Determinants of Health: Effects of Funding on Quality of Care for Patients with severe TBI

- Facts about traumatic brain injury
- Definitions & Outcomes
- Methods
- Results
- Conclusions
Facts about TBI

► TBI (traumatic brain injury) is the leading cause of death for Europeans aged 1 – 45 years
► Total (= fatal plus hospitalized) incidence rate is 235 cases/10^5/year
► Average mortality is 15/10^5/year (case fatality rate 2.7%)
► Ratio of mild to moderate to severe TBI is 22 : 1.5 : 1 (6.8% of all ICU pts in Austria)
► 10 cases of severe TBI/10^5/year

Definitions & Outcomes

- **Severe TBI**: Glasgow Coma Scale Score (GCS) <9 within the first 48 hours after trauma
- **Moderate TBI**: GCS 9 – 11
- **Mild TBI**: GCS 12 – 15

**Outcomes:**
- **Severe TBI**: 35 – 50% death, 25 – 35% GR
- **Moderate TBI**: 3 – 5% death, 50 – 75% GR
- **Mild TBI**: 0 – 1% death, >90% GR

*INRO database; 1200 patients with severe TBI*
Methods

- Collection of data
  - Patient data
  - Treatment data
  - System data
- Quality of care scoring
  - Prehospital care
  - Hospital care
- Collection of data on funding
  - WHO data
Data Collection

- Collection period: 01/2001 and 12/2005
- Internet-based database (ITCP – international traumatic coma project)
- 13 centres from 3 European regions with different economies:
  - “high income” (Austria, 5 centres)
  - “upper middle income” (Croatia, Slovakia, 6 centres)
  - “lower middle income” (Bosnia, Macedonia, 2 centres)
ITCP – available information

- personal data
- prehospital status and treatment
- mechanism and severity of trauma
- results of CT scans and lab testing
- data on surgical procedures
- details of ICU treatment (first 10 days)
- summary of ICU treatment at discharge
- outcomes: GCS at ICU discharge, GOS at 90, 180 and 360 days after injury.
Quality of Care Score

Prehospital treatment

- Airway management (guideline):
  - not indicated = 0
  - endotracheal intubation = +5
  - other airway management = +3
  - no airway management = -5

- Direct transfer to study center (guideline):
  - yes = +3
  - no = -3
Quality of Care Score

Hospital treatment (first 48 hours)

➤ Interval admission – CT scan:
   ➤ <60 min = +3; >60 min = -3

➤ Intracranial pressure monitoring (guideline):
   ➤ used = +3; not used = -3

➤ Normoventilation: arterial pCO₂ between 32 and 40 mmHg (guideline):
   ➤ yes = +3; no = -3

➤ Body temperature below 38.5 °C:
   ➤ yes = +3; no = -3

➤ Steroids used (guideline):
   ➤ yes = -5; no = +5
Quality of Care Score

System factors

- Number of nurses per ICU bed:
  - <2 = +1
  - 2-3 = +2
  - >3 = +3

- ICU patients with MRSA infections:
  - <2% = +3
  - 2-5% = +2
  - 5.1-10% = +1
  - >10% = 0
# Health Care Funding (HCF)

<table>
<thead>
<tr>
<th>Variables</th>
<th>A</th>
<th>SK</th>
<th>CRO</th>
<th>FYROM</th>
<th>BIH</th>
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<tbody>
<tr>
<td>Economy</td>
<td>HI</td>
<td>UMI</td>
<td>UMI</td>
<td>LMI</td>
<td>LMI</td>
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<tr>
<td>LE (m, yrs)</td>
<td>77.3</td>
<td>70.3</td>
<td>72.6</td>
<td>71.1</td>
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<tr>
<td>LE (f, yrs)</td>
<td>82.9</td>
<td>78.2</td>
<td>79.4</td>
<td>76.1</td>
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<tr>
<td>GDP (US$/c)</td>
<td>37.213</td>
<td>8.803</td>
<td>7.724</td>
<td>2.637</td>
<td>2.183</td>
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<tr>
<td>HCF (% GDP)</td>
<td>10.3</td>
<td>7.2</td>
<td>7.7</td>
<td>8.0</td>
<td>8.3</td>
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<tr>
<td>HCF (US$/c)</td>
<td>7.213</td>
<td>634</td>
<td>595</td>
<td>211</td>
<td>181</td>
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Data Analysis

- Computation of individual quality scores for each patient
- Calculation of average score for each center / each region
- Analysis of effects of quality of care on outcomes
  - Mortality, rates of good recovery
- Analysis of funding on quality of care
Mortality

<table>
<thead>
<tr>
<th></th>
<th>% observed mortality</th>
<th>% expected mortality</th>
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<tbody>
<tr>
<td>HI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UMI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LMI</td>
<td></td>
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</tbody>
</table>

O/E ratio

- HI: 0.83
- UMI: 0.94
- LMI: 1.38
Quality Scores

- HI
- UMI
- LMI

QHT mean, QPT mean, QST mean, TQS mean
Quality Scores vs. O/E ratio

TQS vs. O/E ratio (ICU)

\[ y = -8.3763x + 13.294 \]

\[ R^2 = 0.79252 \]
Factors related to ICU survival
(logistic regression, survival coded as “1”)

Model 1:
center effects \( (R^2 = 0.026; \text{HI centers} = 1) \)

<table>
<thead>
<tr>
<th>Factors</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>UMI center</td>
<td>0.70</td>
<td>(0.51- 0.96)</td>
<td>&lt;0.05</td>
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<tr>
<td>LMI center</td>
<td>0.51</td>
<td>(0.38- 0.68)</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>
Factors related to ICU survival
(logistic regression, survival coded as “1”)

Model 2:
adjusted for age, GCS and ISS ($R^2 = 0.457$)

<table>
<thead>
<tr>
<th>Factors</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>P</th>
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</thead>
<tbody>
<tr>
<td>UMI center</td>
<td>0.75</td>
<td>(0.51-1.10)</td>
<td>n.s.</td>
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<tr>
<td>LMI center</td>
<td>0.16</td>
<td>(0.11-0.24)</td>
<td>&lt;0.0001</td>
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<tr>
<td>Age</td>
<td>0.96</td>
<td>(0.96-0.97)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>First GCS</td>
<td>1.44</td>
<td>(1.34-1.54)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>ISS</td>
<td>0.95</td>
<td>(0.93-0.96)</td>
<td>&lt;0.0001</td>
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</table>
Factors related to ICU survival (logistic regression, survival coded as “1”)

Model 3: adjusted for age, GCS, ISS and Quality Score ($R^2 = 0.469$)

<table>
<thead>
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<th>Factors</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>UMI center</td>
<td>1.23</td>
<td>(0.66-2.24)</td>
<td>n.s.</td>
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<tr>
<td>LMI center</td>
<td>0.49</td>
<td>(0.23-1.08)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Age</td>
<td>0.96</td>
<td>(0.95-0.97)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>First GCS</td>
<td>1.46</td>
<td>(1.35-1.57)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>ISS</td>
<td>0.94</td>
<td>(0.93-0.96)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>QPT</td>
<td>0.99</td>
<td>(0.95-1.03)</td>
<td>n.s.</td>
</tr>
<tr>
<td>QHT</td>
<td>1.04</td>
<td>(1.01-1.06)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>QST</td>
<td>1.20</td>
<td>(1.03-1.41)</td>
<td>&lt;0.05</td>
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</tbody>
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Conclusions

- Patients from regions that spend more on health care have better outcomes after TBI.
- These outcomes are determined by the quality of care these patients received.
- Quality of care is dependent on the level of health care funding.
- Funding of health care is a major determinant of health and health care.