Two Decades of Evidenced-based Outcomes Research: The Erlangen Stroke Registry

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Erlangen Stroke Registry – Study Design

- Location in south of Germany, northern Bavaria
- Longitudinal study (started in 1994)
- Prospective
- Population of 108,000 inhabitants
- Well-defined geographic area
Erlangen Stroke Registry - Geographical Area
Erlangen Stroke Registry - Study Criteria

- **Source population**: all residents of Erlangen (Community Registration Office)

- **Age**: no restriction of age

- **Case ascertainment**: hospitalized
  
  non-hospitalized stroke-patients

- **Follow-up**: 3 months
  
  12 months
  
  yearly follow-up (according to Helsingborg Declaration)
  
  home visits with f2f interviews
Gold Standards for an “Ideal” Stroke Study

1. Complete case ascertainment

Concept of ’overlapping sources of information’ to ensure complete case ascertainment

Regular checks of:

- hospital wards
- residential and nursing homes
- records of ambulance and emergency services
- general practitioners
- death certificates

Reference: Malmgren at al., Lancet 1987; Sudlow & Warlow, Stroke 1996; Feigin et al., Lancet 2004
Gold Standards for an “Ideal” Stroke Study (Cont.)

2. Specification of diagnosis/ exclusion of stroke-like events

- Diagnosis of stroke
  - Diagnostic criteria
  - WHO stroke definition

- Classification of stroke subtypes
  - Brain CT-scan at admission
  - CT scan rate of 98%

- Etiology of ischemic stroke
  - TOAST-classification

Reference: Malmgren at al., Lancet 1987; Sudlow & Warlow, Stroke 1996; Feigin et al., Lancet 2004
## Erlangen Stroke Registry - Outcome variables

<table>
<thead>
<tr>
<th>Category</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical assessment (acute)</td>
<td>NIHSS modified Rankin Scale</td>
</tr>
<tr>
<td></td>
<td>ABDC2 score (TIA)</td>
</tr>
<tr>
<td>Risk factors assessment</td>
<td>CHA2DS2-VASc Score</td>
</tr>
<tr>
<td></td>
<td>TOAST- classification (Adams et al. 1998)</td>
</tr>
<tr>
<td>Clinical assessment (long-term)</td>
<td>Barthel Index</td>
</tr>
<tr>
<td></td>
<td>Functional Independence Measure</td>
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<tr>
<td></td>
<td>Frenchay Activity Index</td>
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<td></td>
<td>Social Support Scale</td>
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<tr>
<td>Cognitive assessment</td>
<td>MMST</td>
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<tr>
<td></td>
<td>Depression Status Inventory</td>
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<tr>
<td></td>
<td>SF-36</td>
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<tr>
<td>Quality of Life</td>
<td>SF-36</td>
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<tr>
<td></td>
<td>Care Giver Burden Scale</td>
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</tbody>
</table>
Resource Use of Stroke Survivors

- Stroke Unit
- Aid tools
- Physiotherapy
- Occupational therapy
- Cognitive training
- General Practitioners
- Long-term Care
- Medication
Direct cost of ischemic stroke by time horizon
Statutory Health Insurance in Germany
(Euros, discounted)

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Men</th>
<th>Women</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 y</td>
<td>15,566</td>
<td>14,799</td>
<td>15,140</td>
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<tr>
<td>5 y</td>
<td>30,159</td>
<td>29,582</td>
<td>29,837</td>
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<tr>
<td>10 y</td>
<td>37,711</td>
<td>36,176</td>
<td>36,873</td>
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<tr>
<td>Lifetime</td>
<td>45,549</td>
<td>41,304</td>
<td>43,129</td>
</tr>
</tbody>
</table>

Reference: Kolominsky-Rabas et al., Stroke 2006
# National Direct Ischemic Stroke Cost Projections

Statutory Health Insurance in Germany

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Men</th>
<th>Women</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strokes</td>
<td>Cost (Billion)</td>
<td>Strokes</td>
</tr>
<tr>
<td>2006-2010</td>
<td>331,000</td>
<td>13.8</td>
<td>425,000</td>
</tr>
<tr>
<td>2006-2015</td>
<td>701,000</td>
<td>27.1</td>
<td>880,000</td>
</tr>
<tr>
<td>2006-2020</td>
<td>1,108,000</td>
<td>39.7</td>
<td>1,367,000</td>
</tr>
<tr>
<td>2006-2025</td>
<td>1,547,000</td>
<td>51.5</td>
<td>1,883,000</td>
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</tbody>
</table>
Erlangen Stroke Registry - Cost-of-Illness of Stroke

European Journal of Neurology 2005, 12: 264–267

Care needs and economic consequences after acute ischemic stroke: the Erlangen Stroke Project


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Received 17 May 2004
Accepted 7 July 2004

The objective was to determine the short-term care needs, costs, Erlangen Stroke Project, Germany.

Keywords: acute ischemic stroke, care, caregivers and function based on good function (95–100) were admitted with cost estimates for Germany. Hospitalized, 383 were alive 3 months and the majority of patients with poor function (17955) or not (11032) compared to hospitalization (poor: 26375; moderate: 25375; good: 19250). Hospitalization and rehabilitation each level of function. Many patients and the costs associated with provide economic consequences of stroke.

Lifetime Cost of Ischemic Stroke in Germany: Results and National Projections From a Population-Based Stroke Registry

The Erlangen Stroke Project

Peter L. Kolominsky-Rabas, MD, PhD; Peter U. Heuschmann, MD, PhD; Daniela Marschall, MSc; Martin Emmert; Nikoline Balzter, Brussels; Bernhard Neundörfer, MD, PhD; Oliver Schöflski, PhD; Karl J. Kroboth, MD, PhD; for the CompetenceNet Stroke

Background and Purpose—The number of stroke patients and the healthcare costs of strokes are expected to rise. The objective of this study was to determine the direct costs of first ischemic stroke and to estimate the expected increase in costs in Germany.

Methods—An incidence-based, bottom-up, direct-cost-of-ischemic-stroke study from the third-party payer’s perspective was performed, incorporating 10-year survival data and 5-year resource use data from the Erlangen Stroke Registry. Discounted lifetime year 2004 costs per case were obtained and applied to the expected age and sex evolution of the German resident population in the period 2006 to 2025.

Results—The overall cost per first-year survivor of first-ever ischemic stroke was estimated to be 18,517 euros (EUR). Rehabilitation accounted for 37% of this cost, whereas in subsequent years outpatient care was the major cost driver. Discounted lifetime cost per case was 45,320 EUR overall and was higher in men (45,580 EUR) than in women (41,304 EUR). National projections for the period 2006 to 2025 showed 1.5 million and 1.9 million new cases of ischemic stroke in men and women, respectively, at a present value of 51.5 and 57.1 billion EUR, respectively.

Conclusions—The number of stroke patients and the healthcare costs of strokes in Germany will rise continuously until the year 2025. Therefore, stroke prevention and reduction of stroke-related disability should be made priorities in health planning policies. (Stroke. 2006;37:1179-1183.)

Key Words: costs and cost analysis; cost of illness; ischemic stroke; resource use; stroke
Erlangen Stroke Registry - Long Term Outcome of Stroke
Erlangen Stroke Registry - Epidemiology

A Prospective Community-Based Study of Stroke in Germany—The Erlangen Stroke Project (ESPro)
Incidence and Case Fatality at 1, 3, and 12 Months

Peter L. Kolominsky-Rabas, MD, Cinzia Sarli, MD, PhD; Peter Ulrich Hessmann, MD; Christian Graf, MD; Sven Simonsen, MD, Bernd Neundörffer, MD, PhD; Alexandre Katsiou, MD; Ertel Liang, MD, PhD; Karl-Günter Gesemann, MD; Theodor Ritter von Stockert, MD

Variations in Stroke Incidence and Survival in 3 Areas of Europe

Charles D.A. Wolfe, MD, Maurice Girouard, MD, Peter Kolominsky-Rabas, MD, Ruta Dudas, MS; Martine Lemaire, MD, Peter Hessmann, MD, Anthony Rudd, FRCP, for the European Registers of Stroke (ERSOS) Collaboration

Original Contributions
Epidemiology of Ischemic Stroke Subtypes According to TOAST Criteria
Incidence, Recurrence, and Long-Term Survival in Ischemic Stroke Subtypes: A Population-Based Study

Peter L. Kolominsky-Rabas, MD; Margarete Weber, MD; Olaf Geißler, MS, PhD; Bernd Neundörffer, MD, PhD, Peter U. Hessmann, MD, MPhil

Time Trends in Incidence of Pathological and Etiological Stroke Subtypes during 16 Years: The Erlangen Stroke Project

Peter L. Kolominsky-Rabas, Silke Wiedmann, Michael Weingärtner, Thomas G. Linnan, Matthias Endres, Stefan Schwab, Michael Buchfelder, Peter U. Hessmann
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