ERA Update

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Cumming School of Medicine

University of Calgary

Disclosure Slide

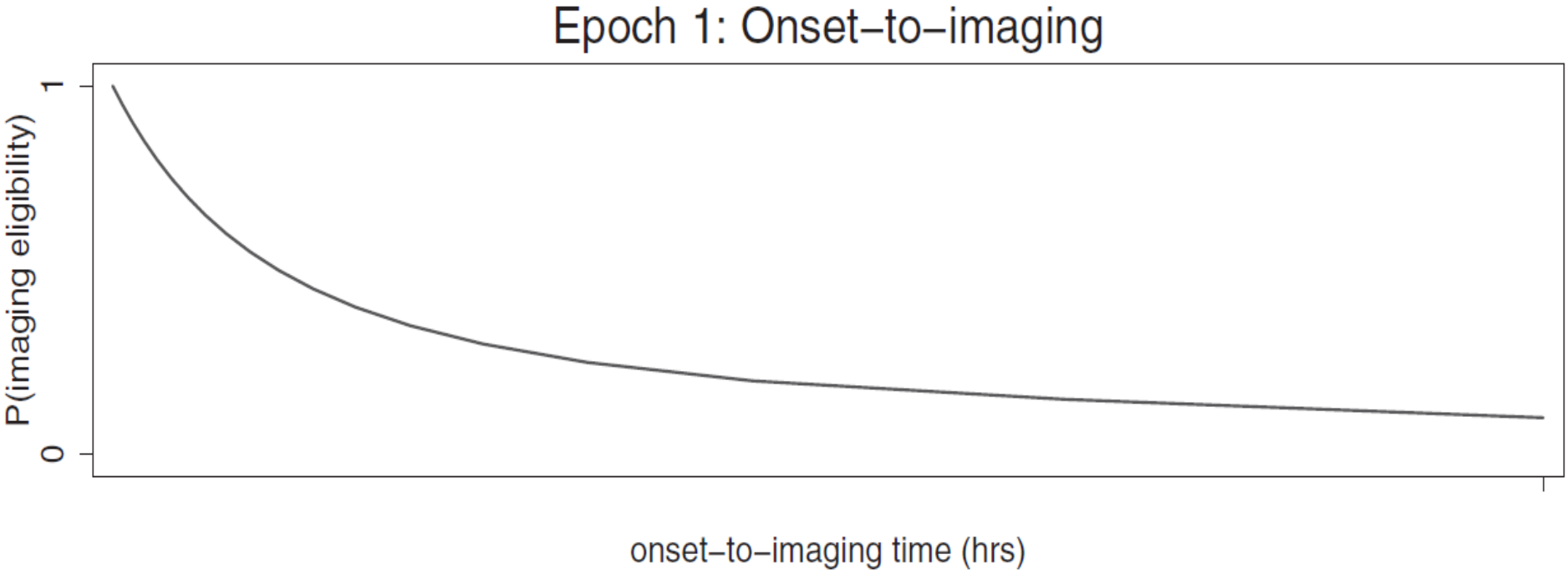
- I have not received an honorarium from Hoffman LaRoche (licensure of tPA) but have received honorarium from Medtronic (supplier of SOLITAIRE FR stentriever) for CME events

- No stocks or direct investments with pharmaceutical or device companies involved in stroke
- Co-founder/shareholder Quikflo Health start-up (acute stroke software)
- Several clinical trial responsibilities:
  - IMS-3- Exec committee, CT core lab PI
  - ESCAPE- Neuro-PI
  - REVASCAT- CT core lab co-PI
  - CLOTBUST-ER – CTA substudy PI
  - ARTSS-2 – CTA substudy core lab PI
  - ENCHANTED – International Advisory Committee
  - PRACTICE- DMC chair
  - DEFUSE 3- Safety monitor
  - ANNEXA-4 – Adjudication committee

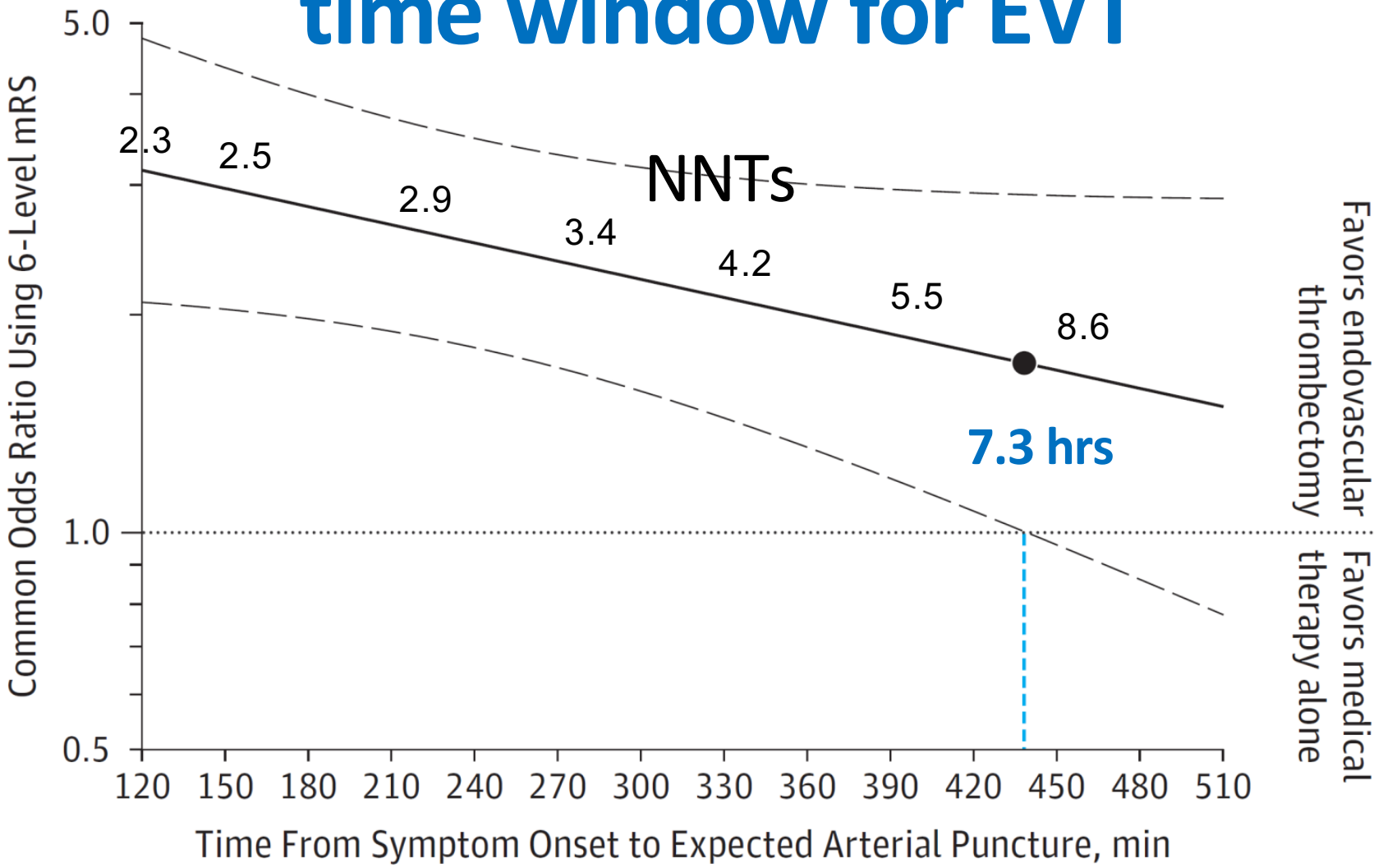
In Alberta, EVT is only available in Calgary (Foothills Medical Centre) and Edmonton (University of Alberta Hospital). Our health care system must adapt to ensure the timeliness and accessibility of this procedure for all Albertans. The Cardiovascular Health and Stroke Strategic Clinical Network™ has undertaken the Endovascular Reperfusion Alberta (ERA) project to increase access to endovascular therapy for patients with acute ischemic stroke.

Ischemic Stroke Tissue-Window in the New Era of Endovascular Treatment

Michael D. Hill, MD, MSc; Mayank Goyal, MD; Andrew M. Demchuk, MD; Marc Fisher, MD, PhD



7.3 hour onset to groin puncture time window for EVT

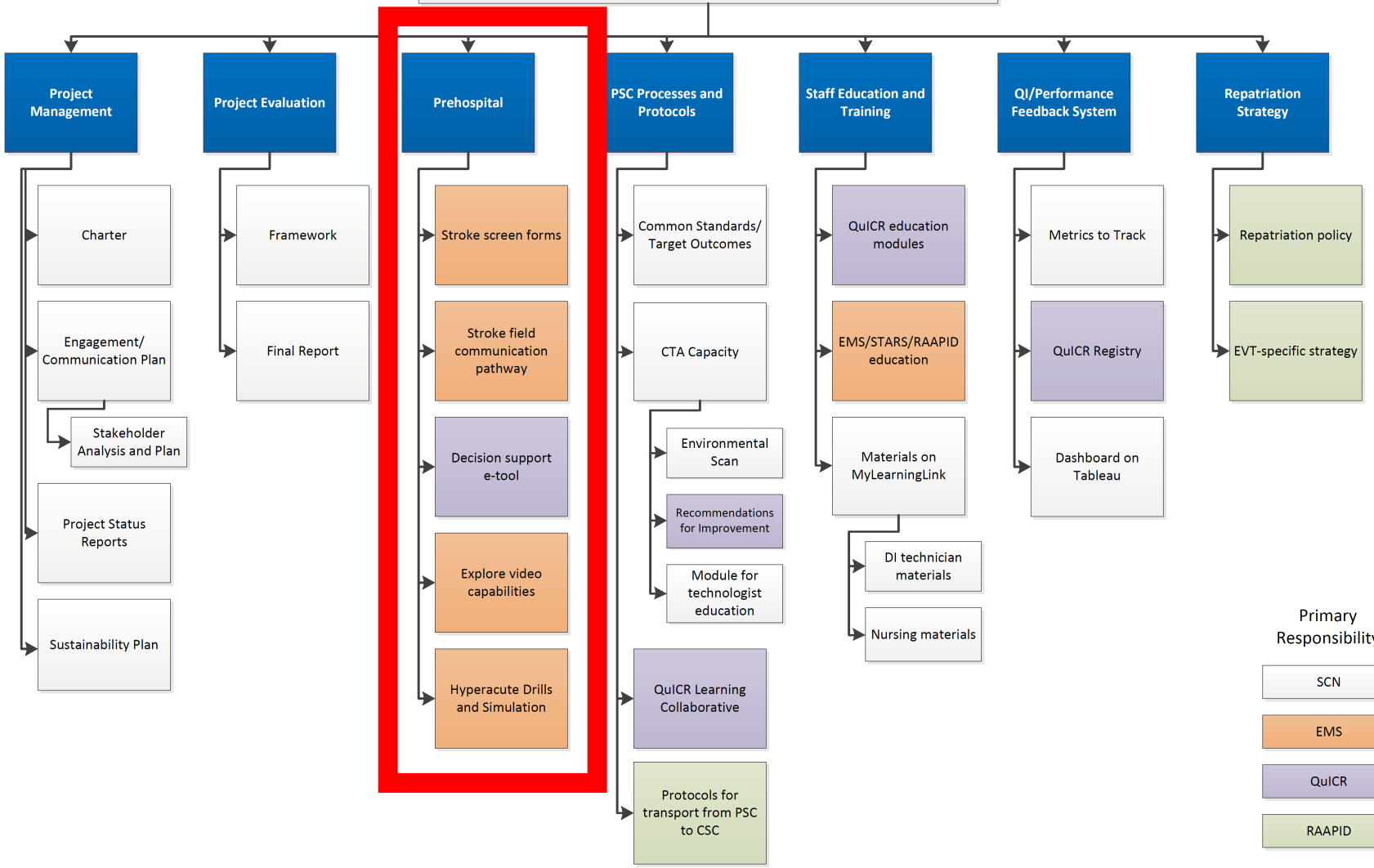


JAMA. 2016;316(12):1279-1288. doi:10.1001/jama.2016.13647

Improve Timely Access

- Revision of EMS triage and transport pathways and inter-hospital referrals
- Implementation of appropriate imaging in the remote stroke centres to assess for EVT eligibility
- Improvement in care processes to reduce the time to treatment

Endovascular Recanalization Alberta (ERA) Project



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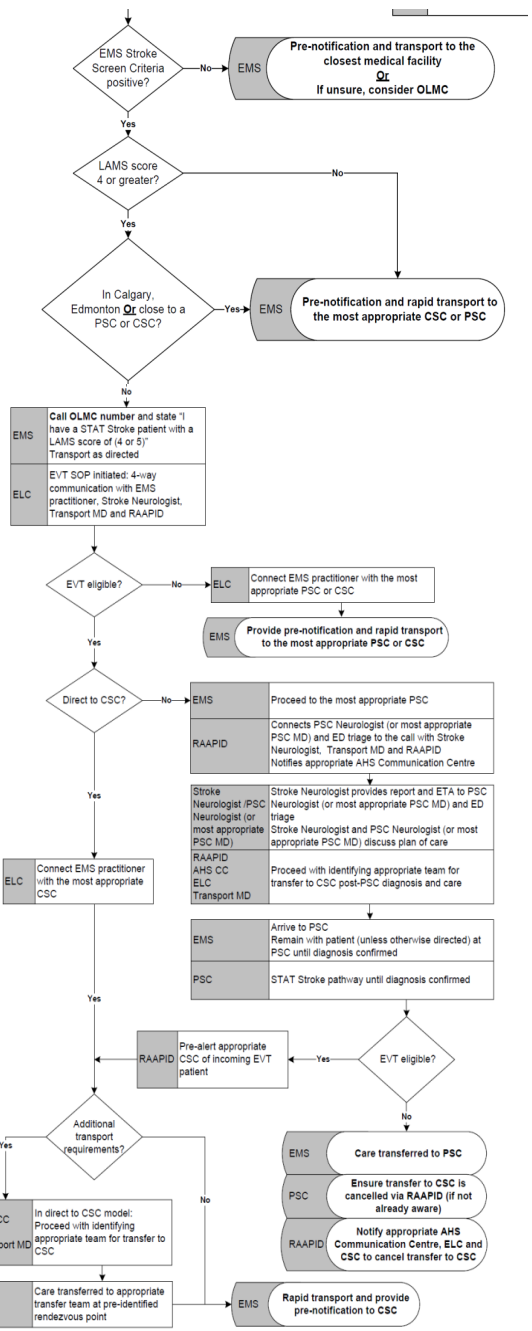
EMS Stroke Screen Criteria positive?
No
EMS
Pre-notification and transport to the closest medical facility
Or
If unsure, consider OLMC
Yes
LAMS score 4 or greater?
No
Yes
In Calgary, Edmonton Or close to a PSC or CSC?
Yes
EMS
Pre-notification and rapid transport to the most appropriate CSC or PSC
No
EMS
Call OLMC number and state "I have a STAT Stroke patient with a LAMS score of (4 or 5)"
Transport as directed
ELC
EVT SOP initiated: 4-way communication with EMS practitioner, Stroke Neurologist, Transport MD and RAAPID
EVT eligible?
No
ELC
Connect EMS practitioner with the most appropriate PSC or CSC
EMS
Provide pre-notification and rapid transport to the most appropriate PSC or CSC
Yes
Direct to CSC?
No
EMS
Proceed to the most appropriate PSC
RAAPID
Connects PSC Neurologist (or most appropriate PSC MD) and ED triage to the call with Stroke Neurologist, Transport MD and RAAPID
Notifies appropriate AHS Communication Centre
Yes
Stroke Neurologist /PSC Neurologist (or most appropriate PSC MD)
Stroke Neurologist provides report and ETA to PSC Neurologist (or most appropriate PSC MD) and ED triage
Stroke Neurologist and PSC Neurologist (or most appropriate PSC MD) discuss plan of care
RAAPID
AHS CC
ELC
Transport MD
Proceed with identifying appropriate team for transfer to CSC post-PSC diagnosis and care
ELC
Connect EMS practitioner with the most appropriate CSC
EMS
Arrive to PSC
Remain with patient (unless otherwise directed) at PSC until diagnosis confirmed
PSC
STAT Stroke pathway until diagnosis confirmed
Yes
EVT eligible?
Yes
RAAPID
Pre-alert appropriate CSC of incoming EVT patient
Additional transport requirements?
Yes
No
No
EMS
Care transferred to PSC
PSC
Ensure transfer to CSC is cancelled via RAAPID (if not already aware)
RAAPID
Notify appropriate AHS Communication Centre, ELC and CSC to cancel transfer to CSC
AHS CC
ELC
Transport MD
In direct to CSC model:
Proceed with identifying appropriate team for transfer to CSC
EMS
Care transferred to appropriate transfer team at pre-identified rendezvous point
EMS
Rapid transport and provide pre-notification to CSC

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REVISED Stroke Screen

Place Label Here

EMS must obtain critical patient information on scene and complete the Stroke Screen en route.

Patient last seen neurologically normal	Patient name	Event number
Date *(dd-Mon-yyyy)* / Time *(hh:mm)*		
History provided by ☐ Patient ☐ Family member ☐ Other *(specify)*	Patient last seen by *(witness name)*	Witness phone
	History provider name	History provider phone

Complete **Physical Examination Findings** below, then continue with screening process →

Physical Examination Findings

Level of Consciousness	Speech	Leg Strength
☐ Alert	☐ Normal (0)	☐ Normal
☐ responds to Verbal	☐ Slurred	☐ Right-Drifts down
☐ responds to Pain	☐ Incomprehensible or mute	☐ Left-Drifts down
☐ Unresponsive		☐ Right-Falls rapidly
		☐ Left-Falls rapidly

Facial Smile	Hand Grips	Arm Strength
☐ Normal (0)	☐ Normal (0)	☐ Normal (0)
☐ Right-Droop (1)	☐ Right-Weak grip (1)	☐ Right-Drifts down (1)
☐ Left-Droop (1)	☐ Left-Weak grip (1)	☐ Left-Drifts down (1)
	☐ Right-No grip (2)	☐ Right-Falls rapidly (2)
	☐ Left-No grip (2)	☐ Left-Falls rapidly (2)

LAMS Score (0 - 5): Calculated by adding the corresponding number from each of the three categories above TOTAL = ☐

Thrombolytic Criteria	Yes	No	U/K
On warfarin therapy at present			
Recent MI within 3 months			
Recent stroke within 3 months			
Recent trauma within 3 months			
Recent surgery within 3 months			
Recent bleeding (including GI) within 3 months			
Recent seizure activity within 24 hours			

EMS Care and Transport	Yes	No
Was the nearest hospital bypassed?		
Was a patch placed to the receiving hospital?		
Was the patient transported lights and siren?		

Is blood glucose level greater than 3.0 mmol/L?
- ☐ No → Treat as per Adult Stroke MCP and continue screening process
- ☐ Yes → Continue screening process

Is one or more **red Physical Examination Findings checked?**
- ☐ No → Transport to closest medical facility
- ☐ Yes → Continue screening process

Last seen normal to arrival at Primary or Comprehensive Stroke Centre **6 hours or less OR awoke with symptoms?**
- ☐ No → STOP screening process - Treat and transport as per local stroke strategy guidelines
- ☐ Yes → EMS Stroke Screen is positive. Continue screening process

Is the LAMS score 4 or greater?
- ☐ No → STOP Provide early pre-notification and rapid transport to the closest Primary or Comprehensive Stroke Centre. Notify the triage nurse of a "STAT Stroke"
- ☐ Yes → STOP **Mandatory** call to Emergency Link Centre stating "I have a STAT Stroke patient with a LAMS score of 4 or 5"

Screening Process

Practitioner name *(print)* | Date *(dd-Mon-yyyy)*

09336(Rev2011-02) **White** - Chart **Canary** - EMS **Stroke Screen**

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Affix patient label within this box

EMS Stroke Screen

EMS must obtain critical patient information and complete this form on scene

Patient last seen neurologically normal	Patient name	Event number
Date *(yyyy-Mon-dd)* / Time *(hh:mm)*		
History provided by ☐ Patient ☐ Family member ☐ Other *(specify)* _____	Patient last seen by *(witness name)*	Witness phone
	History provider name	History provider phone

Complete **Physical Examination Findings** and **LAMS scoring,** then continue with **screening process**

Physical Examination Findings

Level of Consciousness
- ☐ Alert
- ☐ Responds to Verbal
- ☐ Responds to Pain only
- ☐ Unresponsive

Speech
- ☐ Normal
- ☐ Slurred
- ☐ Incomprehensible or mute

Leg Strength
- ☐ Normal
- ☐ Right-Drifts down
- ☐ Left-Drifts down
- ☐ Right-Falls rapidly
- ☐ Left-Falls rapidly

	LAMS
Facial Smile Smile, show teeth, raise eyebrows and squeeze eyes shut ☐ Normal (0) ☐ Right-Droop (1) ☐ Left-Droop (1)	
Arm Strength Elevate with palm down and hold for 10 second count *(45 degrees if laying down, 90 degrees if sitting)* ☐ Normal (0) ☐ Right-Drifts down (1) ☐ Left-Drifts down (1) ☐ Right-Falls rapidly (2) ☐ Left-Falls rapidly (2)	
Grip Strength Have patient try to grasp examiners fingers ☐ Normal (0) ☐ Right-Weak grip (1) ☐ Left-Weak grip (1) ☐ Right-No grip (2) ☐ Left-No grip (2)	
Total LAMS Score	

Is blood glucose level greater than 3.0 mmol/L?
- ☐ No → Treat as per Adult Stroke MCP, then continue screening process
- ☐ Yes → Continue screening process

Is one or more **red Physical Examination Findings** checked?
- ☐ No → Transport to closest medical facility
- ☐ Yes → Continue with screening process

Patient last seen normal **less than 6 hours** ago or **awoke with stroke symptoms?**
- ☐ No → STOP screening process; Treat and transport as per local stroke strategy guidelines.
- ☐ Yes → EMS Stroke Screen is positive; Continue with screening process

Is the LAMS Score **4 or greater**?
- ☐ No → STOP Provide early pre-notification and rapid transport to the most appropriate Primary or Comprehensive Stroke Centre.
- ☐ Yes → STOP Call OLMC number and state: "I have a STAT Stroke patient with a LAMS Score of 4 or 5"

Los Angeles Motor Scale (LAMS) Scoring
1. Score the **affected side** using the values provided
2. Score Facial Smile, Arm Strength and Grip Strength
3. Calculate Score (0-5)

A score of 4 or greater is predictive of large artery occlusion

Screening Process

Practitioner Name *(print)*	Practitioner Signature	Date *(yyyy-Mon-dd)*

09336 (Rev2017-02) **White** - Chart **Canary** - EMS **EMS Stroke Screen**

Physical Examination Findings

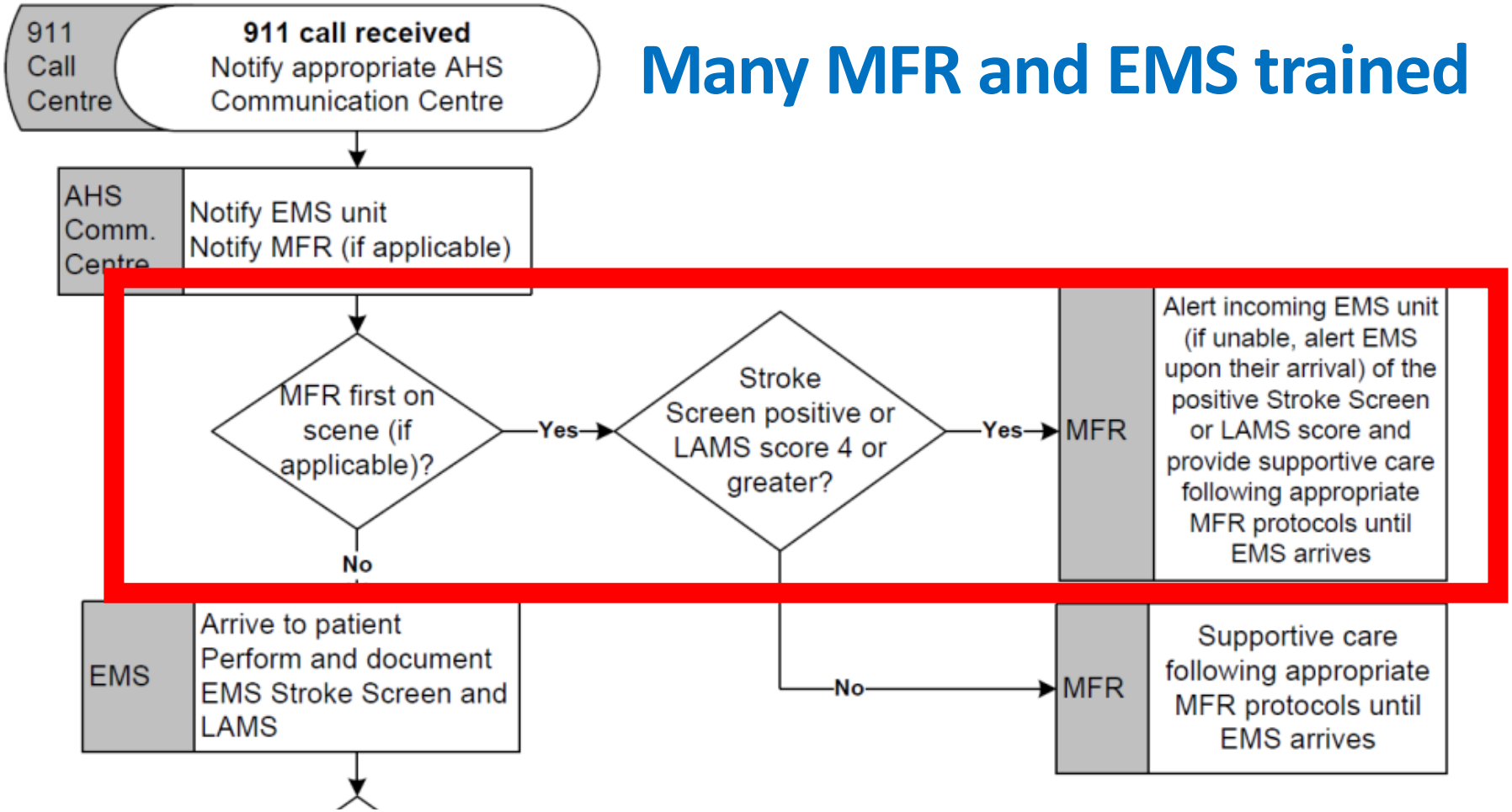
Level of Consciousness	Speech
☐ Alert	☐ Normal
☐ Responds to Verbal	☐ Slurred
☐ Responds to Pain only	☐ Incomprehensible or mute
☐ Unresponsive	

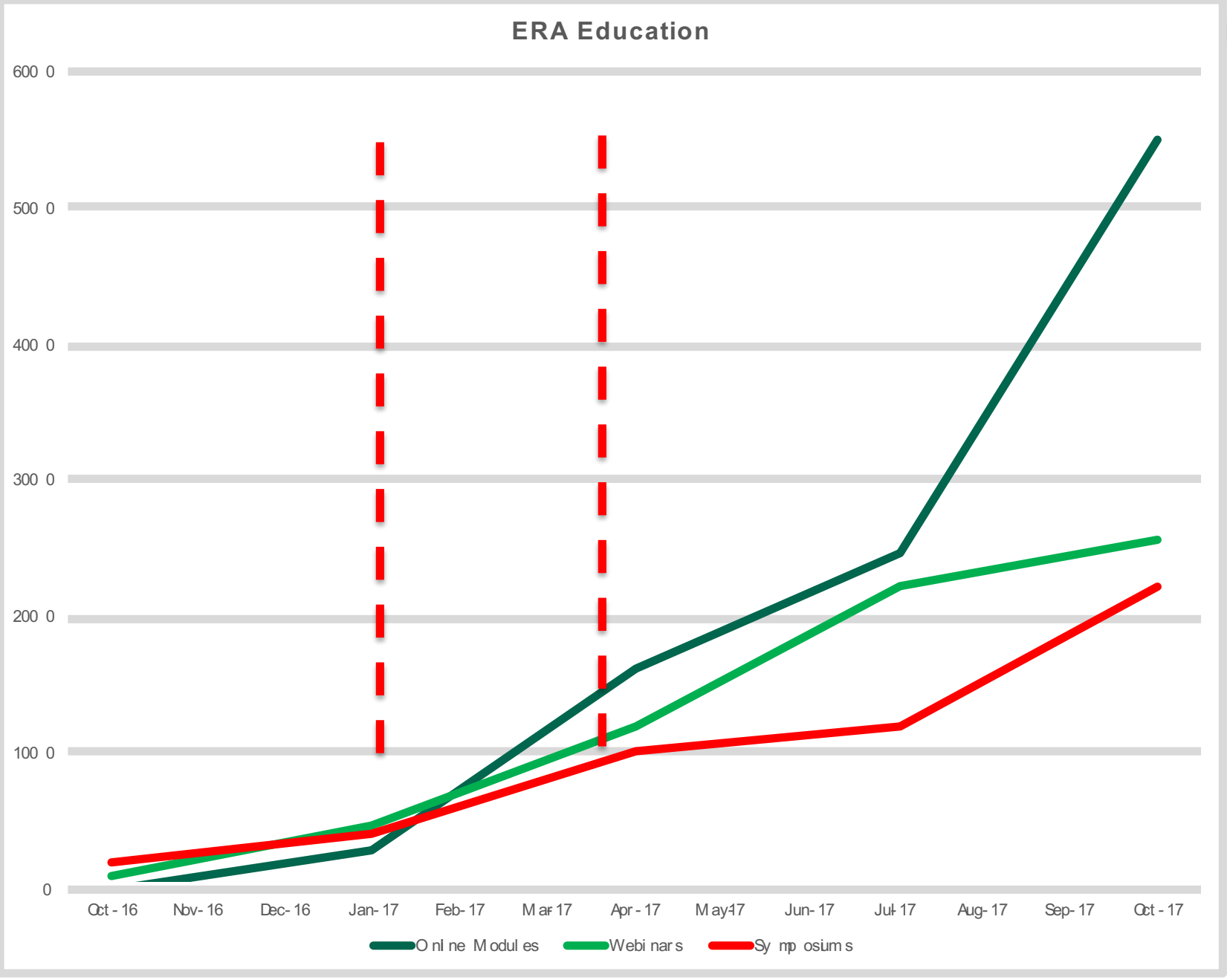
Leg Strength

- ☐ Normal
- ☐ Right-Drifts down
- ☐ Left-Drifts down
- ☐ Right-Falls rapidly
- ☐ Left-Falls rapidly

	LAMS
Facial Smile Smile, show teeth, raise eyebrows and squeeze eyes shut ☐ Normal (0) ☐ Right-Droop (1) ☐ Left-Droop (1)	
Arm Strength Elevate with palm down and hold for 10 second count *(45 degrees if laying down, 90 degrees if sitting)* ☐ Normal (0) ☐ Right-Drifts down (1) ☐ Left-Drifts down (1) ☐ Right-Falls rapidly (2) ☐ Left-Falls rapidly (2)	
Grip Strength Have patient try to grasp examiners fingers ☐ Normal (0) ☐ Right-Weak grip (1) ☐ Left-Weak grip (1) ☐ Right-No grip (2) ☐ Left-No grip (2)	
Total LAMS Score	

Many MFR and EMS trained





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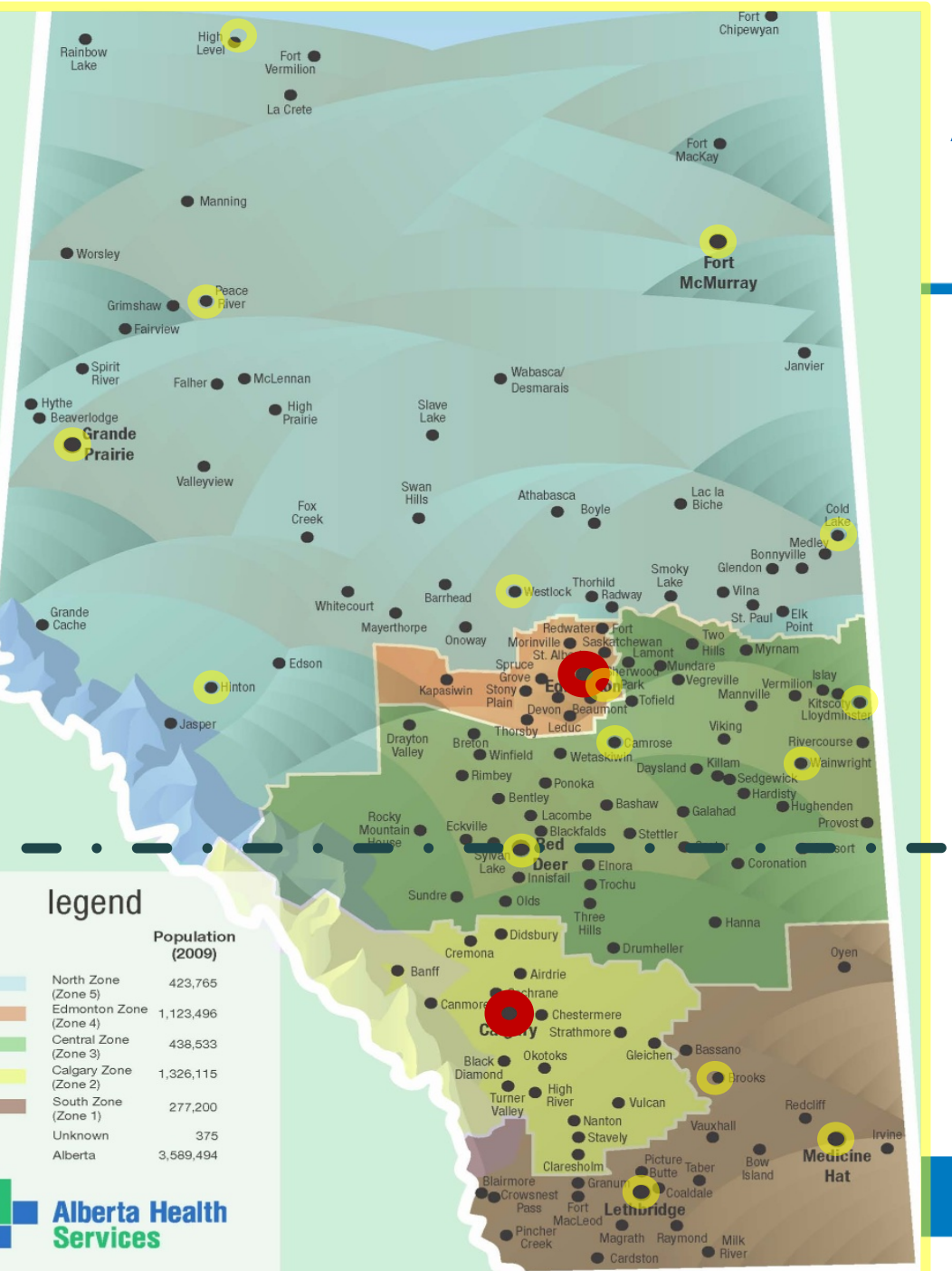
Alberta Acute Stroke Treatment 2018



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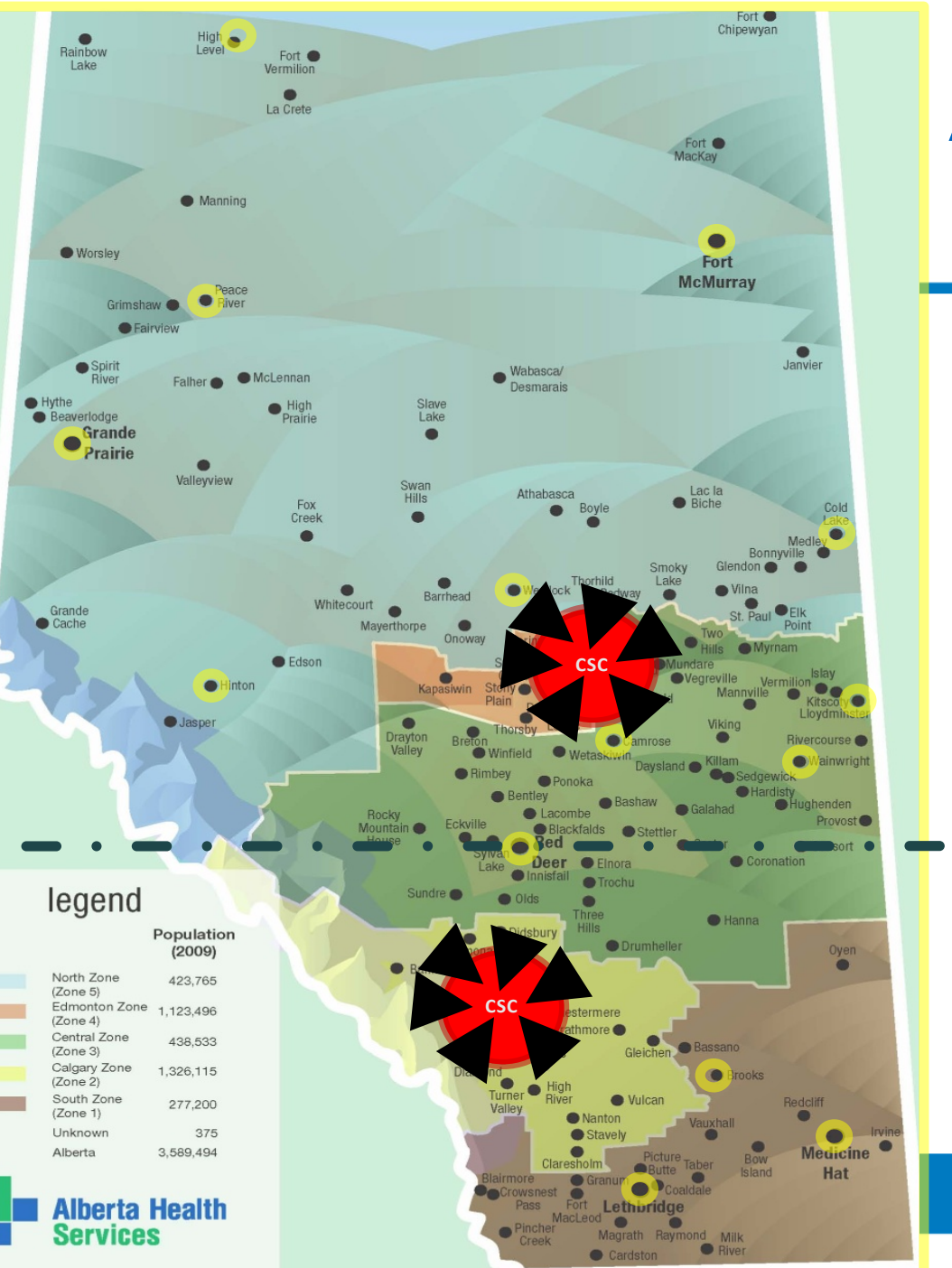
Alberta Acute Stroke Treatment 2018



Comprehensive Stroke Centre

Primary Stroke Centre

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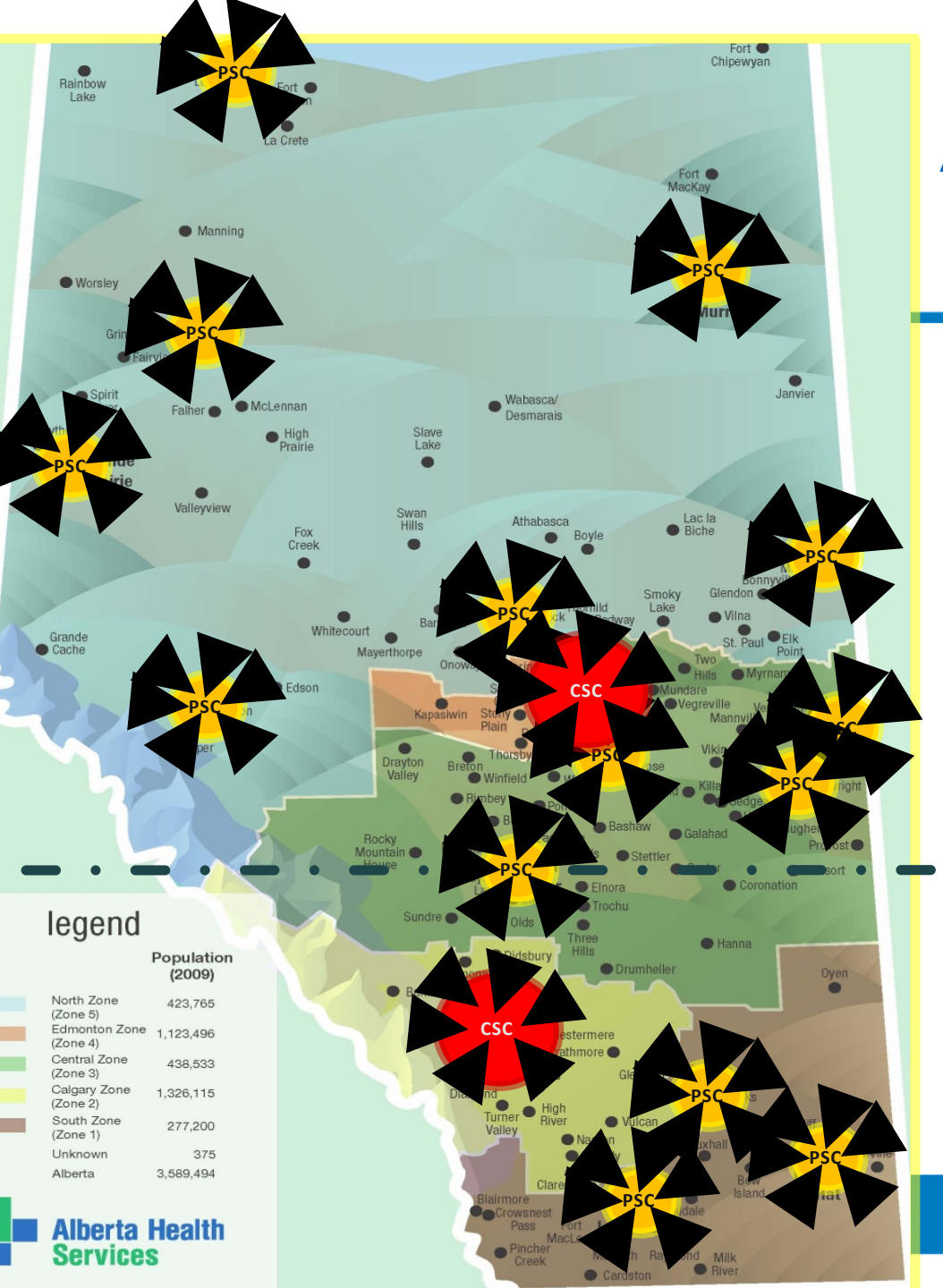
Alberta Acute Stroke Treatment 2018



Comprehensive Stroke Centre

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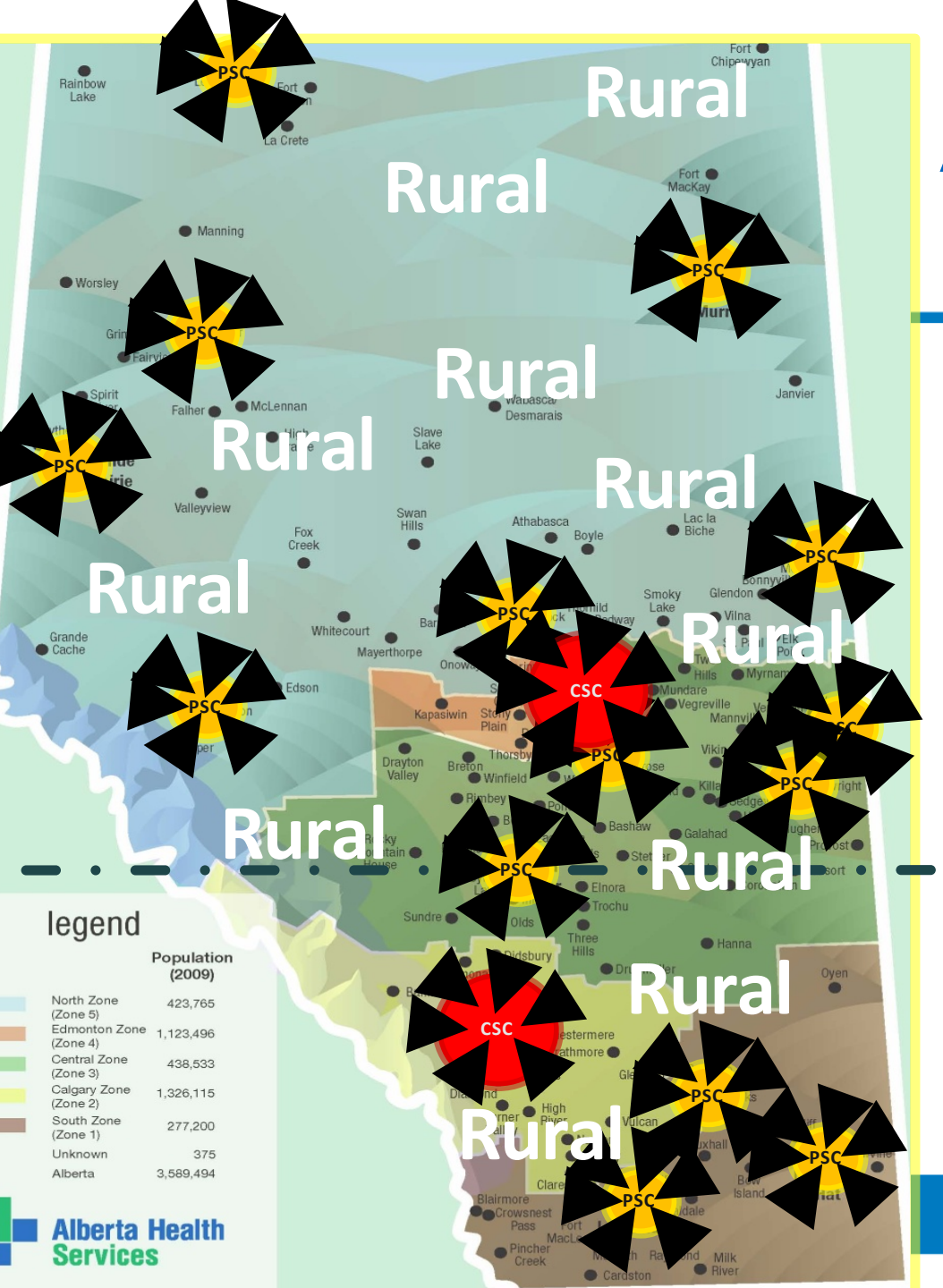
Alberta Acute Stroke Treatment 2018



Comprehensive Stroke Centre

Primary Stroke Centre

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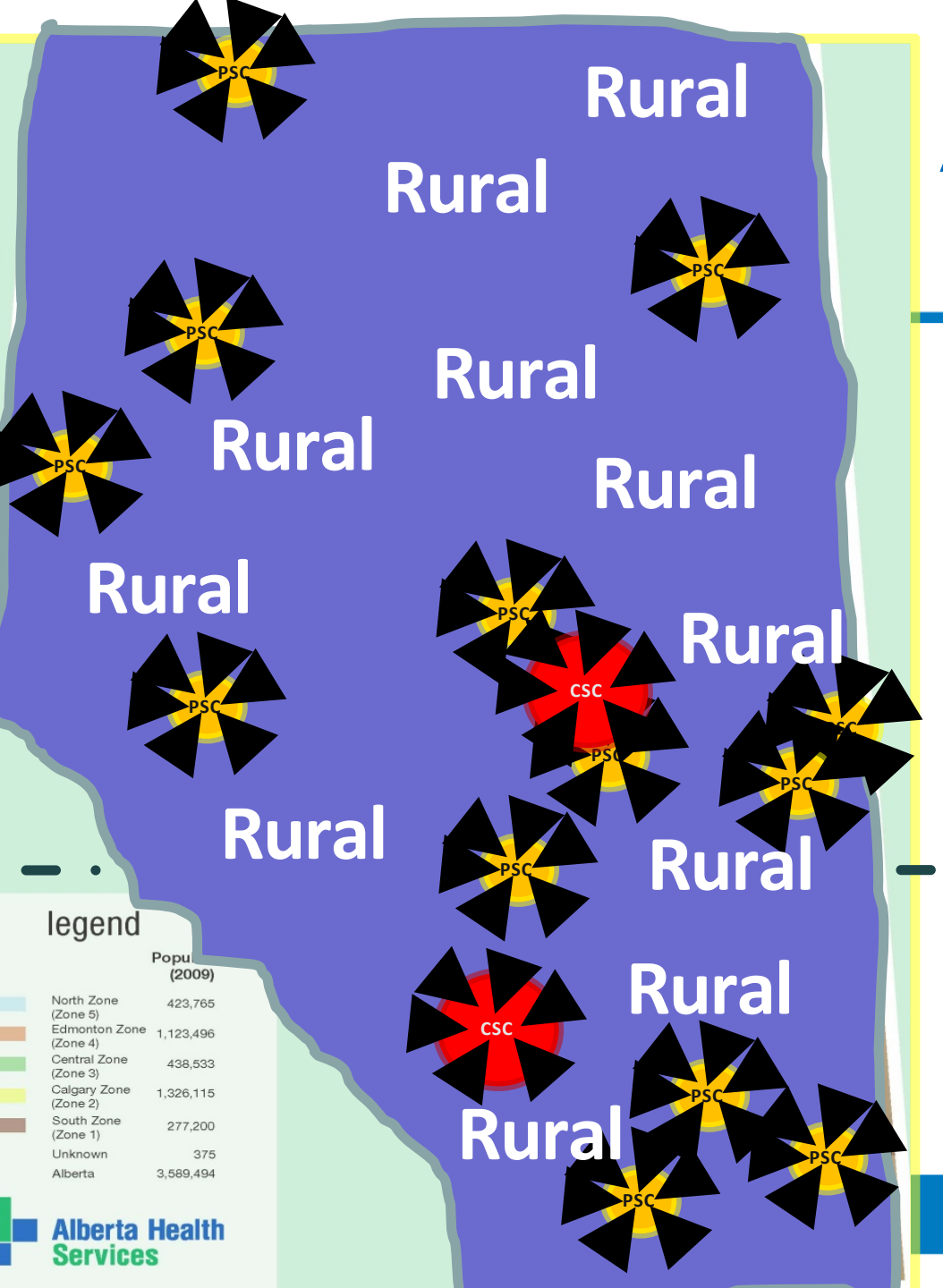
Alberta Acute Stroke Treatment 2018



Comprehensive Stroke Centre

Primary Stroke Centre

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LVO populations to develop better access

- **Metro area patients- EMS activation** ✓
- Small urban area patients- EMS activation
- Rural patients- EMS activation
- Walk-in/private vehicle- no EMS activation
- In hospital stroke

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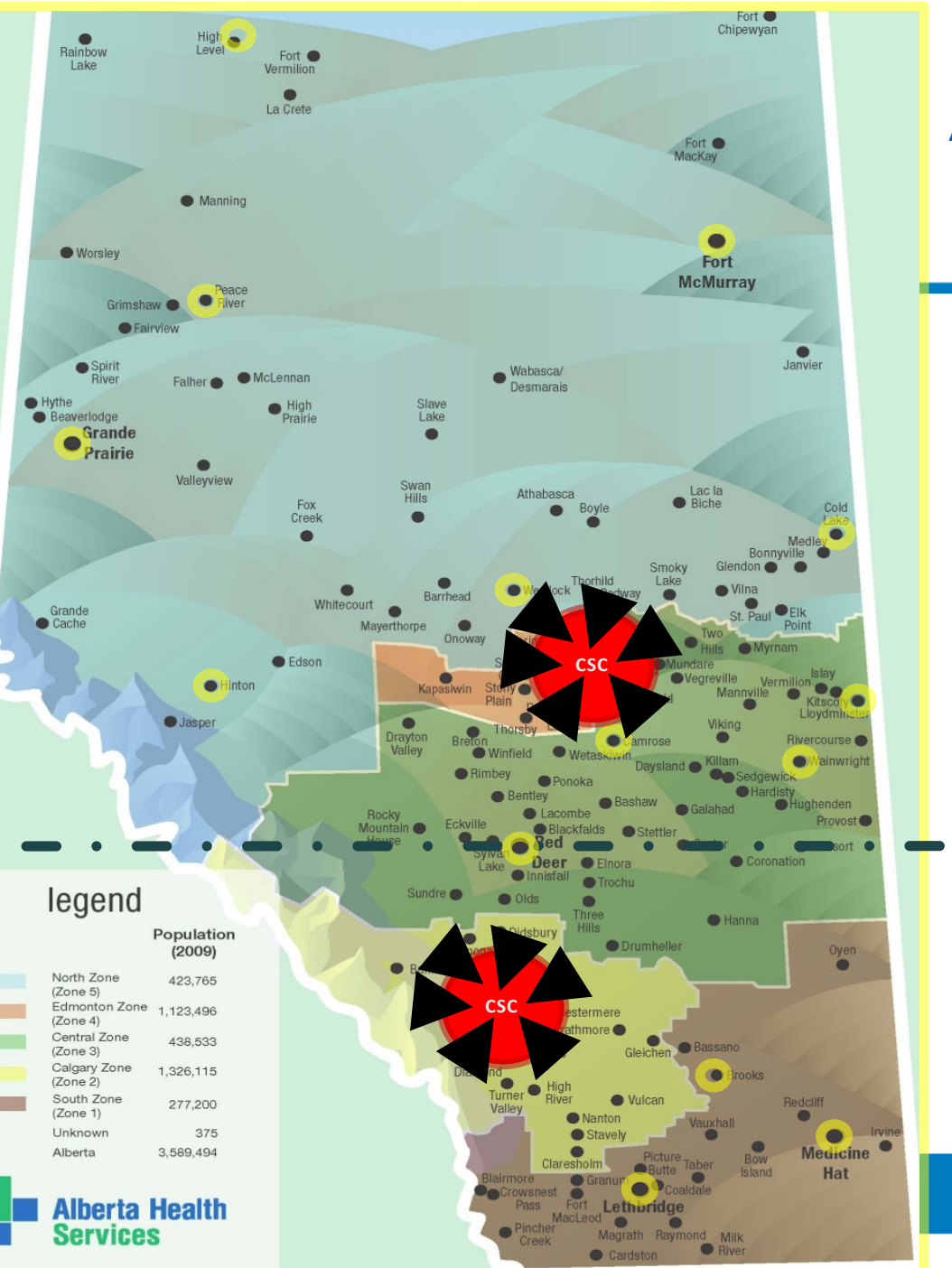
Alberta Acute Stroke Treatment 2018



Comprehensive Stroke Centre

Primary Stroke Centre

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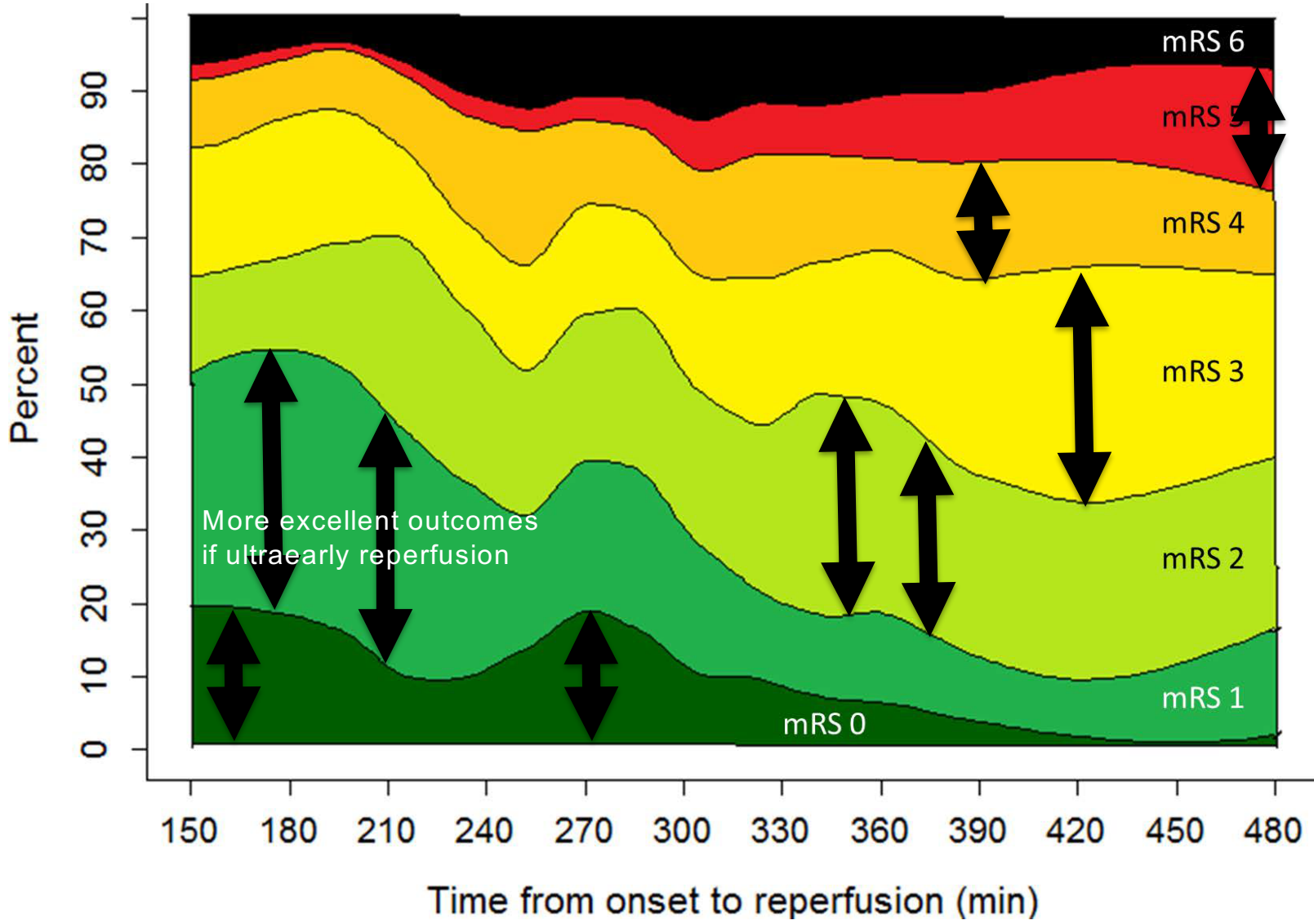
Non linear analysis of OTR (TICI 2b/3) by outcome



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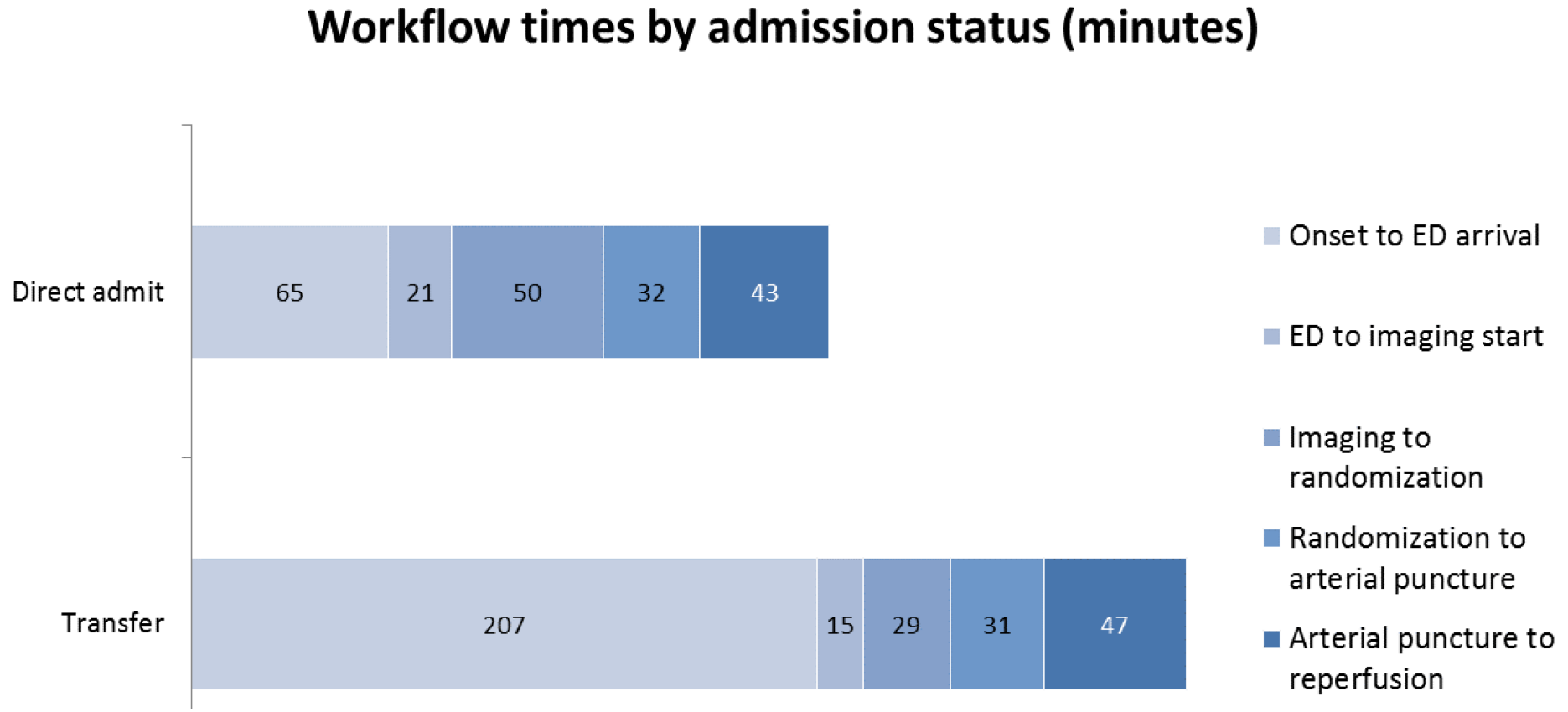
Workflow metrics direct vs transfer



eFigure 8. Workflow time intervals in Direct-Arriving and Inter-Hospital-Transfer Patients. Median time values, in minutes, are shown.

Baseline Characteristics Differed by Time Window of Randomization

	30-120 mins	121-240 mins	241-360 mins	>360 mins
N	194	657	352	79
Age	68.7	66.5	65.8	64.5
Sex (female)	53.1%	46.0%	44.7%	53.2%
NIHSS	17.2	17.0	16.5	16.1
Direct (vs transfer)	97.9%	75.5%	37.8%	66.7%
IV tPA	85.6%	89.0%	86.9%	45.6%
Location				
ICA	32.1%	21.8%	16.2%	21.8%
M1	62.2%	70.2%	76.2%	71.8%
ASPECTS	9.0	8.4	7.8	8.0

Metro: CSC near Small Urban: PSC near Rural

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Physical Examination Findings

Level of Consciousness	Speech
☐ Alert	☐ Normal
☐ Responds to Verbal	☐ Slurred
☐ Responds to Pain only	☐ Incomprehensible or mute
☐ Unresponsive	

Leg Strength

- ☐ Normal
- ☐ Right-Drifts down
- ☐ Left-Drifts down
- ☐ Right-Falls rapidly
- ☐ Left-Falls rapidly

	LAMS
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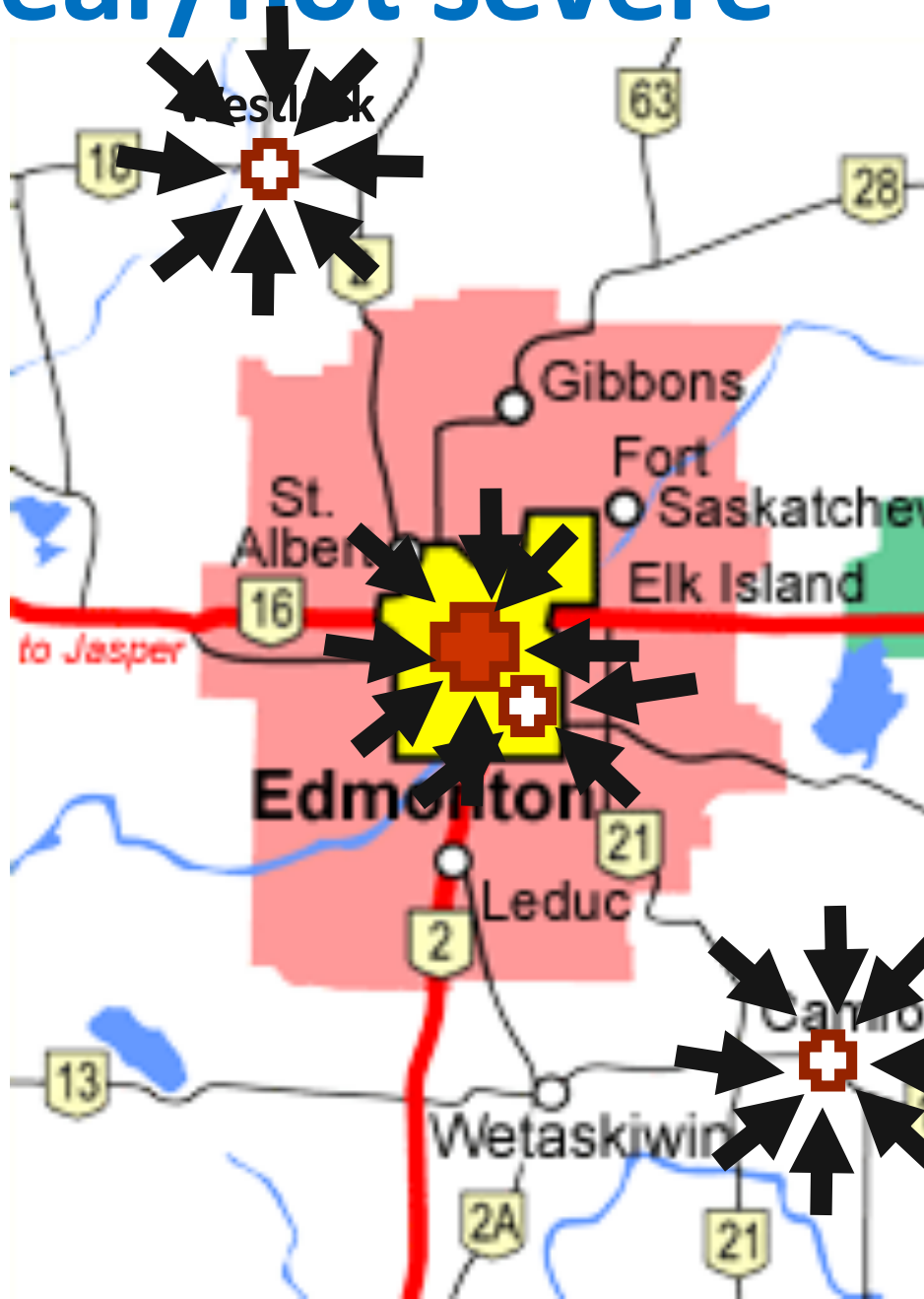
Grip Strength Have patient try to grasp examiners fingers ☐ Normal (0) ☐ Right-Weak grip (1) ☐ Left-Weak grip (1) ☐ Right-No grip (2) ☐ Left-No grip (2)	
Total LAMS Score	

Metro Zone-CSC near/not severe

LAMS <4 go to nearest stroke centre ✚ **or** ✚

CSC ✚

PSC ✚



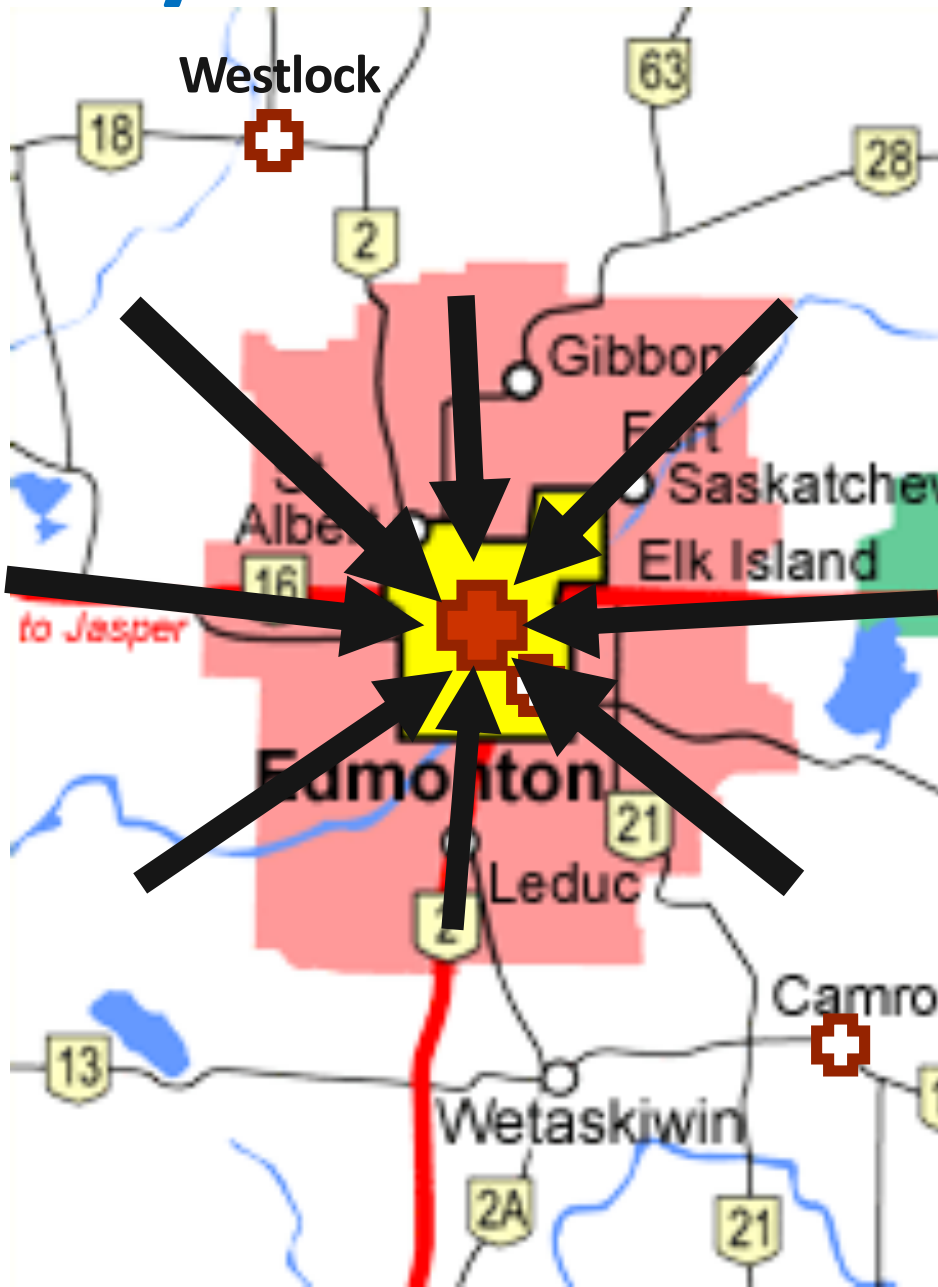
Metro Zone-CSC near/severe stroke

LAMS ≥4 go to CSC

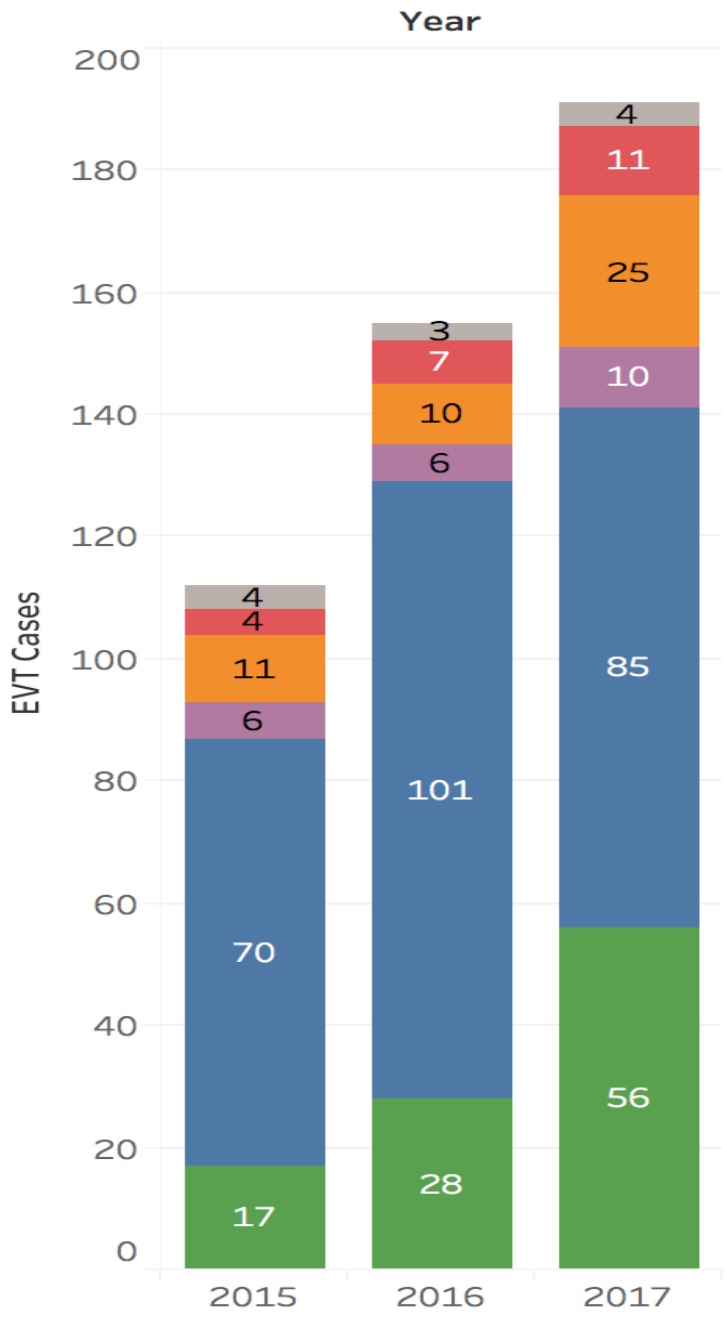
Bypassing closer PSCs

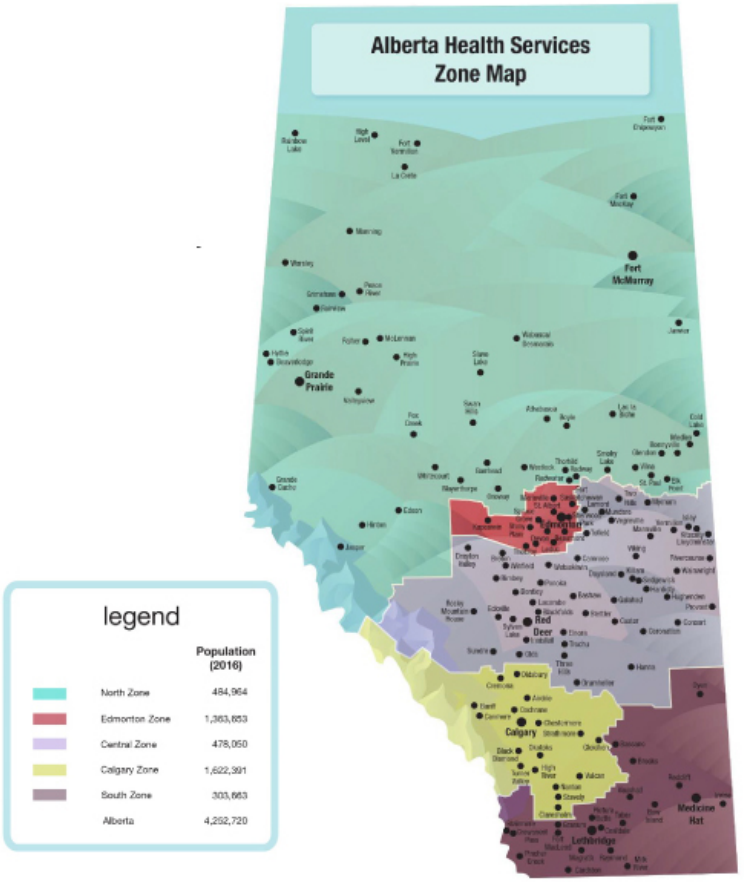
CSC

PSC



Origin of EVT cases





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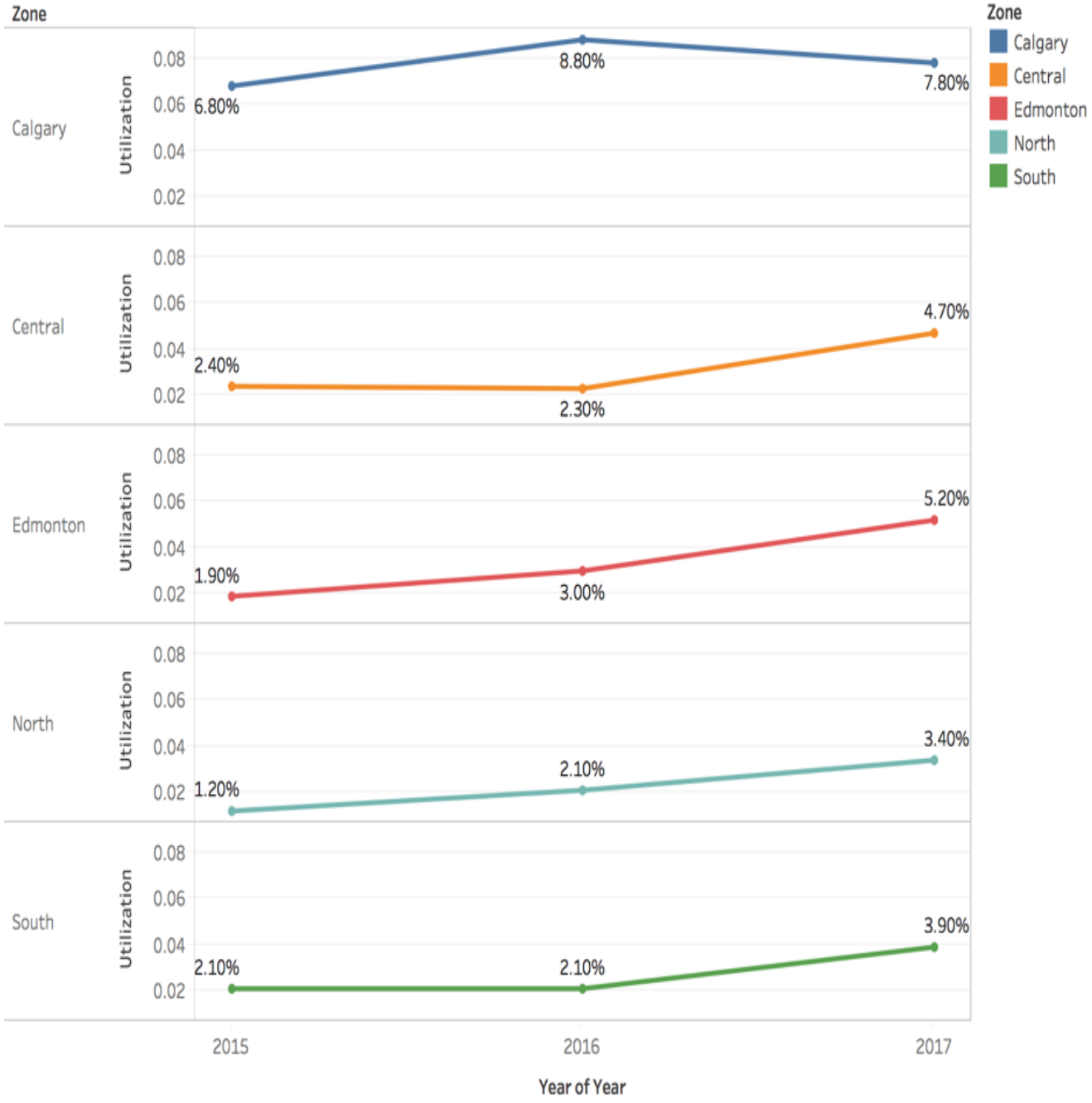
EVT Utilization



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ENDOVASCULAR RECANALIZATION ALBERTA

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UAH Outperformed FMC in Jan and Feb 2018!

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EVT Volumes

Jan - Mar 2018

	January	February	March	Grand Total
Foothills Medical Centre	9	8	9	26
University of Alberta Hospital	13	10	8	31
Grand Total	22	18	17	57

ENDOVASCULAR RECANALIZATION ALBERTA
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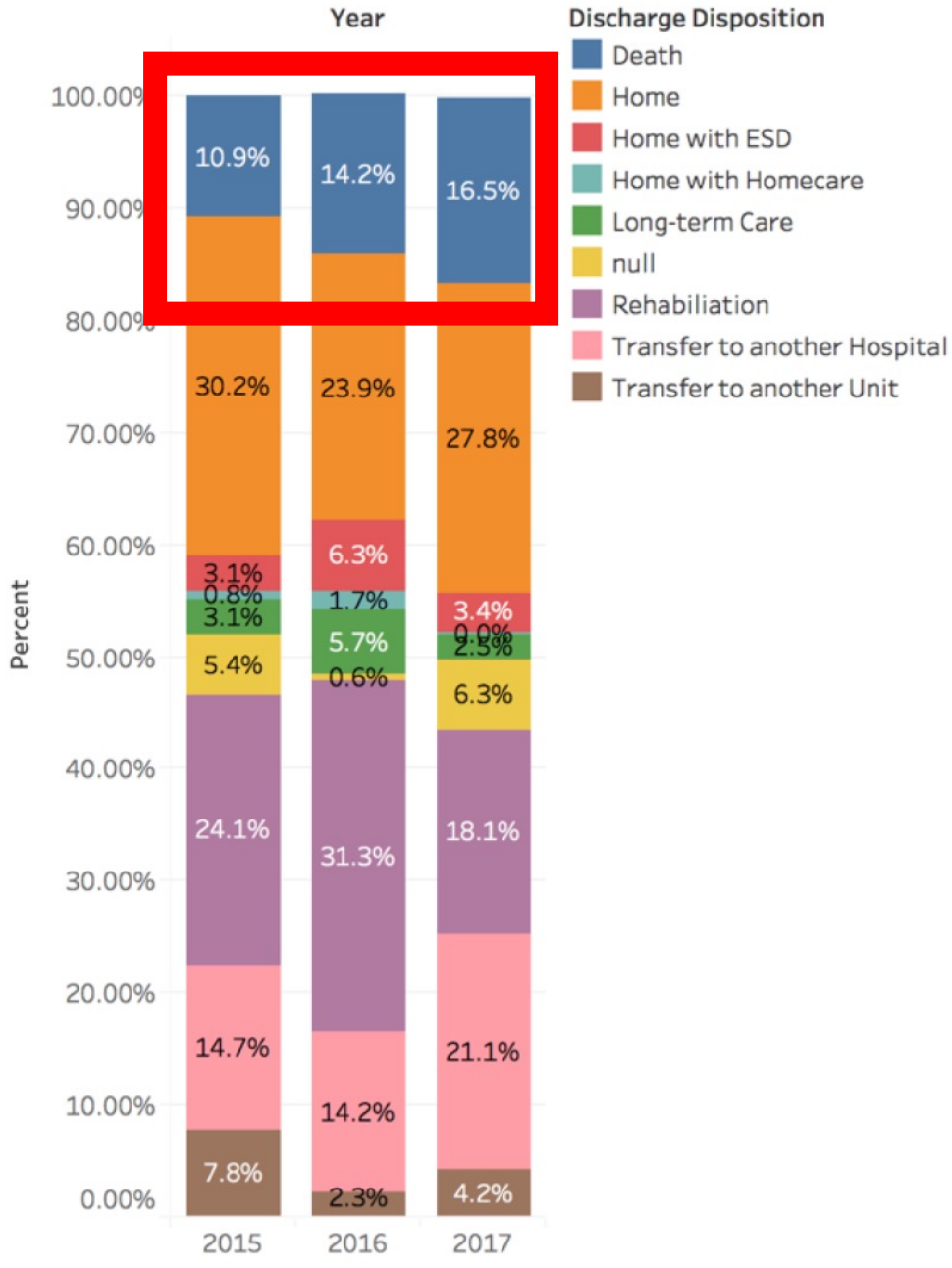
Discharge Disposition

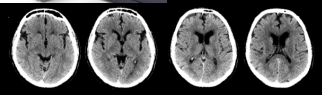


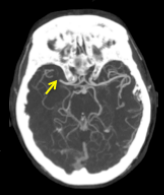
Comprehensive stroke centre
30-60-90 DTN DTGP DTR rule

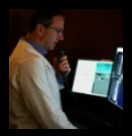
Door to tPA bolus
<30 min

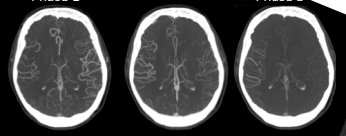
tPA bolus to groin puncture
<30 min

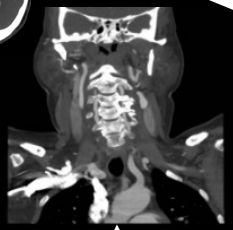
groin puncture
to first reperfusion
<30 min

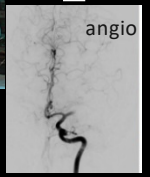


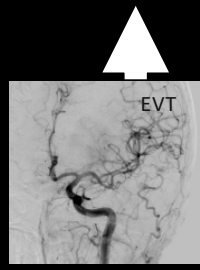




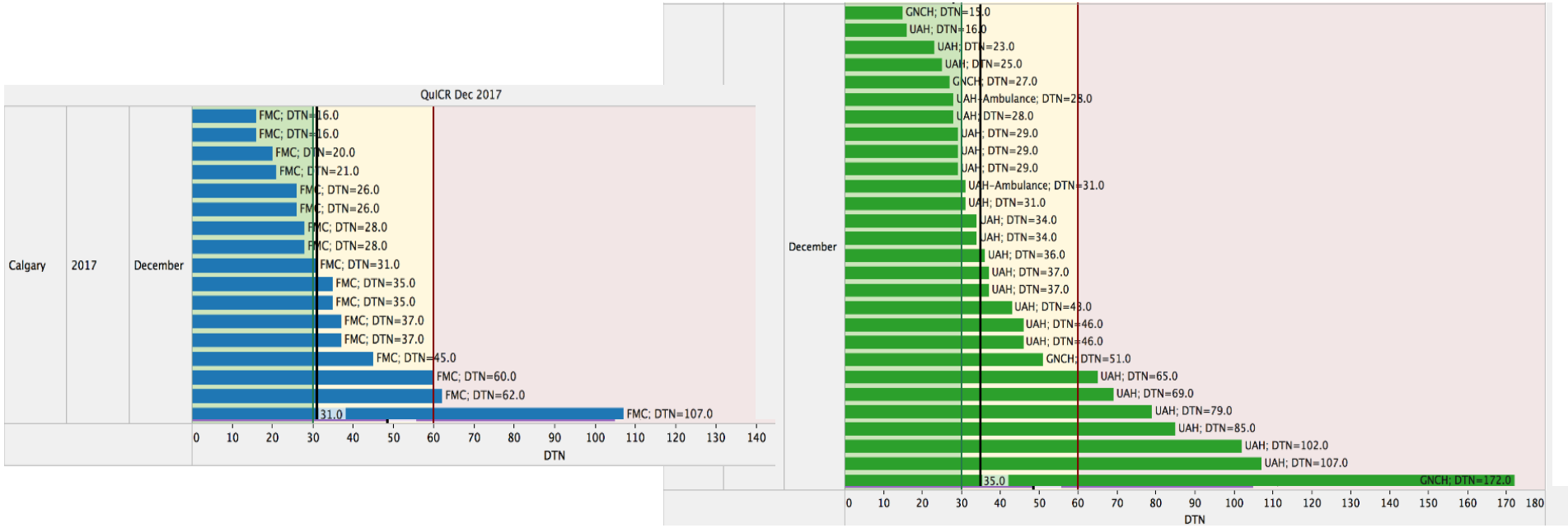








Median Door to needles close to target



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ENDOVASCULAR RECANALIZATION ALBERTA ERA

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Median Door to punctures

Site		2015	2016	2017
UAH	Door-to-Puncture	101 min	106 min	104 min
	90th Percentile	125 min	148 min	154 min
FMC	Door-to-Puncture	62 min	54 min	59 min
	90th Percentile	180 min	111 min	129 min

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ENDOVASCULAR RECANALIZATION ALBERTA ERA

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Alberta Health Services
Strategic Clinical Network
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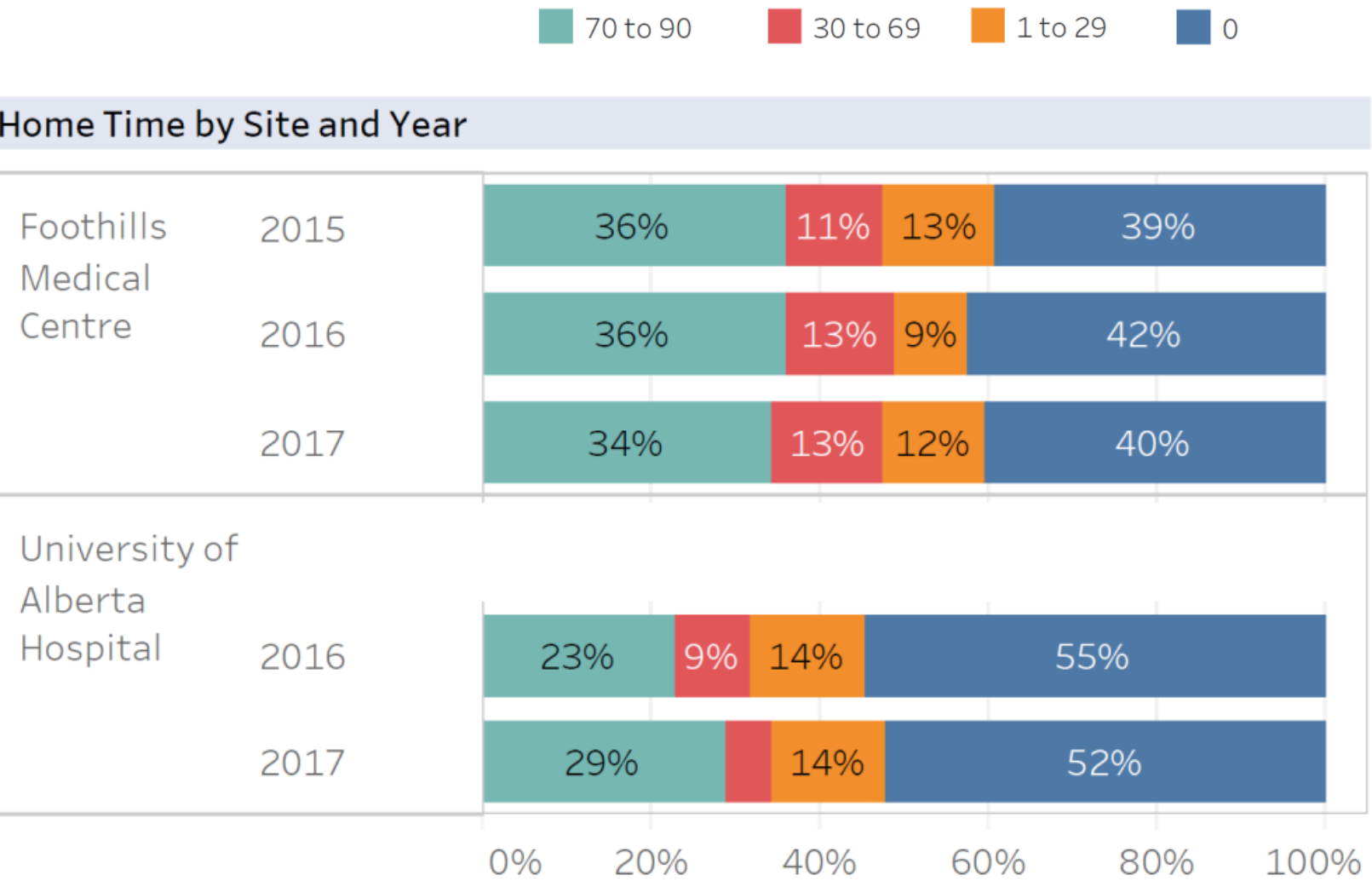

ENDOVASCULAR RECANALIZATION ALBERTA ERA

LVO populations to develop better access

- Metro area patients- EMS activation ✓
- **Small urban area patients- EMS activation** ✓
- Rural patients- EMS activation
- Walk-in/private vehicle- no EMS activation
- In hospital stroke

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ENDOVASCULAR RECANALIZATION ALBERTA
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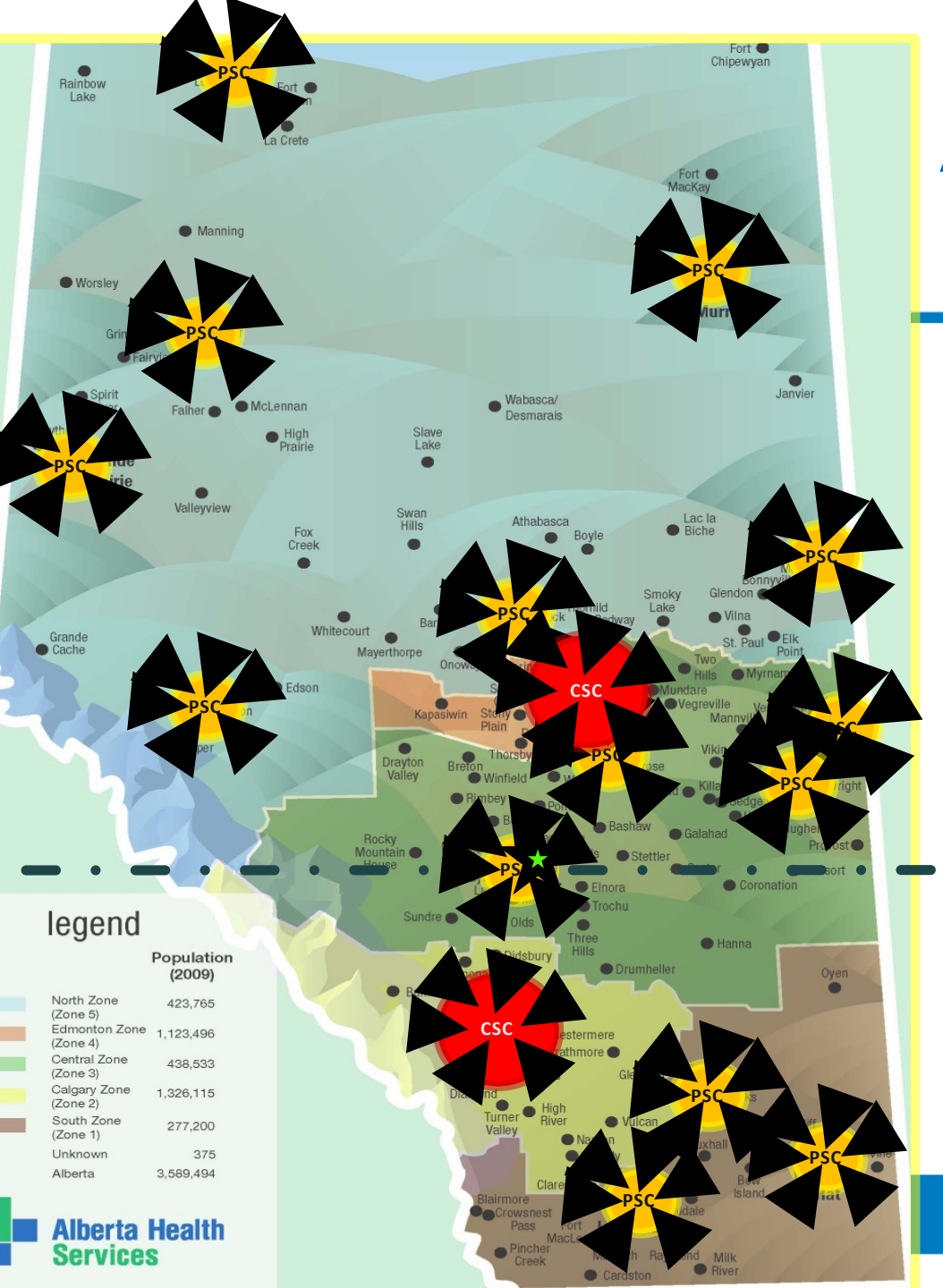
Alberta Acute Stroke Treatment 2018



Comprehensive Stroke Centre

Primary Stroke Centre

Alberta Health Services

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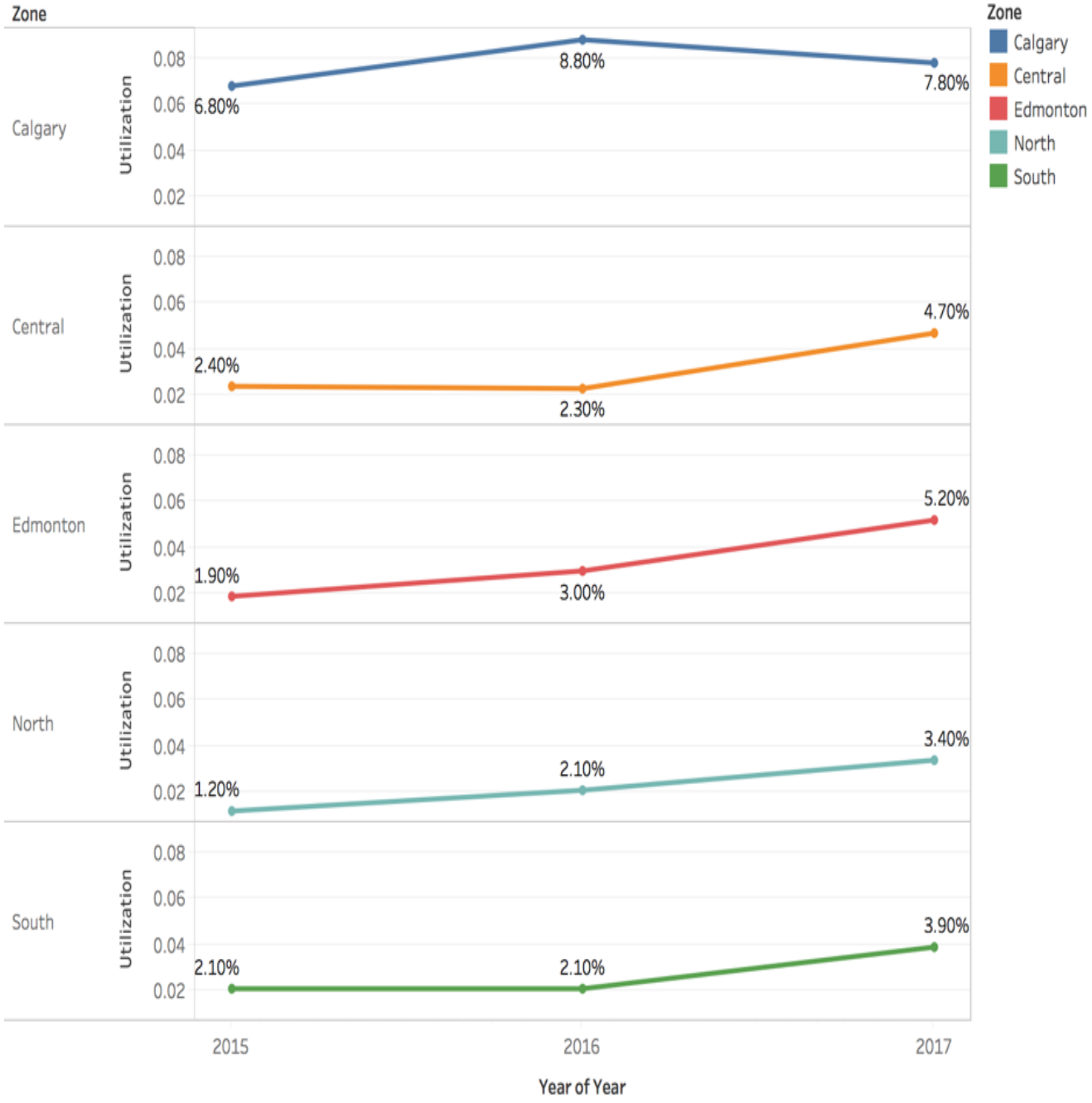
EVT Utilization



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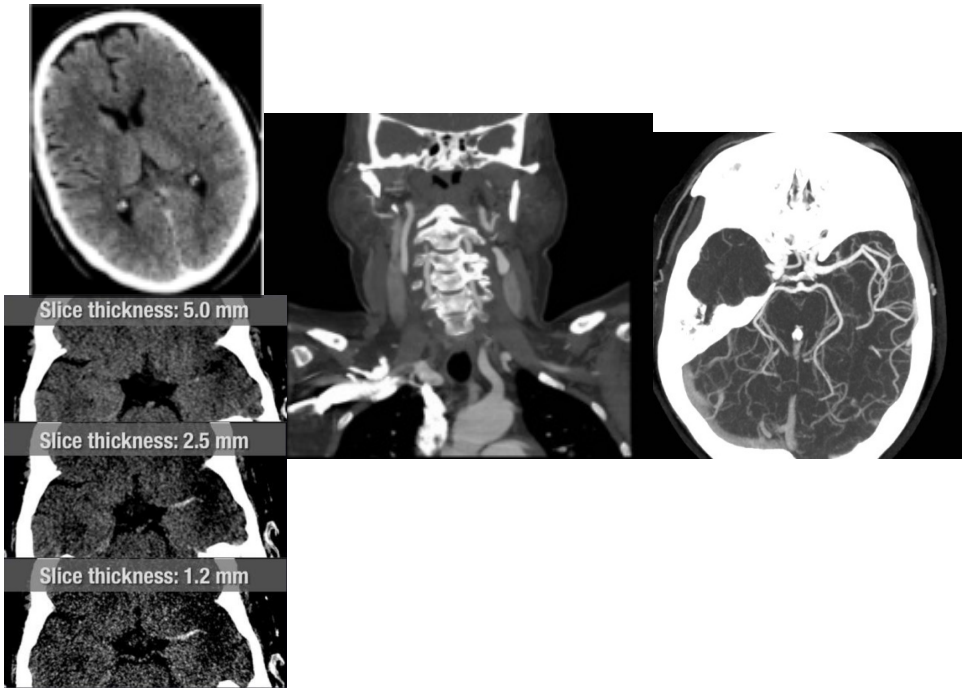
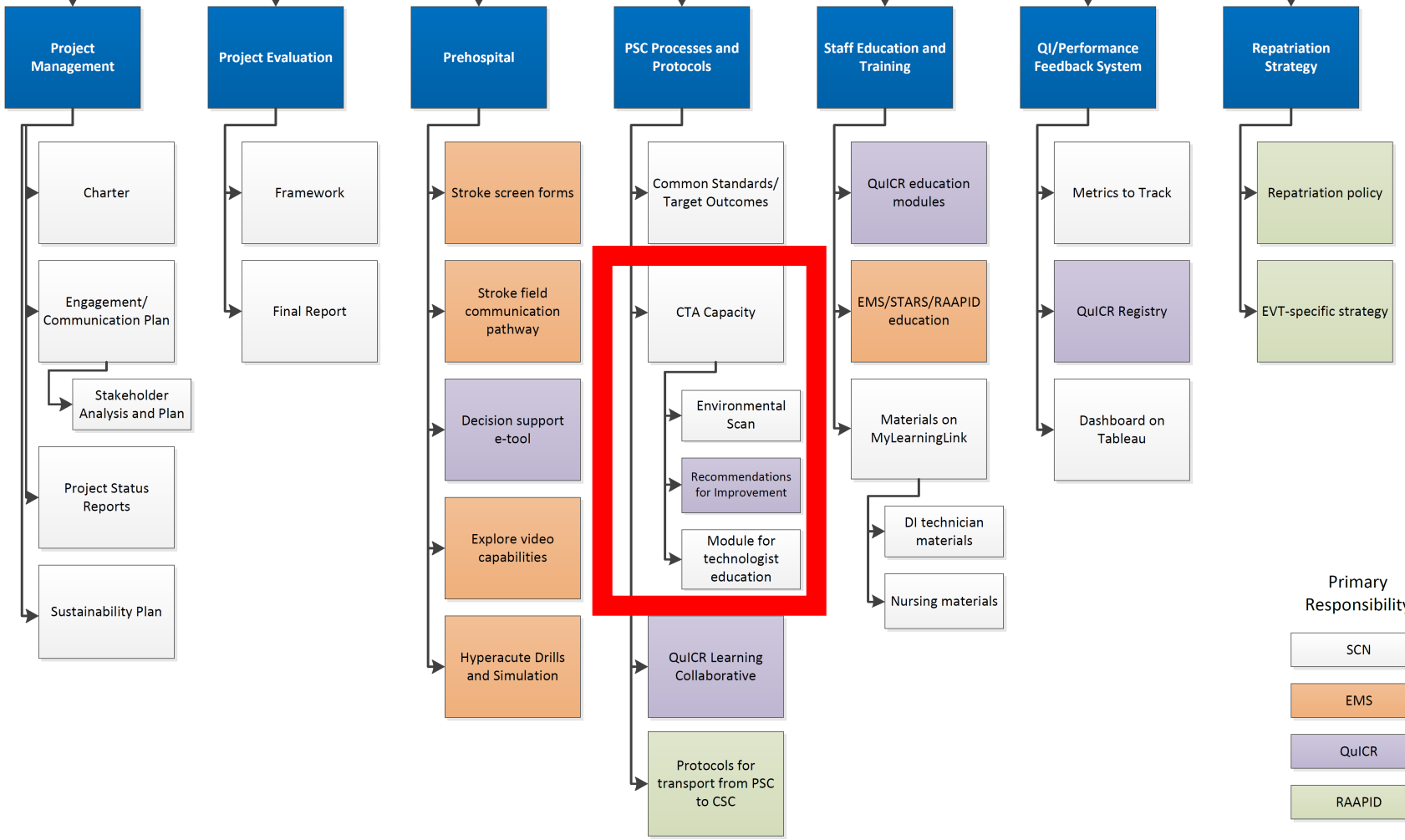
ENDOVASCULAR RECANALIZATION ALBERTA

ERA

- **Primary Stroke Centres**
  - Geographically challenged areas
  - **Telestroke capability to hub CSC**
  - **CT/CTA 24/7**



Endovascular Recanalization Alberta (ERA) Project



UNIVERSITY OF CALGARY
CUMMING SCHOOL OF MEDICINE

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Review

International Journal of Stroke WSO

Computed tomographic angiography in stroke and high-risk transient ischemic attack: Do not leave the emergency department without it!

International Journal of Stroke
0(0) 1–14

DOI: 10.1177/1747493018764172
journals.sagepub.com/home/wso
SAGE

Brett R Graham[1], Bijoy K Menon[1,2,4], Shelagh B Coutts[1,2,3,4], Mayank Goyal[1,2,4] and Andrew M Demchuk[1,2,3,4]

Table 2. Indications for emergent/urgent CT-angiography of head/neck.[a]

Emergency CT/CTA (minutes; without creatinine)	Urgent CT/CTA (hours; with eGFR >30 ml/min)
1. Acute stroke with major deficits <12 h from onset (motor, speech)	3. High-risk TIA (motor or speech symptoms that occurred in the past 48 h)
2. Sudden stupor or coma with hemiparesis or quadriplegia	4. Rule out carotid or vertebral artery dissection—focal neurological symptoms in the setting of neck, pain, recent trauma, etc.
	5. Amaurosis Fugax or central retinal artery occlusion.
	6. Minor stroke—patients with persistent minor deficits >12 h.

CT: computed tomography; CTA: computed tomography angiography; eGFR: estimated glomerular filtration rate; TIA: transient ischemic attack.
[a]The following is an approach utilized by the Calgary Health Zone to identify cases that warrant an urgent or emergent CTA from the aortic arch to the vertex. Isolated dizziness or numbness, as well as isolated sensory symptoms, do not require urgent or emergent CTA as they are low yield, but may be ordered after consultation with a stroke physician.

Alberta Health Services
Cardiovascular Health & Stroke Strategic Clinical Network™

Harmonizing the CT/CTA Stroke Protocol in Alberta for Major Stroke

Critical	Strongly Encouraged

Suggested Guideline	Description	Supporting Evidence
No wait for creatinine philosophy	Immediately do a CTA after a NCCT while patient is still on the CT table. Contrast induced nephropathy called into question as an entity. Recent large case control studies with propensity matching show no evidence of this condition.	Canadian Stroke Best Practice Recommendations- Hyperacute Wait for a serum creatinine before giving intravenous contrast? No!
Noncontrast CT which includes thin section CT for hyperdense sign length determination	NCCT head thin section 0.5-mm slice thickness to identify Hyperdense artery signs and length as well as tPA response. No additional radiation with sequential imaging. Thrombus length was measured as length of arterial hyperdensities in admission nonenhanced CT images with a slice width of 1.25 to 2.5 mm. No recanalization was noted in any intravenous tPA patient with a thrombus length >8 mm. – *Reconstruction without extra imaging- if no CTA available can may decision on large long clots .5mm is good for this*	Topical Review Imaging – Stroke Detection of Thrombus in Acute Ischemic Stroke Value of Thin-Section Noncontrast-Computed Tomography
CTA neck and head 0.625 mm source images	Neck CTA with mCTA head 0.5-mm source images can be used for quick determination of proximal occlusion Residual flow at intracranial occlusion site/ Nonocclusive thrombi Extracranial thrombus (donut sign).*	Topical Review Imaging – Stroke
Multiphase CTA (2 additional movements of gantry) 1 mSV additional radiation	Evidence of moderate-to-good pial collateral filling defined by multi-phase or dynamic CTA, or evidence of CT perfusion mismatch. Multiphase CTA is an alternative technique that generates time-resolved cerebral angiograms of brain vasculature from the skull base to the vertex in 3 phases after contrast injection. It identifies crucial pathophysiology, such as slow flow, delayed collateral filling, and delayed contrast leakage (ICH), similar to 4D CTA. Aortic arch to vertex CTA is performed with a multidetector CT scanner during the first phase of acquisition timed to capture the peak arterial phase in a healthy brain for 7 s. The remaining 2 phases are from the skull base to the vertex in the equilibrium/peak venous and late venous phases by the movement of the CT gantry over the cranium ≈8 s apart. Multiphase CTA has advantages, including the speed of acquisition and interpretation, minimal additional radiation, no additional contrast material, whole-brain coverage, and no post processing.	Canadian Stroke Best Practice – Endovascular Topical Review Imaging – Stroke Escape Trial New Tool For Imaging Triage of Patients with Acute Ischemic Stroke
Multiphase CTA thick section (23 mm) MIPs of all three phases	Allows for collateral grading. Good collaterals have good collateral filling on 1st phase. Fair collaterals have one or two phase delay in collateral filling and poor collaterals have absent filling on any phases in significant portion of MCA territory.	
Thick section coronal neck and thick section coronals and sagittal MIPs	The mCTA head coronal thick MIPs will help identify terminal ICA occlusion and determine type M1 versus M2 occlusion. The mCTA head sagittal thick MIPs will help identify distal M2 and beyond occlusions; ACA occlusions, and distal vasculopathy.	Topical Review Imaging – Stroke
Noncontrast sequential "point and shoot" is preferred versus spiral acquisition to optimize EIC detection	NCCT head standard 5-mm slice thickness axial plane images.** Image quality for early ischemic change detection best with sequential imaging. Less bony artifacts than spiral acquisition. Very low mAmp-sec and kV will result in very poor tissue contrast. The imaging acquisition parameters should be optimized for tissue contrast. – *Sequential imaging takes about 15 seconds longer to optimize.*	Topical Review Imaging – Stroke

**It is not required to show 3-D Terra-recon images. It is not useful to center the images around the carotid artery only – this is not always the vessel of interest. If these are desired, they should be programmed AFTER the fact to avoid delaying the movement of the images to PACS. These extra images are non-essential for decision-making*

***It is not necessary to show coronal or sagittal MIPs. If other planes are desired, they should be programmed AFTER the fact to avoid delaying the movement of the images to PACS. These extra images are non-essential for decision-making.*

Key programming and data movement decisions are the following:

a) NCCT head and reconstructions should be completed and sent to PACS immediately.
b) mCTA arch-to-vertex and reconstructions should be completed and sent to PACS next.

Thus, there are two pushes to PACS. The purpose of this is to maximize decision making information as early as possible after imaging is completed:

1.) Detection of Thrombus in Acute Ischemic Stroke
2.) Value of Thin-Section Noncontrast-Computed Tomography

For questions, please contact the Cardiovascular Health & Stroke Strategic Clinical Network™ at:
CardiovascularHealthStroke.SCN@ahs.ca Office: 403-617-0115

Revised: 27Feb2017

Harmonized Provincial CT/CTA Protocol

- No wait for creatinine philosophy. CTA not performed in what scenario?
- Noncontrast CT non-helical “point and shoot” versus helical acquisition to optimize EIC detection
- Noncontrast CT which includes thin section CT for hyperdense sign length determination
- CTA neck and head 0.625 mm source images
- CTA 23 mm thick MIPs
- Multiphase CTA (2 additional movements of gantry) 1 mSV additional radiation
- Multiphase CTA thick section (23 mm) MIPs of all three phases
- Thick section coronal neck and thick section coronals and sagittal MIPs

Harmonized Provincial CT/CTA Protocol

- **No wait for creatinine philosophy**. CTA not performed in what scenario?
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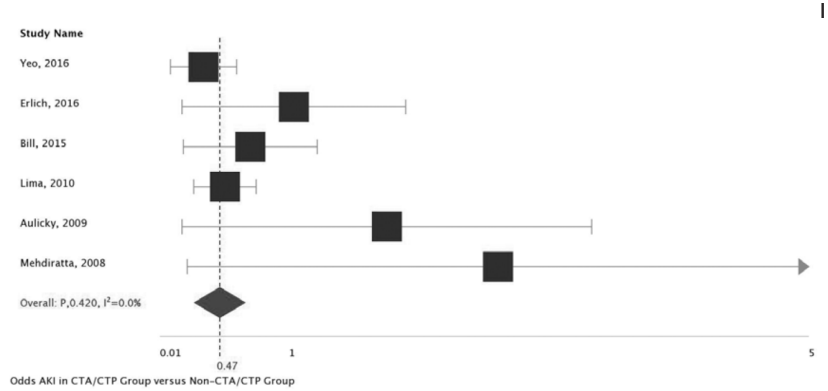
- Multiphase CTA thick section (23 mm) MIPs of all three phases
- Thick section coronal neck and thick section coronals and sagittal MIPs

Neurons Over Nephrons

Systematic Review and Meta-Analysis of Contrast-Induced Nephropathy in Patients With Acute Stroke

Waleed Brinjikji, MD; Andrew M. Demchuk, MD; Mohammad H. Murad, MD; Alejandro A. Rabinstein, MD; Robert J. McDonald, MD, PhD; Jennifer S. McDonald, PhD; David F. Kallmes, MD

(*Stroke*. 2017;48:00-00.



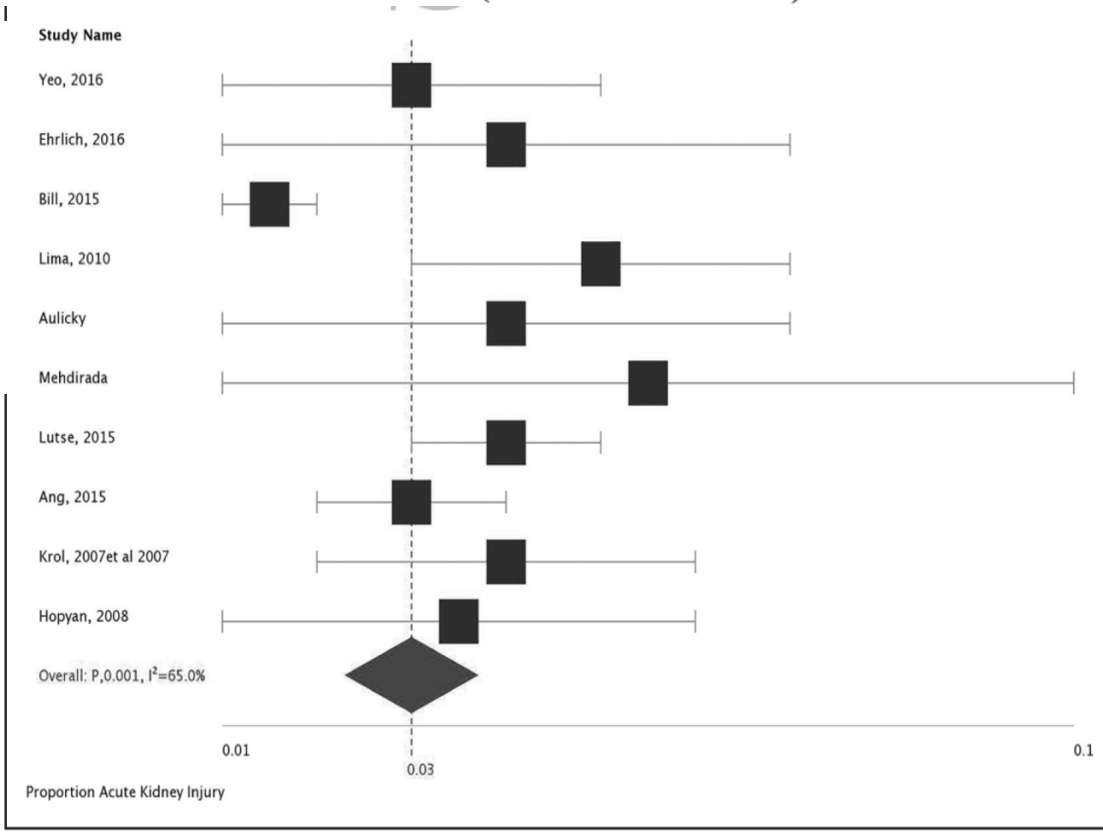
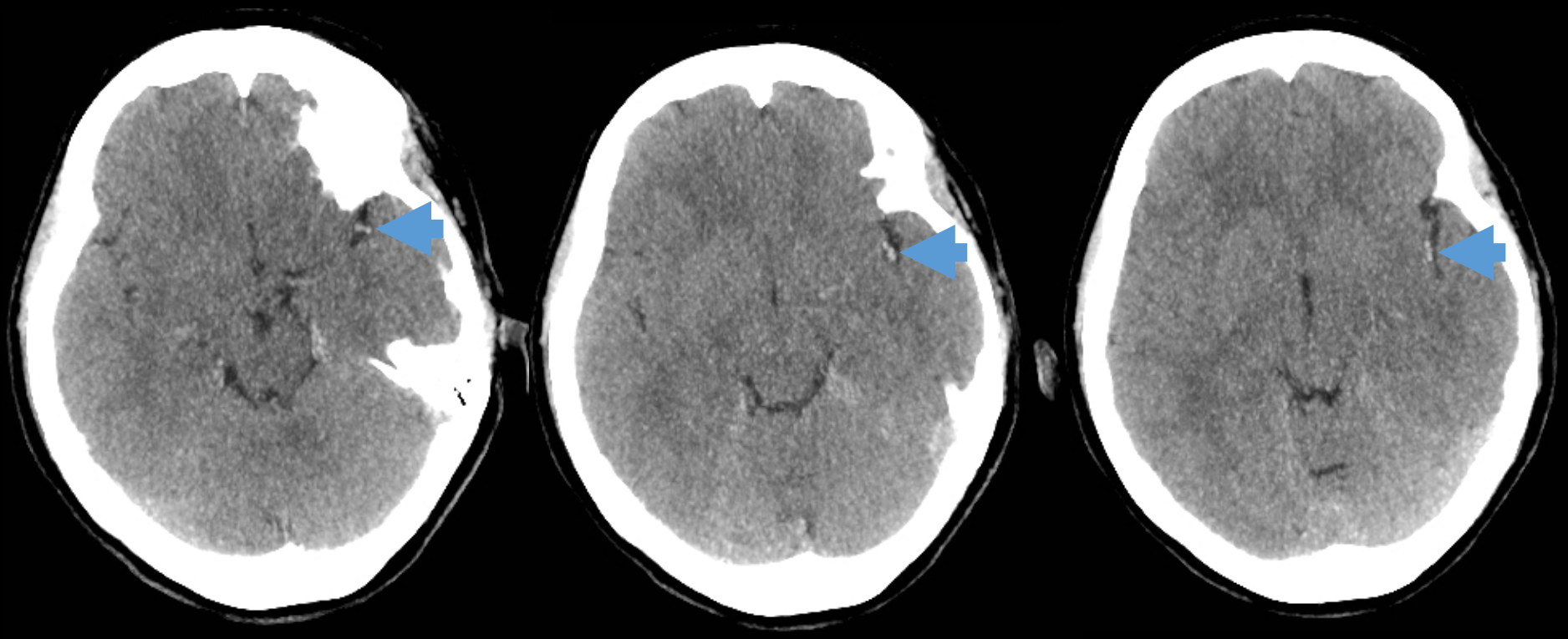


Figure 4. Meta-analysis of overall acute kidney injury rates.

The overall rate of hemodialysis in the CTA/CTP group was 0.07% (3 of 4373).

CT head (thin slices)



COMMENTARY

Good is not Good Enough: The Benchmark Stroke Door-to-Needle Time Should be 30 Minutes

Noreen Kamal, Oscar Benavente, Karl Boyle, Brian Buck, Ken Butcher, Leanne K. Casaubon, Robert Côté, Andrew M Demchuk, Yan Deschaintre, Dar Dowlatshahi, Gordon J Gubitz, Gary Hunter, Tom Jeerakathil, Albert Jin, Eddy Lang, Sylvain Lanthier, Patrice Lindsay, Nancy Newcommon, Jennifer Mandzia, Colleen M. Norris, Wes Oczkowski, Céline Odier, Stephen Phillips, Alexandre Y Poppe, Gustavo Saposnik, Daniel Selchen, Ashfaq Shuaib, Frank Silver, Eric E Smith, Grant Stotts, Michael Suddes, Richard H. Swartz, Philip Teal, Tim Watson, Michael D. Hill

doi:10.1017/cjn.2014.41

Can J Neurol Sci. 2014; 41: 694-696

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Strategic Clinical Network

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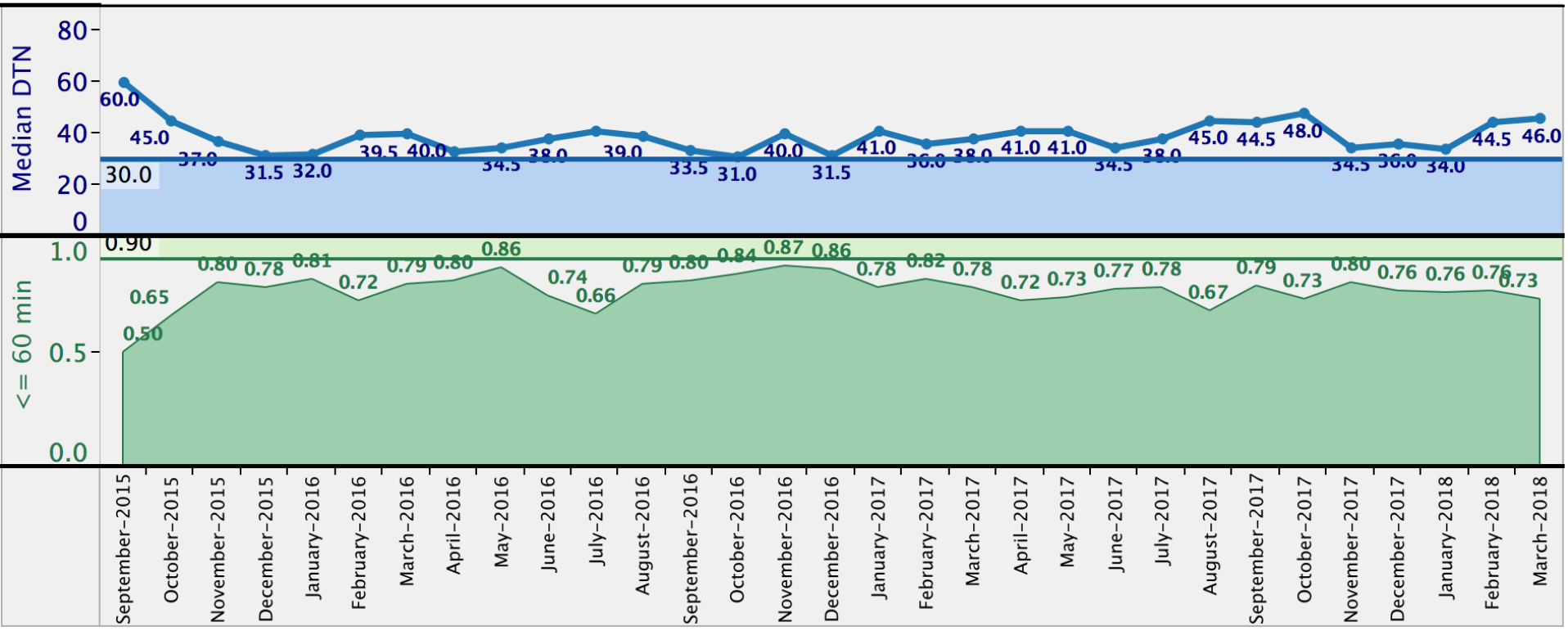
QuICR DTN performance in Alberta



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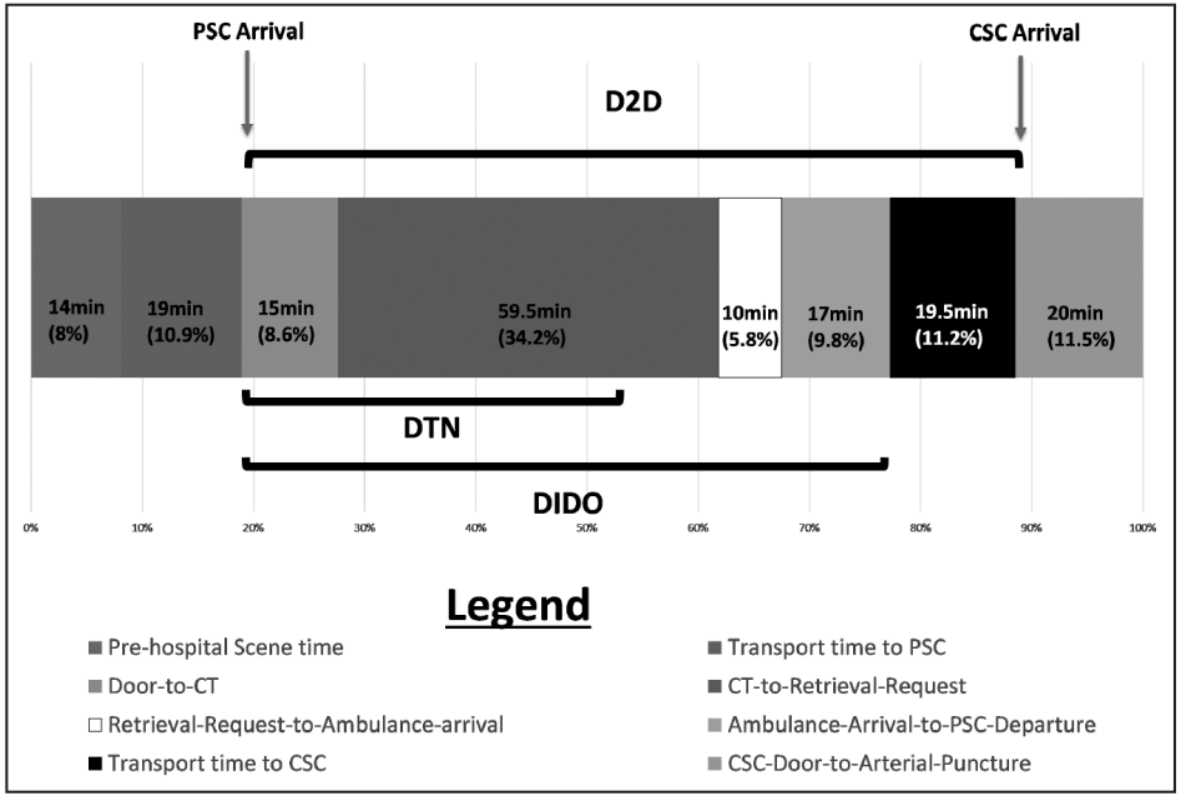
ERA

DIDO Times are terrible currently!

Deconstruction of Interhospital Transfer Workflow in Large Vessel Occlusion

Real-World Data in the Thrombectomy Era

Felix C. Ng, MBBS, MPH; Essie Low, DPsych; Emily Andrew, BBiomedSc; Karen Smith, PhD; Bruce C.V. Campbell, PhD; Peter J. Hand, MD; Douglas E. Crompton, PhD; Tissa Wijeratne, MD; Helen M. Dewey, PhD; Philip M. Choi, MBChB



DIDO (median 106 minutes;

QuICR registry Jan 2015 to Jan 2018.

79 patients that were transported from a PSC for EVT in Alberta.

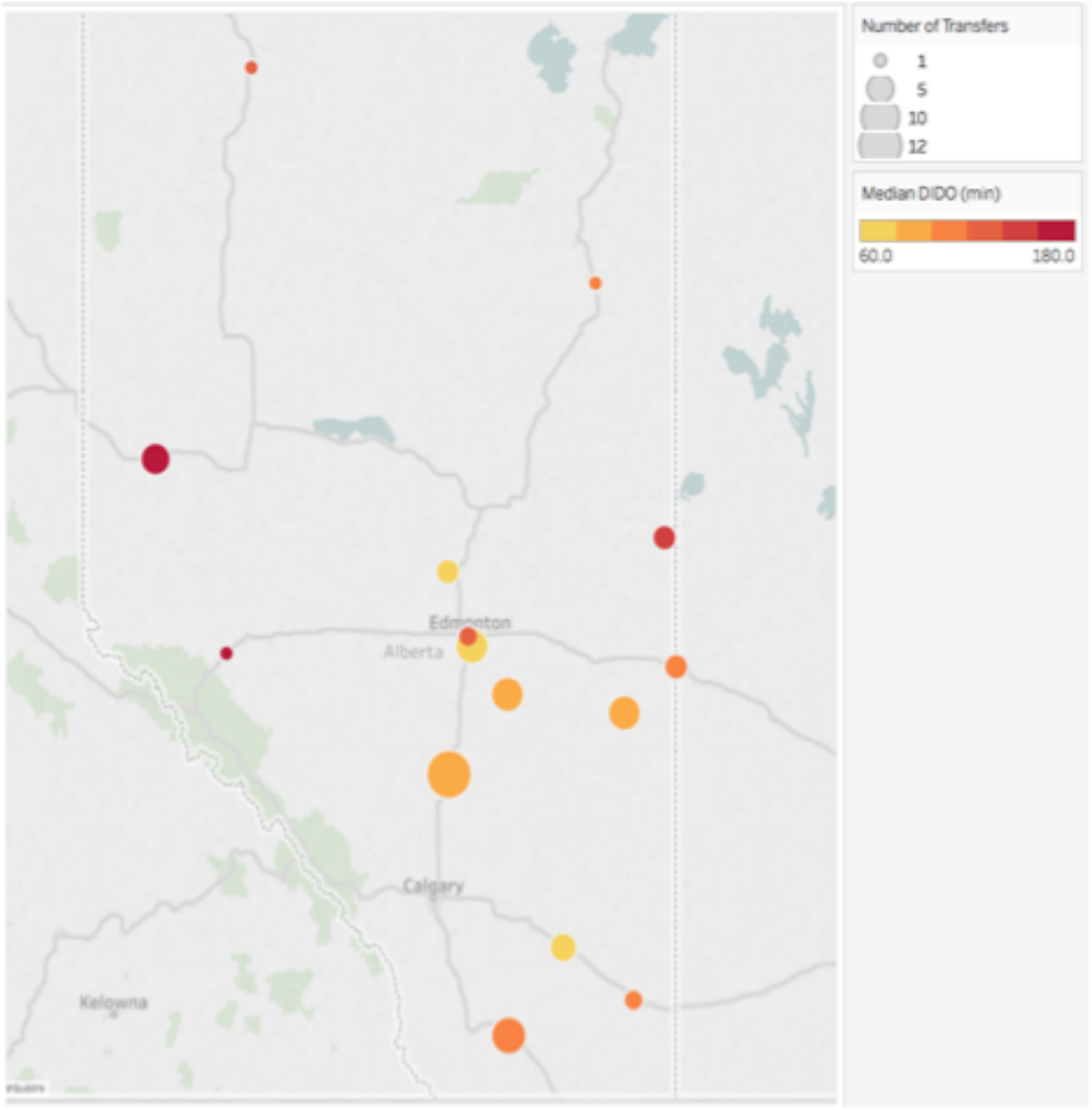
67% received EVT.

The **median DIDO time was 100min** and the median DNT time was 47min.

Faster DNT correlated with faster DIDO times (r^2=0.188,p=0.0004).

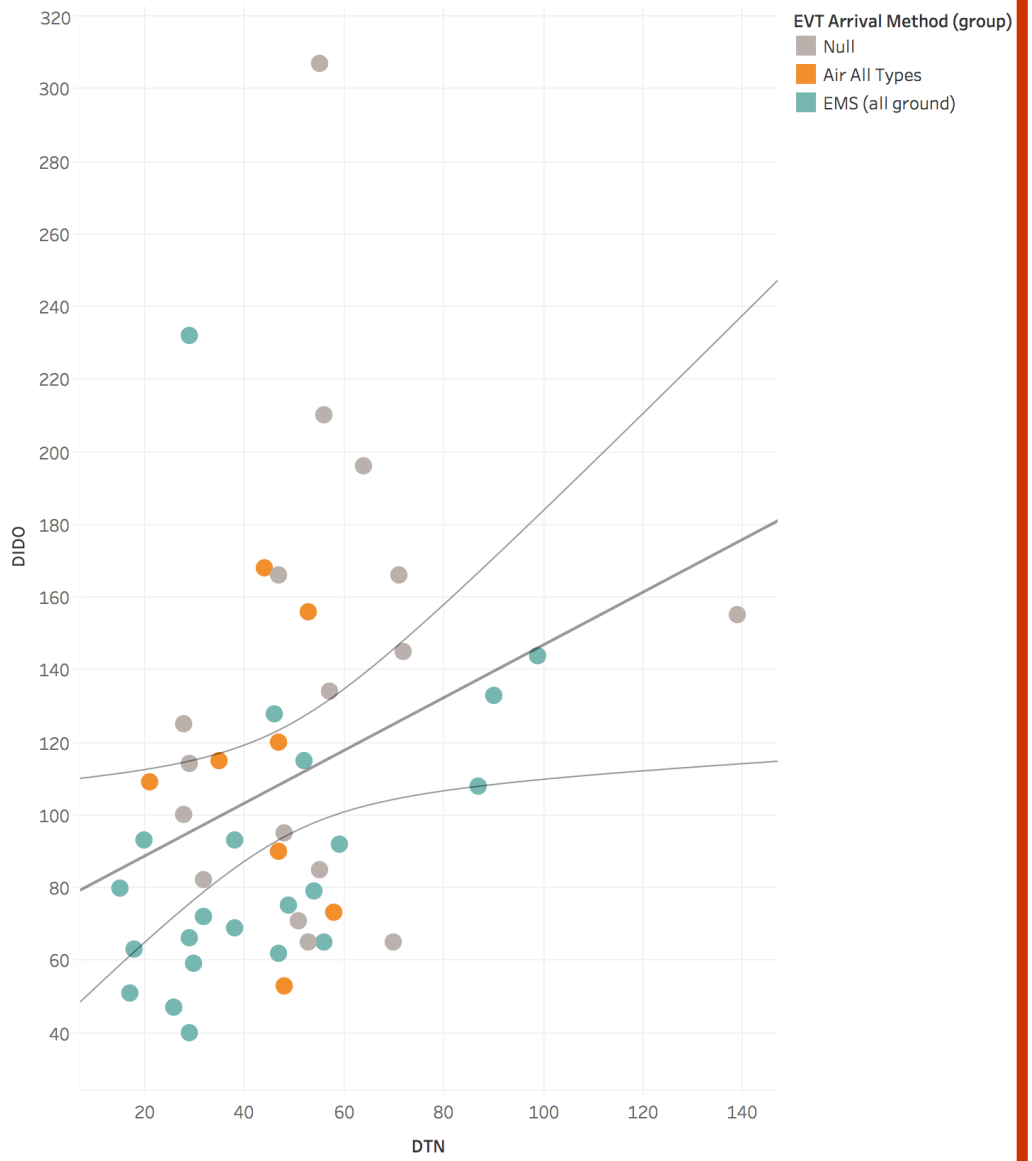
Greater distance correlated with longer DIDO times (r^2=0.168,p=0.0001).

DIDO Times in Alberta



DTN DIDO Correlation

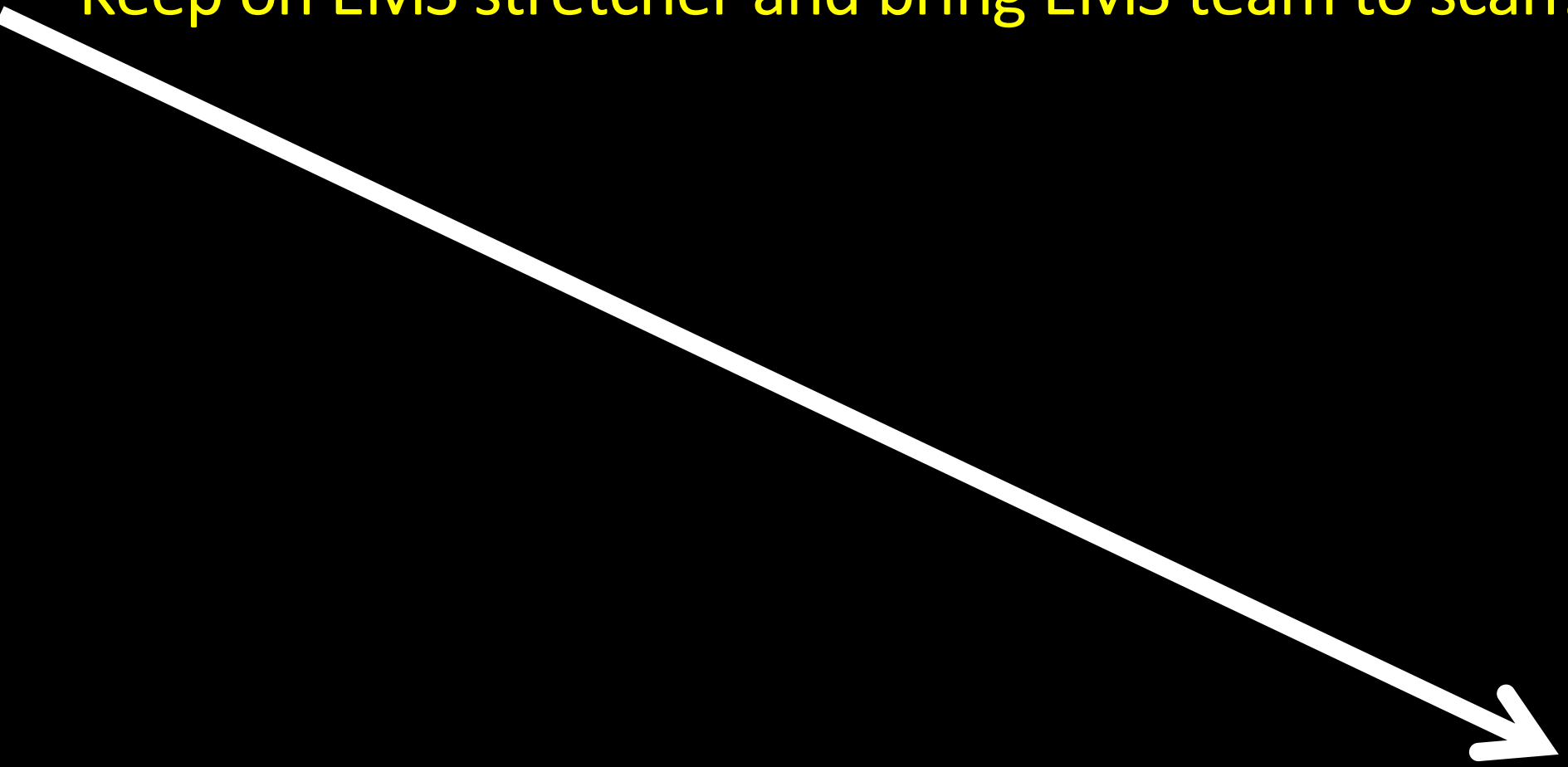
Figure 5: DTN vs DIDO



DTN <30 min/ DIDO <45 min

Door to CT scanner <10 min

Keep on EMS stretcher and bring EMS team to scan!



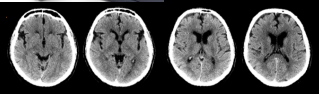
DTN <30 min/ DIDO <45 min

Door to CT scanner <10 min

Keep on EMS stretcher and bring EMS team to scan!

NCCT prep/scanning time <5 min

Keep on the CT table for immediate CTA!



NCCT to tPA decision via telestroke <10 min

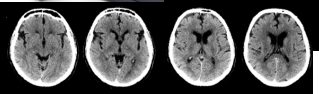
DTN <30 min/ DIDO <45 min

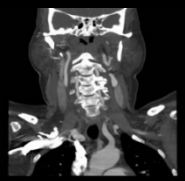
Door to CT scanner <10 min

Keep on EMS stretcher and bring EMS team to scan!

NCCT prep/scanning time <5 min

Keep on the CT table for immediate CTA!





NCCT to tPA decision via
telestroke <10 min
mix/prep for bolus <5 min

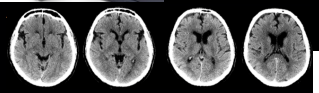
DTN <30 min/ DIDO <45 min

Door to CT scanner <10 min

Keep on EMS stretcher and bring EMS team to scan!

NCCT prep/scanning time <5 min

Keep on the CT table for immediate CTA!

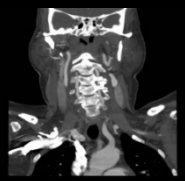


CTA reformatting time <5 min

All images to decision <10 min

Same EMS team and stretcher out door!

Prep for CSC <10 min



Door in door out <45 minutes

NCCT to tPA decision via telestroke <10 min

mix/prep for bolus <5 min

Door to needle <30 minutes

LVO populations to develop better access

- Metro area patients- EMS activation ✓
- Small urban area patients- EMS activation ✓
- **Rural patients- EMS activation** ✓
- Walk-in/private vehicle- no EMS activation
- In hospital stroke

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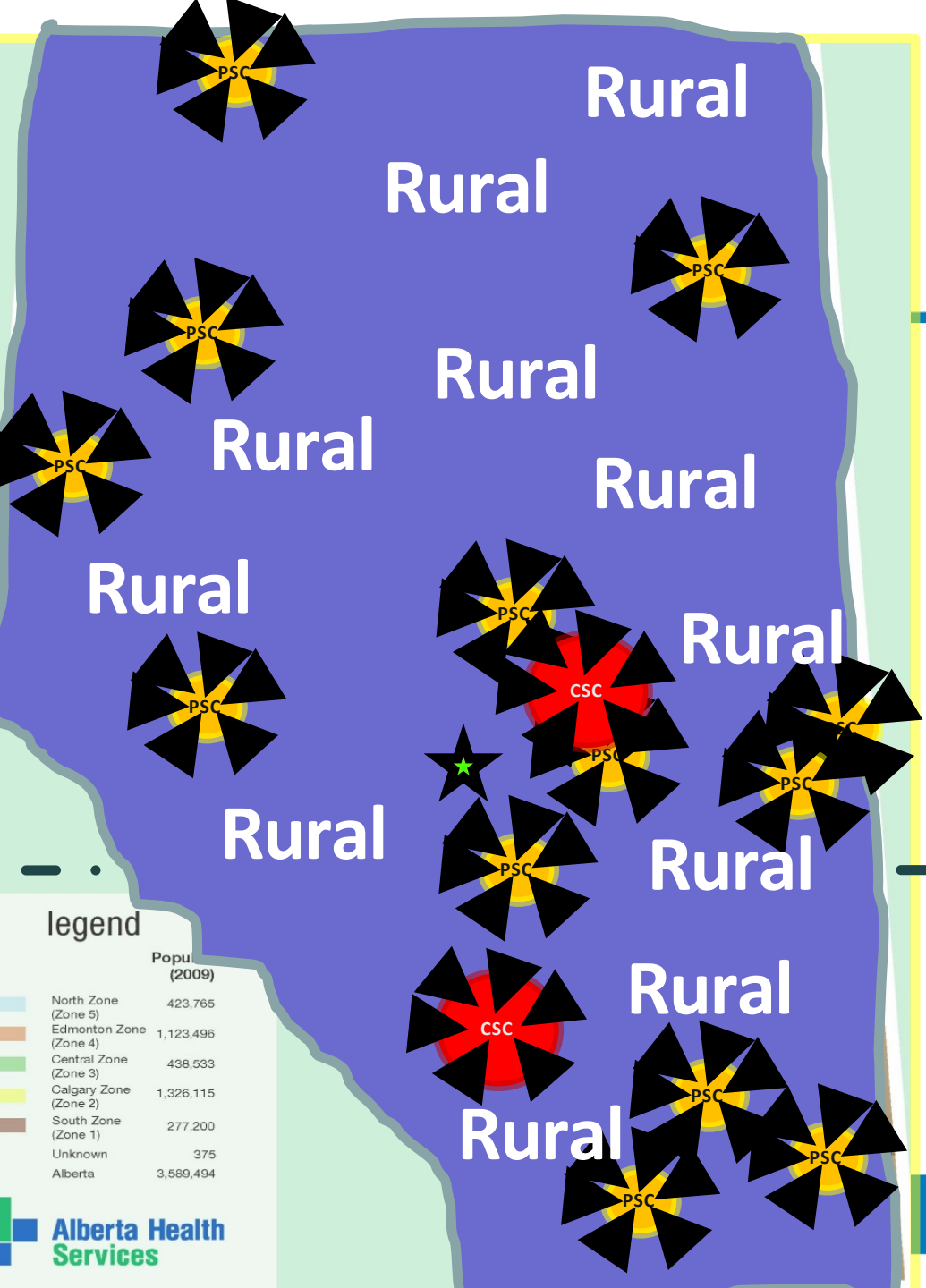
PSC or CSC?

Alberta Acute Stroke Treatment 2018



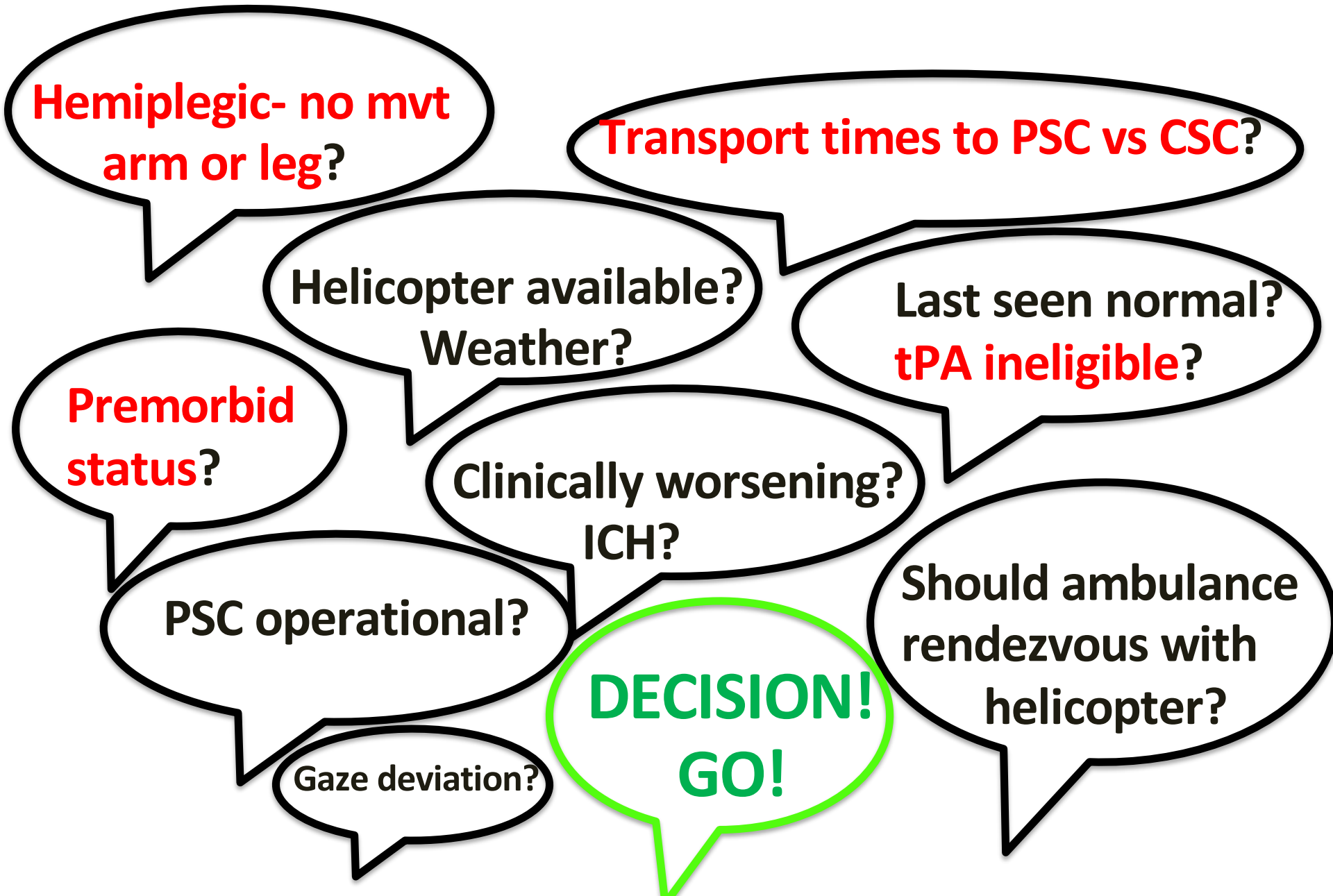
Comprehensive Stroke Centre

Primary Stroke Centre

Alberta Health Services

Strategic Clinical Network

Lots of factors to consider?



Rural Zone (PSC far and CSC far)
LAMSS ≥4 triggers communication pathway

Complete **Physical Examination Findings below,** then continue with screening process →

Physical Examination Findings		
Level of Consciousness ☐ **A**lert ☐ responds to **V**erbal ☐ responds to **P**ain ☐ **U**nresponsive	**Speech** ☐ Normal (0) ☐ Slurred ☐ Incomprehensible or mute	**Leg Strength** ☐ Normal ☐ Right-Drifts down ☐ Left-Drifts down ☐ Right-Falls rapidly ☐ Left-Falls rapidly
Facial Smile ☐ Normal (0) ☐ Right-Droop (1) ☐ Left-Droop (1)	**Hand Grips** ☐ Normal (0) ☐ Right-Weak grip (1) ☐ Left-Weak grip (1) ☐ Right-No grip (2) ☐ Left-No grip (2)	**Arm Strength** ☐ Normal (0) ☐ Right-Drifts down (1) ☐ Left-Drifts down (1) ☐ Right-Falls rapidly (2) ☐ Left-Falls rapidly (2)
LAMS Score (0 - 5): Calculated by adding the corresponding number from each of the three categories above		**TOTAL =** ☐

EMS has the patient

LAMS Score Calculated

Communication Pathway Triggered

Decision Made

Direct Transport to a CSC "Mothership"

Drip and Ship

PSC

Standard Site Protocol: DTN times <30minutes Followed by Fast Transport to a CSC if the patient is eligible for EVT

CSC

Patient Arrives at a Comprehensive Stroke Centre for Endovascular Therapy

Rural Zone (PSC far and CSC far)
3 way rural field consultation

EMS has the patient

LAMS Score Calculated

Communication Pathway Triggered

Decision Made

Direct Transport to a CSC "Mothership"

PSC

Drip and Ship

CSC

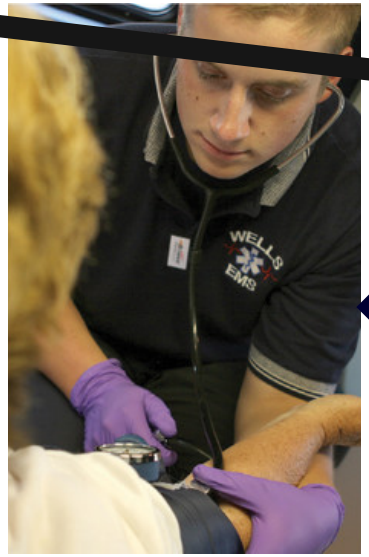
Patient Arrives at a Comprehensive Stroke Centre for Endovascular Therapy

Standard Site Protocol: DTN times <30minutes Followed by Fast Transport to a CSC if the patient is eligible for EVT

Complete **Physical Examination Findings** below, then continue with screening process

Physical Examination Findings		
Level of Consciousness ☐ Alert ☐ responds to Verbal ☐ responds to Pain ☐ Unresponsive	**Speech** ☐ Normal (0) ☐ Slurred ☐ Incomprehensible or mute	**Leg Strength** ☐ Normal ☐ Right-Drifts down ☐ Left-Drifts down ☐ Right-Falls rapidly ☐ Left-Falls rapidly
Facial Smile ☐ Normal (0) ☐ Right-Droop (1) ☐ Left-Droop (1)	**Hand Grips** ☐ Normal (0) ☐ Right-Weak grip (1) ☐ Left-Weak grip (1) ☐ Right-No grip (2) ☐ Left-No grip (2)	**Arm Strength** ☐ Normal (0) ☐ Right-Drifts down (1) ☐ Left-Drifts down (1) ☐ Right-Falls rapidly (2) ☐ Left-Falls rapidly (2)
LAMS Score (0 - 5): Calculated by adding the corresponding number from each of the three categories above		TOTAL = ☐

AHS stroke neurologist



Rural Field Consultation

- EMS at scene
- Stroke Neurology
- Transport/Medical control physician

Stroke team at stentsville are you on the call? Crew 39 here. We have an 81 yr old male with stroke sx

We are now leaving scene in Hamletville

Airway, Breathing ok

AHS stroke neurologist

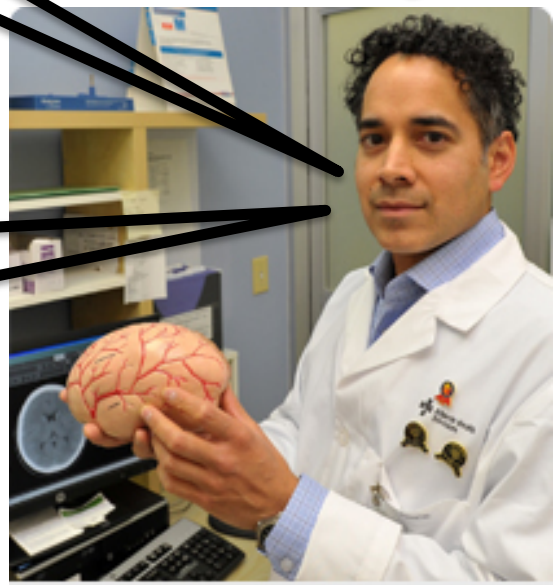
Rural Field Consultation

- EMS at scene
- Stroke Neurology
- Transport/Medical control physician

I wonder where Hamletville is?

10-4 Crew 39

Transport physician are you on call?



AHS stroke neurologist

Rural Field Consultation

- EMS at scene
- Stroke Neurology
- Transport/Medical control physician

Yes I am here.
PSC Townsville 35 min by ground in current weather/traffic.

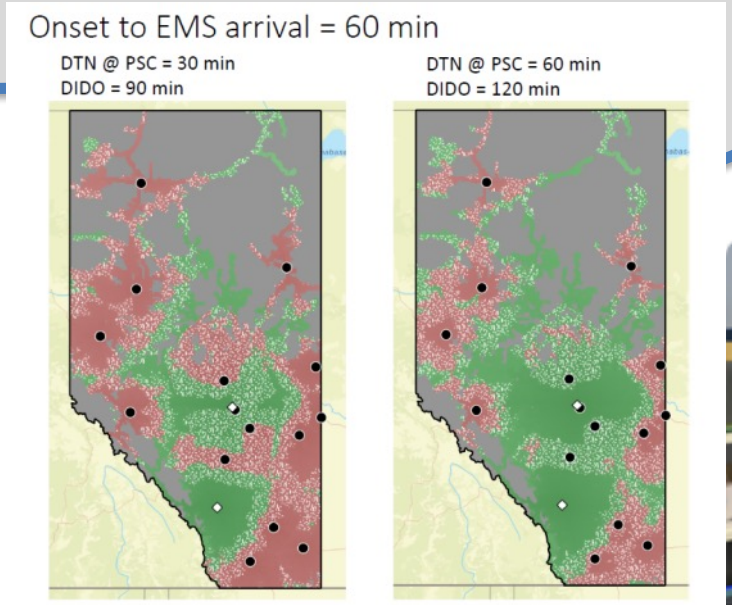
Confirmed CSC Stentsville 70 min ETA using ambulance rendezvous with helicopter

AHS stroke neurologist

Rural Field Consultation

- EMS at scene
- Stroke Neurology
- Transport/Medical control physician

Now to remember stroke centre metrics
PSC Townsville DTN 60 min, DIDO 120 min
CSC Stentsville DTN 25 min



AHS stroke neurologist

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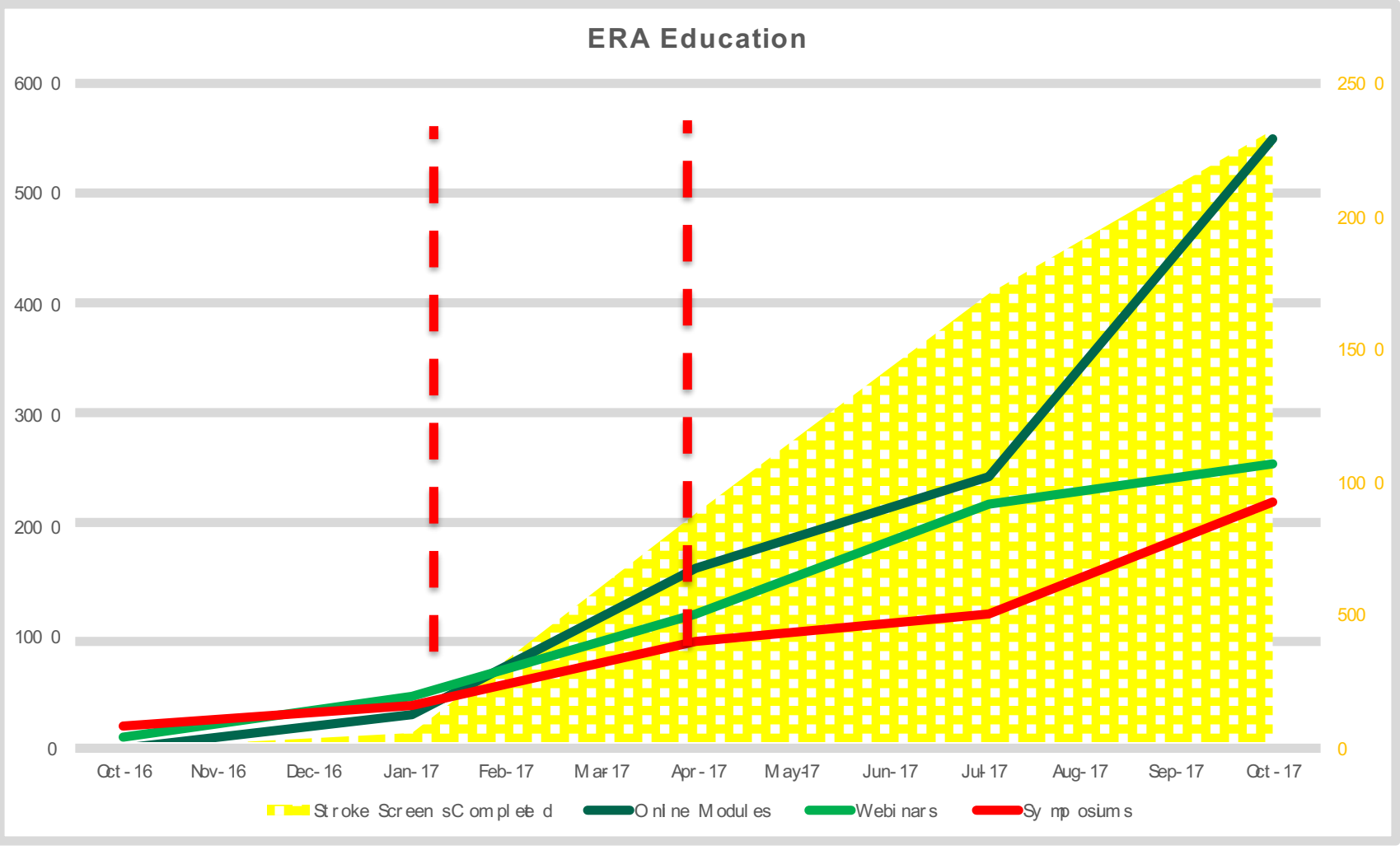

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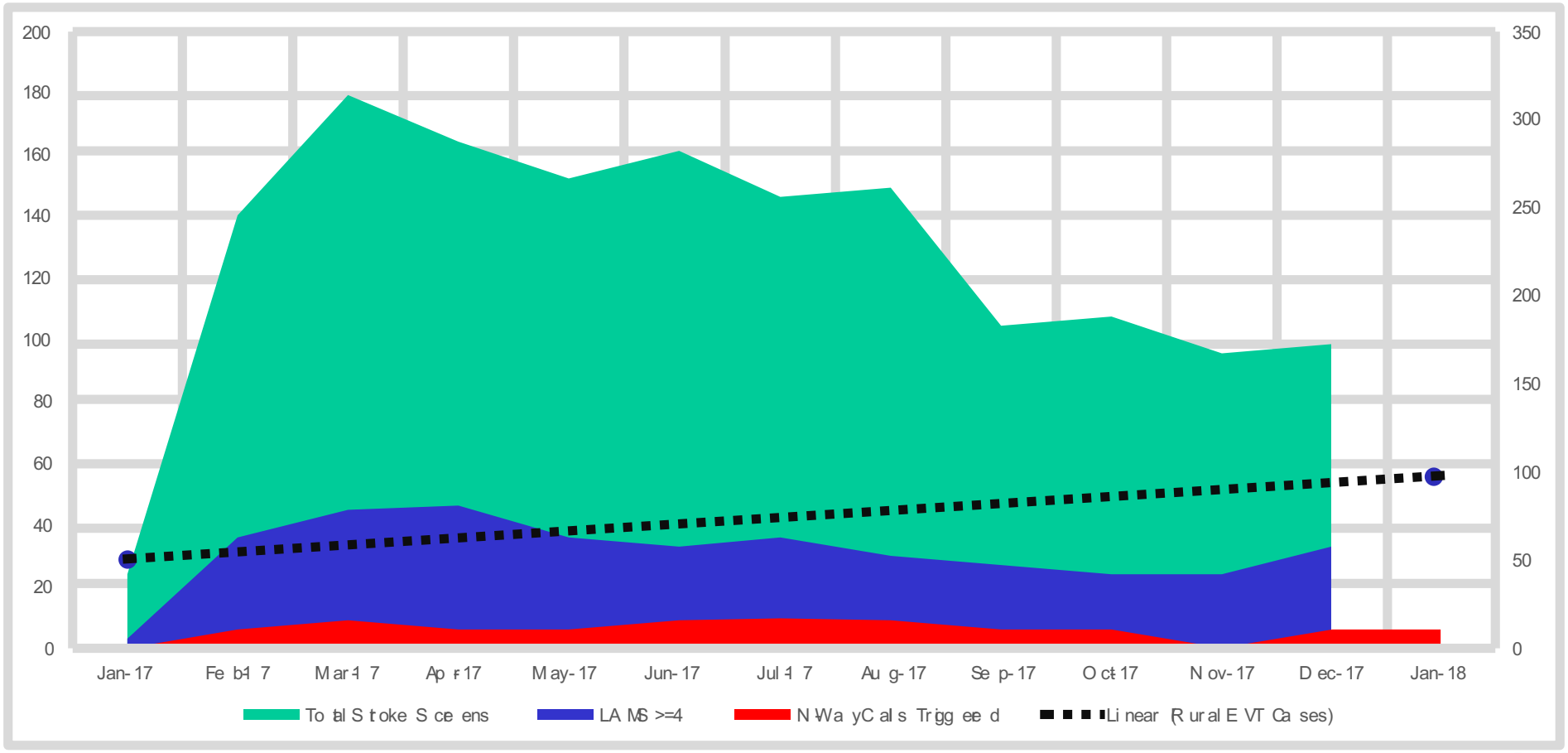
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180
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Jan-17
Feb-17
Mar-17
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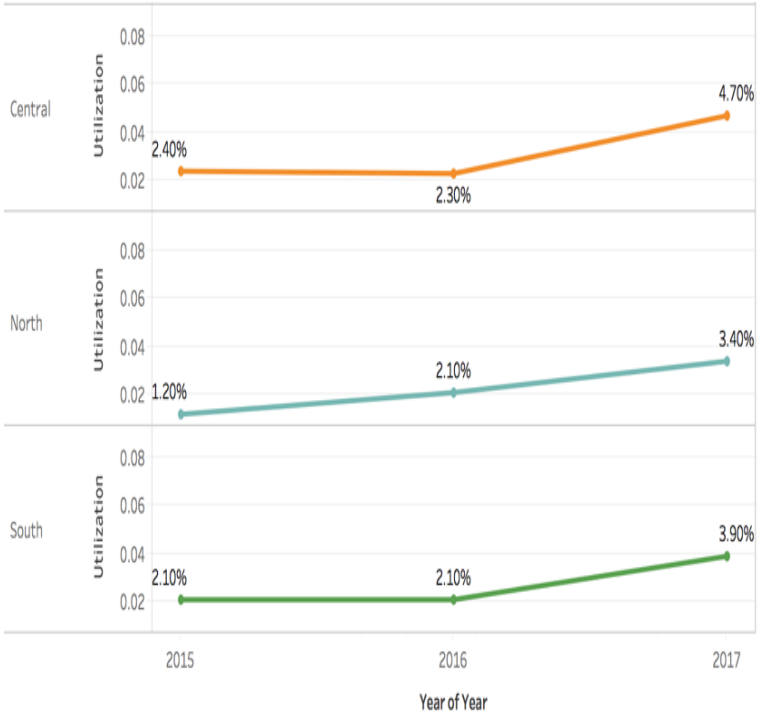
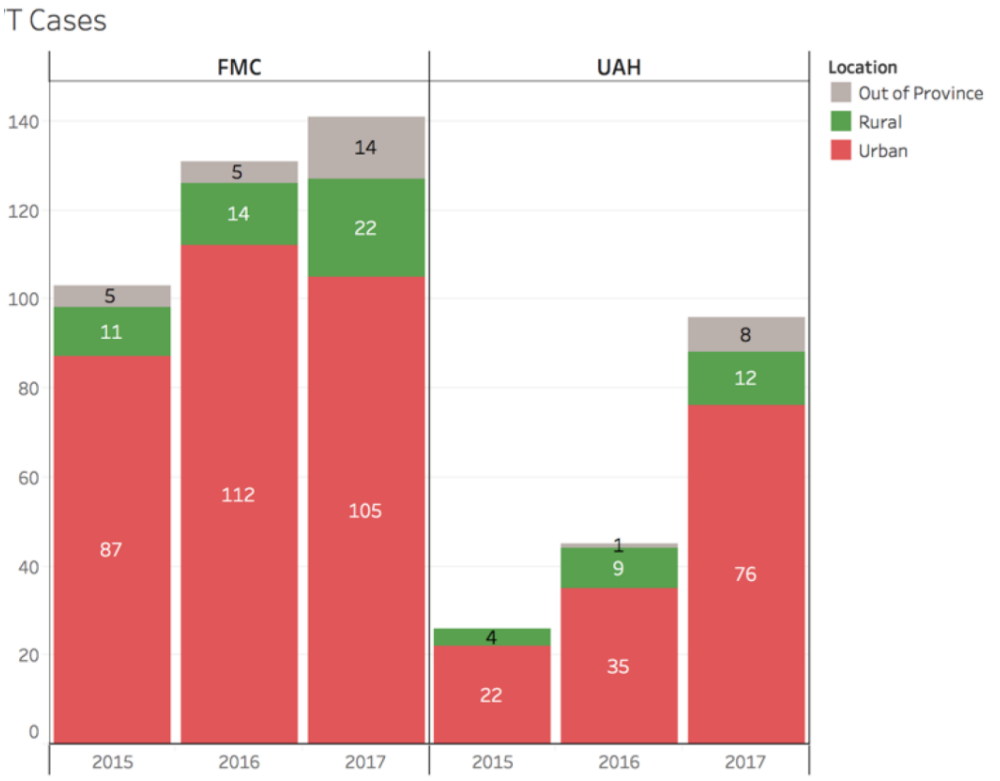
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
Jan-18
Total Stroke Screens
LAMS >=4
NIHSS Triggered
Linear (Rural EVT Cases)


Central
North
South
Utilization
0.08
0.06
0.04
0.02
2.40%
2.30%
4.70%
1.20%
2.10%
3.40%
2.10%
2.10%
3.90%
2015
2016
2017
Year of Year


T Cases
FMC
UAH
Location
Out of Province
Rural
Urban
140
120
100
80
60
40
20
0
5
11
87
5
14
112
14
22
105
4
22
1
9
35
8
12
76
2015
2016
2017
2015
2016
2017

LVO populations to create faster EVT access for

- Metro area patients- EMS activation ✓
- Small urban area patients- EMS activation ✓
- Rural patients- EMS activation ✓
- **Walk-in/private vehicle- no EMS activation**
- In hospital stroke

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Alberta Stroke Program

ENDOVASCULAR RECANALIZATION ALBERTA
ERA

Alberta Health Services
Strategic Clinical Network

Original Article

Patterns of Emergency Medical Services Use and Its Association With Timely Stroke Treatment

Findings From Get With the Guidelines-Stroke

Olaniyi James Ekundayo, MD, DrPH; Jeffrey L. Saver, MD; Gregg C. Fonarow, MD; Lee H. Schwamm, MD; Ying Xian, MD, PhD; Xin Zhao, MS; Adrian F. Hernandez, MD, MHS; Eric D. Peterson, MD, MPH; Eric M. Cheng, MD, MS

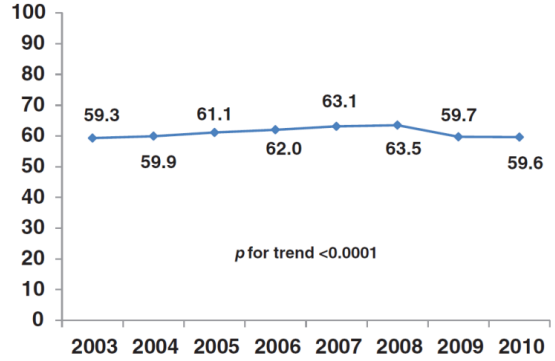


Figure 2. Temporal trend in emergency medical service use 2003–2010.

Table 2. Factors Associated With Emergency Medical Services Use Among Stroke Patients With Documented National Institute of Health Stroke Score and Insurance Status (n=185 997)**

	EMS Use (n=118 837)	Non-EMS (n=67 160)	Adjusted Odds Ratio	95% Confidence Interval
Age (per 10-y increase) among women (mean±SD)*	74.2±14.3	68.5±15.0	1.21	1.19–1.22
Age (per 10-y increase) among men (mean±SD)*	69.0±14.0	65.6±13.6	1.16	1.14–1.17
Race/ethnicity (ref, non-Hispanic white), %	71.4	68.9		
Black*	15.6	17.0	0.87	0.83–0.91
Hispanic*	6.2	6.9	0.73	0.69–0.77
Asian*	2.7	3.2	0.67	0.62–0.72
Others	3.6	3.4	0.95	0.88–1.03
Rural (ref, urban), %†	3.1	4.1	0.85	0.74–0.97

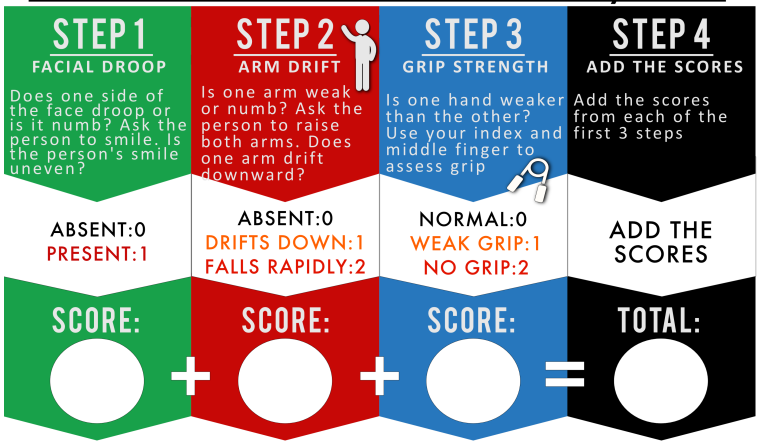
Non-EMS Activated
Non-Stroke Centre Arrival

If you see STROKE...
Then you CALL RAAPID

SIGNS OF STROKE

FACE is it drooping?
ARMS can patient raise both?
SPEECH is it slurred or jumbled?
TIME last seen/known well?

LAMS Score for Stroke Severity



LAMS<4	Proceed with YOUR SITE'S Stroke Protocol. Depending on geographical location, transfer to nearest PSC/CSC
LAMS≥4	Severe stroke - patient is a potential EVT candidate. **CALL RAAPID.** Stroke Neurologist will consult and direct if patient should be transferred to a Comprehensive Stroke Centre (CSC) or nearest Primary Stroke Centre (PSC). Confirm transport.

RAAPID North of Red Deer: 1-800-282-9911
RAAPID Red Deer and South: 1-800-661-1700

Physical Examination Findings	
Level of Consciousness ☐ Alert ☐ Responds to Verbal ☐ Responds to Pain only ☐ Unresponsive	**Speech** ☐ Normal ☐ Slurred ☐ Incomprehensible or mute
Leg Strength ☐ Normal ☐ Right-Drifts down ☐ Left-Drifts down ☐ Right-Falls rapidly ☐ Left-Falls rapidly	
Facial Smile Smile, show teeth, raise eyebrows and squeeze eyes shut ☐ Normal (0) ☐ Right-Droop (1) ☐ Left-Droop (1)	LAM
Arm Strength Elevate with palm down and hold for 10 second count *(45 degrees if laying down, 90 degrees if sitting)* ☐ Normal (0) ☐ Right-Drifts down (1) ☐ Left-Drifts down (1) ☐ Right-Falls rapidly (2) ☐ Left-Falls rapidly (2)	
Grip Strength Have patient try to grasp examiners fingers ☐ Normal (0) ☐ Right-Weak grip (1) ☐ Left-Weak grip (1) ☐ Right-No grip (2) ☐ Left-No grip (2)	
Total LAMS Score	

RAAPID team to walk a triage nurse through LAMSS scoring

UNIVERSITY OF CALGARY
CUMMING SCHOOL OF MEDICINE

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ENDOVASCULAR RECANALIZATION ALBERTA ERA

Alberta Health Services
Strategic Clinical Network

Non-EMS Activated
Non-Stroke Centre Arrival

If you see STROKE... Then you CALL RAAPID

SIGNS OF STROKE

- **F**ACE is it drooping?
- **A**RMS can patient raise both?
- **S**PEECH is it slurred or jumbled?
- **T**IME last seen/known well?

©Adapted from the Heart and Stroke Foundation of Canada, 2014

LAMS Score for Stroke Severity

STEP 1	STEP 2	STEP 3	STEP 4
FACIAL DROOP	ARM DRIFT	GRIP STRENGTH	ADD THE SCORES
Does one side of the face droop or is it numb? Ask the person to smile. Is the person's smile uneven?	Is one arm weak or numb? Ask the person to raise both arms. Does one arm drift downward?	Is one hand weaker than the other? Use your index and middle finger to assess grip	Add the scores from each of the first 3 steps
ABSENT:0 PRESENT:1	ABSENT:0 DRIFTS DOWN:1 FALLS RAPIDLY:2	NORMAL:0 WEAK GRIP:1 NO GRIP:2	ADD THE SCORES
SCORE: ( )	+ SCORE: ( )	+ SCORE: ( )	= TOTAL: ( )

LAMS<4 Proceed with YOUR SITE'S Stroke Protocol. Depending on geographical location, transfer to nearest PSC/CSC

LAMS≥4 Severe stroke - patient is a potential EVT candidate. **CALL RAAPID.** Stroke Neurologist will consult and direct if patient should be transferred to a Comprehensive Stroke Centre (CSC) or nearest Primary Stroke Centre (PSC). Confirm transport.

RAAPID North of Red Deer: 1-800-282-9911
RAAPID Red Deer and South: 1-800-661-1700

EMS has the patient

LAMS Score Calculated

Communication Pathway Triggered

Decision Made

Direct Transport to a CSC "Mothership"

Drip and Ship

CSC

Patient Arrives at a Comprehensive Stroke Centre for Endovascular Therapy

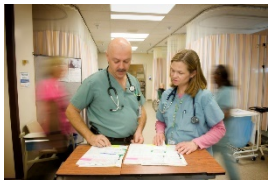
Routed to a CSC or PSC

Non-PSC

EMS will bypass Non-PSC But if a patient 'walks-in' and a stroke is identified the non-PSC can initiate the communication protocol via RAAPID

PSC

Standard Site Protocol: DTN times <30minutes Followed by Fast Transport to a CSC if the patient is eligible for EVT



AHS stroke neurologist

Non Stroke Centre Consultation

- Non stroke centre ED
- Stroke Neurology
- Transport/Medical control physician

We are here at Villageville hospital,
LAMSS 4 right face droop
no mvt right arm, no right grip

Last normal
2 hours ago

Old stroke with
right side
weakness

AHS stroke neurologist

5 Stroke Scenarios of EVT eligible patients

- Metro area patients- EMS activation
- Small urban area patients- EMS activation
- Rural patients- EMS activation
- Walk-in/private vehicle- no EMS activation
- **In hospital stroke**

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Thank-you for your attention!

Email: ademchuk@ucalgary.ca