

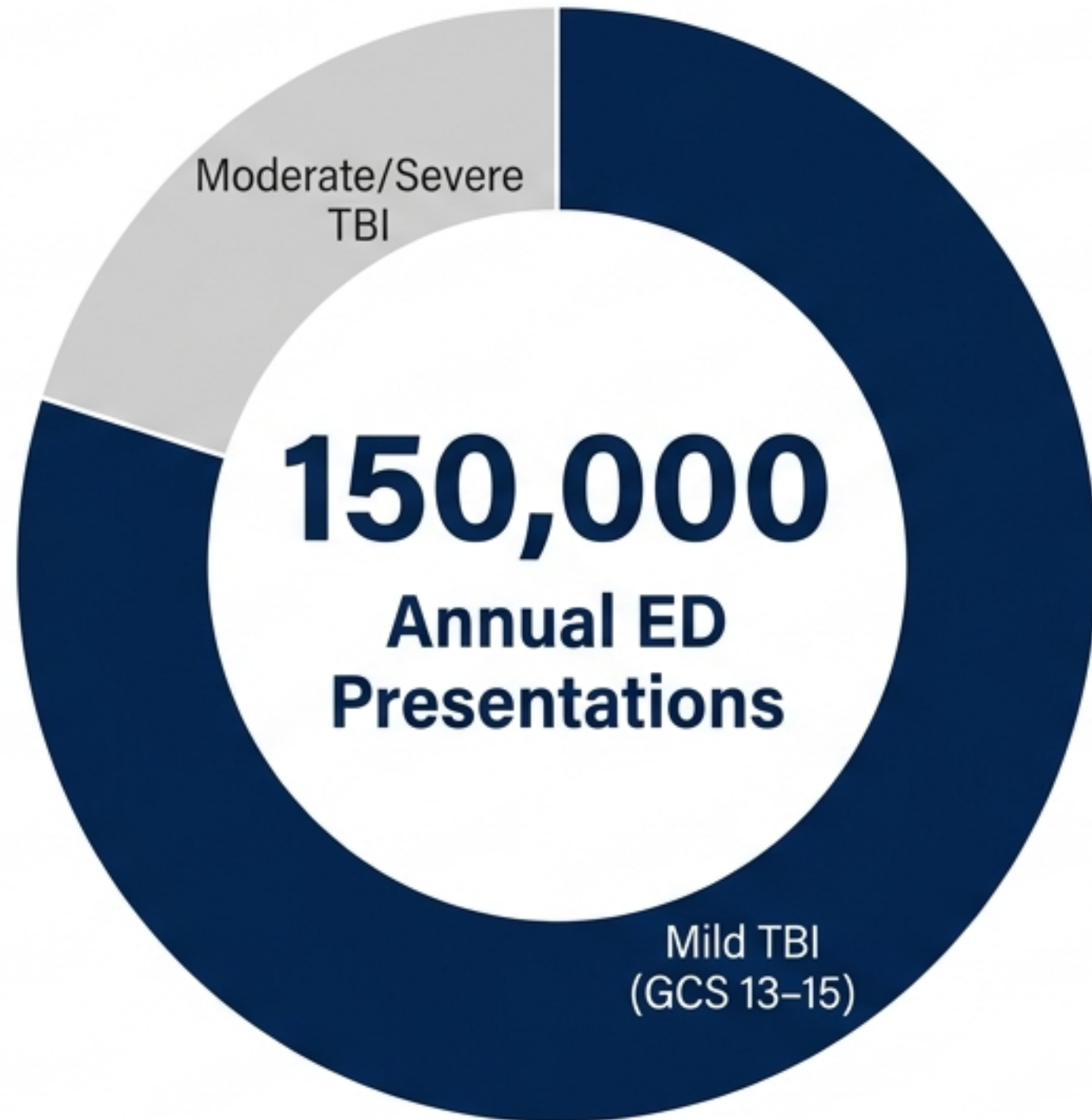


The Clinical Pathway for Mild Traumatic Brain Injury

Evidence-based triage, management, and recovery
protocols for the Australian healthcare setting.

Built on the Consensus Statement on Concussion in Sport
(Amsterdam 2023) & Australian clinical standards.

Donut Chart



Direct Annual Healthcare Cost

\$8.6 Billion

Driven by falls, transport accidents, and sport-related trauma.

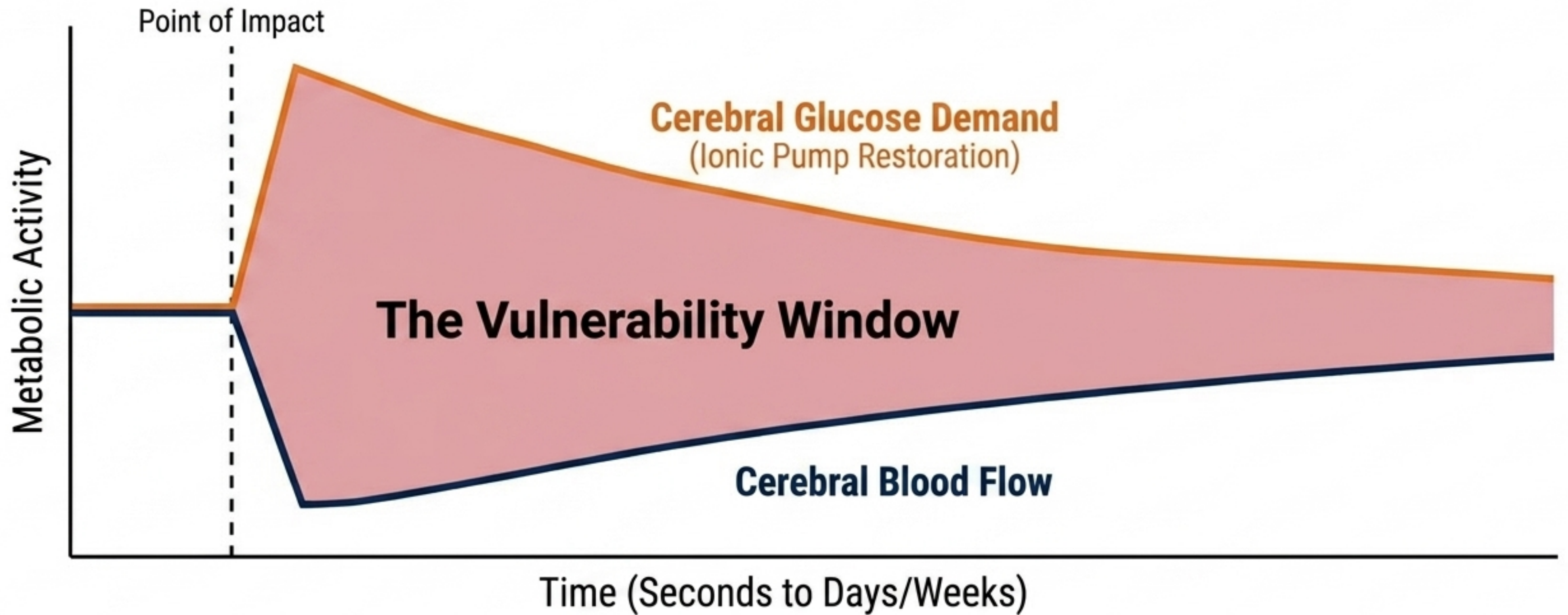
Demographic Peaks



Aboriginal & Torres Strait Islander Communities

2x-3x Higher Incidence Rate

Driven by regional road trauma and assault.



At Impact:
Indiscriminate K⁺ and
Glutamate release.

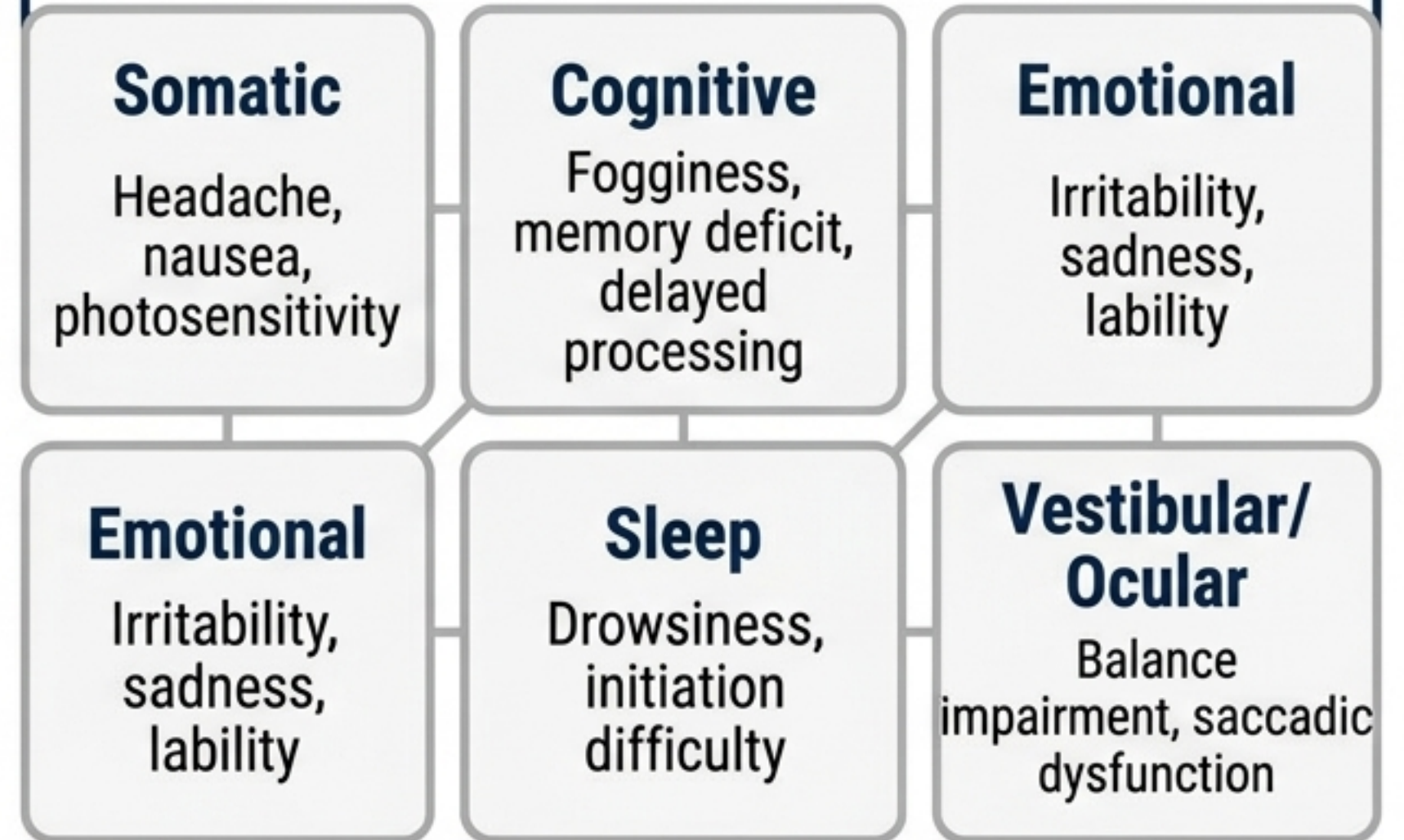
Inside the Gap:
Transient energy crisis. Brain is
metabolically vulnerable.

⚠ Second Impact Syndrome Risk:
A second impact during this window
risks severe cerebral oedema.
Mandatory stand-down is critical.

Diagnostic Criteria (CDC/WHO)

1. Biomechanical force mechanism
2. Acute clinical signs (Confusion, LOC \leq 30m, PTA \leq 24h)
3. GCS 13–15 at presentation
4. Normal structural neuroimaging (if performed)

Presenting Symptom Domains



Standardised Assessment Tools:

- SCAT6 (Age 13+)
- Child SCAT6 (Ages 5-12)
- SAC (Sideline)

GCS <15 at 2 hours post-injury

Suspected skull fracture signs

Focal neurological deficit

Post-traumatic seizure

Vomiting (>1 episode)

Anticoagulant / Antiplatelet use

Age ≥ 65 with any LOC/Amnesia

Dangerous mechanism (>1m fall, MVA)

Retrograde amnesia >30 minutes



**IMMEDIATE
NON-CONTRAST CT HEAD**

Neurosurgical referral if
structural pathology identified.

CT Head Decision Rules Matrix

| | Canadian CT Head Rule | New Orleans Criteria | PECARN |
|-------------------|--|--|--|
| Target Population | Adults, GCS 13–15, <24 hrs | Adults, GCS 15, <24 hrs | Paediatric (<18 yrs) |
| Sensitivity | ~100% for neurosurgical lesion | ~99% | ~97–99% |
| Key Triggers | GCS drop, fracture signs, ≥2 vomits, age ≥65 | Headache, intoxication, visible clavicle-up trauma | Stratified <2 and ≥2 yrs: Altered mental status, severe headache, mechanism |

Low Risk (Simple)

Profile

GCS 15, no LOC, normal CT. Resolves in 7–10 days.

Setting

ED discharge with advice. GP follow-up in 1–2 weeks.

Moderate Risk (Complicated)

Profile

GCS 13–14, brief LOC (<5m), skull fracture (linear), anticoagulant use, use, or prior concussions.

Setting

ED observation 4–6 hrs minimum. Specialist follow-up within 1 week.

High Risk (Intracranial)

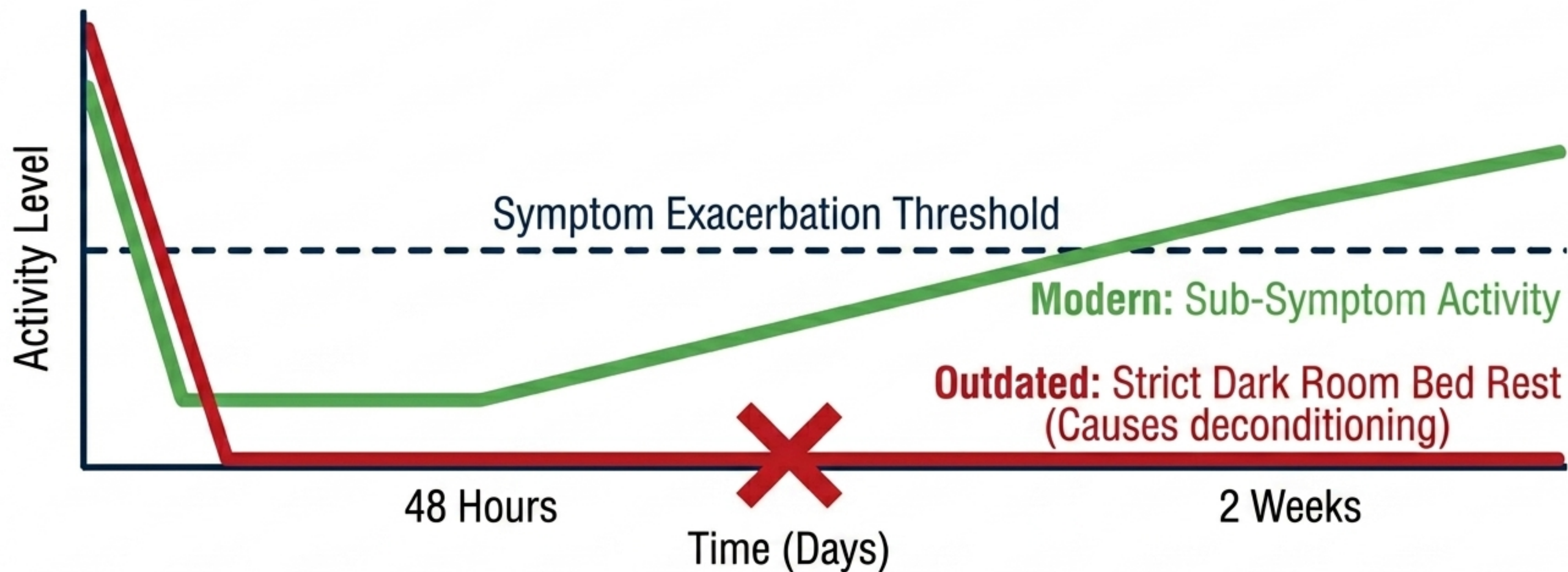
Profile

GCS <13, intracranial haemorrhage, depressed fracture, deteriorating GCS.

Setting

Neurosurgical referral, Admission/ICU. Transfer to tertiary centre.

The Sub-Symptom Threshold Model



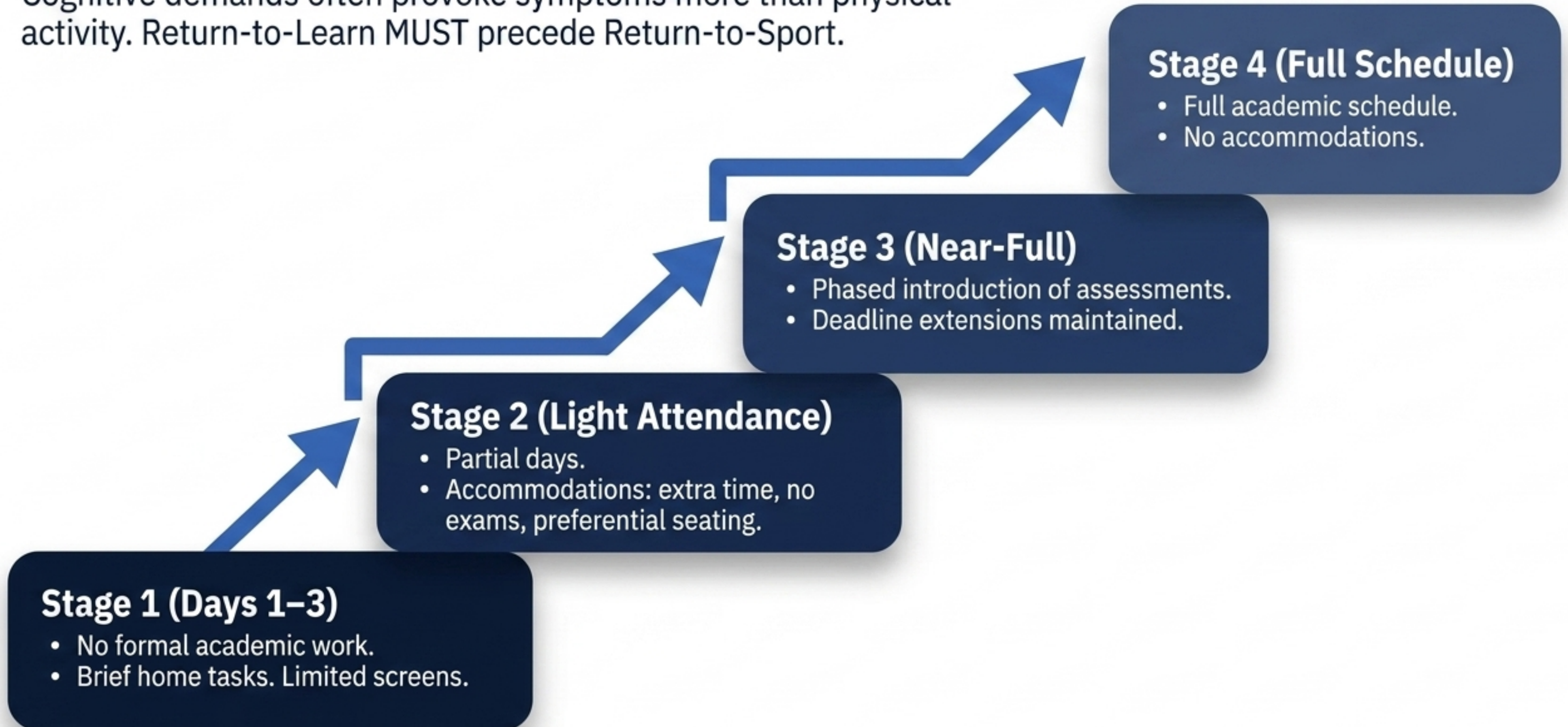
0–48 Hours: Relative rest.
Sleep encouraged.
No hourly waking.

48 Hrs – 2 Weeks: Routine
daily tasks permitted below
symptom threshold.

>2 Weeks: Progressive
RTP/RTL protocols.

Return-to-Learn (RTL) Protocol

Cognitive demands often provoke symptoms more than physical activity. Return-to-Learn MUST precede Return-to-Sport.



Return-to-Play (RTP) Protocol



Mandatory Rule: Minimum 24 Hours Per Step. If symptoms recur, revert to previous step.



Australian Code Mandates:

- AFL: 12-day mandatory stand-down.
- NRL: 11-day mandatory stand-down.
- Children/Adolescents: Minimum 14-day stand-down. No same-day return.

Post-Concussion Syndrome (PCS)

Persistence of symptoms
>2 weeks (adults) or
>4 weeks (children).

Affects 10–30% of
patients.

Prognostic Risk Factors

- Prior concussions (≥ 2)
- Pre-existing migraine
- Anxiety / Depression
- Age >55 or Female sex
- High initial symptom burden (PCSS >30)




Red Flags

for Persistent Symptom Referral

- Worsening neuro symptoms
- New focal signs
- Suicidal ideation
- Post-event seizures

Pharmacotherapy Formulary

| Medication | Indication | Adult Dose | PBS Status | Clinical Notes |
|---------------|---------------------|---------------|-------------------------|---|
| Paracetamol | Acute headache | 1g QID PRN | General | Avoid NSAIDs in first 48hrs (bleeding risk) |
| Amitriptyline | Migraine/Sleep | 10-25mg nocte | Authority | Titrate to 50-75mg; dual benefit |
| Sertraline | Depression/Anxiety | 50mg mane | General | SSRIs preferred over benzodiazepines |
| Melatonin | Sleep disturbance | 2mg MR nocte | Authority (≥ 55) | Private script if under 55 yrs |
| Ibuprofen | Short-term headache | 200-400mg TDS | General | Avoid if eGFR < 30 |

 **AVOID ACUTELY:** Benzodiazepines, Opioids, Codeine (children < 12), routine stimulants.

Non-Pharmacological Management



Dizziness & Vestibular

Screening

Perform Dix-Hallpike manoeuvre (BPPV is found in 20-30% of post-concussion dizziness).

Interventions

- Canalith repositioning
- Gaze stabilisation
- Balance retraining
- Oculomotor physio (for convergence insufficiency)



Cognitive & Mood

Cognitive Interventions

- Graduated aerobic exercise therapy (Strongest evidence base for cognitive improvement)
- Occupational therapy (Task management, energy conservation)

Mood Interventions

- Cognitive Behavioural Therapy (CBT) is first-line for anxiety and depression

Special Populations: Age Extremes



Paediatric (<18 Years)

- Recovery is significantly longer (typically 2–4 weeks).
- Use Child SCAT6 (ages 5–12) & PECARN rules for imaging.
- Minimise CT use due to radiation sensitivity; observe low-risk presentations.
- Under 5s: Rely on parental report of behavioural changes (irritability, vomiting, lost skills).



Elderly (≥65 Years)

- High risk of chronic subdural haematoma (SDH).
- Lower threshold for CT head required.
- Brain atrophy delays symptom onset; monitor for subacute SDH (gait changes, confusion weeks later).
- Anticoagulant management: DOAC omission, Warfarin bridging via haematology.

Systemic Considerations & Comorbidities



Renal Impairment

- Avoid NSAIDs and iodinated contrast if eGFR <30. Amitriptyline requires close monitoring. Altered drug clearance in dialysis patients requires pharmacist review.



Hepatic Impairment

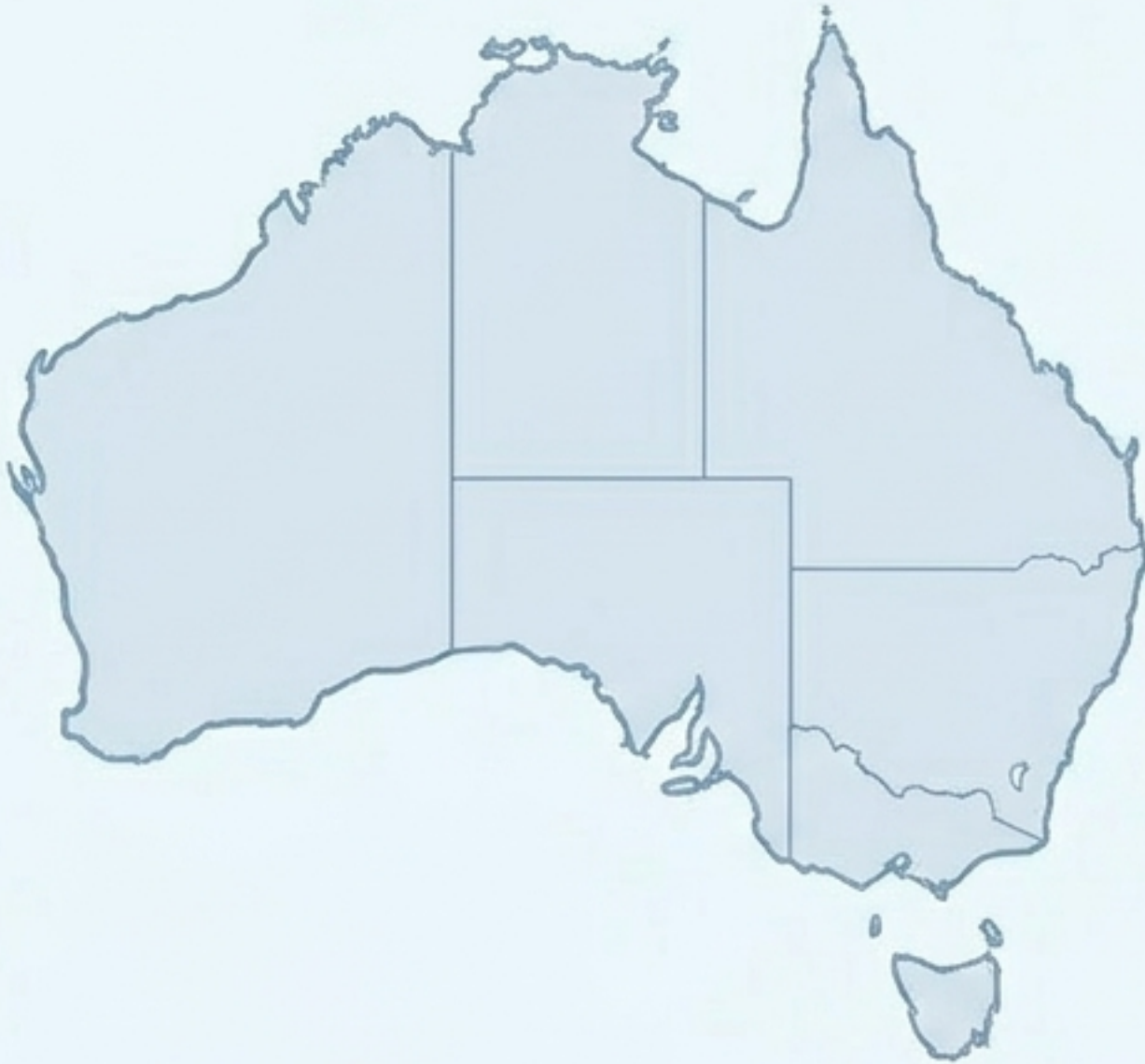
- Maximum 2g/day Paracetamol in severe disease. Sertraline preferred over other SSRIs.
- Coagulopathy increases intracranial bleeding risk—lower the threshold for CT imaging.



Pregnancy

CT head is SAFE (negligible foetal radiation at ~2 mSv); do NOT withhold if red flags present. Paracetamol is safe. Avoid NSAIDs (especially >30 weeks: risk of premature ductus arteriosus closure). Monitor BP (preeclampsia mimics post-concussion headache).

Aboriginal & Torres Strait Islander Health



The Burden

- 2–3x higher TBI rate compared to non-Indigenous population. Driven by road trauma and assault. Directly impacts Closing the Gap life expectancy targets.



Acute Care & Access

- Limited CT scanners in remote areas. Rely on validated clinical tools (PECARN/Canadian rules). Maintain a low threshold for RFDS retrieval or the Australian Tele-Neurosurgery Service.



Culturally Safe Follow-Up

- Engage Aboriginal Community Controlled Health Organisations (ACCHOs) for discharge planning. Acknowledge cultural obligations ('Sorry business') affecting attendance. Utilise Yarning-based education.

Advanced Investigations Timeline

Essential (Acute)



Non-Contrast CT Head

- Indicated only when clinical red flags are present.
- Guided by Canadian/PECARN rules.
- Normal CT does not exclude concussion.

Available (Subacute >4 Weeks)



MRI Brain

- Use if symptoms persist >4-6 weeks or if microhaemorrhage suspected.



Neuropsychological Testing

- Assess processing/memory; best with pre-injury baseline.



C-Spine Imaging

- Concurrent c-spine injury in ~30% of sport concussions.

Emerging (Future Standard)



Blood Biomarkers (GFAP, UCH-L1)

- Not yet standard-of-care in Aus EDs.
- Awaiting local validation to reduce CT use in low-risk mTBI.

The Post-Concussion Ecosystem

Prolonged recovery requires a coordinated, multi-disciplinary ecosystem, not isolation.

