

Cost of Rolling on Rough and Smooth Ground for Assistants Pushing the Motivation *Rough Terrain* and Whirlwind *RoughRider* Wheelchairs

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ABSTRACT

In less-resourced settings, powered wheelchairs are rarely available for users who cannot self-propel. These users must rely on somebody, usually family members or friends, for assistance to push them across variable terrain. In situations where people with disabilities are grouped together, assistants may themselves be disabled. Provision of mobility for the wheelchair user may be a great physiological cost for the assistant. Objective outcomes measures can provide valuable feedback to manufacturers which can constructively influence wheelchair design modification. We hypothesized that measuring the energy cost for an assistant pushing two types of wheelchairs on rough and smooth ground would allow us to differentiate between the chairs and provide useful feedback to manufacturers. This study compared the Motivation *Rough Terrain* and Whirlwind *RoughRider*, wheelchairs designed for less-resourced settings. Able-bodied volunteer college-aged students (n=29: 16M, 13F, age 19±1.3) completed six-minute timed walk tests (TWT) with both wheelchair types on smooth and rough ground courses, the smooth course on a paved parking lot and the rough course on a gravel parking lot. Exercise and non-exercise heart rate was collected for each subject using *Polar Pro* monitors. Exercise heart rate consisted of the last four minutes of heart rate collected during the TWT. The physiological cost index (PCI) was then calculated⁴. Subjects completed a visual analog scale (VAS) question for each TWT. Two-way within-subject ANOVA and post-hoc paired t-tests were used to compare data. Results showed the Motivation *Rough Terrain* outperformed the Whirlwind *RoughRider* in most categories. ANOVA showed significant results with the Whirlwind chair having a higher PCI. Post-hoc paired t-tests showed a significantly higher PCI for the Whirlwind chair on both smooth and rough ground. There was no significance found between the two chairs for the TWT. VAS results indicated subjects perceived significantly greater difficulty with the Whirlwind chair than the Motivation chair on both smooth and rough ground. Comments revealed that subjects favored the single front castor of the Motivation chair. Based on the results of this study, it seems as though the design of the Motivation chair utilizes important features that could be of potential benefit to assistants pushing wheelchair users in less-resourced settings. These features may also have a positive impact on the production of efficient rough terrain wheelchairs.

