Many countries seem at last to be taking stroke seriously, recognizing that it is a treatable disease and that failing to treat it effectively results in unnecessary suffering and a huge waste of health service resources. However, too many patients in high, low, and middle income countries still receive inadequate care. Rates of thrombolysis in most countries are still below 1% and in only a few countries is there more than a 50% chance that a patient will be treated in a specialized stroke unit. Access to brain imaging is often too slow and rehabilitation, particularly after the acute phase, is frequently absent or lacking in the necessary quantity or quality. Recognition that there is a need for central planning, which should be done as a collaborative effort between clinicians, healthcare planners and politicians, is described in the essay by Larry Goldstein using the United States experience of policy development for stroke at a national and state level. He stresses the importance of clinicians being willingly engaged in the process to provide high quality information and expertise. George et al identify the importance of the components of a public health strategy designed to improve the quality of stroke care at a state level. The key issues are provision of leadership through policy development and assurance, sharing of information with providers, building capacity for conducting quality improvement activities and providing evidence-based guidelines, policies and plans as well as developing and enforcing laws and regulations to ensure the quality of stroke care. All of this requires the active participation of stakeholders and high quality data defining how care is being provided.

England is embarking on an ambitious program of redesign of stroke services at a national level. After years of repeated national audits demonstrating the inadequacy of stroke care, a National Stroke Strategy was published in December 2007. The document was a product of the work of clinicians including doctors, nurses and therapists, health service managers, and politicians. There was a strong representation from patients, carers and voluntary groups. Before publication it was subjected to wide public consultation. It covers the whole stroke pathway including public awareness, acute treatment, rehabilitation and secondary prevention. Twenty quality markers that are expected to be delivered over the next ten years have been set. With the provision of additional funding and strong guidance to the regional strategic health authorities that this is a policy that needs to be delivered, major reorganization is taking place with the development of clinical networks, commissioning of hyperacute stroke centers, and improvements in the organization and delivery of community care. Investment is being made in the training of additional stroke specialists, and Department of Health money is to be spent on a national public awareness campaign. It will be fascinating to see whether such a strategy is able to deliver a step change in the quality of care for the whole population. Canada has also produced a set of national policy recommendations this year as a result of an initiative joining together clinicians, policy makers and managers developing the recommendations and associated performance measures. They have developed teaching materials, learning modules and point-of-care tools to enable an active dissemination policy via provincial and local clinicians and policy makers.

In Australia in 2001 the New South Wales government enacted a health system redesign program to improve access to evidence-based care. Only 19% of acute public hospitals at that time had a stroke unit, suggesting a major policy-practice gap. A task force was created bringing clinicians and consumers together to work with government to develop better quality services. Substantial additional funding was provided. Networks were developed to provide training and share protocols. The whole process was externally evaluated and Cadilhac et al reported the results. Significant postprogram improvements for most process indicators were found. Access to stroke unit care increased 22-fold, and there was a significant increase in inpatient independence when adjusted for patient clustering and case-mix. This is one of the first articles to report the benefits of a systematic national approach to quality improvement. The key factor identified by the authors was that there was the close-working relationship between clinicians and health service management. Australia’s National Stroke Foundation also published an acute stroke services framework summary, focusing on defining and monitoring optimal structures and processes of stroke care. This framework includes stroke unit types and definitions, definitions of case complexity, suggested clinical indicators, and staffing ratios for stroke units (http://www.strokefoundation.com.au/news/latest/acute-stroke-services-framework-summary-2008).

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Many countries seem at last to be taking stroke seriously, recognizing that it is a treatable disease and that failing to treat it effectively results in unnecessary suffering and a huge waste of health service resources. However, too many patients in high, low, and middle income countries still receive inadequate care. Rates of thrombolysis in most countries are still below 1% and in only a few countries is there more than a 50% chance that a patient will be treated in a specialized stroke unit. Access to brain imaging is often too slow and rehabilitation, particularly after the acute phase, is frequently absent or lacking in the necessary quantity or quality. Recognition that there is a need for central planning, which should be done as a collaborative effort between clinicians, healthcare planners and politicians, is described in the essay by Larry Goldstein using the United States experience of policy development for stroke at a national and state level. He stresses the importance of clinicians being willingly engaged in the process to provide high quality information and expertise. George et al identify the importance of the components of a public health strategy designed to improve the quality of stroke care at a state level. The key issues are provision of leadership through policy development and assurance, sharing of information with providers, building capacity for conducting quality improvement activities and providing evidence-based guidelines, policies and plans as well as developing and enforcing laws and regulations to ensure the quality of stroke care. All of this requires the active participation of stakeholders and high quality data defining how care is being provided.

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Getting Evidence into Practice

Translating evidence into routine practice remains a challenge for all health systems. One widely used method is the publication of guidelines; however, a systematic review of the quality of stroke guidelines currently available makes depressing reading. One hundred and seventeen documents were identified from the literature published between 1999 and 2005. Most guidelines received an overall score of 'would not recommend' (77.8%). The lowest scoring domains were stakeholder involvement, rigor of development and applicability. Only 5 guidelines were highly recommended. This article highlights the importance of using guidelines that can be relied on, the difficulty of producing high quality guidelines, and the need for more collaboration between guideline development groups to minimize the time and expense involved in producing them. One idea currently being worked on is the development of a central database that lists the searches and systematic reviews that guideline developers have already performed so that the data can then be updated and adapted to local need. The American Heart Association (AHA) has a good track record of enabling evidence-based practice. The model they have developed is described by Jones et al and includes funding research and developing next generation clinicians, disseminating scientific information, developing and implementing evidence based guidelines, statements and performance indicators, producing decision support and quality improvement tools and campaigning.

Another model for promoting the translation of evidence into practice is the US Veterans Affairs Quality Enhancement Research Initiative (QUERI), a program that exists to link health services research to clinical operations system-wide in the systematic promotion of best practices10; this program includes a group focused on stroke care in the VA and is expected to release national VA data on inpatient stroke quality indicators in 2009.

A large proportion of stroke and transient ischemic attack patients fail to receive prompt and appropriate preventative treatment. The PROTECT (Preventing the Recurrence Of Thromboembolic Events through Coordinated Treatment) program systematically attempts to implement 8 medication and behavioral secondary prevention measures through the use of treatment guides, preprinted order sheets, discharge checklists, better patient information and a number of other interventions. It is significantly associated with better treatment use at discharge and better outcomes in the postdischarge settings. This model is of interest because it has proved extremely difficult in the past to make much impact on reducing vascular risk factors. This relatively low technology intervention would be easily transferable to other healthcare settings. Another initiative that could be fairly easily implemented but that might meet with more resistance from clinicians is the publication of details of individual hospital performance for the general public. Whereas this is now common practice for surgical performance, it is less frequent for common medical conditions. A fascinating article describes how intensive public reporting compared to limited reporting (just to hospitals or limited public reporting) of 6 medical conditions (one of which was stroke) in Pennsylvania, USA (between 1997 to 1999 and 2000 to 2003) resulted in significantly better outcomes. As an example the odds ratio for hemorrhagic stroke mortality was 0.59 (95% CI, 0.46 to 0.76) in the hospitals with public reporting compared to those where the results of care were not published. Similar results were obtained for all of the conditions studied. There were some limitations to the article, particularly the fact that the participating hospitals were self-selected, but the policy does warrant further analysis.

Measuring Quality of Care and Health Inequalities

National audit is becoming more widespread, and several articles report their data highlighting particular issues that need addressing. Argentina has developed a prospective multicenter countrywide stroke registry comprising 74 academic and nonacademic institutions with 1991 patients included over 2 years. They report low levels of thrombolysis and stroke unit admission (5.7%) and high levels of pneumonia. Outcomes are better in academic units indicating the urgent need to develop a national stroke program. Audit in Canada has shown that patients from low income groups are more likely to be admitted to low volume hospitals, and this group of patients had higher risk-adjusted mortality than higher income groups admitted to high volume hospitals. A review of literature from the United States particularly focuses on prehospital care, rural hospital emergency department care, and interhospital transfer of patients. It shows that acute stroke management practices in rural areas are suboptimal, which creates an unacceptable health disparity between urban stroke patients and their rural counterparts (25% of the US population). The authors say that these problems could be solved by comprehensively addressing the issues, including better recognition of stroke by emergency services personnel (especially volunteer paramedics in rural communities), certification of primary stroke centers, education and training of local physicians, remote assistance from tertiary center neurologists via telemedicine or formal hub, and spoke systems that allow treatment to be initiated in the rural hospital under supervision of a tertiary center and then moving the patient to the specialist unit (‘drip and ship’). This model has, however, never been formally tested for safety.

A few countries now have national prospective registers for stroke rather than conducting episodic audit. Although this clearly offers great advantages in being able to continuously monitor quality, an article from one center in Sweden that has contributed data to the RIKS register over the last 12 years raises important issues about interpretation of such long-term disease registers, particularly where the data are collected separately from routine clinical data. There is clearly variation in the completeness of case ascertainment and data completeness particularly for follow-up data. Data are more likely to be submitted for patients admitted to a stroke unit bed than elsewhere. It is a major problem that the register does not record data on nonadmitted patients as the number of these may be increasing as community services improve. They also highlight the difficulty of adjusting for variations over time in case severity.
**Recognition of Stroke and Improving Emergency Response From the Public**

No country has yet solved the problem that many people do not recognize the symptoms of stroke and if they do getting them to respond appropriately by calling for urgent medical assistance. Although recognition of stroke symptoms continues to be part of most stroke education programs, the Joint Commission added to its harmonized inpatient stroke education quality measure the specific requirement to educate patients about activating emergency medical systems when stroke was suspected. Two other interesting articles report the results of studies of attempting to resolve this education gap by addressing the issue with schoolchildren. A stroke literacy program for elementary school children (9 to 11 year olds) to recognize stroke and form an urgent action plan was introduced in New York, including a music and dance program incorporating messages about the FAST tool. After 3 months, 86% retained knowledge about the FAST criteria. A randomized controlled trial to teach middle school children to recognize stroke and call 911 was conducted involving 3 intervention and 3 control schools randomly selected in Texas. Although there were significant improvements in knowledge between pre- and postintervention assessments and between intervention and control students, parents did not appear to benefit.

**Factors Influencing Outcomes**

Interesting differences in outcomes after rehabilitation in different ethnic and racial groups are reported by Ottenbacher et al. Retrospective analysis of over 160 thousand patients who received inpatient rehabilitation after a first stroke in 2002 and 2003 were included in the study. There were no differences in length of stay, but nonhispanic white patients had higher admission and discharge functional levels than the minority groups. Despite this, nonhispanic white patients were less likely to be discharged home than black patients (odds ratio 0.64; 95% CI, 0.62 to 0.66) or Hispanics (odds ratio 0.58; 95% CI, 0.55 to 0.62). The reasons for the differences are unclear but may be due to the appropriateness or effectiveness of rehabilitation provided or patient preferences. The association between prestroke mobility, poststroke mobility and mortality, institutionalization or the combined outcome of these two is examined by Dallas et al. The sample was retrospective cohort of over 67,000 Medicare beneficiaries. All of the outcomes were worse for the 6% of patients admitted with prestroke mobility problems, with greater than a 3-fold risk of being discharged to a nursing home and twice the risk of death. This persists following multivariate analysis taking into account age, ethnicity, gender, prestroke residence at home, stroke severity and comorbidities. It is clear that prestroke mobility is a strong prognostic indicator for poor outcome and indicates the need for particular care to be taken with these patients. Age over 80 years is also a strong predictor for poor outcome. A multicenter cohort study of 26,676 patients admitted to 606 patients across Canada of whom over 10,000 were over 80 showed they were less likely to be admitted to an intensive care unit. Case fatality for the over 80s was 24.2% compared to 13% for the 70 to 79 year olds. Length of stay was greater at 10 days compared to 7 days for the those under 80, and they were less likely to be discharged to their prestroke residence (47% versus 61%). There is an even greater need for older patients to get access to specialist stroke facilities given the considerably greater risks they have of poor outcome.

**Organisation of Care and Impact on Outcome**

An important study examines the effect of a quality improvement program in Dutch hospitals. For 16 months, 23 hospitals participated in a quality improvement collaborative with the prime aim of reducing length of hospital stay. There was a close link between the presence of high functioning teams and well organized stroke care and shorter lengths of stay. Overall, over the period of the collaborative, the average length of stay fell from 18.3 to 13.3 days. The data showed that the composite of team functioning is pivotal in quality-of-care improvement, and this should be the prime focus of any quality improvement program. Saposnik et al. address the issue of what effect the quality of care delivered in a stroke unit has on outcome. They graded the care that patients received 0 to 3 depending on whether the patient received physiotherapy and occupational therapy, whether they received stroke team assessment, and whether they were admitted to a stroke unit and then correlated the score with mortality. Higher levels of care were associated with lower death rates (odds ratio 0.09; 95% CI, 0.05 to 0.17 for 30 day mortality). The correlation held even for patients with more severe strokes and after multivariable analysis. The number needed to treat to prevent one death is only 5 for 30 day mortality and 6 for 1 year mortality. This study highlights the importance of organized care being more than just a sign above the door. General practitioner opening hours influence patients’ healthcare seeking behavior after transient ischemic attack and minor stroke. This article identifies the need for easier access to primary care at all times and public education about the need for emergency care if the maximum number of strokes are to be prevented.

**Predicting Outcomes**

König et al have previously developed a model for predicting survival and functional independence at 3 months based on age and the National Institute of Health Stroke Scale at 6 hours. The validity of the score was tested on 5419 patients from the Virtual International Stroke Trials Archive. It was successful in 74.8% of patients for survival and 74.0% for functional recovery. This is a potentially useful score for looking at large cohorts and deciding on inclusion and exclusion criteria for randomized trials, but is insufficiently accurate to be useful for predicting outcome and making treatment decisions for individual patients where adopting a universally optimistic approach is probably safer.

Several studies examined methods for analyzing outcome in acute stroke trials. Current strategies are well described in a systematic review. A recent survey demonstrated that many stroke specialists favor the shift analysis strategy, in that it considers each individual subject’s change across the full range of observed outcomes and may be more sensitive to detecting a treatment effect than traditional dichotomized outcome analyses. Although the shift analysis may be
Growing in popularity, most published trials have used dichotomized outcomes. The OAST collaborative group found that across different trial types and sizes, analyses that retained scale scores as ordered categorical data (eg, ordinal logistic regression) performed superiorly to tests that dichotomized categorical data (eg, $\chi^2$ tests).28

Disclosures

None.

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