

Validation of HeadMinder Tests with Healthy and Clinical Populations

HeadMinder test batteries can be rapidly customized to answer specific questions. Researchers select from an extensive catalog of subtests to create a test battery that meets specific research goals and assesses targeted cognitive functions. In addition, these online batteries can be adapted to include standard or customized questionnaires pertaining to medical history, quality of life, anxiety/depression, pain, fatigue, or other variables of interest. HeadMinder tests can be administered from any Internet-connected computer.

HeadMinder tests have been extensively validated with both healthy and clinical populations. Validation efforts have supported the use of the tests as single-use screenings and as longitudinal measurement instruments.

- An examination of normative data by age reveals expected age-performance relationships, and correlations between HeadMinder tests and traditional paper-and-pencil tests are as expected.
- HeadMinder factors yield patterns consistent with diagnosis-based criteria at first administration, and HeadMinder tests record patterns of change at second administration consistent with expected clinical course.
- Extensive validation efforts have ensured that the measures are stable – that test instructions and the computer interface are clear, and that computer anxiety does not interfere with accurate collection of data.
- HeadMinder tests have administration success rates of more than 98% with many patient populations.
- HeadMinder tests have demonstrated high reliability with many diagnostic groups including early-stage Alzheimer’s disease, Multiple Sclerosis, non-primary CNS Cancer, AD/HD, Schizophrenia, and HIV.

Test-Retest Reliability

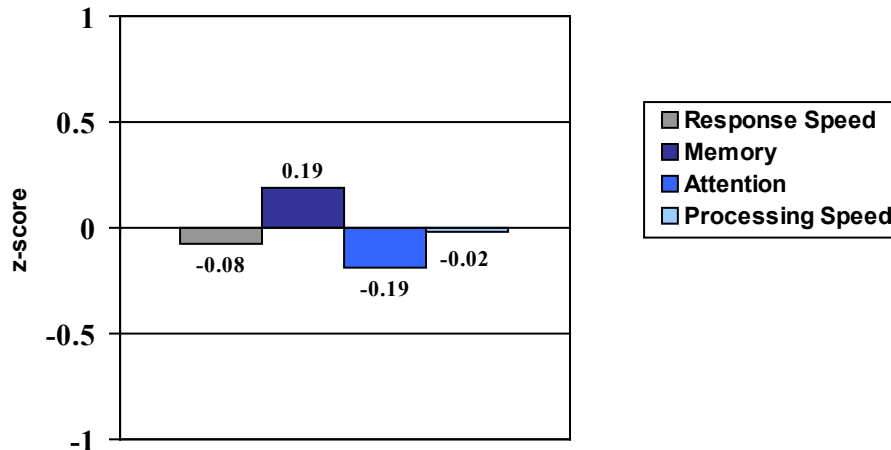
HeadMinder factors are stable across test instances. Test-retest reliability coefficients range from .68 to .94. In addition, HeadMinder tests have demonstrated equal or improved reliability with many diagnostic groups, including early-stage Alzheimer’s disease, Multiple Sclerosis, non-primary CNS Cancer, AD/HD, Schizophrenia, and HIV. (Erlanger, Kaushik, Broshek, et al., 2002, *Journal of Head Trauma Rehabilitation*)

Concurrent Validity

HeadMinder factors have been shown to be similar to corresponding traditional measures, including the Controlled Oral Word Association Test, Stroop test, Trail Making A & B, Symbol Digit Modalities Test, Symbol Search, WMS-III Logical Memory & Visual Reproduction, Buschke Selective Reminding Test, Digit Span, WASI Matrix Reasoning, and the Grooved Pegboard Test. (Erlanger, Kaushik, Broshek, et al., 2002, *Journal of Head Trauma Rehabilitation*; Erlanger, Feldman, Kutner, et al., 2002, *Archives of Clinical Neuropsychology*)

Cross-Validation of Normative Data

When HeadMinder tests were administered to a group of elderly individuals by independent researchers at the University of Georgia, mean factor scores were nearly identical to the HeadMinder norms for the same age group (within .19 standard deviations).



z-scores: Norm sample mean = 0.0, SD=1.5

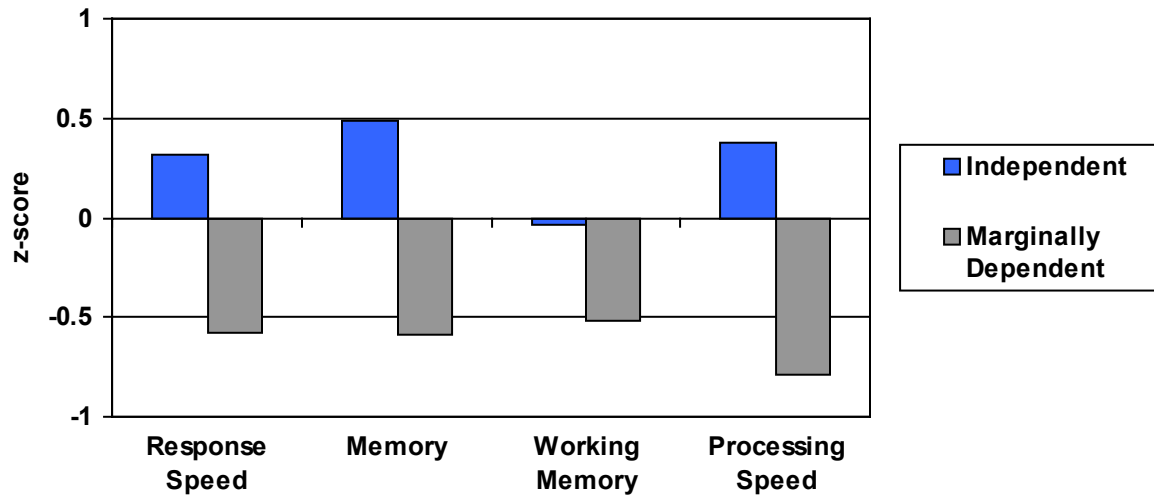
Cross-Cultural Validation of Normative Data

When HeadMinder tests were administered to a sample of healthy Swedish adult athletes by independent researchers at Luleå University of Technology, factor scores were nearly identical to the HeadMinder norms (within .13 standard deviations).

Validation with Older Adults

An independent study of B₁₂ deficiency revealed that HeadMinder tests were able to identify statistically significant differences in medically stable elderly individuals who were B₁₂ deficient from those who were B₁₂ non-deficient (N=114) on measures of Memory and Processing Speed. These differences were still apparent at follow-up four months later. Participants were from rural areas, mean age was 76.2, and 70.5 percent had less than a high-school education. *This study demonstrated that relatively subtle changes in cognitive functioning associated with incipient dementia can be measured by employing HeadMinder tests with older persons, who have limited education and limited computer experience, and that those functions can be tracked over time.* (Lewis, Johnson, Hawthore, et al., 2002, *Archives of Clinical Neuropsychology*)

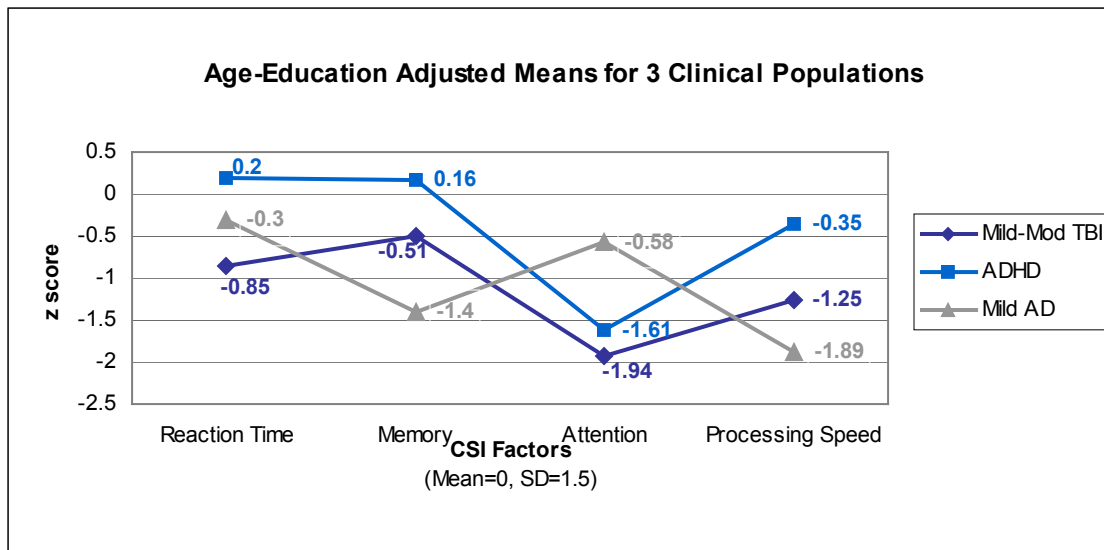
HeadMinder tests were also able to differentiate between two levels of functioning in an elderly population: those who were living independently and those who were marginally dependent due to physical limitations. Although both groups scored within a normal range on all factors, the independent living group scored significantly better on the Response Speed (p=.039), Memory (p=.043), and Processing Speed (p=.022) measures. *This study demonstrates that HeadMinder tests can differentiate functionally relevant differences in healthy elderly populations.* (Petrilla, Miller, & Cress, 2001, *American College of Sports Medicine*)



z-scores: Norm sample mean = 0.0, SD=1.5

Validation with Central Nervous System Disorders

Patterns of age- and education-adjusted scaled scores obtained by three clinical groups – Mild-to-Moderate traumatic brain injury, AD/HD, and Mild Alzheimer’s disease – provided evidence of the validity, stability, and independence of HeadMinder test factors in these clinical groups. Patterns of performance were highly consistent with expectations based on diagnostic groups. (Erlanger, Kaushik, Broshek, et al., 2002, *Journal of Head Trauma Rehabilitation*) Longitudinal case studies of traumatic brain injury, AD/HD (pre- and post-stimulant medication), and Alzheimer’s disease patients have demonstrated the clinical application of the HeadMinder repeated-measures database to individual cases. (Erlanger, Kaushik, Broshek, et al., 2002, *Journal of Head Trauma Rehabilitation*)



z-scores: Norm sample mean = 0.0, SD=1.5

Validation with Thought and Mood Disorders

HeadMinder tests were administered to 238 individuals diagnosed with Thought Disorder or Mood Disorder.

- Although this was a “hard-to-test” population, and 73 percent had less than a high-school education, HeadMinder achieved an 86 percent successful data capture rate.
- HeadMinder tests significantly discriminated ($p < .01$) between low versus high functioning Thought Disorder groups on measures related to vocational readiness: Attention, Working Memory, Learning, Memory, and Keyboard Proficiency.
- HeadMinder tests also significantly discriminated ($p < .01$) patients diagnosed with Mood Disorder from matched controls diagnosed with Thought Disorder on measures related to functional status and vocational readiness: Attention, Working Memory, Verbal & Non-verbal Learning.

Sensitivity and Specificity to Subtle Brain Dysfunction

Classification of athletes according to their greatest decrease from baseline following mild sports-related concussion yielded a *sensitivity* to these very mild injuries of 91 percent for athletes assessed within 24 to 48 hours. Classification of healthy, uninjured athletes according to their decrease from baseline following physical exertion yielded a *specificity* of 97 percent correct classification. (Erlanger, Kaushik, Cantu, et al., 2003, *Journal of Neurosurgery*)