449. Outcomes and assessment methods in physiotherapy and rehabilitation

P4381

Predicting the risk of falls in patients with COPD: Does age matter?

Alda Marques[1,2], Joana Cruz[1], Daniela Figueiredo[1,2]. [1]*Escola Superior de Saúde da Universidade de Aveiro (ESSUA), University of Aveiro, Portugal;* [2]*Unidade de Investigação e Formação Sobre Adultos e Idosos (UnIFai), University of Porto, Portugal*

Introduction: The extrapulmonary manifestations of COPD have been associated with deficits in mobility and balance, which potentiate the risk of falls. This is more evident in advanced COPD. However, research in the risk of falling in this population is scarce. Furthermore, as deterioration of balance increases with age, it is important to understand how age influences the fall risk in these patients.
Aim: To assess the risk of falls in different age groups of patients with advanced COPD.
Methods: Fifty-five outpatients with COPD (GOLD III and IV) were recruited. The risk of falling was assessed using the Timed Up & Go (TUG) test. Two TUG tests were performed and the best performance was considered. Participants (39 males) were divided into 4 groups according to their age: <60 (n=11; G1), 60-69 (n=11; G2), 70-79 (n=20; G3) and 80-99 years old (n=13; G4).
Results: The mean TUG time for each group was G1 11.03±3.11; G2 10.73±1.36; G3 11.22±4.35; G4 14.34±4.87 seconds. No statistical significant differences between groups were found. However, all groups presented worse values than the average performance of their age-matched healthy peers[1].
Conclusion: Patients with advanced COPD exhibit changes in balance and are at risk of falling, regardless of their age. The results suggest that pulmonary rehabilitation, a recommended standard of care for patients with COPD aimed to optimize functional status and increase participation, should include a specific component of balance training and strategies to prevent falls, to restore the highest possible level of independent function in this population.
Reference:

[1] Bohannon, R.W., Reference Values for the Timed Up and Go Test: A Descriptive Meta-Analysis. J Geriatr Phys Ther 2006; 29(2):64-68.

P4382

Does the incremental shuttle walking test (ISWT) require maximal effort in healthy subjects of different ages?

Cristiane Golias Gonçalves[1,2], Rafael Mesquita[1,3], Daniela Hayashi[1,2], Josiane Marques Felcar[1,3], Fábio Pitta[2,3], Karen Barros Parron Fernandes[1,2], Vanessa Suziane Probst[1,3]. [1]*Centro de Pesquisa em Ciências da Saúde (CPCS), Centro de Ciências Biológicas e da Saúde (CCBS), Universidade Norte do Paraná (UNOPAR), Londrina, Brazil;* [2]*Programa de Mestrado Associado UEL-UNOPAR em Ciências da Reabilitação, Universidade Estadual de Londrina (UEL) e Universidade Norte do Paraná (UNOPAR), Londrina, Brazil;* [3]*Laboratório de Pesquisa em Fisioterapia Pulmonar (LFIP), Universidade Estadual de Londrina (UEL), Londrina, Brazil*

Background: It is unknown whether the ISWT requires maximal effort in subjects of different ages.
Objective: To evaluate if the ISWT requires maximal effort in healthy subjects of different ages.
Methods: 331 individuals (158 men) performed two ISWT, allowing more than 12 levels of the test, if necessary. The participants were separated into six groups according to their age (G1: 18-28, G2: 29-39, G3: 40-50, G4: 51-61, G5: 62-72 and G6: 73-83 years). Heart rate (HR) and symptoms of dyspnea and fatigue were recorded. HR achieved at the end of the test was expressed as a percentage of the maximum heart rate (HR_{max}).
Results: 31% of the subjects achieved more than 12 speed levels. The majority of subjects reached HR values greater than 90% of HR_{max} at the end of the test with a median [interquartile range] of: G1: 100[95-104]; G2: 100[96-105]; G3: 102[97-107]; G4: 99[91-105]; G5: 95[87-106] and G6: 95[90-109]%HR_{max}. Regarding symptoms, all groups showed higher values of dyspnea and fatigue at the end of the test ($p < 0.05$). A multivariate analysis (logistic regression) identified that female gender (odds ratio: 3.3 [95% confidence interval:1.4-8.1], worse performance in the ISWT (low: 4.2 [1.7-10.2]; normal: 2.6 [1.3-5.4] *versus* high performance) and older age (4.7 [1.7-12.9]) increased the chance for not achieving 90% of HR_{max} at the end of the ISWT.
Conclusion: The Incremental Shuttle Walking Test is a field test that requires maximum effort for most healthy individuals, and for that it is necessary to extend the test beyond twelve speed levels. Female gender, older age and worse performance in the test are the determinants for not reaching maximal effort during the ISWT.

P4383

Are 30 minutes of rest between two incremental shuttle walking tests enough for cardiovascular variables and symptoms to return to baseline values?

Laís Regina Ribeiro[1,2], Rafael Mesquita[1,2], Myriam Fernanda Merli[1,2], Cristiane Gonçalves[1,2], Daniela Hayashi[1,2], Josiane Felcar[1], Vanessa Suziane Probst[1,2]. [1]*Centro de Pesquisa em Ciências da Saúde (CPCS), Universidade Norte do Paraná (UNOPAR), Londrina, PR, Brazil;* [2]*Programa de Mestrado Associado UEL-UNOPAR em Ciências da Reabilitação, Universidade Norte do Paraná (UNOPAR), Londrina, PR, Brazil*

Background: The Incremental Shuttle Walking Test (ISWT) is commonly performed twice for purposes of reproducibility, with in general, 30 minutes of rest between the tests. However, it is unknown if the 30 minutes' rest is sufficient for stabilization of cardiovascular and symptomatological variables.
Aim: To investigate if 30 minutes of rest between two ISWTs are enough for cardiovascular and symptomatological variables to return to baseline values in healthy subjects of different ages.
Methods: 457 healthy subjects (154 men, 63[45-70] years, 27[24-30] kg/m^2) were assessed and separated into quartiles according to their age: Q1 (18 to 45 years, n=117), Q2 (46 to 63 years, n=116), Q3 (64 to 70 years, n=121) and Q4 (71 to 83 years, n=103). Two ISWTs were performed with at least 30 minutes of rest in between, and heart rate (HR), blood pressure (BP) and symptoms of dyspnea and fatigue were assessed before and after the tests.
Results: The HR before the ISWT was higher in the second test compared to the first one in the whole group and in all subgroups ($p<0.0001$ for all). The systolic BP was higher before the second test only in the whole group ($p=0.04$). Regarding symptoms, fatigue showed statistical significance only in Q1 ($p=0.02$), being higher before the second test compared to the first. Diastolic BP and symptoms of dyspnea were similar before the two ISWTs in the whole group and in all subgroups.
Conclusions: 30 minutes of rest between two ISWTs are not enough for the cardiovascular system to return to baseline values in healthy subjects, regardless of age. For perceived symptoms of dyspnea, this amount of rest seems to be enough.

P4384

Predictors for longitudinal change in 6-minute walk distance in COPD patients

Bente Frisk[1,2], Birgitte Espehaug[1], Jon Andrew Hardie[2], Liv Inger Strand[4], Rolf Moe-Nilssen[4], Tomas M. Eagan[5], Per S. Bakke[2], Einar Thorsen[2,3]. [1]*Center for Evidence Based Practice, Bergen University College, Bergen, Norway;* [2]*Institute of Medicine, University of Bergen, Norway;* [3]*Dept. of Occupational Medicine, Haukeland University Hospital, Bergen, Norway;* [4]*Dept. of Public Health and Primary Health Care, University of Bergen, Norway;* [5]*Dept. of Thoracic Medicine, Haukeland University Hospital, Bergen, Norway*

Introduction: The 6-min walk distance (6MWD) is widely used to evaluate exercise capacity in patients with Chronic Obstructive Pulmonary Disease (COPD), and is predictive of mortality and exacerbations.
Aims: To examine the change in 6MWD over 3 yrs in COPD patients and elucidate factors at baseline that may predict the change.

Methods: This prospective observational study included 389 patients aged 40-75 yrs, with clinically stable COPD in GOLD stage II-IV. Measurements at baseline and after 1 and 3 yrs included 6MWD, spirometry, body mass index (BMI), and assessment of smoking habits and exacerbations by questionnaires. Adjusted generalized estimating equations (GEE) regression analyses were used to analyze predictors for change in 6MWD.
Results: There was no significant change in 6MWD from baseline to 1 yr for any GOLD stage, or from baseline to 3 yrs for patients in GOLD II. For GOLD III (β= -36 m, 95% CI=-55, -17) and IV (β=-86 m, 95% CI= -138, -33) 6MWD decreased (fig.1). In the multivariate GEE forced expiratory volume in one second (FEV_1) ($p<0.001$), forced vital capacity ($p<0.001$), age ($p<0.001$), exacerbations ($p=0.018$), BMI ($p=0.001$) and pack years ($p=0.003$) were predictors for 6MWD, though only FEV_1 predicted change over time ($p=0.003$).

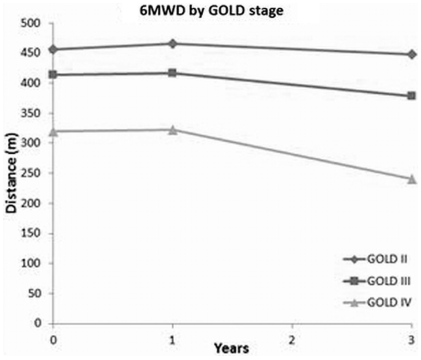


Figure 1. Mean 6MWD (unadjusted) by GOLD stage.

Conclusion: Patients in GOLD stage II maintained 6MWD at 3 yrs, while patients in GOLD III and IV reduced 6MWD significantly. FEV_1 was a strong predictor for longitudinal change in 6MWD.

P4385
Twelve-minute walking distance predicts COPD mortality
R. Harpa Arnardóttir[1,2,3], Christer Janson[1], Hans Hedenström[1], Margareta Emtner[1]. *[1]Department of Medical Sciences, Uppsala University, Uppsala, Sweden; [2]School of Health Sciences, University of Akureyri, Iceland; [3]Rehabilitation Unit, Akureyri Hospital, Akureyri, Iceland*

Background: Patients in pulmonary rehabilitation (PR) suffer from poor lung function, exercise capacity and health-related quality of life (HRQoL). Some of these factors have been shown to relate to mortality in COPD. Drop-out from clinical PR-studies is often high and might indicate worse prognosis in that group.
Aims: To measure the five-year survival of 89 COPD-patients enrolled in a four-month PR at Uppsala University Hospital and investigate if the 12 min walking distance (12MWD), peak exercise capacity (Wpeak), HRQoL and being able to fulfill the training period had prognostic value for survival.
Methods: Lung function (FEV_1, VC), 12MWD, Wpeak and HRQoL (SF-36) were measured at baseline. Of 89 included patients, 53 fulfilled the PR-program.
Results: Mean baseline FEV_1 was 34±12 (% pred.) and most patients had GOLD stages III or IV. Mean follow-up time was 1732±324 days. Twenty patients (22%) died during follow-up. Causes of death were cancer (n=9), COPD (n=6) and cardiovascular diseases (n=5). Survival among drop-outs and fulfillers (mortality 31% and 17%, respectively) did not differ significantly ($p=0.06$). At baseline, survivors were younger than non-survivors ($p=0.01$) and had higher values of FEV_1 ($p=0.01$), Wpeak ($p=0.03$) and 12MWD ($p=0.0003$), but HRQoL was similiar in both groups. Cox proportional hazard analysis including age, FEV_1, Wpeak, 12MWD and the factor "drop-outs/fulfillers", revealed low 12MWD ($p=0.008$) as the only significant mortality predictor in the model, with HR= 0.82 (95% CI: 0.7-0.95), per 50 m increase. With 12MWD < 850 m (= median), relative risk of dying within five years was 4.4 (95% CI:1.2-16.9; $p = 0.03$).
Conclusion: 12MWD is a strong predictor of survival in patients with COPD.

P4386
A symptom-limited incremental step test determines maximal physiological responses in patients with COPD
Simone Dal Corso[1], Carla Malaguti[2], Anderson Alves de Camargo[1], Meyer Izbicki[3], Luiz Eduardo Nery[3]. *[1]Rehabilitation Sciences, Nove de Julho University, Sao Paulo, SP, Brazil; [2]Human Physiology, Federal University of Juiz de Fora, MG, Brazil; [3]Pneumology, Federal University of São Paulo, SP, Brazil*

Background: Step tests (StTs) have been used to evaluate exercise tolerance and effort-related hypoxaemia in different diseases. StTs can be classified as paced (fixed rate) or self-paced cadence. However, an incremental step test (IStT) has never been tested in COPD patients.
Aim: To compare maximal physiological responses between an IStT and symptom-limited incremental cycle ergometry (CE), and to test the reliability of the IStT in patients with COPD on different days.
Material and methods: Twenty-two patients (VEF_1 47±13%) underwent two IStTs (IStT-1 and IStT-2, height of 20 cm) and a CE. For the IStT, the initial step rate was set at 10 steps/min and was increased by one step every 30 seconds. The stepping rate was dictated by an audio signal played on a CD.
Results: Despite significant differences in peak VO_2 (1.18±0.36 L for 1.26±0.41 L and 1.26±0.43 L, respectively), no differences were observed for VE, L/min (42.0±13.9, 42.5±14.6, 41.2±13.7, respectively) and for heart rate expressed as a percentage of the predicted rate (89±12, 90±13, 88±11, respectively). The desaturation was significantly lower for CE compared to IStT-1 or IStT-2 (-3.4±3.4%, -6.3±4.9%, -6.3±4.0%, respectively). Both IStTs showed highly reproducible VO_2 peaks (intraclasse correlation coefficient (ICC)=0.99) and number of steps (ICC=0.98). A strong correlation was found between the work performed on the IStT [step height (m) x number of steps x weight (kg) x 0.16357] and peak VO_2 on CE ($r=0.93$).
Conclusion: A symptom-limited incremental step test, externally paced, elicits maximal cardiopulmonary and metabolic responses, and is well tolerated and reproducible in patients with COPD.

P4387
The impact of MRC classification on daily physical activity and physical health-related quality of life in mild to moderate COPD
Hans Van Remoortel[1,2], Miek Hornikx[1,2], Heleen Demeyer[1,2], Kristien De Bent[3], Erica Balligand[3], Laurence Vrancken[3], Chris Burtin[1,2], Daniel Langer[1,2], Marc Decramer[1,2], Rik Gosselink[1,2], Wim Janssens[2,3], Thierry Troosters[1,2]. *[1]Rehabilitation Sciences, Katholieke Universiteit Leuven, Faculty of Kinesiology and Rehabilitation Sciences, Leuven, Belgium; [2]Respiratory Division and Pulmonary Rehabilitation, University Hospital K.U. Leuven, Belgium; [3]Clinical Trial Unit, Department of Pneumology, University Hospital K.U. Leuven, Belgium*

Dyspnea, reduced physical activity (PA) and impaired health-related quality of life (HRQL) are common features in COPD. This study aimed to investigate the impact of dyspnea on PA and HRQL in mild/moderate COPD.
Fifty-three subjects with COPD and 60 smoking controls were recruited. Medical Research Council (MRC) classified patients by symptoms of dyspnea. The SenseWear Armband was worn for 7 days and time spent in at least moderate intense PA and amount of steps served as PA estimates. HRQL was assessed by the SF-36 physical functioning score and the EQ5D general health VAS score.

Table 1. Patient characteristics

	MRC1 COPD (n=29)	MRC0 COPD (n=24)	MRC1 smokers (n=24)	MRC0 smokers (n=36)
Age (y)	64±7	63±6	63±5	61±7
Gender,%male	83	75	62	75
BMI	27.3±4.3	26.5±4.1	27.3±4.1	26.3±4.1
FEV1 (%pred)	79±16*	93±15	106±15	104±13
GOLD I/II, n	15/14*	20/4		
Moderate PA (min/day)	13[3-34]**	38[11-68]	40[23-59]	44[14-96]
Daily steps	7051±3317	9135±4586	8667±2887	9720±3780

*p<0.05 MRC1 vs MRC0, **p<0.05 MRC1 COPD vs MRC1 smokers.

Moderate intense PA was significantly reduced in MRC1 COPD compared to MRC1 smokers and tended to be lower versus MRC0 COPD ($p=0.10$). A trend for reduced daily steps in MRC1 COPD was observed versus MRC1 smokers and MRC0 COPD, $p=0.09$. MRC1 COPD reported reduced physical functioning and VAS scores versus MRC1 smokers and MRC0 COPD (70±19 vs 81±13 vs 91±7 for physical functioning, $p<0.01$ and 71±12 vs 77±7 vs 81±10 for VAS score, $p<0.05$).
PA levels are reduced in symptomatic patients with mild to moderate COPD. MRC classification, as proposed by the new GOLD guidelines, is useful in identifying reductions in PA and (physical) HRQL, even in the early stages of COPD.

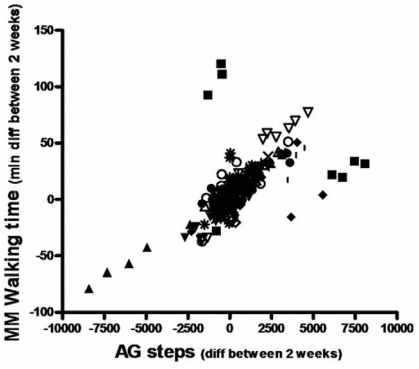
P4388
Does the energy expenditure of patients with COPD reflect their time spent walking and intensity of walking in daily life?
Thaís Sant'Anna, Carlos Augusto Camillo, Renato Vitorasso, Anaisa Cortez Vercese, Victoria Cristina Escobar, Nidia Aparecida Hernandes, Fabio Pitta. *Laboratory of Research in Respiratory Physiotherapy (LFIP), Department of Physiotherapy, State University of Londrina, Londrina, Brazil*

Introduction: The level of physical activity in daily life (PADL) is frequently expressed by energy expenditure (EE) measurement. However, patients with chronic obstructive pulmonary disease (COPD) often present high EE due to increased work of breathing, systemic inflammation and other factors. Thus, EE might not be a good outcome to characterize PADL in this population.
Aim: To verify the influence of time spent walking, movement intensity and other PADL variables on EE of patients with moderate to severe COPD.
Methods: The PADL of 53 patients (35men, 66±9yrs, FEV1 38±15%pred) was evaluated by two activity monitors (DynaPort MiniMod and SenseWear). The DynaPort mainly registers time spent walking (TW), standing, sitting, lying (TL), and movement intensity during walking (MI). The SenseWear mainly registers total energy expenditure (TEE) and active energy expenditure (AEE). Patients wore both motion sensors in daily life during two consecutive weekdays (12hs/day).

Results: Only TW (r=0.41) and TL (r= -0.31) significantly explained TEE (r2=0.40, p<0.001). AEE was explained only by TW (r2=0.19, p<0.001). MI did not help explaining TEE (p=0.16) or AEE (p=0.24).
Conclusions: Time spent walking and lying in daily life explained together 40% of the variation in TEE, whereas time spent walking explained only 19% of AEE. Furthermore, movement intensity did not affect significantly any variation in EE. This suggests that assessment of time spent actively and inactively, movement intensity and energy expenditure in daily life do not provide similar or related information on the assessment of PADL in patients with moderate to severe COPD.

P4389
Comparison of outcomes of the Actigraph and the Dynaport activity monitor in patients with COPD; results from PROactive
Juliana Maria Sousa Pinto[1], Thierry Troosters[1], Laurence Vranken[1], Miek Hornikx[1], Heleen Demeyer[1], Wim Janssens[1], Marc Decramer[1], Judith Garcia-Aymerich[2]. *[1]Rehabilitation Sciences and Respiratory Division, KU Leuven and UZ Leuven, Leuven, Belgium; [2]Center for Research in Environmental Epidemiology, CREAL, Barcelona, Spain*

Activity monitors are increasingly used to assess physical activity. We aimed to compare wearing time and walking between two activity monitors in COPD. Fifty four patients (FEV1 62±22%pred, 6MWD 495±138m) wore the Actigraph (AG) and Dynaport (DP) twice for 14 days with 14 days in between, in the frame of the PROactive project. Wearing time (h/d); walking time(min/d) of DP (DPWT) and steps/day of AG (AGsteps) were retrieved. Calculations were done on the mean wearing and walking variables obtained over 28 days (Inter-patient correlations). Intra-patient correlations were calculated over the 28 days obtained in each patient, as well as between mean weekly values of the 4 weeks (6 contrasts).
Results: Wearing time of the AG and DP were strongly related (R=0.80 p<0.001). Despite being worn on the same belt the DP reported 83±69min more wearing time (p<0.001). Mean DPWT and AGsteps related strongly (R=0.90 p<0.001). Median day-by-day correlations between AGsteps and DPWT was 0.88 (IQR 0.75 to 0.95). Week-to-week variability was large (AGsteps 424 range -8412 to 8083; DPWT 6 range -79 to 120min). Median correlations of differences in 6 weekly PA levels, (n=39) was good (median R=0.88 IQR 0.71 to 0.98).



Conclusion: These data show that both monitors provide comparable outcomes and are capable of measuring differences between separate weeks of assessment. The difference in wearing time needs clarification.

P4390
Cell phone based physical activity monitoring: A validation study
Filippo Gravante[1], Emmanuel Stamatakis[2], David Prieto[3], Eleanor Main[1]. *[1]Cardiorespiratory Sciences, UCL Institute of Child Health, London, United Kingdom; [2]Epidemiology & Public Health, UCL Population Health, London, United Kingdom; [3]Medical Statistic, London School Of Hygiene and Tropical Medicine, London, United Kingdom*

Background: Accelerometers are accurate and useful for monitoring Physical Activity (PA) in people with chronic lung disease (eg. COPD) and can help motivate clients to comply with rehabilitation. However, they are expensive and largely limited to research. Similar motion sensors are embedded within the majority of newer mobile phones, which are widely accessible.
Aim: This study investigated whether the built-in accelerometers within mobile phones may be valid and reliable for monitoring PA.
Method: A mobile phone application to record real time tri-axial acceleration was developed. The accelerometer integrated within 2 mobile phones (HTC Wildfire and HTC Desire HD) was compared to a validated accelerometer (ActiGraph GT3X). Wearing all 3 devices, 7 healthy adults performed 7 different activities, paced with a metronome, each repeated 7 times. Absolute values of 3D acceleration signals were summed and averaged over each time period. Reliability was evaluated using Intra-class Correlation Coefficients (ICC). Concurrent validity was assessed using a general linear model for repeated measures (GLM) and Pearson correlation.
Results: The ICC for both phone devices ranged between 0.82 and 0.98. GLM and

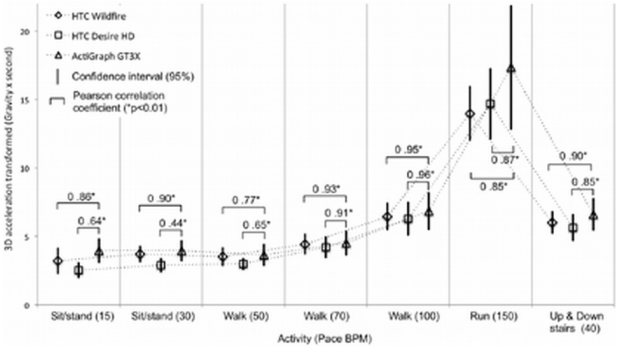


Figure 1. Tri-axial acceleration during different activities.

Pearson coefficient confirmed good correlation between phones and ActiGraph in all activities (Figure 1).
Conclusion: Mobile phone accelerometers appear to be reliable and valid for measuring PA. Further research is needed to confirm these data in a patient population.

P4391
Walking speed and muscle strength are determinants of physical activity level (PAL) – A cross-sectional study in COPD
Mikael Andersson[1,2], Frode Slinde[3], Anne Marie Grönberg[3,5], Ulla Svantesson[4], Christer Janson[2], Margareta Emtner[1,2]. *[1]Department of Neuroscience, Physiotherapy, Uppsala University, Uppsala, Sweden; [2]Department of Medical Science, Respiratory Medicine and Allergology, Uppsala University, Uppsala, Sweden; [3]Department of Internal Medicine and Clinical Nutrition, Sahlgrenska Academy at Gothenburg University, Gothenburg, Sweden; [4]Department of Clinical Neuroscience and Rehabilitation, Sahlgrenska Academy at Gothenburg University, Gothenburg, Sweden; [5]Department of Internal Medicine, Respiratory Medicine and Allergology, Sahlgrenska Academy at Gothenburg University, Gothenburg, Sweden*

Introduction: Physical activity level (PAL) is a strong predictor of mortality in patients with COPD, only explained to a small degree by lung function. If simple measures that contribute in determining PAL were identified, this might be a valuable addition to the routine assessment of patients.
Aims and objectives: The aim was to describe PAL and potential determinants in a sample of COPD patients. Furthermore these predictors were used as independent variables in a hierarchical multiple regression model to investigate their ability to determine PAL (dependent variable) beyond that of lung function (FEV1, % pred.).
Methods: In 69 patients (FEV1% pred. 43*m*16) resting metabolic rate (RMR) was assessed by indirect calorimetry, and total energy expenditure (TEE) by activity monitor (ActiReg) during a 7-day period. PAL was derived from TEE/RMR. Walking speed (30-meter Walk Test, m/s) and isometric quadriceps strength (SteveStrong, N) were assessed.
Results: (Preliminary data) Mean PAL was 1.47*m*0.18, self-selected walking speed 1.01±0.23m/s and quadriceps strength 305±110N. The overall fit of the final model was R2=0.34 (p<0.001).

Multiple regression model

		B	SE B	Beta
Step 1	Constant	1.259	0.059	
	FEV1 (%-predicted)	0.005	0.001	0.415**
Step 2	Constant	1.028	0.092	
	FEV1 (%-predicted)	0.004	0.001	0.326**
	30mWT (self-selected speed)	0.272	0.087	0.341**
Step 3	Constant	0.968	0.092	
	FEV1 (%-predicted)	0.004	0.001	0.315**
	30mWT (self-selected speed)	0.208	0.087	0.260*
	Quadriceps strength	0.000	0.000	0.262*

R2 = 0.17 for step 1, R2-change = 0.11 for step 2, R2-change = 0.06 for step 3 (p<0.001). **p<0.01, *p<0.05.

Conclusion: Measures of physical capacity and/or function are valuable complements to lung function in understanding PAL in COPD.

P4392
Upper limb strength and lung function as determinants of upper limb work capacity in COPD
Jennifer Alison[1,2], Peter Bye[3], Zoe McKeough[1]. *[1]Discipline of Physiotherapy, The University of Sydney, NSW, Australia; [2]Department of Physiotherapy, Royal Prince Alfred Hospital, Sydney, NSW, Australia; [3]Department of Respiratory Medicine, Royal Prince Alfred Hospital, Sydney, Australia*

Aim: To determine the relationship between upper limb strength, lung function

and upper limb exercise capacity in people with chronic obstructive pulmonary disease (COPD).
Methods: Repeated measures design. Participants were included if they had a diagnosis of COPD, FEV_1/FVC ratio < 0.7. Exclusion criteria were an acute infection in the prior month, or neurological, musculoskeletal or cardiovascular conditions that limited upper limb exercise. Participants completed the following assessments: spirometry, incremental supported arm exercise (SAE) to peak work capacity on an arm ergometer, incremental unsupported arm exercise (UAE) to peak capacity using an unsupported arm test (Takahashi, T. *et al.* JCRP 2003;23:24-30), isometric upper limb strength measurements using a hand held dynamometer. Dominant arm strength was calculated by the mean of the following strength measurements: shoulder flexion & extension, horizontal abduction & adduction, internal & external rotation and elbow flexion. SAE and UAE were performed in random order based on concealed allocation sequence.
Results: 68 participants completed the study, mean (SD) age 65(8) yrs, FEV_1 %pred 50 (17)%, FVC %pred 77 (17)%, FEV_1/FVC 0.48 (0.1). Peak oxygen consumption (VO_{2peak}) for SAE and UAE was 0.80 (0.28) L/min and 0.71 (0.31) L/min respectively. Dominant arm strength was 103 (29) Newtons. Multiple regression on VO_2SAE and VO_2UAE using combined dominant arm strength and FEV_1%pred as predictors, accounted for 66% ($p<0.001$) and 55% ($p<0.001$) of the variance, respectively.
Conclusion: Upper limb strength combined with FEV_1%predicted are significant predictors of both supported and unsupported upper limb exercise capacity in COPD.

P4393
The VE/VCO_2 slope as a factor associated with the health status in patients with COPD
Miek Hornikx[1], Hans Vanremoortel[1], Heleen Demeyer[1], Kristien Debent[2], Erica Balligand[2], Laurence Vrancken[2], Marc Decramer[2], Rik Gosselink[1], Wim Janssens[2], Thierry Troosters[1]. *[1]Rehabilitation Sciences and Physiotherapy, KULeuven, Belgium; [2]Respiratory Rehabilitation, University Hospital, Leuven, Belgium*

Rationale: Submaximal exercise test outcomes are seldomly linked to health status in patients with Chronic Obstructive Pulmonary Disease (COPD). Our aim was to explore whether a poor ventilatory efficiency is associated with symptoms, functionality and mental status in these patients.
Methods: 86 patients with COPD (FEV_1=70*m*22%) underwent an incremental exercise test to determine the VE/VCO_2 slope. To identify symptoms, activity limitation and emotional dysfunction, the Chronic COPD Questionnaire (CCQ) was used.
Results: Data on ventilatory efficiency and the subscore of each of the three domains of the CCQ are presented in Table 1.

Table 1. General data

Parameter	Mean±Sd	Correlation Coefficient
VE/VCO2	29±6	
CCQ_Symp (Points)	1.8±1.1	0.20
CCQ_Ment (Points)	1.5±1.2	0.20
CCQ_Funct (Points)	1.3±1.1	0.30†
CCQ_Tot (Points)	1.6±1.0	0.30*

Sd = Standard Deviation; CCQ_Symp = Symptom domain of CCQ; Mental state domain of CCQ; Functional state domain of CCQ; Total CCQ score; †$p<0.05$; *$p<0.01$.

The VE/VCO_2 slope is modestly related to functional status in COPD (R=0.30; p=0.005) (Figure 1).

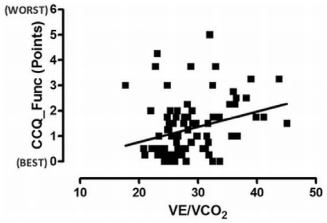


Figure 1. Correlation between the functional status domain of the CCQ and the VE/VCO_2 slope in patients with COPD.

Multiple stepwise regression analysis showed the VE/VCO_2 slope to be the only significant variable explaining the variance in CCQ_funct.
Conclusion: Ventilatory efficiency is modestly associated with functional status in patients with COPD. Interventions, impacting on the VE/VCO_2 slope may potentially enhance the functioning of the patient.

P4394
Relationship between oxygen uptake kinetics and BODE index at the onset of high-intensity exercise in moderate-to-severe COPD patients
Audrey Borghi-Silva, Thomas Beltrame, Michel Silva Reis, Luciana Maria Malosa Sampaio Jorge, Ross Arena, Dirceu Costa. *Physiotherapy Department, UFSCar, Sao Carlos, SP, Brazil Physiotherapy Department, UFRJ, Rio de Janeiro, RJ, Brazil Physiotherapy Department, UNI9, Sao Paulo, SP, Brazil*

Background: Patients with chronic obstructive pulmonary disease (COPD) present reduced exercise capacity due impaired oxygen uptake delivery-utilization, caused primarily by pulmonary dysfunction and deleterious peripheral adaptations. Assuming that COPD patients present with slower VO_2 and heart rate (HR) kinetics, we hypothesized that this finding is related to degree of severity in according to BODE index.
Aim: To evaluate the relationship between oxygen consumption (VO_2) on-kinetics during high intensity exercise and the BODE index in patients with COPD.
Methods: Twenty males with moderate to severe stable COPD and thirteen healthy control subjects matched by age and gender were evaluated. Initially, COPD patients were screening by BODE index and then, all volunteers were submitted to an incremental cardiopulmonary exercise testing, and subsequently, a constant speed on a treadmill at 70%, for 6 minutes. The on-transient (first 360 seconds) response of VO_2 and HR was modeled according to a monoexponencial fit.
Results: VO_2 and HR on-kinetics were slower in the COPD group than controls. Additionally, VO_2 on-kinetic parameters revealed a strong correlation ($r=0.77$, $p<0.05$) between BODE scores and negative and moderate correlation between walking distance ($r=-0.45$, $p<0.05$).
Conclusion: Our data show that moderate to severe COPD is related to impairment of oxygen delivery and utilization during the onset of intense exercise. In addition, there is a relationship between walking distance as well as BODE index with VO_2 on-kinetic behavior. Thus, the severity of COPD is reflected by progressive slowing of VO_2 on-kinetics.
Financial support: FAPESP.

P4395
Quantifying the variability of physical activity in daily life caused by seasonality in smokers
Karina Couto Furlanetto, Jully Anne Felici, Gianna Kelren Waldrish Bisca, Andrea Akemi Morita, Mahara Proença, Juliana Zabatiero, Leandro Cruz Mantoani, Demetria Kovelis, Fabio Pitta. *Departamento de Fisioterapia, Laboratório de Pesquisa em Fisioterapia Pulmonar (LFIP), Universidade Estadual de Londrina (UEL), Londrina, Brazil*

Background: The level of physical activity in daily life (PADL) depends on many factors, such as social, economical, physiological and demographic aspects. Despite these many causes of variability, the influence of the seasons of the year on PADL is unknown in smokers.
Aims: To compare changes in the level of PADL in apparently healthy smokers who started in different climatic conditions a protocol aiming at improving PADL; and to quantify the proportion of subjects who achieved 8000 steps/day before and after the intervention.
Methods: 20 smokers with normal lung function were submitted to a 5-month protocol using booklets and pedometers (or step counters) in order to improve PADL by aiming to increase the number of steps/day. They had their baseline PADL assessed for 6 days with a pedometer during Spring/Summer (SS: n=10, 5 men, 51[39-59] years, BMI 26[23-29] kg/m^2, 36[14-49] pack-years) or Autumn/Winter (AW: n=10, 5 men, 53[48-57] years, BMI 26[24-28] kg/m^2, 38[17-50] pack-years). Reassessment was performed after the protocol, in the opposite climatic condition as compared to baseline.
Results: Both groups improved their PADL after the protocol (Δ steps/day = SS: 3191[1888-4461] and AW: 2903[517-5377]; p=0.002 for both). There were no between-groups statistical differences concerning baseline PADL, changes after the protocol, and proportion of subjects who reach 8000 steps/day before and after the protocol (SS: from 40% to 80%; AW: from 30% to 70%).
Conclusions: These preliminary results showed that climatic variation does not incur in significant impact in the level of PADL in apparently healthy smokers, since the same benefits could be achieved regardless of the seasonality.

P4396
Chest wall motion and volume changes with and without non-invasive ventilation in patients with amyotrophic lateral sclerosis
Cristiana Magalhães, Mauro Vidigal, Danielle Vieira, Bruna Vieira, Verônica Parreira. *Educação Física, Fisioterapia e Terapia Ocupacional, Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil*

In Amyotrophic Lateral Sclerosis (ALS), inspiratory, expiratory, and bulbar muscles are altered, leading to chronic respiratory failure. Non-invasive ventilation (NIV) can be used to improve gas exchange in this patient population.
Aim: To analyze the chest wall motion and operational volume changes in patients with ALS with and without NIV in the supine position.
Method: Ten patients with ALS, aged 54±13 years were included. Optoelectronic plethysmography (BTS, Milan, Italy) was used to measure: tidal volume of the chest wall (VtTcw), tidal volume of the pulmonary rib cage (Vtrcp), tidal volume of the abdominal rib cage (Vtrca), tidal volume of the abdomen (Vtab),

end-inspiratory (Veicw) and end-expiratory (Veecw) volumes of the chest wall, respiratory frequency (f) and minute ventilation (VE). All patients were evaluated in the supine position with and without NIV for five minutes (Trilogy 100, Respironics, USA) NIV was used in the spontaneous/timed mode, with inspiratory and expiratory pressures of 14 cmH2O and 4 cmH2O, respectively.Paired t-tests were used for statistical analyses ($p<0.05$).
Results: See Table 1.

Table 1. Chest wall motion and volume changes with and without NIV

Variable	Supine without NIV	Supine with NIV	p-value
Vtcw (L)	0.4±0.2	0.6±0.2	0.025
Vtrcp%	29±15	32±15	0.572
Vtrca%	13±5	11±6	0.180
Vtab%	58±15	57±18	0.830
Veicw (L)	18.9±4	19.4±3.9	0.008
Veecw (L)	18.5±4	18.8±4	0.019
f (irpm)	19±9	21±11	0.212
VE (L/min)	6.9±2.5	10.7±4	0.013

Conclusion: NIV led to significant increases in tidal, end-inspiratory, and end-expiratory volumes, with no changes in the contributions of the three chest wall compartments.
Partly supported by FAPEMIG and CNPq.

P4397
Can breathing pattern parameters be differentiated between healthy and severe asthma patients?
Wai Lo[1], Anne Bruton[1], Anna Barney[2]. *[1]Faculty of Health Sciences, University of Southampton, United Kingdom; [2]Institute of Sound and Vibration, University of Southampton, United Kingdom*

Abnormal breathing patterns during acute episodes of asthma are common. However, little is known about breathing pattern parameters (BPP) in severe asthma (SA) patients during the asymptomatic phase, or how they relate to those in the healthy population.
Aim: To determine which BPP differentiate SA patients from healthy controls.
Method: Ten SA patients and 10 healthy controls were recruited. BPP were monitored over a 30 minute period by respiratory inductive plethysmography. Recorded BPP were: 1. Tidal volume (Vt); 2. Variability in tidal volume (VVt); 3. Expiration time (Te); 4. Symptoms of hyperventilation (SH); 5. End-tidal carbon dioxide ($ETCO_2$). VVt was assessed by coefficient of variation (CV). Time series of breath by breath Vt were inspected for abnormal pattern. SH were assessed by Nijmegen questionnaire (NQ). $ETCO_2$ was monitored by capnography. Differences between healthy controls and SA patients were explored using one-way ANOVA.
Results: Mean NQ score was higher in SA patients than in healthy controls ($p=0.00$). $ETCO_2$ levels were significantly correlated with NQ score ($r=-0.8$, $p<0.01$) in the SA patients but not in healthy volunteers ($r=-0.6$, $p>0.01$). Time series analysis revealed sporadic episodes of frequent sighs in both groups. No significant differences between groups for any BPP were identified.
Conclusion: The recorded BPP did not differentiate between the SA patients and healthy volunteers in our small study. The higher SH found in the SA group do not appear to be associated with differences in BPP. This study raised doubt that there is a 'pattern' that is common within the SA population and therefore BPP must be considered on an individual basis.

P4398
Respiratory occupational therapy (OT) within a community respiratory team: Referral and intervention patterns
Lynsey Wright, Jessica Callaghan, Claire Morris, Fran Dyer, Julia Bott.
Respiratory Care Team, Surrey Community Health, Chertsey, United Kingdom

Introduction: OT aims to maximise independence, occupational performance and improve quality of life. Respiratory OT provides a specialist functional and psychological dimension to assess and manage respiratory patients.
The psychological dimension is predominantly based on cognitive behavioural therapy principles in anxiety, depression and hyperventilation management.
Aim: To determine the relationship between the intervention requested (whether for psychological functioning (Psy F) and/or physical functioning (Phy F)) and the intervention provided by respiratory OT.
Method: All referrals to West Surrey respiratory OT between January and December 2011, and the reason for referral and intervention provided were recorded.

Table 1. Intervention requestion

Phy F	Psy F	Phy & Psy F
n= 66 28%	n= 141 59%	n= 32 13%

Table 2. Intervention provided

Phy F	Psy F	Phy & Psy F
n= 45 22%	n= 85 41%	n= 76 37%

Results: 239 OT referrals were recorded in 2011. 33 of these were excluded from the analysis, as OT was not required or the patient had died.
Of the 206 patients who received OT, 47 required physical and psychological intervention, however the intervention requested for 32 of these had been for psychological and 15 for physical only.
Conclusion: We observe from the data that most referrals are for Psy F. However a noticeable proportion of these also required intervention to address Phy F (need identified at OT assessment).
Having received joint physical and mental health training, OT is well placed to identify and address the link between psychological and physical symptoms, which limit daily functioning, in this complex patient group. This supports the need for the specialist respiratory OT role.