

ORIGINAL ARTICLE

# Recovery Over 6 Months of Medical Decision-Making Capacity After Traumatic Brain Injury



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## Abstract

**Objective:** To investigate recovery of medical decision-making capacity (MDC) over 6 months in persons with traumatic brain injury (TBI) stratified by injury severity.

**Design:** Longitudinal study comparing controls and patients with TBI 1 month after injury (t1) and 6 months after injury (t2).

**Setting:** Inpatient TBI rehabilitation unit and outpatient neurology department.

**Participants:** Participants (N=151) consisted of control subjects (n=60) and patients with TBI (n=91) stratified by injury severity: mild TBI (mTBI; n=27), complicated mild TBI (cmTBI; n=20), and moderate/severe TBI (msevTBI; n=44).

**Interventions:** Not applicable.

**Main Outcome Measures:** We used the Capacity to Consent to Treatment Instrument to evaluate MDC performance on 5 consent standards (expressing choice, reasonable choice, appreciation, reasoning, and understanding). We also assigned capacity impairment ratings on the consent standards to each participant with TBI using cut scores referenced to control performance.

**Results:** Control performance was stable across time on the consent standards. Patients with mTBI and cmTBI performed below controls on the understanding standard at t1 but not t2. Patients with msevTBI performed below controls on appreciation, reasoning, and understanding at t1, and on appreciation and understanding at t2, but showed substantial improvement over time.

**Conclusions:** Regardless of injury severity, all groups with TBI demonstrated baseline impairment of MDC with subsequent partial or full recovery of MDC over a 6-month period. However, a sizeable proportion of individual patients with TBI in each group continued to demonstrate capacity compromise at 6 months postinjury. Clinically, this finding suggests that individuals with TBI, regardless of injury severity, need continued monitoring regarding MDC for at least 6 months after injury.

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Medical decision-making capacity (MDC), also known as treatment consent capacity, is a key clinical issue for persons with traumatic brain injury (TBI) and their families, and for physicians who treat them. MDC refers to a person's cognitive and emotional

ability to accept or refuse a proposed treatment or to select among treatment alternatives.<sup>1,2</sup> Persons with TBIs can experience a range of cognitive impairments that may impair their ability to make treatment decisions, including whether to undergo orthopedic surgery, rehabilitation, and psychiatric treatment.<sup>3,4</sup> Rehabilitation and other clinicians need guidance regarding the effects of TBI injury severity on the initial impairment of MDC and on the expected recovery of such abilities over time. Such information is important for planning purposes, for making clinical recommendations, and for knowing when intervention might be beneficial.

An audio podcast accompanies this article.  
Listen at [www.archives-pmr.org](http://www.archives-pmr.org).

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A prior study previously investigated MDC longitudinally in a small TBI sample with moderate to severe injury.<sup>4</sup> This earlier study found that most of this group had impaired MDC at 1 month after TBI with partial recovery by 6 months. In addition, a cross-sectional study<sup>5</sup> recently showed that MDC was largely intact in patients with uncomplicated mild TBI but was impaired in patients with complicated mild TBI. However, there are no longitudinal studies of MDC in milder forms of TBI. As such patients represent most of the TBI cases, the lack of MDC research in mild TBI represents an important gap in the TBI literature.

The present study longitudinally investigated MDC over 6 months in persons representing a spectrum of TBI severity: uncomplicated mild TBI (mTBI), complicated mild TBI (cmTBI), and moderate/severe TBI (msevTBI). Based on prior cross-sectional research, we hypothesized that the cmTBI and msevTBI groups would demonstrate impaired MDC at baseline (1mo postinjury). We also hypothesized that 6 months postinjury, persons in all 3 TBI groups would show significant improvements in performance from baseline on the treatment consent standards of appreciation, reasoning, and understanding. We further hypothesized that 6 months after injury, persons with mTBI would not differ significantly from healthy controls on appreciation, reasoning, and understanding, but that persons with cmTBI would continue to show some MDC impairment. Finally, we hypothesized that patients with msevTBI at 6 months would show improvement but continue to be impaired relative to controls on the 3 consent standards.

## Methods

### Participants

Healthy adult controls and persons with subacute TBI (within 30d of injury) were prospectively enrolled between October 2007 and December 2011 as part of a National Institutes of Health-funded longitudinal study investigating MDC after TBI (Recovery of Lost Abilities in Medical Decision-Making Study [RECLAIMED Study]). Of the 112 persons with TBI in RECLAIMED, 21 were excluded (noncompleters), resulting in 91 persons with TBI for this article. Of the 21 noncompleters in the TBI sample, 2 were excluded at baseline (noncompleters) because of self-reported poor test effort. Nineteen were missing 6-month data because of the following: scheduling problems (n=1), not interested in participating (n=3), too ill (n=1), no shows (n=5), distance (n=1), skipped visit caused by being outside of window for follow-up (n=1), and unknown (n=7). Persons with TBI were recruited through the emergency department, neurosurgery inpatient service, and Spain Rehabilitation Center at the School of Medicine, University of Alabama at Birmingham. The mean time  $\pm$  SD from the date of brain

**Table 1** Causes of TBI in patient sample (n=91)

Cause	No. of Patients	%
Motor vehicle crash	50	54.9
Motorcycle crash	8	8.8
ATV/go-cart crash	3	3.3
Assault with blunt instrument	4	4.4
Sports	2	2.2
Falls	18	19.8
Hit by falling or flying object	1	1.1
Pedestrian	1	1.1
Other	2	2.2

Abbreviation: ATV, all-terrain vehicle.

injury to the date of initial study evaluation was  $32.4 \pm 12.2$  days. Participants were also assessed 6 months after injury with a 2-week scheduling window on either side. All participants with TBI were assigned a study diagnosis and injury severity level by a board-certified rehabilitation neuropsychologist (T.A.N.) using diagnostic criteria from TBI Model Systems.<sup>6</sup> These criteria define TBI as damage to brain tissue caused by an external mechanical force as evidenced by loss of consciousness attributable to brain trauma, posttraumatic amnesia (PTA), or objective neurologic findings reasonably attributed to TBI on physical or mental status examination.<sup>7</sup> All study participants had closed head injuries; individuals with penetrating brain injuries (eg, gunshot wound) were excluded. Table 1 lists the causes of injury for the TBI sample.

An mTBI was characterized by 1 or more of the following criteria: (1) initial Glasgow Coma Scale (GCS) score  $\geq 13$ <sup>8</sup>; (2) PTA, if extant,  $\leq 24$  hours; and/or (3) any loss of consciousness  $\leq 30$  minutes. In addition, patients with mTBI had no evidence of structural brain changes on computed tomography (CT) scans.

A cmTBI was characterized like mTBI except that participants also had evidence of structural brain changes (such as contusions, subdural hematoma, or diffuse axonal injury) on cranial magnetic resonance imaging or CT scan.<sup>9</sup>

An msevTBI was characterized by 1 or more of the following criteria: (1) initial GCS score  $\leq 12$ <sup>10,11</sup> and/or (2) PTA  $> 24$  hours,<sup>8,12,13</sup> and (3) evidence of structural brain changes on cranial magnetic resonance imaging or CT scan. Initial GCS scores were not available for intubated patients with msevTBI.

Patients were excluded if they had received substance abuse treatment within 1 year of enrollment (per patient/family report) or had a preexisting diagnosed central nervous system disorder (including prior msevTBI), developmental disorder, or severe psychiatric disorder. Individuals with a prior mTBI were included if their prior injury occurred at least 1 year before enrollment.

Of 66 control subjects recruited through local advertisements, 6 were lost to follow-up (noncompleters), resulting in 60 controls. Reasons for control attrition included the following: employment (n=1), no show (n=1), self-reported poor effort (n=1), illegal drug use disclosed after enrollment (n=1), and unknown (n=2). Controls were selected to match participants with TBI on demographic variables of age, sex, ethnicity, and education. Controls were without diseases/conditions that could potentially affect cognition, including psychiatric disorders (except mild depression), substance abuse, cerebrovascular disease, or other neurologic diseases. None of the controls were taking medications known to affect cognition.

#### List of abbreviations:

ANOVA	analysis of variance
CCTI	Capacity to Consent to Treatment Instrument
cmTBI	complicated mild TBI
CT	computed tomography
GCS	Glasgow Coma Scale
MDC	medical decision-making capacity
msevTBI	moderate/severe TBI
mTBI	mild TBI
PTA	posttraumatic amnesia
TBI	traumatic brain injury

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