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## Stroke 112: A universal stroke awareness program to reduce language and response barriers

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### Abstract

**Background and purpose**—To improve stroke awareness and reduce life-threatening prehospital delays worldwide, a universal stroke educational program is needed. To meet this unmet need, we developed a universal program without language barriers and tested its acceptance in Taiwan, where Chinese is the native language.

**Methods**—Stroke 112 was developed using the universal emergency phone number, 112. The numbers imply an emergency and correspond to the three stroke recognition signs used in FAST (Face, Arm, Speech, and Time): 1 uneven face (crooked mouth); 1 weak arm (arm weakness); 2 incoherent lips (slurred speech). An online survey was used to determine the acceptance of the Stroke 112 program compared to that of FAST in Chinese. The surveys were delivered using SurveyMonkey ([www.surveymonkey.com](http://www.surveymonkey.com)) on two separate occasions in Taiwan; in August 2017 for an initial estimation of the acceptance of Stroke 112 and in March 2018, two weeks after the official release of Stroke 112 in Taiwan, including a special introductory lecture for neurologists hosted by the Stroke Treatment and Research Society -Taiwan.

**Results**—The initial survey with 465 survey responders, 54.6% thought that Stroke 112 was easier to remember for people in Taiwan compared to FAST (41.2%). After Stroke 112's official release in Taiwan, 610 individuals completed the survey, and the majority (66.4%) thought that Stroke 112 was easier to remember, a significant increase compared to the initial survey ( $P=0.0001$ ). Among the 130 neurologists who attended the Stroke 112 introductory lecture, 55

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completed the online survey. A greater acceptance of Stroke 112 (74.6%) compared to FAST (16.4%) was observed among these 55 neurologists ( $P=0.0001$ ).

**Conclusions**—Stroke 112, a universal stroke educational program without language barriers was developed. It could potentially be implemented worldwide, especially where 112 is used as an emergency phone number.

### Keywords

Stroke; pre-hospital delay; Stroke 112; awareness; international health

## Introduction

Stroke is the second leading cause of death worldwide, with non-English speaking countries and regions having the highest mortality and disability rates<sup>1</sup>. This is partly due to the significant prehospital delays<sup>2-4</sup>. A novel educational tool or strategy to trigger the emergency medical system (EMS) and reduce prehospital delays is needed. The FAST (Face, Arm, Speech, and Time)<sup>5</sup> stroke awareness and educational program has helped reducing prehospital delays, though predominantly in English-speaking areas<sup>6</sup>. However, people using English as the primary language worldwide account for only 4.4-4.8% of the global population. About 6.3%-13.3 % people in the world can speak English including those who use English as a second language. Prehospital delays and stroke related mortality remain high in non-English speaking countries and regions due to the lack of an effective educational tool suitable for the specific language environment. Language is the major limiting factor for expanding FAST to non-English speaking countries<sup>7</sup>. It is difficult for non-English speaking people to remember “FAST” and the related meaning of each Roman character, which generally does not translate well into other languages without the loss of the concept of “fast action.” A universal program without language barriers for non-English speaking countries and regions needs to be developed. To address this need, we developed a universal stroke program modeled on FAST and tested its acceptance in Taiwan.

## Method

The survey design and the high-resolution video for stroke 112 are included in the supplemental materials. The original data is available for request. The investigation protocol was approved by the Institutional Review Board of the Minhang Branch, Zhongshan Hospital affiliated to Fudan University. Stroke 112, is a novel stroke awareness educational tool, based on FAST, using the universal emergency number, 1-1-2, used in over 70 countries and regions ([https://en.wikipedia.org/wiki/112\\_\(emergency\\_telephone\\_number\)](https://en.wikipedia.org/wiki/112_(emergency_telephone_number))); last accessed April 4, 2018). The numbers, 1-1-2, correspond to the three stroke recognition symptoms used in FAST: 1 uneven face (crooked mouth); 1 weak arm (arm weakness); 2 incoherent lips (slurred speech), as indicated in Figure 1A. If any of the above symptoms suddenly occur, 1-1-2 or the regional medical emergency phone number (if 1-1-2 is not the primary emergency phone number) must be immediately dialed. To demonstrate whether the new tool would be well accepted in a non-English speaking environment, we translated Stroke 112 into Traditional Chinese (Figure 1 B) and compared it with the Chinese version of FAST used in Taiwan (supplemental data) by conducting an initial online survey in

Taiwan in August 2017. The survey consisted of the following questions: 1) Which stroke awareness educational program can be easily remembered by the most people in Taiwan: FAST or Stroke 112? 2) What is your age? 3) What is your gender? 4) Are you a medical professional? The Stroke 112 program was officially released to the public domain in Taiwan by the Stroke Treatment and Research Society -Taiwan (STARS-Taiwan) on March 11, 2018, along with a release of an educational video of Stroke 112 in Chinese (<https://youtu.be/6lVZnyzjNE>). Two weeks later, on March 23, 2018, the same survey was distributed electronically through social media (<https://line.me>) in Taiwan and the registered E-mail list of STARS-Taiwan with one additional question: “Did you attend the introductory lecture for Stroke 112?” A person or device was allowed to answer the survey only one time to avoid duplicate answers from the same individual. SurveyMonkey ([www.surveymonkey.com](http://www.surveymonkey.com)) was used to design and deliver the surveys. We performed a power analysis by including the population size based on our initial survey a similar design with 90% confidence interval (z-score 1.645) and 5% of margin of error, and 50% of response distribution, which yielded at least 300 people to respond. GraphPad Prism (Version 6.01, GraphPad Software, Inc. CA) was used for statistical analysis (chi-square test with Yates’ correction or Fisher’s exact test). *P* value less than 0.05 was considered as statistically significant.

## Results

In the first round of the survey, 465 individuals (122 males and 343 females) with an age range of 11-80 years, and consisting of 84 medical professionals (18.4%) and 381 non-medical professionals, completed the survey. Among the survey responders, 54.6% thought that Stroke 112 would be easier for the people in Taiwan to remember than FAST (41.2%). Among the responders who were not medical professionals, 57.3% thought that Stroke 112 was much easier to remember than FAST (39.4%). There was no significant gender difference in the preference of Stroke 112 (62.0% in males and 55.6% in females;  $p=0.27$ ).

About 6 months later, after the formal introduction of Stroke 112, the survey was repeated in Taiwan, with 622 individuals (253 males, 369 females with an age range of 20-70 years, and consisting of 273 medical professionals (43.8%) and 349 non-medical related individuals, completed the survey. Of the survey responders, 66.7% thought that Stroke 112 was easier to remember compared to FAST (28.6%). Fifty-five of the 130 neurologists (42.3% response rate) who attended the formal Stroke 112 release event completed the survey; among which, 75.4% agreed that Stroke 112 was easier to remember than FAST (16.4%). The significant difference of preference for Stroke 112 over FAST was observed ( $P<0.0001$ ). Subpopulation analysis associated with gender revealed no significant difference in the preference of Stroke 112 vs FAST ( $p=0.2188$ ). It is important to note that the acceptance of Stroke 112 increased from 54.6% with the first survey to 66.4% ( $p=0.0001$ ) after the official release. The acceptance rate of Stroke 112 among medical professionals increased from 41.7% in the initial survey to 66.5% ( $P=0.0001$ ) after the formal release of the program to the public domain.

## Discussion

The major goal of this short report is to introduce the very simple but potentially powerful tool, Stroke 112, to overcome the language barrier and the barrier between stroke recognition and the immediate response to call the emergency number, 112. The latter may be more critical to reduce treatment delays. Taiwan was chosen as the initial test site because of the Chinese speaking population. Furthermore, we have successfully implemented a similar program in China, Stroke 120<sup>7</sup>, where 1-2-0 is the specific medical emergency phone number. The program was officially endorsed by the Chinese Stroke Association, which promoted the program nationwide and incorporated the strategy into the stroke management guidelines in China<sup>8</sup>. It is interesting to note that while the initial acceptance rate of Stroke 112 in Taiwan was only marginally above 50%, the acceptance rate increased significantly after it was officially released into the public domain by the professional society, STARS-Taiwan, which helped people to understand the significance and benefit of using Stroke 112 as an alternative public stroke educational program in Taiwan. It is striking that as high as 74.5% of neurologists who responded to the survey and attended the Stroke 112 educational lecture, believed that Stroke 112 was easier to remember despite the fact that FAST has been used in Taiwan as an educational tool for more than 8 years. The actual clinical impact of Stroke 112 still needs to be investigated in the future.

Unlike “FAST,” the “Stroke 112” strategy can be translated into any language (as seen in Figure 1B for traditional Chinese, and Figure 2A-D for other united nation languages) and eliminates the need to remember the English word, “fast” and its affiliated Roman characters. Even in some countries where 112 is not the primary emergency number, a call to 112 can be redirected to the primary emergency phone number in some countries and regions. For example, in the United States, a call to 112 will be directed to 911 via ATT and T-Mobile. It is important to note that 112 can be dialed free of charge even when the cellphone is locked or without an active service contract. In addition, the location of the caller can be detected by the operator immediately if the caller’s phone has a Global Positioning System function, a critical feature that could avoid significant delay in locating the patient, especially when a patient has speech problem due to stroke or the caller does not speak the local language.

To demonstrate the simplicity and feasibility of the strategy, we produced an educational video for Stroke 112 in English (supplemental video 1:Stroke 112\_E). This video is translated into Traditional Chinese without losing its core concept for easy understanding (supplemental video 2:Stroke 112\_C).

The Stroke 112 strategy could potentially overcome the existing response barrier; the dissociation between stroke recognition and failing to use EMS<sup>9</sup> since it links stroke recognition directly with the emergency phone number. Even though there is a high rate of awareness of “FAST” in the US (70%) and UK (63%), unfortunately, only about 50% of individuals were likely to call for EMS as shown in a study published in 2015<sup>10</sup>. A recent study conducted in Greece, indicated that there was poor stroke awareness and that only 43.5% of people would use EMS and 43.6% of people would use a private car to transport the patient to a hospital<sup>11</sup>. Dissociation exists between stroke recognition and the utilization

of the EMS<sup>10, 12</sup>. A well-designed clinical trial is needed to investigate whether Stroke 112 can improve the response rate to quickly call the EMS.

The major limitation of this investigation is the small sample size and the sample is biased on these who use the social media only. Further investigation is needed especially for people living in rural areas and for those who do not use social media.

In summary, Stroke 112, a universal stroke awareness program without language barriers, was engineered, and could be used as, at the least, an alternative stroke educational tool in non-English speaking environments due to its higher acceptance than that of FAST. This strategy could potentially penetrate the response barrier due to its direct linkage to the emergency phone number.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments




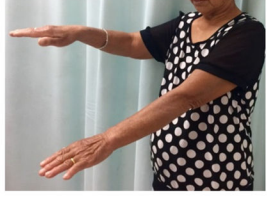




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## References


1. Sarti C, Rastenyte D, Cepaitis Z, Tuomilehto J. International trends in mortality from stroke, 1968 to 1994. *Stroke*. 2000; 31:1588–1601. [PubMed: 10884459]
2. Faiz KW, Sundseth A, Thommessen B, Ronning OM. Prehospital delay in acute stroke and tia. *Emerg Med J*. 2013; 30:669–674. [PubMed: 22886891]
3. Walter S, Kostopoulos P, Haass A, Keller I, Lesmeister M, Schlechtriemen T, et al. Diagnosis and treatment of patients with stroke in a mobile stroke unit versus in hospital: A randomised controlled trial. *Lancet Neurol*. 2012; 11:397–404. [PubMed: 22497929]
4. Pulvers JN, Watson JDG. If time is brain where is the improvement in prehospital time after stroke? *Front Neurol*. 2017; 8:617. [PubMed: 29209269]
5. Hodgson CS. To fast or not to fast? *Stroke*. 2007; 38:2631–2632. [PubMed: 17761911]
6. Mellon L, Doyle F, Rohde D, Williams D, Hickey A. Stroke warning campaigns: Delivering better patient outcomes? A systematic review. *Patient Relat Outcome Meas*. 2015; 6:61–73. [PubMed: 25750550]
7. Zhao J, Liu R. Stroke 1-2-0: A rapid response programme for stroke in china. *Lancet Neurol*. 2017; 16:27–28.
8. Dong Q, Dong Y, Liu L, Xu A, Zhang Y, Zheng H, et al. The chinese stroke association scientific statement: Intravenous thrombolysis in acute ischaemic stroke. *Stroke Vasc Neurol*. 2017; 2:147–159. [PubMed: 28989804]
9. Mellon L, Doyle F, Williams D, Brewer L, Hall P, Hickey A. Patient behaviour at the time of stroke onset: A cross-sectional survey of patient response to stroke symptoms. *Emerg Med J*. 2016; 33:396–402. [PubMed: 26781460]


10. Dombrowski SU, Ford GA, Morgenstern LB, White M, Sniehotta FF, Mackintosh JE, et al. Differences between us and uk adults in stroke preparedness: Evidence from parallel population-based community surveys. *Stroke*. 2015; 46:3220–3225. [PubMed: 26419968]
11. Hatzitolios AI, Spanou M, Dambali R, Vraka K, Doumarapis E, Petratos K, et al. Public awareness of stroke symptoms and risk factors and response to acute stroke in northern greece. *Int J Stroke*. 2014; 9:E15. [PubMed: 24798041]
12. Fassbender K, Balucani C, Walter S, Levine SR, Haass A, Grotta J. Streamlining of prehospital stroke management: The golden hour. *Lancet Neurol*. 2013; 12:585–596. [PubMed: 23684084]


<b>A</b> <b>Stroke 112</b>	<b>B</b> <b>中風112</b>
<p><b>1</b> <b>uneven Face:</b> Crooked mouth</p> 	<p><b>1</b> 張臉 不對稱 嘴巴歪</p> 
<p><b>1</b> <b>weak Arm:</b> Arm weakness</p> 	<p><b>1</b> 側手臂 沒力氣 不能抬</p> 
<p><b>2</b> <b>incoherent lips:</b> Slurred Speech Δα..*Ωα....</p> 	<p><b>2</b> 片嘴唇 言語不清 不明白 我...啊...嗯...呃...</p> 
<p><b>Time to call 1-1-2</b> if any of the above symptom(s) occur suddenly</p> 	<p><b>立即撥打 112</b> 有上述任何突發 症狀</p> 


**Figure 1. Representation of Stroke 112 in English and Traditional Chinese**  
Stroke 112 is presented in two official languages of the United Nation, including English (A) and Traditional Chinese (B)

### A ACCIDENT VASCULAIRE CEREBRAL 1-1-2


**1** observation d'un visage assymétrique 


**1** examen d'un bras faible en levant les deux bras 


**2** lèvres pour troubles de l'élocution Δα..\*Ωα... 


Appelez le **112** si un de ces symptômes survient soudainement 

### B Инсульт 1-1-2


**1** искривление 1-ой стороны лица 


**1** слабость 1-ой руки 


**2** невнятная речь при произношении 2-ух простых фраз Δα..\*Ωα... 


Звоните на **112** при наличии любого из данных признаков 

### C Derrame Cerebral 1-1-2


**1** Observación de una (1) cara desigual o irregular 


**1** Examinación de un (1) brazo débil levantando ambos al mismo tiempo 


**2** Dificultad con los labios para hablar o mala pronunciación Δα..\*Ωα... 


Llame al **112** si usted o alguna persona padece de estos síntomas 

### D 1-1-2 المسكته الدماغية

**1** ملاحظه اعوجاج الوجه 

**1** عدم القدره علي تحريك الذراع عند محاوله تحريك الذراعين معا 

**2** في (التأتاه) التلعثم الكلام Δα..\*Ωα... 

عندملاحظه احد الاعراض السابقه **112** اتصل برقم 

**Figure 2. Representation of Stroke 112 in additional four official languages of the United Nation** It is shown for French (A), Russian (B), Spanish (C), and Arabic (D). It is important to note that instead of literal translation in the Russian version, pragmatic culture-oriented translation was used. Particularly, “2 incoherent lips for slurred Speech” was described as “2 phrases for slurred speech” in Russian. Similar approach could be used in other languages to aid the memory in each specific language if there are any cultural concerns. These translations are simply used to demonstrate the feasibility, and not intended for final usage.



It should be modified as needed to be suitable for local culture and medical emergency system.

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