Co-occurring Chronic Conditions and Economic Burden among Stroke Survivors in the United States: A Propensity Score-Matched Analysis

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Objective: This study examined the impact of co-occurring chronic conditions on healthcare expenditures among noninstitutionalized older adults (age ≥50 years) with stroke in comparison to non–stroke-matched controls. *Methods:* This study used a retrospective, cross-sectional, matched case-control design using pooled 2002-2012 Medical Expenditure Panel Survey (MEPS) data. Stroke survivors (N = 2913) were compared with matched controls (N = 8739) based on propensity scores. Healthcare expenditures for co-occurring chronic conditions were compared between stroke survivors and matched controls using ordinary least squares (OLS) regressions. All analyses were conducted in SAS 9.4 (SAS Institute Inc., Cary, NC, USA) using survey procedures adjusting for the complex survey design of the MEPS. *Results:* The annual mean total healthcare expenditures (expressed in 2012 United States dollars) were significantly higher among stroke survivors compared with matched non-stroke controls ($18,796 versus $14,391, *P* < .001). OLS regressions revealed that co-occurring chronic conditions partially explained the excess healthcare expenditures among stroke survivors. The annual mean total healthcare expenditures among stroke survivors were significantly higher for most of the co-occurring chronic conditions compared with matched controls (e.g., in presence of hyperlipidemia, stroke survivor expenditures were $18,807 compared to $15,807 among matched controls). Stroke survivors with co-occurring arthritis, diabetes, or hypertension had significantly greater inpatient, emergency room, and prescription expenditures compared with matched controls. *Conclusions:* Stroke survivors experience a high economic burden. Interdisciplinary team-based treatment approaches to provide holistic care may help reduce the burden due to co-occurring chronic medical conditions among stroke survivors. **Key Words:** Stroke—co-occurring chronic conditions—healthcare—expenditures—propensity score.
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Introduction

It is estimated that approximately 795,000 Americans experience a new or recurrent stroke annually and in 2011 nearly 130,000 died from stroke.[1] Although stroke is one of the leading causes of mortality in the United States,[2] the trend of stroke mortality has been declining, and it is estimated that the stroke mortality rate and actual stroke mortality numbers in the United States declined by 35.1% and 21.2%, respectively, from 2001 to 2011.[3] Hence, it can be speculated that due to longer survival life expectancy among stroke survivors, the healthcare expenditures for these individuals may also be increasing. It is well known that stroke survivors have a substantial burden of co-occurring chronic conditions. For example, according to the Committed to Assisting with Recovery after Stroke study, stroke survivors have an average of 2.38 co-occurring conditions (e.g., hypertension, diabetes).[4] Some of these co-occurring conditions are risk factors that may contribute to the second stroke event (e.g., hyperlipidemia), whereas others are stroke complications (e.g., depression, seizure).[4]

Despite the high burden of co-occurring chronic diseases among stroke survivors, to the best of the authors' knowledge, no study has looked into their influence on healthcare expenditures in this vulnerable population. Although several studies have provided projections of lifetime costs of stroke survivors in different settings in the Unites States,[5-8] no report specifically examined the effect of co-occurring chronic conditions on healthcare expenditures among stroke survivors. Hence, the objectives of this study were to examine incremental expenditures associated with stroke and the role of co-occurring chronic conditions in contributing to these excess expenditures among community dwelling stroke survivors in comparison to propensity score matched non-stroke controls using a nationally representative sample of noninstitutionalized older adults in the United States, using a robust study design approach.

Methods

Study Design

This study used a retrospective, cross-sectional, matched case-control study design. The sample for this study was derived from the 2002 to 2012 Medical Expenditure Panel Survey (MEPS). The cases (noninstitutionalized older adults with stroke) were matched to controls (older adults without stroke) based on propensity scores to minimize the effect systematic differences between these 2 groups. The stroke group was matched on a yearly basis with non-stroke controls (e.g., stroke cases in 2002 were matched with non-stroke controls in 2002) to avoid matching between cases and controls separated by several years. Propensity scores were generated based on the following covariates: age (50-64 years, ≥65 years), gender (male, female), race (white

and other), area of residence (metro, rural), employment status (yes/no), perceived health status, perceived mental health status (excellent or very good, good, fair, or poor), body mass index (underweight or normal [BMI <25 kg/m²]); overweight or obese [BMI ≥25 kg/m²]), smoking status (currently smoking, other), activity of daily living (ADL) limitations, instrumental activity of daily living (IADL) limitations, functional disability, and activity disability. ADL and IADL were considered present when a person required help to do daily activities (e.g., using phone [IADL], going shopping [ADL]) for at least 3 months (yes, no). Functional disability was present only when a person was expected to have difficulty with physical functioning (e.g., walking), cognitive functioning (e.g., confusion), seeing, or hearing. Activity disability was present when a person experienced work or housework limitation. These demographic, socioeconomic, and psychosocial factors obtained from interviewing the patients were selected because they are risk factors of stroke and increase healthcare utilization. Although some chronic conditions (e.g., diabetes, hypertension) are risk factors of stroke, they were not included in the propensity scores as the study aimed to quantify the impact of these conditions on healthcare expenditures. This study was approved by the University of Arizona Institutional Review Board.

Data Source

Publicly available data from the MEPS (2002-2012) were the data source for the study. The MEPS is a nationally representative survey of the U.S. civilian noninstitutionalized population collected by the Agency for Healthcare Research and Quality.[9] The MEPS uses the sampling framework of the National Health Interview Survey and oversamples minority groups to achieve nationally representative estimates. The MEPS data files used in this study included (1) household component where data on demographic characteristics, health status, healthcare expenditure, health service use, health insurance, employment, and incomes were available and obtained from surveyed individuals and their household; and (2) medical conditions where data on self-reported medical conditions were reported using either Clinical Classification Codes (CCC) or International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes.[10]

Study Population

The study population included (1) adults aged 50 years or older; (2) alive during the calendar year; and (3) had positive total healthcare expenditure. Stroke survivors (case group) were identified with ICD-9-CM codes of 430-438.[11] Older adults without stroke comprised the control group. An 8 to 1 GREEDY matching algorithm of propensity score was used to match 1 case to 3 controls without replacement.[12,13]