

Effect of Weekend Admission on In-Hospital Mortality in Patients with Ischemic Stroke: An Analysis of Korean Nationwide Claims Data from 2002 to 2013

Kyoung Hee Cho, MPH,*† Eun-Cheol Park, MD, PhD,†‡ Chung Mo Nam, PhD,†§
Young Choi,*† Jaeyong Shin, MD, MPH,†‡ and Sang Gyu Lee, MD, PhD†||

Background: Studies conducted on patients with stroke in countries other than Korea demonstrated a phenomenon known as the weekend effect on 7-day, 30-day, and in-hospital mortalities. We studied patients with stroke using nationwide cohort data to determine if there was a weekend effect on mortality in a Korean population. *Methods:* Nationwide cohort data, collected from 2002 to 2013, were searched for all hospitalizations via the emergency department due to ischemic stroke. Cox's proportional hazards frailty model was employed, and we adjusted for all patient and hospital characteristics. *Results:* There were 8957 patients with ischemic stroke admitted via the emergency department: 2632 weekend admissions and 6325 weekday admissions. Of these, 478 (5.3%) patients were dead. After adjusting for patient and hospital characteristics, the frailty model analysis revealed significantly higher in-hospital mortality in patients admitted on weekends than in those admitted on weekdays (hazard ratio [HR], 1.22; 95% confidence interval [CI], 1.01-1.47). We obtained consistent results for the 30-day mortality findings (HR, 1.27; 95% CI, 1.04-1.55). However, no significant differences were observed in the 7-day mortality (HR, 1.13; 95% CI, .88-1.45). *Conclusions:* Weekend admission for ischemic stroke was significantly associated with higher in-hospital and 30-day mortality after adjusting for individual characteristics and hospital factors. **Key Words:** Weekend effect—weekend admissions—ischemic stroke—in-hospital mortality—frailty model.

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From the *Department of Public Health, Graduate School, Yonsei University, Republic of Korea; †Institute of Health Services Research, College of Medicine, Yonsei University, Republic of Korea; ‡Department of Preventive Medicine, College of Medicine, Yonsei University, Republic of Korea; §Department of Biostatistics, College of Medicine, Yonsei University, Republic of Korea; and ||Graduate School of Public Health, Yonsei University, Republic of Korea.

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Address correspondence to Sang Gyu Lee, Graduate School of Public Health and Institute of Health Services Research, Yonsei University, 50 Yonsei-ro, Seodaemun-gu, Seoul 120-752, Republic of Korea. E-mail: LEEVAN@yuhs.ac.1052-3057/\$ - see front matter

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Introduction

Mortality due to cerebrovascular disease, including stroke, has decreased. However, stroke is a risky condition and is the leading cause of death due to a single disease in Korea.¹ The incidence of stroke is very high in the elderly. Consequently, health-care expenditures and/or complications due to stroke are critical health-care issues in Korea, as it is becoming an aging society. The Agency for Health-care Research and Quality regards acute stroke mortality in particular as an inpatient quality indicator, as the corresponding mortality substantially varies across institutions, and evidence suggests that high mortality may be associated with deficiencies in the quality of care.² Clinical predictors of stroke mortality and incidence are well established; therefore, many countries have made efforts to reduce these predictors, such as introducing tobacco policy, encouraging lifestyle changes, and using thrombolytic agents.³

Stroke can occur at any time; hence, efficient and consistent stroke care must be provided. To reduce acute stroke mortality, improving the quality of acute care following stroke is critically important. However, limited human and institutional resources result in inconsistent stroke care in real-world practice.⁴ Previous studies revealed a hospital admission weekend effect: greater mortality⁵⁻⁹ and/or poor clinical outcomes in patients admitted on a weekend compared those admitted on a weekday.^{10,11} Hospitals generally provide comprehensive care on weekdays but have decreased staffing levels on weekends. Reduced clinical personnel on weekends and holidays may lead to a reduction in the quality of care (e.g., multidisciplinary care) and this may influence outcomes following stroke.⁹ In Korea, the acute stroke care system varies and the expertise level of the staff is lower on weekends and holidays.

Hospital admission due to stroke over a weekend compared with a weekday is associated with higher mortality in Canada,⁷ Sweden,⁸ Japan,⁹ and Taiwan.⁶ Conversely, in-hospital mortality did not differ in the United States.¹¹ One previous study on this topic that was performed in Korea analyzed patients from only 4 hospitals.⁴ No association was found between weekend admission and 3-month mortality in patients with ischemic stroke in the Korean study. The aim of the current study was to investigate the weekend effect on mortality in patients with stroke in Korea.

Methods

Data Source

We conducted a cohort study using data extracted from the Korean National Health Insurance (KNHI) claims database from 2002 to 2013. The National Health Insurance Corporation collects cohort data representative of the country's population. These data include information on 1,025,340 subjects: these subjects represent a stratified

random sample selected according to age, sex, region, health insurance type, income quintile, and individual total medical costs based on the year 2002. The database includes information on reimbursement for each medical service, including basic patient information, an identifier for the clinic or hospital, a disease code, costs incurred, results of health screening, past/family health history, health behaviors, and information related to death. These data are publicly available for research purposes. Ethical approval for this study was granted by the institutional review board of the Graduate School of Public Health, Yonsei University, Seoul, Korea. The requirement for informed consent was waived because the study was based on routinely collected administrative or claims data.

Study Sample

The total number of individuals admitted to acute care hospitals via the emergency department due to ischemic stroke from January 1, 2002, to December 31, 2013, was 9010. An ischemic stroke diagnosis was indicated by International Classification of Diseases, 10th Revision diagnosis codes: I63 (cerebral infarction) and G45 (transient cerebral ischemic attacks and related syndrome) with or without G81 (hemiplegia). Of these individuals, we excluded 53 patients: 14 patients were less than 20 years old and 39 patients were admitted to clinics. The Korean health-care delivery system is classified into 3 steps based on fee-for-service as the reimbursement mechanism: clinics function as primary care institutions, hospitals function as secondary care institutions, and general hospitals function as tertiary care institutions. The exclusion criteria were necessary to ensure study population homogeneity and were selected because (1) clinics were likely to receive only low-risk or a limited number of patients, and (2) patients who were 19 years of age or younger were different from adults with respect to disease mechanism and/or treatment. The final study sample included 8957 participants.

Variables

Dependent Variables

The dependent variable in the present study was mortality upon in-hospital admission and at 7 and 30 days after admission. Death was assumed to be the outcome of interest. Death was determined by linking inpatient records with death certificate records from the national death registry. The death certificate records indicated only the month and year of death; we had to determine whether the patient was dead at discharge. We defined in-hospital, 7-day, and 30-day mortalities as follows. First, we matched the discharge and death dates. If the discharge date month/year was the same as the death date, we determined if the patients acquired discharge medication or utilized any medical services after the

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