Sports medicine

Sports medicine clinicians routinely use computerized neurocognitive testing in sport-related concussion management programs. Debates continue regarding the appropriateness of normative reference comparisons versus obtaining individual baseline assessments, particularly for populations with greater likelihood of having below- or above-average cognitive abilities. Improving normative reference methods could offer alternatives to perceived logistical and financial burdens imposed by universal baseline testing.

OBJECTIVES: To develop and validate the Concussion Assessment, Research, and Education (CARE) Consortium Multiple Variable Prediction (MVP) norms for the Immediate Postconcussion Assessment and Cognitive Testing (ImPACT).

METHODS: We developed the CARE-MVP norms for ImPACT composite scores using regression-based equations. Predictor variables included sex, race (white/Caucasian, black/African American, Asian, or Multiple Races), medical history [attention-deficit/hyperactivity disorder (ADHD), learning disorder (LD), prior concussion(s), prior psychiatric diagnosis], and an estimate of premorbid intellect (Wechsler Test of Adult Reading). CARE-MVP norms were first validated in an independent sample of healthy collegiate athletes by comparing predicted and actual baseline test scores using independent-samples t-tests and Cohen's d effect sizes. We then evaluated base rates of low scores in athletes self-reporting ADHD/LD (vs. non-ADHD/LD) and black/African American race (vs. white/Caucasian) across multiple normative reference methods (Chi square, Cramer's V effect size). Lastly, we validated the CARE-MVP norms in a concussed sample (dependent samples t test, Cohen's d effect size).

RESULTS: A total of 5233 collegiate athletes (18.8 ± 1.2 years, 70.5% white/Caucasian, 39.1% female) contributed to the CARE-MVP norms (development N = 2616; internal validation N = 2617). Race and WTAR score were the strongest and most consistent ImPACT score predictors. There were negligible mean differences between observed and predicted (CARE-MVP) baseline scores (Cohen's $d < 0.1$) for all ImPACT composite scores except Reaction Time (predicted ~ 20 ms faster than observed, $d = -0.28$). Low score base rates were similar for athletes across subpopulations when using CARE-MVP norms (ADHD/LD, V = 0.017-0.028; black/African American, V = 0.043-0.053); while, other normative reference methods resulted in disproportionately higher rates of low scores (ADHD/LD, V = 0.062-0.101; black/African American race, V = 0.163-0.221). Acute (24-48 h) postconcussion ImPACT scores were significantly worse than CARE-MVP norms but notably varied as a function of concussion symptom severity.

CONCLUSIONS: Results support CARE-MVP norm use in populations typically underrepresented or not adjusted for in traditional normative reference samples, such as those self-reporting ADHD/LD or black/African American race. CARE-MVP norms improve upon prior normative methods and may offer a practical, simple alternative for collegiate institutions concerned about logistical and financial burden associated with baseline testing. An automated scoring program is provided [1)].

1)

Asken BM, Houck ZM, Schmidt JD, Bauer RM, Broglio SP, McCrea MA, McAllister TW, Clugston JR; Care Consortium Investigators. A Normative Reference vs. Baseline Testing Compromise for ImPACT: The CARE Consortium Multiple Variable Prediction (CARE-MVP) Norms. Sports Med. 2020 Feb 7. doi: 10.1007/s40279-020-01263-2. [Epub ahead of print] Erratum in: Sports Med. 2020 Mar 3;:. PubMed PMID: 32034702.