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Fiabilidade e validade do Questionário Internacional de Atividade Física versão curta (IPAQ-sf) em pessoas com DPOC

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Dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Fisioterapia ramo Respiratória, realizada sob a orientação científica da Doutora Alda Marques, Professora Adjunta da Escola Superior de Saúde da Universidade de Aveiro e da Doutora Joana Cruz, Professora Adjunta Convidada da Escola Superior de Saúde do Instituto Politécnico de Leiria.

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O júri

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Palavras-chave Acelerómetro, atividade física, doença pulmonar obstrutiva crónica, estudo de validação, questionário internacional de atividade física, propriedades psicométricas.

Resumo

Enquadramento: Pessoas com doença pulmonar obstrutiva crónica (DPOC) apresentam baixos níveis de atividade física em comparação com as pessoas saudáveis. Como tal, são aconselhados pelos profissionais de saúde para realizarem o máximo de atividade física (AF) que a sua condição de saúde permitir. Uma vez que a AF tem um papel benéfico no prognóstico da doença, a sua avaliação e promoção torna-se crucial. O Questionário Internacional de Atividade Física versão curta (IPAQ-sf) é muito usado para avaliar a AF, no entanto ainda existe evidência limitada acerca das suas propriedades clinimétricas na DPOC.

Objetivo: O objetivo deste estudo consistiu na avaliação da fiabilidade teste-reteste e validade do IPAQ-sf em pessoas com DPOC.

Métodos: Cinquenta e cinco participantes, com média de idades de 68.6±7.8 anos, 48 homens (87.3%), FEV_1 52.3±22.5% do predito, preencheram o IPAQ-sf e usaram o acelerómetro à cintura durante 7 dias. Posteriormente voltaram a preencher o IPAQ-sf. A fiabilidade teste-reteste e a percentagem de acordo foram avaliadas para as variáveis contínuas através do coeficiente de correlação intra-classe (ICC, 95% CI), dos 95% limites de acordo (95% LoA), do erro standard de medida (SEM) e da mudança mínima detectável (MDC_{95}). Para as variáveis categóricas “fisicamente ativo” vs. “fisicamente inativo” e “baixa AF”, “moderada AF” e “elevada AF” usou-se a percentagem de acordo. A validade foi avaliada através de correlações de Spearman (ρ) entre o IPAQ-sf (METs-min/semana, tempo em AF vigorosa, moderada e caminhada) e para as variáveis do acelerómetro (METs-min/semana, tempo em AF vigorosa e moderada e contagem de passos). Para as variáveis categóricas recorreu-se à percentagem de acordo, ao kappa de Cohen, à sensibilidade e à especificidade (95% CI).

Resultados: A fiabilidade teste-reteste apresentou resultados aceitáveis (ICC=0.738, 95% CI 0.629 ─ 0.873) mas com 95% LoA largos (-5713 ─ 4793.3 METs-min/semana). O SEM e a MDC_{95} foram 1844.7 e 5113.3 METs-min/semana, respetivamente. O acordo entre as duas aplicações do IPAQ-sf foi de 85.5% (kappa=0.660, 95% CI 0.444 ─ 0.876). Foram encontradas correlações positivas, moderadas e significativas entre os METs-min/semana através do IPAQ-sf e do acelerómetro ($0.515 \leq \rho \leq 0.596$), exceto para a AF vigorosa ($p > 0.05$). O acordo entre os dois instrumentos foi de 67.3% (kappa=0.350, 95% CI 0.279 ─ 0.571), apresentando alta sensitividade (0.89, 95% CI 0.887 ─ 0.891) mas baixa especificidade (0.46, 95% CI 0.46 ─ 0.47).

Conclusão: Os presentes resultados sugerem que o IPAQ-sf pode não ser a medida mais adequada para avaliar a AF em doentes com DPOC.

Keywords Accelerometer, chronic obstructive pulmonary disease, international physical activity questionnaire, physical activity, psychometric properties, validation study.

Abstract

Background: People with chronic obstructive pulmonary disease (COPD) present low levels of physical activity (PA) in daily life and they are advised to undertake as much PA as their health allows. Since PA is crucial to improve COPD prognosis, its assessment and promotion is a priority. The International Physical Activity Questionnaire Short-Form (IPAQ-sf) is widely used for this propose, but there is limited evidence on its clinimetric properties in COPD.

Aim: This study aimed to assess the test-retest reliability and validity of the IPAQ-sf in people with COPD.

Methods: This prospective cross-sectional non-experimental study assessed the validity of IPAQ-sf in 55 participants using accelerometry (ActiGraph GT3X+) and the test-retest reliability/agreement using the IPAQ-sf results obtained in two different occasions. The period between the two assessments was 7 days, corresponding to the time that participants were using the accelerometer. Test-retest reliability/agreement was assessed with: intraclass correlation coefficient (ICC 95% CI), 95% limits of agreement (95% LoA), standard error of measurement (SEM) and minimal detectable change (MDC_{95}) for continuous variables; and percentage of agreement for categories “physically inactive” vs “physically active” and “low PA”, “moderate PA” and “high PA”. The criterion validity of IPAQ-sf was assessed using Spearman’s correlations (ρ) between results obtained from IPAQ-sf (METS-min/week, time in vigorous and moderate PA and walking) and the accelerometer-based data (total METs-min/week, time in vigorous and moderate PA per week and step counts). For categorical variables was use percentage of agreement and Cohen’s kappa coefficient, as well as sensitivity and specificity.

Results: Test-retest reliability of the IPAQ-sf METs-min/week was acceptable (ICC=0.738, 95% CI 0.629 ─ 0.873) but with wide 95% LoA (-5713 ─ 4793.3 METs-min/week). SEM and MDC_{95} were 1844.7 and 5113.3 METs-min/week, respectively. The agreement among IPAQ-sf categories of PA intensities was 67.3% with moderate weighted Cohen's kappa of 0.523 (95% CI 0.352 ─ 0.693). The agreement in identifying "physically active" and "physically inactive" patients increase to 85.45% with substantial kappa of 0.660 (95% CI 0.444 ─ 0876). Significant, positive and moderate were found between IPAQ-sf METs-min/week and accelerometer-based data ($0.515 \leq \rho \leq 0.596$), except for time in vigorous PA which has no statistical significance ($p>0.05$). Agreement between the IPAQ-sf and accelerometer in identifying "physically inactive" and "physically active" patients was 67.3%, with fair Cohen's kappa of 0.350 (95% CI 0.279 ─ 0.571). The IPAQ-sf presented a high sensitivity (0.89, 95% CI 0.887 ─ 0.891) but a low specificity (0.46, 95% CI 0.46 ─ 0.47).

Conclusion: Overall, the present findings seem to suggest that the IPAQ-sf could not be the most appropriate measurement tool in patients with COPD to assess their PA levels.

Abbreviations and/or acronyms

AE - Acute Exacerbations

BA - Bland and Altman

BMI - Body Mass Index

CAT - COPD Assessment Test

CCI - Charlson Comorbidity Index

CHBV – Hospital Centre of Baixo Vouga

CHLeiria - Hospital Centre of Leiria

CI - Confidence Intervals

COPD - Chronic obstructive pulmonary disease

COSMIN - COnsensus-based Standards for the selection of health Measurement INstruments

EE - Energy Expenditure

FEV_1 - Forced Expiratory Volume in first second

FVC - Forced Vital Capacity

GOLD - Global Initiative for Chronic Obstructive Lung Disease

ICC - Intraclass Correlation Coefficient

IPAQ-sf - The International Physical Activity Questionnaire Short-Form

LoA - Limits of Agreement

MDC - Minimal Detectable Change

METs - Metabolic Equivalent of Task

mMRC - modified Medical Research Council

MVPA - Moderate and Vigorous Physical Activity

PA - Physical Activity

SD - Standard Deviation

SEM - Standard Error of Measurement

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1. Introduction

Chronic obstructive pulmonary disease (COPD) is currently the 3rd leading cause of death (1), being one of the biggest causes of chronic morbidity and mortality throughout the world, which accounts for a great burden on the healthcare resources (1). This burden tends to increase in coming decades because of continued exposure to COPD risk factors, i.e. tobacco smoking, indoor air pollution (e.g. burning of wood, animal dung and coal in open fires or poorly functioning stoves), outdoor air pollution, occupation dusts and chemicals (e.g. vapours, irritants and fumes) (1), and aging of the population (2). In Portugal, respiratory diseases represent the second leading cause of death (3) and it is estimated that 800.000 people aged 40 years or older suffer from COPD (4). Acute care and exacerbations-associated annual costs are estimated between 330€ (US $290.69) and 8000€ (US $7047.30) per patient (5). The disease is characterised by airflow limitation which is progressive and not reversible (1). It is associated with an abnormal inflammatory response of the lungs to noxious particles or gases (6). The consequences are not restricted to the lungs, having systematic consequences too, such as weight loss and skeletal muscle dysfunction/wasting (6).The symptoms such as dyspnoea, muscle fatigue and exercise intolerance have huge impact in patient's daily life, which together with behavioural aspects, contribute to physical inactivity in these patients (7).

Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure (EE) (8). It can be categorised into occupational, sports, conditioning, household, or other activities (8). According to its intensity, PA is expressed in METs (metabolic equivalent) and can be classified as light (1.5 ─ 3 METs), moderate (3 ─ 6 METs) or vigorous (> 6 METs) (8, 9). At least 150 minutes per week of moderate-intensity activity (30 minutes per day) or 75 minutes per week of vigorous-intensity activity are recommended for adults and older people (10). Physical inactivity is the 4th leading risk factor for death worldwide (10, 11). People with COPD are markedly inactive in daily life (12) and over time, the physical activity (PA) substantially decreases across all severity stages of COPD. This decline is accompanied by a worsening of lung function, health status (13), increased risk of acute exacerbations (AE), hospitalisations and mortality in this population (14). Thus, people with COPD are advised to undertake as much PA as their health allows (7). There are no specific PA recommendations for

patients with COPD, therefore general guidelines are used. Since PA is a modifiable factor with potential to improve COPD prognosis, the latest Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines (1) have underlined the importance of assessing and promoting regular PA as part of COPD management. Nevertheless, if strategies/interventions for PA promotion are to be widely implemented in clinical practice, healthcare professionals need to be able to assess their patients' PA levels in routine clinical assessments. There are two different methods of assessing PA in daily life: 1) using objective measures, i.e., accelerometers or motions sensors, which are recommended by the GOLD guidelines (1), and/or 2) using self-reported measures, i.e., questionnaires and diaries (15-17).

Accelerometers are sensors which measure the accelerations of objects in motion along reference axes (18), i.e., they can monitor movements in more than one plane. These devices use piezoelectric transducers and microprocessors to quantify the magnitude and direction of the acceleration, referred to by the dimensionless "counts" (19). Accelerometers have been frequently used for assessing and monitoring PA objectively (1), specifically, to determine the time spent in activities performed at various intensities and for predicting EE associated with PA (15). Advantages of their use include the fact of being small devices, comfortable for patients to use and they are an objective measure of PA capable of quantify the movement patterns of individuals in real-world (19). However, these devices are expensive to be used in resource-constrained settings (20) and the measurement of some activities (e.g. swimming) is still not possible with some devices (15, 21, 22). To study large sample or population, other devices less expensive are also a good choice, such as the pedometers and PA questionnaires (20).

The International Physical Activity Questionnaire Short-Form (IPAQ-sf) is one of the most widely used self-reported questionnaires primarily designed for PA surveillance in people with an age range of 15 ─ 69 years with acceptable measurement properties (23). As other questionnaires, the IPAQ-sf is simple to administer in clinical practice and low in cost (24). In addition to vigorous and moderate PA, the IPAQ-sf has the advantage to assess walking which is a very common activity incorporated into daily tasks. The disadvantages include its imprecise and overestimating character (24).

The IPAQ-sf has been used in several studies to estimate PA levels of patients with COPD (25-27). However, the clinimetric properties of the IPAQ-sf, specifically its validity

and test-retest reliability, have only been explored in a small exploratory study which included 10 patients with COPD (28). Strong, positive and significant correlations between the IPAQ-sf METs-min/week and moderate and vigorous physical activity (MVPA) measured with an accelerometer (r=0.729, p=0.017) were found but a low percentage of agreement between the IPAQ-sf and accelerometer-based data in identifying "physically active" and "physically inactive" patients (agreement=20%, kappa= -0.538), and poor to moderate test-retest reliability (ICC=0.439, 95%CI -0.267 ─ 0.838) was observed. Nevertheless, the small sample size hindered the generalisability of the findings and more studies are still needed.

Thus, the aim of this study was to assess the test-retest reliability/agreement and validity of the IPAQ-sf in people with COPD. Based on previous research (29, 30), it is expected that a good PA assessment measure presents an intraclass correlation coefficient (ICC) ≥ 0.70 in test-retest reliability and a positive correlation ≥ 0.50 with the accelerometer.

2. Methods

2.1 Study design

This was a prospective cross-sectional non-experimental study that was part of a larger study entitled "*OnTRACK - On Time to Rethink ACtivity Knowledge: a personalized mHealth coaching platform to tackle physical inactivity in COPD*" (ref. POCI-01-0145-FEDER-028446). Criterion validity of the IPAQ-sf was assessed using accelerometer-based data and test-retest reliability/agreement was calculated using the IPAQ-sf results obtained in two different occasions. The period between the two assessments was 7 days, corresponding to the time that participants were using the accelerometer.

2.2 Sample size

Sample size was defined according to the COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) guidelines (29, 30), which recommend that a minimum of 50 individuals should be recruited to ensure the quality of studies assessing the measurement properties of instruments.

2.3 Ethical considerations

Ethical approval was obtained prior to study commencement from the Ethics Committees of Polytechnic of Leiria, the Hospital Centres of Leiria (CHLeiria) (10/01/2019) and Baixo Vouga (CHBV) (15-03-2018, 01/02/2019) (Annex I). Participants' enrolment and data collection were preceded by a written description of the study and its purpose (Appendix I) and obtention of the written informed consent of all participants (Appendix II).

2.4 Participants

Patients with COPD were identified by the physicians of the CHLeiria and CHBV, who ensured the fulfilment of the eligibility criteria. Patients included in the study had to be: 18 years old or more; diagnosed with COPD according to the GOLD criteria (1); clinically stable in the last month (i.e., no hospital admissions or AE); able to understand Portuguese and to provide informed consent. Exclusion criteria consisted of the presence of severe neurologic (e.g. Parkinson, stroke), musculoskeletal (e.g. severe osteoarthritis) or psychiatric disorders (e.g. schizophrenia), unstable cardiovascular disease, or other health condition/impairment (e.g., severe visual or hearing impairment) that could preclude patients from understanding the study and participating in data collection.

After received a list of patients eligible for the study, I contacted the patients by telephone to invite them for participation and scheduled de data collection. Data were collected at the Centre for Innovative Care and Health Technology (ciTechCare) of the Polytechnic Institute of Leiria and Lab3R-Respiratory, Research and Rehabilitation Laboratory, School of Health Sciences, University of Aveiro (ESSUA).

2.5. Data collection

Participants completed a structured questionnaire with sociodemographic (age, sex, education level, work status and marital status), anthropometric [height and weight to calculate the body mass index (BMI)], and general clinical information to characterise the sample, such as smoking status (never, current or former smokers), dyspnea perception assessed with the modified Medical Research Council (mMRC) scale, comorbidities, medication and lung function with spirometry. Comorbidities were assessed and scored according to the Charlson Comorbidity Index (CCI) (31), which classifies comorbidities as mild (CCI scores of 1 ─ 2), moderate (CCI scores of 3 ─ 4) or severe (CCI scores ≥

5). Then, participants completed the IPAQ-sf and received an accelerometer (ActiGraph GT3X+, Pensacola, FL) to use for 7 days. The patients were instructed to wear the accelerometer at the waist, on the dominant side, all day, except for bathing and sleeping. A second appointment were scheduled 8 days after the first appointment to collect the accelerometers. Participants were asked to complete the IPAQ-sf once more for further assessment of test-retest reliability and agreement of the tool.

2.6 Measures

International Physical Activity Questionnaire short-form (IPAQ-sf)

The IPAQ-sf is composed of 7 questions and provides information on the number of days/week and average time/day spent walking, in moderate- and vigorous- intensity activities and in sedentary activity, based on the previous 7 days, to further calculate EE (23). Both continuous and categorical indicators of PA are possible to obtain from the IPAQ-sf.

The continuous score can be calculated as "MET level × minutes of activity per day × days per week" and is expressed in MET-min/week. One MET is the amount of oxygen consumed while sitting at rest and is equal to 3.5 ml O_2 kg^{-1} min^{-1} (32). The MET level of each category is considered as follows: walking = 3.3 METs; moderate-intensity activities = 4.0 METs; vigorous-intensity activities = 8.0 METs. The continuous score can be calculated for each type of PA (i.e., walking, moderate- and vigorous-intensity activities) and/or as a combined PA continuous score. The question regarding the time spent sitting (sedentary activities) is not included as part of the continuous score.

The categorical score of the IPAQ-sf classifies a patients' PA level as "low", "moderate" or "high" (33). These classifications can be then translated to "physically active" (corresponding to "moderate" or "high" PA levels) and "physically inactive" (which corresponds to "low" PA level) (Table 1). The Portuguese version of IPAQ-sf was used in this study (23) and it takes about 10 minutes to complete. Detailed scoring information can be found in the IPAQ website (https://sites.google.com/site/theipaq/home) and the questionnaire is free of charge and free-access.

Accelerometry

Accelerometery was used as a criterion measure to validate the IPAQ-sf as previously reported in the validation of other self-reported PA measures (34, 35). It has also been previously used as a criterion measure to validate the IPAQ-sf in other populations (22, 36-38). In this study, it was used the triaxial accelerometer ActiGraph GT3X+ (Pensacola, FL) which has been validated for the COPD population (22, 37). For example, in the study of Rabinovich (2013) the ActiGraph GT3X explained 53% of total EE and a strong, positive and significant correlation with activity EE ($r=0.71$, $p<0.001$) was reported.

After its initialisation, the device collects and stores PA data which can be downloaded and converted into time-stamped PA counts, step counts and EE using specific software (ActiLife 6, version 6.13.3, Pensacola, FL). Participants wore the device at the waist on an elastic belt over the hip of the dominant side for 7 consecutive days during waking hours, except when bathing or swimming. They were asked to perform their usual activities during data collection. Data were recorded at 1-minute epoch intervals and a valid day was defined as a minimum of 8 hours of wearing time (39). Accelerometer data were then downloaded and analysed using the algorithms of Freedson (1998) (40) incorporated in the Actilife software and included: daily time (in min) spent in light-intensity PA [≤ 1951 counts-per-minute (CPM)], moderate-intensity PA (1952 ─ 5724 CPM), vigorous-intensity PA (≥ 5725 CPM) (40). The number of steps per week was also collected. Participants were classified as "physically active" or "physically inactive" using two approaches, an intensity-based approach and a step-based approach, according to the American College of Sports Medicine (ACSM) guidelines since it is the most knowledgeable entity on the subject today (41) (Table 1).

Table 1 - Categories of "physically active" and "physically inactive" possible to be obtained with the IPAQ-sf and accelerometer-based data.

Category	Physically active	Physically inactive
IPAQ-sf	Correspond to "high" and "moderate" scores of the IPAQ-sf: **"High PA level"**	Correspond to "low" score of the IPAQ-sf: **"Low PA level"** a) No PA is reported

	a) vigorous-intensity PA on ≥ 3 days achieving ≥ 1500 MET-min/week OR b) 7 days of any combination of walking, moderate- or vigorous-intensity PA achieving ≥ 3000 MET-min/week **"Moderate PA level"** a) ≥ 3 days of vigorous-intensity PA of ≥ 20 min/day OR b) ≥ 5 days of moderate-intensity PA and/or walking of ≥ 30 min/day OR c) ≥ 5 days of any combination of walking, moderate- or vigorous-intensity PA achieving ≥ 600 MET-min/week	OR b) Some PA is reported but not enough to meet categories "high" or "moderate"
Accelerometer (intensity-based approach)	a) ≥ 20 min/day of vigorous-intensity PA on ≥ 3 days OR b) ≥ 30 min/day of moderate-intensity PA on ≥ 5 days OR c) a combination of both	a) No PA is reported OR b) Some PA is reported but not enough to meet the guidelines
Accelerometer (step-based approach)	a) ≥ 7000 steps/day	a) Not achieving the minimum of 7000 steps/day

Abbreviations: IPAQ-sf, International Physical Activity Questionnaire - short form; METs, metabolic equivalent; PA, physical activity.

2.7 Data analysis

Descriptive statistics, such as frequencies, means, median, interquartile ranges, SD (standard deviation), were used to characterise the sample regarding to age, sex, FEV_1% (Forced Expiratory Volume in first second) predicted, BMI, education level, work status, marital status, smoking status (never, current, former smokers), GOLD grade, mMRC, CCI and PA results (self-reported and with accelerometer-based data). The Normality of the data was assessed using the Kolmogorov-Smirnov test.

Reliability test-retest was assessed between: 1) continuous values of IPAQ-sf 1 and IPAQ-sf 2 (METs-min/week); and 2) categories of IPAQ-sf 1 and 2 (i.e. "low PA", "moderate PA" and "high PA" and "physically active" vs. "physically inactive"). According to the guidelines (42), the following analyses were conducted:

1) For continuous variables:
    a. Reliability was assessed using intraclass correlation coefficient ($ICC_{2,1}$) and 95% confidence intervals (CI) (43). An ICC ≥ 0.70 was considered as a minimum standard for good reliability (44).
    b. Agreement was calculated using the standard error of measurement ($\mathrm{SEM} = \frac{\mathrm{SD}_{\mathrm{differences}}}{\sqrt{2}}$), minimal detectable change ($\mathrm{MDC} = \mathrm{SEM} \times \sqrt{2} \times 1.96$) (44) and Bland and Altman (BA) limits of agreement (45).
2) For categorical variables:
    a. Percentage of agreement was defined as the total number of participants assigned to the same category (either "physically active" or "physically inactive") by both measures, divided by the total number of participants.
    b. Cohen's kappa coefficient and its 95% CI for nominal variables ("physically inactive" and "physically active"); and Cohen's weight kappa for ordinal variables ("low PA", "moderate PA" and "high PA") were determined. The results were interpreted as (46): poor (< 0.00), slight (≤ 0.20), fair (0.21 ─ 0.40), moderate (0.41 ─ 0.60), substantial (0.61 ─ 0.80) and almost perfect (0.81 ─ 1.00). An acceptable value of kappa was considered as ≥ 0.70 (44).

To assess the criterion validity of IPAQ-sf, the IPAQ-sf 2 and accelerometer-based data were used since they refer to the same time period. According to the guidelines (42), the following analyses were conducted:

1) For continuous variables:
    a. METs-min/week, time spent in vigorous PA (min/week) and time spent in moderate PA and walking (min/week) were determined from the variables of the IPAQ-sf.
    b. Total MVPA (min/week), time spent in vigorous (min/week) and very vigorous PA (min/week), time spent in moderate PA (min/week) and step counts (steps/week) were determined from accelerometer-based data.
    c. Spearman's rank-order correlations (ρ) or Pearson's correlation coefficient (r) were used [according to the (non-)normality of the data] to assess criterion validity of these continuous variables. Correlations were also performed in following sub-groups: 1) age (< and > 65 years); 2) sex

(male and female); and 3) COPD severity (GOLD A–B and GOLD C–D). Criterion validity was considered good if correlations were positive, significant and ≥ 0.50 (44). Strength of correlations were based on criteria from Evans (1996) (47): very weak (0.00 – 0.19), weak (0.20 – 0.39), moderate (0.40 – 0.59), strong (0.60 – 0.79) and very strong (0.80 – 1.0).

2) For categorical variables:
    a. The ability of the IPAQ-sf for classifying "physically active" and "physically inactive" patients was evaluated against the accelerometer-based data, using the cut-off points as previously described Table 1. Percentage of agreement and Cohen's kappa coefficient were used.
    b. Sensitivity (i.e., those who were correctly classified as "physically active" by the IPAQ-sf using the accelerometer-based data) and specificity (i.e., those who were correctly classified as "physically inactive" by the IPAQ-sf using the same criteria) were also calculated, including the 95% CI. The 95% CI were calculated for sensitivity and specificity using the following formula $= \mathrm{p} \pm 1.96\sqrt{\frac{\mathrm{p}(1-\mathrm{p})}{\mathrm{n}}}$, where "p" is the relevant proportion (i.e., sensitivity or specificity) and "n" is the total sample (43).

All data were analysed using SPSS version 24 (IBM Corp., Armonk, USA) and statistical significance was set at $p<0.05$.

3. Results

3.1 Sample characterisation

Fifty-eight (n=58) patients with COPD participated in the study, however, according to IPAQ scoring guidelines (48), one participant was excluded from the final analyses for presenting a very high score (> 16 hours at walking, moderate and vigorous PA), and two patients were excluded from the analyses due to missing data in accelerometry. The final sample was composed of 55 participants.

Participants (n=55) had a mean (± SD) age of 68.6±7.8 years old, 48 males (87%). They had a mean BMI of 26.5±4.8 kg/m^2 and a FEV_1 of 52.3±22.5% of the predicted. Their detailed sociodemographic and clinical characteristics are presented in Table 2. Fifty-four (n=54) participants were taking medications and the most frequent were asthma

medication and bronchodilators (n=35, 63.6%), followed by antihypertensives (n=18, 32.7%) and medication for dyslipidemia (n=14, 25.5%). All participants reported comorbidities, the most common being arterial hypertension (n=24, 43.6%), dyslipidemia (n=16, 29.1%) and mental health problems, such as anxiety and depression (n=19, 34.5%). Regarding to GOLD grade, the majority were GOLD A (n=18, 32.7%) and GOLD B (n=15, 27.3%), and according to FEV_1% predicted, majority stages were GOLD 2 (n=23, 41.8%) and GOLD 3 (n=18, 32.7%).

Table 2 - Sociodemographic and clinical characteristics of the participants (n=55).

	n	
Age (years), mean (SD)	55	68.6 (8)
Sex (male), n (%)	55	48 (87.3%)
FEV_1% predicted, mean (SD)	55	52.3 (22.5)
BMI (kg/m^2), mean (SD)	55	26.5 (4.8)
Education Level, n (%)	55	
No qualifications		2 (3.6%)
1^{st} cycle (years 1-4)		23 (41.8%)
2^{nd} cycle (years 5-6)		7 (12.7%)
3^{rd} cycle (years 7-9)		7 (12.7%)
High school (years 10-12)		8 (14.5%)
Adult education (post-high school)		3 (5.5%)
University		5 (9.1%)
Work status, n (%)	54	
Retired		45 (81.8%)
Full/part-time employment		4 (7.3%)
Unemployed (health-related reason)		4 (7.3%)
Marital status, n (%)	54	
Married		40 (72.7%)

Divorced		4 (7.3%)
Widowed		6 (10.9%)
Smoking status, n (%)	55	
Never		11 (20%)
Current smokers		10 (18.2%)
Years, mean (SD)		44.8 (6.6)
Current daily amount, mean (SD)		13.3 (12.1)
Former smorkers		34 (61.8%)
Number of years, mean (SD)		38.33 (9.93)
Average daily amount, mean (SD)		30.5 (14.2)
GOLD_FEV_1 % predicted, n (%)	55	
GOLD 1 (FEV_{1pp} >80%)		5 (9.1%)
GOLD 2 (FEV_{1pp} 50-79)		23 (41.8%)
GOLD 3 (FEV_{1pp} 30-49)		18 (32.7%)
GOLD 4 (FEV_{1pp} <30)		9 (16.4%)
GOLD grade, n (%)	41[1]	
GOLD A		18 (32.7%)
GOLD B		15 (27.3%)
GOLD C		3 (5.5%)
GOLD D		5 (9.1%)
mMRC, n (%)	55	
0		4 (7.3%)
1		17 (30.9%)
2		21 (38.2%)
3		12 (21.8%)
4		1 (1.8%)

CCI, n (%)	55	
Mild		8 (14.5%)
Moderate		39 (70.9%)
Severe		8 (14.5%)

Abbreviations: BMI, body mass index; CCI, Charlson comorbidity index; FEV1, forced expiratory volume in first second; FVC, forced vital capacity; mMRC, Modified Medical Research Council; SD, standard deviation. [1]Due to missing data in number of exacerbations in the last year in 14 patients, GOLD ABCD was applied only in to 41 participants.

3.2 Physical activity levels

Using the accelerometer-based data as reference, in general, participants spent most of their time in sedentary behaviour followed by light PA activities. With the increase in PA intensity, the values related to the time that the participants perform were decreasing. Half of participants did not meet the PA recommendations (median of moderate PA=19.42 < 150 minutes/week) (Table 3). Results from IPAQ-sf indicated more time spent in vigorous and moderate PA, such as in walking, than accelerometer-based data (Table 3). Relatively to number of steps, the mean was 784±458 steps/day.

In short, accelerometer-based data showed that patients spent, in average, 26.8±16.6 min/day in light PA, 4.0±3.5 min/day in moderate PA, 0.13±0.43 min/day in vigorous PA and 4.1±3.6 min/day in MVPA. Through the results of IPAQ-sf it was observed an overestimation of the time spent in PA intensities, of IPAQ-sf 2 in relation to IPAQ-sf, i.e., in IPAQ-sf 1 time spent in vigorous PA=3±6.2 min/day and in MVPA=14.5±14.2 min/day; in IPAQ-sf 2 time spent in vigorous PA=5.9±7.8 min/day and in MVPA=15±13 min/day. The overestimation of time through IPAQ-sf was also observed in relation to the accelerometer based-data.

Table 3 - Descriptive analysis from IPAQ-sf, IPAQ-sf 2 (reteste) and accelerometer-based data in patients with chronic obstructive pulmonary disease (n=55).

	n	Mean (SD)	Median (Interquartile ranges: Q1; Q3)
IPAQ-sf 1			
Total energy expenditure (METs-min/week)	55	2503.6 (3332.8)	1386 (273; 3066)

Time in vigorous PA (min/week)	55	21.4 (43.5)	0 (0; 15)
Time in moderate PA and walking (min/week)	53	101.6 (99.7)	60 (30; 145)
IPAQ-sf 2			
Total energy expenditure (METs-min/week)	55	2963.5 (3024.8)	2027 (480; 4284)
Time in vigorous PA (min/week)	54	41.6 (54.6)	7.5 (0; 60)
Time in moderate PA and walking (min/week)	55	105 (90.7)	75 (20; 180)
Accelerometry (per week)	55		
Sedentary time (min)		706 (271.0)	642.6 (544.6; 760.8)
Time in light PA (min)		187.6 (116.3)	141.8 (95.8; 251.2)
Time in moderate PA (min)		28.2 (24.3)	19.4 (9.1; 39.8)
Time in vigorous PA (min)		0.97 (3.04)	0.12 (0.05; 0.33)
Total time in MVPA (min)		29 (25.5)	18.3 (9.2; 44)
Number of steps (mean of 7 days)		5484.8 (3206.9)	5133.3 (2838.1; 8167.4)

Abbreviations: IPAQ-sf, International Physical Activity Questionnaire-short form; METs, metabolic equivalent; Min, minutes; MVPA, moderate and vigorous physical activity; PA, physical activity; SD, standard deviation. Q1 corresponds to the percentile 25 and Q3 corresponds to the percentile 75.

3.2 Test-retest reliability and agreement of IPAQ-sf

Continuous scores of the IPAQ-sf

Test-retest reliability and agreement of the IPAQ-sf were first analysed using the continuous variables from IPAQ-sf 1 and 2 (total EE, in METs-min/week). The ICC was 0.783 (95% CI 0.629 ─ 0.873), and the values of the SEM and MDC_{95} were 1844.7 METs-min/week and 5113.3 METs-min/week, respectively (Table 4).

Table 4 - Test-retest reliability and agreement of continuous variables of IPAQ-sf 1 and IPAQ-sf 2 in patients with chronic obstructive pulmonary disease (n=55).

	ICC (95% CI)	SEM (METs-min/week)	MDC_{95} (METs-min/week)
IPAQ-sf 1 and 2	0.783 (0.629 – 0.873)	1844.7	5113.3

Abbreviations: CI, confidence intervals; ICC, intraclass correlation coefficient; IPAQ-sf, International Physical Activity Questionnaire-short form; MDC, minimal detectable change; SEM, standard error of measurement.

Figure 1 presents the 95% LoA using the BA plots between the IPAQ-sf 1 and 2 (METS-min/week). A bias (i.e., mean of differences between IPAQ-sf 1 and 2) of -459.8 METs-min/week (SD of bias = 2680.2) was observed, with the 95% LoA ranging from -5713.0 to 4793.3 METs-min/week.

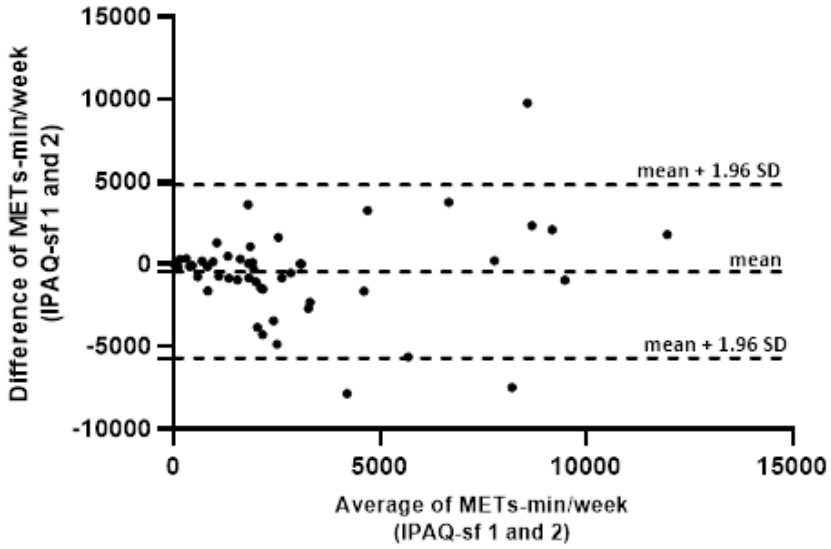

Figure 1 - Bland and Altman plots between IPAQ-sf 1 e 2 (total METs-min/week) in patients with chronic obstructive pulmonary disease (n=55).

IPAQ-sf categories

The agreement among IPAQ-sf categories (“low PA”, “moderate PA” and “high PA”) obtained from IPAQ-sf 1 and 2 was 67.3% and the weighted Cohen’s kappa was 0.523 (95% CI 0.352 ─ 0.693), as shown in Table 5.

Table 5 - Percentage of agreement and weighted Cohen's kappa among IPAQ-sf categories ("low PA", "moderate PA" and "high PA") in patients with chronic obstructive pulmonary disease (n=55).

		IPAQ-sf 2			% agreement	Kappa (95% CI)
		Low PA	Moderate PA	High PA		
IPAQ-sf 1	Low PA	13	1	4	67.3%	0.523 (0.352 to 0.693)
	Moderate PA	3	13	9		
	High PA	0	1	11		

Abbreviations: CI, confidence intervals; IPAQ-sf, International Physical Activity Questionnaire-short form; PA, physical activity.

When considering the categories "physically inactive" (i.e., low PA) and "physically active" (i.e., moderate to high PA), the agreement was 85.45% and the Cohen's kappa was 0.660 (95% CI 0.444 ─ 0.876), as shown in Table 6.

Table 6 - Percentage of agreement and weighted Cohen's kappa among IPAQ-sf categories ("physically inactive" and "physically active") in patients with chronic obstructive pulmonary disease (n=55).

		IPAQ-sf 2		% agreement	Kappa (95% CI)
		Physically Inactive	Physically Active		
IPAQ-sf 1	Physically Inactive	13	5	85.45%	0.660 (0.444 to 0.876)
	Physically Active	3	34		

Abbreviations: CI, confidence intervals; IPAQ-sf, International Physical Activity Questionnaire-short form.

3.3 Validity of the IPAQ-sf

Correlations between the IPAQ-sf and accelerometry (continuous variables)

None of the variables from the IPAQ-sf or accelerometer-based data followed a normal distribution; therefore, the Spearman correlation coefficient was used to assess correlations between variables. Correlations between IPAQ-sf 2 and accelerometer-based data ranged from -0.007 to 0.596 (Table 7).

Table 7 - Correlations between IPAQ-sf 2 and accelerometry in patients with chronic obstructive pulmonary disease (n=55).

	IPAQ-sf 2
IPAQ-sf (Total METs-min/week) Total MVPA (min/week)	0.596**
Time in vigorous PA (Question 2 of IPAQ-sf) (min/week) Time in vigorous PA (min/week)	-0.007
Time in moderate PA and walking (Question 4 and 6 of IPAQ-sf) (min/week) Time in moderate PA (min/week)	0.515**
Time in moderate PA and walking (Question 4 and 6 of IPAQ-sf) (min/week) Number of steps/week	0.547**

Abbreviations: IPAQ-sf, International Physical Activity Questionnaire-short form; MVPA, moderate to vigorous physical activity; PA, physical activity.

Legend: * p<0.05 **p<0.001.

Correlations between the IPAQ-sf and Accelerometry (categorical variables)

When analysing the ability to identify participants physically active or inactive, the agreement was 67.27% and the Cohen's kappa was 0.350 (95% CI 0.279 ─ 0.571) (Table 8). The sensitivity and specificity of IPAQ-sf 2 were 0.89 (95% CI 0.887 ─ 0.891) and 0.46 (95% CI 0.46 ─ 0.47), respectively (Table 8).

Table 8 – Comparison of the activity categories ("physically active" and "physically inactive") obtained from the IPAQ-sf 2 and accelerometer-based data in patients with chronic obstructive pulmonary disease (n=55).

		Accelerometer		%agreement	Kappa (95% CI)	Sensitivity (95% CI)	Specificity (95% CI)
		Physically Inactive	Physically Active				
IPAQ-sf 2	Physically Inactive	13	3	67.27%	0.350 (0.279 to 0.571)	0.89 (0.887 to 0.891)	0.46 (0.46 to 0.47)
	Physically Active	15	24				

Abbreviations: CI, confidence intervals; IPAQ-sf, International Physical Activity Questionnaire-short form.

When analysing the Spearman's correlations by age, sex and COPD severity, significant, positive and moderate correlations were found in patients with < 65 years and in male patients. The exception were the correlations between the IPAQ-sf question 2 about

vigorous PA and time spent in vigorous PA by accelerometer, which were not significant. When stratifying by disease severity, the variables of IPAQ-sf 2 were significantly correlated with all PA variables obtained by accelerometry in GOLD A–B ($0.457 \leq \rho \leq 0.538$, $p<0.001$), except for vigorous PA ($\rho=0.118$, $p>0.05$). GOLD C–D presented no significant correlations, except for the correlation between time in moderate PA and walking with number of steps per week ($\rho=0.874$, $p<0.05$) (Table 9).

Table 9 - Correlations (ρ) between IPAQ-sf 2 and accelerometer-based data stratified by age, sex and COPD severity (age and sex n=55; COPD severity n=41) in patients with COPD (n=55).

	Correlations (ρ) between IPAQ-sf 2 and accelerometer-based data in patients with COPD (n=55)					
	Age		**Sex**		**COPD severity**	
	< 65 years (n=18)	**≥ 65 years (n=37)**	**Male (n=48)**	**Female (n=7)**	**GOLD A-B (n=33)**	**GOLD C-D (n=8)**
Total METs-min/week Total MVPA (min/week)	0.747**	0.512*	0.677**	-0.179	0.538**	0.719
Time in vigorous PA (Question 2) (min/week) Time in vigorous PA (min/week)	0.383	-0.290	0.084	-0.248	0.118	0.316
Time in moderate PA and walking (Question 4 and 6) (min/week) Time in moderate PA (min/week)	0.656**	0.451**	0.554**	0.018	0.457**	0.635
Time in moderate PA and walking (Question 4 and 6) (min/week) Number of steps/week	0.583*	0.499**	0.564**	-0.162	0.468**	0.874**

Abbreviations: COPD, Chronic obstructive pulmonary disease; IPAQ-sf, International Physical Activity Questionnaire-short form; MVPA, moderate to vigorous physical activity; PA, physical activity.

Legend: * p<0.05 **p<0.001.

4. Discussion

The present study aimed to assess the test-retest reliability of the IPAQ-sf using the results obtained in two different occasions and the criterion validity of the instrument by comparing the IPAQ-sf with an objective measure of PA (accelerometry). Findings

suggest that the IPAQ-sf is valid to be used in patients with COPD and has high test-retest reliability but with large limits of agreement which may limit the accuracy of this instrument.

Through accelerometer-based data, it was observed that patients spent most of their time in sedentary activities (100.9±38.7 min/day), followed by light intensity PA (26.8±16.6 min/day). Results showed that half of the participants did not meet the criteria to be classified as physically active according to the international PA recommendations (10), since the median of moderate PA was 3.8 min/day which is lower than the 30 min/day recommended. The same trend was observed in the number of steps per day, which was lower than the recommended value (784±458 steps/day). Levels of PA have been found to be lower in patients with COPD in comparison with healthy individuals (12), therefore low values were already expected.

Reliability of the continuous score of the IPAQ-sf showed an acceptable ICC (0.783, 95% CI 0.629 ─ 0.873) (30) although the 95% limits of agreement were somewhat wide (ranging from -5713.0 to 4793.3 METs-min/week), with no evidence of consistent bias. These results are in line with other studies that assessed the reliability of IPAQ-sf. The original study (23) reported a ρ of 0.76 for reliability of IPAQ-sf and other study (49) revealed a ρ of 0.70 for test-retest MET-min/week. None of the studies reported ICC and 95% LoA which represents a limitation of these studies, because ICC is widely used to assess interrater, test-retest and intrarater reliability and it is the most appropriated one since assess the reliability and the agreement between measurements (50).

Instead IPAQ-sf 1 (first administration), IPAQ-sf 2 (second administration after using the accelerometer) was used for correlations with accelerometer-based data since they refer to the same period. An overestimation regarding to IPAQ-sf 1 was observed in IPAQ-sf 2 which may interfere with the reliability of the results. This may be justified by the increased PA awareness by wearing the accelerometer and/or a learning effect (51, 52).

The agreement among IPAQ-sf intensity categories (“low”, “moderate” and “high PA”) was 67.3% and presented a moderate weighted Cohen’s kappa (46). However, when analysing the agreement between the IPAQ-sf categories “physically active” and “physically inactive”, the agreement increased to 85.45% and the Cohen’s kappa was substantial. These results are, in general, more positive than the previous exploratory

study conducted in the COPD population (28) which revealed lower ICC in test-retest reliability (ICC=0.439, 95% CI -0.267 ─ 0.838). These results are slightly better than other study that assess the reliability of IPAQ in a fibromyalgia population, which showed that IPAQ-sf may not be a reliable PA assessment tool (53).

Although the IPAQ-sf has been shown to be a reliable and valid measure of PA in the general population (22, 54), like any other questionnaires, it may be vulnerable to recall and reporting bias (55). According to the ACSM guidelines (41), the cut-offs for categorising patients as “physically active” and “physically inactive” ranges from 600 to 3000 METs-min/week. These results shown that the IPAQ has a large error associated to the test-retest reliability (± 5000 METs-min/week) which suggests that IPAQ-sf may not be an appropriate tool to assess patients’ PA levels throughout time. Alternatively, patients may have altered their PA levels from one week to the other and this may have biased the results. Further research is needed to confirm these results.

In terms of the validity of the IPAQ-sf, correlations between IPAQ-sf 2 and accelerometer-based data were positive and above the recommended threshold ($\rho>0.50$) (44). The best correlation was found between total METs-min/week from IPAQ-sf 2 and total MVPA (min/week) from accelerometer-based data. The correlation between time in moderate PA and walking (through IPAQ-sf 2) had a better correlation with steps counts from accelerometer ($\rho=0.547$, $p<0.001$) than time in moderate PA ($\rho=0.515$, $p<0.001$), which can suggest that walking of patients remains majority in light intensity of PA. These results are in line with evidence that claim that older adults (which are included the majority of COPD patients) tend to spend a big portion of their day performing light intensity activities and have difficult to initiate or maintain MVPA (50). No significant correlations were found in vigorous PA, which were already expected, since few patients engage in vigorous-intensity PA and its duration is normally limited (56).

In general, the results of this study are slightly better than the results from other studies that assessed the validity of IPAQ in other clinical populations. In adults with systemic lupus erythematosus (36), MVPA (METs min/day) obtained through the IPAQ-sf showed weak correlations with MVPA (min/day) obtained from accelerometry (r=0.16, 95% CI -0.02 ─ 0.33). In patients with Chronic Fatigue Syndrome (57), the IPAQ-sf presented significant but low correlation between EE in MVPA and accelerometer-based data (r

ranging from 0.282 to 0.426). However, the exploratory study carried out in patients with COPD (28) revealed higher results then the present study (r=0.729, p=0.017). The sample size of the present study can justify the differences found between studies and it suggests that larger studies should be carried out in this population to ensure more robust results. In comparison to another questionnaire that has been explored in the Portuguese COPD population, the Brief Physical Activity Assessment Tool (BPAAT), the IPAQ-sf presented a higher correlation, since the BPAAT presented significant moderate correlations with accelerometry (r=0.529, p<0.001) (58). BPAAT consists of two questions, one that assesses the frequency and duration of vigorous PA and other about moderate PA, including walking, in a usual week (34). Although it is a quicker questionnaire to administer in clinical practice, it just allows to classify patients in "sufficiently active" or "insufficiently active", according PA guidelines (41).

The IPAQ-sf revealed more time spent in vigorous and moderate PA, such as walking, than accelerometer-based data, which is in line with other studies indicating that the IPAQ-sf may overestimate the PA when compared with objective methods (59, 60), which is a characteristic related to the majority of the questionnaires (24). Other study that assessed the validity of IPAQ-sf in patients with rheumatoid arthritis (61) also revealed that IPAQ-sf overestimated EE from PA in 40% of the participants.

When considering the categorical measures, specifically the categories "physically active" and "physically inactive" obtained from the IPAQ-sf and accelerometer-based data, the agreement was 67.27% and the Cohen's kappa was fair. These findings are different from the results from the previous study conducted in COPD which revealed a lower agreement (20%) but a higher kappa (0.538) (28).

Since PA is a modifiable factor crucial to improve COPD prognosis (1), health professionals have an important role in encouraging patients to be physically active (62). Therefore, accurate tool for assessing PA levels and identifying patients who are physically inactive if crucial. In COPD, the IPAQ-sf seems to not be a useful tool for stratifying patients according to their PA level, since present a high sensitivity but a low specificity (0.89 and 0.46, respectively). This suggests that IPAQ-sf is good for identifying physically active patients (sensitivity) but has limited ability to identify physically inactive patients (specificity).

When stratifying patients by age, sex and COPD severity, the correlations between total METs-min/week and total MVPA (min/week) presented the highest values in patients with < 65 years and in male patients. The sub-group of < 65 years presented higher correlations when compared to patients with > 65 years, which is in line with the fact that IPAQ-sf was initially developed to people with < 65 years (23) and, thus, it may not be appropriate for older people. In female patients (n=7), no significant correlations were found between the IPAQ-sf 2 and any of the PA variables obtained through accelerometry. This could be justified by the lower sample size in the female sub-group. A similar finding was observed in the sub-group GOLD C─D, possibly also due to the small sample size. Further research with a larger sample of female patients and patients in GOLD C─D is needed to confirm these findings.

In general, the IPAQ-sf presented correlations superior but close to the recommended threshold (ρ>0.50) (44) and a high test-retest reliability but wide limits of agreement. Although the IPAQ-sf is recommended and widely used in several populations (36, 53, 60, 61), this study provides weak evidence to support the use of the IPAQ-sf as isolated indicator of PA in COPD (60).

4.1 Limitations and future work

This study has some limitations that need to be acknowledged. The IPAQ-sf was designed to be used by adults aged 18 ─ 65 years (23) and, in this study, participants had a mean (± SD) age higher than that range (68.6±7.8years) which may have had influenced the results.

The original authors of the IPAQ-sf (23) recommended the “last 7 days recall” version of IPAQ-sf for studies assessing PA. However, the last 7 days may not represent the usual pattern of weekly physical activity of patients, that are dependent of weather conditions, health status or family, occupational or other commitments. Future studies should also explore the “usual week” IPAQ-sf to understand if the correlations remain consistent.

Since this study was conducted with stable patients with COPD, it is not possible to generalize the results to other states of COPD and/or to other diseases. Also, most of the participants in this sample were male and in less severe stages of the disease. Future studies should be conducted with larger and different samples, at different stages of the disease and in different countries to ensure more robust results. The content validity of

the IPAQ-sf may also need to be assessed in future studies to ensure that the items, the language and the examples of the IPAQ-sf are suitable to patients with COPD.

5. Conclusions

Due to huge importance of promoting PA in patients with COPD, accurate tools for assessing patients' PA levels is needed. The results from this study showed that the IPAQ-sf has high test-retest reliability but with large 95% limits of agreement. In terms of validity, IPAQ-sf has shown acceptable, positive and statistically significant correlations. The present results are slightly better than the results from previous studies assessing the validity of IPAQ-sf in other populations. However, overall, findings suggest that the IPAQ-sf may not be an adequate tool to assess PA levels in the COPD population. More studies are needed in same population to ensure more robust results.

References

1. Global Strategy for the Diagnosis Management and Prevention of COPD. Global Initiative for Chronic Obstructive Lung Disease (GOLD). Available from: https://goldcopd.org/gold-reports/. 2020.

2. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Med. 2006;3(11):e442.

3. Programa Nacional para as Doenças Respiratórias. Programa Nacional para as Doenças Respiratórias 2017. 2017.

4. de Araújo AT. 11º Relatório do Observatório Nacional das Doenças Respiratórias: Prevenir as doenças respiratórias, acompanhar e reabilitar os doentes. Observatório Nacional das Doenças Respiratórias; 2016.

5. Maricoto T, Marques-Gomes J, Correia-de-Sousa J, Taborda-Barata L. Inhaler Review in Older Adults with Asthma or COPD: A Cost-Effectiveness Study and a Perspective in Portugal. Journal of the American Geriatrics Society. 2019;67(7):1430-6.

6. Cooper CB. Airflow obstruction and exercise. Respiratory Medicine. 2009;103(3):325-34.

7. Troosters T, van der Molen T, Polkey M, Rabinovich R, Vogiatzis I, Weisman I, et al. Improving physical activity in COPD: towards a new paradigm. Respiratory Research. 2013;14(1):115.

8. Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. Public Health Reports. 1985;100(2):126-31.

9. Whaley M, editor. ACSM's Guidelines for Exercise Testing and Prescription. . Baltimore: Lippincott, Williams, & Wilkins;; 2006.

10. WHO. World Health Organization: Global Recommendations on Physical Activity for Health. [], [http://whqlibdoc.who.int/publications/2010/9789241599979_eng.pdf]. 2010.

11. Ding D, Lawson KD, Kolbe-Alexander TL, Finkelstein EA, Katzmarzyk PT, van Mechelen W, et al. The economic burden of physical inactivity: a global analysis of major non-communicable diseases. The Lancet. 2016;388(10051):1311-24.

12. Vorrink SNW, Kort HSM, Troosters T, Lammers JWJ. Level of daily physical activity in individuals with COPD compared with healthy controls. Respiratory Research. 2011;12:1-8.

13. Waschki B, Kirsten AM, Holz O, Mueller KC, Schaper M, Sack AL, et al. Disease Progression and Changes in Physical Activity in Patients with Chronic Obstructive Pulmonary Disease. Am J Respir Crit Care Med. 2015;192(3):295-306.

14. Watz H, Pitta F, Rochester CL, Garcia-Aymerich J, ZuWallack R, Troosters T, et al. An official European Respiratory Society statement on physical activity in COPD. Eur Respir J. 2014;44(6):1521-37.

15. Choi L, Liu Z, Matthews CE, Buchowski MS. Validation of accelerometer wear and nonwear time classification algorithm. Medicine and science in sports and exercise. 2011;43(2):357-64.

16. Sievi NA, Brack T, Brutsche MH, Frey M, Irani S, Leuppi JD, et al. Accelerometer-versus questionnaire-based assessment of physical activity and their changes over time in patients with COPD. International journal of chronic obstructive pulmonary disease. 2017;12:1113-8.

17. Skender S, Ose J, Chang-Claude J, Paskow M, Brühmann B, Siegel EM, et al. Accelerometry and physical activity questionnaires - a systematic review. BMC Public Health. 2016;16(1):515.

18. Yang C-CH, Y.-L. . A Review of Accelerometry-Based Wearable Motion Detectors for Physical Activity Monitoring. Sensors and Actuators B: Chemical. 2010;10:7772-88.

19. Vanhees L, Lefevre J, Philippaerts R, Martens M, Huygens W, Troosters T, et al. How to assess physical activity? How to assess physical fitness? Eur J Cardiovasc Prev Rehabil. 2005;12(2):102-14.

20. Strath SJ, Kaminsky LA, Ainsworth BE, Ekelund U, Freedson PS, Gary RA, et al. Guide to the Assessment of Physical Activity: Clinical and Research Applications: A Scientific Statement From the American Heart Association. Circulation. 2013;128:2259-79.

21. Hecht A, Ma S, Porszasz J, Casaburi R, Network CCR. Methodology for Using Long-Term Accelerometry Monitoring to Describe Daily Activity Patterns in COPD. Copd-Journal of Chronic Obstructive Pulmonary Disease. 2009;6(2):121-9.

22. Rabinovich RA, Louvaris Z, Raste Y, Langer D, Van Remoortel H, Giavedoni S, et al. Validity of physical activity monitors during daily life in patients with COPD. Eur Respir J. 2013;42(5):1205-15.

23. Craig CL, Marshall AL, Sjostrom M, Bauman AE, Booth ML, Ainsworth BE, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc. 2003;35(8):1381-95.

24. Schaller A, Rudolf K, Dejonghe L, Grieben C, Froboese I. Influencing Factors on the Overestimation of Self-Reported Physical Activity: A Cross-Sectional Analysis of Low Back Pain Patients and Healthy Controls. BioMed research international. 2016;2016:1497213-.

25. Nyssen SM, Santos JGd, Barusso MS, Oliveira Junior ADd, Lorenzo VAPD, Jamami M. Levels of physical activity and predictors of mortality in COPD. Jornal Brasileiro de Pneumologia. 2013;39:659-66.

26. Saglam M, Vardar-Yagli N, Savci S, Inal-Ince D, Calik-Kutukcu E, Arikan H, et al. Functional capacity, physical activity, and quality of life in hypoxemic patients with chronic obstructive pulmonary disease. Int J Chron Obstruct Pulmon Dis. 2015;10:423-8.

27. Voncken-Brewster V, Tange H, de Vries H, Nagykaldi Z, Winkens B, van der Weijden T. A randomized controlled trial evaluating the effectiveness of a web-based, computer-tailored self-management intervention for people with or at risk for COPD. Int J Chron Obstruct Pulmon Dis. 2015;10:1061-73.

28. Cruz J, Jácome C, Marques A. Is the international physical activity questionnaire (IPAQ-sf) valid to assess physical activity in patients with COPD? Comparison with accelerometer data. BMC Health Services Research. 2018;18(2):684.

29. Mokkink LB, Prinsen CA, Bouter LM, Vet HC, Terwee CB. The COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) and how to select an outcome measurement instrument. Braz J Phys Ther. 2016;20(2):105-13.

30. Terwee CB, Mokkink LB, van Poppel MN, Chinapaw MJ, van Mechelen W, de Vet HC. Qualitative attributes and measurement properties of physical activity questionnaires: a checklist. Sports Med. 2010;40(7):525-37.

31. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chronic Dis. 1987;40(5):373-83.

32. Ainsworth BE, Haskell WL, Herrmann SD, Meckes N, Bassett DR, Jr., Tudor-Locke C, et al. 2011 Compendium of Physical Activities: a second update of codes and MET values. Med Sci Sports Exerc. 2011;43(8):1575-81.

33. IPAQ. Guidelines for the data processing and analysis of the International Physical Activity Questionnaire. 2005.

34. Marshall AL, Smith BJ, Bauman AE, Kaur S. Reliability and validity of a brief physical activity assessment for use by family doctors. Br J Sports Med. 2005;39(5):294-7; discussion -7.

35. Puig-Ribera A, Martín-Cantera C, Puigdomenech E, Real J, Romaguera M, Magdalena-Belio JF, et al. Screening Physical Activity in Family Practice: Validity of the Spanish Version of a Brief Physical Activity Questionnaire. PLOS ONE. 2015;10(9):e0136870.

36. Ahn GE, Chmiel JS, Dunlop DD, Helenowski IB, Semanik PA, Song J, et al. Self-reported and objectively measured physical activity in adults with systemic lupus erythematosus. Arthritis care & research. 2015;67(5):701-7.

37. Van Remoortel H, Giavedoni S, Raste Y, Burtin C, Louvaris Z, Gimeno-Santos E, et al. Validity of activity monitors in health and chronic disease: a systematic review. International Journal of Behavioral Nutrition and Physical Activity. 2012;9(1):84.

38. Wanner M, Probst-Hensch N, Kriemler S, Meier F, Autenrieth C, Martin BW. Validation of the long international physical activity questionnaire: Influence of age and language region. Preventive Medicine Reports. 2016;3:250-6.

39. Demeyer H, Burtin C, Van Remoortel H, Hornikx M, Langer D, Decramer M, et al. Standardizing the analysis of physical activity in patients with copd following a pulmonary rehabilitation program. Chest. 2014;146(2):318-27.

40. Freedson PS, Melanson E, Sirard J. Calibration of the Computer Science and Applications, Inc. accelerometer. Medicine and Science in Sports and Exercise. 1998;30(5):777-81.

41. Garber CE, Blissmer B, Deschenes MR, Franklin BA, Lamonte MJ, Lee IM, et al. American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. Medicine and Science in Sports and Exercise. 2011;43(7):1334-59.

42. Kottner J, Audige L, Brorson S, Donner A, Gajewski BJ, Hróbjartsson A, et al. Guidelines for Reporting Reliability and Agreement Studies (GRRAS) were proposed. International Journal of Nursing Studies. 2011;48(6):661-71.

43. Watson PF, Petrie A. Method agreement analysis: a review of correct methodology. Theriogenology. 2010;73(9):1167-79.

44. Terwee CB. Qualitative Attributes and Measurement Properties of Physical Activity Questionnaires. Sports Medicine. 2010;40(7):525-37.

45. Bland MJ, Altman DG. Statistical Methods for Assessing Agreement between Two Methods of Clinical Measurement. The Lancet. 1986;327(8476):307-10.

46. Landis GKJ. The measurement of observer agreement for categorical data. Biometrics. 1977;33(1):159-74.

47. Evans JD. Straightforward statistics for the behavioral sciences. Pacific Groove: Brooks/Cole Publishing; 1996.

48. IPAQ Research Committee. Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire (IPAQ) – Short and Long Form. https://sites.google.com/site/theipaq/scoring-protocol; 2005 November.

49. Faulkner G, Cohn T, Remington G. Validation of a physical activity assessment tool for individuals with schizophrenia. Schizophrenia research. 2006;82(2-3):225-31.

50. Buman MP, Hekler EB, Haskell WL, Pruitt L, Conway TL, Cain KL, et al. Objective light-intensity physical activity associations with rated health in older adults. American journal of epidemiology. 2010;172(10):1155-65.

51. Blikman T, Stevens M, Bulstra SK, van den Akker-Scheek I, Reininga IH. Reliability and validity of the Dutch version of the International Physical Activity Questionnaire in patients after total hip arthroplasty or total knee arthroplasty. J Orthop Sports Phys Ther. 2013;43(9):650-9.

52. Wendel-Vos GC, Schuit AJ, Saris WH, Kromhout D. Reproducibility and relative validity of the short questionnaire to assess health-enhancing physical activity. J Clin Epidemiol. 2003;56(12):1163-9.

53. Kaleth AS, Ang DC, Chakr R, Tong Y. Validity and reliability of community health activities model program for seniors and short-form international physical activity questionnaire as physical activity assessment tools in patients with fibromyalgia. Disability and rehabilitation. 2010;32(5):353-9.

54. Rosenberg DE, Bull FC, Marshall AL, Sallis JF, Bauman AE. Assessment of sedentary behavior with the International Physical Activity Questionnaire. J Phys Act Health. 2008;5 Suppl 1:S30-44.

55. Marmeleira J, Laranjo L, Marques O, Batalha N. Criterion-related Validity of the Short Form of the International Physical Activity Questionnaire in Adults who are Blind. Journal of Visual Impairment & Blindness. 2013;107:375-81.

56. Hartman JE, Boezen HM, Zuidema MJ, de Greef MHG, ten Hacken NHT. Physical Activity Recommendations in Patients with Chronic Obstructive Pulmonary Disease. Respiration Physiology. 2014.

57. Meeus M, Van Eupen I, Willems J, Kos D, Nijs J. Is the International Physical Activity Questionnaire-short form (IPAQ-SF) valid for assessing physical activity in Chronic Fatigue Syndrome? Disability and rehabilitation. 2011;33(1):9-16.

58. Cruz J, Jácome C, Marques A. Validity of the Brief physical activity assessment tool for clinical use in COPD. European Respiratory Journal. 2017;50(suppl 61):PA2565.

59. Benitez-Porres J, Delgado M, Ruiz JR. Comparison of physical activity estimates using International Physical Activity Questionnaire (IPAQ) and accelerometry in fibromyalgia patients: the Al-Andalus study. J Sports Sci. 2013;31(16):1741-52.

60. Lee PH, Macfarlane DJ, Lam TH, Stewart SM. Validity of the International Physical Activity Questionnaire Short Form (IPAQ-SF): a systematic review. The international journal of behavioral nutrition and physical activity. 2011;8:115-.

61. Tierney M, Fraser A, Kennedy N. Criterion validity of the International Physical Activity Questionnaire Short Form (IPAQ-SF) for use in patients with rheumatoid arthritis: comparison with the SenseWear Armband. Physiotherapy. 2015;101(2):193-7.

62. Lewthwaite H, Effing TW, Olds T, Williams MT. Physical activity, sedentary behaviour and sleep in COPD guidelines: A systematic review. Chron Respir Dis. 2017;14(3):231-44.

Appendix I – Participant information sheet

Documento Informativo ao Participante

Título do estudo: Tempo de repensar as estratégias para a atividade: uma plataforma personalizada mHealth de treino para combater a inatividade física na DPOC (OnTRACK)

Investigadora Principal: Joana Cruz, Instituto Politécnico de Leiria

O Sr./Sr.ª está a ser convidado/a para participar no estudo de investigação clínica intitulado: "OnTRACK: uma plataforma personalizada mHealth de treino para combater a inatividade física na DPOC". Antes de decidir participar, é importante que compreenda porque é que a investigação está a ser realizada e o que é que a mesma envolve. Por favor, leia a informação com atenção e, se houver algo que não esteja claro para si ou necessitar de informação adicional, por favor pergunte aos investigadores (contactos no final deste documento).

Muito obrigado desde já por ler a informação.

1. Qual é o objetivo do estudo?

O objetivo do estudo OnTRACK é promover a atividade física em pessoas com doença pulmonar obstrutiva crónica (DPOC) através do desenvolvimento, avaliação e disseminação de uma plataforma mHealth inovadora que incluirá uma aplicação móvel para smartphone com recomendações de atividade física, de acordo com as preferências e fatores contextuais de cada indivíduo. As pessoas com DPOC apresentam baixos níveis de atividade física e estes níveis têm sido associados a piores resultados em saúde e a um maior número de hospitalizações. Neste sentido, é importante perceber que fatores influenciam as pessoas a ser ou não fisicamente ativas para desenvolver intervenções que promovam a atividade física a longo prazo nesta população. Para que seja possível alcançar este objetivo, vimos solicitar a sua participação neste estudo que será desenvolvido na região de Leiria (através do Instituto Politécnico de Leiria) e na região de Aveiro (através da Universidade de Aveiro).

2. Porque é que fui escolhido?

Foi escolhido/a porque é uma pessoa com DPOC em fase estável, e é acompanhado/a por profissionais de saúde de uma das instituições que colaboram no estudo. Iremos recolher dados de aproximadamente 130 pessoas com uma condição clínica semelhante à sua.

3. Sou obrigado a participar no estudo?

A decisão de colaborar no estudo é sua. Caso decida participar, solicitamos-lhe que assine o consentimento informado, documento este que, para além de garantir o seu conhecimento relativo aos procedimentos necessários à investigação, assegura que participa de livre vontade. Mesmo após a assinatura deste documento, pode desistir em qualquer momento, sem que isso interfira nos cuidados de saúde ou sociais que lhe são prestados.

4. O que irá acontecer se eu decidir participar?

Caso decida participar, solicitamos-lhe que responda a algumas perguntas relativas aos seus dados sociodemográficos, de saúde e relacionados com o seu estilo de vida, e se necessário, para realizar uma espirometria. A espirometria é um teste simples que avalia a velocidade e a quantidade de ar que é capaz de colocar para fora dos pulmões e realiza-se expirando pela boca através de um tubo conectado a um espirómetro. Posteriormente, ser-lhe-á pedido para preencher alguns questionários sobre os seus sintomas, qualidade de vida relacionada com a saúde, atividade física, motivação e condições existentes na sua área de residência para a prática de atividade física, e a realização de alguns testes físicos. Estes procedimentos são simples e recolhidos sem qualquer desconforto para si. No final da sessão, iremos entregar-lhe um acelerómetro. Os acelerómetros são pequenos equipamentos que se usam discretamente na cintura e monitorizam o movimento, e deste modo permitem conhecer o seu nível de atividade física. Neste estudo

o acelerómetro deverá ser usado durante 7 dias consecutivos. No final de 1 semana, será realizada a recolha do acelerómetro e ser-lhe-á pedido para voltar a responder às questões relativas à atividade física. O agendamento das sessões de recolha de dados será sempre de acordo com a sua disponibilidade.

5. Quanto tempo demorará a sessão de recolha de dados?

A sessão de recolha de dados demorará aproximadamente 1 hora.

6. O que irá acontecer aos dados recolhidos?

Os dados recolhidos serão analisados pelos investigadores deste estudo. A confidencialidade e o anonimato da informação fornecida serão assegurados pela atribuição de códigos a cada participante. A informação recolhida servirá apenas para este estudo e fará parte de trabalhos académicos (por exemplo monografias para a obtenção de grau de licenciado, dissertações de mestrado), de comunicações e/ou de artigos científicos. Contudo, os participantes nunca serão identificados. Se pretender uma cópia do resultado final do estudo, por favor contacte os investigadores.

7. O que tenho de fazer?

Não é requerida qualquer precaução específica. Pedimos apenas a sua disponibilidade de tempo para as recolhas de dados acima mencionadas.

8. Quais são os possíveis benefícios de participar neste estudo?

Não existem benefícios diretos ao participar no estudo. No entanto, a sua participação irá contribuir para o aumento do conhecimento relativo aos fatores que influenciam a atividade física nas pessoas com DPOC e para o desenvolvimento de intervenções futuras. A informação clínica recolhida poderá ser fornecida ao seu profissional de referência ou a si, para que seja do seu conhecimento e incluída no seu processo clínico.

9. Poderá alguma coisa correr mal?

Não se preveem desvantagens ou riscos para os participantes do estudo.

10. Quem devo contactar em caso de dúvida ou se surgir algum problema?

Em caso de dúvida ou necessidade de esclarecimento, por favor contacte os investigadores:

Leiria: Escola Superior de Saúde do Instituto Politécnico de Leiria (ESSLei)
Joana Cruz (Investigadora Principal), E-mail: joana.cruz@ipleiria.pt, Telemóvel: 969 196 218
Sofia Flora, E-mail: sofiiaflora@gmail.com, Telemóvel: 917 257 840
Nádia Hipólito, E-mail: nadia.hipolito@ipleiria.pt, Telemóvel: 918 563 605
Aveiro: Escola Superior de Saúde da Universidade de Aveiro (ESSUA)
Alda Marques (Co-Investigadora Principal), E-mail: amarques@ua.pt, Telemóvel: 927 992 279
Liliana Santos, E-mail: ftlilianaalmeidasantos@gmail.com, Telemóvel: 914 122 671
Encarregada de Proteção de Dados do Politécnico de Leiria: Ana Maria Pratas dos Reis
E-mail: ana.reis@ipleiria.pt, Telefone: (+351) 244 830 010

Muito obrigado por ter lido esta informação.

Appendix II – Informed consent

CONSENTIMENTO INFORMADO,

LIVRE E ESCLARECIDO PARA PARTICIPAÇÃO EM INVESTIGAÇÃO

Por favor, leia com atenção a seguinte informação. Se concordar com a proposta, queira por favor assinar este documento.

Título do estudo: Tempo de repensar as estratégias para a atividade: uma plataforma personalizada mHealth de treino para combater a inatividade física na doença pulmonar obstrutiva crónica – OnTRACK

Somos um grupo de investigadores que está a desenvolver um estudo no âmbito do projeto OnTRACK (Ref. POCI-01-0145-FEDER-028446), financiado pela Fundação para a Ciência e Tecnologia e pelo Programa Operacional Competitividade e Internacionalização na sua componente FEDER e, no qual o Instituto Politécnico de Leiria é promotor e a Universidade de Aveiro copromotor, e que **tem como principal objetivo** promover a atividade física em pessoas com doença pulmonar obstrutiva crónica (DPOC), através do desenvolvimento, avaliação e disseminação de uma plataforma mHealth inovadora com recomendações personalizadas de atividade física, de acordo com as preferências e fatores contextuais de cada indivíduo com DPOC.

Assim, e para atingir os objetivos do estudo, solicitamos que responda a algumas perguntas e efetue alguns testes físicos, que serão realizados por profissionais devidamente treinados para o efeito.

Este estudo mereceu parecer favorável da Comissão de Ética e da Direção da instituição onde está a ser recrutado. A sua participação é voluntária e todas as informações obtidas através desta entrevista são anónimas e confidenciais e serão apenas utilizadas para fins da investigação, estando em todos os momentos assegurada a sua privacidade. Neste sentido, em qualquer momento pode interromper a sua participação, sem qualquer tipo de prejuízo. Caso necessite de algum esclarecimento adicional, não hesite em contactar:

Leiria: Escola Superior de Saúde do Instituto Politécnico de Leiria (ESSLei)
Joana Cruz (Investigadora Principal), E-mail: joana.cruz@ipleiria.pt, Telemóvel: 969 196 218
Sofia Flora, E-mail: sofia.flora@ipleiria.pt, Telemóvel: 917 257 840
Nádia Hipólito, E-mail: nadia.hipolito@ipleiria.pt, Telemóvel: 918 563 605
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Alda Marques (Co-Investigadora Principal), E-mail: amarques@ua.pt, Telemóvel: 927 992 279
Liliana Santos, E-mail: lilianassantos@ua.pt, Telemóvel: 914 122 671

Encarregada de Proteção de Dados do Politécnico de Leiria: Ana Maria Pratas dos Reis
E-mail: ana.reis@ipleiria.pt, Telefone: (+351) 244 830 010

Obrigado pela sua colaboração.

A Investigadora: _____

Declaro ter lido e compreendido este documento, bem como as informações verbais que me foram fornecidas pela(s) pessoa(s) que acima assina(m). Foi-me garantida a possibilidade de, em qualquer altura, recusar participar neste estudo sem qualquer tipo de consequências. Desta forma, aceito participar neste estudo e permito a utilização de dados, confiando em que apenas serão utilizados para esta investigação e nas garantias de confidencialidade e anonimato que me são dadas pelos investigadores.

Nome:_____

Assinatura:_____

Data:_____/_____/_____

Appendix III – Abstract submitted to ERS Congress 2020

09.02 - Physiotherapists

24221
Reliability and validity of the international physical activity questionnaire short-form (IPAQ-sf) in COPD

Physical activity, COPD, Quality of life

S. Flora[1], N. Hipólito[1], L. Santos[2], F. Januário[3], S. Silva[4], C. Valente[5], L. Andrade[5], F. Rodrigues[6], A. Marques[7], J. Cruz[8]

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Physical activity (PA) may improve COPD prognosis, thus its assessment and promotion are crucial. The International Physical Activity Questionnaire Short-Form (IPAQ-sf) is widely used for assessing PA but there is limited evidence on its clinimetric properties in COPD. We assessed the test-retest reliability and validity of the IPAQ-sf in patients with COPD. Fifty-five participants (68.6±7.8yrs, 48 males, FEV1 52.3±22.5%pred) completed the IPAQ-sf, wore an accelerometer for 7 days and completed a second IPAQ-sf. Test-retest reliability/agreement was assessed with: Intraclass Correlation (ICC, 95%CI), 95% Limits of Agreement (LoA), standard error of measurement (SEM) and minimal detectable change (MDC95) for continuous variables; %agreement for categories ("active" vs "inactive"). Validity was assessed with Spearman's correlations (ρ) between the IPAQ-sf (METs-min/week, time in vigorous [VPA] and moderate PA [MPA] per week) and accelerometry [time in MVPA, VPA and MPA per week] for continuous variables; %agreement, Cohen's kappa, sensitivity and specificity (95%CI) for categories. Reliability was acceptable (ICC=0.738, 0.629→0.873) but with wide LoA (-5713→4793.3 METs-min/week). SEM and MDC95 were 1844.7 and 5113.3 METs-min/week, respectively. %agreement of the two IPAQ-sf was 85.5% (kappa=0.660, 0.444→0.876). Significant correlations were found between METs-min/week and accelerometry (0.515≤ρ≤0.596), except for VPA ($p>0.05$). %agreement between tools was 67.3% (kappa=0.350, 0.279→0.571) with high sensitivity (0.89, 0.887→0.891) but low specificity (0.46, 0.46→0.47). The IPAQ-sf could be used as PA measurement tool in COPD although caution is needed to avoid misclassification.

Annex I – Ethics approval

CENTRO HOSPITALAR DO BAIXO VOUGA, E.P.E. / AVEIRO

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Exma. Senhora
Dra. Joana Patrícia dos Santos Cruz
Escola Superior de Saúde
Instituto Politécnico de Leiria
Campus 2 – Morro do Lena – Alto do Vieiro
Apartado 4137 2411-901 Leiria

S/ Ref.ª *S/ Comunicação de* *N/ Ref.ª* 15-03-2018 *Aveiro,* 07.02.2019

ASSUNTO: Resposta ao s/ Pedido de confirmação para a realização de estudo no CHBV, E.P.E.

Em resposta à s/ solicitação subordinada ao tema "On Time to Rethink Activity Knowledge: a personalized mHealth coaching platform to tackle physical inactivity in COPD" vimos, pelo presente, informar que por deliberação do Conselho de Administração, nesta data, se encontra autorizado o pedido formulado.

Nesse sentido, solicitamos a V. Exa se digne enviar um relatório final ao Serviço de Investigação e Formação do CHBV, E.P.E.

Com os melhores cumprimentos,

A Diretora do Serviço de Investigação e Formação

(Dra. Joana Guimarães)

Na resposta indicar o número e as referências deste documento. Em cada ofício tratar só de um assunto.

De: Sónia Guerra
Enviado: 21 de janeiro de 2019 12:22
Para: Joana Patrícia dos Santos Cruz
Assunto: Autorização do estudo "On Time to Rethink ACtivity Knowledge: a personalized mHealth coaching platform to tackle physical inactivity in COPD (OnTRACK)"

Exma. Sra.
Doutora Joana Cruz,

No seguimento do Vosso pedido, sobre o estudo em epígrafe, informamos V. Exa. que o **Conselho de Administração, na sua reunião de 2018.01.10, deliberou autorizar** a sua realização conforme solicitado.
Após conclusão do estudo, gostaríamos de receber um exemplar do trabalho final (preferencialmente em PDF, para o presente email).

Mais se informa que é dado conhecimento desta informação ao Diretor do Serviço de Pneumologia, Dr. Salvato Feijó e à Diretora do Serviço de Medicina Física e de Reabilitação, Dra. Mafalda Bártolo.

Com os melhores cumprimentos,

Sónia Guerra
Técnica Superior - Centro de Investigação/GEFOP

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