Modelling the Use of a New Large Vessel Occlusion Screening Tool for Ischemic Stroke Transport Decision Making in Victoria, Australia

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Background

- Clinical triage tools facilitate pre-hospital recognition of large vessel occlusion (LVO) for endovascular thrombectomy (EVT).
- Tools have variable positive predictive value (PPV), which impacts transport decision-making.
- We modelled the effects of the Los Angeles Motor Scale (LAMS) and Ambulance Clinical Triage For Acute Stroke Treatment (ACT-FAST) algorithm, on transport strategies for EVT in Victoria, Australia.

Methods

- The PPVs of both screening tools from a prospective validation study, the efficacy decay of alteplase and EVT over time, and treatment and transport times were combined to create a conditional probability model.
- Using the model the probability of good outcome (mRS 0–1 at 90 days) for both drip-and-ship and mothership transport strategies was predicted.
- Colour coded maps were then created depicting the best transport strategy.

Results

- Because the PPV of ACT-FAST+ is higher than LAMS ≥4 (56% vs 43%) the areas where mothership predicts the best patient outcome are larger regardless of treatment times at the thrombolysis and EVT centres (Figure).
- This difference is especially pronounced if door to needle times at thrombolysis centres are slow (Figure – Panel B).
- Using ACT-FAST the absolute probability of good outcome decreases as a function of the increased PPV, this is due to more large vessel occlusion strokes (with inherently poorer outcomes than most false positives) being identified.

Discussion

- Due to the efficacy of EVT for large vessel occlusion stroke, a triage tool with a high positive predictive value increases the area where a mothership transport strategy predicts the greatest probability of good outcome for patients with suspected large vessel occlusion.
- Because screening tool PPV impacts transport decision making, the tool used in each jurisdiction should be taken into consideration when designing EMS coverage areas and transport protocols.
- These models represent average patients under average conditions.
- In the scenarios where widespread mothership transport is predicted to produce best outcomes, practical considerations such as capacity at the EVT centre, weather, and redundancy in ambulance systems when an ambulance has to travel outside of its jurisdiction are also relevant.

Figure: Maps depicting the best predicted transport strategy for patients with suspected ischemic stroke with large vessel occlusion, defined as Ambulance Clinical Triage For Acute Stroke Treatment (ACT-FAST) positive or Los Angeles Motor Scale (LAMS) Score ≥4 in the state of Victoria, Australia. Thrombolysis centres are depicted by black dots and endovascular therapy (EVT) centres are depicted by blue diamonds. Three different treatment efficiency scenarios are shown (Panels A – C). Red indicates areas where drip-and-ship predicts the greatest probability of excellent outcome and green indicates areas where mothership predicts the greatest probability of excellent outcome. White stippling indicates areas where the optimal transport method supersedes the other by 1% or less. The degree of colour saturation reflects the value of the probability of excellent outcome. Grey areas indicate a lack of road infrastructure data thus transport times and therefore optimal transport method could not be determined.