Table 2. A comparison of psychometric properties of DOCS relative to published findings of other instruments.

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<tr>
<td>Study Samples*</td>
<td>95 unconscious persons who had an initial (initial = score computed before administration of neuroparalytic agents) GCS score ≤ 8 and who received 383 DOCS evaluations.</td>
<td>23 minimally responsive patients as defined by IP rehab admission DRS scores = 17–29 and RLA II–IV.&lt;sup&gt;[1]&lt;/sup&gt;</td>
<td>30 persons in a vegetative state.</td>
<td>57 persons with IP rehab admission RLA III–V.</td>
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<tr>
<td>Scales of Measurement</td>
<td>Rating Scale: 0 = No response. 1 = General response. 2 = Localized response. Logits: Equal interval measures derived from ordinal raw scores.</td>
<td>Dichotomous Scale indicating: • Expected behavior is demonstrated or • Expected behavior is not demonstrated. Ordinal raw scores.</td>
<td>For 7/8 subscales, a Dichotomous Scale is used that indicates: • Expected behavior is demonstrated or • Expected behavior is not demonstrated. For level of wakefulness, a scale of 1–5 is used. Ordinal raw score range = 7 to 35 points.</td>
<td>Multiple rating scales mixed within each subscale. Scores are determined according to accuracy, response latency, and provision of cueing. Nominal and ordinal</td>
</tr>
</tbody>
</table>
Scale Properties

- Average measures: –15.71, 15.71
- Step thresholds: 76% of step thresholds for each item (26/34) maintain stability over time.

Reliability Indices

- Interrater for over 40 different raters:
  - % of exact agreements (54%) is greater than predicted (43%).
  - Ratings between rater pairs are not significantly different ($\chi^2 = 8_{df}, p = 0.15$).
  - Adjusted averages across 6 discipline groups indicate that the DOCS measure is impacted by only 0.18 points.
- Person separation reliability of 2.38 for CHI and 1.8 for Other BI indicates that items detect 3 levels of functioning within continuum of altered consciousness.
  - Cronbach’s alpha = 0.77

Construct Validity

- PCA Items: 34 DOCS items explain majority (61%; 53.5/87) of total variance in observations. First factor explained 4% of total unexplained variance.
  - Fit Statistics: 23 of 34 items have infit mean square statistics > 0.7 ≤ 1.3 and calibrations (difficulty) remain stable over time (fall within 0.95 CI).

Concurrent

- One published case study comparing DOCS and fMRI.

- Histogram reflects symmetrical distribution of CRS-revised total scores.\[^6\]
- Interrater findings for 2 raters:
  - $\kappa = 0.83$.\[^1\]
  - Spearman $r = 0.60$ to 0.96 and $\kappa = 0.69$.\[^2\]
  - Spearman’s rank order $r = 0.84$.\[^6\]
  - Test-retest Spearman $r = 0.94$—1 day separated between tests.

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### Validity
- One published case study comparing DOCS, fMRI, and QEEG.
- Analyses comparing DOCS with GCS are ongoing in 2004.

<table>
<thead>
<tr>
<th>Outcome predicted: Recovery of consciousness within 365 days of injury.</th>
<th>Outcome predicted: DRS score at time of hospital discharge.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significant predictor variables:</td>
<td>Significant predictor variable:</td>
</tr>
<tr>
<td>- Dichotomized DOCS-1 ($p = 0.01$).</td>
<td>Difference of CRS admission and discharge raw scores ($r = -0.78$, $p &lt; 0.01$).[2]</td>
</tr>
<tr>
<td>- DOCS-Average, ($p = 0.02$).</td>
<td>None.[6]</td>
</tr>
<tr>
<td>- LOS dichotomized at 28 days ($p = 0.001$).</td>
<td></td>
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<tr>
<td>- Presence of CHI ($p = 0.03$).</td>
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<tr>
<td>Predictive values for DOCS-1:</td>
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<tr>
<td>- True positive = 0.71.</td>
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<td>- True negative = 0.68.</td>
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</table>

### Predictive Validity

<table>
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<th>4 emerged late</th>
<th>11 no emerge</th>
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<tr>
<td>$\chi^2 = 0.6_{2df}$</td>
<td>$\chi^2 = 6.7_{2df}$</td>
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</table>

$\chi^2$ values: $\chi^2 = 8_{2df}$

$\chi^2$ values: $\chi^2 = 1_{2df}$

$p \leq 0.03$ level

### Targeting of Test to Population

- Average person measures for CHI and Other BI samples are closely aligned with average item calibrations.
- No floor.
- No ceiling.

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### Author’s Conclusions

1. DOCS rating scale reflects progressively improving levels of neurobehavioral functioning throughout the continuum of altered consciousness.
2. Allied health professionals can reliably administer the DOCS given 2 h of training.
3. The DOCS produces a sensitive, reliable, and valid measure of neurobehavioral functioning for patients emerging from coma.
4. Detecting differences between those persons who did recover consciousness versus those who did not improved if first DOCS was obtained within 94 days of injury.
5. First DOCS measure when dichotomized to reflect rate of improvement, as measured by change from admission CRS to discharge CRS, predicts DRS hospital discharge score.[1]
6. CRS-revised reliably and accurately distinguishes between vegetative and minimally conscious states.[6]

Rate of improvement, as measured by change from admission CRS to discharge CRS, predicts DRS hospital discharge score.[1]

Emergence from vegetative state may be able to be determined with use of rate of change score; a larger confirmatory study is indicated.

Specific items capable of predicting rehabilitation readiness and recovery rate.

Floor effect noted by O’Dell.[2]

Scale is administered reliably by trained

Subsequent research needed.

Specific items capable of predicting rehabilitation readiness and recovery rate.
high and low performers predicts recovery of & lack of recovery of consciousness 1 yr after injury.

6. Predicting recovery & lack of recovery of consciousness 1 yr after injury is improved further with use of a multivariate model composed of DOCS-Average, length of IP rehabilitation stay, and an etiological variable.

CRS-revised total score is stable when repeated assessment is done within 24 h of initial assessment.\(^6\)

*Sources (correspond with sample descriptions, reported results, and conclusions):*


CHI = closed head injury, CI = confidence interval, CNC = Coma Near Coma Scale, CRS = Coma Recovery Scale, DOCS = Disorders of Consciousness Scale, DRS = Disability Rating Scale, GCS = Glasgow Coma Scale, Initial GCS = GCS score calculated in the field or at admission to trauma center and prior to the administration of neuromuscularly paralytic agent, IP = inpatient, NS = not significant, Other BI = other types of brain injury, \(p\)-value = level of statistical significance, PCA = Principal Component Analyses (X-E = Residual), RLA = Ranchos Los Amigos Levels of Cognitive Functioning, SMART = Sensory Modality Assessment and Rehabilitation Technique, WNSSP = Western Neuro Sensory Stimulation Profile

\(^{\dagger}\) \(p \leq 0.05\)