What Twenty Years of Educational Concussion Data Can Teach Us about the Future of Return-to-Learn

# Introduction

# Annually, individuals in the United States (US) sustain 1.7 million traumatic brain injuries with 70-90% of all injuries classified as concussion (Arbabi et al., 2020). Sport-related concussion (SRC) represents the second highest cause of concussion, accounting for an estimated 300,000 annual injuries in the US (Marar et al., 2012). To combat SRC in youth and adolescents, much attention has focused on the development of return-to-play (RTP) protocols to safely return athletes to competition. The RTP literature base lead to the development of a graduated 6-step RTP protocol agreed upon in the 2016 Berlin consensus statement on concussion in sport (McCrory et al., 2017). The 6-step protocol aims to return athletes to the playing field as they gradually resolve symptoms at each step beginning with limited activity and concluding with a full return to sport, and recent studies suggest the duration of time to complete the full RTP protocol ranges from 20-30 days following the injury (Kerr et al., 2016; McAvoy et al., 2020; Tamura et al., 2020). Although the successful completion of RTP presumes a successful return-to-learn (RTL), there is limited empirical research on what supports or interventions youth athletes require to achieve RTL (McAvoy et al., 2020).

## RTL in the Literature

Presently, theoretical position statements on the development of RTL guidelines provide stakeholders with information on how to facilitate a student’s return to the classroom following a concussion. The two common themes identified in these statements promote both a gradual return to activity with the early identification and implementation of educational interventions as well as multidisciplinary participation.

### Gradual Return to Activity

Original concussion management guidelines promoted total physical or cognitive inactivity until the student achieved completed symptom resolution; however, the literature has shifted over the course of the past 10-15 years to reduce prolonged inactivity as it may prolong recovery (Gioia, 2016; Halstead et al., 2013; McAvoy et al., 2020). Instead, published position statements suggest a brief period of cognitive rest for 24 to 48 hours immediately following the injury should initiate the RTL process where the student removes cognitive stressors (e.g., video games, homework) that may exacerbate symptoms (Dachtyl & Morales, 2017; Gioia, 2016; Halstead et al., 2013; McAvoy et al., 2020). Following cognitive rest, it has been suggested that students return to school when they can tolerate 30-45 minutes of cognitive stimulation (Halstead et al., 2013). After the student initially returns, they are encouraged to gradually elevate through the stages of the RTL process, where each stage removes rest breaks and homework restrictions while increasing the work load until the student achieves the final stage corresponding to a return to their full academic schedule (Gioia, 2016).

### Identification and Implementation of Academic Interventions

As the student completes the gradual RTL process, the school possesses several existing options to provide appropriate support. Informal academic adjustments, such as a reduced temporary workload or class schedule, provide short-term changes to the student’s schedule and correspond with Tier 1 support within a multi-tiered system of support framework (MTSS) (Halstead et al., 2013; McAvoy et al., 2018). Because most students fully recover from their concussion within 30 days, McAvoy et al. (2018) has suggested Tier 1 should be the primary level of support provided to students following a concussion as it is more efficient to implement than more formal supports provided at MTSS levels 2 or 3. For students who do not recover within the typical timeframe and develop prolonged concussion symptoms (PCS), more formal academic accommodations and modifications triggered at MTSS levels 2 and 3 are recommended (McAvoy et al., 2020).

### Multidisciplinary Participation

Consistent across RTL position statements and proposed models is (a) the call for multidisciplinary coordination between the family, medical personnel, and school personnel to ensure successful RTL completion and (b) the consistent training of school staff (e.g., general education teachers, clinical support staff) to reduce the knowledge gap on supporting students in the classroom following a concussion (Gioia, 2016; Hossler et al., 2014; McAvoy et al., 2020). Both Halstead et al. (2013) and McAvoy et al. (2020) stress the importance of first completing a medical evaluation, and, if available, a neuropsychological evaluation to establish the injury prognosis, which can influence the student’s RTL plan.

Within the school, various RTL models have been proposed centered around multidisciplinary communication. Davies (2016) discussed one model, titled the School-Based Concussion Management Program (SBCM), where one dedicated liaison was responsible for the implementation and oversight of academic supports, communication between home and school, and progress monitoring for all students recovering from a concussion in the district. The SBCM model has not been evaluated empirically, but Davies (2016) concluded such a model may be more cost-effective for a district to empower one person or a team of individuals across to oversee concussion management across an entire district rather than identifying one person within every individual school. In the proposed model Cognitive Return to Exertion (CoRTEx), RTL is facilitated through direct coordination between the school speech-language pathologist (SLP) and athletic trainer (AT), where the SLP assesses academic needs and disseminates academic adjustments to the student’s teachers followed by weekly progress monitoring of symptom severity and academic needs; once the SLP clears the student from the RTL process, the AT commences the RTP protocol (Dachtyl & Morales, 2017). Like the SBCM model, CoRTEx has not been empirically evaluated to determine its efficacy, limiting its generalizability to schools on a broader basis.

### The RTL Necessities

The aforementioned position statements and proposed models highlight the key components of an RTL program that require empirical evaluation. In addition to multidisciplinary coordination and staff training, it is imperative to establish a method of identification for concussed students, especially for injuries that occur off campus in non-sporting events. Further, standardized methods of evaluating a student’s individualized needs following their concussion and throughout their recovery are warranted. Lastly, it is critical to develop criteria-based measurements to determine appropriate discharge from the RTL process. The identification of these RTL necessities directly influenced the present retrospective analysis of concussion data to inform the future of RTL.

## Purpose of Retrospective Analysis

The Hawaii Concussion Awareness and Management Program (HCAMP) was established in 2010 as a collaboration between the Hawaii Departments of Health and Education and the University of Hawaii to research evidence-based practices for concussion management. HCAMP implements a 7-step RTP protocol across the state of Hawaii adopted from the 2009 consensus statement on concussion in sport where the first step is divided into two steps to differentiate cognitive rest from a full return to school. RTL is considered complete at stage 3 when the student has achieved a full return to school without accommodations or adjustments, and RTP is considered complete when the student returns to their sport without limitations. The 7-step HCAMP protocol has previously been evaluated and identified an average RTP duration time of 20.2 days (Tamura et al., 2020). Of interesting note, however, is that female students were identified to require a significantly longer duration of time to achieve both the RTL (stage 3) and RTP protocols (stage 7) (Tamura et al., 2020). One possible explanation for the discrepancy in time to complete both RTL and RTP between genders is that females have been identified to report higher symptom severity at the time of initial concussion evaluation (Alsalaheen et al., 2021). Given the identified differences in both recovery time and symptom reporting, we developed the purpose of the present retrospective analysis to review symptom reporting across 20 years of Post-Concussion Symptom Scale (PCSS) results obtained at the time of Immediate Postconcussion Assessment and Cognitive Testing (ImPACT; ImPACT Applications, Inc, San Diego, CA) that students complete during their concussion recovery. Our rationale to explore trends in symptom reporting post-injury is that an increased understanding of symptom trajectories during the recovery process can influence the development of an empirically driven RTL protocol to improve student outcome.

# Methods