

Article details: 2012-0067	
Title	The quality of hyperacute ischemic stroke treatment in Canada
Authors	Aravind Ganesh, Marie Camden, Patrice Lindsay, Moira K. Kapral, Robert Cote, Jiming Fang, Brandon Zagorski, Michael Douglas Hill ; for the Canadian Stroke Audit Group
Reviewer 1	Dr. Scott Sloka
Institution	St. John's, Newfoundland and Labrador
General comments	<p>The paper is a large chart review of patients who have had acute strokes in Canada over one year beginning in 2008. Even though it is, at the most basic, a descriptive study, the paper is comprehensive, of very high quality, well-designed, and the information is important in that it will be used by district stroke centres in Canada as a benchmark for improvement strategies.</p> <ol style="list-style-type: none"> <li>1. The introduction is well organized; however, the statement that the use of thrombolysis is an important quality indicator should have a reference or two. It is the basis of the entire study and should be strongly justified.</li> <li>2. Reference 9 on page 16 has multiple spelling mistakes.</li> <li>3. The use of reference 9 in the introduction suggests a low rate of tPa. Reference 9 is again used in the interpretation. Is a comparison possible between the two datasets, separated by 9 Pa, or even a reference to the previous rate of tPa? Is the current paper a descriptive study stating only the rate of tPa in 2008, or is it meant to demonstrate an improvement over time by using references 22–24?</li> <li>4. Page 5. What percentage of charts did not contain 30% of the data? This would be important to state briefly as it adds a bias.</li> <li>5. Why not describe regional statistics? Even though regional QA testing is invoked in some parts of the country, if this paper is used as a basis for improvement, then regional numbers could be useful as general benchmarks. Regional comparisons would not be necessary, but if the paper is space-limited either by max number of tables or word count, this suggestion can be left aside.</li> <li>6. Page 6. The 38 206/88% is a little bit confusing. Does this mean that 12% were lost due to data cleaning, or due to weighted adjustment, or both?</li> <li>7. Page 6. I realize that quoting percentage that received tPa for both all strokes and ischemic strokes includes an extra data point, but it is a little confusing for a general reader as one would not normally give tPa for a hemorrhagic stroke. Not a criticism as I understand what is meant, but a general readership for the CMAJ might not easily make the leap. Can this sentence (line 13) be clarified?</li> <li>8. The average length of stay was 16 days. Was this median or mean? It makes a difference as patients with more devastating outcomes will skew the results. As well, is this the length of stay at the acute stroke unit, or combined with any rehabilitation facility stay in total?</li> <li>9. Interpretation. Any statement as to why the thrombolysis rate is double at comprehensive stroke centres compared with primary stroke centres if the most common limitation is during the pre-hospital phase? This would make this difference even more meaningful and might help the primary stroke centres focus for improvement, unless for the comprehensive stroke centres, the out-of-hospital infrastructure is better/less spread out geographically, etc.</li> <li>10. This question does not have to be answered, but is there a plan to repeating the study in the future, or is the plan to encourage regional QA to take this on and improve quality of care?</li> </ol>
Reviewer 2	Dr. John Wootton
Institution	Shawville, Que.
General comments	This is a timely paper on an important subject and it is good to have Canadian data to enhance the discussions that are taking place in many provinces.

	<p>A non-statistician might find him/herself somewhat perplexed by the statistical manipulation of the data, which allowed a 22% sample to be described as representative of 88% of all cases. Although the described “weighting” is undoubtedly appropriate, it might not seem so to the statistically naive reader.</p> <p>One of the differences that may explain some of the difference between Finland and Canada, is the relative differences in population distribution and geography. It might be interesting to see these element mentioned. Centralization of all cases to stroke centers may not be realistic in the Canadian context.</p>
<p>Author response</p>	<p>Reviewer: 1</p> <p>1. The introduction is well-organized, however the statement that the use of thrombolysis is an important quality indicator should have a reference or two. It is the basis of the entire study and should be strongly justified.</p> <p>We have added 3 references demonstrating that thrombolysis use is a focal point of quality improvement initiatives internationally.</p> <p>2. Reference 9 itself on page 16 has multiple spelling mistakes.</p> <p>This has been corrected (it is now reference 12).</p> <p>3. The use of reference 9 in the introduction suggests a low rate of tPA. Reference 9 is again used in the interpretation. Is a comparison possible between the two data sets, separated by 9 years, or even a reference to the previous rate of tPA? Is the current paper a descriptive study stating only the rate of tPa in 2008, or is it meant to demonstrate an improvement over time by using references 22-24?</p> <p>We have attempted such a comparison, which in this case demonstrates the great distance that remains to be covered in Canadian stroke care, despite the successes of individual centres that have been referenced. In page 9, paragraph 1, we write:</p> <p style="padding-left: 40px;">Salient differences in study design including the types of centres included prevent a fair comparison between the CASES study and this audit, but it is worth noting that the median onset-to-treatment time in CASES was 155 minutes with a door-to-needle time of 85 minutes, compared to a mean of 252 and 121 minutes respectively in this audit. This demonstrates the need to translate the successes of selected centres into national strategies targeting treatment times.</p> <p>4. Page 5. What percentage of charts did not contain 30% of the data? This would be important to state briefly as it adds a bias.</p> <p>We 9940 audited charts, of which 9588 were usable. Thus there were 352 (3.5%) discarded charts due to incomplete data (n=142), or a non-stroke diagnosis (n=143) or a duplicate record (n=67). We have amended the results to show this result.</p> <p>5. Why not describe regional statistics? Even though regional QA testing is invoked in some parts of the country, if this paper is used as a basis for improvement, then regional numbers could be useful as general benchmarks. Regional comparisons would not be necessary, but if the paper is space-limited either by max number of tables or word count, this suggestion can be left aside.</p> <p>See response to editorial comment #5 above. We intend analyses by province in a parallel report.</p> <p>6. Page 6. The 38,206/88% is a little bit confusing. Does this mean that 12% were lost due to data cleaning, or due to weighted adjustment, or both?</p> <p>As mentioned above, 5.35% or 542 of the 10,130 charts that were reviewed were discarded in the data cleaning process. Upon applying our weighted adjustment to the sample of 9,588 charts that remained, the sample was deemed to represent 38,206 cases which would account for 88% of the total number of stroke cases.</p> <p>7. Page 6. I realize that quoting percentage that received tPA for both all strokes and ischemic strokes includes an extra data point, but it is a little confusing for a general reader as one would not normally give tPA for a hemorrhagic stroke. Not a criticism as I understand what is meant, but a general readership for the CMAJ might not easily</p>

*make the leap. Can this sentence (line 13) be clarified?*

In general, ischemic stroke makes up 85% of all strokes and hemorrhagic stroke types (SAH, ICH) make up 15% of all strokes. Further, in the literature the varying use of the correct denominator – as the reviewer has astutely remarked – causes confusion. We have clarified this as follows:

A total of 5.4% (95% confidence interval [CI] 5.1-5.6) of all stroke patients in Canada received thrombolysis, and on considering the subtype of ischemic stroke patients – since the treatment is contraindicated in hemorrhagic strokes – we found that 6.1% (95% CI 5.8-6.4) them received thrombolysis (Table 1b).

*8. The average length of stay was 16 days. Was this median or mean? It makes a difference as patients with more devastating outcomes will skew the results. As well, is this the length of stay at the acute stroke unit, or combined with any rehabilitation facility stay in total?*

As indicated in Table 3 (page 17), this number is a mean. We appreciate and agree with **the reviewer's comment that the mean would be more sensitive to skewing by devastating outcomes.** The length of stay included only stay in an acute care facility and did not include additional stay in a rehabilitation facility.

*9. Interpretation. Any statement as to why the thrombolysis rate is double at comprehensive stroke centres compared with primary stroke centres if the most common limitation is during the pre-hospital phase? This would make this difference even more meaningful and might help the primary stroke centres focus for improvement, unless for the comprehensive stroke centres, the out-of-hospital infrastructure is better/less spread out geographically, etc.*

Indeed, the out-of-hospital infrastructure – facilitated by the pathways at these centres – does appear to contribute to the difference. We have included the following statement on the difference in the pre-hospital phase itself that was seen between **comprehensive stroke centres and other centres (Page 7 paragraph 3). We've also highlighted the fact that these centres have a clear "brain attack" pathway:**

There was a statistically significant difference between onset-to-arrival time for the comprehensive stroke centres and other facilities, including primary stroke centres, with a shorter time seen at the comprehensive centres, which likely facilitated higher thrombolysis rates. Yet even at comprehensive stroke centres where most patients arrive by ambulance, and thus present with a **presumed stroke diagnosis allowing for activation of "stroke code" or "brain attack" pathways, the mean onset-to-arrival time is slightly more than 3 hours.**

In page 8 paragraph 2 we also discuss the remedial barrier of in-hospital processes which applies to both comprehensive and primary stroke centres.

*10. This question does not have to be answered, but is there a plan to repeating the study in the future, or is the plan to encourage regional QA to take this on and improve quality of care?*

There are ongoing efforts to improve the quality of care in hyperacute stroke across the country. We do intend to repeat this type of audit in the future; the timing will depend upon funding.

**Reviewer: 2**

*1. A non-statistician might find him/herself somewhat perplexed by the statistical manipulation of the data which allowed a 22% sample to be described as representative of 88% of all cases. Although the described 'weighting' is undoubtedly appropriate, it might not seem so to the statistically naive reader.*

We were sent the following comment from the editorial team, in response to this comment: *Our statistician thought your use of weighting was well done so please do not feel obliged to respond to the reviewer's comment on this point.*

*2. One of the differences, which may explain some of the difference between Finland and Canada, is the relative differences in population distribution and geography. It might be interesting to see these elements mentioned. Centralization of all cases to*

*stroke centers may not be realistic in the Canadian context.*

We have mentioned the salient geographical and population distribution differences, but have highlighted that the Helsinki approach could be replicated at the individual facility level in Canada – while the great travel distances in Canada pose a bigger challenge for reducing time in the pre-hospital phase, the key challenge highlighted by the paper when referring to Helsinki is not that of centralization but that of reducing in-hospital times (Page 8, paragraph 2). Further, in Canada 90% of the population lives within 60 minutes' drive of a CT scanner, implying that even with our low population density (3 persons per km<sup>2</sup>), we ought to be able to do better.

Whereas the smaller land area of Finland may facilitate faster transport or onset-to-door times compared to the more widespread population served in **Canada, we should be able to replicate Helsinki's success with door-to-treatment times by optimizing in-hospital processes.** Melbourne recently demonstrated the rapid transferability of the Helsinki stroke thrombolysis model, achieving a 25 minute door-to-needle time within 8 months of protocol change [25].