TACSM Abstract

Using a Lego© NXT Robotic Vehicle as a Constant Speed Device in Replacement of a Wheelchair Treadmill for use in Determining Physical Cost Index of Pushing a Wheelchair

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ABSTRACT

Summary: A Lego© robot is being tested as a constant speed device to enable more sensitive data collection on the energy cost of pushing two different wheelchairs designed for low income countries. **Introduction:** For many years, treadmills of all kinds including wheel chair treadmills have been utilized to enable energy cost studies to be done at a constant speed because there is a non-linear relationship between the speed of travel and the energy cost of moving[1]. However, these treadmills are expensive, bulky, and simply not available in low-income countries where we have been collecting data on the function of pediatric wheelchairs. In a parallel study done in the USA with volunteers pushing wheelchairs, we are testing a Lego© NXT robotic vehicle built and programed to perform as a constant speed device. The robot is much more reasonably priced and is easily transported from one location to the next. The objective of this study is to determine if the vehicle is an adequate replacement for a wheelchair treadmill. **Materials and Methods:** Using a Lego© NXT Education set, engineers at LeTourneau University have designed and built a small robotic vehicle. This robot's purpose is to travel in front of a wheelchair, and give the user a reference speed while testing. The kit used to build this robot costs less than $300[2]. Subjects walked 1-2 meters behind the robot at a constant speed of 2.8 mph for 10 minutes while wearing a heart rate monitor in order to obtain an accurate Physiological Cost Index for pushing the wheelchair[3]. University students pushed two types of wheelchairs, one after the other, on a smooth surface twice, once following the constant speed robot and once selecting their own speed. **Preliminary Results:** T-tests comparing data from the two wheelchairs taken at a self-selected speed were far from significant, while t-tests from data taken while following the robot were much closer to being able to distinguish between the two wheelchairs though they were not quite significant (slightly higher than 0.05). **Conclusion:** The preliminary data shows promise in confirming that this robot will play the role of a treadmill in enabling more sensitive data on energy cost. Additional data is being collected to see if stronger statistical power enables significant results. It seems likely that this robot may provide an adequate substitute for a treadmill.