Stroke in Rural Areas and Small Communities

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Abstract

—The management of stroke in rural and regional areas is variable in both the developed and developing world. Informed by best-practice guidelines and recommendations for systems of stroke care, adaptable models of care that are appropriate for local needs should be devised for rural and regional settings. This review addresses the issue of the provision of appropriate services in rural and regional settings, with particular attention to the barriers involved, according to the classification of Low Human Development Country (LHDC), Medium Human Development Country (MHDC) and High Human Development Country (HHDC). We discuss the need and feasibility of developing implementing stroke care in rural settings according to best-practice recommendations, within models of care adapted to local conditions. ([Stroke. 2008;39:1920-1928.]

Key Words: health care ■ stroke ■ stroke care ■ stroke delivery ■ rural

After heart disease, HIV/AIDS and unipolar depression, stroke is the fourth major cause of disease burden, worldwide.1 Of the 5.7 million stroke deaths in 2005, 87% occurred in low and middle income countries where 80% of the population live in rural areas.2,3 Moreover, rural populations have been identified as being particularly vulnerable to stroke.4 The development of adaptable models implementing best-practice recommendations for stroke management in rural areas is important.

Rural Definition

The US Census Bureau5 defines rural as a term of exclusion. An urbanized area is defined as an adjacent, densely settled census block groups which meet minimum population density requirements where together they encompass a population of at least 50 000 people. Urban clusters have a similar definition; however, the overall population can be 2500 to <50 000. All other areas not meeting such criteria are defined as rural.

Definition of Level of Development

We used the classification of High (HHDC), Medium (MHDC) and Low Human Development (LHDC) Countries according to the United Nations Human Development Report.6 This employs data from its member nations and applies a Human Development Index (HDI) to each country that represents its overall level of development. The countries are segregated into 3 levels of development, namely: HHDC (63 countries including United States, United Kingdom, and Western Europe; MHDC (82 countries including China and India); and LHDC (30 countries, including Nigeria and Ethiopia).

See the Figure for a global map showing the distribution of these levels of human development. The above database can also consider countries by geographical regions, income level or any other criteria of interest. Table 1 presents data from developing countries, Central and Eastern Europe and the CIS, as well as OECD countries according to levels of Human Development, income, urbn or rural location and age. The urban and ageing populations have been calculated under the above groupings to evaluate the extent of rural areas from different demographic perspectives. Rurality has several important characteristics (see Table 2).

Methodology and Search Strategy

The data for this review were identified by searches using the gold standard search strategy for stroke developed by...
the Cochrane Stroke Group adapted for use with both PubMed and Ovid versions of MEDLINE. These results were combined with a MeSH and text word searches on Rural Populations and Telemedicine. The search results were limited to post-1990 publications but included articles in languages other than English. This search was replicated in the Cochrane Library, and an appropriate version of the search strategy was also used with the Cumulative Index of Nursing and Allied Health (CINAHL). Hand-searching of the reference lists from key articles and supplementary database searches on relevant individual authors yielded some additional articles. Search terms used included “cerebrovascular disease,” “stroke,” “rural,” “service provision,” “telemedicine,” “awareness,” “risk factors,” “rural urban differentials,” “pathology,” “primary prevention,” “secondary prevention,” “rural population,” “developing countries,” “thrombolysis,” “transport” (507 articles).

![Global distribution of human development.](figure)

**Table 1. Human Development Country Data**

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Adapted from UN Human Development Report 2006, Demographic Table 5.
Table 2. Characteristics of Rural Populations

- Nearly one half of the world population is rural.
- High Human Development countries have a significantly lower rural populations compared to the Medium and Low level countries.
- Over half the rural populations earn low incomes.
- Over two thirds of the world populations are in medium human development.
- Over three quarters of rural populations are in medium human development.
- Over two thirds of the populations in low developed countries are rural.

Urban-Rural Differences
Stroke Incidence and Prevalence

High Human Development Country
In the United States, the 1996 National Health Interview Survey revealed that stroke was 1.45 times more prevalent in rural than in urban areas (15.1 per 1000 individuals and 10.4 per 1000 individuals respectively). In Canada the incidence per 10 000 was similar in urban and rural areas. In Spain, there were no differences in life prevalence of stroke between rural and urban persons aged 65 and older. In Portugal, however, the annual incidence of stroke was higher in rural men and women compared with their urban counterparts.

Medium Human Development Country
A study in Bulgaria suggested that stroke incidence is disproportionately higher in rural areas compared with in urban areas. The male incidence of stroke was 909/100 000 and the female incidence was 667/100 000 for ages between 45 to 84 years.

In China, previous studies suggest that people in rural areas are less vulnerable to cerebrovascular disease, but there have been no population studies that have satisfied the criteria for ideal incidence studies. A review of stroke epidemiology in India showed that crude prevalence rates varied significantly between urban and rural areas. Crude prevalence rates per 100 000 during the period 1971 to 1993 crude in urban areas were 44 (Rohtak), 220 (Mumbai), 147 (Kolkata) compared to rural rates per 100 000 of 143 (Kuthar Valley, Kashmir), 126 (Malda, West Bengal), 57 (Vellore) and 52 (Gowribidinur).

Low Human Development Country
Several door-to-door studies have been performed in sub-Saharan Africa. In rural Ethiopia between 1986 and 1988, in a random sample of 60 820 people between the age of 28 to 85 years, a crude prevalence of 15 per 100 000 was found. In rural Tanzania the prevalence of disabling stroke was 154 for women and 114 for men per 100 000 over the age of 15 years. In the rural South African a prevalence study revealed a (age-standardized to the Segi World population) stroke prevalence of 290 per 100 000 (95% CI, 238 to 343). In sub-Saharan Africa there are no reliable data for either urban prevalence or stroke incidence.

A rural study in Bolivia showed a crude prevalence of stroke of 174/100 000 (322/100 age adjusted to the world standard population) and 663/100 000 in persons aged 35 years or older. In developing countries, incidence data are rare and relatively unreliable as 20% to 30% of stroke victims do not go to hospital.

Stroke Mortality

High Human Development Country
In Bulgaria, France, and Australia there was a higher stroke mortality in rural than in urban areas. In Canada, urban and rural mortality are similar, but more rural patients die in emergency departments.

Medium Human Development Country
One Chinese survey showed that stroke mortality rates were lower in rural areas than urban centers in China whereas another found no difference between rural and urban areas in Tianjin, China. Case-specific mortality data based on uniform methodology is not available from India.

Low Human Development Country
In the Agincourt rural district of northeast South Africa, between 1992 and 1995 in a population of 63 000, stroke was found to be the cause of 6% of deaths, the crude mortality rate being 127 per 100 000 (95% CI, 93 to 160) over the age of 35 years.

In Tanzania, a verbal autopsy study found that, overall, stroke was the cause of adult deaths in 5.5% in a population of 307 820. Urban mortality was significantly higher than rural, for both men and women. In The Gambia, in-hospital mortality was 41% and at 1 year was 62%.

Stroke-Related Disability

High Human Development Country
Rural areas and minority groups in the United States—for instance, native rural American-Indians and migrants—are predisposed to increased stroke-related disability because of lack of access to and usage of preventive services.

Medium Human Development Country
In rural India there is no reliable data regarding stroke-related disability.

Low Human Development Country
In rural northern South Africa, 66% of the survivors required help with at least 1 activity of daily living, a significantly higher rate compared not only to neighboring Tanzania but also New Zealand. However, in rural Bolivia, residual disability is relatively minor, presumably due to high case fatality.

Pathology
There is evidence in the literature that the pathology of stroke differs between rural and urban areas. In France, comparing the Avallon (rural) and Dijon (urban) region rural patients had higher rates of cerebral hemorrhage. In The Gambia, hemorrhagic strokes were more frequent than ischemic strokes according to clinical scoring methods.

Service Delivery in Rural Areas
Service delivery is often variable even within developed countries, and even more so in developing countries.
Neuroimaging

High Human Development Country
In rural Australia, over 90% of hospitals had 24-hour access to CT scanning, but residents had to travel, on average, about 100 km. Of 58 frontier hospitals in Wyoming and Montana, only 39% had 24-hour CT capabilities.

Medium Human Development Country
The use of CT scanning in rural areas as compared to urban ones was reported as “low” in China but precise data are not available. There is no reliable information on rural Indian CT services.

Low Human Development Country
In The Gambia, at the time of a nationwide study (1990), there was no CT in the country. In 1998, 18 African countries had no CT scanner and 13 had only 1. Only 9% of Nigerian patients could afford CT.

Neurology/Stroke Services
High Human Development Country
In a study of stroke services in 21 rural hospitals in Idaho, 77.8% reported patient and 66.7% transport delays. There were equipment delays in 22.2% and ancillary service delays in 61.1%. Only 33.3% of hospitals were involved in quality improvement programs. Thrombolytic therapy (tissue plasminogen activator [tPA]) was available for stroke in only 55.6%. No hospital had a designated stroke team. In Scotland, although the admission rate for symptomatic carotid disease was significantly higher in deprived rural populations, less carotid endarterectomies were performed in the rural compared to urban areas. Rural Australian patients were less likely than urban ones to receive CT of the head within 24 hours of admission, swallowing assessment, echocardiography, carotid-imaging, lipid or glucose estimations or services from allied health professionals. No rural hospital in New South Wales had a stroke-specific clinical nurse specialist, compared to 21 stroke nurse case manager positions in metropolitan New South Wales. Only one third of the rural hospitals had access to a neurologist.

Medium Human Development Country
There is no data regarding stroke services in rural India and China.

Low Human Development Country
According to WHO, the median number of neurologists in sub-Saharan Africa is 0.3/million, and there is less than one ancillary health worker per 1000 population. In rural South Africa, equipment such as sphygmomanometers is often lacking.

Stroke Management Issues in Rural Areas

Management Guidelines/Best Practice
Editorials in Stroke and The Lancet respectively have indicated that adherence to best-practice guidelines would reduce stroke risk by about 80%. However, in rural New South Wales, Australia, despite availability of the National Stroke Guidelines, only 50% rural hospitals used them.

Acute Management
Aspirin: The CAST and IST trials have shown that aspirin administered within 48 hours of a suspected ischemic stroke reduces the risk of death and dependency. During these trials, 800 noncomatose patients with cerebral hemorrhage were given aspirin without adverse effects. In The Gambia, the early use of aspirin alone had a significantly improved stroke outcome. Despite these data, a prospective evaluation in 2 east Texas rural communities revealed that heparin (9%) was used more commonly than aspirin (5%) in acute stroke.

Tissue Plasminogen Activator
In a selected group of patients tPA administered intravenously has significant benefits. The earlier the treatment occurs after onset of symptoms, the better the functional outcome. One method of expediting early hospital presentation is helicopter transport. In rural northeastern Florida/southeastern Georgia, prospectively collected data from 111 consecutive helicopter stroke transports showed that 18 (38%) ischemic stroke patients were treated with tPA. Sixty-five patients arrived within 135 minutes of stroke onset.

Edwards reported the experience in a 100-bed rural hospital in Nebraska where standing orders and a stroke protocols were implemented. Between 1998 and 2004, 493 patients were admitted with TIA or stroke, one third (n=169) arriving within the 3-hour time window. A total of 4% were treated with tPA. There was no symptomatic intracranial hemorrhage and 0 mortality. A recent study has shown that a structured telephone interview from a rural physician with a stroke specialist was effective resulting in an elapsed door-to-tPA time of 132±34 minutes. The rates of symptomatic bleeding (2.5% versus 6.4%) and hospital mortality (7.5% versus 13%) compared favorably with the urban National Institute of Neurological Disorders and Stroke (NINDS) study.

Although a possibility for stroke management in developed countries, tPA is not currently an option in LHDCs because of delayed presentation and cost. Because Activase (the tPA marketed by Genetech USA) costs $1375 US for 50 mg, it is invariably out of reach for the majority of LHDCs. Thrombolysis is used in <1% of strokes in China because patients cannot afford it, a situation paralleled in India.

Telemedicine in Rural Areas
Telemedicine tools range from a simple telephone consultation between rural center and a stroke center, to low-cost videoconferencing tool radiological transfer of CT images. A study from Phoenix, Ariz demonstrated that simple telephone support from a stroke center increased the number of tPA-treated patients by 72%.

In rural Georgia, the Remote Evaluation for Acute Ischemic Stroke (REACH) program has tested a video-based low-cost Web-based telestroke tool deployed in a hub-and-spoke hospital network, and has found this to be effective in facilitating acute stroke care, especially when tPA is appropriate.

The RUN program in France and the Calgary Stroke Program in Canada have both shown that telemedicine can making centralized stroke unit expertise routinely available to rural hospitals. The Telemedical Pilot Project for Integrative
Stroke Care (TEMPiS) was the first rural randomized controlled study evaluating telemedicine for stroke. It showed that 3 months after a first stroke, 44% of the patients admitted to rural hospitals served by telemedicine and 54% in the control group (no telemedicine) had a poor outcome (defined as death, institutional care, or disability). There was a 42% relative risk reduction in poor outcome after multivariable analysis (odds ratio 0.62, 95% CI, 0.52–0.74; \( P<0.0001 \)). More patients in the telemedicine-linked hospitals had an appropriate diagnostic procedure: for instance, rapid brain-imaging (74% versus 32%), carotid ultrasonography (83% versus 62%), and evaluation of dysphagia (73% versus 48%). Complication rates were similar to those reported in the NINDS study. The cost of the TEMPiS project was estimated at $300,000 euros per year. It required internet connections, CT scanners and 24-hour physician access and was only cost-effective with regard to consultations for possible thrombolysis which amounted to 396 of 2182 teleconsultations.

The Telemedicine in Stroke in Swabia (TESS) project demonstrated relevant contributions regarding both diagnostic work-up and management of strokes >75%. An advanced practicing nurse (APN) supported by an emergency physician via a telemedicine network been found useful in rural areas. An APN with telemedicine support may be a practical method of overcoming lack of doctors in rural areas.

**Subacute Care**

There is increased awareness worldwide of the need for compliance with published guidelines for acute and subacute care as well as management of risk factors after discharge. However, in rural areas and small communities these recommendations are often not implemented both in Europe and the United States.

Of 58 hospitals in Montana and Wyoming, 79% were located in frontier counties. Only 30% of the frontier hospitals met 6 to 10 of the Brain Attack Coalition criteria, compared to 67% of hospitals in the nonfrontier counties. Of 21 rural hospitals in Idaho, none had a designated stroke team. Compliance with published guidelines for the lowering of blood pressure, the use of antithrombotics and heparin after admission was lacking in 2 east Texas communities. Similarly, adherence to published guidelines was deficient in small regional European hospitals.

Significant discrepancies in following standardized protocols and best-practice recommendations were noted in Australian rural and smaller hospitals compared to urban hospitals. Despite 100% awareness, only 50% rural Australian hospitals implemented the published guidelines for stroke management.

**Efforts in Rural Settings to Implement Best-Practice Recommendations**

In response to this, an Australian initiative, the Rural Organisation of Australian Stroke Teams (ROAST) program, conducted at 6 rural hospitals has shown more than 10% improvement in adherence to published guidelines for in-hospital care of stroke patients. A rural stroke network in Swabia, the TESS project, has incorporated videoconferencing into routine practice. A variety of rural models of stroke care delivery have been initiated in the United States and Canada.

**Rehabilitation in Rural Settings**

A study in Northern Scotland suggested that patients after a first-time stroke in rural or remote areas are not disadvantaged compared to those in urban areas with respect to outcome or to the use of health and social care services. Similarly, a study in Nebraska comparing urban and rural settings showed that access to health care in rural Nebraska was as good, if not better, than access to health care in urban parts of the same state.

**Caregiver Burden and Support Systems**

Caregiver burden and the support systems in place are important in long-term management of stroke survivors in rural areas. An Australian study found rural caregivers experiencing severe physical and emotional effects and a lack of on-going psychosocial and rehabilitation support. The Temple Foundation Stroke project recommended that more time should be spent on caregivers of rural patients. A qualitative examination of the narratives of rural black stroke survivors and their families in North Carolina identified 5 main themes: discovering stroke, delaying treatment, living with uncertainty, discovering the impact of stroke, and reconstructing life. A study comparing white and black female caregivers in rural Mississippi that identified cultural differences needs to be highlighted in rural nursing curricula. A web-based support for rural caregivers has been piloted in rural Ohio and Michigan.

**Prevention in Rural Areas**

**Awareness of Warning Signs**

Awareness of signs of stroke is variable in rural areas. In Montana a telephone survey of 800 rural residents revealed that 70% were able to identify 2 or more warning signs, although only 38% recognized that speech difficulty was a sign of a stroke. In West Virginia only 20% of residents were able to identify all stroke warning signs, most were unaware of the importance of loss of vision and severe headache as indications of stroke. The results of a survey in northeast Bulgaria were similarly disappointing. A study in rural Georgia, USA revealed a low level of awareness of stroke warning signs. Although 48% reported a stroke in the family, and 95% considered stroke an emergency, only 39% of 602 adults could name 1 or more stroke warning signs in response to an unaided question. A component of a current web-based support tool for rural caregivers piloted in rural Ohio and Michigan is raising awareness of features of stroke in caregivers. Stroke signs were readily identified by Tsongan and Mozambican populations, but the reaction was to consult traditional healers.

**Awareness of Risk Factors**

Awareness of stroke risk factors is patchy in rural areas. In a rural Mennonite community only 8% of the study population had ever been screened for serum cholesterol despite the fact that one-third of those over the age of 55 years had had...
either a stroke or a myocardial infarction. Five independent cross-sectional population rural surveys, conducted between 1985 and 2000/2001 in the Czech Republic, that evaluated the awareness and control of hypertension demonstrated a significant increase of awareness of hypertension (49.5% to 67.2%) coupled with a significant decrease in the prevalence of hypertension (47.1% to 39.1%). Cooper reported that in sub-Saharan Africa hypertension awareness rates were as low as 20%. In Montana only 44% of participants were able to identify hypertension as a risk factor for stroke. A rural-urban study of awareness of hypertension in China in a population of 35 years and older showed that awareness of hypertension was 2.6% in rural populations compared to 4.4% in urban ones.

Primary Prevention Projects in Rural Areas
Innovative rural projects to promote stroke prevention have been launched in the United States and Canada. The Mississippi Stroke Education Consortium (MSEC) is a state-based volunteer advocacy group that targets rural Mississippi’s inhabitants through a continuous educational process. In Alabama, the Pine Apple Heart and Stroke Project trained and employed community health workers (CHWs) to promote risk reduction for stroke, specifically targeting black women. The training curriculum includes national guidelines for stroke prevention. In southeastern Alabama the rural Community-Based Stroke Risk Screening and Education Program targets high risk populations and has demonstrated a positive correlation between stroke education and ED presentation time. The Minnesota Heart Health Program was a rural community program using disease prevention methods in 3 Upper Midwestern communities comparing these with 3 matched communities. There was neither no significant change in risk factors morbidity or mortality for either stroke or coronary heart disease in 30 to 74 years old men and women. Systematic primary prevention models of hypertension detection and control have been effective in the prevention of stroke in rural Japanese men. In Canada, the Saskatchewan Heart Health Program was initiated in 1998, and targets 33 districts, of which all but 2 are rural. A large focus of the program targets information dissemination and raising awareness in these rural areas.

Secondary Prevention Programs in Rural Areas
In Maine, a secondary prevention nurse-driven community program has demonstrated significant time-dependent and dose-dependent reduction in both cardiovascular and total mortality. In Australia there is increased emphasis, in the exploration of different models of care for chronic disease such as stroke, in improving consumer access to information, improving provider-carer and patient communication, putting into place patient-empowered models of care and promoting self-management in rural areas. In several rural areas in the United States, internet-based education and support tools are being developed. In rural Africa, prevention of stroke recurrence is hampered by the lack of basic equipment such as sphygmomanometers and access to medication. In Mozambique, only 18% of health facilities can measure blood glucose. In The Gambia a year after discharge only 7% of those prescribed aspirin and 13% prescribed antihypertensives were taking it 1 year later. In rural South Africa, 83% of stroke survivors were prescribed antihypertensive medication at discharge but at 1 year only 8% were still on medication.

Government and Nongovernment Support for Rural Stroke Initiatives
There are numerous initiatives to improve rural stroke care often at state level in North America. In Australia, 88% of rural hospitals have until recently received no direct financial support for development of stroke services.

In Africa, although there is recognition of the gravity of the situation and the need for systems of management, review of the literature shows a remarkable lack of government initiatives. Some developing countries have a health budget per capita per year of US$10 or less. South Africa’s situation epitomizes the challenge of facing Government and nongovernment organizations in tackling the burgeoning problem of rural stroke. There are approximately 120 neurologists present in South Africa working with a population of over 30 million people. Only 10% to 20% of the population are able to access acute stroke units and rehabilitation services.

In developing countries provision of health services is often heavily dependent on non-Government Organizations (NGOs). An example is the Royal Australian Flying Doctor Service, that serves huge areas of the Outback.

Discussion
In rural and regional areas, the implementation of best-practice recommendations for stroke management is often suboptimal, particularly in developing countries. Factors contributing to this worldwide are difficult terrain, long distances, poor transportation and communications, traditional practices, lack of medical services and personnel, lack of equipment, hospitalization and financial support.

In developed countries such as the United States and Western Europe, the quality of stroke services for rural patients is variable. Technological advances have been used to improve acute management, but there are little data on effective implementation of rural systems of care that encompass all aspects of stroke management. In the developing world there are little rural data and basic facilities are often lacking.

In evaluating the management of stroke in rural areas and small communities worldwide, certain observations can be drawn (Tables 1 and 2).

Cost
In rural areas of the developing world an impediment to obtaining treatment is cost. For instance, in China 79% of rural inhabitants have no health insurance and 39% cannot afford medical treatment. Investigations should therefore be practical and tailored to resources. In Africa, CT studies have demonstrated 5% to 7% misdiagnosis of stroke. In the developing world, both in Africa and South America, mimics of stroke are frequently infective and therefore treatable. However, in many developing countries only a minority can
larger than those treated with thrombolysis. This is significantly greater benefit than thrombolysis, simply because the number of patients treated in stroke units is currently much higher than the number treated with thrombolysis. Practical measures for management of all steps in the care of stroke patients have been shown by Hankey and Warlow to have significantly greater benefit than thrombolysis, simply because the number of patients treated in stroke units is currently much higher than the number treated with thrombolysis. Practical measures for management of all steps in the care of stroke patients have been shown by Hankey and Warlow to have significantly greater benefit than thrombolysis, simply because the number of patients treated in stroke units is currently much higher than the number treated with thrombolysis.

**Systems and Models of Care**

There is consensus that stroke care needs systematic management. Expert panels have determined what systems are required as well as the most effective components of stroke services, and recommendations for prevention of recurrent stroke. Though there has been agreement that optimal systems should be in place, there is uncertainty whether the models needed should be “top-down or bottom-up”. However, the recommendations of the expert European panel, such as CT, carotid Doppler and ECG, may simply not be feasible in certain developing countries. These ideal recommendations should be tailored to meet the requirements of cost-effectiveness and practicality in developing countries and rural situations in scalable models.

Coordinated stroke care in stroke units reduces death and dependency by 56 per 1000 people treated. Stroke units have been shown by Hankey and Warlow to have significantly greater benefit than thrombolysis, simply because the number of patients treated in stroke units is currently much larger than those treated with thrombolysis. This is particularly applicable to rural settings in both developed and developing countries. Low-level stroke units with dedicated staff can identify and treat stroke-related problems according to standardized orders, implementing proactive general measures and early mobilization. In rural areas, these basic stroke units can later be “upgraded” and linked to specialist units.

National recommendations are available in most countries, and cost-effective guidelines have been promulgated by WHO. Practical measures for management of all steps in the detection and management of stroke, appropriate for low-resource rural areas should be emphasized. The approach should be context specific, effective, evidence-based and sustainable. Appropriate patient information is necessary.

Models of stroke care according to national recommendations are being applied in many developing countries, but there are no data on models of care being applied in rural China, Africa or India. The general recommendations for stroke treatment such as rapid diagnosis, proactive measures such as early use of aspirin, addressing swallowing difficulties, treating fever and pulmonary infections, are all feasible, even in poor developing countries (see Table 3). Thus in The Gambia and China the early use of aspirin was shown to have a significant effect on stroke outcome.

Most stroke worldwide is related to several traditional risk factors, and in this context strategies of management should not differ very much between countries.

More than 60% of stroke mortality in low income countries is due to a small number of modifiable risk factors and with correct management is estimated to reduce stroke risk significantly. Risk factors such as hypertension, low intake of fruit and vegetables, smoking, raised cholesterol and excess alcohol intake are common to all countries and populations, and emphasis should be on improving these factors. Particular emphasis should be placed, in whatever rural setting, on management of hypertension as the most consistent predictor of stroke, causing about 54% of stroke mortality in the developing world. Cheap and safe medications are available, but in the developing world have been underused. Lemogoum in his review of stroke management in sub-Saharan Africa stresses that the priority in developing countries should be prevention, as expensive acute treatment may not be possible. In rural areas, the importance of family participation in stroke care is important. Home rehabilitation has been shown to be as effective as inpatient rehabilitation and can be used in rural settings.

Apart from the limitations imposed by geography, cultural factors may play a role in obstructing prompt medical care. In rural Bolivia, up to 50% of stroke victims do not seek conventional medical help, while in rural South Africa, 10% to 33% of patients seek help from traditional healers before western medicine.

**Applicability of the WHO Model**

Although in developed countries stroke management as assessed against the WHO model would fall into the
category of “marketplace care”, in developing and low-income societies, the majority of rural patients will be treated in the category of “communal care”. Models of care that would promote adherence to best-practice guidelines and be adaptable to local circumstances are needed. One such multimodal model, the effectiveness which was demonstrated in a randomized controlled trial setting in urban Melbourne, has been developed into a patient-empowered, integrated care model, Integrated Care for Reduction of Recurrent Stroke (ICARUSS). It is an example of a scalable model that could be adapted to rural settings in both developed and developing countries and is currently being tested in a rural setting in Australia. Its features lie between Integrated Care and Managed Care.

Current Strategies

WHO guidelines for cost-effective secondary prevention strategies for low- and middle-income populations include lifestyle management, the use of antithrombotic and antihypertensive agents and the lowering of blood cholesterol. The WHO is actively aiming to integrate neurological care in villages in developing countries and is engaged in the production of a report detailing the public health challenges of neurological disorders including stroke, which will catalyze management and prevention programs. The WHO STEPS Stroke methodology for cerebrovascular disease surveillance, which is being implemented in several developing countries will assist in delineating the true incidence and prevalence of stroke in rural regions of developing countries, and allow for appropriate service planning.

Summary

The management of stroke in rural and regional areas is variable in both the developed and developing world. Informed by best-practice guidelines and recommendations for systems of stroke care, adaptable models of care that are appropriate for local needs should be devised for rural and regional settings.

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None.

References

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