"Multiple sclerosis (MS) is a degenerative chronic immune-mediated disease that leads to cumulative neurologic disability over several years"

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RCEU History: I applied and received RCEU funding last year. My student has two articles that are under current review for Perpetua. Also, an abstract submission was completed for a regional American College of Sports Medicine Conference.

Project Summary

Multiple sclerosis (MS) is a degenerative, chronic, immune-mediated disease that leads to cumulative neurologic disability over several years. The body's immune system attacks and damages the central nervous system, including the myelin (the sheath that surrounds and protects nerve fibers) and the underlying nerve fibers. This damage interferes with the transmission of nervous signals between the central nervous system and results in a decreased ability of the body to orchestrate movements needed to perform exercise. Over 400,000 individuals in the United States and about 2.1 million individuals worldwide are currently diagnosed with MS. The total lifetime cost per patient with MS is estimated to be $4.1 million.

Currently, exercise is one of the treatments used for MS patients, but individuals with MS have higher amounts of muscle fatigue and weakness. As a result, PA in this population can result in diminished health, inability to move limbs, sensory impairment, and lowered quality of life (QOL). Ground reaction forces are the total amount of impact that is experienced on the bones and joints from performing weight bearing exercise. Previous research has shown that adults with MS have increased GRFs when performing dry land walking. These studies have been performed in laboratory settings using force plates either built into treadmill belts or placed on the ground.

As a result of the comorbidities of MS, aquatic exercise interventions are being performed to help combat the issue of GRF and the effects of the prolific disease. However, the overall effect of aquatic treadmill walking on GRF compared to dry-land treadmill walking, is still unknown. Thus, the clinical trial is aimed to provide insight into the differences in GRF and the locations of the GRF at different walking speeds while utilizing in-shoe wearable pressure sensors in adults with MS. The findings of the study will help to quantify the total differences in GRF between dry-land and aquatic exercise, which has previously not been determined. The results of this study will also be used to help optimize the development and implementation of effective aquatic exercise programs in persons with such a debilitating neurological disease.

Female and minority students are encouraged to apply.

Student Prerequisites

No course work perquisites are needed but the individual should be in either junior-or-senior level standing.
**Student duties**

The student will be expected to work closely with faculty mentor to perform following duties in the exercise physiology laboratory:

- Creating and distributing participant recruitment flyers and emails
- Measuring and analyzing pre-and-post outcome measures such as: body composition, balance, functionality, and ground reaction force measurements
- Preparation, cleaning, and sanitation of the underwater treadmill
- Conducting both dry-land and underwater treadmill walking sessions

Main benefits to the students are

- Unique opportunity to use state-of-the-art experimental and numerical tools, such as:
  - Underwater treadmill
  - In-shoe wearable force plates
- Opportunity to perform exercise testing and assessment in adults with MS
- Opportunity to contribute to a journal paper or conference presentation, depending on the progress of the study

Recruitment for this study will begin in the later portion of the spring 2019 semester. All pre-baseline measurements and treadmill (aquatic and dry-land) walking sessions are expected to begin at the start of the summer 2019 semester. Testing sessions will occur and be finished by the end of the summer 2019 full semester.

**Mentor Supervision and Interaction**

The faculty mentor will provide the daily supervision to the student. In addition, the student is expected to update the mentor with a weekly progress report and during bi-weekly meetings. The followings are the specifics.

- **Weekly progress update report**
  - Written together with the student
  - To discuss recruitment efforts, aquatic exercise physiology, collected data, any issues, and plans for the following week
  - Evaluation: the mentor will provide feedback to all reports. The mentor will assess and provide feedback on the writing, scientific progress, and quality of the analysis.

- **Bi-weekly progress update meetings with the student** will cover:
  - The results and any issues that have taken place.
  - Frequency of the meeting will be increased as needed throughout the summer.
  - Evaluation: the mentor will provide detailed instruction for the on-going work and offer suggestions for improvement.