



ANALYSIS

China's response to the rising stroke burden

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Zixiao Li and colleagues discuss why the number of strokes is growing in China and how the country is taking steps to reduce the rate and improve care

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Stroke is the leading cause of death in China, with the country accounting for roughly one third of worldwide stroke mortality.¹ Distribution of stroke burden and risk factors varies greatly among regions in China and, with the added challenge of an ageing population, it is difficult for policy makers to develop tailored strategies to reduce stroke. Comprehensive healthcare reforms have led to gradual improvement in stroke care in recent years, including in public education, organisation of care systems, rapid access to acute care, and secondary prevention. The country's experience and challenges in reforming stroke care provide useful lessons for other countries and regions.

Effect of rapid ageing on stroke burden

The crude death rate from stroke has been increasing steeply in China, rising faster than in other countries over the past three decades. In addition, the prevalence and incidence of stroke have risen faster than in other countries (fig 1).¹ As the world's most populated country with a fast ageing population, China faces increasing challenges to reduce morbidity and mortality from stroke.

Ageing has become one of the major contributors to the increased prevalence, incidence, and mortality of stroke.¹ In 2015, 15.2% of China's population was over 60 years old, and it is projected that this proportion will rise to 36.5% in 2050.² Although China changed its one child policy in 2016, the ageing trend is unlikely to be reversed in the near future, putting huge pressure on the public health system.

China's economy has achieved unprecedented growth in the past 30 years, and expenditure on healthcare and public health has also grown rapidly. The increase in costs of healthcare has surpassed economic growth, and out-of-pocket health expenditure has gradually decreased (fig 2) (box 1).³ China has introduced comprehensive healthcare reforms since 2007.⁴

Health insurance coverage has increased from 45% in 2006 to over 95% in 2017.⁵ The broader insurance coverage may improve the detection rate of stroke and access to stroke care, and therefore increase the cost of stroke care.

Box 1: Definition of health expenditure in China³

Total health expenditure—The total monetary value of health resources in a country or a region collected by the whole society for public health based on source approach

Government health expenditure—The expenditure of the governments at all levels on medical and healthcare services, medical subsidies, health administration and health insurance management, and undertakings of family planning, etc

Social health expenditure—All inputs of society except the government in public health, including expenditures on social medical security, commercial health insurance, social donation and contribution, and income from administrative fees, etc

Out-of-pocket health expenditure—Expenditure in cash on various health services by rural and urban residents, including self payments of residents within the system of multimedical insurance

Despite increases in the crude rates of prevalence, incidence, and mortality of stroke, age standardised rates have fallen, suggesting substantial improvement in stroke prevention, management, and care.⁶ However, those improvements have not yet completely reversed the increase in stroke burden. Better stroke prevention strategies need to be developed. The multidimensional and complex strategies must consider stroke aetiology in China, public education, barriers to controlling risk factors, access to stroke care, and reorganisation of stroke care system.

Epidemiology and aetiology

Stroke accounts for more deaths than any other cause in China.¹ This differs from most other regions, including the Middle East,

North America, Australia, and Europe, which have more deaths from ischaemic heart disease than stroke.⁷ The average age of stroke patients in China is 66.4,⁸ almost 10 years younger than in white European populations.⁹ Around 15% of strokes occur in people younger than 50, resulting in substantial loss of years of life in the working age population.¹

The most common subtype of stroke in China is ischaemic stroke, accounting for 69.6% of all strokes.⁸ However, the rate of intracerebral haemorrhage, 23.8%,⁸ is higher than in the white population.⁹ Among patients with ischaemic stroke, the prevalence of intracranial atherosclerotic stenosis is much higher than that of extracranial carotid stenosis (46% v 14%). Patients with intracranial stenosis were found to have more severe stroke at admission and stayed longer in hospital compared with those without intracranial stenosis.¹⁰ Therefore stroke prevention strategies in China may need different components and emphasis from those in other countries.

Some progress in control of risk factors

The prevalence of major risk factors for stroke remains high, and most of them have increased from 2002 to 2012 (fig 3).^{11 12} Control of risk factors and continuing investment in public health projects have been shown to be the main reasons for the fall in stroke burden in the US over the past 100 years.¹³ Chinese governments have implemented several public education and primary prevention initiatives for stroke, with some success.¹⁴⁻¹⁶ From 2002 to 2012, the awareness rate, treatment rate, and control rate of hypertension improved by 16.3%, 16.4%, and 7.7%, respectively.¹¹ The awareness, treatment, and control rates of diabetes were also up by 36.1%, 33.4%, and 30.6%, respectively.¹¹ Tobacco use fell by 7.2% from 1996 to 2012.¹¹ These improvements are expected to continue.

Success in secondary prevention

The most noticeable progress has been in secondary prevention of stroke. The rates of recurrence within one year and case fatality both fell substantially between 2007 and 2012 (from 17.7% to 6.7% and 14.3% to 8.5%, respectively).¹⁷⁻¹⁹ High quality clinical research has an important role in promoting evidence based stroke care. For instance, the CHANCE trial (Clopidogrel in High Risk Patients with Acute Nondisabling Cerebrovascular Events) showed that dual antiplatelet treatment for 21 days is the optimal antiplatelet strategy in patients with minor stroke and transient ischaemic attack within 24 hours after symptom onset.²⁰ This evidence has been quickly and widely adopted by Chinese and other international guidelines. Adherence to evidence based recommendations and clinical practice in China is still much lower than in developed countries such as the US.²¹ Improvement in the quality of stroke care has become a national priority, and coordinated actions have been taken since 2000.²² The overall quality of secondary prevention of stroke substantially improved from 2007 to 2012.²¹ However, no significant improvement was seen in anticoagulation rates for atrial fibrillation (19.7% in 2007-08 versus 21% in 2012-13).²¹

On monitoring the quality and improvement of stroke care, China has learnt from successful initiatives in other countries, such as the US Get With the Guidelines and the national sentinel stroke audit programme in the UK.^{14 23} The Chinese government sponsored a series of large scale regional and nationwide studies (box 2) to identify the gaps between the adherence to guideline recommended therapy and clinical practice and to design and

evaluate intervention tools to improve the quality of stroke care and patients' outcomes.^{21 22 24}

Box 2: Major registries and improvement initiatives in stroke care since 2000²²

Stroke registries (year)

- Nanjing Stroke Registry (2002)
- Chengdu Stroke Registry (2002)
- China Ischaemic Stroke Registry (2004)
- Quality Evaluation of Stroke Care and Treatment (China QUEST) (2006)
- China National Stroke Registry I (2007)
- China National Stroke Registry II (2012)
- China National Stroke Registry III (2015)

Stroke improvement initiatives (year)

- Stroke unit (2001)
- China National Stroke Prevention Project (2009)
- National Centre for Quality Improvement in Stroke Care (2010)
- Chinese Stroke Centre Alliance (2015)
- Chinese Stroke Association (2015)

A cluster randomised clinical trial (Golden Bridge—AIS) conducted in 2014 showed the feasibility and effectiveness of this multifaceted quality improvement intervention (box 3).²⁵ It was shown to improve the adherence to evidence based performance measures of acute stroke care while reducing 12 month new vascular events and disability.²⁵ Information technology was used to provide real time feedback on the quality of stroke care for physicians, directors, and hospitals. Using this successful model, the Chinese Stroke Association organised the Chinese Stroke Centre Alliance. Since 2015, over 2500 hospitals have joined this national, hospital based, stroke care quality assessment and improvement platform.²⁶ It is still an ongoing and evolving process, and its effect on clinical practice needs further evaluation.

Box 3: Components of stroke quality improvement interventions in Golden Bridge study²⁴

- An evidence based clinical pathway containing general guideline based recommendations about acute stroke management and detailed daily care plan for each of the first seven days of the acute admission and at discharge
- Written care protocols for implementation of performance measures, including intravenous tPA, deep venous thrombosis prophylaxis, swallowing dysfunction management, and evidence based antithrombotic therapy; anticoagulation for patients with atrial fibrillation; and statin, antihypertensive, and hypoglycaemic medications as appropriate
- A full time quality coordinator interacting with physicians once gaps in applying evidence based interventions are identified, ensuring that all components of the quality improvement intervention are used for every patient, identifying barriers for the implementation of the quality improvement tools and evidence based therapies, and training the healthcare staff caring for patients with acute ischaemic stroke patients
- Monitoring and feedback system for performance measures to collect data and feedback on adherence to predefined performance measures through a web based patient management tool. An independent quality management account is assigned to hospitals to allow them to see the level of implementation of predefined performance measures at any time and compare them with previous performance and that of other hospitals

There is still substantial room to improve the quality of stroke care in China. The rate of use of intravenous tissue-type plasminogen activator (tPA) in eligible patients was only 18.3% in 2012.²¹ Potential reasons for the low rate of thrombolysis include prehospital delay, lack of regional stroke care network, the high cost of tPA, low insurance coverage, and concern about haemorrhagic risk.²¹ Currently, over 30 cities in China have established an emergency service triage centre with thrombolysis maps indicating real time availability and capacity for thrombolytic therapy in local hospitals.⁶ This approach aims to

reduce prehospital delay and improve the adherence to acute reperfusion therapy.

Suboptimal rehabilitation

Rehabilitation after stroke is still suboptimal in China. Registry data from 2012-13 showed that only 59.4% patients with stroke received rehabilitation assessment during hospital admission, and only half of these were assessed by a rehabilitation therapist.²⁷ Reasons for suboptimal stroke rehabilitation in China include lack of insurance coverage for rehabilitation, lack of a well established stereoscopic rehabilitation system, less developed rehabilitation technology, and lack of awareness of rehabilitation, especially early rehabilitation.²⁸ Work is needed to overcome the potential obstacles to rehabilitation to improve patients' functional status after stroke.

Unintegrated care and healthcare information systems

The chain of stroke care for patients in China has been gradually improving in the past decade. However, the stroke care pathway is still far from integrated, which makes it less likely that patients will get full care and prevents the development of stroke prevention strategies. The chain from emergency service system to designated stroke centres, multidisciplinary organisation, and discharge to community hospital or rehabilitation centre is weak, and this is reflected in longer prehospital delay, low tPA treatment, poor long term medication adherence, and low rehabilitation service.^{21 27 29}

In addition, the data from the various parts of the care pathway are not linked, which prevents them being used together to assess the overall quality of stroke care. Connecting the information silos for stroke care service is urgent.

In the UK, the sentinel stroke national audit programme monitors the quality of stroke care throughout the whole care pathway using a comprehensive healthcare information system for collecting and reporting data.²³ This programme provides stakeholders with an unprecedented insight into the performance of stroke services. Learning from this successful model, China has established some regional stroke networks to improve stroke care.³⁰ In addition, the Chinese government has begun to designate national resources to integrate healthcare information with the aim of using the data to guide its policy and allocation of resources.³¹ Although community health and hospital information systems are beginning to provide support for monitoring healthcare quality, feedback, and improvement, nationwide healthcare and health data integration and sharing are still far off.

Conclusion

With its ageing population, China faces increasing challenges for stroke care and prevention. The ongoing quality improvement interventions seem to be a cost effective way to reduce stroke burden. Although some progress has been made, the Chinese government should continue to develop and advance its healthcare reforms and policies to improve the insurance coverage, establish integrated stroke care systems, train more rehabilitation therapists, and develop more effective and suitable strategies for stroke prevention and treatment.

Key messages

- Stroke burden and risk factors have increased in recent decades in China, although regional differences exist
- Comprehensive healthcare reforms have been implemented to provide accessible, affordable, and efficient healthcare for all citizens in China
- Quality improvement interventions in stroke care are increasing adherence to guideline based performance measures in acute stroke care and improving long term outcomes

Contributors and sources: This article was developed based on discussion about stroke burden and care and the healthcare reforms and policy to improve the healthcare system including stroke care in China at the roundtable discussion organised by *The BMJ* on 7 December 2018 in Beijing. ZL is a vascular neurologist and secretary of the China National Center for Healthcare Management in Neurological Diseases. YJ is a stroke epidemiologist and director of the Center for Big Data, China National Clinical Research Center for Neurological Diseases. HL is a senior epidemiologist and director of the Department of Statistics and Epidemiology, China National Clinical Research Center for Neurological Disease. YX is an associate professor of neurology and medicine at the Duke University Medical Center and Duke Clinical Research Institute. YW is a vascular neurologist and vice director of the China National Clinical Research Center for Neurological Disease. ZL was responsible for the sections on stroke care. YJ took charge of the sections on stroke burden, risk factors, and stroke characteristics. ZL, YJ, and HL drafted and revised the manuscript. YX revised the manuscript. YW was responsible for the whole design, generation of the opinions, and analysis. ZL and YJ contributed equally to this article and are the guarantors.

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Figures

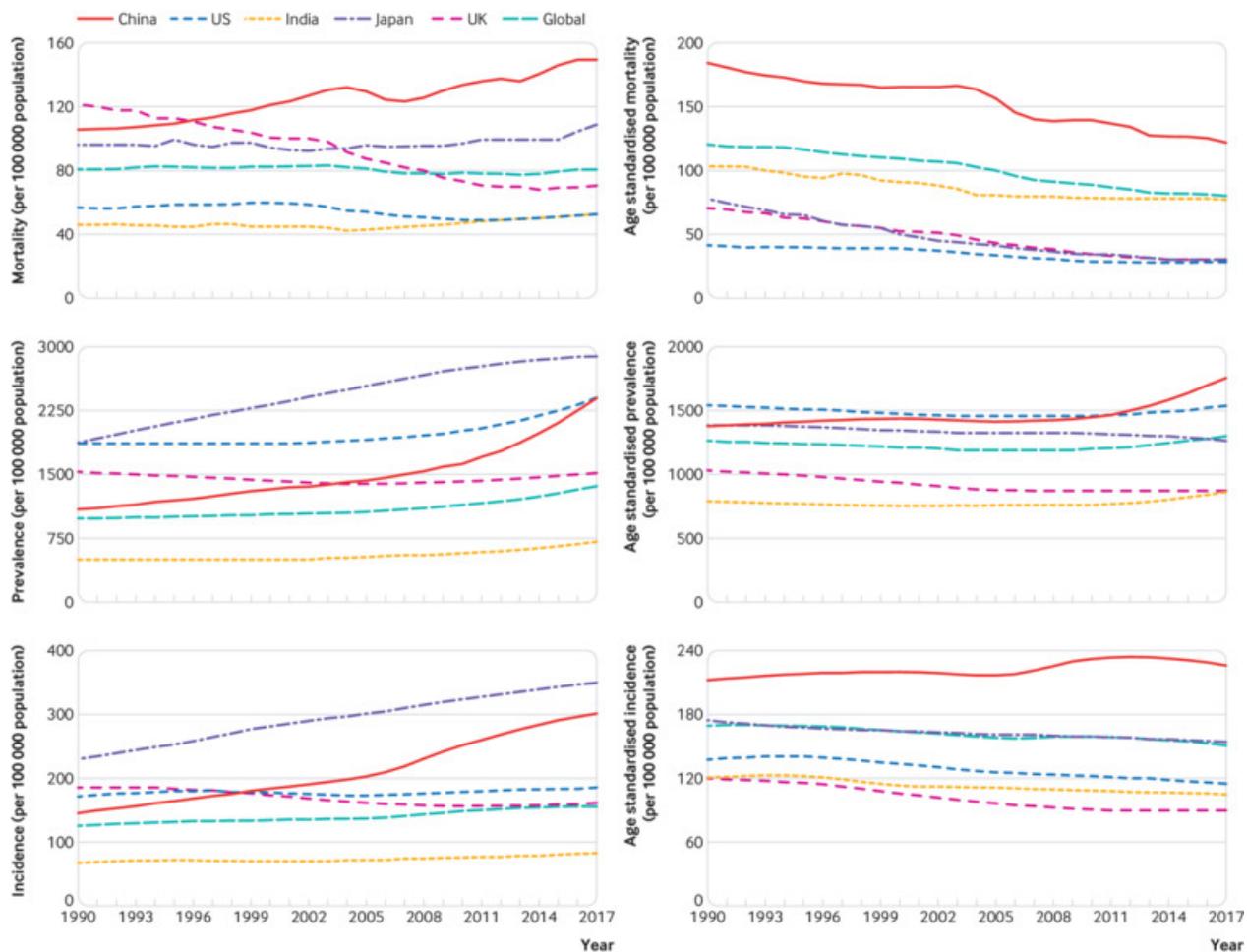


Fig 1 Trends in mortality, prevalence, and incidence and age standardised mortality, prevalence, and incidence of stroke around the world¹

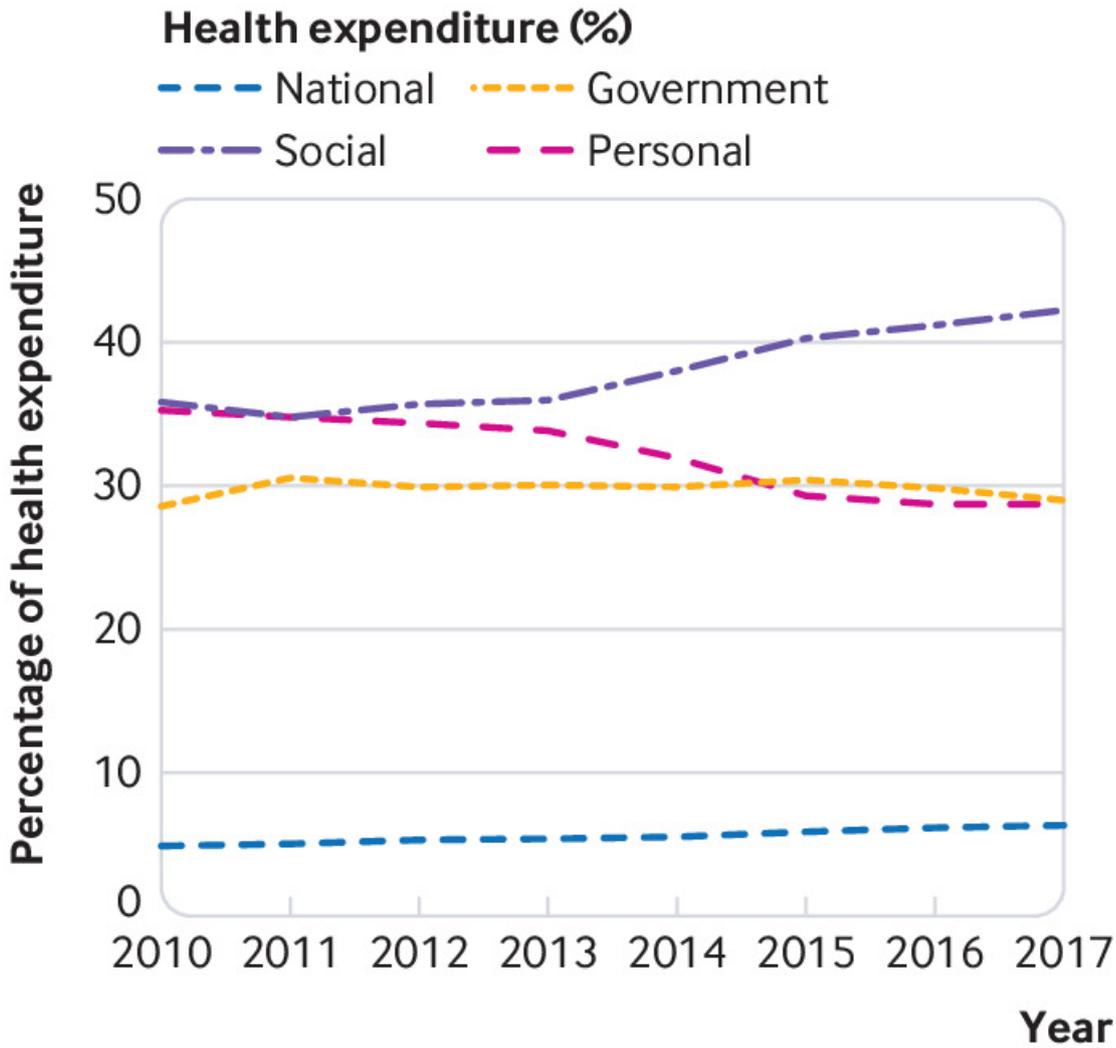


Fig 2 Health expenditure in China. National health expenditure as a percentage of gross domestic product and government, social, and personal health expenditure as a percentage of total health expenditure³

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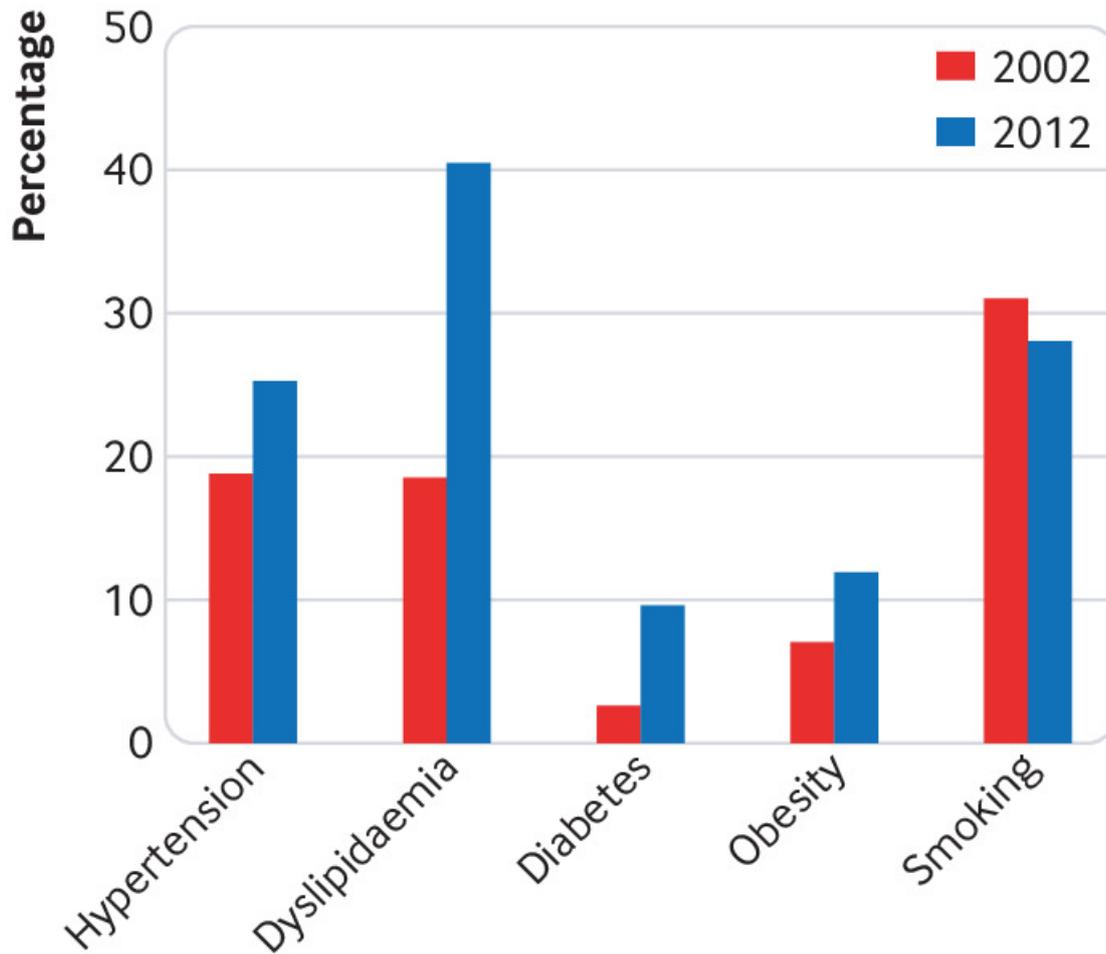


Fig 3 Prevalence of stroke risk factors among Chinese adults in 2002 and 2012^{11 12}

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