Table 2.

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

Variable	DOCS	CRS[1–3]	SMART[4–5]	WNSSP[2,6]
Study Samples*	95 unconscious persons who had an initial (initial = score computed before administration of neuroparalytic agents) GCS score ≤ 8 and who received 383 DOCS evaluations.	23 minimally responsive patients as defined by IP rehab admission DRS scores = 17–29 and RLA II–IV.[1] 18 persons presenting at RLA I–IV. 80 patients who were vegetative or minimally conscious.[6]	30 persons in a vegetative state.	57 persons with IP rehab admission RLA III–V.
Content	Baseline Observation Protocol: 34 test items organized by difficulty in 8 subscales— 1. Social knowledge. 2. Taste & swallowing. 3. Olfactory. 4. Proprioceptive & vestibular. 5. Auditory. 6. Visual. 7. Tactile. 8. Testing readiness.	Has 5 items organized in 6 subscales: 1. Arousal. 2. Auditory. 3. Visual. 4. Motor. 5. Verbal. 6. Communication. CRS items were revised in 2004.	8 subscales: 1. Visual. 2. Auditory. 3. Tactile. 4. Olfactory. 5. Gustatory. 6. Communication. 7. Motor. 8. Level of "wakefulness."	33 items organized in 6 subscales: 1. Arousal. 2. Auditory comprehension. 3. Visual comprehension. 4. Visual tracking. 5. Object manipulation. 6. Expressive communication.
Scales of Measurement	Rating Scale: 0 = No response. 1 = General response. 2 = Localized response. Logits: Equal interval measures derived from ordinal raw scores.	Dichotomous Scale indicating: • Expected behavior is demonstrated or • Expected behavior is not demonstrated. Ordinal raw scores.	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.	Multiple rating scales mixed within each subscale. Scores are determined according to accuracy, response latency, and provision of cueing. Nominal and ordinal

						raw scores.
Scale Properties	Average measures: –15.71, 15.71 Step thresholds: 76% of step thresholds for each item (26/34) maintain stability over time.	Histogram reflects symmetrical distribution of CRS-revised total scores.[6]	Not reported.			Not reported.
Reliability Indices	Interrater for over 40 differet raters: • % of exact agreements (54%) is greater than predicted (43%). • Ratings between rater pairs are not significantly different ($\chi^2 = 8_{5df;}$ $p = 0.15$). • 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	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[6]—1 day separated between tests.	Not reported.			Interrater: $r = 0.70$
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).	Not reported. Items misfitting in CRS were revised in CRS-revised.[6]	Not reported.			Not reported.
Concurrent	• One published case study comparing DOCS and fMRI.	GCS: $r = 0.90$.[1] DRS: $r = –0.93$.[1]	7 emerged	WNSSP $\chi^2 = 7_{2df}$†	SMART $\chi^2 = 13_{2df}$†	RLA: $r = 0.73$

Validity	• One published case study comparing DOCS, fMRI, and QEEG. • Analyses comparing DOCS with GCS are ongoing in 2004.	CNC: $r = 0.48$ ($p < 0.10$).[2] WNSSP: $r = 0.36$ (NS) .[2] CRS-revised: $r = 0.97$.[6] CRS-revised & DRS: $r = 0.90$.[6]	4 emerged late 11 no emerge $p \leq 0.03$ level	$\chi^2 = 8_{2df}$ † $\chi^2 = 0.6_{2df}$	$\chi^2 = 6.7_{2df}$ † $\chi^2 = 1_{2df}$	
Predictive Validity	Outcome predicted: Recovery of consciousness within 365 days of injury. Significant predictor variables: • Dichotomized DOCS-1 ($p = 0.01$). • DOCS-Average, ($p = 0.02$). • LOS dichotomized at 28 days ($p = 0.001$). • Presence of CHI ($p = 0.03$). Predictive values for DOCS-1: • True positive = 0.71. • True negative = 0.68.	Outcome predicted: DRS score at time of hospital discharge. Significant predictor variable: Difference of CRS admission and discharge raw scores ($r = -0.78$, $p < 0.01$).[2] None.[6]	Not reported.			Not reported.
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.	Not reported.	Not reported.			Not reported by authors. Floor effect noted by O'Dell.[2].
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] CRS-revised reliably and accurately distinguishes between vegetative and minimally conscious states.[6] Scale is administered reliably by trained	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.

	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.	neurophysiologists.[6] 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):

1. Giacino JT, Kezmarsky K, DeLuca J, Cicerone K. Monitoring rate of recovery to predict outcome in minimally responsive patients. Arch Phys Med Rehabil. 1991;72:897–901.
2. O'Dell M, Jasin P, Lyons N, Stivers M, Mezaros F. Interrater reliability of the Coma Recovery Scale. J Head Trauma Rehabil. 1996;3:61–66.
3. Giacino JT, Kalmar K, Whyte J. The JFK Coma Recovery Scale-Revised: measurement characteristics and diagnostic utility. Arch Phys Med Rehabil. 2004;85(12): 2020–29.
4. Gill-Thwaites H. The Sensory Modality Assessment Rehabilitation Technique—a tool for assessment and treatment of patients with severe brain injury in a vegetative state. Brain Inj. 1997;11(10):723–34.
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6. Ansell B, Keenan J. The Western Neuro Sensory Stimulation Profile: a tool for assessing slow-to-recover-head-injured-patients. Arch Phys Med Rehabil. 1989;70(2):104–8.

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 neuroparalytic 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

$^{\dagger}p \leq 0.05$