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52. Physical activity, methodology and impact

P279**Seasonal variability in physical activity in healthy subjects and patients with early COPD**

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Background: Physical activity (PA) is an important parameter related to morbidity in both patients with COPD and in healthy subjects. Little is known on the variability in PA measurements. We aimed at computing the intra-individual variability of PA assessments within one week and when measured 6 months apart in stable subjects.

Methods: 78 Subjects (Age 63±7 years; 6MWD 92±9% pred), including 45 healthy persons and 33 patients with COPD (23 GOLD I;10 GOLD II), were instructed to wear the SenseWear Armband during 7 consecutive days, six months apart, to measure PA. The difference in the average amount of steps (PA_{steps}) and the time spent in moderate PA (> 3 METS) (PA_{mod}) were chosen as primary outcomes. The coefficient of variation (CV) was calculated for these 7 days. Outcomes are linked to the season of assessment.

Results: The CV for the number of steps was 33±14% and accounted 59±28% for PA_{mod}. Table 1 provides an overview of physical activity at follow-up for the four seasons.

Table 1. Seasonal follow-up of PA

Outcome	First season	First assessment	Second assessment	Percentage difference (%)
Steps (average amount)	Winter	8212±2912 [‡]	9160±3198	5±5
	Spring	10253±3950 [†]	10681±4032	2±1
	Summer	10368±4239 [†]	7018±2952	-19±18
	Autumn	7735±3421 [‡]	9490±4359	10±12*
PA _{mod} (minutes)	Winter	83±52 [‡]	125±97	20±30*
	Spring	111±53 [‡]	107±55	-2±2
	Summer	117±58 [†]	73±50	-23±7*
	Autumn	89±62 [‡]	113±82	12±14*

Mean ± std. Similar symbols ([‡],[†]) indicate no significant difference. *p<0.05.

Conclusion: Our analysis indicate that, within one visit, the variability in PA is large. Average PA is reduced during autumn and winter time. Trials using PA as an outcome should take these seasonal fluctuations into account.

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Profile of physical activity in daily life in apparently healthy smokers and its correlate factors

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Objectives: To evaluate the characteristics of physical activity in daily life (PADL) in Brazilian smokers; and to study the factors which correlate with PADL in this population.

Methods: Eighty-three smokers with normal lung function (GS; 34 male, 48±11 years, BMI 26±5 kg.m⁻²) and 29 nonsmokers (GNS; 10 male, 45±11 years, BMI 27±5 kg.m⁻²) were included. Subjects were submitted to assessment of lung function, smoking habits, functional exercise capacity, health related quality of life (HRQL), anxiety and depression, as well as PADL using a step counter. The groups were divided in active or inactive subgroups according to the number of steps/day (< or > 10000 steps/day).

Results: Average steps/day was 8645±4204 in GS and 9480±3550 in GNS (p>0.05). In GS, there was significant difference between active and inactive subgroups in steps/day, distance walked and %pred of the 6-minute walk test (6MWT) (13209±2939 steps/day; 569±70 m; 84±8%pred versus 5985±2529 steps/day; 514±53 m; 78±8%pred, respectively; p=0.02 for all). Active smokers showed no difference in comparison to active nonsmokers concerning steps/day, lung function and HRQL (p>0.05 for all), despite a significant difference in the 6MWT (p<0.05). PADL level in GS correlated modestly with the 6MWT both in meters and %pred (r=0.34 and 0.31; p<0.002 for both). A linear regression model showed that 6MWT explained 10% of GS steps/day variation (adjusted R²=0.104).

Conclusions: In general, smokers walk as much as nonsmokers in daily life, especially when comparing the physically active subjects from both groups. Active smokers showed PADL, lung function and HRQL similar to active nonsmokers, although with reduced exercise capacity.

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Physical activity and its relation with exercise capacity in patients with early COPD

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Background: Physical activity (PA) and exercise capacity are reduced in patients with severe COPD. We aimed to assess PA and its relation with exercise capacity in mild COPD.

Methods: We assessed PA (SenseWear Armband) for 7 days (reported as the average number of steps (PA_{steps}) and the time spent in moderate PA (> 3METs,

Table 1. Group characteristics

	COPD (n=49)	Smoking (n=74)	Non-smokers (n=55)
Age (y)	64±6	60±8*	62±6
Gender (% male)	90	62	47**
Packyears	49±24	34±21	0**
FEV1 (% pred)	86±17	105±14	116±17**
FEV1/FVC (%)	62±7	76±4	78±5 [†]
Season (% winter)	48	39	45
PAsteps (steps/day)	7647±3464	9440±3755	10762±3442 [†]
PAmod (min/day)	83±64	116±66	114±52 [†]
VO2max (% pred)	104±25	118±31	126±31 [†]
6MWT (% pred)	90±10	92±8	103±11 [‡]

Means ± std; *p<0.05 COPD vs smokers; **p<0.05 COPD vs smokers vs non-smokers; [†]p<0.05 COPD vs (non-)smokers; [‡]p<0.05 non-smokers vs smokers/COPD.

PA_{mod}) in 123 (ex-)smokers (49 with COPD; 33 GOLD I and 16 GOLD II) and 55 non-smokers. Exercise capacity was determined by VO_{2max} and six minute walking distance (6MWD).

Results: Group characteristics are given in table1. PA was significantly correlated (p<0.0001) with 6MWD (r=0.37 and r=0.27 with PA_{steps} and PA_{mod}, respectively) and VO_{2max} (r=0.39 and r=0.35 with PA_{steps} and PA_{mod}, respectively). Stepwise multiple regression analysis showed that PA_{steps} is determined by age (R²=0.17), 6MWT (R²=0.09), season of PA assessment (1=summer/spring/autumn, R²=0.02) and diagnosis of COPD (R²=0.02; total R²=0.30). PA_{mod} is determined by season (R²=0.12), age (R²=0.05), 6MWD (R²=0.04), gender (R²=0.02) and COPD (R²=0.02; total R²=0.25).

Conclusion: PA is reduced in patients with mild COPD. Age, season of PA assessment and 6MWD are predictors of PA.

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Differences between active and inactive patients with COPD

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Objectives: To investigate differences between patients with COPD who achieve or not the minimum physical activity recommended by the American College of Sports Medicine (ACSM) according to age.

Methods: Physical activity in daily life (DynaPort monitor and SenseWear armband), lung function, exercise capacity, body composition, quality of life, respiratory and peripheral muscle force and disease severity indexes (BODE and GOLD) were evaluated in 70 patients (41 male, 66±9 years, FEV₁ 38±14%pred, BMI 27±6kg m⁻²). Groups were divided according to ACSM guideline in: active (>30 minutes/day of moderate physical activity [threshold: 4 MET for 40-64 years; 3.2 MET for 65-79 years and 2 MET for >80 years]; and inactive (those who did not achieve these recommendations).

Results: There was significant difference between the groups in body composition (weight, BMI, fat mass and %fat-free mass; p<0.05 for all), quality of life (p=0.04), FEV₁%pred (p=0.007), number of steps/day (p=0.0009), time spent walking/day (p=0.001), total energy expenditure (p=0.04) and GOLD stage (p=0.05). No differences were observed concerning exercise capacity, muscle force and BODE index. Modest but significant correlations were found between time spent daily in moderate physical activity and age (r=-0.32), BMI (r=-0.28), fat mass (r=-0.32), steps/day (r=0.56), time spent walking/day (r=0.48), total energy expenditure (r=0.43), FEV₁ (r=0.36) and GOLD (r=0.33).

Conclusion: Physically inactive patients with COPD have worse pulmonary function, quality of life and body composition than those who are active. Differences between active and inactive patients in terms of daily physical activity involve both time spent walking and energy expenditure.

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Respiratory and peripheral muscle strength, functional capacity, dyspnea and physical activity levels in patients with COPD and heart failure

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Aim: To compare lung function, respiratory and peripheral muscle strength, functional capacity, dyspnea and physical activity levels between patients with COPD and heart failure and find out the best determinant factors of functional capacity.

Methods: Thirty patients in each group; COPD (64.30±6.37 years, FEV₁=52.86±11.92, GOLD II/III=20/10) and heart failure (67.73±9.28 years, EF=34.68±7.41, NYHA II/III=20/10) were included. Pulmonary function was evaluated using spirometry, respiratory muscle strength (MIP and MEP) using a mouth pressure device, quadriceps femoris (QF) muscle strength using a hand held dynamometer, functional capacity using six-minute walk test (6MWT), dyspnea using Modified Medical Research Council Dyspnea Scale, energy expenditure during physical activities using International Physical Activity Questionnaire.

Results: Pulmonary function, QF muscle strength and MMRC scores were significantly lower; MIP, 6MWT distance and energy expenditure in activities were higher in patients with COPD compared to heart failure (p<0.05). In the multiple regression analysis, 33% of the variance in the 6MWT distance was explained by MIP (R²=0.17, p=0.039) and QF muscle strength (R²=0.28, p=0.024) in COPD; 75% of the variance was explained by QF muscle strength (p<0.001) in heart failure.

Conclusion: COPD patients are more active in daily living and have better functional capacity and respiratory muscle strength with less dyspnea perception. Pulmonary function and peripheral muscle strength are more impaired in patients with COPD compared to heart failure. Muscle strength best predict functional capacity in COPD and heart failure.

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P284**Daily physical activity in patients with COPD living alone or not: Preliminary results**

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Background: Although patients with chronic obstructive pulmonary disease (COPD) are known to be physically inactive, we hypothesized that those living alone are less inactive in daily life than patients living with family in order to maintain their functional needs.

Objective: To compare the physical activities in daily life between patients with COPD either living alone or with their families.

Methods: Physical activities in daily life were evaluated in 10 patients living alone (4 male, 64 [61-68] years, FEV₁ 39 [26-62]%pred, BMI 23 [21-30] kg m⁻²) and 10 paired patients living with their families (4 male, 66 [61-71] years, FEV₁ 41 [30-49]%pred, BMI 22 [20-29] kg m⁻²) using a multi-axial accelerometer (MiniMod, McRoberts, the Netherlands) during 12 hours/day for two consecutive weekdays. Other measurements were: spirometry, respiratory and peripheral muscle force (maximal respiratory pressures [MIP and MEP] and quadriceps one-repetition maximum test [1RM], respectively) and functional exercise capacity (6-minute walk test, 6MWT).

Results: The two groups had similar 6MWT, MIP, MEP and quadriceps 1RM. Time spent walking/day was 71 [37-112] min/day in patients living alone and 49 [19-80] min/day in patients living with their families (p=0.129). Moreover, patients living with their families tended to spend more time lying/day (143 [112-244] vs. 87 [48-177] min/day, p=0.093).

Conclusion: These preliminary results suggest that patients with COPD living alone are more active in daily life than patients living with their families, despite presenting similar functional exercise capacity and muscle force. This might implicate in a different treatment approach in patients living alone or with family.

P285**Activity limitations in patients with chronic obstructive pulmonary disease**

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Aim: Breathlessness causes limitations in activities of daily living (ADL) in COPD patients. The aims of the study were to determine most prevalent ADL limitations, and to analyze relationship between changes in occupational performance and dyspnea, respiratory and peripheral muscle strength, fatigue and quality of life in COPD.

Materials and methods: Thirty-five COPD patients (FEV₁ 50.6±23.0%) participated. Activity limitations were measured with Canadian Activity Performance Measure (COPM). Patients identified activity limitations due to respiratory disorders in self care, productivity, and leisure. They rated the most important five activities as performance and satisfaction score on 1-10 point scale. Quadriceps and respiratory muscle strength were measured. Dyspnea and fatigue were evaluated with modified Medical Research Council dyspnea (MMRC) scale and Fatigue Severity Scale (FSS), respectively. Quality of life was determined with St George Respiratory Questionnaire (SGRQ).

Results: Seventy seven percent of COPD patients reported difficulty in active recreation and functional mobility, 74% in community management, 60% in socialization, and 51% in personal care. COPM performance score was significantly related with quadriceps strength (r=0.34), inspiratory muscle strength (r=0.37), MMRC (r=-0.52), FSS (r=-0.66), and SGRQ-total scores (r=-0.61, p<0.05). FSS and SGRQ explained 75% of the variance in COPM performance.

Conclusion: Performance in ADL is related to respiratory and peripheral muscle strength, dyspnea, fatigue, and quality of life. Fatigue and quality of life are the independent determinants of occupational performance in COPD. ADL performance should be included in pulmonary rehabilitation.

P286**Short-term effects of using pedometers to increase daily physical activity in smokers**

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Background: In adults, it is recommended that the minimum of 10000 steps/day should be performed in order to consider an individual as physically active. The pedometer, a small device which counts steps, has been used to monitor and/or motivate physical activity in various populations.

Objectives: To study the short-term effects of a protocol involving the use of pedometers or an informative booklet in order to increase daily physical activity in apparently healthy smokers who reach or do not reach the minimum recommendation of 10000 steps/day.

Methods: The smokers were randomly divided in two groups: group pedometer (GP; n=23), which wore a pedometer every day during 1 month aiming to achieve 10000 steps/day; and group booklet (GB; n=17), which received a booklet with encouragement to walk as much as possible in everyday life. Each group was subdivided according to their baseline daily physical activity level: physically active (subjects who achieved 10000 steps/day) and physically inactive (those who did not achieve this minimum).

Results: Only the physically inactive GP increased significantly its daily physical activity (pre versus post; 7437±1678 vs 10290±1310 steps/day; p<0.0001), with a concomitant increase in the 6-minute walking test (6MWD) (540 [501-586] vs 566 [525-604]m; p=0.03). In the GP, D post-pre steps/day correlated significantly with baseline number of steps/day (r=-0.63; p=0.01), but not with 6MWD, Fagerström Tolerance Questionnaire for nicotine dependence and smoking habits.

Conclusions: Physically inactive smokers increase their daily physical activity level by using a simple tool (pedometer), and the improvement is negatively related to the baseline activity level.

P287**Performance of activities of daily living and inspiratory muscle force in patients with COPD**

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Background: Patients with COPD often experience a decline in exercise tolerance, resulting in disability in the performance of activities of daily living (ADL). Inspiratory muscle weakness is commonly observed in these patients and contributes to dyspnea, fatigue and reduced exercise capacity. However it is unclear if inspiratory muscle weakness decreases the performance during ADL.

Aim: To assess the correlation between inspiratory muscle force and performance during a standardized protocol of ADL.

Methods: 18 patients (FEV₁ 47±16%pred; MIP 52±20cmH₂O) performed different activities during 30 minutes approximately. A portable metabolic system was used to assess VE, VO₂ and MET during different ADL such as wake up and making bed, taking shower and washing one's back, putting on clothes, brushing teeth and combing hair, lifting and lowering containers on a shelf at eye level, lifting and lowering containers on a shelf above the scapular waist and hanging. The Borg scale was used to verify dyspnea and fatigue.

Results: There was no significant correlation (r=0.2, p=0.08) between MIP and performance indicators (VE, VO₂), dyspnea and fatigue observed during this protocol of ADL.

Conclusion: Performance during this specific protocol, which is representative of some daily life tasks was not related to the MIP. Preliminary data suggest that ventilatory and metabolic responses had no influence of inspiratory muscle capacity during this standardized protocol of ADL in patients with COPD.

P288**Differences in the quality of life of patients with chronic obstructive pulmonary disease living in different countries**

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Aim: To evaluate the differences in the quality of life (QoL) of patients with Chronic Obstructive Pulmonary Disease (COPD) living in different countries.

Methods: A cross-sectional and comparative study with 80 COPD outpatients of the Respiratory Service of public hospitals of Salamanca (Spain) and Fortaleza (Brazil) from September to December 2010. The sampling was selected by pairs depending on the severity (Global Initiative for Chronic Lung Disease criteria). Socio-demographic and spirometric data (American Thoracic Society criteria) were collected. The QoL was evaluated by the Saint George Respiratory Questionnaire (SGRQ) and the World Health Quality of Life-Bref (WHOQOL-BREF). Descriptive analysis, the t-student test and the chi-square test were applied (SPSS).

Results: The severity was 7.5% of mild, 30% of moderate, 47.5% of severe and 15% of very severe COPD. The mean age of Brazilian patients was 66.6 years (SD 8.0years) and the Spanish one was 69.1 years (SD 8.9years). There were significant differences in gender, civil state, monthly income, place of residence, being smoker and ex-smoker, the forced expiratory volume in 1s (FEV₁) in both samples. There were also significant differences in all domains and the total SGRQ and in all WHOQoL-Bref domains except the Environment. Brazilian patients presented higher scores in the SGRQ (worse QoL) while Spanish patients had lower scores in the WHOQoL-Bref (worse QoL).

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Conclusions: The differences in the QoL of these patients can be related with the differences in the FEV₁ and the socio-demographic characteristics.

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Validation of two physical activity fatigue questionnaires in cystic fibrosis children

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Cystic Fibrosis (CF) is a chronic respiratory disease with a multisystemic involvement resulting in peripheral muscle fatigue. There are specific questionnaires that assess physical activity fatigue in children. Children Sport Fatigue Questionnaire (CSFQ) and Short Fatigue Questionnaire (SFQ).

Objective: To validate the Spanish version of both questionnaires in healthy sportive children and to measure the sensitivity of both tools on children with CF that follow regular physical activity.

Methodology: After the questionnaires translation and retro-translation, they were applied in 44 healthy sportive children twice. Sensitivity was measured in 20 children with CF and the results were compared with the Cystic Fibrosis Questionnaire Revised (CFQ-R).

Results: *Healthy children:* age (12±2.6 years), BMI (19±2.7 kg/m²). Cronbach index showed good consistency, 0.86 to 0.78, CSFQ and SFQ and intraclass correlation coefficient showed: 0.85 and 0.83, CSFQ and SFQ, respectively. *CF children:* age (13±3.8 years), BMI (18±2.7 kg/m²). Significant correlations were obtained between CFQ-R and CSFQ: Physical 0.76, Body 0.66 and Role 0.85 for CFQ-R14+; Digestive 0.34 and Treatment 0.33 for CFQ-R Child. Correlations between CFQ-R and SFQ: Physical 0.53 and Role 0.54 for CFQ-R14+, and Treatment 0.40 for CFQ-R Child.

Conclusion: The CSFQ and SFQ questionnaires are valid and reliable for assessing the fatigue caused by physical activity and being suitable for use in CF children that follow regular physical activity such as pulmonary rehabilitation.

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Physical activity behaviour and sedentary time in persons with obstructive sleep apnea and obesity

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Background: Physical activity has not only been proven to enhance health in the general population but is also related to the severity of obstructive sleep apnea syndrome (OSAS). Studies reporting physical activity level in persons with OSAS often use questionnaire but none has described the physical activity pattern using accelerometer.

Aim: The aim of the study was to measure physical activity and sedentary behaviours in a sample of persons with OSAS and obesity.

Methods: 35 persons (7 women) with moderate/severe OSAS (AHI ≥15) and obesity (mean BMI: 36.3) were enrolled in the study. They wore a three-axis accelerometer (Sensewear Armband) for five days. Measurements used were daily median for number of steps, minutes of physical activity above 3.0 METs (i.e moderate and vigorous intensity) and amount of time spent in sedentary (<1.0 METs). A visual analysis was made regarding number of 10-minute bouts of physical activity above 3.0 METs.

Results: Participants were sedentary for a daily median of 11 h 25 min (IQR 5:08). They took a median daily amount of 7121 steps (IQR 4945) and were physically active above 3.0 METs for a median of 54.4 min (IQR 63). The median number of 10-minute bouts of physical activity above 3.0 METs was 2.4 (IQR 3) and when calculating these bouts, only a median of 29.6 min (IQR 39) of physical activity above 3.0 METs was identified.

Conclusions: The participants' daily median of steps and minutes spent on at least moderate-intensity physical activity fairly well match the general recommendations. However, the results do not meet the recommendations set for physical activity in weight reduction, i.e 300 minutes/week of moderate-intensity physical activity.

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A new model to understand the concept physical activity for patients with COPD

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Background: Although physical activity (PA) is a relevant concept for patients with COPD, no Patient Reported Outcome (PRO) exists to measure PA from the patient's perspective. Regulatory guidance requires that PROs should be underpinned by a conceptual framework. In absence of such framework on PA, the IMI PROactive consortium aimed to develop a new framework to guide the item generation of the PROactive instruments to measure PA in COPD. In this study, PA includes all activities requiring bodily movement, not just exercise or sports.

Methodology: The conceptual framework used a) content analysis of interviews and focus groups undertaken in 4 European countries with patients sampled to include diverse demographic and COPD phenotypes, b) systematic reviews; and c) iterative discussions with experts in COPD and PRO development.

Results: 78 patients (59% male; 40% GOLD III-IV; 55% >65 years) provided 23 one-to-one interviews and 8 focus groups (N= 55). Three overarching themes emerged from the qualitative interviews, explaining the concept PA from the patients' perspective, i.e. 1) what activities patients with COPD actually do (amount of PA); 2) how they feel when physically active (symptoms); and 3) how they organize their PA (adaptations patients make to facilitate PA).

Discussion: This conceptual framework provides comprehensive insight on the concept of PA from a patient perspective. It will guide the item generation for new PROs aiming to assess PA in COPD. A prospective study, using factor analysis, is planned to evaluate whether these 3 themes of the PROactive instruments indeed represent different domains of PA or rather one central concept, i.e. physical activity.

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Assessing COPD patients' experiences of physical activity: From qualitative interviews to item generation

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Background: Physical activity (PA) is a relevant outcome in COPD. We developed a conceptual framework on PA. In line with regulatory guidance documents, we used this framework to generate items for the Proactive Patient Reported Outcomes currently being developed to capture PA from the patients' perspective.

Methodology: We conducted 23 one-to-one interviews and 8 focus groups (N=55) with a representative group of COPD patients from 4 European countries (59% male; 40% GOLD III-IV; 55% >65 years). Quotes of patients' PA experiences and potential items were grouped per theme using Atlas ^{TI}. Information was supplemented with systematic reviews. Item phrasings, response options and recall period were iteratively discussed amongst experts in PRO development.

Results: Patients experience difficulties related to amount of PA. Climbing stairs and walking are the first activities impacted by the disease, although almost all activities of daily life are affected, such as lifting, chores, and self-care. Patients notice symptoms during PA such as breathlessness, or tiredness. Patients adapt to these restrictions by pacing or slowing down and taking breaks to recover, among others. We developed 2 item pools covering the conceptual framework: for daily use (25 items with 5-point Likert scales); and for clinic visits (7 days recall; 33 items with 5-point Likert scales).

Discussion: Culturally sensitive translations of these item pools are currently undergoing cognitive debriefings in 4 European countries to ensure clarity of instruction and items. A quantitative clinical study will then be conducted to finalize the items for each of the instruments.

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P293**Experiences of physical activity are similar among European COPD patients**

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Background: The PROactive consortium aims to develop Patient Reported Outcome instruments capturing physical activity (PA) in COPD patients. Qualitative studies showed that amount of PA is important, yet, when developing items, one should ascertain that the specific activities representing this theme are relevant to all patients, irrespective of demographics or cultural background.

Methodology: Fifty five COPD patients with diverse demographic and disease characteristics from Belgium, the Netherlands, United Kingdom (Scotland) and Greece were enrolled in 8 focus groups (38.2% female; 61.6% gold stage I-II; 45% ≤ 65 years), with the aim to understanding how they experience PA. The proportion of patients who expressed difficulties with activities between countries, age groups and gender were compared using non-parametric statistics.

Results: The proportion of patients experiencing difficulties was similar between the 4 countries for walking, climbing stairs, chores, hobbies, carrying/lifting objects, and self-care activities. Significant differences were noted for cycling (p=0.007), which was an activity specific to the Netherlands and Belgium only; and for walking uphill (p=0.023), which was more common in Greece and Scotland, due to the country geographic characteristics. No differences between gender and age groups (≤ 65 vs. > 65 years) were detected.

Discussion: Physical activity is most likely a universal concept, as patients from diverse countries report similar activities that are affected when sharing their PA experiences. Activities that are only relevant to certain subgroups should not be selected as items in PROs on PA.

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