



Canadian Stroke Network

Réseau canadien contre
les accidents cérébrovasculaires

ICES Institute for Clinical
Evaluative Sciences

Enhancing the effectiveness of health care
for Ontarians through research

In-Hospital Stroke: *the Neglected Group*

NECC

Boston, MA

October 29, 2009

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Professor of Medicine (Neurology)
University of Toronto





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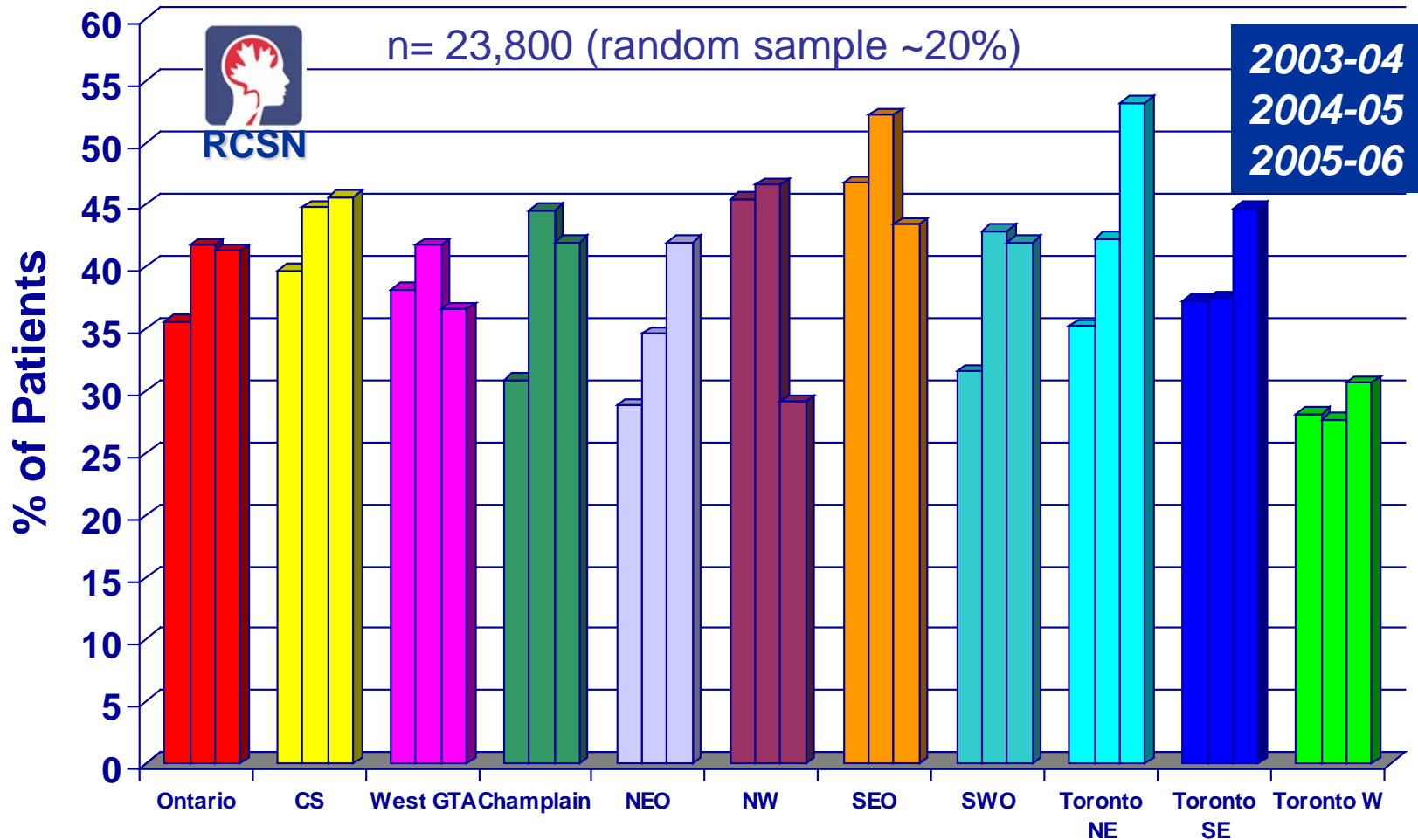


Disclosures

- I have given lectures sponsored by Boehringer Ingelheim Canada Ltd., Hoffman LaRoche Canada, Merck Frosst, Pfizer, Sanofi and Servier
- I have been a member of Stroke Advisory Boards for AstraZeneca Canada, Boehringer Ingelheim Canada, Pfizer, Novo Nordisk, Solvay, and Sanofi
- I own no shares in any pharmaceutical company
- Supported by grants from the Canadian Stroke Network



Stroke Onset (LSN) to ED Arrival Times



Patients presenting within 2.5 hrs of stroke onset



In-hospital Stroke

- If the most common reason why patients are ineligible for thrombolytic therapy is they get to hospital too late
- Then, the best place to have a stroke is in the hospital
 - the stroke onset to hospital arrival time = 0!

BUT . . .



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In-Hospital Stroke



City of Toronto Archives, Fonds 1231, f1231_jt0207b



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Outline

- Background to in-hospital stroke
- Background to the Registry of the Canadian Stroke Network (RCSN)
- Results of our In-hospital stroke study
- Conclusions
- Recommendations



In Hospital Stroke

- ischemic stroke can occur while patients are admitted to hospital for another reasons
- one would suspect that these patients are more likely to have:
 - co-morbidities
 - atherosclerotic risk factors
 - they may be prothrombotic
 - » infection, inflammatory disease, cancer
 - they undergo investigations that have a significant risk of producing emboli



Previous studies

- In hospital stroke
 - 4.4 - 15% of all strokes occur in hospitalized patients
 - more severe strokes
 - higher co-morbidities and complexity
 - tended to occur in surgical or cardiac patients
 - tend to have worse outcomes

David Blacker *Lancet Neurology* 2003; 2:741-46

Kimura et al. *European Neurology* 2006; 55(3):155-9.



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RCSN Phase 3

11 Ontario Stroke Hospitals



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Canadian Stroke
Network (CSN)

Registry of the Canadian
Stroke Network (RCSN)



**Ontario
Audit**

**SPIRIT
Acute**

**SPIRIT
SPC**



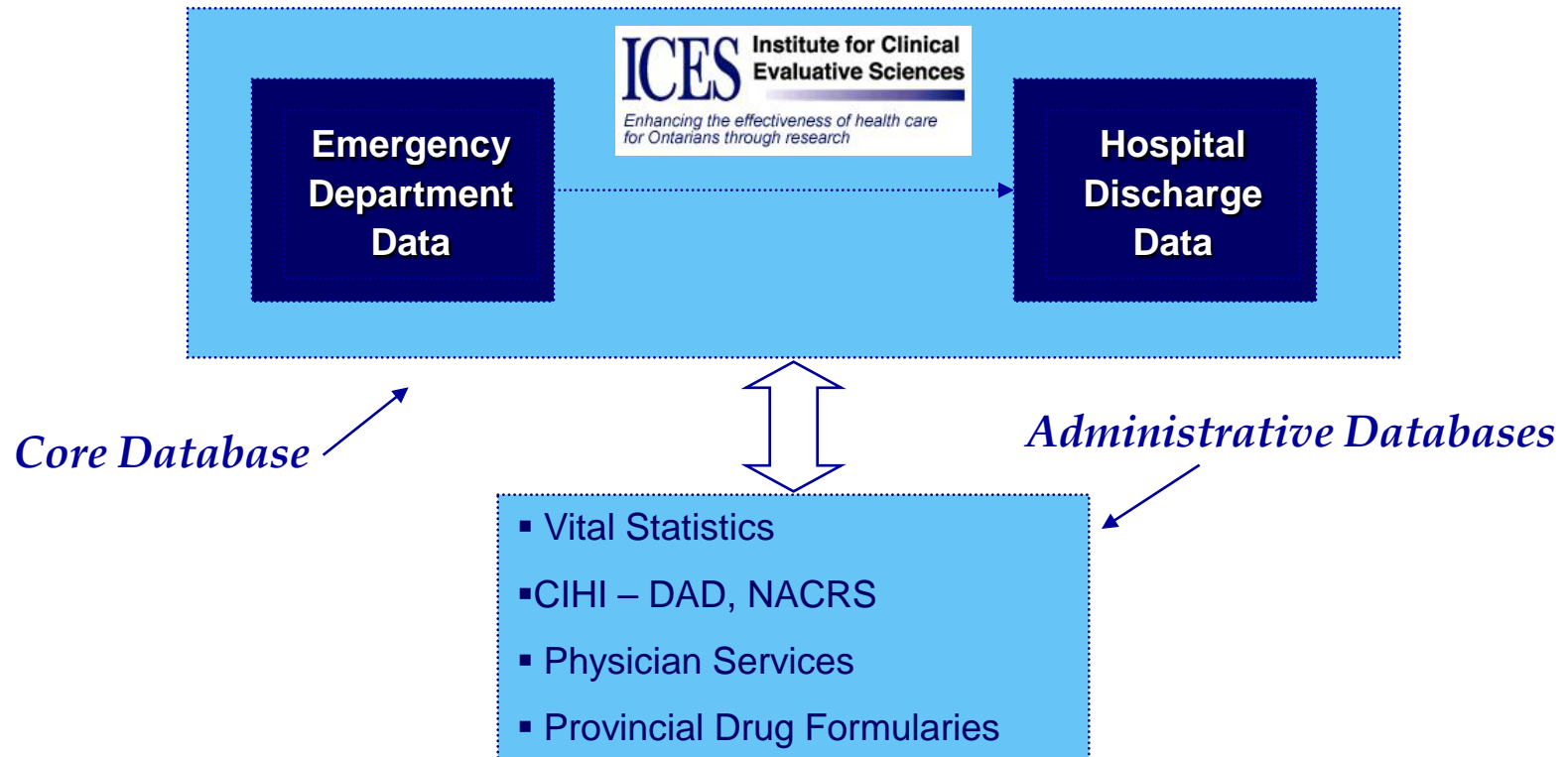


Registry of the CSN

Phase 3: Jul 2003 - present

Inclusion Criteria:

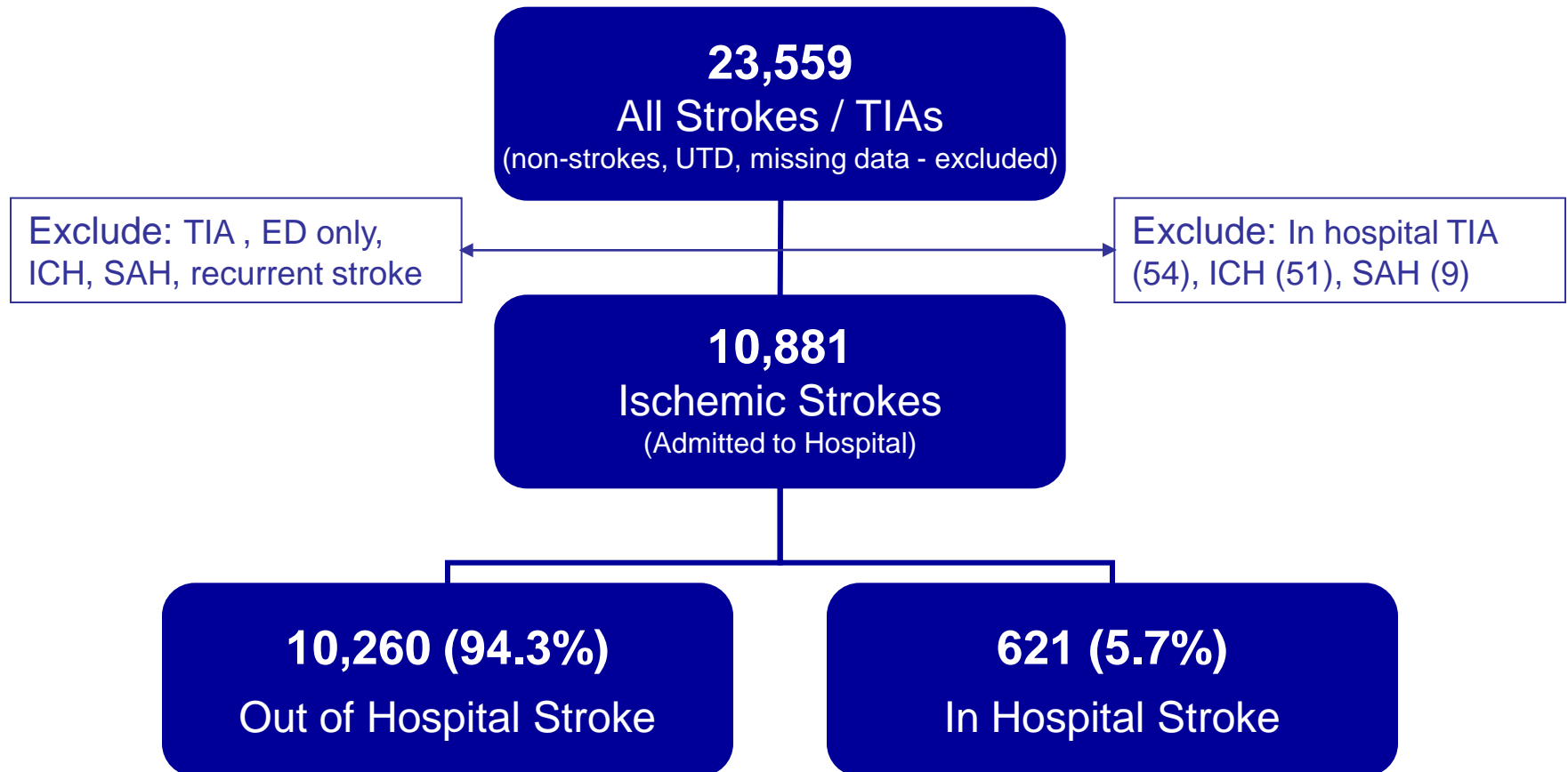
- ED diagnosis of stroke/TIA
- onset \leq 2 weeks of hospital visit





Cohort

RCSN Phase 3 Patients: Jul 2003 - Mar 2008 (57 Months)
(Ontario Sites Only)





Patient Characteristics

Variable	Out of Hospital Stroke	In Hospital Stroke	p
Total n = 10,881	10,260	621	
Mean Age	72.2 0.14	70.5 0.52	0.0042
% < 65	25.9	27.3	0.5197
Female %	48.1	44.8	0.1075
CNS Score: Mean	7.70 0.03	6.71 0.14	0.0001
<8 (severe)	46.2%	58.9%	0.0001



Past Medical History

	Out of Hospital Stroke (%)	In Hospital Stroke (%)	p
Charlson >1	35.3	51.2	0.0001
Diabetes	25.3	30.6	0.0035
Hypertension	67.6	68.0	0.8396
Dyslipidemia	33.4	44.6	0.0001
Prior Stroke	20.8	15.6	0.0017
Atrial Fibrillation	17.9	21.9	0.0123
Previous MI	14.9	33.0	0.0001
Current Smoker	19.5	20.0	0.7858



Patient Characteristics of those Rx with tPA

Variable	Out of Hospital Stroke	In Hospital Stroke	P
All Ischemic Stroke Patients n = 10,881	16.0% (1,641)	11.8% (73)	0.005
Patients arriving within 2.5 hrs: (n = 4,653)	38.6% (1,556)	11.8% (73)	0.000
NIHSS: (Median)	13 (8-18)	13 (7-18)	0.867



Hospital Location Where Stroke Occurred

Location	n=621	%
Medical Unit		28.7
Surgical Unit – Cardiac		32.2
Surgical Unit – Other		23.2
Angiography Suite		10.6
Other		4.8
Unknown (not documented)		0.5



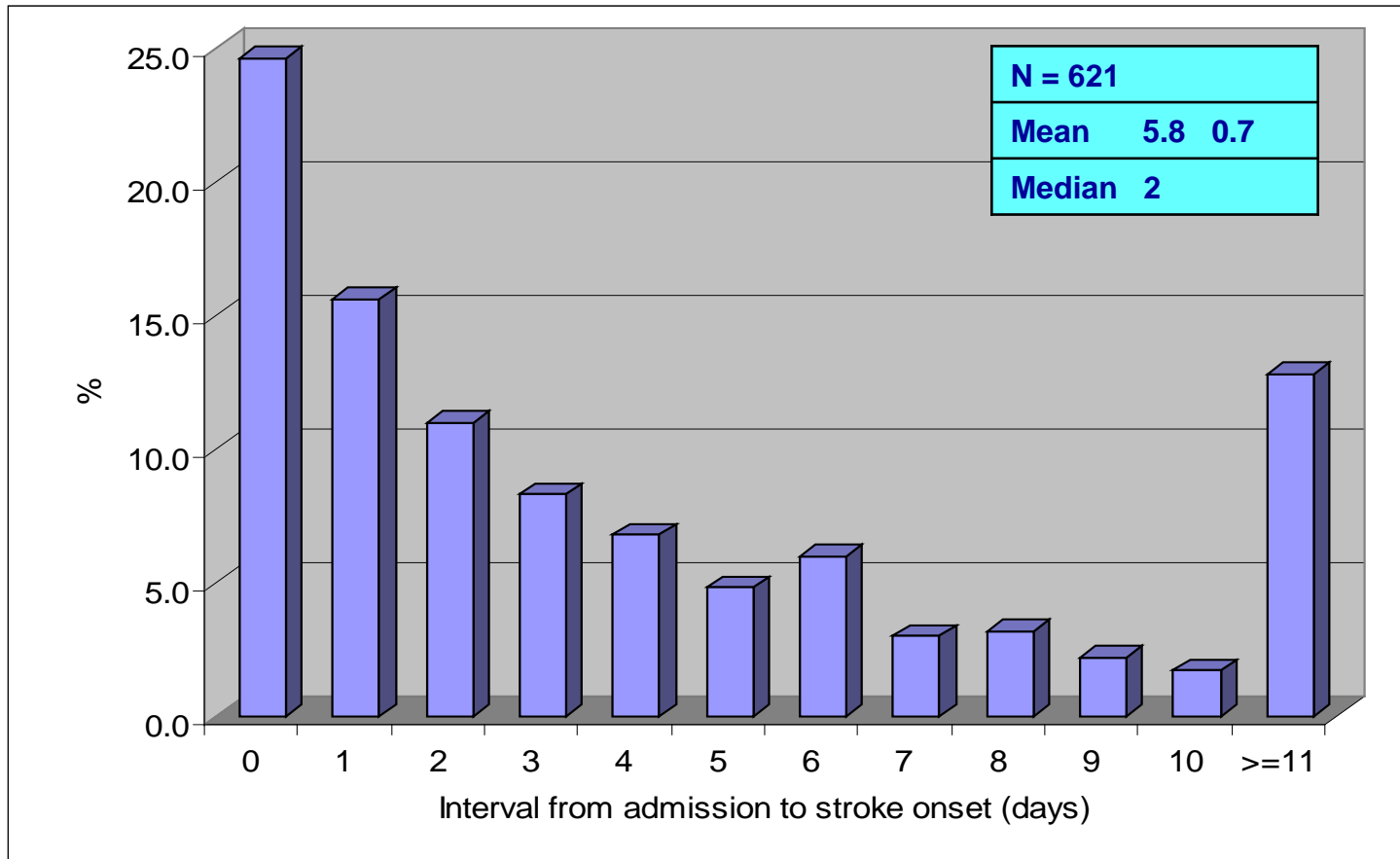
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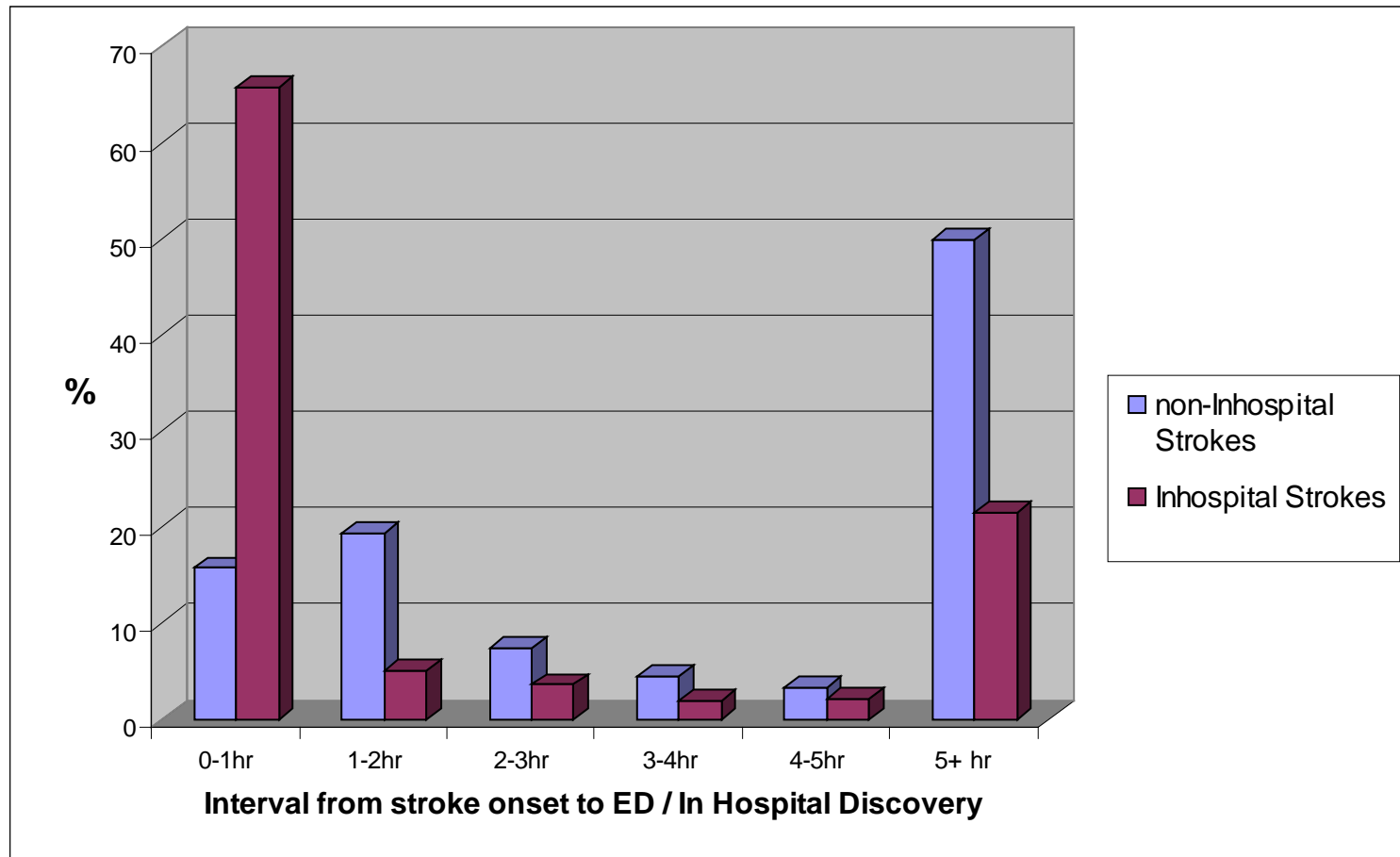
In Hospital Ischemic Strokes

Interval from Hospital Admission to Stroke Onset





Stroke onset to ED Arrival / In Hospital Discovery





Thrombolysis Treatment Times

		Out of Hospital Strokes	In Hospital Strokes	p
n		1640	73	
LSN to ED ¹ / Discovery ²	Median Q1-Q3 (hours)	1.0 (0.75-1.48)	0.0 (0.0 – 0.17)	0.0289
ED / Discovery to CT	Median Q1-Q3 (minutes)	30 (19-44)	66 (40-100)	0.0001
CT to tPA	Median Q1-Q3 (minutes)	43 (27-64)	54 (35-91)	0.0025
ED / Discovery to tPA	Median Q1-Q3 (minutes)	73 (55-95)	124 (90-164)	0.0001
LSN ³ to tPA	Median Q1-Q3 (minutes)	148 (120-175)	136 (105-170)	0.0477

¹ED= Emergency Department ²DISCOVERY = time when stroke was first recognized, ³LSN = Stroke Onset (Last Seen Normal)



Outcomes

		Out of Hospital Stroke n = 10,260	In Hospital Stroke n = 621	p
Length of Stay*	Median (Q - Q3)	9 (5-17)	14 (8-27)	<0.001
30 Day Mortality (unadjusted)	%	13.8	17.6	0.006
30 Day Mortality (adjusted ¹)	% (95% CI)	13.8 (13.1, 14.6)	14.3 (11.5 – 17.6)	

* **Length of Stay** for: *Out of Hospital Stroke* = Admission to Discharge to Discharge, for *In Hospital Stroke* = LSN to Discharge, LSN = Stroke Onset (Last Seen Normal)

¹**Adjusted by** age, sex, CNS (severity) and Charlson (co-morbidity)



Multivariable logistic regression analysis

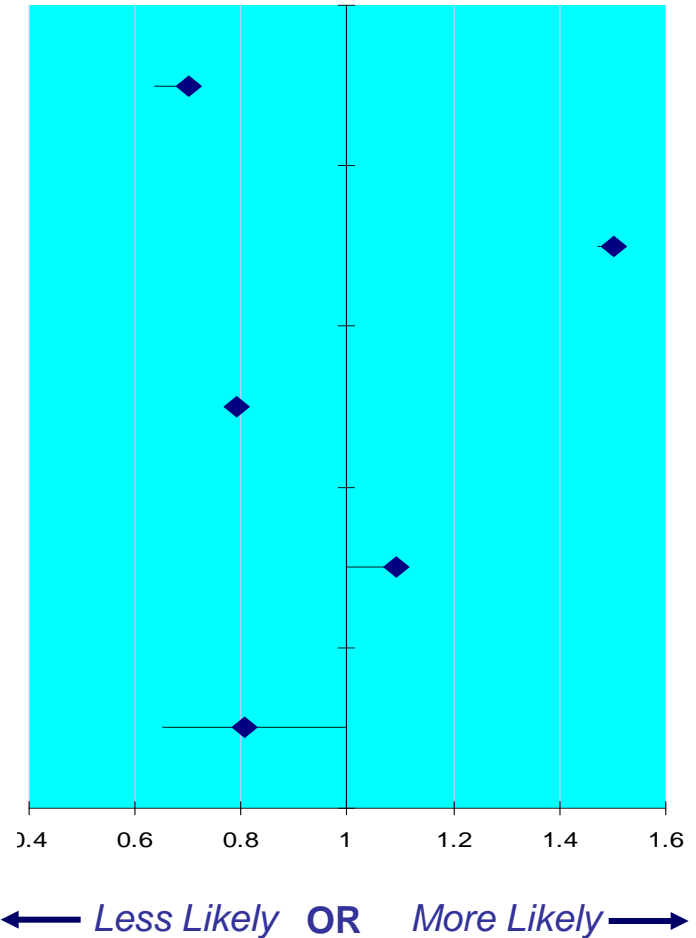
- to assess the impact of *In Hospital* ischemic stroke vs. *Out of Hospital* ischemic stroke
- model included age, gender, stroke severity (CNS), co-morbidity (Charlson Score)
- clinical outcome measures
 - treatment with tPA
 - mortality (30 day)
 - independent at discharge (mRS 0-2)
- separate analysis for patients treated with tPA vs. all patients



Independence at Discharge (mRS 0-2)

all patients

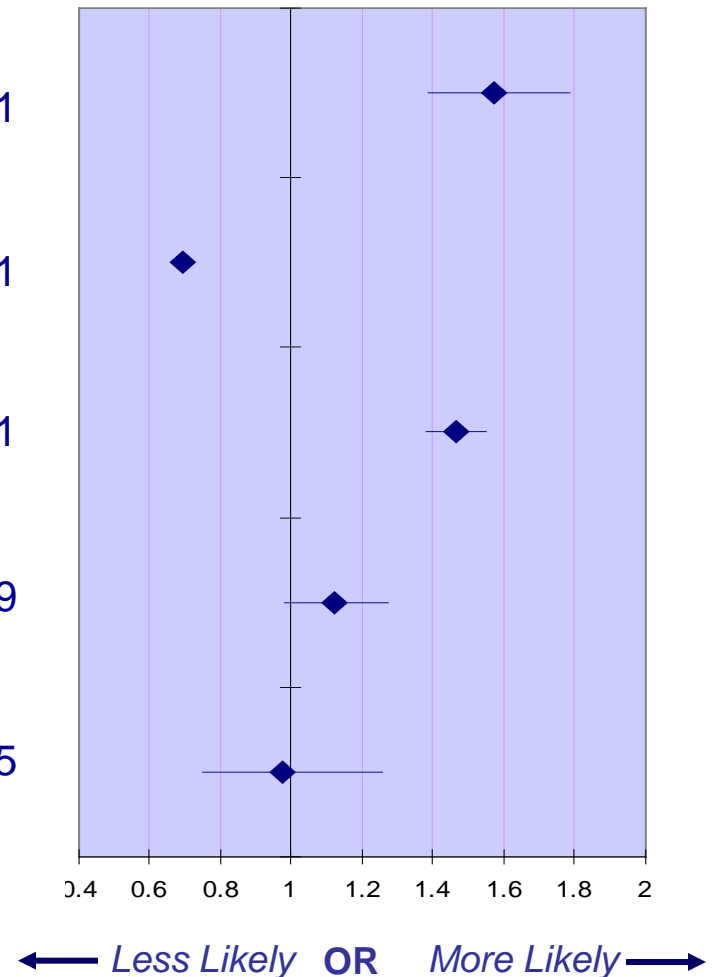
	<i>Odds Ratio</i>	<i>95% CI</i>	<i>p</i>
Charlson >1	0.70	(0.64 - 0.77)	<.0001
CNS Score	1.53	(1.47 - 1.53)	<.0001
Age (10 yrs)	0.79	(0.77 - 0.82)	<.0001
Male vs Female	1.09	(1.00 - 1.20)	0.056
In Hosp vs Out	0.81	(0.65 - 1.00)	0.053





30 Day Mortality *all patients*

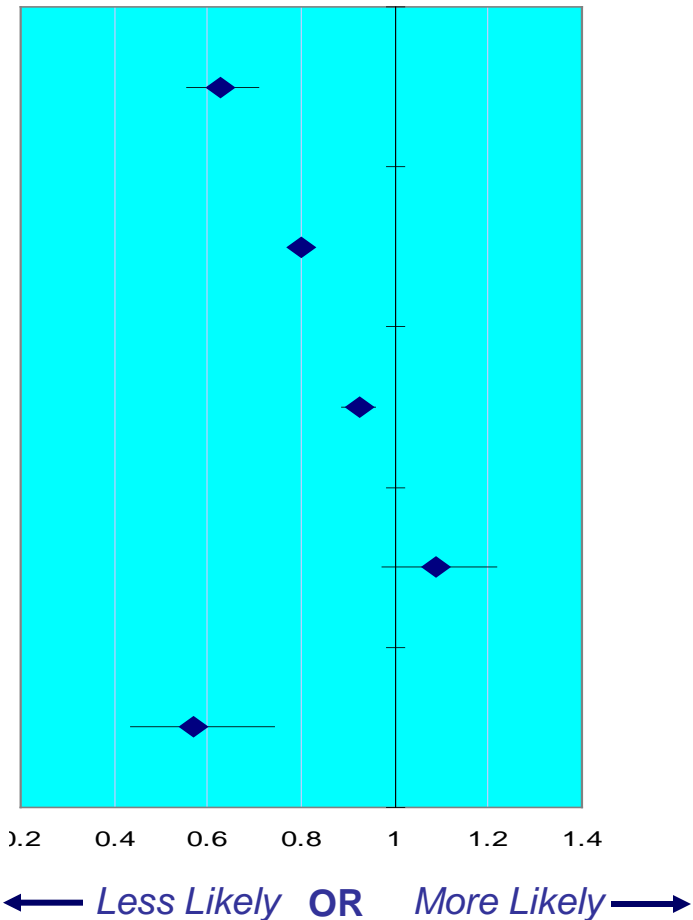
	<i>Odds Ratio</i>	<i>95% CI</i>	<i>p</i>
Charlson >1	1.57	(1.38 – 1.78)	<.0001
CNS Score	0.69	(0.68 – 0.70)	<.0001
Age (10 yrs)	1.46	(1.38 – 1.55)	<.0001
Male vs Female	1.12	(0.98 - 1.27)	0.089
In Hosp vs Out	1.97	(0.72 – 1.23)	0.835





Odds of Receiving tPA *all patients*

	<i>Odds Ratio</i>	<i>95% CI</i>	<i>p</i>
Charlson >1	0.63	(0.56 - 0.71)	<.0001
CNS Score	0.80	(0.79 - 0.81)	<.0001
Age (10 yrs)	0.92	(0.89 - 0.96)	<.0001
Male vs Female	1.01	(0.98 - 1.22)	0.132
In Hosp vs Out	0.57	(0.43 - 0.74)	<.0001

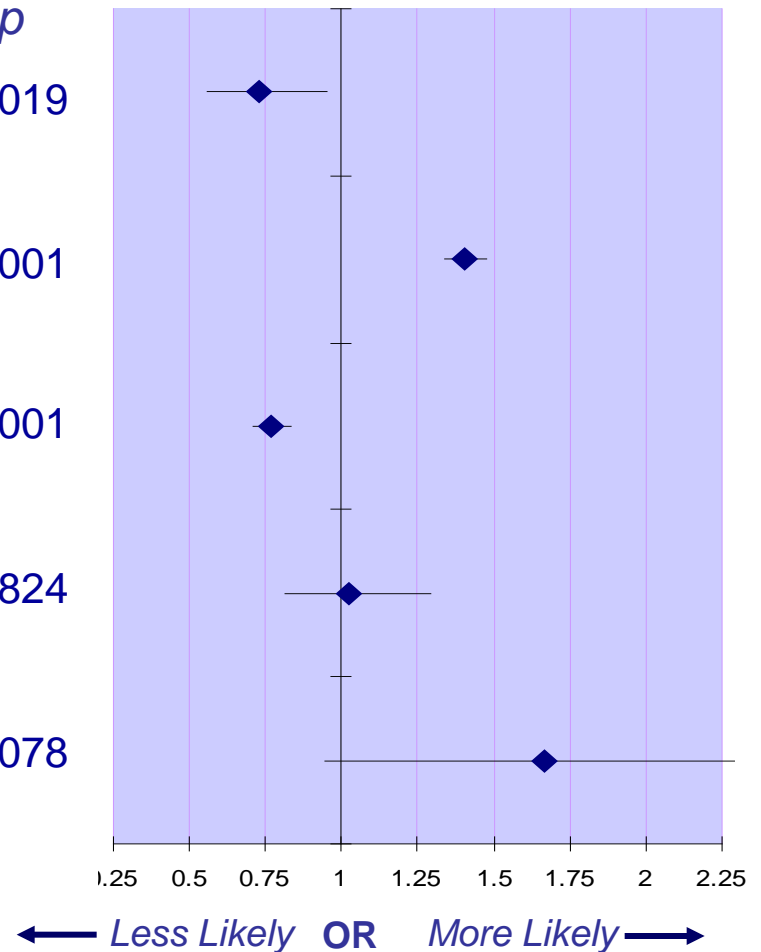




Independence at Discharge (mRS 0-2)

tPA patients

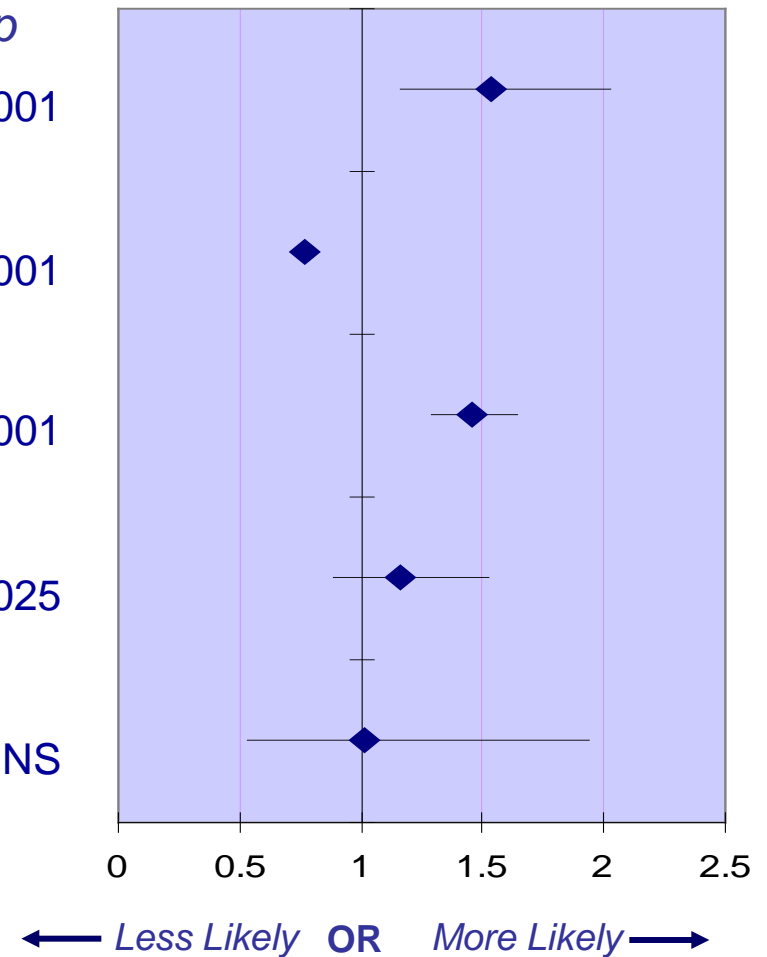
	Odds Ratio	95% CI	p
Charlson >1	0.73	(0.57 – 0.95)	0.019
CNS Score	1.40	(1.34 – 1.47)	<.0001
Age (10 yrs)	0.77	(0.71 – 0.83)	<.0001
Male vs Female	1.01	(0.81 - 1.30)	0.824
In Hosp vs Out	1.66	(0.94 – 2.93)	0.078





30 Day Mortality *tPA* patients

	<i>Odds Ratio</i>	<i>95% CI</i>	<i>p</i>
Charlson >1	1.53	(1.16 – 2.26)	.0001
CNS Score	0.77	(0.73 – 0.82)	<.0001
Age (10 yrs)	1.46	(1.29 – 1.64)	<.0001
Male vs Female	1.17	(0.89 - 1.53)	0.025
In Hosp vs Out	1.01	(0.53 – 1.94)	NS





Conclusions

About 6% of ischemic strokes occurred in hospital

Patients suffering acute ischemic stroke in hospital

- had more co-morbidities
- were more likely to have DM, dyslipidemia and atrial fibrillation
- had more severe strokes
- took longer to get to imaging and receive tPA



Conclusions (2)

After accounting for age, gender, co-morbidity and stroke severity, patients having ischemic stroke in hospital:

- » more likely to die
- » had worse functional scores at discharge
- » had longer lengths of stay
- » were less likely to receive tPA, but did better when treated with tPA



Recommendations

- Education is needed to:
 - increase the awareness of hospital staff to recognize patients with acute stroke
 - special protocols are needed to facilitate rapid access to acute stroke care
- tPA should be considered for patients having stroke in hospital as their outcomes were similar to patients with out of hospital ischemic stroke



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STROKE NETWORK

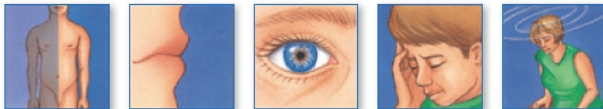
Ontario
Stroke System
Fewer strokes. Better outcomes.

CALL **CODE STROKE** IMMEDIATELY

Page 416-790-0277

For patients exhibiting a
SUDDEN ONSET

of any one of the following symptoms
with an onset time of <4.5 hours.



Stroke Symptoms include:

- **Sudden** unilateral face, arm or leg weakness
- **Sudden** slurred speech or difficulty speaking
- **Sudden** vision loss or blurred vision, particularly in one eye
- **Sudden** severe, unusual headache
- **Sudden** dizziness or unsteady gait

After contacting the stroke team, please do:

- Vital signs and STAT Blood Glucose (accucheck)
- A Brain CT ordered STAT (acute stroke in comments)
- PT, INR, PTT and CBC (within last 24hr, if on Warfarin, re-draw CBC and PTT, INR and send to Rapid Response)



University Health Network

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