

**Objective:** There is a dearth of an appropriate standardized tool to assess neuropsychological functions in rural population, which has low literacy rates, are culturally diverse, and have limited access to healthcare resources. The NIREH Neuropsychological Battery for Rural Population (NINB-RP) is a relatively brief and easy-to-administer battery comprising multiple tests that are modified or adopted as per rural community settings to evaluate verbal learning, fine coordination, attention efficiency, executive task, concentration, and visual attention, mental flexibility, and motor coordination in rural populations. The present study aimed to examine the clinical validity and establish cut-off scores for impairment of neuropsychological functions for different age, gender, and education levels of NINB-RP in a rural community in central India.

**Participants and Methods:** This was a prospective cross-sectional study conducted in participants aged  $\geq 18$  years ( $n=2952$ , M: F=1407:1545) recruited through a stratified sampling technique from 23 randomly selected villages from central India. The data of nine neuropsychological tests [(Finger and Tweezer dexterity test (FDT, TDT); Digit Forward and Backward test (DFT, DBT); Serial subtraction test (SST); Trail Making-A and B; Finger Tapping test (FTT); and Letter Digit Substitution test, LDST)] from 215 cognitively impaired and 2737 healthy control subjects were analyzed. The tests were performed in a village school/community hall or an outdoor camp. Independent sample t-test, Chi-square test, and Receiver Operating Characteristic (ROC) curve were used to calculate the area under the curve (AUC), cut-off scores, and sensitivity (ST)/specificity (SP) values for seven conditions, i.e., gender (male vs. female), age groups (up to 49 years and above 50 years); and educational levels (illiterate, intermediate and college). For those variables where ST/SP values were lower than 0.70, a unique cut-off score was calculated for the entire sample, adjusting by age and educational levels.

**Results:** A significant difference in mean (median) scores between the healthy control and cognitively impaired groups were observed in all tests except Trail Making A and B and LDST. The AUC for most of the tests ranged from 0.70 to 0.81, and the ST/SP values ranged from 69-73% and 65-75%, respectively. The results showed that most tests of NINB-RP reached moderate to good sensitivity and specificity for gender, age and education levels,

except for DBT for females, above 50 years, and illiterate and intermediate education groups. FDT for males [AUC: 0.85 (95%CI 0.80-0.91), ST/SP=76/82%] and females [AUC=0.78 (95%CI 0.74-0.82), ST/SP=71/70%], TDT for intermediate education group [AUC=0.82 (95%CI 0.60-1.00), ST/SP=86/83%] and FTT for less than 49 years age group [AUC=0.75 (95%CI 0.67-0.84), ST/SP=71/76%] were the most useful tests to discriminate among healthy control and cognitively impaired rural population.

**Conclusions:** The present study is an attempt to establish the cut-off scores of a neuropsychological battery for a large rural population in the community setting. The proposed cut-off values might be helpful in clinical assessment in rural areas where clinical neuropsychology services are not readily available. NINB-RP can be a valuable tool for clinical research studies in rural communities. Further studies on similar samples in other countries need to be undertaken.

#### Categories:

Assessment/Psychometrics/Methods (Adult)

**Keyword 1:** neuropsychological assessment

**Keyword 2:** validity (performance or symptom)

**Keyword 3:** demographic effects on test performance

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### 3 Rey Complex Figure Scoring Made Simple: Data from the Emory Healthy Brain Study

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**Objective:** The Rey Complex Figure (CF) is a popular test to assess visuospatial construction and visual memory, but its broader use in clinical research is limited by scoring complexity. To widen its application, we developed a new CF scoring system similar to the Benson Figure in which 10 primary CF elements are scored according to presence and location. A novel

Criteria	CF Copy	CF Immediate	CF Delay	CF Recognition
EHBS	19.4 (SD=1.5)	13.4 (SD=4.5)	13.1 (SD=4.6)	7.5 (SD=2.1)
Osterrieth	32.2 (SD=4.0)	19.6 (SD=6.8)	18.9 (SD=7.1)	20.8 (SD=1.9)

recognition task was also created for each of these 10 items consisting of a 4-choice recognition condition containing the primary rectangle and major interior lines with qualitative variations of target elements as distractors. The current investigation was designed to characterize the relationship between scoring methods and establish whether comparable results are obtained across both traditional and new CF scoring approaches.

**Participants and Methods:** Participants from the Emory Health Brain Study (EHBS) who had completed the Rey CF copy during their cognitive study visit were studied. All participants were self-identified as normal, and administered the CF according to our previously published procedure that included the Copy, Immediate Recall (~ 30 seconds), and 30-minute Delayed Recall (Loring et al., 1990). Following delayed recall, CF recognition was assessed using the Meyers and Myers (1995) recognition followed by the newly developed forced choice recognition. The final sample included 155 participants ranging in age from 51.6 years to 80.0 years ( $M=64.9$ ,  $SD=6.6$ ). The average MoCA score was 26.8/30 ( $SD=6.6$ ).

**Results:** Mean performance levels across conditions and scoring approaches are included in the table. Correlations between Copy, Immediate Recall, Delayed Recall, and Recognition were calculated to evaluate the relationship between the traditional 18 item/36 point Osterrieth criteria and newly developed CF scoring criteria using both parametric and non-parametric approaches. Pearson correlations demonstrated high agreement between approaches when characterizing performance levels across all CF conditions (Copy  $r=.72$ , Immediate Recall  $r=.87$ , Delayed Recall  $r=.90$ , and Recognition  $r=.52$ ). Similar correlations were present using non-parametric analyses

(Copy  $\rho=.46$ , Immediate Recall  $\rho=.83$ , Delayed Recall  $\rho=.91$ , and Recognition  $\rho=.42$ ).

Table. Mean performance levels across conditions and scoring approaches

**Conclusions:** The high correlations, particularly for Immediate and Delayed Recall conditions, suggest that the modified simpler scoring system is comparable to the traditional approach, thereby suggesting potential equivalence between scoring methods. When comparing Rey's original 47 point scoring approach to his 36 point scoring system, Osterrieth (1944) reported a correlation in fifty adults of  $\rho=.95$  and a correlation in twenty 6-year-olds of  $\rho=.92$ . In this investigation, lower correlations were observed for copy and recognition conditions, in part representing smaller response distribution across participants.

Although these preliminary results are encouraging, to implement the new EHBS scoring method in clinical evaluation, we are developing normative data in participants across the entire EHBS series, many of whom were not administered the new CF Recognition. We are also examining performances in patients undergoing DBS evaluation for Parkinson Disease to explore its clinical sensitivity. Simpler scoring will permit greater CF clinical and research application.

**Categories:**

Assessment/Psychometrics/Methods (Adult)

**Keyword 1:** visuospatial functions

**Keyword 2:** test development

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