# Costs of Hospitalization for Stroke from Two Urban Health Insurance Claims Data in Guangzhou City, Southern China

**Dr. ZHANG, Hui (Vivienne)***

Sun Yat-sen University

School of Public Health

13 January 2020

*Email: zhanghui3@mail.sysu.edu.cn

# Outline

- Research Paper: Costs of Hospitalization for Stroke from Two Urban Health Insurance Claims Data in Guangzhou City, Southern China

- Research Grants: Comparison of the Clinical Effectiveness and Patient-Centered Outcomes Between Telestroke Care and Usual Stroke Care in Guangdong, China

# Introduction

- Stroke remains a **major global health problem**.
- In China, stroke was **the leading cause of death**.
- Stroke imposed a huge financial burden on the healthcare systems.

# Objective

This study aims to examine hospitalization costs by **five stroke types** and investigate the associated factors for patients with stroke in Guangzhou city, Southern China.

- 1) subarachnoid haemorrhage **(SAH)**
- 2) intracerebral haemorrhage **(ICH)**
- 3) ischaemic stroke **(IS)**
- 4) transient ischaemic attack **(TIA)**
- 5) other strokes

# Methodology

- This was a prevalence-based, cross-sectional study.
- Data were obtained from urban health insurance claims database of Guangzhou city (UEBMI+URBMI).
- Samples including all the reimbursement claims submitted for inpatient care with the primary diagnosis of stroke from **2006 to 2013** were identified using the International Classification of Diseases codes.

# Methodology

- The final sample had **114,872** stroke inpatients, including:
  - **--86,126 IS (75%)**
  - **--1,736 SAH**
  - **--11,928 ICH**
  - **--7,298 TIA**
  - --7,784 others
- Descriptive analysis and multivariate regression analysis based on the Extended Estimating Equations model were performed.

# Results: Socio-demographic characteristics

中山大學 SUN YAT-SEN UNIVERSITY

**Table 1** Socio-demographic characteristics of inpatients by types of stroke, inpatient data 2006–2013

| Characteristics | % or mean ± standard deviation | | | | | |
|---|---|---|---|---|---|---|
| | Overall *n* = 114,872 | IS *n* = 86,126 | SAH *n* = 1736 | ICH *n* = 11,928 | TIA *n* = 7298 | Other strokes *n* = 7784 |
| Gender (%) | | | | | | |
| Male | 54.2 | 53.8 | 44.9 | 60.8 | 52.0 | 52.5 |
| Female | 45.8 | 46.2 | 55.1 | 39.2 | 48.0 | 47.5 |
| Age (years) | 71.7 ± 11.8 | 72.5 ± 10.9 | 60.3 ± 17.1 | 67.1 ± 14.8 | 71.2 ± 12.1 | 73.5 ± 11.6 |
| 18 ≤ Age < 45 | 2.4 | 1.4 | 16.9 | 8.0 | 2.6 | 1.8 |
| 45 ≤ Age < 65 | 21.8 | 20.4 | 38.1 | 29.4 | 24.9 | 18.1 |
| 65 ≤ Age < 75 | 28.2 | 29.0 | 21.1 | 26.0 | 26.8 | 25.3 |
| 75 ≤ Age < 80 | 21.4 | 22.2 | 12.1 | 17.0 | 19.3 | 23.1 |
| ≥ 80 | 26.3 | 27.0 | 11.8 | 19.7 | 26.4 | 31.7 |
| Comorbidities (%) | | | | | | |
| None | 48.3 | 46.7 | 72.3 | 61.0 | 45.1 | 43.8 |
| Coronary heart disease | 13.9 | 14.4 | 7.0 | 7.1 | 19.4 | 16.3 |
| Hypertension | 45.6 | 46.7 | 24.9 | 36.0 | 47.5 | 49.9 |
| Diabetes | 17.7 | 18.9 | 6.6 | 9.3 | 17.0 | 19.9 |
| Alzheimer's disease | 0.7 | 0.7 | 0.2 | 0.5 | 0.9 | 0.9 |
| Parkinson's disease | 1.7 | 1.8 | 0.4 | 0.9 | 1.7 | 2.1 |
| Mental disorder | 0.3 | 0.3 | 0.2 | 0.1 | 0.3 | 0.1 |
| Chronic kidney disease | 0.4 | 0.4 | 0.2 | 0.4 | 0.5 | 0.3 |
| Insurance type (%) | | | | | | |
| UEBMI | 92.3 | 92.3 | 91.7 | 91.9 | 93.6 | 92.4 |
| URBMI | 7.7 | 7.7 | 8.3 | 8.1 | 6.4 | 7.6 |
| ICU admission (%) | 0.2 | 0.1 | 2.2 | 1.0 | 0.0 | 0.1 |
| Referral from other hospitals (%) | 1.8 | 1.8 | 3.5 | 2.9 | 0.2 | 1.3 |
| Readmission in 15 days (%) | 0.6 | 0.6 | 0.9 | 1.0 | 0.3 | 0.7 |
| Length of stay (days) | 26.7 ± 55.3 | 25.1 ± 52.7 | 25.2 ± 34.4 | 41.0 ± 73.2 | 11.7 ± 11.0 | 36.9 ± 72.1 |
| < 10 | 27.0 | 26.5 | 29.6 | 20.0 | 48.1 | 22.8 |
| 10 ≤ Days< 20 | 43.1 | 45.6 | 29.3 | 28.9 | 43.2 | 41.3 |
| ≥ 20 | 29.9 | 28.0 | 41.1 | 51.1 | 8.6 | 36.0 |
| Hospital level (%) | | | | | | |
| Primary | 9.5 | 9.5 | 3.0 | 7.2 | 4.3 | 19.6 |
| Secondary | 30.4 | 29.7 | 18.7 | 26.5 | 33.8 | 43.3 |
| Tertiary | 60.1 | 60.8 | 78.3 | 66.3 | 61.9 | 37.1 |

*IS* Ischaemic stroke, *SAH* Subarachnoid haemorrhage, *ICH* Intracerebral haemorrhage, *TIA* Transient ischaemic attack, *UEBMI* Urban Employee-based Basic Medical Insurance scheme, *URBMI* Urban Resident-based Basic Medical Insurance scheme

# Results: Socio-demographic characteristics



- The average age was **71.7 years old**
- 54.2% were male; 40.3% had hypertension
- 60.1% received medical treatment in the tertiary hospitals; 92.3% were under the UEBMI scheme
- The mean length of stay (LOS) was **26.7days**

# Results: Direct inpatient costs by types of stroke



**Table 2** Direct inpatient costs and cost composition by types of stroke, in Chinese Yuan (CNY)

| Composition of total costs | Overall $n = 114,872$ | IS $n = 86,126$ | SAH $n = 1736$ | ICH $n = 11,928$ | TIA $n = 7298$ | Other strokes $n = 7784$ | *P*-Value |
|---|---|---|---|---|---|---|---|
| Total inpatient costs | | | | | | | |
| Mean (CNY) | 20,203.1 | 17,730.5 | 62,494.2 | 38,757.6 | 10,365.3 | 18,920.6 | 0.000 |
| SD | 33,068.4 | 25,679.9 | 76,861.2 | 58,584.3 | 11,618.4 | 32,441.7 | |
| Laboratory and diagnostic costs | | | | | | | |
| Percentage of total inpatient cost (%) | 11.0 | 11.9 | 6.5 | 8.9 | 18.6 | 7.5 | |
| Mean (CNY) | 2215.8 | 2104.2 | 4051.2 | 3453.3 | 1923.1 | 1418.4 | 0.000 |
| SD | 2892.0 | 2480.5 | 5178.2 | 4872.2 | 1604.3 | 2575.2 | |
| Non-medication treatment costs | | | | | | | |
| Percentage of total inpatient cost (%) | 38.2 | 36.3 | 57.6 | 39.1 | 34.2 | 42.6 | |
| Mean (CNY) | 7716.2 | 6441.1 | 36,001.8 | 15,136.5 | 3543.0 | 8058.6 | 0.000 |
| SD | 16,043.5 | 12,388.9 | 50,174.8 | 24,657.8 | 7821.1 | 15,903.3 | |
| Medication costs | | | | | | | |
| Percentage of total inpatient cost (%) | 42.0 | 42.9 | 31.4 | 43.0 | 40.4 | 38.5 | |
| Mean (CNY) | 8486.3 | 7600.7 | 19,615.7 | 16,672.1 | 4188.8 | 7288.0 | 0.000 |
| SD | 14,557.9 | 11,046.6 | 28,326.1 | 28,423.9 | 4313.5 | 13,618.8 | |
| Bed fees | | | | | | | |
| Percentage of total inpatient cost (%) | 5.9 | 6.2 | 2.4 | 5.2 | 5.1 | 7.8 | |
| Mean (CNY) | 1184.3 | 1093.6 | 1480.3 | 2013.6 | 528.3 | 1465.7 | 0.000 |
| SD | 2211.2 | 2037.1 | 2182.1 | 3249.6 | 594.0 | 2650.1 | |
| Other fees | | | | | | | |
| Percentage of total inpatient cost (%) | 3.0 | 2.8 | 2.2 | 3.8 | 1.8 | 3.7 | |
| Mean (CNY) | 600.8 | 490.9 | 1345.3 | 1484.6 | 182.0 | 689.7 | 0.000 |
| SD | 1798.8 | 1401.9 | 2915.7 | 3555.5 | 421.9 | 1717.3 | |
| Out-of-pocket spending | | | | | | | |
| Percentage of total inpatient cost (%) | 24.2 | 24.1 | 31.6 | 23.4 | 30.5 | 19.2 | |
| Mean (CNY) | 4885.1 | 4266.7 | 19,724.5 | 9059.8 | 3164.0 | 3634.2 | 0.000 |
| SD | 8480.3 | 5969.9 | 26,910.3 | 15,317.7 | 4443.0 | 6566.6 | |

*P*-values are based on the Kruskal-Wallis test

*IS* Ischaemic stroke, *SAH* Subarachnoid haemorrhage, *ICH* Intracerebral haemorrhage, *TIA* Transient ischaemic attack

SUN YAT-SEN UNIVERSITY SUN YAT-SEN UNIVERSITY

# Results: Direct inpatient costs by types of stroke

- The mean total direct inpatient costs per patient was **CNY20,203.1 (US$3212.1)**
- The average costs for **SAH (CNY 62,494.2)** was the highest.
- Followed by ICH (CNY 38,757.6), other strokes (CNY 18,920.6)， IS (CNY 17,730.5)and TIA (CNY 10,365.3) (P＜0.01).

# Results: Factors associated with costs

SUN YAT-SEN UNIVERSITY

**Table 4** Factors associated with total inpatient costs (EEE model)

| | All cases ($n = 114,872$) | | | *P*-value |
|---|---|---|---|---|
| | Coef. | Adjusted Std. Err. | Marginal Effect | |
| Male (Reference: Female) | 0.007 | [0.004] | 131.6 | 0.050 |
| Age (Reference: 17≤Age < 45) | | | | |
| 45 ≤ Age < 65 | −0.012 | [0.019] | − 222.3 | 0.515 |
| 65 ≤ Age < 75 | −0.019 | [0.019] | − 336.8 | 0.321 |
| 75 ≤ Age < 80 | −0.028 | [0.019] | − 500.7 | 0.140 |
| ≥ 80 | −0.046** | [0.019] | −817.4 | 0.015 |
| Insurance Type (Reference: URBMI) | | | | |
| UEBMI | 0.052*** | [0.008] | 910.4 | 0.000 |
| Comorbidities (Reference: None) | | | | |
| Coronary heart disease | −0.011 | [0.005] | −190.4 | 0.052 |
| Hypertension | −0.049*** | [0.004] | − 875.8 | 0.000 |
| Diabetes | 0.035*** | [0.005] | 638.6 | 0.000 |
| Alzheimer's disease | −0.057*** | [0.017] | −991.1 | 0.001 |
| Parkinson's disease | −0.033*** | [0.012] | −588.6 | 0.005 |
| Mental disorder | −0.039 | [0.028] | −687.3 | 0.166 |
| Chronic kidney disease | −0.005 | [0.026] | −93.6 | 0.843 |
| Stroke Types (Reference: TIA) | | | | |
| IS | 0.111*** | [0.007] | 1959.1 | 0.000 |
| SAH | 1.024*** | [0.037] | 27,497.1 | 0.000 |
| ICH | 0.468*** | [0.013] | 9655.8 | 0.000 |
| Other strokes | 0.047*** | [0.010] | 848.3 | 0.000 |
| ICU admission (Reference: None) | 1.726*** | [0.059] | 62,499.3 | 0.000 |
| Referral from other hospitals (Reference: None) | 0.207*** | [0.022] | 4017.2 | 0.000 |
| Readmission in 15 days (Reference: None) | 0.157*** | [0.033] | 2989.6 | 0.000 |
| Length of stay (Reference: < 10) | | | | |
| 10 ≤ Days< 20 | 0.379*** | [0.006] | 7244.3 | 0.000 |
| ≥ 20 | 1.610*** | [0.010] | 35,417.4 | 0.000 |
| Hospital level: Primary (Reference) | | | | |
| Secondary | 0.213*** | [0.007] | 4005.0 | 0.000 |
| Tertiary | 0.700*** | [0.010] | 11,787.4 | 0.000 |

# Results: Factors associated with costs

- **The types of stroke, insurance types, age, comorbidities, severity of disease, length of stay and hospital levels** were significantly associated with inpatient costs of stroke (P<0.01).

- SAH was linked with the highest inpatient costs, followed by ICH, IS, other strokes and TIA (P<0.01)

# Discussions

- This was **the first** study using a large urban health insurance claims database from an entire city to estimate the costs of hospitalization for stroke and compare the inpatient costs among five different stroke subtypes in China.

- SAH predicted the highest inpatient costs, followed by ICH, IS, other strokes, and TIA. This variation might be attributable to disease severity and cost composition.

# Discussions

- The average **LOS was 26.7 days**, **much longer than** that reported by academic hospitals in the United States (10.8 days – 19.4 days), and similar to or longer than that in some European countries as well (12 days – 27days).

- **The lengthy LOS in China** might be due to that most stroke patients tend to stay in hospitals during the post-stroke period.

- The heavy focus of hospitalization **is not cost-effective** for the management of stroke.

# Discussions

- Chinese patients with stroke invested much less in rehabilitation and nursing care (2.3% and 9.8% of the direct cost, respectively) due to a lack of community-based rehabilitation centres or nursing care institutions (Hu et al. 2013).

- Strategies to reduce LOS such as **building more community-based care facilities** along with **the long-term care insurance** to cover the entire stroke care might be an effective method to contain the costs of stroke.

# Conclusions

- The costs of hospitalization for stroke were high and differed substantially by types of stroke.

- These findings could provide economic evidence for evaluating the cost-effectiveness of interventions for the treatment of different stroke types as well as useful information for healthcare policy in China.

https://doi.org/10.1186/s12913-019-4530-2



BMC Health Services Research

RESEARCH ARTICLE Open Access

# Costs of hospitalization for stroke from two urban health insurance claims data in Guangzhou City, southern China

Hui Zhang[1], Yujie Yin[1], Chao Zhang[2] and Donglan Zhang[3*]

**Abstract**

**Background:** Stroke remains a major global health problem. In China, stroke was the leading cause of death and imposed a large impact on the healthcare system. This study aimed to examine the hospitalization costs by five stroke types and the associated factors for inpatient costs of stroke in Guangzhou City, Southern China.

**Methods:** This was a prevalence-based, cross-sectional study. Data were obtained from urban health insurance claims database of Guangzhou city. Samples including all the reimbursement claims submitted for inpatient care with the primary diagnosis of stroke from 2006 to 2013 were identified using the International Classification of Diseases codes. Descriptive analysis and multivariate regression analysis based on the Extended Estimating Equations model were performed.

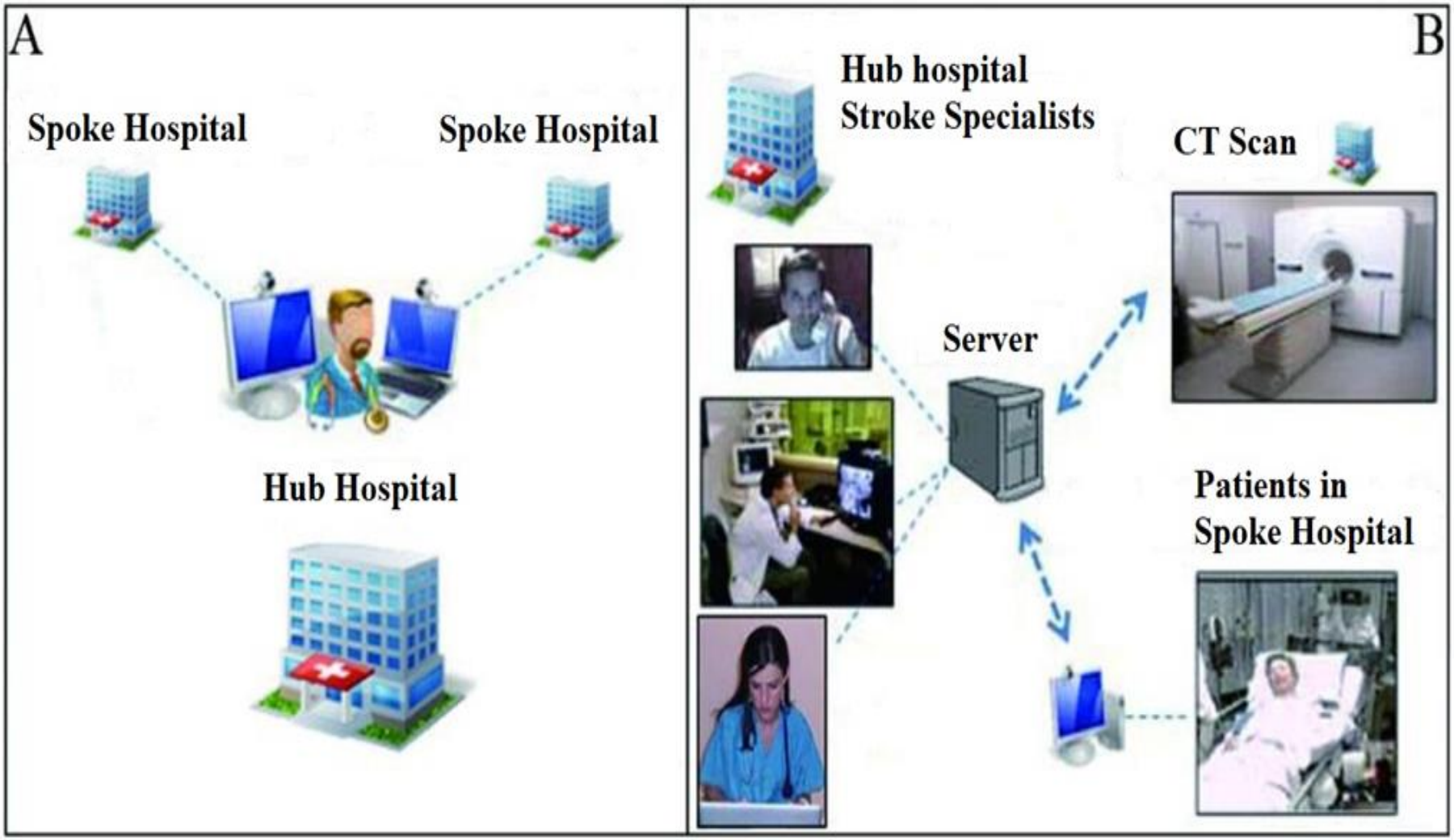
**Results:** A total of 114,872 hospitalizations for five stroke types were identified. The average age was 71.7 years old, 54.2% were male and 60.1% received medical treatment in the tertiary hospitals, and 92.3% were covered by the urban employee-based medical insurance. The average length of stay was 26.7 days. Among all the hospitalizations (average cost: Chinese Yuan (CNY) 20,203.1 = $3212.1), the average costs of ischaemic stroke (IS), subarachnoid haemorrhage (SAH), intracerebral haemorrhage (ICH), transient ischaemic attack (TIA), and other strokes were CNY 17,730.5, CNY 62,494.2, CNY 38,757.6, CNY 10,365.3 and CNY 18,920.6, respectively. Medication costs accounted for 42.9, 43.0 and 40.4% of the total inpatient costs among patients with IS, ICH and TIA, respectively, whereas for patients with SAH, the biggest proportion of total inpatient costs was from non-medication treatment costs (57.6%). Factors significantly associated with costs were stroke types, insurance types, age, comorbidities, severity of disease, length of stay and hospital levels. SAH was linked with the highest inpatient costs, followed by ICH, IS, other strokes and TIA.

**Conclusions:** The costs of hospitalization for stroke were high and differed substantially by types of stroke. These findings could provide economic evidence for evaluating the cost-effectiveness of interventions for the treatment of different stroke types as well as useful information for healthcare policy in China.

**Keywords:** Stroke, Cost, Hospitalization, China, Health insurance, Cost of illness

# Overview of Telestroke

- **Telestroke** is a **well-developed telemedicine technology** that uses two-way video conferencing to facilitate communications between specialists in stroke centers **(hub hospitals)** and physicians and their patients in lower-resourced health care facilities **(spoke hospitals)**, including community health centers in urban regions and hospitals in rural regions.




**A telestroke network** was often developed voluntarily by a **"hub" hospital**, usually a primary/comprehensive stroke center that connected with several **"spoke" hospitals** to provide remote care and facilitate patient referral.

# Telestroke Care Hospitals and Usual Stroke Care Hospitals

- Since 2017, **10 "spoke" hospitals** participating in GSPH telestroke network, including 5 "spoke" hospitals within Guangzhou city, and 5 "spoke" hospitals in other cities and counties in Guangdong province.

- In order to have the comparator, **another 10 hospitals** will be matched and selected in Guangdong province, which provide **usual stroke care (non-telestroke)**

中山大學
SUN YAT-SEN UNIVERSITY

# Thank you very much!