The Effectiveness of a Stroke Educational Activity Performed by a Schoolteacher for Junior High School Students

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Background: The purpose of this study was to determine whether our stroke education system can help junior high school students acquire stroke knowledge when performed by a schoolteacher. *Methods:* A stroke neurologist gave a stroke lesson to 25 students (S group) and a schoolteacher through our stroke education system. After instruction, the schoolteacher performed the same lesson using the same education system to another 75 students (T group). Questionnaires on stroke knowledge were examined at baseline, immediately after the lesson (IL), and at 3 months after the lesson (3M). We analyzed the results of stroke knowledge assessment by linear mixed effects models adjusted for gender and class difference using the student number. *Results:* We assessed 24 students in the S group and 72 students in the T group. There were no significant differences in the changes of predicted scores of symptoms and risk factors adjusted for gender, class difference, and each student knowledge level until 3M between the 2 groups. Correct answer rates for the meaning of the FAST (facial droop, arm weakness, speech disturbance, time to call 119) at IL were 92% in the S group and 72% in the T group, respectively. At 3M, they were 83% in the S group and 84% in the T group. The correct answer rates of FAST at 3M were not significantly different adjusted for group, gender, class difference, and correct answer rate at IL. *Conclusions:* A schoolteacher can conduct the FAST message lesson to junior high school students with a similar outcome as a stroke neurologist using our stroke education system. **Key Words:** School-based intervention—stroke enlightenment—FAST—online system.
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Introduction

Stroke is the leading cause of disability and a main cause of death in Japan. The number of stroke patients and the burden of the elderly population will increase as society ages. With the advantage of acute thrombolytic therapy with intravenous recombinant tissue-type plasminogen activator for stroke outcome,[1,2] shortening the time between symptom onset and hospital arrival is essential for improving stroke outcome. Although the

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European Cooperative Acute Stroke Study III led to the expansion of the therapeutic time window of thrombolysis for acute ischemic stroke,[3] only a small proportion of patients arrive at the hospital within the time window.[4] Improving stroke awareness is an important factor for rapid access to the acute stroke center at symptom onset.

Although several studies have reported that stroke educational campaigns improve public knowledge about stroke in adults,[5-9] only a few studies have examined stroke education programs for children. Stroke enlightenment for youth is a promising strategy for the prevention of cardiovascular disease. Because of compulsory education, implementing stroke lessons in the education programs of elementary or junior high school is a promising means for spreading stroke knowledge in Japan. We developed a stroke education system that is performed by stroke neurologists for junior high school students.[10] As the next step, to extend stroke enlightenment all over the country, we investigated whether this education system was effective when schoolteachers rather than physicians present the stroke lessons to students. The aim of this study was to verify the effectiveness of our education system in junior high schools when performed by a schoolteacher.

Methods

The research was carried out in partnership with the Suita City Board of Education. The Suita City Board of Education approved this study, and this study obtained exempted approval from the institutional review board based on our domestic guideline because of using only an anonymized and unconnectable data set of questionnaire responses.

Subjects

This study was conducted at a public junior high school at Suita City, Osaka Prefecture, Japan, from July 2011 to October 2011. Subjects were 100 students in 4 classes of the third grade (40 girls, 14-15 years old). The subjects were divided into 2 groups: 1 class with 25 students received a 45-minute stroke lesson by a stroke neurologist (S group), and the remaining 3 classes with 75 students in total received a 45-minute lesson by a schoolteacher of health and physical education (T group).

Stroke Education System and Items with FAST Message

Our stroke education system consisted of an online system and the lecture materials were Power Point files including stroke risk factors, signs, symptoms, and the FAST massage (facial droop, arm weakness, speech disturbance, time to call 119).[5] All junior high schools in Suita City have their own computer systems, and each student could use the online systems during the stroke lesson. At first, a stroke neurologist (T.A.) gave the stroke lesson to 25 students (S group) using our online stroke education system (Fig 1, A). A schoolteacher monitored the lecture and received instructions on how to use the stroke education system. Within 2 weeks after the instruction, the schoolteacher performed the lesson using the same system to the other 75 students (T group). Education items of a pen, file, magnet, and sticky note, all recorded with the FAST message (Fig 1, B), were distributed to all the students after the lesson.

Assessments

A questionnaire on stroke knowledge (a total of 12 items for stroke signs and 10 items for risk factors) was examined using the online system in all the students before (baseline [BL]) and immediately after the lesson (IL). At 3 months after the lesson (3M), the same questionnaire was applied. The questionnaire comprised multiple choice questions and close-ended questions, which assessed stroke signs and risk factors. The 12 items for stroke signs included 6 symptoms of stroke ("headache," "vision loss," "facial weakness," "speech disturbance," "numbness on 1 side of the body," and "weakness on 1 side of the body") and 6 incorrect or atypical symptoms ("chest pain," "dyspnea," "weakness on 4 limbs," "abdominal pain," "edema in feet," and "joint pain"). The 10 items for risk factors consisted of 7 stroke risk factors ("alcohol intake every day," "smoking," "hypertension," "dyslipidemia," "hyperglycemia," "obesity," and "arrhythmia") and 3 incorrect or atypical risk factors ("constipation," "urinary frequency," and "stiffness of neck"). Furthermore, the meaning of the FAST message, such as each word of F, A, S, and T, was also examined by a single choice test, at IL and 3M.

Analysis of Data

Statistical analysis was performed using the JMP 8.0 statistical software (SAS Institute Inc., Cary, NC) or Stata software, version 12.0 (StatCorp LP, College Station, TX). We collected individual results of questionnaires on stroke knowledge at each time point until 3M using the unconnectable student number. Results of the questionnaire in each group at BL were compared with those at 3 months and those at IL by the Fisher exact test. For calculating scores, the student got 1 point if he chose a correct answer or did not choose an incorrect answer. Therefore, the scores of questionnaires on stroke signs and risk factors ranged from 0 to 12 and 0 to 10, respectively. In each questionnaire on stroke signs and risk factors, we summed these points of each student in assessing stroke knowledge. Because each student's score was measured repeatedly in a longitudinal manner, linear mixed effects models adjusted for gender and class difference and were used to analyze the association between the score of knowledge for symptoms or risk and lessons

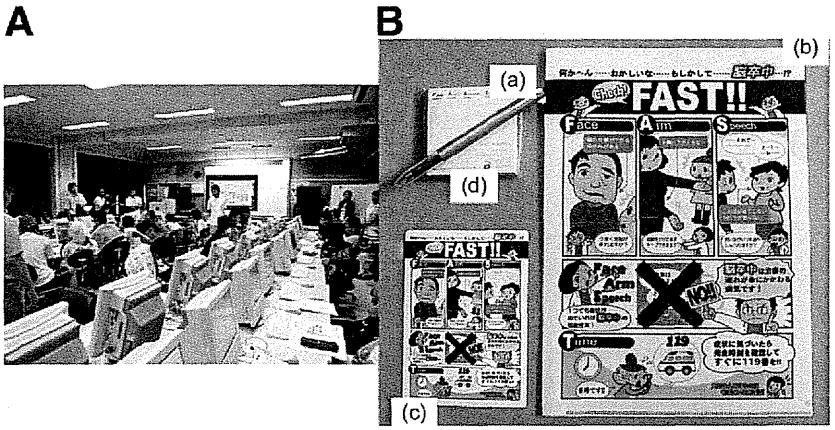

Figure 1. *Stroke lesson and items for junior high school students. (A) Stroke lesson with our online system of stroke enlightenment. (B) School items consisted of pen (a), file (b), magnet (c), sticky note (d) with the FAST message, and stroke pamphlet.*

by each group. It included both a random intercept and time effect for each student. All statistical analyses for assessing stroke knowledge were performed with Stata software using the linear mixed model (MIXED) framework. Statistical significance was established at P less than .05.

Results

Four students who did not complete questionnaires at 3M were excluded. Finally, we assessed 24 students (11 girls) in the S group and 72 students (26 girls) in the T group.

Assessment for Stroke Signs and Risk Factors

Changes in the percentage of correct answers to each question about stroke signs and risk factors until 3M are shown in Tables 1 and 2. In the questionnaire on stroke signs at 3M, the correct answers for facial weakness in the S group and facial weakness and speech disturbance in the T group were significantly higher than those at the BL. The proportions of correct answers for alcohol intake, smoking, and obesity in the S group and smoking and hyperglycemia in the T group at IL were significantly higher than those at the BL; however, those differences were disappeared at 3M.

The median scores of the questionnaire on stroke signs and risk factors in the S group at BL, IL, and 3M were 6 (interquartile range 6-8.75), 10.5 (8-11), and 8 (8-9) and 7 (5-7), 9 (8-9), and 8 (6-9), respectively. Those in the T group were 7 (6-9), 10 (8.25-11), and 9 (7-10) and 7 (6-8), 8 (7-9.75), and 7 (6-8), respectively. From the analysis of linear mixed model adjusted for gender, class difference, and each student knowledge level, the scores for symptoms in the T group were 1.38 points higher than those of the S group (P = .016). IL, the scores for symptoms were 2.26 points higher, and even after 3 months, the scores were .97 points higher than the scores before lessons (P < .001, respectively). The scores for the risks in

Table 1. *Changes of the percentage of correct answers to questions about stroke signs and risk factors in the S group*

	BL (%)	IL (%)	3M (%)	BL vs IL, P*	BL vs 3M, P*
1. Stroke signs					
Headache	71	88	42	.287	.080
Vision loss	17	67	13	.001	1.000
Facial weakness	38	71	83	.042	.003
Speech disturbance	67	96	83	.023	.318
Numbness on 1 side of body	46	71	58	.143	.564
Weakness on 1 side of body	54	75	71	.227	.372
2. Risk factors					
Alcohol intake	63	92	83	.036	.193
Smoking	63	92	75	.036	.534
Hypertension	79	83	75	1.000	1.000
Dyslipidemia	71	88	67	.287	1.000
Hyperglycemia	67	71	50	1.000	.380
Obesity	38	79	54	.008	.385
Arrhythmia	67	38	46	.082	.244

Abbreviations: BL, baseline (before the lesson); IL, immediately after the lesson; 3M, 3 months after the lesson.
*Fisher exact test.

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Table 2. *Changes of the percentage of correct answers to questions about stroke signs and risk factors in the T group*

	BL (%)	IL (%)	3M (%)	BL vs IL, *P**	BL vs 3M, *P**
1. Stroke signs					
Headache	85	69	50	.046	<.001
Vision loss	40	72	25	<.001	.075
Facial weakness	54	69	90	.086	<.001
Speech disturbance	69	90	92	.003	.001
Numbness on 1 side of body	67	71	64	.719	.861
Weakness on 1 side of body	65	88	74	.003	.366
2. Risk factors					
Alcohol intake	78	89	90	.116	.067
Smoking	74	90	82	.008	.158
Hypertension	83	89	79	.471	.670
Dyslipidemia	69	71	57	1.000	.167
Hyperglycemia	61	78	57	.046	.735
Obesity	51	65	57	.128	.616
Arrhythmia	60	68	49	.386	.181

Abbreviations: BL, baseline (before the lesson); IL, immediately after the lesson; 3M, 3 months after the lesson.
*Fisher exact test.

the T group were also 1.39 points higher compared with those of the S group ($P = .008$). IL, the scores for risks were 1.24 points higher ($P < .001$). However, after 3 months, the increases of the scores were not significant ($P = .246$; Table 3). The predicted score adjusted for gender, class difference, and each student knowledge level are summarized in Figure 2. There were no significant differences in the changes of predicted scores of stroke symptoms or risk factors until 3M between the 2 groups.

Assessment for FAST Message

Correct answer rates for the meaning of the FAST at IL were 92% in the S group and 72% in the T group. At 3 months, the correct answer rates were 83% in the S group and 84% in the T group. Although there was a significant difference among the 4 classes in the correct answer of FAST at IL, no differences were observed between the 2 groups or gender. The correct answer rates of FAST at 3 months were also not significantly different when adjusted for group, gender, class difference, and correct answer rate at IL (Table 4).

Discussion

In this study, we showed that a schoolteacher could conduct a stroke knowledge lesson using our stroke education system that includes stroke symptoms, risk factors, and FAST message to junior high school students with the same outcomes as those obtained by a stroke neurologist. The stroke knowledge of the FAST message and stroke symptoms were preserved until 3 months after the stroke lesson by a schoolteacher and by a stroke neurologist.

Some reports have indicated the significance of school-based interventions of stroke enlightenment. Morgenstern et al[11] reported that a scientific, theory-based, educational intervention could improve intention to call 911 for stroke among middle school children. Williams et al reported that incorporating cultural elements such as hip-hop music improved retention of stroke knowledge for elementary

Table 3. *Linear mixed effect model of symptom and risk scores for the effect of lectures in the S group and time after the lecture adjusted for gender, class difference, and each student*

	Symptom score				Risk score			
	Coefficient	Z	*P* value	95% CI	Coefficient	Z	*P* value	95% CI
Girl	.55	1.97	.048	.00 to 1.09	.59	2.27	.023	.08 to 1.10
Class difference	−.47	−2.49	.013	−.85 to −.10	−.47	−2.64	.008	−.82 to −.12
T group	1.38	2.42	.016	.26 to 2.49	1.39	2.65	.008	.36 to 2.42
Timing of tests								
IL	2.26	8.66	<.001	1.75 to 2.78	1.24	5.43	<.001	.79 to 1.68
3M	.97	3.72	<.001	.46 to 1.48	.26	1.16	.246	−.18 to .71

Abbreviations: IL, immediately after the lesson; 3M, 3 months after the lesson.

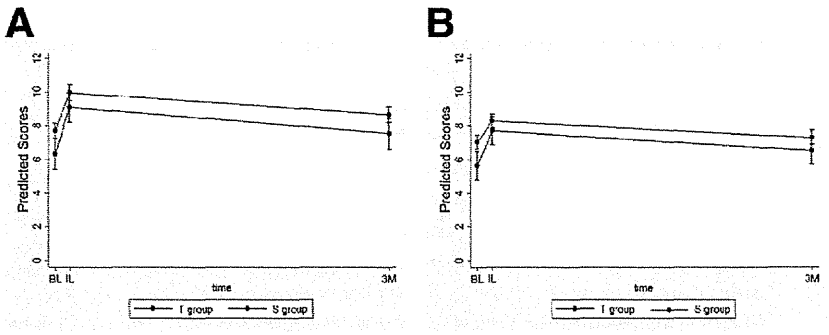

Figure 2. *Predicted score of symptoms (A) or risk factors (B) adjusted for gender, class difference, and each student knowledge level. There were no significant differences in the changes of predicted scores of stroke symptoms and risk factors until 3M between the 2 groups. BL, baseline (before the lesson); IL, immediately after the lesson; 3M, 3 months after the lesson.*

school children[12] and that they would be effective conduits of critical stroke knowledge to their guardians.[13] Previously, we showed that our stroke education program improved stroke knowledge, especially the FAST message, for junior high school students and their parents.[10] These results indicate that school-based interventions of stroke enlightenment are effective for the prevention of not only cardiovascular diseases but also lifestyle-related diseases such as hypertension, diabetes mellitus, and dyslipidemia. In addition, children may educate their parents or grandparents indirectly by communication about their acquisitions of stroke knowledge. From the results of the present study, we propose a new strategy for promoting school-based interventions all over the country that uses schoolteachers in an important role for stroke enlightenment.

In the present study, we analyzed results of questionnaires on stroke knowledge by measuring repeatedly in a longitudinal manner; linear mixed effects models were adjusted for gender and class difference using the student number. These analyses demonstrated the efficacy of our education system performed by either the schoolteacher or stroke neurologist with the handling of the between- and within-student attainment of stroke knowledge. Although the attainment and the BL of stroke knowledge were different between the genders, 2 groups, and among the 4 classes, the correct answer rate of FAST at 3 months is preserved in spite of groups, gender, class differences, and the results at IL. Our stroke enlightenment items, such as the magnet poster on the refrigerator at home and stationaries printed with the FAST mnemonic, may fix the FAST message in their minds. On the other hand, stroke symptoms other than FAST, such as headache and vision loss, were not recalled by the students after the lesson. Our items of stroke enlightenment need to be improved for stroke symptoms not involved in the FAST mnemonic and stroke risk factors.

There are several limitations to our study. First, a relatively small number of subjects in a single junior high school may cause selection bias. However, we showed the effect of our education system by the schoolteacher with the analysis of the between- and within-student difference using linear mixed effects models. Second, we examine the acquisition of stroke knowledge only for students but not their family. We could not evaluate an indirect education effect to their family through students in this study. However, we have showed that our education system was beneficial for their guardians and the student.[10] Third, the assessment of stroke knowledge was examined by multiple-choice and closed-type questions, possibly associated with an overestimate of stroke knowledge compared with open-ended questions. Fourth, our education program in the present study requires access to the Internet for the stroke lesson. However, the online

Table 4. *Multivariate logistic regression of the correct answer of FAST*

	Correct answer of FAST (IL)			
	Odds ratio	*Z*	*P* value	95% CI
T group	7.48	1.54	.125	.57-97.44
Girl	1.19	.3	.766	.38-3.77
Class difference	.21	−3.55	<.001	.09-.50
		Correct answer of FAST (3M)		
T group	1.74	.51	.608	.21-14.41
Girl	.92	−.14	.892	.30-2.87
Class difference	.81	−.46	.645	.34-1.97
Correct answer of FAST at IL	1.22	.27	.791	.28-5.25

Abbreviations: FAST, facial droop, arm weakness, speech disturbance, time to call 119; IL, immediately after the lesson; 3M, 3 months after the lesson.

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systems can be accessed by anyone, from anywhere, and at any time, although there may be security issues and server technical issues. The stroke education program with these online systems is a promising means of spreading stroke enlightenment nationwide. Finally, this is a cross-sectional study, and behavioral change of calling emergent medical service at awareness of stroke remained unknown. Significant delays in seeking care after stroke were reported, even after a campaign to promote public awareness of stroke.[14] A lack of association between stroke symptom knowledge and the intent to call EMS was also indicated from a population-based survey.[15] Time monitoring of prehospital delay in the stroke centers within the area of the intervention of stroke education is expected.

In summary, a schoolteacher could play an important role for spreading stroke knowledge all over the country using our stroke education system. Our stroke education system of an online system and school items with the FAST message is a promising means of education for larger student populations. A large study of our education system with multiple urban junior high schools should confirm these findings, and monitoring the changes of prehospital delay in the community is essential.

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References

1. The National Institute of Neurological Disorders and Stroke rtPA Stroke Study Group. Tissue plasminogen activator for acute ischemic stroke. N Engl J Med 1995; 333:1581-1587.
2. Yamaguchi T, Mori E, Minematsu K, et al. Alteplase at 0.6 mg/kg for acute ischemic stroke within 3 hours of onset: Japan Alteplase Clinical Trial (J-ACT). Stroke 2006; 37:1810-1815.
3. Hacke W, Kaste M, Bluhmki E, et al. Thrombolysis with alteplase 3 to 4.5 hours after acute ischemic stroke. N Engl J Med 2008;359:1317-1329.
4. de Los Rios la Rosa F, Khoury J, Kissela BM, et al. Eligibility for intravenous recombinant tissue-type plasminogen activator within a population: The effect of the European Cooperative Acute Stroke Study (ECASS) III Trial. Stroke 2012;43:1591-1595.
5. Wall HK, Beagan BM, O'Neill J, et al. Addressing stroke signs and symptoms through public education: the stroke heroes act fast campaign. Prev Chronic Dis 2008;5:A49.
6. Silver FL, Rubini F, Black D, et al. Advertising strategies to increase public knowledge of the warning signs of stroke. Stroke 2003;34:1965-1968.
7. Fogle CC, Oser CS, McNamara MJ, et al. Impact of media on community awareness of stroke warning signs: a comparison study. J Stroke Cerebrovasc Dis 2010;19:370-375.
8. Fortmann SP, Varady AN. Effects of a community-wide health education program on cardiovascular disease morbidity and mortality: The Stanford Five-City Project. Am J Epidemiol 2000;152:316-323.
9. Miyamatsu N, Kimura K, Okamura T, et al. Effects of public education by television on knowledge of early stroke symptoms among a Japanese population aged 40 to 74 years: a controlled study. Stroke 2012;43:545-549.
10. Amano T, Yokota C, Sakamoto Y, et al. Stroke education program of act fast for junior high school students and their parents. J Stroke Cerebrovasc Dis, in press.
11. Morgenstern LB, Gonzales NR, Maddox KE, et al. A randomized, controlled trial to teach middle school children to recognize stroke and call 911: the kids identifying and defeating stroke project. Stroke 2007;38:2972-2978.
12. Williams O, Noble JM. 'Hip-hop' stroke: a stroke educational program for elementary school children living in a high-risk community. Stroke 2008;39:2809-2816.
13. Williams O, DeSorbo A, Noble J, et al. Child-mediated stroke communication: findings from hip hop stroke. Stroke 2012;43:163-169.
14. Addo J, Ayis S, Leon J, et al. Delay in presentation after an acute stroke in a multiethnic population in south London: The South London Stroke Register. J Am Heart Assoc 2012;1:e001685.
15. Fussman C, Rafferty AP, Lyon-Callo S, et al. Lack of association between stroke symptom knowledge and intent to call 911: a population-based survey. Stroke 2010;41:1501-1507.

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Effects of Intensive and Moderate Public Education on Knowledge of Early Stroke Symptoms Among a Japanese Population: The Acquisition of Stroke Knowledge Study

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Effects of Intensive and Moderate Public Education on Knowledge of Early Stroke Symptoms Among a Japanese Population

The Acquisition of Stroke Knowledge Study

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Background and Purpose—To assess the effects of intensive and moderate public education on knowledge of early stroke symptoms among a general Japanese population.

Methods—Information on early stroke symptoms was distributed by leaflet 12× and by booklet twice in an intensive intervention area >22 months, and by leaflet and booklet once each in a moderate intervention area. No distribution occurred in the control area. Before and after the intervention, a mailed survey was conducted in the 3 areas. A total of 2734 individuals, aged 40 to 74 years, who did not select all 5 correct symptoms of stroke in the preintervention survey were eligible for our analysis.

Results—The numbers of correct answers selected about stroke symptoms did not differ significantly among the 3 areas in the preintervention survey (P=0.156). In the postintervention survey, the proportions of participants who selected sudden 1-sided numbness or weakness (94.2% in the intensive intervention area, 88.3% in the moderate intervention area, and 89.2% in the control area; P<0.001) and sudden severe headache (76.8%, 70.1%, and 70.4%, respectively; P<0.001) differed significantly among the 3 areas. After adjustment for confounding factors, the multivariable-adjusted odds ratios (95% confidence intervals) for correctly choosing all 5 symptoms were 1.35 (1.07–1.71) in the intensive intervention area and 0.96 (0.74–1.24) in the moderate intervention area compared with the control area.

Conclusions—Our findings suggest that frequent distribution of leaflets and booklets significantly improved the short-term knowledge of community residents about early symptoms of stroke. **(*Stroke*. 2013;44:2829-2834.)**

Key Words: early stroke symptoms ■ knowledge ■ leaflet/booklet distribution ■ public education

Reducing the time between stroke onset and hospital arrival offers the greatest opportunity for effective acute stroke therapy.[1] Previous studies have demonstrated that alteplase treatment within 4.5 hours of onset improved functional outcome.[2–4] However, it has also been reported that there often remain substantial delays in hospital presentation of patients with acute stroke.[5–7] The major reason for the delay was attributed to a lack of knowledge of stroke symptoms.[7,8] Therefore, it would seem that knowledge of the early stroke symptoms should be disseminated more widely in the general population.

Some reports have maintained that multimedia campaigns using television and newspapers are optimal for improving public knowledge of stroke.[9–12] However, multimedia campaigns are very expensive and usually run on a commercial basis.[9,10] Therefore, it is also necessary to present sustainable methods that can be conducted by local governments, patient associations, nonprofit organizations, academic societies, and volunteer groups. In the present study, we set out to determine the effects of intensive or moderate public education initiatives by the Japan Stroke Association among a general Japanese population, which involved home distribution of leaflets and booklets giving information on the early stroke symptoms.

Methods

Study Setting

The Acquisition of Stroke Knowledge study was a nonrandomized community intervention trial, which aimed to improve public knowledge about the early stroke symptoms and the appropriate

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response to stroke onset, in 3 cities of Japan (ie, Akita [Akita, Japan], Kure [Hiroshima, Japan], and Shizuoka [Shizuoka, Japan]).[13] Characteristics of the 3 cities are shown in Table I in the online-only Data Supplement. In the present study, 2 districts of Akita, namely Kawabe and Yuwa, were selected as the intensive intervention area. Kure was selected as a moderate intervention area, and Shizuoka was selected as a control area. A 3-month preintervention survey (April 2006 to June 2006) was followed by 22 months of community intervention (July 2006 to April 2008). After the community intervention, a 2-month postintervention survey (May 2008 to June 2008) was performed. This study was approved by the ethics committee of Shiga University of Medical Science (17–97).

Participants

From the 3 areas, 11306 (3776 in the intensive intervention area, 3695 in the moderate intervention area, and 3835 in the control area) community residents, aged 40 to 74 years, were randomly selected by an age-stratified random sampling method from the Basic Resident Register, and 5540 individuals (49.0%) responded to the preintervention mailed survey.[13] Of 5509 individuals who agreed to participate in the postintervention survey, 3926 individuals responded to the postintervention mailed survey. In consequence, a response rate was 71.3% in total, 73.8% (1719/2329) in the intensive intervention area, 71.4% (1116/1562) in the moderate intervention area, and 67.4% (1091/1618) in the control area ($P<0.001$ for χ^2 test). Of these respondents, we excluded 915 (378 in the intensive intervention area, 279 in the moderate intervention area, and 258 in the control area) individuals who selected all 5 correct symptoms of stroke in the preintervention survey, 30 individuals who did not complete the self-administered questionnaire by themselves, 6 individuals who selected all 10 items (including 5 decoys) as early stroke symptoms, and 241 individuals who had missing data. A total of 2734 individuals (1140 in the intensive intervention area, 804 in the moderate intervention area, and 790 in the control area) were included in the analysis.

Community Intervention

The community intervention was conducted by distribution of leaflets and booklets and by holding lectures. Leaflets and booklets were distributed to all homes in the intensive and moderate intervention areas. Contents of the leaflets and booklets are shown in Table 1. In the intensive intervention area, we distributed leaflets 12× and booklets twice, and presented lectures 13× not only about the early symptoms of stroke, but also about the risk factors for stroke. In the moderate intervention area, we distributed leaflets and booklets once each, and presented lectures 5×. The control area did not receive any of these interventions.

Main Outcome Measures

In both pre- and postintervention surveys, a self-administered questionnaire was mailed to each participant. A closed-ended questionnaire included demographic information, social factors, history of disease, presence or absence of patients with stroke living close to the participants, and early symptoms of stroke. The questions on early symptoms of stroke consisted of 5 correct answers (sudden confusion or trouble speaking or understanding speech, sudden 1-sided numbness or weakness of the face, arms, or legs, sudden severe headache with no known cause, sudden trouble with walking, dizziness, or loss of balance or coordination, and sudden visual disturbances in 1 or both eyes)[14,15] and 5 decoy answers (sudden nasal bleeding, sudden increase in body temperature, sudden pain on left shoulder, numbness of both hands and fingers, and sudden difficulty in breathing) as multiple-choice items. Participants were asked to choose which of 10 listed symptoms were early stroke symptoms. The main outcome was the choice of all 5 correct symptoms of stroke in the postintervention survey among individuals who did not select all 5 correct symptoms of stroke in the preintervention survey.

A nationwide stroke campaign with newspaper advertisements about the early stroke symptoms by Advertising Council (AC) Japan was also conducted in the intervention period after the introduction of thrombolytic therapy with tissue-type plasminogen activator for cerebral infarction. In the postintervention survey, therefore, we asked participants whether they had seen the newspaper advertisements by AC Japan and adjusted for this as a confounding factor.

Table 1. Contents of Leaflets and Booklets Distributed to All Homes in Intensive and Moderate Intervention Areas

Intervention Area	Time	Leaflet or Booklet	Content
Intensive	April 2007	Booklet 1	A+B
	May 2007	Leaflet 1	A
	May 2007	Leaflet 2	C
	June 2007	Leaflet 3	A
	July 2007	Leaflet 4	A
	August 2007	Leaflet 5	A+D (hypertension)
	September 2007	Leaflet 6	A+D (arrhythmia)
	October 2007	Leaflet 7	A+D (diabetes mellitus)
	November 2007	Leaflet 8	A+D (smoking)
	December 2007	Leaflet 9	A+D (alcohol consumption)
	January 2008	Booklet 2	A+B
	February 2008	Leaflet 10	A+D (dyslipidemia)
	March 2008	Leaflet 11	A+D (salt and fat intake)
	April 2008	Leaflet 12	A+D (obesity)
Moderate	May 2007	Leaflet 1	A
	January 2008	Booklet 1	A+B

A indicates early stroke symptoms and appropriate response to stroke onset; B, prevention, treatment, and rehabilitation of stroke; C, intravenous thrombolytic therapy; and D, risk factors of stroke.

Statistical Analysis

Differences in demographic characteristics and knowledge of the early stroke symptoms among the 3 areas were determined using ANOVA for age and the χ^2 test for dichotomous and categorical data. Logistic regression analysis was used to estimate the multivariable-adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for the correct choice of all 5 symptoms of stroke in the intensive intervention area and the moderate intervention area compared with the control area. Data were adjusted for age, sex, education (≤12 or >12 years), living alone (yes or no), history of stroke (yes or no), history of transient ischemic attack (yes or no), and presence or absence of patients with stroke living close to the participants in the pre- and postintervention surveys, and exposure to newspaper advertisements by AC Japan (presence or absence) in the postintervention survey. All data were analyzed using SPSS statistical software (version 19.0J; SPSS Japan Inc, Tokyo, Japan).

Results

A comparison of demographic characteristics among the 3 areas in the preintervention survey is shown in Table 2. Education level ($P<0.001$), living alone ($P=0.005$), and presence of patients with stroke living close to the participants ($P<0.001$) differed significantly among the 3 areas. Age, sex, history of stroke, and history of transient ischemic attack did not differ significantly among the 3 areas. The knowledge of early symptoms of stroke among individuals in the preintervention survey is also shown in Table 2. The numbers of correct answers selected did not differ significantly among the 3 areas. The numbers of incorrect answers selected differed significantly among the 3 areas ($P=0.039$).

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Table 2. Demographic Characteristics and Knowledge of Early Stroke Symptoms in the Preintervention Survey of 3 Areas

	Control Area (n=790)	Intervention Areas		P Value
		Moderate (n=804)	Intensive (n=1140)	
Age*, y	58.9±9.5	59.4±9.7	58.8±9.8	0.390
Men	358 (45.3)	381 (47.4)	523 (45.9)	0.687
Education, y				<0.001
≤12	554 (70.1)	538 (66.9)	983 (86.2)	...
>12	236 (29.9)	266 (33.1)	157 (13.8)	...
Living alone	54 (6.8)	81 (10.1)	71 (6.2)	0.005
History of stroke	20 (2.5)	21 (2.6)	28 (2.5)	0.977
History of transient ischemic attack	5 (0.6)	5 (0.6)	5 (0.4)	0.805
Presence of patients with stroke living close to the participants	392 (49.6)	332 (41.3)	728 (63.9)	<0.001
Correct answer about stroke symptoms				
Sudden confusion or trouble speaking or understanding speech	679 (85.9)	685 (85.2)	926 (81.2)	0.009
Sudden 1-sided numbness or weakness of the face, arms, or legs	655 (82.9)	652 (81.1)	977 (85.7)	0.022
Sudden severe headache with no known cause	524 (66.3)	515 (64.1)	767 (67.3)	0.329
Sudden trouble with walking, dizziness, or loss of balance or coordination	401 (50.8)	406 (50.5)	651 (57.1)	0.004
Sudden visual disturbances in 1 or both eyes	135 (17.1)	137 (17.0)	157 (13.8)	0.066
Numbers of correct answers selected				0.156
None	24 (3.0)	46 (5.7)	40 (3.5)	...
1	48 (6.1)	51 (6.3)	74 (6.5)	...
2	125 (15.8)	116 (14.4)	165 (14.5)	...
3	276 (34.9)	252 (31.3)	370 (32.5)	...
4	317 (40.1)	339 (42.2)	491 (43.1)	...
Incorrect answer about stroke symptoms				
Numbness of both hands and fingers	280 (35.4)	304 (37.8)	470 (41.2)	0.032
Sudden difficulty in breathing	117 (14.8)	113 (14.1)	188 (16.5)	0.308
Sudden nasal bleeding	44 (5.6)	24 (3.0)	85 (7.5)	0.001
Sudden pain on left shoulder	24 (3.0)	22 (2.7)	29 (2.5)	0.808
Sudden increase in body temperature	12 (1.5)	7 (0.9)	17 (1.5)	0.417
Numbers of incorrect answers selected				0.039
None	423 (53.5)	428 (53.2)	538 (47.2)	...
1	270 (34.2)	298 (37.1)	453 (39.7)	...
2	85 (10.8)	65 (8.1)	118 (10.4)	...
3	11 (1.4)	10 (1.2)	25 (2.2)	...
4	1 (0.1)	3 (0.4)	5 (0.4)	...
5	0 (0.0)	0 (0.0)	1 (0.1)	...

*Age was analyzed using ANOVA, and is shown in the mean and SD. Dichotomous and categorical data were analyzed using the χ^2 test, and are shown as number (%).

In the postintervention survey (Table 3), ≈90% of participants correctly selected sudden speech problems and sudden 1-sided numbness or weakness as early symptoms, followed by sudden severe headache (72.8%) and sudden dizziness or loss of balance (63.8%). Furthermore, 33.3% of participants selected sudden visual problems. The symptoms sudden 1-sided numbness or weakness ($P<0.001$) and sudden severe headache ($P<0.001$) differed significantly among the 3 areas. The proportions of participants who selected all 5 correct symptoms were 22.8% in the intensive intervention area, 18.5% in the moderate intervention area, and 18.6% in the control area, with a significantly higher proportion in the intensive intervention area ($P=0.011$). The numbers of incorrect answers selected did not differ significantly among the 3 areas. In addition, in the postintervention survey, the proportions of participants who reported that they had participated in the lectures were only 3.3% in the intensive intervention area and only 2.4% in the moderate intervention area. The proportions of participants who reported that they had read newspaper advertisements about early symptoms of stroke

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Table 3. Knowledge of Early Stroke Symptoms in the Postintervention Survey of Areas

	Control Area (n=790)	Intervention Areas		*P* Value
		Moderate (n=804)	Intensive (n=1140)	
Correct answer about stroke symptoms in preintervention survey				
Sudden confusion or trouble speaking or understanding speech	725 (91.8)	733 (91.2)	1055 (92.5)	0.430
Sudden 1-sided numbness or weakness of the face, arms, or legs	705 (89.2)	710 (88.3)	1074 (94.2)	<0.001
Sudden severe headache with no known cause	556 (70.4)	564 (70.1)	876 (76.8)	<0.001
Sudden trouble with walking, dizziness, or loss of balance or coordination	486 (61.5)	511 (63.6)	752 (66.0)	0.065
Sudden visual disturbances in 1 or both eyes	252 (31.9)	270 (33.6)	395 (34.6)	0.210
Numbers of correct answers selected				0.011
None	15 (1.9)	18 (2.2)	6 (0.5)	...
1	25 (3.2)	27 (3.4)	45 (3.9)	...
2	97 (12.3)	95 (11.8)	118 (10.4)	...
3	240 (30.4)	238 (29.6)	305 (26.8)	...
4	266 (33.7)	277 (34.5)	406 (35.6)	...
5	147 (18.6)	149 (18.5)	260 (22.8)	...
Incorrect answer about stroke symptoms				
Numbness of both hands and fingers	341 (43.2)	341 (42.4)	523 (45.9)	0.263
Sudden difficulty in breathing	115 (14.6)	118 (14.7)	193 (16.9)	0.258
Sudden nasal bleeding	30 (3.8)	29 (3.6)	50 (4.4)	0.589
Sudden pain on left shoulder	26 (3.3)	29 (3.6)	47 (4.1)	0.623
Sudden increase in body temperature	10 (1.3)	9 (1.1)	16 (1.4)	0.859
Numbers of incorrect answers selected				0.272
None	387 (49.0)	396 (49.3)	533 (46.8)	...
1	300 (38.0)	310 (38.6)	441 (38.7)	...
2	88 (11.1)	82 (10.2)	128 (11.2)	...
3	14 (1.8)	12 (1.5)	31 (2.7)	...
4	1 (0.1)	4 (0.5)	7 (0.6)	...
5	0 (0.0)	0 (0.0)	0 (0.0)	

Dichotomous and categorical data were analyzed using the χ^2 test, and are shown as number (%).

by AC Japan were 42.5% in the intensive intervention area, 41.9% in the moderate intervention area, and 36.2% in the control area.

The Figure presents the multivariable-adjusted ORs for the correct choice of all 5 symptoms in the postintervention survey among the 3 areas. After adjustment for age, sex, education, living alone, history of stroke, history of transient ischemic attack, presence or absence of patients with stroke living close to the participants, and exposure to newspaper advertisements by AC Japan, the multivariable-adjusted ORs and 95% CIs for correctly choosing all 5 symptoms were 1.35 (1.07–1.71) in the intensive intervention area and 0.96 (0.74–1.24) in the moderate intervention area compared with the control area. In the covariates used for the adjustment, education (OR for >12/≤12 years, 1.46 [95% CI, 1.16–1.83]), presence of patients with stroke living close to the participants (OR for presence/absence, 1.28 [95% CI, 1.05–1.57]), and exposure to newspaper advertisements by AC Japan (OR for presence/absence, 1.52 [95% CI, 1.26–1.85]) were significantly associated with the correct choice of all 5 symptoms of stroke. Age, sex, living alone, history of stroke, and history of transient ischemic attack were not significantly associated with the correct choice of all 5 symptoms.

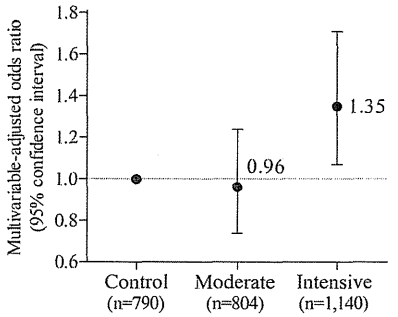

Figure. Multivariable-adjusted odds ratios for the correct choice of all 5 stroke symptoms in the postintervention survey by the 3 areas. Adjusted for age, sex, education, living alone, history of stroke, history of transient ischemic attack, and presence or absence of patients with stroke living close to the participants in the pre- and postintervention surveys, and exposure to newspaper advertisements by Advertising Council Japan in the postintervention survey.

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Discussion

Ours is the first community-based study to survey not any household member but individuals, and to show an improvement in the knowledge of early stroke symptoms by public education, consisting of repeated distribution of leaflets and booklets to all homes among a general Japanese population. The intensive intervention area was 1.35× more likely to correctly choose all 5 stroke symptoms compared with the control area, with no difference seen in the moderate intervention area. Accordingly, frequent distribution of leaflets and booklets significantly improved the short-term knowledge of community residents about early stroke symptoms. Furthermore, the intensive intervention area had the highest response rate in the postintervention survey, although proportion of participants with education >12 years in the intensive intervention area was lower than in other areas. We think our intervention may also affect response rate in the intervention area irrespective of their education level.

It has been reported that intermittent long-term intervention was effective in increasing the knowledge about early symptoms of stroke, but short-term intervention was less effective.[16] Multimedia campaigns are powerful for improving the knowledge about stroke,[9–13] and nowadays there are many healthcare programs and news bulletins of recent medical breakthroughs on television. It can be possible to negotiate with the producers of these programs, but many television campaigns usually require content to be produced on a commercial basis, and are bound by audience ratings. In addition, the cost of educational multimedia campaigns using television and newspapers is expensive,[9,10] so that it might be difficult to continue a multimedia campaign over a long time. However, the costs of leaflets and booklets can be reduced when they are distributed through monthly or weekly free official gazette of local municipalities, which often have space for health education for community residents. Therefore, the present study shows the usefulness of a practical long-term strategy to educate the population. In performing a long-term strategy, effective frequency and timing of distribution of leaflets and booklets should be considered. This study suggested that such community intervention should be performed more frequently than that in the moderate intervention area. Community residents, however, may skip the information of leaflets and booklets in the long-term intervention, and we should present these in a way that is not boring. Alternatively, it may be more feasible to conduct such intensive interventions according to seasonal increases of stroke incidence.

In previous studies, it was reported that 35% to 70% of participants had knowledge about the early stroke symptoms.[9,11,17] The discrepancy in the proportion of people with stroke knowledge between previous studies and the present study may be because of the difference in the definitions of having knowledge of stroke symptoms. In the present study, individuals with the knowledge were defined as those who selected all 5 stroke symptoms from 10 symptoms. However, in previous studies, the effectiveness of campaigns was assessed by the ability to name 2 early symptoms of stroke without being shown multiple-choice items.[9,17] However, patients with stroke are unable to choose their own symptoms at the time of onset, and people should be aware of all the typical early symptoms of stroke. In addition, it has been reported that British people poorly recognized symptoms not included in the Face, Arm, Speech Test Time to call 999 campaign (leg weakness and visual symptoms) and indicated that this lack of the knowledge might lead to delays in hospital presentation.[18] Accordingly, the present study assessed improvements in knowledge on the basis of increase of the proportions of participants who correctly chose all 5 early symptoms from preintervention to postintervention surveys. Less severe symptoms, such as sudden dizziness or loss of balance and sudden visual problems, which were poorly recognized as in the British survey, should be emphasized in any long-term strategy to educate the population about early stroke symptoms.

There are several limitations in the present study. First, we only evaluated the effectiveness of the intervention by the improvement in short-term knowledge about early symptoms of stroke by intensive and moderate interventions; therefore, further study is necessary to assess the effectiveness by the behavioral changes of patients with stroke. For example, time from symptom onset to hospital presentation, the number of patients with stroke calling an ambulance, how soon bystanders called the emergency center after having noticed early symptoms, and the number of patients able to undergo intravenous thrombolytic therapy should be evaluated. Second, we did not evaluate exposure to mass media, such as television programs or newspaper articles about stroke. However, we surveyed participants who had read newspaper advertisements by AC Japan and adjusted for its effect in our multivariable model. We think that this represented a surrogate marker for exposure to mass media because those participants would likely be exposed to information by other mass media. Third, respondents may have been community residents who were relatively interested in stroke, such that the effects of intervention on knowledge of early stroke symptoms in a group not interested in stroke could not be determined. Fourth, closed-ended questions may provide the respondent with some prompt as to what the correct answer should be,[15] and, therefore, may have been likely to produce substantially higher identification of early stroke symptoms. Finally, the nationwide stroke campaign with newspaper advertisements by AC Japan may have influenced the knowledge of early stroke symptoms in the control area.

In conclusion, our findings suggest that intensive intervention comprising distribution of leaflets and booklets to all homes was effective in improving the short-term knowledge about early stroke symptoms, and was more effective than moderate intervention. The costs of leaflet and booklet distribution can be reduced by delivery in free official gazette issued by local municipalities. The findings of this study indicate that this would be an effective and practical long-term strategy to educate the general population.

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Disclosures

None.

References

1. Naganuma M, Toyoda K, Nonogi H, Yokota C, Koga M, Yokoyama H, et al. Early hospital arrival improves outcome at discharge in ischemic but not hemorrhagic stroke: a prospective multicenter study. *Cerebrovasc Dis*. 2009;28:33–38.
2. Yamaguchi T, Mori E, Minematsu K, Nakagawara J, Hashi K, Saito I, et al; Japan Alteplase Clinical Trial (J-ACT) Group. Alteplase at 0.6 mg/kg for acute ischemic stroke within 3 hours of onset: Japan Alteplase Clinical Trial (J-ACT). *Stroke*. 2006;37:1810–1815.
3. Wahlgren N, Ahmed N, Dávalos A, Hacke W, Millán M, Muir K, et al. Thrombolysis with alteplase 3–4.5 h after acute ischaemic stroke (SITS-ISTR): an observational study. *Lancet*. 2008;372:1303–1309.
4. Hacke W, Kaste M, Bluhmki E, Brozman M, Dávalos A, Guidetti D, et al; ECASS Investigators. Thrombolysis with alteplase 3 to 4.5 hours after acute ischemic stroke. *N Engl J Med*. 2008;359:1317–1329.
5. Morris DL, Rosamond W, Madden K, Schultz C, Hamilton S. Prehospital and emergency department delays after acute stroke: the Genentech Stroke Presentation Survey. *Stroke*. 2000;31:2585–2590.
6. Evenson KR, Rosamond WD, Morris DL. Prehospital and in-hospital delays in acute stroke care. *Neuroepidemiology*. 2001;20:65–76.
7. Chang KC, Tseng MC, Tan TY. Prehospital delay after acute stroke in Kaohsiung, Taiwan. *Stroke*. 2004;35:700–704.
8. Williams LS, Bruno A, Rouch D, Marriott DJ. Stroke patients' knowledge of stroke. Influence on time to presentation. *Stroke*. 1997;28:912–915.
9. Silver FL, Rubini F, Black D, Hodgson CS. Advertising strategies to increase public knowledge of the warning signs of stroke. *Stroke*. 2003;34:1965–1968.
10. Marx JJ, Klawitter B, Faldum A, Eicke BM, Haertle B, Dieterich M, et al. Gender-specific differences in stroke knowledge, stroke risk perception and the effects of an educational multimedia campaign. *J Neurol*. 2010;257:367–374.
11. Fogle CC, Oser CS, McNamara MJ, Helgerson SD, Gohdes D, Harwell TS. Impact of media on community awareness of stroke warning signs: a comparison study. *J Stroke Cerebrovasc Dis*. 2010;19:370–375.
12. Miyamatsu N, Kimura K, Okamura T, Iguchi Y, Nakayama H, Toyota A, et al. Effects of public education by television on knowledge of early stroke symptoms among a Japanese population aged 40 to 74 years: a controlled study. *Stroke*. 2012;43:545–549.
13. Miyamatsu N, Okamura T, Nakayama H, Toyoda K, Suzuki K, Toyota A, et al. Public awareness of early symptoms of stroke and information sources about stroke among the general Japanese population: the Acquisition of Stroke Knowledge Study. *Cerebrovasc Dis*. 2013;35:241–249.
14. National Institute of Neurological Disorders and Stroke. 2005. Stroke information page. http://www.ninds.nih.gov/disorders/stroke/stroke.htm. Accessed March 15, 2013.
15. Nicol MB, Thrift AG. Knowledge of risk factors and warning signs of stroke. *Vasc Health Risk Manag*. 2005;1:137–147.
16. Hodgson C, Lindsay P, Rubini F. Using paid mass media to teach the warning signs of stroke: the long and the short of it. *Health Promot J Austr*. 2009;20:58–64.
17. Hodgson C, Lindsay P, Rubini F. Can mass media influence emergency department visits for stroke? *Stroke*. 2007;38:2115–2122.
18. Robinson TG, Reid A, Haunton VJ, Wilson A, Naylor AR. The face arm speech test: does it encourage rapid recognition of important stroke warning symptoms? *Emerg Med J*. 2013;30:467–471.

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SUPPLEMENTAL MATERIAL

Supplemental Table I. Characteristics of the three cities

	Akita	Kure	Shizuoka
Population size*	330,901	252,325	700,477
Population size: 40-74 years*	154,120	118,097	330,971
Proportion of people aged 40-74, %*	46.6	46.8	47.2
Proportion of people aged ≥ 65, %*	22.4	26.0	21.9
Area size, km^2	905.7	353.9	1411.9
Distance, km			
Akita-Kure		903.2	
Akita-Shizuoka		548.6	
Kure-Shizuoka		538.0	

*Data of 2006

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Public Awareness of Early Symptoms of Stroke and Information Sources about Stroke among the General Japanese Population: The Acquisition of Stroke Knowledge Study

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Key Words
Stroke symptoms · Warning signs · Knowledge · Education campaign · Prehospital delay

Abstract
Background: It is important that the general population be aware of the early symptoms, since it has been shown that early arrival to hospitals leads better prognosis of stroke patients. However, the general population is not well informed about the early symptoms of stroke. This study was conducted to clarify which stroke symptoms are less well known and which information sources are related to awareness of stroke symptoms. ***Methods:*** A multiple-choice, mail-in survey involving 5,540 randomly selected residents, aged 40–74 years, of 3 cities in Japan was conducted. Their knowledge about stroke symptoms and their information sources were surveyed; information sources were classified as mass media (television/newspaper/radio) and personal communication sources (posters/leaflets/internet/health professionals/family and/or friends). 'Awareness' was defined as selecting all 5 of the correct stroke symptoms from among 10 listed symptoms with decoy choices. The estimated fraction of the possible impact due to each source on the whole population was also calculated by odds ratios (ORs) and the proportion of respondents who selected each source (Pe). The combined effects of mass media and personal communication sources on awareness were also assessed. ***Results:*** Of the 5,540 residents, only 23% selected all 5 correct symptoms. Visual disturbance was the least known of the 5 symptoms (35%). All sources were positively related to awareness, with ORs (Pe) of: television, 1.58 (72.5%); newspaper, 1.79 (48.0%); radio, 1.74 (13.3%); posters, 1.73 (7.6%); leaflets, 1.50 (24.7%); Internet, 1.66 (5.6%); health professionals, 1.33 (34.8%), and family/friends, 1.21 (44.6%). The estimated fraction of the possible impact due to each source was higher for mass media (television, 0.31 and newspaper, 0.28) than personal communication sources (Internet, 0.04 and leaflets, 0.12). Mass me-

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dia only and mass media/personal communication sources were significantly associated (ORs: 1.66, 2.75, respectively). ***Conclusions:*** As a single method of public education, television could be the most effective strategy. Moreover, the combined approach involving mass media and personal communication sources might have a synergistic effect. Less well-known symptoms, such as visual disturbances, should be noted in public education campaigns.

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Introduction

Stroke is the leading cause of permanent disability in adults and one of the major leading causes of death and disability worldwide [1–5]. Some previous studies examining time limit for initiation of intravenous thrombolysis therapy using alteplase demonstrated that alteplase treatment within 4.5 h of onset improved functional outcome [6, 7]. However, it was also reported that delay in hospital presentation of patients with acute stroke still remained substantial [8–11]. The reasons for this delay were attributed to both lack of awareness of stroke attacks and nonuse of ambulances in previous studies [8, 12]. Thus, it is important for improving stroke outcomes to educate citizens to react immediately and appropriately at their stroke onset. Such community education should be focused on the recognition of early symptoms of stroke onset and appropriate reaction at stroke onset, i.e., to call an ambulance as soon as possible. Despite the importance of recognizing early symptoms, the population remains poorly informed about the early symptoms of stroke [13–17].

The purpose of the present study was to clarify which early symptoms of stroke are less well known, and which information sources are used to obtain knowledge about stroke by the general Japanese population. The study aimed furthermore to identify which information sources were related to awareness of stroke symptoms.

Methods

Acquisition of Stroke Knowledge (ASK) Study

This study was conducted as a baseline survey of a nonrandomized community intervention trial, the Acquisition of Stroke Knowledge Study, to improve awareness about early symptoms of stroke and the appropriate response to stroke onset. Three cities in Japan, i.e., Akita, Shizuoka and Kure, were selected. Akita is located in the northern part of Japan. In the present study, two districts of Akita city, i.e., Kawabe and Yuwa, were selected in order to prepare for future intensive intervention targeting improvement of knowledge about stroke. Kure is a city in Hiroshima prefecture in the western part of Japan, and Shizuoka is located in the central part of Japan. A preintervention survey was followed by community intervention. After the community intervention, postintervention surveys have been performed to assess a long-term effect of our intervention, which are now ongoing and under analysis. This article was based on the preintervention survey in 2006.

From these three areas, 11,306 community dwellers, aged 40–74 years, were randomly selected by an age-stratified random sampling method from the Basic Resident Register. To align the age distribution among participants in the three areas, the number of listed participants in each age bracket, i.e., 40–49, 50–59, 60–69 and 70–74, was almost equal.

Measures and Procedure

A mail-in survey was conducted from April to July in 2006, and a closed-end questionnaire was mailed to each participant. The questionnaire consisted of the following: general knowledge of stroke, early symptoms of stroke, what to do at the time of stroke onset, information sources for knowledge about stroke, and sociodemographic factors (see 'Appendix'). The questions regarding 'early symptoms of stroke' consisted of 5 correct answers and 5 decoy answers as multiple-choice items. The questions regarding 'information sources about stroke' consisted of 11 multiple-choice items. For these questions, multiple answers were allowed. The questions regarding 'Response to stroke attack' consisted of 7 multiple-choice items, for which a single answer was required.

This study was approved by the ethics committee of Shiga University of Medical Science (17–97).

Analysis Methods

Differences in responses among age groups were assessed with the χ^2 test. In this study, respondents with 'awareness' of early symptoms were defined as those who selected all 5 correct early symptoms of stroke from the 10 symptoms listed, except for those who selected all items. The odds ratio (OR) of having 'awareness' of early symptoms from an information source was calculated with logistic regression analysis after adjusting for age, sex, survey site, with/without risk factors for stroke, with/without stroke patients close to respondents, and living alone or not, among respondents who did not have a past history of stroke. In addition, the estimated fraction of possible impact due to each information source on the whole population was calculated according to the ORs mentioned above and the proportion of respondents who chose each information source using this formula in analogy to Levin's [18] formula for population-attributable risk: [Pe × (multivariate adjusted OR -- 1)]/[Pe × (multivariate adjusted OR -- 1) + 1], where Pe is the proportion of respondents who chose one information source as their own information source, and OR is the odds ratio of having awareness of early symptoms in the same respondents. We believe that both of them are important to improve public awareness. Further logistic regression analysis was performed to assess the combined effect of mass media and personal communications on awareness of stroke symptoms.

All significance tests were two-tailed, and $p < 0.05$ was considered significant in all analyses. Data were analyzed with SPSS version 15.0 for Windows (SPSS Inc.).

Table 1. Response rate and characteristics of respondents by sex and age

	Overall	Sex		Age, years			
		men	women	40–49	50–59	60–69	70–74
Responses, n	5,540	2,618	2,922	1,390	1,524	1,779	847
Subjects, n	11,306	5,672	5,634	3,184	3,311	3,207	1,604
Response rate, %	49.0	46.2	51.9	43.7	46.0	55.5	52.8
	(n = 5,540)	(n = 2,618)	(n = 2,922)	(n = 1,390)	(n = 1,524)	(n = 1,779)	(n = 847)
Past history of stroke	128 (2.3)	81 (3.1)	47 (1.6)	7 (0.5)	14 (0.9)	60 (3.4)	47 (5.5)
Self-reported underlying diseases of stroke							
High blood pressure	1,211 (21.9)	656 (25.1)	555 (19.0)	107 (7.7)	270 (17.7)	518 (29.1)	316 (37.3)
High cholesterol	729 (13.2)	325 (12.4)	404 (13.8)	94 (6.8)	217 (14.2)	306 (17.2)	112 (13.2)
Diabetes	429 (7.7)	270 (10.3)	159 (5.4)	43 (3.1)	85 (5.6)	193 (10.8)	108 (12.8)
Heart diseases	213 (3.8)	127 (4.9)	86 (2.9)	10 (0.7)	26 (1.7)	103 (5.8)	74 (8.7)
Arrhythmia	423 (7.6)	241 (9.2)	182 (6.2)	50 (3.6)	102 (6.7)	172 (9.7)	99 (11.7)
Transient ischemic attack	31 (0.6)	19 (0.7)	12 (0.4)	1 (0.1)	4 (0.3)	11 (0.6)	15 (1.8)
At least one of diseases mentioned above	2,143 (38.7)	1,131 (43.2)	1,012 (34.6)	253 (18.2)	521 (34.2)	888 (49.9)	481 (56.8)
With stroke patients close to respondents	3,031 (54.7)	1,426 (54.5)	1,605 (54.9)	703 (50.6)	883 (57.9)	1,010 (56.8)	435 (51.4)
Living alone	471 (8.5)	230 (8.8)	241 (8.2)	92 (6.6)	115 (7.5)	166 (9.3)	98 (11.6)

Data shown as number of subjects with percentage in parentheses.

Results

Response Rate and Age Distribution of the Survey Population

The respondents of this study were 5,540 individuals (response rate 49.0%) with a mean age of 58.1 ± 9.8 years, 52.7% were women (table 1). Of the respondents, 2.3% reported a history of stroke, 54.7% reported that a close acquaintance had suffered a stroke, and 38.7% had at least one of the risk factors for stroke (table 1).

Knowledge of Stroke

As shown in table 2, approximately 80% of all respondents reported knowing what stroke was. Concerning the early symptoms of stroke, approximately 90% of respondents appropriately selected 'sudden hemiplegia' and 'sudden speech problem' as early symptoms, followed by 'sudden, severe headache' (72.3%) and 'sudden dizziness or loss of balance' (62.7%). However, only 35.0% of respondents selected 'sudden vision problem'. Of all respondents, 1,288 (23.2%) were classified as having 'awareness' of early symptoms, which was defined as complete selection of the 5 correct early symptoms. The proportion of respondents who had 'awareness' was higher in those aged less than 60 years (26.8, 19.3%, respectively, $p < 0.001$ for the χ^2 test), and was higher in those who had someone close who was a stroke patient than those who did not (26.1, 19.8%, respectively, $p < 0.001$ for the χ^2 test). Even among 4,285 respondents who reported that 'I generally know what a stroke is', only 1,076 (25.1%) were defined as those who had awareness of early symptoms of stroke (data not shown). Over 80% of respondents answered that they would call an ambulance at stroke onset (table 2).

Associations between Information Sources and Awareness of Early Symptoms of Stroke

In the present study, eight information sources were grouped into two major types of information sources. Television, newspaper, and radio were categorized as 'mass media', and Internet, family/friends, leaflets, posters, and health professionals were categorized as 'personal communication sources'. As shown in table 3, the proportion of respondents who chose television (72.4%) was higher than other information sources, especially 'personal communication sources'. Few respondents selected the Internet and posters as the information source about stroke. Substantial gender difference was not observed. Health professionals were chosen by elders, whereas Internet was chosen by young people.

The results of multivariate-adjusted logistic regression analyses, which were performed to assess associations between each information source and 'awareness' of early symptoms, are shown in table 4. These results demonstrated that respondents who obtained information for

Table 2. General knowledge, knowledge of risk factors and early symptoms of stroke, and reaction to stroke onset by sex and age

	Overall (n = 5,540)	Age, years				p value
		40–49 (n = 1,390)	50–59 (n = 1,524)	60–69 (n = 1,779)	70–74 (n = 847)	
Do you know what is 'stroke'?[a]						<0.001
Generally know	4,285 (77.3)	1,017 (73.2)	1,194 (78.3)	1,401 (78.8)	673 (79.5)	
Only name of disease	1,063 (19.2)	339 (24.4)	284 (18.6)	310 (17.4)	130 (15.3)	
Do not know	96 (1.7)	9 (0.6)	21 (1.4)	40 (2.2)	26 (3.1)	
Nonresponding	96 (1.7)	25 (1.8)	25 (1.6)	28 (1.6)	18 (2.1)	
What are the early symptoms of stroke onset?[b]						
Sudden one-sided numbness or weakness of the face, arm, or leg	4,797 (86.6)	1,242 (89.4)	1,346 (88.3)	1,512 (85.0)	697 (82.3)	<0.001
Sudden confusion or trouble speaking or understanding others	4,796 (86.6)	1,255 (90.3)	1,371 (90.0)	1,495 (84.0)	675 (79.7)	<0.001
Sudden severe headache with no known cause	4,008 (72.3)	1,077 (77.5)	1,158 (76.0)	1,222 (68.7)	551 (65.1)	<0.001
Sudden dizziness, trouble walking, or loss of balance or coordination	3,471 (62.7)	882 (63.5)	997 (65.4)	1,111 (62.5)	481 (56.8)	<0.001
Sudden trouble seeing in one or both eyes	1,938 (35.0)	571 (41.1)	579 (38.0)	544 (30.6)	244 (28.8)	<0.001
Palsy of both hands and/or fingers[c]	2,461 (44.4)	675 (48.6)	712 (46.7)	729 (41.0)	345 (40.7)	<0.001
Selected all 5 correct warning signs of stroke	1,288 (23.2)	373 (26.8)	408 (26.8)	344 (19.3)	163 (19.2)	<0.001
Selected all 5 correct warning signs of stroke[d]	1,267 (23.0)	367 (26.4)	399 (26.2)	339 (19.1)	162 (19.1)	<0.001
How do you respond if you are having a stroke attack?[a]						<0.001
Immediately call an ambulance	4,500 (81.2)	1,176 (84.6)	1,265 (83.0)	1,401 (78.8)	658 (77.7)	
Immediately call a primary physician at clinic or hospital	401 (7.2)	44 (3.2)	89 (5.8)	171 (9.6)	97 (11.5)	
Immediately call a large and/or special hospital	150 (2.7)	40 (2.9)	38 (2.5)	48 (2.7)	24 (2.8)	
Immediately see a primary physician at clinic or hospital	124 (2.2)	24 (1.7)	29 (1.9)	54 (3.0)	17 (2.0)	
Immediately see a doctor in large and/or special hospital	261 (4.7)	78 (5.6)	82 (5.4)	72 (4.0)	29 (3.4)	
See a primary physician at clinic or hospital during office hours	24 (0.4)	6 (0.4)	2 (0.1)	9 (0.5)	7 (0.8)	
See a doctor in large and/or special hospital during office hours	11 (0.2)	4 (0.3)	2 (0.1)	3 (0.2)	2 (0.2)	
Wait and observe symptoms for several days	11 (0.2)	3 (0.2)	3 (0.2)	4 (0.2)	1 (0.1)	
Unknown	58 (1.0)	15 (1.1)	14 (0.9)	17 (1.0)	12 (1.4)	

Data shown as number of subjects with percentage in parentheses. [a] Single answer was required. [b] Multiple answers allowed. [c] Decoy answer. [d] Of the 5,519 respondents, excluding those who chose all 10 items. p value for χ^2 test.

Table 3. Proportion of respondents who chose each information source among 5,391 members[a] of the general population (%, by sex and age)

Type of information source	Overall (n = 5,391)	Sex		Age, years			
		men (n = 2,527)	women (n = 2,864)	40–49 (n = 1,377)	50–59 (n = 1,501)	60–69 (n = 1,714)	70–74 (n = 799)
Mass media							
Television	72.4	68.5	75.9	74.2	71.8	73.2	69.0
Newspaper	48.0	48.1	47.8	48.0	50.2	49.5	40.3
Radio	13.2	14.4	12.1	11.1	14.9	14.3	11.1
Personal information							
Internet	5.5	7.1	4.1	10.7	6.9	2.1	1.3
Family/friends	44.5	40.5	48.0	39.7	48.7	47.0	39.5
Leaflets	24.6	25.6	23.7	20.0	29.2	25.9	20.9
Posters	7.5	8.2	6.9	7.8	9.3	7.0	4.6
Health professionals[b]	34.7	36.6	33.0	21.9	30.5	41.4	50.2

[a] 5,391 respondents excluding respondents who had a past history of stroke (n = 128) or selected all 10 as early symptoms (n = 21). [b] Medical doctors and/or nurses.

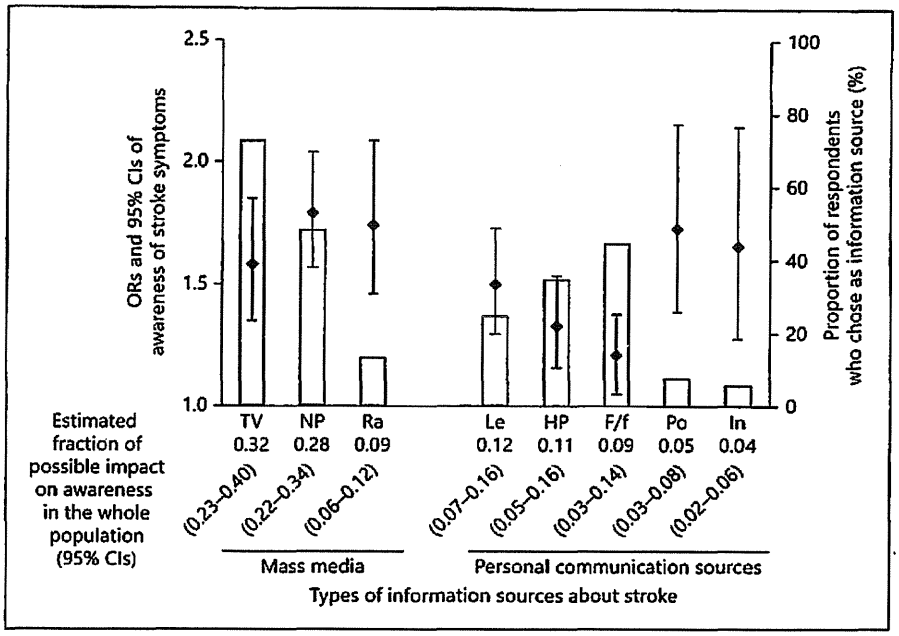

Fig. 1. Estimated fraction of possible impact of each information source on awareness about stroke symptoms on the whole population (for formula, see text). ORs were calculated adjusting for age, sex, survey site, with/without close stroke patients, living alone or not, with/without risk factors of stroke such as high blood pressure, high cholesterol, diabetes, heart disease, arrhythmia, and transient ischemic attack, along with each information source. Rhombus markers and whiskers indicate ORs and 95% CIs. Gray bars show the proportion of respondents who chose each information source. TV = Television; NP = newspaper; Ra = radio; Le = leaflet; HP = health professionals; F/f = family/friends; Po = poster; In = internet.

Table 4. Awareness of stroke symptoms by each information source among 5,391 members of the general population

Type of information source	Univariate		Multivariate adjusted[b]	
	ORs	95% CIs	ORs	95% CIs
Mass media				
Television	1.68	1.44–1.96	1.65	1.41–1.93
Newspaper	1.83	1.61–2.08	1.81	1.59–2.06
Radio	1.67	1.41–1.98	1.75	1.47–2.08
Personal information				
Internet	1.94	1.51–2.48	1.68	1.30–2.16
Family/friends	1.27	1.12–1.44	1.21	1.06–1.38
Leaflets	1.53	1.33–1.76	1.53	1.32–1.76
Posters	1.78	1.44–2.22	1.74	1.40–2.17
Health professionals[a]	1.23	1.08–1.40	1.34	1.16–1.54

'Awareness of stroke symptoms' was defined as to select all of 5 correct early symptoms of stroke (n = 1,241, 23.3%). ORs and 95% CIs were calculated among 5,391 respondents, excluding respondents who had a past history of stroke (n = 128) or selected all 10 as early symptoms (n = 21).

[a] Medical doctors and/or nurses.

[b] Multivariate-adjusted ORs and 95% CIs were calculated adjusting for age, sex, survey site, with/without closed person with stroke, living alone, with/without risk factors of stroke such as high blood pressure, high cholesterol, diabetes, heart disease, arrhythmia, and transient ischemic attack for each information source.

stroke from any type of sources were more likely to be aware of early symptoms of stroke than their counterparts: newspaper (OR: 1.81), radio (OR: 1.75), and television (OR: 1.65) as 'mass media', and posters (OR: 1.74), Internet (OR: 1.68), leaflets (OR: 1.53), health professionals (OR: 1.34), and family/friends (OR: 1.21) as 'personal communication sources'.

Estimated Fraction of Impact due to Each Information Source on the Whole Population

Figure 1 shows the estimated fraction of the impact due to each information source about awareness of stroke symptoms on the whole population. Mass media, especially television and newspapers, were found to have a large estimated fraction, i.e., 0.32 (95% confidence interval, CI, 0.23–0.40) for television and 0.28 (95% CI, 0.22–0.34) for newspaper. On the other hand, despite high ORs, posters and the Internet as personal communication sources had a relatively small estimated fraction due to the small proportion of respondents who chose them as information sources, 0.05 (95% CI, 0.03–0.08) for posters and 0.04 (95% CI, 0.02–0.06) for the Internet.

Combination of Mass Media and Personal Communications

To assess the combined effect of mass media and personal communications on 'awareness' of early symptoms, respondents were divided into four groups according to the

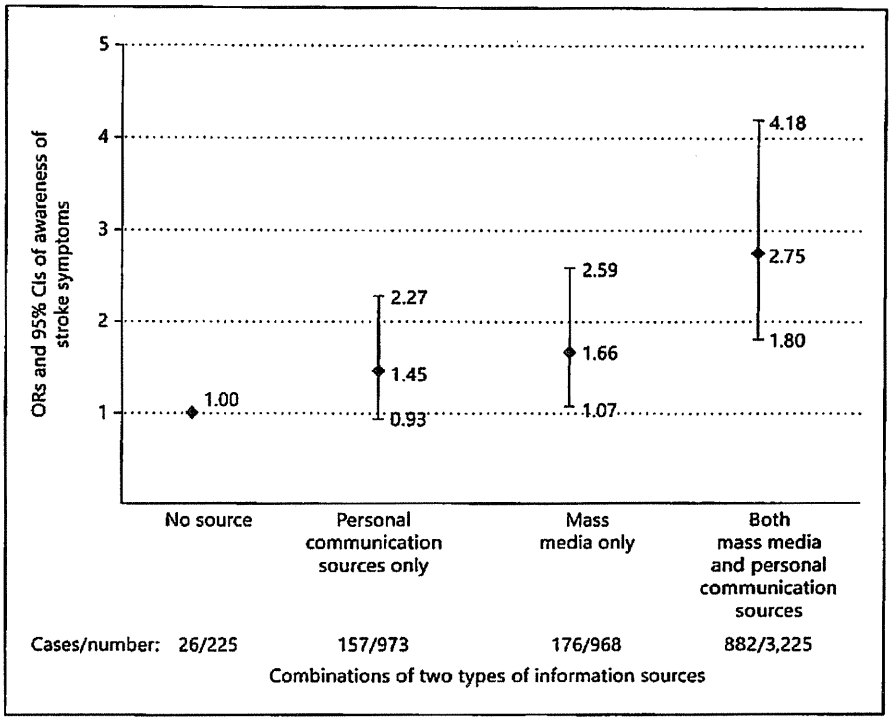

Fig. 2. ORs and 95% CIs of awareness of stroke symptoms by types of communication source among 5,391 participants of the general population. 'Awareness of stroke symptoms' was defined as selecting all 5 correct early symptoms of stroke. ORs and 95% CIs were calculated among the 5,391 respondents, except for respondents who had a past history of stroke (n = 128) or selected all 10 as early symptoms (n = 21). ORs were calculated adjusting for age, sex, survey site, with/without close stroke patients, living alone or not, with/without risk factors of stroke such as high blood pressure, high cholesterol, diabetes, heart disease, arrhythmia, and transient ischemic attack, along with each information source.

type of information source (no source, personal communication sources only, mass media only, both mass media and personal communication sources). On multivariate-adjusted logistic regression analysis using 'no information source' as the reference group, as shown in figure 2, obtaining knowledge about stroke from 'mass media only' was positively related to 'awareness' of early symptoms of stroke (OR: 1.66). The combination of mass media and personal communication sources was significantly related to better knowledge of early symptoms of stroke (OR: 2.75). 'Personal communication sources only' did not have a significant association with awareness of stroke symptoms.

Discussion

The present study is the first community-based study focusing on information sources for 'awareness' of early symptoms of stroke among the general population in Japan. In the present study, the proportion of the general population reported that they would call an ambulance if attacked by a stroke was higher than in the United States [19]. However, only about one fourth of respondents (23.2%) selected all of the correct early symptoms of stroke. Furthermore, despite the low prevalence of respondents who selected all 5 correct answers, nearly 80% of respondents reported that 'I generally know what stroke is'.

In previous studies that focused on knowledge about stroke, 35–70% of respondents had awareness of the early symptoms of stroke [20–22]. The discrepancy in the proportion of people with awareness between previous studies and the present study may be due to the difference in the definitions of 'to be aware' of stroke symptoms. In the present study, persons with awareness were defined as those who selected all 5 correct early symptoms of stroke from among 10 symptoms. On the other hand, knowledge of only 1–2 of correct symptoms was defined as awareness in the analysis of previous studies, i.e. Fogle et al. [22] defined a person reporting two or more symptoms of stroke as one who had awareness of stroke symptoms, and they reported that the proportion of people with awareness was 68–73% before the campaign. The reason why such a strict definition was used for the assessment of awareness about stroke symptoms in the present study is that people cannot choose their stroke symptom when it occurs. Robinson et al. [23] reported that symptoms not included in the FAST campaign (leg weakness and visual loss) were poorly recognized by British people and indicated that this lack of knowledge might lead to delays in hospital presentation. Actually, in the Greater