

Public Education Strategies to Increase Awareness of Stroke Warning Signs and the Need to Call 911

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Rapid identification and treatment of ischemic stroke can lead to improved patient outcomes. We implemented a 20-week public education campaign to increase community awareness of warning signs for stroke and the need to call 911. Telephone surveys were conducted in adults aged 45 years and older before and after the intervention to evaluate its impact. There was a significant increase in awareness of two or more warning signs for stroke from baseline to follow-up (67% to 83%). Awareness increased significantly among both men and women and younger and older respondents. There was no significant change in the proportion of respondents indicating that they would call 911 if they witnessed someone having a stroke (74% to 76%). However, after the campaign, an increased proportion of respondents indicated that they would call 911 if they experienced sudden speech problems (51% to 58%), numbness or loss of sensation (41% to 51%), or paralysis (46% to 59%) that would not go away. Our findings suggest that a high-intensity public education campaign can increase community awareness of the warning signs for stroke and the need to call 911.

KEY WORDS: awareness, stroke, 911 emergency medical services, mass media risk factors, signs and symptoms

Lack of awareness of stroke warning signs and the need to call 911 and emergency medical services may partially explain why people delay seeking urgent care for stroke.^{1,2} Several studies have shown that public knowledge regarding stroke warning signs and risk factors is suboptimal.^{3,4} Although it remains uncertain whether improving community awareness will translate into more patients seeking both preventive

stroke care and timely acute care, public education campaigns to promote awareness of stroke warning signs and the need to seek urgent treatment have been an integral part of interventions, which have successfully improved timely access to short-term treatment for ischemic stroke.⁵⁻⁹ Recent studies have found that

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both low- and high-intensity media campaigns were associated with increased community awareness of stroke warning signs and increased emergency department presentation of stroke patients associated with public education.^{10,11} However, relatively few studies have been conducted to evaluate the use of media campaigns.

In 2006, the Montana Department of Public Health and Human Services implemented a public education campaign as part of a multilevel public health intervention to decrease the morbidity and mortality from stroke. This report describes the impact of this education campaign on community awareness of stroke warning signs and the need to call 911.

● Methods

Setting

The population for this study included residents living in Missoula County, which includes the city of Missoula. The estimated 2006 census population for the county was 101 417.¹² Most of residents were non-Hispanic White (93.6%) or American Indian (2.6%). The median age was 34.5 years and the median household income was \$38 168.

Public education campaign

A high-intensity public education campaign was conducted during two 10-week periods from July to September 2006 and from January to February 2007 in the Missoula media market (Missoula and surrounding counties). The target audience was men and women aged 45 years and older. The campaign included four paid television and three paid radio advertisements that addressed the warning signs for stroke, and the need to call 911 and act quickly. One television advertisement addressed stroke warning signs and depicted former stroke patients who survived because their spouses knew the stroke signs and called 911. A second television advertisement described a simple three-step test that consumers could take if they or someone they witnessed may be having a stroke. The third television advertisement depicted a female physician describing stroke risk factors, and the fourth advertisement focused on brain cell death associated with delays in treatment. The radio and newsprint advertisements contained similar messages on stroke signs, the stroke test, and the need to call 911 immediately. The gross rating points (GRPs) for the television and radio advertisements were 3 425 and 4 030, respectively, for the first 10-week period and 3 477 and 3 350, respectively, for the second 10-week period. GRPs are the sum of all

rating points achieved for a particular time period and are calculated by multiplying the rating of the show(s) in which the advertisement was aired by the number of times it is shown (frequency). A higher GRP indicates greater population exposure to the advertisement. Newsprint advertisements were placed in the community newspaper each Sunday during the 20-week period.

Program evaluation

To evaluate this intervention, the Montana Department of Public Health and Human Services conducted sequential random-digit-dial telephone surveys of adults aged 45 years and older living in Missoula County before and after the awareness campaign. The survey methodology has been described previously.¹³ Briefly, trained interviewers using computer-assisted telephone interviewing software conducted the survey. Eligible persons living in households with more than one eligible respondent were randomly selected, and up to 15 attempts were made to complete unanswered calls. The survey was field-tested to detect potential problems with questions or answer categories, and then revised as needed. Four hundred surveys were completed in each time period.

The survey included questions regarding the warning signs for stroke, the respondents' recall of advertisements regarding the warning signs for stroke, calling 911 regarding stroke, previous diagnoses of risk factors for stroke, and demographic information. Open-ended questions adapted from Pancioli and colleagues were used to assess the respondents' knowledge of the stroke warning signs.¹⁴ Respondents were prompted to name up to three warning signs for stroke. Respondents were asked whether they remembered seeing or hearing any television, radio, or newsprint advertisements regarding the warning signs for stroke in the past 3 months. Respondents were also asked four questions adapted from a study by Yoon and colleagues to identify what they would do if they witnessed someone having a stroke, or if they experienced sudden stroke symptoms including numbness, paralysis, or speech problems that would not go away.¹⁵ Respondents were asked a series of questions to identify whether they had a history of myocardial infarction, angina or coronary heart disease, stroke, transient ischemic attack, atrial fibrillation, diabetes, high blood pressure level, and high cholesterol level and whether they currently smoked cigarettes.

On the basis of the current recommendations from a national organization, the sudden onset of the following symptoms were considered to be warning signs for stroke: dizziness, difficulty understanding or slurred speech, severe headache, problems with vision, weakness on one or both sides of body or face, numbness on

one or both sides of body or face, trouble walking, loss of balance, or lack of coordination.¹⁶ High blood pressure level, high cholesterol level, smoking, diabetes, atrial fibrillation, heavy alcohol use, history of heart disease, and a history of stroke or transient ischemic attack were considered stroke risk factors.

Data analyses were completed using SPSS version 14.0 software (SPSS Inc, Chicago, Illinois). To evaluate the impact of the campaign, χ^2 tests and independent t tests were used to compare differences in respondent awareness of the warning signs for stroke, recall of stroke-related media, and the use of 911 emergency medical services at baseline in comparison with follow-up.

● Results

Overall, there were no statistically significant differences in the demographic characteristics of respondents aged 45 years and older at baseline in comparison with follow-up (Table 1). There were also no statistically significant differences in the prevalence of risk factors for stroke among respondents during the two time periods, except that respondents in the follow-up survey reported a higher prevalence of high blood pressure levels than respondents in the baseline survey (37% vs 45%, $P < .05$).

There was a statistically significant increase in the proportion of respondents who recalled seeing or hearing television advertisements about stroke (35% to 80%, $P < .001$) and radio advertisements (14% to 28%,

TABLE 1 ● Characteristics of respondents aged 45 years and older in Missoula County at baseline and follow-up, 2006 to 2007

	Time period	
	Baseline (<i>N</i> = 400)	Follow-up (<i>N</i> = 400)
	<i>n</i> (%)	<i>n</i> (%)
Age ≥ 65 y	147 (37)	150 (38)
Sex, female	250 (63)	234 (59)
Education ≥ 12 y	370 (93)	377 (95)
Current smoker	58 (15)	48 (12)
History of		
Atrial fibrillation	44 (11)	41 (10)
Diabetes	43 (11)	35 (9)
High blood pressure level	147 (37)	178 (45) ^a
High cholesterol level	147 (37)	169 (42)
Heart disease	47 (12)	50 (13)
Stroke or transient ischemic attack	16 (4)	26 (7)

^a $P \leq .05$.

TABLE 2 ● Awareness of the warning signs for stroke among respondents aged 45 years and older at baseline and follow-up, Missoula County, 2006 to 2007

	Time period	
	Baseline (<i>N</i> = 400)	Follow-up (<i>N</i> = 400)
	Mean (SD)	Mean (SD)
Number known	1.82 (1.05)	2.25 (0.90) ^a
	<i>n</i> (%)	<i>n</i> (%)
Number known		
0	65 (16)	28 (7)
1	66 (17)	40 (10)
2	145 (36)	138 (35)
3	124 (31)	194 (49) ^a
Warning signs		
Speech	151 (38)	278 (70) ^a
Dizziness	115 (29)	65 (16) ^a
Numbness or loss of sensation	191 (48)	225 (56) ^a
Vision	83 (21)	48 (12) ^a
Headache	60 (15)	46 (12)
Difficulty walking	70 (18)	85 (21)
Paralysis	58 (15)	147 (37) ^a

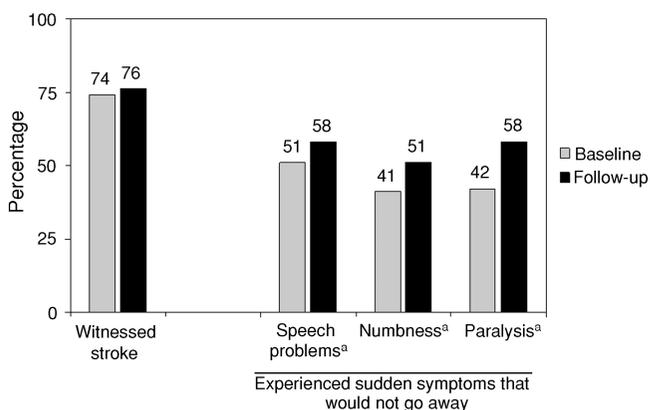
^a $P \leq .05$.

$P < .001$) in the past 3 months from baseline to follow-up (data not shown). There was no significant increase in the proportion of respondents who reported seeing newspaper advertisements about stroke in the past 3 months from baseline to follow-up (40% to 45%, $P = .17$).

Overall, there was a statistically significant increase in the mean number of correctly identified warning signs for stroke among respondents from baseline to follow-up (Table 2). The proportion of respondents correctly identifying speech problems, numbness or loss of sensation, and paralysis as stroke warning signs increased from baseline to follow-up. Awareness of two or more warning signs for stroke increased significantly from baseline to follow-up among men (65% to 80%, $P = .002$), among women (69% to 85%, $P < .001$), among respondents aged 45 to 64 years old (71% to 85%, $P < .001$), and among respondents aged 65 years and older (61% to 80%, $P < .001$) (data not shown).

There was no significant change in the proportion of respondents indicating that they would call 911 if they thought someone was having a stroke at baseline in comparison with follow-up (Figure 1). There was a statistically significant increase in the proportion of respondents who would call 911 if they experienced sudden speech problems, numbness or loss of sensation, or paralysis that did not go away over the two time periods (Figure 1). Among men, there was a significant increase in the percentage of those who indicated that

FIGURE 1 ● Respondents' Intentions to Call 911 Emergency Medical Services if They Witnessed Someone Experiencing a Stroke or if They Experienced Sudden Symptoms for Stroke at Baseline and Follow-Up, Missoula County, 2006 to 2007. ^a $P \leq .05$.



they would call 911 if they experienced speech problems (47% to 59%, $P = .03$), numbness (41% to 54%, $P = .02$), or paralysis (42% to 58%, $P = .02$) from baseline to follow-up. Among women, There was a significant increase in the percentage of those who indicated that they would call 911 if they experienced paralysis (46% to 58%, $P = .008$) from baseline to follow-up, but there was no significant change for speech problems (54% to 58%, $P = .36$) or numbness (41% to 49%, $P = .07$). Among respondents aged 45 to 64 years old, there were significant increases in the percentage of those who indicated that they would call 911 if they experienced numbness (43% to 54%, $P = .02$) or paralysis (47% to 62%, $P = .001$) from baseline to follow-up, but there was no significant change for speech problems (52% to 59%, $P = .10$). Among respondents aged 65 years and older, there were no significant increases in the percentage of those who indicated that they would call 911 if they experienced speech problems, (49% to 57%, $P = .18$), numbness (38% to 48%, $P = .09$) or paralysis (45% to 54%, $P = .11$) from baseline to follow-up.

● Discussion

Our findings suggest that this intervention was effective in increasing community awareness of the warning signs for stroke and the need to call 911 when one is experiencing stroke symptoms. There were significant increases in awareness of the warning signs for stroke overall, among men and women, and among older and young respondents. There were also significant increases in awareness of the need to call 911 when experiencing specific stroke-related symptoms overall. However, this improvement was not seen in each of the

subgroups. We did not see increases in awareness of the proportion of people who reported that they would call 911 if they witnessed a potential stroke.

Few studies have assessed effective public education strategies to increase community awareness of stroke. A recent comparative study by Silver and colleagues in Canada found that both low- and high-intensity television campaigns over a 2-year period increased community awareness of two or more stroke warning signs from 39 percent to 50 percent, and from 40 percent to 54 percent, respectively, in comparison with print advertising (42% to 41%).¹⁰ No increases were found in a comparison community (44% to 36%). They also found a significant increase in awareness of warning signs among men, women, and persons aged 45 to 64 years, but no change in persons aged 65 years and older. The authors suggested that the lack of increased awareness among persons aged 65 years and older in the television-exposed communities may have been related to the format and message of their advertisement. In comparison, the baseline levels of awareness of two or more warning signs for stroke in Missoula County were considerably higher (67%). Similar to the study by Silver and colleagues, there was a comparable increase in awareness of two or more warning signs for stroke associated with the intervention, overall (16 percentage point increase), among men (15 percentage point increase), among women (16 percentage point increase), and younger respondents (14 percentage point increase). In contrast to the Canadian study, we found a significant increase in recognition of stroke warning signs among persons aged 65 years and older (19 percentage point increase).

At baseline, 74 percent of respondents reported that they would call 911 if they witnessed a stroke, but fewer respondents (41% to 51%) reported that they would call 911 if they experienced sudden stroke-related symptoms. Our baseline findings were similar to those described in a study from Australia, where 67 percent of respondents reported that they would call 911 if they witnessed a stroke, but less than half would call 911 if they experienced sudden stroke-related symptoms that did not go away.¹⁵ The intervention was successful in increasing awareness of the need to call 911 when experiencing sudden symptoms of a stroke but did not have an impact on intentions to call 911 when witnessing a potential stroke. We were unable to identify other intervention studies targeting this issue for comparison. Additional research is needed to identify effective strategies to address this issue.

There are a number of limitations to this study. First, telephone surveys do not include residents without telephones. Second, self-reported information regarding risk factors for stroke is subject to recall bias. Previous studies, however, have found that self-reported

risk factors for cardiovascular disease are reported reliably.^{17,18} Third, respondents were asked “unaided” questions to assess respondent knowledge of the warning signs and risk factors for stroke. A previous study assessing awareness of stroke warning signs used aided questions and found higher levels of knowledge than the levels found in this study.³ It is possible that unaided questions may underestimate awareness of the warning signs of stroke, and aided questions may overestimate awareness. Fourth, our translation study did not include a comparison community to evaluate the impact of our intervention. Previous research studies have established that high-intensity mass media campaigns can significantly increase community awareness of the warning signs for stroke.¹⁰ It is possible that the increases in community awareness of the warning signs for stroke and the need to call 911 were because of other factors such as community stroke screening programs or public service announcements. An American Stroke Association stroke awareness public service announcement ran a small number of times within this media market during the time period of our study (Julie Grabarkewitz, BS, American Stroke Association, oral communication, June 13, 2006). We found a two-fold increase in respondent recall of television and radio advertisements, addressing the warning signs for stroke. It is unlikely that limited public service announcements would have had such an impact. Interestingly, 35 percent of respondents at baseline recalled seeing television advertisements regarding stroke warning signs prior to the intervention. In a previous study assessing the impact of a media campaign to promote pneumococcal vaccinations, we documented a similar phenomenon.¹⁹ A likely explanation is that respondents were providing a socially desirable response to the question regarding media recall. Finally, this study was conducted primarily in a non-Hispanic White population, and the impact of the longer-term campaign may not be generalizable to other communities in the United States. Further studies will be needed to evaluate the impact of stroke public awareness campaigns in other geographic, racial, and ethnic communities in the United States.

Utilizing media to target public health messages can be useful to reach large populations (both persons at risk for stroke and family members and friends who may witness a stroke); however, media is costly, and its impact on behavior change has not been documented consistently. Previous studies suggest that increasing community awareness of stroke warning signs and the need to call 911 may be necessary,^{20,21} but not sufficient²² to improve timely diagnosis and treatment for stroke. A recent study found that ongoing mass media campaigns can increase community awareness of stroke warning signs and was also associated with increased

emergency department visits by stroke patients.¹¹ Community stroke screening programs are an alternative strategy to increase community awareness of stroke warning signs and risk factors. However, these programs have modest effects on knowledge of stroke warning signs, or behavior changes, and reach a very small portion of the population.²³ Education and counseling of high-risk patients regarding the warning signs for stroke and the use of 911 by primary care providers would likely be an effective strategy to increase patient awareness. Unfortunately, few patients report ever receiving counseling regarding their risk for stroke.²⁴

Sustained public health and clinical efforts to improve prompt recognition and transport to emergency care for stroke and to increase public knowledge and control of stroke risk factors will obviously require a coordinated approach.⁶ Strategic public awareness campaigns are only one part of such statewide efforts in Montana, and we plan to continue conducting and evaluating public education campaigns in conjunction with other activities to improve stroke care and outcomes. A statewide stroke work group has convened to implement supporting activities, including assessing statewide capacity for acute stroke care, training health-care professionals about prehospital and acute stroke care, sharing protocols for prehospital stroke screening and prenotification programs, and developing regional stroke networks to coordinate care between the tertiary care hospitals and the outlying hospitals.²⁵

REFERENCES

1. Jorgensen HS, Nakayama H, Reith J, Raaschou HO, Olsen TS. Factors delaying hospital admission in acute stroke: the Copenhagen stroke study. *Neurology*. 1996;47(2):383–387.
2. Clark JM, Renier SA. A community stroke study: factors influencing stroke awareness and hospital arrival times. *J Stroke Cerebrovasc Dis*. 2001;10(6):274–278.
3. Greenlund KJ, Neff LJ, Zheng ZJ, et al. Low public recognition of major stroke symptoms. *Am J Prev Med*. 2003;25(4):315–319.
4. Schneider AT, Pancioli AM, Khoury JC, et al. Trends in community knowledge of the warning signs and risk factors for stroke. *JAMA*. 2003;289(3):343–346.
5. Morgenstern LB, Staub L, Chan W, et al. Improving delivery of acute stroke therapy: the TLL Temple Foundation Stroke Project. *Stroke*. 2002;33(1):160–166.
6. Morgenstern LB, Bartholomew LK, Grotta JC, Staub L, King M, Chan W. Sustained benefit of a community and professional intervention to increase acute stroke therapy. *Arch Intern Med*. 2003;163(18):2198–2202.
7. Goldstein LB. Advertising strategies to increase the public knowledge of the warning signs of stroke [editorial]. *Stroke*. 2003;34(8):1968–1969.
8. Alberts MJ, Perry A, Dawson DV, Bertels C. Effects of public and professional education on reducing the delay in presentation and referral of stroke patients. *Stroke*. 1992;23(3):352–356.

9. Barsan WG, Brott TG, Broderick JP, Haley EC Jr, Levy DE, Marler JR. Urgent therapy for acute stroke: effects of a stroke trial on untreated patients. *Stroke*. 1994;25(11):2132–2137.
10. Silver FL, Rubini F, Black D, Hodgson CS. Advertising strategies to increase public knowledge of the warning signs of stroke. *Stroke*. 2003;34(8):1965–1968.
11. Hodgson C, Lindsay P, Rubini F. Can mass media influence emergency department visits for stroke? *Stroke*. 2007;38(7):2115–2122.
12. United States Census Bureau. Census estimates for 2006. <http://factfinder.census.gov/> Accessed September 20, 2007.
13. Blades LL, Oser CS, Dietrich DW, et al. Rural community knowledge of stroke warning signs and risk factors. *Prev Chronic Dis*. 2005;2(2):A14.
14. Pancioli AM, Broderick J, Kothari R, et al. Public perception of stroke warning signs and knowledge of potential risk factors. *JAMA*. 1998;279(16):1288–1292.
15. Sug Yoon S, Heller RF, Levi C, Wiggers J, Fitzgerald PE. Knowledge of stroke risk factors, warning symptoms, and treatment among an Australian urban population. *Stroke*. 2001;32(8):1926–1930.
16. Goldstein LB, Adams R, Becker K, et al. Primary prevention of ischemic stroke: a statement for healthcare professionals from the stroke council of the American Heart Association. *Stroke*. 2001;32(1):280–299.
17. Kehoe R, Wu SY, Leske MC, Chylack LT Jr. Comparing self-reported and physician-reported medical history. *Am J Epidemiol*. 1994;139(8):813–818.
18. Jackson C, Jatulis DE, Fortmann SP. The behavioral risk factor survey and the Stanford five-city project survey: a comparison of cardiovascular risk behavior estimates. *Am J Public Health*. 1992;82(3):412–416.
19. Holzman GS, Harwell TS, Johnson EA, Goldbaum G, Helgerson SD. A media campaign to promote pneumococcal vaccinations: is a telephone survey an effective evaluation strategy? *J Public Health Manag Pract*. 2005;11(3):228–234.
20. Evenson KR, Rosamond WD, Morris DL. Prehospital and in-hospital delays in acute stroke care. *Neuroepidemiology*. 2001;20(2):65–76.
21. Daley S, Braimah J, Sailor S, et al. Education to improve stroke awareness and emergent response. the NINDS rt-PA stroke study group. *J Neurosci Nurs*. 1997;29(6):393–396.
22. Williams LS, Bruno A, Rouch D, Marriott DJ. Stroke patients' knowledge of stroke: influence on time to presentation. *Stroke*. 1997;28(5):912–915.
23. DeLemos CD, Atkinson RP, Croopnick SL, Wentworth DA, Akins PT. How effective are "community" stroke screening programs at improving stroke knowledge and prevention practices? Results of a 3-month follow-up study. *Stroke*. 2003;34(12):e247–e249.
24. Harwell TS, Blades LL, Oser CS, et al. Perceived risk for developing stroke among older adults. *Prev Med*. 2005;41(3–4):791–794.
25. Okon NJ, Rodriguez DV, Dietrich DW, et al. Availability of diagnostic and treatment services for acute stroke in frontier counties in Montana and northern Wyoming. *J Rural Health*. 2006;22(3):237–241.