4 Extending the 5P Clinical Decision Rule Predicting Concussion Recovery Using an Evidence-Based Assessment Model

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Objective: Construction of predictive algorithms of concussion symptom recovery at 4 and 12 weeks post-injury using an evidence-based assessment (EBA) model to guide clinical decision-making, extending the 2016 5P decision rule.
Participants and Methods: Children and adolescents, ages 8-18 (n=1,551; mean age=12.78; 62% male), followed over 12 weeks in the prospective multicenter cohort study (Predicting Persistent Post-Concussive Problems in Pediatrics, 5P; Zemek et al., 2016). The age-specific PostConcussion Symptom Inventory (PCSI) (8-12, 17 items; 13-18 years, 20 items) was completed at six timepoints from the ED and at 1, 2, 4, 8, and 12-weeks post-injury. Logistic regression analysis was applied to the set of key variables including the PCSI Total Retrospective-Adjusted Post-Injury Difference (RAPID) scores, patient demographics and pre-injury history, and injury characteristics to predict participant recovery status (Recovered, Not Recovered) at the 4- and 12-week endpoints. The resulting recovery-predictive equations identified the significant sets of variables with symptom scores at four successive post-injury timepoints (ED, 1, 2, 4 weeks). Logistic Regression Threshold values were established at the 90th CI against which individual patient data was applied to determine recovery status. Participants with sub-threshold sums were deemed recovered at the target endpoint (4- or 12-weeks post-injury).
Results: A total of 19 predictive equations were generated for the two age groups across the recovery timeline. Four sets of equations were developed to predict symptom recovery status at 4-weeks post-injury for the two age groups (8-12 AUC=0.679-0.884; 13-18 AUC=0.752-0.909). Prediction of symptom recovery status at 12-weeks post-injury yielded six equations for the 8-12 age group (AUC=0.723-0.825), and five equations for the 13-18 age group (AUC=0.724-0.887). Total PCSI RAPID score was identified as a significant variable in each of these 19 equations. Participant sex was identified as significant in 18 of the 19 constructed equations. Other variables that were identified as significant at varying timepoints included age, pre-injury history of learning disability and migraines, and an early post-injury sign in the ED (answering questions more slowly than usual). Examples of the equations include: Week 1 predicting symptom recovery status at 4-weeks: 8-12 yr group-(Sex*.802)+(Week 1 Total RAPID Score*.142)+(Age2* .053)+(-3.851) with AUC=0.808; 13-18 yr group-(Sex*.980)+(Week 1 Total RAPID Score*.071)+(-3.261) with AUC=0.861.
Conclusions: Clinicians' management of the concussion recovery of children and adolescents can benefit from EBA guidance. The 5P dataset (Zemek et al., 2016) provides an important window into "typical" and "atypical" recovery trajectories, establishing an initial predictive decision rule for a 4-week recovery endpoint, at the ED timepoint only, reporting AUC=0.69. The current study extends the prediction modeling using successive post-injury timepoints reflecting a typical management timeline. Symptom reports from both 1- and 2-weeks post injury with patient demographics/ history predicted symptom recovery status at 4- and 12-weeks post-injury, significantly improve predictive accuracy over the ED timepoint alone. These predictive equations, when applied to the individual patient, can serve to assist the clinician's understanding of the patients' recovery trajectory, i.e., on track for a typical or atypical recovery, further informing the intervention strategy.

Categories: Concussion/Mild TBI (Child)
Keyword 1: concussion/ mild traumatic brain injury
Keyword 2: pediatric neuropsychology
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5 Cognitive Reserve in Amyotrophic Lateral Sclerosis: The Role of Occupational Skills and Requirements

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Objective: Amyotrophic Lateral Sclerosis (ALS) is a devastating neurodegenerative disease that results in progressive decline in motor function in all patients and cognitive impairment in a subset of patients. Evidence suggests that cognitive reserve (CR) may protect against cognitive and motor decline in ALS, but less is known about the impact of specific occupational skills and requirements on clinical outcomes in ALS. We expected that a history of working jobs with more complex cognitive demands would protect against cognitive decline, while jobs that require fine and complex motor skills would protect against motor dysfunction.
Participants and Methods: Participants were 150 ALS patients recruited from the University of Pennsylvania's Comprehensive ALS Center. Participants underwent clinical and neuropsychological evaluations within 1 year of ALS diagnosis. Cognitive performance was measured using the Edinburgh Cognitive and Behavioral ALS Screen (ECAS), which includes ALS-Specific (e.g., verbal fluency, executive functions, language, social cognition) and Non-Specific (e.g., memory, visuospatial functions) composite scores. Motor functioning was measured using the Penn Upper Motor Neuron (UMN) scale and the ALS Functional Rating Scale (ALS-FRS). Occupational skills and requirements for each participant were assessed using data from the Occupational Information Network (O*NET) Database. O*NET data were assessed using principal components analysis, and 17 factor scores were derived representing distinct worker characteristics (n=5), occupational requirements (n=7), and worker requirements (n=5). These scores were entered as independent variables in multiple linear regression models using ECAS, UMN, and ALS-FRS scores as dependent variables covarying for education.
Results: Preserved ECAS ALS-Specific performance was associated with jobs that involve greater reasoning abilities (β=2.03, S.E.=0.79, p<.05), analytic skills (β=3.08, S.E.=0.91, p<.001), and humanities knowledge (β=1.20, S.E.=0.58, p<.05), as well as less exposure to environmental hazards (β=-2.42, S.E.=0.76, p<.01) and fewer demands on visual-perceptual (β=-1.75, S.E.=0.73, p<.05) and technical skills (β=-1.62, S.E.=0.63, p<.05). Preserved ECAS Non-Specific performance was associated with jobs that involve greater exposure to conflict (β=0.82, S.E.=0.33, p<.05) and social abilities (β=0.65, S.E.=0.29, p<.05). Jobs involving greater precision skills (β=1.92, S.E.=0.79, p<.05) and reasoning ability (β=2.10, S.E.=0.95, p<.05) were associated with greater disease severity on the UMN, while jobs involving more health services knowledge were associated with worse motor functioning on the ALS-FRS (β=-1.30, S.E.=0.60, p<.05).
Conclusions: Specific occupational skills and requirements show protective effects on cognitive functioning in ALS, while others confer risk for cognitive and motor dysfunction. Preserved cognitive functioning was linked to a history of employment in jobs requiring strong reasoning abilities, social skills, and humanities knowledge, while poorer cognitive functioning was linked to jobs involving a high risk of exposure to environmental hazards and high visuo-perceptual and technical demands. In contrast, we did not find evidence of motor reserve, as no protective effects of occupational skills and requirements were found for motor symptoms, and jobs involving greater precision skills, reasoning abilities, and health services knowledge were linked to worse motor functioning. Our findings offer new insights into how occupational history may protect against cognitive impairment or confer elevated risk for cognitive and motor dysfunction in ALS.

Categories: Multiple Sclerosis/ALS/Demyelinating Disorders
Keyword 1: cognitive reserve
Keyword 2: amyotrophic lateral sclerosis
Keyword 3: motor function
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6 Remote Smartphone Cognitive and Motor Testing in Frontotemporal Dementia Research: Feasibility, Reliability, and Validity

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