Overview
Many athletes with learning related challenges (learning disabilities-LD or Attention Deficit Disorder-ADD) participate in sports. In fact, sports are known to have a highly positive impact on the social, emotional and physical well-being of athletes of all ages. However, as they would be in all sport and recreational activity, these groups of athletes are at risk for concussion. Furthermore, managing athletes with LD or ADD/ADHD can be challenging as these groups perform differently on neurocognitive tests in comparison to the general population.
For this reason, the use of norms based on non-LD or ADD groups is problematic. Two recently published articles examined the issue of concussion baseline testing with athletes.\textsuperscript{1,2} Both of these studies are based on the analyses of differences between large groups of young (teenage) athletes with and without LD or ADD/ADHD based on data from different geographic areas. Both studies demonstrate significant differences on the ImPACT test battery between LD and ADD/ADHD athletes and highlight the importance of conducting ImPACT baseline testing in these groups.

**Purpose of the Studies**
Both the Elbin et al. study and the Zuckerman et al. study were designed to investigate potential differences in teenage athletes who either do or do not have a history of LD or ADD. Both studies also examine test performance in groups of athletes who have both LD and ADD/ADHD. The overall number of subjects in both studies was large (thousands of athletes).

**Methodology and Results**
Although the samples analyzed for both studies were culled from different geographic areas, the results are highly similar (please read original articles for a complete review). Athletes with either LD or ADD/ADHD consistently perform more poorly on all ImPACT composite scores. In addition, LD and ADD athletes reported a higher level of symptoms on the ImPACT\textsuperscript{®} Post Concussion Symptom Inventory (PCSI). Finally, both studies found that athletes with both LD and ADD/ADHD performed more poorly than did athletes with one of the conditions.

**Implications of Study**
Although both of these studies provide norms on large groups of athletes with LD and or ADD/ADHD, the authors stress that care should be taken to complete baseline testing in special populations rather than relying on norms. This is a very important point for several reasons. First, the term Learning Disability is non-specific and serves more as a general category that includes many types of disabilities that may affect cognitive functioning differently. For instance, some athletes may have dyslexia, which relates specifically to reading, whereas other athletes may have a non-verbal learning disability that may differentially affect visuo-spatial process. Obviously, these two athletes would be expected to perform quite differently on ImPACT even though their overall diagnosis may be the same. The athlete who has difficulty processing written or verbal information may have difficulty reading instructions and perform more poorly on the Word Memory or Three Letter Memory subtests. In contrast, an individual with a non-verbal learning disability might be more likely to be challenged by the Design Memory subtest or by X's and O's.

Additionally, athletes with ADD often have difficulty across multiple domains given that ImPACT is quite challenging and places demand on the attentional systems within the brain.

**Clinical Keys in Working with Athletes Who Have LD or ADD/ADHD**
The following represent general suggestions for working with athletes who have LD or ADD/ADHD:

1. Always attempt to establish a baseline test. If this is not possible, rely on the norms discussed in the papers referenced in this article. **DO NOT** compare the athlete to non-LD or non-ADD/ADHD athletes.

2. Don't be surprised if the baseline test is flagged as invalid, but carefully review the results to assure the athlete did put forth good effort in the areas that do not represent areas of challenge to him/her. In other words, athletes with LD or ADD/ADHD disabilities often perform poorly on some, but not all, subtests.

3. **DO NOT** continue to re-administer the baseline test to athletes with LD or ADD issues if they produce an invalid test due to scoring poorly on a few subtests that are consistent with their specific disorder. For instance, if an athlete has difficulty reading and scores poorly on the Word Memory test, this score may accurately reflect his or her level of functioning. It is frustrating for the athlete to be asked to take the test multiple times when their performance is due to their disability.
4. As noted above, the term learning disability refers to a family of disabilities and athletes may vary greatly. Therefore, if you are working with an athlete who has a learning challenge, it is important to understand the specific nature of their issue. Do they have trouble reading? If so, they may require assistance in taking the test, such as having the instructions read to them in a one-on-one setting.

5. For athletes who have a diagnosis of ADD or ADHD, it is important to know whether they were taking their medication at the time of baseline testing. Medications such as methylphenidate (Ritalin) may affect test results. Furthermore, it is also important to document whether they were taking their medication post-injury. In addition, athletes who have trouble focusing may not be able to tolerate group testing where there are distractions.


Introducing ImPACT® Workplace


While medical professionals and Athletic Trainers have used The ImPACT Test to aid in the evaluation of concussions for many years, the corporate world is just beginning to recognize the importance of neurocognitive testing. The “brain health” of a company’s employees can have significant economic and organizational implications for employers and insurers. Neurocognitive status is an important factor in determining if an employee is “fit for duty” after a physical illness, injury, Traumatic Brain Injury or incidence of a mental health disorder (i.e., depression, ADHD). In a 2012 advisory on return to work issues, the CDC stated that “return-to-work planning should be based upon careful evaluation of symptoms and neurocognitive status.” The CDC also recommended repeated evaluation of both symptoms and cognitive status to help guide management considerations. Regular neurocognitive testing will become increasingly important as the aging U.S. workforce continues to grow. The US Department of Labor estimates that by the year 2020, about 25% of the U.S. workforce will be composed of workers aged 55 and over.

ImPACT addresses these workforce concerns with the latest addition to its family of products - ImPACT® Workplace (IW). IW is a derivative of the base ImPACT product and is designed to provide employers, healthcare providers, and wellness professionals with an empirically validated and reliable procedure for evaluating the neurocognitive status of their employee or patient. IW is a computerized test that takes about 25 minutes to complete and includes these features:

- Records patient’s symptoms
- Measures verbal and visual memory, processing speed, and reaction time
- Reaction time measured to a 1/100th of second
- Assists healthcare providers in making difficult employment related decisions
- Provides reliable baseline test information
- Produces a comprehensive report of test results
- Results presented as a PDF file and can be emailed
- Automatically stores data from repeat testing
- Testing administered online for individuals or groups
- Compatible with PC and MAC
- Enabled on ImPACT Passport™ which allows for immediate availability of results regardless of location of baseline testing

Visit www.impacttest.com to learn more about ImPACT Workplace.