




Ontario Neurotrauma Foundation  
Fondation ontarienne de neurotraumatologie

**Determining Catastrophic Impairment:  
Results of an Expert Panel**


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**Project Team Members**

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Ontario Neurotrauma Foundation  
 Toronto Rehabilitation Institute  
 St. Joseph Health's Care, London  
 The Rehabilitation Centre, Ottawa  
 Ministry of Health and Long-Term Care

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**Overview**

- Introduction
- Project Objectives
- Methods
- Results
- Discussion
- Questions?

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● ● ● | Introduction

- Predicting outcome following TBI is a complex and difficult task
- families identified information about prognosis as one of their most important information needs
- Current legislative framework in Ontario for determining catastrophic brain impairment after MVC has come under scrutiny from stakeholders

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● ● ● | Introduction

- Catastrophic brain impairment is not a medically diagnostic term.
- Severe brain injury as defined in the scientific literature does not necessarily have the same meaning as the concept of catastrophic impairment as articulated in statutory accident benefits legislation
- Challenge= translating the knowledge and terminology from the scientific literature

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● ● ● | Project Objectives

- Identify feasible clinical assessments or techniques that could be used to predict the degree of future rehabilitation and healthcare needs in people with traumatic brain injury
- to conduct a systematic literature search and convene a panel of experts to develop a prognostic framework based on best evidence to predict future care needs for adults older than 21 years of age with traumatic brain injury

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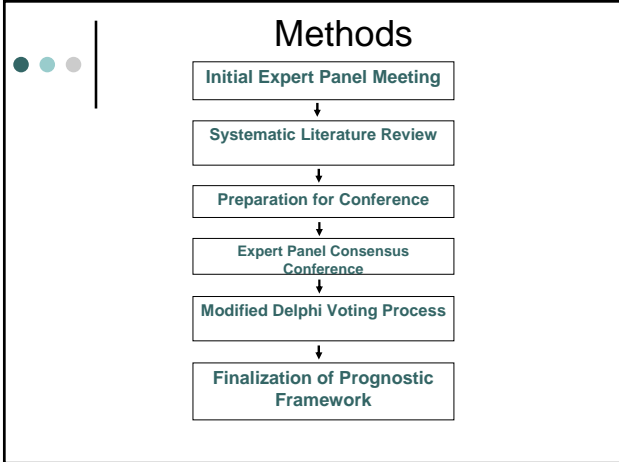
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## Initial Expert Panel Meeting

- o Purpose:
  - (1) Identify existing measures of brain impairment that would assist in classifying patients as having severe (catastrophic) brain injury and perform a detailed literature search
  - (2) Assign experts in the areas identified in order to guide the literature search strategy

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## Expert panel:

**Kent Bassett-Spiers**, Chief Executive Officer, Ontario Neurotrauma Foundation  
**Brenda Barry**, Consultant, Insurance Bureau of Canada  
**Robert Brison**, Emergency Physician, Kingston General Hospital  
**John Connolly PhD** Neuroimaging, Université de Montréal  
**Carol DeMatteo**, Associate Professor, McMaster University  
**Jane Gillett, MD, FRCPC** Medical Director, ABI Program, Hamilton Health Sciences  
**Corinne Kagan**, Senior Program Director, Ontario Neurotrauma Foundation  
**John Kumpf**, Executive Director, Ontario Brain Injury Association  
**Carolyn Lemsky, PhD, C.Psych**, Clinical Director, Community Health Injury Resources Services  
**Scott McCullagh, MD, FRCPC, Psychiatrist**, Director, Sunnybrook TBI Clinic  
**Judy Moir**, Executive Director, GTA Rehab Network/Toronto ABI Network  
**Laura Moll, MSW, RSW, PhD (candidate)** Research Associate, Toronto Rehab  
**Richard Riopelle**, Chair, Department of Neurology and Neurosurgery, McGill University  
**Barb Sulzenko-Laurie**, Director, Health Issues & Policy, Insurance Bureau of Canada  
**Robin Taylor, HBSC, BS, DC**, Consumer Representative, Taylor Chiropractic Clinic  
**Diana Velikonja**, Neuropsychologist, Hamilton Health Sciences Corp.

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## Proposed Measures

Clinical Assessment		Neuro-Imaging	Special Tests	Neuropsychological Tests
Early	Post Acute			
Age	Functional Independence Measure (FIM)	Magnetic Resonance Imaging (MRI)	Apolipoprotein E (APOE)	Transcranial Magnetic Stimulation (TMS)
Co-injury	Rancho Los Amigos	Positron Emission Tomography (PET)	Magneto-encephalography (MEG)	Trail Making Test A & B
Co-morbidity (Alcohol/Drug, Psychiatric)	Glasgow Outcome Scale (GOS)	Near Infrared Imaging	Transcortical Stimulation Cognitive Evoked Potentials	Wisconsin Card Sorting Test (WCST)
Glasgow Coma Scale (GCS)	Disability Rating Scale (DRS)	Functional MRI	Seizures-Electroencephalography	The Western Neuro Sensory Stimulation Profile (WNSSP)
Intracranial Pressure	Post Traumatic Amnesia	Computed Tomography (CT) Scan	Somatosensory Evoked Potentials (SEPs)	
Length of Coma	Hypotension	Single Photon Emission Computed Tomography (SPECT) Scan	SP100	
Pupillary Reflexes	Hypoxia			
Galveston Orientation and Amnesia Test (GOAT)				
Pre-hospital History				

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## Systematic Literature Review

- Inclusion Criteria:
  - English and French language measures
  - Sufficient information on their validity as related to brain impairment
  - Articles that described the predictive ability for the prognosis of moderate or severe TBI

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## Systematic Literature Review

Exclusion Criteria:

- Not adequately tested in a significant number of individuals with a brain injury;
- Measure was used in less than three publications
- Was used only by the original developer
- Was used for another population (i.e. stroke population).
- Mild TBI or paediatric study sample

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● ● ● | Preparation for Conference

- Binders with all relevant articles
- Key findings from studies were compiled and tabulated: including psychometric properties as reliability, validity and predictive value

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● ● ● | Expert Consensus Conference

- Small group work and discussion
- Proposed prognostic framework
- Modified Delphi voting technique
- Final discussion to review the findings of voting
- Identifying any evidence that required further review
- Post-consensus conference follow-up

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● ● ● | Results

- Consensus-based definitions:
  - Traumatic brain injury
  - Severe brain impairment outcome
  - Provisionally catastrophic
  - Potentially catastrophic

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## Definitions - TBI

- Acute brain injury that results from mechanical energy to the head from external physical forces.
- at least 1 and likely more of :
  - Confusion, disorientation, and/or loss of consciousness
  - Period of post-traumatic amnesia i.e. a period of time following the trauma characterized by inability to remember ongoing events.
  - Development of other neurological abnormalities such as focal signs or seizures
  - Intracranial lesions on imaging tests.

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## Definitions: Catastrophic Brain impairment

- Trauma to the brain that results in physical and/or cognitive difficulties severe enough that an individual:
  - cannot function in the community in normal expected adult roles
  - requires regular professional, social and/or physical support to maintain them safely in the environment in which they live.
  - are usually unable to return to any form of paid employment

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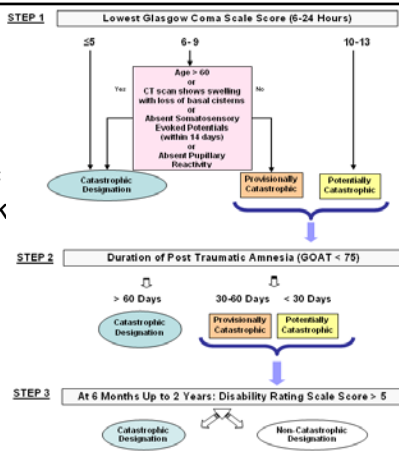
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## Prognostic Framework




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## Discussion:Glasgow Coma Scale (GCS)

Threshold	Timing
<b>Automatically Considered Severe Catastrophic:</b> Lowest GCS<5	6- 24 Hours Post Onset
<b>Provisionally/Probably Catastrophic:</b> Lowest GCS =6-9	6- 24 Hours Post Onset
<b>Potentially Catastrophic:</b> Lowest GCS 9-14	6- 24 Hours Post Onset

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## Discussion-Age

Threshold	Timing
<b>Automatically Catastrophic:</b> Lowest GCS $\leq 9$ and age greater than 60 years of age	6- 24 Hours Post Onset

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## Discussion:Computed Tomography (CT) Scan

Threshold	Timing
<b>Automatically Catastrophic:</b> Lowest GCS <9 and CT scan shows obliteration of the cerebral ventricles by brain swelling	6- 24 Hours Post Onset

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## Discussion: Somatosensory Evoked Potentials (SEPs)

Threshold	Timing
Automatically Catastrophic: Lowest GCS <9 and SEPS show unilateral or bilateral absence of potentials	First 2 weeks

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## Discussion: Duration of Post Traumatic Amnesia (PTA)

Threshold	Timing
Catastrophic/Severe Impairment: GOAT Score <75	At 30 Days and 60 Days

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## Discussion

- o Disability Rating Scale (DRS)

Threshold	Timing
>5	6 Months Up to 2 Years

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● ● ● | Discussion- Excluded Measures

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● ● ● | Recommendations for Implementation of the Framework

- Prospective evaluation of the framework.
- Pediatric evidence based review is required.
- Education of Adjusters and all Stakeholders that even for those with non-catastrophic impairment
  - may have relatively high care needs
  - Some may require case managers to coordinate their complex programs.
- Feasibility- training of raters, education.
- Implementation issues- These tools were developed in the clinical realm and without medicolegal overtones so the raters must

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● ● ● | Limitations and Caveats

- Any TBI can have serious consequences and even those with non-catastrophic impairment may have significant difficulties in returning to normal roles such as work.
- The panel considered the evidence and did not do any formal evaluation of whether the framework would increase or decrease the number of insurance claims considered catastrophic.
- The evidence base review was done relatively rapidly and therefore some relevant literature may have been overlooked.
- applies to persons >21 years of age

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## Limitations and Caveats

- Very little literature that provides a guaranteed cutoff score for identification of catastrophic impairment therefore cutoff scores were established using a modified Delphi voting method to build the thresholds.
- 5. No discussion was undertaken for how to combine the brain injury related care needs and impairments with those with orthopaedic or other impairments arising from the trauma

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## Conclusions

- Recommendations from this initiative use current scientific evidence and expert consensus to measure and define catastrophic brain impairment.
- Need to focus on variables that have already shown promise as being clinically useful (PTA, GCS, pupillary reactions, etc.) to aid in clinical prognostication.
- Framework should be validated by a prospective study of its application in clinical practice.
- Need for further research.

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