|  |  |
| --- | --- |
| Question | |
| **Recognition of stroke** | |
| **Population:** | Adults with suspected acute stroke |
| **Intervention:** | Use of a rapid stroke scoring system or scale (or test) (as FAST, LAPSS, CPSS, OPSS, KPSS, MASS or others.) |
| **Comparison:** | Basic first aid assessment without the use of a scale |
| **Main outcomes:** | * Change time to treatment (e.g. symptom onset to hospital/emergency department arrival or hospital admission * Recognition of stroke:   + high number considered beneficial for observational study   + high sensitivity and high specificity considered beneficial for diagnosis study * Discharge with favorable neurologic status (increase considered beneficial) * Survival with favorable neurologic outcome (increase considered beneficial) * Increased public/layperson recognition of stroke signs |
| **Setting:** | Prehospital setting |
| **Perspective:** | First Aid |
| **Background:** | Stroke is one of the leading causes of death and disability worldwide (Collaborators GMaCo 2016 1459). Over the last 20 years, new treatments such as intravenous thrombolysis or endovascular reperfusion techniques for ischaemic strokes have been shown to significantly improve outcomes from stroke*.* For haemorrhagic stroke, medical treatment for hypertension or coagulopathy and the use of surgical treatment to reduce haematoma growth are also providing better clinical outcomes (Emberson 2014 1929, Bracard 2016 1138, Saver 2019 1279). Many of these studies have shown the importance of time to treatment with the longer the time, the less effective are these therapies.  Earlier detection of stroke by lay people, first aid providers, paramedics or nurses in a prehospital setting may reduce time to treatment delays. Prenotification of the hospital and a direct admission of individuals to a stroke centre or to a hospital able to provide acute stroke treatment is key to the continued improvement in providing successful treatment (Lin 2012 514, Schlemm 2017 2184, Medoro 2017 476).  In recent years, stroke recognition campaigns have been carried out for laypeople. In addition, first aid providers and paramedics have received specific training to increase their capability to identify strokes as quickly as possible. These campaigns and training are all based on the use of a scale to facilitate stroke detection. Several stroke scales have been proposed such as the Face-Arms-Speech-Time (FAST) or Cincinnati Prehospital Stroke scale. These scales differ from the scores traditionally used in hospital, such as National Institutes of Health Stroke Scale (NIHSS), by the low number of criteria, the ease of identifying the clinical signs and the simplicity of their implementation. It’s important that any scale proposed and used in a prehospital setting requires a short training, can be quickly administered and has the best specificity and sensibility for stroke detection (Medoro 2017 476, Singer 2005 773, Mould-Millman 2018 1, McMullan 2017 481). |
| **Conflict of interests:** |  |

# Assessment

|  |  |  |
| --- | --- | --- |
| Problem Is the problem a priority? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know | Stroke is one of the leading causes of death and disability worldwide (Collaborators GMaCo-2016-1459). Over the last 20 years, new treatments such as intravenous thrombolysis or endovascular reperfusion techniques for ischaemic strokes have been shown to significantly improve outcomes from stroke*.* For haemorrhagic stroke, medical treatment for hypertension or coagulopathy and the use of surgical treatment to reduce haematoma growth are also providing better clinical outcomes (Emberson 2014 1929, Bracard 2016 1138, Saver 2019 1279). Many of these studies have shown the importance of time to treatment with the longer the time, the less effective are these therapies.  Earlier detection of stroke by lay people, first aid providers, paramedics or nurses in a prehospital setting may reduce time to treatment delays. Prenotification of the hospital and a direct admission of individuals to a stroke centre or to a hospital able to provide acute stroke treatment is key to the continued improvement in providing successful treatment (Lin 2012 514, Schlemm 2017 2184, Medoro 2017 476). |  |
| Desirable Effects How substantial are the desirable anticipated effects? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Trivial ● Small ○ Moderate ○ Large ○ Varies ○ Don't know | **Intervention studies**   1. **KPSS versus standard assessment:** {Iguchi 2011 51}  | **Certainty assessment** | | | | | | | **№ of patients** | | **Effect** | | **Certainty** | **Importance** | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **№ of studies** | **Study design** | **Risk of bias** | **Inconsistency** | **Indirectness** | **Imprecision** | **Other considerations** | **KPSS** | **Standard assessment** | **Relative (95% CI)** | **Absolute (95% CI)** | | Rate of patient admitted < 3h with stroke diagnosis | | | | | | | | | | | | | | 1 | observational studies | serious a | not serious | serious b | not serious | none | 161/256 (62.9%) | 91/174 (52.3%) | **RR 1.20** (1.01 to 1.43) | **105 more per 1 000** (from 5 more to 225 more) | ⨁◯◯◯ VERY LOW | CRITICAL | | Nb of patients who received tPA | | | | | | | | | | | | | | 1 | observational studies | serious a | not serious | serious b | not serious | none | 35/256 (13.7%) | 25/174 (14.4%) | **RR 0.95** (0.59 to 1.53) | **7 fewer per 1 000** (from 59 fewer to 76 more) | ⨁◯◯◯ VERY LOW | IMPORTANT | | Onset to admission | | | | | | | | | | | | | | 1 | observational studies | very serious a,c | not serious | serious b | not serious | none | 256 | 174 | - | MD **0**  (0 to 0 ) | ⨁◯◯◯ VERY LOW | CRITICAL |  1. The score was not calculated for 174 patients in our series and the patient and the outcome assessment are not aware of the intervention 2. The KPSS is used to identified thrombolytic candidates. 3. Selected result reported   **2- LAPSS versus standard assessment:** {Wojner-Alexandrov 2005 1512}   | **Certainty assessment** | | | | | | | **№ of patients** | | **Effect** | | **Certainty** | **Importance** | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **№ of studies** | **Study design** | **Risk of bias** | **Inconsistency** | **Indirectness** | **Imprecision** | **Other considerations** | **LAPSS** | **Standard assessment** | **Relative (95% CI)** | **Absolute (95% CI)** | | Rate onset to admission < 2 h | | | | | | | | | | | | | | 1 | observational studies | not serious | not serious | serious a | not serious | none | 418/674 (62.0%) | 210/362 (58.0%) | **RR 1.07** (0.96 to 1.19) | **41 more per 1 000** (from 23 fewer to 110 more) | ⨁◯◯◯ VERY LOW | CRITICAL | | Onset to ED Arrival | | | | | | | | | | | | | | 1 | observational studies | not serious | not serious | serious a | not serious | none | 680 | 359 | - | MD **132 higher** (14.68 higher to 249.32 higher) | ⨁◯◯◯ VERY LOW | CRITICAL | | Treatment with IVtPA of confirmed stroke cases | | | | | | | | | | | | | | 1 | observational studies | not serious | not serious | serious a | not serious | none | 64/533 (12.0%) | 21/198 (10.6%) | **RR 1.13** (0.71 to 1.80) | **14 more per 1 000** (from 31 fewer to 85 more) | ⨁◯◯◯ VERY LOW | IMPORTANT | | Nb of good diagnosis by paramedics at discharge | | | | | | | | | | | | | | 1 | observational studies | not serious | not serious | serious a | not serious | none | 709/895 (79.2%) | 198/323 (61.3%) | **RR 1.29** (1.18 to 1.42) | **178 more per 1 000** (from 110 more to 257 more) | ⨁◯◯◯ VERY LOW | IMPORTANT |  1. The LAPSS was used by paramedics. The assessment is not limited to the LAPSS only.   **3- OPSS versus standard assessment:** {Chenkin 2009 153}   | **Certainty assessment** | | | | | | | **№ of patients** | | **Effect** | | **Certainty** | **Importance** | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **№ of studies** | **Study design** | **Risk of bias** | **Inconsistency** | **Indirectness** | **Imprecision** | **Other considerations** | **OPSST** | **Standard assessment** | **Relative (95% CI)** | **Absolute (95% CI)** | | Ischemic stroke patients arriving <3 hours | | | | | | | | | | | | | | 1 | observational studies | very serious a | not serious | not serious | not serious | none | 178/554 (32.1%) | 69/307 (22.5%) | **RR 1.43** (1.12 to 1.82) | **97 more per 1 000** (from 27 more to 184 more) | ⨁◯◯◯ VERY LOW | CRITICAL | | Rate of tPA administration (all patients) | | | | | | | | | | | | | | 1 | observational studies | very serious a | not serious | not serious | not serious | none | 56/554 (10.1%) | 18/307 (5.9%) | **RR 1.72** (1.03 to 2.88) | **42 more per 1 000** (from 2 more to 110 more) | ⨁◯◯◯ VERY LOW | IMPORTANT | | Diagnosis ischemic stroke | | | | | | | | | | | | | | 1 | observational studies | very serious a | not serious | not serious | not serious | none | 290/554 (52.3%) | 145/307 (47.2%) | **RR 1,11** (0.96 to 1.28) | **52 more per 1 000** (from 19 fewer to 132 more) | ⨁◯◯◯ VERY LOW | IMPORTANT |  1. Risk of bias due to deviation from intended interventions, missing data and confounding.   **4- FASTER versus standard assessment:** {O’Brien 2012 241}   | **Certainty assessment** | | | | | | | **№ of patients** | | **Effect** | | **Certainty** | **Importance** | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **№ of studies** | **Study design** | **Risk of bias** | **Inconsistency** | **Indirectness** | **Imprecision** | **Other considerations** | **FASTER** | **Standard assessment** | **Relative (95% CI)** | **Absolute (95% CI)** | | symptom onset to treatment time | | | | | | | | | | | | | | 1 | observational studies | very serious a | not serious | not serious | serious b | none | 17 | 17 | - | MD **0**  (0 to 0 ) | ⨁◯◯◯ VERY LOW | CRITICAL | | Door to CT time | | | | | | | | | | | | | | 1 | observational studies | very serious a | not serious | not serious | serious b | none | 17 | 17 | - | MD **0**  (0 to 0 ) | ⨁◯◯◯ VERY LOW | CRITICAL | | Door to needle time | | | | | | | | | | | | | | 1 | observational studies | very serious a | not serious | not serious | serious b | none | 17 | 17 | - | MD **0**  (0 to 0 ) | ⨁◯◯◯ VERY LOW | CRITICAL | | Rate of thrombolytic therapy | | | | | | | | | | | | | | 1 | observational studies | very serious a | not serious | not serious | serious b | none | 22/115 (19.1%) | 5/67 (7.5%) | **RR 2.56** (1.02 to 6.45) | **116 more per 1 000** (from 1 more to 407 more) | ⨁◯◯◯ VERY LOW | IMPORTANT |  1. Risk of bias due to confounding and selection for the reported results 2. Incomplete data provided - imprecision   **5- FAST versus standard assessment:** {Harbison 2003 71   | **Certainty assessment** | | | | | | | **№ of patients** | | **Effect** | | **Certainty** | **Importance** | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **№ of studies** | **Study design** | **Risk of bias** | **Inconsistency** | **Indirectness** | **Imprecision** | **Other considerations** | **FAST** | **Standard assessment** | **Relative (95% CI)** | **Absolute (95% CI)** | | Rate of patient admitted < 3h with stroke diagnosis | | | | | | | | | | | | | | 1 | observational studies | serious a | not serious | not serious | not serious | none | 66/137 (48.2%) | 32/219 (14.6%) | **RR 3.30** (2.29 to 4.75) | **336 more per 1 000** (from 188 more to 548 more) | ⨁◯◯◯ VERY LOW | CRITICAL |  1. Fast is integrated in a rapid protocol ambulance and compare with PCDs and ED doctor’s diagnosis of stroke.   **Test accuracy (diagnosis studies)**  **1- FAST** (Berglund 2014 212, Berg 2010 2, Fothergill 2013 2007, Pickam 2018 195)  **Pooled sensitivity**: 0.86 (95% CI: 0.69 to 0.94) | **Pooled specificity**: 0.38 (95% CI: 0.16 to 0.66)   | **Test result** | **Number of results per 1000 patients tested (95% CI)** | **№ of participants (studies)** | **Certainty of the evidence (GRADE)** | | --- | --- | --- | --- | | **Prevalence 51%** | | True positives: patients with stroke and TIA | 449 (360 to 490) | 827 (4) | ⨁◯◯◯ VERY LOWa,b,c | | False negatives: patients incorrectly classified as not having stroke and TIA | 73 (32 to 162) | | True negatives: patients without stroke and TIA | 182 (77 to 316) | 758 (4) | ⨁◯◯◯ VERY LOWa,b,c | | False positives: patients incorrectly classified as having stroke and TIA | 296 (162 to 401) |  1. 3 studies at high risk of bias for patient selection: 1 at high risk of bias for reference standard; 2 at moderate risk of bias for reference standard; 1 at moderate risk of bias for continuity and timing 2. One study includes the FAST in a protocol but does not only test FAST (Berg 2010) 3. Inconsistency was considered serious with less than 5 studies   **2- LAPSS** (Asimos 2014 509, Bergs 2010 2, Bray 2005 28, Chen 2013 e70742, Kidwell 2000 71)  **Pooled sensitivity**: 0.78 (95% CI: 0.75 to 0.81) | **Pooled specificity**: 0.86 (95% CI: 0.67 to 0.95)   | **Test result** | **Number of results per 1000 patients tested (95% CI)** | **№ of participants (studies)** | **Certainty of the evidence (GRADE)** | | --- | --- | --- | --- | | **Prevalence 66%** | | True positives: patients with stroke and TIA | 517 (498 to 537) | 1928 (5) | ⨁⨁◯◯ LOWa | | False negatives: patients incorrectly classified as not having stroke and TIA | 146 (126 to 165) | | True negatives: patients without stroke and TIA | 289 (226 to 320) | 764 (5) | ⨁⨁◯◯ LOWa | | False positives: patients incorrectly classified as having stroke and TIA | 48 (17 to 111) |  1. Risk of bias due to high risk for patient selection (4/5) and reference standard, moderate risk of bias due to reference standard (2/5) and flow and timing (1/5).   **3- CPSS** (Asimos 2014 509, Berg 2010 2, Bray 2010 1363, Bray 2005 28, Frendl 2009 754, Greenberg 2017 1, Kidwell 2000 71, Ramanujan 2008 307, English 2018 919, Kim 2017 867, Vanni 2011 499, Studnek 2013 348)  **Pooled sensitivity**: 0.80 (95% CI: 0.67 to 0.88) | **Pooled specificity**: 0.52 (95% CI: 0.40 to 0.64)   | **Test result** | **Number of results per 1000 patients tested (95% CI)** | **№ of participants (studies)** | **Certainty of the evidence (GRADE)** | | --- | --- | --- | --- | | **Prevalence 41%** | | True positives: patients with stroke and TIA | 331 (277 to 364) | 1988 (10) | ⨁⨁◯◯ LOWa | | False negatives: patients incorrectly classified as not having stroke and TIA | 83 (50 to 137) | | True negatives: patients without stroke and TIA | 305 (234 to 375) | 2754 (10) | ⨁⨁◯◯ LOWa | | False positives: patients incorrectly classified as having stroke and TIA | 281 (211 to 352) |  1. High risk of bias for patient selection (9 studies on 12) and unclear risk of bias for reference standard (8 studies on 12) and for continuity and timing (9 studies on 12)   **4- MASS** (Berg 2010 2, Bray 2005 28, Bray 2010 1363)  **Pooled sensitivity**: 0.85 (95% CI: 0.79 to 0.90) | **Pooled specificity:** 0.82 (95% CI: 0.69 to 0.91)   | **Test result** | **Number of results per 1000 patients tested (95% CI)** | **№ of participants (studies)** | **Certainty of the evidence (GRADE)** | | --- | --- | --- | --- | | **Prevalence 29%** | | True positives: patients with stroke and TIA | 254 (235 to 267) | 291 (3) | ⨁⨁⨁◯ MODERATEa | | False negatives: patients incorrectly classified as not having stroke and TIA | 43 (30 to 62) | | True negatives: patients without stroke and TIA | 580 (487 to 639) | 1157 (3) | ⨁⨁⨁◯ MODERATEa | | False positives: patients incorrectly classified as having stroke and TIA | 123 (64 to 216) |  1. Serious risk of bias due to patient selection and unclear risk of bias due to reference standard and continuity and timing |  |
| Undesirable Effects How substantial are the undesirable anticipated effects? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Large ○ Moderate ○ Small ● Trivial ○ Varies ○ Don't know | See desirable effect above |  |
| Certainty of evidence What is the overall certainty of the evidence of effects? | | |
| Judgement | Research evidence | Additional considerations |
| ● Very low ● Low ○ Moderate ○ High ○ No included studies | For all the outcomes, we have identified:   * Very low certainty of evidence downgrade for risk of bias, indirectness and imprecision for intervention studies and, * low to very-low certainty of evidence for serious risk of bias for patient’s selection, moderate risk of bias for reference standard and continuity and timing and low risk of bias for applicability concerns for diagnosis studies. | The certainty of evidence depends on outcomes and study design.  For intervention studies we have identified:  - moderate to low quality evidence for serious bias due to confounding,  - moderate and serious bias due to missing data,  - moderate and serious bias in measurement of the outcome.  For diagnosis studies, we have identified:  - serious risk of bias for patient selection,  - moderate risk of bias due to reference standard and flow and timing.  The risk of bias is low for applicability concern. |
| Values Is there important uncertainty about or variability in how much people value the main outcomes? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Important uncertainty or variability ○ Possibly important uncertainty or variability ● Probably no important uncertainty or variability ○ No important uncertainty or variability | No evidence | We do not think that uncertainty exists about variability in how much people value the main outcomes. |
| Balance of effects Does the balance between desirable and undesirable effects favor the intervention or the comparison? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ● Probably favors the intervention ○ Favors the intervention ○ Varies ○ Don't know | The research demonstrates that the practical use of a stroke scale in a prehospital setting by paramedics or nurses:  - increased the number of patients with confirmed stroke or TIA admitted time from symptom onset to hospital arrival within 3h (FAST & KPSS) (Harbison 2003 71, Iguchi 2010, 51).  - decreased the symptom onset to admission time (KPSS) (Iguchi 2010, 51);  - increased thenumber of patients with time from symptom onset to hospital arrival within 3h (OPSS) (Chenkin 2009, 153)  - decreased the EMS on-scene time (CPSS) (Frendl 2009, 754)  - decreased symptom onset to treatment time, door to CT time and door to needle time for patients receiving tPA (FASTER scale) (*O’Brien 2012, 241*)  No effect is found on symptom onset to door time for patients receiving tPA, on rate of patient admitted within 120 min and on symptom onset to emergency department arrival time.  The intervention studies show that when a stroke scale are used by paramedics or nurses in a prehospital setting, the number of good diagnosis of stroke and the rate of patients who received thrombolytic therapy are higher (Harbison 2003 71, Wojner-Alexandrov 2005 1512, Chenkin 2009, 153, O’Brien 2012 241).    The accuracy of recognition for stroke the five studies evaluating the **LAPSS** reported relatively consistent accuracy estimates that allowed pooling of results. The summary estimate sensitivity is **0,78 (95%CI 0.75 - 0.81)** and the summary estimate specificity is **0,86 (95%CI 0.67 - 0.95).**  The 10 **CPSS** studies reported extremely variable accuracy estimates, the risk of bias was high or unclear in most of these studies, and it was not appropriate to pool the result. Nevertheless, CPSS is one of the scales with an important sensitivity.  For the other scale, FAST, MASS, OPSST, MedPACS and PreHAST, we have found a small number of heterogeneous studies, most of them were at high risk of bias. It was not appropriate to pool the result to assess their accuracy when there were more than one studies per scale, |  |
| Resources required How large are the resource requirements (costs)? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Large costs ○ Moderate costs ○ Negligible costs and savings ● Moderate savings ○ Large savings ○ Varies ○ Don't know | No more resources are necessary except for scales that include blood glucose measurement which would need a glucometer.  However, in each study, a specific training would be required before implementing the use of a scale. The type training is variable. In all of the studies, we found different training design. Some studies report a short training of 1 to 4 hours of face-to-face training (Berg 2010 2, Bray 2005 28, Bray 2010 1363, Chen 2013 e70742, Chenking 2009 153, Berglund 2014 212, Frendl 2009 754, Studnek 2013 348, Kothari, Andsberg 2017 1, O’Brien 2012 241, Iguchi 2011 51, Harbison 2003 71, Greenberg 2017 1), some studies report a 1 or 2 hours on-line training (English 2018 919 ) and with video (Kidwell 2000 71, Picham 2019 195) and some studies present a scenario base demonstration educational program (Fothergill 2013 207, Wall 2008 A49) . Most of the training required an assessment of each participant at the end of training (English 2018 919, Bray 2005 28, Andsberg 2017 1, Picham 2019 195, Kidwell 2000 71) and in some cases, monthly or annual refresher training was proposed. |  |
| Certainty of evidence of required resources What is the certainty of the evidence of resource requirements (costs)? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Very low ○ Low ○ Moderate ○ High ● No included studies | No included study |  |
| Cost effectiveness Does the cost-effectiveness of the intervention favor the intervention or the comparison? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Favors the comparison ○ Probably favors the comparison ● Does not favor either the intervention or the comparison ○ Probably favors the intervention ○ Favors the intervention ○ Varies ○ No included studies | No included study | If we include specific training (stroke scale training) in courses of first aid providers, paramedics or nurses the cost effectiveness is similar between the intervention and the comparison.  It's not the same for the lay people who can be informed by specific campaigns about stroke recognition. In this case, the cost effectiveness is in favour of the comparison. |
| Equity What would be the impact on health equity? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Reduced ○ Probably reduced ● Probably no impact ○ Probably increased ○ Increased ○ Varies ○ Don't know |  | The use of stroke scale in a prehospital setting by lay people, first aid providers or paramedics adds no impact on health equity. But we must recognize that patients' access to specific treatment in stroke centres or in hospital able to provide acute stroke treatment is not the same in all countries, especially in low-income countries. |
| Acceptability Is the intervention acceptable to key stakeholders? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know | A recent survey (Li 2019 297) of EMS providers at four hospital EDs that used CPSS for stroke recognition in the prehospital setting showed that:  - 11.0% correctly identiﬁed the time window for IV tPA administration for acute ischemic stroke as within 4.5 hrs from stroke onset  - The majority (82.7%) correctly identiﬁed the comprehensive stroke centre in the local health system.  Some barriers were also identified in this study to provide prenotiﬁcation as:  - short transport time (40.5%),  - information being lost in dispatch (39.5%),  - not having direct communication with ED staff (30.2%).  A large number of people in this survey wanted to received feedback on the stroke patients they transported (93.7%). The use of a mobile App for this feedback is suggested. | The use of score must not be used alone but must be integrated into a complete interactive chain of stroke management. |
| Feasibility Is the intervention feasible to implement? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know | The use of a scale by paramedics, first aid providers and nurses would seem to be simple to implement. Nevertheless, the implementation of public campaigns to inform lay people on the recognition of stroke as FAST or SUDDEN public education, requires more human and financial resources (Kleindorfer 2007 2864). |  |

# Summary of judgements

|  | **Judgement** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Problem** | No | Probably no | Probably yes | **Yes** |  | Varies | Don't know |
| **Desirable Effects** | Trivial | Small | Moderate | **Large** |  | Varies | Don't know |
| **Undesirable Effects** | Large | Moderate | Small | **Trivial** |  | Varies | Don't know |
| **Certainty of evidence** | **Very low** | **Low** | Moderate | High |  |  | No included studies |
| **Values** | Important uncertainty or variability | Possibly important uncertainty or variability | **Probably no important uncertainty or variability** | No important uncertainty or variability |  |  |  |
| **Balance of effects** | Favors the comparison | Probably favors the comparison | Does not favor either the intervention or the comparison | **Probably favors the intervention** | Favors the intervention | Varies | Don't know |
| **Resources required** | Large costs | Moderate costs | Negligible costs and savings | **Moderate savings** | Large savings | Varies | Don't know |
| **Certainty of evidence of required resources** | Very low | Low | Moderate | High |  |  | **No included studies** |
| **Cost effectiveness** | Favors the comparison | Probably favors the comparison | **Does not favor either the intervention or the comparison** | Probably favors the intervention | Favors the intervention | Varies | No included studies |
| **Equity** | Reduced | Probably reduced | **Probably no impact** | Probably increased | Increased | Varies | Don't know |
| **Acceptability** | No | Probably no | **Probably yes** | Yes |  | Varies | Don't know |
| **Feasibility** | No | Probably no | **Probably yes** | Yes |  | Varies | Don't know |

# Type of recommendation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Strong recommendation against the intervention | Conditional recommendation against the intervention | Conditional recommendation for either the intervention or the comparison | **Conditional recommendation for the intervention** | Strong recommendation for the intervention |
| ○ | ○ | ○ | **●** | ○ |

# Conclusions

|  |
| --- |
| Recommendation |
| We recommend that first aid providers use stroke assessment systems for individuals with suspected acute stroke (strong recommendation, low certainty evidence).  For first aid we suggest the use of FAST, MASS, CPSS or LAPSS for stroke assessment (weak recommendation, low certainty evidence).  For first aid we suggest the use of stroke assessment systems that include blood glucose measurement, when available, such as MASS or LAPSS to increase specificity of stroke recognition (weak recommendation, low certainty evidence).  For first aid we suggest the use of FAST or CPSS stroke assessment systems in the absence of the ability to undertake a blood glucose measurement (weak recommendation, low certainty evidence). |
|  |

|  |
| --- |
| Justification |
| The original literature search for the 2015 ILCOR CoSTR was completed in January 2014 (Singletary 2015 S269, Zideman 2015 e225). This literature search was rerun in September 2019 to capture the new evidence between 2014 and 2019. Four additional studies were added (Berglund 2014 212, Pickam 2019 195, English 2018 919, Greenberg 2017 1) and incorporated into the consensus on science and grade tables to update the 2015 consensus on science and treatment recommendations.  The Task Force considers an ideal stroke assessment system for first aid use to have few steps, to be easily understood and remembered, to be sensitive and to take minimal time to complete. These considerations were taken into account in the choice of tests that were studied.  Early treatment can minimize a potentially devastating neurologic injury. In making this recommendation, the Task Force emphasizes that in the initial management of the individual, the assessment using a stroke recognition score compared to no stroke score assessment assists in early stroke recognition, a reduced time from symptom onset to arrival at a hospital emergency department or hospital admission, and faster treatment of confirmed stroke patients.  The Task Force recognizes that in most studies, the stroke scale assessment was performed by paramedics or nurses and not by lay people or first aid providers. The benefit of training first aid providers in stroke assessment systems outweighs the risks, which is largely limited to false-positive identification by first aid providers. The Task Force considers that the lay public or first aid providers should use the stroke scale assessment protocol that provides the highest sensitivity and the least number of false negatives.  Four scales have been the subject of several studies and therefore a large number of participants have been tested (FAST, CPSS, LAPSS, MASS). Four scales (OPSS, ROSIER, BEFAST, MED-PACS) were each the subject of a single study with between 250 and 600 participants (Chenkin 2009 153, Fotherhill 2013 2007, Studneck 2013 348, Pickham 2018 195). The PreHAST scale provided a high level of sensitivity was only tested in a single study, with a low number of participants (Andsberg 2017 1). The Task Force decided to limit its conclusions to those scales with a larger number of patients and to exclude scales with only a single study and low numbers of participants.  In this review of the literature, the stroke assessment systems include various components, such as looking for specific signs and measuring blood glucose levels. Our review found that stroke assessment systems that included blood glucose measurement had similar sensitivity but increased specificity to accurately identify stroke compared with those systems that did not include blood glucose measurement. We recognize that first aid providers may not have access to or the skill to use a properly calibrated glucose measurement device. Although use of blood glucose measurement is not routinely included in first aid training, glucose measurement devices are commonly available and used by the public.  The cost of the intervention is estimated as low. However, the Task Force did take into account that assessment scales that included blood glucose measurement would require the acquisition of measurement devices that can be expensive and that in some countries, the use of such devices by first aid providers is not authorized by law.  Those developing local guidelines for first aid providers can use the results of this review to determine if the benefit of increased specificity with systems that include glucose measurement would be desirable in their settings, compared with using simpler stroke assessment systems that do not include glucose measurement, which have similar sensitivity but lower specificity. |

|  |
| --- |
| Subgroup considerations |
| It would certainly be of interest to undertake a subgroup analysis to review the scoring accuracy of the various test provider groups (paramedics, nurses, first aid providers). Currently there is insufficient data to conduct this subgroup analysis. |

|  |
| --- |
| Implementation considerations |
| The use of a recognition scale for stroke diagnosis requires training, regardless of who is using it.  - For the layperson, public campaigns on the importance of early stroke diagnosis, recognition of early signs and the need for an early call to the emergency services, are necessary.  - For first aid providers, specific short training such as face-to-face training, online training with or without video can be used.  - For paramedics and nurses working in pre-hospital settings, these training courses should be integrated into the regular training programs and be subject to refresher courses and feedback.  Some scores require blood glucose measurement. Blood glucose measurement increases the sensitivity of the test. However, the availability of glucometers differs greatly from country to country due to the cost involved and the lack of legal authorization to use these devices by non-healthcare professionals. |

|  |
| --- |
| Monitoring and evaluation |
| Based on this literature review, we were able to identify a number of different stroke recognition scales. The use of simple scoring systems, easy to remember and usable by the lay public or the first aid providers must remain a major objective. The monitoring and evaluation of the use and accuracy of the different scoring systems is essential in order to be able to develop the most specific and effective stroke recognition scale. |

|  |
| --- |
| Research priorities |
| Large observational or randomized control studies evaluated rapid stroke scoring system or scale by first aid providers are needed.  The effect of the early use of a stroke scale must be assessed in terms of survival rate, CPC level, or survival to hospital discharge and after 30 days |

**References**

Andsberg G, Esbjörnsson M, Olofsson A, Lindgren A, Norrving B, Euler von M. PreHospital Ambulance Stroke Test - pilot study of a novel stroke test. Scand J Trauma Resusc Emerg Med 2017;25(1):1–6. DOI : 10.1186/s13049-017-0377-x

Asimos AW, Ward S, Brice JH, Rosamond WD, Goldstein LB, Studnek J. Out-of-hospital stroke screen accuracy in a state with an emergency medical services protocol for routing patients to acute stroke centers. Ann Emerg Med 2014;64(5):509–15. DOI : 10.1016/j.annemergmed.2014.03.024

Berglund A, Svensson L, Wahlgren N, Euler von M. Face Arm Speech Time Test Use in the Prehospital Setting, Better in the Ambulance than in the Emergency Medical Communication Center. Cerebrovasc Dis 2014;37(3):212–6. DOI : 10.1159/000358116

Bergs J, Sabbe M, Moons P. Prehospital stroke scales in a Belgian prehospital setting: a pilot study. Eur J Emerg Med 2010;17(1):2–6. DOI : 10.1097/MEJ.0b013e32831040ec

Bracard S, Ducrocq X, Mas JL, Soudant M, Oppenheim C, Moulin T, Guillemin F, investigators T. Mechanical thromb- ectomy after intravenous alteplase versus alteplase alone after stroke (THRACE): a randomised controlled trial. Lancet Neurol. 2016;15(11):1138–1147. DOI: 10.1016/S1474-4422(16)30177-6.

Bray JE, Coughlan K, Barger B, Stroke CB, 2010. Paramedic diagnosis of stroke: examining long-term use of the Melbourne Ambulance Stroke Screen (MASS) in the field. Stroke. 2010;41:1363-1366. DO : 10.1161/STROKEAHA.109.571836

Bray JE, Martin J, Cooper G, Barger B, Bernard S, Bladin C. Paramedic Identification of Stroke: Community Validation of the Melbourne Ambulance Stroke Screen. Cerebrovasc Dis 2005;20(1):28–33. DOI: 10.1159/000086201

Chen S, Sun H, Lei Y, et al. Validation of the Los Angeles Pre-Hospital Stroke Screen (LAPSS) in a Chinese Urban Emergency Medical Service Population. PLoS ONE 2013;8(8):e70742. DOI: 10.1371/journal.pone.0070742

Chenkin J, Gladstone DJ, Verbeek PR, et al. Predictive Value of the Ontario Prehospital Stroke Screening Tool for the Identification of Patients with Acute Stroke. Prehosp Emerg Care 2009;13(2):153–9. DOI : 10.1080/10903120802706146

Collaborators GMaCoD. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980–2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet. 2016;388(10053):1459–1544. DOI: 10.1016/S0140-6736(16)31012-1.

Emberson J, Lees KR, Lyden P, Blackwell L, Albers G, Bluhmki E, et al. Effect of treatment delay, age, and stroke severity on the effects of intravenous thrombolysis with alte- plase for acute ischaemic stroke: a meta-analysis of individual patient data from randomised trials. Lancet. 2014;384(9958):1929–1935. DOI: 10.1016/S0140-6736(14)60584-5

English SW, Rabinstein AA, Mandrekar J, Klaas JP. Rethinking Prehospital Stroke Notification: Assessing Utility of Emergency Medical Services Impression and Cincinnati Prehospital Stroke Scale. J Stroke Cerebrovasc Dis 2018;27(4):919–25. DOI : 10.1016/j.jstrokecerebrovasdis.2017.10.036

Fothergill RT, Williams J, Edwards MJ, Russell IT, Gompertz P. Does use of the recognition of stroke in the emergency room stroke assessment tool enhance stroke recognition by ambulance clinicians? Stroke 2013;44(11):3007–12. DOI : 10.1161/STROKEAHA.13.000851

Frendl DM, Strauss DG, Underhill BK, Goldstein LB. Lack of Impact of Paramedic Training and Use of the Cincinnati Prehospital Stroke Scale on Stroke Patient Identification and On-Scene Time. Stroke 2009;40(3):754–6. DOI : 10.1161/STROKEAHA.108.531285

Greenberg K, Lesenskyj A, Eichorn D, Maxwell CR, et al. (2017). Change Takes Time: EMS as the Spark Plug for Faster Acute Ischemic Stroke Care. Mathews J Emergency Med. 2(2): 025.

Harbison J, Hossain O, Jenkinson D, Davis J, Louw SJ, Ford GA. Diagnostic Accuracy of Stroke Referrals from Primary Care, Emergency Room Physicians, and Ambulance Staff Using the Face Arm Speech Test. Stroke 2003;34(1):71–6. DOI : 10.1161/STROKEAHA.13.000851

Iguchi Y, Kimura K, Watanabe M, Shibazaki K, Aoki J. Utility of the Kurashiki Prehospital Stroke Scale for Hyperacute Stroke. Cerebrovasc Dis 2011;31(1):51–6. DOI : 10.1159/000320854

Kidwell CS, Starkman S, Eckstein M, Weems K, Saver JL. Identifying stroke in the field. Prospective validation of the Los Angeles prehospital stroke screen (LAPSS). Stroke 2000;31(1):71–6. DO I: 10.1161/01.STR.31.1.71

Kim DH, Kim SW, Jun SM, Kim JK. Accuracy of prehospital stroke recognition by paramedics and TPA therapy rate after transportation. Journal of the Neurological Sciences 2017;381:867. DOI : 10.1016/j.jns.2017.08.2444

Li T, Munder SP, Chaudhry A, Madan R, Gribko M, Arora R. Emergency Medical Services Providers' Knowledge, Practices, And Barriers To Stroke Management. Open Access Emerg Med 2019;11:297–303. doi: [10.2147/OAEM.S228240](https://dx.doi.org/10.2147%2FOAEM.S228240)

Lin CB, Peterson ED, Smith EE, Saver JL, Liang L, Xian Y, Olson DM, et al. Emergency medical service hospital prenotification is associated with improved evaluation and treat- ment of acute ischemic stroke. Circ Cardiovasc Qual Outcomes. 2012;5(4):514–522. DOI: 10.1161/CIRCOUTCOMES.112.965210. Epub 2012 Jul 10.

McMullan JT, Katz B, Broderick J, Schmit P, Sucharew H, Adeoye O. Prospective prehospital evaluation of the Cincinnati Stroke Triage Assessment Tool. Prehosp Emerg Care. 2017;21(4):481–488. DOI: 10.1080/10903127.2016.1274349. Epub 2017 Jan 25.

Medoro I, Cone DC. An analysis of EMS and ED detection of stroke. Prehosp Emerg Care. 2017;21(4):476–480. DOI: 10.1080/10903127.2017.1294222. Epub 2017 Mar 24.

Mould-Millman NK, Meese H, Alattas I, Ido M, Yi I, Oyewumi T, Colman M, Frankel M, Yancey A, II. Accuracy of prehospital identification of stroke in a large stroke belt municipality. Prehosp Emerg Care. 2018:1–9. doi: 10.1080/ 10903127.2018.1447620 DOI: 10.1080/10903127.2018.1447620.

O'Brien W, Crimmins D, Donaldson W, et al. FASTER (Face, Arm, Speech, Time, Emergency Response): experience of Central Coast Stroke Services implementation of a pre-hospital notification system for expedient management of acute stroke. J Clin Neurosci 2012;19(2):241–5. DOI : 10.1016/j.jocn.2011.06.009

Pickham D, Valdez A, Demeestere J, et al. Prognostic Value of BEFAST vs. FAST to Identify Stroke in a Prehospital Setting. Prehospital Emergency Care 2018;23(2):195–200. DOI : 10.1080/10903127.2018.1490837

Ramanujam P, Guluma KZ, Castillo EM, et al. Accuracy of Stroke Recognition by Emergency Medical Dispatchers andParamedics—San Diego Experience. Prehosp Emerg Care 2008;12(3):307–13. DOI : 10.1080/10903120802099526

Saver JL, Goyal M, van der Lugt A, Menon BK, Majoie CB, Dippel DW, et al. Time to treatment with endovascular thrombectomy and outcomes from ischemic stroke: a meta- analysis. JAMA. 2016;316(12):1279–1288. DOI: 10.1001/jama.2016.13647.

Schlemm E, Ebinger M, Nolte CH, Endres M, Schlemm L. Optimal transport destination for ischemic stroke patients with unknown vessel status: use of prehospital triage scores. Stroke. 2017;48(8):2184–2191. DOI: 10.1161/STROKEAHA.117.017281. Epub 2017 Jun 27.

Singer OC, Dvorak F, du Mesnil de Rochemont R, Lanfermann H, Sitzer M, Neumann-Haefelin T. A simple 3- item stroke scale: comparison with the National Institutes of Health Stroke Scale and prediction of middle cerebral artery occlusion. Stroke. 2005;36(4):773–776. DOI: [10.1161/01.STR.0000157591.61322.df](https://doi.org/10.1161/01.STR.0000157591.61322.df)

Singletary EM, Zideman DA, De Buck ED, Chang WT, Jensen JL, [Swain JM](https://www.ncbi.nlm.nih.gov/pubmed/?term=Swain%20JM%5BAuthor%5D&cauthor=true&cauthor_uid=26472857), [Woodin JA](https://www.ncbi.nlm.nih.gov/pubmed/?term=Woodin%20JA%5BAuthor%5D&cauthor=true&cauthor_uid=26472857), Blanchard IE, Herrington RA, Pellegrino JL, Hood NA, Lojero-Wheatley LF, Markenson DS, Yang HJ; Part 9: First Aid: 2015 International Consensus on First Aid Science with Treatment Recommendations. Circulation. Oct 20 2015;132 (16 Suppl 1):S269-311. DOI: [10.1161/CIR.0000000000000278](https://doi.org/10.1161/CIR.0000000000000278)

Studnek JR, Asimos A, Dodds J, Swanson D. Assessing the Validity of the Cincinnati Prehospital Stroke Scale and the Medic Prehospital Assessment for Code Stroke in an Urban Emergency Medical Services Agency. Prehosp Emerg Care 2013;17(3):348–53. DOI : 10.3109/10903127.2013.773113

Vanni S, Polidori G, Pepe G, et al. Use of biomarkers in triage of patients with suspected stroke. J Emerg Med 2011;40(5):499–505. DOI : 10.1016/j.jemermed.2008.09.028

Wall HK, Beagan BM, O'Neill J, Foell KM, Boddie-Willis CL. Addressing stroke signs and symptoms through public education: the Stroke Heroes Act FAST campaign. Prev Chronic Dis 2008;5(2):A49.

Wojner-Alexandrov AW, Alexandrov AV, Rodriguez D, Persse D, Grotta JC. Houston Paramedic and Emergency Stroke Treatment and Outcomes Study (HoPSTO). Stroke 2005;36(7):1512–8. DOI:

You JS, Chung SP, Chung HS, et al. Predictive value of the Cincinnati Prehospital Stroke Scale for identifying thrombolytic candidates in acute ischemic stroke. Am J Emerg Med 2013;31(12):1699–702. DOI : 10.1016/j.ajem.2013.08.029

Zideman DA, Singletary EM, , De Buck EDJ, Chang WT, Jensen JL, Swain JM, Woodin JA, Blanchard IE, Herrington RA, Pellegrino JL, Hood NA, Lojero-Wheatley LF, Markenson DS, Yang HJ; on behalf of the First Aid Chapter Collaborators. Part 9: First aid: 2015 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations. Resuscitation. 2015; 95: e225 - e261. DOI:[10.1016/j.resuscitation.2015.07.047](https://doi.org/10.1016/j.resuscitation.2015.07.047)