

Stroke Knowledge Among Urban and Frontier First Responders and Emergency Medical Technicians in Montana

Michael J. McNamara, MS;¹ Carrie Oser, MPH;¹ Dorothy Gohdes, MD;¹ Crystelle C. Fogle, MBA, MS, RD;¹ Dennis W. Dietrich, MD;² Anne Burnett, MN, APRN-BC, FNP;² Nicholas Okon, DO;³ Joseph A. Russell, NREMT-P;⁴ James DeTienne, EMT-B;¹ Todd S. Harwell, MPH;¹ and Steven D. Helgerson, MD, MPH¹

ABSTRACT: *Purpose:* To assess stroke knowledge and practice among frontier and urban emergency medical services (EMS) providers and to evaluate the need for additional prehospital stroke training opportunities in Montana. *Methods:* In 2006, a telephone survey of a representative sample of EMS providers was conducted in Montana. Respondents were stratified into 2 groups: those working in urban and frontier counties. *Findings:* Compared to EMS providers from urban counties, those from frontier counties were significantly more likely to be older (mean age 44.7 vs 40.1 years), have fewer personnel working in their service (mean 17.7 vs 28.6), to be located farther away from a computed tomography scan (CT scan) (mean 41.3 vs 17.6 miles), and to be volunteers (84% vs 49%). They were also less likely to have a stroke protocol (58% vs 66%) and use a stroke screening tool (36% vs 47%) than their urban counterparts. There were no significant differences between frontier and urban EMS respondents' ability to correctly identify 4 or more stroke warning signs (58% vs 61%), 4 or more stroke risk factors (46% vs 43%), or the 3-hour recombinant tissue plasminogen activator (rt-PA) treatment window (56% vs 57%). Approximately two thirds of respondents from urban and frontier counties believed they had adequate stroke knowledge, but 90% indicated they were interested in additional stroke-related training. *Conclusions:* Although stroke knowledge did not differ between urban and frontier groups, stroke screens and stroke protocols were less likely to be used in the frontier areas. Training opportunities and the implementation of stroke protocols and screening tools are needed for EMS providers, particularly in frontier counties.

decrease the morbidity caused by stroke.² However, at present only 3.0%-8.5% of potentially eligible stroke patients are treated with rt-PA.³ The benefit of intravenous (IV) rt-PA is strongly influenced by the timely administration of the drug, with best results seen if treatment begins within 3 hours of symptom onset.⁴ Major barriers in the rapid presentation of stroke patients to the emergency department (ED) include the inability of stroke victims and bystanders to recognize symptoms and the failure to activate emergency medical services (EMS).⁵⁻⁹ Studies have indicated that stroke patients arriving by EMS were more likely to arrive at the ED within 3 hours of symptom onset, had significant reductions in the time seen by the ED physician, and had a reduction in door-to-computed tomography scan (CT scan) time compared to patients arriving by private vehicle.¹⁰⁻¹³ Thus, many states and regions have implemented stroke protocols and stroke screening tools

¹Montana Department of Public Health and Human Services, Helena, Mont.

²Benefis Healthcare Stroke Center, Great Falls, Mont.

³St. Vincent Healthcare Stroke Center, Billings, Mont.

⁴Great Falls Fire Rescue, Great Falls, Mont.

For further information, contact: Michael J. McNamara, MS, Montana Cardiovascular Health Program, Montana Department of Public Health and Human Services, Cogswell Building, C314 PO Box 202951, Helena, MT 59620-2951; e-mail mmcnamara@mt.gov.

Stroke is a leading cause of death and disability in the United States.¹ Advances in treating ischemic stroke, most notably the approval of recombinant tissue plasminogen activator (rt-PA) in 1996, hold promise to

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administered by EMS providers in the field to increase the identification of potential stroke patients, allowing for prenotification to the receiving hospital, thus reducing prehospital and in-hospital delays.¹⁴⁻¹⁷

A nationwide survey of emergency medical technician (EMT)-intermediates (EMT-I) and paramedics (EMT-P) published in 1999 highlighted opportunities for improvement in prehospital stroke care knowledge and practice.¹⁸ In rural areas where there are a significant number of volunteer first responders (FR) and EMT-basics (EMT-B) who lack advanced EMS training, less is known about knowledge and practice related to prehospital stroke care. In order to quantify stroke knowledge and skills and to assess the need for added educational opportunities, we conducted a survey of FR, EMT-B, EMT-I, and EMT-P in Montana. This report compares the service characteristics, knowledge, and practice related to prehospital stroke care of EMS providers in frontier and urban counties.

Methods

Montana is a geographically large state with a relatively small population. In 2000, the total population of Montana was 902,195, spread across 147,042 square miles.¹⁹ Definitions used for Montana's "urban" and "frontier" counties were based on the 5 urbanization levels as defined by Eberhardt et al.²⁰ We combined small metropolitan counties ($n = 2$) and nonmetropolitan counties with a city of 10,000 or more population ($n = 6$) into the category we defined as "urban." The remaining 48 counties, defined as nonmetropolitan counties without a city of 10,000 or more population, we defined as "frontier." The terms "urban" and "frontier" as used in this document are general descriptors only.

The telephone survey was adapted from a nationwide mailed survey published by Crocco et al, which assessed knowledge and practice from a sample of EMT-I and EMT-P.¹⁸ The Montana Board of Medical Examiners database was used to identify individuals licensed as FRs and EMTs in the state. In 2005, there were approximately 4,400 licensed FRs, EMT-Bs, EMT-Is, and EMT-Ps practicing in Montana, of which 27% were FRs, 65% were EMT-Bs and EMT-Is, and 8% were EMT-Ps. Due to the small number of licensed EMT-Is ($n = 39$), EMT-Bs and EMT-Is were combined into 1 group. A stratified sample of FRs, EMT-Bs and EMT-Is, and EMT-Ps were selected to complete the survey. The data analyses were weighted to ensure that the respondents were representative of the overall population of FRs and EMTs. Respondents were classified as practicing in frontier or urban counties

based on the location where the individual FR/EMT primarily provided service. The survey consisted of 71 questions specifically evaluating their demographic characteristics, practice and service, and interest in additional training.

A weighted analysis based on the sample design was conducted using SPSS v14.0 software (SPSS, Inc., Chicago, Ill). Chi-square tests were used to compare differences in the service characteristics, stroke knowledge, experience, and training needs between respondents in frontier and urban counties. Analysis of variance was used to compare differences in demographic and service characteristics of respondents for continuous variables (ie, age and miles from CT).

Results

A total of 988 EMS personnel completed the telephone survey with an overall response rate of 77% (988/1,285). Fifty-nine percent of the respondents were practicing in frontier counties, while 41% were practicing in urban counties. Respondents practicing in frontier counties were more likely to be older (mean age 44.7 vs 40.1), have fewer EMS personnel working in their service (mean 17.7 vs 28.6), and to be located farther away from a health care facility with CT scan capability compared to respondents practicing in urban counties (mean 41.3 vs 17.6 miles). Respondents practicing in urban counties were more likely to be male (mean 76% vs 54%), and to report working with more paid employees (mean 49% vs 16%) compared to respondents practicing in frontier counties.

There were no significant differences in the ability to name 4 or more warning signs of stroke, or 4 or more stroke risk factors, between respondents practicing in urban versus frontier counties (Table). There were also no significant differences in awareness of the 3-hour rt-PA treatment window or acute management strategies initiated in the field that included cardiac monitoring, starting an IV, oxygen administration, and blood glucose monitoring. However, urban EMS providers were more likely to have a service-wide stroke protocol and utilize a stroke screening tool compared to respondents from frontier services. No significant differences were found regarding the need for stroke patients to be evaluated emergently or that high blood pressure should not be treated in the field. Respondents from urban and frontier counties were equally knowledgeable about the high priority of establishing symptom onset.

Respondents from urban counties were more likely to have received training in the use of a prehospital stroke screening tool compared to those respondents from frontier counties (Table). Approximately two

Table. Stroke Knowledge and Practice Patterns of Emergency Medical Service Respondents in Frontier and Urban Counties, Montana, 2006

	Frontier (N = 582) %	Urban (N = 406) %	Total (N = 988) %	P Value
Identification of stroke warning signs				
4 or more warning signs	58	61	59	.73
2-3 warning signs	38	35	37	
0-1 warning signs	4	4	4	
Identification of stroke risk factors				
4 or more risk factors	46	43	45	.13
2-3 risk factors	36	42	38	
0-1 risk factors	18	14	17	
Time frame for administration of thrombolytic therapy				
≤3 h	56	57	57	.67
>3 h	6	7	6	
Do not know	38	36	37	
Identified acute management strategies for potential stroke patients				
Cardiac monitor*	95	96	96	.70
Insert IV*	92	98	95	.13
Oxygen	97	99	98	.14
Check blood glucose*	89	96	93	.07
Stroke protocol available	58	66	61	.04
Stroke screening tool used	36	47	40	.002
Respond to stroke as an emergency	89	86	88	.173
Hypertension should not be treated in field	19	23	21	.132
Establishing symptom onset time as a high priority	99	99	99	.803
Trained in using stroke screening tool	38	47	42	.01
Feel stroke knowledge adequate	65	68	66	.35
Interested in more training on prehospital stroke care	93	85	90	<.001

*Includes only those respondents in which cardiac monitoring, IV management, and blood glucose monitoring are within their scope of care.

thirds of the respondents from both urban and frontier counties felt that their knowledge of stroke was adequate, but most (90%) expressed interest in receiving additional stroke training.

Discussion

Our findings suggest that stroke knowledge and practice were similar between those practicing in frontier and urban counties, but respondents practicing in urban counties were more likely to have a stroke protocol, to have received training on the use of a prehospital stroke screening tool, and to utilize a prehospital stroke screening tool compared to respondents in frontier counties. Interestingly, even

with the higher percentage of stroke protocol use and additional training in urban counties, no significant differences were noted in basic stroke knowledge, awareness of the 3-hour rt-PA treatment window, or acute stroke management strategies. Although most respondents reported adequate knowledge about stroke, most expressed interest in additional training.

Compared to the national survey, we found a higher level of stroke knowledge.¹⁸ Crocco et al. reported that only a small percentage (22% and 35%, respectively) of EMT-I and EMT-P were aware of the 3-hour rt-PA treatment window. Eighty-one percent of the EMT-P and 69% of the EMT-I respondents felt prehospital glucose monitoring was important. Between 25% and 35% of the respondents felt that

stroke could be treated on a nonemergent basis. In our study, even with the inclusion of FRs and EMT-Bs, approximately 44% of the respondents were aware of the 3-hour treatment window, over 90% felt prehospital glucose monitoring was important, and 88% indicated that stroke patients should be treated on an emergent basis. However, both studies identified a need for additional training regarding blood pressure management in the prehospital setting.

There are 3 limitations to this study. First, self-reported information regarding stroke knowledge and practice was collected, which may not accurately reflect practice patterns. Second, there may be differences in knowledge and practice in FR and EMT nonresponders compared to those who responded. Third, our findings may not be generalized to EMS providers working in large urban settings; however, EMS providers working in other rural areas are likely similar to the respondents in this survey.

Finally, the survey of EMS providers was a part of a more comprehensive effort to improve prehospital and acute stroke care in Montana. The Montana Cardiovascular Health (CVH) Program in partnership with the Montana Stroke Initiative (MSI)—a group of physicians, nurses, EMS personnel, and public health practitioners working to improve stroke care in Montana—responded by developing a Web site that provides Web-based training opportunities, including presentations and links to other sites that offer training and continuing education for EMS personnel. The CVH Program has also provided all the state's EMS services with the American Heart Association/American Stroke Association's *Stroke Prehospital Care* compact disc (CD) and collaborated with the National Stroke Association to bring the *Stroke Rapid Response™* program to Montana. The survey results also played a crucial role in the development of a statewide stroke protocol approved by the Board of Medical Examiners. Key elements of the protocol included the documentation of symptom onset time and the use of a prehospital stroke screening tool. In addition, to augment the crucial role EMS plays in the continuum of stroke care, the CVH Program and MSI are conducting public education campaigns to increase community knowledge of stroke risk factors, signs and symptoms, and the importance of prompt activation of EMS.

Conclusion

Although basic stroke knowledge did not differ between respondents practicing in urban and frontier counties, stroke screens and stroke protocols were less likely to be used in the frontier areas. The majority of

respondents felt that their knowledge of prehospital stroke care was adequate. However, opportunities for improvement were identified and the level of interest in additional training was high.

References

1. American Heart Association. *Heart Disease and Stroke Statistics-2005 Update*. Dallas, Tex: American Heart Association; 2005.
2. The National Institute of Neurologic Disorders and Stroke (NINDS) rt-PA Stroke Study Group. A systems approach to immediate evaluation and management of hyperacute stroke: experience at eight centers and implication for community practice and patient care. *Stroke*. 1997;28:1530-1540.
3. Reeves MJ, Arora S, Broderick JP, et al. Acute stroke care in the US: results from 4 pilot prototypes of the Paul Coverdell National Acute Stroke Registry. *Stroke*. 2005;36(6):1232-1240.
4. Hacke W, Donnan G, Fieschi C, et al. Association of outcome with early stroke treatment: pooled analysis of ATLANTIS, ECASS, and NINDS rt-PA stroke trials. *Lancet*. 2004;363:768-774.
5. Moser DK, Kimble LP, Alberts MJ, et al. Reducing delay in seeking treatment by patients with acute coronary syndrome and stroke: a scientific statement from the American Heart Association council on cardiovascular nursing and stroke council. *Circulation*. 2006;114:168-182.
6. Bambauer KZ, Johnson C, Bambauer DE, Zivin JA. Reasons why few patients with acute stroke receive tissue plasminogen activator. *Arch Neurol*. 2006;63:661-664.
7. Harwell TS, Blades LL, Oser CS, et al. Perceived risk for developing stroke among older adults. *Prev Med*. 2005;41(3-4):791-794.
8. Ferris A, Robertson RM, Fabunmi R, Mosca L. American Heart Association and American Stroke Association national survey of stroke risk awareness among women. *Circulation*. 2005;111:1321-1326.
9. Wein TH, Staub L, Felberg R, et al. Activation of emergency medical services for acute stroke in a nonurban population: the T.L.L. Temple Foundation stroke project. *Stroke*. 2000;31:1925-1928.
10. Morris DL, Rosamond WD, Madden K, Schultz C, Hamilton S. Prehospital and emergency department delays after acute stroke: the Genentech stroke presentation survey. *Stroke*. 2000;31:2585-2590.
11. Schroeder EM, Rosamond WD, Morris DL, Everson KR, Hinn AR. Determinants of the use of emergency medical services in a population with stroke symptoms: the second delay in accessing stroke healthcare (DASH II) study. *Stroke*. 2000;31:2591-2596.
12. Morris DL, Rosamond WD, Hinn AR, Gorton RA. Time delays in accessing stroke care in the emergency department. *Acad Emerg Med*. 1999;6(3):218-223.
13. Lacy CR, Suh DC, Bueno M, Kostis JB. Delay in presentation and evaluation for acute stroke: Stroke Time Registry for Outcomes Knowledge and Epidemiology (S.T.R.O.K.E.). *Stroke*. 2001;32:63-69.
14. Suyama J, Crocco TJ. Prehospital care of the stroke patient. *Emerg Med Clin North Am*. 2002;20:537-552.
15. Gordon D, Issenberg S, Gordon M, LaCombe D, McGahie WC, Petrusa ER. Stroke training of prehospital providers: an example of simulation-enhanced blended learning and evaluation. *Med Teach*. 2005;27(2):114-121.

16. Kothari RU, Pancioli A, Liu T, Brott T, Broderick J. Cincinnati prehospital stroke scale: reproducibility and validity. *Ann Emerg Med.* 1999;33(4):373-378.
17. Bray JE, Martin J, Cooper G, Barger B, Bernard S, Bladin C. An interventional study to improve paramedic diagnosis of stroke. *Prehosp Emerg Care.* 2005;9(3):297-302.
18. Crocco TJ, Kothari RU, Sayre MR, Liu T. A nationwide prehospital stroke survey. *Prehosp Emerg Care.* 1999;3:201-206.
19. United States Department of Commerce. Census 2000 Summary File (SF 1). Washington, DC: U.S. Department of Commerce, Economic and Statistics Administration, Bureau of the Census; 2000.
20. Eberhardt MS, Ingram DD, Makuc DM, et al. Urban and rural health chartbook: health, United States, 2001. Hyattsville, Md: National Center for Health Statistics, Centers for Disease Control and Prevention, Department of Health and Human Services; 2001, Publication no. (PHS) 01-1232.