Aspects of Wheelchair Mobility Protocol

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Introduction

The Aspects of Wheelchair Mobility Protocol (AWMP) is being developed to provide comparative effectiveness data on mobility provided by different types of wheelchairs in rolling environments commonly encountered in low resource areas. This study describes the preliminary development and discriminatory validity of the AWMP. Most tests of mobility are primarily aimed at assessing the capability or skills of wheelchair users[1], and many use a professional report questionnaire format producing categorical data[2]. Many of these tests can only be done in controlled settings. Discriminatory validity is also improved when data is suitable for analysis of variance (ANOVA) enabled statistically normal quantitative data[3]. Discriminatory validity is also improved by triangulation between objective, subjective, quantitative and qualitative data[4]. High individual variation is a challenge in outcomes studies for wheelchairs[4]. This can be somewhat mitigated by a repeated measures study design[5]. The goal of AWMP is to focus on the impact of wheelchair types and designs on mobility in the environment of use. Over the period of several years, preliminary protocols were developed and trialed in studies in a low resource setting. In this study, the protocol was re-evaluated and updated. We then sought to test discriminatory validity of the updated AWMP in a study done in Kenya with the hypothesis that the AWMP will be used successfully in that setting and that the data will discriminate between wheelchair types.

Methods

The AWMP can be used in a repeated measures study design in which wheelchair users complete timed tests on tracks that represent commonly encountered rolling environments. The tests are completed in one wheelchair type and then another. Each track is intended to be a separate domain that can be used along with other tracks, or on its own. The commonly encountered rolling environments were rough ground, smooth ground, low curbs, and tight spaces. For each test, participants roll over a measured track for a set period of time. Mean exercise heartrate and velocity are calculated. Participants complete a response question by evaluating performance using a visual analogue scale (VAS) and providing written feedback on completion of each track (figure1). This study was done at a boarding school for students with disabilities in a low resource area. The protocol was approved by authors' universities and the partner organizations. Participants and their guardians completed consent and assent forms. The wheelchair types utilized were Motivation Rough Terrain (TMV), Whirlwind RoughRider (WRR), Hope Haven KidChair (HKC) and Free Wheelchair Mission Gen-2 (FG2) (fig. 2). HKC and FG2 were tested on the smooth, rough, and tight tracks, and all four wheelchair types were tested on the curb track.

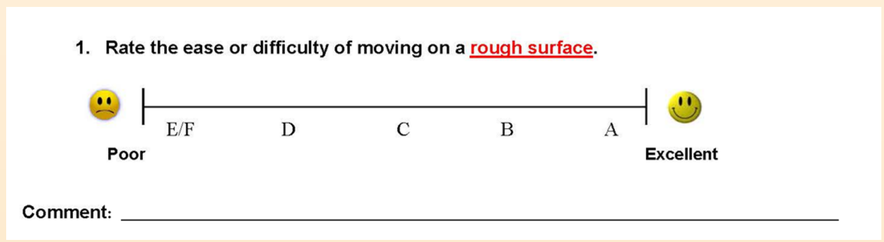

Figure 1. Visual analogue scale question format.

Figure 2. study wheelchair types configured as used at the study location.

Results

Anderson Darling test indicated that velocity, exercise heart rate, and VAS score distributions were suitable for parametric statistical analysis. Analysis of variance (ANOVA) indicated results differed significantly between wheelchairs and tracks. Heart rate differed between track types but not between wheelchair types, except on the curb track. On the tight spaces, smooth, and rough tracks, participants traveled faster in the FG2 chair, and also rated it significantly higher than HKC (figure 3). On the curb track, chi-squared analysis of proportion indicated a significantly lower proportion of participants were able to complete the test in the HKC chair than the other chairs (figure 4. For the 12 participants who completed the curb track in all four chair types, ANOVA and indicated that participants traveled faster, and rated WRR and TMV more highly than HKC. Participants had a significantly higher heart rate in WRR (figure 5).

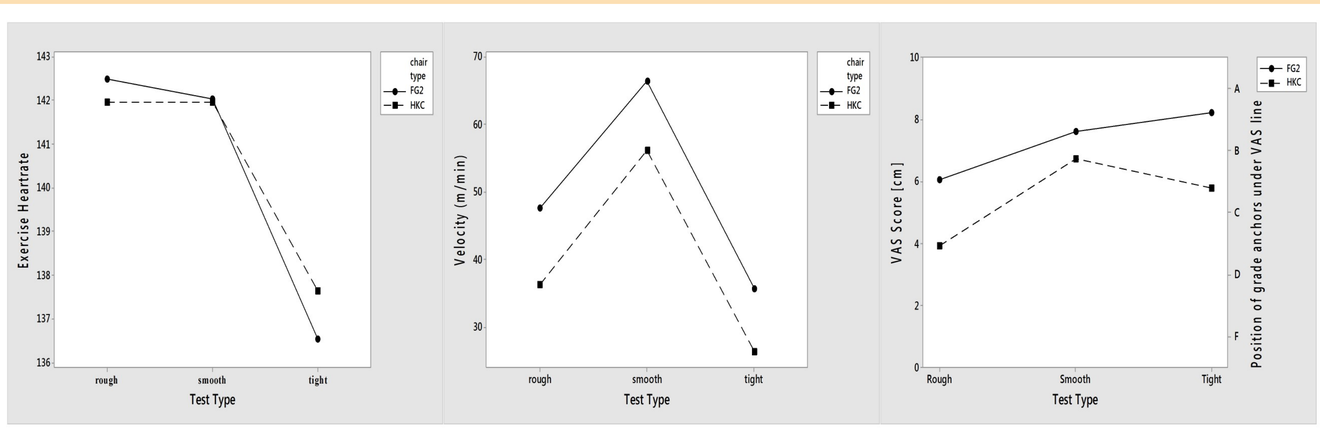

Figure 3. ANOVA interaction plots showing mean values for velocity, heart rate and participant response scores on smooth, rough and tight tracks (n=30).

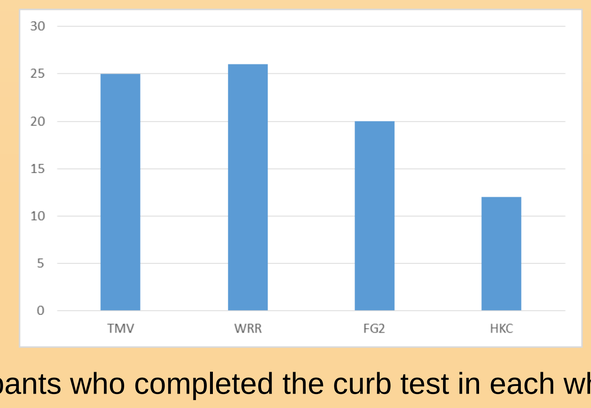

Figure 4. Number of participants who completed the curb test in each wheelchair type

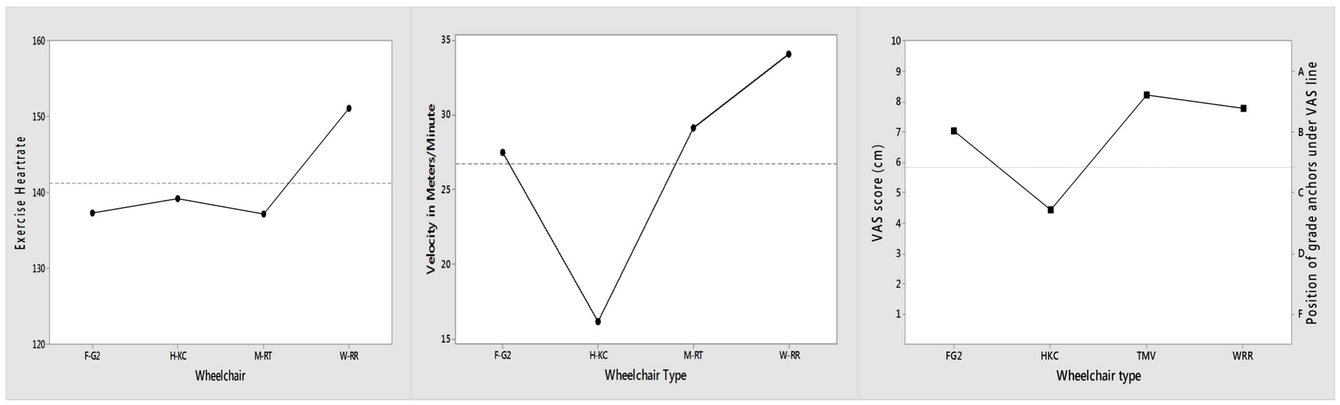

Figure 5. ANOVA main effects plots showing mean values on the curb track for exercise heartrate, velocity and participant response scores for the 12 able to complete the track in all four wheelchair types (n=12).

Discussion

The Aspects of Wheelchair Mobility Protocol was successfully utilized in local conditions of a low resource area. Discriminatory validity was indicated. AWMP was able to discriminate between wheelchair types and track types. Because the wheelchairs were set up as they are used at our study site, and the rough, smooth, tight and curb rolling environments were specific to that location, this study enables a snapshot of the mobility provided by the study chairs at that location. Because this study location shares many characteristics with other low income settings, findings from this study are able to shed light on mobility and user satisfaction issues with wheelchair design. The difference between the wheelchairs is also specific to the wheelchair configuration typically used at our study site. Wheelchairs are fit by clinicians who have had World Health Organization intermediate level wheelchair training. However, they are caring for many wheelchair users and wheelchairs may not be shifted into the less stable more energy efficient configurations. Both WRR and TMV had such settings. HKC and FG2 did not. Wheelchair manufacturers and stake holders have expressed great interest in our results. Further validation is needed at other locations. Plans are underway for test re-test reliability validation.

Citations

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