Original Contribution

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Differences Between US and UK Adults in Stroke Preparedness

Evidence From Parallel Population-Based Community Surveys

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Background and Purpose—Although time-dependent treatment is available, most people delay contacting emergency medical services for stroke. Given differences in the healthcare system and public health campaigns, exploring between-country differences in stroke preparedness may identify novel ways to increase acute stroke treatment.

Methods—A survey was mailed to population-based samples in Ingham County, Michigan, US (n=2500), and Newcastle upon Tyne, UK (n=2500). Surveys included stroke perceptions and stroke/nonstroke scenarios to assess recognition and response to stroke. Between-country differences and associations with stroke preparedness were examined using *t* tests and linear mixed models.

Results—Overall response rate was 27.4%. The mean age of participants was 55 years, and 58% were female. US participants were better in recognizing stroke (70% versus 63%, d=0.27) and were more likely to call emergency medical services (55% versus 52%, d=0.11). After controlling for demographics and comorbidities, US participants remained more likely to recognize stroke but were not more likely to respond appropriately. A greater belief that medical treatment can help with stroke and understanding of stroke was associated with improved stroke recognition and response.

Conclusions—Overall, stroke recognition and response were moderate. US participants were modestly better at recognising stroke, although there was little difference in response to stroke. Future stroke awareness interventions could focus more on stroke outcome expectations and developing a greater understanding of stroke among the public. (***Stroke*. 2015;46:00-00. DOI: 10.1161/STROKEAHA.115.009997.)**

Key Words: behavior ■ perception ■ prehospital delay ■ prevention ■ psychology ■ stroke

Despite widespread availability and evidence of effectiveness, acute stroke treatments, such as tissue plasminogen activator, are underutilized in industrialized countries.[1–3] Less than 8% of ischemic stroke patients receive tissue plasminogen activator in the US and the UK.[4,5] The main reason for low rates of tissue plasminogen activator use is prehospital delay related to patient/witness decision-making after a stroke.[6,7] Therefore, stroke preparedness (ie, recognition of stroke signs and responding by contacting emergency medical services [EMS] immediately) is crucial to optimal stroke care.

Despite the importance of stroke preparedness, a limited number of studies have examined differences across countries. A recent cross-country comparison study found that symptom and response knowledge was highest in UK participants compared with the Australians and Canadians.[8] Between-country differences in stroke preparedness could be as a result of differences in healthcare systems or regional stroke awareness campaigns, but comparative evidence to date is sparse.

A cross-country comparison of stroke preparedness between the UK and the US could be informative for 2 reasons. First, in England, the Department of Health rolled out the national Stroke—Act FAST (Face, Arms, Speech: Time to call Emergency Medical Services) campaign[9] in 2009 to raise awareness of common stroke symptoms (ie, Face, facial droop; Arm, unilateral weakness; Speech, speech disturbances) and the need for emergency contact (ie, Time to call 999, the British emergency contact number). Act FAST has been implemented in 9 waves until 2014 and primarily

Received May 7, 2015; final revision received August 7, 2015; accepted August 21, 2015.

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***Stroke* is available at http://stroke.ahajournals.org** **DOI: 10.1161/STROKEAHA.115.009997**

by TV advertisement. No comparable government-sponsored national campaign had been disseminated in the US at the time of the study, suggesting that stroke preparedness ought to be higher in England. Second, the 2 countries have different healthcare systems. While, for those under 65, the US has a predominantly employee-based health insurance system, the UK operates under the National Health Service providing universal healthcare free at point of delivery to all. Given the lack of personal monetary costs associated with UK healthcare use, UK residents might be more likely to engage with EMS in the event of acute health threats, such as stroke. The primary purpose of this study was to determine whether differences exist in stroke preparedness between the US and the UK. Secondary aims were to predict stroke preparedness using country- and stroke-relevant perceptions (ie, stroke self-efficacy and illness representations) and explore differences between countries in obtaining stroke information and and stroke relevant perceptions.

Methods

Design and Setting

Parallel postal surveys were conducted in 2 population-based samples in Ingham County, Michigan, USA (n=2500), and in Newcastle upon Tyne, UK (n=2500). Ingham County is located in central Michigan in the Midwest of the United States. It has a population of 282 324, of which 12% are African Americans.[10] At the time of the survey, ≈8% of the working-age population was unemployed.[11] Newcastle upon Tyne is a city in North East England with a population of 280 200, of which 85% are white British, with 15% from other ethnic groups, and 15.6% of the working-age population are unemployed and claim benefits.[12]

Participants and Recruitment

In Ingham County, an address-based sample, excluding PO Boxes, was used. The list was stratified by socioeconomic status and had a 20% oversample of individuals from low socioeconomic status areas. Potential participants were mailed an introductory letter and survey in November 2012 and a reminder card 2 weeks later. Nonresponders received a replacement survey 1 month after the first survey. No incentives were provided. The University of Michigan Institutional Review Board approved the study.

In Newcastle upon Tyne, a general population sample was selected randomly from the electoral register (obtained May 2012), which lists names and addresses of all adults aged over 18 years who are eligible to vote. British participants were recruited as part of an experimental survey assessing the effects of providing a leaflet.[13] All participants included in the current study were part of the control group who only received a questionnaire, identical to the US participants. Registering to vote is a legal responsibility in the UK. Individuals are given a yearly opportunity to opt out of their details being visible in the edited register—which is freely available for purchase.

Measures

Stroke Scenario Measures and Knowledge

Stroke Preparedness. A previously validated scenario-based tool was adapted to be applicable in a US and UK cultural context.[14] Participants were provided with 12 stroke and 4 nonstroke scenarios. Stroke recognition was assessed by asking whether a scenario was a "potential stroke" "not stroke," or "don't know" (Cronbach α=0.78). Stroke response was assessed with the item "If this happened, what would you do first?" followed by five response options: "Call the doctor's surgery (GP)," "Wait a couple of hours, then decide," "Call a family member or friend," "Call 999/911," or "Other" followed by space for free text (Cronbach α=0.80). Stroke recognition and responses were classified as poor, moderate, and good if participants achieved an average of 0% to 50%, 50% to 70%, and 70% to 100% correct answers on average, respectively.

Stroke History

All items were binary (yes/no) assessing stroke experience, stroke experience of close social others, stroke witness experience, and health-related EMS contact.

Stroke Information

Based on a previous study,[15] participants indicated whether they had "seen, heard, or read anything about strokes in the last year or so" (yes/no) and were given response options.

Stroke-Relevant Perceptions

Stroke Self-Efficacy. Based on a previous study,[14] recognition and response self-efficacy for stroke were assessed (ie, "I would be able to tell if someone was having a stroke" and "If I saw someone having a stroke, I would know what to do"). Responses ranged from 1 (strongly disagree) to 5 (strongly agree).

Stroke Illness Representations. We adapted the Brief Illness perception questionnaire[16] for stroke. Items were assessed on 10 point scales (eg, for illness coherence: "How well do you feel you understand stroke?", responses ranged from 1, don't understand at all, to 10, understand very clearly).

Analysis

The mean percent of correct responses for the 12 stroke vignettes was calculated. For testing between-country differences, a series of *t* tests and chi-squared test were conducted, and Cohen's d was calculated. Statistical inferences of the *t* tests were based on a nonparametric bootstrapping procedure with 5000 resamples stratified by country, which made no assumptions about the sampling distribution.[17] Linear mixed models with restricted maximum likelihood estimates and unrestricted covariance matrices were used to explore the association of country (random intercept variable) with stroke recognition and response after accounting for demographics, modeled as fixed effects (including age [continuous]; sex [male/female], ethnicity [white/other], living alone [yes/no], previously called EMS for medical reason [yes/no], and education [coded yes/no for no qualification, basic education, vocational education and degree]), comorbidities (stroke, hypertension, heart attack, diabetes mellitus, and atrial fibrillation [all yes/no]), and stroke history (past stroke self [yes/no], past stroke close friend or family [yes/no], witnessed stroke [yes/no], seen stroke information in last 12 months [yes/no]). Psychological factors, recognition and response self-efficacy, and Illness Perception Questionnaire items (all continuous) were added as fixed-effect variables in a second step to ascertain whether these explained potential between-country variance in the outcome. Continuous independent variables were grand mean centered, and categorical independent variables were coded 0 and 1 before entering them into the linear mixed models. Intraclass correlation (ICC), the ratio of the between-country variance to the total variance, was used to evaluate the proportion of the total variance in the respective outcome accounted for by country differences.

Results

The overall response rate was 27.4% (1369 out of 5000). In the US and the UK, 543 and 826 participants participated out of the 2500 completed surveys, respectively. Survey participants between the 2 countries were broadly comparable (Table 1). UK participants were slightly younger (mean age difference =−1.89 years, 95% confidence interval −3.74, −0.25) and more likely to be white (93.6% UK versus 57.0% US). UK participants had

Table 1. Sample Description: Demographics, Education, and Proportions of Morbidities

Variable	UK	US	*P* Value
Age, mean (SD)	53.9 (17.4)	55.8 (16.3)	0.043
Sex (% male)	41.3	43.8	0.353
Ethnicity (% white)	93.6	57.0	<0.001
Education, %			<0.001
No qualification	23.4	3.6	
Basic education	23.2	13.5	
Vocational education	24.3	29.4	
Degree	29.1	38.9	
Stroke history, %			
Previous stroke (including TIA)	5.0	5.7	0.547
Hypertension	17.8	29.7	<0.001
Previous heart attack	3.6	5.5	0.093
Diabetes mellitus	7.3	13.4	<0.001
Atrial fibrillation	2.3	3.7	<0.131

TIA indicates transient ischaemic attack.

less educational attainment than US participants. Among US participants, 7% were uninsured.

Between-Country Difference in Stroke Preparedness

US participants were significantly better at recognizing stroke vignettes compared with UK participants (63.3% UK versus 70.0% US, *P*<0.001, d=0.27; Table 2). UK participants were more likely to incorrectly state that a scenario was not a potential stroke (10.7% UK versus 6.3% US, *P*<0.001, d=0.32).

The majority of participants in both countries stated that they would contact EMS first if they thought someone was having a stroke (92.2% UK versus 88.2% US, *P*<0.001). For the scenarios, both UK and US participants showed only moderate knowledge in how to respond correctly to stroke (51.8% UK versus 54.9% US, *P*=0.051, d=−0.11).

Predicting Stroke Preparedness

Of the total variance in stroke recognition, 3.6% (ICC=0.036) was because of differences between the countries in an unconditional model (ie, a model that has no covariate) and 4.8% (ICC=0.048) in a conditional model controlling for demographics, comorbidities, and stroke history (Table 3). When psychological variables were included in the conditional model, confidence in the ability to recognize correctly that somebody was having a stroke (b=0.04, *P*<0.001), believing that medical treatment can help with stroke (b=0.02, *P*=0.008), and a coherent understanding of stroke (b=0.06, *P*<0.001) were associated with stroke recognition.

Country accounted for 0.5% (ICC=0.005) of the variance in stroke response in the unconditional model, and 0.4% (ICC=0.004) in a conditional model controlling for demographics, comorbidities, and stroke history. When psychological variables were included in the conditional model, confidence in the ability to recognize stroke (b=2.67, *P*=0.01), confidence in the ability to respond correctly to stroke (b=4.09, *P*<0.001), believing that medical treatment can help with stroke (b=2.79, *P*=0.001), a coherent understanding of stroke (b=3.29, *P*=0.004), and believing that stroke affects patients emotionally (b=1.96, *P*=0.039) were associated with stroke response.

Between-Country Difference in Obtaining Stroke Information

UK participants were more likely to report having seen, heard, or read about strokes in the previous year (85.1% UK versus 75.9% US, *P*<0.001; Table 4). The sources of information for stroke differed between the countries. Although UK participants reported significantly higher exposure to stroke information through billboards, TV news, and TV public service announcements, stroke information sources for US participants were significantly higher through health professionals, radio news, and radio service announcement.

Between-Country Difference in Stroke Perceptions

No significant differences in stroke-relevant psychological perceptions between UK and US participants were found. In general, participants of both countries were moderately confident that they would be able to recognize and respond to stroke. Participants in both countries indicated that stroke severely affects someone's life, does not last a short time, is not personally controllable, can be treated medically, has several symptoms, is something that they are somewhat concerned about, is something that they somewhat understand, and is something that greatly affects someone emotionally.

Discussion

The current study is the first cross-country comparison of stroke preparedness between UK and US adults. This comparative postal survey found moderate stroke preparedness among US and UK participants. US participants were better at recognizing stroke, and participants in both countries had equally moderate levels of response knowledge. Overall, significant gaps in stroke recognition and response knowledge remained in both countries and suggest the need for aggressive public

Table 2. Mean Percentage for Stroke Response and Recognition to Stroke-Based Scenario Vignettes

	UK % (SD)	US % (SD)	*P* Value	Cohen's d
Recognition*				
Stroke	63.3 (23.9)	70.0 (24.7)	<0.001	−0.27
Not Stroke	10.7 (14.7)	6.3 (12.4)	<0.001	0.32
Don't know	23.9 (22.2)	21.1 (22.4)	0.024	0.13
Response†				
Call GP	22.6 (20.0)	19.8 (20.6)	0.013	0.14
Wait	13.9 (15.7)	9.4 (12.8)	<0.001	0.31
Call family member/ friend	3.0 (7.7)	2.1 (6.0)	0.021	0.13
Call EMS	51.8 (26.6)	54.9 (29.7)	0.051	−0.11
Other	7.1 (13.5)	10.7 (18.6)	0.001	−0.22

EMS indicates emergency medical services; and GP, General Practitioner.
*UK, n=817; US, n=540.
†UK, n=825; US, n=542.

Table 3. Fixed-Effects Estimates (Top) and Variance–Covariance Estimates (Bottom) for Models of the Predictors of Stroke Recognition and Stroke Response

	Model on Stroke Recognition			Model on Stroke Response		
	Model 1 B (SE)	Model 2 B (SE)	Model 3 B (SE)	Model 1 B (SE)	Model 2 B (SE)	Model 3 B (SE)
Fixed-effects estimates						
Intercept	0.67 (0.03)*	0.70 (0.07)†	0.67 (0.07)†	53.26 (1.54)*	59.10 (7.34)†	56.56 (7.38)†
Comorbidity						
Stroke		0.01 (0.07)	−0.03 (0.07)		−1.24 (7.93)	−6.47 (8.13)
Hypertension		−0.02 (0.02)	−0.02 (0.02)		−4.47 (2.05)*	−4.24 (2.01)
Heart attack		0.01 (0.04)	0.01 (0.04)		−0.36 (4.17)	−0.30 (4.22)
Diabetes mellitus		0.01 (0.03)	−0.01 (0.02)		1.08 (2.91)	−1.61 (2.96)
Atrial fibrillation		0.01 (0.04)	−0.01 (0.04)		−1.21 (5.22)	−0.90 (5.22)
Sex (being female)‡		0.02 (0.01)	0.01 (0.02)		0.37 (1.66)	−0.46 (1.63)
Age, y		0.02 (0.008)*	0.02 (0.01)*		2.21 (0.95)*	1.73 (0.96)
Living alone		0.01 (0.02)	−0.01 (0.02)		3.23 (1.96)	2.48 (1.95)
Stroke history						
Past stroke self		−0.003 (0.07)	0.05 (0.07)		4.64 (8.11)	8.64 (8.19)
Past stroke close social network		−0.02 (0.01)	−0.005 (0.01)		−1.05 (1.68)	−0.89 (1.64)
Witnessed stroke		−0.05 (0.02)*	0.03 (0.02)		−0.31 (2.40)	7.25 (2.41)§
Called EMS		−0.004 (0.01)	0.01 (0.01)		−4.70 (1.67)§	−3.80 (1.63)*
Stroke info		−0.12 (0.02)†	−0.03 (0.02)		−12.66 (2.10)†	−4.56 (2.17)*
Ethnicity (being white)‖		0.06 (0.19)§	0.05 (0.02)§		1.56 (2.14)	0.37 (2.02)
Education¶						
No qualification		−0.13 (0.02)†	−0.15 (0.02)†		−7.20 (2.76)†	−7.64 (2.78)§
Basic		−0.08 (0.02)†	−0.09 (0.02)†		−4.47 (2.30)	−6.84 (2.23)§
Vocational		−0.04 (0.02)*	−0.05 (0.02)§		−3.84 (2.04)	−5.05 (2.00)*
Self-efficacy						
Recognition self-efficacy			0.04 (0.01)†			2.67 (1.04)§
Response self-efficacy			0.01 (0.01)			4.09 (1.03)†
Illness perceptions						
Consequences			0.004 (0.01)			0.06 (0.91)
Timeline			0.001 (0.01)			1.29 (0.84)
Personal control			−0.01 (0.01)			−1.48 (0.82)
Treatment control			0.02 (0.01)§			2.79 (0.85)†
Identity			−0.005 (0.01)			−0.08 (0.85)
Concern			−0.005 (0.01)			−0.51 (0.89)
Coherence			0.06 (0.01)†			3.29 (1.12)§
Emotional effect			0.01 (0.01)			1.96 (0.95)*
Estimates of covariance						
Parameters						
Residual	0.06 (0.002)†	0.05 (0.002)†	0.042 (0.002)†	777.21 (29.75)†	711.40 (30.43)†	611.95 (27.61)†
Random intercept estimate (subject=country US and UK)	0.002 (0.003)	0.003 (0.004)	0.001 (0.003)	3.59 (6.76)	2.98 (7.03)	0.60 (3.69)
ICC	0.036	0.048	0.040	0.005	0.004	0.001
−2 *restricted log likelihood (deviance)	11.12	−24.76	−167.77	12 976.87	10 379.33	9251.17

EMS indicates emergency medical services; and ICC, intraclass correlation.
*$P<0.05$.
†$P<0.001$.
‡Gender was dummy coded: 1, male; and 2, female.
§$P<0.01$.
‖Ethnicity was dummy coded: 0, not white; and 1, white.
¶Education was dummy coded where degree served as reference category.

Table 4. Sources of Stroke Information Accessed in the Previous Year

Information Source	UK	US	*P* Value
Billboards	21.7	15.6	0.01
Doctor/nurse	16.6	25.3	<0.001
Newspaper/magazine	39.8	53.0	<0.001
Work	11.2	14.2	0.123
Radio news	8.8	18.6	<0.001
Radio service announcement	9.9	27.1	<0.001
TV news	28.6	10.7	<0.001
TV public service announcement	61.2	35.1	<0.001

health campaigns to improve stroke preparedness. Stroke self-efficacy, believing that medical treatment can help, and having an understanding of stroke were associated with improved stroke recognition and response, even when controlling for country effects, suggesting important targets for future stroke preparedness interventions.

Similar to previous research,[8,14,15] we found that participants in both countries had a high level of general stroke response knowledge stating that they would call EMS in the event of stroke. However, when assessing stroke preparedness (ie, ability to recognize stroke and respond appropriately by calling EMS immediately) using scenario-based measures, we found moderate knowledge for recognition and response knowledge. Stroke recognition was higher and response knowledge was lower compared with a previous community survey of African American participants conducted in the US using the same stroke preparedness measure.[14] In addition, previous research examining differences in stroke knowledge between different countries indicated that UK participants had higher levels of response and symptom knowledge compared with Australians and Canadians.[8] Our findings coupled with previous studies show that stroke preparedness varies by country, suggesting opportunities for further cross-country comparisons of acute stroke systems of care as a potential avenue for improving access to acute stroke treatments.

In line with previous research,[18] we found that participants encountered stroke information through a variety of channels. The Act FAST campaign might also explain why more UK participants reported having seen, heard, or read anything about strokes in the previous year (85% UK versus 76% US). Alternative ways of increasing stroke preparedness should be examined, including raising awareness of stroke within preventative health contexts.[19] Despite the difference in sources of stroke information between countries, and by extension the likely differences in information content, no notable differences in stroke-relevant perceptions were found.

A possible explanation for the differences in stroke preparedness between UK and US participants is the difference in the stroke information environment. The UK participants were likely to have been exposed to a national stroke awareness raising campaign ACT FAST,[9] whereas the US participants were not. The narrow focus of the FAST acronym (ie, Face, Arms, Speech: Time to call Emergency Medical Services) on which the UK campaign was based might explain why UK participants were less likely to identify stroke. Although FAST is sensitive to stroke detection,[20] UK participants might have perceived difficulty in responding to scenarios describing symptoms that were not in line with FAST. Alternatively, although evidence has suggested a high retention for the FAST campaign in the UK population, some research has indicated that FAST is not in line with stroke patient/witness experiences, and it is difficult to use in practice.[21–23] FAST alternatives, such as the 5 suddens, might cover more signs and symptoms of stroke, but may be more difficult to remember and are less specific to stroke.[20]

Our study has several limitations. The overall response rates were moderate and differed somewhat between countries, but comparable to similar survey studies.[24] As registering to vote is not a legal responsibility in the US, an address-based sample was the most comparative sampling method to the UK electoral registration sample. However, these methods are not identical. The samples from both countries were not comparable for all the demographic and stroke-relevant variables assessed, with US participants displaying higher levels of racial/ethnic diversity, educational attainment, employment, and some comorbidities. In addition, our results are unlikely to reflect the overall differences between countries given that these were not national samples. All responses obtained are self-report only, and some variables were assessed using single item measures only. Although the use of questionnaire-based scenarios is the best way to assess stroke preparedness on a population level, it is unclear whether these responses accurately reflect actual behavior in a stroke context. Finally, the motivation behind the differences in stroke response might differ between countries and could be explored in future research.

Our findings highlight important differences and similarities in stroke preparedness between 2 countries facing equally low numbers of stroke patients receiving time-dependent treatment mostly because of prehospital delay. Our results suggest that future interventions could consider adding information on the benefits of medical treatment for stroke and increasing the understanding of stroke and could work to increase stroke self-efficacy in future stroke preparedness campaigns. More work is needed to inform intervention elements that may be country-specific, as well as those that can be used universally.

Sources of Funding

Dr Skolarus is supported by National Institutes of Health/National Institute of Neurological Disorders and Stroke K23NS073685. This article presents independent research funded by the National Institute for Health Research (Programme Grant Reference RP-PG-0606-1241. Development and evaluation of hyperacute services for patients with acute stroke). The views expressed are those of the author(s) and not necessarily those of the National Health Service, the National Institute for Health Research, or the Department of Health.

Disclosures

G.A. Ford developed the Face Arm Speech Test and was a member of the Department of Health Stroke Programme Management Board. G.A. Ford's previous institution has received research grants from Boehringer Ingelheim and honoraria from Lundbeck for stroke-related activities. G.A. Ford has also received personal remuneration for educational and advisory work from Boehringer Ingelheim and Lundbeck. Also, G.A. Ford is supported by an National Institute for Health Research Senior Investigator award. The other authors report no conflicts.

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Stroke. published online September 29, 2015;
Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231

Print ISSN: 0039-2499. Online ISSN: 1524-4628