

# Co-construction of a test battery to assess physical activity performance of manual wheelchair users

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## INTRODUCTION

In the last global disability action plan (2014-2021), the WHO<sup>1</sup> declared the promotion of physical activity a critical factor for promoting the health, functioning and well-being of people with disabilities. As such, the updated WHO physical activity guidelines (2020) include, for the first time, specific recommendations for adults and children with disabilities; individuals with disability require the same level of physical activity as people without disability. Specifically, leisure time physical activity (LTPA), any activity that one chooses to do in their free time (eg, sport, exercise, walking)<sup>2</sup>, is encouraged to optimize physical and social benefits<sup>3</sup>. The physical and psychosocial impacts of LTPA are well documented, and the benefits are amplified for manual wheelchair users who are predisposed to secondary health conditions and psychosocial sequelae<sup>4</sup>. More than half of manual wheelchair users (MWCUs) do not participate in any form of LTPA because they face many barriers (i.e. environmental<sup>5</sup> and personal<sup>6</sup>). Among the existing approaches to increase participation in LTPA, it was identified that there are gaps in the assessment of LTPA skills in MWCUs<sup>7</sup>. In fact, the assessment of these skills would provide tools for integration, training and guidance for UFRMA in a LTPA. This study is one of the steps to construct a LTPA selection toolkit for manual wheelchair users based on the MWCUs skills. While choice is critical to quality participation, LTPA selection for MWCUs is commonly based on sport availability and not on individual preferences or LTPA skills<sup>8</sup>. A first step was completed to establish a conceptual model that highlighted the physical qualities (i.e strength, speed, power, endurance, coordination, flexibility and equilibrium). These physical qualities are the<sup>9</sup> basis for development and acquisition of motor abilities. In fact, measuring each of them allow having an indication of LTPA capacity performance. Such a battery of tests would allow the development of the LTPA selection tool but also the collection of evidence to better understand LTPAs for MWCUs

The aim of this study is to construct a test battery to evaluate the LTPA capacity performance of MWCUs through physical quality. It was conducted by two steps:

- 1) Identified and classify existing tests that measure one or more physical quality.
- 2) Select the tests that are most likely to be used in real-life conditions.

## METHOD

A mixed method was used to complete this aim.

First, a systematic review was conducted by following the "Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)" guidelines<sup>10</sup>. For literature search, keywords were designed around three concepts, namely (#1) the wheelchair users ("Wheelchair"), (#2) the physical quality ("Strength" OR "Speed" OR "Power" OR "Muscular endurance" OR "Cardiovascular endurance" OR "Coordination" OR "Equilibrium" OR "Flexibility" ) and, (#3) exercise testing ("Exercise test"). A more detailed search strategy was developed including key words related to the three basic concepts and their synonyms. The search strategy was conducted in each database: Medline (OVID), Embase, CINAHL. To be included in this systematic review, the studies should have: (1) Measures a component of physical fitness: strength, speed, power, muscular endurance, cardiorespiratory capacity, flexibility, coordination, (2) Be done with MWCUs users, (3) Described methodology to measure component of physical quality, (4) Been published in English or French. Two reviewer performed a complete data extraction from the articles included in this review. Tests including in the articles were extract and add in a table. For each test, the following targeted variables were extracted: Authors who use this test, with physical quality the test allow measuring, population validity and reliability mentioned in studies, material and equipment required, outcomes of the test.

After this first selection of test, a Delphi questionnaire<sup>11</sup> was diffused to an expert panel of MWCUs, trainers in LTPA for MWCUs and other professional with implications in LTPA for MWCUs. Delphi's method is a commonly used method to obtain consensus between expert of the topic. The purpose of this survey was to determine the selection factors (SFs) (e.g. cost of materials, test duration) influencing the utilization of the test battery. 7 SFs were proposed and rated (importance of 0-10) by the participants to obtain a consensus ( $\geq 70\%$ ). The survey had to be modified and rerun until consensus was reached. Participants had the opportunity to add SFs, to give a critical value (CV)

for the Ss at which they considered the test unusable (e.g. budget, time available to realize the test), and to give their opinions on the uses of the test battery.

## RESULTS

2329 studies were included in the study and 144 were selected because they include physical quality tests. In the basis of these studies, 96 tests of physical quality were extracted and compiled in a table with all variables. Each test was ranked according to the physical quality it measured. Thus, the tests included: 14 measures of strength, 9 measures of speed, 17 measures of power, 19 measures of cardiovascular endurance, 5 measures of muscular endurance, 24 measures of coordination, 3 measures of flexibility, 5 measures of balance. 68% of the tests are validated in the literature for at least one population and 32% have not been subjected to any scientific validation.

Then, 81 people responded (25 UFRMa, 29 coaches and other professionals, 3 from both categories, 24 others) to the Delphi questionnaire. The submitted SFs were accepted from the first one and a new SFs was added. The final SFs are : cost of the equipment to be acquired, time for training in the use of the test, time for preparing, carrying out and uninstalling the test, time needed to analyse the results, size of the equipment for carrying out the test, minimum number of accompanying persons needed to carry out the test, risks associated with carrying out the test (falls, injuries, material damage), space available for carrying out the test. 5 possible uses of the test battery were identified, 2 of which were of particular interest: Structuring the content of training sessions, Guiding towards an optimal LPA. Using the SFs and their associated VCs, the test battery was created, and 27 tests were selected. The proposed test battery details each test according to the physical quality it assesses. The tests were also distinguished if they were intended for a specific LTPA. Thus, the test battery includes general tests and more LTPA-specific tests (e.g. wheelchair basketball, wheelchair tennis, athletics)

## DISCUSSION

The current physical quality measures focus mainly on ECV, F, P and C. In contrast, EM, S and EQU are under-represented. However, the other physical qualities appear to be essential in the APL of UFRMa. For instance, UFRMa generally does not reach maximum cardio-vascular endurance during prolonged wheelchair propulsion, as muscular endurance restricts it before<sup>12</sup>. Flexibility and equilibrium are essential in LTPAs with a ball but are not assessed in the associated performance tests<sup>13</sup>. New performance assessments in FRMa LTPAs need to take into account the full range of physical qualities to fully understand an LTPA. the delphi questionnaire was used to survey a panel of experts to create a user-friendly toolkit. It also highlighted certain needs to promote the practice of LPTA for MWCUs.

The aim of this study was to construct a test battery to evaluate the LTPA capacity performance of MWCUs with physical qualities testing. This test battery allows measuring 7 physical quality through 27 test. To obtain the LTPA capacity performance of MWCUs, it is necessary to assess each of the physical qualities by selecting the appropriate tests for the person. This test battery for UFRMa will help coaches and UFRMa to optimise the choice of LPAs, trainings and contribute to increase the participation of UFRMa in LPAs. The next steps are to validate and collect data to develop tools for the UFRMa LPA. Further step is to collect data to have a construct validity of this test battery and use these data to develop a sport selection toolkit to helps MWCUs choose optimal LTPA and exercise according to their LTPA capacity performance.

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