

# Disparities in the utilization of ischemic stroke inpatient services in China: the role of urban health insurance

**Yong Yang**

Beijing University of Chinese Medicine

**Xiaowei Man**

Beijing University of Chinese Medicine

**Stephen Nicholas**

Tianjin Normal University

**Shuo Li**

Beijing University of Chinese Medicine

**Qian Bai**

Beijing University of Chinese Medicine

**Lieyu Huang**

Beijing University of Chinese Medicine

**Yong Ma**

China Health Insurance Reaserch Association

**Xuefeng Shi** (✉ [shixuefeng981206@163.com](mailto:shixuefeng981206@163.com))

Beijing University of Chinese Medicine

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## Research article

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## Abstract

**Background:** As the second most common cause of death globally, strokes impose a significant financial burden on patients and a country's health system. This study demonstrates the disparities in the utilization of inpatient health services for stroke patients covered by different urban basic health insurance schemes in China.

**Methods:** We conducted statistical analysis based on the data containing urban employee-based basic medical insurance scheme (UEBMI) and urban resident-based basic medical insurance scheme (URBMI) groups, supplied by the China Health Insurance Research Association (CHIRA). Descriptive analysis was the main method to finish this study.

**Results:** Of the inpatients (N=56485) who had been diagnosed with ischemic stroke, extracted from the CHIRA claimed database, 64.6% (36487) were covered by UEBMI and 35.4% (19998) were covered by URBMI. The annual frequency of hospitalization of UEBMI subgroup was 1.21 times and 1.15 times for URBMI subgroup. The average length of stay of UEBMI subgroup(13.93days) was longer than URBMI subgroup (10.82 days). The UEBMI group had higher hospitalization costs but fewer out-of-pocket costs: for the UEBMI subgroup, the average hospitalization cost was RMB11187.64(\$1724.02), the average total out-of-pocket costs was RMB2646.42(\$407.81). While for the URBMI subgroup, the average hospitalization cost was RMB6402.27(\$986.59) and the average total out-of-pocket costs was RMB2746.10(\$423.17). All the above differences were significant( $P<0.001$ ). Meanwhile, patients with UEBMI had higher reimbursement rate (82.65% and 63.82%) and lower self-paid ratio (23.65% and 42.89%).

**Conclusions:** We found that there were nonnegligible disparities in the utilization of inpatient health services between UEBMI and URBMI. Thus, our results call for a systemic strategy to improve the fragmented social health insurance system and narrow the gap in health insurance schemes in China.

## Background

Expanding health insurance coverage is the main approach to strengthen household financial protection from ill health and to improving healthcare accessibility. (1, 2). In 2005, WHO encouraged its members to achieve the Universal Health Coverage (UHC) goal that all people obtain good-quality essential health services, including promotion, prevention, treatment, rehabilitation and palliation, that they need without enduring financial hardship (3, 4). Many countries, including China, have taken effective measures to expand their health coverage. In the process of achieving the UHC goals, low-level insurance coverage and disparities between social health insurance schemes were identified as major issues hindering equity in healthcare access (5, 6). Health services utilization has been considered as one of the important elements of health equity (7, 8).

In order to achieve the goal of universal access to basic medical and health services, the Chinese government initiated a series of health care reforms in 2009. One of the primary objectives was to expand

China's basic health insurance schemes, including assuring basic medical insurance coverage, increasing government subsidies and regulating the management of the basic medical funds (9). Over the past decade, China's health insurance system has improved significantly, with the 2009 insured rate of 89.25% increasing to over 95% by 2017. Today, more than 1.35 billion Chinese people are covered by basic medical insurance (10). Before 2015, there were three main health insurance schemes in China: the rural new cooperative medical scheme (NCMS) for rural residents, the urban resident-based basic medical insurance scheme (URBMI) for the unemployed, retired, students and children and urban employee-based basic medical insurance scheme (UEBMI) for employed urban workers (11). However, wide gaps existed between the different health insurance schemes. The main disparities lay in the targeted population, source of funding, funding level and administration and benefit packages (12, 13). Table 1 exhibits the key details of the disparities between UEBMI and URBMI, especially the benefit package, reimbursement rates and payment ceilings (11). Some of these differences caused inequity in health care utilization (13, 14) and impose differential financial burdens on households (15, 16). Scholars have analyzed the disparities in health care utilization under different health insurance schemes from the perspective of certain diseases. For example, urban insurance scheme mental patients accessed hospitals more than rural insured mental patients (17) and UEBMI tuberculosis patients had higher utilization rates than the URBMI insured subgroup(18). Although stroke is the first highest cause of death in China, there is a paucity of research about the utilization of stroke inpatient services under different China's different health insurance schemes. For insured ischemic stroke inpatients, we investigate how the two basic urban insurance schemes cause inequities in health care utilization and exposed households to different financial risks from medical expenses.

Stroke is the second most common cause of death after myocardial infarction worldwide, with high morbidity, mortality and mutilation rates, as well as imposing a heavy financial burden on families and the health system (19, 20). Worldwide, there are 10 million new cases of strokes and 6.5 million people die from stroke every year (21). Stroke care imposes high financial costs on families, health insurance schemes and society. On average, one-year healthcare costs in Italy was US\$13376 with societal costs estimated to be US\$22720 per stroke survivor (22), The economic burden caused by ischemic stroke was estimated to be US\$3.658 billion in Korea in 2015, with the average economic burden per stroke case about US\$7247 (23). The average 2010-2015 inpatient expenditure per visit for each ischemic stroke patient in China was US\$1498 (24), which severely strained family finances and family stroke care (25, 26).

Table 1 provides an overview comparing the differences between the UEBMI and URBMI: UEBMI offers compulsory, comprehensive insurance for employed people with a per capita fund of RMB3144 (US\$505) based on contributions from employers and employees, with an 80% reimbursement rate and basic urban wage reimbursement ceiling; URBMI is voluntary, offering limited insurance to unemployed urban residents, including children, students and people with disabilities, with a per capita fund of RMB560 (US\$90) based on a government subsidy and individual premiums, with a 70% reimbursement rate and farmer income-based reimbursement ceiling.

**Table 1** Basic information about the two medical insurance schemes for urban residents in China

	URBMI	UEBMI
Inception year	2007	1998
Eligible population	Children, students, older people, people with disabilities, other non-working urban residents	Urban, employed
Enrollment type	Voluntary	Compulsory
Number of people insured	377 million	289 million
Source of funding	Government subsidy (380 Yuan) and individual premium (varied by locations)	Contributory (8% of annual wage, 6% from employers, and 2% from employees)
Per-capita fund	560 Yuan	3144 Yuan
Benefit package	Inpatient and catastrophic outpatient medical service	Outpatient and inpatient medical service
General outpatient services	Limited and varied by locations	Comprehensive
Rate of reimbursement (inpatient)	over 80%, varies across cities/counties	About 70%, varies across cities/counties
Annual reimbursement	Six-times income of local farmers	Six-times average wage of employee in the city
Ceiling Demand for payment	Once a year, Always	25 years for men, 20 years for women, have no more need of contributions after retirement

UEBMI: Urban Employee Basic Medical Insurance; URBMI: Urban Resident Basic Medical Insurance;

Data resource: 2015 National Health Statistics Annual

## Materials And Methods

### Data sources

From the population of UEBMI and URBMI payments, a 5% random sample of the medical information for each ischemic stroke beneficiary was collected in 2015, including age, date of visit, health institute name, primary diagnosis (classified according to International Classification of Diseases, 10th edition (ICD-10)), city of residence, cost per inpatient treatment (including out-of-pocket (OOP) expenses) and length of hospital stay (LOS).

### Indicators

The annual frequency of hospitalization, average length of stay (ALOS) and average hospitalization cost of ischemic stroke inpatients were the three indicators of inpatient healthcare services utilization (27-29).

All costs were adjusted according to the average annual 2015 US\$-RMB exchange rate: US\$1.0 = RMB6.2284 (30). OOP expenses were categorized as within insurance, or medical expenses above those reimbursed by insurance, and OOP cost beyond insurance, or expenses that patients paid that were not covered by health insurance.

## Statistical analysis

Individual stroke inpatients were divided into different groups according to factors that impacted their utilization of inpatient health services (31). Using ICD-10, ischemic stroke types were defined by I63 and I63.0-5 (cerebral infarction due to thrombosis of precerebral arteries, embolism of precerebral arteries, unspecified occlusion or stenosis of precerebral arteries) and I63.8 and I63.9 (other and unspecified cerebral infarction). Based on size, location and functional orientation, hospitals in China are divided into primary hospitals, with less than 100 beds, providing basic health services to residents in a community; secondary hospitals, with 100-500 beds, providing comprehensive health services to several communities as well as medical training and regional-based research; and tertiary hospitals, with over 500 beds, providing complex healthcare for several districts and undertaking missions like medical education and research.

According to the development level and geographical location, we divided our hospitals into three regions: east, central and west. In terms of development level and medical resources, industrialized eastern China had a per capita disposable income of US\$4531.4 (RMB28223.3), with the less developed central region a per capita disposable income of US\$2961.0 (RMB18442.1) and mainly agricultural and underdeveloped western China a per capita disposable income of US\$2708.3 (RMB16868.1) (32). Descriptive analysis was then used to calculate the demographic information of inpatients. Chi-square tests were employed to analyze the differences between UEBMI and URBMI within each subgroup. Second, descriptive statistics, including mean, standard deviation and percentage, frequency were calculated for the annual frequency of hospitalization, ALOS, the average inpatient hospitalization costs, the average OOP expenses and reimbursement rate. Since the frequency of hospitalization, ALOS and hospitalization cost data had a skewed distribution, we adopted Mann–Whitney test to identify whether the differences in patients' utilization of inpatient health and OOP costs of two health insurance schemes were statistically significant. A p-value of less than 0.05 was considered statistically significant. All statistical calculations were performed using STATA version 15.0.

## Results

### ***Basic information of sample***

As shown in Table 2, a total of 56485 ischemic stroke inpatients were included in our analysis, of whom 64.60% (36487) were covered by UEBMI and 35.40% (19998) were covered by URBMI. There was no statistical difference in the average age of UEBMI inpatients (68.64 years old) and URBMI inpatients (67.45 years); nearly half of the inpatients (47.68%) choose secondary hospitals to have their medical treatment and 32.65% (18443) sought medical treatment in tertiary hospitals; 46.40% (26184) of the

patients were in hospital in the central China, 36.91% (20850) in the east and 16.73% (9451) in the western region. 80.75% of the stroke inpatients admitted to tertiary hospitals were covered by UEBMI.

**Table 2** Sample descriptive statistics (N=56485)

	Overall	UEBMI	URBMI	c2	P
Gender				1751.785	<0.001
Male	32658(57.82)	23445(64.26)	9213(46.07)		
Female	23827(42.18)	13042(35.74)	10785(53.93)		
Age(years)				Z=-12.799	<0.001
Mean ± SD	68.22±11.12	68.64±11.06	67.45±11.20		
Age group				44.139	<0.001
0-44	1222(2.16)	789(2.16)	433(2.17)		
45-59	10825(19.16)	6694(18.35)	4131(20.66)		
≥60	44438(78.67)	29004(79.49)	15434(77.18)		
Stroke types				233.673	<0.001
I63	472(0.84)	446(1.22)	26(0.13)		
I63.0	5(0.01)	3(0.01)	2(0.01)		
I63.1	4(0.01)	2(0.01)	2(0.01)		
I63.2	14(0.02)	11(0.03)	3(0.02)		
I63.3	41(0.07)	31(0.08)	10(0.05)		
I63.4	45(0.08)	25(0.07)	20(0.1)		
I63.5	54(0.10)	25(0.07)	29(0.15)		
I63.8	78(0.14)	75(0.21)	3(0.02)		
I63.9	55772(98.74)	35869(98.31)	19903(99.52)		
Hospital levels				4772.498	<0.001
Primary	11110(19.67)	4725(12.95)	6385(31.93)		
Secondary	26932(47.68)	16713(45.81)	10219(51.1)		
Tertiary	18443(32.65)	15049(41.24)	3394(16.97)		
Region				280.351	<0.001
East	20850(36.91)	13960(38.26)	6890(34.45)		
Central	26184(46.36)	17116(46.91)	9068(45.34)		
West	9451(16.73)	5411(14.83)	4040(20.2)		

n (%) for categorical variables; Mean ± SD (standard deviation) for continuous variables

### ***Utilization of inpatient health services for stroke patients***

Table 3-Table 5 describe the utilization of inpatient health services for all insured, UEBMI and URBMI inpatients for hospitalization frequency, ALOS and hospital costs. As shown in Table 3, the annual frequency of hospitalization among UEBMI inpatients (1.21 times) was more than those covered by URBMI (1.15 times) ( $p<0.001$ ). Furthermore, the higher annual frequency of hospitalization of UEBMI inpatients compared to URBMI inpatients significantly differed according to gender and hospital levels. (all  $P < 0.001$ )

There was a statistically significant difference in the ALOS between UEBMI inpatients and URBMI inpatients according to gender, age group, hospital levels and region (see Table 4). For example, the ALOS for inpatients with the UEBMI (13.92 days) was significantly longer than patients with the URBMI scheme (10.82 days).

Table 5 shows that the UEBMI inpatient hospital costs were significantly higher than the URBMI group, which differed significantly according to gender, age group, hospital levels and region (all  $p < 0.001$ ). Overall, the mean total hospitalization costs in the UEBMI group was RMB11187.64 (US\$1724.02) was significantly higher than the URBMI group (¥6402.27/US\$986.59). As shown in Table 5, these costs significantly differed by gender, age group, hospital levels and region.

### ***Composition of average total hospitalization costs***

Table 6 describes the composition of average total hospitalization costs per inpatient for each insurance type. We found that inpatients with UEBMI (RMB2646.42/US\$407.81) had lower average total OOP expenses than those with URBMI (RMB2746.10/\$423.17), although inpatients with UEBMI (RMB11187.64/\$1724.02) had much higher average total hospitalization costs than those with URBMI (RMB6402.37/US\$986.61). This difference in OOP expenses was mainly due to the different reimbursement rates of hospitalization costs, which were 82.65% for UEBMI versus 63.82% for URBMI, with the different benefit packages set out in Table 1. Table 6 explores OOP expenses, which shows that inpatients with UEBMI scheme had fewer OOP costs within insurance (RMB1793.35/US\$276.36) than URBMI inpatients (RMB2072.85/US\$319.43), while OOP costs beyond health insurance of the UEBMI subgroup (RMB853.06/US\$136.95) was significantly higher than URBMI inpatients (RMB673.24/\$103.75). Furthermore, the self-paid ratio, or the total out-of-pocket costs as a proportion of the total hospitalization costs, of URBMI (42.89%) was almost twice the amount of UEBMI (23.65%).

Table 6 composition of average total hospitalization costs

	Overall	UEBMI	URBMI	P-value
Number	56485	36487	19998	
Hospitalization cost (RMB)	9493.42	11187.64	6402.27	<0.001
Total OOP costs (RMB)	2681.71	2646.42	2746.10	<0.001
Out-of-pocket (%)	28.25%	23.65%	42.89%	
Reimbursement rate (%)	78.26%	82.65%	63.82%	
Out-of-pocket costs (RMB)	1892.31	1793.35	2072.85	<0.001
(within insurance)				
Out-of-pocket costs (RMB)	789.40	853.06	673.24	<0.001
(beyond insurance)				
self-paid ratio		23.65%	42.89%	

The quantitative data in the table displays the mean value; All costs were based on a constant 2015 RMB; P-values are based on the Mann–Whitney test; self-paid ratio refers to the total out-of-pocket

costs as a proportion of the total hospitalization costs

## Discussion

In China, the stroke inpatient rate has increased at a rate of nearly 9% per year, with a high proportion in high-risk groups (33, 34). Ischemic stroke, primary intracerebral hemorrhage, and subarachnoid hemorrhage are major pathological types of stroke. Among them, ischemic stroke has the highest number of cases (35). To our knowledge, this is the first study using a large nation-wide Chinese health insurance claims database to show disparities in the utilization of ischemic stroke inpatient services under different urban basic health insurances schemes. Our study provides clear empirical evidence of the remarkable disparities between UEBMI and URBMI on the utilization of ischemic stroke inpatient health services. For UEBMI inpatients, the annual frequency of hospitalization was 1.21 times versus 1.15 times, ALOS 13.93 days versus 10.82 days, and the average hospitalization cost RMB11187.64(US\$1724.02) versus RMB 6402.27 (US\$1027.87) compared to URBMI inpatients.

Stroke inpatients with UEBMI had lower OOP costs for within insurance coverage, but higher OOP cost for beyond insurance coverage than those covered by URBMI. The explanation is related to the disparity in reimbursement rates (36). The source and level of within insurance reimbursements reflect different financing for UEBMI and URBMI, which affects the amount of funds available for patients and then results in different reimbursement levels and anti-risk capacity (18, 37, 38). Also, higher reimbursement rates led to lower OOP expenditures, leading inpatients to consume more and better health services (37, 39, 40). The OOP expenses for beyond insurance packages was higher for the UEBMI group than the UEBMI group. Patients covered by UEBMI generally have stable jobs and higher incomes, and this endow them greater capacity and willingness to pay for additional health services (8). Our data shows that UEBMI inpatients visited higher level of medical institutions and were more likely to be prescribe expensive medicines, which fell outside the reimbursement guidelines of their insurance packages (14).

The annual frequency of hospitalization of the UEBMI group was higher than that of URBMI group, likely associated with the higher ability to pay for hospital expenses due to higher income. UEBMI members were likely to use inpatient services, while URBMI members used more outpatient services, with lower OOP and hospital expenses (41). We speculate that inpatients covered by UEBMI had higher levels of education and socioeconomic status than URBMI members, as well as paying more attention to their personal health (42), which meant UEBMI members likely visited the hospital more frequently than URBMI members. Similarly, socioeconomic status and education level have been found to be important influential factors in pre-hospital delay, which will affect the LOS for ischemic stroke inpatients (43) and delay related behavior to avoid OOP expenses.

Government policies and incentives reflected in the BEBMI and URBMI are also a leading influencing factor in the ALOS (44), which was also affected by immediate causes, such as stroke type as well as stroke severity (45). A US study (46) showed that the ALOS was significantly longer for stroke patients with Medicaid than those with private insurance by more than 2 days. The different benefit packages, and

UEBMI's higher financial protection, impacted URBMI versus UEBMI ALOS in our study (47). Under the protection of health insurance, cerebral infarction inpatients with higher financial support tended to increase their length of stay, although there was may have been no medical need for more treatments (48).

We also found that patients with UEBMI had higher hospitalization costs, which is consistent with existing studies (17, 49). Doctors' behavior towards UEBMI inpatients partly explain these higher costs. Depending on a patient's health insurance status, different therapeutic schedules would be considered by doctors, which could result in the differences in the effectiveness of stroke treatment (50, 51). Additionally, supply-induced demand may be another involved behavior of doctors. A study (52) has shown that under the influence of supply-induced demand, a higher benefit level for a health insurance scheme was associated with a stronger impact on total medical expenses. There may also have been a hyper-demand for medical treatment. UEBMI inpatients may have demanded more treatment, especially drugs, given the benefit package and the reimbursement rates of the UEBMI scheme.

In contrast to UEBMI inpatients, URBMI inpatients incurred lower hospitalization costs. One possible explanation is that URBMI members were mainly unemployed or students or children and not in a strong financial protection. URBMI inpatients were unable to afford high hospitalization costs forgoing the same level of health services to those with UEBMI (53). Facing possible catastrophic health expenditure, URBMI members may reduce the use of health services, staying in hospital a shorter time and seeking reduced drugs, tests and treatment compared to UEBMI members. While not reflected in our data, we speculate that the high economic burden of hospital inpatient treatment meant some stroke patients, especially URBMI members, with low family incomes either reduced the amount of inpatient treatment, sought outpatient, but not inpatient, treatment or gave up visiting hospitals (54).

Differences in the sample characteristics also impacted our results. The UEBMI scheme covers more male inpatients while the URBMI scheme covers more female inpatients. Males have a higher probability of having stroke and incur higher healthcare costs than females (55, 56). Regarding age, younger stroke patients had higher hospitalization costs in the URBMI subgroup, since URBMI was targeted at children, students and the non-working young, a result consistent with previous studies (57, 58). However, in the UEBMI subgroup, inpatients over 60 years incurred higher hospitalization costs than those between 45-59years old. Possibly patients over 60 years covered by UEBMI had a stable retirement salary, their financial status was better than their peers covered by URBMI scheme, which led them to consume more health services (59). Most importantly, higher hospitalization costs were strongly related to longer length of stay (60, 61), with UEBMI inpatients having longer length of stays, and therefore higher hospitalization costs, than URBMI inpatients.

In order to improve China's fragmented social health insurance system and narrow the gap in health insurance schemes, the government officially launched the medical security system for urban and rural residents in 2016, covering people covered by URBMI and NCMS (62). The gap between urban and rural residents in terms of contribution levels, financial subsidies and treatment was narrowed (63).

Nevertheless, the disparities between urban-rural resident medical insurance and UEBMI remains. This strongly suggests that the further consolidation of China's social health insurance schemes is required. The key challenges are to unite the funding levels, cost-sharing methods, standards of payment systems and service provisions of different schemes (11). Meeting these challenges can play a positive role in improving health equity.

## Limitations

The study has a number of limitations. NCMS rural households are excluded since our database only provides information on disparities in the utilization of ischemic stroke inpatient health services between UEBMI and URBMI. Disparities between the urban and rural household insurance schemes remain for further study. Second, our database lacked reasons for the length of hospital stays. There was also no information on patient socioeconomic status, education or income.

## Conclusion

Large disparities existed between UEBMI and URBMI members' utilization of ischemic stroke inpatient health services in China, with UEBMI providing better financial support for medical expenses, especially OPP expenses, than URBMI members. The reimbursement ratio of the two urban health insurance schemes provide a crucial policy tool for addressing the utilization of health services. Our findings suggest consolidating the social health insurance schemes to the higher UEBMI levels to reduce the economic burden on households caused by stroke and improving health equity. This recommendation has international significance: stroke is a global disease, and effective health insurance measures are required to control it. This study has shown that health insurance was an important factor in stroke treatment in China. To fulfil the UHC global action goals, this study provides a valuable reference by identifying the need for a comprehensive and integrated health insurance scheme, especially in countries where the health insurance system is fragmented.

## Abbreviations

UEBMI: Urban Employee Basic Medical Insurance;

URBMI: Urban Resident Basic Medical Insurance;

UHC: universal health coverage

## Declarations

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## Availability of data and materials

Permission to use the dataset was provided by the China Health Insurance Research Association.

## Authors' Contributions

While conducting this study, YY and XFS developed the research aims, analyzed the data and drafted the manuscript; XWM and SL analyzed the data and edited the manuscript; QB, LYH and YM developed the research idea and helped interpreted the data analysis; SN wrote part of the draft and edited the manuscript; YM oversaw the data collection; XFS collecting the data, helped develop the idea and edited the manuscript.

## Ethics approval and consent to participate

Beijing University of Chinese Medicine Institutional Review Board considered the project was exempt from ethical approval because only aggregate, nonindividual and anonymous data were used.

## Consent for publication

Not applicable

## Competing interests

The authors declare that they have no competing interests.

## Author details

<sup>1</sup> School of Management, Beijing University of Chinese Medicine, Beijing, China, <sup>2</sup> School of Economics and School of Management, Tianjin Normal University, Tianjin, China. <sup>3</sup> Research Institute for International Strategies, Guangdong University of Foreign Studies, Guangzhou, China. <sup>4</sup> TOP Education Institute, Sydney, New South Wales, Australia. <sup>5</sup> Newcastle Business School, University of Newcastle, Newcastle, Callaghan, Australia. <sup>6</sup> China Health Insurance Research Association, Beijing, China

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