A Better Standard of Practice: Baseline Cognitive Assessment for All

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Background

Recent advances in digital mobile technology have progressed to the point that accurate and low-cost baseline cognitive testing should become the standard of practice in patient care, particularly for those over age 60. Over the last 15 years there has been increasing awareness of the need to acquire baseline cognition for athletes so that informed return to play decisions can be made and treatments can begin as soon as possible. Preseason baseline cognitive testing has made a positive impact upon the treatment and secondary injury reduction of athletes. This push has undoubtedly been very beneficial to the athletic community and may hopefully reduce serious injuries in the future. However, while athletes are receiving the majority of the press coverage about head injuries, the actual quantity of head injuries incurred from athletics is relatively small as compared to the general population. In fact, the majority of brain injuries do not occur in athletes. According to the Brain and Spinal Cord Organization[1] the breakdown of head injuries is 28% falls, 20% motor vehicle accidents, 19% struck by objects or against objects, and 11% violence.

The CDC[2] reports that half of all head injuries go undiagnosed and untreated. Without baseline comparison, it is much harder to evaluate for cognitive change in the general population. Multiple challenges exist including premorbid cognitive abilities, premorbid and concurrent emotional health, learning disorders, ADHD, and difficulties obtaining and verifying history. In the elderly population, concerns for premorbid dementia can be a significant confound in evaluating for new cognitive decline following a head injury.

Application

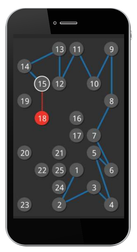
New digitized cognitive assessment tools offer inexpensive versions of the traditional pan and paper tests offered by neuropsychologists. For example, Savonix offers a self-administered digital mobile app that can deliver neurocognitive tests via Android and iOS mobile operating systems and is supported by a web-based client dashboard for data tracking and analytics

Access to a neuropsychologist is challenging in many parts of the world. In the US there are approximately 43.4 million people with diagnosed cognitive disorders and approximately 1,129 board certified neuropsychologists to provide cognitive testing. Globally there are approximately 4,000 neuropsychologists but hundreds of millions of people in need around the world and, in many places, it is just not possible to a see a neuropsychologist. Additionally, neuropsychological exams tend to be expensive (estimates between from $500 to $3,000), and time intensive (average time from consult to report varies from 4 to 8 weeks).

Measures

The Savonix mobile battery can be delivered in English, Mandarin or Japanese and is comprised of 11 subtests that measure immediate and delayed verbal memory, complex figure copy, working memory and spatial maze learning, auditory attention, color word interference, emotion identification, impulsivity, processing speed and cognitive flexibility that are grouped and analyzed according to composite domains. Tests are delivered via Android and iOS mobile operating systems supported by a web-based client dashboard for data tracking and analytics. The tests are analogues of standard paper and pencil neuropsychological tasks typically used in clinically, yielding for greater response measurement precision and millisecond accuracy. This allows for a sensitive poly-cognitive evaluation that can easily be compared to should a TBI occur.

Trail Making



Go/ No-Go

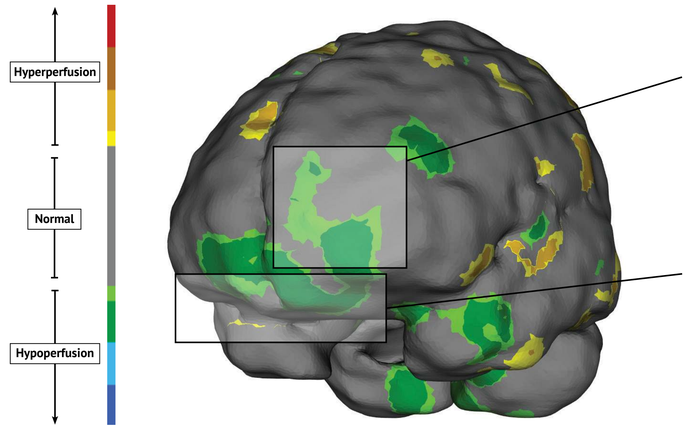
Verbal Interference

Complex Figure Copy/ Recall

Maze

Verbal Memory Recognition

Ceremetrix* Brain Perfusion Map



Dorsolateral Prefrontal Cortex
- Executive Function
- Working Memory
- Impulse Control

Orbital Prefrontal Cortex
- Cognitive Inhibition
- Decision Making
- Working Memory

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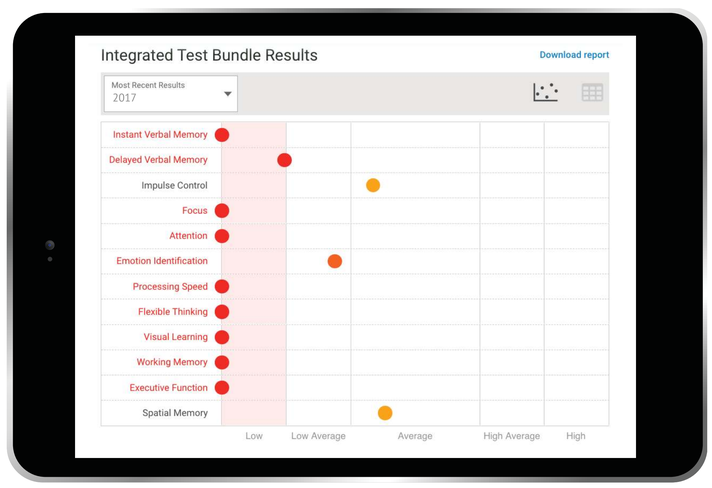
Savonix Dashboard Showing Cognitive Results



Savonix dashboard showing cognitive results and perfusion mapping above for a 38 year old male TBI subject. Hypoperfusion areas match up well with cognitive testing, particularly for cogntive domains typically associated with the executive system.

Cognitive Domains Assessed by Savonix
- Instant Verbal Memory
- Delayed Verbal Memory
- Impulse Control
- Focus
- Attention
- Emotion Identification
- Processing Speed
- Flexible Thinking
- Visual Learning
- Working Memory
- Executive Function
- Spatial Memory

Discussion

This presentation shows the feasibility and economic efficiency of using new digital technology to assess baseline cognition and re-administer testing when a suspected head injury has occurred which will streamline assessment to treatment time and accuracy. We propose that acquiring baseline cognitive data will lead to more efficient use of fiduciary resources, neuropsychologists time, and streamline treatment and outcomes of patients with new head injuries.

References

1. Brain and Spinal Cord Organization https://www.brainandspinalcord.org/brain-injury-statistics
2. Centers for Disease Control https://www.cdc.gov/headsup/basics/baseline_testing.html

Disclosures

Dr Mylea Charvat is CEO and Founder of Savonix, Inc (USA).
Drs Kevin Carroll and Jim McCollum are employees of Savonix, Inc.