Epidemiological Analysis to Inform Stroke Clinical Practice Guidelines Development


European JBI symposium of Evidence-Based Healthcare in Clinical Practice Guidelines, Decision making process and Evidence synthesis in the Czech Republic, Brno, 12th – 14th December 2018
Disclosure

- I have no conflicts of interest
Aims

• to analyse epidemiology of prevalence and incidence of ischaemic stroke
• main causes
• brain imaging using MRI
• recanalization therapies
• secondary prevention with antiplatelet and anticoagulants
• mortality data
• to inform development of Czech clinical practice guideline in stroke
YLLs = years of life lost

Communicable, maternal, neonatal, nutritional

Non-communicable disease

Injuries
### YLLs = years of life lost

<table>
<thead>
<tr>
<th>Leading causes 1990</th>
<th>Leading causes 2005</th>
<th>% change</th>
<th>Median all-age % change</th>
<th>Age-standardised % change</th>
<th>Leading causes 2015</th>
<th>% change</th>
<th>Median all-age % change</th>
<th>Age-standardised % change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Lower respiratory infections</td>
<td>1 Ischaemic heart disease</td>
<td>25.8</td>
<td>2.3</td>
<td>-12.6</td>
<td>1 Ischaemic heart disease</td>
<td>-10.2</td>
<td>-2.5</td>
<td>-14.8</td>
</tr>
<tr>
<td>2 Neonatal preterm birth complications</td>
<td>2 Lower respiratory infections</td>
<td>-37.3</td>
<td>-49.0</td>
<td>-37.5</td>
<td>2 Cerebrovascular disease</td>
<td>-0.9</td>
<td>-12.4</td>
<td>-23.0</td>
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<tr>
<td>3 Diarrhoeal diseases</td>
<td>3 Cerebrovascular disease</td>
<td>21.2</td>
<td>-1.4</td>
<td>-13.3</td>
<td>3 Lower respiratory infections</td>
<td>-23.9</td>
<td>-32.7</td>
<td>-31.1</td>
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<tr>
<td>4 Ischaemic heart disease</td>
<td>4 HIV/AIDS</td>
<td>597.5</td>
<td>467.3</td>
<td>458.7</td>
<td>4 Neonatal preterm birth complications</td>
<td>-25.9</td>
<td>-34.5</td>
<td>-29.8</td>
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<tr>
<td>5 Cerebrovascular disease</td>
<td>5 Neonatal preterm birth complications</td>
<td>-39.4</td>
<td>-50.7</td>
<td>-37.4</td>
<td>5 Diarrhoeal diseases</td>
<td>-29.2</td>
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<td>-35.8</td>
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<tr>
<td>6 Neonatal encephalopathy</td>
<td>6 Diarrhoeal diseases</td>
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<td>-20.5</td>
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<tr>
<td>7 Malaria</td>
<td>7 Malaria</td>
<td>21.1</td>
<td>-1.5</td>
<td>19.1</td>
<td>7 HIV/AIDS</td>
<td>-33.9</td>
<td>-41.5</td>
<td>-41.4</td>
</tr>
<tr>
<td>8 Measles</td>
<td>8 Neonatal encephalopathy</td>
<td>-3.5</td>
<td>-21.6</td>
<td>-0.3</td>
<td>8 Road injuries</td>
<td>-8.1</td>
<td>-18.7</td>
<td>-18.5</td>
</tr>
<tr>
<td>9 Congenital anomalies</td>
<td>9 Road injuries</td>
<td>11.0</td>
<td>-9.7</td>
<td>-7.8</td>
<td>9 Malaria</td>
<td>-40.1</td>
<td>-47.0</td>
<td>-44.7</td>
</tr>
<tr>
<td>10 Road injuries</td>
<td>10 COPD</td>
<td>-4.6</td>
<td>-22.4</td>
<td>-30.1</td>
<td>10 COPD</td>
<td>-3.0</td>
<td>-14.2</td>
<td>-25.0</td>
</tr>
</tbody>
</table>

**2017**

- **Non-communicable disease**
- **Communicable, maternal, neonatal, nutritional**
- **Injuries**

Masaryk University
GRADE Centre
## Leading ten causes of YLLs

<table>
<thead>
<tr>
<th>Country Type</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td>IHD</td>
<td>Stroke</td>
<td>LRI</td>
<td>NN preterm</td>
<td>Diarrhoea</td>
<td>NN encephalitis</td>
<td>HIV</td>
</tr>
<tr>
<td></td>
<td>(0.98)</td>
<td>(0.98)</td>
<td>(0.67)</td>
<td>(0.72)</td>
<td>(0.74)</td>
<td>(1.18)</td>
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<tr>
<td>High SDI</td>
<td>IHD</td>
<td>Stroke</td>
<td>Lung C</td>
<td>Self-harm</td>
<td>Alzheimer’s</td>
<td>LRI</td>
<td>Colorect C</td>
</tr>
<tr>
<td></td>
<td>(1.58)</td>
<td>(1.09)</td>
<td>(1.08)</td>
<td>(0.94)</td>
<td>(0.98)</td>
<td>(0.81)</td>
<td>(0.86)</td>
</tr>
<tr>
<td>High-middle SDI</td>
<td>IHD</td>
<td>Stroke</td>
<td>Road injuries</td>
<td>Lung C</td>
<td>LRI</td>
<td>HIV</td>
<td>COPD</td>
</tr>
<tr>
<td></td>
<td>(0.88)</td>
<td>(0.92)</td>
<td>(0.9)</td>
<td>(0.93)</td>
<td>(0.81)</td>
<td>(0.51)</td>
<td>(1.12)</td>
</tr>
<tr>
<td>Middle SDI</td>
<td>IHD</td>
<td>Stroke</td>
<td>Road injuries</td>
<td>COPD</td>
<td>LRI</td>
<td>NN preterm</td>
<td>Congenital</td>
</tr>
<tr>
<td></td>
<td>(0.8 )</td>
<td>(1.15)</td>
<td>(0.73)</td>
<td>(1.37)</td>
<td>(0.6)</td>
<td>(0.7)</td>
<td>(0.74)</td>
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<tr>
<td>Low-middle SDI</td>
<td>LRI</td>
<td>NN encephalitis</td>
<td>Diarrhoea</td>
<td>NN preterm</td>
<td>IHD</td>
<td>HIV</td>
<td>Malaria</td>
</tr>
<tr>
<td></td>
<td>(0.77)</td>
<td>(1.5)</td>
<td>(1.02)</td>
<td>(0.79)</td>
<td>(1.02)</td>
<td>(0.71)</td>
<td>(15.93)</td>
</tr>
<tr>
<td>Low SDI</td>
<td>LRI</td>
<td>Malaria</td>
<td>Diarrhoea</td>
<td>HIV</td>
<td>NN preterm</td>
<td>NN encephalitis</td>
<td>Congenital</td>
</tr>
<tr>
<td></td>
<td>(0.53)</td>
<td>(2.96)</td>
<td>(0.45)</td>
<td>(1.62)</td>
<td>(0.51)</td>
<td>(0.68)</td>
<td>(0.93)</td>
</tr>
<tr>
<td>High income</td>
<td>IHD</td>
<td>Lung C</td>
<td>Stroke</td>
<td>Alzheimer’s</td>
<td>Self-harm</td>
<td>COPD</td>
<td>LRI</td>
</tr>
<tr>
<td></td>
<td>(1.08)</td>
<td>(1.05)</td>
<td>(0.7)</td>
<td>(1.04)</td>
<td>(0.81)</td>
<td>(1.46)</td>
<td>(0.75)</td>
</tr>
</tbody>
</table>
TYPES OF STOKES

- Ischaemic stroke: 88%
- Haemorrhagic: 12%
- Atherosclerotic cerebrovascular disease: 20%
- Small vessel disease “lacunes”: 25%
- Cardiac embolism: 20%
- Cryptogenic: 30%
- Other: 5%
TYPES AND CAUSES OF STOKES

- Ischaemic stroke: 88%
- Atherosclerotic cerebrovascular disease: 20%
- Small vessel disease “lacunes”: 25%
- Haemorrhagic: 12%
- Other: 5%
- Cryptogenic: 30%
- Cardiac embolism: 20%
Atrial Fibrillation Is the Most Common Cause of Cardioembolic Ischemic Stroke

Cardiac Diseases Leading to Cardioembolic Events

- Atrial fibrillation: 50%
- Ventricular thrombus: 15%
- Valvular heart disease: 15%
- Structural heart defects or tumors: 20%
Methods

- Institute of Health Information and Statistics of the Czech Republic data
- Primary source of data – National Register of Reimbursed Health Services from health insurance companies
  - *In-patients & out-patients settings*
- Data linked with data from death certificates
- *From 2015 to 2017*
Methods

• Main diagnosis I63 (cerebral infarction)

• Secondary diagnosis:

  I48 (atrial fibrillation and flutter)

  I35.9 (non-specified aortic valve disease)

  Q21.1 (atrial septal defect)

  I33.0 (acute and subacute endocarditis)
Methods

• Patients with ischaemic stroke and MRI head performed in the same year as a diagnosis of stroke was entered into the registries.

• Patients with ischaemic stroke who underwent intravenous thrombolysis or mechanical thrombectomy and a specific ATC group B01AD02 medication or intervention (89321, 90952) was entered into the registries.

• Patients with ischaemic stroke and of following medication were prescribed and reimbursed: Anopyrin (B01AC06), Trombex (B01AC04), Warfarin (B01AA03), Xarelto (B01AF01), Pradaxa (B01AE07) or Eliquis (B01AF02).
Results
Patients with a diagnosis I63 and one of the secondary diagnosis I48, I35.9, Q21.1 or I33.0 (2015 – 2017)

N = 159 344 patients with diagnosis I63
N = 16 946 patients with a diagnosis I63 and one of the secondary diagnosis
Main diagnosis I63 claimed and secondary diagnosis I48, I35.9, Q21.1 or I33.0

Percentage of secondary diagnosis in patients with I63 2015 – 2017 (N = 16 946)

- **I48 - fibrilace a flutter síní**: 16 599; 98,0 %
- **Q21.1 - vrozený defekt sínového septa**: 293; 1,7 %
- **I33.0 - akutní a subakutní infekční endokarditida**: 48; 0,3 %
- **I35.9 - nespecifikovaná nereumatická onemocnění aortální chloupě**: 43; 0,3 %
Main diagnosis I63 and some of the other secondary diagnosis

2015 – 2017 (N = 16 946)

% patients
Patients with stroke and secondary diagnosis and their region of residence in 2017

(N = 5,817)

Patients with stroke per 100,000 inhabitants

Region of residence

- Moravskoslezský kraj: 70.7
- Zlínský kraj: 66.0
- Jihočeský kraj: 66.0
- Královéhradecký kraj: 63.7
- Olomoucký kraj: 62.5
- Kraj Vysočina: 55.2
- ČR: 54.9
- Jihomoravský kraj: 53.8
- Liberecký kraj: 53.5
- Ústecký kraj: 53.4
- Pardubický kraj: 52.2
- Středočeský kraj: 47.0
- Plzeňský kraj: 44.4
- Hlavní město Praha: 42.8
- Karlovarský kraj: 30.7

Stroke centres

- > 65.0
- 55.1–65.0
- 45.1–55.0
- ≤ 45.0

- Moravskoslezský kraj: 6
- Zlínský kraj: 2
- Jihočeský kraj: 2
- Královéhradecký kraj: 3
- Olomoucký kraj: 2
- Kraj Vysočina: 2
- ČR: 45
- Jihomoravský kraj: 6
- Liberecký kraj: 2
- Ústecký kraj: 5
- Pardubický kraj: 2
- Středočeský kraj: 4
- Plzeňský kraj: 1
- Hlavní město Praha: 6
- Karlovarský kraj: 2
Demographic profile of patients with a stroke and a secondary diagnosis in 2017

(N = 5 817 patients)

<table>
<thead>
<tr>
<th></th>
<th>Male:</th>
<th></th>
<th>Female:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>N</td>
<td>Mean (SD)</td>
<td>Median (IQR)</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>2 491</td>
<td>75,4 (10,2)</td>
<td>76 (70; 83)</td>
<td>3 326</td>
</tr>
</tbody>
</table>
Patients with a stroke and MRI head performed between 2015 – 2017
N = 16 946 patients with I63 and a secondary diagnosis

NRHZS 2015–2017:
1 698 (10 %) patients with a stroke and MRI head in the same year
Demographic profile of patients with a stroke and MRI head in 2017

(N = 5 817 patients in 2017)

<table>
<thead>
<tr>
<th></th>
<th>Male:</th>
<th>N</th>
<th>Mean (SD)</th>
<th>Median (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Věk</td>
<td>301</td>
<td>69.3 (11.0)</td>
<td>72 (64; 77)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Female:</th>
<th>N</th>
<th>Mean (SD)</th>
<th>Median (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Věk</td>
<td>263</td>
<td>72.5 (12.9)</td>
<td>75 (68; 81)</td>
<td></td>
</tr>
</tbody>
</table>
Demographic profile of patients with a stroke and MRI head

N = 5,817 patients with I63 and a secondary diagnosis, N = 564 patients with a stroke and MRI head

<table>
<thead>
<tr>
<th>Region</th>
<th>Počet pacientů s MR na 100 všech pacientů s definovanou CMP v daném kraji</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hlavní město Praha</td>
<td>19,2</td>
</tr>
<tr>
<td>Karlovarský kraj</td>
<td>15,4</td>
</tr>
<tr>
<td>Středočeský kraj</td>
<td>14,2</td>
</tr>
<tr>
<td>Olomoucký kraj</td>
<td>14,1</td>
</tr>
<tr>
<td>Jihočeský kraj</td>
<td>13,3</td>
</tr>
<tr>
<td>Pardubický kraj</td>
<td>11,9</td>
</tr>
<tr>
<td>Česká republika</td>
<td>9,7</td>
</tr>
<tr>
<td>Jihomoravský kraj</td>
<td>9,4</td>
</tr>
<tr>
<td>Liberecký kraj</td>
<td>6,8</td>
</tr>
<tr>
<td>Královéhradecký kraj</td>
<td>6,0</td>
</tr>
<tr>
<td>Zlínský kraj</td>
<td>5,7</td>
</tr>
<tr>
<td>Moravskoslezský kraj</td>
<td>5,4</td>
</tr>
<tr>
<td>Ústecký kraj</td>
<td>5,3</td>
</tr>
<tr>
<td>Kraj Vysočina</td>
<td>4,6</td>
</tr>
<tr>
<td>Plzeňský kraj</td>
<td>3,5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stroke centres in a region</th>
<th>MRI scanners in a region</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>17</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Map of stroke centres and MRI scanners in regions.
Patients with stroke received i.v. thrombolysis and/or embolectomy 2015 – 2017

Data NRHZS 2015–2017:
3 754 patients with a stroke received i.v. thrombolysis and/or embolectomy

- 22.2% received i.v. thrombolysis and/or embolectomy
- 77.8% received no treatment

![Graph showing the percentage of patients with a stroke receiving i.v. thrombolysis and/or embolectomy from 2015 to 2017.](image-url)
Patients with stroke received i.v. thrombolysis and/or embolectomy in 2017

- IVT i mechanická rekanalizace
- Pouze IVT
- Pouze mechanická rekanalizace

Total: 20.4 %
Millennial: 66.7 %
Older: 12.8 %

- IVT and/or mechanical revascularization
- Only IVT
- Only mechanical revascularization

N = 5,817
N = 2,491
N = 3,326
N = 70
N = 54
N = 105
N = 230
N = 479
N = 870
N = 1,036
N = 1,132
N = 1,158
N = 580
N = 103
Demographic profile of patients with stroke and IVT and/or embolectomy in 2017

N = 1 278 in 2017

<table>
<thead>
<tr>
<th>Male:</th>
<th>N</th>
<th>Mean (SD)</th>
<th>Median (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Věk</td>
<td>581</td>
<td>74,6 (10,3)</td>
<td>75 (69; 82)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Female:</th>
<th>N</th>
<th>Mean (SD)</th>
<th>Median (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Věk</td>
<td>697</td>
<td>79,1 (10,7)</td>
<td>81 (74; 87)</td>
</tr>
</tbody>
</table>

- **Male:** 54.5%
- **Female:** 45.5%
IVT/embolectomy performed in the Czech regions in 2017

N = 5,817 patients with stroke and secondary diagnosis
N = 1,430 patients with stroke and IVT and/or embolectomy

Počet pacientů s definovanou CMP a IVT/mechanickou rekanalizací na 100 všech pacientů s definovanou CMP v daném kraji

<table>
<thead>
<tr>
<th>Kraj bydliště</th>
<th>Stroke centres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ústecký kraj</td>
<td>31.1</td>
</tr>
<tr>
<td>Karlovarský kraj</td>
<td>26.4</td>
</tr>
<tr>
<td>Hlavní město Praha</td>
<td>24.1</td>
</tr>
<tr>
<td>Středočeský kraj</td>
<td>24.0</td>
</tr>
<tr>
<td>Jihočeský kraj</td>
<td>23.9</td>
</tr>
<tr>
<td>Jihomoravský kraj</td>
<td>23.8</td>
</tr>
<tr>
<td>Plzeňský kraj</td>
<td>23.3</td>
</tr>
<tr>
<td>Česká republika</td>
<td>22.0</td>
</tr>
<tr>
<td>Moravskoslezský kraj</td>
<td>21.1</td>
</tr>
<tr>
<td>Liberecký kraj</td>
<td>20.8</td>
</tr>
<tr>
<td>Královéhradecký kraj</td>
<td>20.2</td>
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<tr>
<td>Olomoucký kraj</td>
<td>17.9</td>
</tr>
<tr>
<td>Kraj Vysočina</td>
<td>15.3</td>
</tr>
<tr>
<td>Zlínský kraj</td>
<td>13.0</td>
</tr>
</tbody>
</table>

N = 5,817 patients

Map showing the distribution of stroke centers across the Czech regions.
Patients with stroke treated with antiagregants / anticoagulants in 2015 – 2017

Data NRHZS 2015–2017: 14 088 patients with stroke and AA/AC

N = 16 946 of patients with a stroke and secondary diagnosis

Data NRHZS 2015: 5 111 patients (48 per 100 000)

Data NRHZS 2016: 5 174 patients (49 per 100 000)

Data NRHZS 2017: 4 814 patients (45 per 100 000)
Patients with stroke treated with antiagregants / anticoagulants in 2015 – 2017

Patients treated with AA/AC - % from all stroke patients

- **Anopyrin**
  - 2015: 46.1%
  - 2016: 45.9%
  - 2017: 42.5%

- **Trombex**
  - 2015: 17.7%
  - 2016: 17.4%
  - 2017: 16.8%

- **Warfarin**
  - 2015: 53.7%
  - 2016: 53.3%
  - 2017: 55.2%

- **Xarelto**
  - 2015: 6.1%
  - 2016: 6.6%
  - 2017: 6.3%

- **Pradaxa**
  - 2015: 9.7%
  - 2016: 10.2%
  - 2017: 10.2%

- **Eliquis**
  - 2015: 6.4%
  - 2016: 7.5%
  - 2017: 9.9%
Patients with stroke treated with antiaggregants / anticoagulants in 2017

N = 4,814 patients with stroke in 2017

- **Anticoagulants only**: 49.6%
- **Antiplatelets only**: 28.7%
- **Anticoagulants and antiplatelets**: 21.7%

The diagram shows the distribution of patients treated with different combinations of anticoagulants and antiplatelets in 2017.
Patients with stroke treated with antiagregants / anticoagulants in 2017 in the Czech regions

N = 4 814 patients with stroke in 2017
Acute hospital admission for stroke in 2017 – hospital stay

Acute hospital admission in 2017 coded I63 and some of the secondary diagnosis I48, I35.9, Q21.1 or I33.0 (N = 13 561 events)

Mean acute hospital stay in 2017 was 13.7 days.
Acute hospital admission for stroke in 2017

Acute hospital admission in 2017 coded I63 and some of the secondary diagnosis I48, I35.9, Q21.1 or I33.0 (N = 13 561 events)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Průměr (SD)</th>
<th>Medián (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muži</td>
<td>6 178</td>
<td>14,3 (16,1)</td>
<td>10 (6; 17)</td>
</tr>
<tr>
<td>Ženy</td>
<td>7 383</td>
<td>13,2 (12,8)</td>
<td>10 (6; 16)</td>
</tr>
</tbody>
</table>

Mean acute hospital stay in 2017 was 1.1 days shorter in females
Mortality for stroke of cardioembolic cause

N = 16,946 patients with I63 and some of the secondary diagnoses in 2015 – 2017

N = 7,605 patients died in 2015 – 2017 (44.9 % of all diagnosed I63 and secondary diagnosis patients)

Data NRHZS 2015–2017:
7,605 died
44.9 %

- Data NRHZS 2015:
  2,123 patients (20 per 100,000)

- Data NRHZS 2016:
  2,637 patients (25 per 100,000)

- Data NRHZS 2017:
  2,845 patients (27 per 100,000)

N = 16,946 patients with I63 and some of the secondary diagnoses in 2015 – 2017
N = 7,605 patients died in 2015 – 2017 (44.9 % of all diagnosed I63 and secondary diagnosis patients)
CONCLUSIONS 1/3

- 61,464 events identified in the NRHZS database in 2015 – 2017 and 16,946 unique patients with I63 and some of the secondary diagnoses I48, I35.9, Q21.1 nebo I33.0 suggesting cardioembolic cause of a stroke.

- Prevalence of stroke and one of the cardiogenic diagnosis increases with an age and was 10.6 % in 2015 – 2017.

- 57.2 % of patient in 2017 were female, 2017, 42.8 % male.

- Onset of stroke is 5.6 years earlier on average in male than female patients.

- 564 patients with a diagnosis of stroke had MRI head performed in the same year of diagnosis; 9.7 % of all stroke patients in 2017. More MRI head scans were done for male and decreases with increasing age. MRI head has been performed in younger patients.
CONCLUSIONS 2/3

- 1,278 patients received i.v. thrombolysis and/or embolectomy in 2017 = 22 % of all stroke patients.

- 66.7 % received i.v. thrombolysis only, 20.4 % received i.v. thrombolysis and embolectomy, and 12.8 % underwent embolectomy only.

- 4,814 patients diagnosed with stroke in 2017 had prescribed anitplatelets or anticoagulants; 82.8 % of all stroke patients in 2017.

- 49.6 % received anticoagulants, 28.7 % antiplatelets and 21.7 % had prescribed both.

- The most common combination was Warfarin and Anopyrin (10.6 %).
CONCLUSIONS

- 2,845 patients with a stroke died in 2017. 60.7 % female and 39.3 % male.
- Average age at the time of death was 4.8 higher in females than males.
- The most common place of death was hospital.
Thank you 😊