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Modified Functional Walking Categories and participation in people with multiple sclerosis

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ABSTRACT

Background: Gait velocity influences the ability of a person to move in different outdoor or indoor contexts and has accordingly been classified through the Modified Functional Walking Categories (MFWC). Community ambulation in persons with multiple sclerosis (PwMS) may give information on their social and productive participation, as well as independence in household activities.
Objectives: To investigate factors associated with walking and mobility restrictions as classified by the Modified Functional Walking Categories (MFWC) and analyze the influence of disease characteristics, demographical and walking factors on participation in PwMS.
Methods: 155 PwMS attending two rehabilitation center were evaluated. Community ambulation was classified with the MFWC; participation was measured with the Community Integration Questionnaire (CIQ). MFWC and statistically significant variables associated with CIQ score were entered in a multivariate logistic model to assess the multiple relationships.
Results: PwMS with a secondary progressive type of disease, longer disease duration and using walking aids were classified in the worse MFWC. Participation restrictions were more frequent in Limited Household (72.3%) and in Physiological Walkers (93.7%). The final multivariate model ($p < 0.0001$) showed that the use of a walking aid (OR = 2.59), being male (OR = 2.94) and older (OR = 1.06) increased the likelihood of having participation restrictions. The same variables predicted home participation; MFWC and age predicted productive participation while only age influenced social participation.
Conclusions: Modified Functional Walking Categories were associated with type of disease, disease duration, disability level and type of walking aid. The best clinical predictor of participation restriction was walking aid while walking categories only predicted productive participation.

1. Introduction

Community ambulation has been defined as locomotion outdoors encompassing activities such as visits to the supermarket, shopping mall and bank, leisure activities, (Lord et al., 2004) all activities that are important for independence in daily life. Reduction in mobility for persons with Multiple Sclerosis (PwMS) can profoundly impact on independence and community integration (Kister et al., 2013; LaRocca, 2011). Various studies have reported on how walking impairments in PwMS lead to a reduced ability to participate in community activities, including home-based activities, social activities, and work (Cattaneo et al., 2017; Kierkegaard et al., 2012).

Participation, as involvement in life situations or community integration, is a complex construct composed of several dimensions influenced by personal and environmental factors, health conditions, body function and activities (World Health Organization, 2001). The Community Integration Questionnaire (CIQ) (Willer et al., 1994) was found to be a valid and reliable instrument, able to detect changes at participation level in a cohort of PwMS (Negahban et al., 2013; Taheri et al., 2016). There are indications that symptoms related to cognition and mobility may impact on community participation as measured by CIQ (Cattaneo et al., 2017; Hughes et al., 2015; Kratz et al., 2016; Cameron et al., 2014).

Walking has already been stated as a factor influencing participation in PwMS (Cattaneo et al., 2017). Kwiatkowski et al. (2014) reported moderate to strong correlations of social participation with disability status as measured by the Expanded Disability Status Score (EDSS); Kierkegaard et al. (2012) similarly noted that walking speed

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was a good predictor of activity/participation. Paltamaa et al. (2008) in a cohort of PwMS identified gait velocity and domestic life participation as the most responsive measures to deterioration due to MS.

Categorization of community walking performance according to walking speed and self reported ability to move in different environments has been explored in MS in order to go beyond the description of symptoms and disability when describing participation (Feys et al., 2014). Perry et al. (1995) exploring walking speed and self reported ability to move in different environments classified walking capacity in six functional walking categories, the Modified Walking Functional Categories (MFWC). A successive study by Kempen et al. (2011) further defined the gait speed thresholds for each category of the MFWC in a cohort of PwMS at the time of definite diagnosis. To date the relationship with categorization of functional community ambulation or the effect of the use of a walking aid with respect to participation has not been explored. Community ambulation is supposed to be bound to participation but at present no studies have examined the relationship between MFWC and a measure of participation in PwMS.

The first aim of the present study was to investigate factors associated with walking and mobility restrictions as classified by the Modified Functional Walking Categories; the second aim was to analyze the influence of functional walking category, use of a walking aid and EDSS on community participation in a convenient sample of PwMS attending a rehabilitation center. We hypothesized that MFWC would be a better predictor of participation restrictions than the use of a walking aid or disability level as classified by EDSS.

2. Material and methods

One hundred and sixty PwMS were screened among people attending two different rehabilitation centres in Milan, IRCCS Fondazione Don Carlo Gnocchi (Italy) and Hasselt, REVAL Rehabilitation Research Institute (Belgium) for rehabilitation or routine medical examinations. Inclusion criteria were confirmed MS diagnosis and age ≥ 18 years; people with cognitive impairment leading to inability to follow testing instructions or having other neurological or orthopaedic co-morbidities that could interfere with the execution of the assessment protocol were excluded. All participants received full information about the study and signed an informed consent form; the study was approved by the local ethics committee.

For each participant age, gender, EDSS, disease duration, type of MS and employment status were registered. All data were collected at the same occasion for each participants.

The Community Integration Questionnaire (CIQ) (Willer et al., 1994) inquires on participation in three different domains: home, social and productive activities. For each domain maximum scores are, respectively, 10 (home); 12 (social) and 7 (productive) points while maximum total score of 29 points is indicative of a good level of participation. Scores for each item are based on self-reported independency or frequency of the community activity inquired upon. The following cut off scores differentiating between normal and abnormal CIQ scores have been established for a sample of healthy subjects: 17 out of 29 points for Total participation score; 3 out of 10, 8 out of 12 and 2 points out of 7 respectively for Home, Social and Productive participation subscores. (Cattaneo et al., 2017)

Walking speed for ambulant PwMS was measured with the Timed 25 Foot Walk (T25FW) (Fischer et al., 1999). Subjects were asked to walk twice at fast but safe walking speed, and mean velocity of the two trials in m/s was calculated. Usual walking aid was permitted during the T25FW and recorded for further analyses. Mean velocity for PwMS unable to walk even with aid for 25 ft was recorded as 0 m/s.

Subjects' mean velocity was used to categorize the whole sample in 5 categories based on the Modified Functional Walking Categories provided by Kempen et al. (2011) for PwMS to assess the influence of walking speed on participation:

1) Unlimited/Least-limited community walker (≥ 1.35 m/s)
2) Most-Limited community walker (< 1.35 m/s)
3) Unlimited household walker (< 1.04 m/s)
4) Limited household walker (< 0.48 m/s)
5) Physiological Walker and non ambulant PwMS (< 0.10 m/s)

Physiological walkers were all wheelchair bound people unable to walk with aid or that had a gait velocity lower than 0.10 m/s. The examinations were performed by experienced physiotherapists. To ensure standardization between centers, an instruction booklet was created and practice sessions were held to minimize the differences between the assessors.

2.1. Data analysis

To ensure a sufficient sample size for statistical analysis, Least-limited and Unlimited community walkers categories were collapsed in one, hereafter named Unlimited Community walkers. Likewise MS type was analyzed as progressive or non-progressive, due to the insufficient primary progressive sample size.

Box-plot analysis was used to detect outliers, then between categories differences for demographical and clinical characteristics were calculated using Kruskal-Wallis (K-W) test or Chi square (χ^2) test when appropriate; post-hoc tests (Bonferroni correction) were applied to investigate differences between categories.

On the basis of published total CIQ cut-off scores subjects were then divided into having (≤ 17 points) or not having (> 17 points) participation restrictions (Cattaneo et al., 2017). Further, for each subscale the relative cut off score was used (Cattaneo et al., 2017).

Univariate logistic models were used to assess associations between being restricted or not restricted in participation according to the CIQ total score and clinical variables, MFWC, walking aid and EDSS. According to the Hosmer and Lemershow approach for two-step modeling (Hosmer and Lemeshow, 2000) statistically significant variables ($p < 0.05$) associated with the CIQ score were entered in a multivariate logistic regression analysis to identify factors predicting the having or not having participation restrictions with a stepwise approach and the resultant significant factors were then entered in a final reduced predictive logistic model. The same procedure was used for the three CIQ subscales. Models were checked for distribution of residuals and presence of influential points.

3. Results

Preliminary statistical analysis revealed that out of the 155 PwMS matching inclusion criteria six were outliers and were thus excluded from the analyses. Demographic (age, gender, EDSS, type of MS and disease duration) and clinical characteristics for the whole sample and MFWC are reported in Table 1.

Comparisons among MFWCs are reported in Table 2. We found an overall statistically significant age difference between MFWCs. Post hoc analysis revealed differences only for Physiological walkers compared to Unlimited Community category, with the Physiological walkers being older. EDSS scores increased through walking categories, presenting statistical differences among all groups except between Unlimited Household and Most-Limited Community categories where EDSS values tend to overlap. Statistical differences were found between MFWCs also in disease duration; at post-hoc analysis, Physiological walkers had a longer disease duration compared to Most-Limited and Unlimited Community categories; also Unlimited Household showed a longer disease duration with respect to Unlimited Community categories.

Proportion of PwMS with RR and progressive type of MS varied according to MFWC. At post hoc analysis there were statistically significant differences between all groups except between Most-Limited Community and Household categories and between Limited Household