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**LETTER TO THE EDITOR**

# Reliable Change formula query

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In a recent article, Temkin et al. (1999) contrasted four models for detecting significant change in individual performance on neuropsychological tests. Two of these models relied on the calculation of the Reliable Change Index (RCI) by Jacobson and Truax (1991), with and without a correction for practice associated with repeated testing. The other two models were based on simple linear regression and multiple regression, respectively. The models were contrasted based on the width of 90% prediction intervals (PI) and normal-distribution-based prediction accuracy of classifying unusual cases. Participants were tested twice (Time 1 and Time 2), on seven common neuropsychological measures. Prediction accuracy was based on the discrepancy between obtained and predicted Time 2 scores.

However, the calculation procedure outlined for determining confidence intervals based on the RCI appeared to be incorrect. The authors describe the 90% PI as extending in either direction by 1.645 standard deviations of the test–retest difference scores ($s_D$). The actual standard error term recommended by Jacobson and Truax (1991), and used in many subsequent publications, involves the standard error of the difference between the two test scores, or $S_{diff}$:

$$S_{diff} = \sqrt{2(S_E)^2}$$

Where $S_E$ is the standard error of measurement, which takes into account $s_1$—the standard deviation of test scores at initial testing, and $r_{xx'}$—the test–retest reliability coefficient:

$$S_E = s_1\sqrt{1 - r_{xx'}}$$

The 90% PI values for the Jacobson and Truax (1991) RCI formula were calculated based on the $s_1$ and $r_{xx'}$ values presented in Temkin at al. (1999). These values appear in Table 1 with the 90% PI based on the Temkin et al. RCI formula. When comparing the 90% PI values obtained for the Jacobson and Truax RCI formula to those from the Temkin et al. RCI formula across the seven tests, three showed a reduced 90% PI and three showed an increased 90% PI, while the value for one test remained relatively static regardless of formula (it reduced at the third decimal place).

Using the original RCI formula appears to alter the width of the 90% PI. However, one can not deduce what effect this may have on the percentage of participants that may have shown significantly improved or deteriorated scores at Time 2. Though there appeared to be an error in calculating the 90% PI for each model, it is impossible to determine how using the original formula would affect the relative prediction accuracy of the four models. The results of the Temkin et al. paper may be considered misleading until some clarification is obtained. The same authors refer to calculating the RCI using $s_D$, rather than $s_{diff}$, in a companion paper (Dikmen et al., 1999).

**Table 1.** Reliability and variability estimates and 90% prediction intervals based on RCI

| | | | | 90% prediction intervals | |
|---|---|---|---|---|---|
| Test | $s_1$ | $r_{xx'}$ | $s_D$ | Jacobson & Truax | Temkin et al. |
| VIQ | 13.7 | .94 | 4.8 | ±7.8 | ±7.9 |
| PIQ | 11.5 | .86 | 6.4 | ±10.0 | ±10.6 |
| Category | 26.1 | .84 | 14.1 | ±24.3 | ±23.2 |
| TPT total | 0.49 | .88 | 0.29 | ±0.39 | ±0.48 |
| Trails B | 45.2 | .88 | 21.6 | ±36.4 | ±35.5 |
| Halstead Index | 0.28 | .82 | 0.17 | ±0.28 | ±0.28 |
| AIR | 0.56 | .92 | 0.22 | ±0.37 | ±0.36 |

*Note*. $s_1$ = standard deviation of scores at Time1, $r_{xx'}$ = test–retest reliability coefficient, $s_D$ = standard deviation of the difference scores, PIQ = Performance IQ, VIQ = Verbal IQ, Category = Category Test, TPT = Tactual Performance Test–total time, Trails B–time to complete (seconds), Halstead = Halstead Impairment Index, AIR = Average Impairment Rating.

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