

March2020

Does participation in team-oriented challenges improve neurocognitive outcomes in combat-wounded veterans?

ABSTRACT

There is abundant data on the qualitative benefit of sports and recreation programs in the rehabilitation and recovery of wounded, ill and injured veterans; however, there are very few studies to determine if there are quantitative neurocognitive benefits from these types of programs. The goal of this study was to determine whether or not neurocognitive improvement could be detected in a cohort of veterans following participation in a physical challenge. The Montreal Cognitive Assessment (MoCA) tool was selected because it is short, easy to administer, and useful as a screening tool for detecting neurocognitive impairment. In September 2019 the Combat Wounded Veteran Challenge (CWVC) organization conducted a team-based sailing Challenge at Sea Star Base, Galveston consisting of a week of sailing instruction and racing. All participants had histories of traumatic brain injury (TBI), post-traumatic stress (PTS), or other medical or musculoskeletal conditions. 18 participants volunteered for this study. The MoCA was conducted on each volunteer before and after the Challenge. Of 18 study participants, 10 improved their scores at the end of the Challenge, six scores were unchanged, and two scores decreased. Seven of 18 veterans' MoCA scores were consistent with pre-participation neurocognitive impairment. Of those, MoCA scores of six (85.7%) improved at the end of the challenge, with all six testing in the neurocognitively normal range. MoCA scores for four of six participants with TBI improved after the Challenge. Though this was a small study, these objective results indicate that there may be neurocognitive benefits derived from participating in physically and mentally demanding events that stimulate and challenge veterans. A similar study on a larger group of CWVC participants is planned for summer, 2020.

Summary: In September 2019, the Combat Wounded Veran Challenge (CWVC) conducted a Sailing Challenge at Sea Star Base, Galveston (SSBG) consisting of a week of sailing instruction and racing. All participants had TBI, PTSD, or medical/musculoskeletal conditions. To determine if there was objective improvement for participants, the Montreal Cognitive Assessment (MoCA) was conducted on each participant before and after the Challenge. Seven of 18 showed pre-participation neurocognitive impairment. Of those, 6 (85.7%) MoCA scores improved, all becoming neurocognitively normal following the challenge. This small study shows potential for the Sailing Challenge to benefit veterans. Several participants were Texas residents or were in Texas-based Warrior Transition Units. Utilizing SSBG brought money into that nonprofit organization, further enabling it to continue its service to the community. We are seeking funding for five additional challenge events to further study the neurocognitive benefits and develop a model for other CWVC challenge environments and other organizations seeking to benefit veterans.

Background: There is abundant data on the benefit of sports and recreation programs in the rehabilitation and recovery of wounded, ill and injured veterans.* Incorporating sports and recreation has been shown to improve quality of life and enhance physical recovery.* However, there is little data available to ascertain whether or not these types of programs produce neurocognitive improvements. The goal of this study was to determine whether or not neurocognitive improvement could be detected in a cohort of veterans following participation in a physical challenge. Researchers did not want to burden participants with a lengthy neurocognitive assessment, and did not want to interfere with the flow of events during the challenge. The Montreal Cognitive Assessment tool was selected because it is short, easy to administer, and useful as a screening tool for detecting neurocognitive impairment.* Some studies have shown that it is also a reliable screening tool for impairment caused by traumatic brain injury.*

The Combat Wounded Veteran Challenge is a non-profit organization that strives to improve the lives of wounded or injured veterans by providing challenging expeditions in austere environments. CWVC also conducts research to advance the care and treatment of veterans with physical, neurological and psychological injuries. This particular Challenge entailed a week of sailing instruction and team-based sailboat racing at Sea Star Base, Galveston (SSBG). Participants were provided room and board at SSBG.

There were 17 participants enrolled in the sailing challenge. Two cadre who also had a history of significant traumatic injuries also participated in the Challenge and the MoCA testing. Participant medical conditions are summarized below:

Two participants had a history of traumatic brain injury (TBI) with no other significant injuries or medical conditions. Three had a diagnosis of post-traumatic stress disorder (PTSD) without TBI, but with other comorbid musculoskeletal or spinal injuries. One of the three PTSD was combat-related. Four participants had both TBI and PTSD. Three of the four cases with both TBI and PTSD were combat-related, and all four had a history of other injuries.

Three participants disclosed a history of depression.

Nine participants had a history of musculoskeletal injuries.

Eight participants had a history of spinal injuries.

Seven participants had medical conditions only.

A total of seven participants had TBI, PTSD, or other injuries that were directly related to combat.

Methods: The CWVC had a well-established process for selecting Challenge participants that was unrelated to conducting this study. Nineteen veterans were selected for the Challenge. Participation in this study was voluntary, and completion of the MoCA signified consent. Demographic data including age, gender, education level and illness/injury was collected by the CWVC and shared with the research team.

A team of three researchers administered pre-participation MoCA the day that participants arrived at SSBG, before sailing instruction began. On the last day of the Challenge, the same team of researchers administered different post-participation MoCA. Demographic information as well as pre- and post-Challenge MoCA scores were recorded on a spreadsheet. Data was then de-identified for analysis.

The MoCA is a 30-point abbreviated neurocognitive screening test. Scores of 26-30 are considered normal. MoCA is not a diagnostic test; if abnormalities are detected, further diagnostic testing is warranted. Domains tested include attention, concentration, executive function, visuospatial function, calculation, language and memory. MoCA claims a sensitivity of 90% for detection of mild cognitive impairment, and specificity of 87% for mild Alzheimer's disease.* There are several versions of the MoCA test to eliminate a "learning effect" when sequential tests are administered.

Results: One participant was unable to complete the post-challenge MOCA and was therefore excluded from data analysis, resulting in an n=18.

The range of initial MoCA scores was 22-30. Seven participants scored below 27, indicating possible neurocognitive impairment. Eleven participants scored in the normal range, between 27-30.

The range of post-Challenge MoCA scores was 22-30, with 17 participants scoring within the normal range.

Comparison of initial and post-Challenge scores: Of the seven participants who's initial MoCA was below 27, six improved (85.7%) and one declined.

Of the 11 participants who's initial MoCA scores were in the normal range, 4 improved their scores (36.4%), 6 were unchanged (54.5), and one declined.

Detailed analysis: Of 18 participants, 10 improved their scores at the end of the Challenge, 6 scores were unchanged, and two scores decreased.

Of the 10 who improved: 4 had TBI, 3 had PTSD, 2 had both TBI and PTSD; 2 had depression, 4 had musculoskeletal injuries, 3 had spinal injuries; 3 occurred as a result of combat; 3 had other medical issues.

Of the 6 that were unchanged: One began with a perfect score. That individual had spinal and musculoskeletal combat-related injuries with no disclosed history of TBI or PTSD. The 5 remaining: 2 had combat-related musculoskeletal and spinal injuries with no TBI/PTSD. 1 had a medical condition only, with non-combat injuries related to the medical condition. 1 had PTSD, MST and musculoskeletal injuries. 1 had TBI and PTSD, as well as combat-related musculoskeletal and spinal injuries. 1 had PTSD only, as well as combat-related musculoskeletal and spinal injuries.

Results Summary:

	TBI (no PTSD)	PTSD (no TBI)	TBI and PTSD	Depression	Spinal or MSK	Combat- related	Medical
Improved (n=10)	2 (100%)	1 (33.3%)	2 (50%)	2 (66.7%)	7 (53.8%)	3 (42.9%)	3 (60%)
Decreased (n=2)	0		1	1	1	0	1
Stable (n=6)	0	2	1	0	5	4	1
Total 18	2	3	4	3	13	7	5

MSK = musculoskeletal

Of all participants, post-challenge score improvements were most significant in delayed recall (11/18 improved) and MIS (11/18 improved). Delayed recall is a function of frontal lobe and subcortical circuits.

Of all participants, the least improvement was in overall attention and abstraction (2/18 improved for each).

The Challenge seems to have had the least impact on overall abstraction scores (16/18 did not change). This category did not exhibit significant variability between participants either.

Discussion (see Results Summary table above): Results of this small study indicate that this type of event may be the most beneficial to participants with TBI, given the 100% post-Challenge score improvement by both participants that had TBI (without PTSD). Neither of these two participants disclosed any other significant medical issues or injuries.

Even more remarkable was that 17 participants scored in the MoCA's normal range after the Challenge, compared to only 11 normal-range pre-participation scores. Six of the seven participants with abnormal pre-Challenge MoCA scores improved their scores after the Challenge (85.7%), and of those six, all of them (100%) scored

within the MoCA's normal range at the conclusion of the Challenge. There was even improvement among 36.4% of participants who's initial MoCA scores were within the normal range.

These objective results indicate that there may be neurocognitive benefits derived from participating in events that stimulate and challenge veterans. This was a small sample, and more studies of this type are needed to accurately ascertain whether or not there is a neurocognitive benefit of the CWVC Challenge and similar events.

References:

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