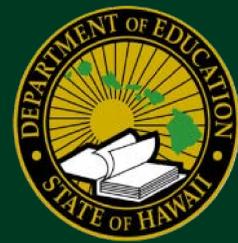




# Comparison of Concussion Management Programs on Return to Participation Outcomes of Concussed High School Student-Athletes during 2011-2012



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## Context

A multifaceted approach for the management of sport related concussion that includes a clinical examination, graded symptom check list, postural stability testing, neurocognitive testing, and Graded Return to Play Protocol (GRPP) has been recommended by several concussion consensus statements and position papers (Table 1). Health care professionals caring for concussed student-athletes across the United States may not be following these guidelines and may be allowing student-athletes to Return to Participation (RTP) prematurely.

## Objective

To investigate how the duration of RTP and GRPP for concussed high school student-athletes was influenced by the type of Concussion Management Program (CMP) which incorporated two different neuropsychological testing batteries (paper & pencil and computerized) for RTP decision-making (Figure 1).

## Design

Retrospective cross-sectional investigation design.

## Setting

Two different neurocognitive tests were utilized within a CMP in 37 public high schools and 3 private high schools in the State of Hawaii.

	Step 1.	Complete cognitive rest
Physical & Cognitive Rest	Step 2.	Return to school full-time.
	Step 3.	Light exercise. This step cannot begin until athlete is cleared by the treating physician for further activity. At this point the student athlete may begin walking or riding a stationary bike.
Graduated Return to Play Protocol	Step 4.	Running in the gym or on the field. No helmet or other equipment.
	Step 5.	Non-contact training drills in full equipment. Weight training can begin.
	Step 6.	Full contact practice or training.
	Step 7.	Play in game
	<b>Note.</b> GRPP (Steps 3-7) are supervised by the Athletic Trainer at the high school. Each step is separated of a minimum of 24 hr.	

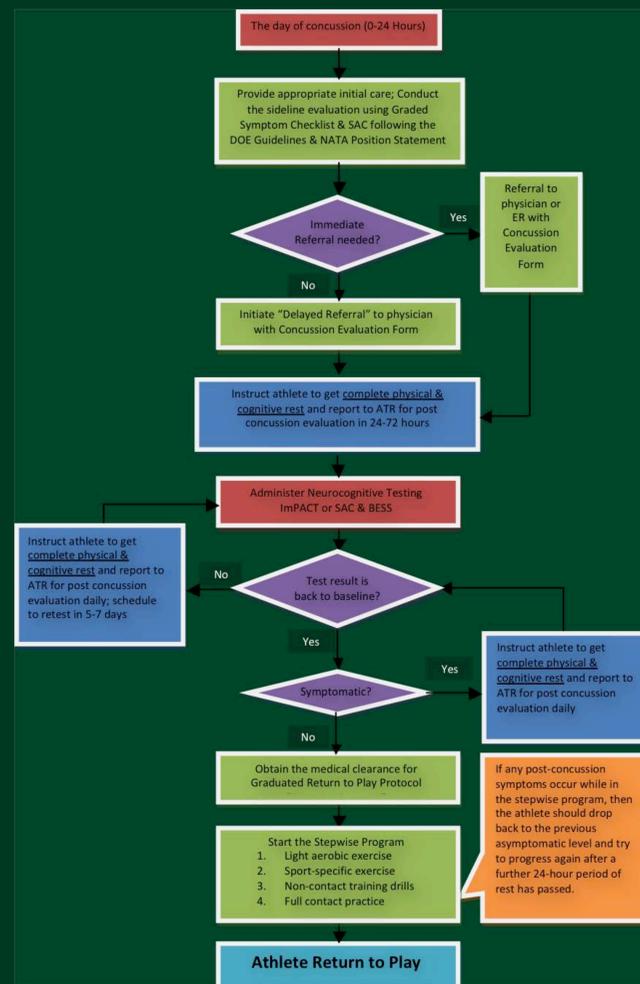


Figure 1. Concussion Management Program Protocol

	ImPACT	SAC
Duration of Restricted Participation	26.25 ± 18.99*	22.50 ± 14.17*
Duration of GRPP (Steps 3 - 7)	10.30 ± 7.06	10.18 ± 7.37

\*p=.033

**Note.** SBCT = School Based-Concussion Team; ImPACT = Immediate Post-Concussion Assessment and Cognitive Testing; SAC = Standard Assessment of Concussion; BESS= Balance Error Scoring System

## Participants

Concussed student-athletes ( $n=390$ , between age 13 to 18) who underwent baseline and post-concussion neurocognitive testing during school year 2011-12.

## Interventions

Concussed student-athletes completed the CMP (Figure 1) using two different neurocognitive assessments: 19 schools utilized the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT,  $n=225$ ) and 21 schools utilized Standard Assessment of Concussion (SAC,  $n=165$ ).

## Main Outcome Measures

The duration of restricted participation between two different neurocognitive tests (ImPACT and SAC, Table 2) used in the CMP were compared using an independent sample t-test. Days of restricted participation post-concussion, days of the GRPP Step 3 (light aerobic exercise) to Step 7 (return to unrestricted participation), and 95% confidence interval (CI) were reported. The GRPP was the physical rehabilitation portion of the RTP that consisted of five steps, each separated by a minimum of 24 hours during which concussed student-athletes must be asymptomatic to progress to the next step.

## Results

A significant difference was found between the duration of restricted participation post-concussion that incorporated ImPACT (mean= $26.25 \pm 18.99$  days) compared to SAC (mean= $22.50 \pm 14.17$  days) ( $p=.033$ , CI=0.308-7.056). No significant difference was found for the duration of the GRPP (Step 3 - 7) that incorporated ImPACT (mean= $10.30 \pm 7.06$  days) compared to SAC (mean= $10.18 \pm 7.37$  days) ( $p=.870$ , CI=-1.559-1.320) as shown in Table 2.

## Conclusions

The days of restricted participation post-concussion was significantly different when using the two different neurocognitive testing batteries (SAC or ImPACT) within the CMPs, however, the duration of the GRPP was not significantly different. The schools that utilized ImPACT in the CMP had a significantly increased number of days restricted than the schools that utilized SAC in the CMP. Our study indicates a more conservative approach to RTP decision-making by Athletic Trainers who utilized the CMP incorporating ImPACT. Therefore, concussed student-athletes were provided more cognitive rest before starting the GRPP. The two testing batteries used in this study are just one part of the multifaceted approach to RTP decision-making within a comprehensive CMP. Thus, we suggest utilizing computerized neuropsychological testing is vital to prevent the premature release of concussed student-athletes.