

Regional Variations in In-hospital Mortality, Care Processes, and Spending in Acute Ischemic Stroke Patients in Japan

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Background: Little is known about the regional variations in ischemic stroke care in Japan. This study investigates the regional variations and associations among outcomes, care processes, spending, and physician workforce availability in acute ischemic stroke care. *Methods:* Using administrative claims data from National Claims Database, we identified National Health Insurance beneficiaries aged 65 years and older and Long Life Medical Care System beneficiaries from 9 prefectures who had been hospitalized for acute ischemic stroke between April 2010 and March 2012. Patients were grouped according to their subprefectural regions of residence known as secondary medical areas (SMAs). Performances in 8 outcome and process of care measures were analyzed in each SMA. Multilevel regression models with 2 levels (patient and regional) were used to analyze age- and sex-adjusted in-hospital mortality, hospitalization spending, and tissue plasminogen activator (tPA) utilization rate. The associations between regional supply of physicians for stroke care and the various quality measures were investigated. *Results:* We analyzed 49,440 acute ischemic stroke patients. The regional variations among SMAs in in-hospital mortality, spending, and tPA utilization were 3.2-, 1.7-, and 5.9-fold, respectively. Higher physician supply was significantly associated with lower in-hospital mortality and higher spending. Additionally, spending had a significantly negative correlation with regional continuity of care planning rate but a significantly positive correlation with rehabilitation rate. *Conclusions:* The study revealed substantial regional variations in Japanese ischemic stroke care. Improving the allocative efficiency of physicians and establishing continuity of care networks may be useful in mitigating regional disparities and reconstructing the stroke care system. **Key words:** Ischemic stroke—acute care—regional variation—indicator—claims data.

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Introduction

Understanding geographic variations in stroke care is an important step in improving the provision of care as

this can help to increase clinical, political, and public awareness of unwarranted variations.¹ Analyses of regional variations have, particularly in the United States, contributed to a clearer understanding of the disparities

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in stroke incidence, care processes, and clinically important outcomes.¹⁻⁶ However, a systematic review of the existing literature has shown that the most regional variation analyses for cardiovascular diseases (including stroke) have been conducted in the United States, United Kingdom, and Canada.⁷ Although regional variations studies have been conducted in Japan, these tend to focus on regions within a single prefecture.⁸

As with other developed countries, the enhancement of the stroke care delivery system is regarded as one of the most important health policy issues in Japan. The push to improve equality in the stroke care system not only stems from the national government but also from the various local governments. The Medical Care Plan is a roadmap concerned with regional health care policy in Japan, and it emphasizes care for 5 diseases (stroke, acute myocardial infarction, cancer, diabetes, and psychiatric diseases) and 5 areas of medicine (emergency medicine, pediatric medicine, perinatal medicine, disaster medicine, and rural medicine).⁹ Each prefectural government has a mandatory role in reviewing and modifying the plan as required every 5 years under the provision of the Medical Care Act.⁹ Based on this plan, governments are obligated to support the various stakeholders in

improving stroke care system performance, but resources such as the number of neurologists have been shown to be relatively low.¹⁰

Epidemiologic studies have been extensively conducted on ischemic stroke in Japan through the Hisayama Study, a population-based prospective cohort study, the Japan Standard Stroke Registry Study, the Fukuoka Stroke Registry Study, the Stroke Acute Management with Urgent Risk-factor Assessment and Improvement, and the Japan Multicenter Stroke Investigators' Collaboration.¹¹ These studies report that stroke incidence and mortality rates have declined steeply in Japan¹² but noted that it remains a leading cause of long-term disability and that the associated medical expenditures are increasing.¹³

Such epidemiologic findings may be a core source of information for evidence-informed health policy. However, little is known about the regional variations in stroke care. One reason for this current lack of information is that the integrated information infrastructure for the utilization of health care data in Japan is still incipient. To address this shortcoming, the Ministry of Health, Labour and Welfare (MHLW) has made recent efforts to establish a national-level health care data management system for secondary use of administrative claims data, and these efforts have

Table 1. Characteristics of the acute ischemic stroke patient cohort and study area

Variables		Fiscal Year	Reference
Patient characteristics		2010–2011	Study database
No. of ischemic stroke inpatients	49,440		
Age (%)			
65–69 y	11.5		
70–74 y	16.2		
75–79 y	22.6		
80–84 y	22.5		
85 y and over	27.2		
Female (%)	47.3		
Admission characteristics (%)			
DPC/PDPS–implemented hospital	72.7		
Teaching hospital	62.4		
Crossed secondary medical area boundaries to obtain care	15.0		
Demographic information of the study area			
No. of total population	23,311,155	2010	—*
No. of people aged 65 y and older	5,272,249	2010	—*
NHI or LLMCS beneficiaries aged 65 y and older	4,519,857	2010	—†
Total area (km ²)	37,305	2010	—‡
Inhabitable area (km ²)	11,562	2010	—‡
No. of secondary medical areas	51	2010	—§
Physician supply in study area			
No. of neurologists, neurosurgeons, and cardiologists	4,334	2010	—§

Abbreviations: DPC/PDPS, Diagnosis Procedure Combination/Per Diem Payment System; LLMCS, Long Life Medical Care System; NHI, National Health Insurance.

*Ministry of Internal Affairs and Communications (Population, demographics, and the number of households from Basic Resident Register, 2010).

†Ministry of Health, Labour and Welfare (Survey on National Health Insurance, 2010).

‡Ministry of Internal Affairs and Communications (Statistical observations of shi, ku, machi, mura, 2012).

§Ministry of Health, Labour and Welfare (Survey of Physicians, Dentists, and Pharmacists, 2010).

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