Physical activity patterns and clusters in 1001 patients with chronic obstructive pulmonary disease

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ONLINE ONLY SUPPLEMENTARY MATERIAL

This supplement includes:

- METHODS

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  - Assessment of demographics, anthropometrics, lung function, and clinical data.

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  - Detailed analyses of the components identified in the principal component analysis.

METHODS

Details of data sources

The data from the United Kingdom (UK) was collected in three cities, Leicester, Liverpool and London. In Leicester, the data was collected as part of a randomized controlled trial to evaluate the effectiveness of a self-management program of activity coping and education for COPD delivered in primary care (ISRCTN35501175). Participants were assessed between September 2009 and September 2012 at University Hospitals of Leicester NHS Trust. In London, the data was collected as part of two studies: 1) a multicenter study aiming to investigate the compliance of patients with COPD with wearing an activity monitor, and the relationship between physical activity and clinical outcomes (participants were recruited between 2009 and 2011 at the Royal Brompton Hospital); and 2) a multicenter study aiming to evaluate the effect of aclidinium bromide on exercise endurance, hyperinflation, and dyspnea at rest and during exercise in patients with moderate to severe COPD (NCT01471171). In the latter study, participants were assessed between November 2011 and June 2012. In Liverpool, the data was collected between August 2009 and August 2010 at the University Hospital Aintree, as part of the Evaluation of COPD Longitudinally to Identify Predictive Surrogate Endpoints (ECLIPSE) study.(1) Some of the participants and data from the UK were part of previous publications,(2-6) however there is no overlapping analysis.

The data from Ireland was collected in Dublin as part of a two-phase longitudinal study to examine the short term effects of pulmonary rehabilitation on standard measures and free-living physical activity in patients with COPD (NCT01530412). Participants were

assessed between June 2007 and July 2010 at the Beaumont Hospital. Some of the participants and data from Ireland were part of a previous report,(7) however there is no overlapping analysis.

The data from the Netherlands was collected in two cities, Eindhoven and Horn. In Eindhoven, the data was collected between February 2010 and September 2011 at the Catharina Hospital, as part of a clinical trial to investigate the pathophysiologic mechanisms of osteoporosis in COPD (NCT01067248). In Horn, the data was collected between May 2009 and September 2009 at CIRO+, a Center of Expertise for Chronic Organ Failure, as part of the ECLIPSE study.(1) Some of the participants and data from the Netherlands were part of previous publications,(6, 8, 9) however there is no overlapping analysis.

The data from Germany was collected in different cities. In Grosshansdorf, the data was collected as part of an ongoing prospective observational study aiming to examine the role of extra-pulmonary effects of COPD.(10-12) Participants included were recruited between 2008 and 2009 at the Pulmonary Research Institute at LungClinic Grosshansdorf. A multicenter study aiming to evaluate the effect of aclidinium bromide on exercise endurance, hyperinflation, and dyspnea at rest and during exercise in patients with moderate to severe COPD (NCT01471171) also contributed to the German database. In this study, participants were recruited in Wiesbaden, Hamburg, Berlin, Lübeck, Hannover, Grosshansdorf, and Frankfurt, and assessed between November 2011 and June

2012. Some of the participants and data from Germany were part of previous publications,(2-5, 10-13) however there is no overlapping analysis.

The data from Switzerland was collected in two cities, Basel and Zurich. In Basel, the data was collected between July 2011 and January 2012 at the University Hospital Basel, as part of a cross-sectional study aiming to examine the independent association of objectively measured daily physical activity and functional capacity with health-related quality of life in patients with COPD. In Zurich, the data was collected between January 2010 and August 2011 in patients with COPD referred to the Pulmonary Division, University Hospital of Zurich, as part of a study which aimed to investigate if simple tests commonly used in clinical practice could accurately predict daily physical activity in COPD.(14) Some of the participants and data from Switzerland were part of a previous report,(14-16) however there is no overlapping analysis.

The data from Italy was collected in Pisa, in the Cardio-Thoracic and Vascular Department, University of Pisa, as part of the baseline evaluation of patients with COPD included in an outpatient pulmonary rehabilitation program.

The data from Spain was collected in three regions (Catalonia, Euskadi and Balearic Islands) as part of the Phenotype and Course of COPD (PAC-COPD) study, which was a prospective longitudinal study aiming to identify clinically and epidemiologically meaningful COPD subtypes and to validate them by assessing their relationship with clinically relevant outcomes (hospitalization and death) during a 4 year follow-up.(17, 18)

Participants were recruited between January 2004 and March 2006 in 9 tertiary hospitals. A multicenter study aiming to evaluate the effect of aclidinium bromide on exercise endurance, hyperinflation, and dyspnea at rest and during exercise in patients with moderate to severe COPD (NCT01471171) also contributed to the Spanish database. In this study, participants were recruited in Alicante, Madrid, and Barcelona, and assessed between November 2011 and June 2012. Some of the participants and data from Spain were part of previous publications,(2-5, 17-19) however there is no overlapping analysis.

The data from the United States of America (USA) was collected in Rochester, MN, as part of a cross-sectional study aiming to characterize the relationship between the 4 meter gait speed (4MGS) test and various psycho-physiologic measures in a cohort of patients with chronic lung disease. Participants were recruited between July 2012 and July 2013 at Mayo Clinic. Some of the participants and data from the USA were part of previous publications,(20-22) however there is no overlapping analysis.

The data from Brazil was collected in Londrina, Paraná, as part of an ongoing prospective randomized trial aiming to compare the long term effects of two exercise/training regimens on physical activity in daily life and other relevant outcome measures in patients with COPD. Participants were recruited during the baseline assessment for the outpatient pulmonary rehabilitation program which takes place at the University Hospital of Londrina. Some of the participants and data from Brazil were part of a previous report,(23) however there is no overlapping analysis.

The data from Australia was collected in two cities, Perth and Sydney. In both cities the data was collected as part of an ongoing randomized controlled trial evaluating a walking training program versus usual care on quality of life and exercise capacity in patients with COPD (ACTRN12609000472279). Participants were recruited from referrals to hospital outpatient pulmonary rehabilitation programs. Some of the participants and data from Australia were part of a previous report,(24) however there is no overlapping analysis.

Assessment of demographics, anthropometrics, lung function, and clinical data

Age, gender, body mass index (BMI), post-bronchodilator forced expiratory volume in the first 1 second (FEV_1, % of predicted), post-bronchodilator FEV_1 / forced vital capacity (FVC) ratio, diffusion capacity of the lung for carbon monoxide (D_{LCO}, % of predicted), symptoms of dyspnea by the modified Medical Research Council (mMRC) dyspnea grade,(25) and use of long-term oxygen therapy (LTOT, yes/no) were measured. In addition, the age, dyspnea, and airflow obstruction (ADO) index was calculated, which predicts COPD mortality,(26) and participants were stratified by BMI (underweight, <18.5 $kg \cdot m^{-2}$; normal weight, 18.5 to 24.99 $kg \cdot m^{-2}$; pre-obese, 25 to 29.99 $kg \cdot m^{-2}$; or obese, ≥ 30 $kg \cdot m^{-2}$) and by Global Initiative for Chronic Obstructive Lung Disease (GOLD) classifications (2007,(27) 1 to 4; and 2011,(28) A to D). GOLD 2011 classification (A to D) was based on the degree of airflow limitation (GOLD grades 1 to 4) and symptoms (mMRC dyspnea grades 0 to 4).

Selection of waking hour recordings

Firstly, the data collected with the SenseWear Armband devices was exported in the form of Microsoft Excel spreadsheets with one minute resolution. The data contains

information about the sleeping time and, in particular, each minute assessed is marked by the SenseWear software as "sleeping" or "not sleeping".(29) Then, in order to reduce the variability of the data, only minutes coded as "not sleeping" were selected for analysis. If a minute was coded as "sleeping" but had an intensity value higher than 2.0 METs, which is compatible with light intensity, this minute was considered as "not sleeping" since it is very unlikely that a subject present such a high intensity whilst sleeping.

Stratification of physical activity measures

The software SenseWear Professional versions 6.1 and 7.0 were used for data analysis, providing minute-by-minute energy expenditure (EE) and METs. These two measures were stratified according to different criteria (and the combination of them): intensity (e.g., very light, light or moderate-to-vigorous intensity), duration (e.g., bouts of activity), period of the day (e.g., before or after midday), frequency (e.g., number of bouts per day); and quantity (e.g., absolute numbers or percentage of total). These stratifications were performed with Matlab R2012b (Mathworks Inc., USA) and led to 180 distinct variables referred to as features, which were used for clustering of patients. Table E1 presents the 180 features used for cluster analysis.

Table E1 Features used for cluster analysis

Number	Feature	Number	Feature
1	Daily time in moderate-to-vigorous intensity before midday (min·day^{-1})	91	Daily average duration of 2-min bouts of light intensity before midday (min·bout^{-1})
2	Daily time in moderate-to-vigorous intensity after midday (min·day^{-1})	92	Daily average duration of 2-min bouts of light intensity after midday (min·bout^{-1})
3	Daily time in moderate-to-vigorous intensity (min·day^{-1})	93	Daily average duration of 2-min bouts of light intensity (min·bout^{-1})
4	Daily time in moderate-to-vigorous intensity before midday (% of total assessment time)	94	Daily time in 10-min bouts of light intensity before midday (min·day^{-1})
5	Daily time in moderate-to-vigorous intensity after midday (% of total assessment time)	95	Daily time in 10-min bouts of light intensity after midday (min·day^{-1})
6	Daily time in moderate-to-vigorous intensity (% of total assessment time)	96	Daily time in 10-min bouts of light intensity (min·day^{-1})
7	Daily average intensity in moderate-to-vigorous intensity	97	Daily time in 10-min bouts of light intensity before

	before midday (METs)
8	Daily average intensity in moderate-to-vigorous intensity after midday (METs)
9	Daily average intensity in moderate-to-vigorous intensity (METs)
10	Daily EE in moderate-to-vigorous intensity before midday (METs-min·day^{-1})
11	Daily EE in moderate-to-vigorous intensity after midday (METs-min·day^{-1})
12	Daily EE in moderate-to-vigorous intensity (METs-min·day^{-1})
13	Daily EE in moderate-to-vigorous intensity before midday (% of total EE)
14	Daily EE in moderate-to-vigorous intensity after midday (% of total EE)
	midday (% of total assessment time)
98	Daily time in 10-min bouts of light intensity after midday (% of total assessment time)
99	Daily time in 10-min bouts of light intensity (% of total assessment time)
100	Daily average intensity of 10-min bouts of light intensity before midday (METs)
101	Daily average intensity of 10-min bouts of light intensity after midday (METs)
102	Daily average intensity of 10-min bouts of light intensity (METs)
103	Daily EE of 10-min bouts of light intensity before midday (METs-min·day^{-1})
104	Daily EE of 10-min bouts of light intensity after midday (METs-min·day^{-1})

15	Daily EE in moderate-to-vigorous intensity (% of total EE)	105	Daily EE of 10-min bouts of light intensity (METs-min·day^{-1})
16	Daily time in 2-min bouts of moderate-to-vigorous intensity before midday (min·day^{-1})	106	Daily EE of 10-min bouts of light intensity before midday (% of total EE)
17	Daily time in 2-min bouts of moderate-to-vigorous intensity after midday (min·day^{-1})	107	Daily EE of 10-min bouts of light intensity after midday (% of total EE)
18	Daily time in 2-min bouts of moderate-to-vigorous intensity (min·day^{-1})	108	Daily EE of 10-min bouts of light intensity (% of total EE)
19	Daily time in 2-min bouts of moderate-to-vigorous intensity before midday (% of total assessment time)	109	Daily frequency of 10-min bouts of light intensity before midday (bouts·day^{-1})
20	Daily time in 2-min bouts of moderate-to-vigorous intensity after midday (% of total assessment time)	110	Daily frequency of 10-min bouts of light intensity after midday (bouts·day^{-1})
21	Daily time in 2-min bouts of moderate-to-vigorous intensity (% of total assessment time)	111	Daily frequency of 10-min bouts of light intensity (bouts·day^{-1})
22	Daily average intensity of 2-min bouts of moderate-to-	112	Daily average duration of 10-min bouts of light intensity

	vigorous intensity before midday (METs)		before midday (min·bout^{-1})
23	Daily average intensity of 2-min bouts of moderate-to-vigorous intensity after midday (METs)	113	Daily average duration of 10-min bouts of light intensity after midday (min·bout^{-1})
24	Daily average intensity of 2-min bouts of moderate-to-vigorous intensity (METs)	114	Daily average duration of 10-min bouts of light intensity (min·bout^{-1})
25	Daily EE of 2-min bouts of moderate-to-vigorous intensity before midday (METs-min·day^{-1})	115	Daily time in very light intensity before midday (min·day^{-1})
26	Daily EE of 2-min bouts of moderate-to-vigorous intensity after midday (METs-min·day^{-1})	116	Daily time in very light intensity after midday (min·day^{-1})
27	Daily EE of 2-min bouts of moderate-to-vigorous intensity (METs-min·day^{-1})	117	Daily time in very light intensity (min·day^{-1})
28	Daily EE of 2-min bouts of moderate-to-vigorous intensity before midday (% of total EE)	118	Daily time in very light intensity before midday (% of total assessment time)
29	Daily EE of 2-min bouts of moderate-to-vigorous intensity after midday (% of total EE)	119	Daily time in very light intensity after midday (% of total assessment time)

30 Daily EE of 2-min bouts of moderate-to-vigorous intensity (% of total EE)

31 Daily frequency of 2-min bouts of moderate-to-vigorous intensity before midday (bouts·day^{-1})

32 Daily frequency of 2-min bouts of moderate-to-vigorous intensity after midday (bouts·day^{-1})

33 Daily frequency of 2-min bouts of moderate-to-vigorous intensity (bouts·day^{-1})

34 Daily average duration of 2-min bouts of moderate-to-vigorous intensity before midday (min·bout^{-1})

35 Daily average duration of 2-min bouts of moderate-to-vigorous intensity after midday (min·bout^{-1})

36 Daily average duration of 2-min bouts of moderate-to-vigorous intensity (min·bout^{-1})

37 Daily time in 10-min bouts of moderate-to-vigorous

120 Daily time in very light intensity (% of total assessment time)

121 Daily average intensity in very light intensity before midday (METs)

122 Daily average intensity in very light intensity after midday (METs)

123 Daily average intensity in very light intensity (METs)

124 Daily EE in very light intensity before midday (METs-min·day^{-1})

125 Daily EE in very light intensity after midday (METs-min·day^{-1})

126 Daily EE in very light intensity (METs-min·day^{-1})

127 Daily EE in very light intensity before midday (% of total

intensity before midday (min·day^{-1})

38 Daily time in 10-min bouts of moderate-to-vigorous intensity after midday (min·day^{-1})

39 Daily time in 10-min bouts of moderate-to-vigorous intensity (min·day^{-1})

40 Daily time in 10-min bouts of moderate-to-vigorous intensity before midday (% of total assessment time)

41 Daily time in 10-min bouts of moderate-to-vigorous intensity after midday (% of total assessment time)

42 Daily time in 10-min bouts of moderate-to-vigorous intensity (% of total assessment time)

43 Daily average intensity of 10-min bouts of moderate-to-vigorous intensity before midday (METs)

44 Daily average intensity of 10-min bouts of moderate-to-vigorous intensity after midday (METs)

EE)

128 Daily EE in very light intensity after midday (% of total EE)

129 Daily EE in very light intensity (% of total EE)

130 Daily time in 2-min bouts of very light intensity before midday (min·day^{-1})

131 Daily time in 2-min bouts of very light intensity after midday (min·day^{-1})

132 Daily time in 2-min bouts of very light intensity (min·day^{-1})

133 Daily time in 2-min bouts of very light intensity before midday (% of total assessment time)

134 Daily time in 2-min bouts of very light intensity after midday (% of total assessment time)

45 Daily average intensity of 10-min bouts of moderate-to-vigorous intensity (METs)

46 Daily EE of 10-min bouts of moderate-to-vigorous intensity before midday (METs-min·day^{-1})

47 Daily EE of 10-min bouts of moderate-to-vigorous intensity after midday (METs-min·day^{-1})

48 Daily EE of 10-min bouts of moderate-to-vigorous intensity (METs-min·day^{-1})

49 Daily EE of 10-min bouts of moderate-to-vigorous intensity before midday (% of total EE)

50 Daily EE of 10-min bouts of moderate-to-vigorous intensity after midday (% of total EE)

51 Daily EE of 10-min bouts of moderate-to-vigorous intensity (% of total EE)

52 Daily frequency of 10-min bouts of moderate-to-vigorous

135 Daily time in 2-min bouts of very light intensity (% of total assessment time)

136 Daily average intensity of 2-min bouts of very light intensity before midday (METs)

137 Daily average intensity of 2-min bouts of very light intensity after midday (METs)

138 Daily average intensity of 2-min bouts of very light intensity (METs)

139 Daily EE of 2-min bouts of very light intensity before midday (METs-min·day^{-1})

140 Daily EE of 2-min bouts of very light intensity after midday (METs-min·day^{-1})

141 Daily EE of 2-min bouts of very light intensity (METs-min·day^{-1})

142 Daily EE of 2-min bouts of very light intensity before

intensity before midday (bouts·day^{-1})

53 Daily frequency of 10-min bouts of moderate-to-vigorous intensity after midday (bouts·day^{-1})

54 Daily frequency of 10-min bouts of moderate-to-vigorous intensity (bouts·day^{-1})

55 Daily average duration of 10-min bouts of moderate-to-vigorous intensity before midday (min·bout^{-1})

56 Daily average duration of 10-min bouts of moderate-to-vigorous intensity after midday (min·bout^{-1})

57 Daily average duration of 10-min bouts of moderate-to-vigorous intensity (min·bout^{-1})

58 Daily time in light intensity before midday (min·day^{-1})

59 Daily time in light intensity after midday (min·day^{-1})

midday (% of total EE)

143 Daily EE of 2-min bouts of very light intensity after midday (% of total EE)

144 Daily EE of 2-min bouts of very light intensity (% of total EE)

145 Daily frequency of 2-min bouts of very light intensity before midday (bouts·day^{-1})

146 Daily frequency of 2-min bouts of very light intensity after midday (bouts·day^{-1})

147 Daily frequency of 2-min bouts of very light intensity (bouts·day^{-1})

148 Daily average duration of 2-min bouts of very light intensity before midday (min·bout^{-1})

149 Daily average duration of 2-min bouts of very light intensity after midday (min·bout^{-1})

60 Daily time in light intensity (min·day^{-1})

61 Daily time in light intensity before midday (% total assessment time)

62 Daily time in light intensity after midday (% total assessment time)

63 Daily time in light intensity (% total assessment time)

64 Daily average intensity in light intensity before midday (METs)

65 Daily average intensity in light intensity after midday (METs)

66 Daily average intensity in light intensity (METs)

67 Daily EE in light intensity before midday (METs-min·day^{-1})

150 Daily average duration of 2-min bouts of very light intensity (min·bout^{-1})

151 Daily time in 10-min bouts of very light intensity before midday (min·day^{-1})

152 Daily time in 10-min bouts of very light intensity after midday (min·day^{-1})

153 Daily time in 10-min bouts of very light intensity (min·day^{-1})

154 Daily time in 10-min bouts of very light intensity before midday (% of total assessment time)

155 Daily time in 10-min bouts of very light intensity after midday (% of total assessment time)

156 Daily time in 10-min bouts of very light intensity (% of total assessment time)

157 Daily average intensity of 10-min bouts of very light

			intensity before midday (METs)
68	Daily EE in light intensity after midday (METs-min·day^{-1})	158	Daily average intensity of 10-min bouts of very light intensity after midday (METs)
69	Daily EE in light intensity (METs-min·day^{-1})	159	Daily average intensity of 10-min bouts of very light intensity (METs)
70	Daily EE in light intensity before midday (% of total EE)	160	Daily EE of 10-min bouts of very light intensity before midday (METs-min·day^{-1})
71	Daily EE in light intensity after midday (% of total EE)	161	Daily EE of 10-min bouts of very light intensity after midday (METs-min·day^{-1})
72	Daily EE in light intensity (% of total EE)	162	Daily EE of 10-min bouts of very light intensity (METs-min·day^{-1})
73	Daily time in 2-min bouts of light intensity before midday (min·day^{-1})	163	Daily EE of 10-min bouts of very light intensity before midday (% of total EE)
74	Daily time in 2-min bouts of light intensity after midday (min·day^{-1})	164	Daily EE of 10-min bouts of very light intensity after midday (% of total EE)

75 Daily time in 2-min bouts of light intensity (min·day^{-1})

76 Daily time in 2-min bouts of light intensity before midday (% total assessment time)

77 Daily time in 2-min bouts of light intensity after midday (% total assessment time)

78 Daily time in 2-min bouts of light intensity (% total assessment time)

79 Daily average intensity of 2-min bouts of light intensity before midday (METs)

80 Daily average intensity of 2-min bouts of light intensity after midday (METs)

81 Daily average intensity of 2-min bouts of light intensity (METs)

82 Daily EE of 2-min bouts of light intensity before midday

165 Daily EE of 10-min bouts of very light intensity (% of total EE)

166 Daily frequency of 10-min bouts of very light intensity before midday (bouts·day^{-1})

167 Daily frequency of 10-min bouts of very light intensity after midday (bouts·day^{-1})

168 Daily frequency of 10-min bouts of very light intensity (bouts·day^{-1})

169 Daily average duration of 10-min bouts of very light intensity before midday (min·bout^{-1})

170 Daily average duration of 10-min bouts of very light intensity after midday (min·bout^{-1})

171 Daily average duration of 10-min bouts of very light intensity (min·bout^{-1})

172 Daily average intensity of breaks in very light intensity

(METs-min·day^{-1})

83 Daily EE of 2-min bouts of light intensity after midday (METs-min·day^{-1})

84 Daily EE of 2-min bouts of light intensity (METs-min·day^{-1})

85 Daily EE of 2-min bouts of light intensity before midday (% of total EE)

86 Daily EE of 2-min bouts of light intensity after midday (% of total EE)

87 Daily EE of 2-min bouts of light intensity (% of total EE)

88 Daily frequency of 2-min bouts of light intensity before midday (bouts·day^{-1})

89 Daily frequency of 2-min bouts of light intensity after midday (bouts·day^{-1})

before midday (METs)

173 Daily average intensity of breaks in very light intensity after midday (METs)

174 Daily average intensity of breaks in very light intensity (METs)

175 Daily frequency of breaks in very light intensity before midday (breaks·day^{-1})

176 Daily frequency of breaks in very light intensity after midday (breaks·day^{-1})

177 Daily frequency of breaks in very light intensity (breaks·day^{-1})

178 Daily average duration of breaks in very light intensity before midday (min·break^{-1})

179 Daily average duration of breaks in very light intensity after midday (min·break^{-1})

90	Daily frequency of 2-min bouts of light intensity (bouts·day^{-1})	180	Daily average duration of breaks in very light intensity (min·break^{-1})

See Table 2 for definition of abbreviations.

Sample size calculation

The main analysis in our study was the identification of clusters based on physical activity data. To the best of our knowledge, currently there are no sample size calculation formulas for cluster analysis as performed in our study. Some authors have suggested that the minimal sample size to include in studies using cluster analysis should be no less than 2^k cases, preferably 5 x 2^k, with K being the number of variables considered for analysis.(30, 31) In our study, only 3 variables (i.e., the 3 components from the principal component analysis) were used for clustering. Therefore, the minimal sample size in our study should be 40 subjects, which is actually far below the actual number of participants included (i.e., 1001 subjects). Furthermore, our sample size is much larger than that of most previous studies using cluster analysis in COPD, which were still able to identify heterogeneous groups amongst different samples of patients with COPD.(18, 32-35)

RESULTS

Number of participants from each country

The absolute and relative frequency for the number of participants from each country can be found in Table E2.

Table E2 Number of participants from each country

Country	Participants, n (%)
The United Kingdom (UK)	240 (24)
Ireland	37 (4)
The Netherlands	97 (10)
Germany	187 (19)
Switzerland	124 (12)
Italy	23 (2)
Spain	93 (9)
The United States of America (USA)	65 (6)
Brazil	27 (3)
Australia	108 (11)

Daily physical activity measures after stratification for clinical characteristics

Figure E1 presents the daily PA hourly patterns after stratification for age groups, gender, long-term oxygen therapy use, diffusion capacity of the lung for carbon monoxide (DLCO) groups, and age, dyspnea, and airflow obstruction (ADO) index groups. Daily physical

activity measures after stratification for clinical characteristics can be found in Tables E3 to E11.

Table E3 Daily physical activity measures after stratification for age groups

Measure	< median (67 years)	≥ median (67 years)	*P*-value
N	495	504	
Physical activity measures in very light intensity			
Time, min·day^{-1}	792 (697 – 891)	813 (730 – 908)	0.01
EE, METs-min·day^{-1}	1020 (807 – 1341)	1040 (832 – 1308)	0.53
Time in ≥2-min bouts, min·day^{-1}	771 (671 – 870)	794 (706 – 896)	0.006
Time in ≥10-min bouts, min·day^{-1}	636 (507 – 772)	678 (564 – 798)	<0.0001
Frequency of ≥2-min bouts, bouts·day^{-1}	51 (41 – 61)	46 (37 – 54)	<0.0001
Frequency of ≥10-min bouts, bouts·day^{-1}	19 (16 – 21)	18 (15 – 21)	0.001
Average duration of ≥2-min bouts, min·bout^{-1}	14 (11 – 20)	17 (14 – 23)	<0.0001
Average duration of ≥10-min bouts, min·bout^{-1}	32 (26 – 40)	36 (30 – 46)	<0.0001
EE in ≥2-min bouts, METs-min·day^{-1}	981 (772 – 1310)	1013 (802 – 1286)	0.40
EE in ≥10-min bouts, METs-min·day^{-1}	801 (601 – 1163)	877 (658 – 1177)	0.03
Physical activity measures in light intensity			
Time, min·day^{-1}	148 (97 – 203)	137 (87 – 184)	0.003
EE, METs-min·day^{-1}	457 (311 – 689)	417 (264 – 621)	0.03
Time in ≥2-min bouts, min·day^{-1}	109 (68 – 161)	104 (61 – 149)	0.04

Time in ≥10-min bouts, min·day^{-1}	7 (2 – 22)	8 (0 – 23)	0.62
Frequency of ≥2-min bouts, bouts·day^{-1}	32 (22 – 44)	30 (19 – 39)	0.001
Frequency of ≥10-min bouts, bouts·day^{-1}	1 (0 – 2)	1 (0 – 2)	0.24
Average duration of ≥2-min bouts, min·bout^{-1}	3 (3 – 4)	4 (3 – 4)	0.009
Average duration of ≥10-min bouts, min·bout^{-1}	12 (10 – 13)	12 (0 – 14)	0.57
EE in ≥2-min bouts, METs-min·day^{-1}	352 (215 – 546)	323 (192 – 495)	0.15
EE in ≥10-min bouts, METs-min·day^{-1}	25 (4 – 74)	26 (0 – 83)	0.48
Physical activity measures in moderate-to-vigorous intensity			
Time, min·day^{-1}	58 (32 – 121)	45 (23 – 81)	<0.0001
EE, METs-min·day^{-1}	308 (153 – 638)	241 (114 – 448)	<0.0001
Time in ≥2-min bouts, min·day^{-1}	43 (20 – 99)	32 (15 – 64)	<0.0001
Time in ≥10-min bouts, min·day^{-1}	7 (0 – 30)	6 (0 – 19)	0.04
Frequency of ≥2-min bouts, bouts·day^{-1}	11 (6 – 20)	9 (4 – 15)	<0.0001
Frequency of ≥10-min bouts, bouts·day^{-1}	1 (0 – 2)	1 (0 – 1)	0.03
Average duration of ≥2-min bouts, min·bout^{-1}	4 (3 – 5)	4 (3 – 5)	0.22
Average duration of ≥10-min bouts, min·bout^{-1}	13 (0 – 16)	12 (0 – 16)	0.42
EE in ≥2-min bouts, METs-min·day^{-1}	225 (99 – 554)	176 (74 – 365)	<0.0001
EE in ≥10-min bouts, METs-min·day^{-1}	40 (0 – 166)	32 (0 – 107)	0.04

Data expressed as median (interquartile range). See Table 2 for definition of abbreviations.

Table E4 Daily physical activity measures after stratification for gender

Measure	Male	Female	*P*-value
N	654	347	
Physical activity measures in very light intensity			
Time, min·day^{-1}	807 (711 – 911)	790 (706 – 879)	0.09
EE, METs-min·day^{-1}	1091 (877 – 1358)	875 (737 – 1258)	<0.0001
Time in ≥2-min bouts, min·day^{-1}	789 (684 – 896)	771 (683 – 863)	0.09
Time in ≥10-min bouts, min·day^{-1}	666 (547 – 789)	646 (527 – 770)	0.07
Frequency of ≥2-min bouts, bouts·day^{-1}	48 (38 – 57)	49 (39 – 58)	0.57
Frequency of ≥10-min bouts, bouts·day^{-1}	18 (16 – 21)	18 (16 – 21)	0.60
Average duration of ≥2-min bouts, min·bout^{-1}	16 (13 – 22)	15 (12 – 21)	0.14
Average duration of ≥10-min bouts, min·bout^{-1}	35 (28 – 43)	33 (28 – 41)	0.08
EE in ≥2-min bouts, METs-min·day^{-1}	1052 (840 – 1342)	851 (705 – 1229)	<0.0001
EE in ≥10-min bouts, METs-min·day^{-1}	894 (676 – 1200)	734 (554 – 1128)	<0.0001
Physical activity measures in light intensity			
Time, min·day^{-1}	137 (89 – 185)	155 (102 – 205)	0.002
EE, METs-min·day^{-1}	443 (294 – 652)	420 (276 – 663)	0.36
Time in ≥2-min bouts, min·day^{-1}	102 (62 – 147)	119 (73 – 167)	0.001

Time in ≥10-min bouts, min·day^{-1}	6 (0 – 18)	13 (3 – 29)	<0.0001
Frequency of ≥2-min bouts, bouts·day^{-1}	30 (19 – 40)	33 (22 – 43)	0.02
Frequency of ≥10-min bouts, bouts·day^{-1}	1 (0 – 1)	1 (0 – 2)	<0.0001
Average duration of ≥2-min bouts, min·bout^{-1}	3 (3 – 4)	4 (3 – 4)	<0.0001
Average duration of ≥10-min bouts, min·bout^{-1}	12 (0 – 13)	12 (10 – 14)	0.004
EE in ≥2-min bouts, METs-min·day^{-1}	340 (205 – 515)	338 (203 – 540)	0.80
EE in ≥10-min bouts, METs-min·day^{-1}	21 (0 – 65)	35 (6 – 96)	0.001
Physical activity measures in moderate-to-vigorous intensity			
Time, min·day^{-1}	53 (27 – 106)	48 (23 – 87)	0.07
EE, METs-min·day^{-1}	297 (147 – 600)	235 (100 – 448)	<0.0001
Time in ≥2-min bouts, min·day^{-1}	40 (19 – 86)	35 (14 – 71)	0.02
Time in ≥10-min bouts, min·day^{-1}	8 (0 – 26)	5 (0 – 19)	0.004
Frequency of ≥2-min bouts, bouts·day^{-1}	10 (5 – 18)	9 (4 – 16)	0.07
Frequency of ≥10-min bouts, bouts·day^{-1}	1 (0 – 2)	0 (0 – 1)	0.004
Average duration of ≥2-min bouts, min·bout^{-1}	4 (3 – 5)	4 (3 – 5)	0.03
Average duration of ≥10-min bouts, min·bout^{-1}	13 (0 – 16)	12 (0 – 15)	0.007
EE in ≥2-min bouts, METs-min·day^{-1}	225 (98 – 495)	172 (68 – 344)	<0.0001
EE in ≥10-min bouts, METs-min·day^{-1}	42 (0 – 149)	22 (0 – 91)	<0.0001

Data expressed as median (interquartile range). See Table 2 for definition of abbreviations.

Table E5 Daily physical activity measures after stratification for body mass index classification

Measure	Underweight	Normal weight	Pre-obese	Obese	*P*-value
N	68	366	342	225	
Physical activity measures in very light intensity					
Time, min·day^{-1}	739 (668 – 816)	769 (688 – 863)	789 (704 – 881)*	891 (812 – 974)*,†,‡	<0.0001
EE, METs-min·day^{-1}	716 (616 – 806)	857 (736 – 1036)*	1057 (904 – 1256)*,†	1438 (1223 – 1753)*,†,‡	<0.0001
Time in ≥2-min bouts, min·day^{-1}	710 (635 – 788)	745 (662 – 839)	771 (682 – 863)*	875 (797 – 966)*,†,‡	<0.0001
Time in ≥10-min bouts, min·day^{-1}	535 (413 – 631)	605 (502 – 712)*	657 (552 – 768)*,†	789 (693 – 897)*,†,‡	<0.0001
Frequency of ≥2-min bouts, bouts·day^{-1}	64 (54 – 72)	53 (45 – 62)*	47 (39 – 54)*,†	38 (29 – 48)*,†,‡	<0.0001
Frequency of ≥10-min bouts, bouts·day^{-1}	20 (17 – 22)	19 (16 – 22)	18 (16 – 20)*,†	17 (14 – 19)*,†,‡	<0.0001
Average duration of ≥2-min bouts, min·bout^{-1}	11 (9 – 14)	14 (11 – 18)*	17 (14 – 21)*,†	23 (18 – 33)*,†,‡	<0.0001
Average duration of ≥10-min bouts, min·bout^{-1}	26 (22 – 31)	31 (26 – 37)*	35 (30 – 42)*,†	46 (37 – 62)*,†,‡	<0.0001
EE in ≥2-min bouts, METs-min·day^{-1}	682 (583 – 766)	827 (702 – 1008)*	1030 (871 – 1227)*,†	1409 (1199 – 1723)*,†,‡	<0.0001
EE in ≥10-min bouts, METs-min·day^{-1}	509 (420 – 645)	676 (550 – 875)*	880 (710 – 1090)*,†	1251 (1052 – 1630)*,†,‡	<0.0001
Physical activity measures in light intensity					
Time, min·day^{-1}	159 (110 – 183)	166 (116 – 212)	147 (105 – 200)†	88 (45 – 140)*,†,‡	<0.0001
EE, METs-min·day^{-1}	440 (230 – 441)	444 (310 – 615)*	489 (334 – 714)*	391 (200 – 636)‡	<0.0001
Time in ≥2-min bouts, min·day^{-1}	107 (72 – 135)	127 (85 – 170)	113 (76 – 163)	62 (28 – 108)*,†,‡	<0.0001

Time in ≥10-min bouts, min·day^{-1}	3 (0 – 9)	11 (3 – 28)*	11 (4 – 27)*	3 (0 – 11)†,‡	<0.0001
Frequency of ≥2-min bouts, bouts·day^{-1}	36 (25 – 41)	35 (26 – 46)	32 (23 – 41)†	18 (10 – 30)*,†,‡	<0.0001
Frequency of ≥10-min bouts, bouts·day^{-1}	0 (0 – 1)	1 (0 – 2)*	1 (0 – 2)*	0 (0 – 1)†,‡	<0.0001
Average duration of ≥2-min bouts, min·bout^{-1}	3 (3 – 3)	4 (3 – 4)*	4 (3 – 4)*	3 (3 – 4)†,‡	<0.0001
Average duration of ≥10-min bouts, min·bout^{-1}	10 (0 – 12)	12 (10 – 14)*	12 (11 – 14)*	11 (0 – 13)†,‡	<0.0001
EE in ≥2-min bouts, METs-min·day^{-1}	241 (168 – 340)	351 (230 – 514)*	385 (247 – 585)*	281 (129 – 491)†,‡	<0.0001
EE in ≥10-min bouts, METs-min·day^{-1}	5 (0 – 19)	30 (7 – 82)*	39 (11 – 99)*	13 (0 – 49)*,†,‡	<0.0001
Physical activity measures in moderate-to-vigorous intensity					
Time, min·day^{-1}	123 (54 – 183)	63 (30 – 119)*	53 (31 – 88)*	32 (15 – 63)*,†,‡	<0.0001
EE, METs-min·day^{-1}	379 (151 – 675)	258 (121 – 534)	277 (155 – 556)	237 (99 – 536)*	0.02
Time in ≥2-min bouts, min·day^{-1}	92 (40 – 159)	49 (20 – 100)*	39 (20 – 70)*	21 (9 – 49)*,†,‡	<0.0001
Time in ≥10-min bouts, min·day^{-1}	22 (4 – 65)	11 (0 – 35)	6 (0 – 18)*,†	3 (0 – 13)*,†,‡	<0.0001
Frequency of ≥2-min bouts, bouts·day^{-1}	22 (11 – 30)	11 (5 – 19)*	10 (6 – 16)*	6 (3 – 11)*,†,‡	<0.0001
Frequency of ≥10-min bouts, bouts·day^{-1}	2 (0 – 4)	1 (0 – 2)*	1 (0 – 1)*,†	0 (0 – 1)*,†,‡	<0.0001
Average duration of ≥2-min bouts, min·bout^{-1}	4 (3 – 6)	4 (3 – 5)	4 (3 – 5)†	4 (3 – 4)*,†,‡	<0.0001
Average duration of ≥10-min bouts, min·bout^{-1}	14 (10 – 17)	13 (0 – 17)	12 (0 – 16)	11 (0 – 14)*,†,‡	<0.0001
EE in ≥2-min bouts, METs-min·day^{-1}	310 (115 – 612)	207 (85 – 443)	211 (105 – 436)	167 (56 – 405)*	0.004
EE in ≥10-min bouts, METs-min·day^{-1}	75 (10 – 223)	42 (0 – 167)	39 (0 – 114)	17 (0 – 99)*,†,‡	<0.0001

Data expressed as median (interquartile range). See Table 2 for definition of abbreviations. *P<0.05 vs Underweight; †P<0.05 vs Normal weight; ‡P<0.05 vs Pre-obese.

Table E6 Daily physical activity measures after stratification for modified Medical Research Council (mMRC) grades*

Measure	0	1	2	3	4	*P*-value
N	137	268	221	181	61	
Physical activity measures in very light intensity						
Time, min·day^{-1}	743 (675 – 853)	804 (714 – 895)†	819 (718 – 886)†	847 (760 – 934)†,‡,§	884 (756 – 1001)†,‡,§	<0.0001
EE, METs-min·day^{-1}	1027 (829 – 1325)	1045 (822 – 1349)	1028 (822 – 1464)	1063 (852 – 1580)	1092 (777 – 1268)	0.49
Time in ≥2-min bouts, min·day^{-1}	719 (645 – 836)	780 (686 – 877)†	799 (691 – 866)†	830 (737 – 918)†,‡,§	852 (725 – 982)†,‡,§	<0.0001
Time in ≥10-min bouts, min·day^{-1}	588 (507 – 714)	662 (548 – 780)†	669 (548 – 776)†	711 (604 – 834)†	748 (575 – 896)†,‡	<0.0001
Frequency of ≥2-min bouts, bouts·day^{-1}	49 (41 – 57)	47 (37 – 55)	49 (39 – 58)	50 (35 – 61)	49 (38 – 60)	0.48
Frequency of ≥10-min bouts, bouts·day^{-1}	18 (16 – 20)	18 (15 – 21)	18 (16 – 21)	19 (16 – 22)	20 (17 – 22)	0.06
Average duration of ≥2-min bouts, min·bout^{-1}	15 (11 – 19)	16 (13 – 22)†	16 (12 – 21)	17 (13 – 25)†	18 (13 – 25)†	0.006
Average duration of ≥10-min bouts, min·bout^{-1}	32 (27 – 40)	35 (28 – 45)	34 (28 – 42)	35 (29 – 50)†	36 (30 – 46)	0.03
EE in ≥2-min bouts, METs-min·day^{-1}	992 (785 – 1293)	1018 (778 – 1327)	1004 (787 – 1450)	1032 (826 – 1558)	1073 (746 – 1243)	0.46
EE in ≥10-min bouts, METs-min·day^{-1}	843 (626 – 1093)	889 (627 – 1201)	851 (640 – 1278)	899 (683 – 1428)	940 (557 – 1159)	0.38
Physical activity measures in light intensity						
Time, min·day^{-1}	167 (124 – 211)	141 (94 – 199)†	138 (92 – 188)†	127 (71 – 174)†,‡	104 (62 – 170)†,‡	<0.0001
EE, METs-min·day^{-1}	549 (394 – 762)	478 (307 – 691)	410 (272 – 676)†	373 (246 – 575)†,‡	275 (163 – 391)$^{\dagger,\ddagger,\S,\|\|}$	<0.0001
Time in ≥2-min bouts, min·day^{-1}	134 (93 – 170)	108 (69 – 164)†	105 (63 – 149)†	91 (47 – 136)†,‡	76 (40 – 121)†,‡,§	<0.0001

Time in ≥10-min bouts, min·day^{-1}	13 (3 – 31)	11 (3 – 26)	7 (0 – 22)†	4 (0 – 14)†,‡	3 (0 – 8)†,‡,§	<0.0001
Frequency of ≥2-min bouts, bouts·day^{-1}	37 (28 – 45)	30 (20 – 41)†	30 (20 – 40)†	28 (16 – 38)†	23 (13 – 37)†,‡	<0.0001
Frequency of ≥10-min bouts, bouts·day^{-1}	1 (0 – 2)	1 (0 – 2)	1 (0 – 2)†	0 (0 – 1)†,‡	0 (0 – 1)†,‡	<0.0001
Average duration of ≥2-min bouts, min·bout^{-1}	4 (3 – 4)	4 (3 – 4)	3 (3 – 4)	3 (3 – 4)†,‡,§	3 (3 – 4)†,‡	<0.0001
Average duration of ≥10-min bouts, min·bout^{-1}	12 (11 – 14)	12 (10 – 14)	12 (0 – 14)	11 (0 – 13)†,‡	10 (0 – 12)†,‡	<0.0001
EE in ≥2-min bouts, METs-min·day^{-1}	443 (296 – 648)	381 (227 – 568)	314 (202 – 537)†	261 (179 – 465)†,‡	191 (102 – 314)$^{\dagger,\ddagger,\S,\|}$	<0.0001
EE in ≥10-min bouts, METs-min·day^{-1}	49 (12 – 115)	32 (10 – 93)	22 (0 – 66)†	11 (0 – 47)†,‡	7 (0 – 23)†,‡,§	<0.0001
Physical activity measures in moderate-to-vigorous intensity						
Time, min·day^{-1}	74 (43 – 134)	53 (31 – 93)†	45 (26 – 82)†	33 (17 – 76)†,‡	21 (11 – 72)†,‡	<0.0001
EE, METs-min·day^{-1}	374 (211 – 751)	293 (165 – 542)†	224 (122 – 478)†	209 (78 – 451)†,‡	108 (47 – 317)†,‡,§	<0.0001
Time in ≥2-min bouts, min·day^{-1}	56 (29 – 112)	39 (21 – 72)†	33 (15 – 68)†	22 (11 – 57)†,‡	14 (5 – 58)†,‡,§	<0.0001
Time in ≥10-min bouts, min·day^{-1}	13 (3 – 43)	7 (0 – 19)†	5 (0 – 19)†	3 (0 – 14)†,‡	0 (0 – 12)†,‡	<0.0001
Frequency of ≥2-min bouts, bouts·day^{-1}	13 (8 – 23)	10 (6 – 16)†	9 (4 – 16)†	7 (3 – 14)†,‡	5 (2 – 14)†,‡	<0.0001
Frequency of ≥10-min bouts, bouts·day^{-1}	1 (0 – 2)	1 (0 – 1)†	0 (0 – 1)†	0 (0 – 1)†	0 (0 – 1)†	<0.0001
Average duration of ≥2-min bouts, min·bout^{-1}	4 (4 – 6)	4 (3 – 5)	4 (3 – 5)†	4 (3 – 4)†,‡	3 (3 – 5)†,‡	<0.0001
Average duration of ≥10-min bouts, min·bout^{-1}	14 (11 – 18)	13 (0 – 16)	12 (0 – 15)†	11 (0 – 14)†,‡	0 (0 – 13)†,‡,§	<0.0001
EE in ≥2-min bouts, METs-min·day^{-1}	299 (150 – 641)	215 (107 – 431)†	164 (73 – 381)†	141 (49 – 355)†,‡	70 (24 – 264)$^{\dagger,\ddagger,\S,\|}$	<0.0001
EE in ≥10-min bouts, METs-min·day^{-1}	70 (14 – 269)	38 (0 – 123)†	21 (0 – 105)†	13 (0 – 86)†,‡	0 (0 – 53)†,‡,§	<0.0001

Data expressed as median (interquartile range). See Table 2 for definition of abbreviations. *Data available for 868 subjects; †$P<0.05$ vs mMRC0; ‡$P<0.05$ vs mMRC1; §$P<0.05$ vs mMRC2; ‖$P<0.05$ vs mMRC3.

Table E7 Daily physical activity measures after stratification for long-term oxygen therapy use*

Measure	Yes	No	*P*-value
N	67	640	
Physical activity measures in very light intensity			
Time, min·day^{-1}	836 (749 – 925)	804 (711 – 896)	0.04
EE, METs-min·day^{-1}	1082 (845 – 1308)	1051 (836 – 1434)	0.65
Time in ≥2-min bouts, min·day^{-1}	819 (728 – 907)	781 (684 – 879)	0.04
Time in ≥10-min bouts, min·day^{-1}	709 (581 – 837)	662 (550 – 774)	0.08
Frequency of ≥2-min bouts, bouts·day^{-1}	47 (36 – 61)	47 (38 – 56)	0.86
Frequency of ≥10-min bouts, bouts·day^{-1}	18 (16 – 21)	18 (16 – 21)	0.65
Average duration of ≥2-min bouts, min·bout^{-1}	17 (13 – 26)	16 (12 – 21)	0.35
Average duration of ≥10-min bouts, min·bout^{-1}	39 (28 – 51)	35 (29 – 44)	0.15
EE in ≥2-min bouts, METs-min·day^{-1}	1068 (827 – 1302)	1017 (802 – 1396)	0.64
EE in ≥10-min bouts, METs-min·day^{-1}	948 (667 – 1244)	878 (647 – 1239)	0.67
Physical activity measures in light intensity			

Time, min·day^{-1}	113 (65 – 171)	141 (93 – 196)	0.01
EE, METs-min·day^{-1}	341 (196 – 605)	453 (299 – 699)	0.02
Time in ≥2-min bouts, min·day^{-1}	81 (44 – 131)	108 (65 – 156)	0.006
Time in ≥10-min bouts, min·day^{-1}	3 (0 – 8)	8 (2 – 23)	<0.0001
Frequency of ≥2-min bouts, bouts·day^{-1}	25 (15 – 37)	31 (20 – 41)	0.02
Frequency of ≥10-min bouts, bouts·day^{-1}	0 (0 – 1)	1 (0 – 2)	<0.0001
Average duration of ≥2-min bouts, min·bout^{-1}	3 (3 – 4)	3 (3 – 4)	0.005
Average duration of ≥10-min bouts, min·bout^{-1}	11 (0 – 13)	12 (10 – 14)	0.04
EE in ≥2-min bouts, METs-min·day^{-1}	261 (129 – 491)	357 (210 – 566)	0.02
EE in ≥10-min bouts, METs-min·day^{-1}	10 (0 – 51)	29 (5 – 84)	<0.0001
Physical activity measures in moderate-to-vigorous intensity			
Time, min·day^{-1}	37 (17 – 68)	53 (28 – 95)	0.005
EE, METs-min·day^{-1}	176 (79 – 400)	298 (149 – 577)	0.004
Time in ≥2-min bouts, min·day^{-1}	24 (11 – 56)	38 (19 – 76)	0.003
Time in ≥10-min bouts, min·day^{-1}	2 (0 – 9)	7 (0 – 22)	<0.0001

Frequency of ≥2-min bouts, bouts·day^{-1}	6 (3 – 13)	10 (5 – 17)	0.02
Frequency of ≥10-min bouts, bouts·day^{-1}	0 (0 – 1)	1 (0 – 2)	0.003
Average duration of ≥2-min bouts, min·bout^{-1}	4 (3 – 4)	4 (3 – 5)	0.005
Average duration of ≥10-min bouts, min·bout^{-1}	10 (0 – 13)	13 (0 – 16)	<0.0001
EE in ≥2-min bouts, METs-min·day^{-1}	113 (48 – 292)	219 (99 – 461)	0.003
EE in ≥10-min bouts, METs-min·day^{-1}	5 (0 – 59)	40 (0 – 146)	0.001

Data expressed as median (interquartile range). See Table 2 for definition of abbreviations. *Data available for 707 subjects.

Table E8 Daily physical activity measures after stratification for diffusion capacity of the lung for carbon monoxide (DLCO) groups*

Measure	< median (51 % predicted)	≥ median (51 % predicted)	*P*-value
N	241	264	
Physical activity measures in very light intensity			
Time, min·day^{-1}	819 (735 – 919)	802 (708 – 886)	0.05
EE, METs-min·day^{-1}	944 (788 – 1198)	1112 (902 – 1455)	<0.0001
Time in ≥2-min bouts, min·day^{-1}	798 (704 – 900)	781 (683 – 863)	0.08
Time in ≥10-min bouts, min·day^{-1}	666 (552 – 790)	663 (556 – 768)	0.52
Frequency of ≥2-min bouts, bouts·day^{-1}	49 (41 – 59)	45 (37 – 54)	0.002
Frequency of ≥10-min bouts, bouts·day^{-1}	19 (16 – 21)	18 (15 – 20)	0.002
Average duration of ≥2-min bouts, min·bout^{-1}	15 (12 – 21)	17 (13 – 22)	0.15
Average duration of ≥10-min bouts, min·bout^{-1}	34 (29 – 42)	36 (29 – 45)	0.12
EE in ≥2-min bouts, METs-min·day^{-1}	922 (742 – 1155)	1082 (858 – 1411)	<0.0001
EE in ≥10-min bouts, METs-min·day^{-1}	767 (567 – 1058)	928 (698 – 1227)	<0.0001
Physical activity measures in light intensity			

Time, min·day^{-1}	139 (88 – 187)	146 (94 – 197)	0.34
EE, METs-min·day^{-1}	390 (260 – 540)	512 (342 – 712)	<0.0001
Time in ≥2-min bouts, min·day^{-1}	104 (63 – 149)	113 (68 – 160)	0.25
Time in ≥10-min bouts, min·day^{-1}	7 (0 – 20)	11 (3 – 27)	0.004
Frequency of ≥2-min bouts, bouts·day^{-1}	31 (20 – 40)	31 (20 – 41)	0.59
Frequency of ≥10-min bouts, bouts·day^{-1}	1 (0 – 2)	1 (0 – 2)	0.03
Average duration of ≥2-min bouts, min·bout^{-1}	3 (3 – 4)	4 (3 – 4)	0.08
Average duration of ≥10-min bouts, min·bout^{-1}	12 (0 – 13)	12 (11 – 14)	0.003
EE in ≥2-min bouts, METs-min·day^{-1}	298 (186 – 438)	394 (251 – 581)	<0.0001
EE in ≥10-min bouts, METs-min·day^{-1}	21 (0 – 62)	35 (11 – 104)	<0.0001
Physical activity measures in moderate-to-vigorous intensity			
Time, min·day^{-1}	42 (23 – 81)	59 (35 – 98)	<0.0001
EE, METs-min·day^{-1}	196 (93 – 395)	347 (212 – 601)	<0.0001
Time in ≥2-min bouts, min·day^{-1}	30 (15 – 67)	45 (23 – 82)	<0.0001
Time in ≥10-min bouts, min·day^{-1}	4 (0 – 19)	9 (2 – 24)	0.002

Frequency of ≥2-min bouts, bouts·day^{-1}	8 (4 – 15)	11 (6 – 17)	0.001
Frequency of ≥10-min bouts, bouts·day^{-1}	0 (0 – 1)	1 (0 – 2)	0.001
Average duration of ≥2-min bouts, min·bout^{-1}	4 (3 – 5)	4 (3 – 5)	0.02
Average duration of ≥10-min bouts, min·bout^{-1}	12 (0 – 15)	13 (10 – 16)	0.006
EE in ≥2-min bouts, METs-min·day^{-1}	147 (60 – 319)	268 (145 – 495)	<0.0001
EE in ≥10-min bouts, METs-min·day^{-1}	18 (0 – 93)	55 (9 – 169)	<0.0001

Data expressed as median (interquartile range). See Table 2 for definition of abbreviations. *Data available for 505 subjects.

Table E9 Daily physical activity measures after stratification for ADO index groups

Measure	< median (4 points)	≥ median (4 points)	*P*-value
N	317	551	
Physical activity measures in very light intensity			
Time, min·day^{-1}	783 (690 – 879)	827 (739 – 922)	<0.0001
EE, METs-min·day^{-1}	1079 (835 – 1415)	1047 (823 – 1344)	0.38
Time in ≥2-min bouts, min·day^{-1}	765 (661 – 864)	807 (715 – 908)	<0.0001
Time in ≥10-min bouts, min·day^{-1}	642 (516 – 752)	689 (571 – 813)	<0.0001
Frequency of ≥2-min bouts, bouts·day^{-1}	49 (40 – 58)	48 (37 – 58)	0.29
Frequency of ≥10-min bouts, bouts·day^{-1}	18 (16 – 21)	18 (16 – 21)	0.51
Average duration of ≥2-min bouts, min·bout^{-1}	15 (12 – 20)	17 (13 – 23)	0.002
Average duration of ≥10-min bouts, min·bout^{-1}	33 (27 – 41)	35 (29 – 45)	0.003
EE in ≥2-min bouts, METs-min·day^{-1}	1033 (797 – 1386)	1014 (789 – 1306)	0.48
EE in ≥10-min bouts, METs-min·day^{-1}	882 (631 – 1226)	874 (645 – 1201)	0.91
Physical activity measures in light intensity			

Time, min·day^{-1}	156 (108 – 204)	132 (82 – 182)	<0.0001
EE, METs-min·day^{-1}	517 (333 – 734)	393 (252 – 579)	<0.0001
Time in ≥2-min bouts, min·day^{-1}	116 (77 – 169)	98 (58 – 144)	<0.0001
Time in ≥10-min bouts, min·day^{-1}	11 (3 – 28)	6 (0 – 18)	<0.0001
Frequency of ≥2-min bouts, bouts·day^{-1}	33 (23 – 43)	28 (18 – 38)	<0.0001
Frequency of ≥10-min bouts, bouts·day^{-1}	1 (0 – 2)	1 (0 – 2)	<0.0001
Average duration of ≥2-min bouts, min·bout^{-1}	4 (3 – 4)	3 (3 – 4)	0.001
Average duration of ≥10-min bouts, min·bout^{-1}	12 (10 – 14)	12 (0 – 14)	0.02
EE in ≥2-min bouts, METs-min·day^{-1}	403 (244 – 615)	298 (185 – 466)	<0.0001
EE in ≥10-min bouts, METs-min·day^{-1}	39 (9 – 108)	18 (0 – 63)	<0.0001
Physical activity measures in moderate-to-vigorous intensity			
Time, min·day^{-1}	62 (36 – 115)	42 (20 – 78)	<0.0001
EE, METs-min·day^{-1}	348 (191 – 687)	215 (89 – 425)	<0.0001
Time in ≥2-min bouts, min·day^{-1}	43 (23 – 93)	29 (12 – 61)	<0.0001
Time in ≥10-min bouts, min·day^{-1}	9 (0 – 31)	4 (0 – 16)	<0.0001

Frequency of ≥2-min bouts, bouts·day^{-1}	11 (7 – 20)	8 (4 – 15)	<0.0001
Frequency of ≥10-min bouts, bouts·day^{-1}	1 (0 – 2)	0 (0 – 1)	<0.0001
Average duration of ≥2-min bouts, min·bout^{-1}	4 (3 – 5)	4 (3 – 5)	<0.0001
Average duration of ≥10-min bouts, min·bout^{-1}	13 (0 – 17)	12 (0 – 15)	<0.0001
EE in ≥2-min bouts, METs-min·day^{-1}	274 (128 – 600)	153 (57 – 343)	<0.0001
EE in ≥10-min bouts, METs-min·day^{-1}	54 (0 – 173)	20 (0 – 89)	<0.0001

Data expressed as median (interquartile range). See Table 2 for definition of abbreviations. *Data available for 868 subjects.

Table E10 Daily physical activity measures after stratification for Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2007 classification

Measure	1	2	3	4	*P*-value
N	91	395	340	175	
Physical activity measures in very light intensity					
Time, min·day^{-1}	751 (680 – 846)	791 (706 – 882)	817 (731 – 922)*	822 (720 – 929)*	0.0004
EE, METs-min·day^{-1}	1019 (800 – 1405)	1079 (845 – 1409)	1027 (824 – 1308)	960 (759 – 1181)†	0.008
Time in ≥2-min bouts, min·day^{-1}	734 (656 – 828)	773 (682 – 866)	798 (703 – 908)*	798 (690 – 916)*	0.0008
Time in ≥10-min bouts, min·day^{-1}	625 (511 – 720)	653 (543 – 769)	677 (548 – 805)*	656 (530 – 808)	0.04
Frequency of ≥2-min bouts, bouts·day^{-1}	48 (39 – 53)	47 (38 – 54)	49 (37 – 58)	55 (42 – 64)*,†,‡	<0.0001
Frequency of ≥10-min bouts, bouts·day^{-1}	17 (15 – 20)	18 (15 – 21)	18 (16 – 21)	20 (16 – 23)*,†	0.0001
Average duration of ≥2-min bouts, min·bout^{-1}	15 (13 – 21)	16 (13 – 22)	16 (12 – 23)	14 (11 – 19)†,‡	0.01
Average duration of ≥10-min bouts, min·bout^{-1}	33 (28 – 44)	35 (29 – 42)	35 (28 – 44)	32 (27 – 40)†,‡	0.03
EE in ≥2-min bouts, METs-min·day^{-1}	979 (776 – 1355)	1047 (803 – 1386)	991 (796 – 1279)	921 (724 – 1149)†	0.01
EE in ≥10-min bouts, METs-min·day^{-1}	820 (625 – 1152)	878 (652 – 1246)	849 (653 – 1178)	751 (553 – 1052)†	0.006
Physical activity measures in light intensity					
Time, min·day^{-1}	181 (117 – 230)	147 (105 – 198)*	132 (80 – 182)*,†	137 (88 – 184)*	<0.0001
EE, METs-min·day^{-1}	578 (416 – 843)	505 (328 – 727)	389 (253 – 564)*,†	374 (237 – 519)*,†	<0.0001

Time in ≥2-min bouts, min·day^{-1}	142 (86 – 194)	113 (77 – 161)*	98 (54 – 143)*,†	100 (61 – 147)*	<0.0001
Time in ≥10-min bouts, min·day^{-1}	20 (6 – 41)	10 (3 – 27)*	6 (0 – 17)*,†	4 (0 – 11)*,†,‡	<0.0001
Frequency of ≥2-min bouts, bouts·day^{-1}	37 (25 – 47)	31 (23 – 41)	28 (18 – 38)*	31 (19 – 41)*	0.0005
Frequency of ≥10-min bouts, bouts·day^{-1}	2 (1 – 3)	1 (0 – 2)*	1 (0 – 1)*,†	0 (0 – 1)*,†	<0.0001
Average duration of ≥2-min bouts, min·bout^{-1}	4 (3 – 4)	4 (3 – 4)	3 (3 – 4)*,†	3 (3 – 4)*,†	<0.0001
Average duration of ≥10-min bouts, min·bout^{-1}	12 (11 – 14)	12 (11 – 14)	12 (0 – 13)*,†	11 (0 – 13)*,†	<0.0001
EE in ≥2-min bouts, METs-min·day^{-1}	475 (315 – 660)	384 (247 – 603)	296 (183 – 450)*,†	261 (161 – 423)*,†	<0.0001
EE in ≥10-min bouts, METs-min·day^{-1}	71 (21 – 141)	35 (10 – 103)*	19 (0 – 57)*,†	11 (0 – 29)*,†,‡	<0.0001
Physical activity measures in moderate-to-vigorous intensity					
Time, min·day^{-1}	75 (44 – 117)	59 (33 – 108)	44 (21 – 78)*,†	39 (18 – 105)*,†	<0.0001
EE, METs-min·day^{-1}	364 (225 – 684)	328 (183 – 644)	209 (89 – 450)*,†	164 (70 – 450)*,†	<0.0001
Time in ≥2-min bouts, min·day^{-1}	57 (33 – 98)	45 (23 – 88)	31 (14 – 62)*,†	25 (11 – 85)*,†	<0.0001
Time in ≥10-min bouts, min·day^{-1}	12 (3 – 31)	11 (3 – 28)	4 (0 – 17)*,†	3 (0 – 18)*,†	<0.0001
Frequency of ≥2-min bouts, bouts·day^{-1}	13 (8 – 19)	11 (6 – 18)	8 (4 – 15)*,†	8 (3 – 17)*,†	<0.0001
Frequency of ≥10-min bouts, bouts·day^{-1}	1 (0 – 2)	1 (0 – 2)	0 (0 – 1)*,†	0 (0 – 1)*,†	<0.0001
Average duration of ≥2-min bouts, min·bout^{-1}	4 (4 – 5)	4 (3 – 5)	4 (3 – 5)*,†	4 (3 – 5)*,†	<0.0001
Average duration of ≥10-min bouts, min·bout^{-1}	13 (11 – 17)	13 (10 – 17)	11 (0 – 15)*,†	10 (0 – 15)*,†	<0.0001
EE in ≥2-min bouts, METs-min·day^{-1}	293 (171 – 549)	253 (128 – 532)	152 (63 – 362)*,†	123 (41 – 361)*,†	<0.0001

EE in ≥10-min bouts, METs-min·day^{-1}	71 (14 – 165)	64 (13 – 171)	20 (0 – 93)*,†	11 (0 – 79)*,†	<0.0001

Data expressed as median (interquartile range). See Table 2 for definition of abbreviations. $^{*}P<0.05$ vs 1; $^{\dagger}P<0.05$ vs 2; $^{\ddagger}P<0.05$ vs 3.

Table E11 Daily physical activity measures after stratification for Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2011 classification*

Measure	A	B	C	D	*P*-value
N	255	137	150	326	
Physical activity measures in very light intensity					
Time, min·day^{-1}	775 (694 – 869)	830 (746 – 899)†	799 (700 – 899)	832 (738 – 937)†,§	<0.0001
EE, METs-min·day^{-1}	1104 (841 – 1369)	1213 (912 – 1803)	1000 (789 – 1236)‡	1005 (800 – 1299)‡	<0.0001
Time in ≥2-min bouts, min·day^{-1}	755 (666 – 855)	812 (725 – 882)†	775 (674 – 878)	814 (714 – 923)†,§	<0.0001
Time in ≥10-min bouts, min·day^{-1}	645 (530 – 759)	700 (593 – 808)†	629 (519 – 775)	689 (560 – 823)†	0.001
Frequency of ≥2-min bouts, bouts·day^{-1}	47 (39 – 54)	45 (36 – 54)	49 (38 – 59)‡	50 (39 – 61)†,‡	0.0005
Frequency of ≥10-min bouts, bouts·day^{-1}	18 (15 – 20)	18 (15 – 20)	18 (16 – 21)	19 (16 – 22)†,‡	0.0004
Average duration of ≥2-min bouts, min·bout^{-1}	16 (13 – 21)	17 (14 – 25)	15 (11 – 20)‡	16 (12 – 23)	0.03
Average duration of ≥10-min bouts, min·bout^{-1}	35 (28 – 42)	36 (31 – 51)	34 (26 – 43)‡	34 (28 – 43)‡	0.01
EE in ≥2-min bouts, METs-min·day^{-1}	1069 (805 – 1347)	1176 (880 – 1751)	980 (755 – 1214)‡	969 (768 – 1273)‡	<0.0001
EE in ≥10-min bouts, METs-min·day^{-1}	895 (638 – 1229)	1052 (740 – 1594)†	824 (587 – 1081)‡	812 (604 – 1157)‡	<0.0001
Physical activity measures in light intensity					
Time, min·day^{-1}	156 (113 – 206)	136 (77 – 190)†	149 (90 – 197)	128 (79 – 174)†	<0.0001
EE, METs-min·day^{-1}	536 (367 – 758)	480 (275 – 813)	429 (288 – 617)†	352 (226 – 518)†,‡,§	<0.0001

Time in ≥2-min bouts, min·day^{-1}	119 (84 – 170)	104 (54 – 155)†	109 (63 – 155)	92 (53 – 133)†,§	<0.0001
Time in ≥10-min bouts, min·day^{-1}	13 (4 – 32)	8 (0 – 22)†	7 (0 – 25)†	4 (0 – 12)†,‡,§	<0.0001
Frequency of ≥2-min bouts, bouts·day^{-1}	33 (24 – 42)	29 (17 – 41)†	32 (19 – 41)	28 (17 – 37)†	0.0002
Frequency of ≥10-min bouts, bouts·day^{-1}	1 (0 – 2)	1 (0 – 2)	1 (0 – 2)†	0 (0 – 1)†,‡,§	<0.0001
Average duration of ≥2-min bouts, min·bout^{-1}	4 (3 – 4)	3 (3 – 4)	3 (3 – 4)†	3 (3 – 4)†,‡,§	<0.0001
Average duration of ≥10-min bouts, min·bout^{-1}	12 (11 – 14)	12 (0 – 13)†	12 (0 – 13)†	11 (0 – 13)†	<0.0001
EE in ≥2-min bouts, METs-min·day^{-1}	426 (281 – 640)	366 (195 – 660)	349 (209 – 497)†	259 (156 – 411)†,‡,§	<0.0001
EE in ≥10-min bouts, METs-min·day^{-1}	50 (15 – 124)	29 (0 – 99)	22 (0 – 77)†	11 (0 – 40)†,‡,§	<0.0001
Physical activity measures in moderate-to-vigorous intensity					
Time, min·day^{-1}	64 (37 – 104)	44 (23 – 80)†	51 (30 – 105)	37 (18 – 77)†,§	<0.0001
EE, METs-min·day^{-1}	348 (206 – 664)	296 (141 – 591)	243 (140 – 515)†	175 (75 – 378)†,‡,§	<0.0001
Time in ≥2-min bouts, min·day^{-1}	49 (28 – 85)	33 (14 – 65)†	36 (20 – 84)	25 (10 – 61)†,§	<0.0001
Time in ≥10-min bouts, min·day^{-1}	10 (3 – 25)	6 (0 – 19)	5 (0 – 21)	3 (0 – 14)†,§	<0.0001
Frequency of ≥2-min bouts, bouts·day^{-1}	12 (7 – 19)	8 (4 – 15)†	9 (6 – 7)	7 (3 – 15)†	<0.0001
Frequency of ≥10-min bouts, bouts·day^{-1}	1 (0 – 2)	0 (0 – 1)†	0 (0 – 1)†	0 (0 – 1)†	<0.0001
Average duration of ≥2-min bouts, min·bout^{-1}	4 (3 – 5)	4 (3 – 5)	4 (3 – 5)	4 (3 – 5)†,§	<0.0001
Average duration of ≥10-min bouts, min·bout^{-1}	13 (11 – 16)	13 (0 – 16)	13 (0 – 18)	10 (0 – 14)†,‡,§	<0.0001
EE in ≥2-min bouts, METs-min·day^{-1}	276 (150 – 556)	221 (94 – 457)†	188 (92 – 416)†	123 (44 – 295)†,‡,§	<0.0001

EE in ≥10-min bouts, METs-min·day^{-1}	58 (15 – 165)	50 (0 – 135)	29 (0 – 122)†	12 (0 – 70)†,‡,§	<0.0001

Data expressed as median (interquartile range). See Table 2 for definition of abbreviations. *Data available for 868 subjects; $^{\dagger}P<0.05$ vs A; $^{\ddagger}P<0.05$ vs B; $^{\S}P<0.05$ vs C.

Daily physical activity measures in very light and light intensities of healthy subjects and matched patients with COPD

Table E12 presents the daily physical activity measures in very light and light intensities of healthy subjects and matched patients with COPD.

Table E12 Daily physical activity measures in very light and light intensities of healthy subjects and matched patients with COPD

Measure	Healthy subjects	Matched patients with COPD	*P*-value
Physical activity measures in very light intensity			
Time, min·day^{-1}	736 (640 – 816)	798 (670 – 884)	0.03
EE, METs-min·day^{-1}	879 (703 – 1113)	932 (734 – 1236)	0.07
Time in ≥2-min bouts, min·day^{-1}	708 (607 – 797)	777 (642 – 863)	0.03
Time in ≥10-min bouts, min·day^{-1}	595 (464 – 685)	674 (479 – 759)	0.08
Frequency of ≥2-min bouts, bouts·day^{-1}	48 (42 – 56)	51 (39 – 60)	0.66
Frequency of ≥10-min bouts, bouts·day^{-1}	17 (15 – 20)	18 (16 – 20)	0.54
Average duration of ≥2-min bouts, min·bout^{-1}	14 (11 – 18)	16 (11 – 21)	0.43
Average duration of ≥10-min bouts, min·bout^{-1}	31 (27 – 40)	34 (27 – 44)	0.50
EE in ≥2-min bouts, METs-min·day^{-1}	843 (674 – 1060)	900 (698 – 1209)	0.07
EE in ≥10-min bouts, METs-min·day^{-1}	695 (508 – 852)	777 (518 – 1112)	0.07
Physical activity measures in light intensity			
Time, min·day^{-1}	173 (113 – 230)	152 (82 – 217)	0.13

EE, METs-min·day^{-1}	484 (376 – 628)	436 (262 – 612)	0.18
Time in ≥2-min bouts, min·day^{-1}	131 (84 – 191)	116 (58 – 166)	0.12
Time in ≥10-min bouts, min·day^{-1}	16 (6 – 38)	8 (3 – 26)	0.07
Frequency of ≥2-min bouts, bouts·day^{-1}	37 (25 – 47)	33 (18 – 47)	0.19
Frequency of ≥10-min bouts, bouts·day^{-1}	1 (1 – 3)	1 (0 – 2)	0.06
Average duration of ≥2-min bouts, min·bout^{-1}	4 (3 – 4)	4 (3 – 4)	0.27
Average duration of ≥10-min bouts, min·bout^{-1}	13 (11 – 15)	12 (11 – 14)	0.06
EE in ≥2-min bouts, METs-min·day^{-1}	371 (280 – 534)	309 (186 – 497)	0.21
EE in ≥10-min bouts, METs-min·day^{-1}	41 (20 – 90)	31 (10 – 73)	0.13

Data expressed as median (interquartile range). See Table 2 for definition of abbreviations.

Most relevant features in each principal component analysis (PCA) component

The most relevant features of the 1st component were the daily time in ≥2-min bouts of very light intensity, expressed as percentage of total assessment time; the daily time in ≥10-min bouts of very light intensity, in min·day^{-1}; and the daily time in ≥10-min bouts of very light intensity, expressed as percentage of total assessment time. The most relevant of the 2nd component were the daily EE in moderate-to-vigorous intensity, the daily EE in ≥2-min of moderate-to-vigorous intensity, and the daily EE in ≥10-min bouts of moderate-to-vigorous intensity, all expressed as percentage of total EE. The most relevant of the 3rd component were the daily EE in very light intensity after midday, the daily EE in very light intensity, and the daily EE in ≥2-min bouts of very light intensity after midday, all in METs-min·day^{-1}.

Detailed analyses of the components identified in the principal component analysis

A detailed analysis of the relationship between the 3 components identified by PCA and the 5 clusters identified from these components is provided in the following paragraphs.

The first component was clearly able to discriminate clusters 1 and 2 (the most inactive clusters) from the three other clusters (clusters 3, 4 and 5) (Figures 5B and 5C). The second component was not really useful to identify more inactive patients (clusters 1 and 2), but was able to discriminate the most active cluster (cluster 5) from the rest (Figures 5B and 5D). For discriminating clusters 3 and 4 from the others it is important to consider the combination of the three components. Indeed, if only the first component was considered, for instance, these clusters would be added to the most active cluster

(cluster 5) (Figures 5B and 5C). On the other hand, if only the second component was considered these clusters would be added to the inactive clusters (i.e., clusters 1 and 2) (Figures 5B and 5D).

Having a closer look at the most relevant features of each component we can notice that the first component is related to the time spent in bouts of very light intensity, whilst the second component is related to the total daily EE in activities of moderate-to-vigorous intensity, mostly in bouts of PA. Therefore, it can be suggested that the time in bouts of moderate-to-vigorous intensity can be a useful marker to discriminate patients who are very active from the others.

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FIGURE LEGENDS

Figure E1 A and B – age groups (< or ≥ median, 67 years); C and D – gender; E and F – LTOT use (yes or no), data available for 707 subjects only; G and H – DLCO groups (< or ≥ median, 51% predicted), data available for 505 subjects; and I and J – ADO index groups(< or ≥ median, 4 points). Figures A, C, E, G, and I represent weekdays, whilst figures B, D, F, H, and J represent weekend days. Data pooled per hour as mean (95% confidence intervals).