The Burden of Neurological Diseases in Europe: The Case of Epilepsy

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Disclosures

- American ALS Association: RCT on RNS60 in ALS
- Editorial Board of *Amyotrophic Lateral Sclerosis, Epilepsia, Epilepsia Open, Clinical Neurology & Neurosurgery, Neuroepidemiology*
- Italian Ministry of Health: various projects
- Unrestricted educational grants by UCB-Pharma, Shire, EISAI
- Speaker at satellite symposium (UCB-Pharma)
Global Burden of Diseases, Injuries, and Risk Factors Study

- **GBD** is the largest and exhaustive initiative for the measurement of temporal and geographic trends of diseases and injuries in the world.
- Coordinated by the **Institute for Health Metrics and Evaluation** (IHME, University of Washington).
- Supported by the Bill & Melinda Gates Foundation.
- >3,000 collaborators from 146 Countries.
Global Burden of Diseases, Injuries, and Risk Factors Study

- The data, collected and analyzed by the GBD collaborators, capture **premature mortality** and **disability** for more than **300 diseases and injuries** in **146 Countries** by sex and age from 1990 until now.

- The instruments developed by the IHME for the display and the analysis of the available data can be used at a global, national and local level to detect the changes of **health in time, space and socio-demographic status**.
Disability-Adjusted Life Years

- **Disability-adjusted life years (DALYs)** are a summary metric of population health.
- DALYs represent a health gap; they measure the state of a population’s health compared to a normative goal.
- DALYs are the sum of two components: years of life lost due to premature mortality (YLLs) and years lived with disability (YLDs).
Definitions of Epilepsy Used in the GBD

- **Epilepsy**: A condition characterized by recurrent (two or more) epileptic seizures, unprovoked by any immediate identified cause.

- **“Active” epilepsy**: A prevalent case of active epilepsy is defined as a person with epilepsy who has had at least one epileptic seizure in the previous 5 years, regardless of antiepileptic drug (AED) treatment.

*Source*: Guidelines for Epidemiological Studies in Epilepsy 1993
Epilepsy Classification for the GBD

- Epilepsy parent was divided into primary (or idiopathic) and secondary epilepsies.
- Each of these were subdivided into “severe” (on average 1 or more fits per month) and “less severe”.
- Less severe cases were subdivided into “treated” and “untreated”.
- Finally, “treated” cases were divided into “treated cases with fits” (between 1 and 11 fits on average in preceding year) and “treated cases without fits” (no fits reported in preceding year).

Source: Guidelines for Epidemiological Studies in Epilepsy 1993
Prevalence & Mortality of Epilepsy

- **45.9 million individuals** suffered from primary and various causes of secondary epilepsy in **2016** (age-standardized prevalence 621.5 per 100,000 (95% UI 540.1–737.0))

- **20.0 million** had active idiopathic epilepsy, giving a prevalence of 324.1 per 100,000 (276.0–375.2)

- Age-standardized mortality rate of idiopathic epilepsy was **1.74 per 100,000 (1.64-1.87)**

- Prevalence rates peaked at **5-9 years** and at **80+ years**, were similar in men and women, and between countries based on SDI

**UI** = Uncertainty interval

Source: Beghi et al, Lancet Neurol (in press)
Incidence of Idiopathic Epilepsy

- In 2016 there were 1.4 million (95% UI 1.2-1.6) newly diagnosed idiopathic epilepsy cases in men and 1.3 million (1.1-1.6) cases in women.

- Age-standardized incidence rate was 38.9/100,000 person-years (95% UI 32.7-45.7) and 37.1/100,000 person-years (30.8-44.1), respectively.

- Between 1990 and 2016, there were no significant changes in both age-standardized incidence rates (35.8 [30.1-42.0]) and (38.0 [31.7-45.1]) and absolute number of people (2.1 million [1.7-2.4] and 2.8 million [2.3-3.3]) with incident idiopathic epilepsy.

Source: Beghi et al Lancet Neurol (in press)
Age-Standardized Prevalence (x 100,000) of Idiopathic Epilepsy by Country, 2016

Europe: 180-480
## Trends of Prevalence of Epilepsy by SDI

<table>
<thead>
<tr>
<th>Location</th>
<th>2016 counts (95% UI)</th>
<th>Percentage change in age-standardized rates from 1990</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td>23 962 448 (20 401 828 to 27 737 043)</td>
<td>6.0 (-4.0 to 16.7)</td>
</tr>
<tr>
<td>High SDI</td>
<td>3 357 612 (2 678 423 to 4 025 445)</td>
<td>10.6 (-11.6 to 39.1)</td>
</tr>
<tr>
<td>High-middle SDI</td>
<td>3 374 755 (2 637 686 to 4 109 936)</td>
<td>3.0 (-19.6 to 34.0)</td>
</tr>
<tr>
<td>Middle SDI</td>
<td>7 864 730 (6 633 313 to 9 248 943)</td>
<td>8.9 (-5.4 to 26.5)</td>
</tr>
<tr>
<td>Low-middle SDI</td>
<td>6 832 353 (5 380 975 to 8 350 595)</td>
<td>1.6 (-19.3 to 26.1)</td>
</tr>
<tr>
<td>Low SDI</td>
<td>2 479 921 (1 819 635 to 3 214 747)</td>
<td>4.5 (-24.9 to 45.4)</td>
</tr>
</tbody>
</table>

**Socio-demographic Index (SDI)** = Income per capita, education, avg population age, fertility rate
Trends of Deaths in Epilepsy by SDI

<table>
<thead>
<tr>
<th>Location</th>
<th>2016 Counts (95% UI)</th>
<th>% change in age-standardized rates from 1990 (95% UI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td>126 055 (118 632 to 135 517)</td>
<td>-24.5 (-31.8 to -10.8)</td>
</tr>
<tr>
<td>High SDI</td>
<td>12 744 (12 203 to 13 558)</td>
<td>-2.7 (-7.2 to 4.8)</td>
</tr>
<tr>
<td>High-middle SDI</td>
<td>10 938 (10 194 to 12 003)</td>
<td>-39.2 (-45.8 to -27.6)</td>
</tr>
<tr>
<td>Middle SDI</td>
<td>36 153 (34 422 to 38 680)</td>
<td>-33.7 (-38.8 to -22.5)</td>
</tr>
<tr>
<td>Low-middle SDI</td>
<td>48 802 (43 507 to 55 892)</td>
<td>-30.6 (-40.3 to -13.5)</td>
</tr>
<tr>
<td>Low SDI</td>
<td>17 360 (15 695 to 19 187)</td>
<td>-12.1 (-23.3 to 10.3)</td>
</tr>
</tbody>
</table>

*Socio-demographic Index (SDI) = Income per capita, education, avg population age, fertility rate*
Trends of DALYs on Epilepsy by SDI

<table>
<thead>
<tr>
<th>Location</th>
<th>2016 Counts (95% UI)</th>
<th>Percentage change in age-standardized rates from 1990</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td>13 492 251 (11 014 685 to 16 503 078)</td>
<td>-19.4 (-27.6 to -9.0)</td>
</tr>
<tr>
<td>High SDI</td>
<td>1 187 528 (908 278 to 1 533 569)</td>
<td>-7.6 (-23.7 to 11.3)</td>
</tr>
<tr>
<td>High-middle SDI</td>
<td>1 473 794 (1 129 349 to 1 911 994)</td>
<td>-27.1 (-41.2 to -10.6)</td>
</tr>
<tr>
<td>Middle SDI</td>
<td>4 145 107 (3 342 749 to 5 089 933)</td>
<td>-23.0 (-31.3 to -13.6)</td>
</tr>
<tr>
<td>Low-middle SDI</td>
<td>4 753 027 (3 884 858 to 5 876 862)</td>
<td>-26.3 (-38.1 to -10.0)</td>
</tr>
<tr>
<td>Low SDI</td>
<td>1 914 283 (1 543 598 to 2 399 375)</td>
<td>-12.7 (-28.1 to 10.0)</td>
</tr>
</tbody>
</table>

Socio-demographic Index (SDI) = Income per capita, education, avg population age, fertility rate
Disability-Adjusted Life Years in the European Union (EU 28)

DALY Counts, 2016

Western

Central

Eastern

Austria
Belgium
Denmark
Finland
France
Germany
Greece
Ireland
Italy
Malta
Netherlands
Portugal
Spain
Sweden
United Kingdom

Bulgaria
Croatia
Cyprus
Estonia

Central

Eastern

Unpublished
Disability-Adjusted Life Years in the European Union (EU 28)

DALY Rates (age-standardized), 2016

Western
Central
Eastern
Since 1990, significant reduction in the worldwide burden of idiopathic epilepsy has been observed, reflecting the reduction of the case-fatality rates and the severity of the disease in middle-income countries.

The decrease of death and DALY rates in patients with epilepsy is encouraging, but the changes varied across geographic areas and, where available, within countries (even in Europe) and were linked to the socio-demographic development status, in spite of a stable prevalence.

The success of reducing the burden of idiopathic epilepsy relies mostly on access to health services and treatment.
Strengths & Limitations

**Strengths:**
- worldwide assessment of the burden of epilepsy with the same methodology and modelling measures
- continuous refinement of available data through input from new original sources and statistical methods

**Limitations:**
- Bayesian statistical models were used to estimate deaths and prevalence for countries with missing information
- disability weights used for the calculation of YLDs may not be uniform across populations and socio-demographic levels
- 95% UI used to define the precision of the estimates are wide
- *correction for comorbidity was based on the assumption that diseases and their sequelae are independent*
Future Directions

- Further gains can be made in economically deprived populations through prevention of avoidable deaths and adequate management of the disease.

- Health service planners and providers need to be aware that patients with epilepsy are more often poor and marginalized (even in high-income countries) due to stigma, requiring a greater effort to reach them than for most other diseases.

- Future GBD rounds should consider the aggregation of all causes of secondary epilepsy currently estimated as sequelae of the underlying causes, singly or in combination.

- **Regional data will add to the exhaustiveness of each country’s findings**
# Ongoing Epilepsy Projects on Epilepsy Burden in Europe

<table>
<thead>
<tr>
<th>Project</th>
<th>Aims</th>
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</table>
| ESBACE    | To provide standardized data on prevalence, burden and care of epilepsy throughout Europe, via representing countries; specific aims:  
  - Prevalence  
  - Cost  
  - Quality of life/stigma  
  - Acute management  
  - Provision of care |
| NeuroCare  | To map the national and regional structure of neurological healthcare and assess the standard of healthcare for 6 diseases, including epilepsy |
The questionnaire includes an introductory section ("Structure") that is an outline of the health care in each country in terms of facilities (general and disease-specific), personnel and financial coverage.

To verify the distribution of health care in the country, this information will be tentatively provided on a regional basis.

The National Societies will have an active role for the completion of the questionnaire.
NeuroCare Questionnaire (II)

- A number of sub-specialty sections follow, one for each of the six clinical conditions, aiming at verifying how extensive is diagnosis and treatment in the country and the degree of economic coverage in each region.

- A manual for completing the questionnaire is in preparation

- The questionnaire is being revised by representatives of the international societies of each clinical condition
# Burden of Epilepsy by European Region, 2016

<table>
<thead>
<tr>
<th>European Region</th>
<th>Population</th>
<th>DALYs (N)</th>
<th>Deaths (N)</th>
<th>Prevalence (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western</td>
<td>421,189,424</td>
<td>553,078</td>
<td>7,842</td>
<td>1,525,168</td>
</tr>
<tr>
<td>Central</td>
<td>96,946,744</td>
<td>159,221</td>
<td>1,848</td>
<td>358,718</td>
</tr>
<tr>
<td>Eastern</td>
<td>220,712,834</td>
<td>204,537</td>
<td>1,869</td>
<td>431,632</td>
</tr>
<tr>
<td>Total (WHO)</td>
<td>738,849,002</td>
<td>916,836</td>
<td>11,559</td>
<td>2,315,518</td>
</tr>
<tr>
<td>EU 28 (*)</td>
<td>510,277,177</td>
<td>670,373</td>
<td>9,235</td>
<td>1,774,152</td>
</tr>
</tbody>
</table>

(*) Unpublished