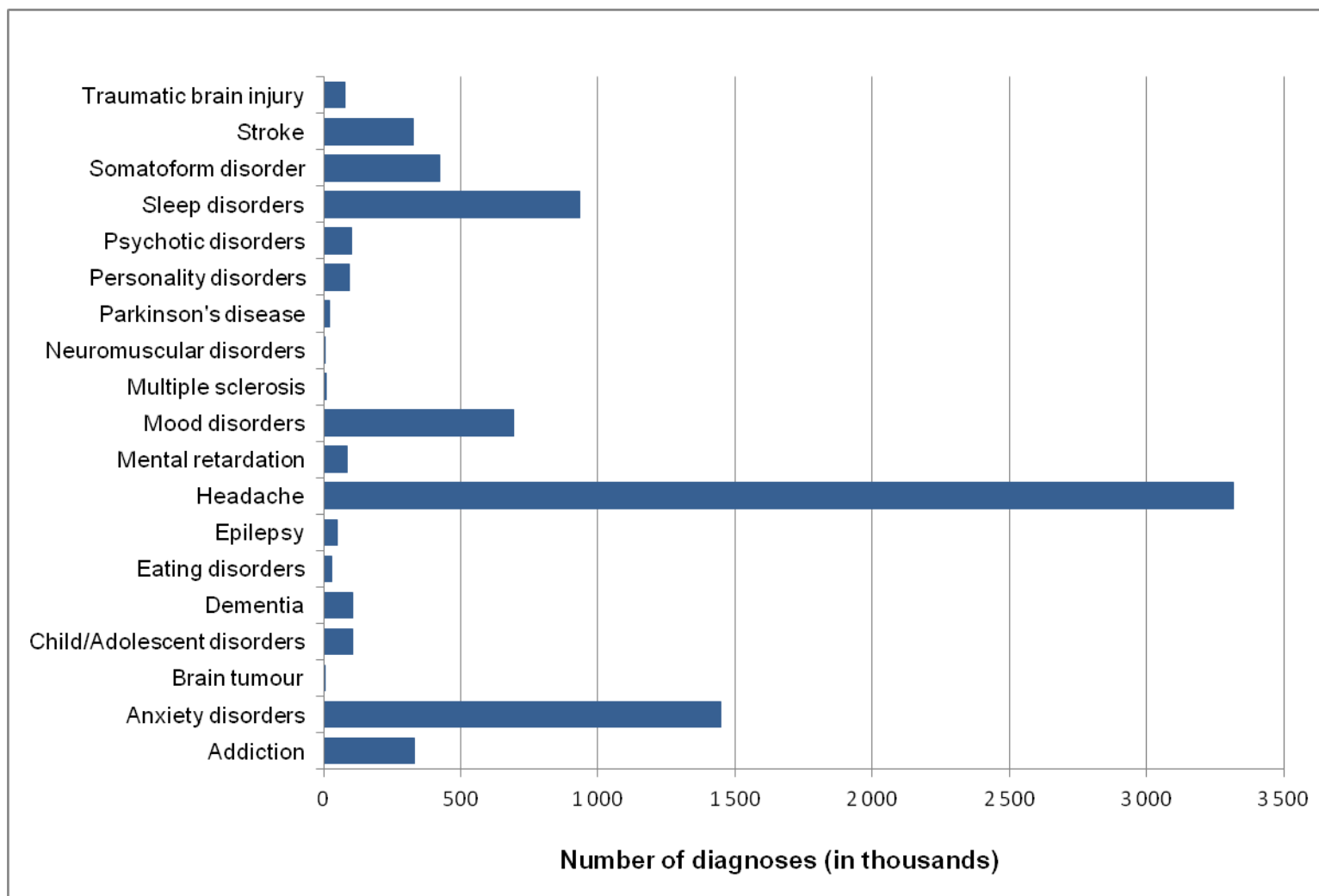
Number of diagnoses – Bulgaria



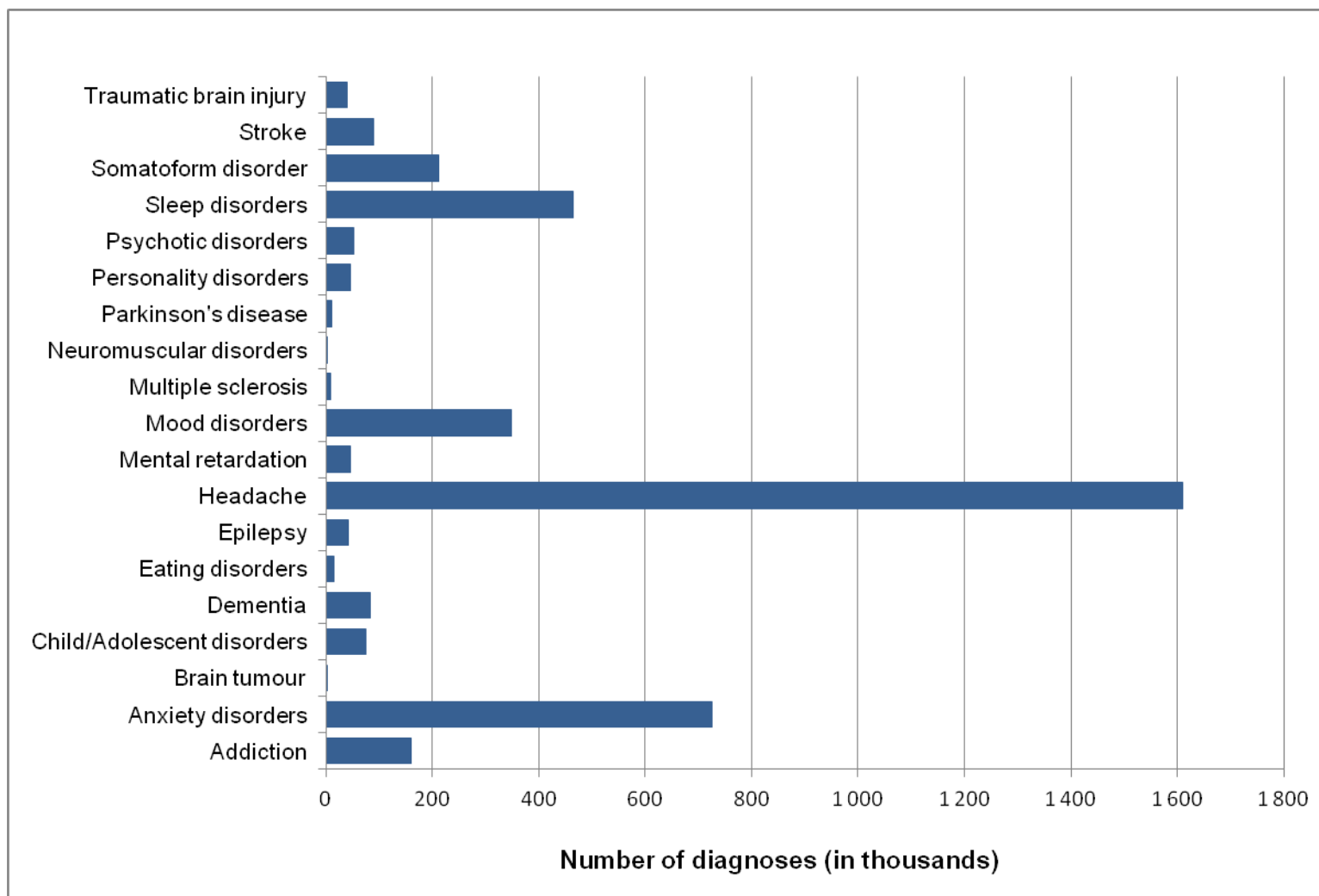
Number of diagnoses – Cyprus



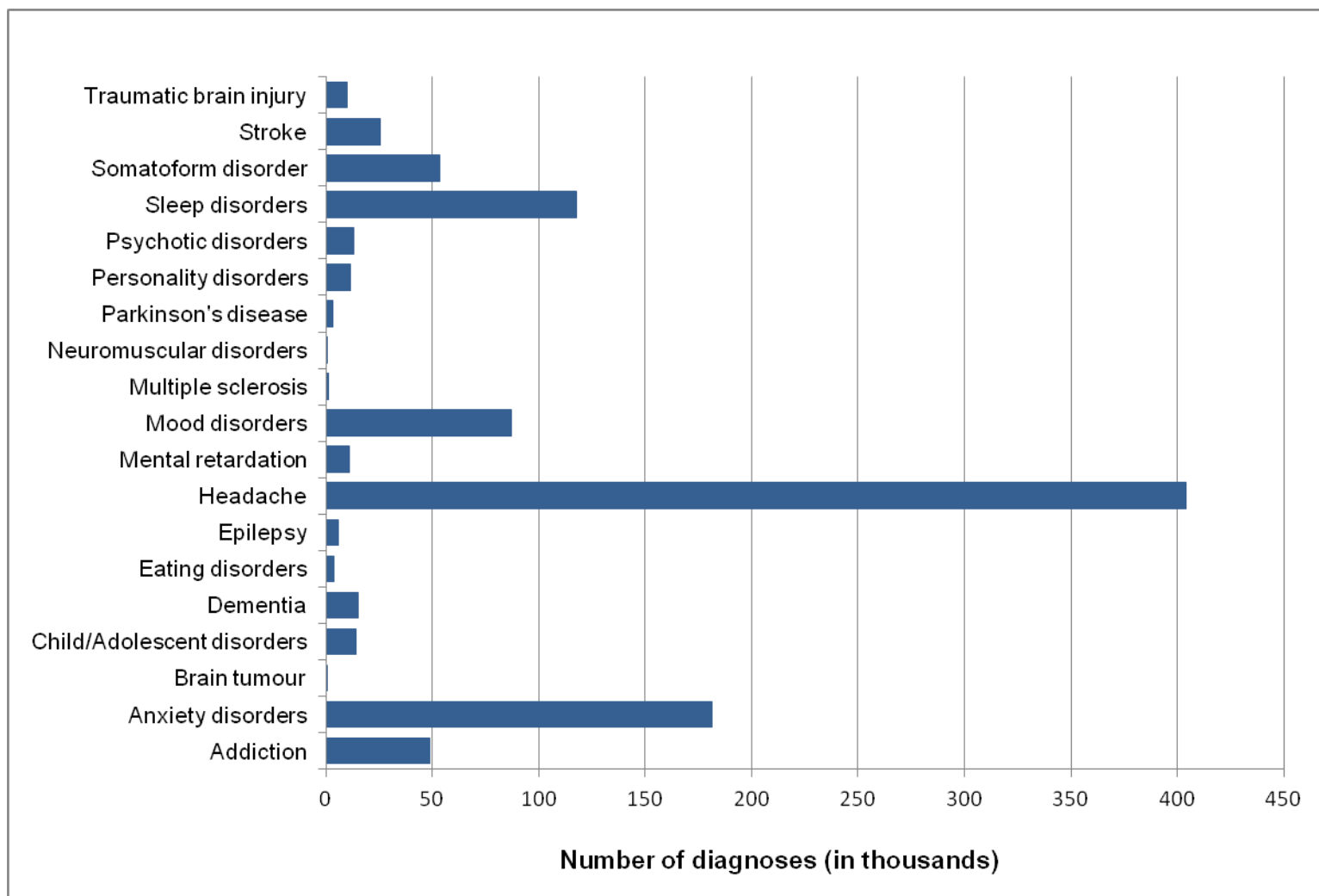
Number of diagnoses – Czech Republic



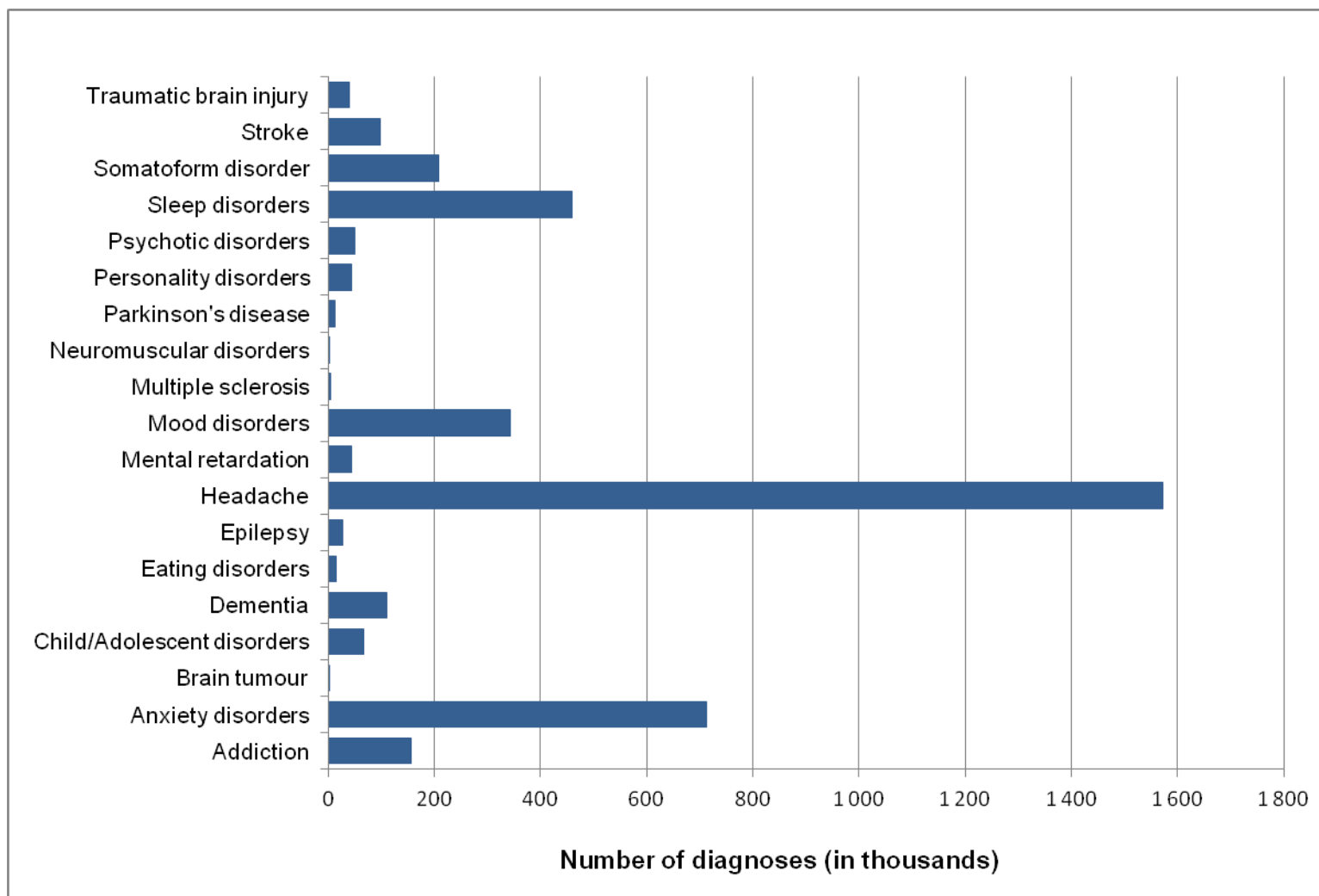
Number of diagnoses – Denmark



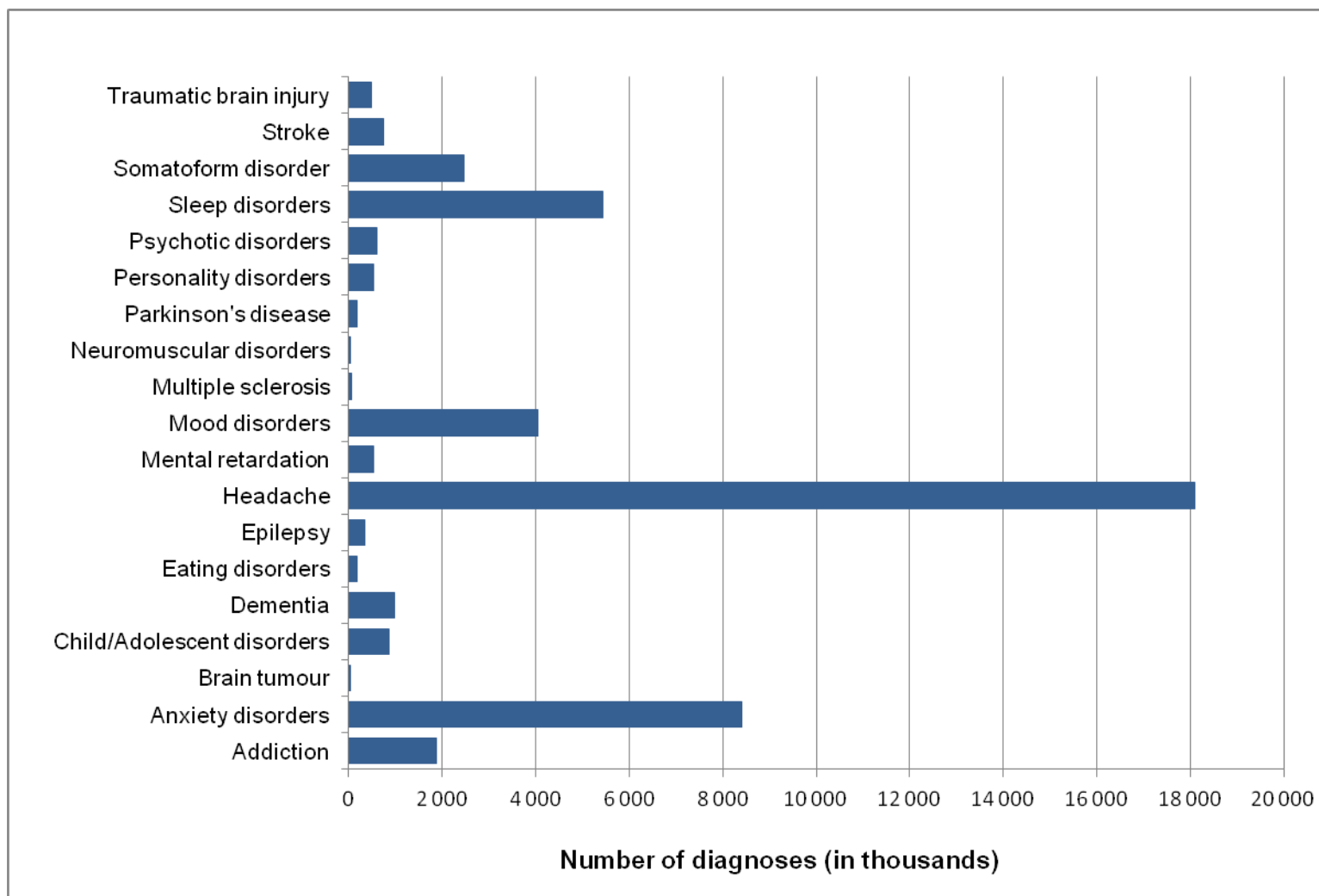
Number of diagnoses – Estonia



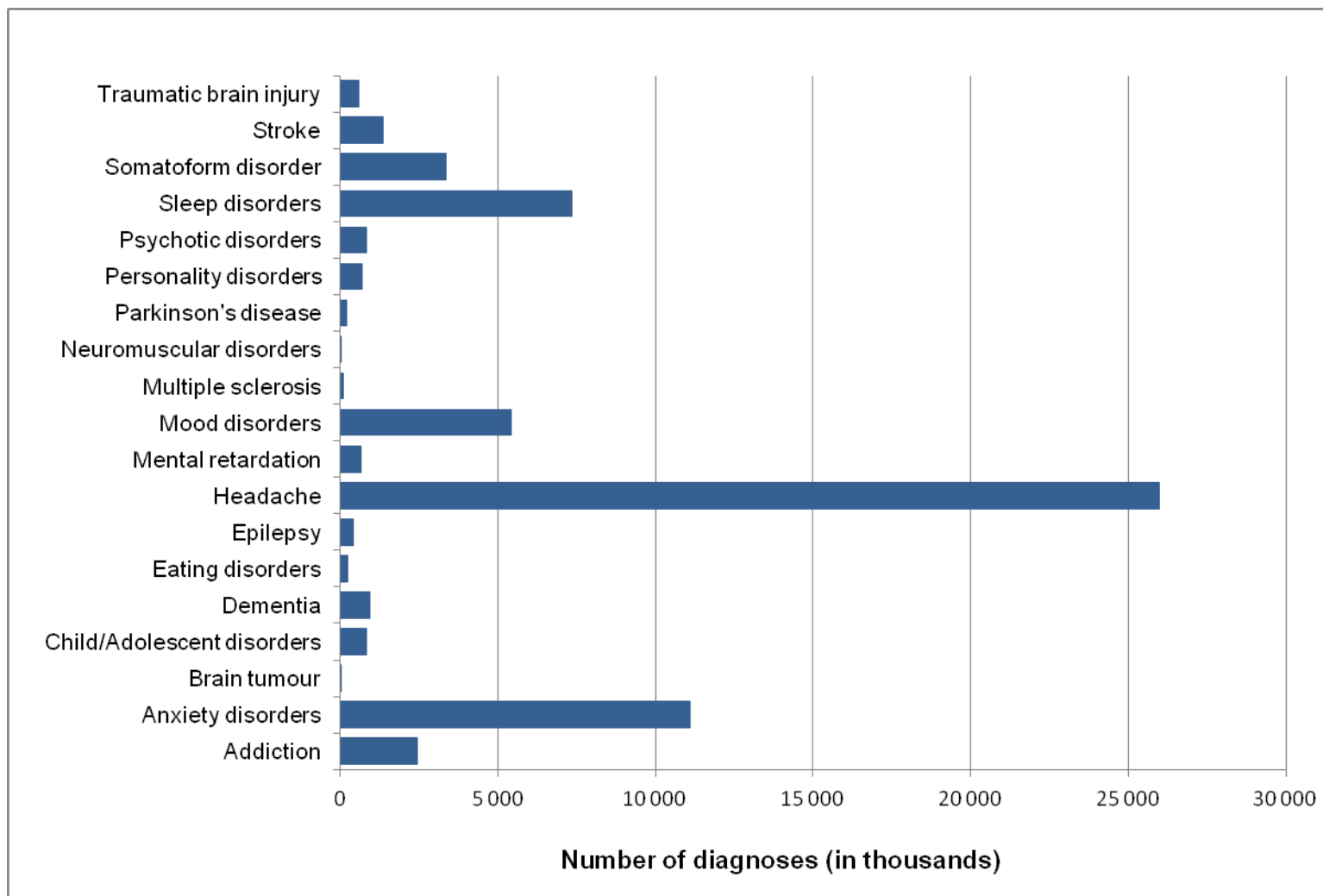
Number of diagnoses – Finland



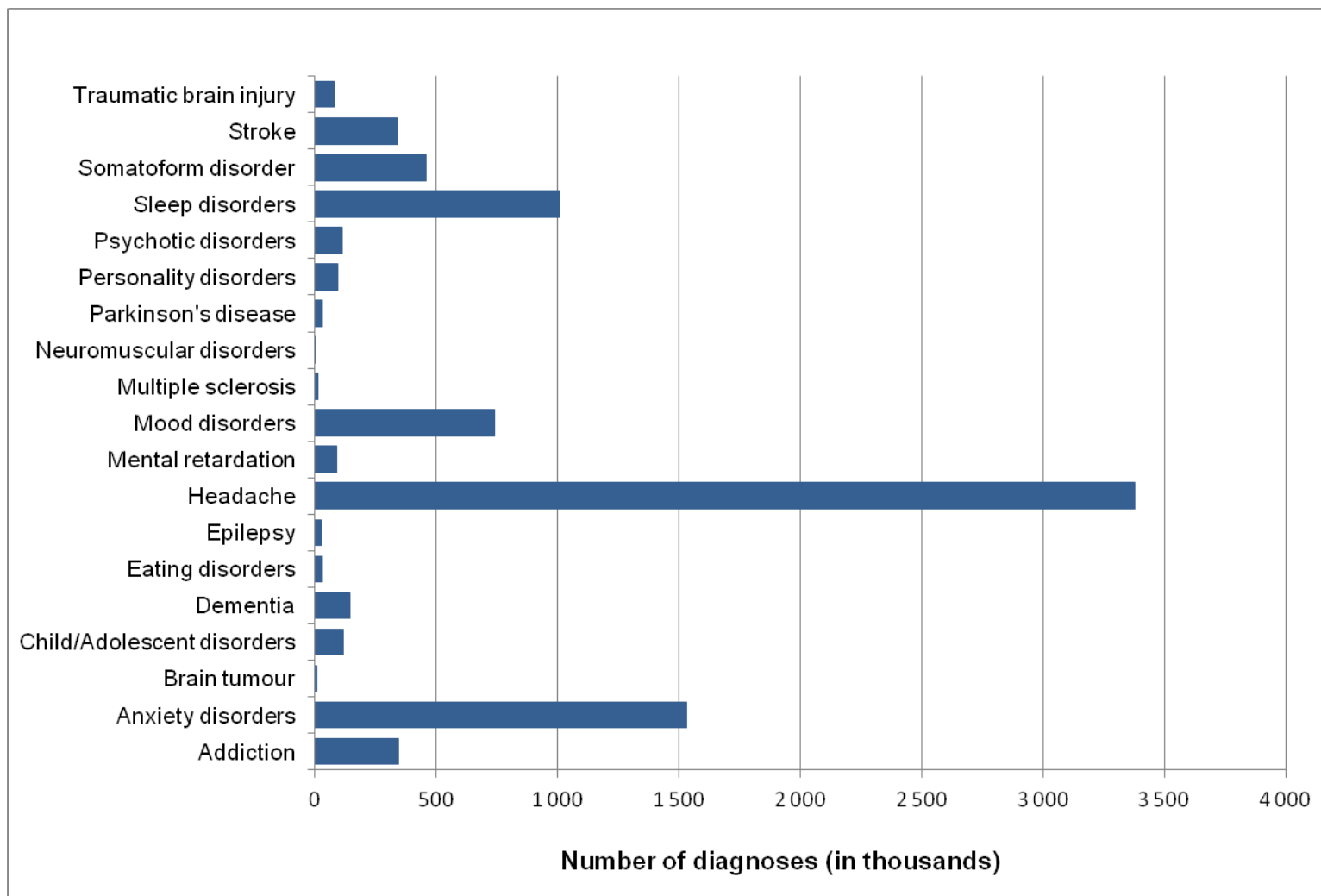
Number of diagnoses – France



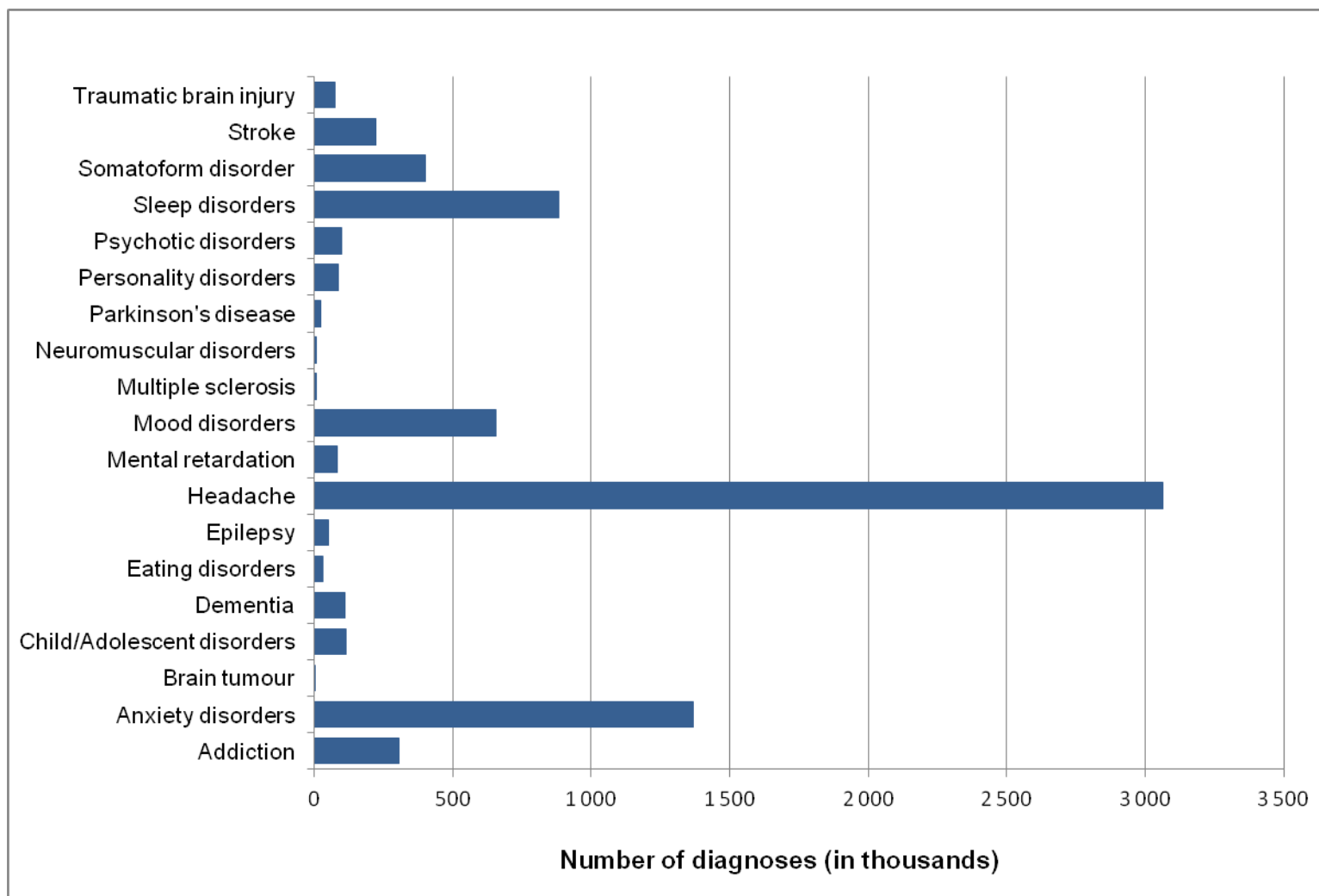
Number of diagnoses – Germany



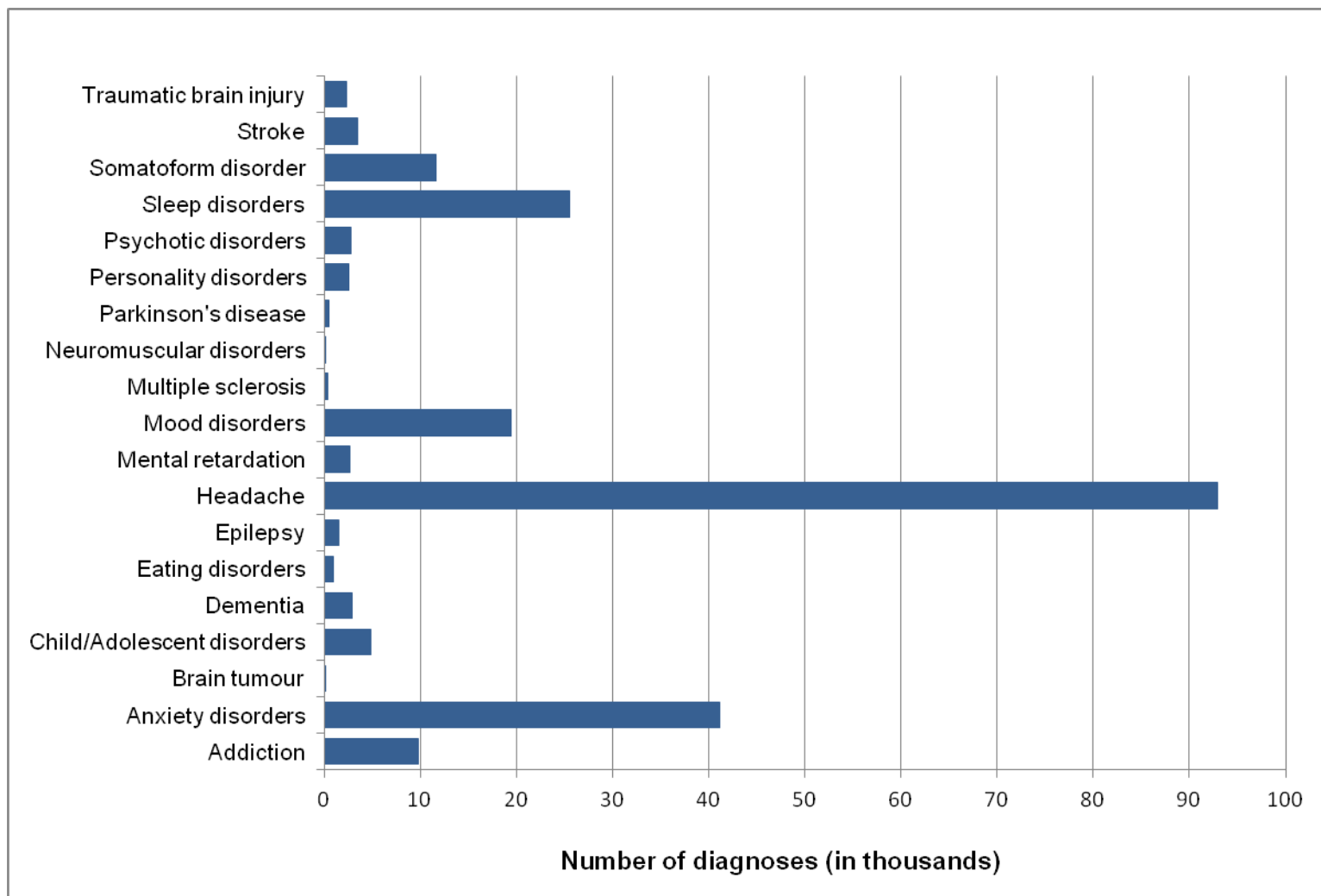
Number of diagnoses – Greece



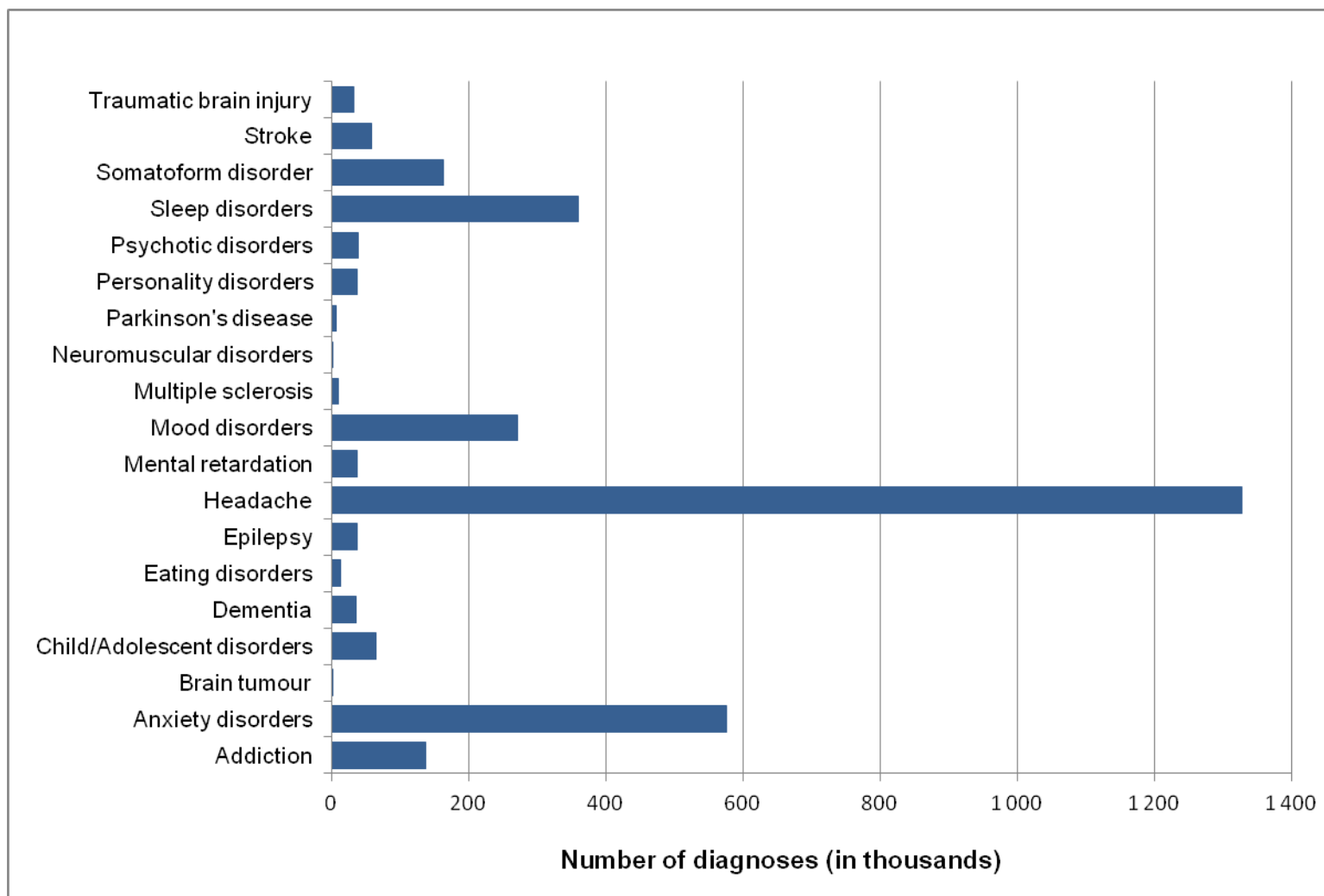
Number of diagnoses – Hungary



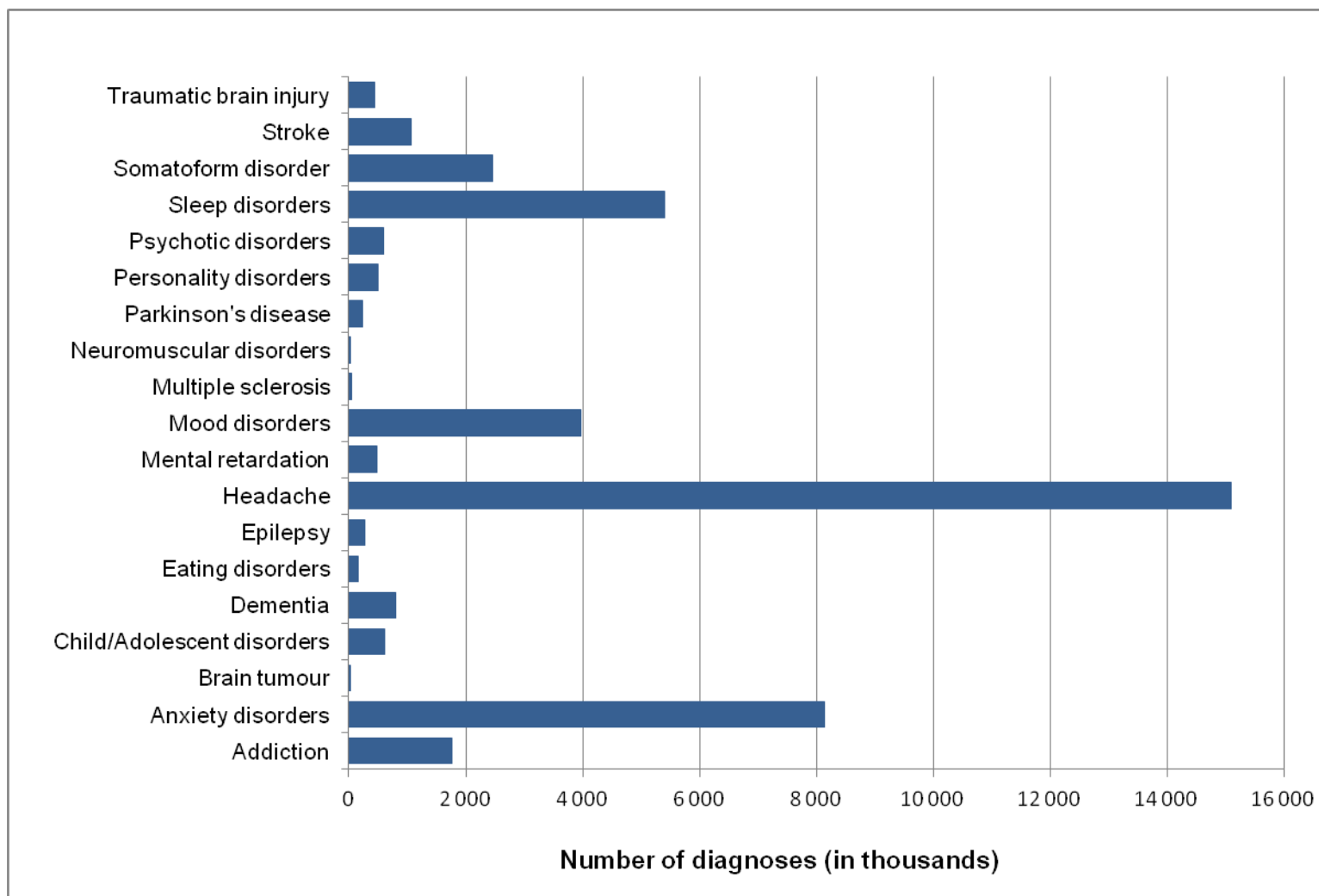
Number of diagnoses – Iceland



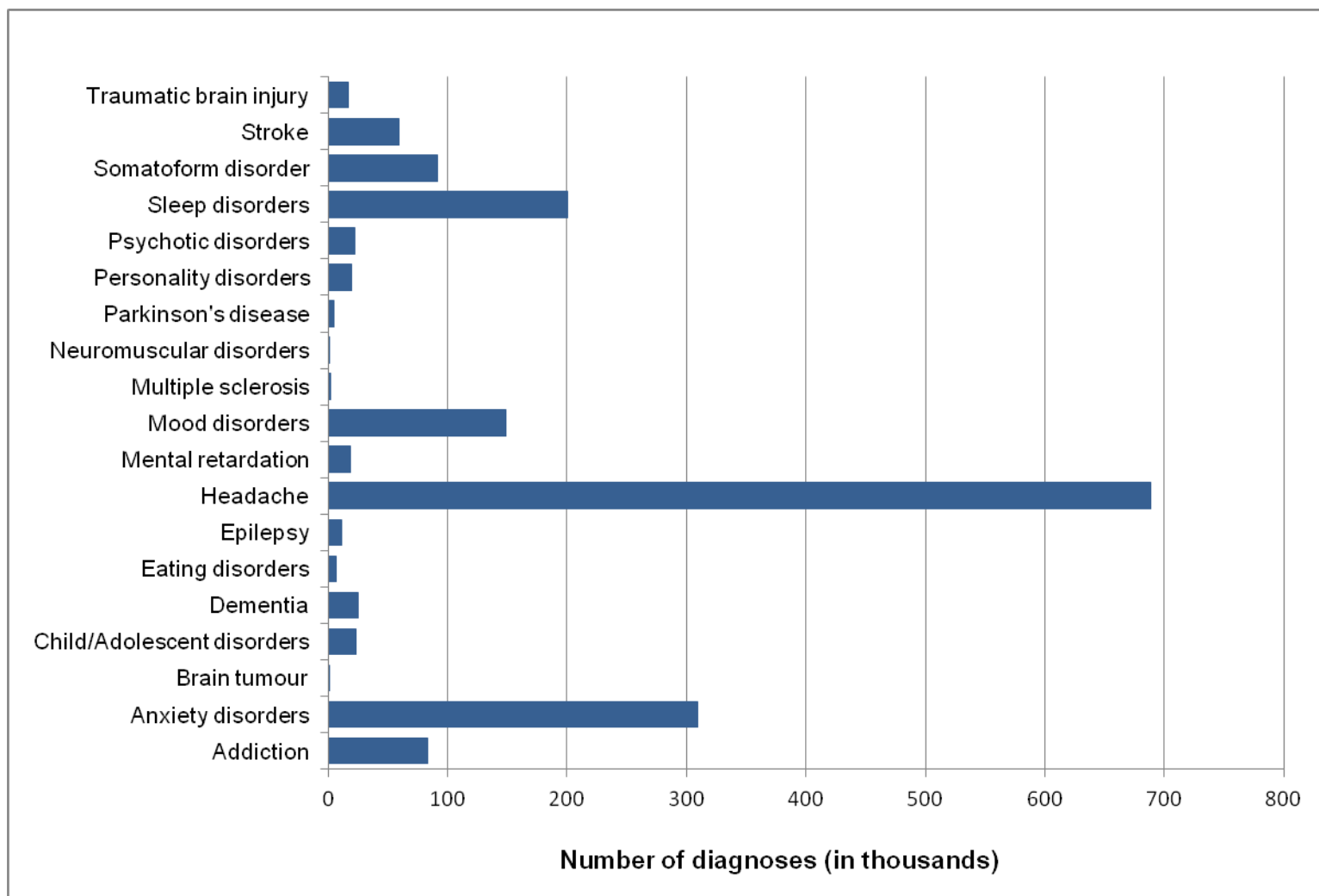
Number of diagnoses – Ireland



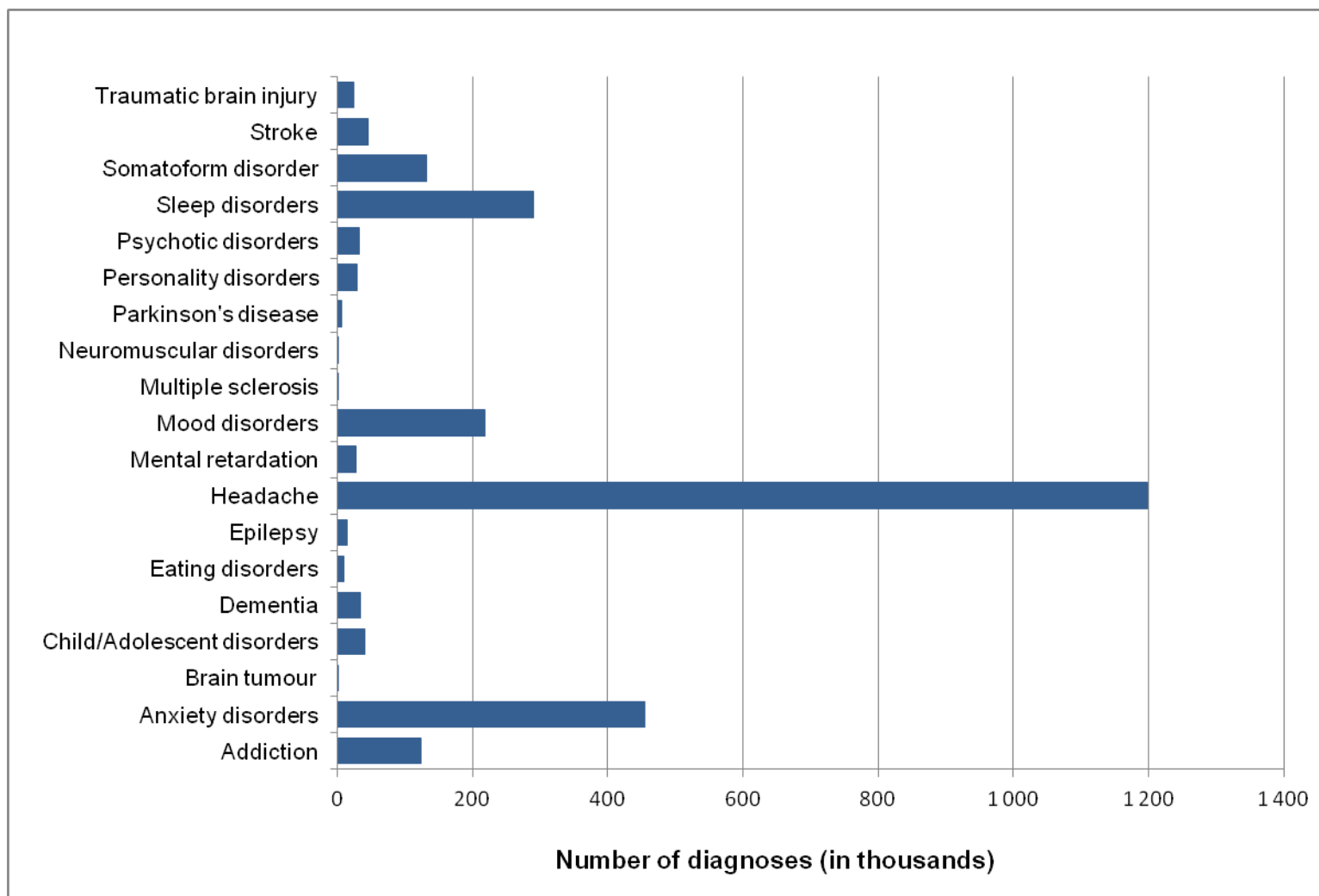
Number of diagnoses – Italy



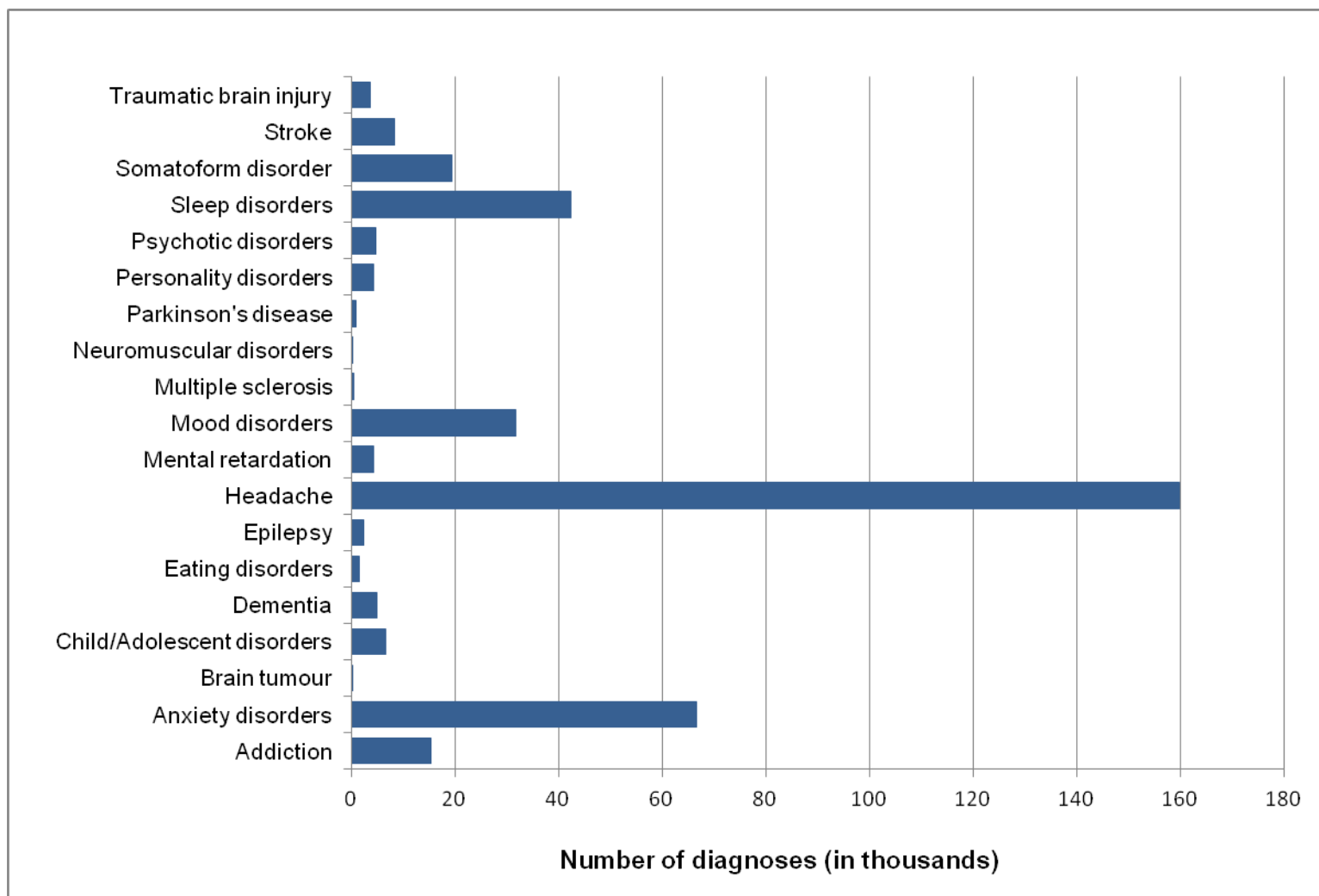
Number of diagnoses – Latvia



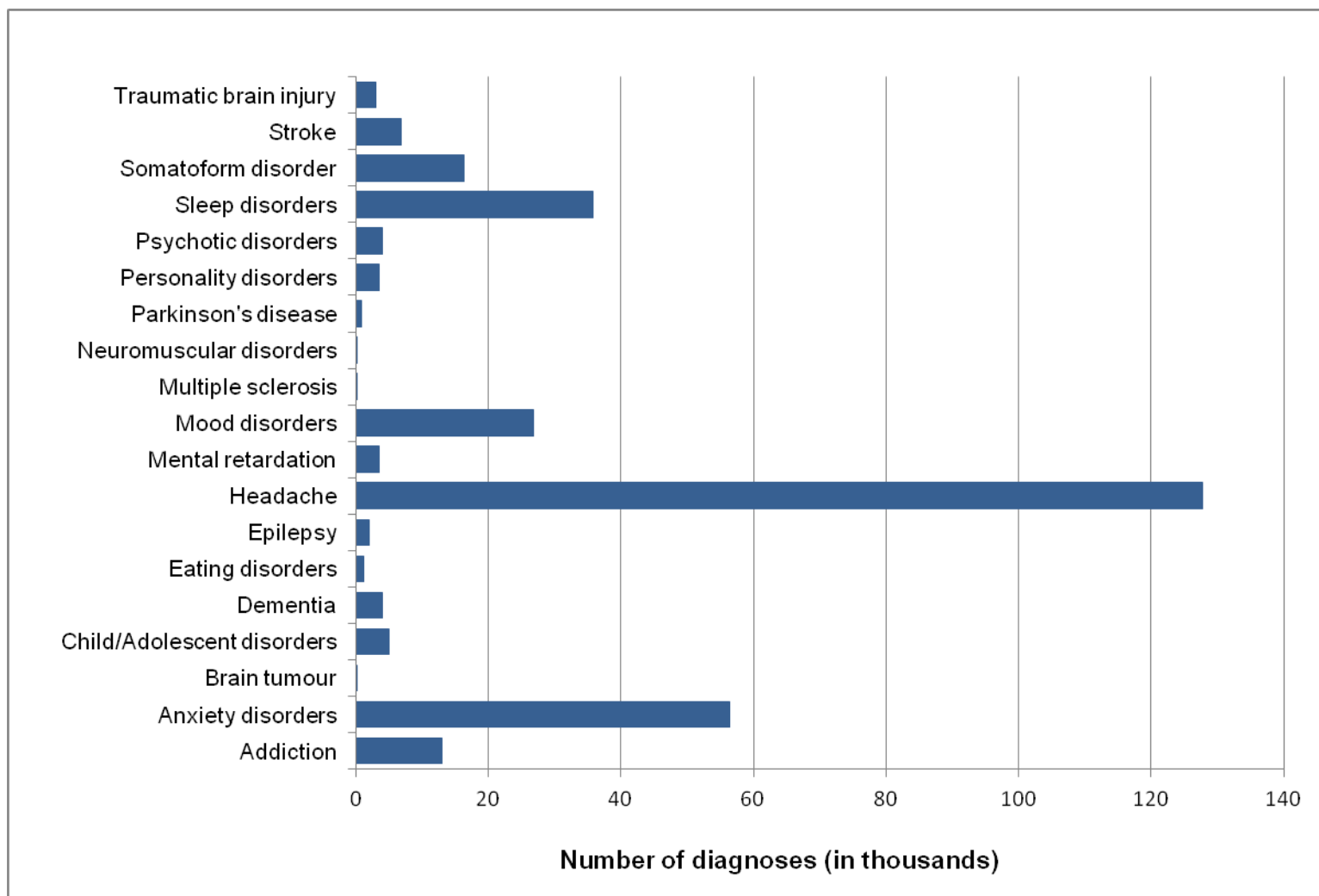
Number of diagnoses – Lithuania



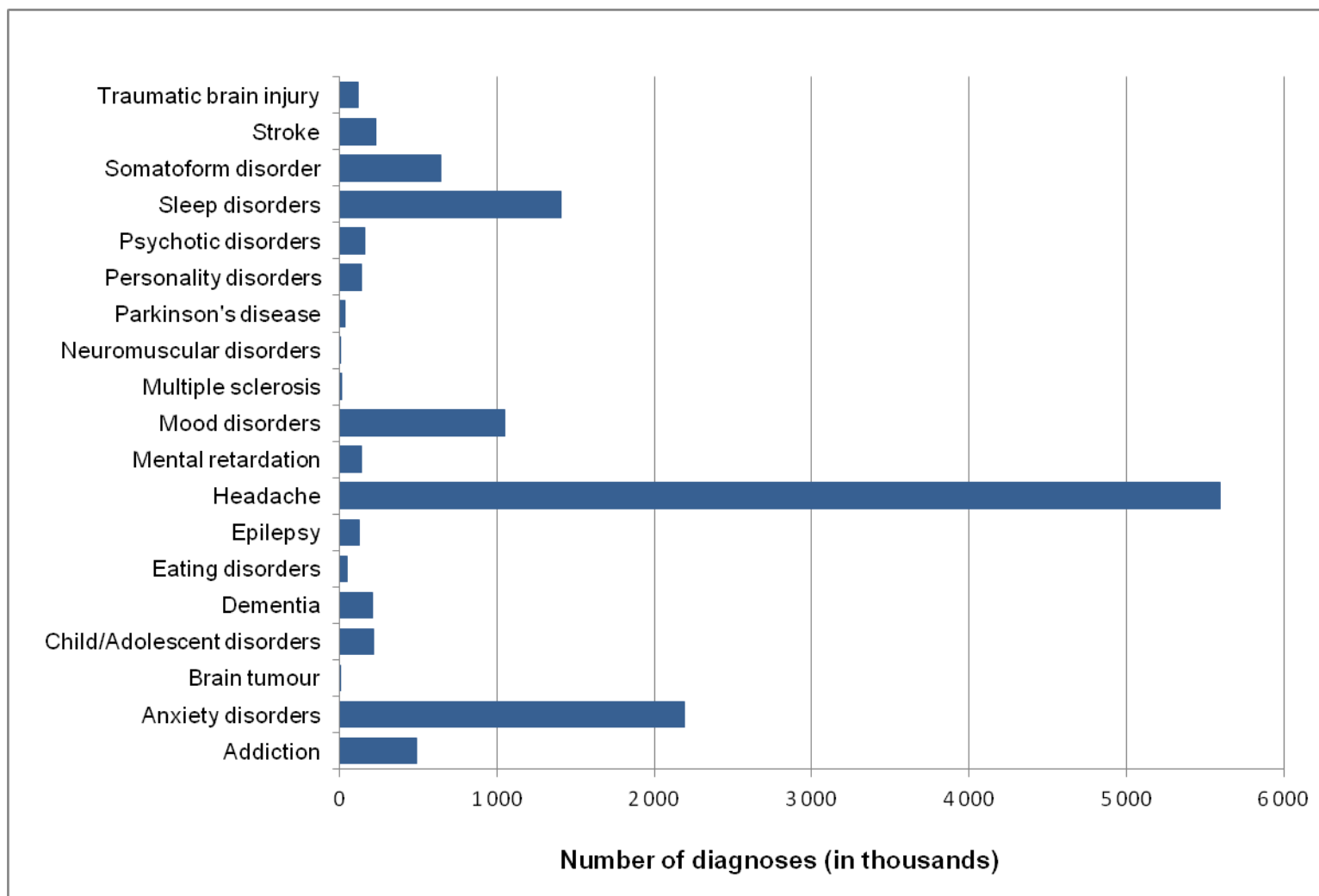
Number of diagnoses – Luxembourg



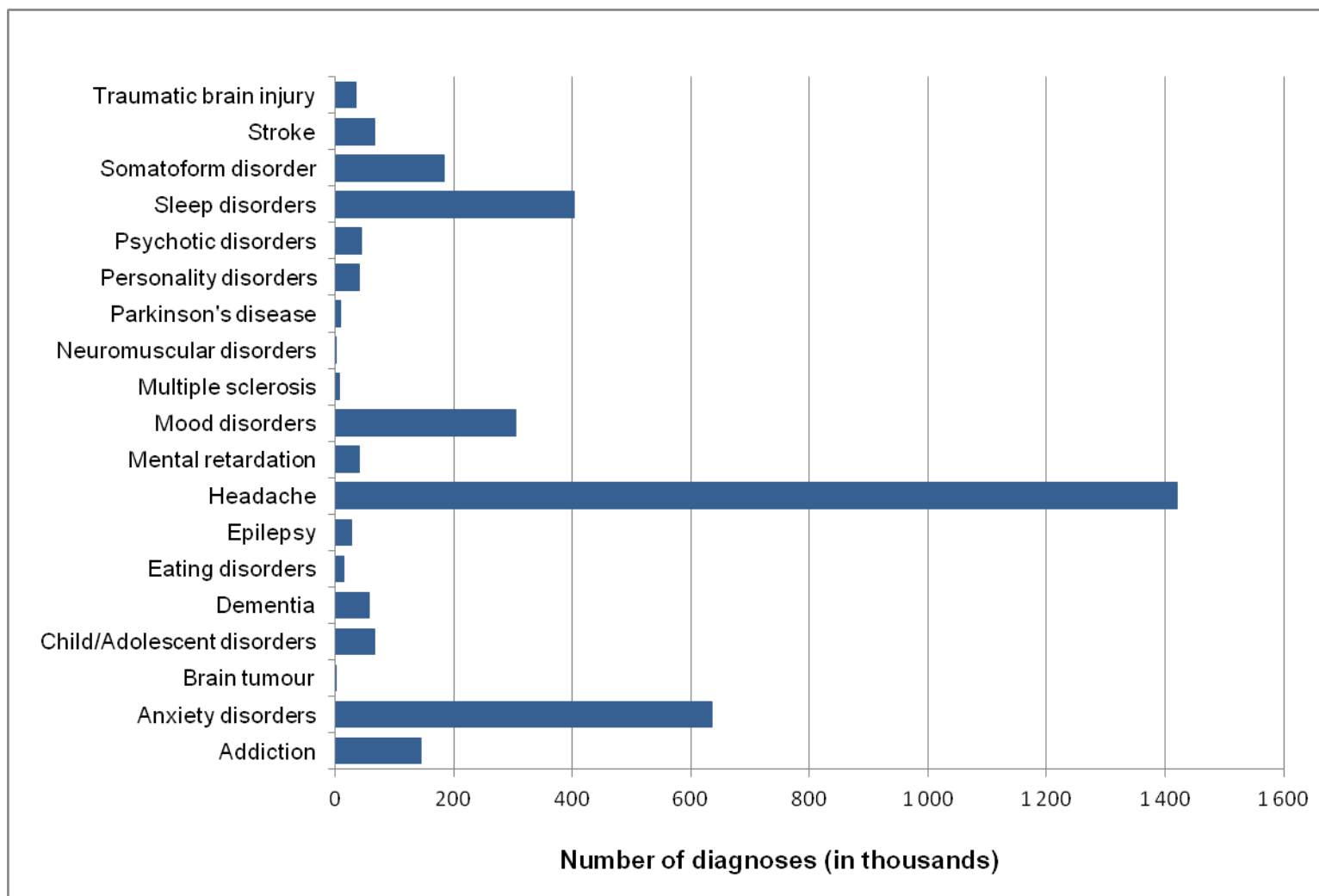
Number of diagnoses – Malta



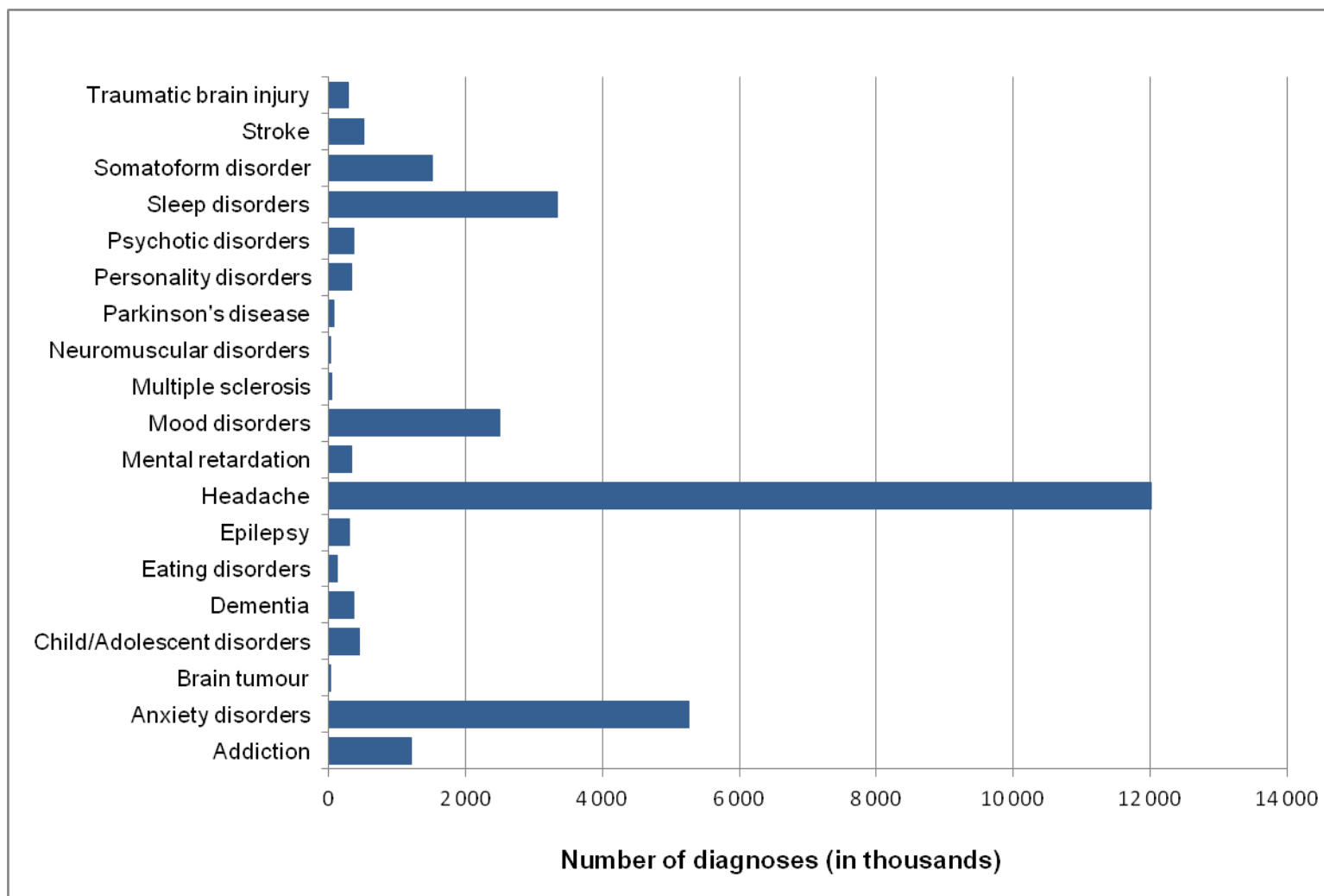
Number of diagnoses – Netherlands



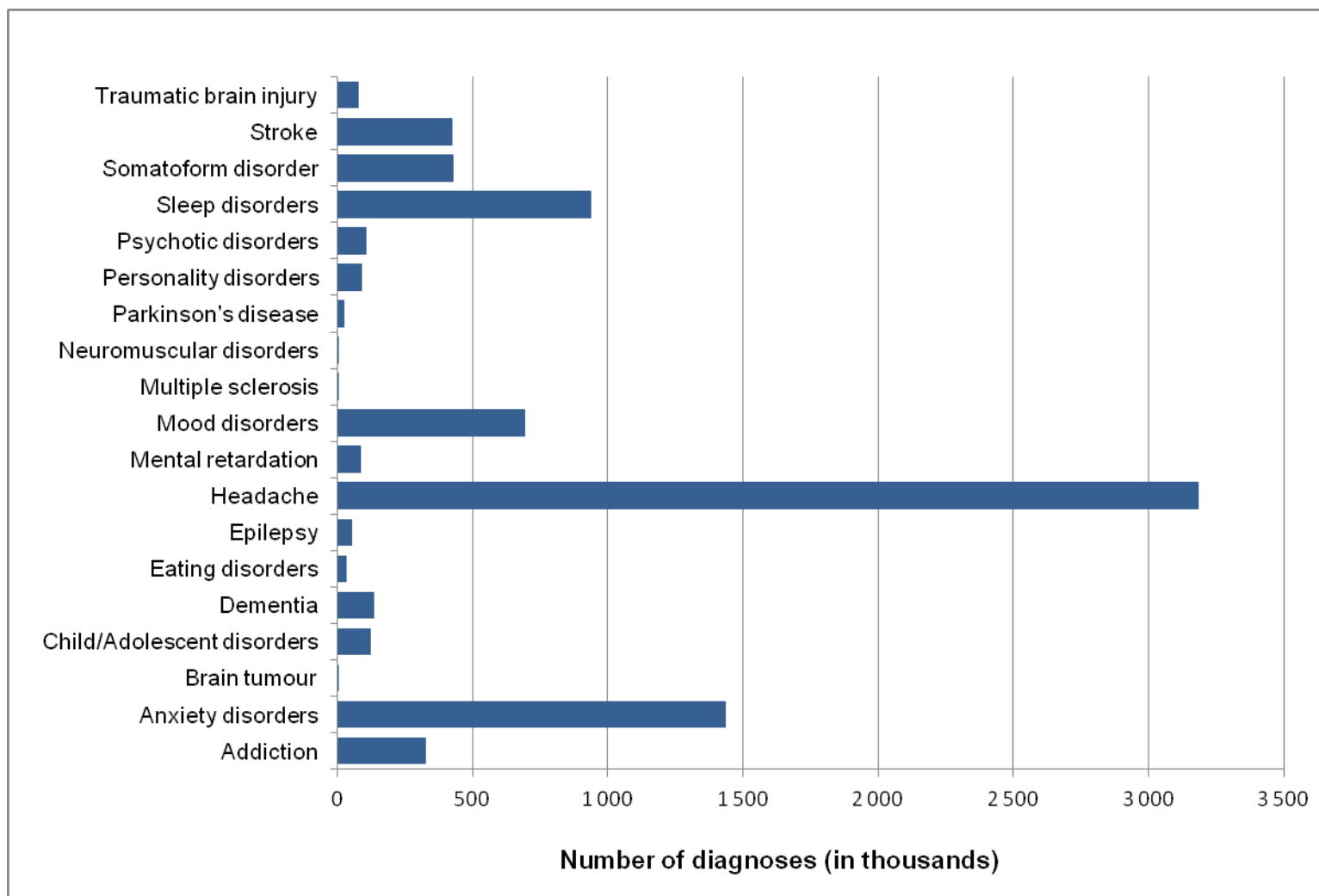
Number of diagnoses – Norway



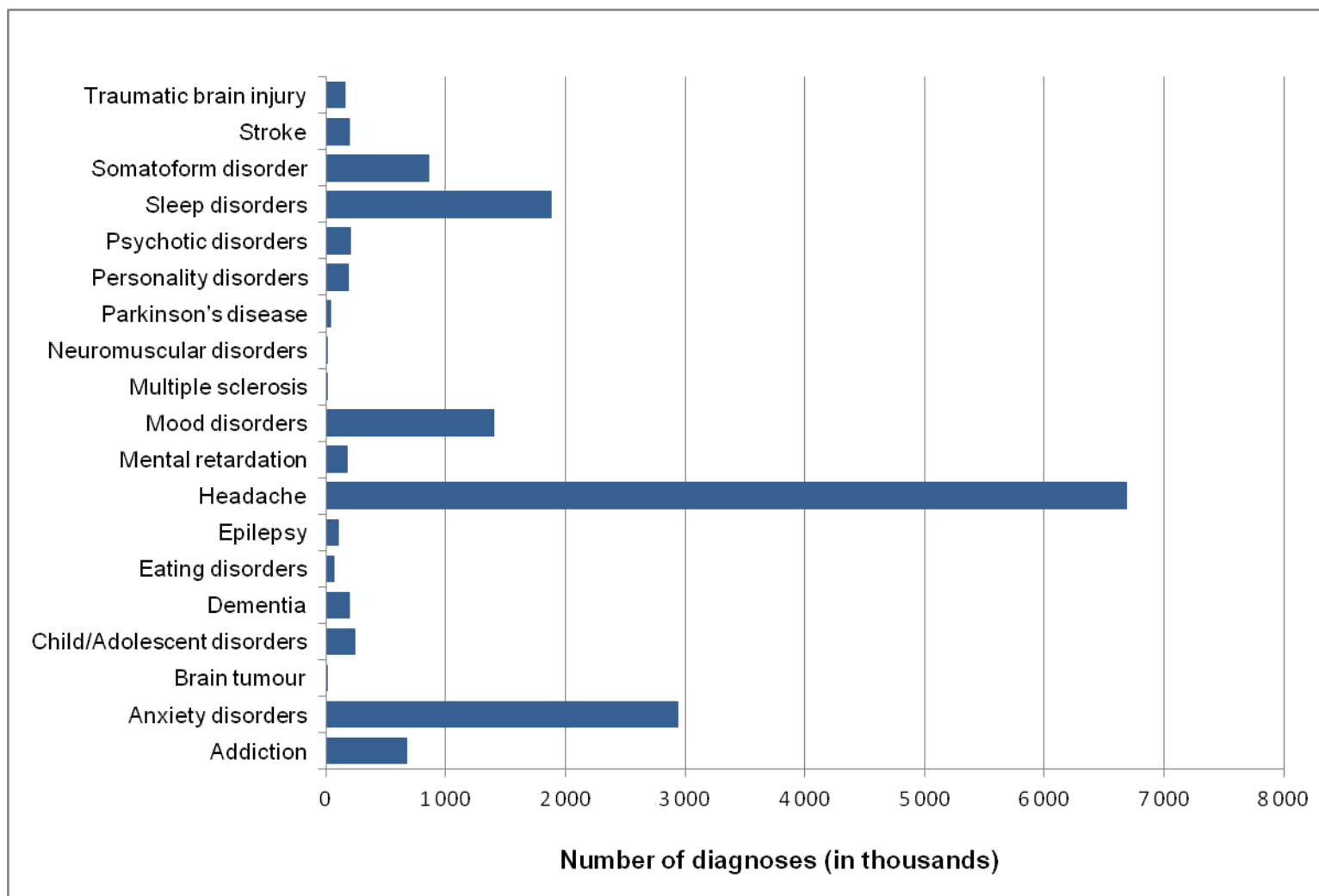
Number of diagnoses – Poland



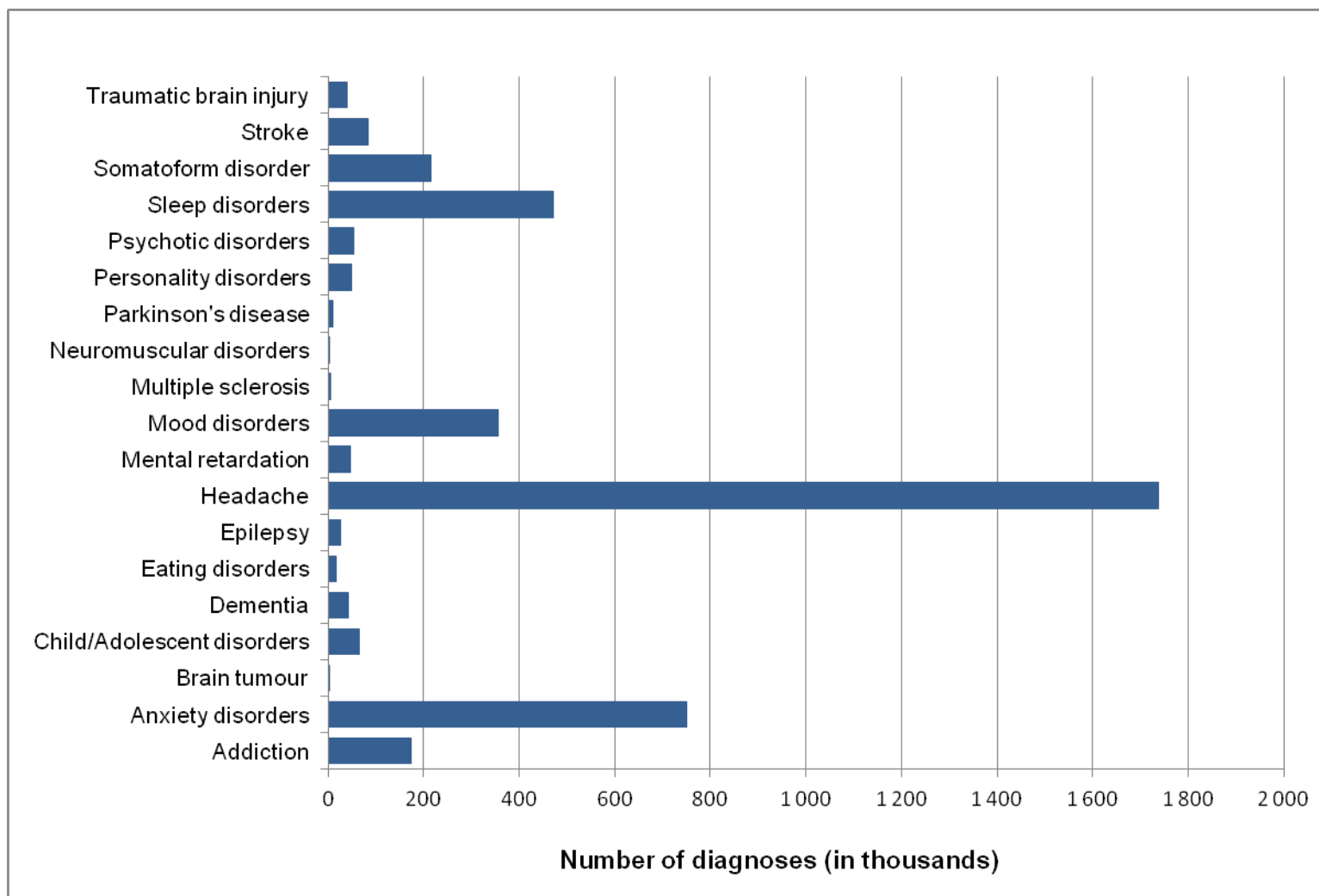
Number of diagnoses – Portugal



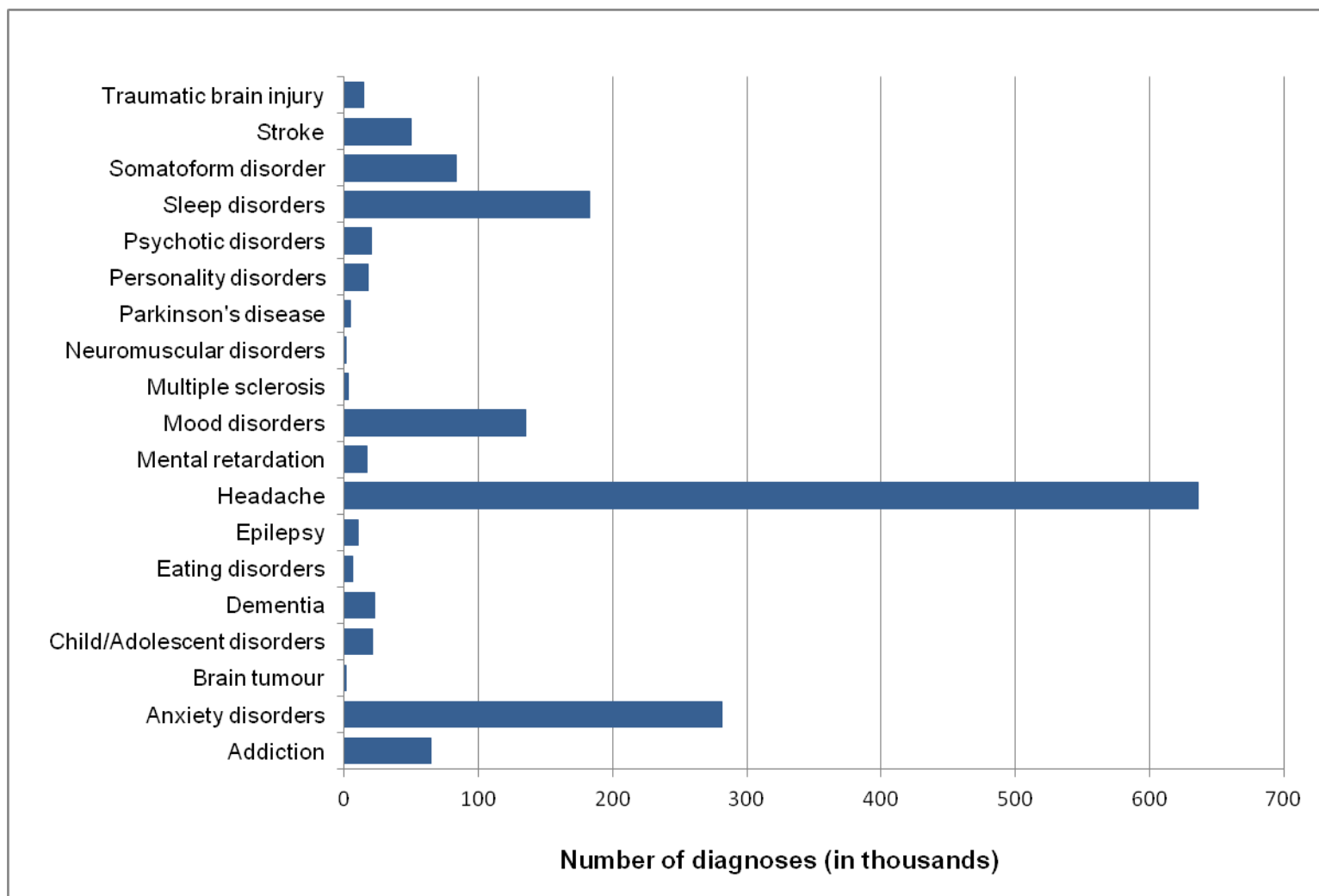
Number of diagnoses – Romania



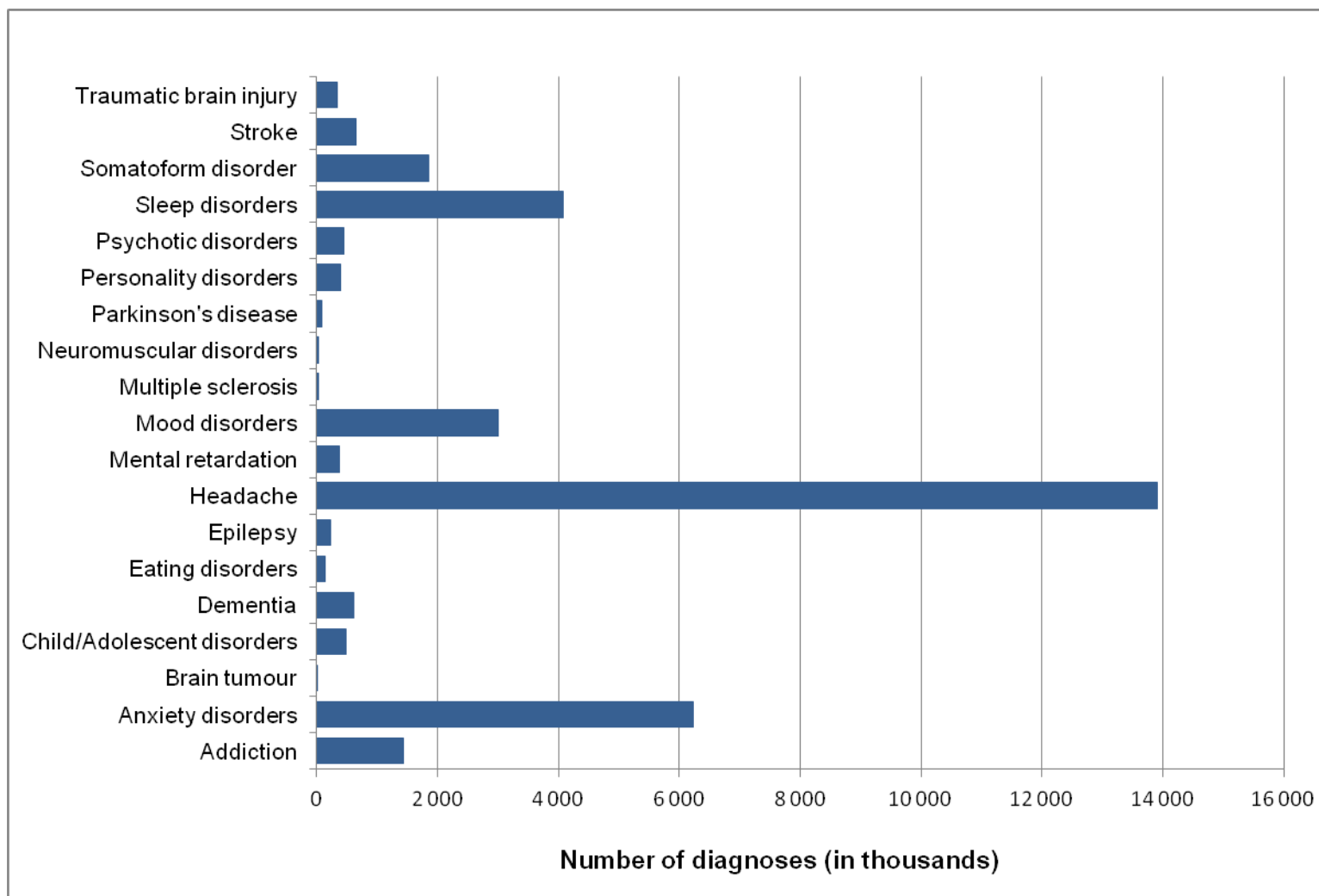
Number of diagnoses – Slovakia



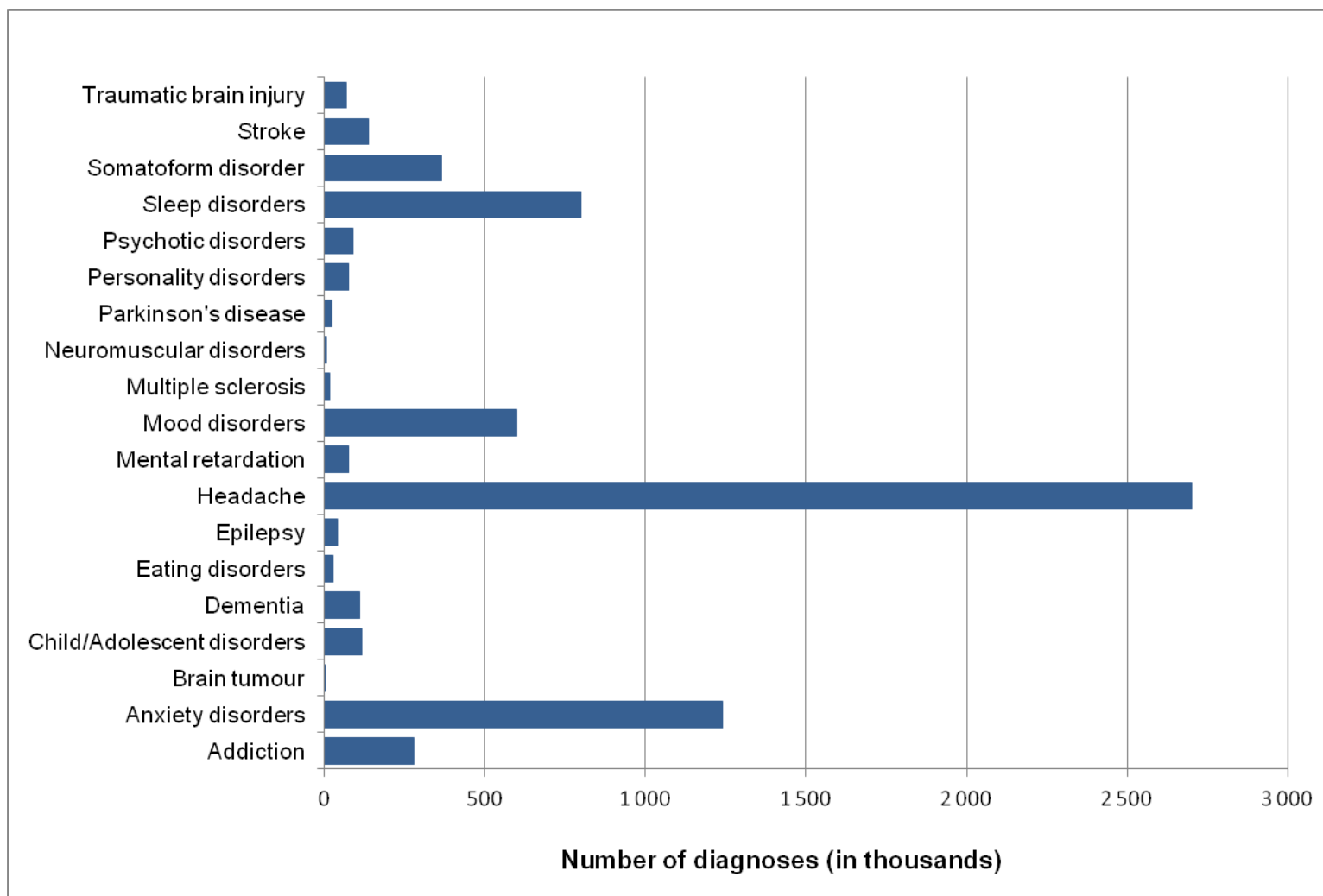
Number of diagnoses – Slovenia



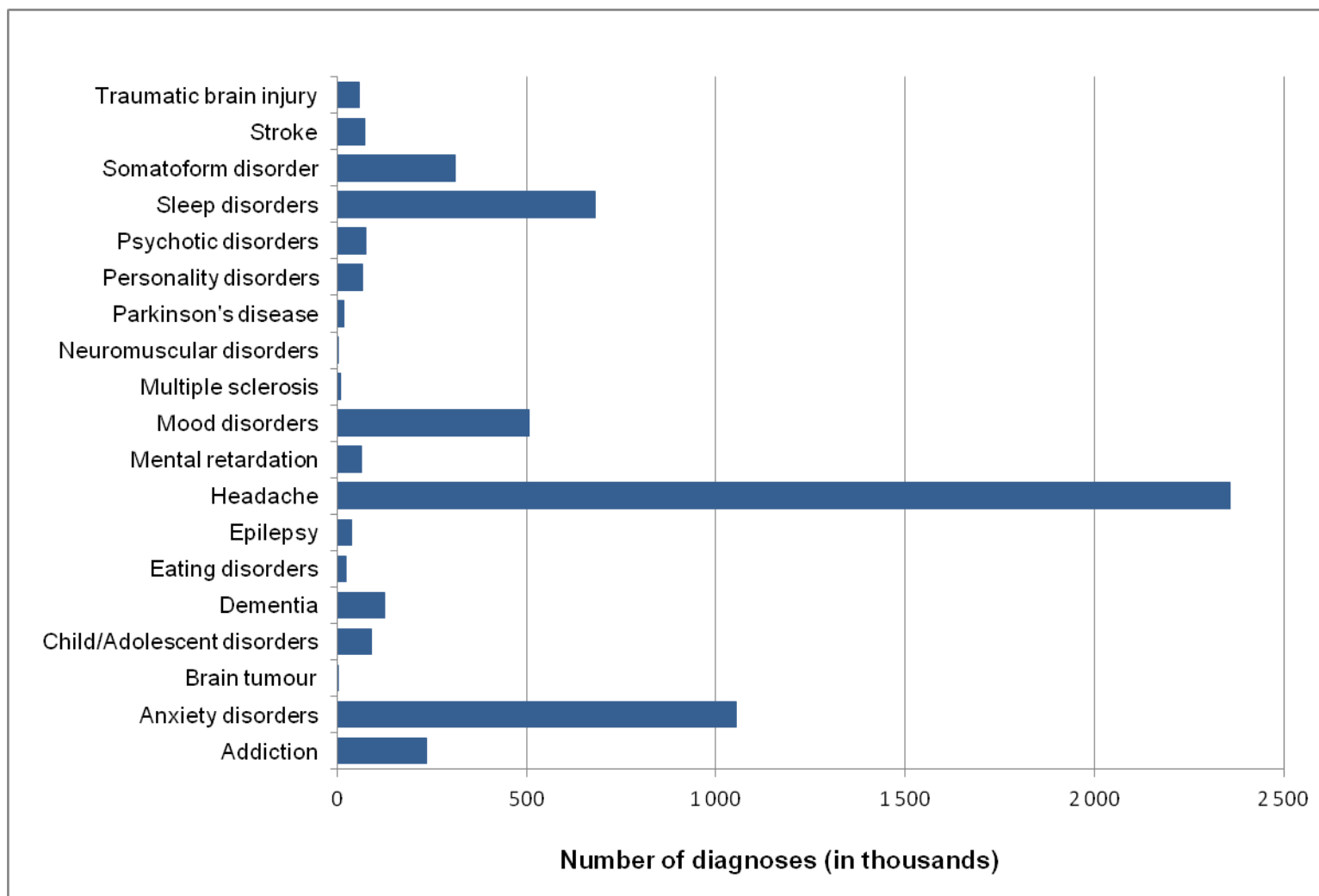
Number of diagnoses – Spain



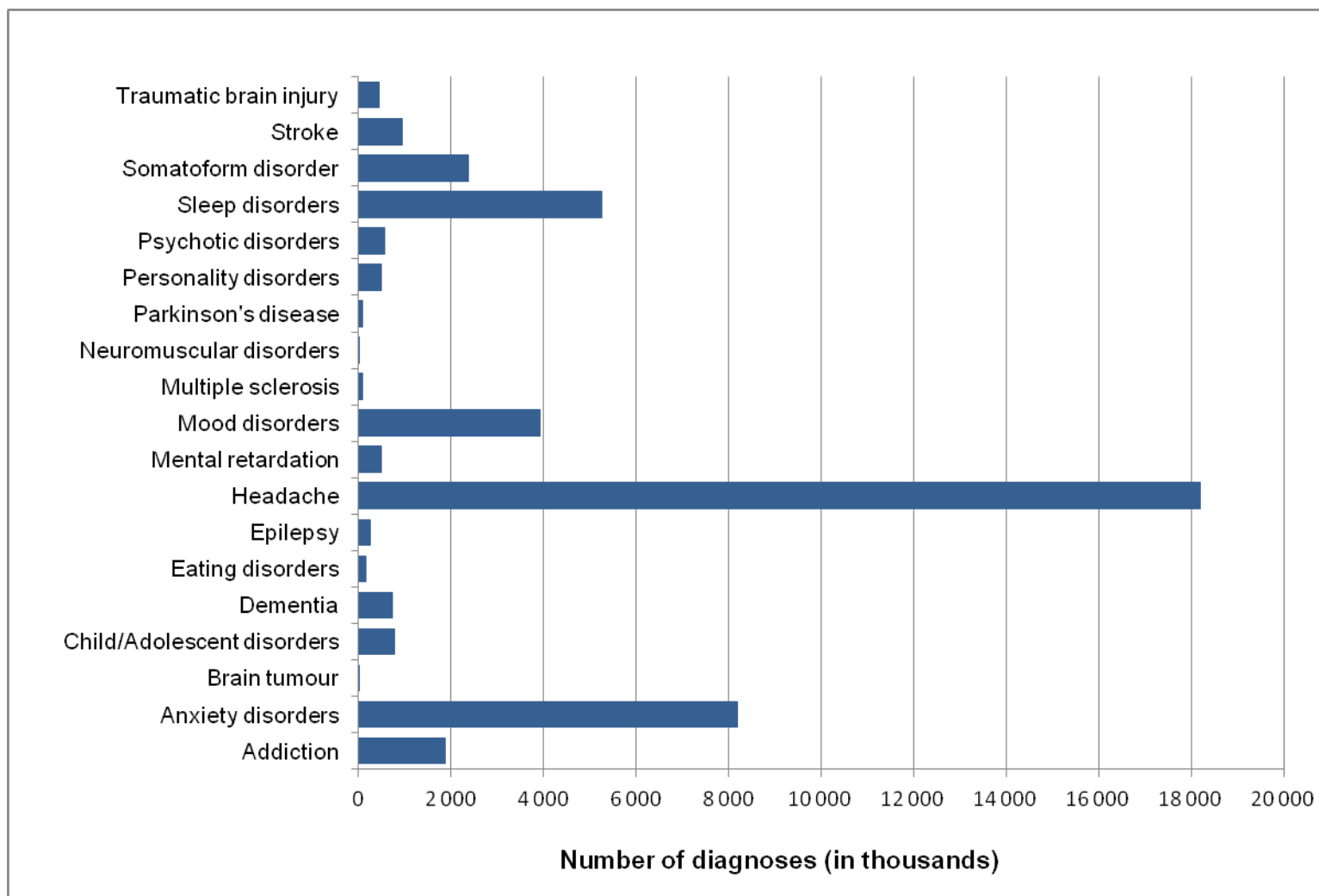
Number of diagnoses – Sweden



Number of diagnoses – Switzerland



Number of diagnoses – UK



Cost per patient, average for disorders (€ PPP) *12 previously reviewed disorders*

- EBC 2005 – € 3 040
- EBC 2010 – € 2 670

Difference:

- Lower cost per patient estimates: alcohol addiction, brain tumor, epilepsy, migraine, mood disorders, psychotic disorders, and traumatic brain injury
- Higher cost per patient estimates: dementia
- Exclusion of cost components (e.g. indirect cost due to mortality for brain tumor)

Cost per patient, average for disorders (€ PPP)

Extension to 12 previously reviewed disorders

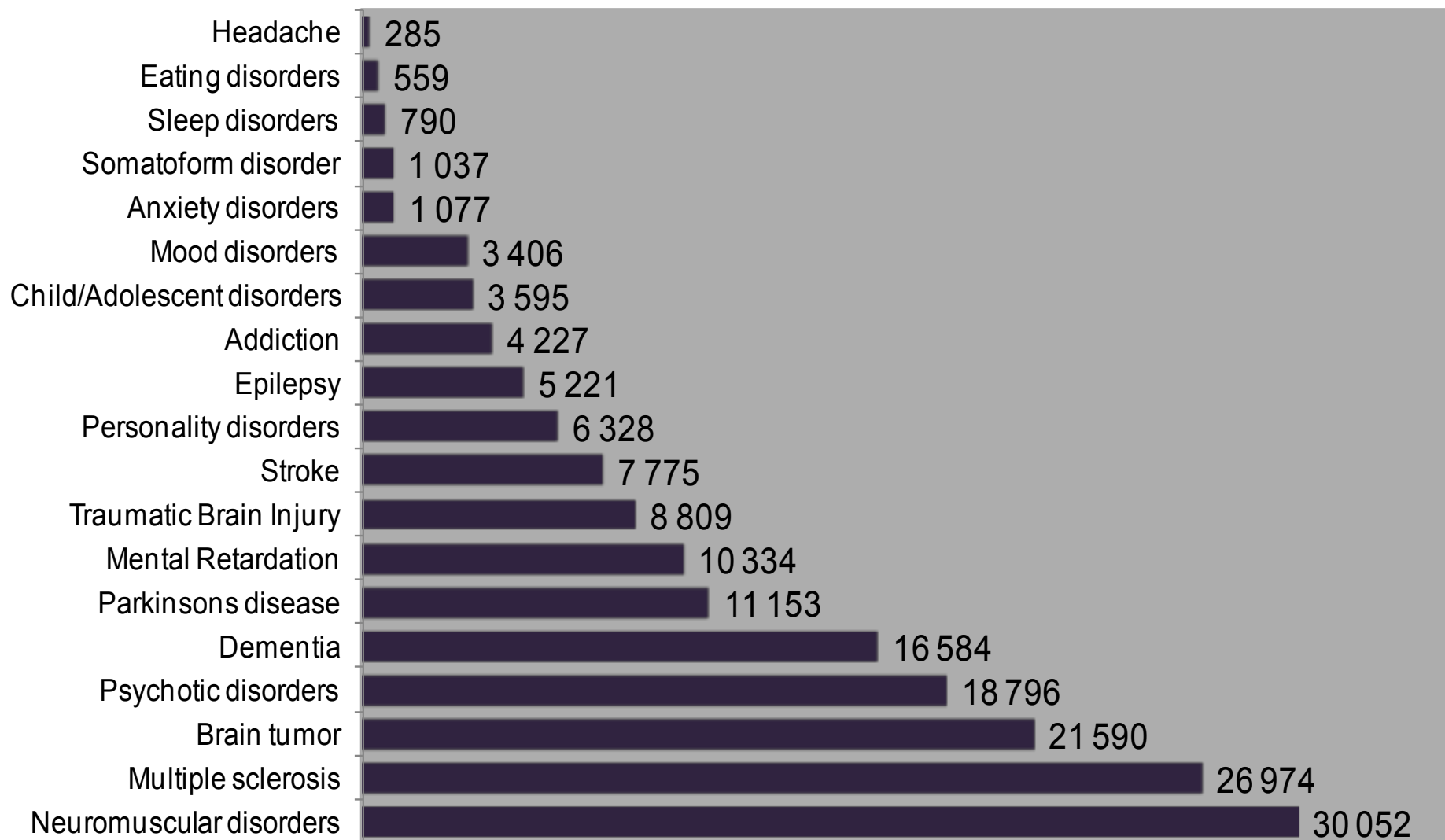
- PTSD - € 1 082
- Headache:
 - Medication overuse headache - € 2 291
 - Other headaches - € 57
 - Tension type headache - € 64
- Psychotic disorders (indirect costs) - € 12 991
- Stroke (prevalent cases) – € 5 368
- Traumatic Brain Injury
 - Moderate and severe prevalent cases – € 9 020
 - Indirect costs of incident cases - € 4 156

Cost per patient, average for disorders (€ PPP)

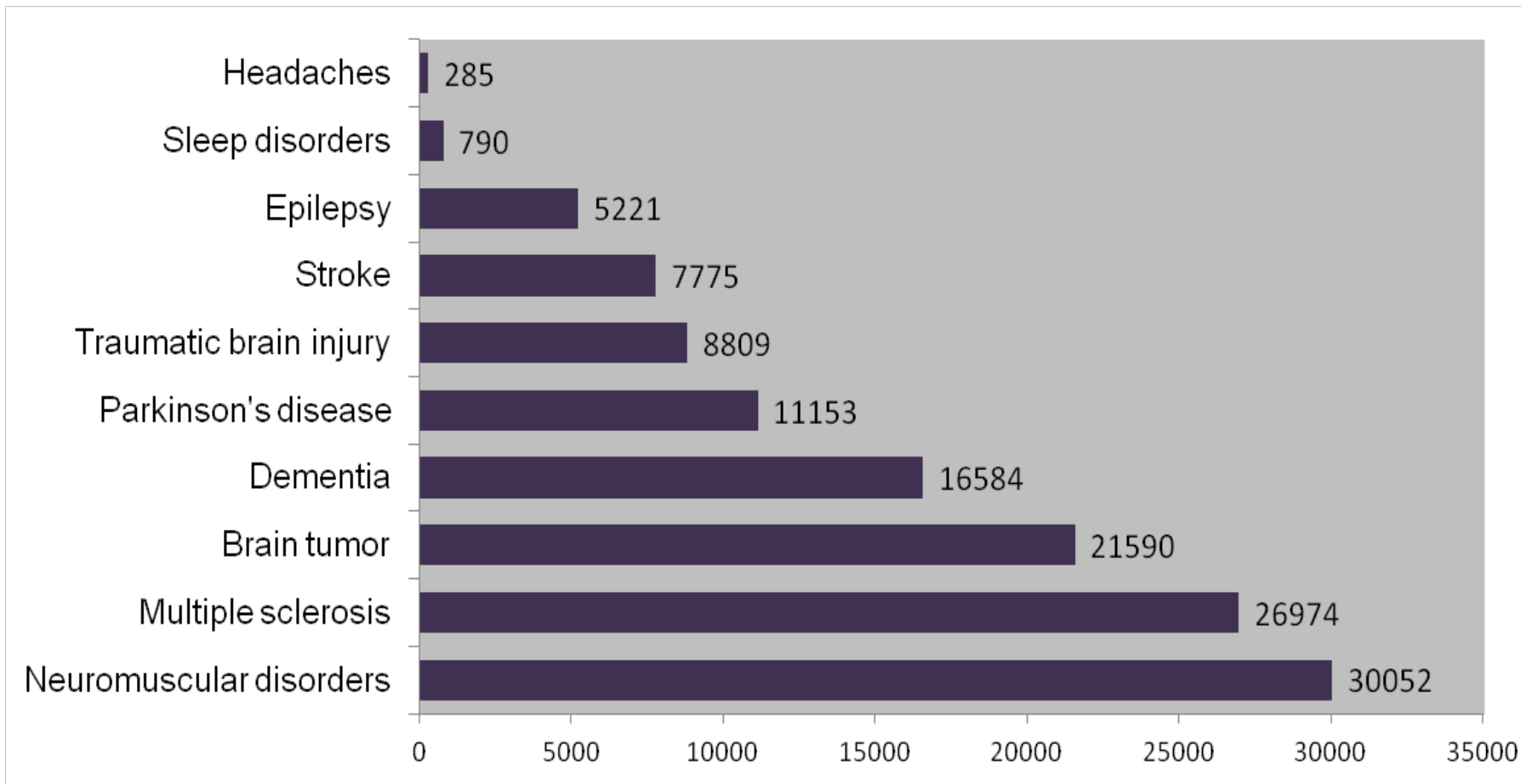
Seven new disorders

- Child/adolescent disorders - € 3 595
- Eating disorders - € 559
- Mental retardation - € 10 334
- Neuromuscular disorders - € 30, 052
- Personality disorders - € 6 328
- Sleep disorders - € 790
- Somatoform disorder - € 1 037

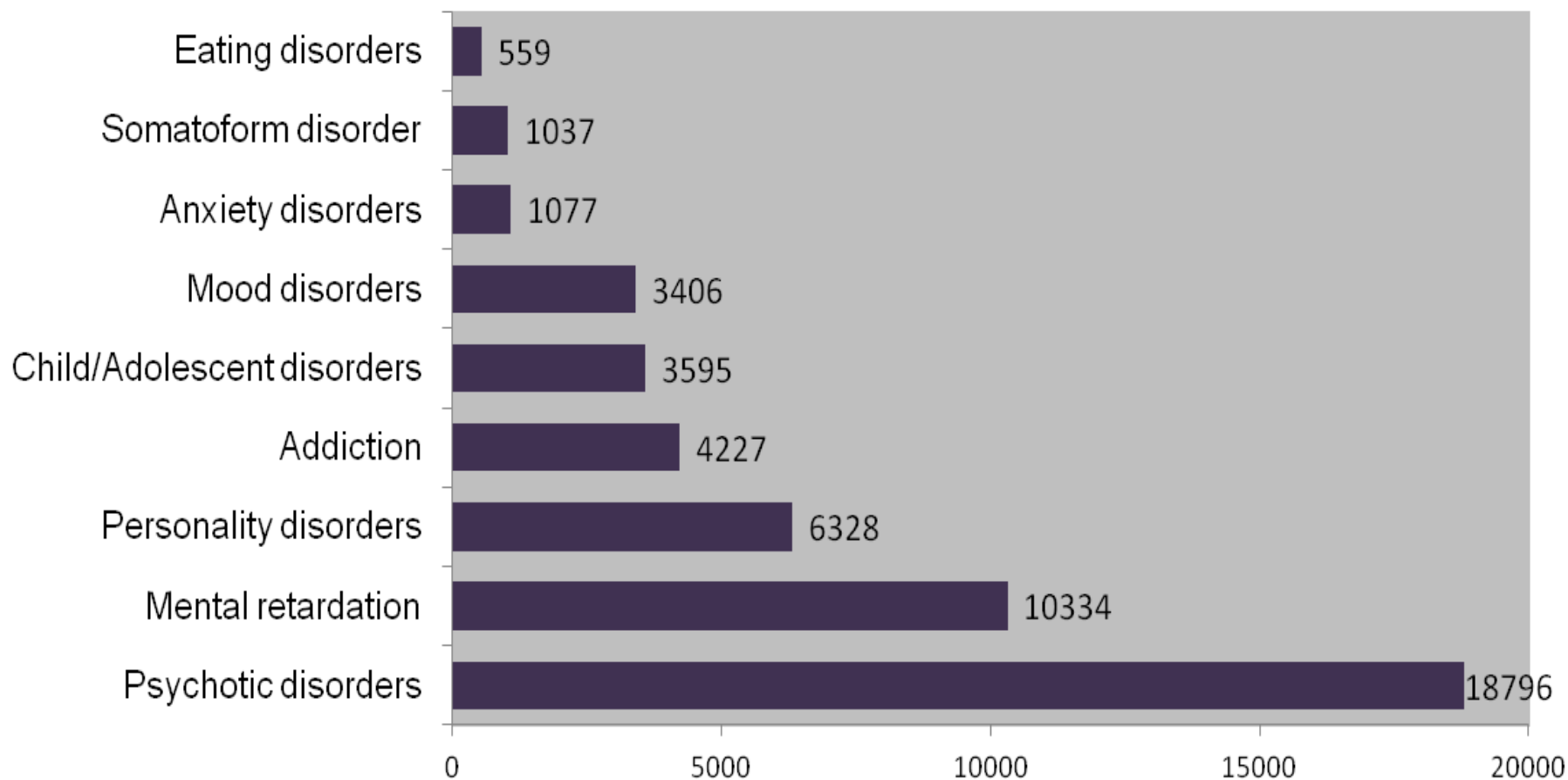
Cost per patient (€ PPP 2010)



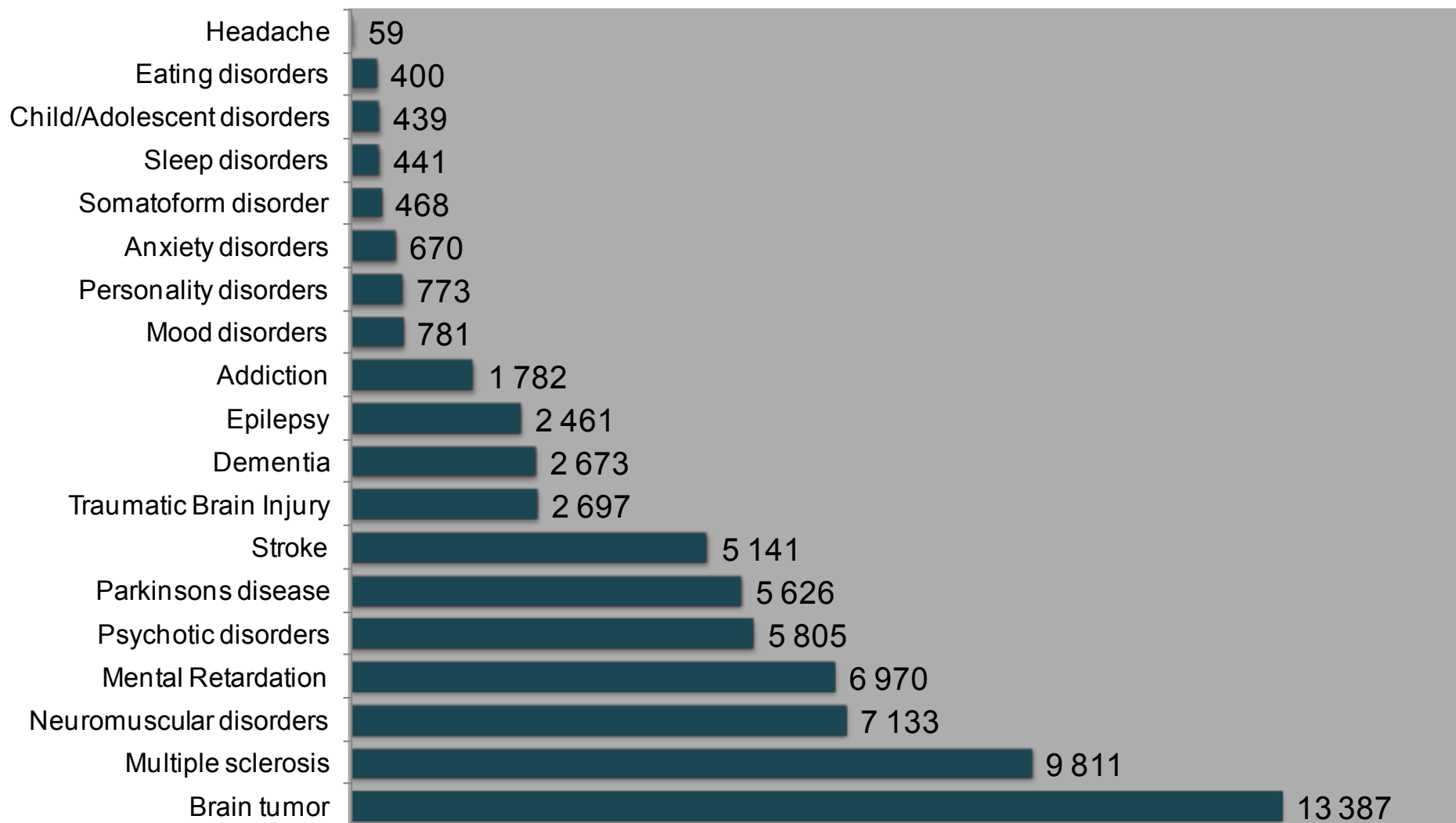
Cost per patient (€ PPP 2010) – Neurologic disorders



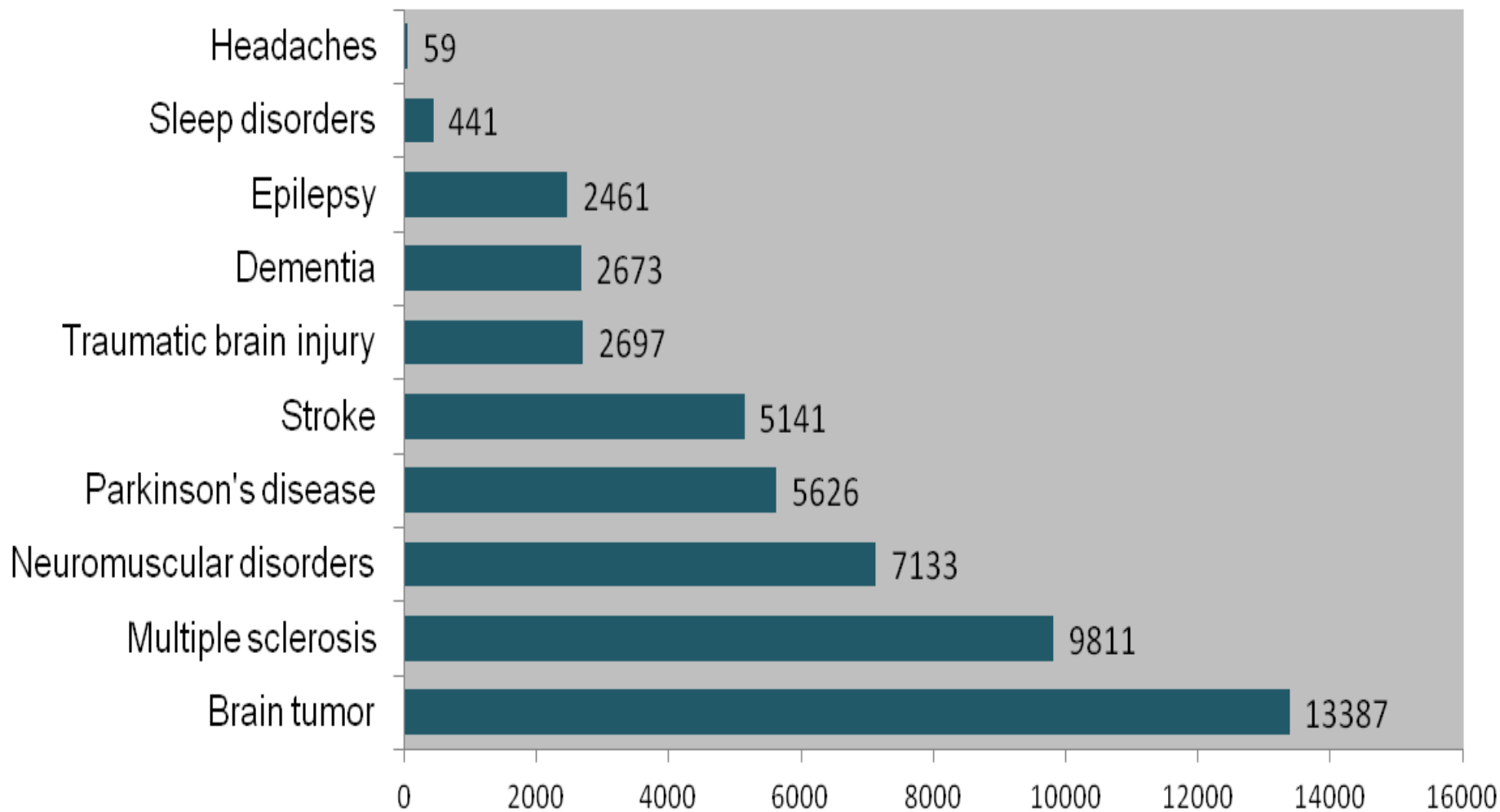
Cost per patient (€ PPP 2010) – Mental disorders



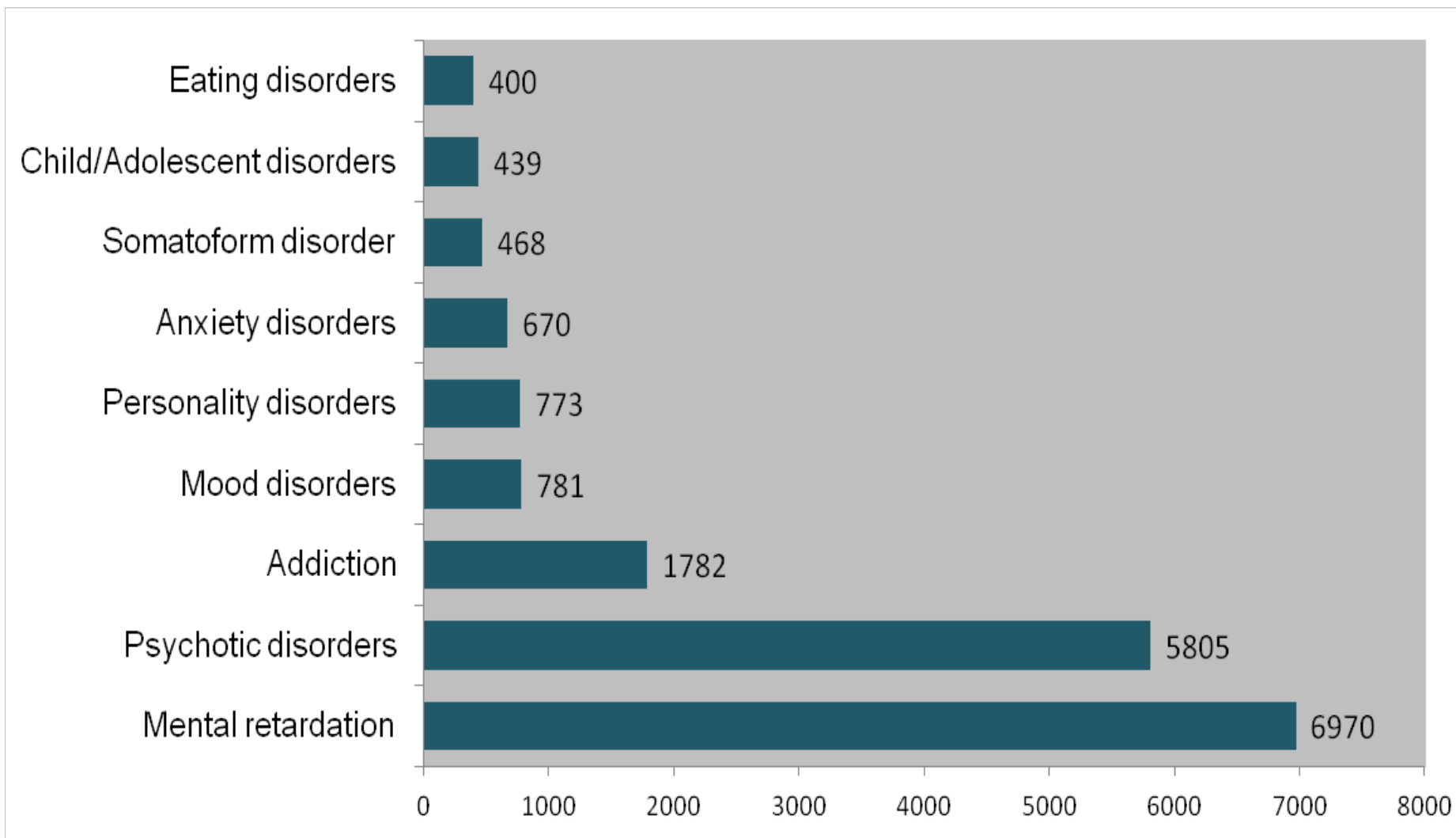
Direct healthcare cost per patient (€ PPP 2010)



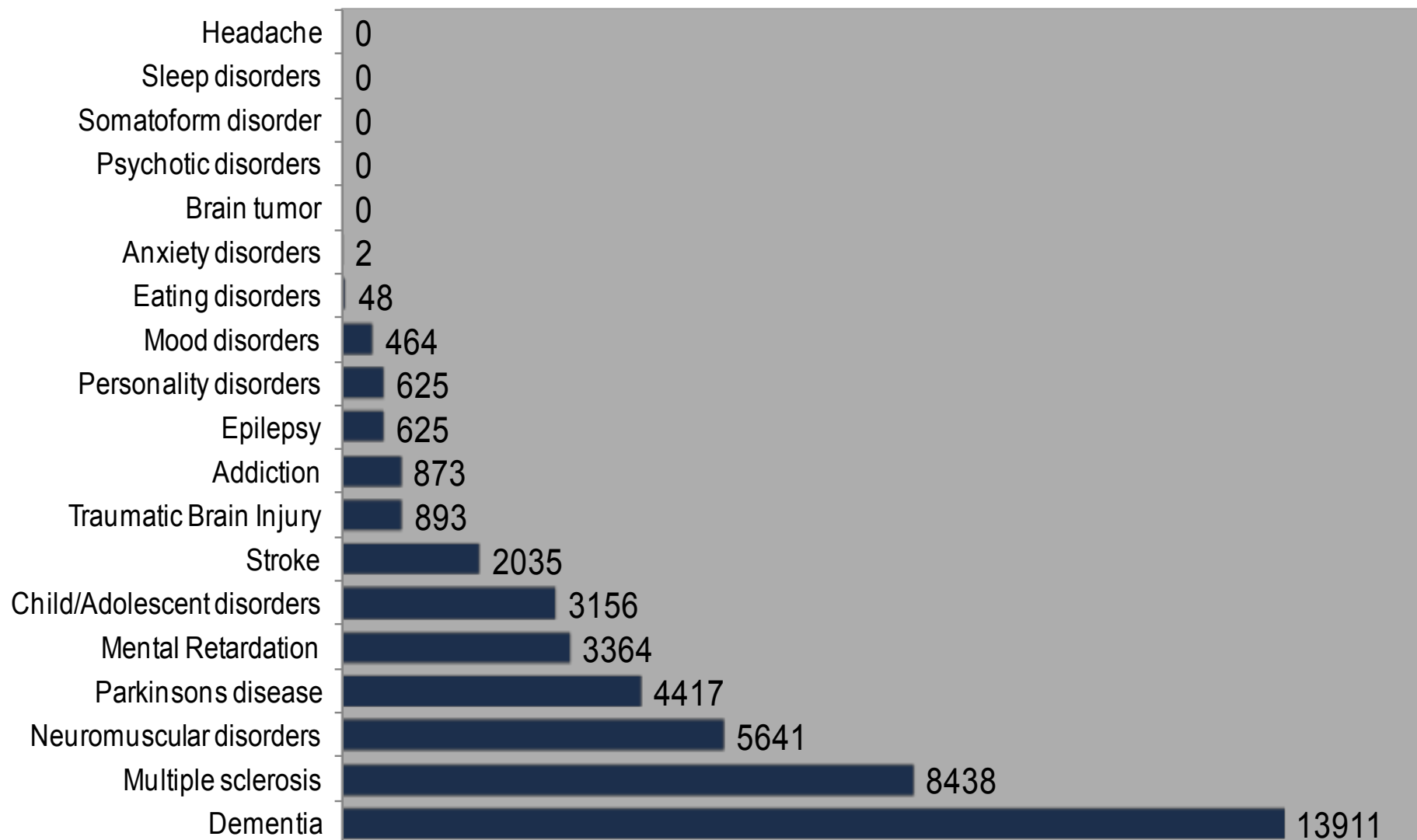
Direct healthcare cost per patient (€ PPP 2010) – Neurologic disorders



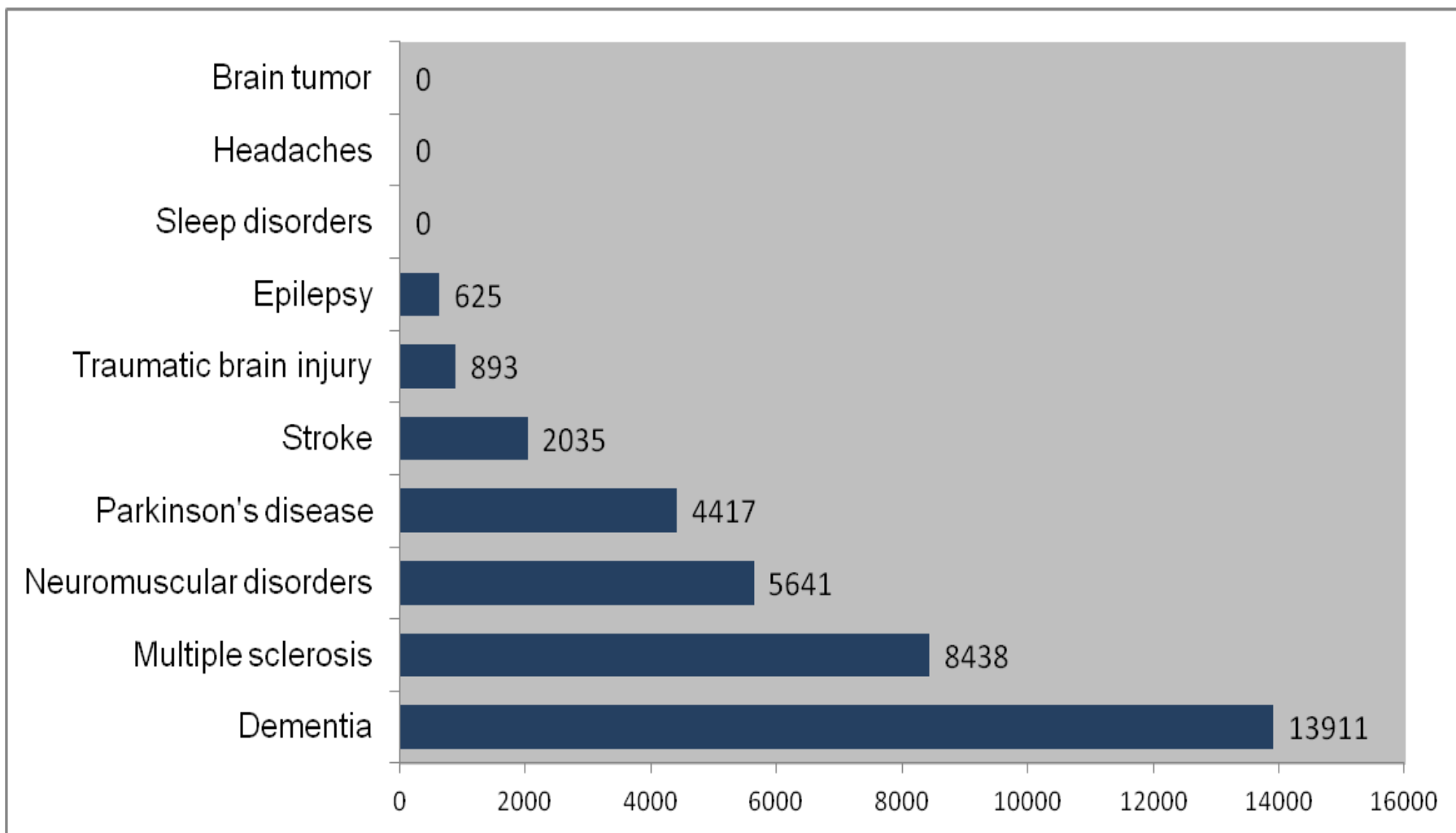
Direct healthcare cost per patient (€ PPP 2010) – Mental disorders



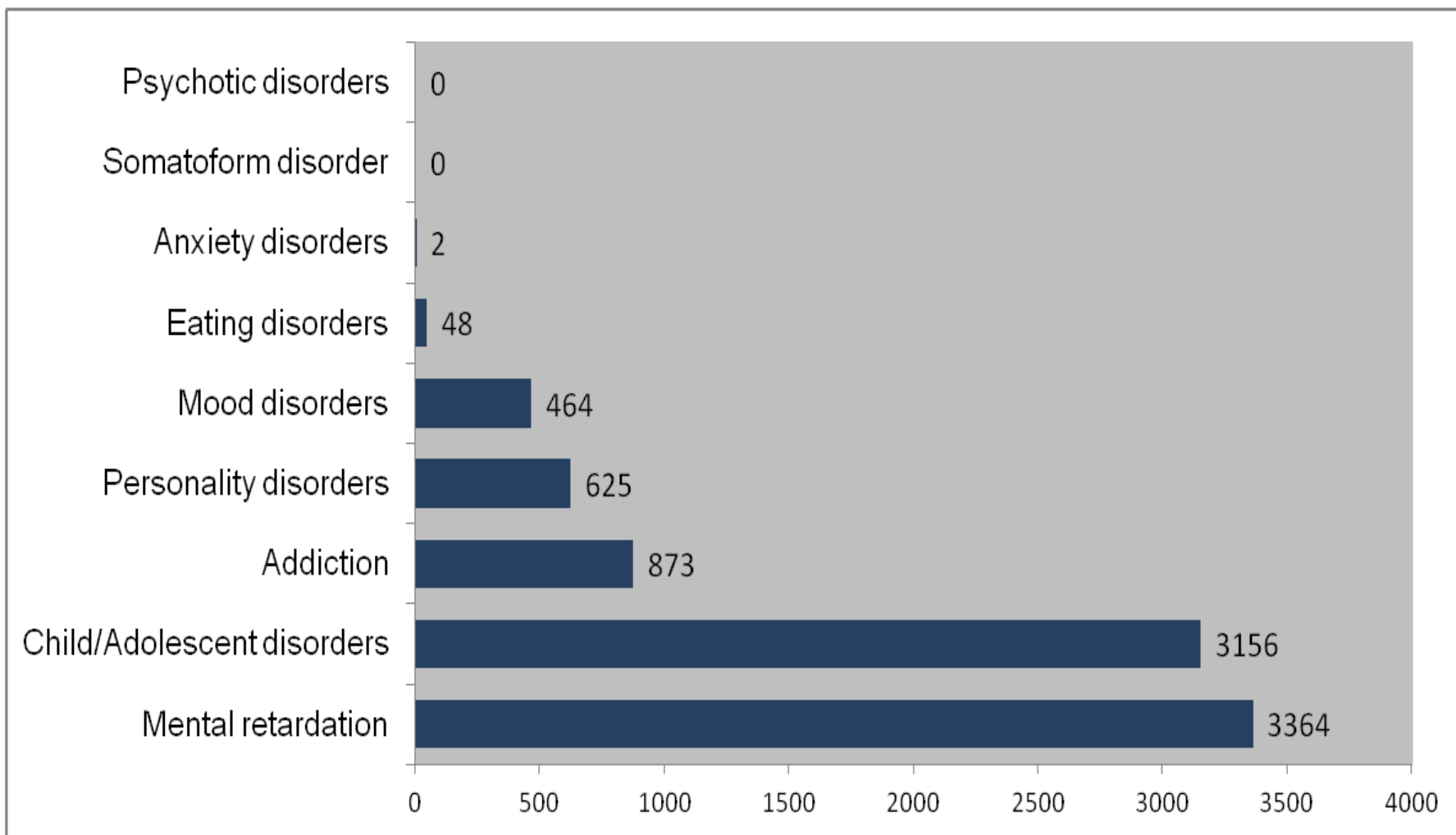
Direct non-medical cost per patient (€ PPP 2010)



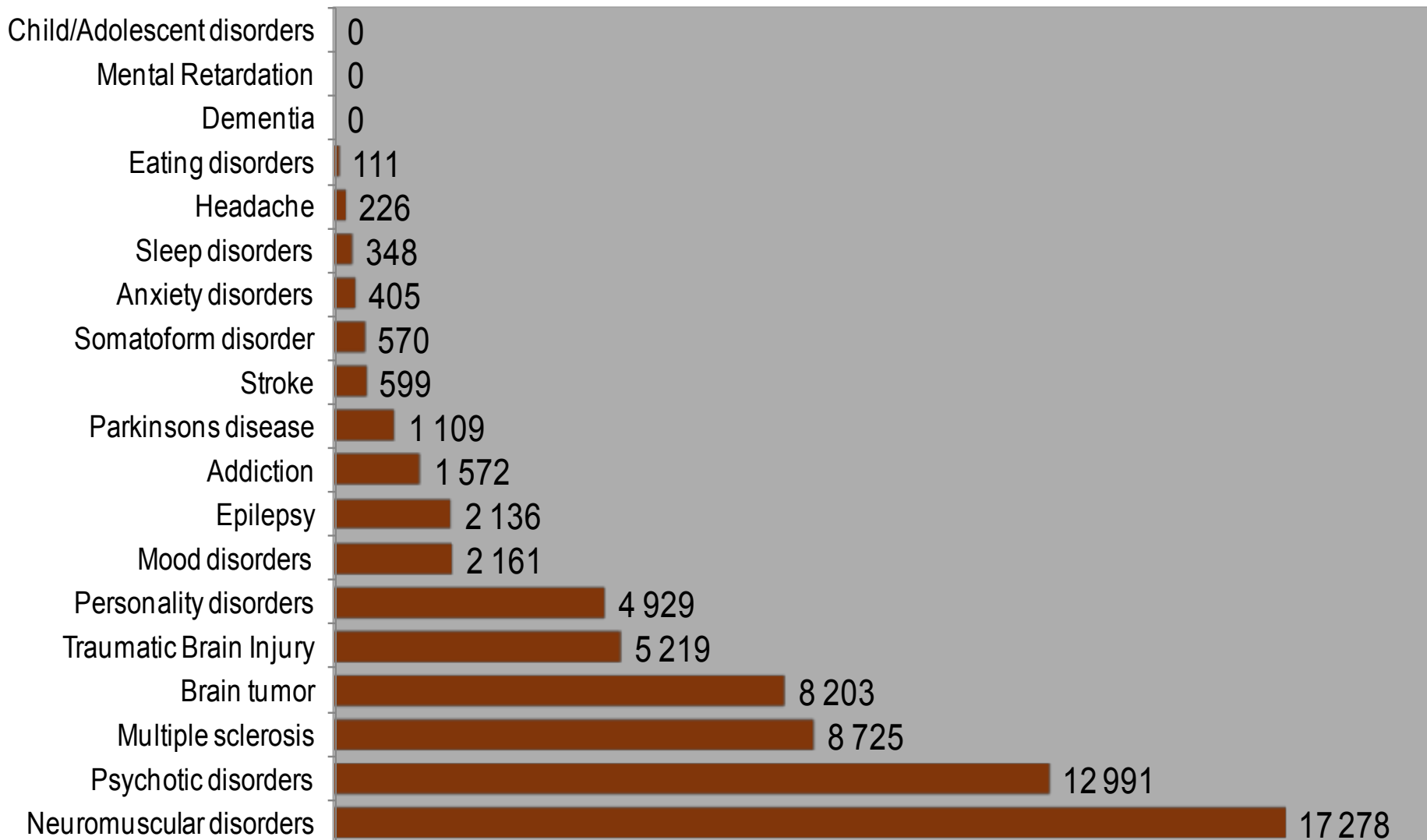
Direct non-medical cost per patient (€ PPP 2010) – Neurologic disorders



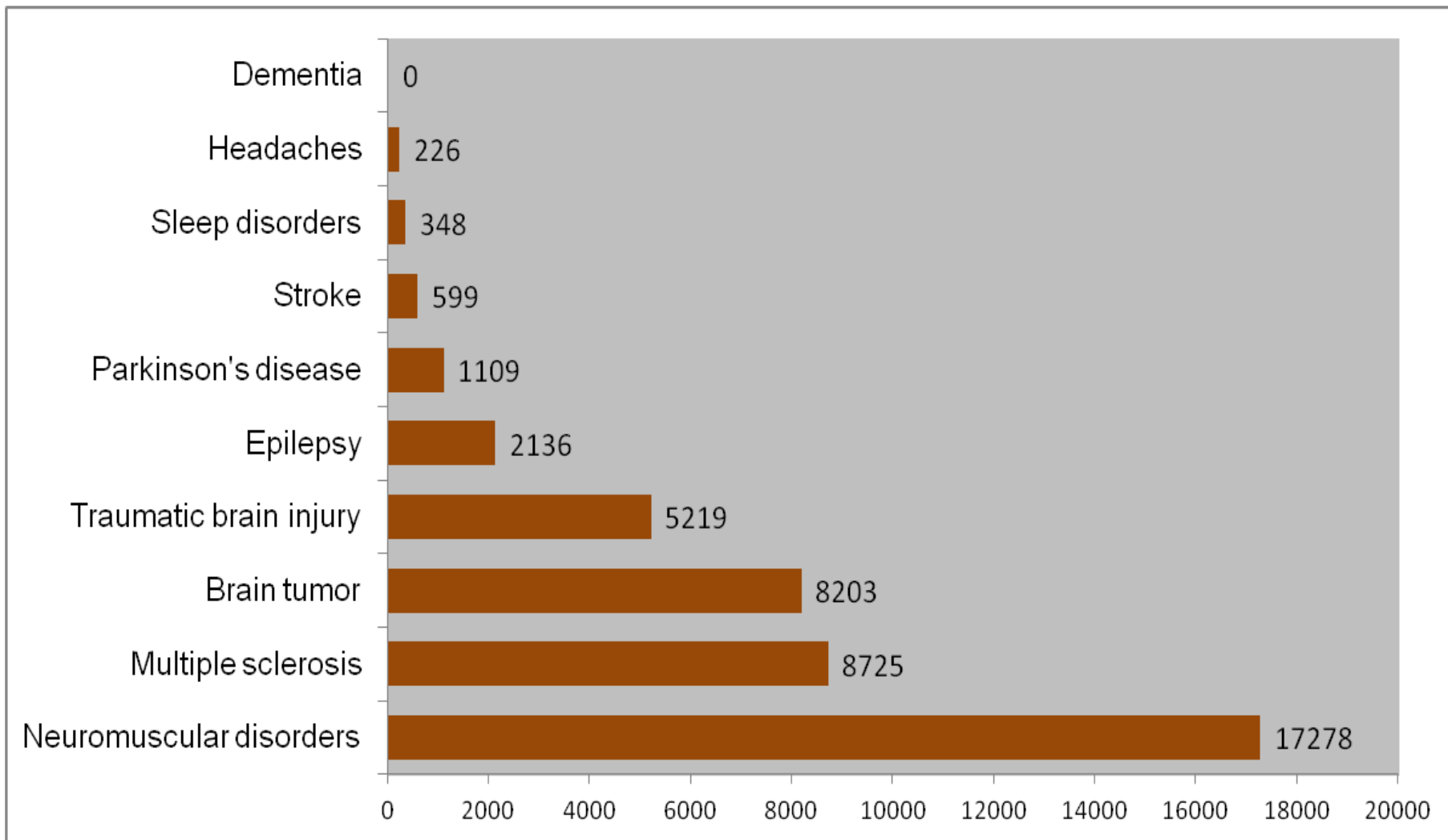
Direct non-medical cost per patient (€ PPP 2010) – Mental disorders



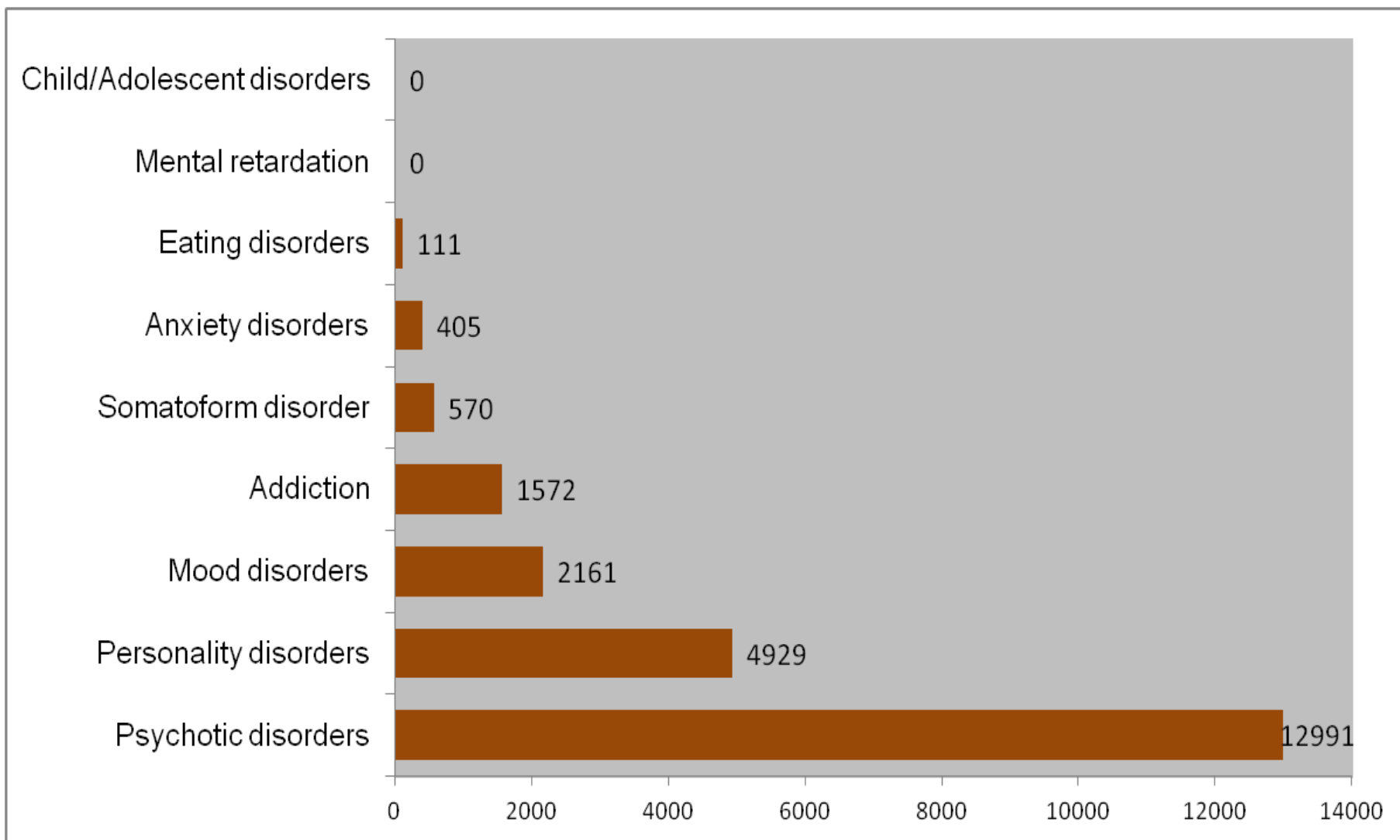
Indirect cost per patient (€ PPP 2010)



Indirect cost per patient (€ PPP 2010) – Neurologic disorders



Indirect cost per patient (€ PPP 2010) – Mental disorders



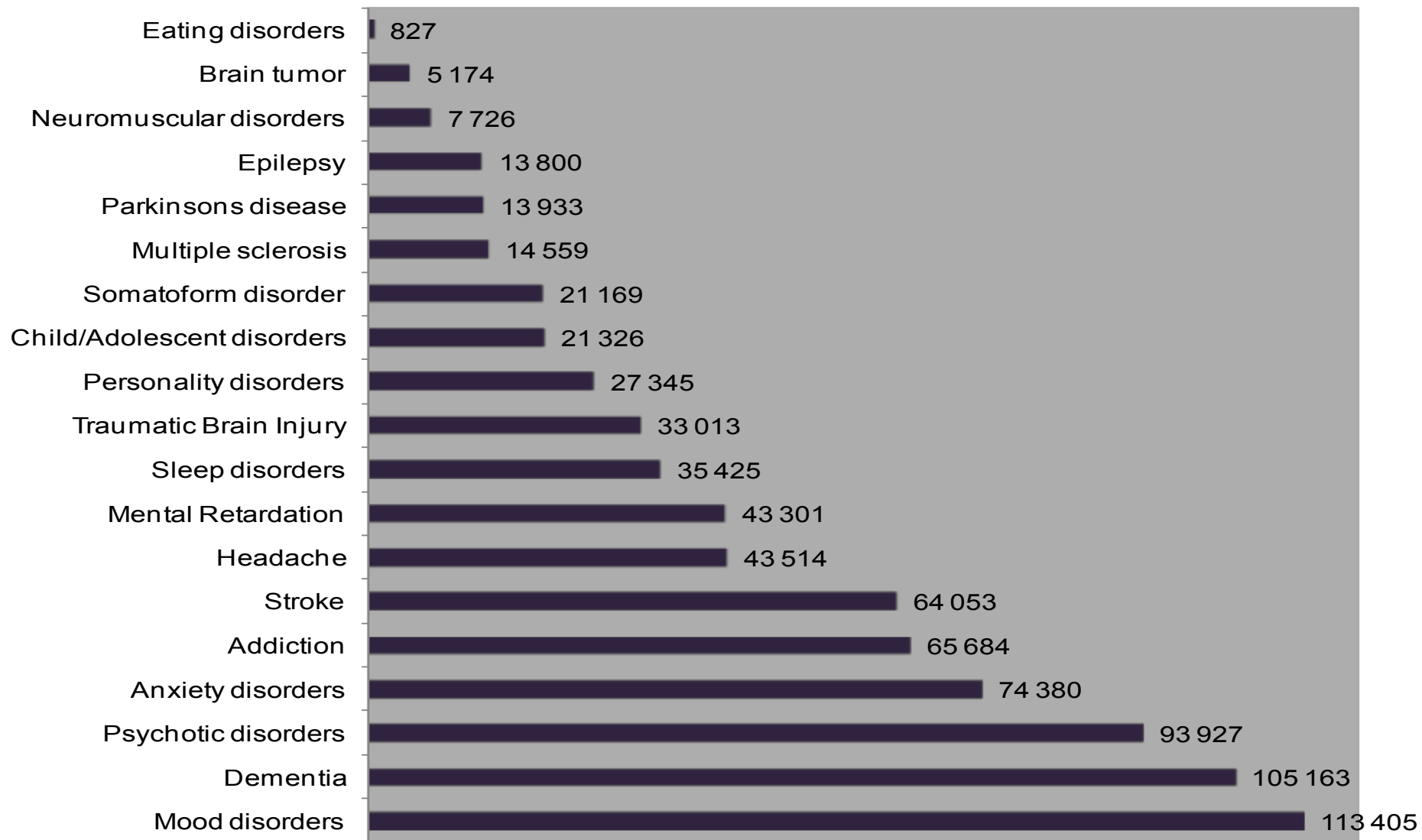
Total cost (€ PPP)

- EBC 2005 – € 386 billion
- EBC 2010 – € 798 billion
 - 12 previously studied disorders (including extensions): € 641 billion
 - 7 new disorders: € 157 billion

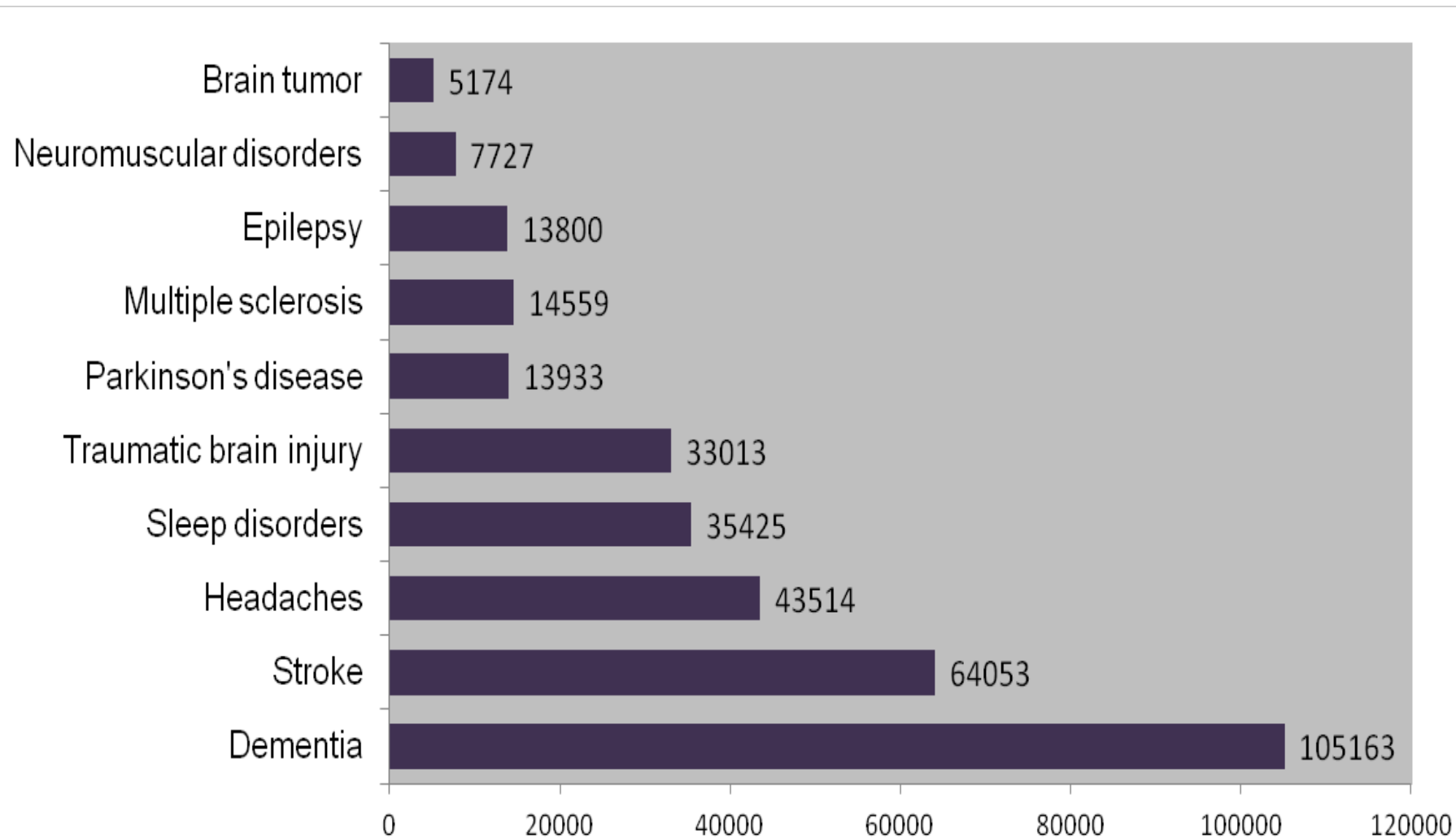
Total cost (€ PPP) – difference with EBC 2005

- Differences in the number of persons
- Differences in the cost per person

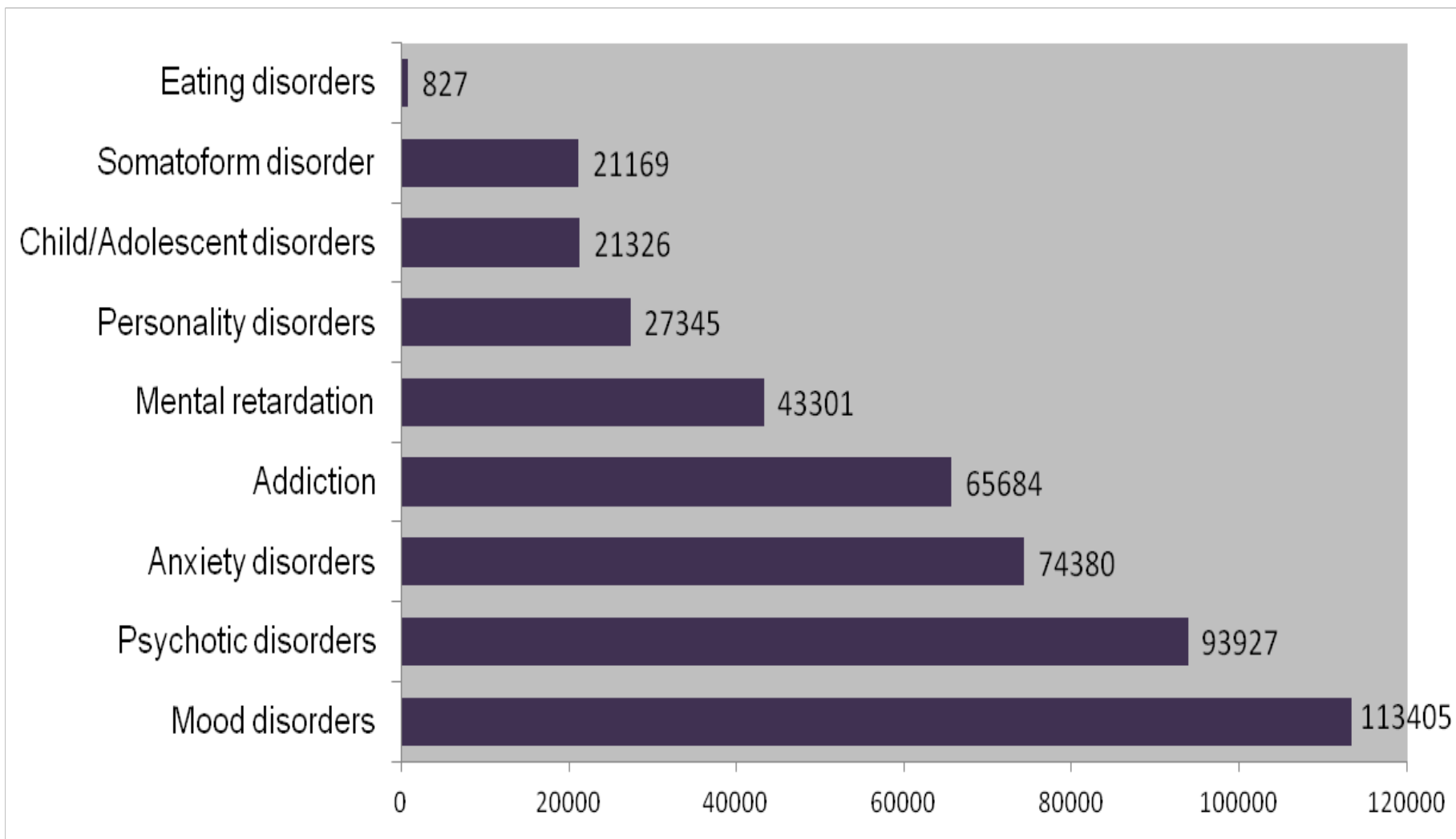
Total cost per disorder (million € PPP 2010)



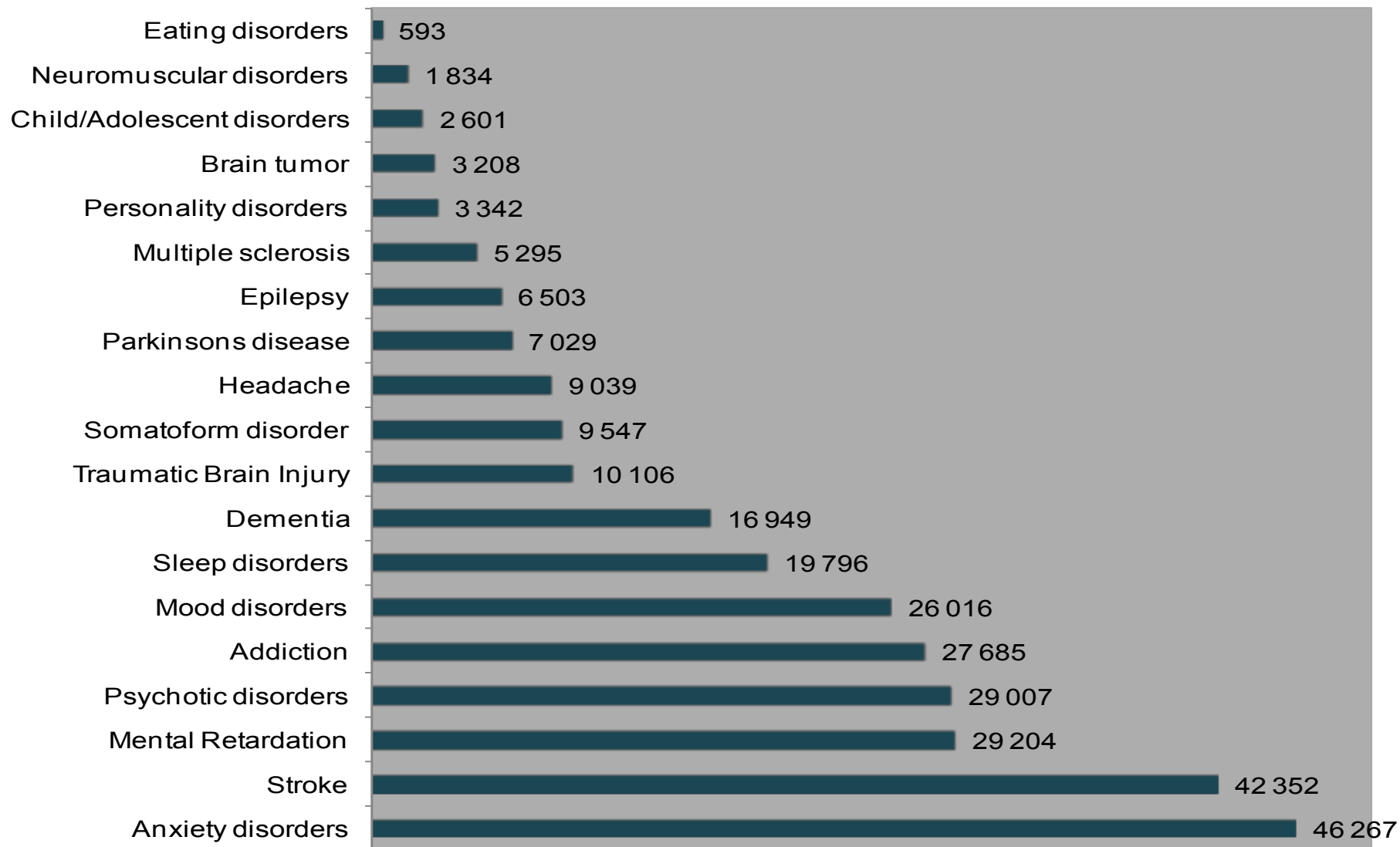
Total cost per disorder (million € PPP 2010) – Neurologic disorders



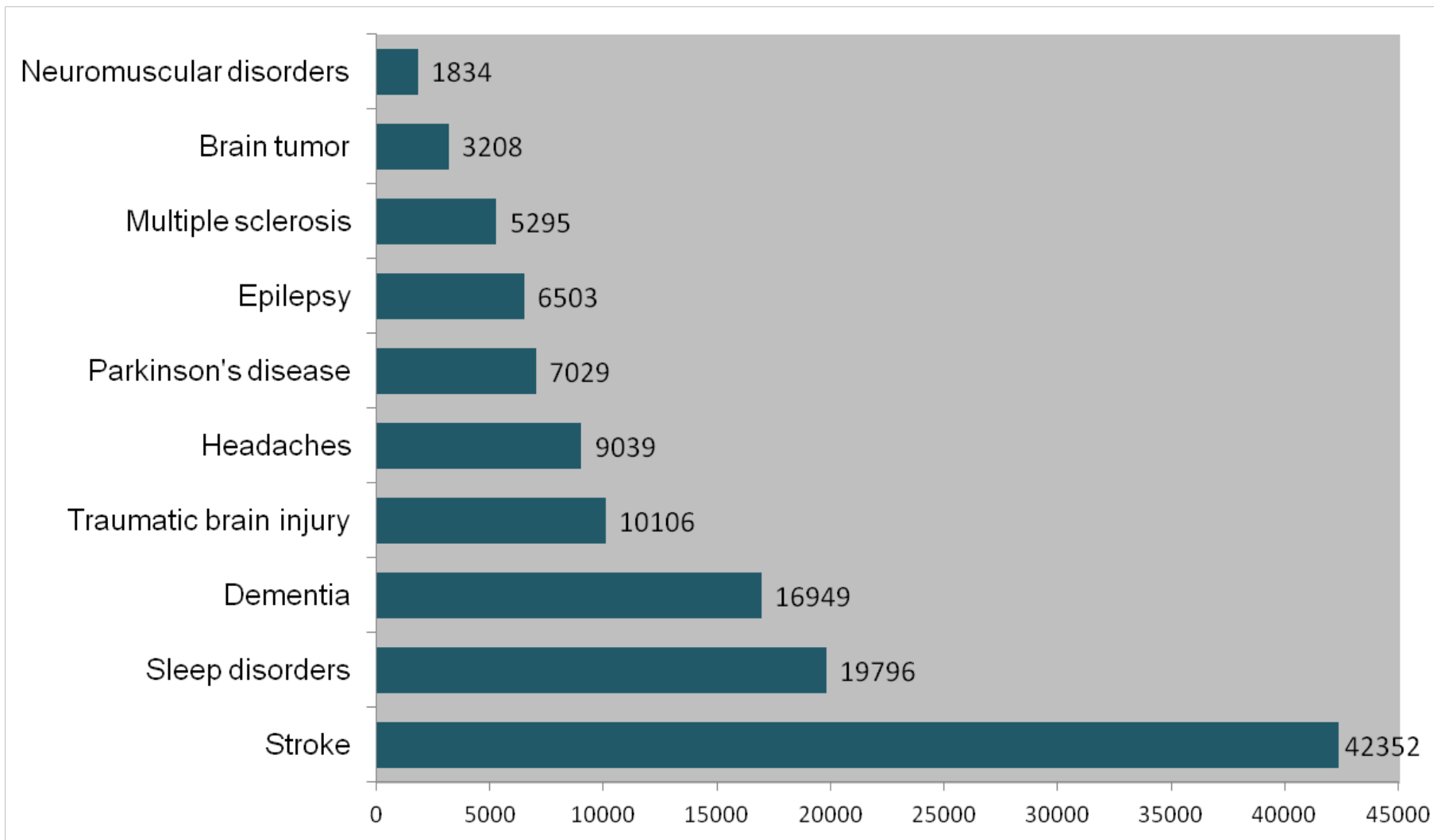
Total cost per disorder (million € PPP 2010) – Mental disorders



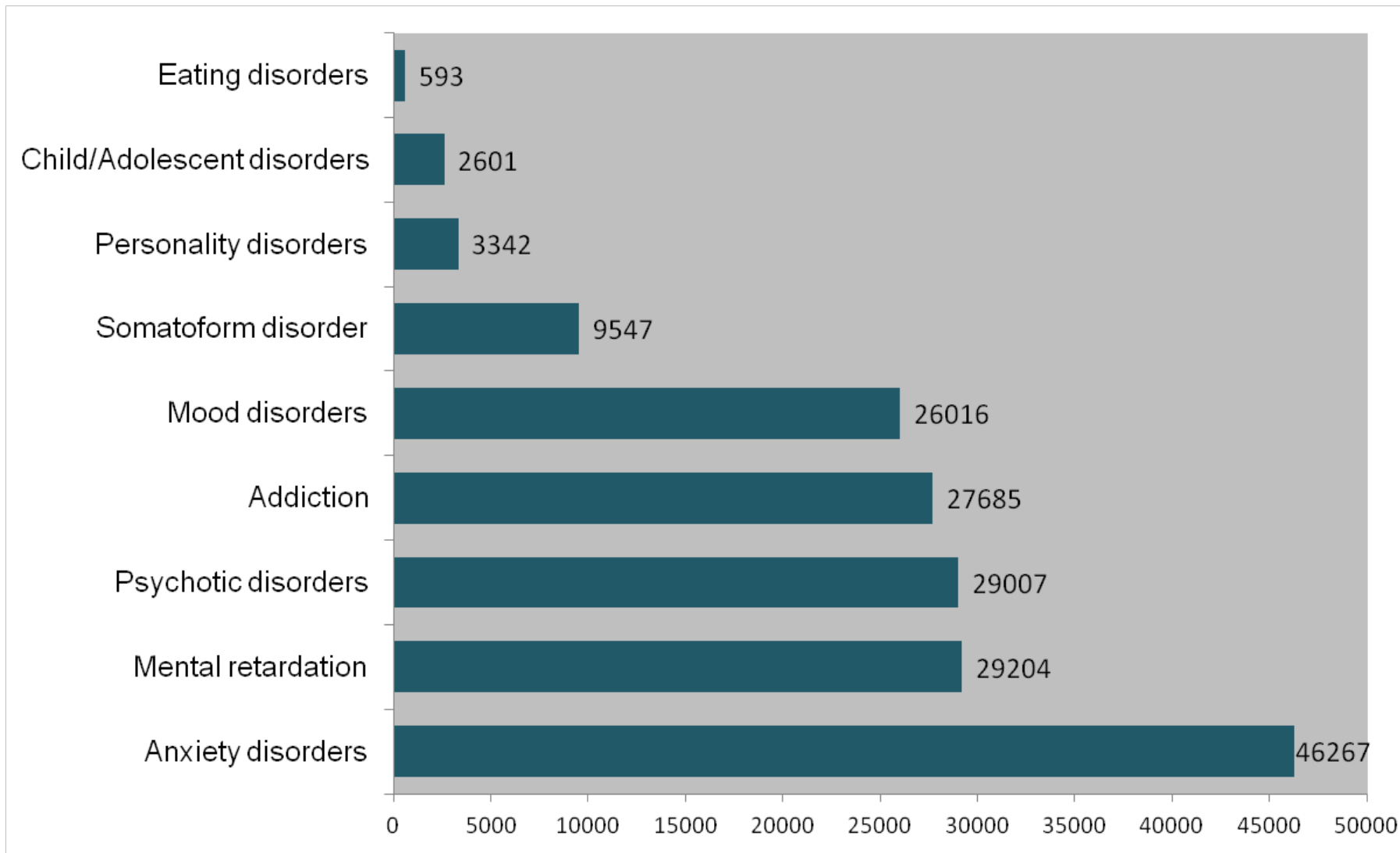
Direct healthcare cost per disorder (million € PPP 2010)



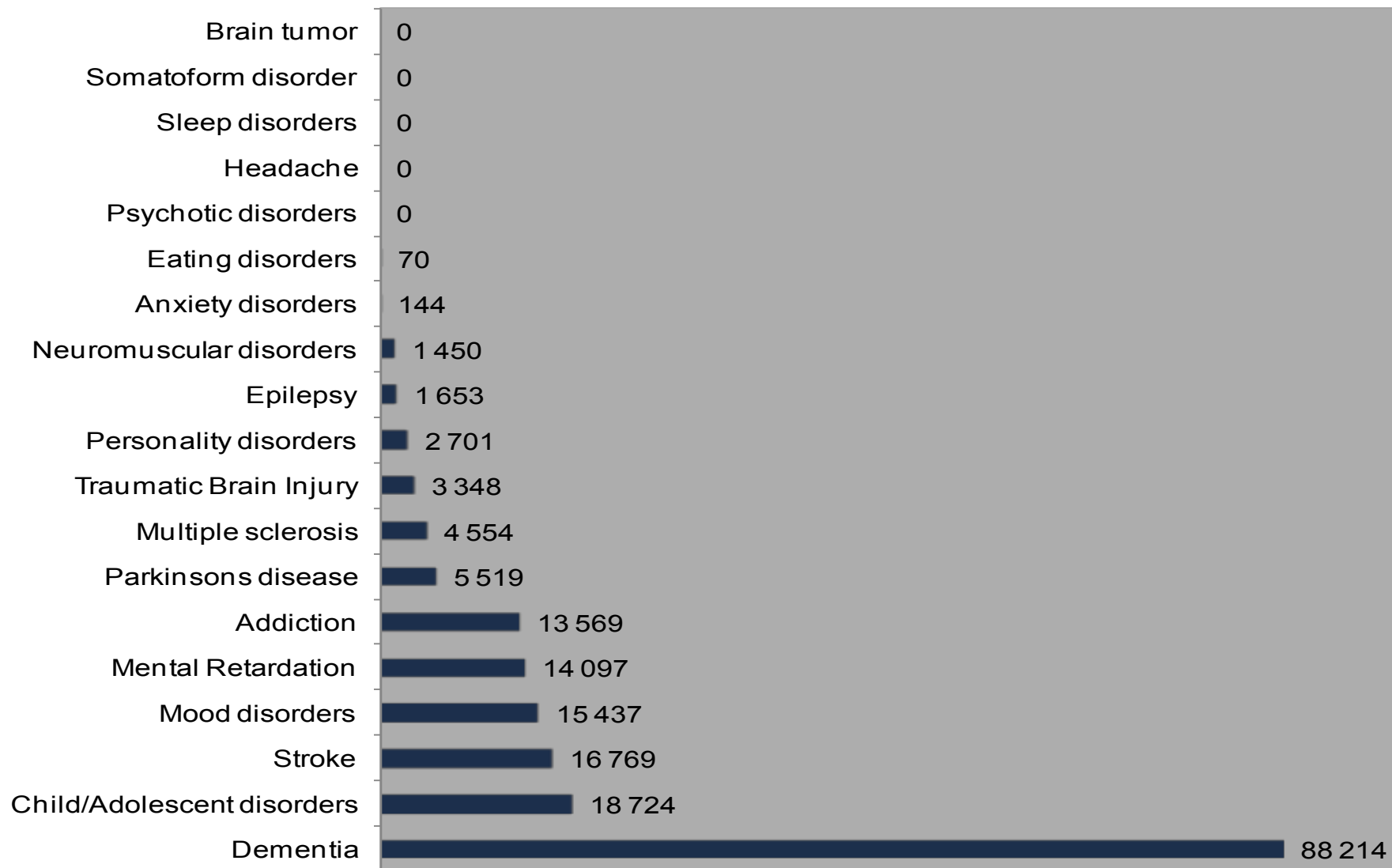
Direct healthcare cost per disorder (million € PPP 2010) – Neurologic disorders



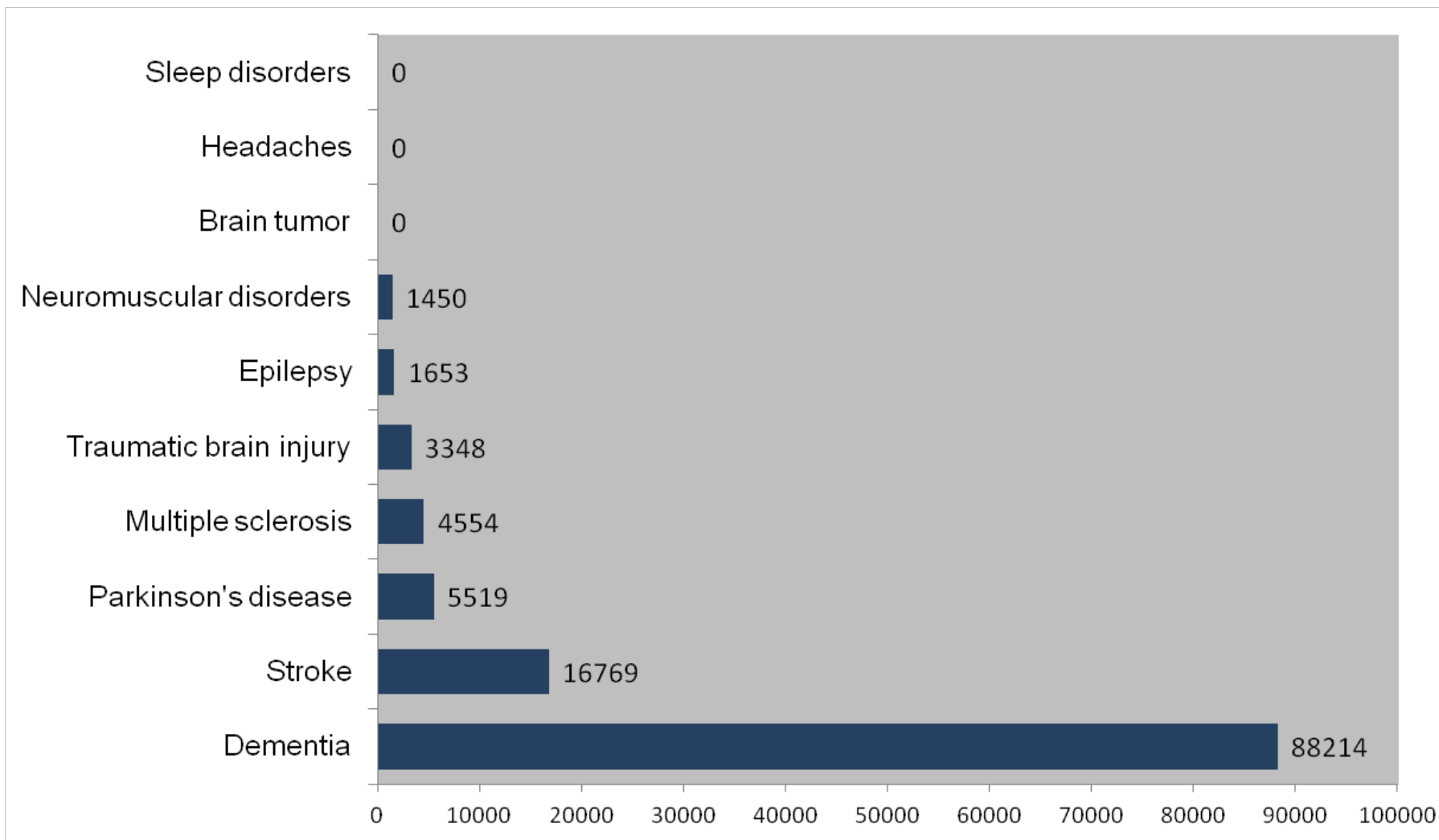
Direct healthcare cost per disorder (million € PPP 2010) – Mental disorders



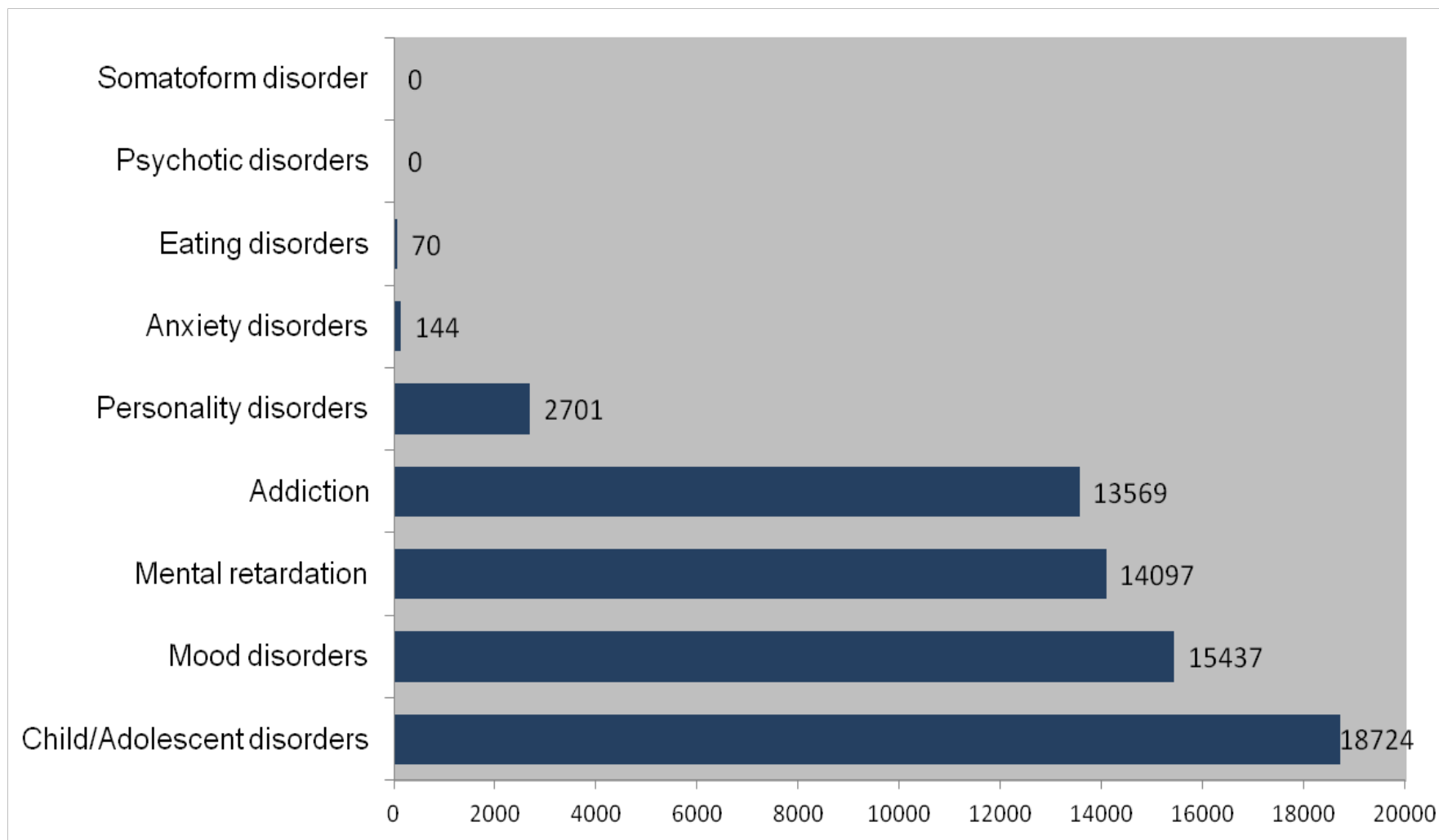
Direct non-medical cost per disorder (million € PPP 2010)



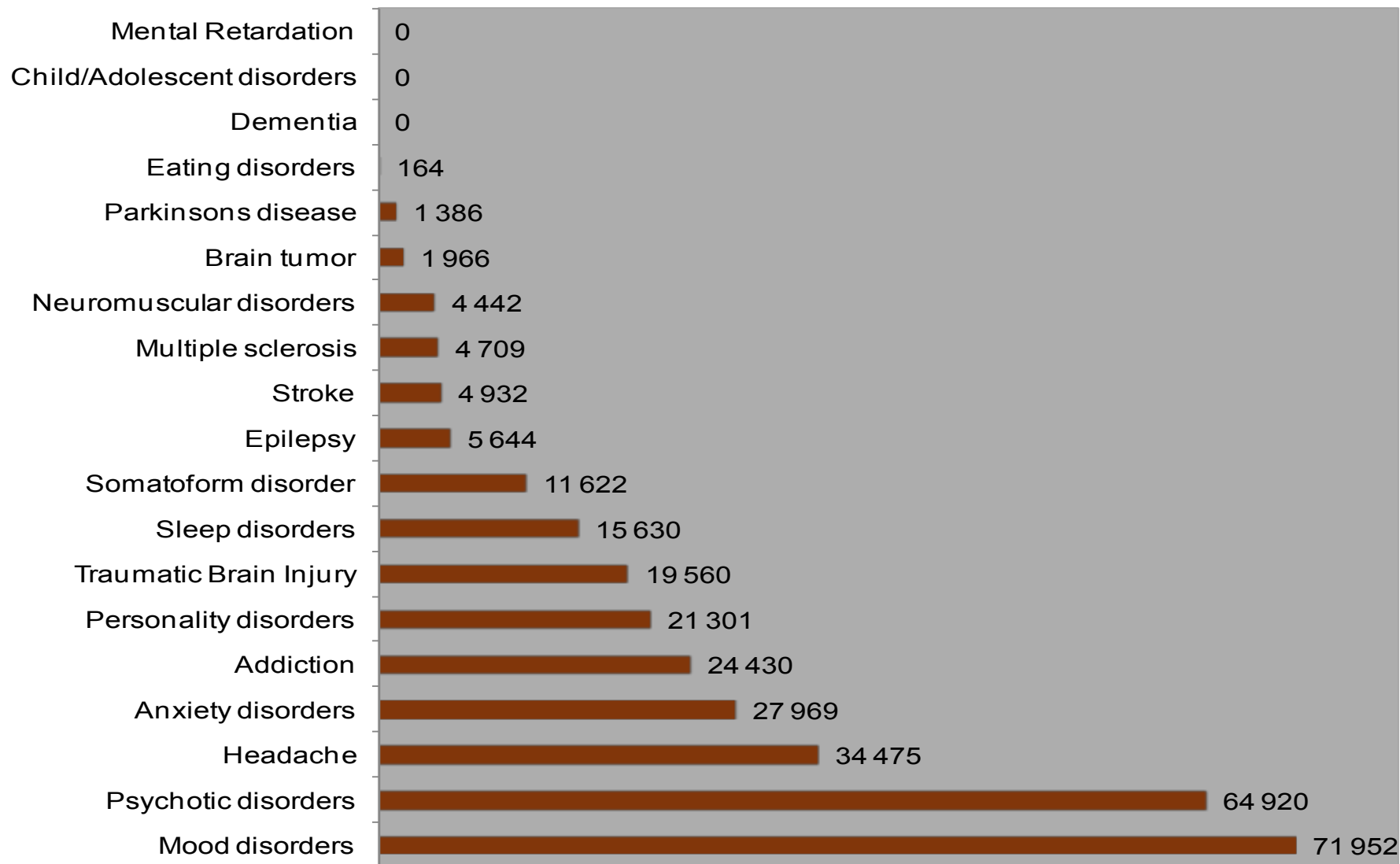
Direct non-medical cost per disorder (million € PPP 2010) – Neurologic disorders



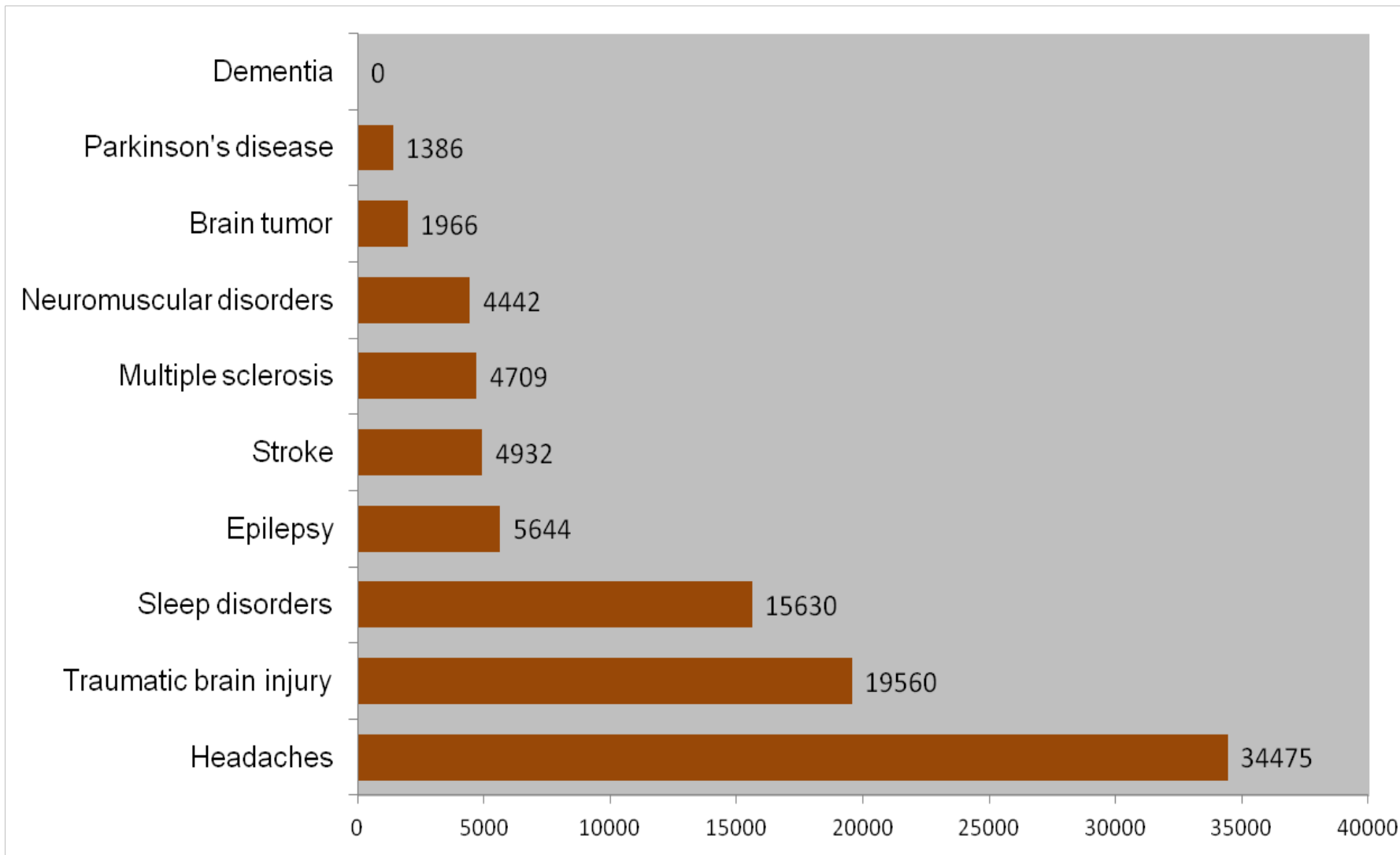
Direct non-medical cost per disorder (million € PPP 2010) – Mental disorders



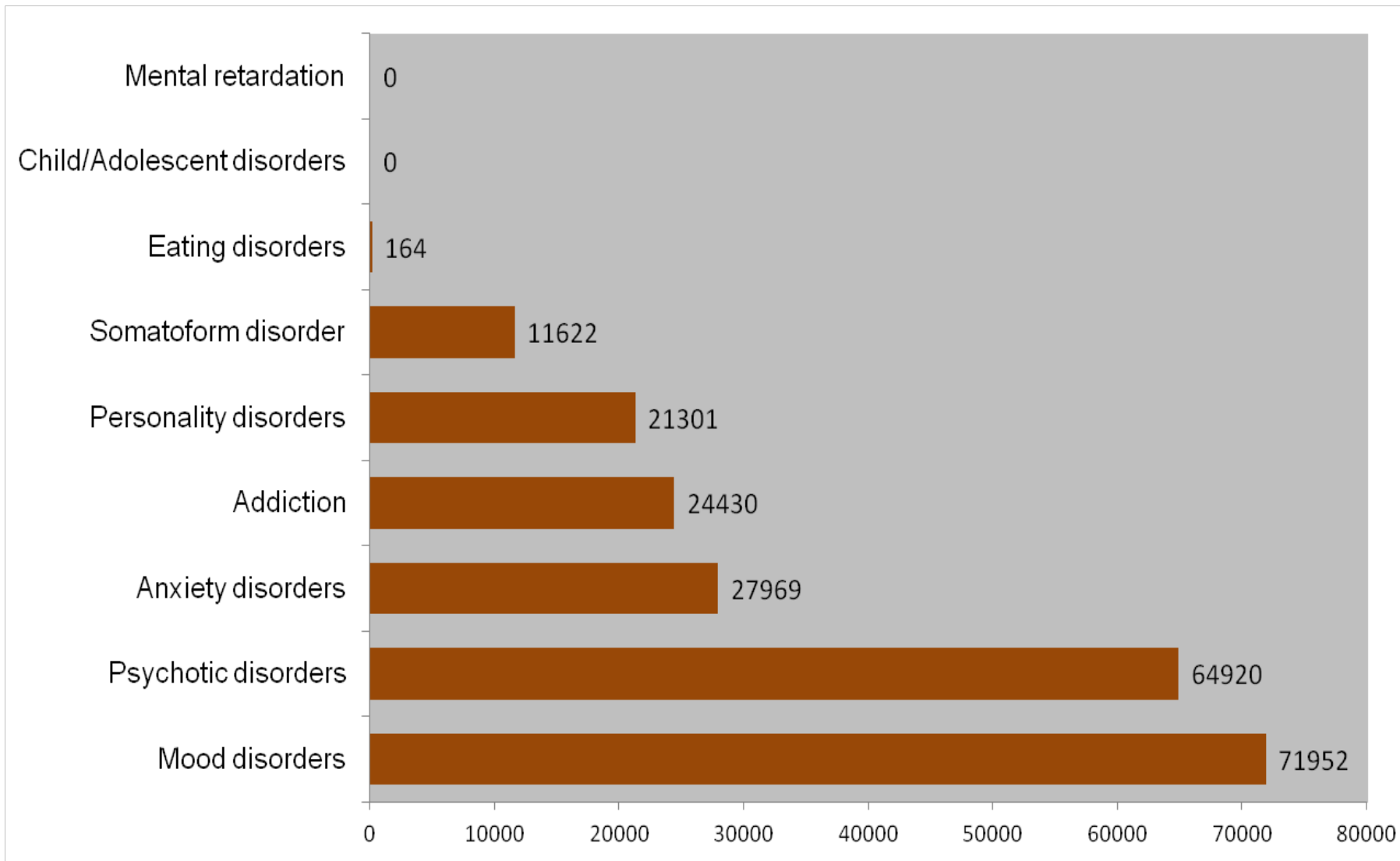
Indirect cost per disorder (million € PPP 2010)



Indirect cost per disorder (million € PPP 2010) – Neurologic disorders

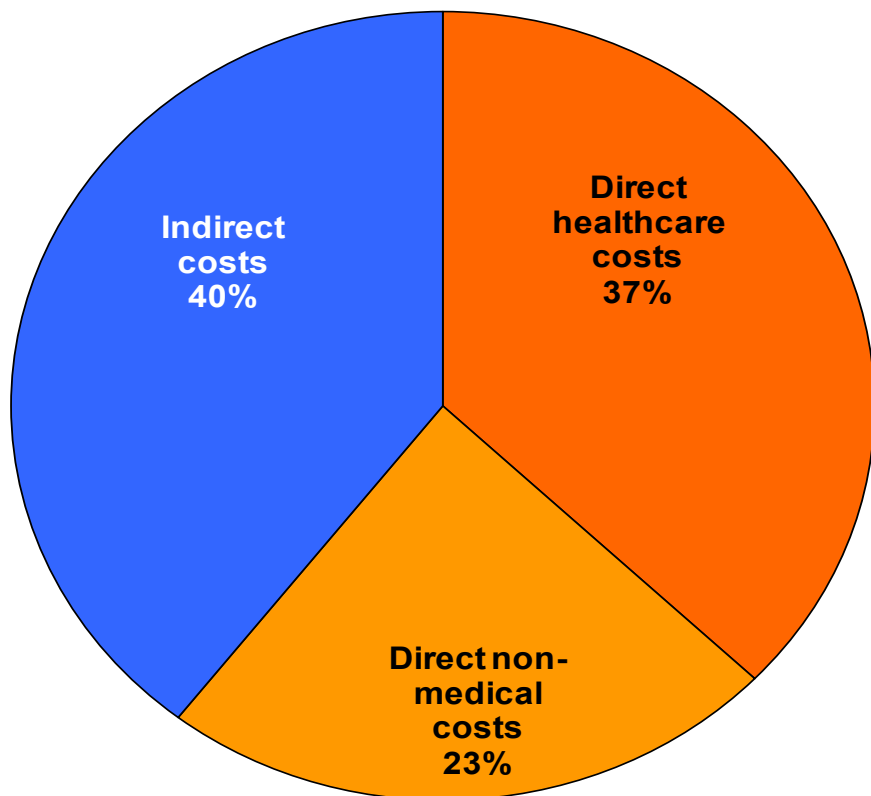


Indirect cost per disorder (million € PPP 2010) – Mental disorders

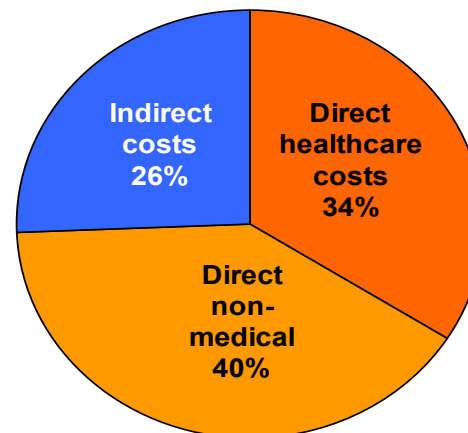


Proportions of three types of costs as a share of the total cost

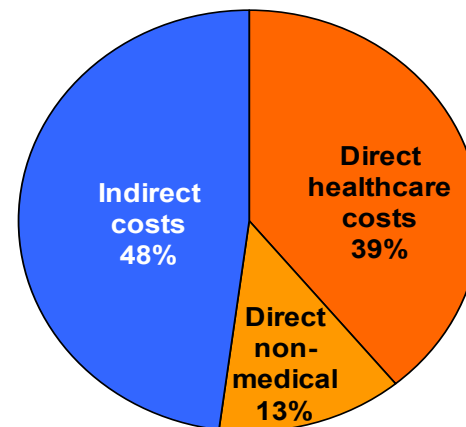
A. Total disorders of the brain



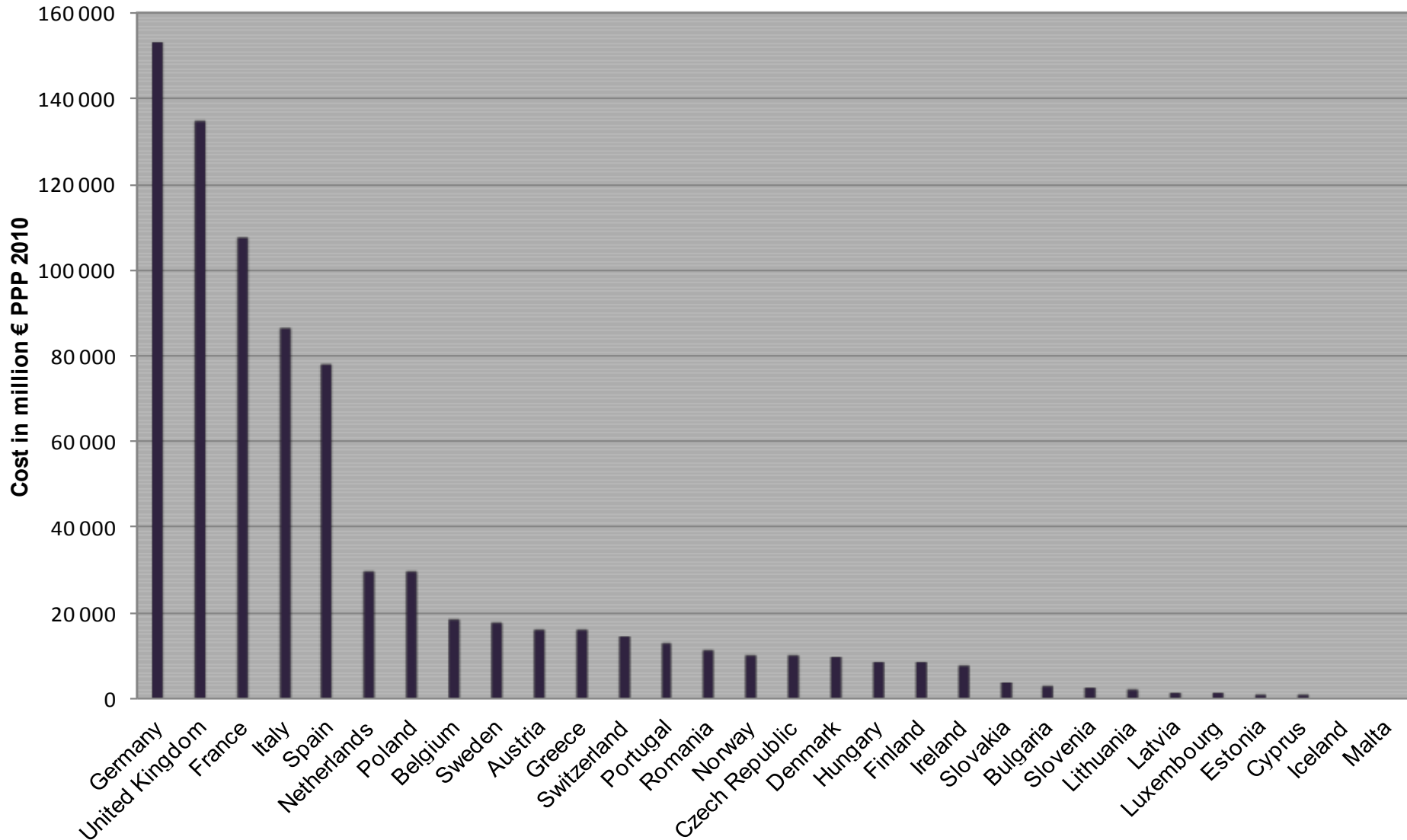
B. Neurological disorders



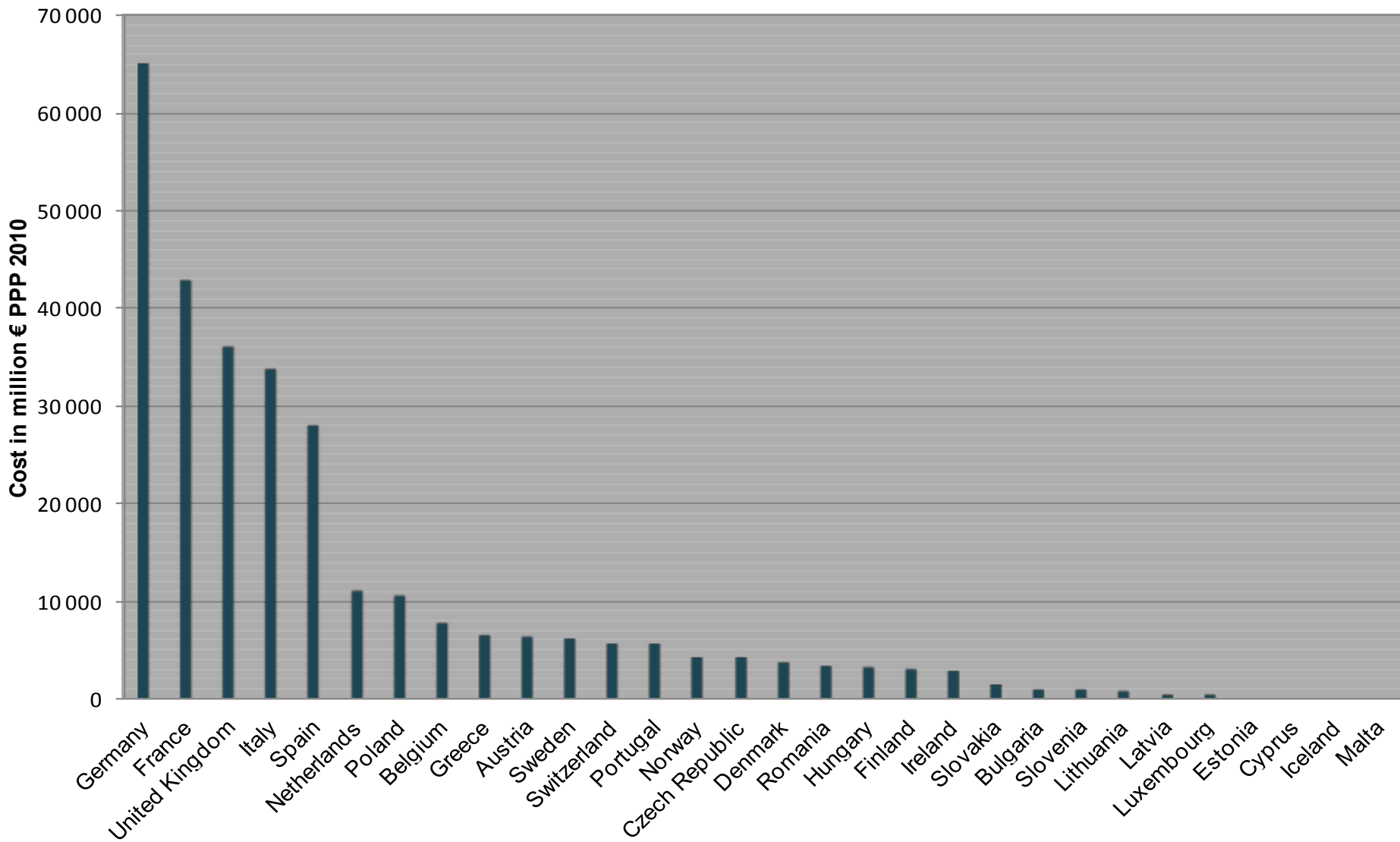
C. Mental disorders



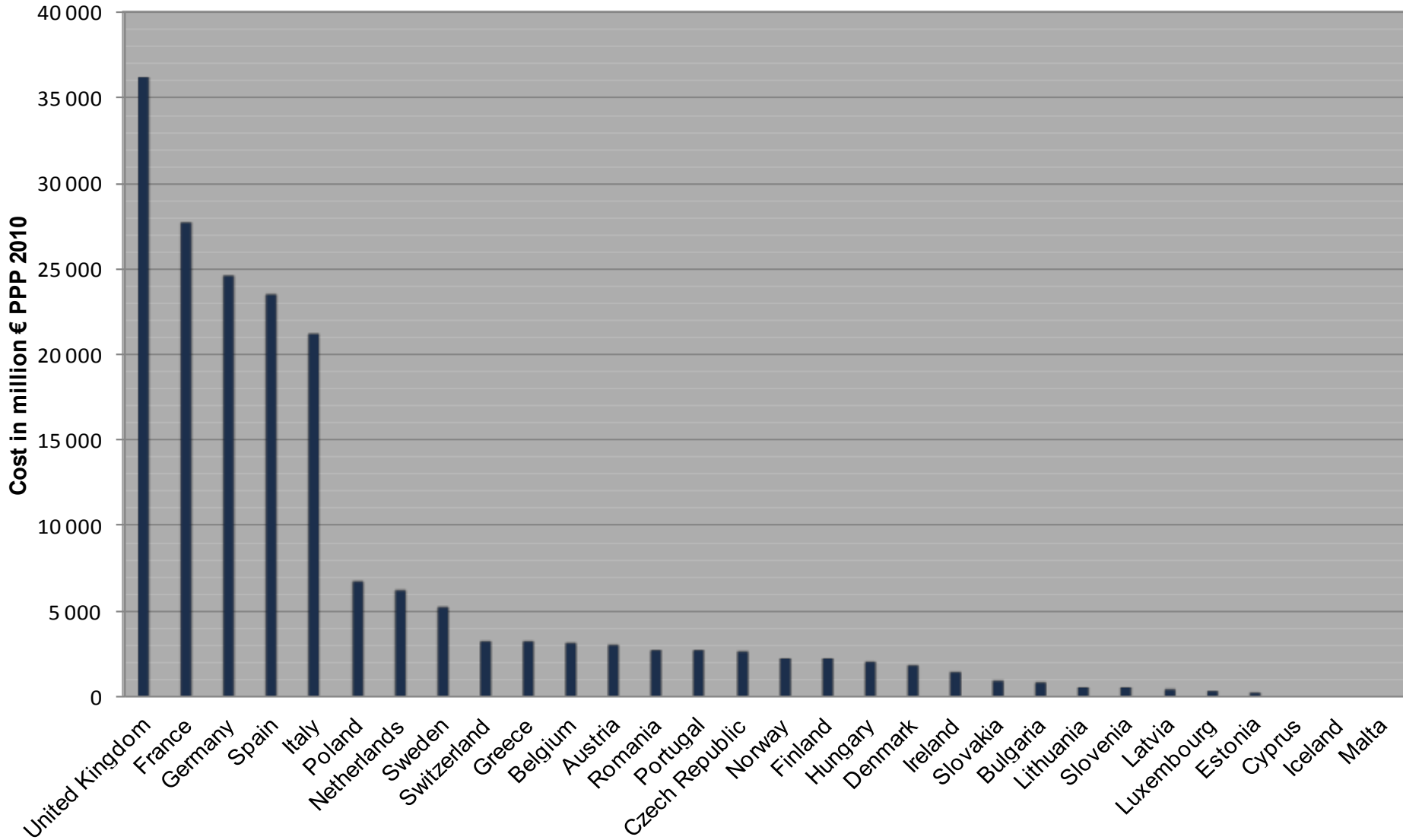
Total cost per country (million € PPP 2010)



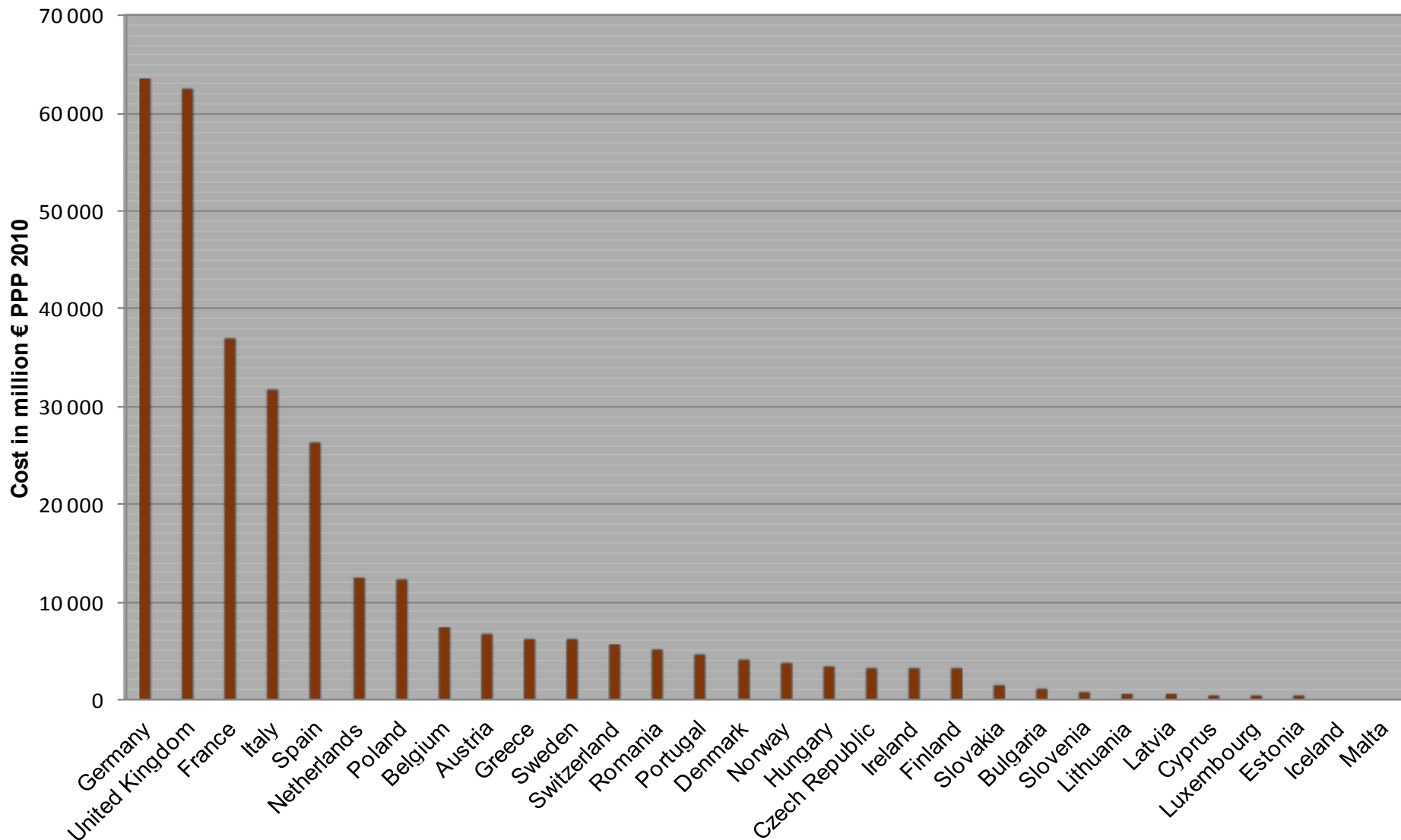
Direct healthcare cost per country (million € PPP 2010)



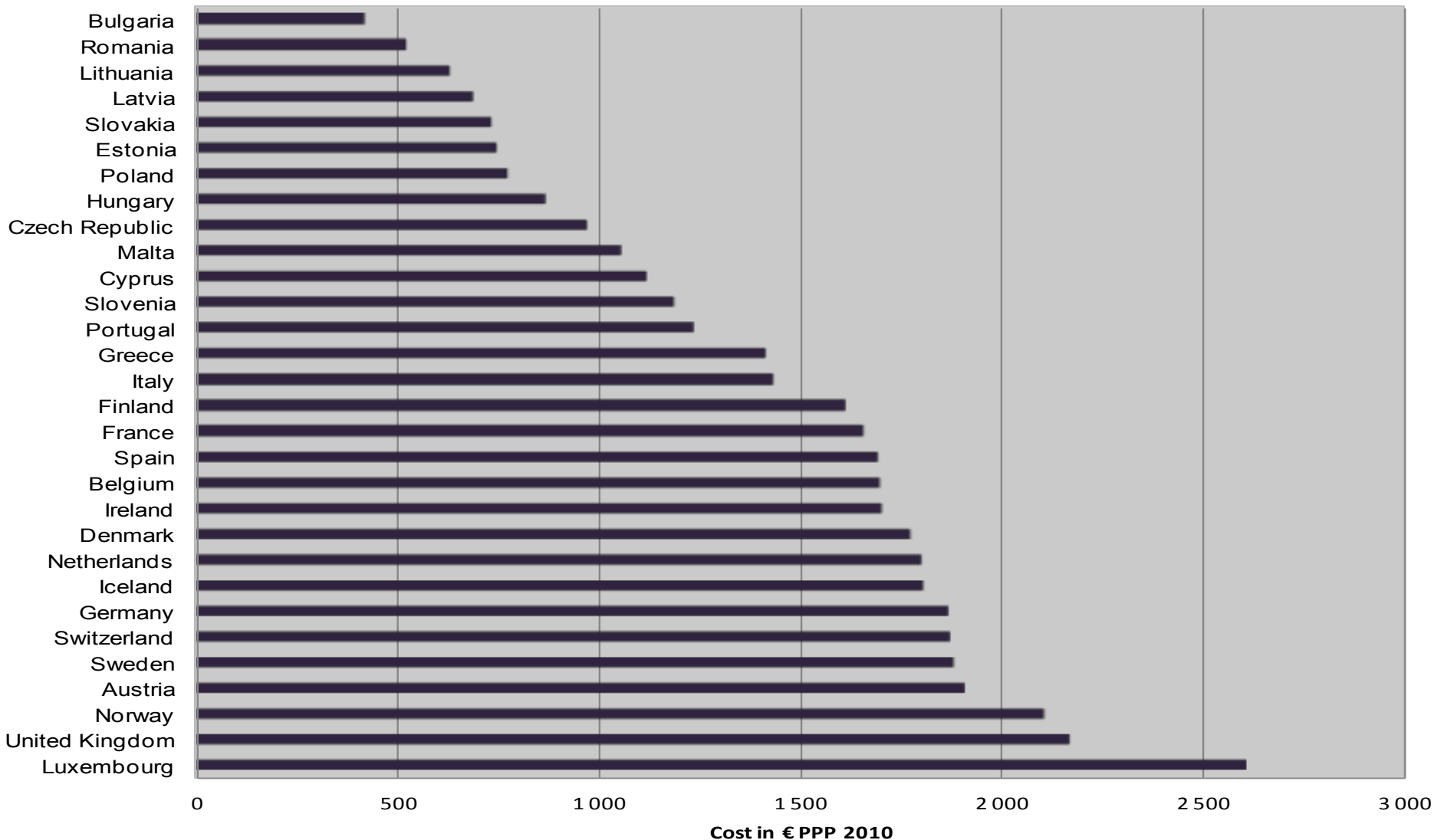
Direct non-medical cost per country (million € PPP 2010)



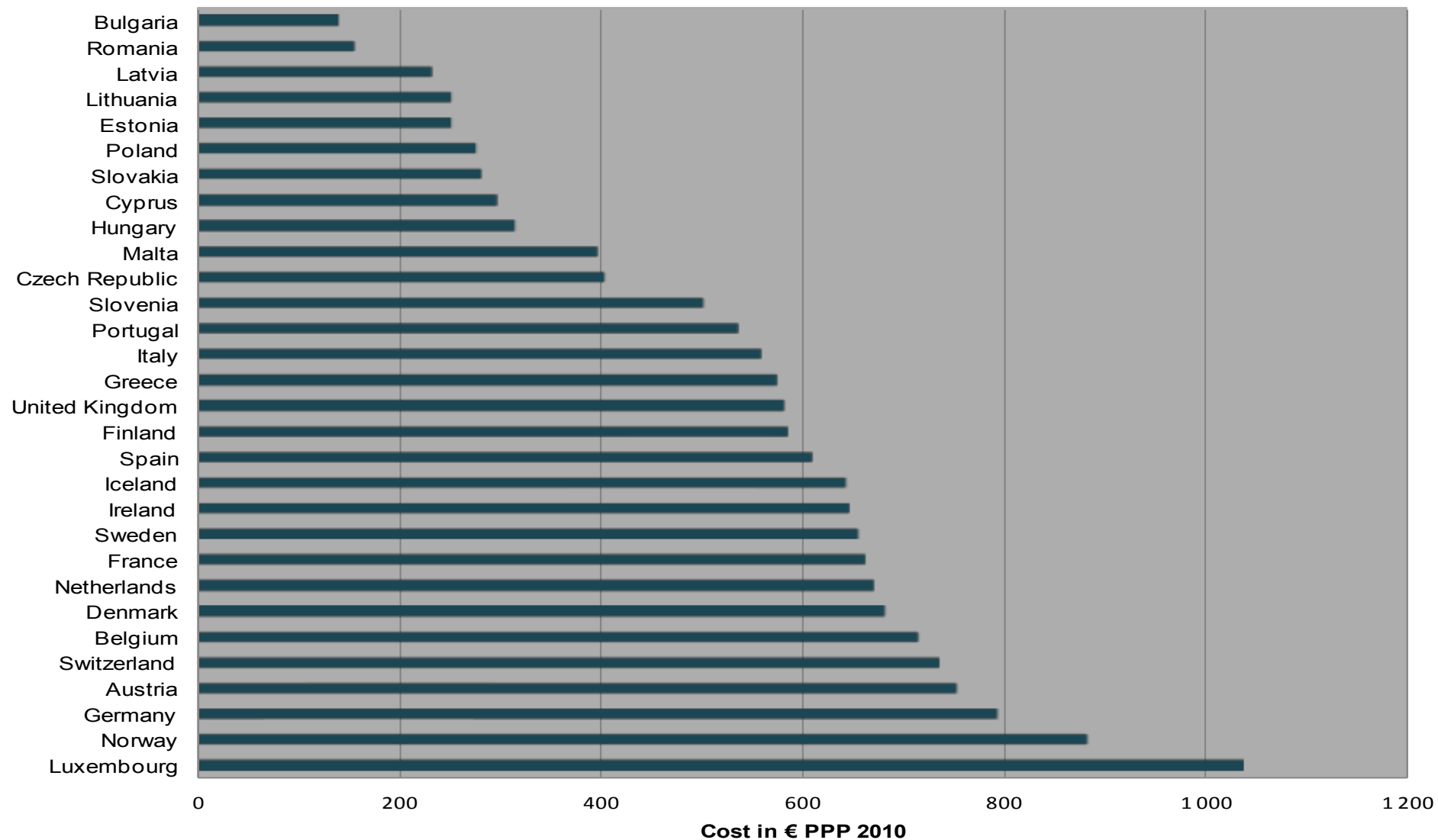
Indirect cost per country (million € PPP 2010)



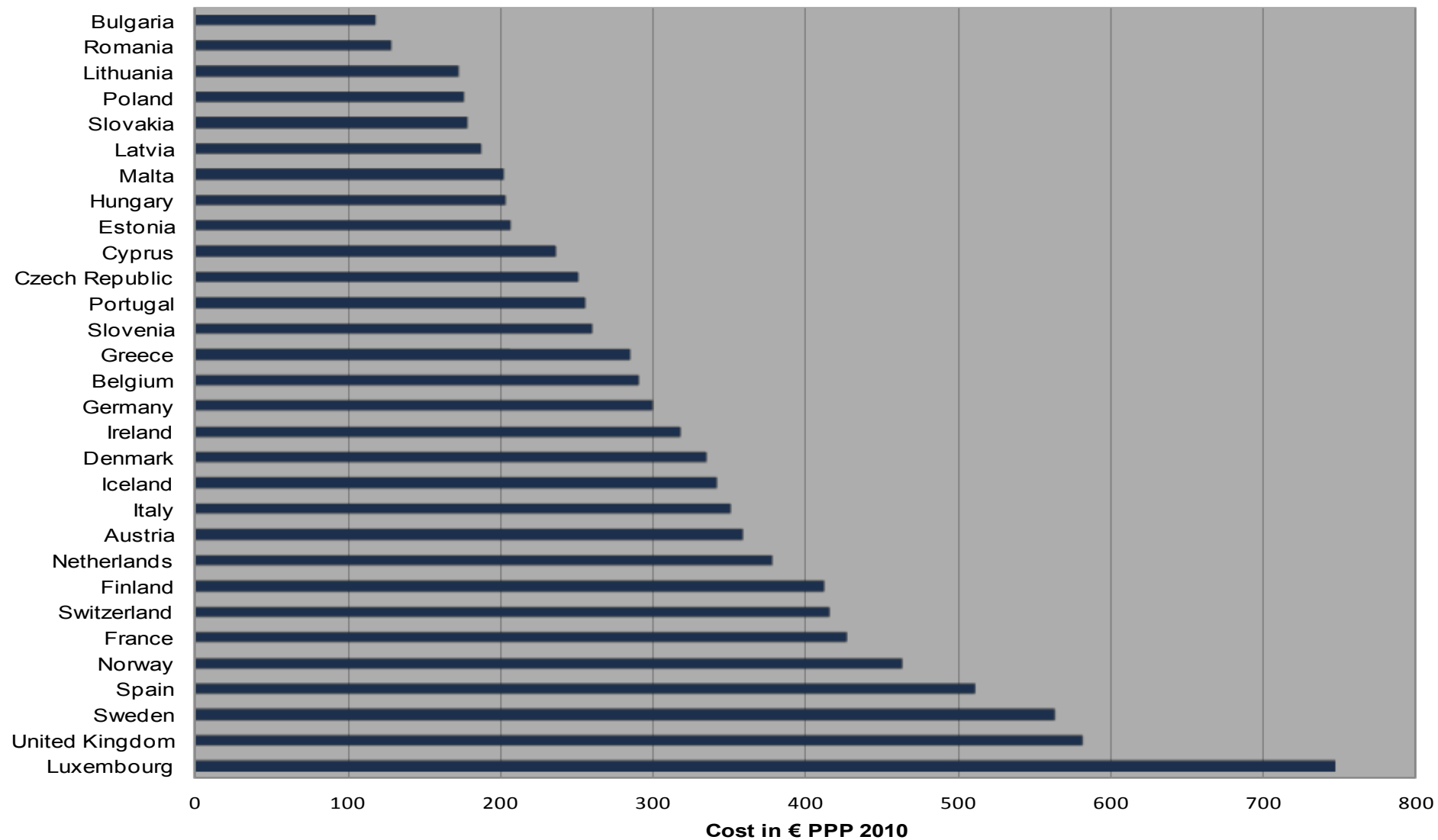
Total cost per capita (€ PPP 2010)



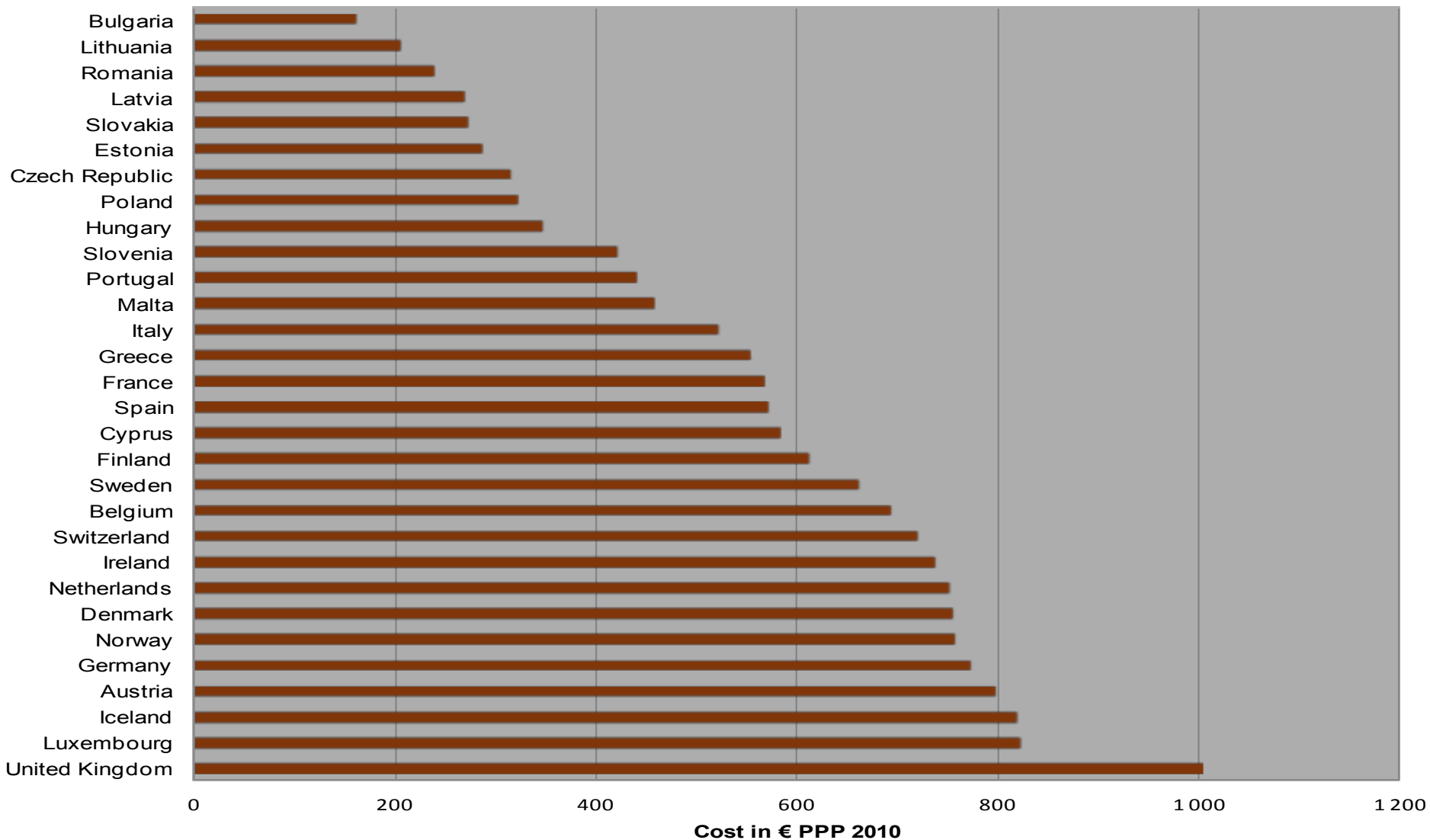
Direct healthcare cost per capita (€ PPP 2010)



Direct non-medical cost per capita (€ PPP 2010)



Indirect cost per capita (€ PPP 2010)



Validation – Healthcare cost of Epilepsy

European review by Koutsopoulos et al. 2001

- Healthcare expenditure between 1.5 – 14 billion
- EBC 2010 € 6.5 billion
 - EBC 2010 estimate is in the middle range

Validation – Healthcare cost of Stroke

European review by Evers et al. 2004

- Healthcare expenditure € 38 billion
- EBC 2010: € 42 billion

Validation – Total cost of dementia in Europe

Cost of dementia in Europe by Wimo et al. 2010

- € 160 billion in 2008
- EBC 2010 estimate: 105.1 billion
 - Higher prevalence and cost estimates in the Wimo et al. 2010 analysis

Validation – Cost per patient with dementia

ICTUS study - Gustavsson et al. 2010

- € 8 000 per patient
- EBC 2010 study: € 16 584 per patient

- Cost per patient from the ICTUS study based on a milder sample of patients
 - For a more severe sub-group: €13 000 - € 20 000

Validation – Cost of MS in Europe

2009 review by Kobelt G. and F. Kasteng

- EU 27 + 3: € 14.9 billion
- EBC 2010 study: € 14.6 billion

- Methodological differences in estimating the total number of patients with MS in Europe
 - 470,000 persons above the age of 19 in the review vs. 440 000 above the age of 18 in the EBC 2010

Validation – US evidence

- Overall, higher healthcare cost estimates in the US studies than in Germany
- US health care cost 17.3% of GNP and 10.4% in Germany
- Variability between disorders

Comparison to European estimates of other major groups of disorders

Cardiovascular disease: €192 billion in 2008
(21% indirect cost, 79% direct cost)

- Cost per capita per year: € 391
 - from € 60 for Bulgaria to € 600 for Germany
- Cost of productivity losses due to illness: € 13.9 billion
- Cost of informal care: € 42 billion

Comparison to European estimates of other major groups of disorders

Cancer: total costs between € 150 and 250 billion in 2010

- Direct healthcare costs: € 79 billion in 2010

Comparison to European estimates of other major groups of disorders

Diabetes (direct healthcare costs): € 20 – 83 billion in 2010

- Hospitalization: 55%
- Drug therapy: 27%
 - Antidiabetic drugs and insulin: 7% of total direct healthcare costs
- Ambulatory care: 18%

Comparison to European estimates of other major groups of disorders

Rheumatoid Arthritis:

Cost per patient with RA: € 12 900

- Direct cost per patient (excluding biologics): € 5 512
- Biologics: €1 028
- Informal care: € 2 012
- Indirect cost: € 4 289

Total cost of RA in Europe: € 25.1 billion in 2008

Comparison to European estimates of other major groups of disorders

Chronic Obstructive Pulmonary disease: Total cost € 39 billion in 2006

- Indirect cost (including the cost due to premature mortality): 60% of total cost
- Direct cost: 54% hospitalization cost, 6% unscheduled visits, 16% COPD medication, 5% medical investigations, 3% oxygen

Discussion

Main findings

- The EBC 2005 cost estimate remains quite stable if correcting for inflation and the increase in the population
- Important elements that were lacking in the 2005 study were added:
 - new sub-diagnoses
 - cost components (indirect costs)
- Cost of extensions – € 164 billion

Main findings

- The cost of disorders of the brain amounts overall to €798 billion in Europe in 2010
- Less prevalent disorders are still missing due to lack of data

“True” estimate of the cost of disorders of the brain is probably considerably higher

Over- and Underestimations

Reasons for overestimation

- Comorbidities – overlap between the disorders of the brain

Reasons for underestimation

- Unable to include certain elements, such as:
 - indirect costs of certain disorders (e.g. insomnia)
 - more than a limited age group for certain disorders (e.g. cost of adult autism)
 - a large number of less prevalent diseases have not been included at all
- Estimates for cannabis dependence were not included

Policy implications – European research

- Not sufficient funding for the disorders of the brain despite their huge burden
- From a societal perspective: the return on investment in brain research far exceeds the return from any other branches of research
- FP7: Specific mention of brain research but uncertain if % of funds increase from FP6 to FP7

FP8: must address clinical and basic brain research

Policy implications – European health care

- Further increase of the burden due to the increasing trend in life expectancy in Europe
- A coordinated policy covering all disorders of the brain is needed

Increased focus on prevention should be of high priority

Policy implications – European health educators

- Normally at most 2 of 24 months or 8% of clinical education at medical schools is allocated to psychiatry and neurology. Cost is 33%
- Even less teaching in brain disorders in other health educations
- Treatment for brain disorders have drastically improved

Increased curricula and teaching efforts are needed

Policy implications – European pharmaceutical industry

- Pharmaceutical industry is moving out of Europe
- Investments in drugs for brain disorders have been disappointing
- Drug development for brain disorders is being abandoned despite huge need
- Unnecessary regulatory barriers to drugs for brain disorders

Political action to halt this exit is needed

simplify procedures for approval/reimbursement

reduce bureaucracy

prolong patents for drugs