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Statewide Efforts to Narrow the Rural–Urban Gap in Acute Stroke Care

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Background: Rural–urban gaps in stroke care remain challenging in part because of the lack of resources, personnel, and necessary infrastructure.

Purpose: The purpose of this study was to assess changes in the acute stroke diagnosis and treatment capacity among rural hospitals before and after implementation of a regionwide stroke initiative.

Methods: In 2004, the Montana Cardiovascular Health Program partnered with stroke stakeholders throughout the state and surveyed hospitals in Montana and northern Wyoming to assess the availability of technology, services, and personnel for acute stroke care. The Montana Stroke Initiative (MSI) developed protocols, educational material, and stroke awareness campaigns to address the geographic disparities identified in the survey. From 2004 to 2006, protocols and educational material were made available on a website and distributed to rural and critical-access hospitals throughout the region. Stroke awareness campaigns were completed, and MSI members conducted acute stroke care training of prehospital, nursing, and primary providers throughout the region. A follow-up survey in 2008 assessed changes in the stroke systems of care between 2004 and 2008. Data were analyzed in 2009.

Results: There were significant increases in availability of prehospital stroke screens, written emergency department protocols, computed tomographic scanning capability, acute stroke teams, and community stroke awareness programs.

Conclusions: A systematic statewide effort to improve stroke care led to improved acute stroke care capabilities in necessary infrastructure in rural facilities and a narrowing of the gap between these facilities and the urban facilities.

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Introduction

Many states and regions have organized^{1–5} stroke systems of care to improve outcomes for acute stroke victims. Stroke centers certified by the Joint Commission are an important part of the system both in the U.S. and in Europe,^{6,7} but organized stroke systems also require public awareness to facilitate prompt activation of emergency medical services (EMS), which

provide EMS protocols for screening, transport, and pre-hospital notification. This enables a rapid emergency department response to potential stroke victims.¹ Access to coordinated stroke systems of care remains a concern in rural and underserved areas. Several groups^{8–11} have highlighted deficiencies in specialty personnel, diagnostic technologies, and acute stroke teams in rural facilities along with a lack of community awareness of stroke as an emergency. Others have shown¹² that non-urban communities may not always follow current evidence-based guidelines for treatment of stroke. To address the rural–urban gaps found in many states, strategies must be sustained and systematic and cannot rely on sporadic voluntary efforts only. However, previous studies^{13–17} suggest that coordinated improvements in infrastructure and systems can result in improved acute stroke care and treatment.

In 2004, the Montana Stroke Initiative (MSI),¹⁸ a cooperative partnership between the Montana Department

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of Public Health and Human Services Cardiovascular Health Program and stroke stakeholders, assessed the availability of diagnostic and treatment services for acute stroke care in Montana and northern Wyoming. Key stakeholders included stroke neurologists from urban communities, stroke center personnel from referral hospitals, and representatives from EMS programs around the state. In addition, representatives from the American Stroke Association also participated in quarterly meetings coordinated by the state's Cardiovascular Health Program, which is supported by the CDC. Rural–urban disparities, similar to those previously reported^{9,10} in Illinois and North Carolina, were identified throughout the region.

Rural facilities lacked the infrastructure necessary for delivering quality stroke care—namely, prehospital stroke screens, written protocols, diagnostic technologies, and access to neurologists. The MSI developed a comprehensive strategy to address the organizational gaps identified in the 2004 survey. The initiative focused initially on the proper assessment and evaluation of acute stroke victims for consideration of thrombolytic therapy. A follow-up survey was conducted in 2008 to reassess stroke care throughout the region. The purpose of the current study was to evaluate the effect of implementing a comprehensive initiative to improve the system of acute stroke care in rural hospitals.

Methods

Montana Stroke Initiative

The comprehensive strategy included the development of protocols, targeted educational programs, and toolkits along with the establishment of a telestroke network and a website dedicated to stroke materials. The resources were intended for Emergency Medical Services (EMS) and emergency department providers region-wide, including those in small, outlying facilities identified in the initial survey as lacking such resources. A stroke toolkit was created containing protocols, forms, and other regional stroke resources to facilitate acute stroke care. The toolkit included modified NIH Stroke Scale forms, bedside swallow screens, criteria for selecting patients for thrombolytic treatment as well as post-thrombolysis management and patient transfer protocols along with selected references and formal guideline statements. The toolkit was distributed to all critical-access hospitals in the region and was also made available as downloadable files on the new website, www.montanastroke.org. Several regional stroke conferences featured the kit to promote its use in the outlying areas.

The MSI developed a prehospital stroke protocol, which the Montana Board of Medical Examiners accepted and incorporated into its statewide EMS protocol. The protocol provided clinical recommendations for EMS personnel, emphasizing the utilization of a prehospital screen, limiting on-scene time and pre-arrival notification to the receiving hospital. Local training programs and regional Montana conferences reached EMS providers with specific details about prehospital stroke screening and other important aspects of care for stroke victims. Educational sessions for emergency department and nursing staff members were also developed and pre-

sent by stroke neurologists and key stroke center nurse coordinators. The presentations were posted on the website for later review. An American Stroke Association prehospital stroke training program was distributed to the 68 EMS medical directors in the state.

There were several additional important activities conducted over the 4-year period between the surveys. Six small facilities from north-central Montana completed a stroke care quality-improvement project facilitated by the Montana Rural Healthcare Performance Improvement Network. Four tertiary referral hospitals in Montana obtained certification as primary stroke centers (PSCs), and a telestroke system was piloted⁷ in a rural facility to allow two-way interactive consults with stroke neurologists. Finally, four community-specific public education campaigns were conducted¹⁹ to raise the residents' level of awareness of stroke as an urgent, treatable medical condition needing immediate attention.

Evaluation. To evaluate the impact of the activities, the Montana Cardiovascular Health Program conducted a follow-up survey of hospitals in 2008 to reassess the availability of diagnostic and treatment services for acute stroke care. Sixty-four Montana hospitals were identified through the Montana Hospital Association website (www.mtha.org). The Wyoming Heart Disease and Stroke Prevention Program provided a list of nine additional hospitals in northern Wyoming because stroke patients from these facilities are often referred to stroke centers in south-central Montana. Five specialty hospitals within the region were excluded because they did not provide acute care for adults.

A letter sent to the chief medical director/officer of the remaining 68 hospitals included the questions for the 2008 survey. The letter explained the purpose of the current survey and encouraged them to ask their stroke/emergency department supervisor/director to complete the questionnaire. A separate but similar letter was sent to the stroke/emergency department supervisor/director explaining the survey and encouraging them to complete it. A stamped envelope was enclosed and a fax number was included on the survey to facilitate responses by any convenient mode. Telephone calls were made 2 weeks after the initial mailing to remind those who had not responded, and a second copy of the survey was sent to those who did not respond initially.

The baseline and follow-up surveys included a core set of 42 questions that assessed availability of diagnostic, treatment, and educational services in the prehospital, hospital, and community setting. The 2008 survey contained an additional 24 questions to allow a more comprehensive assessment than the 2004 survey. Responding hospitals were classified into three categories based on their status of these hospitals in 2004: PSCs, critical-access hospitals, or other. Although there were no formally certified stroke centers in 2004, four hospitals in the region were working toward accreditation and became formally certified prior to 2008. Therefore, these hospitals were classified as PSC for the 2004 and 2008 surveys. Hospitals serving rural communities and having limited services were defined as critical-access hospitals if they had obtained formal certification from Centers for Medicare and Medicaid Services.²⁰ The remaining hospitals were classified as other. Hospitals not completing both the 2004 and the 2008 surveys were excluded from the analyses.

Data analyses were completed in 2009 using SPSS, version 14.0. Chi-square tests were used to compare differences in the availability of individual diagnostic tests, programs, and personnel for acute stroke care stratified by type of hospital.

Results

The overall response rate for hospitals completing both surveys (79%, 54 of 68) was high. The response rates by hospital type were 100% for PSC, 93% for critical-access hospitals, and 52% for other hospitals. From 2004 to 2008, there were significant improvements in the availability of an EMS in-field stroke screen overall and particularly in critical-access hospitals, the largest group of hospitals in the Montana and northern Wyoming region (Table 1). More hospitals reported community stroke awareness programs in 2008 than in 2004. There were also improvements in the availability of written stroke protocols in the emergency department and written tissue plasminogen activator (t-PA) protocols for thrombolytic therapy for acute ischemic stroke.

Overall, CT scan availability improved significantly from 67% in 2004 to 100% in 2008, with 90% having 24/7 availability. This improvement was again especially notable among critical-access hospitals, where CT scan avail-

ability increased from 55% in 2004 to 100% availability in 2008 (Table 1). There was also a significant improvement in the number of facilities with designated stroke teams, from 6% in 2004 to 26% in 2008 (Table 2). In addition, the percentage of hospitals reporting that stroke rehabilitation services were available in their facility or within their community increased slightly from 66% in 2004 to 78% in 2008, but this improvement did not reach significance. In 2008, 100% of PSC, 46% of critical-access hospitals, and 60% of other hospitals reported administering t-PA for stroke in the past year.

Discussion

Our findings suggest that substantial progress has been made to increase diagnostic and treatment capacity for acute stroke in both small and large hospitals across Montana and northern Wyoming and a narrowing of the gap between rural and urban facilities. Substantial improve-

ments were noted in rural critical-access hospitals, which constitute 78% of all hospitals in the region. Critical-access hospitals reported availability of prehospital stroke screens, written emergency department and t-PA protocols and transfer relationships in more than 70% of the facilities surveyed. CT scan capability increased in critical-access hospitals to 100%, and almost half (47%) had conducted community stroke awareness programs. Improvements in personnel commitment were noted by 24/7 CT scan availability (89%) and the formal designation of acute stroke teams in nearly 20% of the rural facilities.

Among the most promising results of the MSI was the notable increase in what

Table 1. Availability of prehospital and hospital services/programs, Montana and northern Wyoming, 2004 and 2008

Services	Primary stroke center		Critical-access hospital		Other		Total	
	2004 n=4	2008 n=4	2004 n=38	2008 n=38	2004 n=12	2008 n=12	2004 N=54	2008 N=54
Prehospital								
In-field assessment tool	100	100	46	76*	45	58	49	74*
Mechanism to pre-notify hospital by EMS	100	100	92	92	100	100	94	94
Professional stroke education for EMS	—	100	—	75	—	55	—	73
Community stroke awareness program	100	75	14	47*	17	73*	21	55*
HOSPITAL								
Written ED stroke protocol	100	100	46	83*	82	83	58	85*
Written rt-PA protocol for acute ischemic stroke	100	100	66	79	75	91	70	83
Administered rt-PA for stroke in past year	—	100	—	46	—	60	—	55
Established relationship to transfer acute stroke	0	25	89	94	83	91	81	88
Stroke diagnostic capabilities	100	100	55	68	92	92	67	76
CT scan	100	100	55	100*	92	100	67	100*
Available 24/7	100	100	82	89	100	89	90	90

Note: Values are percentages. Dashes indicate that the question was not asked in 2004.

* $p < 0.05$

CT, computed tomography; ED, emergency department; EMS, emergency medical services; rt-PA, recombinant tissue plasminogen activator

the Brain Attack Coalition has termed “necessary infrastructure” for acute stroke care beyond adoption of written protocols.⁶ Investigators in North Carolina showed an important association of lower stroke mortality with counties that had adequate stroke infrastructure at the healthcare facility.²¹ To close the infrastructure gap between rural and urban facilities, the MSI provided written protocols and targeted education, but rural facilities themselves committed the resources to develop the necessary infrastructure for providing thrombolytic therapy for acute stroke within the time frames specified by current guidelines.

There are a number of limitations to this study. First, the information collected as part of the surveys was self-reported, and the responses were not confirmed by external review and may not reflect actual changes in clinical practice. Although the intended survey respondent was the stroke/emergency department supervisor/director, respondents from diverse positions completed the survey and may have had varying levels of knowledge about their hospital’s capabilities. Thus, it is possible that some of the improvement could have been simply an increased awareness of the individual responding about local stroke-related activities. Second, the impact of the current intervention was evaluated using baseline and follow-up surveys in the project’s targeted area, and no separate non-intervention region was available for comparison. Third, it may be possible that the changes in the acute stroke care system in Montana occurred as a result of secular trends. However, a previous study in North Carolina found that improvements in their acute stroke care system occurred only after implementation of their state effort.²² Finally, the current study focused on the processes that improve the capabilities for quality stroke care, but stroke-related outcomes were not assessed.

Table 2. Availability of hospital inpatient services, programs, and personnel, Montana and northern Wyoming, 2004 and 2008

Services/personnel	Primary stroke center		Critical-access hospital		Other		Total	
	2004 n=4	2008 n=4	2004 n=38	2008 n=38	2004 n=12	2008 n=12	2004 N=54	2008 N=54
Services/programs								
Intensive care unit	100	100	53	37	83	83	63	52
Stroke unit	50	100	5	0	0	17	8	11
Rehabilitation services	100	100	62	74	67	83	66	78
Intervention capabilities	75	75	13*	0	30	25	22	11
Available 24/7	100	67	80	—	33	100	73	83
Stroke registry/database	—	100	—	32	—	27	—	37
Professional education opportunities	—	100	—	69	—	45	—	67
Personnel								
Acute stroke team	75	100	0	18*	0	25	6	26*
Available 24/7	100	100	N/A	100	N/A	100	100	100
Neurologist available 24/7	100	75	100	75	57	71	75	73

Note: Values are percentages. Dashes indicate that the question was not asked.

* $p < 0.05$

N/A, not applicable

Although others have documented quality improvements in stroke care through statewide registries, the current study might be the first to report on the effects of a statewide effort to improve stroke care in rural hospitals.²³ In contrast to the measurement work in North Carolina, the Montana project took specific actions to fill the gaps identified in the initial survey using regional expertise. Efforts in the current study were somewhat different from the successful organization of stroke teams in rural Australia reported recently.²⁴ In rural Australia, physicians were trained and teams organized to implement stroke guidelines in the setting of general medical wards of the hospitals. The experience in both Montana and Australia shows that the disparity in stroke care between rural and urban facilities can be addressed.

In order to maintain critical-access hospital commitment of resources and personnel, there will be a continued need for support from urban centers in a hub-and-spoke stroke network model. Further improvement in acute stroke care through more accurate decision making for intravenous t-PA is expected as telestroke services expand in the region, enabling a greater number of stroke victims access a neurologist in the first critical hours of a stroke.²⁵ This is one example of how the state Cardiovascular Health Program is expected to continue fostering

communication between rural community hospitals and urban regional centers.

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