Quantifying candidate volume for endovascular therapy for acute ischemic stroke at Health Sciences North: a one-year, retrospective chart review

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Abstract:	Health Sciences North (HSN) is a regional stroke center, delivering Alteplase (r-tPA) through its stroke-on-call team to the residents of Sudbury, Ontario and surrounding district. Several large multi-center trials have demonstrated robust functional benefits of endovascular therapy (EVT) in the treatment of acute ischemic stroke. There are currently 10 centers offering EVT in Ontario. HSN does not currently have the capacity to provide EVT. To optimize treatment benefit, potential EVT candidates must be transported within two hours to an EVT centre. HSN is not within this transport time. Establishing HSN as a centre for EVT would provide access to the residents of Northeastern Ontario. Quantifying the potential procedural volume is an important first step as a minimum of 20 annual procedures are required to maintain physician competency. The medical records and neurovascular imaging of 71 acute ischemic stroke patients seen by the stroke-on-call team at HSN between May 1st, 2016 and April 30th, 2017 were retrospectively reviewed in accordance with ESCAPE trial criteria to identify potential EVT candidates. Nine patients (4.21%) were identified as candidates both clinically and on imaging. Expanding this estimate to include regional referral centres within a 2-hour transport window to HSN, it was conservatively estimated that HSN has the potential to perform 22-23 procedures annually, meeting the minimum requirement to maintain competency. Five of the 9 identified candidates were deceased at 90 days. Establishing HSN as a centre for EVT is an important step in

	improving equity in stroke care and outcomes across Northeastern Ontario.

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Dr. Diane Kelsall
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April 16th, 2018

Dear Dr. Kelsall:

We are pleased to submit an original research article entitled "Quantifying candidate volume for endovascular therapy for acute ischemic stroke at Health Sciences North: a one-year, retrospective chart review" for consideration for publication in CMAJ Open.

In this paper, we show that Health Sciences North (HSN) in Sudbury, Ontario has the necessary volume of acute ischemic stroke patients who would qualify for endovascular therapy (EVT) to support the establishment of HSN as a center for EVT. The benefit of EVT has been demonstrated in several large multi-center trials. We modelled our eligibility criteria after the ESCAPE trial, which not only demonstrated drastically improved functional outcomes but also decreased mortality in acute ischemic stroke patients who received EVT compared to medical management alone. Although there are currently 10 centers in Ontario offering this therapy, none are accessible within the recommended 2-hour maximum transport time from hospitals within Northeastern Ontario (NEO). As such, the residents of NEO are currently without access to this new standard of care.

We believe that this paper is an excellent fit for CMAJ Open. This research study is the first step in capacity planning to establish HSN as an EVT center. It confirms that there is indeed the quantity of candidates in NEO to maintain physician competency. It allows us to continue the planning process to establish HSN as a center for EVT in NEO. If successful, this would ensure the residents of Northeastern Ontario have equitable access to the right service at the right time.

Thank you for considering our article for publication in your journal.

Sincerely,

P. Puranam

Quantifying candidate volume for endovascular therapy for acute ischemic stroke at Health Sciences North: a one-year, retrospective chart review

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Abstract

Health Sciences North (HSN) is a regional stroke center, delivering Alteplase (r-tPA) through its stroke-on-call team to the residents of Sudbury, Ontario and surrounding district. Several large multi-center trials have demonstrated robust functional benefits of endovascular therapy (EVT) in the treatment of acute ischemic stroke. There are currently 10 centers offering EVT in Ontario. HSN does not currently have the capacity to provide EVT. To optimize treatment benefit, potential EVT candidates must be transported within two hours to an EVT centre. HSN is not within this transport time. Establishing HSN as a centre for EVT would provide access to the residents of Northeastern Ontario. Quantifying the potential procedural volume is an important first step as a minimum of 20 annual procedures are required to maintain physician competency. The medical records and neurovascular imaging of 71 acute ischemic stroke patients seen by the stroke-on-call team at HSN between May 1st, 2016 and April 30th, 2017 were retrospectively reviewed in accordance with ESCAPE trial criteria to identify potential EVT candidates. Nine patients (4.21%) were identified as candidates both clinically and on imaging. Expanding this estimate to include regional referral centres within a 2-hour transport window to HSN, it was conservatively estimated that HSN has the potential to perform 22-23 procedures annually, meeting the minimum requirement to maintain competency. Five of the 9 identified candidates were deceased at 90 days. Establishing HSN as a centre for EVT is an important step in improving equity in stroke care and outcomes across Northeastern Ontario.

Introduction

The publication of five large, randomized, multi-center studies have demonstrated the efficacy of endovascular therapy (EVT) in improving functional outcomes among patients presenting with an acute ischemic stroke (AIS) secondary to occlusion of a large proximal intracerebral artery (1-5). A review of these trials found a significantly greater rate of functional independence at 90 days among those receiving EVT vs. medical management alone, as demonstrated by a number needed to treat (NNT) of 2.6 (6). EVT involves the retrieval of an intracerebral thrombus by means of a retrieval stent or thrombus aspiration device (7). Despite being more resource-intensive than other therapies, EVT has been found to be cost-effective (8). Of the five randomized trials, the ESCAPE trial demonstrated the most drastically improved functional outcomes and decreased mortality in those receiving EVT compared to medical management alone (2).

Currently, there are 10 health sciences centres in Ontario that offer EVT, the majority of which are clustered in Southern Ontario. Health Sciences North (HSN) is the Regional Stroke Centre for Northeastern Ontario. HSN accepts hyperacute stroke patients from the district via an EMS bypass protocol. It has access to advanced medical neuroimaging with fellowship trained Neuroradiologists, intensive care services, neurosurgery and acute stroke and rehabilitation units. HSN currently does not offer EVT, requiring transport of candidates to an existing center. Current EMS standards dictate transport time from a referral centre to an EVT centre by land or air ambulance should not exceed 2 hours (9). HSN is outside this maximum transport time, largely precluding eligible patients from accessing this new standard of care. The CorHealth Ontario EVT steering committee thus suggests that centres outside the maximum transport time start capacity planning to establish new EVT centres to improve access (9).

The current Health Quality Ontario (2016) guidelines suggest that an EVT centre perform a minimum of 20 procedures annually to maintain competency (9), which is in accordance to the guidelines set out by the World Federation of Interventional Neuroradiology, adopted by the American Society for Neuroradiology, the Canadian Interventional Neuroadiology Group and the Canadian Society for Neuroradiology (10). As such, the objective of this study was to determine how many patients presenting to HSN with AIS would have potentially qualified for EVT. We predicted that this volume, once projected to include referring centres within Northeastern Ontario, would meet the minimum value of 20 annual procedures to support establishment of an EVT centre.

Methods

Inclusion/Exclusion Criteria

The study design was a retrospective chart review of all patients with a discharge diagnosis of cerebral infarction admitted to HSN between May 1st, 2016 and April 30th, 2017. Only patients presenting within 24 hours of symptom onset and seen by the stroke-on-call team, were included in the review. Only patients seen by stroke-on-call, who consult for thrombolysis eligibility, were included as these are the AIS patients who receive the requisite imaging as described below. Patients that either bypassed or presented to an emergency department (ED) in HSN's catchment area and were subsequently transferred to HSN were also included. Bypass protocol allows EMS to bypass a community hospital and present directly to HSN if the patient meets protocol criteria. In the study period, 214 patients were discharged from HSN with a diagnosis of cerebral infarction. After excluding patients that did not meet the inclusion criteria, a total of 71 patient charts were reviewed.

Data Collection

Each chart was reviewed to determine clinical and imaging candidacy for EVT in accordance with the ESCAPE trial criteria (Table 1). Data was collected from the patient's paper chart and electronic medical records. Clinical data recorded included date and time of symptom onset, time of presentation to HSN's ED, and time of assessment by stroke-on-call. Date and time of relevant imaging, including non-contrast CT of the head and multiphasic CTA arch-to-vertex, was also noted. The NIHSS score assigned by stroke-on-call was recorded. Since modified Barthel index scores were not available, pre-event functional status was determined through review of the occupational therapy assessments. Patients were considered independent if they could complete activities of daily living independently. Other relevant clinical data collected included whether the patient was bypassed or if r-tPA was administered.

Clinical Criteria	**Imaging Criteria**
Functionally independent pre-stroke (Barthel index above 90)	Proximal intracerebral artery occlusion M1-MCA, carotid L/T, basilar, M1-MCA equivalent on computed tomography angiography (CTA) of the extra- and intracerebral arteries
Moderate to Severe symptoms on presentation (National Institute of Health Stroke Scale (NIHSS) score above 5)	Moderate- good collateral circulation on Multiphasic CTA
Time from presentation to femoral artery puncture < 6 hours **consideration also given to presentation between 6-12 hours	ASPECTS (Alberta Stroke Program Early CT Score) > 5 on non-contrast computed tomography (CT)

Table 1. Criteria for eligibility for endovascular therapy (EVT) for acute ischemic stroke patients as per the ESCAPE trial (11). Patients that met all criteria, both clinical and imaging, were randomly assigned to receive EVT and best medical management or best medical management alone.

Imaging data was collected from the unenhanced CT of the head and multiphasic CTA arch-to-vertex. An ASPECTS score was calculated from the unenhanced CT to estimate the size of the infarct core. Site of occlusion and quality of collateral circulation were determined from

the multiphasic CTA. The multiphasic CTA also determined feasibility of arterial access based on vessel tortuosity, diameter, and stenosis.

Data Analysis

The clinical and imaging data collected were reviewed independently by a staff internist and staff neuroradiologist at HSN, respectively. Candidacy was determined by the inclusion and exclusion criteria as previously outlined. Only candidates that were independently determined to qualify for EVT both clinically and on imaging were considered candidates. If sufficient data were available, a modified Rankin score (mRS) at 90 days post-stroke was calculated for identified candidates to track functional outcomes (12).

Results

Relevant demographic and clinical data from the 71 admissions reviewed are listed in Table 2. Of the cases reviewed, 87% presented within the r-tPA window of 4.5 hours from symptom onset, 93% presented within the EVT window of 6 hours, and 97% presented within the extended EVT window of 12 hours. Imaging data is summarized in Table 3.

Following an independent review of the clinical and imaging data, 22 patients were identified as clinical EVT candidates and 11 patients were identified as EVT candidates on imaging. Of the 49 clinical non-candidates, 87.5% were excluded due to an NIHSS score below 5, indicating a mild stroke, or a NIHSS score was not recorded (Table 4). Of the 60 patients that did not meet the imaging criteria for EVT, 33.3% were considered non-evaluable due to a lack of a CTA on presentation (Table 5). Only 3 (15%) of these patients did not receive a CTA due to dye allergy or elevated creatinine. 60% of imaging non-candidates were eliminated based on the absence of a proximal vessel occlusion on CTA. Overall, 9 patients met both sets of criteria (Table 6). The two imaging candidates that did not meet the clinical eligibility criteria were

eliminated due to a low NIHSS score. The location of vessel occlusions for the 9 identified candidates is listed in Table 6.

Of the 9 identified EVT candidates, 5 were deceased at 90 days post-stroke and were assigned a mRS score of 6. Three of the candidates were lost to follow-up. The remaining candidate was assigned a mRS score of 3 at 90 days, indicating moderate disability.

Clinical Metric	N	Mean/value
Age	71	69.24 ± 14.09 years (38-92 years)
Sex	71	44 males, 27 females
Time from onset to presentation (hh:mm)		
Sudden-onset, non-bypass protocol	47	1:46 ± 1:10
Stroke-on-awakening	5	6:23 ± 2:57 *
Bypass protocol/presented to other ED	12	3:34 ± 2:53
Time from presentation to imaging (hh:mm)	71	0:30 ± 0:41
Time from presentation to stroke-on-call assessment (hh:mm)	66	0:58 ± 0:51
NIHSS	71	7.04 ± 6.50
0-4	24	34%
5-14	16	22%
15-24	5	7%
25+	2	3%
Not available/not completed	24	34%
Pre-stroke functional status	71	
Independent	66	93%
Required assistance	5	7%
Dependent	0	0%
Unknown	0	0%
tPA received	28	
Time from presentation to tPA	26	1:08 ± 0:21
Time from stroke onset to tPA	27	3:14 ± 1:20

Table 2. Values represent mean ± SD. Demographic and clinical data for 71 patients presenting to the emergency department at Health Sciences North with ischemic stroke symptoms between May 1st, 2016 and April 30th, 2017. All patients included presented within 24 hours of symptom onset and were assessed by a stroke-on-call physician. For time from onset to presentation, in-house strokes were not included. For stroke-on-awakening, time to presentation is from the time last seen normal. Bypass protocol represents patients presenting to an ED in HSN's catchment area (Manitoulin, Espanola, Elliot Lake) or if those EDs were bypassed by EMS and brought directly to HSN. For in-house strokes, time to assessment and imaging is from stroke onset. NIHSS: National Institute of Health Stroke Scale, completed at the time of stroke-on-call assessment. * Time from onset to presentation was significantly greater for strokes-on-awakening compared to sudden onset (bypass/non-bypass) strokes ($p<0.01$).

Imaging Metric	N	Mean/value
ASPECTS score	53	8.89 ± 1.86 (1-10)
Multiphasic CTA		
Completed on presentation	51	72%
Completed >12 hrs. after presentation	6	8%
Not completed	14	20%
Site of occlusion	51	
Carotid T	1	2%
Carotid L	1	2%
M1-MCA	9	18%
M1-MCA equivalent (2+ M2-MCAs)	2	4%
Basilar tip	1	2%
No proximal vessel occlusion	37	73%
Quality of collateral circulation	14	
Good	12	86%
Intermediate	2	14%
Poor	0	0%
Vascular access	14	
Suitable/feasible	12	86%
Unsuitable	2	14%

Table 3. Values represent mean ± SD. Values are in units of the associated scale. Imaging data for 71 patients presenting to the emergency department at Health Sciences North with ischemic stroke symptoms between May 1st, 2016 and April 30th, 2017. All patients included presented within 24 hours of symptom onset and were assessed by a stroke-on-call physician. Radiographs were assessed by a staff radiologist at HSN if both an unenhanced CT of the head and multiphasic CTA of the head and neck were completed within 12 hours of presentation to the ED. Quality of collateral circulation and feasibility of vascular access were not determined for patients with no proximal vessel occlusion identified on the CTA. ASPECTS: Alberta Stroke Program Early CT Score.

Clinical Candidacy	N	Mean/value
Clinical candidates	22	31.0%
Non-candidates	49	69.0%
NIHSS below 5	23	47.9%
NIHSS not available	19	39.6%
>12 hrs. from onset to presentation	3	6.3%
Not functionally independent pre-stroke	3	6.3%

Table 4. Clinical candidacy for acute ischemic stroke patients presenting to HSN emergency department within 24 hours of symptom onset (N = 71). All patients were seen by a stroke-on-call physician on presentation. Non-candidates are further stratified by the reason for their preclusion from clinical EVT candidacy.

Imaging Candidacy	N	Mean/value
Imaging candidates	11	15.5%
Non-candidates	60	84.5%
No proximal vessel occlusion	36	60.0%
Multiphasic CTA not completed on presentation	20	33.3%
Unsuitable proximal vessel access	2	3.3%
Extensive early ischemic changes on CT	2	3.3%

Table 5. Imaging candidacy for acute ischemic stroke patients presenting to HSN emergency department within 24 hours of symptom onset (N = 71). All patients were seen by a stroke-on-call physician on presentation. Non-candidates are further stratified by the reason for their preclusion from EVT candidacy on imaging.

EVT Candidacy	N	Mean/value
Clinical candidates	22	31.0%
Imaging candidates	11	15.5%
EVT candidates (both clinical *and* imaging candidates)	9	12.7%
Site of occlusion of EVT candidates		
Carotid T	1	
M1-MCA	6	
M1-MCA equivalent (2 or more M2-MCAs)	1	
Basilar artery (basilar tip)	1	
mRS score 90 days post-stroke (EVT candidates)	6	5.5 ± 1.2

Table 6. EVT candidacy based on clinical and imaging data for acute ischemic stroke patients presenting to HSN emergency department within 24 hours of symptom onset (N = 71). All patients were seen by a stroke-on-call physician on presentation. For patients considered to be candidates clinically and on imaging, the site of the proximal occlusion is listed. Modified Rankin scale (mRS) scores at 90 days post-stroke were also calculated for the EVT candidates if sufficient data were available. This score was able to be calculated for 6 of the 9 candidates.

Incidence Projections

Based on the number of EVT candidates found over the study period, an annual incidence rate of EVT candidates presenting to HSN was calculated both by using the population of HSN's catchment area and the number of AIS discharges from HSN over the study period. HSN's catchment area, including Greater Sudbury, Manitoulin Island, Espanola, and Elliot Lake, has a population of roughly 203 700. This translates to an annual rate of ischemic strokes that would qualify for EVT of 4.42 per 100 000 person-years. Using the metric of AIS discharges, there were 9 EVT candidates out of 214 AIS discharges over the study period, or 4.21% of ischemic stroke discharges. To predict the number of annual procedures that would likely be performed, it is necessary to expand the estimate to include referring centres within Northeastern Ontario, all of which fall outside the current maximum 2-hour transport window to the nearest existing EVT centre. Using population as the basis for this estimate, roughly 509 000 people currently reside in Northeastern Ontario. With an estimated incidence of 4.42 per 100 000 person-years based on the data, this translates into 22.48 candidates per year in Northeastern Ontario.

However, Northeastern Ontario covers over 266 000 km^2 of land, and thus not all its residents will be within the 2 hour transport window by either air or land ambulance to HSN. Thus, the projected number of EVT candidates was also calculated based on the number of AIS discharges

from referring centres within a 2-hour transport radius to HSN by land or air ambulance. A geographic distribution of these centres, along with their ischemic stroke volumes, is illustrated in Figure 1. There are 17 centres within a 2-hour transport time by land and air ambulance to HSN, and these centres discharged 339 ischemic stroke patients in 2016 (13). Assuming that 4.21% of the patients would qualify for EVT, this produces an additional 14.26 EVT candidates that would have been referred to HSN for the procedure. Including HSN and transport by air and land ambulance, the total number of projected EVT candidates calculated using this alternate method generates 23.26 EVT candidates per year. Seven community hospitals in Northeastern Ontario with a total of 13 ischemic stroke discharges are outside of the 2-hour transport time by land or air ambulance to HSN. However, this would result in only 0.55 missed cases per year.

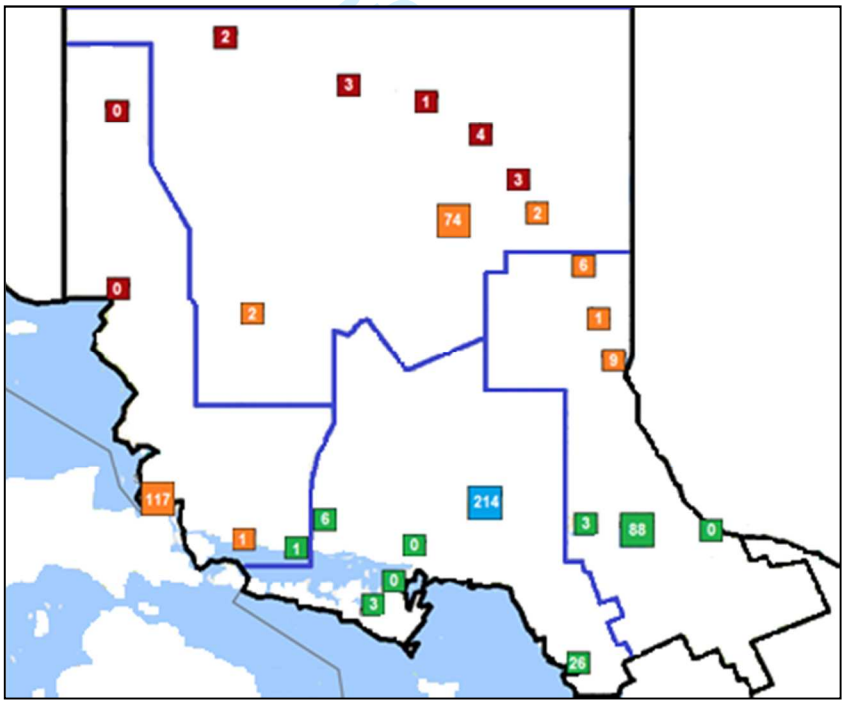

Figure 1. Distribution of hospitals and health centres in Northeastern Ontario. Each hospital is represented by a coloured square. The number inside the square represents the number of ischemic stroke discharges from that hospital in 2016. The **blue** square represents Health Sciences North. **Green** squares represent centres within a 2-hour transport radius to HSN by land ambulance. The **orange** squares represent centres within a 2-hour transport radius to HSN by air ambulance. **Red** squares represent centres outside the 2-hour transport time to HSN by air or land ambulance. The four larger squares represent centres with CTA capabilities that administer tPA. Air ambulance transport times were determined in consultation with Paramedic Services, City of Greater Sudbury.

Discussion

Capacity for EVT at HSN

The retrospective review yielded 9 patients at HSN that would have qualified for EVT both clinically and on imaging. Extending this estimate to encompass other centres within Northeastern Ontario generates 22-24 candidates per year, depending on whether the figure is calculated based on population or AIS discharges. This projection meets the minimum requirement as set out by the CorHealth Ontario EVT steering committee of a minimum of 20 procedures per year to support the establishment of HSN as a centre for EVT (9).

Compared to other population based estimates of the incidence of EVT eligible patients, our numbers are fairly conservative. Rai and colleagues (2016) found an incidence of 10-14 EVT eligible AIS patients per 100 000 person-years discharged from a tertiary-level hospital in West Virginia with a catchment population of 210 000 (14). Similarly, Chia and colleagues (2016) found 11-22 candidates per 100 000 person-years, or 7% of AIS admissions, at a hospital in Australia with a catchment population of 148 027 (15). Despite having similar catchment population sizes and ischemic stroke discharges to HSN, both of these studies yielded far higher estimates than our projection of 4.42 candidates per 100 000 person-years.

The numbers generated as part of our study are conservative for several reasons. Firstly, we used restrictive inclusion criteria to determine which patient charts would be reviewed for candidacy. Only patients seen by stroke-on-call, who consult for thrombolysis eligibility, were included. This potentially excluded patients presenting over 4.5 hours from stroke onset who may have been eligible for EVT (11).

Recently, the DAWN trial has demonstrated improved functional outcomes among patients receiving EVT vs. medical management alone presenting up to 24 hours after symptom onset (16). This could lead to another paradigm shift in stroke care, further increasing the

potential number of EVT candidates. As our study only considered patients presenting up to 12 hours after symptom onset, it is likely that as new data emerges, a greater percentage of AIS patients will be considered EVT eligible, and procedural volumes will increase. Indeed, a study of EVT volumes in Catalonia found a significant increase in the number of mechanical thrombectomies performed between 2011 and 2015, as more data emerged (17).

Furthermore, 20 of 71 patient images reviewed were deemed non-evaluable because a CTA arch-to-vertex was not completed on presentation. It is possible that additional candidates could have been identified had the requisite imaging been completed.

Finally, the criteria used to determine eligibility were fairly restrictive, and did not allow for clinical judgement. The current recommendations by the American Heart Association for EVT eligibility indicate that EVT may be reasonable for carefully selected patients with M2/M3, anterior, posterior, or vertebral artery occlusions, or in patients with ASPECTS and/or NIHSS scores below 6 (18). As such, it is likely that clinical judgement will play a role in selecting patients for EVT that do not match the restrictive criteria used in the ESCAPE trial.

Candidate Outcomes

The importance of improving access to EVT in Northeastern Ontario is underscored by the poor functional outcomes of the candidates identified in our study. These poor outcomes could have been mitigated had these patients had adequate access to EVT. Several large, multi-center studies found EVT to be effective in reducing disability post-stroke, with an NNT of 2.6 (6).

Limitations

As this study was a retrospective chart review, the relevant data necessary to determine clinical and imaging candidacy was not always available. This potentially resulted in several missed cases, as noted previously. As only one year of data was reviewed, this study does not consider year to year variations in AIS volumes that could impact the number of projected candidates. Furthermore, candidate volumes from referral sites were estimated, not quantified, and could vary substantially from our projections.

Conclusions

Based on the review of patient data from 71 admissions for AIS between May 1st, 2016 and April 30th, 2017, we identified 9 patients that met the clinical and imaging criteria to qualify for EVT. Upon extending this projection to include major referral centres in Northeastern Ontario, it is conservatively estimated that HSN could perform between 22 and 23 procedures per year. This value exceeds the recommended minimum of 20 procedures per year as set out by the CorHealth Ontario EVT steering committee. The over 500 000 residents of Northeastern Ontario currently have limited access to this new standard of care. Establishing HSN as a centre for EVT has the potential to drastically improve functional outcomes among AIS patients suffering a large proximal vessel occlusion. As such, bringing EVT to HSN is an essential step in ensuring equitable stroke care for the residents of Northeastern Ontario.

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PRISMA 2009 Checklist: Quantifying candidate volume for endovascular therapy for acute ischemic stroke at Health Sciences North: a one-year, retrospective chart review

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	2
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	3
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	4
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	5
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	

PRISMA 2009 Checklist: Quantifying candidate volume for endovascular therapy for acute ischemic stroke at Health Sciences North: a one-year, retrospective chart review

Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	6-10

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	11-12
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	13

PRISMA 2009 Checklist: Quantifying candidate volume for endovascular therapy for acute ischemic stroke at Health Sciences North: a one-year, retrospective chart review

Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	13
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	1

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

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Study Title: **Endovascular Therapy for the Treatment of Acute Ischemic Stroke: A review of patients referred to Stroke-on-call Physicians at Health Sciences North (HSN) in Northastern Ontario to determine potential eligibility for Endovascular Treatment (EVT)**

Sponsor/Funding Agency: Not Funded

REB Review Type: Delegated

Date of Review: May 25 2017

Date Approval Issued: May 26 2017

Expiry Date: May 25 2018

Notification of REB FINAL Approval

Documents Approved:

1. REB Expedited/Delegated Review Form (April 4, 2017)
2. EVT Chart Review Appendix 1 (May 12, 2017)
3. EVT Chart Review Radiologist Section Appendix 2 (May 12, 2017)
4. EVT Chart Review Appendix 3 (May 12, 2017)
5. HSN EVT Full Study Description (Version 1 May 23, 2017)
6. Request for Program Approval Health Records (May 1, 2017)
7. Request for Program Approval Radiology (May 23, 2017)

Documents Acknowledged:

1. TCPS 2 certificate

Project Number: *17-044*

This Project Number has been assigned to your project. Please use this number on all future correspondence.

The Research Ethics Board of Health Sciences North (REB HSN) has reviewed the above research protocol and considers it to be ethically acceptable.

As Principal Investigator, you are responsible for the ethical conduct of this study as outlined under the *Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans (2nd Edition)*.