See related article, pages 1899–1904.

“Thinking is easy, acting is difficult, and to put one’s thoughts into action is the most difficult thing in the world”.

—Goethe (1749–1832)

Major advances in acute stroke management have been seen over the past decade, including the use of thrombolysis, antithrombotic therapy, and organized in-hospital stroke care. However, relatively few studies have evaluated the effectiveness of these interventions in routine clinical practice, or have assessed issues related to delivery of services, access to care, and long-term care after discharge from stroke.

In this issue of Stroke, Bravata et al contribute to our understanding of outcomes after stroke by analyzing readmissions and deaths in the first 5 years after a hospitalization for stroke. The target population included stroke survivors aged over 65 years who were Medicare beneficiaries and who were discharged from Connecticut acute care hospitals in 1995. This population was followed from discharge in 1995 through 2000 using Medicare claims and Social Security Administration mortality data. Among 2603 patients discharged alive, 40% were readmitted at least once within the first year of discharge, 53% had died or been readmitted within 1 year and only 15% survived admission-free for 5 years. Leading causes for readmission included pneumonia (8.2% to 9.0%), stroke (3.9% to 6.1%) and acute myocardial infarction (4.2% to 6.0%). There was no apparent association between length of hospital stay and readmission rate (unreported data kindly provided by the authors, 2007), and no information was available on potential patient and system factors associated with higher hospital readmission rates.

Lower readmission rates of 25% to 27% within 1 year have been previously reported. These studies found that the average number of days of rehospitalization was 23. Stroke was the single most frequent reason for readmission followed by cardiac disease, with no significant differences among ethnic groups (blacks, Hispanics, and whites). However, the strikingly high death and readmission rates after stroke published by Bravata et al are consistent with findings from some previous reports. For example, in a study including veterans living in the state of Florida, 12-month rehospitalization rate was 31.1%, whereas mortality rate was 11.7%. Dual or triple system use (Veterans Health Administration, Medicare, or Medicaid), malnutrition, dysphagia and stroke type were associated with hospital readmissions. In another study including Medicare beneficiaries from 11 metropolitan regions in the eastern US, mortality (18% to 23%) and rehospitalization (37% to 47%) rates 11 months after stroke were similar for 30-day survivors.

What Does This Study Add to Our Knowledge?

The study of Bravata et al revealed a mixed picture with regard to the often neglected battle against stroke: long-term poststroke care. This descriptive study confirms the enormous impact of stroke on hospitalization-free survival. However, the reasons behind the high observed death and readmission rates remain incompletely understood, and the reader may wonder whether these rates were expected or unexpected. Were these findings the natural consequence of older age, high comorbidity or other factors known to be associated with poor outcomes, or were there inadequacies in the care or follow-up of stroke patients that might have contributed to poor outcomes? The patients in this study cohort were elderly and with a high prevalence of baseline comorbid illness: 50% were aged over 80 years, 52% had a Charlson-Deyo comorbidity index score ≥2 and 27% had been hospitalized in the year before the index stroke admission, all factors likely to be associated with death or hospitalization, regardless of the quality of stroke care delivery. The overall increasing stroke hospitalization rates associated with aging of the US population may be another contributing factor. On the other hand, health system factors (hospital stroke volume, provider specialty, level of experience, hospital status, variations in timing of service-day/night, weekday/weekends) have also been shown to influence stroke outcomes, as have interventions such as risk factor modification, secondary stroke prevention and stroke rehabilitation, and it is here that there may be opportunities for improvements in stroke care and patient outcomes.

Rehospitalization: A New End Point in Clinical Trials?

Rehospitalization is increasingly being used not only as a clinical outcome, but also as an end point in clinical trials of
cardiovascular interventions. For example, in the area of cardiology, digoxin\textsuperscript{13,14} and angiotensin-converting enzyme inhibitors\textsuperscript{15} have been shown to decrease hospitalization rates in patients with congestive heart failure, and \( \beta \)-blockers have been shown to decrease the need for rehospitalization in survivors of an acute coronary syndrome.\textsuperscript{16} In the field of stroke, antiplatelet therapy before hospital discharge is a widely accepted recommendation for secondary stroke prevention as well as an indicator of quality of stroke care.\textsuperscript{17–19}

In the CAPRIE trial (Clopidogrel versus Aspirin in Patients at Risk of Ischemic Events), treatment with clopidogrel was associated with a significant decrease in rehospitalizations for ischemic events or bleeding (12.4\% versus 13.6\%; \( P = 0.015 \)). Because rehospitalization was not a prespecified end point, that information was determined from the adverse event forms not adjudicated by a clinical events committee.\textsuperscript{20} In the CHARISMA trial (Clopidogrel for High Atherothrombotic Risk and Ischemic Stabilization, Management, and Avoidance), the combination of clopidogrel plus aspirin was more effective than aspirin alone in reducing rehospitalizations for unstable angina, transient ischemic attacks or revascularization (11.1\% versus 12.3\%; risk reduction 0.90, 95\% CI 0.82 to 0.98).\textsuperscript{21} In the MATCH trial (Management of Atherosclerosis with Clopidogrel in High-risk patients), patients with a recent stroke or transient ischemic attack were randomized to aspirin plus clopidogrel versus clopidogrel alone. For the primary end point (ischemic stroke, myocardial infarction, vascular death, or rehospitalization for an acute ischemic event), the addition of aspirin to clopidogrel did not provide any additional benefit (event rates were 16\% for aspirin plus clopidogrel and 17\% for placebo plus clopidogrel; relative risk reduction 6.4\%, nonsignificant).\textsuperscript{22} When analyzing readmission rates as a single end point, no significant differences were observed between both arms (4\% versus 5\%, nonsignificant).

Other nonpharmacological interventions showed an impact in preventing death and rehospitalizations. Recently, the role of specialist has also been analyzed in the management of cardio- and cerebrovascular conditions. For example, patients with acute myocardial infarction admitted to hospitals by cardiologists were more likely to have a cardiac procedure performed, but were 12\% less likely to die over the ensuing year than if they were admitted by a noncardiac specialist primary care physician.\textsuperscript{23}

Other studies found that hospital readmissions for congestive heart failure were lower in patients cared for by cardiologists.\textsuperscript{24} In the field of stroke, care by neurologists was associated with lower in-hospital mortality (5.6\% versus 13.5\%; odds ratio=0.38; 95\% CI 0.22, 0.68; \( P = 0.001 \)) and higher proportion of patients discharged with little or no disability (54\% versus 43\%; odds ratio=0.64; 95\% CI 0.45, 0.92; \( P = 0.02 \)) at the time of discharge. The benefit remained after controlling for stroke severity and comorbidity (odds ratio=0.63; 95\% CI 0.42, 0.94; \( P = 0.025 \)).\textsuperscript{25}

**Practical Implications**

Prevention of death, reducing risks of a recurrent event and its complications, and improving functioning and well-being are the main priorities in the treatment of stroke patients. Per-
References


Key Words: stroke mortality outcome research rehospitalization health policy health services research hospital admissions cerebrovascular disease