



TEST-RETEST RELIABILITY ANALYSIS INVOLVING FIVE SUBTESTS FROM THE AUTOMATED NEUROPSYCHOLOGICAL ASSESSMENT METRICS



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Abstract:

Objective: The Automated Neuropsychological Assessment Metrics (ANAM) was first introduced by the US Department of Defense to determine cognitive effects of warfare tactics and stress on soldiers. It has since evolved as a neurocognitive battery used in the assessment of sport-related concussions; however little evidence exists with regard to measurement reliability, especially in athletic populations. This investigation explored the test-retest reliability of throughput scores from a group of interscholastic soccer players using five subtests associated with the ANAM. **Design and Settings:** The ANAM computerized software program was installed on laptop computers and utilized to assess neurocognitive performance on two separate testing occasions. All testing was performed in a quiet and climate-controlled environment. **Subjects:** A group of 14 female interscholastic soccer players (age = 15.7±1.2 yrs.; height = 162.9±7.8 cm; mass = 57.9±8.4 kg) volunteered to participate in this study. The players were part of a larger study examining purposeful heading in soccer. **Measurements:** Throughput scores, measures of performance efficiency, were derived on five subset variables including simple reaction time (SRT), matching to sample (MSP), continuous performance test (CPT), math processing (MTH), and Sternberg memory (STN). Two of the subtests (SRT and CPT) had repeat scores that were also examined. Throughput scores derived on test day one were compared to scores from test day two using Type C intraclass correlation coefficients (ICC) calculated using SPSS 13.0 for Windows® computer software. **Results:** ICC values for each of the subtest throughput scores (Day 1 vs. Day 2 mean±SD) were SRT#1 = .25 (190.2±40.9 vs. 223.7±26.5), MSP = .60 (31.8±9.9 vs. 37.6±12.9), CPT#1 = .39 (87.5±21.4 vs. 109.1±21.1), MTH = .72 (13.5±3.8 vs. 17.9±5.8), STN = .74 (72.7±16.2 vs. 86.2±16.2), SRT#2 = .55 (195.1±30.0 vs. 215.0±37.5), and CPT#2 = .73 (96.7±15.5 vs. 110.9±21.4). Measurement precision was derived using standard error of measurement (SEM) calculations and included the following: SRT#1 = 17.0, MSP = 7.2, CPT#1 = 16.6, MTH = 2.6, STN = 8.3, SRT#2 = 22.6, and CPT#2 = 9.5. **Conclusions:** An important consideration with any neurocognitive battery is the extent to which scores remain stable over time. Results from this study suggest that varying degrees of test-retest reliability (poor to good) exist within the five-subset tests of the ANAM battery. We contend that although the ANAM is easily administered to this group of athletes, perhaps successive baseline measurements need to be taken in order to make improvements in test-retest reliability.

Purpose:

The purpose of this study was to examine the test-retest reliability of throughput scores from a group of interscholastic soccer players using five subtests associated with the ANAM.

Background:

- Neuropsychological testing has been advocated for use in the management of concussions, especially with athletes participating in high-risk sports.
- The NATA Position Statement: "Management of Sport-Related Concussion" recommends baseline testing on concussion assessment measures be performed to establish the individual athlete's "normal" pre-injury performance and to provide the most reliable benchmark against which to measure post-injury recovery.¹
- Reliability can be defined as the extent to which a measurement remains constant as it is repeated under conditions taken to be constant.²
- A recent *Journal of Athletic Training* article exposed the need for reliability studies involving the ANAM test battery.³



Methodology:

Subjects:

- Data from a group of 14 interscholastic female soccer players were used to examine test vs. retest measurement stability using basic correlational techniques.
- The subjects represented one high school from a larger study and ranged in age from 14 to 18 years of age.

Procedures:

- The Automated Neuropsychological Assessment Metrics (ANAM) - National Rehabilitation Hospital Assistive Technology and Neuroscience Center, Washington, DC computer software program was used to assess neuropsychological performance.
- Each athlete took the ANAM test while seated at a laptop computer using a small handheld mouse to complete the individual assessment tasks. Testing occurred in a quiet environment on two separate occasions.



Athlete seated to take the ANAM computerized NP test



ANAM Computer Screen

Statistical Analysis:

- Throughput scores (measures of performance efficiency combining both speed and accuracy) on the five different ANAM subtests and the two repeat tests were compared between test day 1 and test day 2 using intraclass correlation coefficients (ICC).
- Measurement precision was then derived using standard error of measurement (SEM) statistical procedures.

Results:

- Day 1 vs. Day 2 throughput scores (Mean±SD) with resultant ICC and corresponding SEM values are located in the following table:

	SRT	MSP	CPT	MTH	STN	SRT2	CPT2
Day 1 Throughput Scores	190.2±40.9	31.8±9.9	87.5±21.4	13.5±3.8	72.7±16.2	195.1±30.0	96.7±15.5
Day 2 Throughput Scores	223.7±26.5	37.6±12.9	109.1±21.1	17.9±5.8	86.2±16.2	215.0±37.5	110.9±21.4
ICC and (SEM) Values	.25 (17.0)	.60 (7.2)	.39 (16.6)	.72 (2.6)	.74 (8.3)	.55 (22.6)	.73 (9.5)



There are over 18 million boys and girls currently playing soccer in America today.⁴



Discussion/Conclusions:

- This is the first study to report ANAM neuropsychological test vs. retest reliability measurements using a female interscholastic soccer population.
- Throughput scores on each subtest, including the repeat subtests, improved from Day 1 to Day 2.
 - Intuitively one would expect improvement as the novelty of the test wanes.
 - A "learning effect" most likely occurred as subjects became familiar with the test format and layout on test Day 2
- Varying degrees of test-retest reliability were derived from the statistical analysis of the throughput scores in this study, representing poor to good stability over time.
- The MTH (a measure of mental processing speed and efficiency) and STN (a measure of working memory) appear to be the two most reliable measures in the ANAM test battery.
- We recommend that clinicians using the ANAM perform repeat testing in order to improve measurement stability and derive a more accurate baseline standard to be used in post-injury comparisons.

References:

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