Alberta Health Services

CLINICAL NEURO SCIENCES
CALGARY CANADA

ERA Update

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Cumming School of Medicine
University of Calgary

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CALGARY STROKE PROGRAM

HOTCHKISS BRAIN INSTITUTE

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

ENDOVASCULAR RECANALIZATION ALBERTA

CARDIOVASCULAR HEALTH & STROKE
STRATEGIC CLINICAL NETWORK

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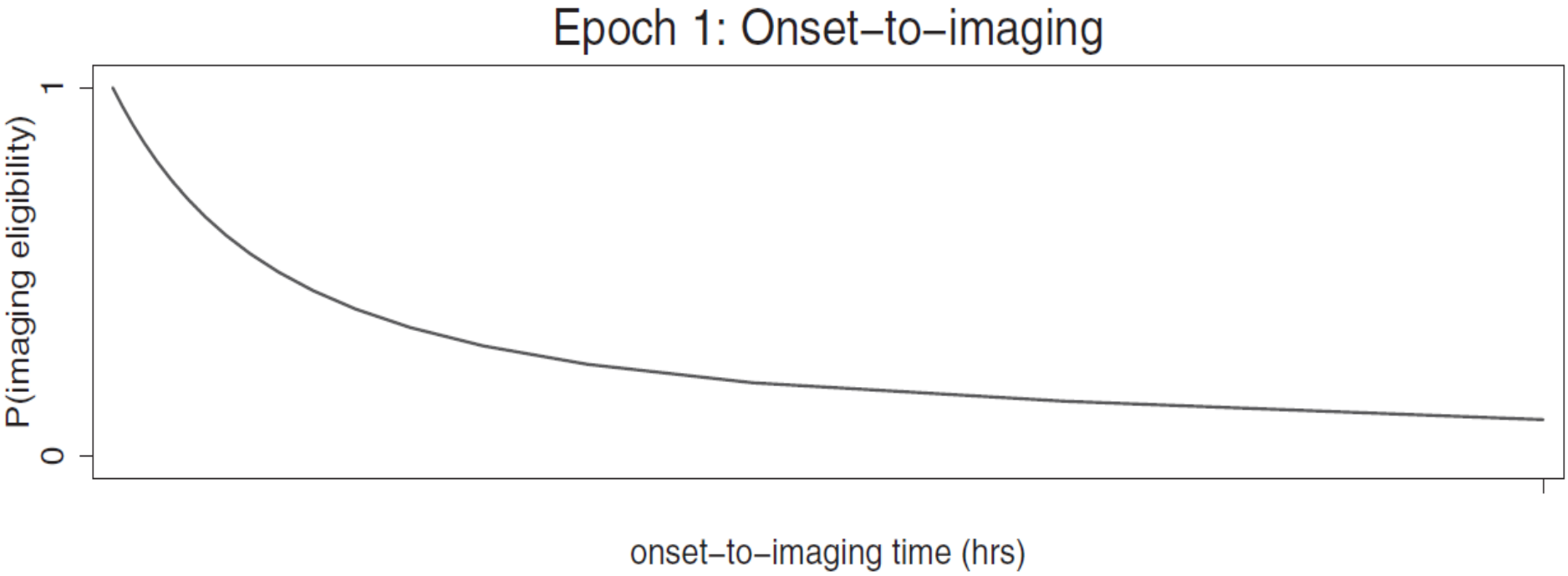
Alberta Health Services
Strategic Clinical Network

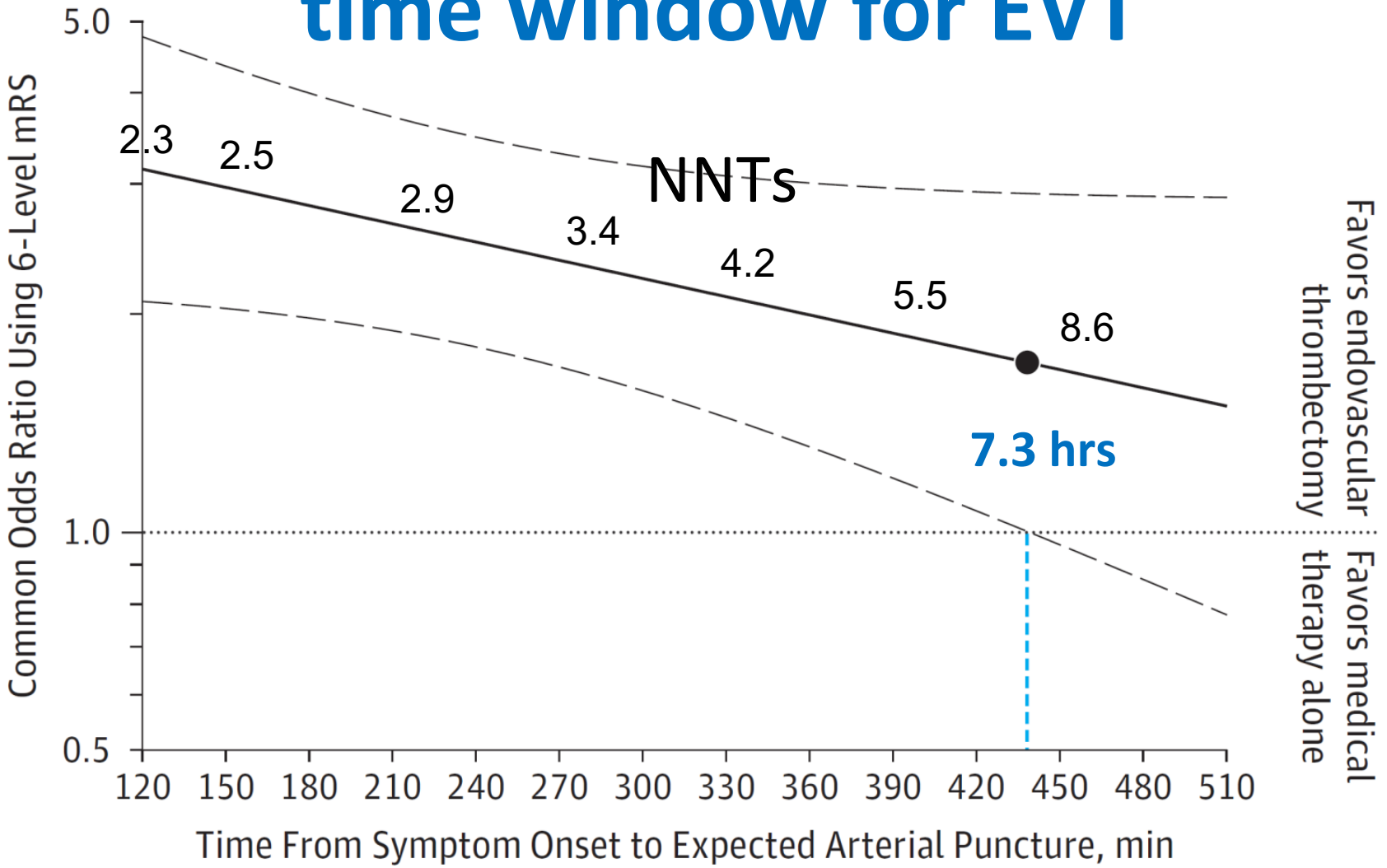
In Alberta, EVT is only available in Calgary (Foothills Medical Centre) and Edmonton (University of Alberta Hospital). Our health care system must adapt to ensure the timeliness and accessibility of this procedure for all Albertans. The Cardiovascular Health and Stroke Strategic Clinical Network™ has 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

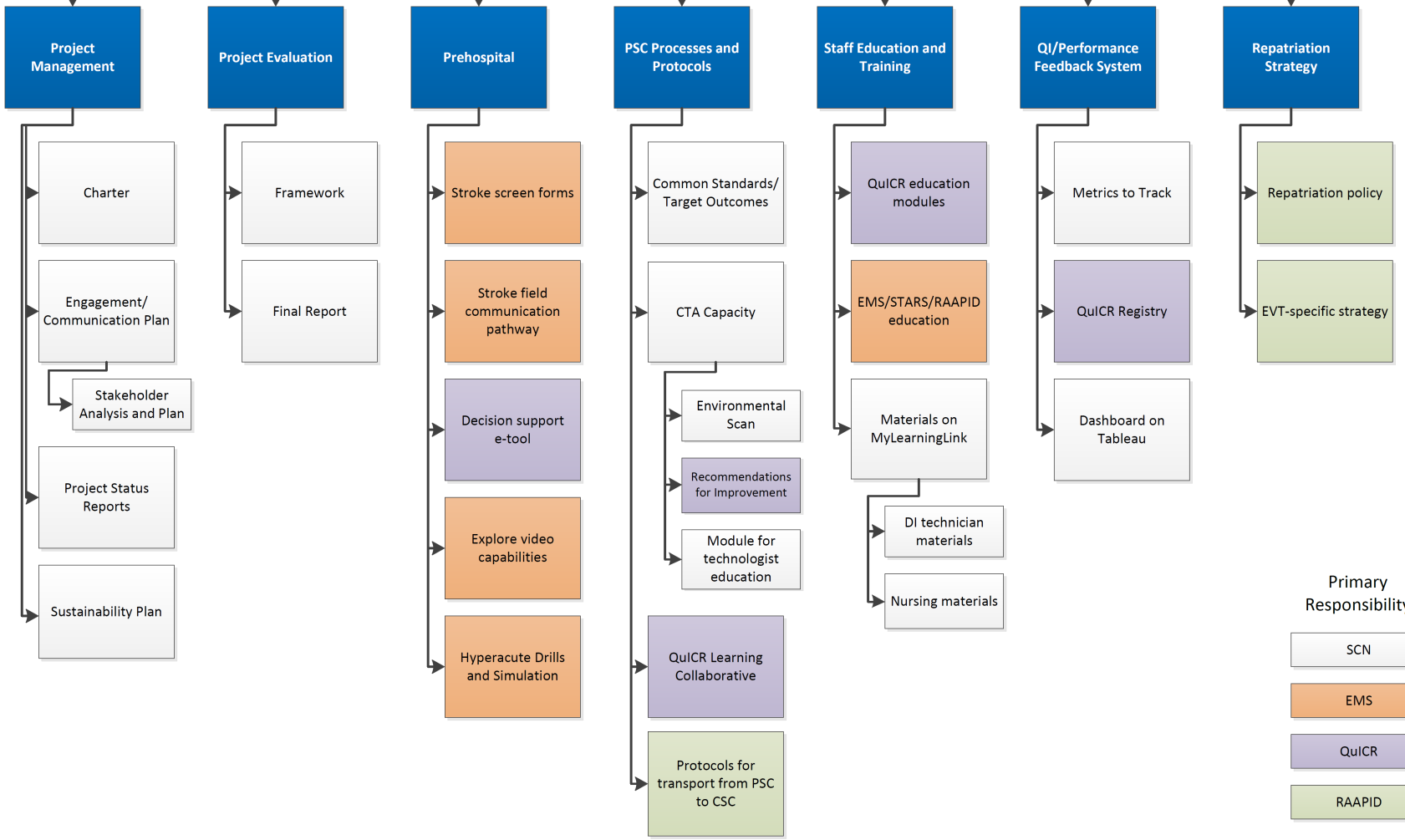


JAMA. 2016;316(12):1279-1288. doi:10.1001/jama.2016.13647

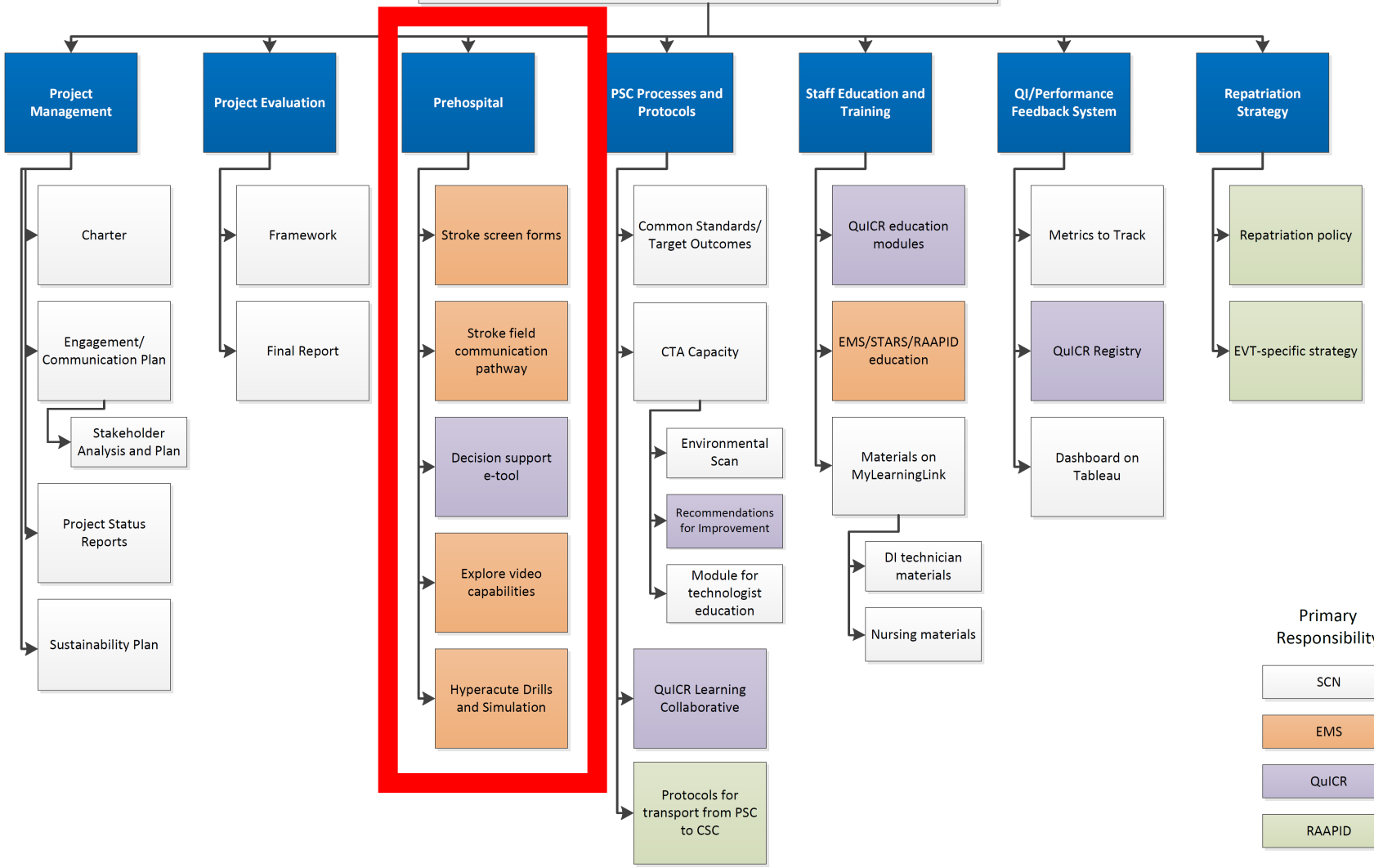
Improve Timely Access

- 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



Endovascular Recanalization Alberta (ERA) Project



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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
☐ 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 = ☐

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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EMS Stroke Screen

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

Affix patient label within this box

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**

ENDOVASCULAR RECANALIZATION ALBERTA ERA

Physical Examination Findings

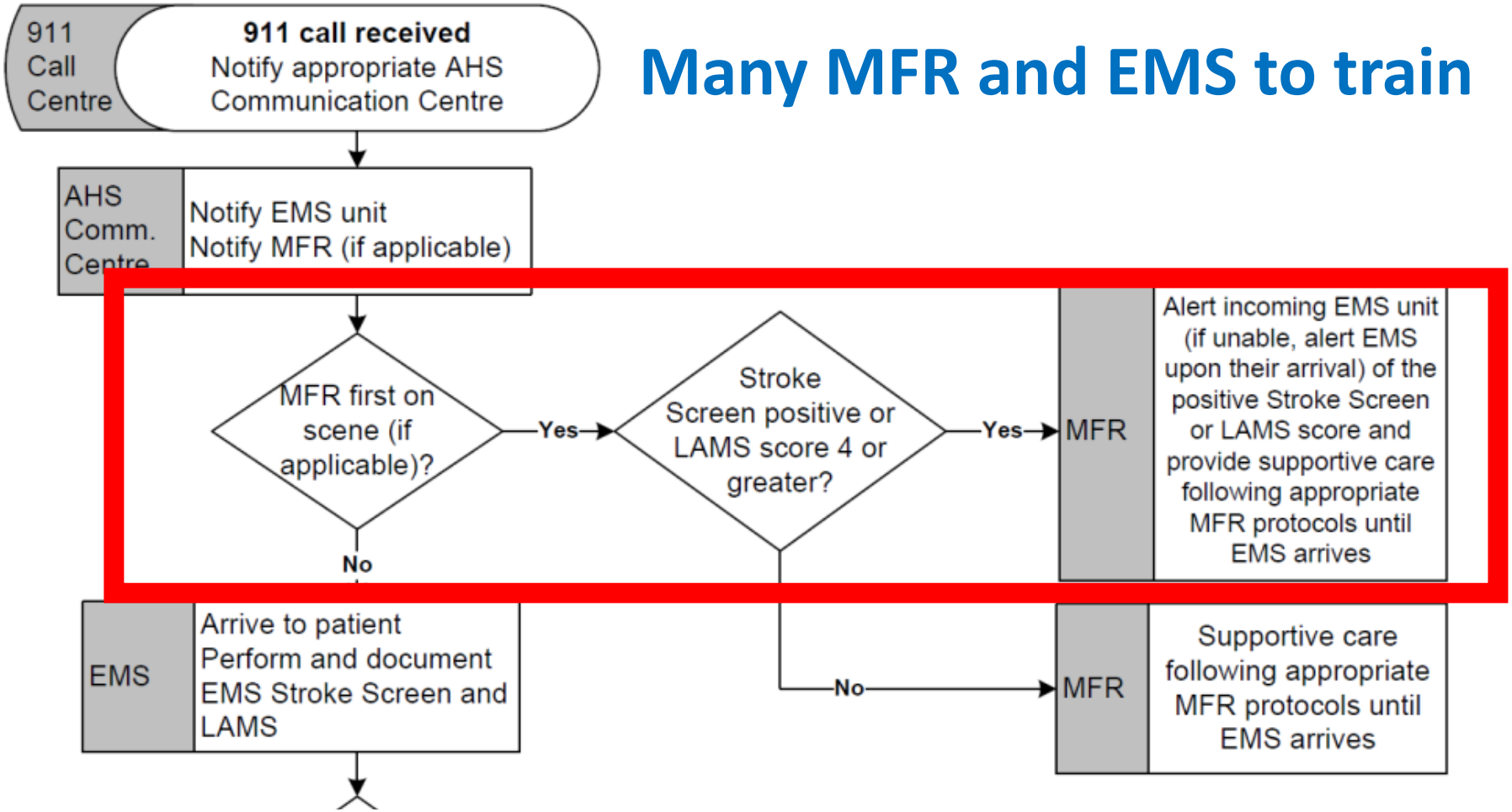
Level of Consciousness	Speech
☐ Alert	☐ Normal
☐ Responds to Verbal	☐ Slurred
☐ Responds to Pain only	☐ Incomprehensible or mute
☐ Unresponsive	

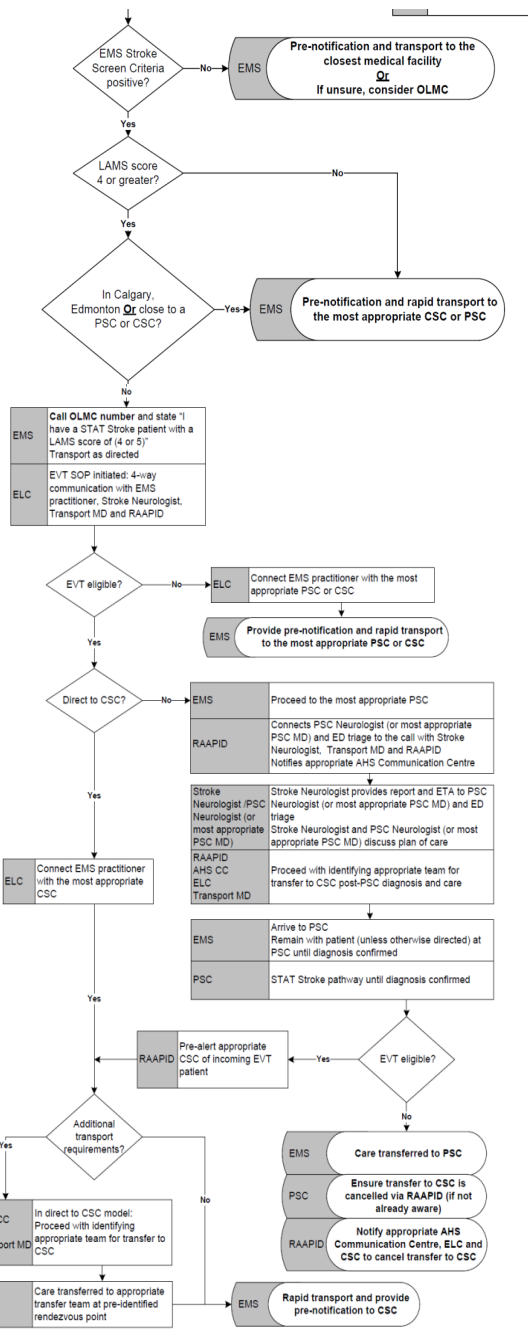
Leg Strength

- ☐ 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 to train




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
ELC
Connect EMS practitioner with the most appropriate CSC
RAAPID
AHS CC
ELC
Transport MD
Proceed with identifying appropriate team for transfer to CSC post-PSC diagnosis and care
EMS
Arrive to PSC
Remain with patient (unless otherwise directed) at PSC until diagnosis confirmed
PSC
STAT Stroke pathway until diagnosis confirmed
Yes
RAAPID
Pre-alert appropriate CSC of incoming EVT patient
Yes
EVT eligible?
No
Additional transport requirements?
Yes
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

Metro: CSC near Small Urban: PSC near Rural

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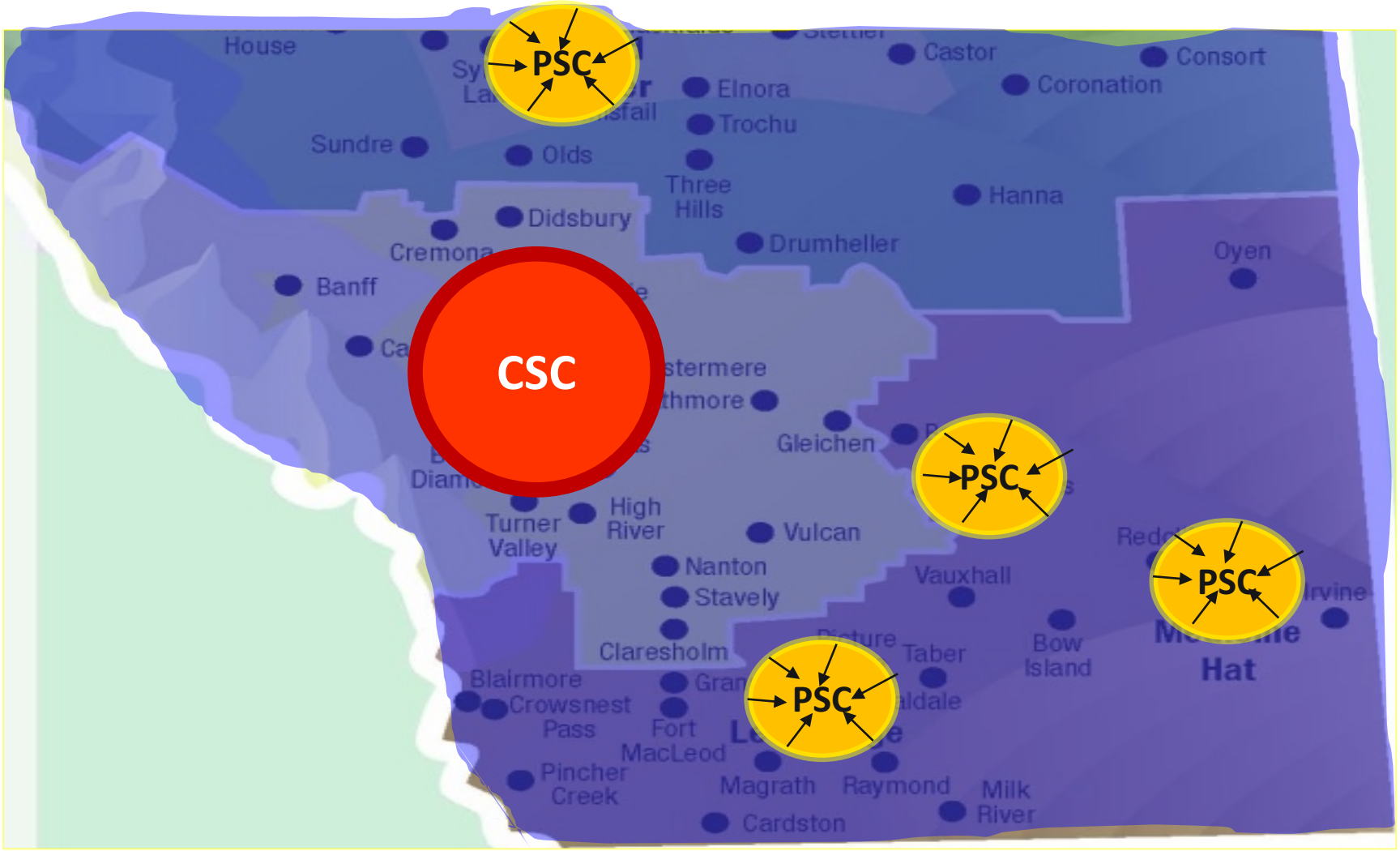
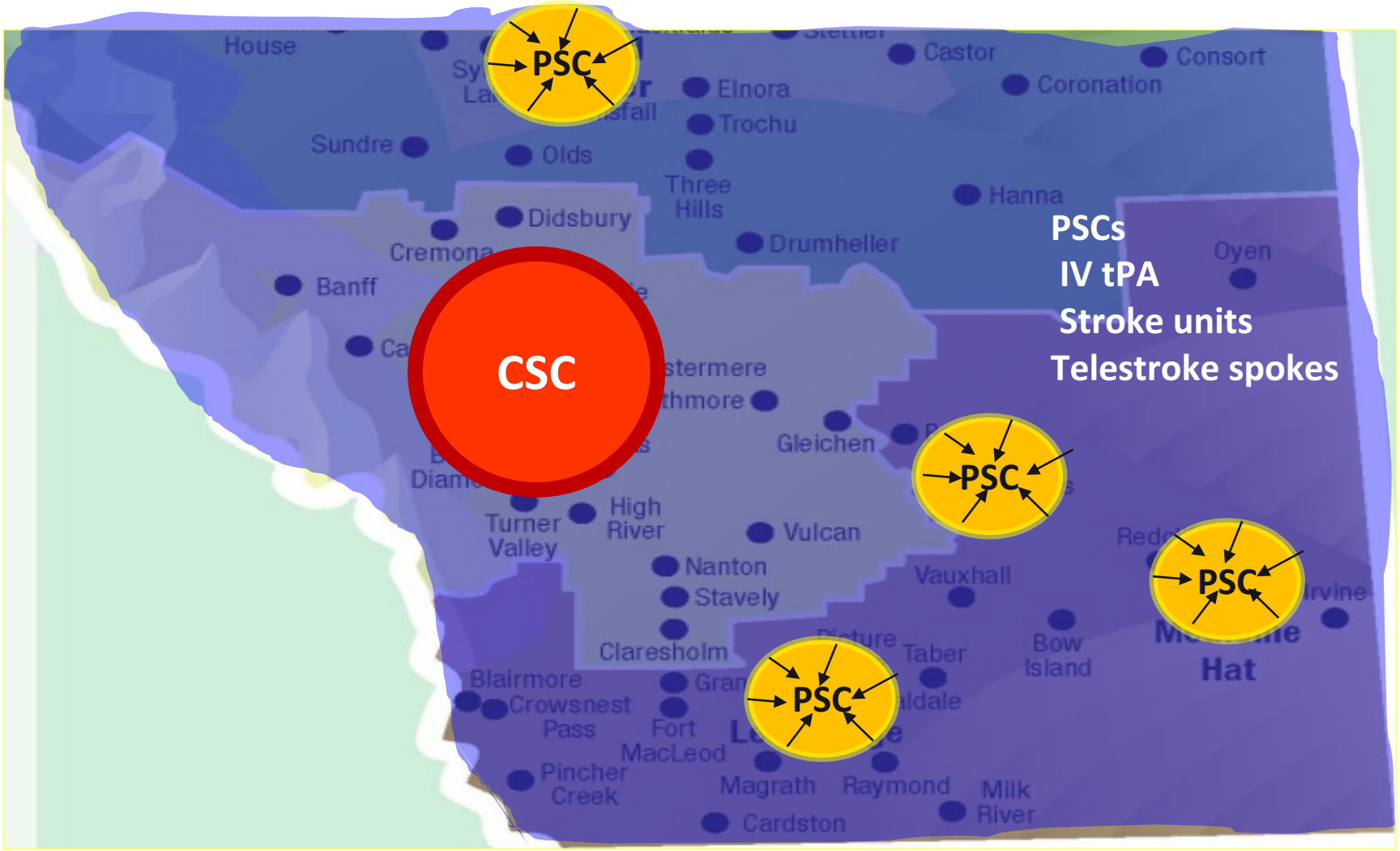
Metro: CSC near Small Urban: PSC near Rural

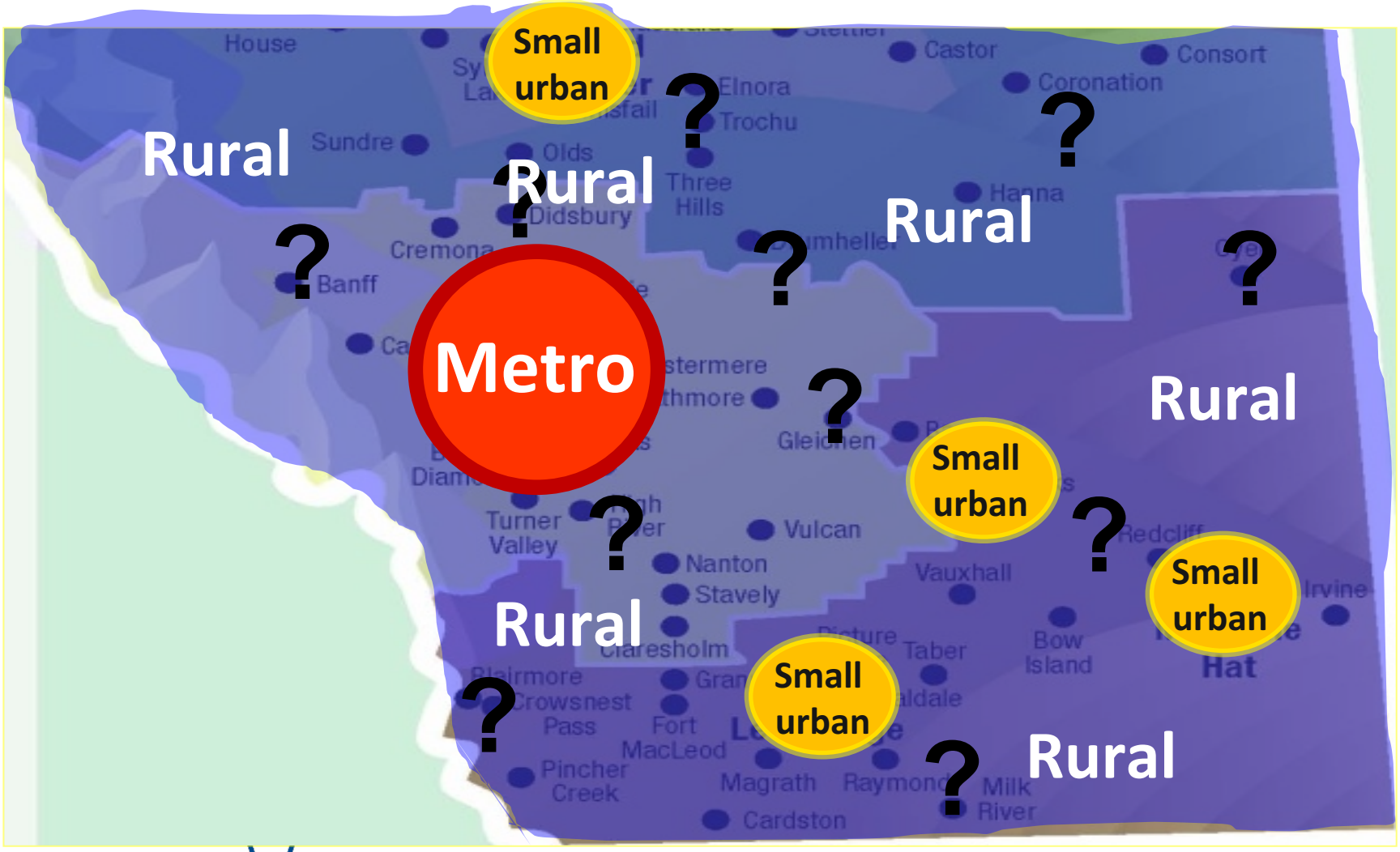


Metro: CSC near Small Urban: PSC near Rural



Creating a Highly Time Efficient Major Stroke Transport Protocol

Metro: CSC near **Small Urban: PSC near** **Rural**



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ENDOVASCULAR RECANALIZATION ALBERTA ERA

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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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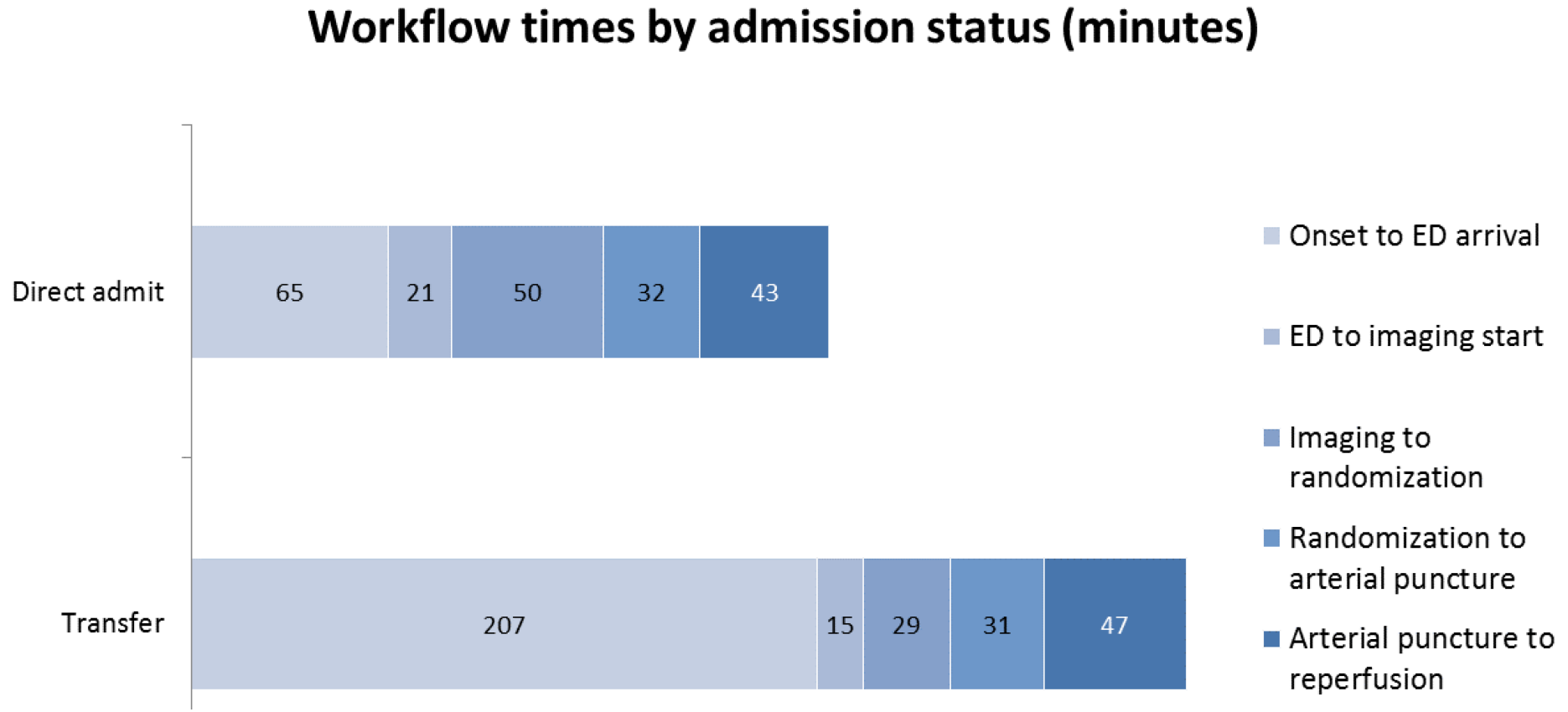
Strategic Clinical Network

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

Workflow metrics direct vs transfer



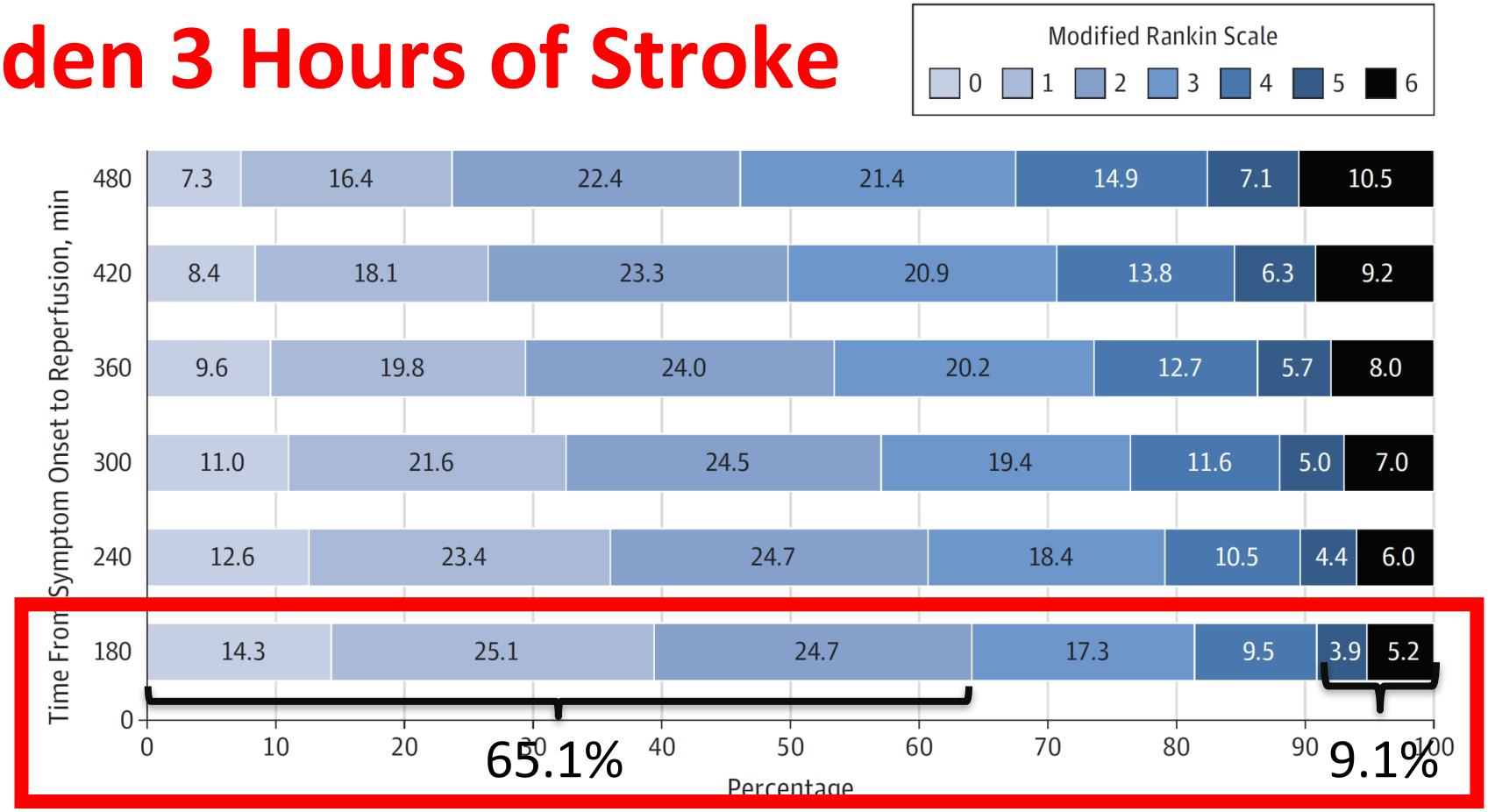
eFigure 8. Workflow time intervals in Direct-Arriving and Inter-Hospital-Transfer Patients. Median time values, in minutes, are shown.

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

Figure 2. Association of Time From Symptom Onset to Actual Reperfusion Among Patients in the Endovascular Thrombectomy Group Achieving Substantial Reperfusion With 90-Day Disability Outcomes Using an Adjusted Ordinal Logistic Regression Model

Golden 3 Hours of Stroke



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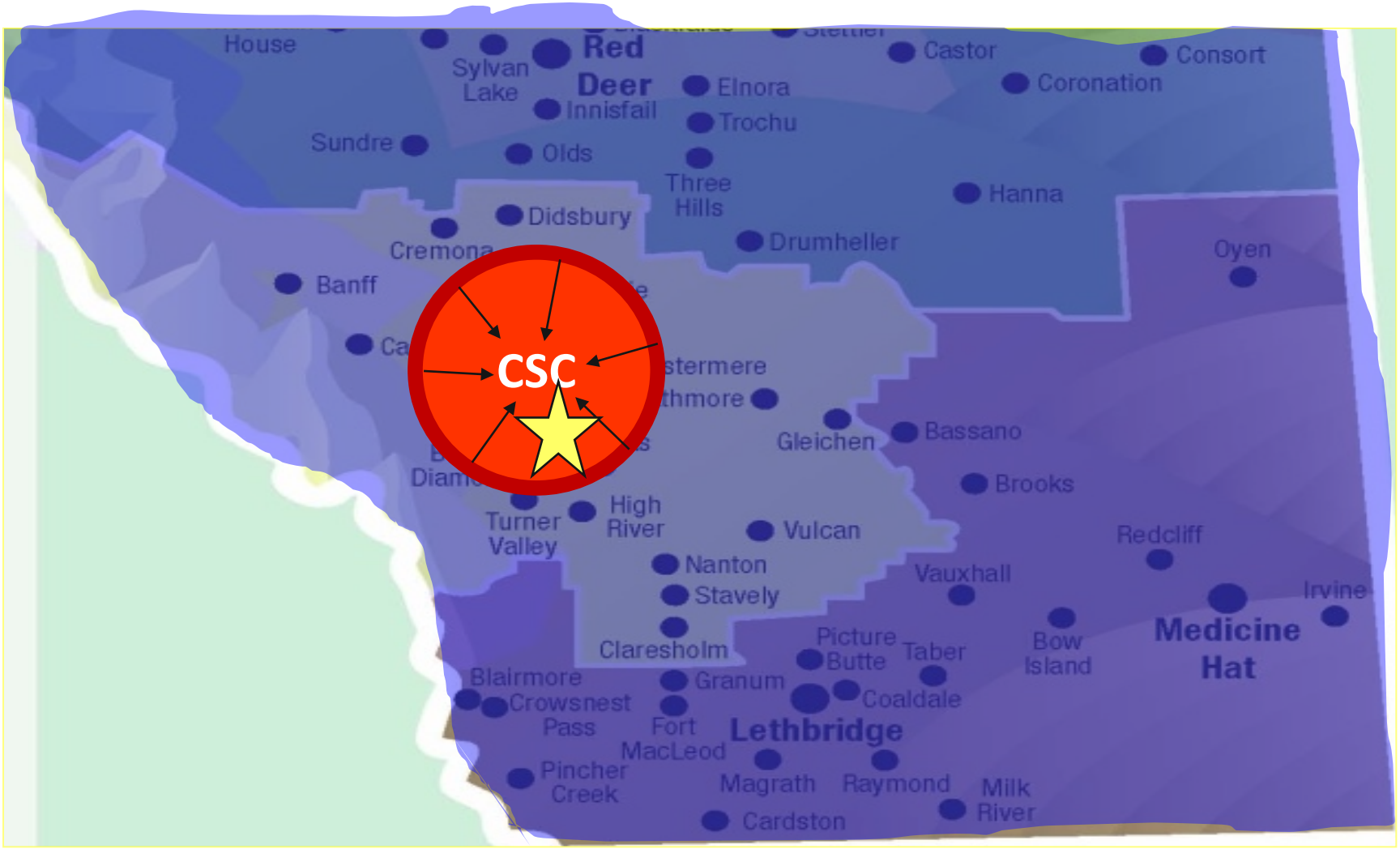

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Physical Examination Findings

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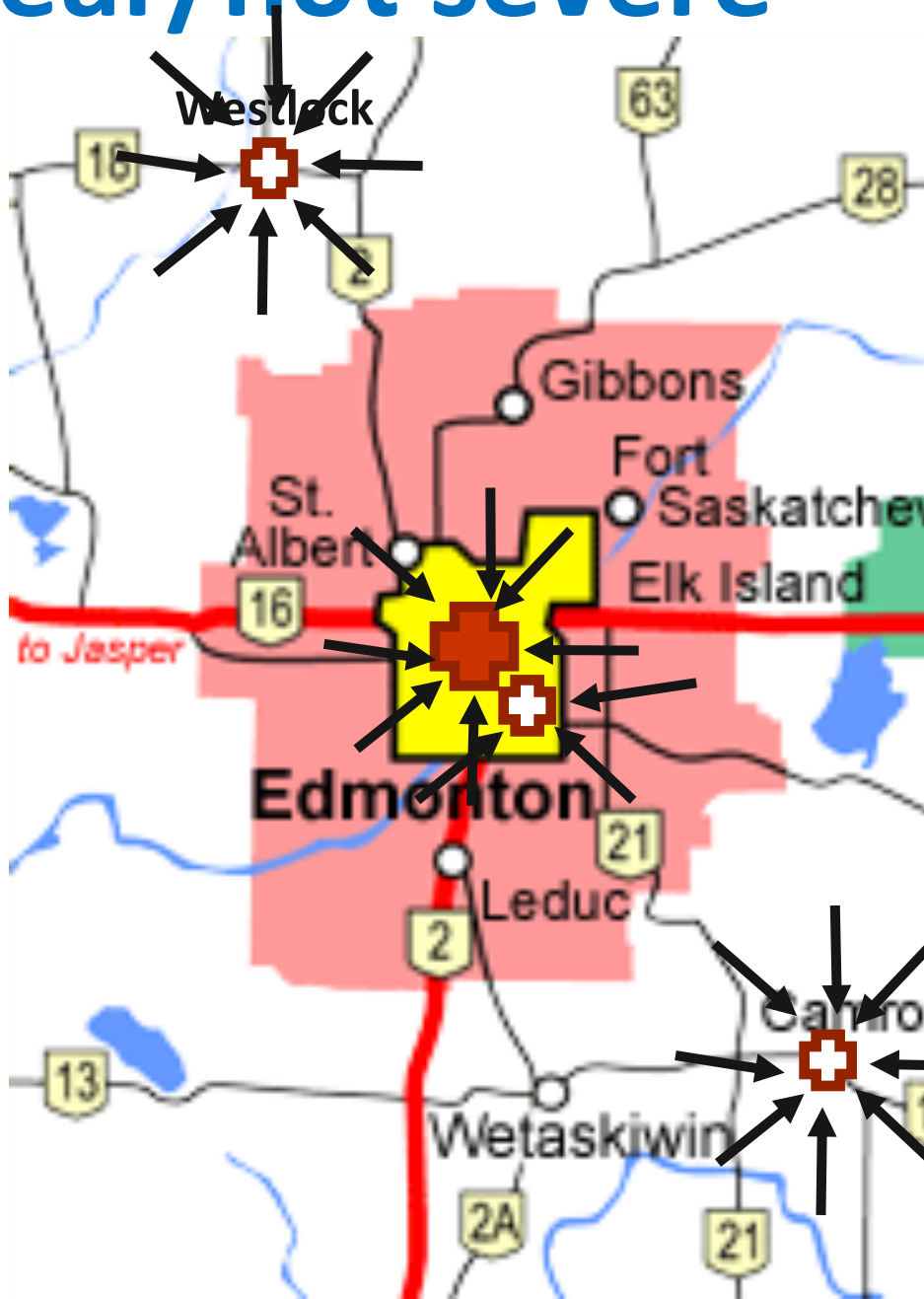
Grip Strength Have patient try to grasp examiners fingers ☐ Normal (0) ☐ Right-Weak grip (1) ☐ Left-Weak grip (1) ☐ Right-No grip (2) ☐ Left-No grip (2)	
Total LAMS Score	

Metro Zone-CSC near/not severe

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

CSC

PSC



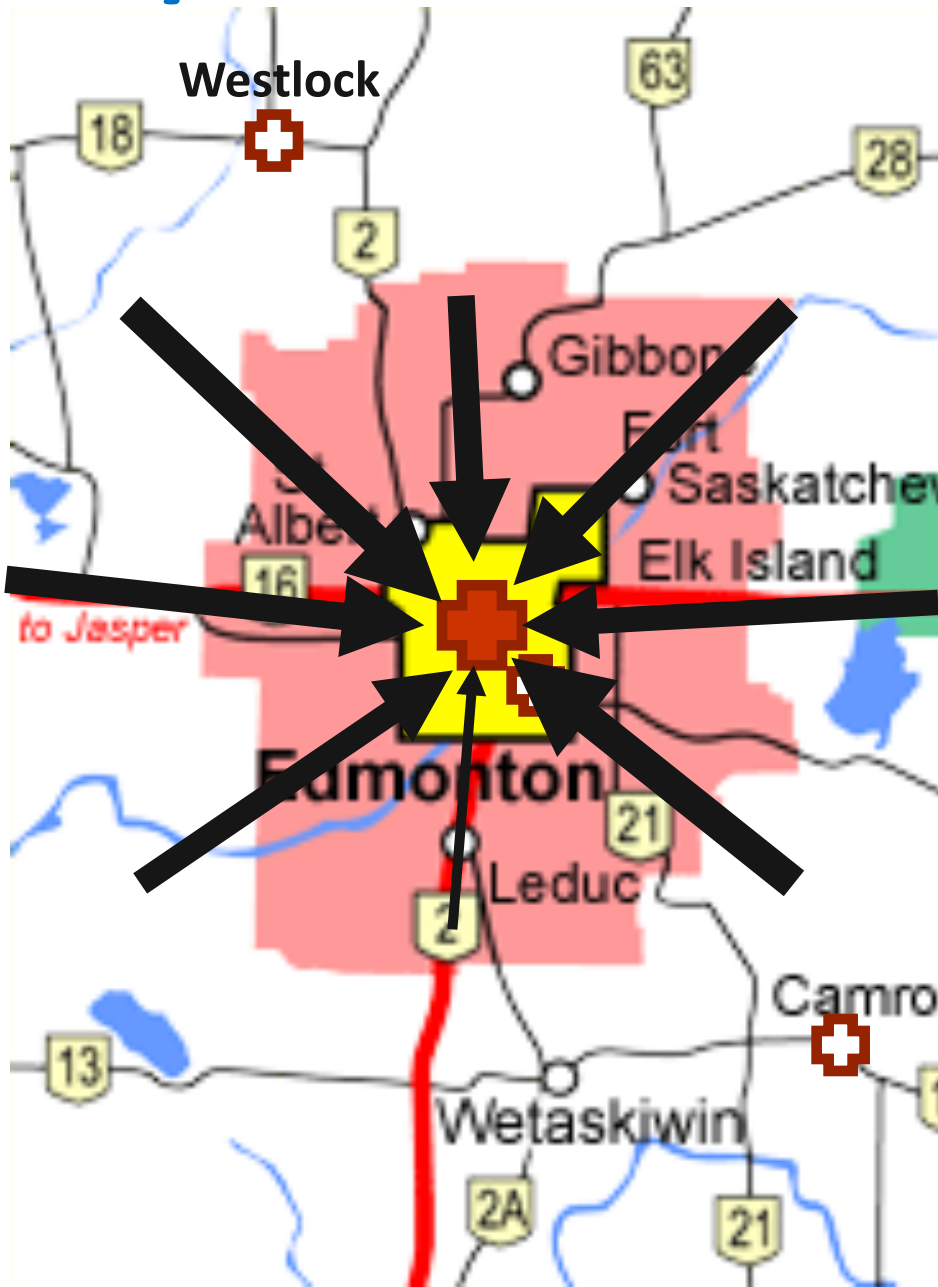
Metro Zone-CSC near/severe stroke

LAMS ≥4 go to CSC

Bypassing closer PSCs

CSC

PSC

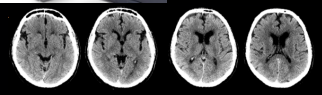


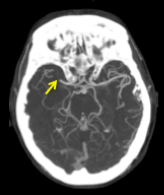
Comprehensive stroke centre
30-60-90 DTN DTGP DTR rule

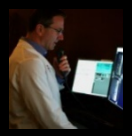
Door to tPA bolus
<30 min

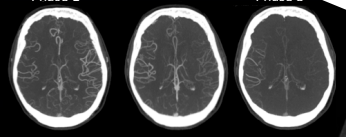
tPA bolus to groin puncture
<30 min

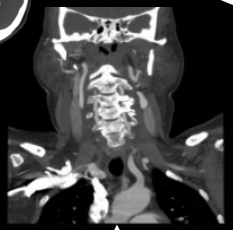
groin puncture
to first reperfusion
<30 min

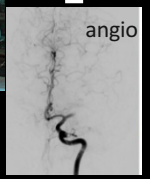












LVO populations to develop better access

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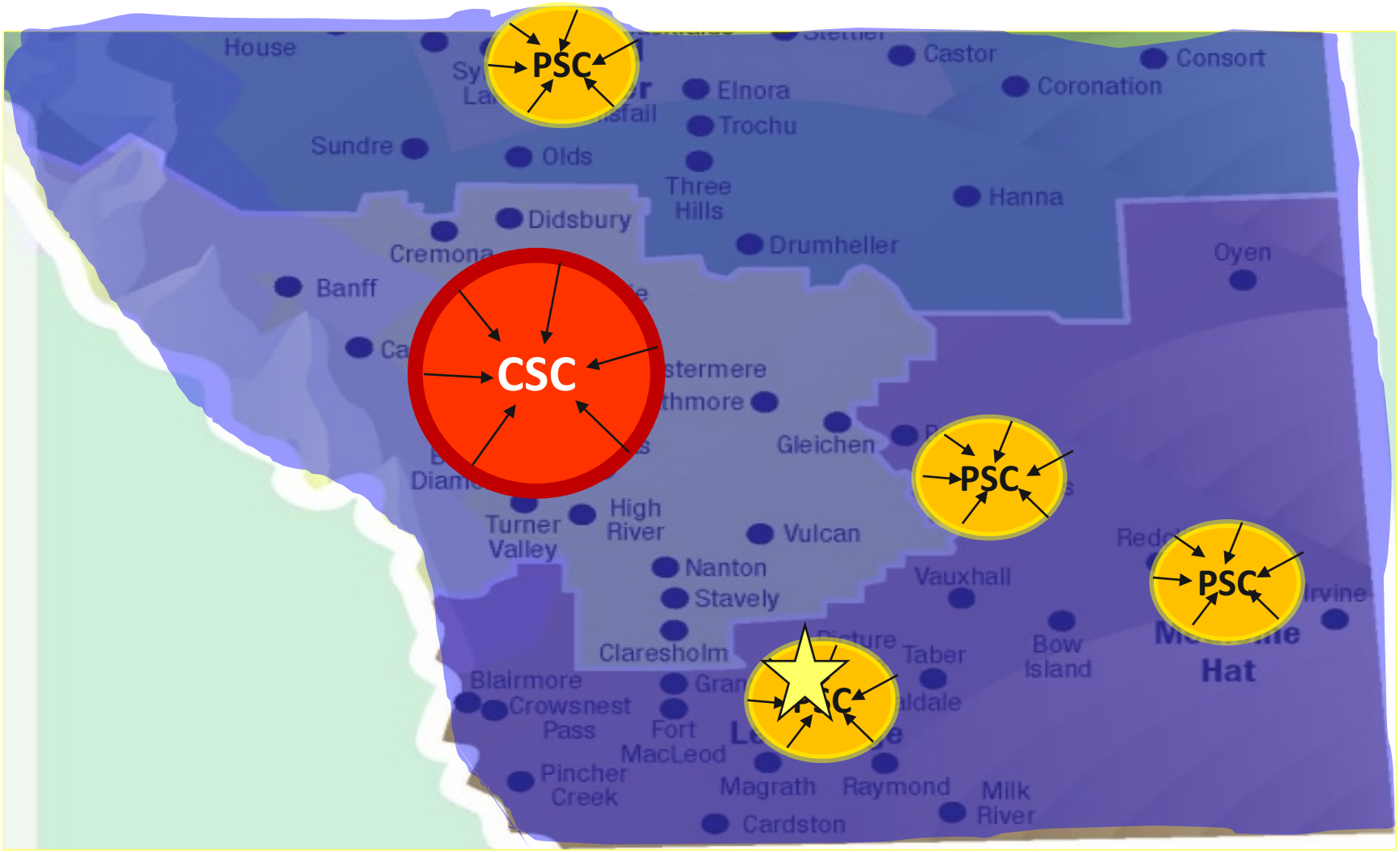

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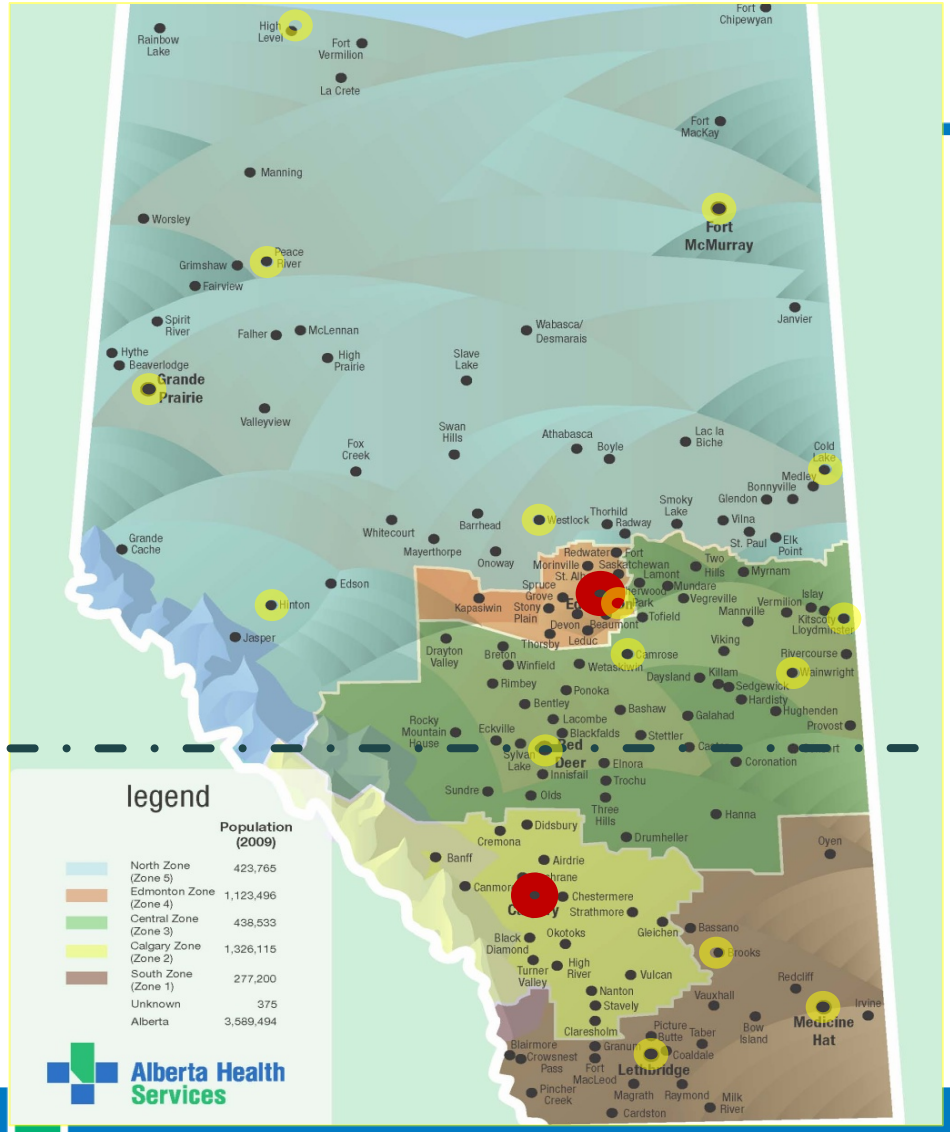
Alberta Acute Stroke Treatment 2016



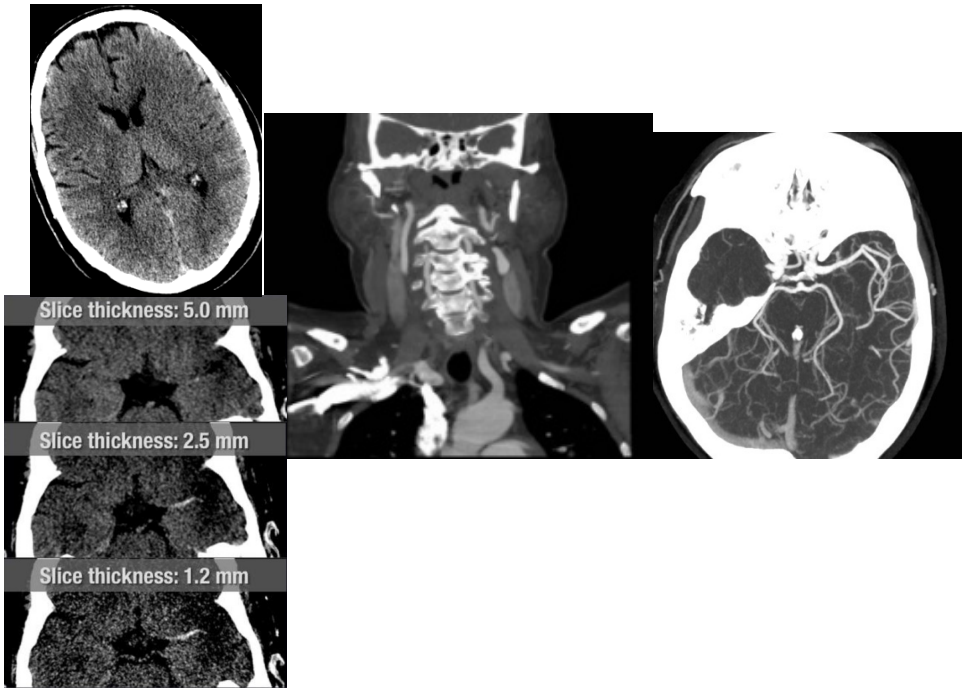
Comprehensive Stroke Centre

Primary Stroke Centre

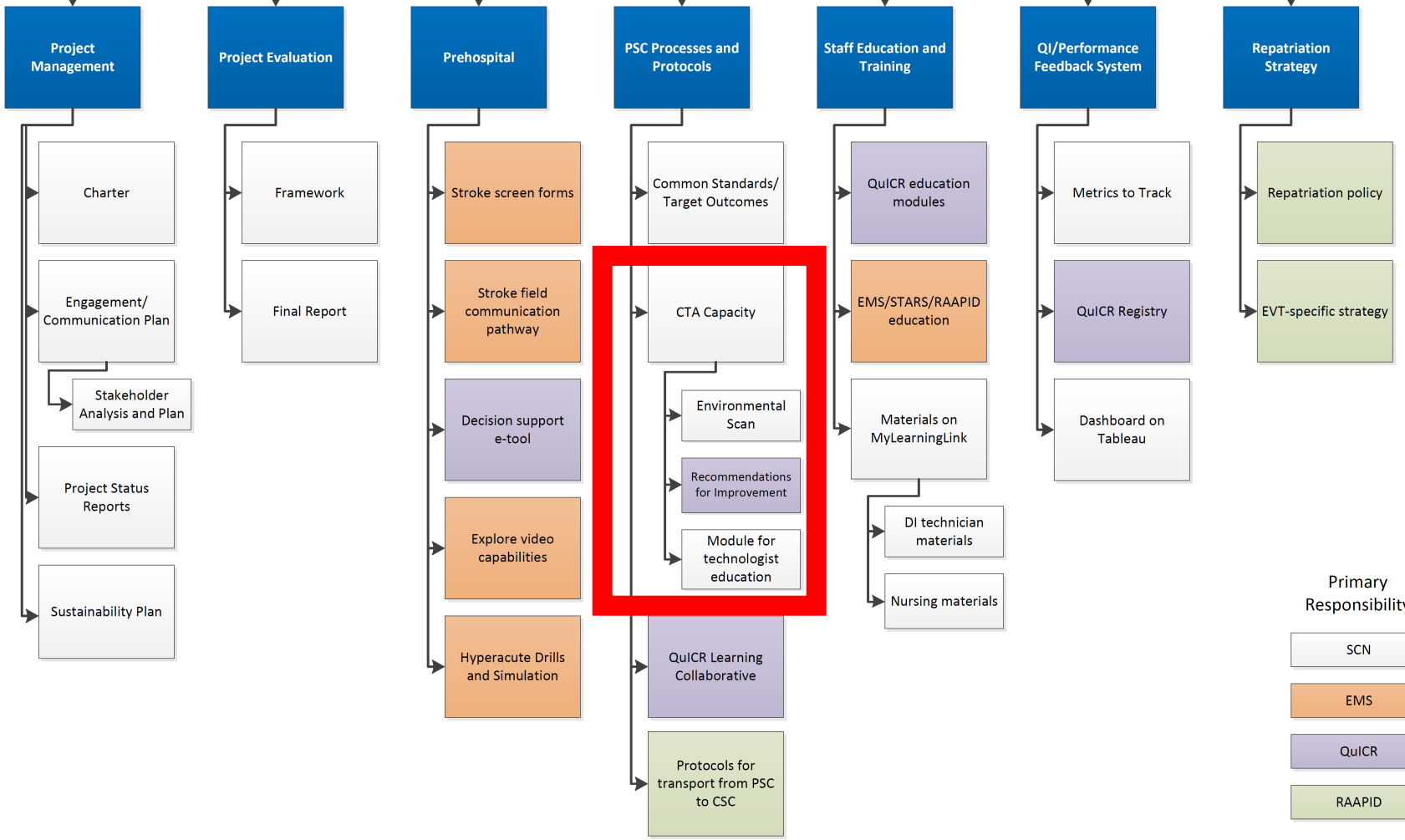
APSS
ALBERTA PROVINCIAL STROKE STRATEGY

Alberta Health Services
Strategic Clinical Network

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



Endovascular Recanalization Alberta (ERA) Project



ENDOVASCULAR RECANALIZATION ALBERTA

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

UNIVERSITY OF CALGARY CUMMING SCHOOL OF MEDICINE

Alberta Health Services Strategic Clinical Network

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

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- Thick section coronal neck and thick section coronals and sagittal MIPs

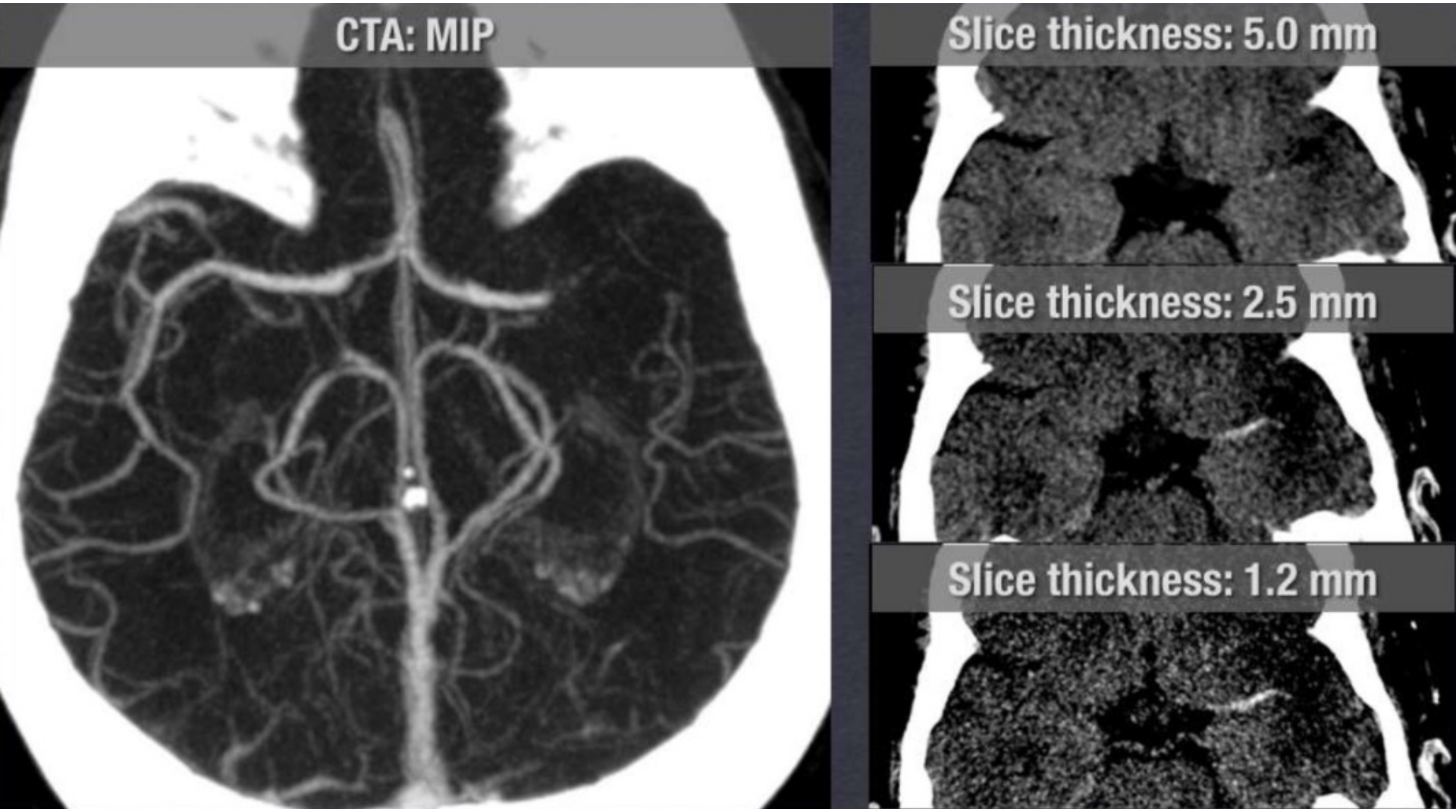
"CIN" called into question

Intravenous Contrast Material Exposure Is Not an Independent Risk Factor for Dialysis or Mortality[1]

Radiology

Propensity Score–adjusted Outcomes

Data Set and Outcome	Contrast Group	Noncontrast Group	Statistics	
			ORs and HRs*	*P* Value
Entire matched data set	10673	10673	. . .	. . .
AKI	515 (4.8)	544 (5.1)	0.94 (0.83, 1.07)†	.38
30-d dialysis	25 (0.2)	27 (0.3)	0.96 (0.54, 1.60)†	.89
30-d mortality	850 (8.0)	875 (8.2)	0.97 (0.87, 1.06)‡	.45
AKI risk groups§				
Low-risk group	7273	7273	. . .	. . .
30-d dialysis	7 (0.1)	8 (0.1)	0.88 (0.32, 2.41)†	.79
30-d mortality	417 (5.7)	426 (5.9)	0.95 (0.83, 1.09)‡	.44
Medium-risk group	2442	2442	. . .	. . .
30-d dialysis	7 (0.3)	7 (0.3)	1.00 (0.35, 2.86)†	.79
30-d mortality	303 (12.4)	314 (12.9)	0.97 (0.83, 1.14)‡	.64
High-risk group	958	958	. . .	. . .
30-d dialysis	11 (1.1)	12 (1.3)	0.92 (0.40, 2.09)†	.84
30-d mortality	130 (13.6)	135 (14.1)	0.93 (0.73, 1.18)‡	.56


CTA: MIP
Slice thickness: 5.0 mm
Slice thickness: 2.5 mm
Slice thickness: 1.2 mm

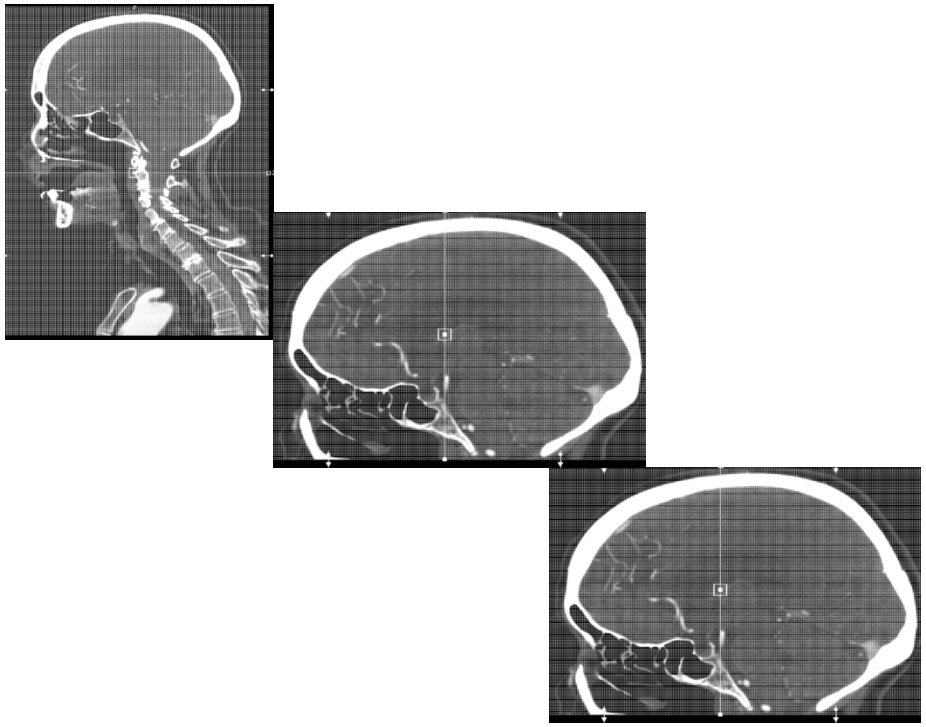
Radiology

Multiphase CT Angiography: A New Tool for the Imaging Triage of Patients with Acute Ischemic Stroke[1]

Bijoy K. Menon, MD
Christopher D. d'Esterre, PhD
Emmad M. Qazi, BSc
Mohammed Almekhlafi, MD[2]
Leszek Hahn, PhD
Andrew M. Demchuk, MD
Mayank Goyal, MD

Purpose: To describe the use of an imaging selection tool, multiphase computed tomographic (CT) angiography, in patients with acute ischemic stroke (AIS) and to demonstrate its interrater reliability and ability to help determine clinical outcome.

Materials and Methods: The local ethics board approved this study. Data are from the pilot phase of PRoveIT, a prospective observational study analyzing utility of multimodal imaging in the triage of patients with AIS. Patients underwent baseline unen-



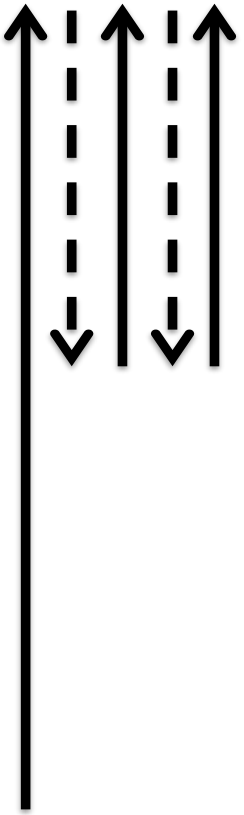


Figure 4: The multi-phase CTA (each phase represented by an arrow). The first phase (long solid arrow) is a conventional arch to vertex CT-angio. The next two phases (short solid arrows) are sequential skull base to vertex acquisitions acquired in the mid venous and late venous phase. The dashed arrows indicate movement of the scanner in between image acquisitions.

ASPECTS/mCTA collaterals inform futile transfer

Futile Interhospital Transfer for Endovascular Treatment in Acute Ischemic Stroke
The Madrid Stroke Network Experience

Blanca Fuentes, MD, PhD; María Alonso de Leciñana, MD, PhD; Alvaro Ximénez-Carrillo, MD; Patricia Martínez-Sánchez, MD, PhD; Antonio Cruz-Culebras, MD; Gustavo Zapata-Wainberg, MD; Gerardo Ruiz-Ares, MD, PhD; Remedios Frutos, MD; Eduardo Fandiño, MD; Jose L. Camiego, MD; Andrés Fernández-Prieto, MD; Jose C. Méndez, MD; Eduardo Bárcena, MD; Begoña Marín, MD; Andrés García-Pastor, MD; Fernando Díaz-Otero, MD; Antonio Gil-Núñez, MD, PhD; Jaime Masjuán, MD, PhD; Jose Vivancos, MD, PhD; Exuperio Díez-Tejedor, MD, PhD; on behalf of the Madrid Stroke Network

50 of whom (41%) ultimately did not undergo ERT

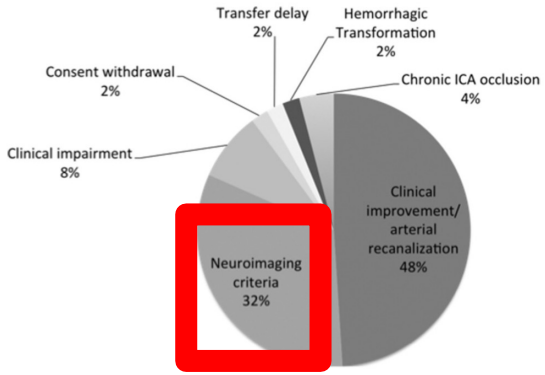
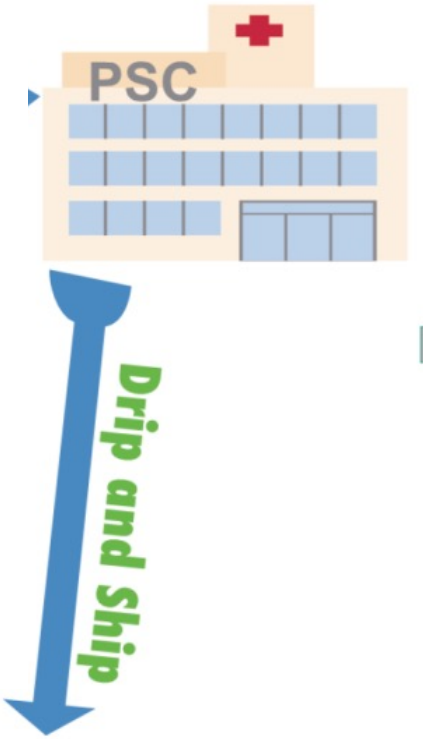
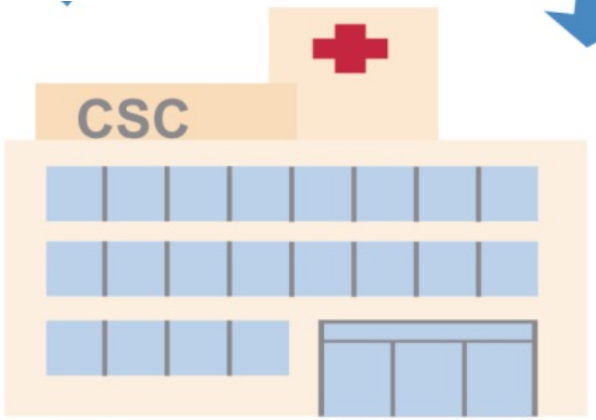


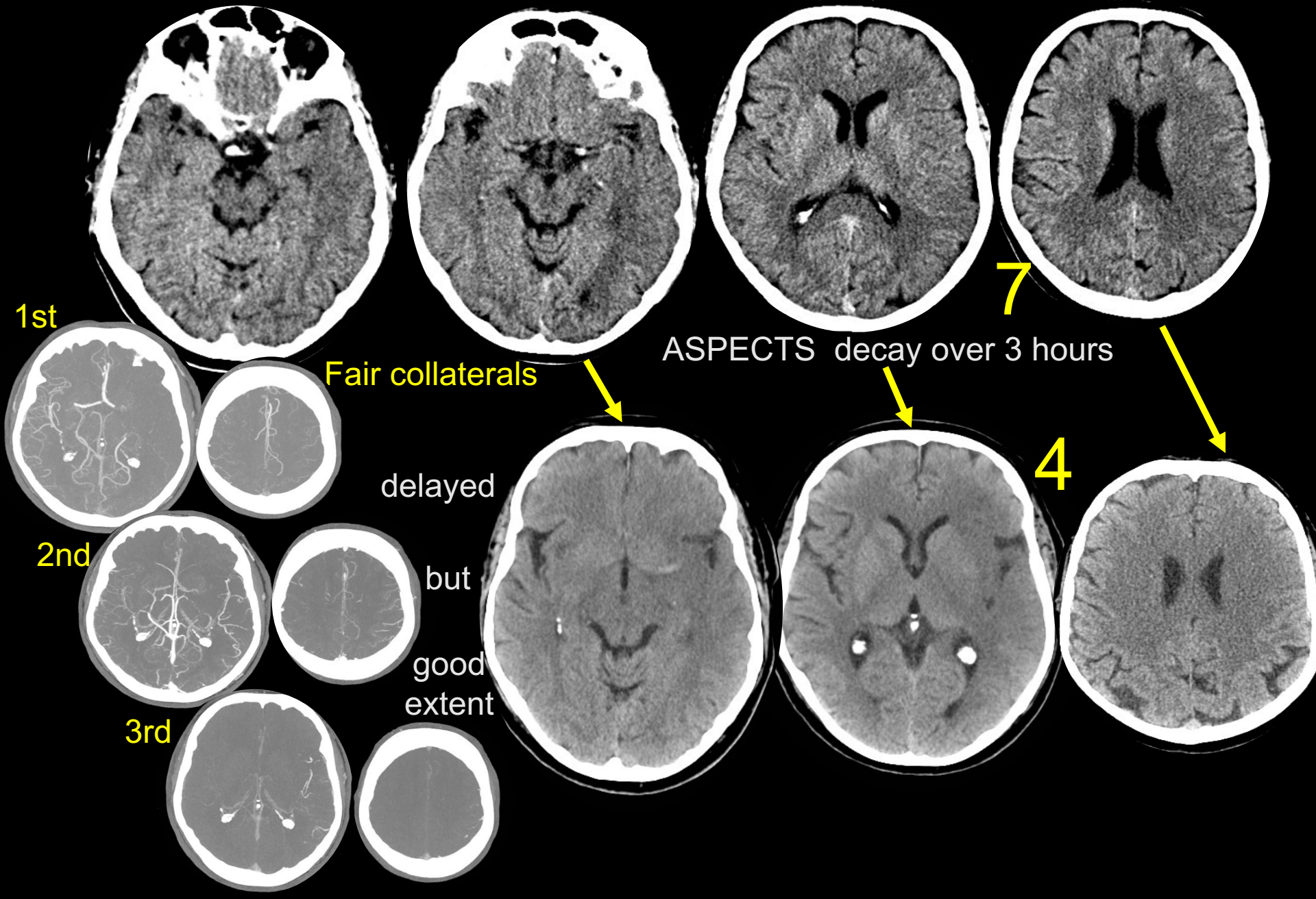
Figure 2. Reasons for the futile transfer. ICA indicates internal carotid artery.





Patient Arrives at a Comprehensive Stroke Centre for Endovascular Therapy

Average expander at risk for futile transfer



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

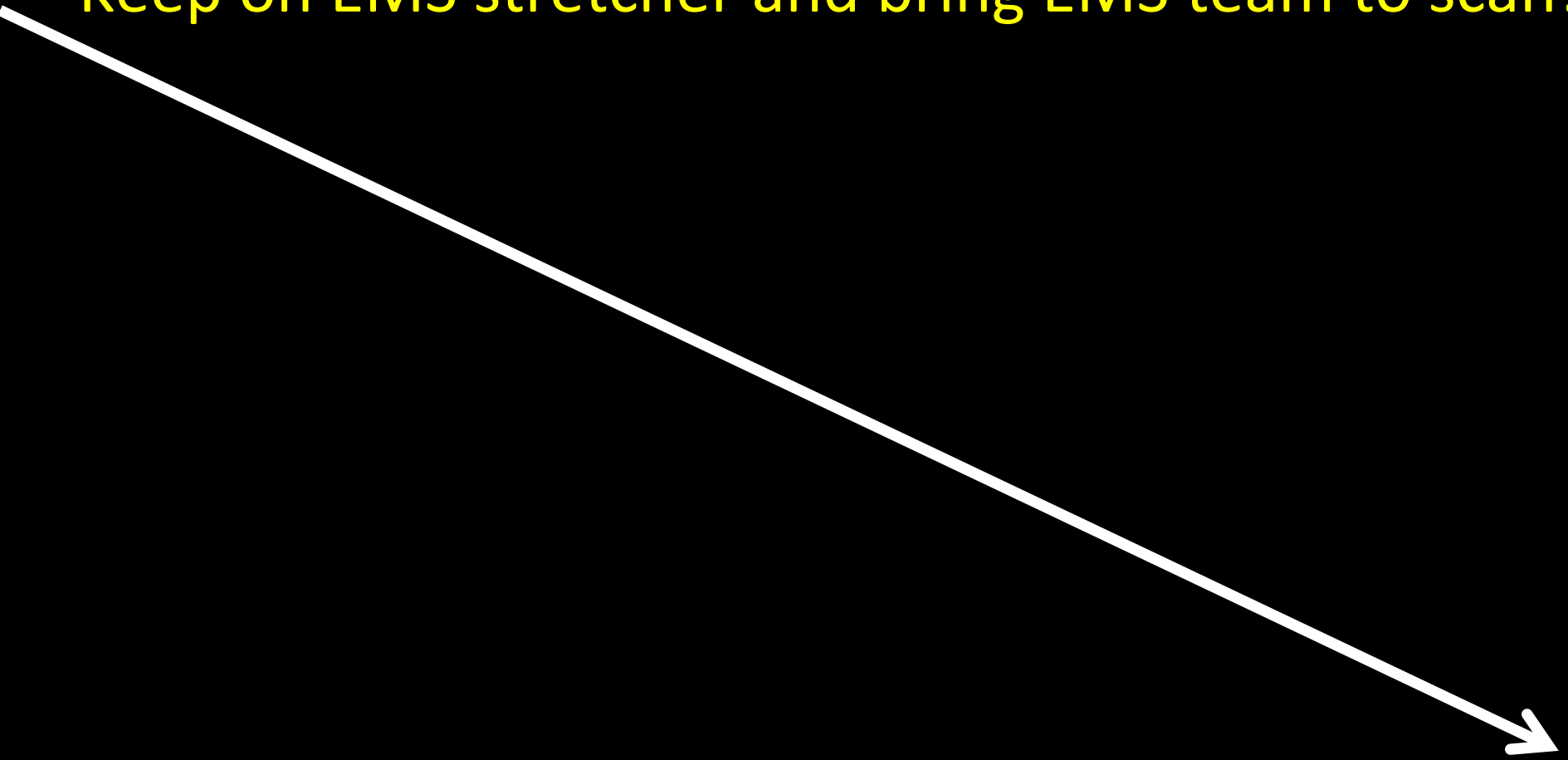
Short Door In- Door Out in STEMI

*Excludes transfer patients treated initially with thrombolytics, no PCI performed, any non-system reason for delay and/or missing information

DTN <30 min/ DIDO <45 min

Door to CT scanner <10 min

Keep on EMS stretcher and bring EMS team to scan!

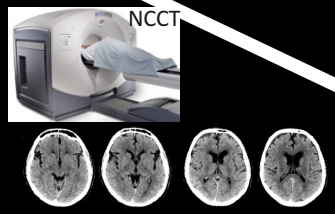


DTN <30 min/ DIDO <45 min

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

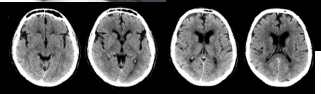
DTN <30 min/ DIDO <45 min

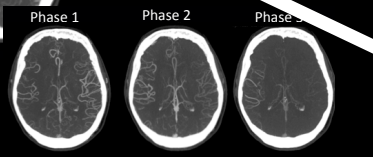
Door to CT scanner <10 min

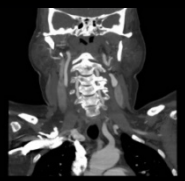
Keep on EMS stretcher and bring EMS team to scan!

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

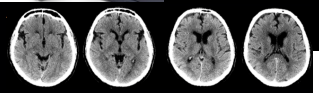
DTN <30 min/ DIDO <45 min

Door to CT scanner <10 min

Keep on EMS stretcher and bring EMS team to scan!

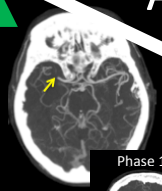
NCCT prep/scanning time <5 min

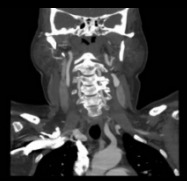
Keep on the CT table for immediate CTA!



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

BROWN
Alpert Medical School

Rhode Island Hospital
Lifespan. Delivering health with care.™

A novel PSC ELVO Protocol that leaves no ELVO behind

Ryan A. McTaggart[1,2,3,4]
Mahesh V. Jayaraman[1,2,3,4]

Departments of Diagnostic Imaging (1), Neurology (2) and Neurosurgery (3)
Warren Alpert School of Medicine at Brown University

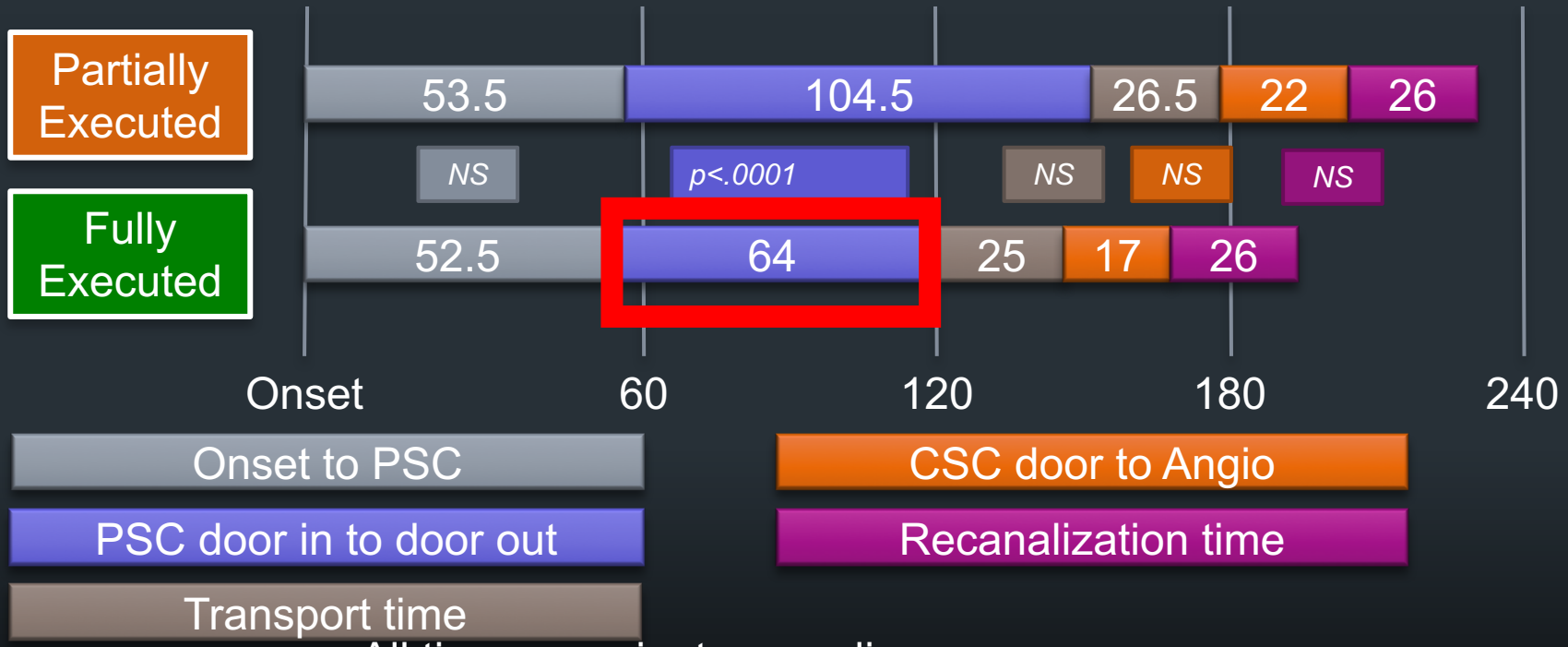
The Norman Prince Neuroscience Institute (4) Lifespan Biostatistics Core (5)
Rhode Island Hospital
Providence, RI

Scaling the protocol

1. Screen patient on arrival
2. Contact CSC if screen +
3. Mobilize transport team before imaging
4. CT & CTA on first trip to scanner
5. Share CTA with CSC

These key components can be replicated anywhere

Workflow



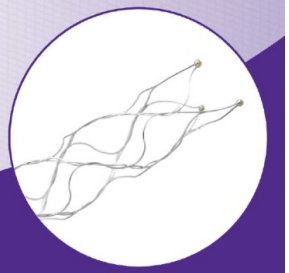
All times as minutes, median.
NS = Not Significant

DAWN TRIAL

DAWN in Full Daylight

DWI or CTP Assessment with Clinical Mismatch in the Triage of Wake-Up and Late Presenting Strokes Undergoing Neurointervention with Trevo

Tudor G. Jovin MD & Raul G. Nogueira MD
on behalf of the DAWN investigators



We are going to all need to screen every severe stroke for LVO!

Patient presentation

	Treatment arm N=107	Control arm N=99	P- value
Time since time last seen well to randomization (hrs)			
Mean ± SD Median (Q1, Q3) Range (min, max)	13.4 ± 4.1 12.2 (10.2, 16.0) (6.1, 23.5)	13.0 ± 4.5 13.2 (9.4, 15.8) (6.4, 23.9)	0.53
Stroke sub-population			
Wake up stroke	64.5%	47.5%	**0.01**
Witnessed stroke	10.3%	14.1%	0.52
Un-witnessed stroke	25.2%	38.4%	0.05

DAWN TRIAL

DAWN TRIAL

DAWN in Full Daylight

DWI or CTP Assessment with Clinical Mismatch in the Triage of Wake-Up and Late Presenting Strokes Undergoing Neurointervention with Trevo

Tudor G. Jovin MD & Raul G. Nogueira MD
on behalf of the DAWN investigators

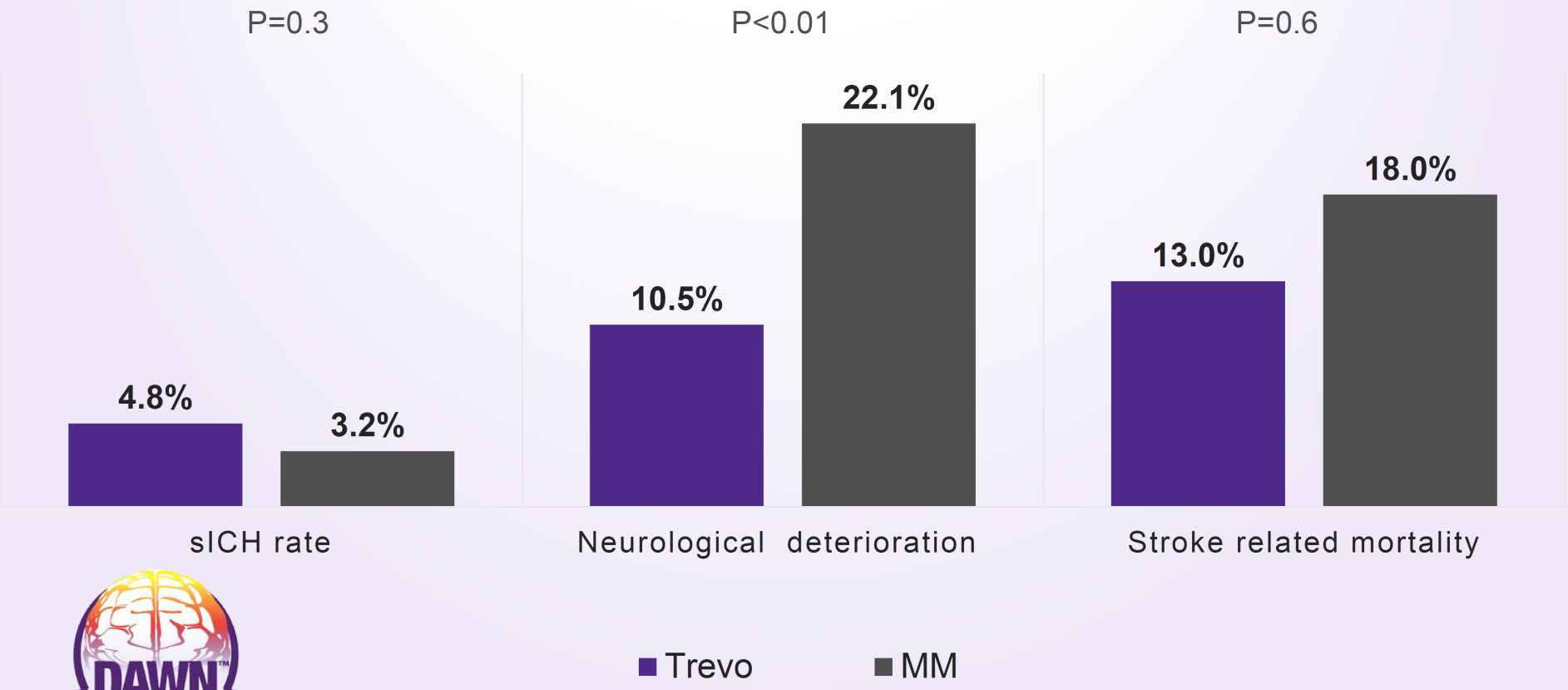
Primary outcome

73% relative risk reduction of dependency in ADL's

NNT for any lower disability 2.0

DAWN TRIAL

CEC adjudicated safety outcomes



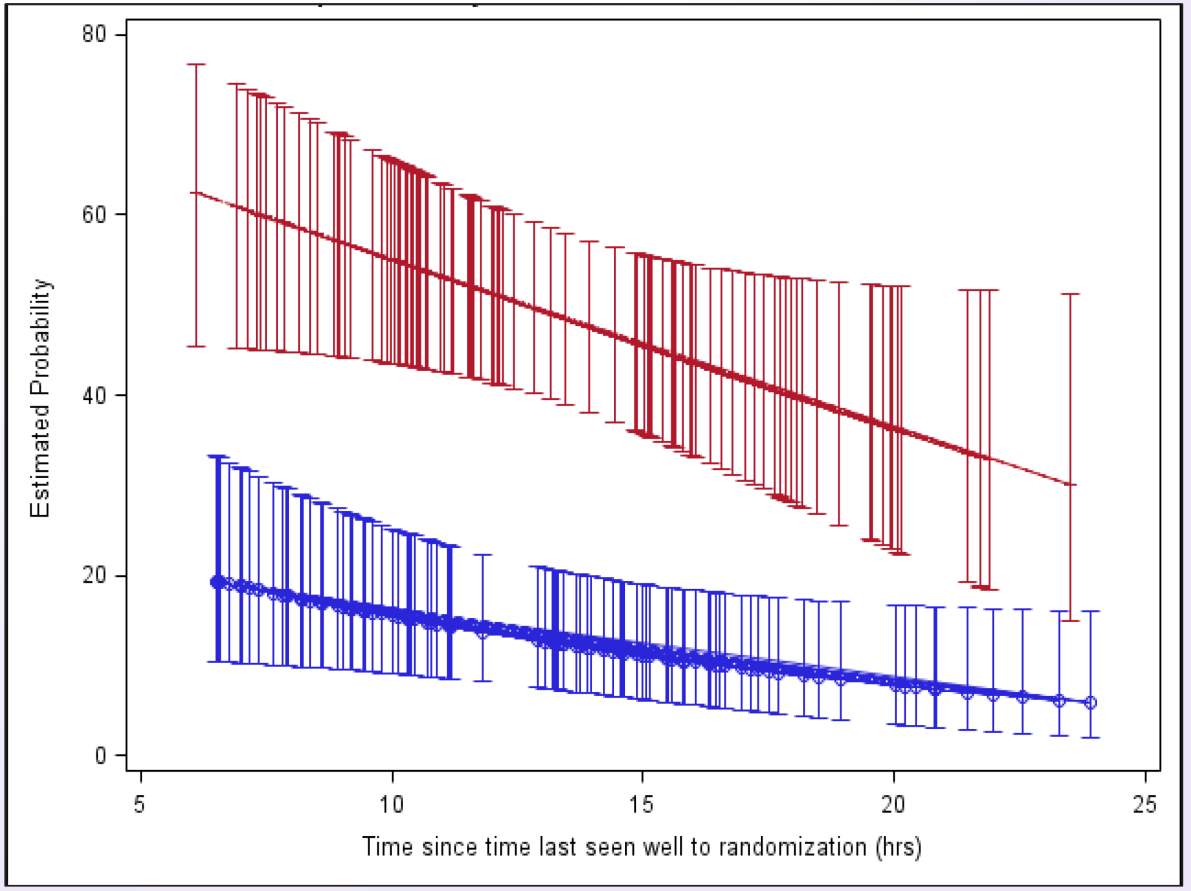
DAWN in Full Daylight

DWI or CTP Assessment with Clinical Mismatch in the Triage of Wake-Up and Late Presenting Strokes Undergoing Neurointervention with Trevo

Tudor G. Jovin MD & Raul G. Nogueira MD
on behalf of the DAWN investigators

90 Day mRS 0-2 by TLSW to Randomization

	Trevo	MM	P-value
6-12h	55.1%	20.0%	<0.001
12-24h	43.1%	7.4%	<0.001



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

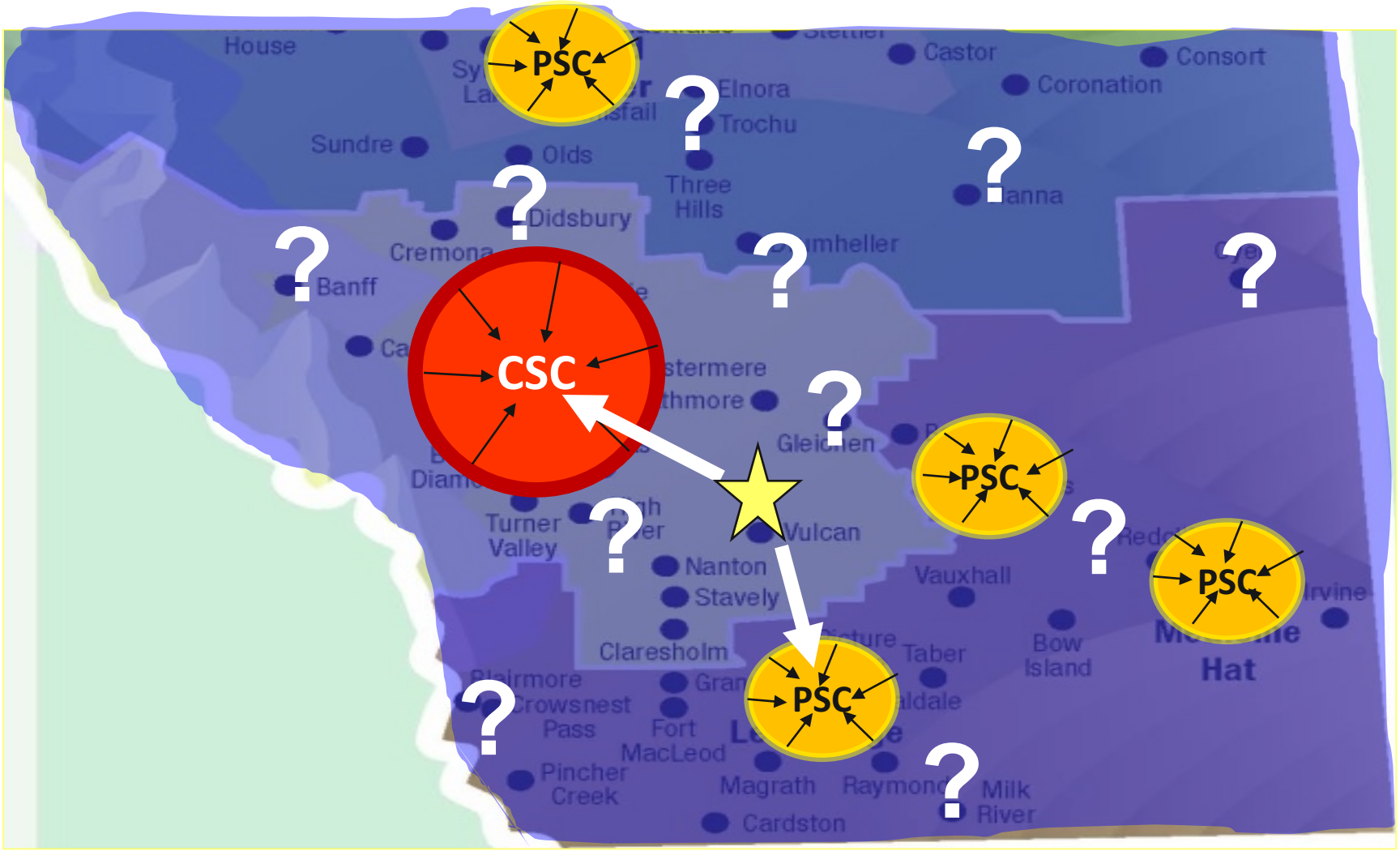
QuICR
Quality Improvement & Clinical Research
Alberta Stroke Program

ENDOVASCULAR RECANALIZATION ALBERTA
ERA

Alberta Health Services
Strategic Clinical Network

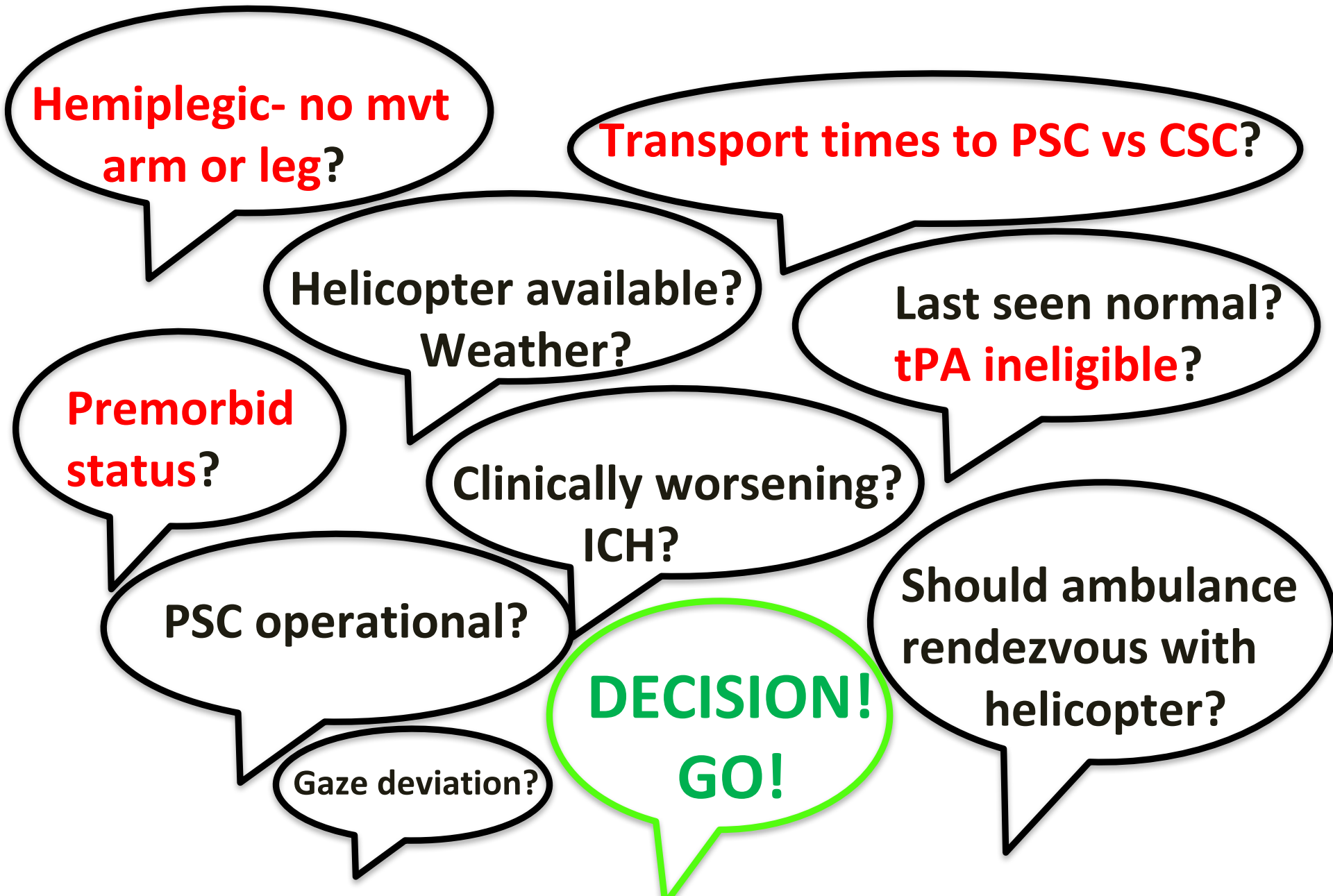
Creating a Highly Time Efficient Major Stroke Transport Protocol

Metro: CSC near **Small Urban: PSC near** **Rural**



PSC or CSC?

Lots of factors to consider?



Alberta Health Services

CALGARY STROKE PROGRAM

Rural field consultation – Canada's Rural Transport Decision Solution?

Alberta Health Services
Strategic Clinical Network

QuICR
Quality Improvement & Clinical Research
Alberta Stroke Program

ENDOVASCULAR RECANALIZATION ALBERTA
ERA

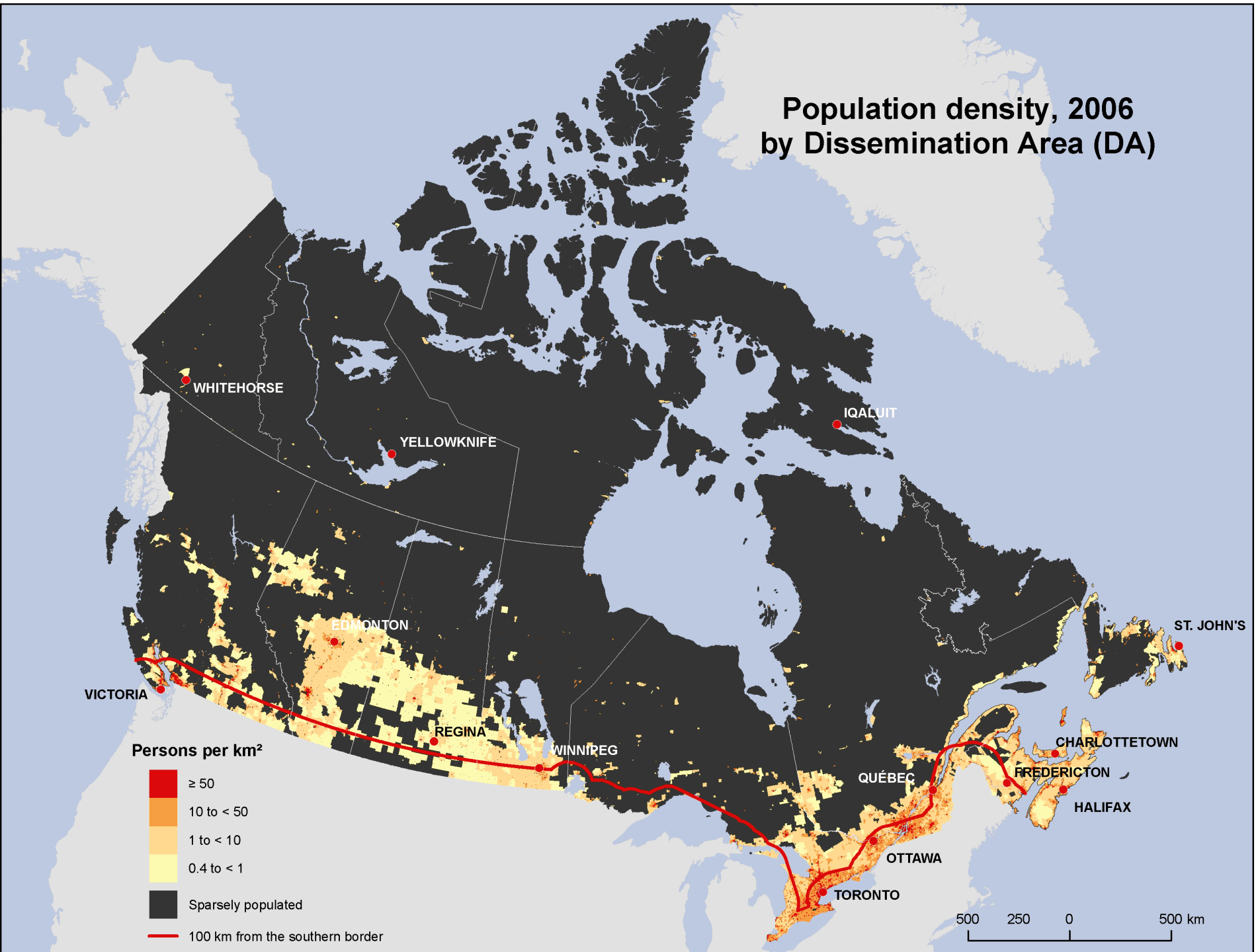
Andrew M. Demchuk MD FRCPC
Director, Calgary Stroke Program
Heart and Stroke Foundation Chair in Stroke Research
Professor, Depts of Clinical Neurosciences/Radiology
Cumming School of Medicine
University of Calgary

UNIVERSITY OF CALGARY

UNIVERSITY OF ALBERTA
QUAECUMQUE VERA

UNIVERSITY OF CALGARY
CUMMING SCHOOL OF MEDICINE

HOTCHKISS BRAIN INSTITUTE


Population density, 2006
by Dissemination Area (DA)
WHITEHORSE
YELLOWKNIFE
IQALUIT
EDMONTON
ST. JOHN'S
VICTORIA
REGINA
WINNIPEG
CHARLOTTETOWN
FREDERICTON
QUÉBEC
HALIFAX
OTTAWA
TORONTO
Persons per km²
≥ 50
10 to < 50
1 to < 10
0.4 to < 1
Sparsely populated
100 km from the southern border
500 250 0 500 km

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

ENDOVASCULAR RECANALIZATION ALBERTA

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

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

CSC

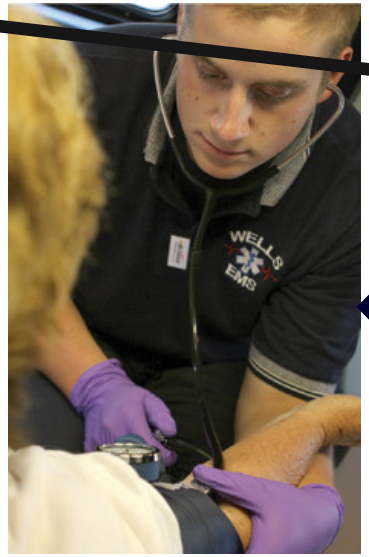
Patient Arrives at a Comprehensive Stroke Centre for Endovascular Therapy

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



ENDOVASCULAR RECANALIZATION ALBERTA ERA

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

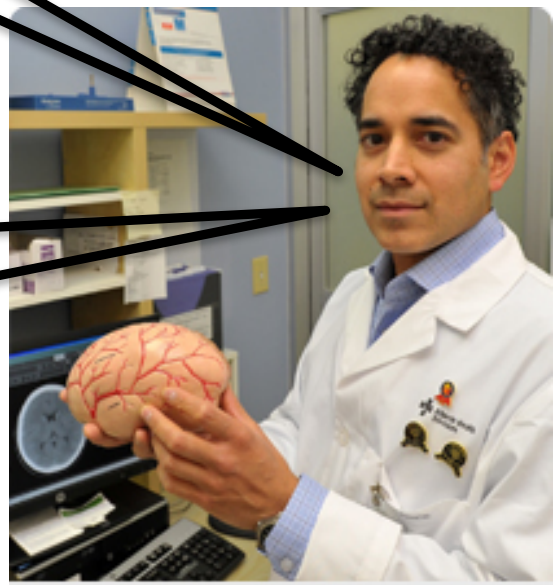
Rural Field Consultation

- 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 here, listening…
Looking up options given weather, air, and ambulance availability

AHS stroke neurologist

Rural Field Consultation

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

LAMSS 4 right face droop
no mvt right arm, no right grip

Last normal
2 hours ago

On warfarin

AHS stroke neurologist

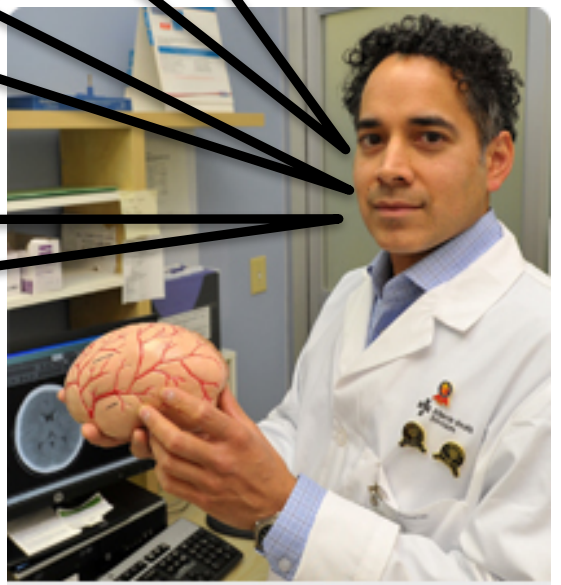
Rural Field Consultation

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

Is the patient independent? Does he live at home?

Did he take warfarin today?

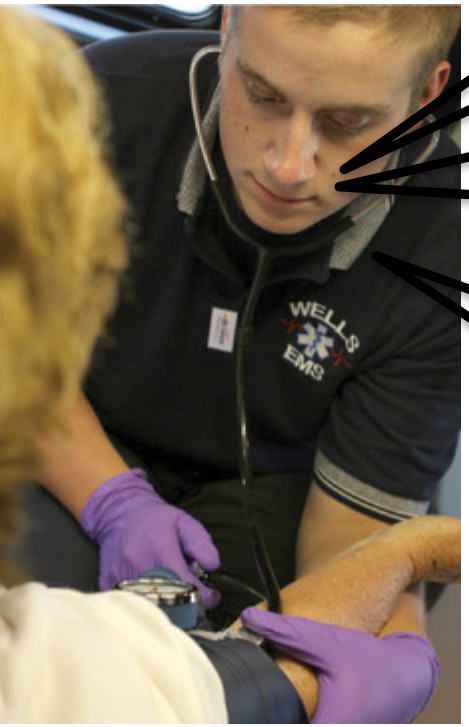
Any speech?



AHS stroke neurologist

Rural Field Consultation

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



Independent, active
lives at home with wife

Wife says
not sure whether
he took warfarin

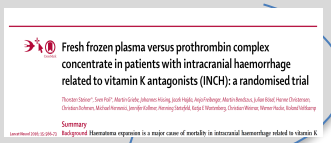
No speech
Seems confused

AHS stroke neurologist

Rural Field Consultation

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

On warfarin could be ICH? Which would need reversal fast!

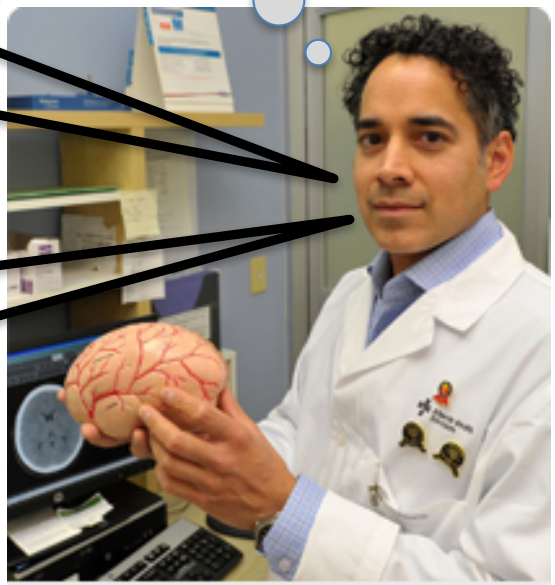

Fresh frozen plasma versus prothrombin complex concentrate in patients with intracranial haemorrhage related to vitamin K antagonists (INCH): a randomised trial

Summary

Background Haematoma expansion is a major cause of mortality in intracranial haemorrhage related to vitamin K

Crew 39
Any worsening since your arrival at scene?

Patient drowsy?
Any vomiting?
BP really high?

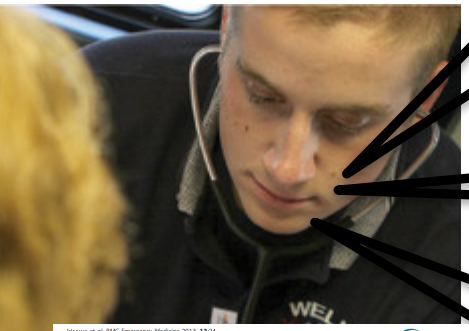


AHS stroke neurologist

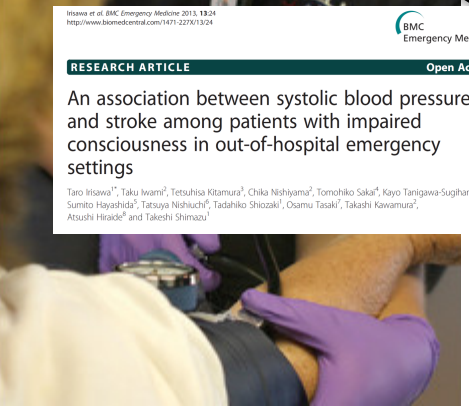
Rural Field Consultation

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

No change in status since arrival



Alert, No N/V



Irisawa et al. BMC Emergency Medicine 2013, 13:24
http://www.biomedcentral.com/1471-227X/13/24

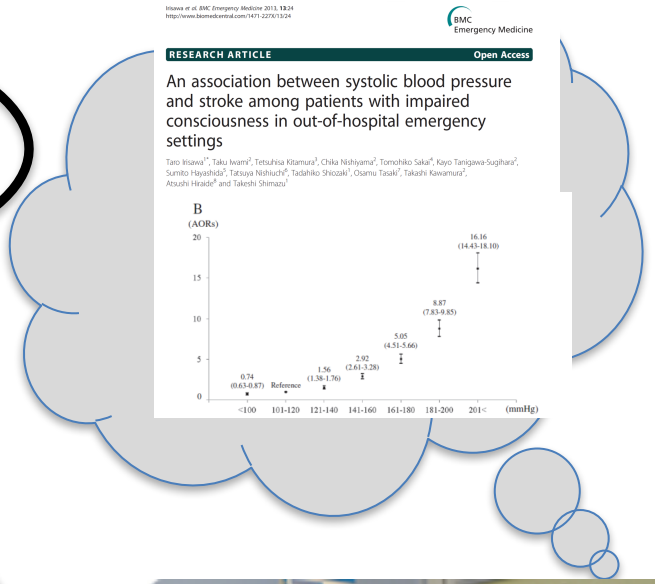
BMC Emergency Medicine

RESEARCH ARTICLE Open Access

An association between systolic blood pressure and stroke among patients with impaired consciousness in out-of-hospital emergency settings

Taro Irisawa[1*], Taku Iwami[2], Tetsuhisa Kitamura[3], Chika Nishiyama[2], Tomohiko Sakai[4], Kayo Tanigawa-Sugihara[2], Sumito Hayashida[5], Tatsuya Nishiuchi[6], Tadahiko Shiozaki[1], Osamu Tasaki[7], Takashi Kawamura[2], Atsushi Hiraide[8] and Takeshi Shimazu[1]

BP 150 systolic



AHS stroke neurologist

Rural Field Consultation

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

Prehospital Acute Stroke Severity Scale to Predict Large Artery Occlusion
Design and Comparison With Other Scales

Sidsel Hastrup, MD; Dorte Damgaard, MD, PhD; Søren Paaske Johnsen, MD, PhD; Grethe Andersen, MD, DMSc

only 3 items derived from the NIHSS. The strongest predictor of large artery occlusion among the NIHSS items was abnormal gaze (NIHSS gaze >0) with a sensitivity=0.54 (95% CI, 0.51–0.58), specificity=0.87 (0.85–0.89), AUC=0.71 (0.69–0.73), and odds ratio=7.88 (6.36–9.76). The most optimal

Clinical Selection Strategies to Identify Ischemic Stroke Patients With Large Anterior Vessel Occlusion
Results From SITS-ISTR (Safe Implementation of Thrombolysis in Stroke International Stroke Thrombolysis Registry)

Jan F. Scheitz, MD*; Azmil H. Abdul-Rahim, MBChB, Msc(StrokeMed)*; Rachael L. MacIsaac, PhD; Charith Cooray, MD; Heidi Sucharew, PhD; Dawn Kleindorfer, MD; Pooja Khatri, MD, MSc; Joseph P. Broderick, MD; Heinrich J. Audebert, MD; Niaz Ahmed, MD, PhD; Nils Wahlgren, MD, PhD; Matthias Endres, MD; Christian H. Nolte, MD*; Kennedy R. Lees, MD, FRCP*; on behalf of SITS Scientific Committee

Results—Among 3505 patients, 23.6% (n=827) had LAVO. Pathological finding on the NIHSS item best gaze was strongly associated with LAVO (adjusted odds ratio 4.5, 95% confidence interval 3.8–5.3). All 3 face–arm–speech–time test (FAST)

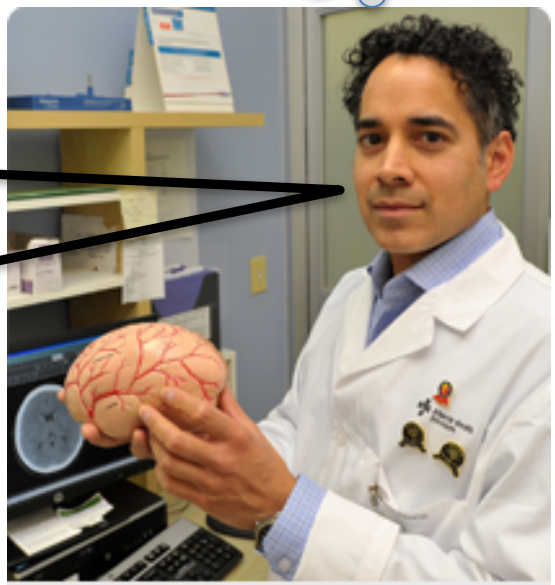
ORIGINAL COMMUNICATION

Clinical prediction of large vessel occlusion in anterior circulation stroke: mission impossible?

Table 3 Odds ratios of different NIHSS subitems predicting large vessel occlusion in acute anterior circulation stroke

	Odds ratio	Univariate 95 % CI	*p*
Best Gaze	9.60	6.765–13.632	<0.0001

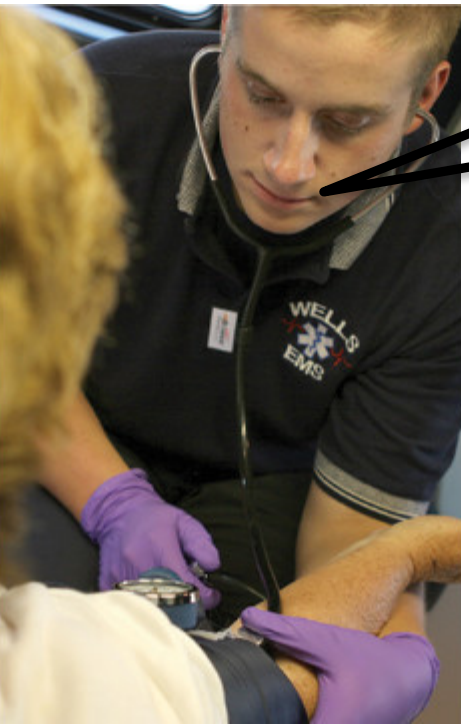
Oh yes almost forgot one more question Are his eyes to his left?



AHS stroke neurologist

Rural Field Consultation

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



Yes! eyes to left and head to left too

AHS stroke neurologist

Rural Field Consultation

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

Okay likely LVO: plegic, eyes deviated no major ICH features, was independent, might not be IV tPA candidate (INR?)

AHS stroke neurologist

Rural Field Consultation

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

10-4 crew 39 thanks!
transport physician are you still there?
What are PSC and CSC transport options;
ETA for each from this location?

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

Rural Field Consultation

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

DECISION TIME!

Ok let's go direct to CSC Stentsville! Please have air transport give us heads-up when 30 minutes out. Thanks all!

AHS stroke neurologist

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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Strategic Clinical Network

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

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
Rural (ref, urban), %†	3.1	4.1	0.85	0.74–0.97
Atrial fibrillation/flutter*	21.7	11.5	1.37	1.33–1.42
Previous stroke/TIA	31.8	31.0	0.99	0.97–1.01
CAD/prior MI*	28.4	24.7	1.10	1.07–1.13
Carotid stenosis†	3.9	4.2	0.93	0.88–0.98
Diabetes mellitus*	30.4	34.1	0.95	0.93–0.97
Hypertension†	81.3	79.5	1.04	1.02–1.07
Dyslipidemia*	40.8	45.2	0.90	0.88–0.92
Insurance (ref, private), %	38.7	44.6		
Medicaid*	8.2	7.2	1.21	1.15–1.28
Medicare*	36.0	30.6	1.06	1.03–1.09
Self-pay/no insurance	6.3	8.1	1.01	0.95–1.07
On-hour arrival (weekdays 7 AM to 6 PM), %*	47.1	53.4	0.82	0.80–0.84
National Institute of Health Stroke Scale (ref, ≤5), %				
6–10*	20.4	13.6	2.65	2.57–2.73
11–15*	13.2	3.7	5.72	5.45–6.01
>15*	24.2	3.1	11.50	10.84–12.20
Region (ref, Northeast), %				
Midwest*	17.5	22.9	0.61	0.54–0.69
South†	37.5	37.9	0.81	0.72–0.91
West†	17.7	17.8	0.82	0.71–0.96
No. of beds (per 100 increase), median†	367	353	1.04	1.02–1.06
Academic hospital (ref, nonacademic), %*	57.6	51.8	1.22	1.11–1.34

CAD/prior MI indicates coronary artery disease/prior myocardial infarction; CI, confidence interval; EMS, emergency medical service; and TIA, transient ischemic attack.
*$P<0.0001$; †$P<0.05$.
**Patients with missing hospital characteristics were excluded.

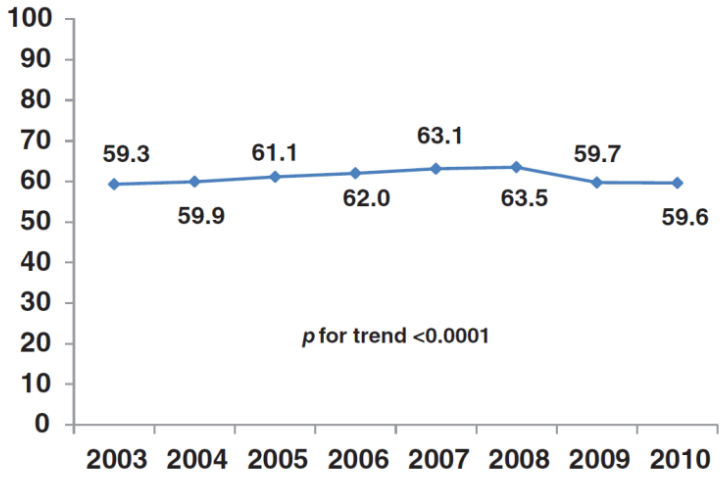

Figure 2. Temporal trend in emergency medical service use 2003–2010.

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?

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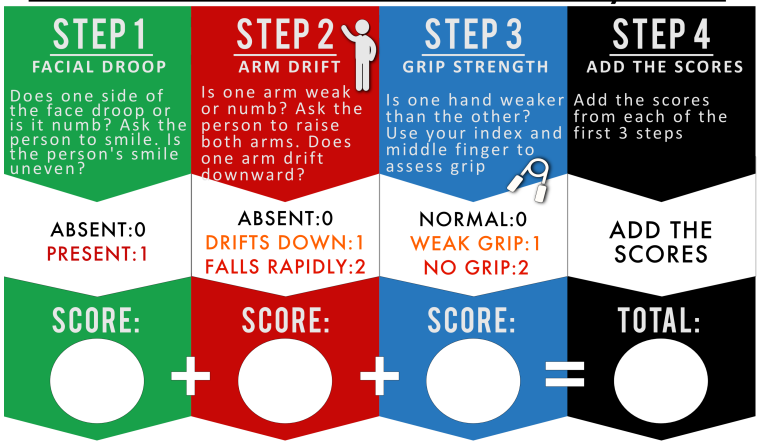
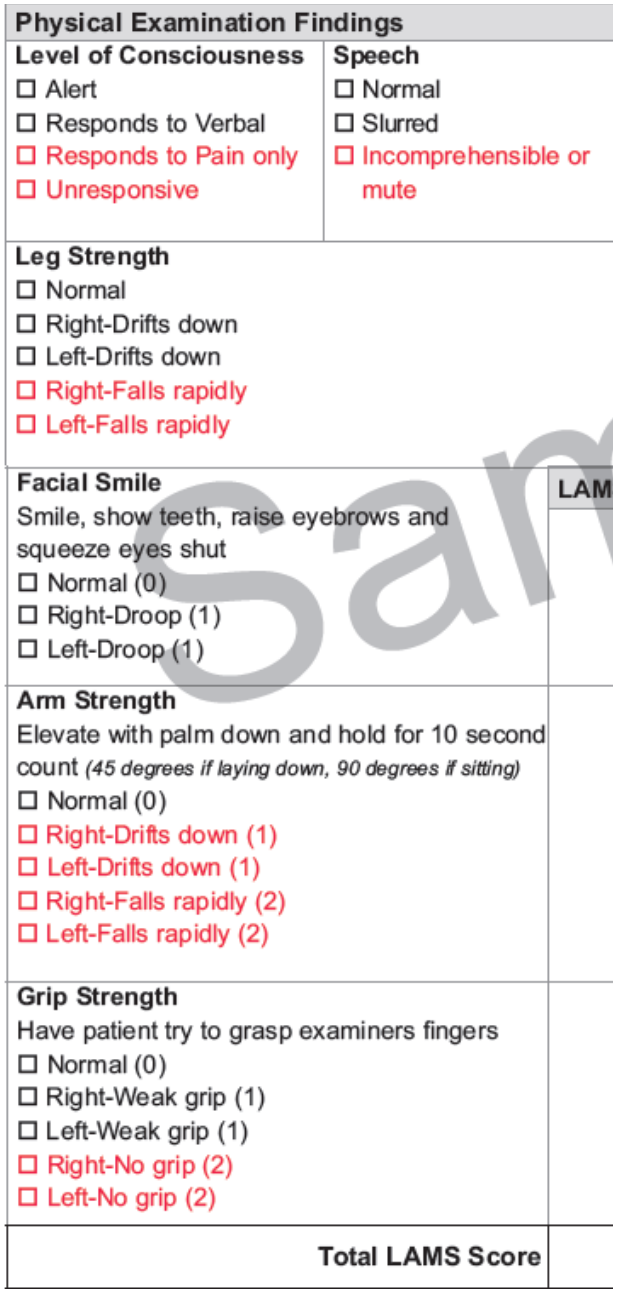
LAMS Score for Stroke Severity



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	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

Facial Smile — LAM
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

RAAPID team to walk a triage nurse through LAMSS scoring

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UNIVERSITY OF ALBERTA

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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

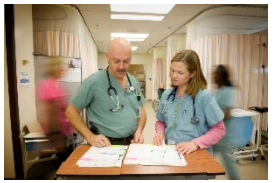
PSC

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

Routed to a CSC or PSC

Non-PSC

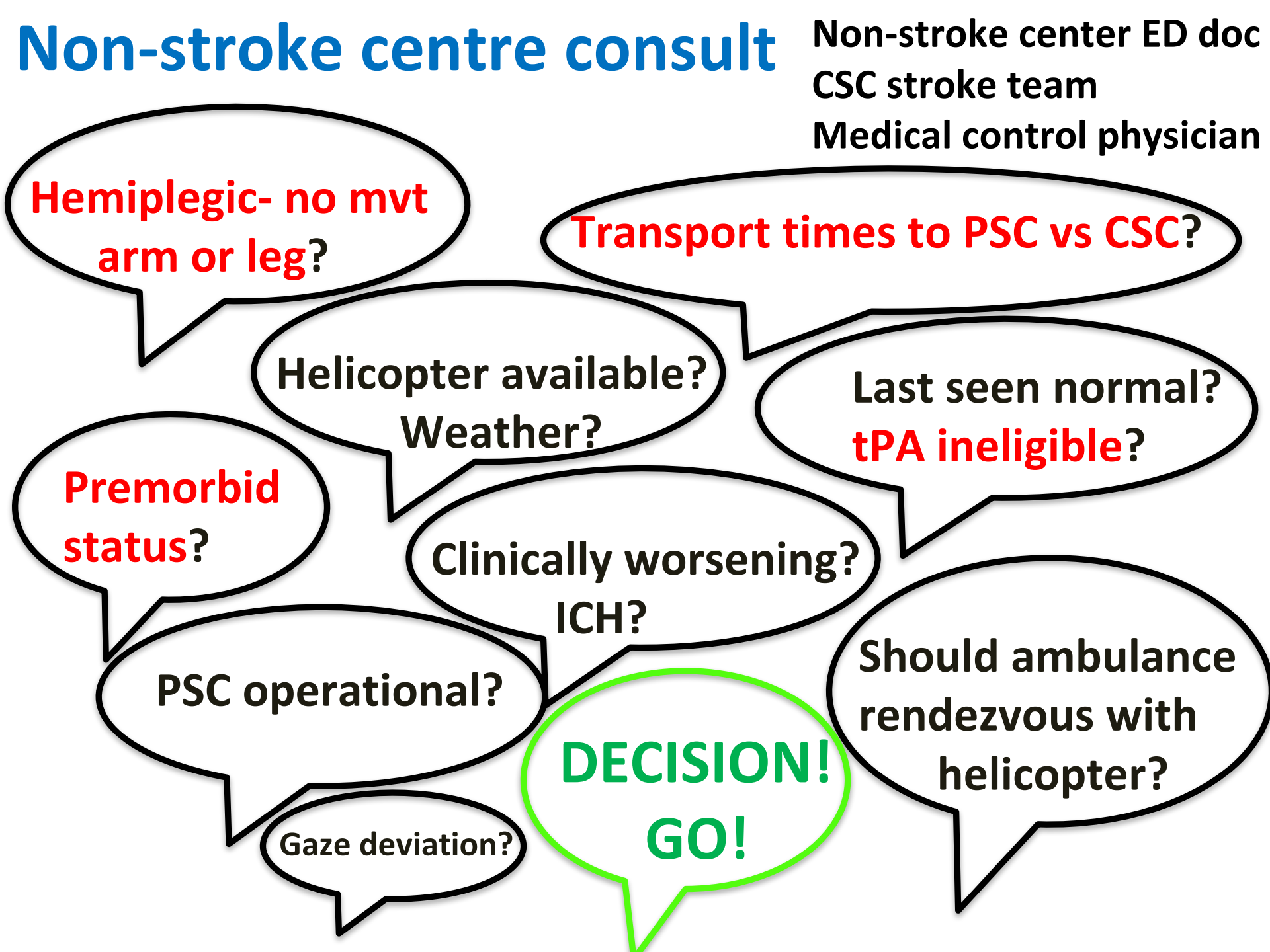
EMS will bypass Non-PSC But if a patient 'walks-in' and a stroke is identified the non-PSC can initiate the communication protocol via RAAPID



AHS stroke neurologist

Non-stroke centre consult

Non-stroke center ED doc
CSC stroke team
Medical control physician



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

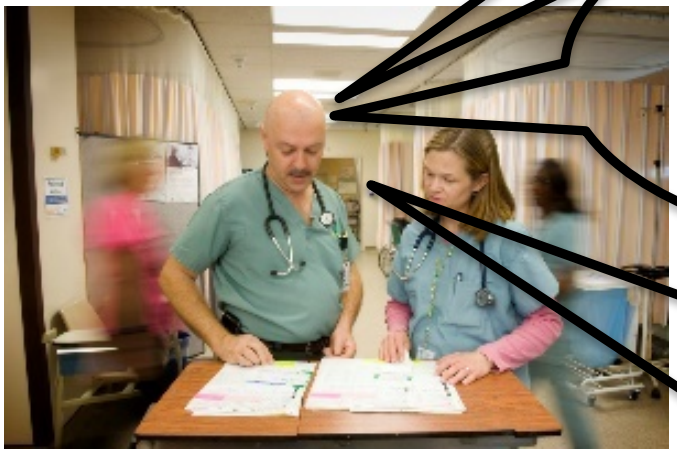
AHS stroke neurologist

Rural Field Consultation

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

Lives in assisted living, some dementia

BP low
100/60



No speech
Seems confused

AHS stroke neurologist

Non Stroke Centre Consultation

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

Yes I am here.
PSC Quietsville 45 min by ground in current weather/traffic.

Confirmed CSC
Stentsville 120 min ETA
using ambulance
rendezvous
with helicopter

AHS stroke neurologist

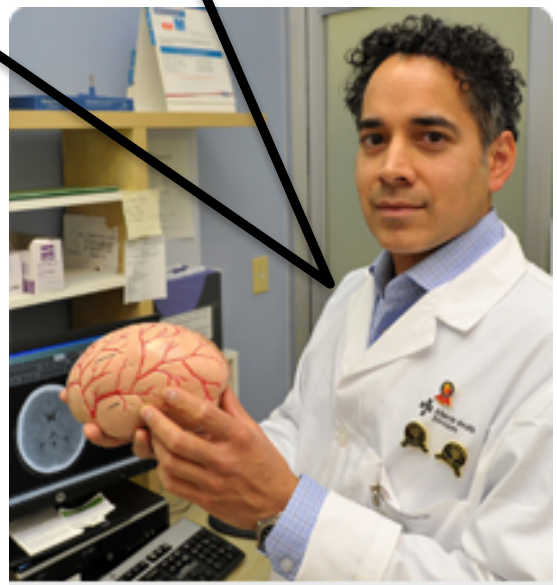
Non Stroke Centre Consultation

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

DECISION TIME!

Ok let's go to PSC Quietsville! Less likely EVT case. Please give Quietsville a heads up. I am available to speak with team there after assessment

Thanks all!



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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Alberta Stroke Program

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Effect size by tPA use

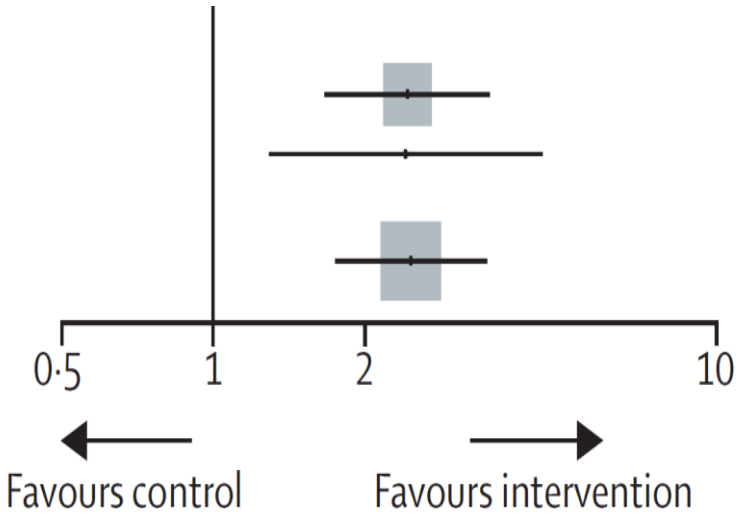
Endovascular thrombectomy after large-vessel ischaemic stroke: a meta-analysis of individual patient data from five randomised trials

Mayank Goyal, Bijoy K Menon, Wim H van Zwam, Diederik WJ Dippel, Peter J Mitchell, Andrew M Demchuk, Antoni Dávalos, Charles BL M Majoie, Aad van der Lugt, Maria A de Miquel, Geoffrey A Donnan, Yvo B W E M Roos, Alain Bonafé, Reza Jahan, Hans-Christoph Diener, Lucie A van den Berg, Elad I Levy, Olvert A Berkhemer, Vitor M Pereira, Jeremy Rempel, Mónica Millán, Stephen M Davis, Daniel Roy, John Thornton, Luis San Román, Marc Ribó, Debbie Beumer, Bruce Stouch, Scott Brown, Bruce C V Campbell, Robert J van Oostenbrugge, Jeffrey L Saver, Michael D Hill, Tudor G Jovin, for the HERMES collaborators

Summary

Background In 2015, five randomised trials showed efficacy of endovascular thrombectomy over standard medical care in patients with acute ischaemic stroke caused by occlusion of arteries of the proximal anterior circulation. In this meta-analysis we, the trial investigators, aimed to pool individual patient data from these trials to address remaining questions about whether the therapy is efficacious across the diverse populations included.

Published Online February 18, 2016 http://dx.doi.org/10.1016/S0140-6736(16)00163-X See Online/Comment1



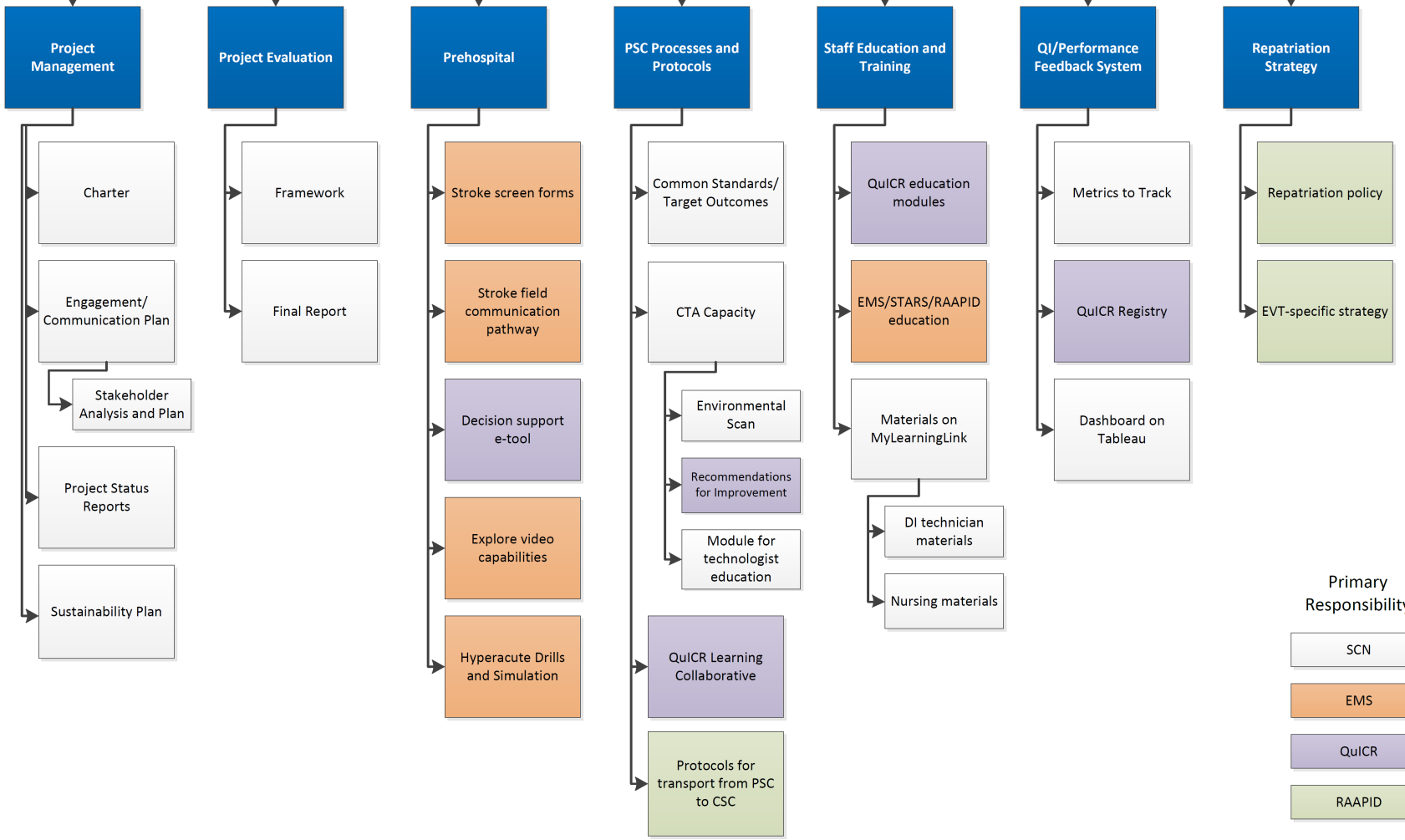
In Alberta 108 hospitals – multiple wards

- Key is one number to call for immediate communication with CSC stroke team and streamlined fastest mode of transport

- Very difficult to educate all health professionals although could focus on geriatric/general medicine/ cardiac surgery wards/CVICUs?

ENDOVASCULAR RECANALIZATION ALBERTA
ERA

Endovascular Recanalization Alberta (ERA) Project



Thank-you for your attention!

Email: ademchuk@ucalgary.ca