

Article details: 2016-0166	
Title	Geospatial analysis to explore access to hyperacute stroke services across Canadian provinces
Authors	Prasanna Venkatesan Eswaradass, Richard H. Swartz, Jamey Rosen, Michael D. Hill, M. Patrice Lindsay
Reviewer 1	Dr. Mohamad Hussein
Institution	Department of Surgery, University of Toronto, Toronto, Ont.
General comments (author response in bold)	<p>Thank you for the opportunity to review this manuscript that explores access to hyperactive stroke services in Canada using geospatial analysis. I have a few comments/questions:</p> <p>1) I'm surprised only 82 EMS locations were present in Ontario compared to 229 in Alberta, although Ontario is a much larger province with respect to geography and population. Do the authors have a hypothesis to explain this observation? Ontario has 82 main EMS base centres and most cities and towns will also have local base centres as well. Access to consistent and reliable data on location of all additional base centres was limited at the time of the study. The 82 main centres were included in the geospatial mapping as they yielded 96% to 97% of the population access to stroke centres. We have revised the text accordingly.</p> <p>2) Figure 1 is unclear. It appears to be a zoomed-in image of a specific geographic area, which I cannot establish. Perhaps a figure showing the complete map of Canada with stroke centers and populations with access to these centers will be more helpful. We agree and have updated the Figure</p> <p>3) Older individuals may live in geographically diverse areas compared to the general Canadian population. Since the majority of patients with stroke are older, a subgroup analysis limited to older individuals (i.e. those aged >65) may help provide further insight into whether these higher risk individuals have better or worse access to care. This is an interesting concept for a future study. However, we are unable to provide subgroup analysis for older individuals now.</p> <p>4) Given residents of SK and NL have suboptimal access to hyper acute stroke services, a figure showing current stroke centers + populations in these provinces may help further emphasize this point. Yes, we agree and have added a supplementary figure</p> <p>5) Are the authors able to provide an estimation of air ambulance services available in provinces? This will be particularly important to know in areas with suboptimal land EMS services (SK + NL), as it may mitigate or further emphasize the problem. Access and availability of air ambulance is inconsistent. The current data is insufficient to make any comments.</p> <p>6) I'm assuming geospatial analysis does not account for variables such as road traffic, construction delays, waster transport, bridges, etc. - this should be noted as a limitation. The algorithm does account for bridges, water transport, historical traffic patterns, and other permanent impediments to driving, however it does not account for transient features such as construction. We agree and have added to methods section.</p>
Reviewer 2	Dr. Joanna Schaafsma MD PhD
Institution	Toronto Western Hospital, Toronto, Ont.
General comments (author response in bold)	<p>The authors describe the proportion of the population in Canada that can be brought to a stroke center within the treatment window for acute ischemic stroke. This is crucial information to optimize the hyper acute stroke care; especially after mechanical thrombectomy became part of the standard stroke treatment.</p> <p>Abstract:</p> <p>1. I understand that part of the questions below will be answered in the article, but it may be helpful if some aspects are further clarified in the abstract.</p> <p>Background:</p> <p>2. A reader who is not involved in stroke management may not be aware of the time windows for hyper acute stroke treatment. Could you briefly mention them? As per Canadian best practice recommendations, intravenous tPA is offered for disabling stroke within 4.5 hours and endovascular thrombectomy for strokes due to large vessel occlusion within 6 hours of onset. We thank the reviewer for mentioning this to us. This has been added to introduction.</p> <p>Methods:</p> <p>3. Could you indicate that the stroke centers were not all endovascular sites? The primary and comprehensive stroke centers can offer tPA. However, only a small number of centers could offer endovascular therapy. Yes, This has been added to methods section.</p> <p>4. What does a 'proportional area' mean? (Reading the article it becomes clear, but this sentence in the abstract remains hard to understand.) A proportional area in this context refers to the method of normalizing the population of a given postal code by the fraction of a given postal code that is within a drive time polygon. For example, if 40% of a postal code with a population of 100,000 is within a drive-time polygon for a stroke center, it is assumed that 40,000 people in that postal code have the associated access to that stroke center.</p> <p>5. Could you explain the abbreviation FSA? FSA refers to Forward Sorting Area, i.e., the region that shares the first three digits of a given postal code. FSA has been expanded in abstract.</p> <p>Results:</p>

6. In the methods a drive time interval of 3.5-6 hours is mentioned, but the results of 4.5 and 6 hours are presented. I would make this consistent.

**We determined the portion of residents that can reach a hospital between 3.5 and 6 hours. (Methods)
We have mentioned the proportion of population that lived within 3.5, 4.5 and 6 hours' drive from a stroke center via EMS in the results section.**

Body of the article:

Methods:

7. Page 5 Line 48: Why 'thus'? Why were 3.5h, 4.5h, 5h, and 6h chosen? Why were the 5h and 6h drive times calculated for centers that do not offer endovascular treatment?

Intravenous tPA is offered to disabling strokes within 4.5 hrs. Patients must present to stroke center earlier than 4.5 hrs to receive the treatment. Hence, 3.5 hrs were chosen. Most patients with large vessel occlusion are offered endovascular therapy (EVT) within 6hrs. Few selected group of patients get endovascular therapy up to 12hrs. Those centers which do not offer EVT for large vessel occlusion would transport the patients to EVT centers within 6 hrs.

8. As you mention in your results and discussion, the model contains many assumptions. Did you consider adding sensitivity analysis to assess how your assumptions impact your results? This would also enable you to provide a level of uncertainty around your point estimates.

By examining differing time windows for access, we are doing a type of sensitivity analysis.

Results:

9. Page 6 Line 42: With respect to the number of hospitals, are these stroke centers? It would be helpful to know the total number of stroke centers in relation to the total number of endovascular sites.

The section has been revised to clarify the hospital categories:

Alberta with 229 EMS centers and 96 hospitals (of which 20 were stroke centres, including 2 ESCAPE EVT sites), and Ontario with 82 EMS main base centres (with additional local centres) and 165 hospitals (of which 38 were stroke centres including 5 ESCAPE EVT sites and 4 planned additional EVT sites)

10. Page 6 Line 56: 'estimated 79%'. Estimated based on what?

79% is the average population in the 8 provinces with access to a Advanced or Comprehensive Stroke Center within a 4.5 hour drive time.

11. In the methods, you do not mention analysis for self-transport while you present some of these drive times in your results and discussion. Could you add this to your methods?

Yes we agree and we have added self-drive to methods

Table 1:

12. Please explain the abbreviations

Thank you for pointing it out. We have explained the abbreviations.

Table 2:

13. Why are only the results presented for 4.5h, and not for 3.5h, 5h, and 6h drive times?

This is the most immediately relevant time period since it represents the current standard eligibility criteria for intravenous alteplase(tPA). In addition, the numbers do not change substantially for longer or shorter times and so these values are representative.