

# Knowledge of stroke risk factors and warning signs in a local population in Switzerland using the Stroke Awareness Questionnaire

Pamela Noella Correia (✉ [pamela.correia@szb-chb.ch](mailto:pamela.correia@szb-chb.ch))

Cantonal Hospital of Biel

Ivo A. Meyer

Cantonal Hospital of Biel

Stephan Salmen

Cantonal Hospital of Biel

Irene Aïcua Rapun

Cantonal Hospital of Biel

---

## Research Article

**Keywords:** stroke, transient ischemic attack, cerebrovascular risk factors, stroke awareness

**Posted Date:** March 9th, 2022

**DOI:** <https://doi.org/10.21203/rs.3.rs-1405125/v1>

**License:**  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

---

# Abstract

## Aims

To ascertain the degree of awareness of stroke risk factors, response in case of symptoms as well as the knowledge of stroke treatments in a local Swiss population.

## Methods

A cross-sectional survey questionnaire-based study using a validated stroke awareness questionnaire. Enrollment was done over six months including patients who had suffered a stroke or a transient ischemic attack (TIA).

## Results

69 patients were included, of whom 35% (n=24) correctly defined a TIA and only 29% (n=20) considered a TIA to be equally serious as a stroke. There was a statistically significant positive relationship ( $p=0.006$ , 95% CI: 0.1-0.53,  $r=0.3$ ) between interpretation of stroke and TIA as a serious event. 56.5% (n=39) of patients were able to correctly identify a minimum of 3 stroke symptoms and 47.8% (n=32) patients responded that they would call an ambulance immediately at symptom onset. The decision to call an ambulance was significantly associated with a good knowledge of stroke risk factors ( $p=0.03$ , 95% CI: 1.09-9.92) and stroke therapies ( $p=0.05$ , 95% CI: 0.99 -7.36). 37% (n=26) of patients were able to cite 3 or more acute stroke therapies or secondary treatment medications and only 8.7% (n=6) were able to name thrombolysis as being one of these therapies.

## Conclusions

Knowledge of stroke risk factors and treatments significantly influences the immediate response to stroke symptoms. Patients who recognise a stroke as a serious medical emergency are more likely to consider a TIA to be the same. Knowledge of acute stroke treatments should be emphasised in future public health programs.

## Introduction

Stroke is responsible for a significant amount of morbidity and mortality worldwide.<sup>1</sup> Improving knowledge of stroke symptoms and risk factors within the community is crucial to reduce time to consultation and long-term outcomes. Stroke knowledge varies across different countries highlighting the need for country specific and culturally appropriate programs.<sup>1-2</sup>

The present study included patients treated at a Stroke unit in the city of Biel within the canton of Bern in Switzerland. It aimed at ascertaining the level of awareness in the local population regarding stroke symptoms and response, risk factors and treatments available in the aftermath of a stroke. This

information was then used to identify features associated with a correct reaction to immediately call an ambulance after the onset of stroke symptoms.

## Methods

### Study design and participants

We conducted a cross sectional survey questionnaire study based on the validated Irish Stroke Awareness Questionnaire by Dr Anne Hickey and colleagues<sup>1</sup>. The questionnaire was translated into French and German with adaptations for the Swiss epidemiological context. Both translations were validated by two native speakers. Patients hospitalized to the Stroke unit or consulting ambulatory services after having suffered a stroke or a transient ischemic attack (TIA) over a period of from January to June 2021 were included. Patients with severe neurological deficits (for example severe aphasia and dysarthria, severe hemiparesis, severe cognitive problems) were excluded from the study. The questionnaire was administered only by the principal investigator.

### Setting

Biel is a town in the canton of Bern, Switzerland with a population of around 106,000 people. It is situated on the language border of French and German-speaking parts of Switzerland and is extensively bilingual. The Biel Regional Hospital is a multi-specialty public hospital with a stroke unit and several rehabilitation facilities including physiotherapy, logotherapy, ergotherapy and neuropsychological services. Patients also receive educational brochures regarding stroke risk factors and other relevant information during their stay.

The city of Biel could help to identify the level of awareness in both French and German speaking populations simultaneously. This is particularly interesting in Switzerland which has three official languages (French, German and Italian) and also considering that other studies evaluating stroke awareness were undertaken predominantly in German speaking populations in Switzerland<sup>2-4</sup>.

### Sample size

Our goal was to include a minimum of 90 patients, considering a total sample size of about 200 patients with an associated standard error of +/- 7.5 % at a 95% confidence interval (CI).

We were able to include 69 patients over a limited time period from January to June 2021. All collected data was and stored in an entirely anonymized manner.

### Measures

#### Demographic information

Age, gender, marital status, residential location, type of insurance and interest or willingness to be contacted in the event of any future stroke/TIA prevention programs was recorded in all cases.

### **Knowledge of warning stroke symptoms and response**

A good awareness of stroke symptoms was defined as the ability to correctly identify 3 or more stroke symptoms. The response to call an ambulance immediately after the onset of stroke symptoms was defined as the only correct response.

### **Knowledge of stroke risk factors and post stroke treatments**

A good knowledge of stroke risk factors and treatments was defined as the ability to identify 3 risk factors. A good awareness of acute stroke treatments and secondary prevention was defined as being able to cite at least 3 or more of the same. Knowledge of two or more therapies (including physiotherapy, ergotherapy, logotherapy and neuropsychological treatment) was considered to be adequate.

### **Statistical analysis**

Descriptive and comparative analyses were conducted using SPSS statistical software, version 25. Demographic patient characteristics were documented as mean (standard deviation, SD) or median (interquartile range (IQR)) values based on whether variables were normally distributed. Chi square and Fischer exact tests using a p value significance level of 0.05 were used to compare relevant nominal variables. Spearman's test of association was performed to identify any association between chosen ordinal variables. A correlation coefficient r-value of less than or equal to 0.3 was considered to be a weak correlation.

### **Ethics**

The study was exempted from the requirement of formal ethics approval by the local cantonal authorities from the canton of Berne, Switzerland. We also took approval to use the stroke awareness questionnaire from the first author (Dr Anne Hickey) of the original publication of the Irish Stroke Awareness Questionnaire<sup>1</sup>.

## **Results**

A total of 69 patients (n =39, women) were included in the study. The mean age of participants was 68 years (+/- SD 11.68) with 57.9 % (n=40) aged more than 65 years of age (Table 1). Only 35% (n=24) of patients knew the correct interpretation of a TIA. 70% (n=47) of patients felt that having a stroke was a very serious medical emergency while only 29% (n=20) considered a TIA to be equally serious. Analysis using Spearman's correlation coefficient (r=0.3) indicated statistically significant weak linear positive relationship (p=0.006, 95% CI, 0.1-0.53) between interpretation of stroke and TIA as a serious event. There was no statistically significant association between correct knowledge of the meaning of a TIA and a patient's age (p=0.2, OR: 2, 95% CI: 0.69-5.80, 69.5% aged more than 65) or gender (p=0.4, OR: 0.68,95%

CI: 0.25-1.89, 62.5% female). 52.9% of patients felt that more women were likely to die from a stroke irrespective of age.

### **Personal risk factor profile**

39.1 % (n=27) of patients had a previous history of a stroke or a TIA and in 77% (n=21) of cases the events occurred in the last 12 months. Atrial fibrillation was verified based on prior medical records. The other common risk factors included hypertension and hypercholesterolemia (Figure 1).

### **Knowledge of stroke risk factors and warning symptoms**

68% (n=47) were able to identify 3 or more stroke risk factors. Smoking (n=34, 49.3%), hypercholesterolemia (n=29,42%) and hypertension (n=28, 40.6%) were the three most cited stroke related risk factors cited by patients included in the study. The commonest reported stroke warning symptom, cited by 88% (n=61) of patients included weakness of the face or one side of the body while slurred speech was cited by 65% of patients (Figure 2).

Only 16% claimed to have seen T.V. or newspaper advertisements or information regarding stroke warning signs recently. 56.5% (n=39) of patients were able to identify a minimum of 3 stroke symptoms. A good knowledge of stroke symptoms was not associated with the age (p=0.7, 60% older than 65 and 39% younger than 65, OR:1.2, 95% CI: 0.44-3.09) or the gender of the individual (p=0.6, 58% female, OR: 0.79, 95% CI: 0.30-2.08).

### **Response to stroke**

47.8% (n=32) patients responded that they would call an ambulance immediately in case of stroke symptoms (Figure 3). The choice to call an ambulance was not associated with the age (53% younger than 65 and 47% older than 65, p= 0.06, OR:0.38, 95% CI:0.14-1.05)

or the gender (p=0.3, 62% females, 37.5% males, OR:0.6, 95% CI:0.24-1.66) of the individual. The decision to immediately call an ambulance immediately after stroke like symptoms was significantly associated with a good knowledge of stroke risk factors (p=0.03, CI: 1.09-9.92) and stroke therapies (p=0.05, CI: 0.99 - 7.36) as shown in Table 2.

### **Awareness of acute stroke treatments, secondary prevention and post stroke therapies**

37% (n=26) of patients were able to cite 3 or more acute stroke therapies or secondary treatment medications. While 86.9% (n=60) of patients affirmatively stated that acute treatments could reduce stroke severity only 8.7% (n=6) were able to name thrombolysis as being one of these therapies. Only 22% of patients had knowledge of 2 or more post stroke therapies (inclusive of physiotherapy, ergotherapy, logotherapy and neuropsychological therapy). The least well-known therapy was ergotherapy (Figure 4).

## **Discussion**

Stroke is responsible for a significant amount of morbidity and mortality worldwide.<sup>5</sup> Time is brain and the faster a patient can get to a hospital and get appropriate medication can significantly influence long term morbidity and mortality.<sup>6</sup> In spite of global efforts to disseminate information regarding the vital importance of time in acute stroke treatment, a very small percentage of stroke patients consult the emergency services within an hour of onset of symptoms. The time delay between symptom onset to hospital consultation has now seen improvements in the last couple of years in many countries.<sup>7</sup>

Stroke prevention entails both educational and pharmacological approaches. These two components need to be implemented at different levels. Risk factor prevention and treatment guidelines have helped streamline pharmacological approaches across different countries. However educational approaches are still lacking and need action at both governmental and societal levels. Another reason to underline this need are results from studies in the European countries within the WHO which reveal that individuals with better economic status may show a better level of recognition of stroke risk factors and warning signs.<sup>8</sup>

The degree of awareness as regards to stroke in adults in Switzerland has not been adequately studied and direct comparison with studies undertaken in other industrialised European countries is not entirely adequate.<sup>9-12</sup> There also gaps within the medical community seen in a another questionnaire based study conducted among family physicians in the canton of Bern, wherein while most physicians overestimated the risk of stroke after a TIA, their rate of referral to the emergency services remained modest as they probably underestimated the benefits of emergency evaluations in elderly patients.<sup>3</sup> A register based study in children within the Swiss Neuropaediatric Stroke registry showed that only one third of children could be diagnosed with a stroke within the first six hours and thereby highlighted the existence of important lacunes both on a parental and professional level in identifying stroke symptoms.<sup>3</sup>

### **Stroke unit services**

The creation of specialised stroke units has helped to reduce the burden of stroke related disability across the entire spectrum of stroke severity.<sup>13</sup> In order to maintain an appropriate level of care stroke units undergo certification procedures every few years. In addition internal auditing measures help in maintaining a continuity of sustained quality stroke care.<sup>14</sup> One of the research and development priorities of the European Stroke Action Plan (ESAP) for 2030 is to assign a named individual in every country or region who is responsible for stroke quality improvement.<sup>7</sup> A first step in this direction is to regularly evaluate effectiveness in hospital communication, especially when it comes to conveying key information regarding stroke warning signs and risk factors. In keeping with this objective in this study we aimed to evaluate the level of awareness among patients who had been recently admitted to the stroke unit due to a stroke or a TIA.

### **Knowledge of Stroke symptoms and response to Stroke**

Europe will see a sharp rise in the percentage of elderly persons between 2017 and 2050 with an estimated increase of about 35%.<sup>15</sup> Paradoxically while older people are at a greater risk for strokes and

TIA's the level of awareness is especially low in this subgroup.<sup>16</sup> Consequently public health campaigns need to be designed to improve stroke awareness in this age group.

Detection of stroke warning signs lies at the very beginning of the stroke chain of survival and stroke care cannot be improved without concentrating on this aspect.<sup>17</sup> However prior to designing educational programs it is essential to undertake a review of the situation among the local public to appropriately prioritize their needs and send across the correct message.<sup>18</sup>

In an isolated closed-ended questionnaire-based study conducted among inhabitants of the canton of Bern, Switzerland while the overall level of stroke knowledge was determined to be good (64.7%) only a small fraction of patients (8.3%) were able to correctly define a TIA.<sup>2</sup> In a telephonic survey using the Stroke awareness questionnaire conducted in the general Irish population to evaluate changes in population knowledge following a media-based stroke awareness campaign only 11.4% could give a correct definition of a TIA.<sup>19</sup> 35% of patients in our study were able to correctly define a TIA and were considered to have a good knowledge of stroke symptoms in 56% of cases. 47.8% of patients in our study said that they would call an ambulance immediately in case of stroke symptoms as compared to 64.4% in the Bernese study.<sup>2</sup> A Spanish study conducted in post stroke patients found that 56.5% were able to identify a minimum of two warning signs of a stroke.<sup>20</sup> TIA was identified as a serious medical event seen by only 29% of our study participants. Individuals who considered a stroke to be a serious medical emergency were more likely to also do the same for a TIA. In the Bernese study only 2.8% of people from the general population considered a TIA to be a severe potentially harmful disease requiring immediate medical attention.<sup>2</sup>

Stroke awareness campaigns need to address both individuals who might experience and stroke symptoms as well as those who might be witness to a stroke and sometimes also family physicians to optimise recognition and intervention for stroke.<sup>21</sup> While we did not specifically address the question of having a relative with a stroke in our study the study conducted in the Bernese Swiss population found that being a woman, advancing age and having an afflicted relative were associated with a good knowledge of stroke warning signs. In our study a good knowledge of stroke symptoms and the response to call an ambulance were not associated with the age or sex of the individual.<sup>2</sup>

### **Knowledge of Stroke risk factors and prevention**

Appropriate secondary prevention focused on modifiable cardiovascular risk factors can diminish the risk of a recurrent cerebrovascular event by as much as 80%.<sup>22</sup> Investigation and treatment starts in the hospital within a stroke unit or stroke center in the acute phase and thereafter continues after discharge throughout life. From a population point of view, it is not enough to focus only those on high risk individuals as a many strokes may eventually develop in those with lower risk,<sup>23</sup> and hence inclusive prevention strategies which target the entire breath of the population are essential, particularly because of the high prevalence several risk factors for stroke.<sup>24</sup>

A large majority of Swiss people have a minimum of one or two vascular risk factors with hypertension and overweight being the most frequent.<sup>25</sup> In a questionnaire based follow up study administered to patients in the outpatient setting at a university hospital clinic in French speaking Switzerland 3 months after their stroke, the level of awareness of cerebrovascular risk factors and their pertinence to recurrent stroke prevention was found to be suboptimal.<sup>26</sup> In our study patients the three most common risk factors were hypertension, hypercholesterolemia and a previous history of stroke or TIA. Thus, simply highlighting the importance of hypertension as a risk factor for stroke could enable faster detection and better compliance to treatment.

Using a more stringent definition requiring correctly naming 5 or more stroke risk factors, the Bernese stroke awareness study identified 6.4% individuals who fulfilled the criteria.<sup>2</sup> Their knowledge was associated with their level of education, but not with age, sex or having an afflicted relative or friend. In our study including only post stroke or TIA patients and using a more lenient definition requiring identification of 3 or more risk factors 68% of patients fulfilled the criteria of a good knowledge of stroke risk factors.

### **Knowledge of acute stroke treatments**

Acute stroke care treatments have evolved significantly in the last few years. In consideration of the time-dependent benefit of recanalisation therapies in patients with acute ischemic stroke, acute care systems need to constantly strive to reduce the time to start of treatment before the ischemic injury is beyond repair.<sup>27</sup> Public awareness campaigns like the FAST campaign are designed to promote stroke symptom recognition. It is an easy-to-use mnemonic which is short and easy to remember and helps in the early identification of warning signs of a stroke (facial paralysis, weakness in an extremity, speech disturbances) and also the immediate response which includes contacting emergency services quickly.<sup>28</sup> However in order to achieve a sustained implementation of the campaign and appropriate response in face of stroke symptoms public education needs to be focused on improving understanding of crucial role of time in acute stroke interventions.<sup>19</sup>

The overall knowledge of acute stroke therapies or secondary treatments was poor in our study with only a small percentage of patients (8.7%) being able to cite thrombolysis as an acute stroke therapy. In a Norwegian study including patients admitted to the stroke unit 6.9% were able to name “intravenous thrombolytic therapy/clot-dissolving treatment” as a treatment option.<sup>29</sup> In an Irish population-based survey conducted after a media campaign for stroke awareness less than 5% of the participants identified thrombolysis an emergency treatment for stroke.<sup>19</sup> Promoting knowledge about acute stroke treatment options is essential to improve utilization of acute stroke services.<sup>30-31</sup> In keeping with the prevailing lack of sufficient knowledge of stroke therapies future public health programs need to improve focus on the same.<sup>32-33</sup>

### **Factors influencing response to stroke**

We found that the response to immediately call an ambulance at the onset of stroke like symptoms was significantly associated with a good knowledge of stroke risk factors and stroke therapies. Thus, reinforcing stroke awareness on a periodic basis among the general population may have the potential to reduce time to hospital consultation following symptom onset. In the Irish telephone-based survey participants using the Stroke awareness questionnaire participants who knew of two or more risk factors or warning signs of a stroke were more likely to call an ambulance. Other factors found to be influencing the intended response to stroke in the Irish study included age under 65 years, having seen relevant advertisements on television and preexisting vascular disease.<sup>19</sup> In a study conducted in the Czech Republic, calling an ambulance was related to the identification of a stroke as a serious and treatable medical emergency and not to the recognition of warning symptoms.<sup>34</sup>

### **Knowledge of post stroke therapies**

Highly effective therapies like thrombolysis and thrombectomy have considerably helped in improved post stroke outcome.<sup>35-36</sup> However only a small minority of patients may meet the criteria to obtain these therapies.<sup>37-38</sup> Furthermore a majority of patients would need neurorehabilitation services inspite of receiving thrombolysis or thrombectomy.<sup>39</sup> The therapies available during neurorehabilitation include physiotherapy, language and speech therapy, occupational therapy and neuropsychological services. In our study only 22% of patients were able to name 2 or more post stroke therapies.

Going back to routine life after hospitalisation for a stroke can be a daunting task for both patients and the extended family. Often patients may fully realise the impact of limitations in activities of daily living only after discharge from the stroke unit.<sup>40</sup> Lack of knowledge about stroke rehabilitation services is a major barrier in accessing these services.<sup>41</sup> Improving awareness about the availability of a variety of post stroke therapy options can help in increasing patient confidence and also encourage utilisation of relevant services whenever needed.

### **Measures for the future**

This study has enabled us to identify the areas that need special attention in relation to patient and caregiver response to stroke symptoms. Only 16% of patients in our study confirmed to have received information about stroke warning signs from television or newspaper advertisements. On the other hand, a Canadian study conducted in a urban population in Toronto found that 60% people received information about stroke from a television source.<sup>42</sup> Regular evaluation of the effect of public health campaigns can help in identifying key points that need to be put forth on a periodic basis in order to sustainably public knowledge taking cultural and regional preferences into consideration.

Organised outpatient care of patients after stroke or TIA is associated with reduced mortality.<sup>43</sup> These ambulatory consultations offer a unique opportunity to reinforce knowledge of stroke risk factors, symptoms, and response to stroke. We plan to use insights gained from this study to improve ambulatory stroke prevention services both for patients and their caregivers.

## Limitations of the study

A possible confounding factor in our study was that we only included patients who had suffered a stroke or a TIA and had therefore more recent access to information on stroke prevention and treatment. We were able to include only a limited number of patients due to the definite time available as this study was conducted as a part of a Master thesis project. The study will need to be reproduced on larger scale to ascertain its applicability in the general population.

## Conclusion

Knowledge of stroke risk factors and treatments can significantly influence the immediate response to stroke-like symptoms. Patients who recognise a stroke as a serious medical emergency are also likely to consider a TIA in the same light. The knowledge about efficient acute stroke treatments like thrombolysis and post-stroke therapies seems to be poor in an urban Swiss population. This topic should be especially addressed in future public health programs as it can help reduce symptom onset to hospital consultation times and thereby improve stroke outcome.

## References

1. Hickey A, Holly D, McGee H, Conroy R, Shelley E. Knowledge of stroke risk factors and warning signs in Ireland: development and application of the Stroke Awareness Questionnaire (SAQ). *Int J Stroke*. 2012; 7:298–306.
2. Nedeltchev K, Fischer U, Arnold M, Kappeler L, Mattle HP. Low awareness of transient ischemic attacks and risk factors of stroke in a Swiss urban community. *J Neurol*. 2007; 254:179–184.
3. Streit S, Baumann P, Barth J et al. Awareness of Stroke Risk after TIA in Swiss General Practitioners and Hospital Physicians. *PLoS One*. 2015;10: e0135885.
4. Martin C, von Elm E, El-Koussy M, Boltshauser E, Steinlin M; Swiss Neuropediatric Stroke Registry study group. Delayed diagnosis of acute ischemic stroke in children - a registry-based study in Switzerland. *Swiss Med Wkly*. 2011;141: w13281.
5. Murray CJ, Lopez AD. Mortality by cause for eight regions of the world: Global Burden of Disease Study. *Lancet*. 1997; 349:1269–76.
6. Kim J, Thayabaranathan T, Donnan GA et al. Global stroke statistics 2019. *Int. J. Stroke*. 2020; 15:819–838.
7. Saver JL. Time is brain—quantified. *Stroke*. 2006; 37:263–66.
8. Norrving B, Barrick J, Davalos A, et al. Action Plan for Stroke in Europe 2018–2030. *Eur Stroke J*. 2018; 3:309–336.
9. Stack K, Robertson W, Blackburn C. Does socioeconomic position affect knowledge of the risk factors and warning signs of stroke in the WHO European region? A systematic literature review. *BMC Public Health*. 2020; 20:1473.

10. Montaner J, Vidal C, Molina C, Alvarez-Sabin J. Selecting the target and the message for a stroke public education campaign: a local survey conducted by neurologists. *Eur J Epidemiol*. 2001; 17:581–586.
11. Derex L, Adeleine P, Nighoghossian N, Honnorat J, Trouillas P. Knowledge about stroke in patients admitted in a French Stroke Unit. *Rev Neurol (Paris)*. 2004; 160:331–337.
12. Carroll C, Hobart J, Fox C, Teare L, Gibson J. Stroke in Devon: knowledge was good, but action was poor. *J Neurol Neurosurg Psychiatry*. 2004; 75:567–57.
13. Parahoo K, Thompson K, Cooper M, Stringer M, Ennis E, McCollam P. Stroke: awareness of the signs, symptoms and risk factors—a population-based survey. *Cerebrovasc Dis*. 2003; 16:134–140
14. Stroke Unit Trialists' Collaboration. Organised inpatient (stroke unit) care for stroke. *Cochrane Database Syst Rev*. 2013; 9: CD000197.
15. Bray BD, Campbell J, Cloud GC, et al. Bigger, faster? Associations between hospital thrombolysis volume and speed of thrombolysis administration in acute ischemic. *Stroke*. 2013; 44: 3129–3135.
16. United Nations, Department of Economic and Social Affairs, Population Division (2017). *World Population Ageing 2017 – Highlights (ST/ESA/SER.A/397)* (accessed 25 March 2021).
17. Nicol MB, Thrift AG. Knowledge of risk factors and warning signs of stroke. *Vasc Health Risk Manag*. 2005; 1:137–147.
18. European Stroke Organisation Executive Committee, ESO Writing Committee. Guidelines for management of ischaemic stroke and transient ischaemic attack 2008. *Cerebrovasc Dis*. 2008; 25:457–507.
19. Bartholomew LK, Parcel GS, Kok G. Intervention mapping: a process for developing theory- and evidence- based health education programs. *Health Educ Behav* 1998; 25:545–563.
20. Hickey A, Mellon L, Williams D, Shelley E, Conroy RM. Does stroke health promotion increase awareness of appropriate behavioural response? Impact of the face, arm, speech and time (FAST) campaign on population knowledge of stroke risk factors, warning signs and emergency response. *Eur Stroke J*. 2018;3:117–125.
21. Soto-Cámara R, González-Bernal JJ, González-Santos J et al. Knowledge on Signs and Risk Factors in Stroke Patients. *J Clin Med*. 2020;9:2557.
22. Fonarow GC. et al. Improving door-to-needle times in acute ischemic stroke: the design and rationale for the American Heart Association/American Stroke Association's Target: Stroke initiative. *Stroke*. 2011; 42:2983–2989
23. Yusuf S, Hawken S, Ounpuu S et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet*. 2004;364:937–952.
24. Rose G. Strategy of prevention: lessons from cardiovascular disease. *Br Med J (Clin Res Ed)*. 1981; 282: 1847–51.

25. GBD 2016 Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet*. 2017; 390: 1345–1422.
26. Nedeltchev K, Arnold M, Baumgartner R et al. on behalf of the Swiss Heart Foundation and the Cerebrovascular Working Group of Switzerland. Vascular risk factors in the Swiss population. *J Neurol* 2005;252:1210–1216.
27. Croquelois A, Bogousslavsky J. Risk awareness and knowledge of patients with stroke: results of a questionnaire survey 3 months after stroke. *J Neurol Neurosurg Psychiatry*. 2006; 77:726–728.
28. Goyal M, Demchuk AM, Menon BK et al.; ESCAPE Trial Investigators. Randomized assessment of rapid endovascular treatment of ischemic stroke. *N Engl J Med*. 2015; 372: 1019–1030.
29. Wolters FJ, Paul NLM, Li L, Rothwell PM on behalf of the Oxford Vascular Study. Sustained impact of UK FAST-test public education on response to stroke: a population-based time-series study. *Int J Stroke*. 2015; 10: 1108–1114
30. Faiz KW, Sundseth A, Thommessen B, Rønning OM. Patient knowledge on stroke risk factors, symptoms and treatment options. *Vasc Health Risk Manag*. 2018;14:37–40.
31. Mellon L, Doyle F, Rohde D, et al. Stroke warning campaigns: delivering better patient outcomes? A systematic review. *Patient Related Outcome Meas*. 2015; 6: 61–73.
32. Lecouturier J, Rodgers H, Murtagh MJ et al. Systematic review of mass media interventions designed to improve public recognition of stroke symptoms, emergency response and early treatment. *BMC Publ Health*. 2010; 10: 784.
33. Bouckaert M, Lemmens R, Thijs V. Reducing prehospital delay in acute stroke. *Nat Rev Neurol*. 2009; 5: 477–483.
34. Mikulik R, Bunt L, Hrdlika D, et al. Calling 911 in response to stroke; a nationwide study assessing definitive individual behaviour. *Stroke* 2008; 39: 1844–1849.
35. Goyal M, Menon BK, van Zwam WH et al. Endovascular thrombectomy after large-vessel ischaemic stroke: A meta-analysis of individual patient data from five randomised trials. *Lancet*. 2016; 387, 1723–1731.
36. Thomalla G, Simonsen, CZ, Boutitie F, et al. MRI-guided thrombolysis for stroke with unknown time of onset. *The New England Journal of Medicine*. 2018; 379, 611–622.
37. Bendszus, M, Bonekamp, S, Berge E et al. A randomized controlled trial to test efficacy and safety of thrombectomy in stroke with extended lesion and extended time window. *International Journal of Stroke*. 2019 ;14, 87–93.
38. Ng SH, Wong AWK, Chen CH et al. Stroke factors associated with thrombolysis use in hospitals in Singapore and US: A cross-registry comparative study. *Cerebrovascular Diseases*. 2019; 47, 291–298.
39. Grefkes C, Fink GR. Recovery from stroke: current concepts and future perspectives. *Neurol Res Pract*. 2020;16,2:17.

40. Hickey A, Horgan F, O'Neill D *et al.* Community-based post-stroke service provision and challenges: a national survey of managers and inter-disciplinary healthcare staff in Ireland. *BMC Health Serv Res.* 2012; 12, 111.
41. Kamalakannan S, Gudlavalleti Venkata M *et al.* Rehabilitation Needs of Stroke Survivors After Discharge From Hospital in India. *Arch Phys Med Rehabil.* 2016; 97:1526–1532.
42. Metias MM, Eisenberg N, Clemente MD, *et al.* Public health campaigns and their effect on stroke knowledge in a high-risk urban population: A five-year study. *Vascular.* 2017; 25:497–503.
43. Webster F, Saposnik G, Kapral MK, Fang J, O'Callaghan C, Hachinski V. Organized outpatient care: stroke prevention clinic referrals are associated with reduced mortality after transient ischemic attack and ischemic stroke. *Stroke.* 2011; 42:3176–82.

## Tables

### **Table 1 Demographic features of survey patients**

Demographic features	Participants	
	Number	%
<b>Age (Mean +/-SD)</b> 68 +/- 11.7		
>65	40	57.9
<65	29	42.0
<b>Gender</b>		
Male	30	43.5
Female	39	56.5
<b>Residential location</b>		
City	16	24.2
Town	22	33.3
Village	26	39.4
Rural	2	3
<b>Marital Status</b>		
Single	7	10.1
Partnership	2	2.9
Married	51	73.9
Divorced	7	10.1
Widowed	2	2.9
<b>Insurance</b>		
General	67	97.1
Private	2	2.9
<b>Willingness to be recontacted</b>		
Yes	46	66.7
No	23	33.3

**Table 2: Association of the decision to call an ambulance with awareness of stroke symptoms and therapies**

Call an ambulance at the onset of stroke symptoms			P value (Pearson Chi Square test)	Odds Ratio (95% CI)
	Knowledge of 3 or more stroke symptoms		0.06	2.59 (0.96-6.95)
	Yes	No		
Yes	22	10		
No/Other	17	20		
	Knowledge of 3 or more stroke risk factors		0.03*	3.3 (1.09-9.92)
	Yes	No		
Yes	26 (81%)	6 (18%)		
No/Other	21 (56%)	16 (43%)		
	Knowledge of 3 or more stroke therapies (acute or secondary prevention)		0.05*	2.7 (0.99-7.36)
	Yes	No		
Yes	16 (50%)	16 (50%)		
No/Other	10 (27%)	27 (73%)		

## Figures

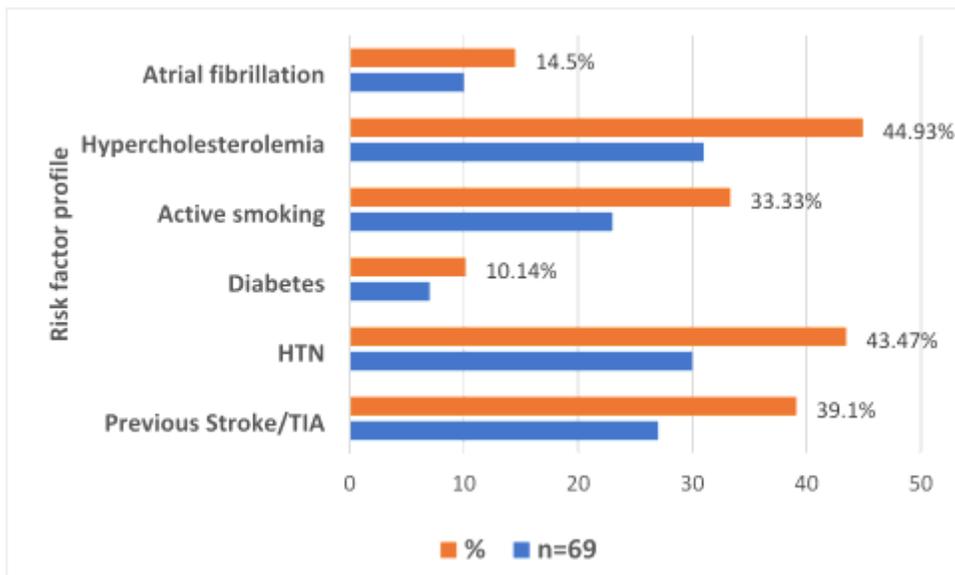


Figure 1

Risk factor profile of survey patients

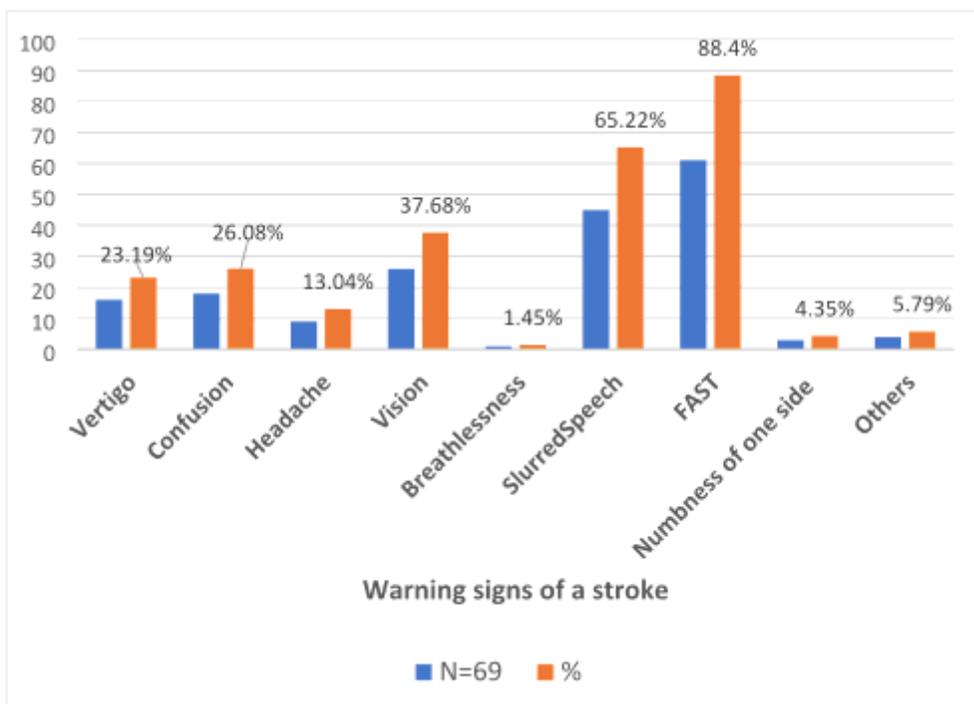
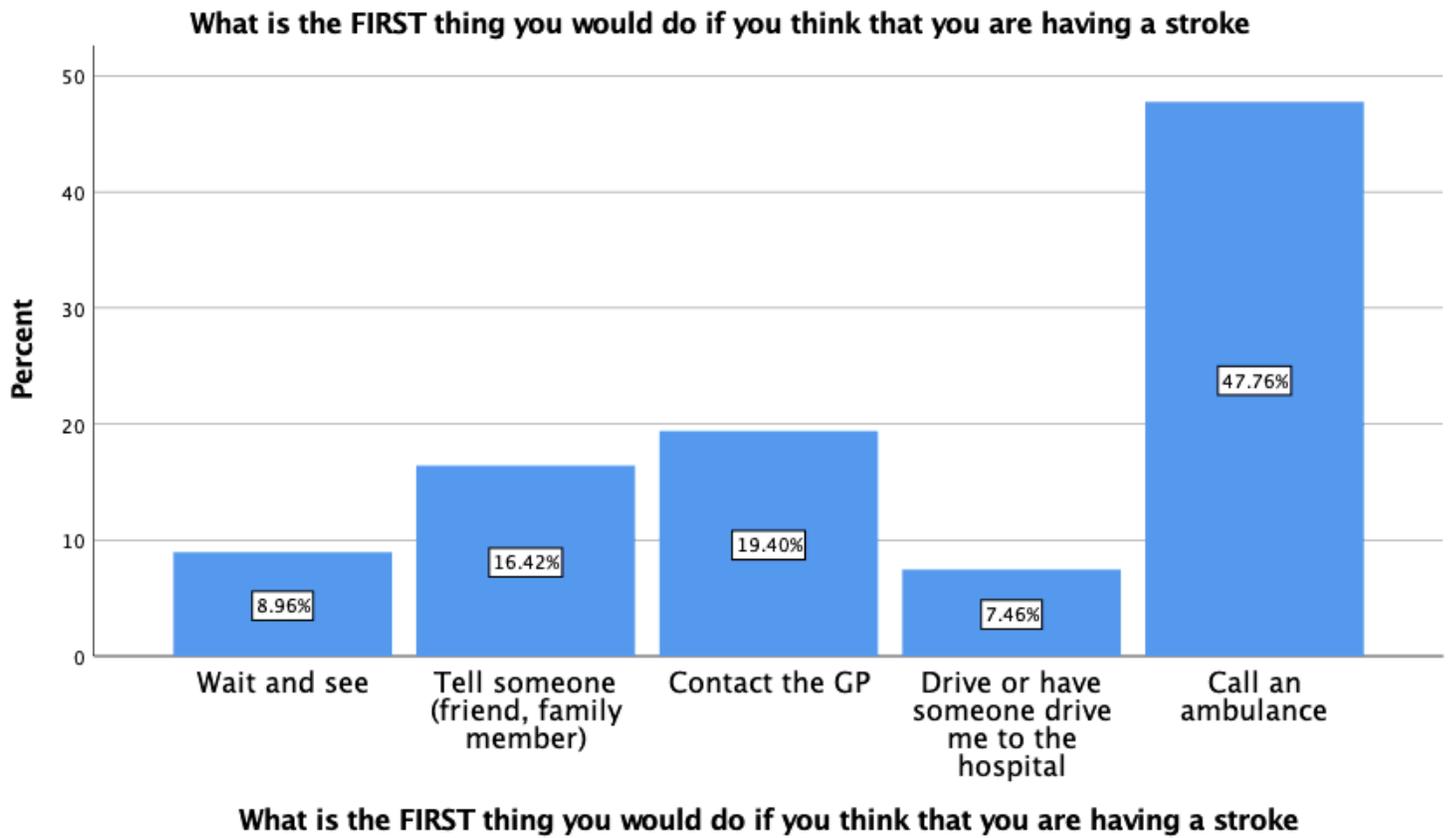


Figure 2

Warning signs of a stroke as cited by survey participants



**Figure 3**

Response to the question: What is the first thing you would do if you think you are having a stroke?

## Knowledge of post stroke therapies

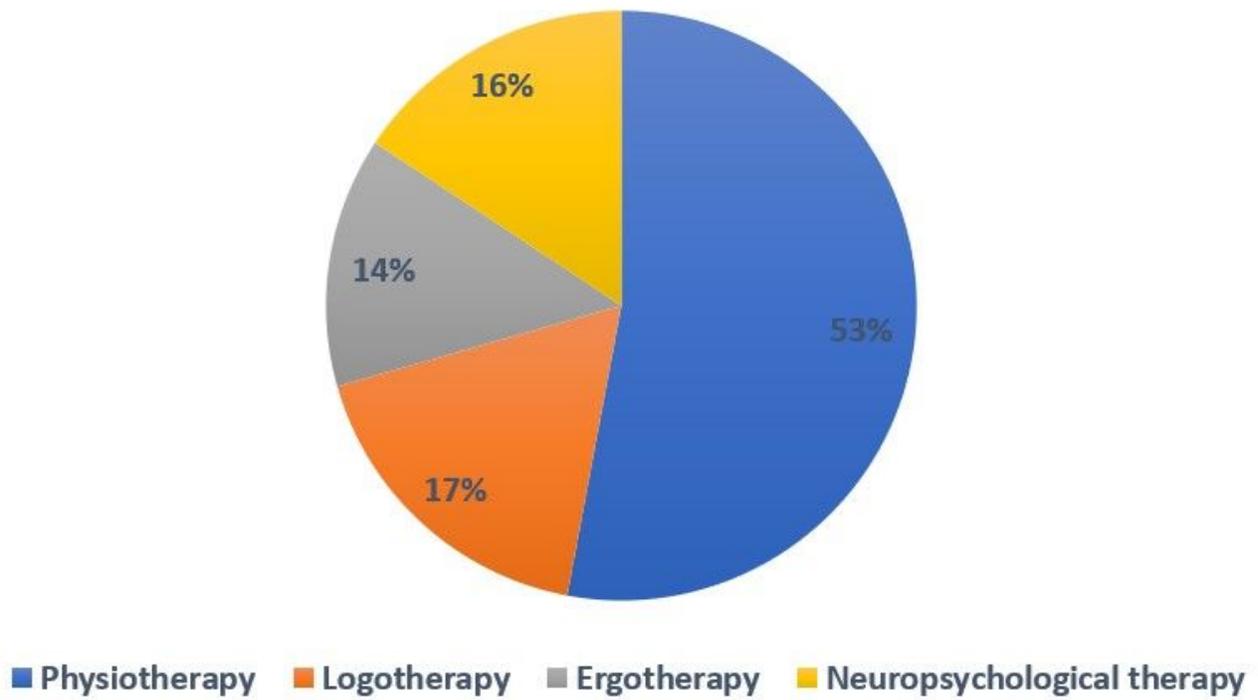


Figure 4

Knowledge of post stroke therapies

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementaryMaterial.docx](#)