Triage of stroke patients in the chain of acute stroke care
Nguyen, T.T.M.

Part I

PATIENT TRIAGE

Chapter 2

Stroke patient's alarm choice: general practitioner or emergency medical services

T Truc My Nguyen, Nyika D Kruyt, Jorien GJ Pierik, Carine JM Doggen, Peter van der Lugt, Saager AV Ramessersing, Naomi T Wijers, Paul JAM Brouwers, Marieke JH Wermer
and Heleen M den Hertog.

ABSTRACT

Background and purpose

Stroke patients should be treated as soon as possible since the benefit of reperfusion therapies is highly time-dependent. The proportion of patients eligible for reperfusion therapy is still limited, as many patients do not immediately alarm healthcare providers. The choice of healthcare system entrance influences the time of arrival in the hospital. Therefore, we assessed differences in these choices to obtain insight for strategies to reduce time delays in acute stroke patients.

Methods

Patients with suspected acute stroke admitted to the participating hospitals received a questionnaire. We assessed differences between patients who initially alarmed the general practitioner (GP) and patients who directly alarmed the emergency medical services (EMS). Additionally, we assessed regional differences and patient trajectories after medical help was sought.

Results

We included 163 patients. Most patients alarmed the GP as primary healthcare provider (n=104; 64%) and median onset-to-door times were longer in these patients (466 minutes [IQR 149 –1586]) compared to patients directly alarming the EMS (n=59; 36%) (90 minutes [IQR 45 –286]). This was even more pronounced in less densely populated areas. Patients who alarmed the GP first, more often had patient delay >15 minutes, hesitated to burden healthcare providers and underestimated symptomatology.

Conclusion

Our results showed that patients who alarmed the GP first instead of the EMS differed in several factors that are potentially modifiable. Strategies to achieve reduction of vital pre-hospital time delays and to improve patient outcome are optimizing public awareness campaigns and GP triage along with adjusting current guidelines by enabling and focusing on immediate involvement of the EMS once acute stroke is suspected.

INTRODUCTION

In patients with acute ischemic stroke, intravenous thrombolysis (IVT) and endovascular treatment (EVT) are effective, and the clinical benefit of both reperfusion therapies is highly time-dependent.[1, 2] Therefore, it is essential to assess and treat acute stroke patients as soon as possible. Previous studies have shown that most treatment delays occur prior to hospital arrival (prehospital delay). Most studies focused on the help seeking behavior of patients in terms of recognition, interpretation and severity perception of symptoms.[3-5] Limited data are available on factors that influence the patient's choice of primary healthcare provider to be alarmed first. This, however, is important as studies have shown that delays to hospital arrival increase when other healthcare providers than the Emergency Medical Service (EMS) are initially alarmed after stroke onset.[6-10] In the Dutch healthcare system, patients can either directly call the EMS with the emergency number 112, or first alarm the General Practitioner. Guidelines state that the EMS should immediately be called if acute stroke is suspected and the public is educated to directly call 112 in case of suspected stroke by stroke awareness campaigns.[11, 12] The aim of this study was to identify factors that determine the patient's choice to enter the healthcare system. Knowledge of these factors can help to develop focused interventions to reduce vital time delays for acute stroke patients. In addition, we assess possible regional differences and patient trajectories after medical help was sought.

2

METHODS

Study design and population

We performed a qualitative study involving a questionnaire, carried out in three hospitals in the Netherlands including Leiden University Medical Centre (LUMC), Medisch Spectrum Twente (MST) and Isala hospital in the period between October 2018 and May 2019. All have well-established acute stroke programs including intravenous thrombolysis, endovascular treatment and a comprehensive stroke unit. The LUMC is an academic medical center situated in a densely populated urban region whereas the other centers (MST and Isala) are large non-academic teaching hospitals situated in less densely populated regions with subsequent longer travel distances to hospitals and between hospitals. The time window for treatment was <4.5 hours for IVT and <6 hours for EVT.

Patients aged 18 years or older admitted with suspected stroke, received a questionnaire during admission on the stroke unit. Patients unable to comprehend the questionnaire (i.e., due to aphasia, language barrier or cognitive impairment) could be included if a partner or relative was able to help. Patients were excluded if they were presented to the emergency department (ED) on their own initiative without first alarming the GP or the EMS. Additional clinical data were collected from hospital registries, including patient characteristics, prior ischemic stroke/Transient Ischemic Attack (TIA), time of symptom onset, time of hospital arrival, onset-to-door-time (OTD: defined as the time between symptom onset and hospital arrival), stroke severity (assessed with the National Institute of Health Stroke Scale (NIHSS) score) and discharge diagnosis.

The questionnaire aimed to assess factors that differ between patients who initially alarmed the GP as primary healthcare provider (the GP group) and those immediately alarming the EMS (the EMS group). First, a pilot study (n=57) was performed with preliminary in-depth semi-structured interviews based on the available literature. Second, experts of various disciplines (stroke neurologists and stroke research nurses) were asked for content validity prior to the start of the study. The final questionnaire includes 30 closed-ended questions on the following topics: (1) socio-demographic factors, (2) stroke symptoms and stroke knowledge, (3) external factors, (4) healthcare system trajectory and (5) emotional aspects.

Socio-demographic factors included: ethnicity and level of education. Stroke symptom knowledge was assessed by asking patients to specify Face-Arm-Speech-Time (FAST) or FAST+ symptoms (e.g. FAST symptoms with accompanying symptoms such as dizziness). External factors involved place of the event (at home or outdoors), presence of bystanders and alarming the primaryhealthcare provider during office

hours (defined as hours between 8 a.m. and 5 p.m. on weekdays). The healthcare system trajectory involves the process after patients alarmed the primary healthcare provider. The time between symptom onset and alarming a healthcare provider (patient delay) was noted. Patients could also state their extent of (dis)agreement on various proposed statements to assess emotional aspects.

2

In secondary analyses, we assessed if regional differences were present between the GP and the EMS group by comparing densely and less densely populated regions. In addition, we studied patient trajectories starting after alarming the primary healthcare provider by examining the referral pattern after initial alarming of the GP. Since we know that involvement of the GP is associated with delays to reperfusion therapy, we took the time window for treatment into account as well. We defined GP triage as the action undertaken by the GP that follows after the patient initially alarmed the GP. Evaluation by the GP occurs after triage and the GP is the first healthcare provider that the patients has seen after initial alarming.

Statistical Analysis

Patient characteristics are presented as mean (standard deviation, SD) or median (interquartile range [IQR]) depending on whether the variables were normally distributed. Differences between the GP and EMS groups were assessed by unpaired t-test (normal distribution) or Mann-Whitney U test (non-normal distribution) for continuous variables and Pearson X^2 test or Fisher exact test (if expected cell count is less than 5 in >20% of the cells) for categorical variables as appropriate. A p-value <0.05 was determined as statistically significant. Data were analyzed with SPSS version 25 (SPSS Inc., Chicago, IL).

RESULTS

Study population and patient characteristics

In total, 179 patients were initially included. Of these, 16 were excluded because entry into the healthcare system remained unknown (n=11) or patients had referred themselves to the emergency department (n=5). This left 163 patients for the analyses. Mean age was 69 years (±14 SD) and 94 patients (58%) were men (Table 1). Median NIHSS score was 3 [IQR 1–4] with a median onset-to-door time (OTD) of 255 minutes [IQR 90–928]. The primary healthcare provider that was alarmed first was the GP in 104 patients (64%) and the EMS in 59 patients (36%) (Figure).

Patient characteristics and socio-demographic factors

We found no differences in age, educational level and prior history of ischemic stroke/TIA or discharge diagnosis between the GP and the EMS groups (Table 1). Patients in the GP group had a lower median NIHSS score (2 [IQR 1–4]) than patients in the EMS group (3 [IQR 2–6]) and median OTD was longer in the GP group (477 [IQR 149–1586]) than in the EMS group (90 [IQR 45–286]). Forty-two of 163 ischemic stroke patients (26%) received reperfusion therapy, 18 out of these 42 (43%) patients alarmed the GP first versus 24 out of 42 (57%) that alarmed the EMS first.

Stroke symptoms and stroke knowledge

Of all 163 patients, 16 (10%) perceived FAST symptoms only and 103 (63%) perceived FAST+ symptoms without differences between the GP and EMS groups (Table 2). Prior stroke experience and knowledge of stroke symptoms did not differ between the GP and EMS groups (Table 2). The GP was alarmed first more often if patient delay was ≥15 minutes or if patients were familiar with public stroke awareness campaigns.
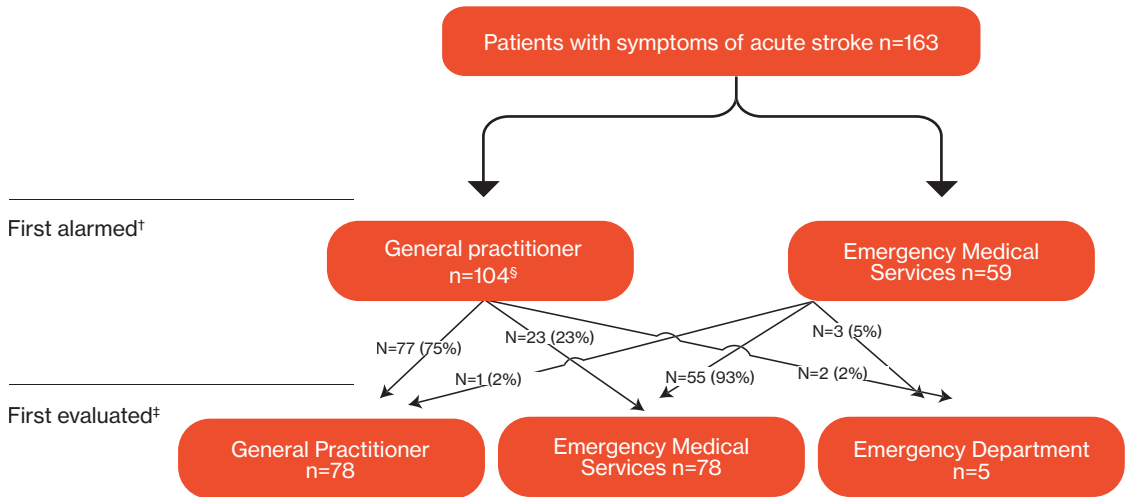
Figure 1.
Flowchart patient's choice of alarm

† First alarmed: first healthcare provider that was alarmed by the patient
‡ First evaluated: first healthcare provider that the patient has seen after initial alarming
§ No. of missing values: 2 (2%) GP patients were unable to recollect the healthcare provider
  by whom they were evaluated after initial alarming.

Table 1.
Patient characteristics and socio-demographic factors

	Total No. (%) n=163	General practitioner n=104	Emergency medical services n=59	p-value
	n (column %)	n (row %)	n (row %)	
Age[†]	69 ±14 y	70 ±12 y	68 ±17 y	0.38
Sex				
Men	94 (58)	54 (57)	40 (43)	0.04
Women	69 (42)	50 (72)	19 (28)	
Level of Education[‡]				
Low	65 (41)	42 (65)	23 (35)	0.88
Medium-high	93 (59)	59 (63)	34 (37)	
Prior ischemic stroke /TIA[§]				
Yes	47 (29)	32 (68)	15 (32)	0.46
No	116 (71)	72 (62)	44 (38)	
Diagnosis				
Ischemic stroke	127 (78)	79 (62)	48 (38)	0.38
Intracerebral hemorrhage	10 (6)	5 (50)	5 (50)	
TIA	10 (6)	7 (70)	3 (30)	
Stroke mimic	16 (10)	13 (81)	3 (19)	
Treatment				
Reperfusion treatment	42 (26)	18 (43)	24 (57)	<0.01
No reperfusion treatment	121 (74)	86 (71)	35 (29)	
NIHSS score[†ǁ]	3 [1,4]	2 [1,4]	3 [2,6]	<0.01
OTD[†±]	255 [90, 928]	477 [149, 1586]	90 [45, 286]	<0.01

[†] Continuous variables are given as mean ± standard deviation (SD) if normally distributed, or median [25th percentile, 75th percentile] if non-normally distributed.

No. of missing values: [‡]: 5 (3%); [§]: 1 (1%); [ǁ]: 1 (1%); [±]: 23 (14%).
TIA = transient ischemic attack;
NIHSS = National Institutes of Health Stroke Scale;
OTD = onset-to-door time in minutes.

Table 2.
Stroke symptoms and stroke knowledge

	Total No. (%) n=163	General practitioner n=104	Emergency medical services n=59	p-value
	n (column %)	n (row %)	n (row %)	
Stroke symptoms				
Only FAST	*16 (10)*	13 (81)	3 (19)	0.45
FAST+	*103 (63)*	63 (61)	40 (39)	
No FAST	*32 (20)*	21(66)	11 (34)	
No FAST and No FAST+	*12 (7)*	7(58)	5 (42)	
Patient delay†				
<15 min	*51 (32)*	18(35)	33 (65)	<0.01
15 min – 1 hour	*41 (26)*	27(66)	14 (34)	
1 – 6 hours	*32 (20)*	26(81)	6 (19)	
>6 hours	*34 (22)*	30(88)	4 (12)	
Knowledge of stroke symptoms‡				
Yes	*106 (67)*	67(63)	39 (37)	0.97
No	*52 (33)*	33(63)	19 (37)	
Familiar with public stroke awareness campaigns§				
Yes	*87 (54)*	60(69)	27 (31)	0.03
No	*59 (37)*	30(51)	29 (49)	
Not Sure	*15 (9)*	12(80)	3 (20)	
Prior experience with stroke‖				
Yes	*115 (71)*	74(64)	41 (36)	0.89
No	*41 (26)*	25(61)	16 (39)	
Not Sure	*5 (3)*	3(60)	2 (40)	

No. of missing values: †: 5 (3%); ‡: 5 (3%); §: 2 (1%); ¶: 2 (1%).
FAST = face-arm-speech-time symptoms; FAST+ = comprising of FAST
symptoms as well as other accompanying symptoms, such as dizziness.

Table 3.
External factors and the healthcare system

	Total No. (%) n=163	General practitioner n=104	Emergency medical services n=59	p-value
	n (column %)	n (row %)	n (row %)	
Presence of bystander[†]				
Yes	139 (87)	87 (63)	52 (88)	0.71
No	21 (13)	14 (66)	7 (12)	
Location of event				
At home	132 (81)	89 (67)	43 (33)	0.04
Outdoors	31 (19)	15 (48)	16 (52)	
Office hours event				
During office Hours	83 (50)	65 (78)	18 (22)	<0.01
Outside office hours	80 (50)	39(49)	41 (51)	

No. of missing values: [†]:3 (2%); [‡]: 4 (2%); [§]: 2 (1%).

External factors

The GP was alarmed more frequently if the event occurred at home (n=89; 67%) and if the event's onset was during office hours (n=65; 78%) (Table 3).

Healthcare system trajectory

Most patients were immediately assessed (n=125; 79%), once a primary healthcare provider was alarmed.

The majority of the patients in the GP group was also evaluated by the GP before admission to the hospital (n=77; 75%) (Figure). Out of these patients, 58 (75%) reported FAST(+) symptoms versus 19 (25%) non-FAST symptoms. Of the 77 patients, 55 (71%) did not arrive in the hospital within the time window for reperfusion therapy (<6 hours) compared to 9 out of 23 (39%) patients in the GP group who were immediately referred to the EMS (data not shown). Moreover, patients from the GP group evaluated by the GP first, had slightly lower median NIHSS scores compared to patients directly referred to the EMS by the GP (median NIHSS 2 [1 –4] vs. 3 [1-4]) and these patients had a higher prevalence of non-FAST symptoms compared to the patients directly referred to the EMS by the GP (25% vs. 4%) (data not shown).

Emotional aspects

Patients who agreed with the following statements, were more frequently present in the GP group compared to the EMS group: (1) the GP knows best what I need (73% vs. 27%), (2) I rather not burden healthcare providers (80% vs. 20%) and (3) I did not perceive my symptoms serious enough to call the EMS directly (92% vs. 8%) (Table 4). Statements regarding anxiety/panic or embarrassment were similar in both groups.

Regional differences

Most patients were residents of the less densely populated region (114 out of 163; 70%).

Secondary analyses for region type showed that, in less densely populated regions, patients alarmed the gp more often than the ems (72% vs. 28%), Whereas in the densely populated region this was reversed (45% vs 55%) (data not shown).

Table 4.
Emotional aspects

	Total No. (%) n=163	General practitioner n=104	Emergency medical services n=59	p-value
	n (column %)	n (row %)	n (row %)	
I prefer to call my GP, he/she knows best what I need[†]				
Agree	105 (66)	77 (73)	28 (27)	<0.01
Neutral	32 (20)	14 (44)	18 (56)	
Disagree	22 (14)	10 (45)	12 (55)	
I rather not burden healthcare providers[‡]				
Agree	43 (27)	34 (80)	9 (20)	0.03
Neutral	23 (15)	15 (65)	8 (35)	
Disagree	91 (58)	51 (56)	40 (44)	
I did not perceive my symptoms serious enough to call the EMS[§]				
Agree	49 (32)	45 (92)	4 (8)	<0.01
Neutral	24 (16)	20 (83)	4 (17)	
Disagree	80 (52)	31 (39)	49 (61)	

No. of missing values: [†]: 4 (2%); [‡]: 6 (4%); [§]: 9 (6%); [ǁ]: 9 (6%); [±]: 9 (6%).
GP = general practitioner; EMS = emergency medical services.

DISCUSSION

In this study, we showed that the majority of acute stroke patients alarm the GP rather than the EMS as primary healthcare provider and patient-related factors seem to have an important contribution in the choice of healthcare provider. Patients alarming the GP more often had patient delays longer than 15 minutes, more often hesitated to burden healthcare providers or did not perceive their symptoms serious enough to call the EMS directly. These factors are potentially modifiable. Furthermore, patients in the GP group had longer onset-to-door times, a lower stroke severity score and more often had knowledge of public stroke awareness campaigns compared to patients in the EMS group.

  We also showed that three-quarter of patients in the GP group were evaluated by the GP first before admission to the hospital. This could possibly result in longer OTD times and subsequent denial of access to reperfusion therapies. These observations appear to be even more pronounced in less densely populated areas, also with longer OTD times in the GP group compared with the EMS group, suggesting that education of the public and triage by the GP could be regionally and nationally improved.

  Our findings are in line with previous studies that showed that involvement of the GP leads to prehospital time delays compared with alarming the EMS directly.[6-10] Our study, however, is the first to assess factors that influence the patient's choices of healthcare provider that was first alarmed, the trajectory thereafter and differences between more and less densely populated areas.

  Our finding that patients more often alarm the GP first, could partially be explained by the Dutch healthcare system that might differ from other healthcare systems in that the GP has a more pivotal role as a gate keeper for hospital referrals. Patients therefore might typically seek medical advice from their GP first. Our study also showed that three-quarter of patients in the GP group was evaluated by the GP first instead of being immediately referred to the EMS. A possible explanation for this could be that these patients more often had clinical presentation of non-FAST symptoms. Therefore, these patients might not be triaged as possible acute stroke suggesting that triage by the GP could be improved, for example, by incorporating other stroke symptoms in addition to FAST symptoms (e.g. dizziness, diplopia, visual disturbances) in the current triage tools and public campaigns as well. Another explanation could be that the guidelines instructing to refer acute stroke patients immediately to the EMS might not be followed thoroughly. The guidelines further states that calling the EMS immediately is not warranted if the diagnosis of acute stroke is uncertain or if the patient is not eligibility for acute therapy and

the GP is advised to urgently visit and evaluate the patient instead. This could possibly lead to a higher threshold for GPs to immediately call an ambulance without evaluating the patient first, with subsequent time delays to treatment.

To help optimize GP triage, GPs should be able to immediately call the EMS when the slightest possibility of acute stroke is suspected in a patient without having to physically evaluate the patient first, this should be adopted into current guidelines to improve rapid hospital arrival of these patients and to minimize time delays that are now caused by the physical evaluation by the GP before the EMS is called. Consistent with a review,[3] a previous stroke experience or stroke knowledge did not lead to alarming the EMS more frequently. Another interesting finding is that 54% of the patients were familiar with public stroke awareness campaigns that advices to call the EMS directly. Despite this knowledge, patients still alarmed the GP first. A previous review showed that public campaigns to raise stroke awareness had limited impact on behavior, however, reasons for these findings were not studied.[13] Thus, it seems that other factors (such as perceived severity of symptoms) are deemed more important by patients than stroke knowledge.

Our study has some limitations. First, we could not include all consecutive patients admitted to the hospital for practical reasons. Second, we excluded patients unable to comprehend the questionnaire resulting in a patient group with relatively mild strokes. Therefore, it is unclear whether our results are generalizable to very severe strokes. Nevertheless, since more severe strokes generally lead to shorter pre-hospital delays, we think that insights in delays are particularly relevant in mild to moderate severe strokes.[3, 8] Therefore, patients with milder strokes are precisely the population who can benefit most from our findings. Moreover, prior studies found that more than half of the acute ischemic stroke patients had a mild stroke (i.e., NIHSS ≤3) at hospital presentation, this is similar to our study. Therefore, our study resembles daily practice, which makes our study relevant[14] Third, we could not entirely rule out that some patients with non-FAST symptoms tried to call 112 but were subsequently referred to their GP. However, we do not believe that this occurred often since these patients were admitted on the stroke unit, which indicates that their symptoms were severe enough to justify hospital admission and calling 112 also indicates a higher sense of urgency, therefore it is less likely that patients were referred to their GP once the call to 112 has been made. Fourth, although questionnaires were taken at a median of 1 day after admission, we cannot rule out that some patients already received stroke education. Finally, due to the retrospective design, patients might have recalled events less accurately. To minimize this, patients were always included within seven days after stroke.

CONCLUSION

Our results shows that most patients first alarm the GP instead of the EMS and patient related factors are of influence on the choice of healthcare provider. Patients alarming the GP have a threshold to burden EMS or underestimate their symptoms. Thus, significant and relevant gains can still be achieved by employing strategies to reduce prehospital delays, including optimization of public awareness campaigns, GP triage and adjusting current guidelines by enabling and focusing on immediate involvement of the EMS once acute stroke is suspected.

2

REFERENCES

1. Tissue plasminogen activator for acute ischemic stroke. *The New England journal of medicine*. Dec 14 1995;333(24):1581-7. doi:10.1056/nejm199512143332401

2. 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 (London, England)*. Apr 23 2016;387(10029):1723-31. doi:10.1016/s0140-6736(16)00163-x

3. Teuschl Y, Brainin M. Stroke education: discrepancies among factors influencing prehospital delay and stroke knowledge. *International journal of stroke : official journal of the International Stroke Society*. Jun 2010;5(3):187-208. doi:10.1111/j.1747-4949.2010.00428.x

4. Pulvers JN, Watson JDG. If Time Is Brain Where Is the Improvement in Prehospital Time after Stroke? *Frontiers in neurology*. 2017;8:617. doi:10.3389/fneur.2017.00617

5. Zock E, Kerkhoff H, Kleyweg RP, et al. Help seeking behavior and onset-to-alarm time in patients with acute stroke: sub-study of the preventive antibiotics in stroke study. *BMC Neurol*. Nov 25 2016;16(1):241. doi:10.1186/s12883-016-0749-2

6. Schroeder EB, Rosamond WD, Morris DL, Evenson KR, Hinn AR. Determinants of use of emergency medical services in a population with stroke symptoms: the Second Delay in Accessing Stroke Healthcare (DASH II) Study. *Stroke*. Nov 2000;31(11):2591-6. doi:10.1161/01.str.31.11.2591

7. Doggen CJ, Zwerink M, Droste HM, et al. Prehospital paths and hospital arrival time of patients with acute coronary syndrome or stroke, a prospective observational study. *BMC Emerg Med*. Jan 9 2016;16:3. doi:10.1186/s12873-015-0065-y

8. Faiz KW, Sundseth A, Thommessen B, Ronning OM. Prehospital path in acute stroke. *Tidsskrift for den Norske laegeforening : tidsskrift for praktisk medicin, ny raekke*. Jun 2017;137(11):798-802. Prehospitalt forlop ved akutt hjerneslag. doi:10.4045/tidsskr.16.0512

9. Mosley I, Nicol M, Donnan G, Dewey H. Family physician decisions following stroke symptom onset and delay times to ambulance call. *BMC family practice*. Aug 4 2011;12:82. doi:10.1186/1471-2296-12-82

10. Faiz KW, Sundseth A, Thommessen B, Ronning OM. Factors related to decision delay in acute stroke. *Journal of stroke and cerebrovascular diseases : the official journal of National Stroke Association*. Mar 2014;23(3):534-9. doi:10.1016/j.jstrokecerebrovasdis.2013.05.007

11. Kwaliteitsinstituut voor de Gezondheidszorg CBO, CBO-richtlijn 'Beroerte' (herziening). https://www.ntvg.nl/system/files/publications/2000110580001a.pdf

12. Genootschap NH. NHG-Standaard Beroerte (eerste partiële herziening). Nederlands

Tijdschift voor Geneeskunde 2018 April:1-52.

13. Lecouturier J, Rodgers H, Murtagh MJ, White M, Ford GA, Thomson RG. Systematic review of mass media interventions designed to improve public recognition of stroke symptoms, emergency response and early treatment. *BMC Public Health*. Dec 23 2010;10:784. doi:10.1186/1471-2458-10-784

14. Reeves M, Khoury J, Alwell K, et al. Distribution of National Institutes of Health stroke scale in the Cincinnati/Northern Kentucky Stroke Study. *Stroke*. Nov 2013;44(11):3211-3. doi:10.1161/strokeaha.113.002881

2