Title: Global functioning of COPD patients with and without functional balance impairment: an exploratory analysis based on the ICF framework

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Running head: FUNCTIONAL BALANCE AND GLOBAL FUNCTIONING IN COPD

Keywords: Balance; Disability; Functioning; ICF Core Set; Rehabilitation

Abstract

Balance impairment is a common manifestation in older people with COPD and may contribute to overall functional decline; however, the relationship between balance and global functioning has not been studied. This study aimed to explore the global functioning of COPD patients with and without functional balance impairment.

Functional balance was assessed with the Timed Up-and-Go (TUG) test and global functioning with the Comprehensive ICF Core Set for Obstructive Pulmonary Diseases. Participants (n=134) were divided in 2 groups according to their performance in TUG (*with* and *without balance impairment*) and the ICF Core Set results were compared between groups.

Fifty-four (40.3%) participants had functional balance impairment. The groups presented a similar extent of problems in several categories of the ICF components. However, participants with balance impairment were more severely affected ($p<0.05$) in energy, pain, respiratory system, weight maintenance, exercise tolerance, neuromusculoskeletal and movement-related functions, and structure of head and neck. They also presented a significantly worse performance in handling psychological demands and activities related to mobility, self-care, domestic, community and social life, and a more negative perception of Environmental factors related to products and technology of buildings for private use and social support services ($p<0.05$).

Patients with functional balance impairment have more functional problems and are more severely restricted in daily life than patients without compromised balance. Understanding the relationship between balance control and global functioning will contribute to guide interventions aimed at maintaining functioning and minimizing disability.

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a highly prevalent disease worldwide and one of the main leading causes of long-term disability [1]. The disease is characterized by a progressive deterioration of pulmonary function associated with systemic features and comorbidities which contribute greatly to functional performance decline [2]. Recent studies have shown that balance impairment is also a common manifestation in patients with COPD [3-10], particularly in older ages. These studies have found relationships between deficits in balance control and disease severity [8], frequency of falls [10], reduced physical activity levels, skeletal muscle weakness [7], dyspnea and fatigue [10]. While research has been focusing on the mechanisms underlying balance control deficits and on the subsequent risk of falling, little is known about the impact of balance impairments on daily functioning of patients with COPD. Balance control, which includes maintaining postural stability during body movements [11], is recognized as an integral component of daily (functional) activities [12]. Therefore, balance impairments may reduce patients' ability to live independently. Understanding the relationship between balance impairment and global functioning is fundamental to guide rehabilitation interventions aimed at maintaining functioning and minimizing disability.

The International Classification of Functioning, Disability and Health (ICF) is a multidimensional framework developed by the World Health Organization [13] to assess human global functioning. The ICF enables a comprehensive view of health states from a bio-psycho-social perspective and provides an unified language for rehabilitation [13]. According to the ICF framework, the problems associated with a health condition may concern body functions and structures, performance of activities and participation in life situations, which may be further facilitated or hindered by contextual (environmental or personal) factors. Therefore, this framework may help professionals to detect changes in global functioning among people with balance impairments. To facilitate the description of functioning and disability in clinical practice and research, ICF Core Sets for specific diseases have been developed [14]. ICF Core Sets provide lists of categories that are relevant for specific health conditions and healthcare contexts, thus reflecting the whole life experience of the person [15]. Specifically for COPD, the application of the Comprehensive ICF Core Set for Obstructive Pulmonary Diseases (OPD) has been found to describe impairments in patients' global functioning [16]. However, the question of whether these impairments differ in patients with and without compromised balance remains unanswered. This study aimed to explore the global functioning of COPD patients with and without functional balance impairment.

Methods

Design and ethics

A cross-sectional study was conducted after full approval from the Institutional Ethics Committee involved.

Recruitment

Community-dwelling older adults with a clinical diagnosis of COPD (according to the ICD-10 code, J40-J44) were identified by the physicians of four primary care centers and one district hospital, who ensured the fulfillment of eligibility criteria. Patients were included if they were: i) 60 years old or over; ii) living in the community; iii) able to walk 3 meters with/without an assistive device (but without the assistance of another person) and iv) able to follow simple instructions. Patients were excluded if they had severe musculoskeletal, neurological or cardiovascular disorders and severe auditory/visual impairments.

Patients were informed by their physicians about the study and asked about their willingness to participate. Patients who agreed to participate were contacted by the researchers to schedule an appointment, from December 2010 to March 2012. Before data collection, more information about the study was provided and the written informed consent obtained.

Data collection

The sample was first characterized. Participants were asked to complete a questionnaire with socio-demographic information, smoking status, oxygen use and need for assistance to perform the basic (mobility and personal care) and instrumental (e.g., domestic work, medication management, transportation) activities of daily living. Height and weight were collected to calculate the body mass index (BMI). Lung function was assessed according to standardized guidelines [17] with a portable spirometer (MicroLab 3500, CareFusion, Kent, UK). COPD severity was determined using the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria [18]: mild COPD ($FEV_1 \geq 80\%$ predicted), moderate COPD ($50\% \leq FEV_1 < 80\%$ predicted), severe COPD ($30\% \leq FEV_1 < 50\%$ predicted) and very severe COPD ($FEV_1 < 30\%$ predicted).

Functional balance

Functional balance is defined as the ability to maintain equilibrium in dynamic situations required for daily activities [11]. The Timed Up-and-Go (TUG) test [19] was used to assess functional balance, as this is a simple and quick test used in clinical settings which incorporates a series of tasks necessary for independent living [11]. Two TUG tests were performed and the best performance was considered. To perform the test, participants were instructed to rise from a chair, walk 3 meters as quickly and as safely as possible, turn around, return to the chair and sit down [20]. Participants were encouraged to rest as needed between the tests. Those who used an assistive device when walking were requested to use it during the tests. The time needed to perform the test was recorded using a stopwatch.

Global functioning

Global functioning was assessed using the Comprehensive ICF Core Set for OPD, under which COPD is included. This ICF Core Set has 71 ICF categories from all components of the ICF checklist, including Body Functions (19 categories) and Structures (5 categories), Activities and Participation (24 categories) and Environmental Factors (23 categories) [15]. Similarly to the checklist, the ICF Core Set uses an alphanumeric coding system composed by a letter that refers to the component (b, Body Functions; s, Body Structures; d, Activities and Participation; e, Environmental Factors) and a numeric code starting with the chapter number (one digit), followed by the second level (two digits) and the third level (one digit each), as in the example:

b2 Sensory functions and pain (chapter level)

b280 Sensation of pain (second level)

b2801 Pain in body part (third level)

This ICF Core Set includes 67 second level and 4 third level categories. For each category, a qualifier was chosen to describe the extent of problems in the respective component according to the following gradation: 0 (no problem), 1 (mild problem), 2 (moderate problem), 3 (severe problem) or 4 (complete problem). Additionally, 8 (not specified) was used when the available information was not sufficient to quantify the severity of the problem and 9 (not applicable) when a category was not applicable to that specific person [13]. In the Environmental Factors component, a positive (+) or negative (-) sign was added to the numeric qualifier to indicate whether the category was viewed by the participant as a facilitator or a barrier, respectively. In the ICF, the domains of the Activities and Participation component can be coded either using the *performance* qualifier, the *capacity* qualifier or both. The *performance* qualifier describes what an individual does in his/her environment ("*the lived experience*" of people in their real context), whereas the *capacity* describes an individual’s ability to execute a task/action in a standardized environment [13]. In this study only the *performance* qualifier was coded to enable gathering the real day-to-day living experience of patients with COPD.

There are still no specific assessment procedures for the ICF coding, therefore, the ICF Core Set was completed by experienced researchers using a standardized protocol developed prior to data collection that included information gathered throughout the interview, medical records and physical exam. The physical exam included the assessment of BMI, heart and respiratory rates, lung function and the observation of patient's posture and performance during the TUG test.

Data analysis

Participants were divided in two groups according to their performance in the TUG test: patients *with* vs. *without* functional balance impairment. This was performed by comparing the TUG score of each participant with the upper limit of 95% confidence interval (95%CI) of the mean reference values of age-matched healthy peers [21]: score>9.0 seconds (60-69 years old); score>10.2 seconds (70-79 years old) and score>12.7 seconds (80-99 years old). Patients with a TUG score higher than the reference values were included in the group with balance impairment.

Descriptive statistics were used to characterize the groups and describe global functioning using the ICF Core Set. To enable between-group comparisons, the qualifiers 8 and 9 of the ICF Core Set were recoded into a missing value and 0 (no problem), respectively. Socio-demographic and clinical variables of both groups were compared using independent *t*-tests for normally distributed data, Mann-Whitney U-tests for non-normally distributed data and ordinal data, and Chi-square tests for categorical data. To assess differences between groups regarding the extent of impairments in global functioning, the Mann-Whitney U-test was used.

A $p<0.05$ was considered for statistical significance. Effect sizes were calculated to measure the strength of association between functional balance and ICF categories, using the formula $r=Z/\sqrt{N}$ [22], where r is the effect size, Z the test statistic of Mann-Whitney U-test and N the total sample size. According to Cohen [23], $r\geq0.1$ indicates a small, $r\geq0.3$ a medium, and $r\geq0.5$ a large effect size. Analyzes were performed using PASW Statistics v18.0 for Windows (SPSS Inc., Chicago, Illinois).

Results

Participants

A total of 143 patients with COPD were contacted; however, 7 refused to participate as they did not perceive the study as relevant and 2 did not complete the assessment. Therefore, 134 patients (85 males) with a mean age of 72.57±8.34 participated in the study. When comparing patient's TUG performance with the reference values [21], 54 participants (40.30%) were included in the group with functional balance impairment and 80 (59.70%) in the group without functional balance impairment (Table 1). The groups performed the TUG test in 14.94±6.58 and 8.22±1.59 seconds, respectively. In both groups, most patients were married, retired and required assistance in at least one instrumental activity of daily living ($p>0.05$). However, the percentage of participants dependent in at least one basic activity of daily living was higher in the group with functional balance impairment (27.8% *vs.* 3.8%, $p=0.001$). This group also presented a worse FEV_1% predicted ($p=0.013$) and a higher BMI ($p=0.005$). The groups included people at all COPD grades, although GOLD 4 was less prevalent.

(Insert table 1)

Global functioning of patients with and without balance impairment

Body Functions

Table 2 presents participants' extent of problems in the Body Functions component. *Emotional functions* (b152) and the respective subcategory (b1522), *Exercise tolerance functions* (b455) and *Sensations associated with cardiovascular and respiratory functions* (b460) were found to be at least moderately impaired in 50% of the participants from both groups (i.e., medians≥2). Participants with functional balance impairment were significantly more affected than those without balance impairment in the categories: *Energy and drive functions* (b130), *Pain in body part* (b2801), *Functions of the respiratory system* (b440, b445), *Weight maintenance functions* (b530), *Exercise tolerance functions* (b455) and in *Sensations associated with cardiovascular and respiratory functions* (b460), and in all categories related to *Neuromusculoskeletal and movement-related functions* (Chapter b7). A large effect size was found for *Muscle power* (r=0.60) and *Endurance functions* (r=0.57) and a marginal medium effect size for *Energy and drive functions* (r=0.29).

(Insert table 2)

Body Structures

The extent of problems in the Body Structures component is presented in Table 3. The groups presented similar problems, with the exception of the *Structure of head and neck region* (s710) which was worse in participants with functional balance impairment (p=0.016; r=0.21). The structure most severely impaired in both groups was the *Structure of the respiratory system* (s430, p=0.249), as presented in Table 3.

(Insert table 3)

Activities and Participation

Table 4 describes the extent of participants' activity limitations and participation restrictions. *Moving around* (d455) was the category more severely rated by both groups. When comparing the groups, significant differences were observed in 15 categories (62.5%) of the Activity and Participation component. Participants with functional balance impairment were more restricted ($p<0.05$) in almost all categories of the Chapter d4 *Mobility*. Within this Chapter, the effect size was moderate to large in the categories *Changing basic body position* (r=0.56), *Lifting and carrying objects* (r=0.38), *Walking* (r=0.56) and *Using transportation* (r=0.39). Other categories significantly affected in this group were *Handling stress and other psychological demands* (d240) and categories related to the Chapters d5 *Self-care* (d510, d540), d6 *Domestic life* (d650, d660) and d9 *Community, social and civic life* (d910, d920). Nevertheless, a medium effect size was only observed for the categories related to *Self-care* (Table 4).

(Insert table 4)

Environmental Factors

Within the Environmental Factors component, the categories *Products or substances for personal consumption* (e110), *Products and technology for personal use in daily living* (e115), *Immediate family* (e310), *Health Professionals* (e355) and the attitude of both family members (e410) and health professionals (e450) were the most important facilitators for both groups (Table 5). The most important barriers were related to *Climate* (e225) and *Air quality* (e260). The categories *Design, construction and building products and technology of buildings for private use* (e155) and *General social support services, systems and policies* aimed at providing support to patients requiring assistance in daily activities (e575) were significantly different between groups, with the participants with functional balance impairment perceiving them more often as a barrier or a non-facilitator (Table 5). Nevertheless, the association between functional balance and these categories was small (r=-0.20 and r=-0.22 for e155 and e575, respectively).

(Insert table 5)

Discussion

This exploratory study showed that, when compared to aged-matched healthy peers, 40.3% of participants with COPD presented functional balance impairment. This group had more functional problems and was more severely restricted in daily life than those without balance impairment.

Body Functions

Both groups presented problems in *Emotional functions* (e.g., anxiety), *Exercise tolerance functions* (e.g., fatigue) and in *Sensations associated with cardiovascular and respiratory functions* (e.g., dyspnea). These functions are known to be often compromised in patients with COPD [16]. However, this study found that, in the group with compromised functional balance, the *Functions of the respiratory system*, *Exercise tolerance functions* and the *Sensations associated with cardiovascular and respiratory functions* were more severely affected. These results confirm the findings from previous research where disease-related factors, such as the degree of airflow obstruction [8], hypoxemia, dyspnea and fatigue [10], were related to balance impairments and falls in patients with COPD.

Patients with functional balance impairment also presented more severe problems in *Energy and drive functions*, i.e., general mental functions that cause the individual to move towards satisfying specific needs and general goals in a persistent way [13]. The concept of motivation is of great relevance for older adults because it is one of the major factors associated to functional limitations [24, 25]. In a previous study, patients with COPD had worse levels of motivation to start an activity ($p<0.001$) when compared to healthy people [26]; however, the association with balance was not explored. To support our results, future studies should investigate the association between these two variables and explore the underlying mechanisms of this association.

In the present study, most patients were above the normal weight values (mean BMI 28.46±4.27 Kg/m^2 and 26.52±3.55 Kg/m^2 in patients with and without balance impairment, respectively), reflecting the increasingly recognized relationship between COPD and obesity [27, 28]. Nevertheless, patients with functional balance impairment had a significantly higher BMI. Though increased body weight has been positively associated with impaired balance [29] and higher prevalence of falls [30], the relationship between obesity and balance control in COPD is yet to be determined.

The category *Pain in a body part* was also rated as more severe in patients with compromised balance. Lihavainen et al. [31], exploring the relationship between musculoskeletal pain and balance impairments in community-dwelling older adults, found that those with moderate to severe musculoskeletal pain had more than twice the risk (Odds Ratio=2.33, 95%CI=1.44-3.76) of having balance impairments when compared to those without pain. Possible mechanisms were described, such as peripheral neuropathy with loss of sensation in the feet or altered proprioceptive feedback from a painful site [31]. In this study, the location of pain was not possible to determine due to the limited information obtained with the category *Pain in body part*. Future studies should explore the role of body pain and its location on balance dysfunctions in patients with COPD.

Neuromusculoskeletal and movement-related functions were significantly worse in patients with functional balance impairment, particularly *Muscle power* (r=0.60) and *Muscle endurance* (r=0.57) functions. Numerous clinical trials have found that muscle endurance is compromised in these patients [32-34]; reduced muscle endurance reflects increased muscle fatigue [32], which in turn has been associated with impaired postural control [35]. In COPD, one study involving 36 patients and 20 healthy controls concluded that fatigue (measured after the sixminute walking test) was one of the disease-related factors associated with balance impairments [10], supporting the findings from the present study. It is also known that muscle power (the product of force and velocity of muscle contraction) declines with age [36] and appears to be more closely related to postural control [37] and functional performance [38, 39] than total muscle strength. In patients with COPD, balance impairments have been associated with lower limb muscle strength ($p<0.05$) [7]. Although muscle power has not been investigated in this population [40], it is unlikely that patients with COPD, with compromised muscle strength [7], could have normal values of muscle power. This needs further clarification.

Body structures

As expected from previous research [41], the respiratory system was the most severely impaired structure in both groups. In contrast, the *Structure of head and neck region* was significantly worse in people with functional balance impairment. In other populations, subjects presenting a more protruded head with extensive neck posture (a similar pattern was observed in the current study) showed a significantly decreased ability to control posture and mobility [42]. In COPD, there are no studies directly evaluating head and neck posture. Nevertheless, this positional change is frequently observed in older people [43] and in people with breathing difficulties [44], such as patients with COPD [45].

Activities and Participation

Moving around was the category more severely rated by both groups. This category has been found to be relevant for patients with COPD [46], with stair climbing being one of the most common activities performed on a daily basis [47].

Handling stress and other psychological demands was significantly affected in the group with compromised balance. This category involves carrying out simple or complex and coordinated actions to manage the psychological demands (i.e., stress, distraction or crises) required to carry out tasks that impose significant responsibilities [13]. It has been suggested that psychological stress associated to task demands could lead to a reduction in balance ability in older adults [48]. In COPD, this topic has not been investigated.

All categories of the Chapter d4 *Mobility* (except *Driving* and *Driving human-powered transportation*) and the categories *Washing oneself* and *Dressing* were significantly more restricted in the group with functional balance impairment, with most of them showing a medium to large effect size. Previous studies [7, 8, 10] using different measures which are linked to the categories of these ICF Chapters [49, 50] also found that these patients have a worse performance than their healthy peers. In this study, patients were also severely compromised in activities related to *Caring for household objects* and *Assisting others*, and in their participation in *Community life*, *Recreation and leisure*. These findings suggest that the domestic and community lives are restricted in patients with functional balance impairment, which may increase dependence on others and social isolation. This warrants further investigation.

Environmental Factors

Most of the categories were similarly rated as facilitators or barriers by both groups. Previous studies support these results [16, 51]. However, the group with compromised balance presented a worse perspective about the *Design, construction and building products and technology of buildings for private use*, suggesting a lack of accessibility conditions for these people in private buildings (e.g., commercial stores). Further studies are needed to understand how this environmental factor affects people with compromised balance and enable the development of strategies to facilitate their access. Moreover, a number of patients with functional balance impairment rated *General social support services, systems and policies* as a barrier, unlike patients in the other group. This finding indicates that those patients may require assistance in areas such as shopping, housework, self-care and care of others, which are not commonly covered by the existing services, systems and policies.

Study limitations

This study has several limitations that need to be acknowledged. First, the groups had uneven distributions of COPD grades, with GOLD 4 (very severe COPD) being the less prevalent. Future studies using samples with a more equitable distribution of COPD grades, including patients from different countries, would be valuable to understand if body functions and structures impairments, activities limitations, participation restrictions and the environmental barriers/facilitators are similar to those found in this study. Second, in the present study, the TUG test was used to stratify patients *with* or *without* balance impairment. Although this test has been extensively used in older people [52] and in patients with COPD [3, 5, 8] to assess functional skills, TUG is a rather basic functional balance test that cannot determine which balance control systems are impaired [11]. Future studies should use a more comprehensive clinical balance test, such as the Berg Balance Scale [53] or the Balance Evaluation Systems Test (BESTest) [54], to identify the underlying balance control systems that are affected and determine their impact on patients' global functioning. Third, the *performance* of the Activities and Participation component was coded to enable gathering patients' daily living experience. However, the assessment of both *capacity* (i.e., ability to execute a task/action in a standardized environment) and *performance* (i.e., what the patient does in his/her environment) may be valuable in future research to understand the impact of the environment on patients' activities and participation in the community. Measuring the gap between these qualifiers (sometimes referred to as patients' *functional reserve* [55]) may, therefore, help determining what can be done to the current environment to improve patients' *performance*. Fourth, data were cross-sectional in nature; thus, the findings cannot demonstrate a causal relationship between variables. Longitudinal studies are needed on this topic. Finally, the current Comprehensive ICF Core Set for OPD does not include specific categories that could be relevant to assess in more depth the impact of balance impairment on global functioning, specifically those related to balance control and risk of falling [56] (e.g., b260 *Proprioceptive function*, b210 *Seeing functions*, b235 *Vestibular functions*). This should be considered in future revisions of this ICF Core Set.

Conclusion

This is the first study exploring the global functioning of COPD patients with and without functional balance impairment. Findings suggest that patients with compromised balance have more functioning problems and are more severely restricted in daily life than those without balance impairment. Understanding the relationship between balance control and global functioning, as performed in this study, will contribute to guide interventions aimed at maintaining functioning and minimizing disability.

Acknowledgments

The authors would like to acknowledge all institutions and patients involved for their participation in this study. We are also very grateful to Ana Gonçalves, Carla Lucas and Sara Silva for their contributions during data collection.

Declaration of Interest

This work was funded by Fundação para a Ciência e Tecnologia, Portugal (project ref. RIPD/CIF/109502/2009). The authors declare that they have no conflicts of interest.

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Table 1 – Socio-demographic and clinical characteristics of participants with and without functional balance impairment.

	Patients without functional balance impairment (n=80)	Patients with functional balance impairment (n=54)	p-value
Age (years), mean (SD)	71.79 (8.23)	73.74 (8.46)	0.185
Gender (male), n (%)	55 (68.8%)	30 (55.6%)	0.145
Living alone, n (%)	9 (11.2%)	11 (20.8%)	0.145
Marital status, n (%)			
Single	3 (3.8%)	0	0.088
Married/Living as a couple	62 (77.4%)	39 (72.2%)	
Separated/divorced	5 (6.2%)	1 (1.9%)	
Widowed	10 (12.5%)	14 (25.9%)	
Current occupation, n (%)			
Employed	7 (8.8%)	1 (1.9%)	0.150
Unemployed	2 (2.5%)	2 (3.8)	
Domestic work	3 (3.8%)	0	
Retired	68 (85.5%)	51 (94.4%)	
Dependency in at least one basic activity of daily living, n (%)	3 (3.8%)	15 (27.8%)	0.001*
Dependency in at least one instrumental activity of daily living, n (%)	49 (61.3%)	38 (77.6%)	0.081
FEV_1% predicted, mean (SD)	68.40 (22.41)	58.00 (24.65)	0.013*
GOLD grade, n (%)			
GOLD 1	31 (38.8%)	14 (25.9%)	0.013*
GOLD 2	33 (41.2%)	15 (27.8%)	
GOLD 3	13 (16.2%)	20 (37.0%)	
GOLD 4	3 (3.8%)	5 (9.3%)	
BMI (Kg/m^2), mean (SD)	26.52 (3.55)	28.46 (4.27)	0.005*
Smokers, n (%)	20 (25.0%)	2 (3.7%)	0.001*
Oxygen use, n (%)	2 (2.5%)	8 (14.8%)	0.015*

SD, standard deviation; FEV_1% predicted, percentage predicted of the forced expired volume in one second; GOLD, Global Initiative for Chronic Obstructive Lung Disease; BMI, body mass index; *Significant at $p<0.05$.

Table 2 - Extent of problems in the Body functions component of participants with and without functional balance impairment.

ICF code	ICF category	Patients without functional balance impairment (n=80)	Patients with functional balance impairment (n=54)	p-value	Effect size (*r*)
b130	Energy and drive functions	0 [0-4]	1 [0-4]	0.001*	0.29
b134	Sleep functions	1 [0-4]	2 [0-4]	0.526	0.05
b152	Emotional functions	2 [0-4]	2 [0-4]	0.283	0.09
b1522	Range of emotion	2 [0-4]	2 [0-4]	0.334	0.08
b280	Sensation of pain	1 [0-3]	2 [0-4]	0.121	0.13
b2801	Pain in body part	1 [0-3]	2 [0-4]	0.009*	0.23
b310	Voice functions	0 [0-3]	0 [0-3]	0.177	-0.12
b410	Heart functions	1 [0-3]	1 [0-3]	0.354	0.08
b430	Haematological system functions	0 [0-4]	0 [0-3]	0.610	0.04
b435	Immunological system functions	0 [0-4]	0 [0-4]	0.799	0.02
b440	Respiration functions	1 [0-4]	1 [0-4]	0.011*	0.22
b445	Respiratory muscle functions	1 [0-4]	1 [0-4]	0.004*	0.25
b450	Additional respiratory functions	1 [0-3]	1 [0-4]	0.858	0.02
b455	Exercise tolerance functions	2 [0-4]	3 [0-4]	0.003*	0.26
b460	Sensations associated with cardiovascular and respiratory functions	2 [0-4]	3 [0-4]	0.002*	0.27
b530	Weight maintenance functions	1 [0-2]	1 [0-3]	0.004*	0.25
b730	Muscle power functions	0 [0-1]	1 [0-3]	0.001*	0.60

b740	Muscle endurance functions	0 [0-1]	1 [0-3]	0.001*	0.57
b780	Sensations related to muscles and movement functions	0 [0-4]	1 [0-4]	0.042*	0.18

The values are presented in median and interquartile range [p_{25}, p_{75}]; *Significant at p<0.05.

Table 3 - Extent of problems in the Body structures component of participants with and without functional balance impairment.

ICF code	ICF category	Patients with functional balance impairment (n=54)	Patients without functional balance impairment (n=80)	p-value	Effect size (*r*)
s410	Structure of cardiovascular system	1 [0-4]	1 [0-4]	0.591	0.05
s430	Structure of respiratory system	2 [0-4]	2 [0-4]	0.249	0.10
s710	Structure of head and neck region	2 [0-2]	0 [0-3]	0.016*	0.21
s720	Structure of shoulder region	0 [0-2]	0 [0-3]	0.053	0.17
s760	Structure of trunk	0 [0-3]	0 [0-3]	0.813	-0.02

The values are presented in median and interquartile range [p_{25}, p_{75}]; *Significant at p<0.05.

Table 4 - Extent of problems in the Activities and Participation component of participants with and without functional balance impairment.

ICF code	ICF category	Patients without functional balance impairment (n=80)	Patients with functional balance impairment (n=54)	p-value	Effect size (*r*)
d230	Carrying out daily routine	1 [0-4]	1 [0-4]	0.073	0.15
d240	Handling stress and other psychological demands	0 [0-4]	1 [0-4]	0.007*	0.23
d330	Speaking	0 [0-3]	0 [0-3]	0.686	0.03
d410	Changing basic body position	0 [0-1]	1 [0-3]	0.001*	0.56
d430	Lifting and carrying objects	0 [0-3]	1 [0-4]	0.001*	0.38
d450	Walking	0 [0-2]	1 [0-4]	0.001*	0.56
d455	Moving around	2 [0-4]	3 [0-4]	0.004*	0.25
d460	Moving around in different locations	1 [0-4]	2 [0-4]	0.026*	0.19
d465	Moving around using equipment	0 [0-4]	0 [0-4]	0.001*	0.28
d470	Using transportation	0 [0-4]	2 [0-4]	0.001*	0.39
d475	Driving	0 [0-2]	0 [0-4]	0.336	0.08
d4750	Driving human-powered transportation	0 [0-4]	0 [0-4]	0.140	0.13
d510	Washing oneself	0 [0-4]	1 [0-4]	0.001*	0.31
d540	Dressing	0 [0-4]	2 [0-4]	0.001*	0.34
d570	Looking after one's health	0 [0-4]	0 [0-3]	0.837	-0.02
d620	Acquisition of goods and services	2 [0-4]	1 [0-4]	0.935	0.01

d640	Doing housework	1 [0-4]	2 [0-4]	0.121	0.13
d650	Caring for household objects	1 [0-4]	2 [0-4]	0.018*	0.20
d660	Assisting others	0 [0-4]	0 [0-4]	0.008*	0.23
d770	Intimate relationships	0 [0-4]	0 [0-4]	0.884	0.01
d845	Acquiring, keeping and terminating a job	0 [0-4]	0 [0-4]	0.160	-0.12
d850	Remunerative employment	0 [0-4]	0 [0-0]	0.026*	-0.19
d910	Community life	0 [0-4]	1 [0-4]	0.042*	0.18
d920	Recreation and leisure	1 [0-4]	2 [0-4]	0.001*	0.28

The values are presented in median and interquartile range [p_{25}, p_{75}]; *Significant at $p<0.05$.

Table 5 - Extent of problems in the Environmental Factors component of participants with and without functional balance impairment.

ICF code	ICF category	**Patients without functional balance impairment (n=80)**	**Patients with functional balance impairment (n=54)**	**p-value**	**Effect size (*r*)**
e110	Products or substances for personal consumption	4 [0-4]	4 [0-4]	0.682	0.04
e115	Products and technology for personal use in daily living	3 [0-4]	3 [0-4]	0.466	0.06
e120	Products and technology for personal indoor and outdoor mobility and transportation	0 [0-4]	0 [-4-4]	0.996	0.00
e150	Design, construction and building products and technology of buildings for public use	0 [-2-4]	0 [-4-2]	0.060	-0.16
e155	Design, construction and building products and technology of buildings for private use	0 [-2-4]	0 [-4-2]	0.018*	-0.20
e225	Climate	-3 [-4-1]	-2 [-4-3]	0.145	0.13
e245	Time-related changes	-1 [-4-0]	-1 [-4-1]	0.857	0.02
e2450	Day/night cycles	-1 [-4-0]	-1 [-4-2]	0.916	0.01
e260	Air quality	-2 [-4-3]	-3 [-4-3]	0.818	-0.02
e310	Immediate family	4 [-4-4]	3 [-4-4]	0.119	-0.13
e320	Friends	0 [0-4]	0 [-1-4]	0.080	-0.15
e340	Personal care providers and personal assistants	1 [-4-4]	1 [0-4]	0.759	-0.03
e355	Health professionals	4 [1-4]	3 [0-4]	0.269	-0.10

e410	Individual attitudes of immediate family members	2 [-3-4]	2 [-2-4]	0.751	0.03
e420	Individual attitudes of friends	0 [0-4]	0 [0-4]	0.361	-0.08
e450	Individual attitudes of health professionals	3 [0-4]	3 [-2-4]	0.679	0.04
e460	Societal attitudes	0 [-1-2]	0 [-3-1]	0.060	-0.16
e540	Transportation services, systems and policies	0 [-2-4]	0 [-2-4]	0.450	0.07
e555	Associations and organizational services, systems and policies	0 [0-4]	0 [-1-2]	0.633	-0.04
e575	General social support services, systems and policies	0 [0-2]	0 [-4-0]	0.011*	-0.22
e580	Education and training services, systems and policies	1 [-3-4]	2 [-4-4]	0.366	0.08
e585	Labour and employment services, systems and policies	0	0 [0-2]	0.224	0.11
e590	Labour and employment services, systems and policies	0 [0-3]	0 [0-2]	0.787	0.02

The values are presented in median and interquartile range [p_{25}, p_{75}]; *Significant at p<0.05.