Socioeconomic status and the quality of acute stroke care:

the China National Stroke Registry

Running title: Socioeconomic status and quality of stroke care

Yuesong Pan, MD[1,2,3,4,5]; Ruoling Chen, MD, PhD[6]; Zixiao Li, MD, PhD[1,2,3,4]; Hao Li, PhD[1,2,3,4]; Xingquan Zhao, MD, PhD[1,2,3,4]; Liping Liu, MD, PhD[1,2,3,4]; Chunxue Wang, MD, PhD[1,2,3,4]; Yilong Wang, MD, PhD[1,2,3,4]; Yongjun Wang, MD[1,2,3,4]

[1] Department of Neurology, Beijing Tiantan Hospital, Capital Medical University, Beijing, China

[2] China National Clinical Research Center for Neurological Diseases, Beijing, China

[3] Center of Stroke, Beijing Institute for Brain Disorders, Beijing, China

[4] Beijing Key Laboratory of Translational Medicine for Cerebrovascular Disease, Beijing, China

[5] Department of Epidemiology and Health Statistics, School of Public Health, Capital Medical University, Beijing, China.

[6] Centre for Health and Social Care Improvement, Faculty of Education Health and Wellbeing, University of Wolverhampton, UK

Corresponding author: Yongjun Wang

Address: No.6 Tiantanxili, Dongcheng District, Beijing, China, 100050

Business telephone: 0086-010-67098350   **Fax numbers:** 0086-010-67013383

E-mail address: yongjunwang1962@gmail.com

Co-corresponding author: Yilong Wang

E-mail: yilong528@gmail.com

Over-sea correspondent: Ruoling Chen

E-mail: R.Chen@wlv.ac.uk

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ABSTRACT

Background and Purpose

The association of socioeconomic status (SES) with quality of stroke care is not well understood and few studies have examined the association with different indicators of SES simultaneously. We assessed the impacts of low levels of education, occupation and income on the quality of stroke care.

Methods

We examined data from the China National Stroke Registry recording consecutive stroke patients between September 2007 and August 2008. Baseline low SES was measured using educational level <6 years, occupation as manual workers or no job and average family income per capita at ≤¥1,000 per month. Compliance with 11 performances was summarized in a composite score defined as the proportion of all needed care given. Poor quality of care was defined as having a composite score of 0.71 or less.

Results

Among 12,270 patients with ischemic stroke, 38.6% had <6 educational years, 37.6% manual workers/ no job and 34.7% income ≤¥1000 per month. There was an increased chance of receiving poor quality of care in patients with low education [adjusted odds ratio: 1.15, 95% confidence interval: 1.03-1.28], low occupation (1.16, 1.01-1.32) and low income (1.18, 1.06-1.30), respectively. People with low SES had poor performances on some aspects of care quality. Combined effects existed among these SES indicators; those with low SES from all 3 indicators had the poorest quality of care.

Conclusions

There was a social gradient in the quality of stroke care. Continuous efforts of socioeconomic improvement will increase the quality of acute stroke care.

INTRODUCTION

Stroke is the leading cause of disability and the second cause of death in the world.[1, 2] There is evidence that increased quality of care during the early phase of stroke is significantly associated with reduced risk of disability and mortality.[3] However, the quality of stroke care has varied globally; high income countries have better quality of stroke care than low and middle income countries,[4, 5] and even in the same country inequalities in stroke care exist across populations.

Although stroke patients with low socioeconomic status (SES) have an increased mortality[6-8] and poorer functional recovery,[9] the association between SES and quality of stroke care remains unclear. Recent findings from the UK suggest that lower socioeconomic status was associated with reduced odds of being admitted to hospital (stroke unit or otherwise).[10] The association was also found in other studies undertaken in high income countries.[11-13] However, other studies[14, 15] did not detect such a social gradient association. These inconsistent findings may be due to different measurements of the quality of stroke care and SES. Few studies have used levels of education, occupation and income or other SES indicators simultaneously to examine their associations with quality of stroke care. It is unknown whether there are interactions and combined effects of these SES indicators on the quality of stroke care. There is lack of data from low- and middle-income countries, where quality of stroke care is much poorer and stroke mortality is higher than these in high income countries.[5, 16, 17] The association of SES with the quality of stroke care has not been well studied. In this paper, we examined a large cohort data from China to assess the impacts of SES indicated by levels of education, occupational class and average family income per capita on quality of care in stroke patients.

METHODS

Study Participants

The study participants were derived from the China National Stroke Registry (CNSR).[18] Details of the design and baseline characteristics of the CNSR have been published previously.[18] In brief, the CNSR is a nationwide, multicenter, prospective registry study including consecutive patients with acute cerebrovascular events from 132 hospitals covering 27 provinces and 4 municipalities across China between September 2007 and August 2008. The survey included 22,216 patients with acute cerebrovascular events who aged ≥18 years and presented to hospital within 14 days after onset. After excluding patients with "undetermined" diagnosis, those transferred from other hospitals, those with missing or incomplete information at baseline and those who did not consent for participation and follow-up, 18580 patients were included in the CNSR, of which 12415 were ischemic strokes. The details of these selection is shown in Figure 1. Acute ischemic stroke was diagnosed according to the World Health Organization criteria[19] and confirmed by magnetic resonance imaging or brain computerized tomography. Etiology of ischemic stroke was classified according to the TOAST (Trial of Org 10172 in Acute Stroke Treatment) criteria.[20] The data collection of the CNSR study was approved by ethics committee at Beijing Tiantan Hospital and all centers. Written informed consent was given by all patients or his/her representatives before being entered into the study.

Baseline SES and other risk factors measurement

Data on demographics, SES, cardiovascular risk factors and other baseline information were collected through face-to-face interviews by trained interviewers (neurologists). We documented the details of educational level, occupational class and average family income in each patient.[21] Educational level was recorded to 5 groups according to the educational year: ">12 years", "10-12 years", "6-9 years", "1-5 years" and "illiteracy". Occupational class was determined as "non-manual workers", "manual workers", "no job" or "retired" based on their main job title. Income level was recorded to 6 groups according to the average family income

per capita per month (ie, the family's actual income per month is divided by the number of family members): "<¥500", "¥500-¥1000", "¥1001-¥3000", "¥3001-¥5000", "¥5001-¥10000", and ">¥10000". We recorded cardiovascular risk factors, history of diseases, stroke severity according to the National Institutes of Health Stroke Scale (NIHSS) score and pre-stroke modified Rankin Scale (mRS) scores (dichotomized to >1 and ≤1). Patients who were lack of knowledge of medical history or risk factor were clarified as "unknown". The data of teaching/non-teaching hospital and total beds of the hospital were also collected.

Quality of care

Our trained interview team used the 9 GWTG-Stroke performance measures and 2 additional evidence-based interventions (antihypertensive and antidiabetic agents at discharge)[22, 23] to document the care of stroke for each of patients with acute ischemic stroke. It includes (1) intravenous recombinant tissue plasminogen activator (IV rt-PA) in patients who arrived <2 hours after symptom onset with no contraindications; (2) antithrombotic medication within 48 hours of admission; (3) deep vein thrombosis (DVT) prophylaxis within 48 hours of admission if nonambulatory; (4) counseling or medication for smoking cessation if current smoker; (5) dysphagia screening prior to any oral intake during hospitalization; (6) rehabilitation services during hospitalization; (7) discharge on antithrombotics among those with no contraindications; (8) discharge on anticoagulants if atrial fibrillation present among those with no contraindications; (9) discharge on statins if dyslipidemia present, low-density lipoprotein (LDL) ≥100 mg/dL, or LDL not documented among those with no contraindications; (10) discharge on antihypertensive agents if hypertension present among those with no contraindications; and (11) discharge on antidiabetic agents if diabetes mellitus present among those with no contraindications.

We calculated an opportunity-based composite score to reflect the summary composite measure of quality of stroke care for each patient. The composite score was defined as the

total number of above interventions performed in each patient divided by the total number of

interventions the patient was eligible for (range 1-11).[23, 24]

Statistical Analysis

We included 12,270 ischemic stroke patients who had data of education, occupation or

income in this study (Figure 1). We defined patients with <6 years education, manual

laboring/ no job, or family income ≤¥1000 per month as having socioeconomic deprivation

(SED).[21] The national data showed that average family income per capita per month is ¥1,423

in the urban area and ¥559 in the rural area of China in 2008 and approximately half of

residents living with family income ≤¥1000 per month.[25] Thus it would be reasonable for us

to use the family income ≤¥1000 per month as SED for analysis. We divided patients into 3

groups according to the tertiles of the composite score of the quality of care and took those

who had low 2 tertiles of the score as having the poor quality of stroke care (because China

has a generally poorer quality of stroke care than those in high income countries[5, 26]). We

examined differences between patients with poor versus good quality of stroke care in

continuous variables using t test or Wilcoxon rank sum test and in categorical variables using

Chi-square test. We employed multivariate adjusted logistic regression models to compute

odds ratio (OR) and its 95% confidence intervals for receiving the poor quality of stroke care

in relation to SED. We adjusted patient's individual-level and hospital-level covariates,

including for age, gender, heavy alcohol drinking, previous stroke, pre-stroke mRS, stroke

subtype, NIHSS on admission, teaching hospital and total beds of hospital. We also created a

hospital level variable that reflected the proportion of stroke patients who were classified as

SED, and then added it to the models to control for poor performing hospitals. Apart from the

composite score, we examined each of 11 performances measured in the quality of care in

relation to SES to identify urgent specific areas for improving the quality of care after stroke.

As the 3 SES indicators in China would not be highly correlated with each other (eg, some

Chinese people were richer but had a low education), we investigated interaction effects between 2 indicators on these specific performances. We examined the combined effects from 3 indicators (scores summed up from each of SED) on the quality of stroke care and tested a social gradient trend in terms of the 3 SES indicators' cumulative impact.

Missing values for education, occupational class and income level were imputed using multiple imputation techniques. We generated 5 imputed data sets replacing each missing value with a set of plausible values, and then combined the ORs with their 95% CIs across the 5 imputations with adjustment of standard errors to account for the additional uncertainty introduced by the imputation. Missing values for other covariates were not imputed using multiple imputation approaches but treated as a separate group in the models. Multilevel approaches in logistic regression models were performed considering the clustering effect at the hospital level. Using the same approaches, we carried out a sensitivity analysis to examine complete data without imputation.

All analyses were performed with SAS software version 9.3 (SAS Institute Inc, Cary, NC).

RESULTS

Among the 12,415 patients, 145(1.2%) were excluded for not having any data of educational level, occupational class or income. The baseline characteristics of those included and excluded were well balanced (Table I in the online-only Data Supplement). In 12,270 patients, their average age was 65.5 (range 18-100), 38.2% were female. 38.6% had educational level <6 years, 37.6% were manual workers/ jobless, and 34.7% had family income ≤¥1000 per capita per month. The median composite score of the patients was 0.60 with an interquartile range of 0.40-0.80, and the tertiled score points were 0.50 and 0.71.

Table 1 shows numbers and percentages of SES variables in patients receiving good or poor quality of stroke care. Patients with the poor quality of stroke care were more likely to have low levels of SES. We also observed that they were more likely to be older and never

smoke, have atrial fibrillation and previous stroke, higher pre-stroke disability, cardio-embolism and higher NIHSS score, and hospitalize in teaching hospitals or hospitals with less total beds, but less diabetes mellitus. There were no significant differences in sex, heavy drink, hypertension, dyslipidemia and coronary heart disease between two groups of patients (Table II in the online-only Data Supplement).

Table 2 shows numbers and adjusted ORs of poor quality of stroke care in relation to each individual of 3 SED indicators. Patients with educational level of <6 years had an increased odds of receiving the poor quality of stroke care (adj.OR: 1.15, 95%CI: 1.03-1.28). This was similar in patients with manual working or no job (adj.OR: 1.16, 95%CI: 1.01-1.32), and with averaged person family income of ≦¥1000 per month (adj.OR: 1.18, 95%CI: 1.06-1.30).

We examined the association between SED and compliance with individual performance indicators of quality of stroke care, and found that patients with low education were less likely to receive DVT prophylaxis <48 hours after admission, dysphagia screening, statins and antihypertensive agents at discharge (Table 3). Patients with low occupational class were less likely to receive antithrombotic and antihypertensive agents at discharge, while those with low income were less likely to receive dysphagia screening, rehabilitation services, antithrombotic agents and statins at discharge. Rates of IV rt-PA treatment, antithrombotics <48 hours after admission, smoking cessation, antidiabetic agents and anticoagulants at discharge were similar across SES subgroups (Table 3). Possible reasons for non-treatment in each indicator were listed in Table III in the online only Supplement and only valid contraindication excluded patients from each measure according to the definition of performance measures.

Interactions and combined effects of educational level, occupational class and income on the 11 performance measurement of the quality of stroke care were showed in Table IV, Table V and Table VI in the online-only Data Supplement. Table 4 shows the combination of

3 SED indicators in relation to poor quality of care. There was a social gradient association of SED with receiving poor quality of care. Patients with a score of 2 and 3 had around 1.2- and 1.4-fold of odds to receive the poor quality of care with a trend p <0.001.

The sensitivity analyses using the complete data without SES variables imputed showed similar findings; for example in Table 2: 1.17 (1.05-1.29) in educational level of <6 years, 1.17 (1.04-1.33) in manual workers or no job, and 1.12 (1.01-1.26) in income of ≤1000 RMB, while in Table 4: 1.13 (0.98-1.30) and 1.37 (1.15-1.63) in patients with a SED score of 2 and 3, respectively.

DISCUSSION

In this large-scale national stroke registry study, we found that low levels of education, occupation and income were simultaneously associated with receiving poor quality of care in patients with ischemic stroke. There was evidence that the higher SED the patients had the lower quality of care they received.

The association of SES with the quality of stroke care has also been observed in some studies undertaken in high incomes countries. A population-based registry in Denmark reported that individuals with low SES were associated with a lower chance of receiving optimal acute stroke care.[11] Results from the Registry of the Canadian Stroke Network showed that higher income was associated with improvements in some aspects of stroke care delivery, such as stroke unit admission and referrals to secondary prevention clinics.[13] However, other studies for example from the UK and Netherlands did not show a significant association between SED and poor provision of stroke care.[14, 15, 27] This may be because these studies[14, 15, 27] had small sample sizes, only used one dimension of SES (education or occupation, respectively) and had a limited measurement of stroke care. Our CNSR study demonstrated that there were significant individual and combined effects of low level of education, occupational class and income on receiving high quality of stroke care.

China has experienced rapid economic growth since its economic reform in 1978 and has had a large increase in income inequality between the rich and poor over the past 30 years.[28] The Gini coefficient (a most commonly used measure of inequality of income or wealth; a Gini coefficient of 0 expresses perfect equality and 1 expresses maximal inequality) for family income in China was reported to have now reached a level above 0.5,[28] comparing to 0.36 in the USA and 0.358 in the UK.[29] The quality of stroke care in China is diverse across the country and on the whole poorer than that in western countries, especially for rt-PA treatment and warfarin use.[5, 26] Knowledge of existing disparities in the quality of stroke care is of importance for improving outcomes of stroke patients. Our study has shown that patients with SED have poorer quality of stroke care. The results would help target subgroups of stroke patients who would most likely benefit from interventions. We consider that general socioeconomic improvement and targeting groups with SED is likely to improve the quality of stroke care provision and then increase better outcomes of stroke. Our results may serve as a relevant reference for reducing inequality in health care, particularly in the low- and middle- income countries.

The findings of the current study may also help explain an association between SED and an increased mortality after stroke.[6-8] The possible mechanisms of SED increasing mortality could be through poorer quality of health-care provision, apart from patient's higher risk-factor prevalence and severity of stroke.[11, 30] The current study showed that patients with SED received poorer quality of some aspects of acute and secondary preventive care of stroke. These could be applied to target high risk groups of stroke patients to improve the prognosis. Patients with low educational or income level might possibly be admitted to low-level hospitals, where services fall below standards of care because of lack of awareness—for example, providing dysphagia screening before any oral intake for stroke patients. We thinkg that providers may not recommend evidence-based therapies to patients if there was

perception that the patient would not be able to pay for them, whether or not patient refusal.

Furthermore, we consider that patients with SED wereboth unaware and lacking in economic

capability to accept rehabilitation services and the evidence-based secondary preventive

interventions of stroke, e.g., statins, antithrombotic and antihypertensive agents at discharge.

Apart from reforming the current system of stroke care, including access to services, we urge

the Chinese governments to increase educational level and reduce the poverty in population

to improve the likelihood that high quality stroke care will be affordable and attainable by the

majority of Chinese citizens.

Strengths and weaknesses of the study

The strength of the current study is that the CNSR is a large scale national representative

registry study, which was used to evaluate the quality of stroke care over time and its

determinants.[18] It includes patients with a diversity of socioeconomic characteristics and

hospitals with disparities in quality of stroke care, which reflects the high level of

socioeconomic inequalities in China.[21] The unique data has helped us examine separate,

interactions and combined impacts of the 3 SES indicators on quality of stroke care. We used

multiple imputation techniques to deal with missing data. Even in a high rate of missingness

such as "income" at about 20%, the multiple imputation technique is valid.[31] Therefore, our

findings of the association between 3 SED indicators and quality of stroke care are robust.

Our study has limitations. First, the CNSR does not cover rural hospitals, and thus we could

not examine differences in the quality of stroke care between the rural and urban areas.

Previous studies showed that rural hospitals have an overall poorer quality of care than urban

hospitals.[32] Thus the associations of low quality of stroke care with SED in this study may be

under-estimated. Second, of 22,216 patients, 1437 did not consent to follow up and were

excluded for analysis. A study from the Canadian Stroke Registry suggested that excluding

those patients could improve the performance since they were more likely to be with higher

severity.[33]   However, our CNSR data had only 6.5% of patients who did not consent to follow up and thus the effects of bias on the findings would be minimized. Third, we took patients with low two-thirds of the composite score for the poor quality of care in analysis. The cut-off point is arbitrary, based on our understanding that stroke patients in China have a poorer quality of stroke care in China than those in high income countries.[5, 26] However, if we used the median score of 0.6 or below defined as having a poor quality of care for data analysis, the findings were similar to the current ones (data now shown). Fourth, there might be some stroke patients who did not search for care from hospital or died before hospitalization. Although they are estimated to be very low, these rates also could be socioeconomic patterned; those with lower level of SES may be less likely to be admitted to hospitals and receive care from the hospitals.[10] Thus, the findings of our current study could be more conservative.

CONCLUSIONS

In *conclusions*, the China nationwide stroke register study has demonstrated that low levels of education, occupation and income were significantly associated with receiving poor quality of care in patients with ischemic stroke. Continuous efforts to reduce socioeconomic deprivation are warranted to improve quality of stroke care, and thus to tackle health inequality.

Disclosures

None.

REFERENCES

1.   GBD 2013 Mortality and Causes of Death Collaborators. Global, regional, and

national age-sex specific all-cause and cause-specific mortality for 240 causes of

death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013.

Lancet. 2015;385:117-171.

2.   Krishnamurthi RV, Moran AE, Feigin VL, Barker-Collo S, Norrving B, Mensah GA,

et al. Stroke Prevalence, Mortality and Disability-Adjusted Life Years in Adults Aged

20-64 Years in 1990-2013: Data from the Global Burden of Disease 2013 Study.

Neuroepidemiology. 2015;45:190-202.

3.   Ingeman A, Pedersen L, Hundborg HH, Petersen P, Zielke S, Mainz J, et al. Quality

of care and mortality among patients with stroke: a nationwide follow-up study. *Med

Care*. 2008;46:63-69.

4.   Wiedmann S, Hillmann S, Abilleira S, Dennis M, Hermanek P, Niewada M, et al.

Variations in acute hospital stroke care and factors influencing adherence to quality

indicators in 6 European audits. *Stroke*. 2015;46:579-581.

5.   Wang Y, Liao X, Zhao X, Wang DZ, Wang C, Nguyen-Huynh MN, et al. Using

recombinant tissue plasminogen activator to treat acute ischemic stroke in China:

analysis of the results from the Chinese National Stroke Registry (CNSR). *Stroke*.

2011;42:1658-1664.

6.   Lindmark A, Glader EL, Asplund K, Norrving B, Eriksson M; Riks-Stroke

Collaboration. Socioeconomic disparities in stroke case fatality--Observations from

Riks-Stroke, the Swedish stroke register. *Int J Stroke*. 2014;9:429-436.

7.   Brown AF, Liang LJ, Vassar SD, Merkin SS, Longstreth WT Jr, Ovbiagele B, et al.

Neighborhood socioeconomic disadvantage and mortality after stroke. *Neurology*.

2013;80:520-527.

8.   Chen R, McKevitt C, Rudd AG, Wolfe CD. Socioeconomic deprivation and survival after stroke: findings from the prospective South London Stroke Register of 1995 to 2011. *Stroke*. 2014;45:217-223.

9.   Chen R, Crichton S, McKevitt C, Rudd AG, Sheldenkar A, Wolfe CD. Association between socioeconomic deprivation and functional impairment after stroke: the South London Stroke Register. *Stroke*. 2015;46:800-805.

10.   Chen R, McKevitt C, Crichton SL, Rudd AG, Wolfe CD. Socioeconomic deprivation and provision of acute and long-term care after stroke: the South London Stroke Register cohort study. *J Neurol Neurosurg Psychiatry*. 2014;85:1294-1300.

11.   Langagergaard V, Palnum KH, Mehnert F, Ingeman A, Krogh BR, Bartels P, et al. Socioeconomic differences in quality of care and clinical outcome after stroke: a nationwide population-based study. *Stroke*. 2011;42:2896-2902.

12.   Kapral MK, Wang H, Mamdani M, Tu JV. Effect of socioeconomic status on treatment and mortality after stroke. *Stroke*. 2002;33:268-273.

13.   Huang K, Khan N, Kwan A, Fang J, Yun L, Kapral MK. Socioeconomic status and care after stroke: results from the Registry of the Canadian Stroke Network. *Stroke*. 2013;44:477-482.

14.   van den Bos GA, Smits JP, Westert GP, van Straten A. Socioeconomic variations in the course of stroke: unequal health outcomes, equal care? *J Epidemiol Community Health*. 2002;56:943-948.

15.   Kerr GD, Higgins P, Walters M, Ghosh SK, Wright F, Langhorne P, et al. Socioeconomic status and transient ischaemic attack/stroke: a prospective observational study. *Cerebrovasc Dis*. 2011;31:130-137.

16. Feigin VL, Mensah GA, Norrving B, Murray CJ, Roth GA; GBD 2013 Stroke Panel Experts Group. Atlas of the Global Burden of Stroke (1990-2013): The GBD 2013 Study. *Neuroepidemiology*. 2015;45:230-236.

17. Zhou M, Wang H, Zhu J, Chen W, Wang L, Liu S, et al. Cause-specific mortality for 240 causes in China during 1990-2013: a systematic subnational analysis for the Global Burden of Disease Study 2013. *Lancet*. 2016;387:251-272.

18. Wang Y, Cui L, Ji X, Dong Q, Zeng J, Wang Y, et al. The China National Stroke Registry for patients with acute cerebrovascular events: design, rationale, and baseline patient characteristics. *Int J Stroke*. 2011;6:355-361.

19. Stroke--1989. Recommendations on stroke prevention, diagnosis, and therapy. Report of the WHO Task Force on Stroke and other Cerebrovascular Disorders. *Stroke*. 1989;20:1407-1431.

20. Adams HP Jr, Bendixen BH, Kappelle LJ, Biller J, Love BB, Gordon DL, et al. Classification of subtype of acute ischemic stroke. Definitions for use in a multicenter clinical trial. TOAST. Trial of Org 10172 in Acute Stroke Treatment. *Stroke*. 1993;24:35-41.

21. Chen R, Hu Z, Chen RL, Zhang D, Xu L, Wang J, et al. Socioeconomic deprivation and survival after stroke in China: a systematic literature review and a new population-based cohort study. *BMJ open*. 2015;5:e005688

22. Fonarow GC, Reeves MJ, Smith EE, Saver JL, Zhao X, Olson DW, et al. Characteristics, performance measures, and in-hospital outcomes of the first one million stroke and transient ischemic attack admissions in get with the guidelines-stroke. *Circ Cardiovasc Qual Outcomes*. 2010;3:291-302.

23.   Reeves MJ, Gargano J, Maier KS, Broderick JP, Frankel M, LaBresh KA, et al.

Patient-level and hospital-level determinants of the quality of acute stroke care: a

multilevel modeling approach. *Stroke*. 2010;41:2924-2931.

24.   Peterson ED, Delong ER, Masoudi FA, O'Brien SM, Peterson PN, Rumsfeld JS, et al.

ACCF/AHA 2010 Position Statement on Composite Measures for Healthcare

Performance Assessment: a report of the American College of Cardiology

Foundation/American Heart Association Task Force on Performance Measures

(Writing Committee to develop a position statement on composite measures).

Circulation. 2010;121:1780-1791.

25.   Ministry of health of the people's republic of China. China health statistics yearbook

2009. Peking Union Medical College Press. Beijing (2009) (in Chinese).

26.   Yang X, Li Z, Zhao X, Wang C, Liu L, Wang C, et al. Use of Warfarin at Discharge

Among Acute Ischemic Stroke Patients With Nonvalvular Atrial Fibrillation in China.

Stroke. 2016;47:464-470.

27.   McKevitt C, Coshall C, Tilling K, Wolfe C. Are there inequalities in the provision of

stroke care? Analysis of an inner-city stroke register. *Stroke*. 2005;36:315-320.

28.   Xie Y, Zhou X. Income inequality in today's China. *Proc Natl Acad Sci U S A*.

2014;111:6928-6933.

29.   Ortiz I, Cummins M; UNICEF (April 2011). "Global Inequality: Beyond the Bottom

Billion". Website:

http://www.unicef.org/socialpolicy/files/global_inequality_revised_-_5_july.pdf.

[Accessed on April 13, 2016].

30.   Addo J, Ayerbe L, Mohan KM, Crichton S, Sheldenkar A, Chen R, et al.

Socioeconomic status and stroke: an updated review. *Stroke*. 2012;43:1186-1191.

31.   Rubin, DB. *Multiple Imputation for Nonresponse in Surveys*. New York, NY: John

       Wiley & Sons; 1987:114.

32.   Shultis W, Graff R, Chamie C, Hart C, Louangketh P, McNamara M, et al. Striking

       rural-urban disparities observed in acute stroke care capacity and services in the

       pacific northwest: implications and recommendations. *Stroke*. 2010;41:2278-2282.

33.   Tu JV, Willison DJ, Silver FL, Fang J, Richards JA, Laupacis A, et al.

       Impracticability of informed consent in the Registry of the Canadian Stroke Network.

       N Engl J Med. 2004;350:1414-1421.

FIGURE LEGENDS

Figure 1. Patient flow diagram.

TABLES

Table 1. Socioeconomic status and quality of acute stroke care in the China National Stroke Registry

Socioeconomic status	Total, (%) (N=12270)	Quality of acute stroke care		p value
		Good quality of care (N=4208)	Poor quality of care (N=8062)	
Educational level (years), n(%)				
>12	1180(9.6)	435(10.3)	745(9.2)	<0.001
10-12	2248(18.3)	816(19.4)	1432(17.8)	
6-9	2922(23.8)	1074(25.5)	1848(22.9)	
1-5	3061(25.0)	1023(24.3)	2038(25.3)	
Illiteracy	1666(13.6)	471(11.2)	1195(14.8)	
Unknown	1193(9.7)	389(9.2)	804(10.0)	
Occupational class, n(%)				
Non-manual workers	1972(16.1)	744(17.7)	1228(15.2)	<0.001
Manual workers	3308(27.0)	1031(24.5)	2277(28.2)	
No job	1303(10.6)	402(9.5)	901(11.2)	
Retired	5244(42.7)	1868(44.4)	3376(41.9)	
Unknown	443(3.6)	163(3.9)	280(3.5)	
Personal income (RMB/month), n(%)				
>10000	21(0.2)	10(0.2)	11(0.1)	<0.001
5001-10000	140(1.1)	74(1.8)	66(0.8)	
3001-5000	665(5.4)	288(6.8)	377(4.7)	
1001-3000	4160(33.9)	1663(39.5)	2497(31.0)	
500-1000	2852(23.2)	1020(24.2)	1832(22.7)	
<500	1407(11.5)	424(10.1)	983(12.2)	
Unknown	3025(24.7)	729(17.3)	2296(28.5)	

Table 2. Number and adjusted OR of poor quality of stroke care

Socioeconomic status	Nos of patients with poor quality of care/ total patients (%)	Adj.OR[†] (95% CI)	p value
Educational level (Years)			
≥6	4468/7009(63.7)	1	
<6	3594/5261(68.3)	1.15(1.03- 1.28)	0.01
Occupational class			
Non-manual workers	1278/2047(62.4)	1	
Manual workers or no job*	3282/4779(68.7)	1.16(1.01-1.32)	0.03
Retired	3502/5444(64.3)	1.05(0.91-1.20)	0.50
Income level (RMB/month)			
>1000	4005/6447(62.1)	1	
≤1000	4057/5823(69.7)	1.18(1.06-1.30)	0.002

CI indicates confidence interval; OR, odds ratio.

* Manual workers: 2351/3430(68.5%), OR=1.16 (95%CI: 1.01-1.33), p=0.04; and in patients with no job: 931/1349(69.0%), OR=1.16 (95%CI: 0.97-1.38), p=0.10.

[†] MI, multilevel modeling, adjusted for age, gender, heavy alcohol drinking, previous stroke, pre-stroke mRS, stroke subtype, NIHSS on admission, teaching hospital, total beds of hospital and a hospital level variable reflecting the proportion of patients classified as socioeconomic deprivation.

Table 3. Overall compliance with individual performance indicators among patients with ischemic stroke

Quality of care – performance measures		Educational Level (Years)		Occupational class			Income Level (RMB/month)	
		≥6	<6	Non-manual workers	Manual workers or no job	Retired	>1000	≤1000
IV rt-PA treatment	% (N Eligible)	13.6(447)	8.7(266)	14.6(132)	8.4(206)	12.7(375)	13.5(434)	9.0(279)
	OR(95% CI)*	1	0.57(0.26-1.27)	1	0.56(0.22-1.40)	1.19(0.54-2.63)	1	0.71(0.28-1.78)
Antithrombotics <48 hours	% (N Eligible)	83.7(6739)	82.7(5042)	84.1(1973)	84.8(4584)	81.6(5224)	84.0(6189)	82.5(5592)
	OR(95% CI)*	1	0.97(0.86-1.10)	1	1.02(0.86-1.21)	0.99(0.83-1.18)	1	0.91(0.80-1.04)
DVT prophylaxis <48 hours	% (N Eligible)	65.7(2245)	62.2(2133)	60.6(572)	62.4(1841)	66.5(1965)	65.3(2294)	62.5(2084)
	OR(95% CI)*	1	0.83(0.70-0.99)	1	0.95(0.75-1.21)	1.15(0.90-1.47)	1	0.94(0.75-1.17)
Smoking cessation	% (N Eligible)	73.0(2281)	66.0(1003)	73.3(767)	70.1(1368)	70.2(1149)	71.7(1713)	70.0(1571)
	OR(95% CI)*	1	0.96(0.73-1.24)	1	0.98(0.75-1.28)	0.96(0.71-1.29)	1	0.97(0.78-1.20)
Dysphagia screening	% (N Eligible)	39.6(6520)	37.1(4746)	37.1(1926)	34.7(4355)	42.5(4985)	43.7(5937)	32.8(5329)
	OR(95% CI)*	1	0.85(0.74-0.98)	1	1.01(0.86-1.18)	1.04(0.88-1.23)	1	0.76(0.67-0.86)
Rehabilitation services	% (N Eligible)	48.6(7009)	48.2(5261)	48.2(2047)	45.4(4779)	51.2(5444)	52.3(6447)	44.1(5823)
	OR(95% CI)*	1	1.00(0.90-1.10)	1	0.98(0.86-1.12)	1.06(0.93-1.21)	1	0.83(0.75-0.92)
Discharged on antithrombotics	% (N Eligible)	71.2(6927)	67.9(5163)	75.0(2033)	70.6(4723)	67.1(5334)	71.8(6336)	67.6(5754)
	OR(95% CI)*	1	0.96(0.86-1.08)	1	0.86(0.75-1.00)	0.95(0.81-1.11)	1	0.88(0.79-0.99)

Discharged on anticoagulants	% (N Eligible)	25.6(371)	24.7(345)	28.6(83)	25.9(246)	23.9(387)	25.6(417)	24.5(299)
	OR(95% CI)*	1	1.28(0.81-2.01)	1	1.14(0.57-2.26)	1.44(0.73-2.85)	1	0.77(0.44-1.36)
Discharged on statins	% (N Eligible)	33.6(2413)	29.4(1949)	36.1(665)	31.4(1803)	30.6(1894)	33.7(2278)	29.6(2084)
	OR(95% CI)*	1	0.79(0.66-0.96)	1	0.80(0.63-1.02)	0.93(0.73-1.18)	1	0.84(0.71-0.99)
Discharged on antihypertensive agents	% (N Eligible)	53.7(4987)	49.6(3727)	56.9(1443)	50.8(3148)	51.1(4123)	53.9(4726)	49.6(3988)
	OR(95% CI)*	1	0.87(0.77-0.98)	1	0.85(0.73-0.98)	0.95(0.82-1.11)	1	0.94(0.83-1.05)
Discharged on antidiabetic agents	% (N Eligible)	61.6(1945)	59.3(1379)	65.2(574)	60.4(1077)	59.2(1673)	61.8(1878)	59.2(1446)
	OR(95% CI)*	1	1.19(0.98-1.44)	1	1.00(0.78-1.29)	0.96(0.75-1.23)	1	1.04(0.81-1.35)
Composite score mean (SD)		0.58(0.26)	0.55(0.26)	0.59(0.25)	0.56(0.25)	0.57(0.27)	0.60(0.25)	0.54(0.27)

CI indicates confidence interval; OR, odds ratio; IV rt-PA, intravenous recombinant tissue plasminogen activator; DVT, deep vein thrombosis; SD, Standard Deviation.

* The same model and adjustment in Table 2.

Table 4. Number and adjusted OR of poor quality of stroke care in relation to SED combinations in patients with stroke

Total score of SED combined[*]	Nos of poor quality of care/ patients (%)	Adj.OR[†] (95% CI)	p value
0	1995/3328(59.9)	Ref.	
1	2537/3879(65.4)	1.07(0.95- 1.21)	0.25
2	2193/3204(68.4)	1.17(1.03- 1.33)	0.02
3	1337/1859(71.9)	1.39(1.19- 1.63)	<0.001

CI indicates confidence interval; OR, odds ratio; SED, socioeconomic deprivation.

[*] Added scores from each of low levels of educational years <6 (1 score), manual workers or no jobs (1 score) and income ≤1000 RMB (1 score).

[†] The same model and adjustment in Table 2.

SUPPLEMENTAL MATERIAL

Table I. Comparison of baseline characteristics of the included and excluded groups

Characteristics	The included group (N=12270)	The excluded group (N=145)	p value
<u>**Socio-demography**</u>			
Age (year), mean(SD)	65.5±12.3	65.1±12.6	0.46
Sex, n(%)			
Men	7583(61.8)	75(51.7)	0.01
Women	4687(38.2)	70(48.3)	
<u>**Medical history**</u>			
Hypertension, n(%)			
No	4339(35.4)	57(39.3)	0.16
Yes	7714(62.9)	83(57.2)	
Unknown	217(1.8)	5(3.5)	
Diabetes mellitus, n(%)			
No	9405(76.7)	106(73.1)	0.41
Yes	2607(21.2)	34(23.4)	
Unknown	258(2.1)	5(3.5)	
Dyslipidemia, n(%)			
No	8296(67.6)	102(70.3)	0.25
Yes	1380(11.3)	10(6.9)	
Unknown	2594(21.1)	33(22.8)	
Coronary heart disease, n(%)			
No	10503(85.6)	120(82.8)	0.33
Yes	1767(14.4)	25(17.2)	
Atrial fibrillation, n(%)			
No	10958(89.3)	131(90.3)	0.69
Yes	1312(10.7)	14(9.7)	
<u>**Stroke case, severity and acute care**</u>			
Previous stroke, n(%)			
No	8083(65.9)	98(67.6)	0.67
Yes	4187(34.1)	47(32.4)	
Subtype of stroke[*], n(%)			
Large-artery atherosclerosis	5507(44.9)	80(55.2)	0.12
Small-vessel occlusion	2066(16.8)	24(16.6)	
Cardioembolism	756(6.2)	7(4.8)	
Other or undetermined	453(3.7)	5(3.5)	
Unknown	3488(28.4)	29(20.0)	
NIHSS on admission, median(IQR)	4(2-9)	5(2-10)	0.67

SD indicates Standard Deviation; IQR, Interquartile Range; mRS, modified Rankin Scale; NIHSS, National Institutes of Health Stroke Scale.

* Stroke subtype was defined by the Trial of Org 10172 in Acute Stroke Treatment (TOAST) classification.

Table II. Characteristics of ischemic stroke patients and quality of acute stroke care in the China National Stroke Registry

Variable	Total, (%) (N=12270)	Quality of acute stroke care		p value
		Good quality of care (N=4208)	Poor quality of care (N=8062)	
Socio-demography				
Age (year), mean(SD)	65.5±12.3	65.1±12.0	65.6±12.5	0.01
Sex, n(%)				
Men	7583(61.8)	2640(62.7)	4943(61.3)	0.12
Women	4687(38.2)	1568(37.3)	3119(38.7)	
Medical history and risk factors				
Smoking status, n(%)				
Never-smoking	7060(57.5)	2337(55.5)	4723(58.6)	<0.001
Former-smoking	1610(13.1)	557(13.2)	1053(13.1)	
Current smoking	3284(26.8)	1225(29.1)	2059(25.5)	
Unknown	316(2.6)	89(2.1)	227(2.8)	
Heavy drink, n(%)				
No	10763(87.7)	3678(87.4)	7085(87.9)	0.19
Yes	1316(10.7)	473(11.2)	843(10.5)	
Unknown	191(1.6)	57(1.4)	134(1.7)	
Hypertension, n(%)				
No	4339(35.4)	1464(34.8)	2875(35.7)	0.33
Yes	7714(62.9)	2661(63.2)	5053(62.7)	
Unknown	217(1.8)	83(2.0)	134(1.7)	
Diabetes mellitus, n(%)				
No	9405(76.7)	3125(74.3)	6280(77.9)	<0.001
Yes	2607(21.2)	985(23.4)	1622(20.1)	
Unknown	258(2.1)	98(2.3)	160(2.0)	
Dyslipidemia, n(%)				
No	8296(67.6)	2817(66.9)	5479(68.0)	0.45
Yes	1380(11.3)	491(11.7)	889(11.0)	
Unknown	2594(21.1)	900(21.4)	1694(21.0)	
Coronary heart disease, n(%)				
No	10503(85.6)	3619(86.0)	6884(85.4)	0.36
Yes	1767(14.4)	589(14.0)	1178(14.6)	
Atrial fibrillation, n(%)				
No	10958(89.3)	3841(91.3)	7117(88.3)	<0.001
Yes	1312(10.7)	367(8.7)	945(11.7)	
Stroke case, severity and acute care				
Previous stroke, n(%)				
No	8083(65.9)	2831(67.3)	5252(65.1)	0.02
Yes	4187(34.1)	1377(32.7)	2810(34.9)	
Pre-stroke mRS >1, n(%)				
No	10952(89.3)	3800(90.3)	7152(88.7)	0.03
Yes	1158(9.4)	359(8.5)	799(9.9)	
Unknown	160(1.3)	49(1.2)	111(1.4)	
Subtype of stroke [*], n(%)				
Large-artery atherosclerosis	5507(44.9)	2185(51.9)	3322(41.2)	<0.001

Small-vessel occlusion	2066(16.8)	902(21.4)	1164(14.4)	
Cardioembolism	756(6.2)	242(5.8)	514(6.4)	
Other or undetermined	453(3.7)	149(3.5)	304(3.8)	
Unknown	3488(28.4)	730(17.4)	2758(34.2)	
NIHSS on admission, median(IQR)	4(2-9)	4(2-8)	5(2-10)	0.004
Teaching hospital, n(%)				
No	5458(44.5)	1934(46.0)	3524(43.7)	0.02
Yes	6812(55.5)	2274(54.0)	4538(56.3)	
Total beds of hospital, median(IQR)	1026(700-1400)	1100(700-1600)	1000(700-1400)	<0.001

SD indicates Standard Deviation; IQR, Interquartile Range; mRS, modified Rankin Scale;
NIHSS, National Institutes of Health Stroke Scale.
* Stroke subtype was defined by the Trial of Org 10172 in Acute Stroke Treatment (TOAST)
classification.

Table III. Possible reasons for non-treatment in each indicator

Quality of care – performance measures	Possible reasons
IV rt-PA treatment	Contraindications of IV t-PA (such as active internal bleeding, systolic blood pressure > 185 mmHg or diastolic blood pressure > 110 mmHg despite treatment, seizure at onset, recent surgery/trauma (within 15 days), history of intracranial hemorrhage or brain aneurysm or vascular malformation or brain tumor, et al) Patient/Family refused for economic reason Patient/Family refused for risk of bleeding IV t-PA was not available in this hospital Didn't know patient needed to be treated Others
Antithrombotics <48 hours	Didn't know patient needed to be treated Contraindications of antithrombotics (such as allergic, serious side effect of antithrombotic agents, concomitant diseases that cannot use antithrombotic agents, high risk for bleeding or discontinued due to bleeding, et al) Patient/Family refused Others
DVT prophylaxis <48 hours	Didn't know patient needed to be treated Contraindications of anticoagulants (such as allergic, serious side effect of anticoagulant agents, concomitant diseases that cannot use anticoagulant agents, high risk for bleeding or discontinued due to bleeding, et al) Contraindications of thrombosis pump Patient/Family refused Physician didn't know how to do Others
Smoking cessation	Didn't know patient needed to be treated Patient's condition not allowed Patient/Family refused Others
Dysphagia screening	Didn't know patient needed to be treated Didn't know how to evaluate it Symptom resolution Fasting Can't be evaluated due to coma Others
Rehabilitation services	No facilities No personnel Didn't know patient needed to be treated No permission due to patient's condition

	Patient/Family refused Others
Discharged on antithrombotics	Didn't know patient needed to be treated Contraindications of antithrombotics (such as allergic, serious side effect of antithrombotic agents, concomitant diseases that cannot use antithrombotic agents, high risk for bleeding or discontinued due to bleeding, et al) Patient/Family refused Terminal illness/palliative care only Allergy Others
Discharged on anticoagulants	Didn't know patient needed to be treated Didn't know how to do Contraindications to anticoagulants (such as allergic, serious side effect of anticoagulant agents, concomitant diseases that cannot use anticoagulant agents, high risk for bleeding or discontinued due to bleeding, et al) Risk of bleeding Risk of falls Liver disease Terminal illness/palliative care only Patient/Family refused Others
Discharged on statins	Contraindications to lipid-lowering treatment (such as allergic, serious side effect of lipid-lowering agents, concomitant diseases that cannot use lipid-lowering agents, et al) Didn't know patient needed to be treated Patient/Family refused Others
Discharged on antihypertensive agents	Contraindications to antihypertensive treatment (such as allergic, serious side effect of antihypertensive agents, concomitant diseases that cannot use antihypertensive agents, et al) Didn't know patient needed to be treated Patient/Family refused Others
Discharged on antidiabetic agents	Contraindications to antidiabetic treatment (such as allergic, serious side effect of antidiabetic agents, concomitant diseases that cannot use antidiabetic agents, et al) Didn't know patient needed to be treated Patient/Family refused Others

Table IV. Overall compliance with individual performance indicators among patients with levels of education and income combined

Quality of care – performance measures	High education and high income[*]		High education and low income		Low education and high income		Low education and low income	
	% (N Eligible)	Ref	% (N Eligible)	OR(95% CI)[†]	% (N Eligible)	OR(95% CI)[†]	% (N Eligible)	OR(95% CI)[†]
IV rt-PA treatment	15.2(302)	Ref	10.3(145)	0.78(0.29-2.14)	9.7(132)	0.62(0.26-1.50)	7.6(134)	0.46(0.13-1.62)
Antithrombotics <48 hours	84.9(3996)	Ref	82.0(2743)	0.88(0.75-1.03)	82.4(2193)	0.94(0.78-1.13)	82.9(2849)	0.90(0.77-1.06)
DVT prophylaxis <48 hours	67.5(1357)	Ref	62.9(889)	0.96(0.70-1.30)	62.2(937)	0.83(0.66-1.05)	62.2(1195)	0.80(0.62-1.03)
Smoking cessation	74.4(1300)	Ref	71.1(981)	1.01(0.79-1.30)	62.9(413)	1.04(0.69-1.57)	68.2(590)	0.90(0.65-1.25)
Dysphagia screening	44.7(3869)	Ref	32.2(2651)	0.78(0.66-0.93)	41.9(2068)	0.89(0.74-1.08)	33.4(2678)	0.68(0.57-0.81)
Rehabilitation services	51.8(4154)	Ref	43.9(2856)	0.86(0.74-0.99)	53.1(2293)	1.07(0.92-1.24)	44.4(2967)	0.84(0.73-0.96)
Discharged on antithrombotics	72.9(4096)	Ref	68.7(2831)	0.93(0.79-1.10)	69.8(2240)	1.04(0.88-1.25)	66.5(2923)	0.86(0.75-0.99)
Discharged on anticoagulants	24.3(242)	Ref	27.9(129)	1.00(0.43-2.30)	27.4(175)	1.72(0.93-3.17)	21.9(170)	0.94(0.48-1.86)
Discharged on statins	34.4(1433)	Ref	32.4(980)	0.97(0.76-1.23)	32.5(845)	0.92(0.72-1.18)	27.1(1104)	0.68(0.54-0.86)
Discharged on antihypertensive agents	55.5(3024)	Ref	50.9(1962)	0.98(0.84-1.14)	51.1(1702)	0.91(0.77-1.07)	48.4(2025)	0.83(0.72-0.96)
Discharged on antidiabetic agents	63.2(1214)	Ref	59.0(731)	1.02(0.75-1.39)	59.2(664)	1.18(0.91-1.53)	59.4(715)	1.22(0.90-1.65)
Composite score mean (SD)	0.61(0.25)		0.55(0.27)		0.58(0.26)		0.54(0.26)	

CI indicates confidence interval; OR, odds ratio; IV rt-PA, intravenous recombinant tissue plasminogen activator; DVT, deep vein thrombosis; SD, Standard Deviation.

[*] High education: ≥6 years; high income: >1000 RMB/month; low education: <6 years; low income: ≤1000 RMB/month.

[†] The same model and adjustment in Table 2.

Table V. Overall compliance with individual performance indicators among patients with levels of education and occupation combined

Quality of care – performance measures	High education and high occupation[*]		High education and low occupation		Low education and high occupation		Low education and low occupation	
	% (N Eligible)	Ref	% (N Eligible)	OR(95% CI)[†]	% (N Eligible)	OR(95% CI)[†]	% (N Eligible)	OR(95% CI)[†]
IV rt-PA treatment	15.5(119)	Ref	10.8(94)	0.60(0.21-1.69)	6.0(13)	0.14(0.00-124.3)	6.3(112)	0.35(0.10-1.19)
Antithrombotics <48 hours	84.2(1693)	Ref	85.5(1881)	1.04(0.84-1.29)	83.1(281)	0.88(0.57-1.39)	84.3(2703)	0.97(0.79-1.19)
DVT prophylaxis <48 hours	61.2(469)	Ref	63.6(649)	1.05(0.78-1.39)	58.2(103)	0.97(0.57-1.64)	61.7(1193)	0.86(0.65-1.15)
Smoking cessation	73.5(690)	Ref	73.9(804)	1.07(0.78-1.46)	70.7(77)	1.17(0.59-2.32)	64.7(563)	0.90(0.63-1.28)
Dysphagia screening	38.1(1650)	Ref	34.9(1809)	1.02(0.84-1.24)	30.9(276)	0.72(0.49-1.03)	34.5(2546)	0.89(0.73-1.07)
Rehabilitation services	48.3(1755)	Ref	45.1(1954)	0.95(0.82-1.12)	47.3(293)	0.96(0.68-1.35)	45.6(2825)	1.00(0.85-1.18)
Discharged on antithrombotics	75.7(1742)	Ref	72.2(1940)	0.88(0.74-1.06)	70.8(291)	0.91(0.63-1.31)	69.5(2783)	0.82(0.68-0.98)
Discharged on anticoagulants	27.3(71)	Ref	33.5(77)	1.40(0.57-3.47)	36.8(11)	2.41(0.40-14.42)	22.4(169)	1.24(0.56-2.78)
Discharged on statins	36.8(569)	Ref	34.4(713)	0.88(0.65-1.20)	31.8(96)	0.70(0.40-1.22)	29.3(1090)	0.66(0.49-0.88)
Discharged on antihypertensive agents	56.4(1234)	Ref	52.1(1241)	0.91(0.75-1.10)	59.8(209)	1.19(0.83-1.70)	49.9(1906)	0.81(0.68-0.98)
Discharged on antidiabetic agents	65.2(483)	Ref	61.5(429)	0.97(0.71-1.33)	65.1(91)	1.36(0.76-2.45)	59.7(648)	1.17(0.86-1.61)
Composite score mean (SD)	0.60(0.25)		0.58(0.25)		0.57(0.25)		0.55(0.25)	

CI indicates confidence interval; OR, odds ratio; IV rt-PA, intravenous recombinant tissue plasminogen activator; DVT, deep vein thrombosis; SD, Standard Deviation.

[*] High education: ≥6 years; high occupation: non-manual workers; low education: <6 years; low occupation: manual workers or no jobs.

[†] The same model and adjustment in Table 2.

Table VI. Overall compliance with individual performance indicators among patients with levels of income and occupation combined

Quality of care – performance measures	High income and high occupation[*]		High income and low occupation		Low income and high occupation		Low income and low occupation	
	% (N Eligible)	Ref	% (N Eligible)	OR(95% CI)[†]	% (N Eligible)	OR(95% CI)[†]	% (N Eligible)	OR(95% CI)[†]
IV rt-PA treatment	12.6(89)	Ref	13.5(95)	1.21(0.31-4.70)	18.6(43)	1.90(0.39-9.32)	4.0(111)	0.31(0.08-1.23)
Antithrombotics <48 hours	85.6(1239)	Ref	84.0(1723)	0.93(0.72-1.19)	81.5(734)	0.82(0.63-1.08)	85.2(2861)	0.96(0.77-1.19)
DVT prophylaxis <48 hours	61.6(361)	Ref	62.5(664)	0.90(0.65-1.24)	59.0(211)	0.83(0.50-1.40)	62.3(1177)	0.89(0.64-1.24)
Smoking cessation	75.3(486)	Ref	68.6(545)	0.93(0.63-1.38)	69.8(281)	0.87(0.56-1.34)	71.1(822)	0.93(0.65-1.33)
Dysphagia screening	41.3(1207)	Ref	40.6(1635)	1.03(0.83-1.28)	30.0(719)	0.67(0.52-0.87)	31.1(2720)	0.77(0.63-0.94)
Rehabilitation services	50.9(1288)	Ref	48.9(1792)	0.97(0.81-1.17)	43.6(760)	0.83(0.65-1.07)	43.3(2987)	0.88(0.73-1.07)
Discharged on antithrombotics	76.5(1278)	Ref	73.1(1767)	0.95(0.78-1.15)	72.4(755)	0.96(0.75-1.23)	69.1(2955)	0.78(0.64-0.94)
Discharged on anticoagulants	25.3(53)	Ref	25.2(104)	1.42(0.54-3.74)	34.5(30)	1.17(0.35-3.88)	26.4(142)	1.07(0.44-2.59)
Discharged on statins	37.3(430)	Ref	34.5(675)	0.89(0.65-1.21)	33.9(235)	0.85(0.56-1.28)	29.5(1128)	0.68(0.49-0.95)
Discharged on antihypertensive agents	67.6(904)	Ref	51.9(1223)	0.87(0.71-1.07)	55.7(540)	1.04(0.80-1.35)	50.0(1925)	0.84(0.68-1.02)
Discharged on antidiabetic agents	64.5(370)	Ref	61.9(458)	1.12(0.78-1.61)	66.6(204)	1.26(0.79-1.99)	59.3(619)	1.07(0.76-1.51)
Composite score mean (SD)	0.61(0.24)		0.58(0.25)		0.56(0.26)		0.55(0.25)	

CI indicates confidence interval; OR, odds ratio; IV rt-PA, intravenous recombinant tissue plasminogen activator; DVT, deep vein thrombosis; SD, Standard Deviation.

[*] High income: >1000 RMB/month; high occupation: non-manual workers; low income: ≤1000 RMB/month; low occupation: manual workers or no jobs.

[†] The same model and adjustment in Table 2.