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Physical activity, functional capacity, and sedentary behaviour in people with interstitial lung disease

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Resumo

Pessoas com doença pulmonar intersticial (DPI) apresentam capacidade funcional e atividade física reduzidas e comportamento sedentário aumentado. Porém, a literatura é escassa. Os objetivos foram: i) caracterizar a capacidade funcional, níveis de atividade física e comportamento sedentário; ii) explorar seus determinantes a sua relação; iii) determinar a distribuição dos participantes nos quadrantes em pessoas com DPI. Foi realizado um estudo retrospetivo transversal. A capacidade funcional foi medida utilizando o teste de 1-minuto-levantar-sentar. A atividade física e o comportamento sedentário foram avaliados com acelerometria. Realizaram-se análises estatísticas para comparar grupos e identificar associações entre variáveis. Participaram 78 indivíduos (média de 68 anos, 41♀). Observaram-se diferenças significativas na atividade física, comportamento sedentário e capacidade funcional conforme a gravidade da DPI. Idade, dispneia, uso de oxigeno-terapia de longa duração e capacidade funcional foram associados à atividade física, enquanto diagnóstico de pneumonite por hipersensibilidade e equilíbrio foram associados ao comportamento sedentário. Os participantes estava predominantemente nos quadrantes "capaz de fazer, faz" e "incapaz de fazer, não faz" na atividade física e nos quadrantes "capaz de fazer, menos sedentário" e "incapaz de fazer, mais sedentário". Pacientes com DPI têm baixa capacidade funcional e atividade física e são sedentários, existindo fatores modificadores associados.

Palavras-chave: atividade física; capacidade funcional; comportamento sedentário; doença pulmonar intersticial.

Abstract

People with interstitial lung disease (ILD) experience reduced functional capacity and physical activity and increased sedentary behaviour. Limited research exists on this topic. We aimed to: i) characterize functional capacity, levels of physical activity, and sedentary behaviour; ii) explore their determinants and relationships; iii) determine the distribution of participants across quadrants in people with ILD. A retrospective cross-sectional study was conducted. Functional capacity was measured with the 1-minute sit-to-stand, physical activity and sedentary behaviour were assessed with accelerometery. Statistical analyses were performed to compare groups and identify associations between variables. 78 individuals (mean age of 68 years, 41♀) participated. Significant differences were observed in physical activity, sedentary behaviour, and functional capacity according to the severity of ILD. Age, dyspnoea, long-term oxygen therapy use, and functional capacity were associated with physical activity, while the presence of hypersensitivity pneumonitis and balance were associated with sedentary behaviour. Most of participants were on the "can do, do do" and the "can't do, don't do" on physical activity quadrants and on the quadrants "can do, less sedentary" and "can't do, more sedentary".

ILD patients have low functional capacity and are highly inactive and sedentary. There are modifying factors associated with these domains.

Keywords: physical activity; functional capacity; sedentary behaviour; interstitial lung disease.

Contents

Abbreviations

1min-STS – one-minute sit-to-stand test

6MWT – six-minute Walk Test

ADLs – Activities of daily living

BMI – Body Mass Index

Brief-BEST test – Brief-Balance Evaluation Systems Test

COPD – Chronic Obstructive Pulmonary Disease

CRD – Chronic Respiratory Disease

CTD-ILD - Connective Tissue Disease related Interstitial Lung Disease

DL_{CO}% predicted - percentage of predicted of Diffusing Capacity of Carbon Monoxide

FACIT-FS - Functional Assessment of Chronic Illness Therapy-Fatigue Subscale

fHP - fibrotic Hypersensitivity Pneumonitis

FVC% predicted - percentage of predicted of Forced Vital Capacity

HADS – Hospital Anxiety and Depression scale

HRQoL – Health-Related Quality of Life

ILD-GAP model - Interstitial Lung Disease- Gender, Age and Physiology model

LTOT- Long-Term Oxygen Therapy

MET – Metabolic Equivalent of Task

mMRC - modified British Medical Research Council

MVPA - Moderate to Vigorous Physical Activity

NIV- Non-Invasive Ventilation

SGRQ-I - St. George's Respiratory Questionnaire- Interstitial Lung Disease

VMU – Vector Magnitude Unit

WHO – World Health Organization

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1. Background

Interstitial lung disease (ILD) is a heterogeneous group of chronic respiratory diseases (CRD), characterised by widespread lung inflammation and/or fibrosis(1). It is an umbrella term for more than 300 lung diseases (Gibson et al., 2013), being the idiopathic pulmonary fibrosis (IPF), connective tissue disease-related ILD (CTD-ILD), fibrotic hypersensitivity pneumonitis (fHP) and sarcoidosis the most common (Hilberg et al., 2022). Although these lung diseases present different aetiology and prognosis, all share common clinical and pathophysiological features. ILD represents the most highly disabling group of CRD, with high healthcare utilisation, significant morbidity and mortality (Gibson et al., 2013). People with ILD commonly present severe symptoms, such as dyspnoea, cough, and fatigue (Aronson et al., 2021), which impairs their functional status and health-related quality of life (HRQoL) (2).

Functional status is the ability to accomplish activities of daily living (ADLs) required to meet basic needs, fulfil usual roles, and maintain health and well-being and includes functional capacity and performance(3). Functional capacity is related to the individuals' maximum capacity to perform ADLs in the different domains of life (e.g., measured by six-minute walk test [6MWT]) whilst functional performance is related to what the person, actually, does during daily life (e.g., measured by physical activity levels)(3). These two concepts reflect different aspects of the functional status during the progression of the disease(4).

Low functional capacity has been reported in people with ILD and is often the main focus of physiotherapy and pulmonary rehabilitation interventions in people with ILD (Dowman et al., 2021; Essam et al., 2022; Holland, 2010). Functional performance, namely, physical activity is defined as "any bodily movement produced by skeletal muscles that requires energy expenditure" (Caspersen et al., 1985). Physical activity is not just limited to exercise, but also includes many different activities (e.g., self-care, leisure and productivity activities), such as, dressing, gardening, walking, working or cleaning(5). It, therefore, reflects what people do in their daily life, i.e., functional performance. Physical activity level is an important predictor of morbidity and mortality in people with ILD/CRD (4,6).

Few studies have shown that people with ILD are physically inactive (7), especially in advanced stages of the disease (8), and that physical activity levels vary greatly across ILD subtypes (9). Evidence about characteristics of physical activity levels in this population is, however, still scarce. Physical activity levels in people with ILD seem to be affected by several factors, namely dyspnoea (10), fatigue (11), psychological factors, such as anxiety and depression (12), and HRQoL

(11). Studies in other CRD (e.g., chronic obstructive pulmonary disease [COPD]) have also found a relationship between physical activity levels and age, sex, acute exacerbations, long-term oxygen therapy (LTOT) use and dyspnoea(13).

Sedentary behaviour is defined as energy expenditure of 1.5 METS (metabolic equivalent of task) or lower (14). Recently, the sedentary behaviour was considered an independent predictor of mortality (15) and some studies have shown that people with IPF spent more than eight hours per day engaging in sedentary behaviour (16). However, the literature is scarce on the time spent in sedentary behaviour in other ILD diagnosis.

ILD can impact an individual's quality of life significantly, particularly in terms of functional capacity, physical activity and sedentary behaviour. Understanding the determinants and characteristics of physical activity levels and sedentary behaviour and their correlation with functional capacity may help healthcare professionals in developing tailored interventions for individuals with ILD.

We hypothesised that: i) severity and subtype of the disease, age, LTOL use, and symptoms (both physical and psychological) will affect negatively and moderately physical activity levels, sedentary behaviour and functional capacity in people with ILD; ii) there will be a high percentage of participants that are capable of doing physical activity but do not do it, and a higher percentage of people that do not have the capacity and do not do physical activity. Thus, this study aimed to i) characterise the physical activity levels, sedentary behaviour, and functional capacity; ii) explore their determinants and relationships; and iii) determine the distribution across the four quadrants (of functional capacity and functional performance and of functional capacity and sedentary behaviour) of people with ILD.

2. Methods

A secondary analysis of data from two randomised controlled studies (NCT04711057 and SFRH/BD/148741/2019) was performed. Studies were conducted at the Respiratory Research and Rehabilitation Laboratory of the School of Health Sciences (Lab3R-ESSUA), University of Aveiro, Aveiro, Portugal or at patients' home.

2.1. Study design

A retrospective cross-sectional study was conducted, according to Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines (17)

2.2. Participants

Individuals were recruited from *Centro Hospitalar do Baixo Vouga* and primary healthcare centres of the centre region of Portugal, between October 2020 and March 2023. Adult individuals were included if diagnosed with stable ILD (i.e., no hospital admissions, exacerbations – i.e., acute, clinically significant respiratory deterioration, typically less than 1 month in duration, with new bilateral glass opacity and/or consolidation superimposed on a background pattern consistent with fibrosing ILD (18) – or changes in their pharmacological treatment strategy) and presented no history of acute cardiac or other respiratory condition (e.g., heart attack, COPD) in the previous month. Individuals were excluded if they presented a clinical condition which may limit their participation (e.g., cognitive impairments) or performance of the one-min sit-to-stand test (1min-STS).

2.3. Ethical considerations

Ethical approval was obtained from the Ethics Committee for Health of the Administração Regional de Saúde do Centro (Ref. 16/2020), from the Ethics Committee of the Centro Hospitalar do Baixo Vouga (N/ref.15-04-2019; 15-05-2019) and the Health Sciences Research Unit: Nursing from the Nursing School of Coimbra (P/NºP619-10/2019; P620-10/2019). Data protection followed the European regulation (EU 2016/679). Informed consent was obtained from each participant prior to any data collection.

2.4. Data collection

A structured questionnaire was used to collect sociodemographic (age and gender), anthropometric (height and weight to compute body mass index [BMI], interpreted as: < 21.0, higher risk of mortality and >32.0, lower risk of mortality (19) and general clinical data (smoking habits, number of exacerbations/falls in the past year, medication, LTOT and non-invasive ventilation [NIV] use and comorbidities). ILD subtype and lung function, such as FVC %predicted (percentage of predicted forced vital capacity) and percentage of predicted diffusing capacity of carbon monoxide (DL_{CO}%predicted) was obtained from participants' medical records and was scored as the ILD-GAP (interstitial lung disease – gender, aged, physiology) model (20).

2.4.1. Severity of the disease

Severity of the disease was assessed using the ILD-GAP model (20). This model uses the ILD subtype (IPF or unclassified ILD: 0 points, CTD-ILD/Idiopathic NSIP [nonspecific interstitial pneumonia] or fHP: -2 points), gender (female: 0 points, male: 1 point), age (≤60: 0 points, 61-65: 2 and >65:3), FVC %predicted (<50%: 2 points, 50%-75%: 1 point, >75%: 0 points) and the DL_{CO} %predicted (when the participant could not perform the test, it was attributed a score of three, ≤35%: 2 points, 36%-55%: 1 point, >55%: 0 points), to score (from 0 to 8) the severity of the ILD. Higher scores indicate higher mortality risk (20).

2.4.2. Dyspnoea

The modified British Medical Research Council dyspnoea scale (mMRC) was used to assess patients' dyspnoea during patients' daily life. This scale consists in five grades respecting five statements about perceived breathlessness: grade 0: "I only get breathless with strenuous exercise"; grade 1: " I get short of breath when hurrying on the level or up a slight hill"; grade 2, " I walk slower than people of the same age on the level because of breathlessness or have to stop for breath when walking at my own pace on the level"; grade 3, "I stop for breath after walking 100 yards or after a few minutes on the level"; and , grade 4: "I am too breathless to leave the house" (21). Grade 2 or above are considered as clinically relevant dyspnoea (22). The mMRC is also validated for the Portuguese population (23) and it has showed strong correlations with the FVC%predicted (r =-0.35), the Hospital Anxiety and Depression Scale (HADS) (r =0.49), the 6MWT (r =-0.38), and the St. George's Respiratory Questionnaire-interstitial lung disease (SGRQ-I) (r=0.67) in people with IPF (24). Moreover, mMRC showed to be useful when assessing disease severity for IPF patients(25).

2.4.3. Fatigue

Fatigue was assessed using the 13-item Functional Assessment of Chronic Illness Therapy-Fatigue subscale (FACIT-FS), with higher scores indicating less fatigue (Webster et al., 2003). Scores below 43 points indicate clinically significant fatigue (26). In individuals with COPD, FACIT-FS has demonstrated good convergent validity with moderate to strong correlation with the SGRQ (r =-0.70) and the mMRC (r =-0.48) (Al-Shair et al., 2012). The internal consistency of FACIT-FS was also high in the COPD population, achieving a Cronbach's α of 0.91 at baseline(27). Although validation of FACIT-FS for the ILD population is not available, earlier studies have used it to measure fatigue in sarcoidosis patients (28).

2.4.4. Anxiety and depression symptoms

The Hospital Anxiety and Depression Scale (HADS) was used to assess symptoms of anxiety and depression (29). This scale consists of 14 items (seven for anxiety and seven for depression) and ranges from zero to 21. Scores below 8 are considered "normal", while scores equal or higher than 8 are considered "abnormal" (30). The HADS has been validated for the Portuguese population, with a Cronbach's α of 0.76 and 0.81 for the anxiety and depression subscales, respectively (31). Even though HADS has not been validated for people with ILD, previous studies have used this scale in that population (32).

2.4.5. Health-related quality of life (HRQoL)

The HRQoL was evaluated using an IPF-specific version of St. George Respiratory Questionnaire, the SGRQ-I (33,34). This questionnaire is comprised by 34-items which assess three domains: symptoms (frequency and severity of the respiratory symptoms), activity (ADL that are limited by breathlessness) and impact (social and psychological caused by the disease) as the original SGRQ (Jones et al., 1991; Prior et al., 2021). Similarly, the total score of SGRQ-I ranges between 0 to 100, with lower scores indicating better HRQoL (34). SGRQ-I internal reliability was similar to the original SGQR (Symptoms Cronbach's α = 0.62; Activity Cronbach's α = 0.80; Impacts Cronbach's α = 0.85) (34).

In cases where SGRQ-I data was unavailable, we used the SGRQ data and then converted it to SGRQ-I using the methodology described by previous studies (33). This conversion method has demonstrated strong psychometric properties, with a Cronbach's α of 0.92, an $ICC_{2,1}$ of 0.99. Additionally, the converted SGRQ-I score exhibited moderate correlations with DL_{CO} %predicted (r = -0.49) and the 6MWT (r = -0.51) based on the SGRQ total score (33).

2.4.6. Balance

Balance was measured using the Brief-Balance Evaluation Systems Test (Brief-BEST test). This test includes the assessment related to mechanical constraints, limits of stability, anticipatory postural adjustments, reactive postural responses, sensory orientation, and stability in gait. Higher scores indicate higher balance (35). Brief-BEST test presented excellent interrater ($ICC_{2,1}$= 0.97) and intrarater reliability ($ICC_{2,1}$=0.82) (36). Moreover, this test demonstrated a percentage

of sensitivity and specificity of 81% and 73%, respectively (36). Scores bellow 16.5 points on Brief-BEST test indicate higher risk of falling (36).

2.4.7. Functional capacity – 1min-STS

Functional capacity was assessed by the number of repetitions performed in the 1min-STS (Bohannon, 1995). A standard 46cm height chair without arm rest which was stabilized against a wall was used to perform the test. Participants were sat with the arms on their side, and they were asked to move forward on the chair far enough to touch the floor with both feet. They were instructed to stand and sit (sit-to-stand-to-sit) as many times as possible for one minute, starting on the command "go". The test was first demonstrated by the researcher. A stopwatch was used to time count. The score was considered the number of complete repetitions, with higher number of repetitions indicating better functional capacity. The 1min-STS has demonstrated excellent reliability ($ICC_{2,1}$=0.937; 95%CI= 0.81-0.98)(37). Additionally, the 1min-STS was highly correlated with the 6MWT(*r* = 0.823; p=0.001) and moderately correlated with peak cycling work capacity during a cardiopulmonary exercise test (*r*=0.702; p=0.003) (37). Functional capacity impairment was considered for repetitions below 19.5 in the 1min-STS or below 70% predicted (38,39).

2.4.8. Functional performance – Physical activity

Functional performance was measured using physical activity levels, which was assessed through time spent in light, moderate, vigorous and moderate-to-vigorous (MPVA) PA (in min/day and min/week) and steps/day, (40,41) with an accelerometer (Actigraph® GT3X+, Actigraph, FL, USA). Participants wore the accelerometer on their waist (i.e., over the right hip) using an elastic belt, for, at least, 4 consecutive days from 7:00am-10:00pm (42). Physical activity raw data was downloaded into 60-second epochs and converted into time-stamped physical activity counts and step counts using a specific software (Actilife, Pensacola, FL, USA). Non-wear periods were identified using the Choi algorithm (43–45). Aguilar-Farias cut-off was used to define sedentary behaviour (vector magnitude unit [VMU]<199) (46) and Santos-Lozano cut-offs were used to define light (≤2750 VMU), moderate (2751-9358 VMU), vigorous (≥9359 VMU) PA (47). Both cut-offs were developed for the older population (48). The Actigraph GT3X® is reliable ($ICC_{2,1}$ = 0.93) for use in people with CRD (42).

According to the World Organization of Health (WHO) a person to be physically active needs to accumulate at least 150 minutes/week of moderate-intensity physical activity or 75

minutes/week of vigorous-intensity physical activity (49). Additionally, if a person did less than 5000 steps per day was considered physically inactive (50).

2.4.9. Sedentary behaviour

The accelerometer (Actigraph® GT3X+, Actigraph, FL, USA) was also used to collected participants' time spent in sedentary behaviour.

Time spent in activities involving an energy expenditure of 1.5 METS (metabolic equivalent of task) or lower (14) was counted. According to WHO guidelines the amount of time spent in sedentary behaviour should be limited (49). It is important to notice that physical inactivity and sedentary behaviour are different constructs. A person is considered physically inactive when she/he do not meet the physical activity guidelines (14). A cut-off point of eight hours (480 minutes) per day was considered in sedentary behaviour by people with IPF and COPD (16,51).

2.5. Data analysis

Data analysis was performed with the IBM SPSS Statistics software version 28 (IBM SPSS, Chicago IL, USA).

Descriptive statistics, including frequencies and percentages for categorical variables and mean and standard deviation (SD) or medians and percentiles for continuous variables, according to data distribution, were used to describe the sample. Assumption of normality was assessed using the Shapiro-Wilk test (Peat & Barton, 2008).

Physical activity levels were compared between ILD subtype (i.e., fHP, IPF, CTD-ILD, and other forms [e.g. sarcoidosis] of ILD) and severity, using the ILD-GAP model (0-3 for lower severity, ≥4 for higher severity) (20). U Mann-Whitney and Kruskal-Wallis tests were used to compare groups (52).

A stepwise, multivariate linear regression was used to determine which variables were associated with physical activity levels among individuals with ILD. If residuals were not normally distributed, a logarithmic transformation was applied to the dependent variable. A p-value<0.05 was set as statistically significant. Variables entering in the model were selected according to the literature available (e.g., age, sex, LTOT, severity of disease, functional capacity, balance).

Correlation between functional capacity and physical activity or sedentary behaviour were explored with the Pearson or Spearman's correlation coefficient, according to data distribution. From 0.1 to 0.3 correlation was considered weak, while from 0.4 to 0.6 and 0.7 to 0.8 were considered moderate and strong correlations, respectively (53).

The quadrant concept was used to present the individuals distribution across the functional capacity and level of physical activity, i.e.: 1) "can't do, don't do" group – low functional capacity (1min-STS<19.5 repetitions) and low physical activity (<5000 steps/day or <150min/week of MVPA); 2) "can do, don't do" group – preserved functional capacity (1min-STS ≥19.5 repetitions) and low physical activity (<5000 steps/day or 150min/week of MVPA); 3) "can't do, do do" group- low functional capacity (1min-STS<19.5 repetitions) and preserved physical activity (≥5000 steps/day or ≥150min/week of MVPA); and, 4) "can do, do do" group- preserved both functional capacity (1min-STS ≥19.5 repetitions) and physical activity (≥5000 steps/day or ≥150min/week of MVPA) (Koolen et al., 2019). Similarly, the quadrant distribution for time spent daily in sedentary behaviour was: 1) "can't do (1min-STS<19.5 repetitions), less sedentary (<480 min/day)" group – low functional capacity and low time spent in sedentary behaviour; 2) "can do (1min-STS ≥19.5 repetitions), less sedentary" (<480 min/day) group – preserved functional capacity and higher time spent in sedentary behaviour; 3) "can do (1min-STS ≥19.5 repetitions), more sedentary (≥480 min/day)" group – preserved functional capacity and higher time spent in sedentary behaviour; 4) "can't do(1min-STS<19.5 repetitions), more sedentary (≥480 min/day)" group – lower functional capacity and higher time spent in sedentary behaviour. Comparisons across quadrants were analysed by Kruskal-Wallis tests or ANOVA according to the distribution of continuous variables. Chi-square test were used in categoric variables across quadrant analysis.

3. Results

Eighty-three participants were recruited. From those, five were excluded due to: missing data on lung function (n=3) and non-compliance with the Actigraph (n=2). Seventy-eight participants were, therefore, included for the analysis as described in Figure 1 – Flow.

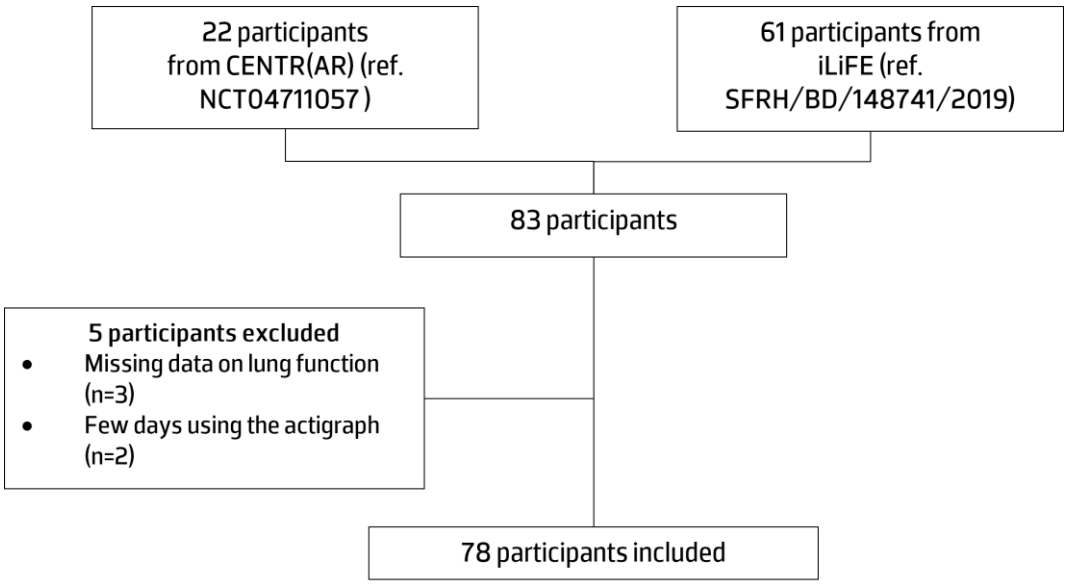

Figure 1 – Flow diagram of the participants included in the study (n=78).

Approximately half of participants were female (n=41, 53%), with a mean age of 68 years old. Individuals had on average a DL_{CO} of 54.5±2.4%predicted and a FVC of 81.0±2.1%predicted. Their ILD-GAP Index ranged between 0-3 (n=64, 82%) and the fHP (n=31, 40%) was the most common diagnosis.

Participants spent on average 367.3±12.8 minutes/day in light, a median of 12.3 [3.3-28.8] minutes/day in moderate, and a median of 0.0[0.0-0.0] minutes/day in vigorous, intensity physical activity. A median of 12.3 [3.3-28.8] minutes/day and a median of 90.0 [17.0-211.0] minutes/week of MVPA were observed. Most participants (n=51; 65.4%) did less than the 150 minutes/week recommended by WHO (49). Participants walked a median of 4629.4[2745.0-6581.7] steps/day, and most (n=47; 60.3%) did less than 5000 steps/day. Approximately half of the sample (n=42; 54.5%) spent more than 8h/day in sedentary behaviour. Detailed characteristics of the sample are described in Table 1.

Table 1 – Baseline characteristics of participants with interstitial lung disease included in study (n=78).

Characteristics	**People with ILD (n=78)**
Age (years)	68±1
Sex (female), n (%)	41 (52.6)
BMI, kg/m²	28.1 [24.7-31.7]
<21, n (%)	4 (5.1)
Between 21 and 32, n (%)	48(61.5)
>32, n (%)	26(33.4)

Smoking status, n (%)	
Never smoked	46 (59.0)
Former smoker	30 (38.5)
Current smoker	2 (2.6)
Exacerbations in the last year	0 [0.0-0.0]
Number of falls in the last year	0 [0.0-1.0]
Respiratory medication, n (%) (n=71)	
Anti-fibrotics	13 (18.3)
Corticosteroids	43 (59.7)
Immunosuppressors	34 (47.9)
Bronchodilators	42 (59.2)
Comorbidities, n (%) (n=77)	
Diabetes	25 (32.5)
Dyslipidaemia	26 (33.8)
Arterial hypertension	42 (54.5)
Other cardiovascular diseases	12 (15.6)
Pulmonary hypertension	1 (1.3)
Obstructive sleep apnoea	5 (6.5)
Anxiety	3 (3.9)
Depression	10 (13.0)
LTOT, n (%)	32 (41.0)
NIV, n (%)	13 (16.7)
Lung Function	
DL_{CO}% predicted	54.5±2.4
FVC% predicted	81.0±2.1
ILD GAP model, n (%)	
0-3	64 (82.1)
≥4	14 (17.9)
ILD subtype, n (%)	
fHP	31 (39.7)
IPF	20 (25.6)
CTD-ILD	13 (16.7)
Other	14 (17.9)
mMRC, n (%) (n=77)	
<2	25 (32.5)
≥2	52 (67.5)
HADS-Anxiety	6.0 [3.0-8.0]
< 8 points, n (%)	49 (62.8)
≥8 points, n (%)	29 (37.2)
HADS-Depression	7.0 [3.0-10.0]
< 8 points, n (%)	49 (62.8)
≥8 points, n (%)	29 (37.2)
SGRQ-I (n=68)	
Symptoms	46.1±3.0
Activity	67.3 [48.2-89.0]
Impact	37.8±2.6
Total	47.0±2.5
FACIT-FS (n=77)	37.0 [28.0-44.0]
≤43 points, n (%)	57 (74.0)
>43 points, n (%)	20 (26.0)
Brief-BEST test (n=78)	18.0[12.0-21.0]

≤16.5 points, n (%)	33 (42.3)
>16.5 points, n (%)	45 (57.7)
1minSTS, %predicted (n=77)	60.2±2.6
1minSTS, repetitions(n=77)	20.1±0.9
<19.5 repetitions, n (%)	39 (50.6)
≥19.5 repetitions, n (%)	38 (49.4)
Physical Activity	
Light (min/day)	367.3±12.8
Moderate (min/day)	12.3 [3.3-28.8]
Vigorous (min/day)	0 [0.0-0.0]
MVPA (min/day)	12.3 [3.3-28.8]
MVPA (min/week)	90.0 [17.0-211.0]
≤150 min/week, n (%)	51 (65.4)
> 150 min/week, n (%)	27 (34.6)
Steps (steps/day)	4629.4 [2745.0-6581.7]
<5000 steps/day, n (%)	47 (60.3)
≥5000 steps/day, n (%)	31 (39.7)
Sedentary (min/day)	**475.5±13.3**
≤ 480 min/day, n (%)	35 (45.5)
> 480min/day, n (%)	42 (54.5)

Legend: 1minSTS, one minute sit-to-stand test; BMI, Body Mass Index; Brief-BEST test, Brief-Balance Evaluation Systems Test; CTD-ILD, connective tissue disease related interstitial lung disease; DL_{CO}% predicted, percentage of predicted diffusing capacity of carbon monoxide; FACIT-FS, Functional Assessment of Chronic Illness Therapy-Fatigue subscale; fHP, fibrotic hypersensitivity pneumonitis; FVC% predicted percentage of predicted forced vital capacity; HADS, hospital anxiety and depression scale; ILD, interstitial lung disease; ILD-GAP model, interstitial lung disease-gender age and physiology index; LTOT, long-term Oxygen Therapy; mMRC, modified British Medical Research Council dyspnoea scale; MVPA, moderate to vigorous physical activity; NIV, non-invasive ventilation; SGRQ-I, St. George's Respiratory Questionnaire- interstitial lung disease.

3.1. Functional capacity, physical activity and sedentary behaviour in people with ILD

Number of repetitions in the 1min-STS, number of steps per day (P=0.001), time spent on MVPA per day (P=0.002) and per week (P=0.002) and time spent during moderate intensity PA (P=0.002) were significantly different across scores of the ILD-GAP model (Table 2).

Table 2 – Functional capacity, physical activity levels and time spent in sedentary behaviour of participants with interstitial lung disease according to the Interstitial Lung Disease – Gender, Age, Physiology model (ILD-GAP model) (n=78)

	ILD GAP index		P value
	0-3 (n=64)	≥4 (n=14)	
1min-STS (repetitions)	21.1±0.9	15.5±1.9	0.012*
Light (min/day)	379.2±13.1	325.7±37.1	0.129
Moderate (min/day)	17.6[5.7-33.4]	2.1[1.0-6.9]	0.002*
MVPA (min/week)	107.5[31.0-244.5]	14.5[5.0-48.0]	0.002*
MVPA (min/day)	17.6[5.7-33.4]	2.1[1.0-6.9]	0.002*
Vigorous (min/day)	0.0[0.0-0.0]	0.0[0.0-0.0]	0.506
Steps (steps/day)	4716.9[3555.0-6896.5]	1732.8[1151.1-3921.3]	0.001*
Sedentary (min/day)	462.9±14.5	532.4±30.4	0.045*

Legend: 1min-STS, one minute sit-to-stand test; MVPA, moderate to vigorous physical activity.

No differences were observed among ILD subtypes (Table 3).

Table 3 – Sedentary behaviour and physical activity levels of participants with interstitial lung disease according to the interstitial lung disease subtypes (n=78)

	ILD Subtype				P value
	fHP (n=31)	IPF (n=20)	CTD-ILD (n=13)	Others (n=14)	
1min-STS (repetitions)	19.8±1.4	18.6±1.8	19.3±2.2	23.6±1.6	0.292
Light (min/day)	386.7±17.3	328.9±31.0	375.5±28.3	384.0±29.8	0.318
Moderate (min/day)	8.6[2.3-33.4]	7.9[1.1-27.3]	16.2[8.1-31.4]	21.6[11.6-61.6]	0.088
MVPA (min/week)	62.0[15.0-234.0]	55.0[5.0-184.0]	115.0[60.0-220.0]	140.0[81.0-431.0]	0.090
MVPA (min/day)	8.6[2.3-33.4]	7.9[1.1-27.3]	16.2[8.1-31.4]	21.6[11.6-61.6]	0.088
Vigorous (min/day)	0.0[0.0-0.0]	0.0[0.0-0.0]	0.0[0.0-0.0]	0.0[0.0-0.0]	0.801
Steps (steps/day)	4428.8[2413.5-5935.1]	4063.2[1205.0-5864.7]	4890.2[3756.4-7735.4]	5686.0[4372-8759.9]	0.104
Sedentary behaviour(min/day)	443.1±19.7	525.5±25.2	480.4±29.8	457.9±35.3	0.083

Legend: 1min-STS, one minute sit-to-stand test; CTD-ILD, connective tissue disease-related interstitial lung disease; fHP, fibrotic hypersensitivity; IPF, idiopathic pulmonary fibrosis; MVPA, moderate to vigorous physical activity

3.2. Determinants of physical activity and sedentary behaviour

Age (B=0.932; P<0.001), having a score of at least 2 in the mMRC (B=0.374; P=0.006), using LTOT (B=0.412; P=0.015) and the number of repetitions on 1min-STS (B=1.058; P=0.030) were identified as contributors to the variance of time spent in MVPA per day. Thus, aging one year will decrease 7% of time spent in MVPA per day and a rate higher than 2 in mMRC and using LTOT will contribute to a reduction of 63% and 41%, respectively.

The mMRC (B=-2296.743; P=0.004), and the number of repetitions in the 1min-STS (B= 104.831; P=0.048), were also significant contributors to the variance of the number of steps/day. Specifically, aging one year will imply a decrease of 126 steps/day, having a score of at least 2 in the mMRC will contribute to a decrease of 2296 steps/day, and an increase of one repetition in the 1min-STS will imply an increase of 104 steps/day.

Contributors identified for sedentary behaviour were the score in the Brief-BEST test (B=-7.445; P<0.003) and having a diagnosis of fHP (B=-91.567; P=0.001). When increasing one point in the Brief-BEST test a decrease of 7 minutes per day in time spent in sedentary behaviour will be observed, while having a diagnosis of fHP will decrease 92 minutes spent in sedentary behaviour when compared to IPF or CTD-ILD. Details about the multivariate analysis are described in Table 4.

Table 4 – Multivariate analysis of contributors for physical activity and sedentary behaviour in people with interstitial lung disease (n=78).

	MVPA (min/week)			Steps (steps/day)			Sedentary behaviour (min/day)		
	B(95%CI)[1]	P Value	R square adjusted	B(95%CI)	P Value	R square adjusted	B(95%CI)	P Value	R square adjusted
Age	0.932(0.895, 0.968)	<0.001	0.367	-126.312(-200.747, -51.876)	0.001	0.453	---	---	0.267
mMRC	0.445(0.210, 0.9445)	0.035		-2296.743 (-3800.913, -792.573)	0.004		---	---	
LTOT	0.414(0.201, 0.852)	0.018		---	---		---	---	
fHP diagnosis	---	---		---	---		-91.567(-144.747, -38.387)	0.001	
1min-STS	---	---		104.831 (0.78,208.880)	0.048		---	---	
Brief-BEST test	---	---		---	---		-7.445(-12.288, -2.602)	0.003	

Legend:1min-STS one minute sit-to-stand test; Brief BEST test, Brief Balance Evaluation Systems Test; fHP, fibrotic hypersensitivity pneumonitis; LTOT, long-term Oxygen Therapy; mMRC, modified Medical Research Council; MVPA, moderate to vigorous physical activity

[1] Exponential of linear regression coefficients.

3.3. Relationship between functional capacity and physical activity and sedentary behaviour

Significant, moderate, and positive correlations between the number of repetitions in the 1min-STS and the time spent in MVPA per week (r_s=0.547, P<0.001) and between the number of repetitions in the 1minSTS and the number of steps and (r_s=0.549, P<0.001) were observed. A significant, moderate, and negative correlation between the number of repetitions in the 1minSTS and the time spent in sedentary behaviour (r=-0.314, P=0.005) was also found. Detailed description of these associations can be found in 5.

Table 5 - Correlations between physical activity, functional capacity, and sedentary behaviour in people with interstitial lung disease (n=77)

	MVPA (min/week)	Steps (steps/day)	Sedentary behaviour (min/day)	1min-STS (repetitions)
1min-STS (repetitions)	r_s=0.547	r_s=0.549	r=-0.338	r=1.000
	P<0.001	P<0.001	P=0.014	
MVPA (min/week)	r_s= 1.000	r_s=0.841	r_s=-0.489	r_s=0.547
		P<0.001	P<0.001	P<0.001
Steps (number/day)	r_s=0.841	r_s=1.00	r_s=-0.678	r_s=0.549
	P<0.001		P<0.001	P<0.001
Sedentary behaviour (min/day)	r_s=-0.489	r_s=-0.678	r=1.000	r=-0.338
	P<0.001	P<0.001		P=0.003

Legend: 1min-STS, one minute sit-to-stand test; MVPA, moderate to vigorous physical activity; r_s, Spearman correlation coefficient; r, Pearson correlation coefficient

3.4. Distribution across quadrants

Participants' distribution according to the quadrants of functional capacity and performance, i.e., time spent in MVPA per week (Figure 2A) was: 1) 32 (42%) on the "can't do, don't"; 2) 18 (23%) on the "can do, don't do"; 3) 20 (26%) on the "can do, do do"; 4) 7 (11%) on the "can't do, do do". Distribution of participants according to the quadrants of functional capacity and performance, i.e., steps per day (Figure 2B) was: 1) 31 (40%) on the "can't do, don't"; 2) 15 (19%) on the "can do, don't do"; 3) 23 (30%) on the "can do, do do"; 4) 8 (10%) on the "can't do, do do".

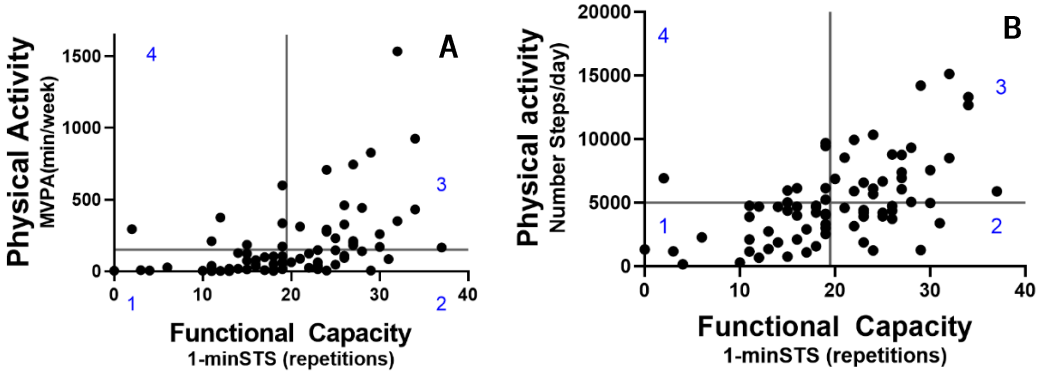

Figure 2 – Scatterplot showing the distribution of participants with interstitial lung disease (n=77) according to their functional capacity measured with the one minute sit to stand test (1min-STS) and: a) their physical activity measured with the time spent in moderate to vigorous physical activity (MVPA) per week; and, b) number of steps per day. Vertical solid black lines represent the 19.5 cut-off point. The horizontal line on graph A represent 150 minutes of MVPA per week. The horizontal line on graph B represents the cut-off of 5000 steps per day. Numbers represent different quadrant groups: 1) can't do, don't do quadrant; 2) can do, don't do; 3) can do, do do; 4) can't do, do do.

Significant differences were found in age (P=0.021), LTOT(P=0.002), mMRC (P=0.015), HADS – anxiety subcale (P=0.028), FACIT-FS (P=0.006), Brief BEST test (P=0.006), 1min-STS (P<0.001) and PA levels, namely in MVPA (P<0.001), and steps per day (P<0.001), and in time spent in sedentary behaviour (P=0.002), among quadrants of the 1minSTS vs MVPA. Detailed information can be consulted in **Error! Reference source not found.**.

Table 6– Sample characteristics per quadrant: 1-minute sit-to-stand (repetitions) vs moderate to vigorous physical activity (minutes per week) in people with interstitial lung disease (n=77)

Chacteristics	Can't do, don't do (n=32)	Can do, don't do (n=18)	Can do, do do (n=20)	Can't do, do do (n=7)	P value
Age, years	71.8 ± 1.9 [a]	67.2±2.5	62.7±2.4	64.3 ± 2.8	0.021*
Sex (female), n (%)	19 (59.4)	7 (38.9)	11 (55.0)	4 (57.1)	0.564
BMI					0.387
<21, n (%)	2 (6.3)	1 (5.6)	0 (0.0)	1 (14.3)	
Between 21 and 32, n (%)	16 (50)	14 (77.8)	13 (65.0)	4 (57.1)	
>32, n (%)	14 (43.8)	3 (16.7)	7 (35.0)	2 (28.6)	
LTOT, n (%)	21 (27.3)	4 (22.2)	4 (20.0)	4 (57.1)	0.002*
ILD GAP model					0.207
0–3, n (%)	23 (71.9)	15(83.3)	19 (95.0)	6 (85.7)	
≥4, n (%)	9 (28.1)	3(16.7)	1 (5.0)	1 (14.3)	
ILD subtype					0.955
fHP, n (%)	14 (43.8)	6 (33.3)	8 (40.0)	3(42.9)	
IPF, n (%)	9 (28.1)	5 (27.8)	5 (25.0)	1 (14.3)	
CTD, n (%)	5(15.6)	4 (22.2)	2 (10.0)	1 (14.3)	
Other, n (%)	4 (12.5)	3 (16.7)	5 (25.0)	2 (28.6)	
mMRC, (n=76)					0.015*
<2, n (%)	4 (12.5)	6(33.3)	11 (55.0)	3 (42.9)	
≥2, n (%)	27 (84.4)	12 (66.7)	9 (45.0)	4 (57.1)	
HADS– Anxiety					0.028*
<8 points, n (%)	15 (46.9)	15 (83.3)	15 (75.0)	3 (42.9)	
≥8 points, n (%)	17 (53.1)	3 (16.7)	5 (25.0)	4 (57.1)	
HADS– Depression					0.221
<8 points, n (%)	17 (53.1)	13 (72.2)	15 (75.0)	3 (42.9)	
≥8 points, n (%)	15 (46.9)	5 (13.3)	5 (25.0)	4 (57.1)	
SRGQ–I total (n=68)	51.6±4.4	37.8±5.5	42.4±3.1	64.4±6.2	0.254
FACIT–FS	31.0 [25.0–41.0] [b]	39.0[36.5–46.0]	40.1 [33.1–56.2]	67.2 [60.0–74.2] [c]	0.006*
Brief–BEST test	14.0[10.0–18.0] [d,e]	20.0 [15.0–22.5]	21.5 [19.5–23.0]	17.0 [14.0–19.0] [f]	0.006*
1min–STS (repetitions)	15.5 [11.5–18.0] [g,h]	23.0 [22.0–26.0]	27.0[25.5–31.0]	15.0 [11.5–19.0] [i,j]	<0.001*

MVPA (min/week)	22.0[7.5-75.5] [k,l]	62.0[24.0-108.0] [m,n]	319.5 [220.5-583.5]	294.0 [197.0-355.0]	<0.001*
Steps/day)	2911.0 ±297.2 [o,p]	4528.5 ± 508.1 [q]	8438.7±726.0	6677.6±836.0	<0.001*
Sedentary behaviour (min/day)	522.0±17.7 [r]	483.3±24.3	404.3±28.2	418.6±32.8	0.002*

Legend: 1min-STS, one minute sit-to-stand test; BMI, Body Mass Index; Brief-BEST test, Brief-Balance Evaluation Systems Test; CTD-ILD, connective tissue disease related interstitial lung disease; FACIT- FS, Functional Assessment of Chronic Illness Therapy-Fatigue subscale; fHP, fibrotic hypersensitivity pneumonitis; HADS, hospital anxiety and depression scale; ILD-GAP model, interstitial lung disease- gender age and physiology model; LTOT, long-term Oxygen Therapy; mMRC, modified British Medical Research Council, dyspnoea scale; MVPA, moderate to vigorous physical activity; SGRQ-I, St. George's Respiratory Questionnaire- interstitial lung disease; * *P value* < 0.05; [a] P=0.016 vs "can do, do do"; [b] P=0.004 vs "can do, do do"; [c] P=0.046 vs "can do, do do"; [d] P<0.006 vs "can do, don't do"; [e] P<0.001 vs "can do, do do"; [f] P=0.041 vs "can do, do do"; [g] P<0.001 vs "can do, don't do"; [h] P<0.001 vs "can do, do do"; [i] P =0.001 vs "can do, don't do"; [j] P <0.001 vs "can do, do do"; [k] P<0.001 vs "can't do, do do"; [l] P<0.001 vs "can do, do do"; [m] P=0.002 vs "can't do, do do"; [n] P<0.001 vs "can do, do do"; [o] P=0.001 vs "can't do, do do"; [p] P<0.001 vs "can do, do do"; [q] P<0.001 vs "can do, do do"; [r] P<0.001 vs "can do, do do";

Significant differences were found in age (p=0.006), LTOT (p=0.001), mMRC (P<0.001), HADS anxiety subscale (P=0.023), SGRQ-I total score (P=0.023), FACIT-FS (P=0.004), Brief-BEST test (P<0.001), MVPA (min/week) (P<0.001), steps/day (P<0.001), time spent in sedentary behaviour(P<0.001) and in the number of repetitions on 1min-STS (P<0.001) among quadrants of the 1min-STS vs number of steps per day. Detailed information is described in Table 7. To validate the results of quadrant distribution for assessing functional capacity using the 70% predicted in the 1min-STS cut-off, a sensitivity analysis was conducted. The analysis yielded similar findings, as shown in Appendix 1.

Table 7 – Sample characteristics per quadrant: 1-minute sit-to-stand (repetitions) vs steps per day in people with interstitial lung disease (n=77)

Characteristics	Can't do, don't do (n=31)	Can do, don't do (n=15)	Can do, do do (n=23)	Can't do, do do (n=8)	P value
Age, years	72.7±1.9 [a,b]	64.3±2.7	65.2 ±2.4	61.6 ± 1.4	0.006*
Sex (female), n (%)	19 (61.3)	4 (26.7)	14 (60.9)	4 (50.0)	0.131
BMI					0.311
<21, n (%)	3 (9.7)	1 (6.6)	0 (0.0)	0 (0.0)	
Between 21 and 32, n (%)	17 (54.8)	10 (66.7)	17 (73.9)	3 (37.5)	
>32, n (%)	11 (35.5)	4(26.7)	6 (26.1)	5 (62.5)	
LTOT, n (%)	21 (67.8)	4 (26.7)	4 (17.4)	4 (50.0)	0.001*
ILD GAP model					
0–3, n (%)	22 (71.0)	12 (80.0)	22 (95.7)	7(87.5)	0.244
≥4, n (%)	9 (29.0)	3 (20.0)	1 (4.3)	1 (12.5)	
ILD subtype					
fHP, n (%)	16 (51.6)	5 (3.3)	9(39.1)	1 (12.5)	0.132
IPF, n (%)	9 (29.0)	4 (26.7)	6 (26.1)	1 (12.5)	
CTD–ILD, n (%)	4 (12.9)	2 (13.3)	4 (17.4)	2 (25.0)	
Other, n (%)	2 (6.5)	4 (26.7)	4 (17.4)	4 (50.0)	
mMRC (n=76)					
<2, n (%)	3 (10.0)[2]	2 (13.3)	15 (65.2)	4 (50.0)	<0.001*
≥2, n (%)	27 (90.0)[2]	13 (86.7)	8 (34.8)	4 (50.0)	
HADS– Anxiety					
<8 points, n (%)	14 (45.2)	13 (86.7)	17 (74.0)	4 (50.0)	0.023*
≥8 points, n (%)	17 (54.8)	2 (13.3)	6 (26.0)	4 (50.0)	
HADS– Depression					
<8 points, n (%)	17 (54.8)	12 (80.0)	16 (69.6)	3 (37.5)	0.148
≥8 points, n (%)	14 (45.2)	3 (20.0)	7 (30.4)	5 (62.5)	
SRGQ–I total (n=68)	55.0 ±4.6[c]	42.8 ± 4.6	38.8±3.9	52.6±7.0	0.023*
FACIT–FS	28.5 [24.5–39.5] [d,e]	39.0[37.0–45.0]	42.0 [38.0–45.0]	35.0 [26.0–42.0]	0.004*
Brief–BEST test	13.0[10.0–16.5] [f,g,h]	20.5 [17.0–23.0]	21.0 [19.0–23.0]	19.0 [16.5–21.5]	<0.001*
1min–STS (repetitions)	16.0[12.5–18.0] [i,j]	24.5[23.0–26.0]	27.0[24.0–30.0]	17.5[15.0–19.0] [k,l]	<0.001*

[2] n=30

MVPA (min/week)	31.0[12.5–88,0] [m,n]	73.5[27.0–108.0] [o]	283.0[165.0–460.0]	178.5 [102.0–314.5]	<0.001*
Steps/day	2960.6 [1726.3–4178.4] [p,q]	4063.6 [3384.9–4428.8] [r,s]	7478.4 [6111.9–9328.4]	6143.4 [5593.9–8188.0]	<0.001*
Sedentary behaviour (min/day)	523.2 ±22.4[t]	537.2 ±22.8	384.4 ±22.0	435.2 ±28.5	<0.001*

Legend: 1min–STS, one minute sit–to–stand test; BMI, Body Mass Index; Brief–BEST test, Brief–Balance Evaluation Systems Test; CTD–ILD, connective tissue disease related interstitial lung disease; FACIT– FS, Functional Assessment of Chronic Illness Therapy–Fatigue subscale; fHP, fibrotic hypersensitivity pneumonitis; HADS, hospital anxiety and depression scale; ILD–GAP model, interstitial lung disease– gender age and physiology model; LTOT, long–term Oxygen Therapy; mMRC, modified British Medical Research Council, dyspnoea scale; MVPA, moderate to vigorous physical activity; SGRQ–I, St. George's Respiratory Questionnaire– interstitial lung disease; * *P value* < 0.05; [a] P= 0.46 vs "can do, do do"; [b] P =0.038 vs "can do, don't do"; [c] P=0.035 vs "can do, do do"; [d] P=0.001 vs "can do, do do"; [e] P=0.005 vs "can do, don't do"; [f] P=0.011 vs "can't do, do do"; [g] P=0.001 vs "can do, don't do"; [h] P<0.001 vs "can do, do do"; [i] P<0.001 vs "can do, do do"; [j] P<0.001 vs "can do, do do"; [k] P=0.002 vs "can do, don't do"; [l] P<0.001 vs "can do, do do"; [m] P=0.001 vs "can't do, do do"; [n] P<0.001 vs "can do, do do"; [o] P<0.001 vs "can do, do do"; [p] P<0.001 vs "can't do, do do"; [q] P<0.001 vs "can do, do do"; [r] P=0.002 vs "can't do, do do"; [r] P<0.001 vs "can do, do do"; [s] P<0.001 vs "can do, don't do

Participants' distribution according to the quadrants of functional capacity and time spent in sedentary behaviour (Figure 3) was: 1) 19 (25%) on the "can't do, don't spend time"; 2) 23 (30%) on the "can do, don't spend time"; 3) 15 (19%) on the "can do, do spend"; 4) 20 (26%) on the "can't do, do spend" as presented in Figure 3. A sensitivity analysis was performed to validate the results of quadrant distribution using the 70% predicted (percentage of predicted) in the 1min-STS cut-off for assessing functional capacity. Similar results were found (Appendix 1).

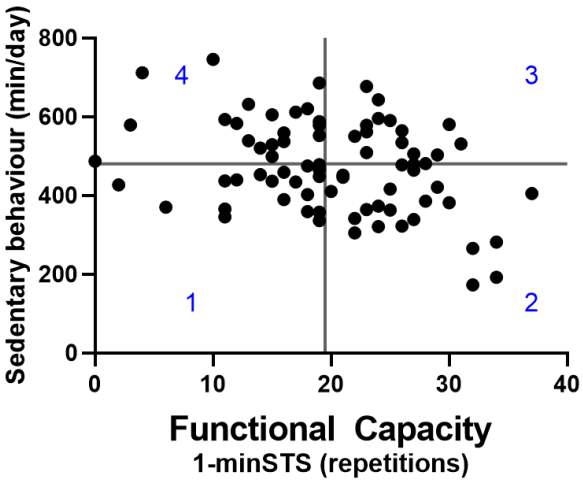

Figure 3 – Scatterplot showing the functional capacity- time spent in sedentary behaviour quadrant distribution (n=77). The vertical line represents the 19.5 repetitions on one minute sit-to-stand. The horizontal line represents the cut-off of eight hours on sedentary behaviour.

Legend: 1) can't do, less sedentary quadrant; 2) can do, more sedentary quadrant; 3) can do, more sedentary quadrant; 4) can't do, more sedentary quadrant. (r=-0.338, P=0.003)

Significant differences were found in sex (P=0.033), LTOT (P=0.002), mMRC (P=0.005), HADS anxiety subscale (P=0.031), SGRQ-I (P=0.037), Brief-BEST test (P<0.001), MVPA (P<0.001), number of steps/day (P<0.001), sedentary behaviour (P<0.001) and the number of repetitions in the 1min-STS (P<0.001) among quadrants of the 1minSTS vs time spent on sedentary behaviour. Comprehensive details are described in Table 8 – Sample characteristics per quadrant: 1-minute sit-to-stand vs time spent in sedentary behaviour in people with interstitial lung disease (n=77)Table 8. A sensitivity analysis was performed to validate the results of quadrant distribution using the 70% predicted (percentage of predicted) in the 1min-STS cut-off for assessing functional capacity. Similar results were found (Appendix 1).

Table 8 – Sample characteristics per quadrant: 1-minute sit-to-stand vs time spent in sedentary behaviour in people with interstitial lung disease (n=77)

Chacteristics	Can't do, less sedentary (n=19)	Can do, less sedentary (n=23)	Can do, more sedentary (n=15)	Can't do, more sedentary (n=20)	P value
Age, years	68.0 [61.0-76.0]	63.5 [57.0-72.0]	68.0 [63.0-74.0]	64.0 [61.0-78.0]	0.196
Sex (female), n (%)	12 (63.2)	15 (65.2)	3 (2)	11 (55.0)	0.033*
BMI					
<21, n (%)	1 (5.3)	1 (4.3)	0 (0.0)	2 (10.0)	0.513
Between 21 and 32, n (%)	11 (57.9)	15 (65.2)	12 (80.0)	9 (45.0)	
>32, n (%)	7 (36.8)	7 (30.4)	3 (20.0)	9 (45.0)	
LTOT, n (%)	12 (63.2)	4 (17.4)	4 (26.7)	13 (65.0)	0.002*
ILD GAP model					
0-3, n (%)	15 (78.9)	22 (95.7)	12 (80.0)	14 (70.0)	0.174
≥4, n (%)	4 (21.1)	1 (4.3)	3 (20.0)	6 (30.0)	
ILD subtype					
fHP, n (%)	10 (52.6)	11 (47.8)	3 (20.0)	7 (35.0)	0.535
IPF, n (%)	4 (21.1)	3 (13.0)	7 (46.7)	6 (30.0)	
CTD-ILD, n (%)	2 (10.5)	4 (17.4)	2 (13.3)	4 (20.0)	
Other, n (%)	3 (15.8)	5 (21.7)	3 (20.0)	3 (15.0)	
mMRC (n=76)					
<2, n (%)	4 (21.1)	12 (54.5)	5 (33.3)	3 (15.0)	0.005*
≥2, n (%)	15 (78.9)	11 (47.8)	10 (66.7)	16 (80.0)	
HADS- Anxiety					
<8 points, n (%)	9 (47.4)	18 (78.3)	12 (80.0)	9 (45.0)	0.031*
≥8 points, n (%)	10 (58.6)	5 (21.7)	3 (20.0)	11 (55.0)	
HADS- Depression					
<8 points, n (%)	10 (52.6)	18 (78.3)	10 (66.7)	10 (50.0)	0.198
≥8 points, n (%)	9 (47.4)	5 (21.7)	5 (33.3)	10 (50.0)	

SRGQ-I total (n=68)	60.4±5.0 [a,b]	41.7±3.4	38.2±5.5	47.6±5.4	0.037*
FACIT-FS	27.0[25.0-35.0] [c,d]	42.0[35.0-45.0] [e,f]	40.5[37.0-47.0]	34.0 [25.5-42.5]	0.004*
Brief-BEST test	16.0 [12.0-19.0] [g]	21.5 [19.0-23.0]	20.5 [16.0-22.0] [h,i]	14.0 [10.0-17.0]	<0.001*
1min-STS (repetitions)	17.0 [14.0-19.0] [j,k]	26.5[24.0-30.0]	24.5 [23.0-27.0] [l,m]	15.0 [13.0-18.5]	<0.001*
MVPA (min/week)	81.0[27.0-209.0] [o]	236.5[93.0-460.0]	123.5[38.0-230.0] [p,q]	35.0[4.0-89.0] [r]	<0.001*
Steps/day	4856.1±454.6 [s,t]	8210.8±684.1 [u,v,w]	4173.8±398.3	2736.9±439.8	<0.001*
Sedentary behaviour (min/day)	416.3±11.6 [y,z]	367.8±17.9 [#,+]	564.5±14.2	597.5±18.3	<0.001*

Legend: 1min-STS, one minute sit-to-stand test; BMI, Body Mass Index; Brief-BEST test, Brief-Balance Evaluation Systems Test; CTD-ILD, connective tissue disease related interstitial lung disease; FACIT- FS, Functional Assessment of Chronic Illness Therapy-Fatigue subscale; fHP, fibrotic hypersensitivity pneumonitis; HADS, hospital anxiety and depression scale; ILD-GAP model, interstitial lung disease- gender age and physiology model; LTOT, long-term Oxygen Therapy; mMRC, modified British Medical Research Council, dyspnoea scale; MVPA, moderate to vigorous physical activity; SGRQ-I, St. George's Respiratory Questionnaire- interstitial lung disease; * *P value* < 0.05; [a] P=0.019 vs "can do, less sedentary"; [b] P=0.012 vs "can't do, more sedentary"; [c] P=0.006 vs "can do, less sedentary"; [d] P=0.004 vs "can't do , more sedentary"; [e] P=0.036 vs "can do, less time"; [f] P=0.019 vs "can't do, more sedentary"; [g] P=0.003 vs "can do, less sedentary"; [h] P=0.005 vs "can't do, more sedentary"; [i] P<0.001 vs "can do , less sedentary"; [j] P<0.001 vs "can't do, more sedentary"; [k] P<0.001 vs "can do, less sedentary"; [l] P<0.001 vs "can't do, more sedentary"; [m] P<0.001 vs "can do, more sedentary; [n] P=0.009 vs "can do, less sedentary"; [o] P<0.001 vs "can do, less sedentary"; [p] P=0.025 vs "can't do, more sedentary"; [q] P=0.009 vs "can do, less sedentary"; [r] P=0.047 vs. "can do, less sedentary"; [s] P<0.001 vs "can do, less sedentary"; [t] P=0.038 vs "can do, more sedentary"; [u] P<0.001 vs "can't do, less sedentary"; [v] P<0.001 can't do, more sedentary"; [w] P<0.001 vs "can do, more sedentary"; [y] P<0.001 vs "can't do, more sedentary"; [z] P<0.001 vs. "can do, more sedentary"; [#] P<0.001 vs "can't do, more sedentary"; [+] P<0.001 vs "can do, more sedentary".

4. Discussion

This study showed most people with ILD have their functional capacity impaired (51%), are physically inactive (65%) and highly sedentary (45.5%). People with ILD in higher severe stages of the disease present lower levels of physical activity, higher sedentary behaviour, and lower functional capacity than those in low severity stages. Moreover, our study showed that physical activity levels can be influenced by age, dyspnoea, the use of LTOT and functional capacity (measured with the 1min-STS) whereas balance and subtype of the disease seem to mainly influence sedentary behaviour, in people with ILD. Furthermore, our investigation found a positive and moderate correlation between physical activity (measured by MVPA and steps per day) and functional capacity (measured with 1min-STS). Sedentary behaviour showed a negative and weak relation between functional capacity. Additionally, we found that sedentary behaviour was negatively correlated with physical activity. In fact, sedentary behaviour was moderately and strongly associated with MVPA and steps per day, respectively. Finally, most of participants were on the "can do, do do" and the "can't do, don't do" on physical activity quadrants and on the quadrants "can do, less sedentary" and "can't do, more sedentary".

High proportions of people with ILD performing less repetitions in the 1min-STS than healthy people (54) and being physically inactive (7,55) has been previously reported. However, these studies had less participants than ours and did not include people with comorbidities. Moreover showed an with an average of 476 minutes time spent on sedentary behaviour being a comparable result to previous in other CRD (51,56). A similar time spent in sedentary behaviour (551.7 min) had been previously reported in people with IPF (57). Our study was the first study including people with all ILD diagnosis and using accelerometer on the waist.

Impaired functional capacity in ILD accelerates the disease progression and mortality risk (58,59). Moreover, physical activity and low sedentary behaviour are considered key outcomes in decreasing mortality risk in respiratory diseases (4,15,49). Therefore, approaches that aim to promote physical activity, improve functional capacity, and reduce sedentary behaviour in this population are fundamental.

This study also showed the possible contributors for the levels of physical activity. Age and dyspnoea were found to be contributors in both MVPA (min/week) and steps per day, which is corroborated by previous studies (10–12). Furthermore, the use of LTOT was considered a contributor for MVPA. Studies in the COPD population have shown that those on home oxygen demonstrated low levels of physical activity (60). Nevertheless, some studies showed a

significantly higher time spent in activities equal or higher than 2 METs between patients who not used LTOT and patients who used oxygen (61). Impairment in gas exchange (i.e., less DL_{CO}% predicted) is related to higher severity of the disease, which can induce to hypoxaemia related to exercise (62). Consequently, hypoxaemia can limit physical activity (62). Functional capacity was identified as a contributor for steps per day, but not to time spent in MVPA, which corroborates with previous studies (10,12). Thus, by identifying the contributors, it is possible to plan meaningful interventions.

Our study also showed that sedentary behaviour can be affected by balance and fHP subtype. Indeed, people with ILD present skeletal muscle dysfunction (either caused by medication or by physical inactivity) (62), which might compromise balance (63). However, to our knowledge the literature about the impact of balance on sedentary behaviour is scarce. Future studies should explore the relationship between balance and sedentary behaviour, to characterize the balance on ILD population. We did not find differences on time spent in sedentary behaviour across ILD subtypes, which might be explained by the similar severity levels among patients independently of their diagnosis.

Considering functional capacity and physical activity quadrants we found a higher percentage of people on the "can do, do do" and on the "can't do, don't do" quadrants. Our findings of the participant's distribution among the quadrants translate the importance of functional capacity as a modifiable enabler or a barrier to physical activity levels. This distribution is also verified in people with COPD (39,64). This is the first study exploring this framework in people with ILD, allowing personalized interventions (such as, pulmonary rehabilitation aiming to improve functional capacity, physical activity counselling, self-management strategies and interventions focused on reducing perceived barriers and promoting enablers to maintain physical activity) (39). Yet interventions planned to take into consideration quadrant distribution need further investigation.

When looking for the functional capacity and sedentary behaviour quadrants, people seem to be distributed similarly across them. Thus, our results shows the need of specific interventions when aiming to change sedentary behaviour (65). It is well known that time spent in sedentary behaviour is an independent predictor of mortality in COPD and international guidelines recommend to minimize as much as possible the time spent in such behaviour (15). Pulmonary rehabilitation programs have shown benefits in improving functional capacity (66) which can be a strategy to be adopted for people on the "can't do, don't spend time" as well as people on "can't

do, do spend time" quadrants. People who are on the "can do, do spend time" and on the "can do, don't spend time" might benefit from physical activity counselling in order to prevent future complications from engaging in sedentary time (15).

The results of this investigation have direct clinical implications in clinical practice to better assess and manage limitations than treating ILD itself (40,67). Functional capacity (64), physical activity (4) and sedentary behaviour (15) are important predictors of poorer prognosis and mortality in people with CRD. By acknowledging the modifiable contributors (e.g., dyspnoea, functional capacity, and balance) of those domains, clinicians can optimize their interventions and consequently patients' outcomes. Additionally, using the quadrants framework will allow clinicians to establish a meaningful treatment to improve physical activity and functional capacity and also to promote a prevention approach for complications from sedentary behaviour and from physical inactivity (39,54).

This study has some strengths and limitations that should be acknowledged. This was the first study describing functional capacity, physical activity, and sedentary behaviour in ILD population. This study also included a real-world sample contributing for a better understanding of ILD. Nevertheless, most participants exhibited milder forms of the disease, specifically fHP or IPF subtypes. Consequently, application of our findings to those with higher severity or different subtypes of the disease, such as CTD-ILD, may be limited. Finally, the cut-off points used for assessing functional capacity were developed for people with COPD, which can be different for people with ILD.

5. Conclusion

People with ILD perform low sit-to-stand repetitions, are highly physically inactivity and sedentary. These results are likely to be caused by age, respiratory and physical symptoms. Moreover, some diagnosis might play a role on physical activity and sedentary behaviour. Distribution of people per quadrants of functional capacity and physical activity and/or functional capacity and sedentary behaviour might guide clinicians to establish a personalised approach to improve physical activity and reduce sedentary behaviour in people with ILD.

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Appendixes

Apendix 1 – Sensibility analysis

The participants' distribution according to their time spent in MVPA (Figure S 1A) was: 1) 36 participants (47%) on the "can't do, don't" quadrant; 2) 14 participants (18%) on the "can do, don't doo" quadrant; 3) 16 participants (21%) on the "can do, do do" quadrant; 4) 11 participants (14%) on the "can't do, do do" quadrant. Moreover, the distribution across the 1min-STS and steps per day quadrants (Figure S 1B) was: 1) 34 participants (44%) on the "can't do, don't"; 2) 12 participants (16%) on the "can do, don't doo"; 3) 18 participants (23%) on the "can do, do do"; 4) 13 participants (17%) on the "can't do, do do". Additionally, a moderate positive correlation between time spent in MVPA (r_s=0.439, P<0.001) and the number of steps (r_s=0.502, P<0.001) and repetitions on 1min-STS.

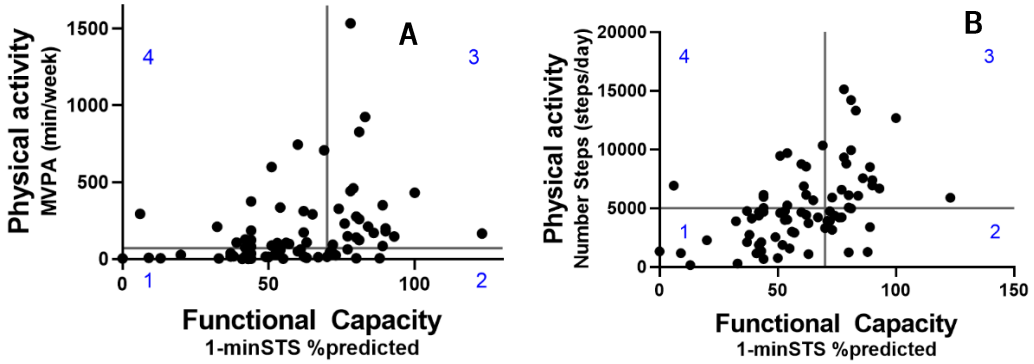

Figure S 1- Scatterplot showing the functional capacity-physical activity quadrant distribution. Sample n=77 Legend: A) Percentage of predicted repetitions during 1min-STS (1-minSTS%predicted) and time spent in MVPA (min/week) (r_s=0.439, P<0.001); B) 1-minSTS%predicted and number of steps per day (r_s=0.502, P<0.001); 1) can't do, don't do quadrant; 2) can do, don't do; 3) can do, do do; 4) can't do, do do.

Considering the percentage of predicted 1minSTS and MVPA quadrants, significant difference among groups was found for age (P=0.029), LTOT(P=0.036), mMRC (P=0.017), total score on SGRQ-I (P=0.009), FACIT-FS (P=0.009), Brief BEST test (P=0.009), 1minSTS (P<0.001) and PA levels, namely in MVPA (P<0.001), steps per day (P<0.001), time spent in sedentary behaviour (P=0.006), and functional impairment using 19.5 repetitions on 1min-STS (P<0.001). Detailed information can be consulted on Table S 1.

Table S1 – Sample characteristics per quadrant: 1-minute sit-to-stand (percentage of predicted) vs moderate to vigorous physical activity (minutes per week) in people with interstitial lung disease (n=77).

Characteristics	Can't do, don't do (n=36)	Can do, don't do (n=14)	Can do, do do (n=16)	Can't do, do do (n=11)	P value
Age, years	67.5 [61.0–80.5]	73.0 [68.0–76.0]	65.0 [58.0–73.0] [a]	62.0 [60.0–64.59] [b,c]	0.029*
Sex (female), n (%)	19 (52.8)	7 (50.0)	9 (56.3)	6 (54.5)	0.988
BMI					
<21, n (%)	2 (5.6)	1 (7.1)	0 (0)	1 (9.1)	0.168
Between 21 and 32, n (%)	18 (50.0)	12 (85.8)	9 (56.3)	8 (72.7)	
>32, n (%)	16(44.4)	1 (7.1)	7 (43.8)	2 (18.2)	
LTOT, n (%)	21 (58.3)	4 (28.6)	3 (18.8)	5 (45.4)	0.036*
ILD GAP index					
0–3, n (%)	27 (75.0)	11 (78.6)	16 (100)	9 (81.8)	0.189
≥4, n (%)	9 (25.0)	3 (21.4)	0	2 (18.2)	
ILD subtype					
fHP, n (%)	16 (44.4)	4 (28.6)	7 (43.8)	4(36.4)	0.747
IPF, n (%)	9 (25.0)	5 (35.7)	4 (25.0)	2 (18.2)	
CTD, n (%)	5 (13.9)	4 (28.6)	1 (6.2)	2 (18.2)	
Other, n (%)	6 (16.7)	1 (7.1)	4(25.0)	3 (27.2)	
mMRC (n=76)					
<2, n (%)	5 (14.3)	5 (35.7)	8 (50.0)	6 (54.5)	0.017*
≥2, n (%)	30 (85.7)	9 (64.3)	8 (50.0)	5 (45.5)	
HADS– Anxiety					
<8 points, n (%)	19 (52.8)	11 (78.6)	12 (75.0)	6 (54.5)	0.226
≥8 points, n (%)	17 (47.2)	3 (21.4)	4 (25.0)	5 (45.5)	
HADS– Depression					

<8 points, n (%)	19 (52.8)	11 (78.6)	12 (75.0)	6 (54.5)	0.226
≥8 points, n (%)	17 (47.2)	3 (21.4)	4 (25.0)	5 (45.4)	
SRGQ-I total (n=68)	52.2±4.0 [d]	31.7±5.5 [e]	42.8±3.6	55.8±5.8	0.009*
FACIT-FS	32.7±1.6 [f]	39.9±1.9	40.7±1.9	32.2±3.8	0.009*
Brief BEST test	14.0 [10.0-19.0] [g,h]	18.0 [11.0-21.0]	21.0 [19.0-22.5]	19.0 [16.5-22.0]	0.009*
1min-STS, repetitions(n=77)					
<19.5 repetitions, n (%)	31 (86.1)	1 (7.1)	0	7 (63.6)	<0.001*
≥19.5 repetitions, n (%)	5 (13.9)	13 (92.9)	16 (100.0)	4 (36.4)	
MVPA (min/week)	31.0[10.0-79.5] [i,j]	54.0 [23.0-123.0] [k,l]	301.0[204.5-451.0]	312.0[250.0-487.0]	<0.001*
Steps (steps/day)	2960.6 [1471.1-4629.4] [m,n]	4076.5 [3312.1-5916.3] [o,p]	7478.4 [5975.0-11002.5]	6925.3 [5812.2-9105.2]	<0.001*
Sedentary behaviour (min/day)	524.6 [442.7-588.0] [q,r]	492.2 [416.3-550.6]	395.3 [301.6-492.2]	427.0 [351.5-443.0]	0.006*

Legend: 1min-STS, one minute sit-to-stand test; BMI, Body Mass Index; Brief-BEST test, Brief-Balance Evaluation Systems Test; CTD-ILD, connective tissue disease related interstitial lung disease; FACIT- FS, Functional Assessment of Chronic Illness Therapy-Fatigue subscale; fHP, fibrotic hypersensitivity pneumonitis; HADS, hospital anxiety and depression scale; ILD-GAP model, interstitial lung disease- gender age and physiology model; LTOT, long-term Oxygen Therapy; mMRC, modified British Medical Research Council, dyspnoea scale; MVPA, moderate to vigorous physical activity; SGRQ-I, St. George's Respiratory Questionnaire- interstitial lung disease; * *P value* < 0.05; a P=0.026 vs "can do, don't do"; b P=0.048 vs "can't do, don't do"; c P=0.010 vs "can do, don't do"; d P= 0.015 vs "can do, don't do"; e P=0.021 vs "can't do, do do"; f P=0.030 vs "can do, do do"; g P=0.042 vs "can't do, do do"; h P=0.002 vs "can do, do do"; i P<0.001 vs "can do, do do"; j P<0.001 vs "can't do, do do"; k P<0.001 vs "can do, do do"; l P<0.001 vs "can't do, do do"; m P<0.001 vs "can't do, do do"; n P<0.001 vs "can't do, do do"; o P=0.017 vs "can't do, do do"; p P=0.003 vs "can do, do do"; q P=0.002 vs "can do, do do"; r P=0.014 vs "can't do, do do";

Regarding percentage of predicted on the 1min-STS and steps per day quadrants, statistically important differences were found on age (p=0.042), LTOT (p=0.014), mMRC (P<0.001), SGRQ-I total score (P=0.020), FACIT-FS (P=0.005), Brief-BEST test (P<0.001), MVPA (min/week) (P<0.001), steps/day (P<0.001), time spent in sedentary behaviour(P<0.001) and the number of repetitions on 1min-STS (P<0.001). Detailed information is described on Table S 2.

Table S 2– Sample characteristics per quadrant: 1-minute sit-to-stand (percentage of predicted) vs steps per day in people with interstitial lung disease (n=77).

Characteristics	Can't do, don't do (n=34)	Can do, don't do (n=12)	Can do, do do (n=18)	Can't do, do do (n=13)	P value
Age, years	70.5 [61.0–81.0] [a]	69.0 [66.5–74.0] [b]	69.5 [59.0–75.0]	61.0[60.0–66.0]	0.042*
Sex (female), n (%)	18 (52.9)	5 (41.7)	11 (61.1)	7 (53.8)	0.778
BMI					
<21, n (%)	3 (8.8)	1 (8.3)	0 (0.0)	0 (0.0)	0.614
Between 21 and 32, n (%)	19 (55.9)	8 (66.7)	13 (72.2)	7 (53.8)	
>32, n (%)	12 (35.3)	3 (25.0)	5 (27.8)	6 (46.2)	
LTOT, n (%)	21 (61.8)	4 (33.3)	3 (16.7)	5 (38.5)	0.014*
ILD GAP index					
0–3, n (%)	25 (73.5)	9 (75.0)	18 (100.0)	11 (84.6)	0.111
≥4, n (%)	9 (26.5)	3 (25.0)	0 (0.0)	2 (15.2)	
ILD subtype					
fHP, n (%)	17 (50.0)	4 (33.3)	7 (38.7)	3 (23.1)	0.606
IPF, n (%)	9 (26.5)	4 (33.3)	5 (27.8)	2 (15.2)	
CTD, n (%)	4 (11.8)	2 (16.7)	3 (16.7)	3 (23.1)	
Other, n (%)	4 (11.8)	2 (16.7)	3 (16.7)	5(38.5)	
mMRC (n=76)					
<2, n (%)	4 (11.8)	1 (8.3)	12 (66.7)	7 (53.8)	<0.001*
≥2, n (%)	29 (85.3)	11 (91.7)	6 (33.3)	6 (46.2)	
HADS– Anxiety					
<8 points, n (%)	17 (50.0)	10(83.3)	13 (72.2)	8 (61.5)	0.157
≥8 points, n (%)	17 (50.0)	2 (16.7)	5 (27.8)	5 (38.5)	

HADS- Depression					
<8 points, n (%)	19 (50.9)	10 (83.3)	13 (72.2)	6 (46.2)	0.168
≥8 points, n (%)	15 (44.1)	2 (16.7)	5 (27.8)	7 (53.8)	
SRGQ-I total (n=68)	54.3±4.2 [c]	41.2±5.2	36.0±4.2	50.9±5.4	0.020*
FACIT-FS (n=76)	31.6±1.8 [d]	39.8±2.1	40.6±1.7	34.9±3.0	0.005*
Brief BEST test	13.5 [10.0-18.0] [e,f]	18.0 [11.0-21.5]	21.0 [18.0-22.0]	21.0 [17.0-22.0]	<0.001*
1min-STS, repetitions(n=77)					
<19.5 repetitions, n (%)	30 (88.2)	1 (8.3)	0 (0.0)	8 (61.5)	<0.001*
≥19.5 repetitions, n (%)	4 (11.8)	11 (91.7)	18 (100.0)	5 (38.5)	
MVPA (min/week)	27.0[8.0-87.0] [g,h]	54.0 [19.0-161.5] [i,j]	204.5 [148.0-442.0]	291.0 [123.0-335.0]	<0.001*
Steps (steps/day)	2829.3 [1363.7-4380.9] [k,l]	3912.7 [3235.2-4301.9] [m,n]	7478.4 [6111.9-9943.1]	6867.7 [5953.9-8759.9]	<0.001*
Sedentary behaviour (min/day)	520.6±18.4 [o]	539.6±17.8 [p]	366.5±23.8	434.3±23.3	<0.001*

Legend: 1min-STS, one minute sit-to-stand test; BMI, Body Mass Index; Brief-BEST test, Brief-Balance Evaluation Systems Test; CTD-ILD, connective tissue disease related interstitial lung disease; FACIT- FS, Functional Assessment of Chronic Illness Therapy-Fatigue subscale; fHP, fibrotic hypersensitivity pneumonitis; HADS, hospital anxiety and depression scale; ILD-GAP model, interstitial lung disease- gender age and physiology model; LTOT, long-term Oxygen Therapy; mMRC, modified British Medical Research Council, dyspnoea scale; MVPA, moderate to vigorous physical activity; SGRQ-I, St. George's Respiratory Questionnaire- interstitial lung disease; * *P value* < 0.05; [a] P= 0.030 vs "can't do, do do"; [b] P=0.005 vs "can't do, do do"; [c] P=0.019 vs "can do, do do"; [d] P=0.008 vs "can do, do do"; [e] P=0.002 vs "can't do, do do"; [f] P<0.001 vs "can do, do do"; [g] P<0.001 vs "can do, do do"; [h] P<0.001 vs "can't do, do do"; [i] P=0.011 vs "can't do, do do"; [j] P=0.002 vs "can do, do do"; [k] P<0.001 vs "can do, do do"; [l] P<0.001 vs "can't do, do do"; [m] P<0.001 vs "can do, do do"; [n] P<0.001 vs "can't do, do do"; o P<0.001 vs "can do, do do"; [p] P<0.001 vs "can do, do do"

Considering time spent in sedentary behaviour, the participants' distribution across the quadrants (Figure S 2) was: 1) 24 (31%) participants on the "can't do, less sedentary"; 2) 12 (16%) participants on the "can do, less sedentary"; 3) 18 (23%) participants on the "can do, more sedentary"; 4) 23 (30%) participants on the "can't do, more sedentary". Furthermore, a moderate negative correlation (r=-0.314, P=0.005) was found between the percentage predicted of repetitions on 1min-STS and sedentary behaviour.

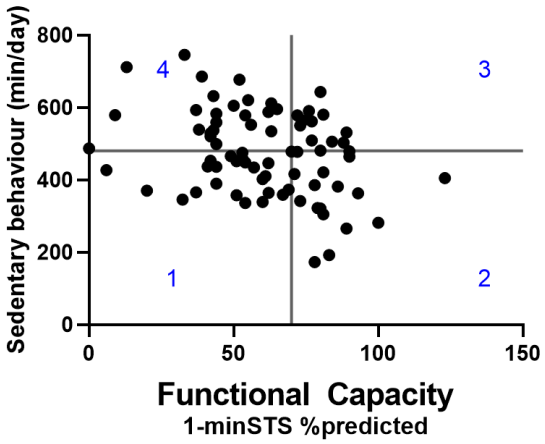

Figure S 2 - Scatterplot showing the functional capacity- time spent in sedentary behaviour quadrant distribution. Sample n=77. The vertical line represents the 19.5 repetitions on one minute sit-to-stand. The horizontal line represents the cut-off of eight hours on sedentary behaviour.

Legend: 1) can't do, don't spend time quadrant; 2) can do, don't spend time quadrant; 3) can do, do spend quadrant; 4) can't do, do spend quadrant. (r=-0.314, P=0.005)

Considering the number of repetitions on 1min-STS and the time spent on sedentary behaviour, statistically important differences were found on LTOT (P=0.041), SGRQ-I (P=0.008), FACIT-FS (P=0.006), Brief-BEST test (P=0.025), MVPA (P<0.001), number of steps/day (P<0.001), sedentary behaviour (P<0.001) and the number of repetitions on 1min-STS (P<0.001). Comprehensive details are described on Table S 3

Table S 3 – Sample characteristics per quadrant: 1-minute sit-to-stand (percentage of predicted) vs sedentary behaviour in people with interstitial lung disease (n=77).

Characteristics	Can't do, less sedentary (n=24)	Can do, less sedentary (n=18)	Can do, more sedentary (n=12)	Can't do, more sedentary (n=23)	P value
Age, years	66.5±2.4	66.3±3.4	70.8±1.7	68.4±2.6	0.684
Sex (female), n (%)	14 (58.3)	13 (72.2)	3 (25.0)	11 (47.8)	0.073
BMI					
<21, n (%)	1 (4.2)	1 (5.6)	0 (0.0)	2 (8.7)	0.603
Between 21 and 32, n (%)	15 (62.5)	11 (61.1)	10 (83.3)	11 (47.8)	
>32, n (%)	8 (33.3)	6 (33.3)	2 (16.7)	10 (43.5)	
LTOT, n (%)	12 (50.0)	4 (22.2)	3 (25.0)	14 (60.9)	0.041*
ILD GAP index					
0–3, n (%)	20 (83.3)	17 (94.4)	10 (83.3)	16 (69.6)	0.230
≥4, n (%)	4 (16.7)	1 (5.6)	2 (16.7)	7 (30.4)	
ILD subtype					
fHP, n (%)	13 (54.2)	8(44.4)	3 (25.0)	7 (30.4)	0.541
IPF, n (%)	4 (16.7)	3 (16.7)	6(50.0)	7 (30.4)	
CTD, n (%)	3 (12.5)	3 (16.7)	2 (16.7)	4 (17.4)	
Other, n (%)	4 (16.7)	4 (22.2)	1 (8.3)	5 (21.7)	
mMRC (n=76)					
<2, n (%)	7 (29.2)	9 (50.0)	4 (33.3)	4 (18.2)	0.192
≥2, n (%)	17 (70.8)	9 (50.0)	8 (66.7)	18 (81.8)	
HADS– Anxiety					
<8 points, n (%)	14 (58.3)	13 (72.2)	10	11 (47.8)	0.156
≥8 points, n (%)	10 (41.7)	5 (27.6)	2	12 (52.2)	
HADS– Depression					

<8 points, n (%)	13 (54.2)	15 (83.3)	8 (66.7)	12 (52.2)	0.160
≥8 points, n (%)	11 (45.8)	3 (16.7)	4 (33.3)	11 (47.8)	
SRGQ-I total (n=68)	57.1±4.5 [a]	40.5±3.7	34.2±6.1	48.5±4.7	0.008*
FACIT-FS	31.7±2.4 [b]	39.3±1.9	41.8±1.8	33.4±2.0	0.006*
Brief BEST test	17.7 [12.5-21.5]	20.5 [18.0-22.0] [c]	19.5 [12.0-21.5]	14.0 [8.0-18.5]	0.025*
1min-STS, repetitions(n=77)					
<19.5 repetitions, n (%)	18 (75.0)	1 (5.5)	0	20 (87.0)	<0.001*
≥19.5 repetitions, n (%)	6 (25.0)	17 (94.5)	12 (100.0)	3 (3.0)	
MVPA (min/week)	84.0[22.0-303.0] d	189.5 [123.0-442.0] [e]	112.0 [30.5-220.5]	35.0 [6.0-106.0]	<0.001*
Steps (steps/day)	418.6 [364.9-447.5] [f]	372.3 [305.1-421.0] [g]	556.2 [507.1-579.4] [h]	582.8 [537.8-615.9]	<0.001*
Sedentary behaviour (min/day)	4726.6 [3940.0-6896.5] [i, j]	7478.4 [5916.3-9943.1]	4218.9[3271.6-5013.6] [k,l]	2110.4[1249.1-4254.4]	<0.001*

Legend: 1min-STS, one minute sit-to-stand test; BMI, Body Mass Index; Brief-BEST test, Brief-Balance Evaluation Systems Test; CTD-ILD, connective tissue disease related interstitial lung disease; FACIT- FS, Functional Assessment of Chronic Illness Therapy-Fatigue subscale; fHP, fibrotic hypersensitivity pneumonitis; HADS, hospital anxiety and depression scale; ILD-GAP model, interstitial lung disease- gender age and physiology model; LTOT, long-term Oxygen Therapy; mMRC, modified British Medical Research Council, dyspnoea scale; MVPA, moderate to vigorous physical activity; SGRQ-I, St. George's Respiratory Questionnaire- interstitial lung disease; * *P value* < 0.05; [a] P=0.011 vs "can do, more sedentary"; [b] P=0.017 vs "can do, more sedentary"; [c] P=0.003 vs "can do, less sedentary"; [d] P=0.020 vs "can't do, more sedentary"; [e] P<0.001 vs "can't do, less sedentary"; [f] P<0.001 vs "can't do, less sedentary"; [g] P<0.001 vs "can't do, more sedentary" ; [h] P<0.001 vs "can do, more sedentary"; i P<0.001 vs "can't do, more sedentary"; [j] P<0.001 vs "can do, more sedentary"; [k] P<0.001 vs "can do, less sedentary"; [l] P<0.001 vs "can't do, less sedentary"