The Prehospital Validation of the Canadian C-Spine Rule by Paramedics

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Physicians' Services Incorporated Foundation

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The Clinical Problem…

- **Estimated 185,000 ED visits per year in Canada**
- **Enough to occupy 4 large Emergency Departments, full time**
- **Only 1% will have c-spine injury**

Drawback of immobilization…

- **Progressive pain in head, neck, and back**
- **Marked pulmonary restriction from chest straps**
- **Risk of aspiration**
- **Claustrophobia / Agitation**
- **Time and resource utilisation**

The Canadian C-Spine Study

0. Variation in Use of C-Spine Radiography (N=6,855)

Can Med Assoc J 1997

I. Derivation of the Rule (N=8,924)

J A M A 2001

II. Prospective Validation (N=8,283)

S A E M 2002

Cumulative Classification Performance for 16,462 Cases

	C-Spine Injury	
	Yes	No
Rule Positive		
Yes	312	9,036
No	1	7,013

Sensitivity	99.7%	(98-100)
Specificity	43.7%	(43-45)
NPV	100%	

Objectives

- To prospectively assess the **Canadian C-Spine Rule** when used by paramedics for alert and stable trauma patients
- Specific objectives are to determine:
  - **accuracy** of the rule
  - **reliability** of the rule
  - **clinical sensibility**, i.e. paramedics' accuracy, comfort, and ease of use
  - **potential to reduce** the need for prehospital c-spine immobilization

Design, Setting, Subjects

- **Prospective cohort study**
- **7 Canadian Sites**
- **Includes alert, stable, and cooperative adults with blunt trauma and potential injury to the neck**
- **Patients for whom standard basic trauma life support (BTLS) protocols require immobilization**

Patient Assessments

- **PCPs and ACPs have been taught to use the Canadian C-Spine Rule**
- **They assess patients at the scene, including tenderness and range of motion**
- **They immobilize according to current guidelines, NOT according to the rule**
- **They record findings on data form**

The Canadian C-Spine Rule

1. Any High-Risk Factor?
2. Any Low-Risk Factor?
3. Ability to Rotate the Neck?

The Canadian C-Spine Rule

Please check off all of the following choices:

1. Any One High-Risk Factor Which Mandates Immobilization?

No	Yes	
O	O	Age≥ 65 years
		OR
O	O	Dangerous Mechanism
		OR
O	O	Numbness or Tingling in Extremities

↓ O No

O Yes →

2. Any One Low-Risk Factor Which Allows Safe Assessment of Range of Motion?

No	Yes	
O	O	Simple rearend MVC **
		OR
O	O	Ambulatory at any time at scene
		OR
O	O	No neck pain at Scene
		OR
O	O	Absence of midline c-spine tenderness

O No → **O C-Spine Immobilization**

↓ O Yes

3. Patient Voluntarily Able to Actively Rotate Neck 45° Left and Right When Requested, Regardless of Pain?

No	Yes
O	O

O Unable →

↓ O Able

O No C-Spine Immobilization

*** Dangerous Mechanism**

- -fall from elevation≥ 3feet/5 stairs
- -axial load to head, e.g. diving
- -MVC high speed (≥ 100km/hr), rollover, ejection
- -motorized recreational vehicles e.g. ATV
- -bicycle collision

**** Simple Rearend MVC Excludes:**

- -pushed into oncoming traffic
- -hit by bus/large truck
- -rollover
- -hit by high speed vehicle (≥ 100 km/hr)

Outcome Measures

- **Clinically Important Cervical Spine Injury**
- **Standard Radiography in ED, CT, MRI**
- **Telephone Follow-up if No Radiography**

Clinically Unimportant Injuries

Require neither specialized treatment nor follow-up:

- **Isolated avulsion fracture of *osteophyte***
- **Isolated fracture of *transverse process* not involving body or facet joint**
- **Isolated fracture of *spinous process* not involving the lamina**
- **Isolated simple *compression fracture* < 25% of body height**

Canadian Participants

Ottawa – May, 2002

Sarnia – October, 2002

Windsor – March, 2003

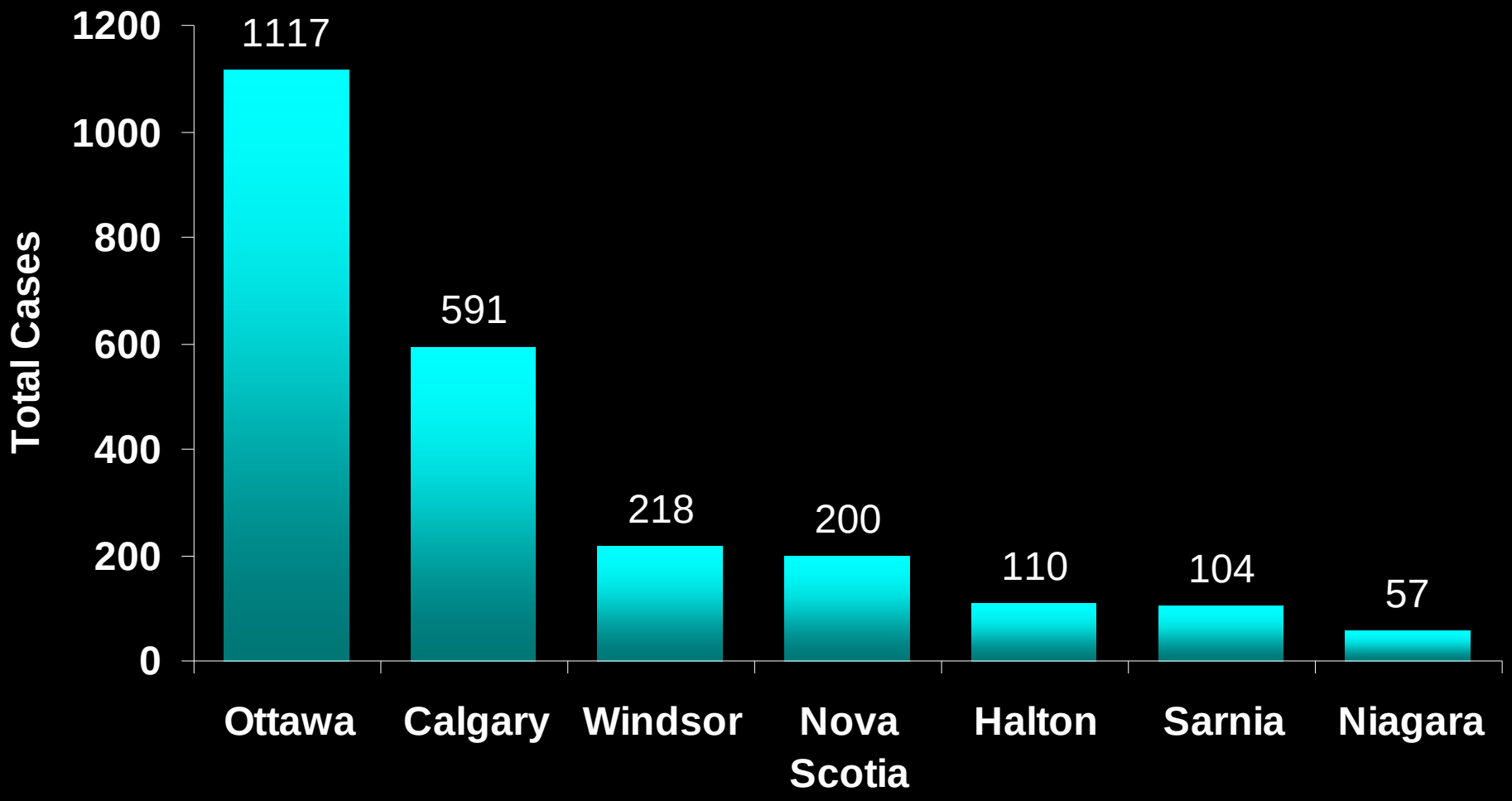
Halton – March, 2003

Calgary – May, 2003

Niagara – December, 2003

Nova Scotia – July, 2005

Recruitment by Center



Flow of Patients

2,397 Enrolled for interpretation of the rule

1,310 (55%) Had diagnostic imaging

1,087 Telephone F-up

783 (72%) Were reached

670 Passed the telephone F-up

1,980 Patients included for rule accuracy

Patient Characteristics (N= 2,397)

Age (median)	40
Male Gender	48%
Mechanism	
MVC	63%
Falls	20%
Pedestrian struck	2%
Bicycle struck	2%
Admitted to Hospital	10%
C-Spine Fracture (n=14)	0.6%

Patient Outcomes (N = 1,980)

Cervical spine injury (n, %)	**17**	**0.7%**
Fracture	14	0.6%
Clinically important injury	12	0.5%
Ligamentous instability	7	0.3%
Dislocation	3	0.1%
Stabilizing treatments (n, %)	**9**	**0.4%**
Internal fixation	5	0.2%
Rigid collar	3	0.1%
Brace	2	0.08%
Halo	1	0.04%

Classification Performance for 12 'Clinically Important' Injury Cases

	C-Spine Injury	
	Yes	No
Rule Positive		
Yes	12	929
No	0	691

Sensitivity	100%	(74-100)
Specificity	42.7%	(40-45)
NPV	100%	

Classification Performance for 17 Cervical Spine Injury Cases

	C-Spine Injury	
	Yes	No
Rule Positive		
Yes	16	925
No	1	690

Sensitivity	94.1%	(69-100)
Specificity	42.7%	(40-45)
NPV	100%	

Classification Performance for 16 Cervical Spine Injury Cases

	C-Spine Injury	
	Yes	No
Paramedic Pos.		
Yes	15	1,158
No	1	717

Sensitivity	93.8%	(68-100)
Specificity	38.2%	(36-41)
NPV	100%	

Classification Performance for 12 'Clinically Important' Injury Cases

	C-Spine Injury	
	Yes	No
Paramedic Pos.		
Yes	12	1,161
No	0	718

Sensitivity	100%	(74-100)
Specificity	38.2%	(36-41)
NPV	100%	

Agreement Among Paramedics
N = 149

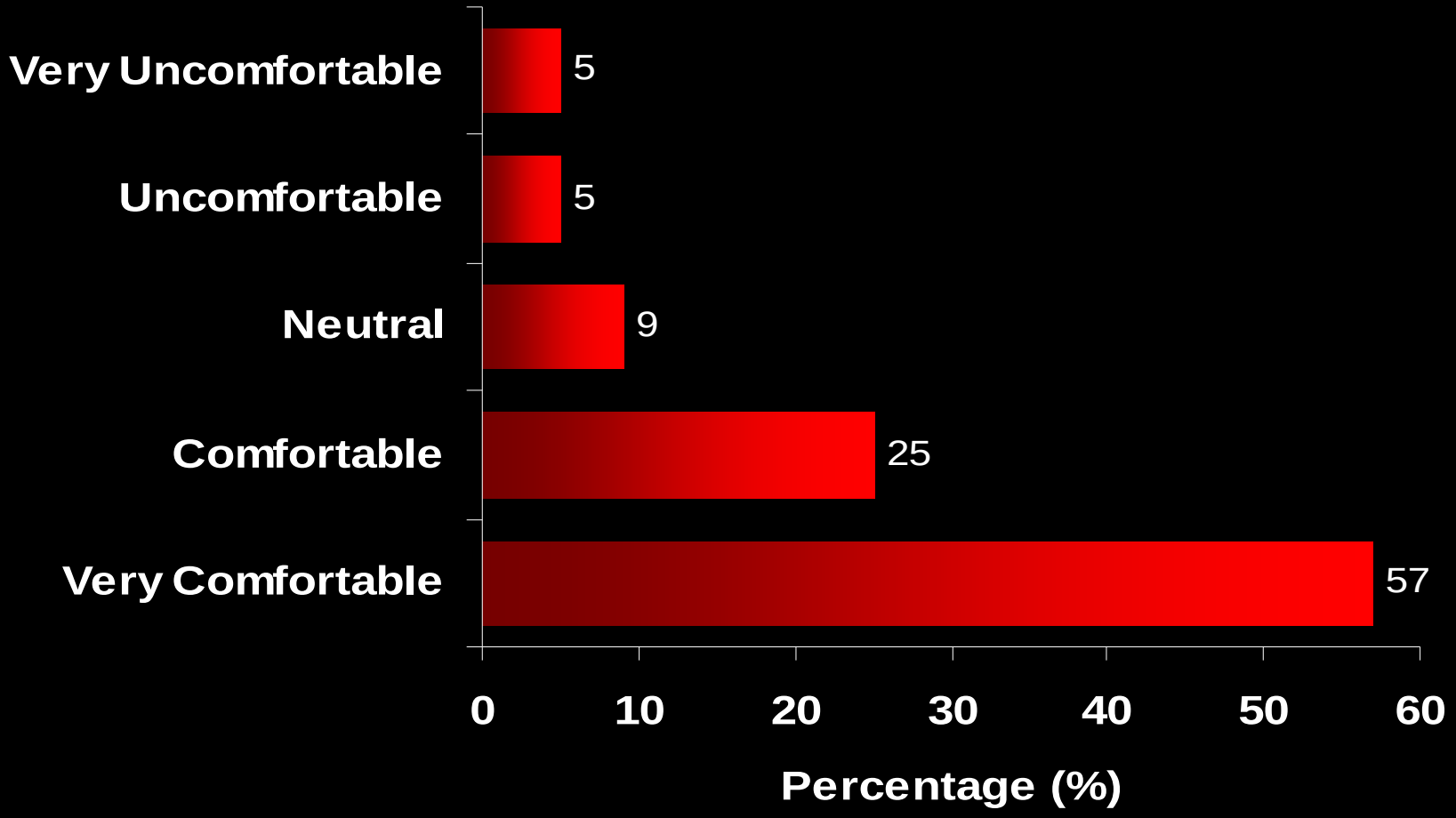
Kappa = 0.96 (0.94 – 0.98)

Rule Interpretation by Paramedics
N = 2,397

6.0% Misinterpreted the Rule

3.3% Did not evaluate ROM

How Comfortable…
N= 2200



Discussion

- Not all eligible cases enrolled
- Some cases indeterminate for CCR
- Some mis-interpretation by paramedics
- Not all cases underwent radiography
- One case not identified

Importance

- **Could lead to a dramatic change in policies and protocols for EMS services throughout Canada and the U.S.**
- **Great potential to have the Canadian C-Spine Rule applied by paramedics**
- **916 immobilizations could have been avoided**
- **Reduced patient discomfort, improved paramedic efficiency, and reduced pressure on our overcrowded EDs**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