

SUPPLEMENTARY MATERIAL FOR THE *ERJ* ONLINE DEPOSITORY

PHYSICAL ACTIVITY IN COPD PATIENTS: PATTERNS AND BOUTS

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Sample size calculations

Sample size calculations were performed with the program GRANMO 7.10 [1] and using data from previous research on physical activity from the SenseWear[®] Pro₂ Armband accelerometer in COPD patients [2,3].

For the estimation of physical activity levels, 163 subjects would have to be recruited to obtain values of steps per day with a precision of +/- 500 units (steps) for an estimated standard deviation of 3000 in the population, assuming that such population is equal to 999999 subjects, accepting an alpha risk of 0.05 for a two-sided test, and anticipating a non-responses rate of 15%. Similarly, and using the same assumptions, 99 subjects would be needed to estimate values of minutes per day in activity with a precision of +/- 15 units (minutes) for an estimated standard deviation of 70 in the population.

Regarding the study of differences across severity groups, the above maximum estimated figure of 163 would allow identifying as statistically significant differences greater than or equal to 1500 steps between two groups of severity, which is lower than differences reported in the literature, accepting an alpha risk of 0.05 and a beta risk of 0.2 in a two-sided test.

Finally, the estimated figure of 163 would allow identifying a proportion of 50% or lower in the adherence to physical activity recommendations with a precision of +/- 7 units, under the same assumptions stated above.

The total available sample of 177 COPD patients exceeded the requirements and therefore allows answering the research questions.

R function to calculate bouts of physical activity

Description

The function `pabout` identifies the bouts performed for an individual, gives the total days registered (`n`), and characterizes their bouts with the median intensity (METs), duration (min/bout), and time (day).

Usage

```
pabout(int, tim, database)
```

Arguments

`int` a numeric value specifying the intensity threshold (in METs) of the bouts
`tim` a numeric value specifying the minimal duration (in minutes) of the bouts
`database` name of the accelerometer data.frame in R

The accelerometer data.frame is unique for each subject and includes a row per minute, being all minutes consecutive, with information on only two variables: `date` (as POSIXt class) and `metS`, as follows:

<code>date</code>	<code>metS</code>
2006-09-13 13:32:00	1.216434121
2006-09-13 13:33:00	1.407135248

```
2006-09-13 13:34:00 1.327723145
2006-09-13 13:35:00 1.191337228
2006-09-13 13:36:00 0.908973336
2006-09-13 13:37:00 1.057457089
2006-09-13 13:38:00 0.896382630
2006-09-13 13:39:00 0.890199065
...
```

Results

The function results in a database with a single row per each physical activity bout with the following variables:

<code>id.bout</code>	identification number of bout
<code>intensity</code>	median energy expenditure (METs) per physical activity bout
<code>duration</code>	mean time spent per physical activity bout (minutes/bout)
<code>day</code>	day when physical activity bouts where registered
<code>ndays</code>	total number of days registered

Function

```
pabout <-function(int,tim,database)
{
  require(doBy)
  names(database)<-tolower(names(database))

  if (!is.numeric(int)|!is.numeric(tim))
    stop("\n variable 'int'&'tim' must be a numeric")

  if (!is.data.frame (database))
    stop("\n variable 'database' must be a data.frame")

  if (sum(names(database)=="mets")==0)
    stop("\n No variable called 'mets' in 'database'")

  if (sum(names(database)=="date")==0)
    stop("\n No variable called 'date' in 'database'")

  if (!any(class(database$date)=="POSIXt"))
    stop("\n variable 'date' in 'database' must be a POSIXt")

  if(!max(difftime(tail(database$date,n=-1),head(database$date,n=-
1),units="mins"))==1)
    stop("\n variable 'date' in 'database' must be contain
consecutive minutes")

  with(database,{
    pa <- 0
    pa[mets>=int] <- 1
```

```

duration<-rep.int(rle(pa)$lengths, rle(pa)$lengths)
day<- format(date,format="%Y-%m-%d")
nbout<-NA

bout<-data.frame(id.bout=0,intensity=NA,duration=NA,
                 day=0,ndays=length(rle(as.character(day))$values))

if(length(rle(pa)$lengths[rle(pa)$values==1 &
                        rle(pa)$lengths>=tim])!=0){
  nbout[duration >=tim & pa ==1]<-
  rep.int(1:length(rle(pa)$values[rle(pa)$values==1 &
                                rle(pa)$lengths>=tim]),
          rle(pa)$lengths[rle(pa)$values==1 &
                            rle(pa)$lengths>=tim])

  bout<-data.frame(id.bout=1:max(nbout,na.rm=T),
                  intensity=sapply(1:max(nbout,na.rm=T),function(y)
                                median(mets[nbout==y],na.rm=T)),
                  duration=rle(pa)$lengths[rle(pa)$values==1 &
                                             rle(pa)$lengths>=tim],
                  day=sapply(as.data.frame(unclass(table(day,nbout))),which
                            .max),
                  ndays=length(rle(as.character(day [!is.na(day)]))$values)
                            )
  bout}
})
}

```

Additional Results

Figure S1. Relation between 6-min walking distance and daily steps, in all COPD patients and according to COPD severity stages.

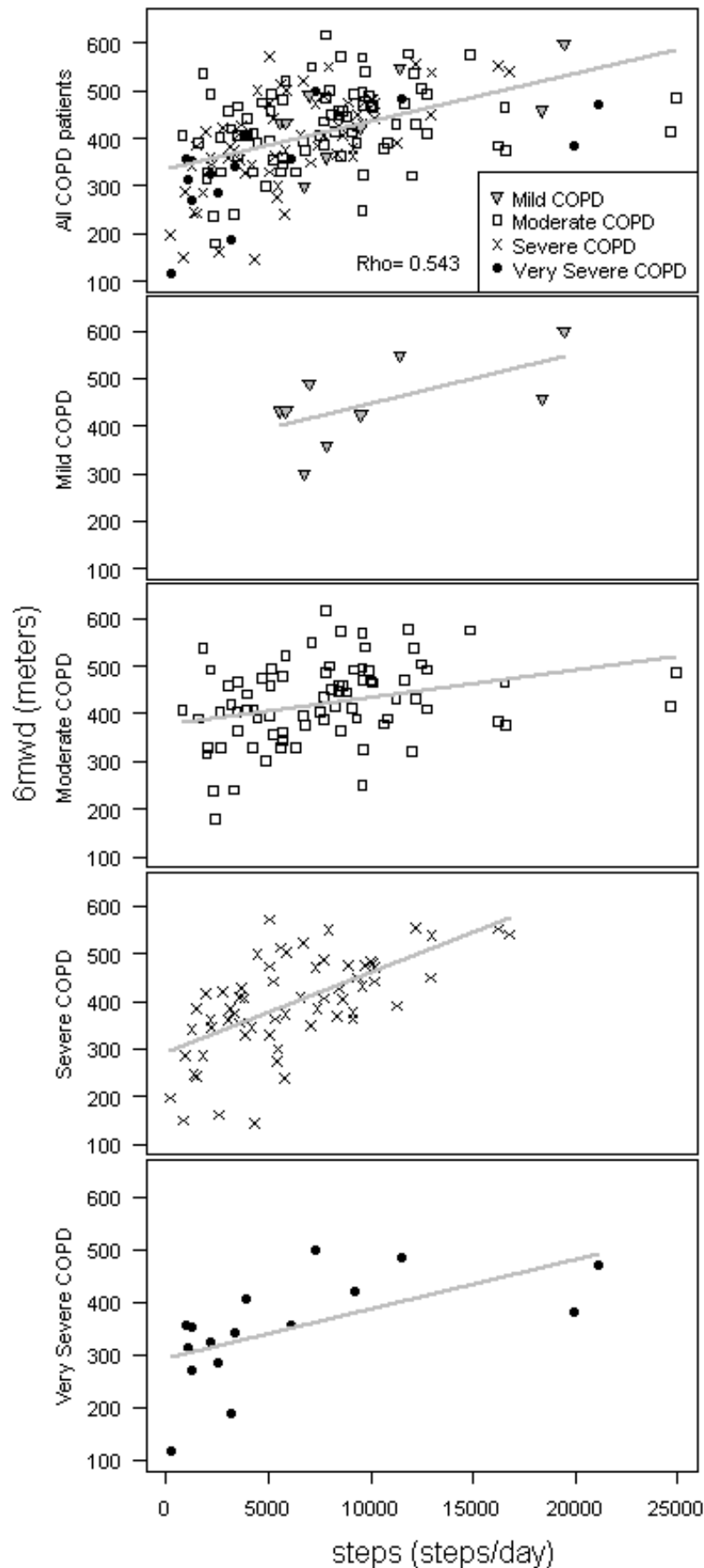


Table S1. Self-reported (Yale Physical Activity Survey) time spent weekly in physical activities, across levels of COPD severity.

	Mild COPD	Moderate COPD	Severe COPD	Very Severe COPD	p-trend
	n=9 (5%)	n=82 (49%)	n=63 (37%)	n=15 (9%)	
Household activities					
Participation, n (%)	8 (89)	76 (93)	53 (84)	12 (80)	0.103
Time spent (h·week ⁻¹), m (SD)	11.3 (9.9)	10.0 (10.9)	9.7 (10.7)	6.6 (6.5)	0.298
Work activities					
Participation, n (%)	0 (0)	12 (15)	7 (11)	1 (7)	0.759
Time spent (h·week ⁻¹), m (SD)	0.0 (0.0)	5.5 (14.0)	4.6 (14.4)	2.7 (10.3)	0.881
Leisure time activities					
Participation, n (%)	9 (100)	80 (98)	61 (97)	15 (100)	0.993
Time spent (h·week ⁻¹), m (SD)	22.2 (14.8)	16.0 (13.5)	12.0 (8.0)	12.2 (14.2)	0.009
Yard work/gardening					
Participation, n (%)	5 (56)	23 (28)	9 (14)	2 (13)	0.006
Time spent (h·week ⁻¹), m (SD)	7.2 (10.9)	3.7 (10.7)	0.3 (1.1)	0.6 (1.6)	0.003
Caretaking					
Participation, n (%)	1 (11)	13 (16)	5 (8)	1 (7)	0.202
Time spent (h·week ⁻¹), m (SD)	0.3 (1.0)	1.3 (5.5)	0.5 (2.0)	0.1 (0.5)	0.293
Exercise					
Participation, n (%)	3 (33)	25 (31)	15 (24)	2 (13)	0.132
Time spent (h·week ⁻¹), m (SD)	1.3 (3.0)	1.9 (4.8)	0.7 (1.6)	0.4 (1.1)	0.061
Recreational activities*					
Participation, n (%)	9 (100)	77 (94)	61 (97)	15 (100)	0.436
Time spent (h·week ⁻¹), m (SD)	13.4 (10.4)	9.2 (8.0)	10.4 (7.8)	11.1 (14.1)	0.754

* “Walking” accounts for 94% of recreational activities.

Table S2. Characteristics of physical activity bouts in COPD patients using standard definition of intensity.

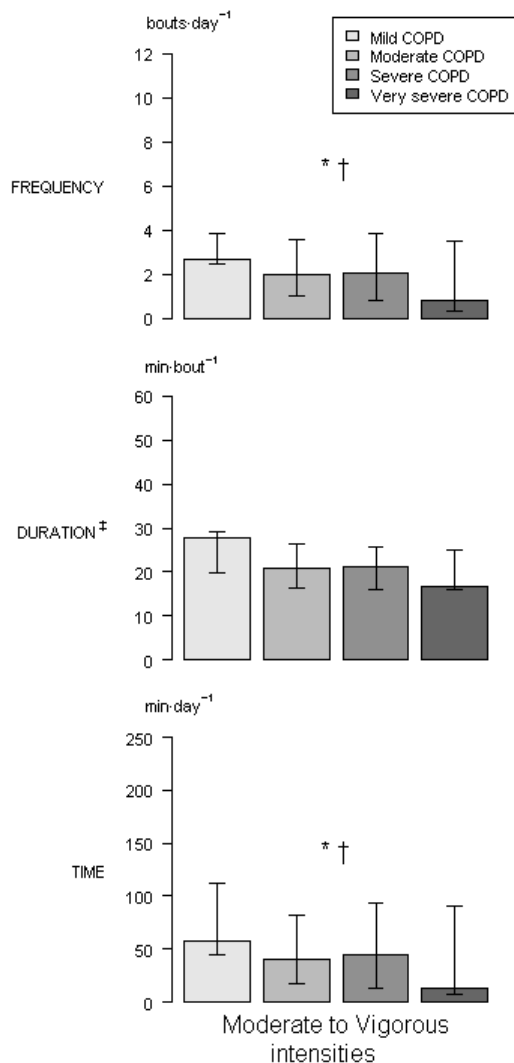
	Moderate-to-vigorous intensities (≥ 3 METs)*
	median (25th-75th percentile)
Characteristics of physical activity bouts	
Participation in physical activity bouts, n (%)	168 (95%)
Frequency (bouts·day ⁻¹) †	2.2 (1-3.9)
Duration (min·bout ⁻¹) †	21 (16-27)
Intensity (METs) †	3.8 (3.5-4.0)
Time in bouts (min·day ⁻¹) †	45 (17-91)
Time in bouts out of total time in activity (%) †	29 (16-49)

n: number; m: mean; SD: standard deviation; MET: metabolic equivalent tasks.

* Standard definition of intensity of physical activity [4].

† The frequency, duration, intensity, time in bouts, and time in bouts out of total time in activity were only computed for subjects that had at least one bout in the whole recording period

Figure S2. Frequency, duration, and time in physical activity bouts of moderate-to-vigorous intensities using standard definition of intensity, across levels of COPD severity.



Bar plots represent median and P25th-P75th values. Frequency: Number of physical activity bouts per day.

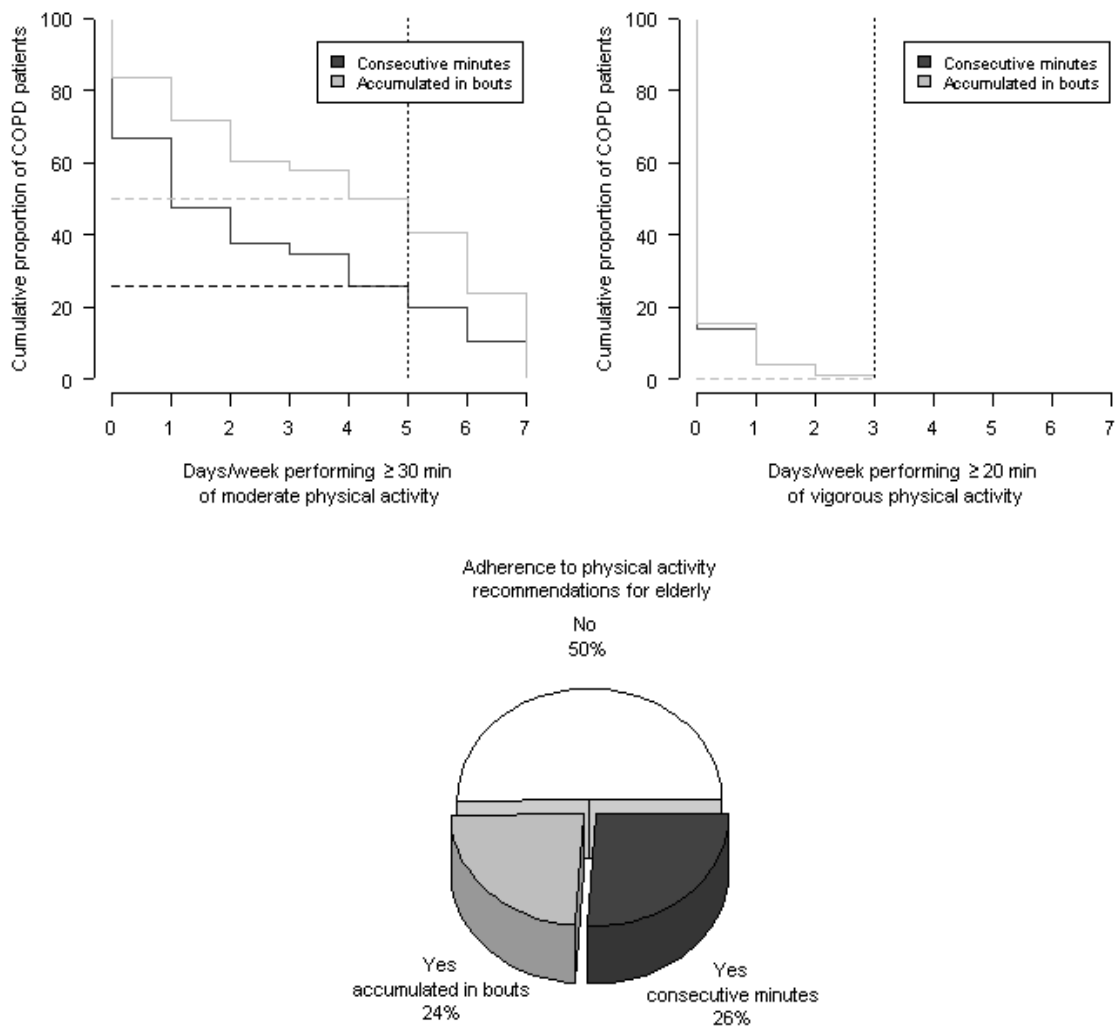
Duration: Mean duration of the physical activity bouts. Time: Total amount of time in physical activity bouts.

* p-trend across COPD severity stages <0.05.

† p-value comparing mild-to-moderate *versus* severe-to-very severe COPD <0.05.

‡ Only patients who participated in bouts.

Figure S3. COPD patients adherence to physical activity recommendations for older adults* using standard definition of physical activity intensity[†].



* Moderate-intensity physical activity for a minimum of 30 min on five days each week or vigorous-intensity aerobic activity for a minimum of 20 min on three days each week [5].

[†] 3 METs for moderate and 6 METs for vigorous physical activity [4].

Table S3. Self-reported (Yale Physical Activity Survey) time spent weekly in physical activities, according to the adherence to physical activity recommendations for older adults* defined using standard cut-offs of intensity[†].

	Adherence to physical activity standard recommendations			p-value
	No n= 85 (50%)	Yes, accumulated in bouts \geq 10 min n= 40 (24%)	Yes, in consecutive min n= 44 (26%)	
Household activities (h·week ⁻¹), m (SD)	8.2 (8.1)	11.7 (13.6)	10.6 (11)	0.322
Work activities (h·week ⁻¹), m (SD)	4.5 (12.7)	3.6 (14.1)	5.8 (14.4)	0.53
Leisure time activities (h·week ⁻¹), m (SD)	12.3 (11.4)	15.4 (10.6)	18 (13.9)	0.007
Yard work/gardening (h·week ⁻¹), m (SD)	1.5 (4.7)	1.7 (4.3)	4.6 (13.7)	0.255
Caretaking (h·week ⁻¹), m (SD)	1.1 (4.6)	0.3 (1.4)	0.8 (3.3)	0.519
Exercise (h·week ⁻¹), m (SD)	1.2 (4)	1.8 (3.8)	1 (2.3)	0.281
Recreational activities (h·week ⁻¹), m (SD)	8.5 (9.3)	11.5 (9.3)	11.5 (6.4)	0.001

* Moderate-intensity physical activity for a minimum of 30 min on five days each week or vigorous-intensity aerobic activity for a minimum of 20 min on three days each week [5]

[†] Standard cut-offs of intensity of physical activity: 3 METs for moderate and 6 METs for vigorous physical activity [4].

Supplement References

1. Marrugat J, Vila J, Pavesi M, Sanz F. Estimation of the sample size in clinical and epidemiological investigations. *Med Clin (Barc)* 1998; 111: 267–276
2. Troosters T, Sciurba F, Battaglia S, Langer D, Valluri SR, Martino L, Benzo R, Andre D, Weisman I, Decramer M. Physical inactivity in patients with COPD, a controlled multi-center pilot-study. *Respir Med* 2010; 104: 1005–1011
3. Watz H, Waschki B, Meyer T, Magnussen H. Physical activity in patients with COPD. *Eur Respir J* 2009; 33: 262–272
4. Garber CE, Blissmer B, Deschenes MR, Franklin BA, Lamonte MJ, Lee I-M, Nieman DC, Swain DP. American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. *Med Sci Sports Exerc* 2011; 43: 1334–1359
5. Nelson ME, Rejeski WJ, Blair SN, Duncan PW, Judge JO, King AC, Macera CA, Castaneda-Sceppa C. Physical activity and public health in older adults: recommendation from the American College of Sports Medicine and the American Heart Association. *Med Sci Sports Exerc* 2007; 39: 1435–1445