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

Dean R Allen[1], Peter K Isquith[2], Roger Zemek[3], Pediatric Emergency Research Canada (PERC)[4], Gerard A Gioia[1]
[1]Children's National Hospital, Washington, DC, USA. [2]Boston's Children's Hospital, Boston, MA, USA. [3]University of Ottawa, Ottawa, Canada. [4]Alberta Children's Hospital, Alberta, Canada

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.

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Correspondence: Dean R Allen, Children's National Hospital, drallen@childrensnational.org

5 Cognitive Reserve in Amyotrophic Lateral Sclerosis: The Role of Occupational Skills and Requirements

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