

# A cost analysis of the first year after stroke – early triage and inpatient rehabilitation may reduce long term costs

Maria-Pia Mahler<sup>a</sup>, Karl Züger<sup>a</sup>, Kurt Kaspar<sup>a</sup>, Andreas Haefeli<sup>a</sup>, Walter Jenni<sup>b</sup>, Tobias Leniger<sup>b</sup>, Jürg H. Beer<sup>c,d</sup>

<sup>a</sup> argomed Ärzte AG, Baden-Dättwil, Switzerland

<sup>b</sup> Rehabilitation Clinic Zurzach, Switzerland

<sup>c</sup> Departement of Internal Medicine, Kantonsspital Baden, Switzerland

<sup>d</sup> the University Hospital of Bern, Switzerland

## Summary

**Aim of the study:** To analyse the costs of stroke in the first year covered by insurance companies and to correlate them with the clinical outcome data.

**Methods:** We contacted the insurance companies of 172 consecutive stroke patients of a single institution cohort for a detailed report of the stroke costs. A complete data set over one year was obtained from 131 patients (76%).

**Results:** Severity of stroke was significantly associated with increasing total costs ( $p = 0.0002$ ). The rehabilitation clinic made up 37% of the total costs followed by nursing home with 21% and acute hospital with 21%. Mean cost of stroke per patient was 31,115 CHF in the first year. Costs per patient for inpatient rehabilitation were similar to those for the nursing home after one

year; however, the Barthel-index of patients with inpatient rehabilitation increased by  $42 \pm 29$  points as compared to patients without inpatient rehabilitation by  $23 \pm 26$  points ( $p < 0.05$ ), and 86% resp. 81% of patients with inpatient stroke rehabilitation lived independently after 6 and 12 months respectively.

**Conclusions:** The high level of independence after inpatient stroke rehabilitation underlines the importance of patient selection and/or rehabilitation. Therefore, long-term stroke costs may be significantly reduced by an early and careful triage in the case management after stroke and a case-dependent investment in initial costly appearing inpatient rehabilitation.

**Key words:** stroke; costs; rehabilitation; outcome

## Introduction

The increasing age of people is associated with an elevated incidence and prevalence of stroke. Further, new therapeutic options such as intravenous thrombolysis after acute stroke have been also shown to be effective and safe in older people [1]. However, the introduction of Swiss DRGs will likely enforce an optimisation of stroke management and rehabilitation. There-

fore, a cost analysis of stroke covered by the insurance companies correlated with outcome for patients in the first year after stroke was of particular interest. This cost-analysis was based on a single cohort study performed by the Kantonsspital Baden (KSB) in close collaboration with the Argomed Doctors AG (Switzerland).

## Patients and methods

A prospective cohort study of a single institution (KSB) evaluated the quality of stroke treatment and outcome in 172 consecutive patients from 1/2002 to 3/2003. In particular, the health status before the event, stroke

risk factors, acute event (size, location, clinical presentation), the psychosocial consequences, and quality of life in the subsequent 6 and 12 months were analysed systematically [2]. The study protocol was approved by the Institu-

We thank Pfizer, Novartis, Mepha and the Cardio Foundation Baden for their generous financial support.

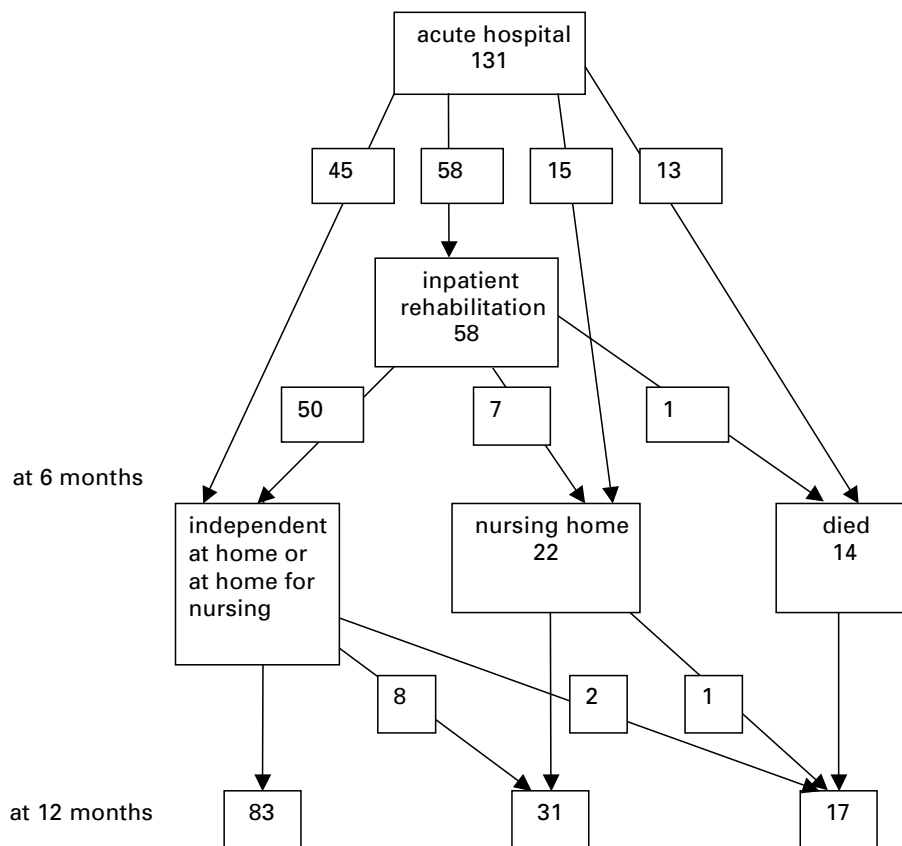
tional Review Board of the hospital. Informed consent was obtained from all patients or their first relatives if patients were unable to give it.

The present cost analysis is a subgroup of 131 patients from this study showing exactly the same outcome data for the total population. Included were patients with the signs and symptoms of an acute stroke according to the WHO definition of acute stroke. Patients had to have been living at home before the event. In order to allow a direct comparison with the Swiss cohort of the international stroke trial (IST) – patients with thrombolytic therapy and/or need for neurosurgical intervention were excluded. Further, TIA with full recovery within 24 hours after the event was an exclusion criterion. All patients received brain imaging (CT or MRI) and were evaluated

for their cardiovascular risk factors, medications and received an extensive workup including standard laboratory evaluation, ECG, 24h-ECG trans-thoracic and transoesophageal, echocardiography, doppler ultrasound of the cerebral arteries. Disease severity was analysed prospectively immediately by our staff and within 24 hrs (= time point B1) of the hospitalisation by a neurologist; the same neurologist (W.J.) re-examined the patient again after 3 (= time point B2) and 6 (= time point C) months. Stroke severity was quantified by stroke scales including the NIH stroke scales, the Barthel-indices and the Rankin-scores at the times indicated above. Quality of life was measured by the SF-36 questionnaire. The clinical diagnosis of “dependency” was defined as the inability to manage the daily activities such as washing, dressing, eat-

**Figure 1**

The patient pathway through the institutions is illustrated and the respective patient numbers are given.



**Table 1**

The summary of the patient characteristics, the stroke location and the severity scores are given for the total population as well as for the categories with and without inpatient rehabilitation.

	All patients (n = 131)	Category with inpatient rehabilitation (n = 58)	Category without inpatient rehabilitation (n = 73)
Age	73 ± 12 years	72 ± 10	74 ± 13
Gender (Female)	63 (48%)	28 (48%)	35 (48%)
Initial NHS-scale	7 ± 6	8 ± 5	6 ± 7
Initial Barthel-Index	51 ± 34	49 ± 31	54 ± 34
Initial Rankingscore	4 ± 5	4 ± 1	3 ± 2
Inpatient rehabilitation	58 pts (44%)	58 pts (100%)	73 pts (100%)
Nursing home at 1 year	31 pts (24%)	10 pts (17%)	21 pts (29%)
Death at 1 year *??	17 pts (12%)	2 pts* (3%)	15 pts* (20%)
TACS	45 pts (34%)	30 pts (52%)	20 pts (27%)
PACS	55pts (42%)	9 pts (16%)	9 pts (12%)
POCS	22pts (17%)	2 pts (3%)	5 pts (7%)
LACS	11pts (8%)	17 pts (29%)	22 pts (30%)
Loss of consciousness	43pts (33%)	12 pts (21%)	15 pts (21%)
Atrial fibrillation	29pts (22%)	16 pts (22%)	1 pt (1%)

\* The 15 deaths include 13 in-hospital deaths.

ing, toilet, etc. The patient pathway through the different institutions is illustrated in figure 1. Basic demographic characteristics and clinical outcome data of the patients are given in table 1.

The detailed cost-analysis started at the day of the incident stroke and lasted for 1 year. We obtained complete data sets from 131/172 patients (76%); among them were all the major Swiss insurance companies. One company went bankrupt in the meantime (6 patients), others were unwilling or unable to transfer their data (33 pts). No selection of particularly expensive or of low cost patients was evident. 80 patients had basic insurance and 51 had additional private insurance coverage. We calculated the costs both ways and the costs of the private insurances are included in the results as well.

Criterion for inpatient stroke rehabilitation was a combined prognostic analysis by the neurologist comprising the size and location of the cerebral lesion, the severity of impairment (Barthel-Index, NIHSS), the patient's co-morbidity and age. The time of discharge from inpatient rehabilitation was discussed in weekly interdisciplinary team reports depending on the individual progress during rehabilitation. Outpatient clinic services consisted of all services including physiotherapy, ergotherapy, and speech training.

We divided the costs into the following categories:

1. Hospital/acute phase
2. Outpatient clinic
3. Rehabilitation clinic
4. Long-term nursing home
5. Primary care physician
6. Outpatient nursing care
7. Medication
8. Physiotherapy
9. Miscellaneous (eg, ambulance transportation etc.)

Prespecified subgroup analysis included a) the costs of subsequently independent vs dependent patients one year after the stroke event, b) the costs of patients who underwent inpatient rehabilitation vs. the ones who did not (ie, were admitted to the nursing home or discharged home, figure 1).

Furthermore, a rank order of the expenses per patient was established and compared with outcome.

### Statistical Analysis

Fisher's exact test was used where appropriate. The total costs were statistically further analysed in a multiple regression model where patient characteristics were included if they contributed significantly. Thus possible bias effects were investigated. We included age, gender, Rankingscore, Barthel-index and NIHSS (within 24 hrs [= B1] and 6 months after stroke [= C]), inpatient rehabilitation, atrial fibrillation and the loss of consciousness in the model, which included all surviving patients. Because of the skewed distribution, logarithmic costs were considered in the linear regression model. The assumptions of this model are holding well. A backward selection procedure with level 5% determined a significant model which includes inpatient rehabilitation, Rankingscore at time point C, NIHSS at time point B1, and also a small interaction between inpatient rehabilitation and NIHSS at time point B1.

Inpatient rehabilitation had the largest impact with a regression coefficient 0.955 ( $p < 0.001$ ) on the mean log-costs. Rankingscore at time point C has a linear increasing effect on the log-costs mean with regression coefficient 0.175 ( $p = 0.0002$ ). The impact of significant effects of other categories of intervention was much smaller. Obviously some of the indices are correlated. So, instead of NIHSS and Rankingscore other indices (such as Barthel-index) could have been selected with a resulting model almost as good as the reported one.

**Table 2**

The mean costs per patient are given in detail by two different modes of calculation: 1. the costs per patient of the total population, and 2. the costs per patient of the subgroup, which in fact obtained the particular treatment.

Type of performance	cost/patient n = 131	Number (and percentage) of patients with the particular treatment	Cost/patient with the particular treatment
Rehabilitation clinic	11 471	58 (44%)	25 908
Nursing home	6 696	30 (23%)	25 799
Hospital/acute care	6 403	131 (100%)	6 403
Medication	2 128	116 (86%)	2 403
Primary care physician	1 437	117 (89%)	1 609
Physiotherapy	1 025	62 (47%)	2 167
Outpatient nursing home	578	27 (21%)	2 807
Outpatient clinic	298	30 (23%)	1 299
Miscellaneous	1 240	106 (92%)	1 532

**Table 3**

The outcome data are summarised after 6 and 12 months indicating a low mortality and a high percentage of independent patients.

	6 months	12 months
Dead	14 (11%)	17 (13%)
Dead or dependent	36 (27%)	48 (37%)
Integrated at home or at the home for the aged	95 (73%)	83 (63%)
Nursing home or other hospital	22 (17%)	31 (24%)

## Results

Out of these 131 patients with complete financial data sets over 12 months, 44% underwent inpatient rehabilitation, and 12% (13%) had died at 6 and 12 months, respectively. 75% of the survivors were independent after one year. Initial stroke severity was  $7 \pm 6$  by the NIHSS. The patient characteristics are summarised in table 1 and the outcome data in table 3.

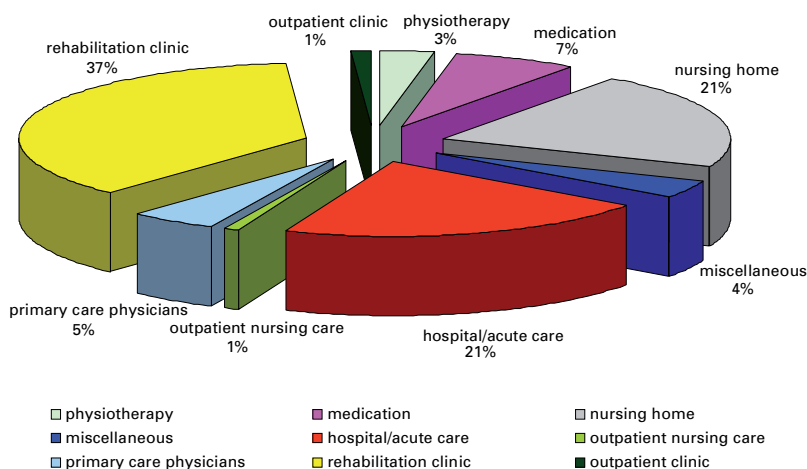
The mean costs per patient were CHF 31,115.–  $\pm$  23,752.–SD (from 3,256.– to 122,443.–, median 26,370.–). The wide range between minimal and maximal costs is reflected by the spectre of the disease severity: 6/10 patients with the lo-

west costs being generated by those who died early. The 10 most expensive patients consisted of mostly younger patients with severe disease who had to be transferred to a nursing home despite maximal efforts of therapy and rehabilitation. Others survived severely impaired and also required costly nursing care.

Our statistical multiple regression analysis confirms that inpatient rehabilitation had the largest impact on mean costs in the first year ( $p < 0.0001$ ). Second, the severity as expressed by the Rankin Score had a linear increasing effect on costs (regression coefficient 0.175,  $p = 0.0002$ ).

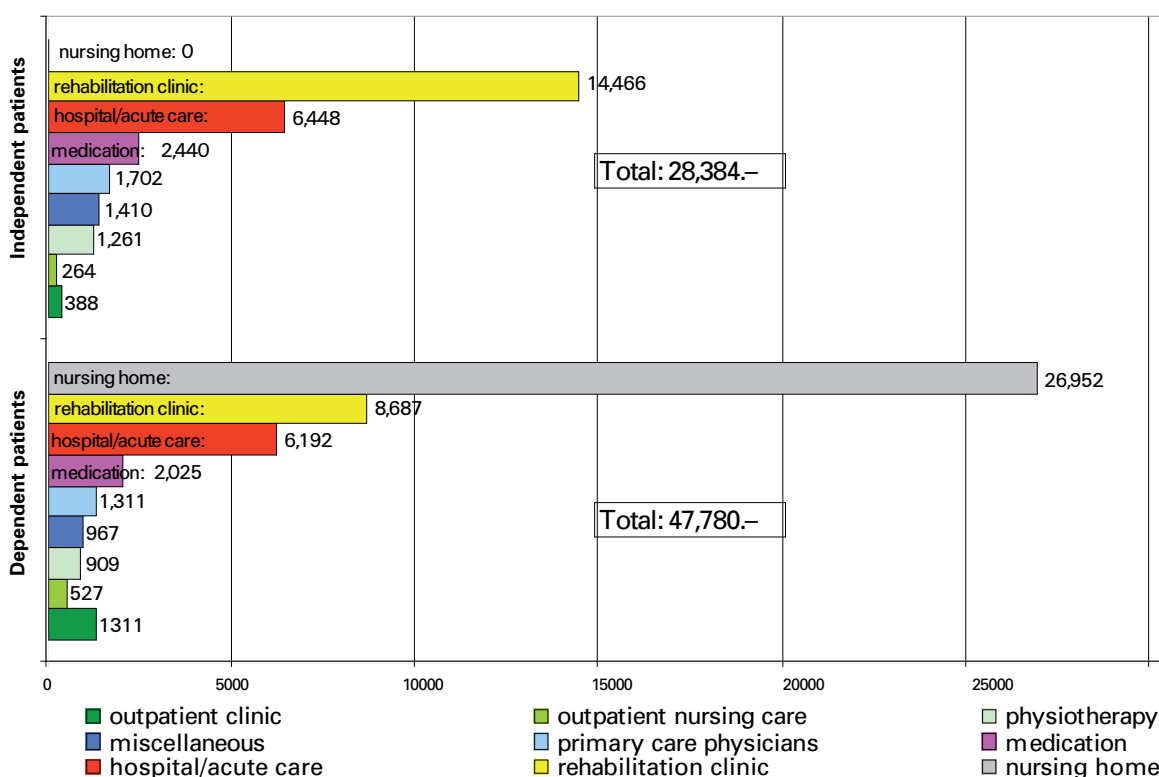
**Figure 2**

The costs are given according to the institutions: The three largest sums are: 1. the inpatient rehabilitation, 2. the long-term costs of the nursing homes and 3. the acute hospital. The out patient care by general practitioners comprises 5% and appears relatively modest. Total costs of the first year include 31,115  $\pm$  23,752 CHF.



**Figure 3**

Analysis of the costs of the independent compared to the dependent patients. The figure illustrates that inpatient rehabilitation is the dominant factor of independence in the first year, whereas the nursing home costs exceed that number by a factor two in the group of the dependent patients already in the first year.



**Table 4**

The outcome data of the patients with inpatient rehabilitation are compared with those without. Note the increase of the Barthel-index and the percentage of patients at the nursing home; 81% of the patients with inpatient rehabilitation were independent at home after 1 year.

	Inpatient rehabilitation	No inpatient rehabilitation	P
Number of patients	58 (44%)	73 (56%)	
Independent after 1 year	47/58 (81%)	37/73 (51%)	<0.05
Increase of Barthel-Index	42 ± 29	23 ± 26	<0.05
Cost at 1 year	45,031 ± 13,492	25,908 ± 9,869	<0.05

It is important to note that the costs included total health insurance costs in the first year and therefore also consisted of costs not directly related to the acute stroke. However, on careful examination, most of the costs were related to the

acute event and the concomitant vascular risk factors: The mean age of our population was  $76 \pm 12$  years. 25% of the patients were diabetics, 31% had suffered TIA or stroke before and 23% had atrial fibrillation.

## Cost analyses by categories

### More versus less expensive patients

A rank order of the 50% more expensive and 50% less expensive patients was established and correlated with the clinical outcome: 23/31 nursing home patients were in the cost-intensive group. As expected, the cost-intensive group usually had a more severe clinical course and only 39% of the patients reached a Barthel-index of 100, whereas the less costly patients reached an index of 100 in 81% ( $P < 0.05$ ).

### Independent versus dependent patients

The analysis of independence after 1 year revealed that the costs of the independent patients were lower already in the first year ( $28,384 \pm 20,763$  CHF vs.  $47,780 \pm 26,276$  CHF for the dependent patients,  $p < 0.01$ ), despite the fact that approximately half of the independent patients were admitted to the rehabilitation clinic as inpatients. A detailed overview of this subgroup analysis is given in figure 3.

58/131 (44%) were rehabilitated in the rehabilitation clinic and accumulated 25,908.– CHF per patient with particular treatment, whereas the costs for the nursing home were at 25,799.– CHF per patient in the first year (table 2). Since the subgroup of patients without rehabilitation included twice the number of nursing home patients and 47/58 of the patients with rehabilitation were independent after one year, it appears likely that the initial “costly” inpatient rehabilitation might result in reduced long-term costs. In fact, the patients who underwent the rehabilitation programme increased their Barthel-index by  $42 \pm 29$  points as compared to patients without (inpatient) rehabilitation whose functional level rose by  $23 \pm 26$  points only ( $p < 0.05$ ). This significant difference underlines the efficacy of the patient selection and/or the rehabilitation programme (table 4).

### Hospital/acute phase

The acute hospital costs are rather modest (21% of total costs, or  $6,403 \pm 6,579$  CHF per patient with the particular treatment); an additional amount of 1,240 CHF per patient or 19% of the acute hospitalisation costs has to be added, if the costs of the private insurances are included. It also reflects re-hospitalisation in the first year after stroke, eg, occurrence of a second event or need for carotid surgery etc. The median length of stay (LOS) in the acute hospital was 15 days (figure 2 and table 2).

### Rehabilitation clinic

The in-patient rehabilitation is most prominent with 37% or a mean of  $25,908 \pm 14,546$  CHF (from 5,544 to 58,806, median 21,504 CHF). Most of these patients (47/58) were independent at the end of the observation period (fig. 1 and tab. 2). The LOS in the rehabilitation clinic was 39 days. If the costs of the privately insured patients are added, the mean increases by 3,220 CHF or by 12%.

### Long-term nursing home

34% of all patients required long-term nursing home care which is second in the ranking of the cost subgroups, namely 21% or  $25,799 \pm 19,137$  CHF, (min. 866, max. 79,797, median 24,786 CHF).

### Other categories

Smaller contributions to the total costs consisted of outpatient nursing care (1.2%), primary care physician (5%), and medication costs (6.9%). 47% of the patients (62/131) were treated by physiotherapists resulting in 3.3% of the total costs (figure 2). Concerning costs per patient of particular treatments, these other categories generated lower costs as compared to the three major categories mentioned above (table 2).



## Discussion

Stroke outcome data in Switzerland show that 20–30% of the patient still die during the first year [3] and 40–50% of the survivors remain mildly to moderately impaired [4]. Survivors of ischaemic strokes have a mortality of 44% over the following five years and 20–40% suffer a second stroke [5]. Improved treatment options and the increasing prevalence of stroke may evoke augmented total stroke costs in future. This study correlated the costs after one year of stroke with the clinical outcome of the patients. Our cost analysis in the year after stroke found mean costs per patient of CHF 31'115.–. Stroke management led to a high level of independence after inpatient stroke rehabilitation as a result of the efficiency of patient selection to receive inpatient rehabilitation and/or the effect of inpatient rehabilitation itself.

### Annual costs

The results of a Danish stroke study with similar diagnostic and therapeutic modalities showed total costs in the first year of 25,500 \$ (= 33,150 CHF, based on a conversion rate of 1,30 at the time of the study). Denmark spent 70% of the costs for the acute hospitalisation and the inpatient rehabilitation [6]. In our study, acute hospitalisation and inpatient rehabilitation made up only 58% of the total costs which may be due to careful triage of patients. Long-term costs of stroke in North-America, Australia, New Zealand and several European countries were found to be highly variable depending on which calculation the analysis is based on [7]. Nevertheless, the annual costs of 54'546 \$ (=70'900.– CHF) were substantially higher than our costs presented. However, it is important to note that in our case only the costs of the insurance were calculated. Thus, it should be kept in mind that the insurance costs underestimate the total costs carried by the state (cantons), the private caregivers, the acute hospitals, and the insurances of the employers. An extrapolated estimate of all these additional costs would be expected to add up to more than double the amount reimbursed by the insurances (73.000.–). This calculation is based on the following assumptions: The state (canton) covers approximately 50% of the costs of the acute hospital, only 23% of nursing home costs, the cost of caregivers at home are 4x higher than those covered, 10% of dependent survivors are 65 years old or less and will lose their working capacity which is conservatively calculated with costs of 50,000.– annually. Taken together, the annual costs in our study were comparable to those published for other countries.

### Lifetime costs

In the USA costs of stroke ranged from 16.000 to 26,000 \$ (= 21,000–34,000 CHF), whereas the lifetime costs were calculated to be

90.000 \$ (=117,000 CHF) [8]. The strokes in the Netherlands contributed to 3,4% of the total health care costs and were at 0,3% of gross domestic product [9]. These data illustrate the socioeconomic impact of cerebrovascular disease, particularly since the insurance costs reflect only part of the expenses. This is underlined by nursing home costs in Switzerland [10]: 41% of this sum are paid by the patients, 23% by the health insurance companies, 23% by the state, 9% by the cantons and the communities, and 4% by miscellaneous sources. This substantial contribution of relatives is not reflected by the statistics but can be extrapolated by the fact that women cost 17% more because they are more likely to survive their partners and their home care cannot be provided as frequently as when they themselves care for their spouses. Therefore, the effective nursing home costs would run four times higher than insurance costs reflect.

### Hospital/acute phase

The costs of the inpatient phase in our acute hospital lies in third place of the total costs (21%, 6,403 ± 6,579 CHF). In Germany (2000), the first phase (acute hospitalisation) costs 3,840 € (= 5,950 CHF) [11] in the USA (2001) 5,837\$ (= 7,580 CHF) [12, 13]. Another recent large US-study in 11,000 patients [14] found acute hospital costs of 6,206 \$ (= 8,068 CHF). The numbers are surprisingly similar, despite major differences in insurance systems, the variability of the diagnostic workup, therapy, lengths of hospital stay and staff costs.

Our results should be judged cautiously as well since they reflect the lump sum system per case (ie, standard costs per patient hospitalised) and does not necessarily correlate with the severity of the case, the intensity of the diagnostic and therapeutic measures or the length of stay. If the additional costs generated by private insurance are included in our system, the acute inpatient phase costs rise by 1,240 CHF /patient or 19%, and the rehabilitation costs by 3,220 CHF per patient or 12%. We decided not to include these costs in the primary calculations. An interesting alternative in the Swiss health insurance system includes the development of a combined compensation for both the acute hospital and the rehabilitation clinic which would represent a further step in the direction of disease management but would put the acute hospital into the role of the gate keeper with an incentive to reduce the percentage of patients admitted to rehabilitation clinics.

### Rehabilitation clinic

Inpatient rehabilitation is the most expensive part of the total cost (37%). However, taking into account the costs per patient with the particular treatment, inpatient rehabilitation is very similar to long-term nursing home after one year already

(25,908 CHF vs. 25,799 CHF). The crucial benefit of inpatient rehabilitation is the high percentage of independent patients after one year (81%) which might be associated with reduced long-term costs.

The expenses for the primary physician were strikingly low with 5% of the total costs despite a large number of controls required included blood pressure control, blood sugar, lipids, psychosocial aspects etc. Our analysis suggests that there is still much potential of reducing the costs in strict implementation of preventative strategies for risk factors, in the early admission for stroke treatment, in the further development of stroke teams and of stroke units. The early and well reflected triage decisions for rehabilitation are likely to influence the long-term costs, particularly with a well developed stroke network which spreads over several institutions.

We conclude that the mean costs per patient over one year after stroke generated by our stroke management is similar to those observed in other countries. Patients who die early or who reach independence early are less expensive, already in the first year. Further, patients admitted for inpatient stroke rehabilitation initially generate higher than

average costs to insurance companies. However, their Barthel-index significantly increases as compared to the others and 81% of these patients live independently after one year. Therefore, efficient selection of patients for inpatient rehabilitation and the rehabilitation itself might result in lower long-term costs.

We thank Prof. Jürg Hüsler, Institute of Mathematical Statistics and Actuarial Science, University of Bern, for the statistical support, Argomed AG for the organisational help, the insurance companies Agrisano, Aquilana, Concordia, CSS, Helsana, Kolping, KPT, Sanitas, EGK Gesundheitskasse, SLKK Lehrerkrankenkasse, SWICA, Visana und Wincare for their cooperation and the data-transfer, Mrs. S. Sonntag, study nurse, for data management and Mrs. K. Zehnder for outstanding secretarial support.

---

*Correspondence:*

*Prof. J.H. Beer, MD*

*Department of Medicine*

*Kantonsspital Baden*

*CH-5404 Baden*

*E-Mail: hansjuerg.beer@ksb.ch*

---

## References

- Engelter ST, Reichhart M, Sekoranjana L, Georgiadis D, Baumann A, Weder B, et al. Thrombolysis in stroke patients aged 80 years and older: Swiss survey of IV thrombolysis. *Neurology*. 2005;65(11):1795-8.
- Weber E, Jenni W, Kaspar K, Mahler MP, Meyer T, Burger M, et al. A prospective Outcome Study of 200 Stroke Patients after 6 months: Effects of a Stroke Team and a Stroke Chain Involving the Primary Care Physician, the Acute Hospital and the Rehabilitation Clinic and Comparison with the Swiss IST-Trial Data. *Forum Med Suisse*. 2004;Supplementum 17(56S):P412.
- Mattle HP, Eicher Vella E, Bassetti C, Sandercock P. International Stroke Trial Switzerland: some epidemiologic data. *Schweiz Med Wochenschr*. 1999;129(50):1964-9.
- Bogousslavsky J, Rutishauser W, Mattle H. Hirnschlag-Kampagne der Schweizerischen Herzstiftung (SHS) und Zerebrovaskulären Arbeitsgruppe der Schweiz (ZAS). *Schweizerische Ärztezeitung*. 2000;13:677-88.
- Baumgartner RW, Georgiadis D. Ischämischer Hirnschlag: Sekundärprävention. *Cardiovasc*. 2002;4:23-9.
- Porsdal V, Boysen G. Costs of health care and social services during the first year after ischemic stroke. *Int J Technol Assess Health Care*. 1999;15(3):573-84.
- Payne KA, Huybrechts KF, Caro JJ, Craig Green TJ, Klittich WS. Long term cost-of-illness in stroke: an international review. *Pharmacoeconomics*. 2002;20(12):813-25.
- Brown DL, Boden-Albala B, Langa KM, Lisabeth LD, Fair M, Smith MA, et al. Projected costs of ischemic stroke in the United States. *Neurology*. 2006;67(8):1390-5. Epub 2006 Aug 16.
- Bergman L, van der Meulen JH, Limburg M, Habbema JD. Costs of medical care after first-ever stroke in The Netherlands. *Stroke*. 1995;26(10):1830-6.
- BSV. Bericht des Netzwerks Ökonomie des Bundesamtes für Soziale Versicherungen: Pflegefinanzierung und Pflegebedarf: Schätzung der zukünftigen Entwicklung. Beiträge zur Sozialen Sicherheit. Forschungsbericht. 2003;22:6-7.
- Dodel RC, Haacke C, Zamzow K, Paweilik S, Spottke A, Rethfeldt M, et al. Resource utilization and costs of stroke unit care in Germany. *Value Health*. 2004;7(2):144-52.
- Evers SM, Struijs JN, Ament AJ, van Genugten ML, Jager JH, van den Bos GA. International comparison of stroke cost studies. *Stroke*. 2004;35(5):1209-15. Epub 2004 Apr 8.
- Reed SD, Blough DK, Meyer K, Jarvik JG. Inpatient costs, length of stay, and mortality for cerebrovascular events in community hospitals. *Neurology*. 2001;57(2):305-14.
- Katzan IL, Dawson NV, Thomas CL, Votruba ME, Cebul RD. The cost of pneumonia after acute stroke. *Neurology*. 2007; 68(22):1938-43.

# SMW

Established in 1871  
Formerly: Schweizerische Medizinische Wochenschrift  
Swiss Medical Weekly

The European Journal of Medical Sciences

## The many reasons why you should choose SMW to publish your research

### What Swiss Medical Weekly has to offer:

- SMW's impact factor has been steadily rising. The 2006 impact factor is 1.346.
- Open access to the publication via the Internet, therefore wide audience and impact
- Rapid listing in Medline
- LinkOut-button from PubMed with link to the full text website <http://www.smw.ch> (direct link from each SMW record in PubMed)
- No-nonsense submission – you submit a single copy of your manuscript by e-mail attachment
- Peer review based on a broad spectrum of international academic referees
- Assistance of professional statisticians for every article with statistical analyses
- Fast peer review, by e-mail exchange with the referees
- Prompt decisions based on weekly conferences of the Editorial Board
- Prompt notification on the status of your manuscript by e-mail
- Professional English copy editing

### Editorial Board

Prof. Jean-Michel Dayer, Geneva  
Prof Paul Erne, Lucerne  
Prof. Peter Gehr, Berne  
Prof. André P. Perruchoud, Basel  
Prof. Andreas Schaffner, Zurich  
(editor in chief)  
Prof. Werner Straub, Berne (senior editor)  
Prof. Ludwig von Segesser, Lausanne

### International Advisory Committee

Prof. K. E. Juhani Airaksinen, Turku, Finland  
Prof. Anthony Bayes de Luna, Barcelona, Spain  
Prof. Hubert E. Blum, Freiburg, Germany  
Prof. Walter E. Haefeli, Heidelberg, Germany  
Prof. Nino Kuenzli, Los Angeles, USA  
Prof. René Lutter, Amsterdam, The Netherlands  
Prof. Claude Martin, Marseille, France  
Prof. Josef Patsch, Innsbruck, Austria  
Prof. Luigi Tavazzi, Pavia, Italy

We evaluate manuscripts of broad clinical interest from all specialities, including experimental medicine and clinical investigation.

We look forward to receiving your paper!

### Guidelines for authors:

[http://www.smw.ch/set\\_authors.html](http://www.smw.ch/set_authors.html)

*All manuscripts should be sent in electronic form, to:*

EMH Swiss Medical Publishers Ltd.  
SMW Editorial Secretariat  
Farnsburgerstrasse 8  
CH-4132 Muttenz

Manuscripts: [submission@smw.ch](mailto:submission@smw.ch)  
Letters to the editor: [letters@smw.ch](mailto:letters@smw.ch)  
Editorial Board: [red@smw.ch](mailto:red@smw.ch)  
Internet: <http://www.smw.ch>