

# Effects of Completing a Neurocognitive Task Versus Walking Task at Different Speeds on End-Tidal Carbon Dioxide in Persistent-Concussion Symptoms

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## Introduction

### Concussion

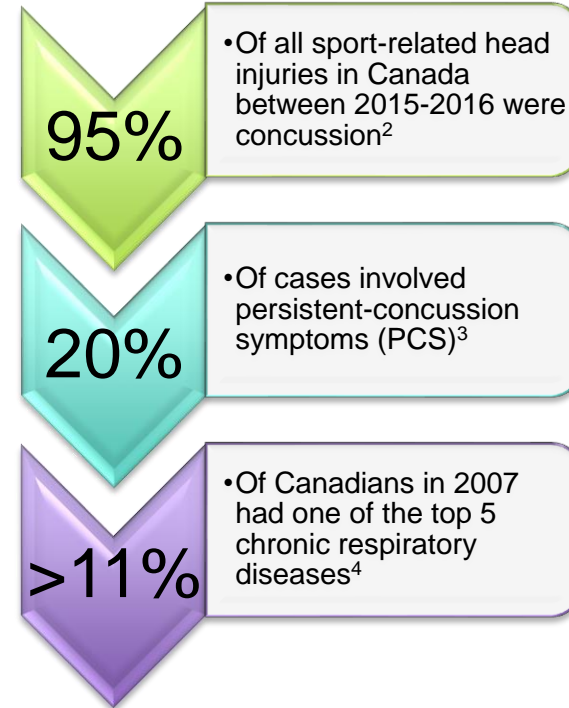
Can cause temporary functional changes to the brain that can affect neurocognitive and physical performance. Concussion can be accompanied by autonomic dysregulation (i.e. altered blood pressure, heart rate) lasting months or years post-injury.

### Respiration

Is controlled by higher brain function within the brainstem and pons. Breathing is modulated by the autonomic nervous system and in severe brain injuries, breathing patterns and respiratory physiology can be altered<sup>1</sup>. Can measure **end-tidal carbon dioxide** (ETCO<sub>2</sub>; peak CO<sub>2</sub> at the end of an exhaled breath) to monitor the efficiency that the ANS can respond to demands placed on the body.



Sustaining a concussion in combination with a history of breathing-related health issues may contribute to persistent-concussion symptoms.



## Purpose

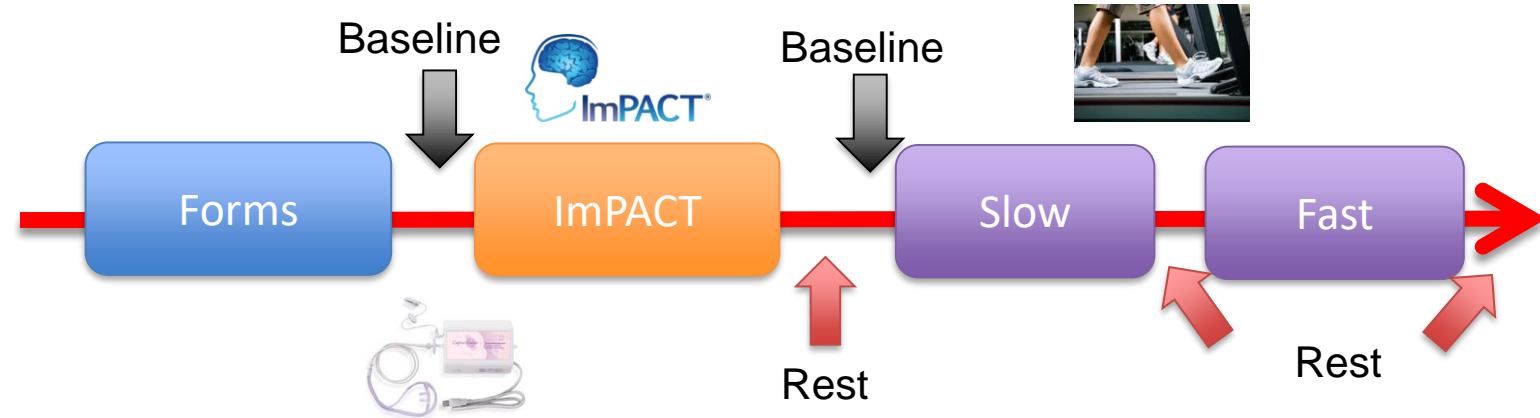
To examine differences between healthy and concussed participants when performing a neuropsychological and physical task on measures of ETCO<sub>2</sub>.

## Methods

- 22 healthy participants were recruited (Table 1).
- ETCO<sub>2</sub> was recorded before and during a neurocognitive and physical task using a capnography breath analyzer (CapnoTrainer©).
- Neurocognitive ability (verbal, visual, and working memory, reaction time, processing speed, and visual motor speed) measured using ImPACT© battery.
- Physical exertion was stimulated by walking under slow (3-3.5mph) and fast (25% faster) speeds.

Table 1

| Group                       | Control<br>(n=17)     | PCS (n=5)            | Total (n=22)          |
|-----------------------------|-----------------------|----------------------|-----------------------|
| Age<br>(year)               | 22.5 (±1.5)           | 21.8 (±4.8)          | 22.3 (±2.5)           |
| Sex                         | Females=12<br>Males=5 | Females=1<br>Males=4 | Females=13<br>Males=9 |
| Weight<br>(kg)              | 73.5 (±14.6)          | 93.7 (±20.9)         | 78.1 (±17.9)          |
| Height<br>(cm)              | 171.3 (±7.1)          | 179.4 (±6.6)         | 173.2 (±7.6)          |
| BMI<br>(kg/m <sup>2</sup> ) | 24.9 (±3.8)           | 28.9 (±4.9)          | 25.8 (±5.0)           |
| PCSS*                       | 4.1 (±4.5)            | 19.8 (±8.6)          | 7.6 (±8.6)            |



## Results & Discussion

Figure 1

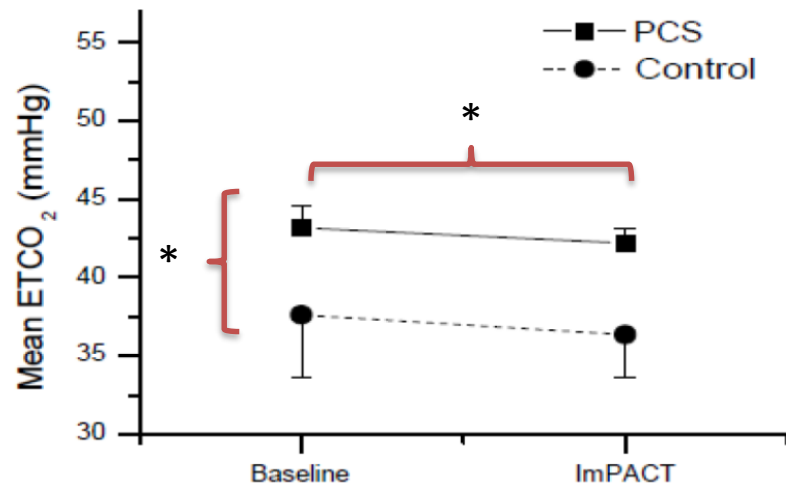
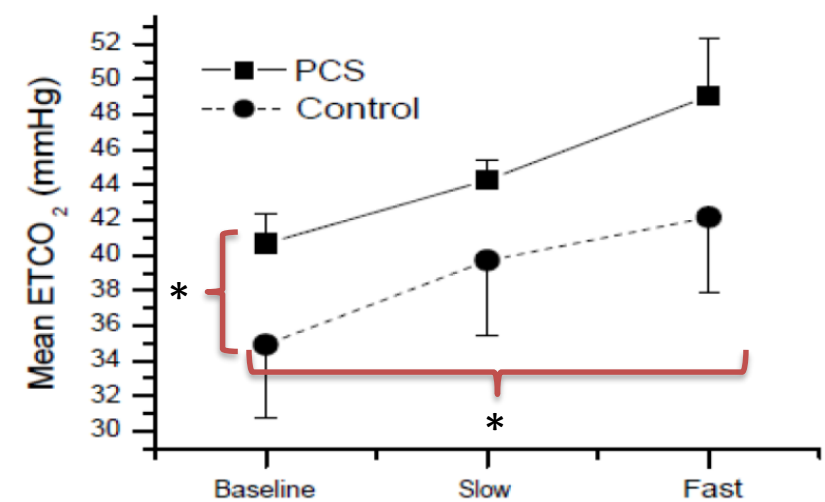


Figure 2



- Statistically significant main effects for time ( $F(1,20)=5.332, p=.032$ ;  $F(2,38)=52.305, p=.001$ ) and group ( $F(1,20)=14.388, p=.001$ ;  $F(1,19)=8.283, p=.01$ ) in  $\text{ETCO}_2$  during the cognitive (Figure 1) and physical (Figure 2) task, respectively.
- Similar normal  $\text{ETCO}_2$  response to cognitive loading and physical stress in both groups.
- Significantly elevated  $\text{ETCO}_2$  in PCS group at rest, during completion of ImPACT battery, and while walking might be due to altered cerebral blood flow<sup>5</sup>.

Abnormal  $\text{ETCO}_2$  levels may occur after concussion and future investigations are warranted.  
 $\text{ETCO}_2$  may be used as a clinical symptom for concussion and used to monitor recovery.

## References

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