

全民健保資料庫於醫療品質 的研究

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Outlines



- **Associations of physician volume and weekend admissions with ischemic stroke outcome in Taiwan: a nationwide population-based study (*Medical Care* 2009; 47, 1018-1025)**
- **The effect of cuts in reimbursement on stroke outcome: a nationwide population-based study during the period 1998 to 2007 (*Stroke* 2010; 41, 504-509)**

Associations of Physician Volume and Weekend Admissions With Ischemic Stroke Outcome in Taiwan

A Nationwide Population-Based Study

Yu-Chi Tung, PhD, Guann-Ming Chang, MD, MS,† and Yi-Haw Chen, PhD‡*

Background: Although volume-outcome and weekend-outcome relationships have been explored for various procedures and interventions, limited information is available concerning “physician volume” and the “weekend effect” on stroke mortality. Moreover, little is known about the relative and combined influence of physician and hospital volume on stroke mortality.

Objectives: We used nationwide population-based data to explore the influences of physician volume and weekend admissions on stroke mortality.

Methods: We analyzed all 34347 ischemic stroke patients admitted in 2005, treated by 2424 physicians practicing in 245 hospitals in Taiwan through Taiwan’s National Health Insurance Research Database. Multilevel logistic regression analysis was performed after adjustment for patient, physician, and hospital characteristics to explore the individual and combined impact of annual physician volume and annual hospital volume, as well as the impact of weekend admissions, on 30-day mortality.

Results: Higher physician volume, simultaneous contribution of higher physician and higher hospital volume, and weekday admissions were associated with decreased 30-day mortality, after adjusting for patient gender and age, comorbidities, surgery, physician age and specialty, hospital ownership, accreditation level, teaching status, geographic location, regional resources, and competition.

Conclusions: Higher physician volume, rather than higher hospital volume is associated with lower 30-day ischemic stroke mortality, but the relationship has become stronger in higher-volume hospitals.

Stroke patients admitted on weekends also have a higher mortality than those admitted on weekdays.

Key Words: stroke, volume, weekend, outcome, mortality

(Med Care 2009;47: 1018–1025)

Stroke is one of the leading causes of death and functional impairment in developed countries. The impact of this disease is also growing in many developing countries.^{1,2} The Agency for Healthcare Research and Quality (AHRQ) has regarded acute stroke mortality in particular as one inpatient quality indicator because the mortality has been shown to vary substantially across institutions, and evidence suggests that high mortality may be associated with deficiencies in the quality of care.³ Although clinical predictors of stroke mortality are well established, other health care determinants of clinical outcomes have not been systematically explored.⁴ Most importantly, to our knowledge, there has been little study evaluating the individual and combined impact of physician volume and hospital volume, as well as the impact of weekend admissions, on ischemic stroke mortality using nationwide population-based data.

During the past 20 years, much research has focused on the relationship between patient outcomes and the volume of health services provided by hospitals and physicians. Many (but not all) studies on several surgical and diagnostic procedures have verified a volume-outcome association due to



The Importance of Stroke Outcomes

- ▶ **Stroke is one of the leading causes of death and functional impairment in developed countries (Ingeman et al., 2008; Rothwell et al., 2005)**
- ▶ **The Agency for Healthcare Research and Quality (AHRQ) has regarded acute stroke mortality as one inpatient quality indicator (AHRQ, 2007)**
 - ▶ The mortality has been shown to vary substantially across institutions
 - ▶ High mortality may be associated with deficiencies in the quality of care

Healthcare determinants of stroke outcomes



- ▶ **Healthcare determinants of stroke outcomes have not been systematically explored (Saposnik et al., 2007)**
- ▶ **There has been little study evaluating the individual and combined impact of physician volume and hospital volume, as well as the impact of weekend admissions, on stroke mortality**

Volume-outcome research



- ▶ **Many studies on several surgical and diagnostic procedures have verified a volume-outcome association due to the “practice makes perfect” hypothesis or a learning effect**
- ▶ **Physician volume seems to be a more important determinant of outcomes than hospital volume (Halm et al., 2002)**
 - ▶ A low-volume physician at a high-volume hospital may have poorer results than a moderate-volume physician at a moderate-volume hospital
- ▶ **Other important synergistic relationships between the effects of hospital and physician volume probably exist as well (Halm et al., 2002)**

Volume and Stroke Outcome



- ▶ **Hospital volume and stroke outcome**
 - ▶ Vortruba and Cebul, 2006 Medical Care
 - ▶ Saposnik et al., 2007 Neurology
- ▶ **There has been no empirical research examining the relative and joint impact of physician and hospital volume on stroke mortality**

Weekend-outcome research



- ▶ **Previous studies have shown increased mortality for different conditions or procedures during weekend admissions**
- ▶ **The level of staffing in hospitals is often lower on weekends than on weekdays (Bell & Redelmeier, 2001; Cram et al., 2004)**
- ▶ **Weekend and stroke outcome**
 - ▶ Saposnik et al., 2007 Stroke

Research Objectives



- ▶ **To explore the associations of physician volume and weekend admissions with 30-day ischemic stroke mortality**
- ▶ **To explore whether synergistic associations between effects of hospital and physician volume exist**

Database



▶ **National Health Insurance Research Database (NHIRD)**

- ▶ Patient-level information
- ▶ Physician-level information
- ▶ Hospital-level information

Study Population



- ▶ **Ischemic stroke discharges, aged 18 years and older, admitted to acute care hospitals in Taiwan between January 1 and December 31, 2005**
- ▶ **34,347 patients from 2,424 physicians and 245 hospitals**

Dependent variables



▶ 30-day mortality

- ▶ Without a standardized period, institutions would have an incentive to adopt strategies that would shift deaths out of the hospital without improving quality of care (AHRQ, 2007; CMS, 2007)
- ▶ 30-day mortality was calculated by linking inpatient admission records with withdrawal certificate records (Lien , Chou & Liu, 2008)
 - ▶ died
 - ▶ jailed for over two months
 - ▶ disappeared for over six months

Independent variables



▶ **Physician Volume**

- ▶ Ischemic stroke case volume for each attending physician in 2005 was calculated using unique physician codes in each discharge

▶ **Weekend admissions**

- ▶ The weekend effect was defined by whether patients were admitted on Saturday or Sunday (yes vs. no)

Control variables



▶ Patient characteristics

- ▶ Gender, age, comorbid conditions, and administration of surgical operation

▶ Physician characteristics

- ▶ Age and specialty

▶ Hospital characteristics

- ▶ Ownership, accreditation level, teaching status, annual hospital volume, geographic location, in-area bed supply, and competition

Statistical Analysis



- ▶ **Multilevel logistic regression (also called a hierarchical generalized linear model, HGLM)**
 - ▶ Increase the statistical significance for the effects of variables measured at the higher level (Austin, Tu, & Alter, 2003)
 - ▶ Atomistic fallacy (Klein & Kozlowski, 2000)
- ▶ **Propensity score analysis**
 - ▶ A higher proportion of weekend admissions were in teaching hospitals as compared to weekdays.
 - ▶ The multilevel logistic regression indicated that teaching status is a risk factor for 30-day mortality.
 - ▶ Selection bias
- ▶ **Receiver operating characteristic (ROC) curves**
 - ▶ What is the minimum number of stroke patients that a physician needs to be seen to prevent higher mortality

Study Population Characteristics and Unadjusted Patient Outcome

	%	Mean	SD
Patient characteristics			
Male	59.4	-	-
Age, years	-	68.7	12.1
Charlson score	-	0.68	0.98
Surgery	2.1	-	-
Weekend admissions	23.5	-	-
Physician characteristics			
Age, years	-	42.5	7.1
Neurologist	76.4	-	-
Volume	-	89.9	74.1

Study Population Characteristics and Unadjusted Patient Outcome (continued)



	%	Mean	SD
Hospital characteristics			
Ownership			
Public	25.0	-	-
Not-for-profit	50.5	-	-
For-profit	24.5	-	-
Accreditation level			
Academic medical center	33.1	-	-
Regional	47.6	-	-
District	19.3	-	-
Teaching status	90.3	-	-
Volume	-	518.0	411.7

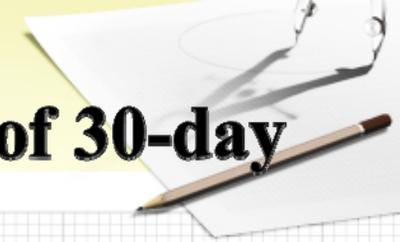
Study Population Characteristics and Unadjusted Patient Outcome (continued)

	%	Mean	SD
Location			
Taipei	23.1	-	-
Northern	15.7	-	-
Central	20.5	-	-
Southern	19.2	-	-
Kao-Ping	18.8	-	-
Eastern	2.7	-	-
Bed / 10000 enrollees	-	64.8	16.9
HHI	-	0.07	0.05
Patient outcome			
30-day mortality	4.7	-	-

30-day mortality by physician volume and weekend admissions

	Dead			Alive			P value
	%	Mean	SD	%	Mean	SD	
Weekend							
Yes	5.3	-	-	94.7	-	-	0.002
No	4.5	-	-	95.5	-	-	
Physician volume	-	65.3	69.4	-	91.1	74.1	<0.001
Hospital volume	-	493.1	397.1	-	519.2	412.3	0.013

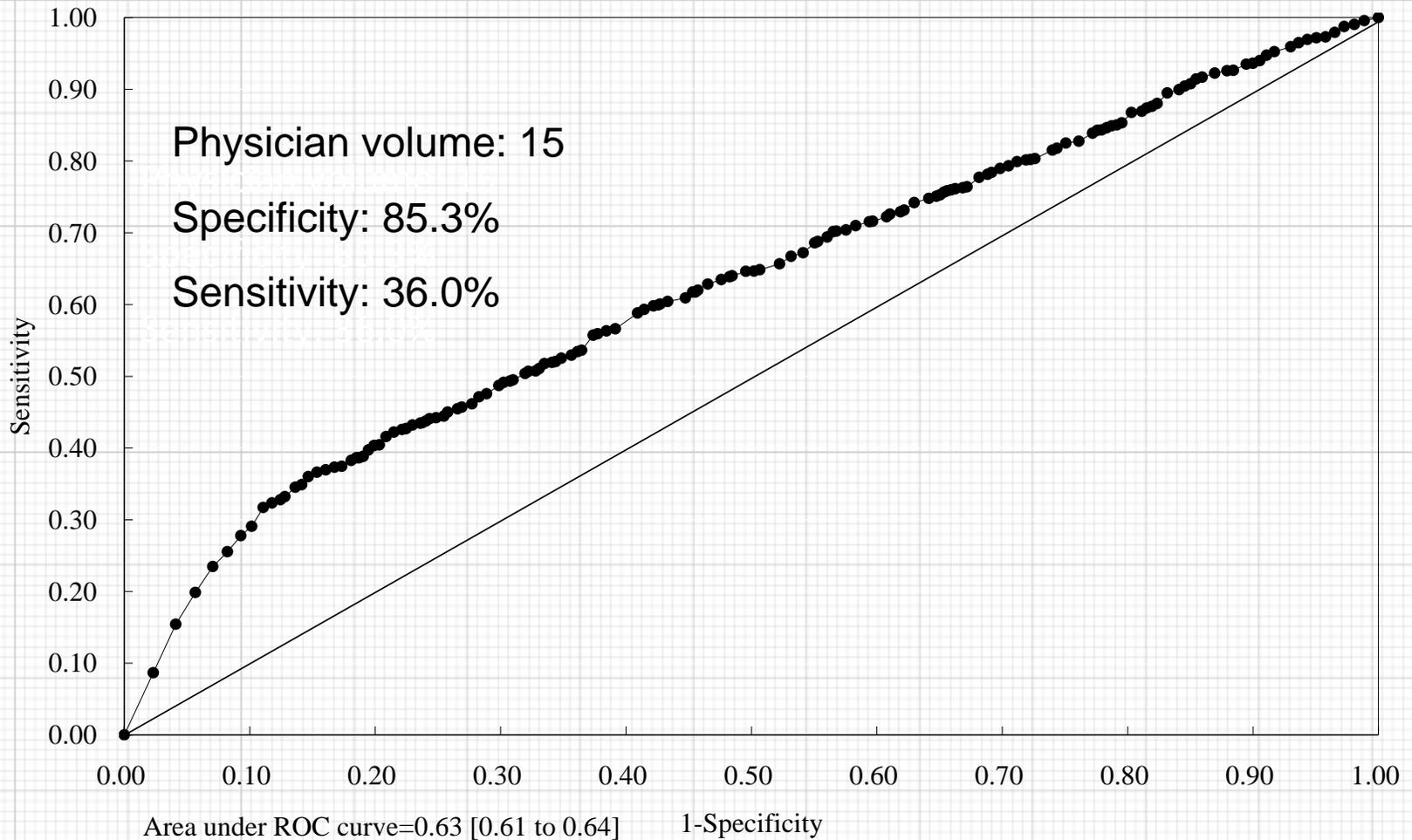
Multilevel logistic regression analysis of 30-day ischemic stroke mortality



	Unweighting			Weighting		
	OR	95% CI		OR	95% CI	
Hospital level						
Physician level						
Physician volume/ 100	0.791	0.630	0.995	0.619	0.447	0.857
In Hospital volume/ 100	0.935	0.896	0.975	0.957	0.919	0.996
Patient level						
Weekend admissions (ref: no)	1.184	1.093	1.281	1.219	1.065	1.396

*Adjusted for other variables

Receiver operating characteristic curve for physician volume to predict 30-day ischemic stroke mortality



Discussion



- ▶ **Higher physician volume, rather than higher hospital volume was associated with lower 30-day ischemic stroke mortality, but the relationship has become stronger in higher-volume hospitals**
- ▶ **Stroke patients admitted on weekends had a higher mortality than those admitted on weekdays**

Volume and Outcome



- ▶ **Physician volume had an influential effect on stroke outcome but hospital volume did not**
 - ▶ Similar: Hu et al. (2003), Lien et al. (2007) and Wen et al. (2006) regarding several surgical procedures
 - ▶ Different: Saposnik et al (2007) and Vortruba and Cebul (2006) concerning stroke care
 - ▶ They only examined the effect of hospital volume but did not consider the effect of physician volume

Volume and outcome (continued)

- ▶ **This study may support the existence of the “practice makes perfect” hypothesis rather than the “selective referral” hypothesis**
 - ▶ Taiwan’s healthcare system allows patients to have free access to any hospital of their choice
 - ▶ Stroke care is not regionalized or centralized in Taiwan
- ▶ **We used a propensity score approach to correct for the selection bias. The use of a propensity score method can help reduce the selection bias and provide more valid analysis results**

Volume and Outcome (continued)

- ▶ **Higher-volume physicians in higher-volume hospitals showed better outcomes than in lower-volume hospitals**
 - ▶ Similar: Hannan et al. (2003) regarding coronary artery bypass graft surgery
- ▶ **The finding conforms to Halm et al.'s argument that synergistic associations between effects of hospital and physician volume probably exist**
- ▶ **Higher-volume physicians in higher-volume hospitals not only have more experience but also receive more assistance from more skillful and interdisciplinary care teams**

Weekend admissions and outcome

▶ Similar

- ▶ Foss and Kehlet (2006) regarding hip fracture
 - ▶ Kostis et al. (2007) concerning acute myocardial infarction
 - ▶ Saposnik et al. (2007)
- ▶ **The weekend-outcome relationship for stroke may hold universally, regardless of health system factors or short-term outcome measures**
- ▶ **Disparities in medical resources, expertise, or the number of healthcare providers working during weekends may exist**

Limitations



- ▶ **In common with other studies using administrative databases, no information on stroke severity was available for stroke risk adjustment**
- ▶ **Due to lack of information on processes of care, we could not identify the mechanisms through which higher-volume physicians are associated with better acute stroke outcomes**
 - ▶ Experience ??
 - ▶ Process Variation ??

Policy and management implications

- ▶ **Policies, advocating selective referral to high-volume providers based solely on hospital volume, are not comprehensive**
- ▶ **It is more important to identify what factors explain the differences in mortality between low-volume and high volume physicians**
 - ▶ National protocols and guidelines
 - ▶ Fellowship programs

Policy and management implications (continued)



- ▶ **Reducing disparities in medical resources on weekends for early and appropriate treatment is one of the ways to improve stroke mortality**
- ▶ **Identifying factors affecting these associations may provide new avenues to implement quality improvement initiatives, through which mortality reduction may be best achieved**



The Effect of Cuts in Reimbursement on Stroke Outcome

A Nationwide Population-Based Study During the Period 1998 to 2007

Yu-Chi Tung, PhD; Guann-Ming Chang, MD, MS

Background and Purpose—As healthcare costs keep rising, cuts in reimbursement such as the Balanced Budget Act in the United States or global budgeting have become the key to healthcare reform efforts. Limited information is available, however, concerning whether reimbursement cuts are associated with changes in stroke outcomes. The objective of this study is to determine whether 30-day mortality rates for patients with ischemic stroke changed under increased financial strain from global budgeting in Taiwan.

Methods—We analyzed all 258 167 patients with ischemic stroke admitted to general acute care hospitals in Taiwan over the period 1998 to 2007 through Taiwan's National Health Insurance Research Database. Multilevel logistic regression analysis was used to examine whether 30-day stroke mortality rates varied after the implementation of hospital global budgeting since July 2002 adjusted for patient, physician, and hospital characteristics.

Results—The magnitude of payment reduction on overall hospital net revenues was between 4.3% and 10.0%. The 30-day mortality rates for patients with ischemic stroke in Taiwan increased after the implementation of hospital global budgeting after adjustment for patient gender and age, comorbidities, surgery, physician age and volume, specialty, hospital volume, ownership, accreditation level, bed size, geographic location, competition, and trend.

Conclusions—The mortality rate of patients with stroke rose under increased financial strain from cuts in reimbursement. Therefore, stroke outcomes are more likely to be affected by hospital financial pressures. It is imperative to monitor stroke outcomes and develop strategies to maintain levels of stroke care as cuts in reimbursement are adopted. (*Stroke*. 2010;41:504-509.)

Reimbursement Cuts and Stroke Outcome

- ▶ As hospitals come under increasing financial stress owing to the adoption of the Balanced Budget Act or global budgeting, they may reduce operating expenses to preserve profits
- ▶ Strategies to reduce operating expenses may include:
 - ▶ reducing the quantity or quality of nursing staff
 - ▶ reducing efforts to train and improve staff performance
 - ▶ curtailing investment in infrastructure
 - ▶ reducing levels and availability of services

(Chang et al, 2006; Seshamani, Schwartz & Volpp, 2006; Seshamani, Zhu & Volpp, 2006)

Reimbursement Cuts and Stroke Outcome

(continued)



- ▶ **The strategies responding to cuts in reimbursement may lead to deficiencies in quality of care, which may result in poor patient outcomes**
- ▶ **There has been no empirical research examining the impact of reimbursement cuts on stroke outcomes**

Research Objectives



- ▶ **To examine whether cuts in reimbursement affected 30-day stroke mortality**

Database



▶ **National Health Insurance Research Database (NHIRD)**

- ▶ Patient-level information
- ▶ Physician-level information
- ▶ Hospital-level information

Study Population



- ▶ **Ischemic stroke discharges, aged 18 years and older, admitted to acute care hospitals in Taiwan between January 1, 1998 and December 31, 2007**
- ▶ **22,744 patients from 1,299 physicians in 1998, gradually increasing to 27,376 patients from 1,739 physicians in 2007**

Variables



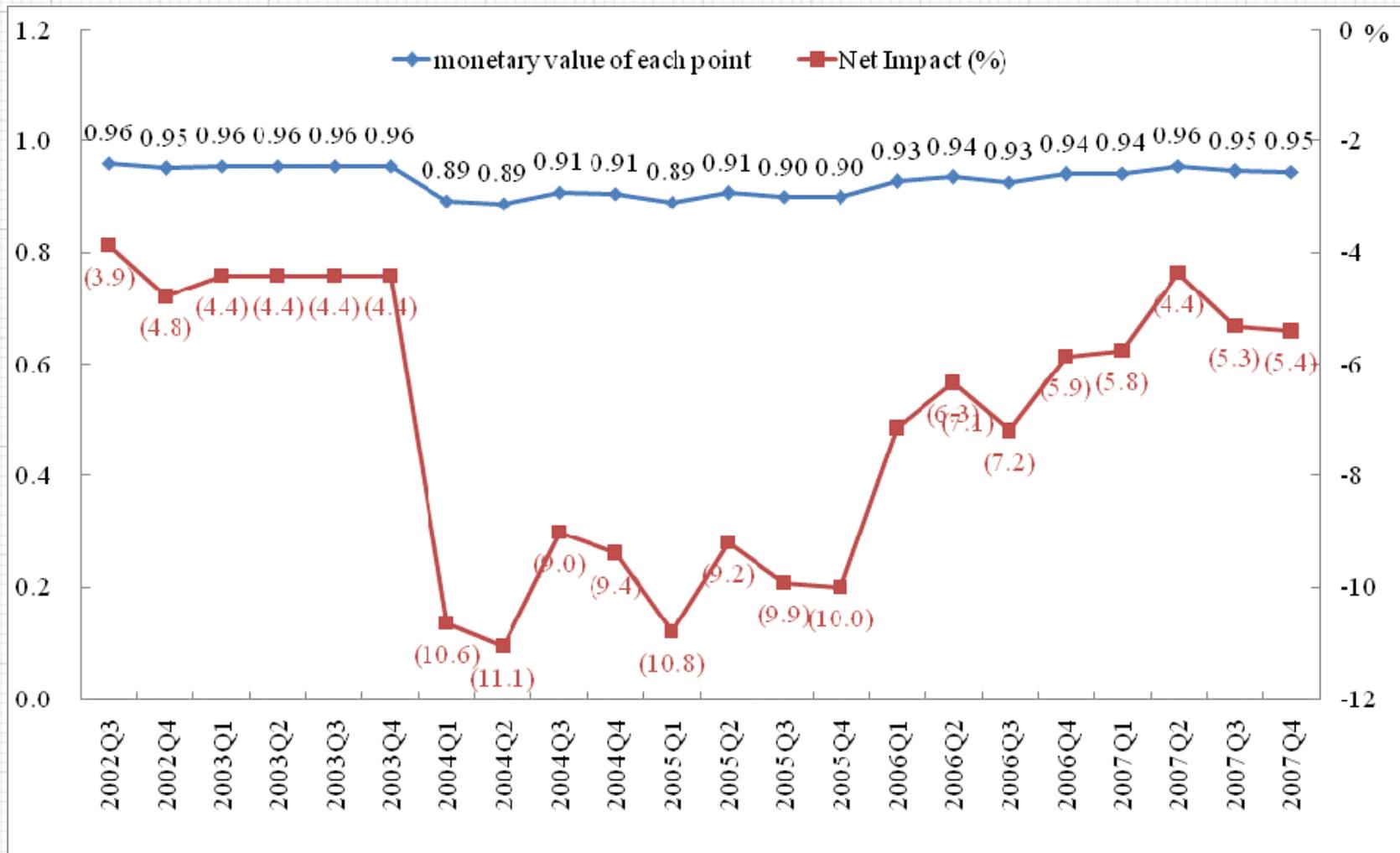
- ▶ **Dependent variable: 30-day mortality**
- ▶ **Independent variable: Monetary value of each point**
- ▶ **Control variables**
 - ▶ Patient-level : Gender, Age, Charlson-Deyo comorbid index, Weekend admission
 - ▶ Physician-level : Age, Specialty, Physician volume
 - ▶ Hospital-level: Ownership, Accreditation level, Hospital volume, Geographic location
 - ▶ Trend

Statistical Analysis

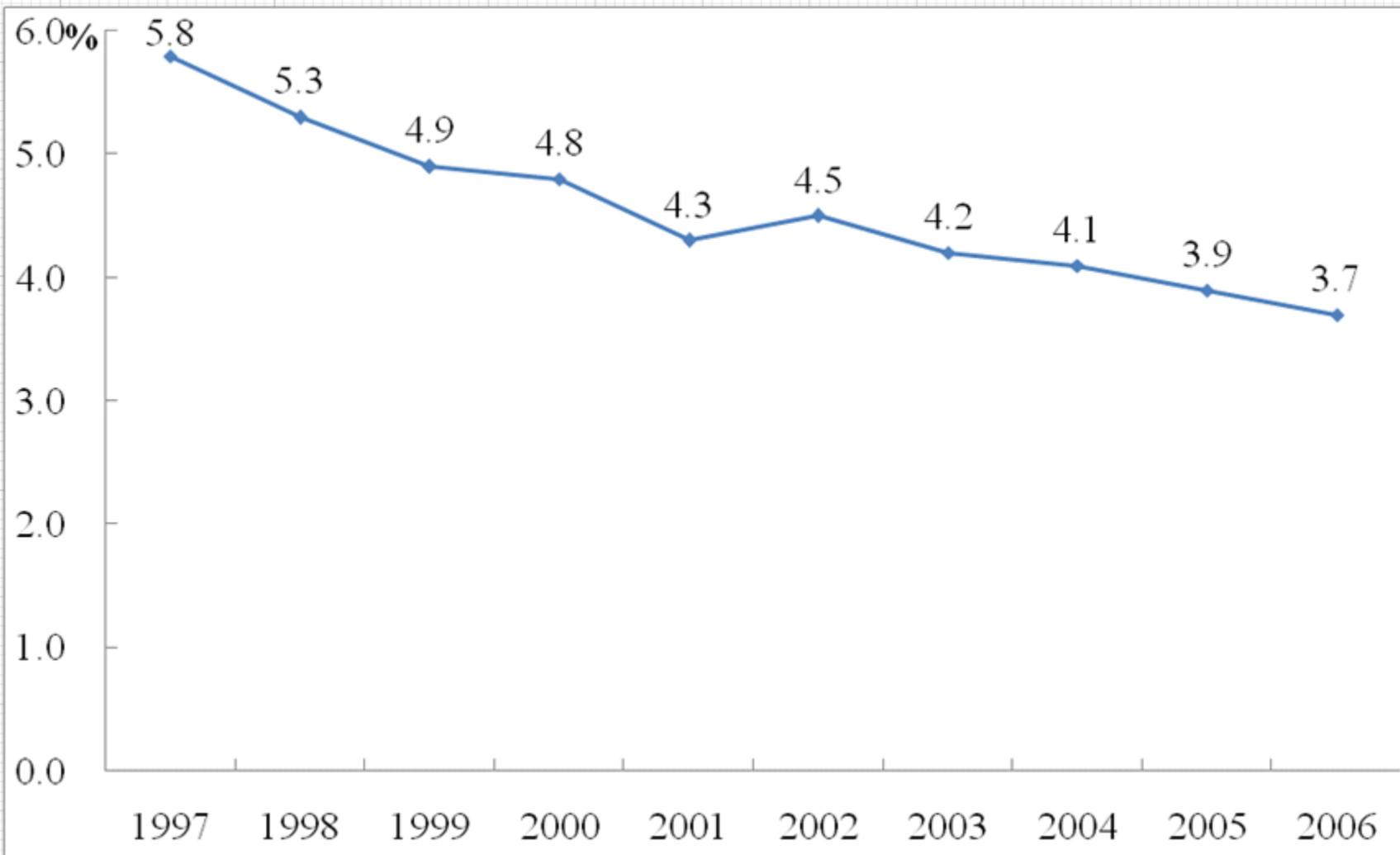


► Multilevel logistic regression

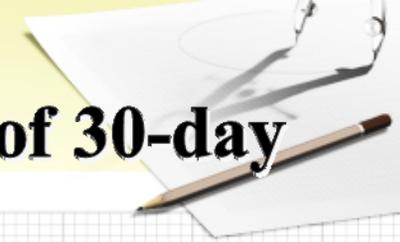
The monetary value of each point under hospital global budgeting



Thirty-day mortality



Multilevel logistic regression analysis of 30-day ischemic stroke mortality



	OR	95% CI	
Cuts in reimbursement			
Quarterly monetary value per 100 points	0.988	0.979	0.997

*Adjusted for other variables

Discussion



- ▶ **Larger cuts in reimbursement from hospital global budgeting of July 2002 led to higher 30-day ischemic stroke mortality**

Reimbursement Cuts and Stroke Outcome

▶ The impact of cuts in reimbursement on ischemic stroke mortality

▶ Similar:

- ▶ Seshamani, Zhu and Volpp (2006) regarding eight postoperative complications

▶ Different:

- ▶ Volpp et al (2005) concerning acute myocardial infarction (AMI)
- ▶ Seshamani, Schwartz and Volpp (2006) regarding hip fracture, stroke, AMI, and gastrointestinal hemorrhage

Reimbursement Cuts and Stroke Outcome (continued)



► Reasons

- In-hospital mortality may be a worse outcome measure than 30-day mortality
- In the United States, clinical practice guidelines for stroke are well defined and implemented so quality of stroke care may be more likely to be maintained and monitored despite increased financial strain from the BBA (Seshamani, Zhu and Volpp, 2006)
- In Taiwan, hospitals may cut their operating expenses to maintain profit margins
- **There is every likelihood that financial stress affects quality of stroke care without implementation of clinical practice guidelines**

Reimbursement Cuts and Stroke Outcome (continued)



- ▶ **The methods of reducing operating expenses include:**
 - ▶ decreasing service provision
 - ▶ providing lower quality of care
 - ▶ reducing nurse staffing
 - ▶ recruiting nurses with low education levels or others
- ▶ **Previous studies showed that decreased nurse staffing or lower educational level of nurses was associated with higher mortality (Aiken et al, 2002; Needleman et al, 2002)**

Limitations



- ▶ **In common with other studies using administrative databases, no information on stroke severity was available for stroke risk adjustment**
- ▶ **Owing to lack of information on processes of care and staff level, we could not identify the mechanisms through which cuts in reimbursement influence stroke outcomes**
 - ▶ It is also possible that other unavailable variables such as number of concomitant medications taken by the patient may explain the differences in stroke mortality

Policy and management implications

- ▶ **It is imperative to monitor processes and outcomes of care for stroke and develop strategies to maintain levels of stroke care as cuts in reimbursement are adopted**
- ▶ **For instance, national protocols and guidelines should be implemented not only to assist all physicians to achieve better outcomes for stroke care but also to aid continuous monitoring of whether stroke care is deficient**

**Thank you
for your attention!**
謝謝聆聽 敬請指教

