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Original Study

Functional Outcomes, Subsequent Healthcare Utilization, and Mortality of Stroke Postacute Care Patients in Taiwan: A Nationwide Propensity Score-matched Study

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A B S T R A C T

Objective: To evaluate the benefits of the national stroke postacute care (PAC) program on clinical outcomes and subsequent healthcare utilization.
Design: Propensity score-matched case-control study using the National Health Insurance data.
Participants: A total of 1480 stroke cases receiving PAC services and 3159 matched controls with similar stroke severity but without PAC services.
Measurements: Demographic characteristics, functional outcomes (modified Rankin Scale, Barthel Index, Lawton-Brody Instrumental Activities of Daily Living, Functional Oral Intake Scale, Mini-Nutritional Assessment, Berg Balance Test, Usual Gait Speed Test, 6-Minute Walk Test, Fugl-Meyer Assessment (modified sensation and motor), Mini-Mental State Examination, Motor Activity Log, and the Concise Chinese Aphasia Test), subsequent healthcare utilization (90-day stroke re-admission and emergency department visits), and 90-day mortality.
Results: After propensity score matching, baseline characteristics, stroke severity, and status of healthcare utilization before index stroke admission were similar between cases and controls. After PAC services, the case group obtained significant improvement in all functional domains and may have reduced subsequent disability. Among all functional assessments, balance was the most significantly improved domain and was suggestive for the reduction of subsequent falls risk and related injuries. Compared with controls, patients receiving PAC services had significantly lower 90-day hospital re-admissions [11.1% vs 21.0%, adjusted odds ratio (aOR) 0.47 with 95% confidence interval (CI) 0.34–0.64], stroke-related re-admissions (2.1% vs 8.8%, aOR 0.22, 95% CI 0.12–0.41), and emergency department visits (13.5% vs 24.0%, aOR 0.49, 95% CI 0.37–0.65), but the 90-day mortality rate remained similar between groups (1.4% case group vs 2.0% control group, aOR 0.68, 95% CI 0.29–1.62).

Conclusions: PAC significantly improved the recovery of stroke patients in all functional domains through the program, with universal interorganizational staff training, periodic functional assessment, and high-intensity rehabilitation. Further longitudinal research is needed to evaluate the long-term survival benefits and healthcare utilization.

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Stroke is a severely disabling disease that causes a 1.5-fold greater loss of disability-adjusted life years than nonfatal myocardial infarction internationally.[1] Studies have shown that 15%–30% of stroke survivors may be permanently disabled, and 20% of them may require long-term institutional care. Although the incidence of stroke in the past decades has been reduced, the burden of stroke care in Asian countries has remained higher than many Western countries.[2–5] In Taiwan, stroke is the third leading cause of death and the major cause of disability.[6] The 2006–2008 Taiwan Stroke Registry showed that only 50.6% of first-ever stroke survivors recovered their functional independence in 6 months, and 10% of these patients may require long-term institutional care after hospital discharge.[7] With a population of 23 million, Taiwan has approximately 80,000 new or recurrent stroke events annually, and stroke-related medical expenditures have reached US $375 million per year.[8] Despite the diversity of healthcare systems between countries, the stroke-related medical and economic burden in Taiwan is no different from other countries.[9] In addition to developing strategies to prevent stroke and to reduce stroke mortality, promoting the functional independence of stroke survivors has become the priority in stroke care.

Caring for stroke patients with disability is an extensive physical, psychological, and economic burden for the healthcare system, family caregivers, and the entire society.[10] Promoting the functional recovery of stroke survivors is, therefore, highly prioritized to promote quality of life for patients themselves and to reduce the burden of care for families and societies. In theory, stroke rehabilitation starts right after the occurrence of stroke, and it usually requires several months or even life-long rehabilitation to achieve the best functional status. Stroke units have been developed for stroke patients in the acute stage, and postacute care (PAC) was designed to maximize the functional recovery of stroke patients. PAC was developed to help patients regain functional independence, as well as to reduce hospital readmissions and premature long-term care placement. The introduction of prospective payment services in the 1980s triggered the development of PAC services. Stroke was one of the first conditions for PAC in Medicare and is currently still a very important disease entity.

Internationally, PAC has become one of the most important elements of modern healthcare systems, covering a wide range of diseases and conditions. In Taiwan, no PAC in any form had been developed except hospitals of the Veterans Affairs, and patients would have to travel between hospitals to meet their long-term rehabilitation needs. Although Taiwan's National Health Insurance reimburses a wide range of healthcare services, the lack of a PAC design resulted in substantial fragmentation in stroke care. In 2014, the Taiwan National Health Insurance Administration (NHIA) launched the first national PAC program for stroke patients, and 39 interorganizational teams consisting of 180 hospitals nationwide participated in this pilot program. Taiwan's stroke PAC program emphasized an interdisciplinary approach and a seamless interorganizational transition to ensure the quality of care similar to most Western countries.

Although stroke PAC programs were developed in different countries, little was known regarding the long-term functional outcomes and subsequent healthcare utilization. Therefore, the main aim of the present study was to evaluate the clinical impacts of stroke PAC services on functional recovery, healthcare utilization, and mortality through a nationwide, propensity score-matched study.

Methods

National Stroke PAC Program

In 2014, Taiwan's NHIA launched the pilot stroke PAC program. Patients with the following criteria were eligible for the stroke PAC program: (1) acute stroke, either ischemic or hemorrhagic, (2) within 30 days of stroke occurrence, and (3) modified Rankin Score (mRS) from 2 to 4. All PAC services were delivered by an interdisciplinary team at community hospitals and an organized national training program was held by NHIA before the activation of PAC services. Moreover, NHIA required all participating hospitals to complete a comprehensive functional assessment and to ensure the rehabilitation intensity. The stroke PAC program provided the maximum of 12 weeks of services, and results of functional assessments were submitted to the NHIA.

Study Design and Study Participants

This study was a retrospective study using NHI claims data to evaluate the functional outcomes, subsequent healthcare utilization, and mortality of the stroke PAC program. Data from all patients who had been screened for stroke PAC services during 2014–2015 were retrieved for this study. Patients who had been successfully referred for PAC services were assigned into the case group, and those who declined the referrals were defined as the controls.

The first stroke admission identified during the study period was defined as the index admission and the date of discharge from the index admission was defined as the index date of both PAC cases and controls for further analysis. Furthermore, because the study was a nonrandomized design, the propensity score-matching technique was adopted to create a matched cohort for further comparisons. The propensity score was assigned based on the probability that an individual enrolled in the PAC program and was estimated using a multivariable logistic regression model adjusted for observed covariates. Covariates in the propensity score model included age, the Charlson comorbidity index (CCI), number of comorbid cardiovascular conditions, admissions for stroke in 2 years before the index date, number of emergency department visits in 1 year before the index date, and the clinical characteristics of index stroke admission [including length of stay and intensive care unit (ICU) care]. Each PAC case was then assigned 1 matched control according to age, sex, and propensity score. The entire study was authorized by the NHIA; the data acquisition and analysis were aligned with the NHIA, which waived Institutional Review Board approval.

Demographic Characteristics of Index Stroke Admission

For all patients, demographic characteristics (age and sex), CCI, number of comorbid cardiovascular conditions, admissions for stroke in 2 years before the index date, healthcare utilization (including outpatient visits, admissions, and emergency department visits in the year before the index date), and the characteristics of index stroke admission (type of stroke, severity of stroke, length of stay, and ICU care) were collected in this study. Comorbid cardiovascular conditions