ORIGINAL ARTICLE

Determinants and outcomes of physical activity in patients with COPD: a systematic review

Elena Gimeno-Santos,[1,2,3,4] Anja Frei,[5,6] Claudia Steurer-Stey,[6] Jordi de Batlle,[1,2,7] Roberto A Rabinovich,[8] Yogini Raste,[9] Nicholas S Hopkinson,[9] Michael I Polkey,[9] Hans van Remoortel,[10] Thierry Troosters,[10] Karoly Kulich,[11] Niklas Karlsson,[12] Milo A Puhan,[5,13] Judith Garcia-Aymerich,[1,2,3] on behalf of PROactive consortium

▶ Additional material is published online only. To view please visit the journal online (http://dx.doi.org/10.1136/thoraxjnl-2013-204763).

For numbered affiliations see end of article.

Correspondence to
Dr Judith Garcia-Aymerich, Centre for Research in Environmental Epidemiology, Doctor Aiguader 88, Barcelona 08003, Spain; jgarcia@creal.cat

Received 31 October 2013
Revised 24 January 2014
Accepted 29 January 2014

ABSTRACT

Background The relationship between physical activity, disease severity, health status and prognosis in patients with COPD has not been systematically assessed. Our aim was to identify and summarise studies assessing associations between physical activity and its determinants and/or outcomes in patients with COPD and to develop a conceptual model for physical activity in COPD.

Methods We conducted a systematic search of four databases (Medline, Embase, CINAHL and Psychinfo) prior to November 2012. Teams of two reviewers independently selected articles, extracted data and used the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) to assess quality of evidence.

Results 86 studies were included: 59 were focused on determinants, 23 on outcomes and 4 on both. Hyperinflation, exercise capacity, dyspnoea, previous exacerbations, gas exchange, systemic inflammation, quality of life and self-efficacy were consistently related to physical activity, but often based on cross-sectional studies and low-quality evidence. Results from studies of pharmacological and non-pharmacological treatments were inconsistent and the quality of evidence was low to very low. As outcomes, COPD exacerbations and mortality were consistently associated with low levels of physical activity based on moderate quality evidence. Physical activity was associated with other outcomes such as dyspnoea, health-related quality of life, exercise capacity and FEV_1 but based on cross-sectional studies and low to very low quality evidence.

Conclusions Physical activity level in COPD is consistently associated with mortality and exacerbations, but there is poor evidence about determinants of physical activity, including the impact of treatment.

Key messages

What is the key question?

- Despite the increasing research on physical activity and COPD, it is unclear which are the determinants and outcomes of physical activity in patients with COPD.

What is the bottom line?

- Physical activity level in COPD is consistently associated with mortality and exacerbations, but this is in contrast to the poor evidence about determinants of physical activity, including current COPD treatments.

Why read on?

- This is a systematic review that will help clinicians to interpret the currently very heterogeneous literature on the topic and investigators to identify which research needs to be prioritised.

INTRODUCTION

A substantial amount of research about physical activity in patients with COPD has been published recently, prompted by studies showing that low levels of physical activity are associated with poor prognosis in COPD[1 2] and by observations that patients with COPD are substantially less physically active than healthy subjects of the same age and sex.[3 4] As a result there is the general notion that physical activity is important for patients with COPD.

Knowledge about the determinants and outcomes of physical activity in patients with COPD is needed to design interventions, to guide further research including randomised clinical trials and to improve the management of patients with COPD. It is currently unclear what the determinants and outcomes of different levels of physical activity are and to what extent current pharmacological and non-pharmacological treatments may modify physical activity levels. A determinant is defined as any factor that brings about change in a health condition or other defined characteristics, such as physical activity levels.[5] Determinants can be modifiable (eg, dyspnea) or non-modifiable (eg, age), and can also include interventions that may modify levels of physical activity, such as pulmonary rehabilitation or behavioural support. In the same way, an outcome is defined as all the possible results that may stem from an exposure, such as low levels of physical activity.[5] Occasionally the same variable may be a determinant or an outcome of physical activity (eg, lung function or health related quality of life).

A recent expert review presented an interesting theoretical framework describing the role and consequences of physical inactivity in patients with

To cite: Gimeno-Santos E, Frei A, Steurer-Stey C, *et al*. *Thorax* Published Online First: [*please include* Day Month Year] doi:10.1136/thoraxjnl-2013-204763

COPD,[6] but was not based on a systematic and thus a complete review of the available literature of the determinants and outcomes of physical activity. Therefore, our aim was to identify and summarise studies assessing associations between physical activity and its determinants and/or outcomes in patients with COPD.

METHODS

Data sources and searches

This study was part of the European Commission funded PROactive project (http://www.proactivecopd.com), which aims to develop and validate patient-reported outcome (PRO) instruments that capture the dimensions of physical activity in daily life relevant to patients with COPD. We utilised standard systematic review methodology following the handbooks of the Centre for Reviews and Dissemination[7] and the Cochrane Collaboration.[8] The manuscript follows the PRISMA[9] statement for reporting of systematic reviews and meta-analyses. All methods were specified in advance, documented in a protocol (see online supplement 1), and approved by the PROactive consortium. Details of the performed searches are provided in online supplement 2.

The bibliographic details of all retrieved articles were stored in a RefWorks-COS file. We removed duplicate records resulting from the various database searches. The source of identified articles (database, hand search, researcher contacts) was recorded in a 'user defined field' of the RefWorks-COS file. An additional 'user defined field' was assigned to individual reviewers where they recorded their decision for inclusion and exclusion.

Study selection

Two reviewers independently assessed the title and abstract of every citation retrieved by the database searches (form available in online supplement 3). The decisions of the reviewers (order full text or reject citation) were recorded in the RefWorks-COS file and compared. We ordered all articles that were deemed potentially eligible by at least one member of the consortium. Two independent reviewers evaluated the retrieved full texts and made a decision on inclusion or exclusion according to the predefined selection criteria (form available in online supplement 4). Any disagreements in any phase were resolved by consensus, with close attention paid to the previously defined inclusion/exclusion criteria. In the case of persistent disagreement, a third member adjudicated. All studies that did not fulfil the predefined criteria were excluded and their bibliographic details were listed with the specific reason for exclusion.

We included studies if they fulfilled the following criteria:

1. Studies in which determinants and outcomes of physical activity, explicitly or implicitly defined as 'any bodily movement produced by skeletal muscles that results in energy expenditure'[10] were assessed.
2. Study design: longitudinal observational studies (prospective and retrospective); randomised and non-randomised trials: both arms (intervention+control) if the outcome was physical activity, or only the control arm when used in an analysis similar to a longitudinal observational study; and cross-sectional and case–control observational studies if they included associations with other variables.
3. Population: patients with COPD defined by spirometry (any definition as long as it was based on spirometry).
4. Causal direction (directionality): with directionality we refer to the establishment of a temporal relationship between a determinant (must exist before levels of physical activity change) and physical activity. We included studies in which the design of the study allowed an assumption of causal direction in associations between 'determinant and physical activity' or 'physical activity and outcome', that is, longitudinal studies and clinical trials, and studies in which the design could not address causality, that is, cross-sectional studies, but the authors clearly stated in the introduction or in the methods which was the hypothesised direction.
5. No language or date restrictions were imposed.

Data extraction and quality assessment

A Microsoft Office Access form was developed and used for data extraction. Two reviewers performed a pilot test of 10 randomly selected articles; the form was then refined prior to the final extraction process. The final version of the data extraction form was used by five independent reviewers to screen the full text of the included studies. Any disagreements were resolved by consensus, with close attention paid to the data extraction criteria (more details in online supplement 5).

We assessed the quality of the evidence for each association of physical activity with its determinants and outcomes following the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach[11 12] (more details in online supplement 5).

Data synthesis and analysis

The results of the data extraction were summarised in structured tables, one for determinants and one for outcomes. We did not perform meta-analyses because we deemed the studies to be too different to summarise their results statistically. However, we illustrated the individual effect of each study graphically for those determinants and/or outcomes that showed consistent results (eg, all showing results in the same direction) and when the quality of evidence was at least moderate. We developed a conceptual model based on the determinants and outcomes included in the assessment and on the quality of evidence, highlighting the directionality, the consistency and the confidence rating.

RESULTS

Summary of studies

Figure 1 shows the flow diagram of the identification of the studies, from 3687 references to 86 articles that were finally included. Online supplementary table S1 shows the reasons for exclusion. From 86 studies included, 59 assessed only determinants of physical activity in COPD, 23 only outcomes and 4 both. Table 1 shows information on reference details, study design and number of subjects included in each study (S1–S86 on references section of online supplement). Regarding the study design, 36 were cross-sectional, 4 case–control, 16 longitudinal, 12 randomised controlled trials and 18 non-randomised and/or non-controlled studies. Online supplementary table S2 shows detailed information on patients' characteristics and instruments for measuring physical activity of the 86 studies included. Almost half of the studies (n=38) measured physical activity using only a direct method (accelerometer and/or pedometer), 43 used only an indirect method (validated or non-validated questionnaire), and 5 used both direct and indirect methods.

A large body of research focused on typical COPD characteristics as determinants of physical activity, such as FEV_1 (13 studies), exercise capacity measured by 6-min walk distance or VO_2 peak obtained during an incremental exercise test (7 studies) and dyspnoea (6 studies).

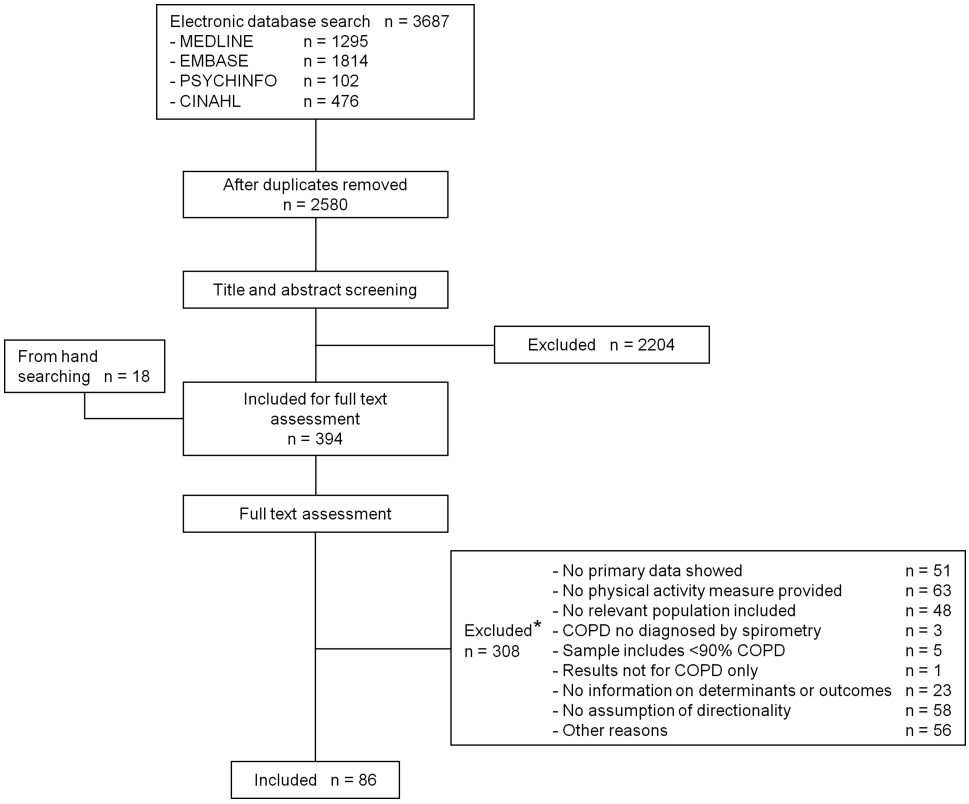


Figure 1 Flow diagram of process of systematic literature search. *Details for reason for exclusion in online supplementary table S1.

Socio-demographic, lifestyle and environmental determinants

Between two and six studies assessed the role of sex, age, cultural group, marital status, socioeconomic status, education, working status, smoking status, alcohol consumption and day of the week as potential determinants of physical activity in patients with COPD. In most of the studies the design was cross sectional, thus limiting interpretation of causal direction. In addition, most studies did not adjust observed associations for potential confounders. Finally, for all of these potential determinants, the results were not consistent across studies. For example, current smoking status compared with former was statistically associated with higher physical activity levels in a given study,[S33] while no statistically significant differences in physical activity were found between smoking groups in another study.[S34] Detailed information on estimates of associations, statistically significant and non-significant, is provided in online supplementary table S3. Overall, the quality of evidence for sex and age as determinants of physical activity in patients with COPD was moderate and very low for the remaining socio-demographic, lifestyle and environmental factors (table 2A).

Clinical and functional determinants

Regarding clinical and functional determinants, including FEV_1, FVC, hyperinflation, gas exchange, exercise capacity, body mass index (BMI), dyspnoea, systemic inflammation, comorbidities, previous exacerbations, quality of life, self-efficacy or emotional status, most studies were cross sectional and lacked adjustment for confounders. Associations of physical activity with hyperinflation, gas exchange, exercise capacity, dyspnoea, systemic inflammation, previous exacerbations, quality of life and self-efficacy were consistent, but were inconsistent for FEV_1, FVC, BMI, comorbidities and emotional status. Overall, almost all associations were based on evidence graded as very low quality, except the association with hyperinflation which was graded as low quality (table 2B, details in online supplementary table S3).

Drug and non-drug treatments

A large body of literature exists on the effect of exercise training on physical activity (21 studies). Although most studies were clinical trials so that the direction of the association could be established, some of them did not include a control group or included a control group without randomised allocation. Some did not control for confounders in the analysis. Furthermore, results on the effects of these interventions were inconsistent and the quality of evidence was low. Other non-pharmacological interventions identified in this review include physical activity advice, long-term oxygen therapy and dietary interventions. Again, design and analytical limitations preclude confidence on the results, so the quality of the evidence was rated as low to very low. Finally, only three studies tested the effect of pharmacological treatment (long-acting ß2 agonist and/or oral and inhaled corticosteroids) on physical activity and combine observational with experimental designs. The results were inconsistent and have several methodological flaws, so the quality of this evidence was rated as very low (table 2C, details in online supplementary table S3).

Outcomes

The literature covering the effect of physical activity on outcomes in COPD was smaller than for the determinants of physical activity, but the overall quality of evidence was better. Clinically relevant outcomes such as COPD exacerbations and mortality were assessed in eight and seven studies, respectively, which were of longitudinal design (thus showing the outcome to occur subsequent to a level of physical activity being

Table 1 Reference details, design and number of subjects of 86 studies reporting associations between physical activity and its determinants or outcomes in patients with COPD

Reference	Study design	n	Reference	Study design	n	Reference	Study design	n
Altenburg WA, 2013[S1]	Cross sectional	155	Garcia-Aymerich J, 2004[S30]	Cross sectional	346	Pitta, F. 2009[S59]	Cross-sectional	80
Beauchamp MK, 2012[S2]	Cross sectional	37	Garcia-Aymerich J, 2006[S31]	Cohort	2386	Pomidori, L. 2012[S60]	Randomised non-controlled parallel study	36
Behnke M, 2005[S3]	Non-randomised controlled study	88	Garcia-Aymerich J, 2008[S32]	Cohort	2226	Probst, VS. 2011[S61]	Randomised non-controlled parallel study	40
Bendstrup KE, 1997[S4]	Randomised controlled trial	32	Garcia-Aymerich J, 2009[S33]	Cross sectional	341	Roig, M. 2011[S62]	Cohort	101
Benzo R, 2010[S5]	Cohort	597	Garcia-Rio F, 2009[S34]	Cross sectional	110	Sandland, CJ. 2008[S63]	Randomised controlled trial	20
Berry M, 2006[S6]	Cross sectional	291	Garcia-Rio F, 2012[S35]	Cohort	173	Schou, L. 2013[S64]	Randomised controlled trial	44
Berry M, 2010[S7]	Randomised non-controlled parallel study	176	Goto Y, 2004[S36]	Non-randomised controlled study	30	Sewell, L. 2005[S65]	Randomised non-controlled parallel study	180
Bestall J, 1999[S8]	Cross sectional	100	Hartman JE, 2013[S37]	Cross sectional	113	Sewell, L. 2010[S66]	Non-controlled study	95
Bon J, 2011[S9]	Cross sectional	190	Hataji O, 2013[S38]	Non-controlled study	23	Silva, DR. 2011[S67]	Cross-sectional	95
Bossenbroek L, 2009[S10]	Case–control	62	Inal-Ince D, 2005[S39]	Cross sectional	30	Skumlien, S. 2006[S68]	Cross-sectional	110
Bourbeau J, 2007[S11]	Cohort	421	Jehn M, 2012[S40]	Cross sectional	107	Skumlien, S. 2008[S69]	Non-randomised non-controlled parallel study	40
Breyer MK, 2010[S12]	Randomised controlled trial	60	Katajisto M, 2012[S41]	Cross sectional	719	Takigawa, N. 2007[S70]	Non-controlled study	225
Chao PW, 2011[S13]	Cross sectional	21	Lahaije A, 2013[S42]	Cross sectional	57	Troosters, T. 2010, Respir Med[S71]	Cross-sectional	70
Chen Y, 2006[S14]	Cohort	145	Lee H, 2011[S43]	Cross sectional	131	Tsara, V. 2008[S72]	Case-control	133
Coronado M, 2003[S15]	Non-controlled study	15	Lemmens KMM, 2008[S44]	Cross sectional	278	Van Gestel, AJ. 2012[S73]	Cross-sectional	154
Dal Negro R, 2010[S16]	Randomised controlled trial	32	Lore, V, 2006[S45]	Cross sectional	23	Van Remoortel, H. 2013[S74]	Cross-sectional	59
Dallas MI, 2009[S17]	Non-controlled study	45	Mador MJ, 2011[S46]	Non-controlled study	24	Vergeret, J. 1989[S75]	Cohort	243
Daly C, 2011[S18]	Non-controlled study	8	Miravitlles M, 2011[S47]	Cohort	346	Waatevik, M. 2012[S76]	Cross-sectional	370
de Blok BM, 2006[S19]	Randomised controlled trial	21	Monteiro F, 2012[S48]	Cross sectional	74	Wakabayashi, R. 2011[S77]	Randomised controlled trial	102
Effing T, 2011[S20]	Randomised controlled trial	153	Moy M, 2009[S49]	Cross sectional	17	Wakabayashi, R. 2011[S78]	Cross-sectional	389
Egan C, 2012[S21]	Non-controlled study	47	Moy M, 2013[S50]	Cohort	169	Walker, PP. 2008[S79]	Non-controlled study	23
Eisner MD, 2008[S22]	Cross-sectional	1202	Nguyen HQ, 2009[S51]	Randomised controlled trial	17	Waschki, B. 2011[S80]	Cohort	169
Eliason G, 2011[S23]	Cross-sectional	44	Nguyen HQ, 2013[S52]	Cross-sectional	148	Watz, H. 2008[S81]	Cross-sectional	170
Esteban C, 2006[S24]	Cohort	611	Nield M, 2005[S53]	Non-controlled study	48	Watz, H. 2009[S82]	Cross-sectional	170
Esteban C, 2010[S25]	Cohort	391	Okubadejo AA, 1997[S54]	Case–control	42	Watz, H. 2009[S83]	Cross-sectional	163
Esteban C, 2011[S26]	Cohort	611	Palop Cervera M, 2010[S55]	Case–control	125	Weekes, CE. 2009[S84]	Randomised controlled trial	59
Faager G, 2004[S27]	Randomised controlled trial	20	Pitta F, 2006[S56]	Cohort	17	Wewel, A. 2008[S85]	Non-controlled study	21
Faulkner J, 2010[S28]	Randomised controlled trial	20	Pitta F, 2006[S57]	Cross sectional	23	Yeo, J. 2006[S86]	Cross-sectional	27
Garcia-Aymerich J, 2003[S29]	Cohort	340	Pitta F, 2008[S58]	Cross sectional	40			

Table 2 Quality of evidence for determinants and outcomes of physical activity in COPD, as identified in 86 studies

Determinant	N studies	Direction established	Control for confounding	Directness	Consistency	Strength	Low precision	Other	Confidence rating
(A) Quality of evidence for socio-demographic, lifestyle and environmental determinants of physical activity									
Age[S30 S33 S34 S57 S71 S81]	6	na	na	Yes	−1[1]	No	No	No	+++ (moderate)
Alcohol consumption[S30 S34]	2	−2[2]	−1[4]	Yes	−1[1]	No	−1[6]	No	+ (very low)
Cultural group[S14 S59 S71]	3	−1[2]	na	−1[3]	−1[1]	No	No	No	+ (very low)
Day of the week[S45 S49 S82]	3	−2[2]	−1[4]	Yes	−1[1]	No	No	No	+ (very low)
Education[S30 S33 S34]	3	−2[2]	−1[4]	Yes	−1[1]	No	No	No	+ (very low)
Marital status[S30 S33]	2	−2[2]	−1[4]	Yes	−1[1]	No	No	No	+ (very low)
Sex[S30 S33 S34 S57 S68 S81]	6	na	na	Yes	−1[1]	No	No	No	+++ (moderate)
Smoking habit[S30 S33 S34]	3	−2[2]	−1[4]	Yes	−1[1]	No	−1[6]	No	+ (very low)
Socioeconomic status[S30 S33]	2	−2[2]	−1[5]	Yes	−1[1]	No	No	No	+ (very low)
Working status[S30 S33 S34]	3	−2[2]	−1[4]	Yes	−1[1]	No	No	No	+ (very low)
(B) Quality of evidence for functional and clinical determinants of physical activity									
BODE index[S34 S49 S57 S81 S83]	5	−2[2]	−1[5]	Yes	−1[1]	No	No	No	+ (very low)
Body mass index[S30 S34 S48 S57 S81]	5	−2[2]	−1[5]	Yes	−1[1]	No	No	No	+ (very low)
Cardiovascular[S30 S81]	2	−2[2]	−1[5]	Yes	−1[1]	No	−1[6]	−1[7]	+ (very low)
Dyspnoea[S8 S41 S30 S34 S52 S57 S83]	7	−2[2]	−1[5]	Yes	yes	No	No	No	+ (very low)
Emotional status[S30 S52]	2	−2[2]	Yes	Yes	−1[1]	No	No	No	+ (very low)
Exercise capacity (VO_2 max, 6MWD)[S1 S6 S34 S37 S49 S52 S57 S74 S83]	9	−2[2]	−1[5]	Yes	yes	No	No	No	+ (very low)
FEV_1[S6 S22 S30 S34 S41 S42 S49 S57 S58 S71 S81 S82 S83 S86]	14	−1[2]	−1[5]	Yes	−1[1]	No	No	No	+ (very low)
FVC[S34 S57]	2	−1[2]	Yes	Yes	−1[1]	No	No	−1[12]	+ (very low)
Gas exchange (DLco)[S34 S74]	2	−2[2]	−1[4]	Yes	yes	No	No	No	+ (very low)
Gas exchange (PCO_2)[S30 S34]	2	−2[2]	−1[4]	Yes	yes	No	No	No	+ (very low)
Gas exchange (PO_2)[S30 S34]	2	−2[2]	−1[4]	Yes	yes	No	No	No	+ (very low)
Hyperinflation[S34 S37 S42 S57 S58]	5	−2[2]	Yes	Yes	yes	No	No	No	++ (low)
Osteoarticular condition[S30 S49]	2	−2[2]	−1[4]	Yes	−1[1]	No	−1[6]	No	+ (very low)
Previous exacerbation[S11 S30 S56]	3	−1[2]	−1[4]	Yes	yes	No	No	−1[7]	+ (very low)
Quality of life/health-related quality of life[S1 S30 S34 S49 S57]	5	−2[2]	−1[4]	Yes	yes	No	No	No	+ (very low)
Self-efficacy[S1 S37]	2	−2[2]	Yes	Yes	yes	No	No	−1[7]	+ (very low)
Systemic inflammation[S34 S81]	2	−2[2]	−1[5]	Yes	yes	No	No	−1[7]	+ (very low)
(C) Quality of evidence for interventions to modify levels of physical activity									
Dietary intervention[S16 S84]	2	Yes	Yes	Yes	−1[1]	No	No	−1[12]	++ (low)
Exercise training[S3 S4 S7 S12 S15 S17 S18 S20 S21 S27 S28 S46 S53 S60 S61 S64 S65 S66 S69 S70 S79]	21	Yes	−1[8]	Yes	−1[1]	No	No	No	++ (low)
Long-acting β2 agonist/corticosteroids[S30 S34 S38]	3	−2[2]	−1[8]	Yes	−1[1]	No	−1[6]	No	+ (very low)
Long-term oxygen therapy[S30 S34 S54 S63 S72 S75]	6	Yes	Yes	Yes	−1[1]	No	No	−1[10,11]	++ (low)
Physical activity advice[S19 S51 S85]	3	Yes	−1[8]	Yes	−1[1]	No	−1[9]	No	+ (very low)
Outcome									
(D) Quality of evidence for outcomes as a result of different levels of physical activity									
Balance[S2 S62]	2	−1[2]	−1[8]	Yes	−1[1]	No	No	−1[12,13]	+ (very low)
Bone mineral density[S9 S67]	2	−2[2]	−1[8]	Yes	−1[1]	No	No	−1[13]	+ (very low)
Dyspnoea[S33 S44]	2	−1[2]	Yes	Yes	Yes	No	No	−1[13]	++ (low)
Exacerbations[S5 S14 S29 S31 S32 S35 S50 S56]	8	Yes	Yes	Yes	Yes	No	No	−1[13]	+++ (moderate)

Continued

Table 2 Continued

Outcome	N studies	Direction established	Control for confounding	Directness	Consistency	Strength	Low precision	Other	Confidence rating
Exercise capacity (6MWD)[S13 S23 S33 S76]	4	−1[2]	Yes	Yes	Yes	No	No	−1[13]	++ (low)
FEV_1[S33 S44]	2	−2[2]	Yes	Yes	Yes	No	No	−1[13]	+ (very low)
Mortality[S24 S26 S31 S32 S35 S55 S80]	7	Yes	Yes	Yes	Yes	No	No	−1[13]	+++ (moderate)
Quality of life/health-related quality of life[S24 S25 S40 S44]	4	Yes	Yes	Yes	−1[1]	No	No	−1[13]	++ (low)

Interpretation of the categories of the quality of evidence: + (very low), there is a little confidence in the effect estimate, the true effect is likely to be substantially different from the estimate of effect; ++ (low), the confidence in the effect estimated is limited, the true effect may be substantially different from the estimate of the effect; +++ (moderate), there is a moderate confidence that the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different; and ++++ (high), there is high confidence that the true effect lies close to that of the estimate of the effect.
Reasons for upgrading or downgrading:
[1]Inconsistent effects (eg, different direction of effects) across and/or within studies with statistically significant and/or non-significant results.
[2]Direction could not be established because the majority (−1) or all (−2) studies were cross-sectional studies.
[3]The majority of studies included some sources of highly selected population (patients candidates for lung volume reduction surgery, patients with very severe COPD or patients included in a rehabilitation programme).
[4]No control for confounding.
[5]Only some studies had some control for confounding.
[6]Determinant was self-reported in most/all studies.
[7]The measures of exposure were so different that results could not be compared.
[8]The majority of studies without control group.
[9]95% CIs too wide to interpret the effect estimates.
[10]Measures of physical activity too different to allow comparison of results across studies.
[11]Potential confounding by indication.
[12]Studies with small to moderate sample size.
[13]Too few measures of physical activity (eg, only indirect and no activity monitor) to judge association with physical activity.
DLCO, Diffusing Lung capacity for carbon monoxide; FEV1, Forced Expiratory Volume in the first second; FVC, Forced Vital Capacity; PCO_2, Partial Pressure of Carbon Dioxide; PO_2, Partial Pressure of Oxygen; VO_2 max, Maximal Oxygen Uptake; 6MWD, 6 min walk distance.

defined), controlled for confounders and provided consistent results. Therefore, quality of evidence was moderate for both outcomes. Unfortunately, we could not perform any meta-analysis because of the heterogeneity of the studies but we illustrated graphically the effect estimate in each study for exacerbations (figure 2) and mortality (figure 3). Associations for other clinical outcomes such as dyspnoea, health-related quality of life, exercise capacity and FEV_1 were lacking in consistency. Although the underlying studies are often of high quality, we downgraded the quality of evidence from high to moderate because of a lack of direct measures of physical activity. Therefore, quality of evidence is rated as low to very low (table 2D, details in online supplementary table S4).

Conceptual model for physical activity in patients with COPD

Using information from table 2, we developed a conceptual model for physical activity in COPD (figure 4). In addition to quality of the evidence, the figure also provides visual information on causal direction and the consistency of associations as supported by existing literature.

DISCUSSION

The main findings of this systematic review are, first, there are many studies on clinical, functional, socio-demographic and lifestyle factors as determinants of physical activity in patients with COPD. Unfortunately, the quality of evidence remains very low, mainly because the causal direction of these associations could not be established due to the cross-sectional nature of most studies or because of a lack of control for confounding factors. Second, only a few interventions have been tested as determinants of physical activity, all with inconsistent results. Third, there is consistent evidence of effects of physical activity on COPD exacerbations and mortality.

Significance of the findings

This systematic review provides important information on what we know today and where research needs to be prioritised. First, available information today does not clearly answer what the determinants of physical activity are in patients with COPD. This is mostly due to the fact that available research has been cross sectional, which even in the case of consistent results, does not conclusively establish if a factor needs to be considered a determinant (exists before levels of physical activity change) or an outcome (results of different levels of physical activity). Some may argue that the rich available data on determinants of exercise capacity (eg, hyperinflation, ventilatory response to exercise, muscle weakness or dyspnoea)[13–15] can be extrapolated as determinants of physical activity. However, it is well known that physical activity (a complex behaviour) and capacity or physical fitness (a set of attributes) are correlated only to a moderate extent[10] and constitute different concepts. This is supported by the fact that some determinants of exercise capacity are not associated with physical activity.

Second, evidence for the effect of therapeutic interventions on physical activity levels is of low to very low quality and is inconsistent. The most studied intervention is exercise training, with 21 studies assessing the effects of exercise training on physical activity in patients with COPD. However, some limitations lowered the confidence in the estimates of effect, such as the lack of a control group in half of the studies or the inconsistency of results (eg, half of studies found significant associations and half did not). In addition, it is important to point out that we included all these interventions that offered at least exercise

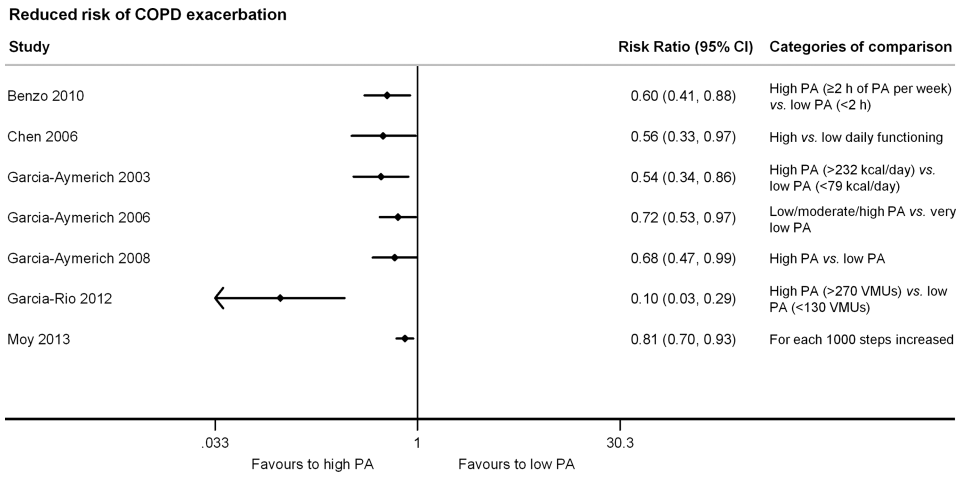


Figure 2 Graphical illustration of the individual study effects of physical activity on reduced risk of exacerbations. Pitta 2006 was excluded from the graph because it did not provide a risk ratio.

training but we did not consider the type of exercise, the duration of the intervention programme or the training intensity used, which varied significantly across studies. Surprisingly, there is scarce evidence about the effects of commonly used pharmacological agents, such as long-acting ß2 agonists, on physical activity levels. This should attract attention of the industry since some drug treatments could theoretically increase levels of physical activity, for example, as a result of decreased hyperinflation, reduced symptoms and enhanced exercise endurance.

Third, we identified that the best available evidence is for the association of physical activity with mortality and COPD exacerbations. These results are based on longitudinal studies, the results are consistent, and all estimates of associations were adjusted for known confounders, such as age, sex, BMI, severity and previous exacerbations. Nevertheless, the quality of the evidence is still moderate since physical activity was assessed using questionnaires instead of more precise tools, such as activity monitors in the largest studies. Finally, we could not establish some clinically important parameters such as FEV_1, dyspnoea and exercise capacity as clear outcomes of physical activity because of the lack of consistent results across studies, small sample sizes leading to imprecise estimates and cross-sectional study design (not allowing directionality). Indeed, diverse cross-sectional studies approached the associations between physical activity and the above-mentioned parameters, some under the hypothesis they would be determinants of physical activity, while other authors hypothesised they would be outcomes of physical activity. Several studies in the general population support bi-directionality for these associations.[16 17]

Critique of the method

A strength of this review is the rigorous systematic review methodology followed which was key to dealing effectively with a very heterogeneous literature. Additionally, we report significant and non-significant associations, which allows a comprehensive evaluation of the consistency and strength of the associations described. A challenge of this review was to identify whether a specific association should be categorised as 'determinant', 'outcome' or be excluded. In most cross-sectional studies the authors did not clearly state the hypotheses about the directionality of associations. Our selection of some (but not all) cross-sectional studies and non-directional measures of association (such as correlation coefficients) was restricted to those where the authors clearly described the hypothesis about directionality in the introduction or methods section.

Future research direction

The results of the present review should be taken into account for further research. Specifically, physical activity should be included as an outcome in randomised controlled trials to provide knowledge on the potential effects of drug and

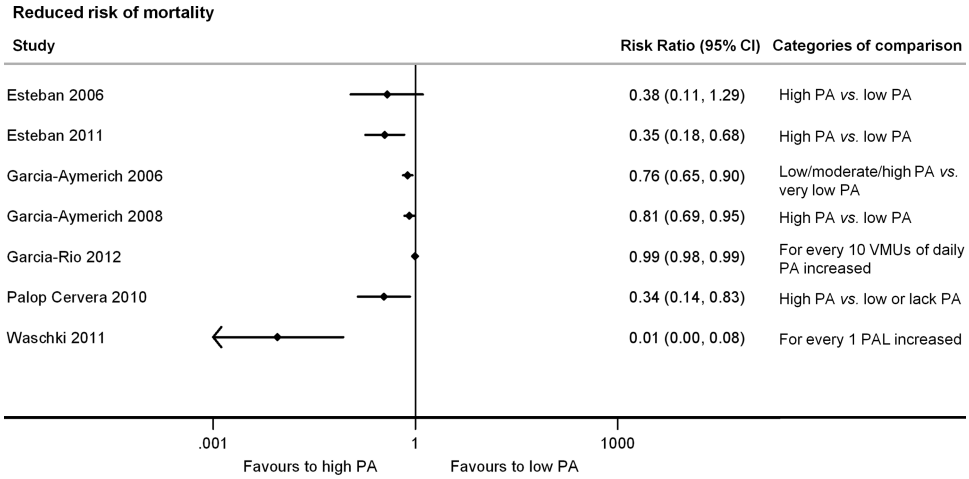


Figure 3 Graphical illustration of the individual study effects of physical activity on reduced risk of mortality.

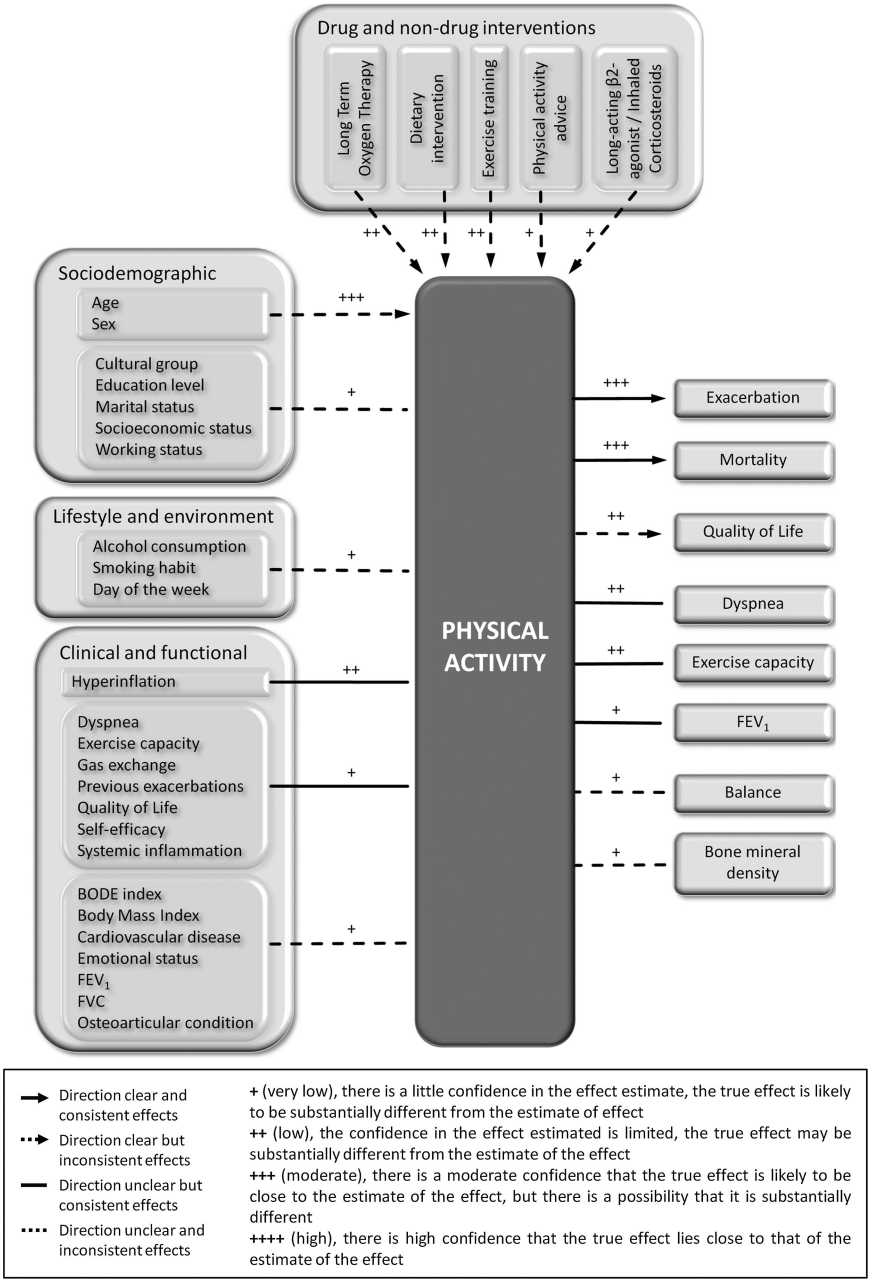


Figure 4 Conceptual model of physical activity in patients with COPD. Grading was done separately for each individual determinant/outcome (table 2). Variables of the same category sharing the same confidence rating are grouped together in this figure for clarity. Socio-demographic, lifestyle and environment, and some clinical variables (FEV_1, body mass index, emotional status and comorbidities) do not show consistent effects on physical activity. The association between other clinical and functional determinants and physical activity such as hyperinflation, exercise capacity, dyspnoea, previous exacerbations, gas exchange, systemic inflammation, quality of life and self-efficacy is consistent across studies, but lacking directionality because mostly it is based on cross-sectional studies. Studies on pharmacological and non-pharmacological treatments as determinants of physical activity are all longitudinal and thus, by design, provided a basis for a clear direction of the associations. But the results are inconsistent with some treatments showing an increase in physical activity and some showing no effect. Regarding the outcomes, only COPD exacerbation and mortality show consistent effects with clear directionality and based on moderate quality evidence.

non-drug treatments on this relevant outcome. Also, this review supports the need, prior to start any study, of a careful review of the existing literature in order not to miss (in data collection or statistical analyses) relevant potential confounders. We acknowledge that cross-sectional studies are easier to perform than longitudinal studies but the quality assessment here shows that they can just yield low-quality evidence about the association of determinants and outcomes of physical activity. The research community should make an effort to conduct prospectively planned cohort studies and randomised trials to provide a stronger evidence base for determinants and outcomes of physical activity and for developing recommendations for or against treatments in clinical guidelines.

In conclusion, the consistent effects of physical activity on mortality and COPD exacerbation are in contrast to the poor evidence about determinants of physical activity, including current COPD treatments and other outcomes of physical activity. There is a need for high-quality observational studies and randomised trials that use valid and accurate measurements of physical activity.

Author affiliations
[1]Center for Research in Environmental Epidemiology (CREAL), Barcelona, Spain
[2]CIBER Epidemiología y Salud Pública (CIBERESP), Barcelona, Spain
[3]Universitat Pompeu Fabra (UPF), Barcelona, Spain
[4]FCS Blanquerna, Research Group in Physiotherapy (GReFis), Universitat Ramon Llull, Barcelona, Spain
[5]Institute of Social and Preventive Medicine, University of Zurich, Zurich, Switzerland
[6]Institute of General Practice and Health Services Research, University of Zurich, Zurich, Switzerland
[7]Section of Nutrition and Metabolism, International Agency for Research on Cancer, Lyon, France
[8]ELEGI/Colt Laboratory, UoE/MRC Centre for Inflammation Research, University of Edinburgh, Edinburgh, UK
[9]NIHR Respiratory Biomedical Research Unit of the Royal Brompton and Harefield NHS Foundation Trust and Imperial College London, London, UK
[10]Respiratory Division, Katholieke University of Leuven, Leuven, Belgium
[11]Respiratory Department, Novartis, Basel, Switzerland
[12]R&D, AstraZeneca, Södertälje, Sweden

[13]Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Johns Hopkins University, Baltimore, Maryland, USA

Acknowledgements The authors thank Mr Jordi Figuerola (Centre for Research in Environmental Epidemiology) for creating the Microsoft Office Access data extraction form and Dr Marla K Beauchamp, Dr Michael Berry, Dr Dina Brooks, Dr Francisco Garcia-Rio, Dr Yoko Goto, Dr Fabio Pitta, Dr Vanessa S Probst and Dr Benjamin Waschki for sending the data requested from their manuscripts.

Contributors MAP and JG-A led the systematic review. EG-S, AF, RAR, NSH, MIP, HvR, TT, KK, NK, MAP and JG-A developed the study protocol. EG-S and AF conducted the electronic database searches; EG-S conducted the additional searches. EG-S and AF coordinated the references in RefWorks. EG-S, AF, YR, NSH, MIP, HvR, KK, MAP and JG-A screened titles and abstracts. EG-S, AF, CS-S, YR, NSH, MIP, HvR, MAP and JG-A assessed full texts. EG-S, AF, CS-S, JdB, MAP and JG-A extracted the relevant data. EG-S, AF, MAP and JG-A performed the quality grading. EG-S, MAP and JG-A drafted the manuscript. All authors contributed to revising the manuscript and approved the final version. PROactive consortium approved the final version of the manuscript.

Funding The PROactive project is funded by the European Commission Innovative Medicines Initiative Joint Undertaking (IMI JU # 115011).

Competing interests MIP institution received payment (<$5000) for the participation in an advisory board organised by Boehringer Ingelheim. TT provided consultancy or given sponsored talks around the topic to Boehringer Ingelheim, Novartis and GSK (amounts paid to the institution <5000 €). KK is employed by Novartis. NK is employed by AstraZeneca.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

1 Garcia-Aymerich J, Lange P, Benet M, *et al*. Regular physical activity reduces hospital admission and mortality in chronic obstructive pulmonary disease: a population based cohort study. *Thorax* 2006;61:772–8.
2 Garcia-Aymerich J, Lange P, Serra I, *et al*. Time-dependent confounding in the study of the effects of regular physical activity in chronic obstructive pulmonary disease: an application of the marginal structural model. *Ann Epidemiol* 2008;18:775–83.
3 Pitta F, Troosters T, Spruit MA, *et al*. Characteristics of physical activities in daily life in chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 2005;171:972–7.
4 Troosters T, Sciurba F, Battaglia S, *et al*. Physical inactivity in patients with COPD, a controlled multi-center pilot-study. *Respir Med* 2010;104:1005–11.
5 Centers for Disease Control and Prevention website. Resource Library: Glossary of Epidemiology Terms. http://www.cdc.gov/excite/library/glossary.htm#D (accessed 8 Jan 2014).
6 Hartman JE, Boezen HM, de Greef MH, *et al*. Consequences of physical inactivity in chronic obstructive pulmonary disease. *Expert Rev Respir Med* 2010;4:735–45.
7 Centre for Reviews and Dissemination Systematic reviews. *CRD's guidance for undertaking reviews in health care*. York: University of York, 2009. http://www.york.ac.uk/inst/crd/SysRev/!SSL!/WebHelp/SysRev3.htm
8 Higgins JPT, Green S. Cochrane Handbook for Systematic Reviews of Interventions, version 5.0.2 (update February 2009).
9 Liberati A, Altman DG, Tetzlaff J, *et al*. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *Ann Intern Med* 2009;151:W65–94.
10 Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Rep* 1985;100:126–31.
11 Guyatt GH, Oxman AD, Schunemann HJ, *et al*. GRADE guidelines: a new series of articles in the Journal of Clinical Epidemiology. *J Clin Epidemiol* 2011;64:380–2.
12 Schunemann H, Hill S, Guyatt G, *et al*. The GRADE approach and Bradford Hill's criteria for causation. *J Epidemiol Community Health* 2011;65:392–5.
13 Bauerle O, Chrusch CA, Younes M. Mechanisms by which COPD affects exercise tolerance. *Am J Respir Crit Care Med* 1998;157:57–68.
14 Foglio K, Carone M, Pagani M, *et al*. Physiological and symptom determinants of exercise performance in patients with chronic airway obstruction. *Respir Med* 2000;94:256–63.
15 Gosselink R, Troosters T, Decramer M. Peripheral muscle weakness contributes to exercise limitation in COPD. *Am J Respir Crit Care Med* 1996;153:976–80.
16 Garcia-Aymerich J, Lange P, Benet M, *et al*. Regular physical activity modifies smoking-related lung function decline and reduces risk of chronic obstructive pulmonary disease: a population-based cohort study. *Am J Respir Crit Care Med* 2007;175:458–63.
17 Spirduso WW, Cronin DL. Exercise dose–response effects on quality of life and independent living in older adults. *Med Sci Sports Exerc* 2001;33:S598–608.

Correction

Gimeno-Santos E, Frei A, Steurer-Stey C, *et al*. Determinants and outcomes of physical activity in patients with COPD: a systematic review. *Thorax* 2014;69:731–39. doi:10.1136/thoraxjnl-2013-204763

The following Collaborator list should be included in this article.

PROactive consortium: Chiesi Farmaceutici S.A.: Caterina Brindicci, Tim Higenbottam; Katholieke Universiteit Leuven: Thierry Trooster, Fabienne Dobbels; Glaxo Smith Kline: Margaret X. Tabberer; University of Edinburgh, Old College South Bridge: Roberto Rabinovich, Bill McNee; Thorax Research Foundation, Athens: Ioannis Vogiatzis; Royal Brompton and Harefield NHS Foundation Trust: Michael Polkey, Nick Hopkinson; Municipal Institute of Medical Research, Barcelona: Judith Garcia-Aymerich; Universität Zürich, Zürich: Milo Puhan, Anja Frei; University Medical Center, Groningen: Thys van der Molen, Corina De Jong; Netherlands Asthma Foundation, Leusden: Pim de Boer; British Lung Foundation, UK: Ian Jarrod; Choice Healthcare Solution, UK: Paul McBride; European Respiratory Society, Lausanne: Nadia Kamel; Pfizer: Katja Rudell, Frederick J Wilson; Almirall: Nathalie Ivanoff; Novartis: Karoly Kulich, Alistair Glendenning; AstraZeneca AB: Niklas X Karlsson, Solange Corriol-Rohou; UCB: Enkeleida Nikai; Boehringer Ingelheim: Damijen Erzen.

Thorax 2014;**69**:810. doi:10.1136/thoraxjnl-2013-204763corr1

Online only material (Online supplement)

Determinants and outcomes of physical activity in patients with chronic obstructive pulmonary disease: a systematic review

Elena Gimeno-Santos, Anja Frei, Claudia Steurer-Stey, Jordi de Batlle, Roberto A Rabinovich, Yogini Raste, Nicholas S Hopkinson, Michael I Polkey, Hans van Remoortel, Thierry Troosters, Karoly Kulich, Niklas Karlsson, Milo A Puhan and Judith Garcia-Aymerich on behalf of PROactive consortium

Online supplement 1. Protocol for systematic review.

The next 10 pages contain the original protocol for the systematic review about "Determinants and outcomes of physical activity in COPD patients" that was approved by the PROactive consortium in October 6th, 2010.

PROactive Work Package 2A: Input from the literature

Protocol for review 5 – Determinants and outcomes of PA for COPD patients

October 6th, 2010

WP2A team Systematic Review 5:

- Milo Puhan, Anja Frei, Claudia Steurer-Stey, University of Zurich, Switzerland
- Judith Garcia Aymerich, Elena Gimeno, Jordi de Batlle Centre for Research in Enviromental Epidemiology-CREAL, Barcelona, Spain
- Roberto Rabinovich, University of Edinburgh, Old College South Bridge, Scotland
- Nick Hopkinson, Michael Polkey, Yogini Raste, Matthew Hind, Royal Bromptom Hospital, London
- Thierry Troosters, Hans van Remoortel, Katholieke University of Leuven, Belgium

Background

The aim of Work Package 2 (WP2) of the PROactive project is to support the development of the initial version of the Patient-Reported Outcome (PRO) tool for physical activity in chronic obstructive pulmonary disease (COPD). The 4 sub-work-packages that contribute to the development are systematic reviews of the literature (WP2a), patient input (WP2b), input from experts (WP2c) and the validation and selection of an activity monitor (WP2d) that will be integrated as assessment of activity levels (performance) in addition to the PRO.

WP2a consists of five systematic reviews of the literature. In this report, we focus on the systematic review of studies that assessed determinants and outcomes of physical activity in COPD in order to develop a conceptual model (referred to as Systematic Review 5). A conceptual model describes the relationship among measurements, in this case the measurements of physical activity and of its determinants (e.g. hyperinflation or low FEV_1) and its outcomes (e.g. hospital admissions or poor health-related quality of life). The conceptual model will inform the planning of the observational study of PROactive (WP4), which will in turn provide additional data for the conceptual model. Finally, the conceptual model will provide an evidence base for developing endpoint models for specific trials. An endpoint model describes the relationship among PRO and non-PRO measured in a specific trial and specifies the primary, secondary and exploratory outcomes.

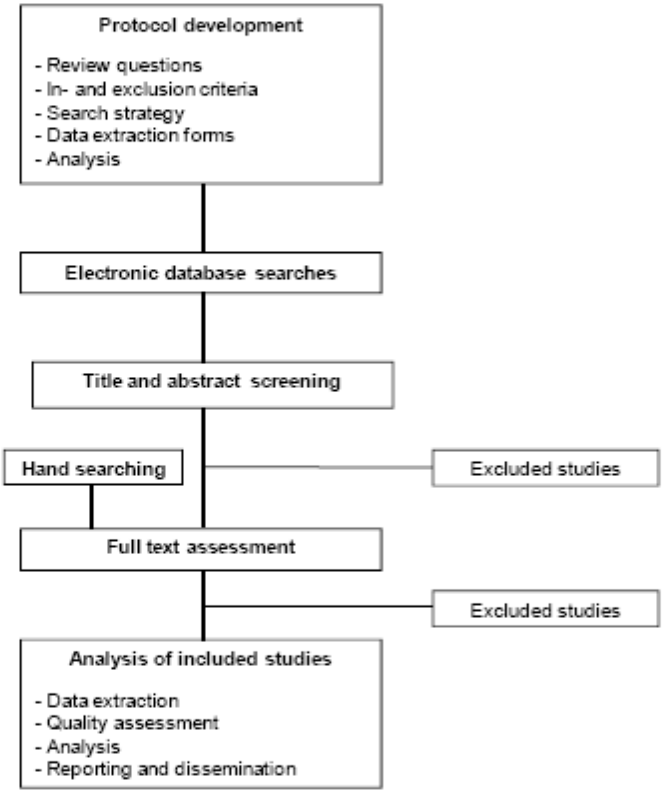
The four other systematic reviews identify and assess available PRO tools for measuring physical activity (Systematic Review 1), qualitative studies about physical activity (Systematic Review 2), validation studies of activity monitors (Systematic Review 3) and studies proposing conceptual frameworks for physical activity for PRO developments (Systematic Review 4). For more detailed information about these reviews and the entire PROactive project, readers are referred to respective reports and the main protocol.

Thus the aim of the report of this systematic review is to describe the methodology for conducting systematic review 5, the search results, available conceptual models as well as to outline implications for PROactive.

Methods

Overview

We will follow standard systematic review methodology following handbooks of the Centre for Reviews and Dissemination (York, UK) and the Cochrane Collaboration. The figure shows the steps we will follow for each review and the protocol below provides details on each step:



Review questions

The objectives of the reviews are to:

Review #5: Identify and summarize studies assessing associations between physical activity and its determinants and outcomes in patients with COPD and to develop an initial conceptual model for physical activity in COPD.

In- and exclusion criteria for studies

Inclusion criteria for review 5 (conceptual model)

Population:

Patients with chronic obstructive pulmonary disease (COPD), defined by spirometry (any definition as long as it is based on spirometry such as the current one: FEV_1/FVC <0.7 and FEV_1 in % predicted <80%).

Content of article:

Articles that consider physical activity and any measurements that may be a determinant or outcome of low levels of physical activity in COPD.

Physical activity is defined as in its classic definition: "any bodily movement produced by skeletal muscles that results in energy expenditure"[S87]. This definition will be broadly interpreted, thus in this review we will consider to include as physical activity:

- quantitative measures (activity monitors and questionnaires)
- activities of daily living (ADL) and instrumental-activities of daily living (I-ADL) (both are actually bodily movements that result in energy expenditure). We will consider any PROs that were included in systematic review 1 and thus follow the same criteria.

Physical activity will not contain measures of fitness/exercise capacity (e.g. 6-minute walk distance)

A determinant is defined as any factor that brings about change in a health condition or other defined characteristics. Examples of determinants in this review could be: age, lung hyperinflation, body mass index, co-morbidities (e.g. diabetes, depression). Determinants can be modifiable (e.g. dynamic hyperinflation, BMI) or non-modifiable (e.g. age).

An outcome is defined as all the possible results that may stem from exposure to a causal factor or from preventive or therapeutic interventions. Examples of outcomes in this review could be: lung function (FEV_1, IC), systemic inflammation (IL-6, CRP),

mortality, exacerbations, health care use, patient-reported outcomes (dyspnea, quality of life), exercise capacity (6-MWD, maximal workload), social participation etc.

Study design:

- Longitudinal observational studies: both prospective and retrospective studies.
- Experimental studies: both arms (interventional + control) if the outcome is "physical activity" (as defined above).
- Experimental studies: only control arm considered for an analysis similar to a longitudinal observational study.
- Cross-sectional studies: No restrictions, but quality will be considered in the analyses.
- Validation of PA instruments if they include associations with other variables.

Exclusion criteria:

- Language restrictions: none

Searches

Electronic search for review 5

Databases:

Search strategy for Medline, Embase, PsycINFO, CINAHL:

(COPD or 'chronic lung disease' or 'chronic obstructive lung disease' or 'chronic bronchitis' or emphysema) AND Human AND ('physical activity' or functioning or function or 'motor activity' or 'chronic limitation of activity' or 'limitation of activity' or 'activity limitation' or 'sedentary lifestyle' or 'physical exertion' or 'physical effort' or 'activities of daily living' or 'daily living activities' or 'daily living activity') AND (determinant or risk factor or predictor or outcome or 'outcome measure' or 'outcome assessment' or 'clinical outcome') AND ('longitudinal study' or 'randomized clinical trial' or 'randomized controlled trial' or 'controlled trial' or 'comparative study' or 'validation studies' or 'experimental study' or 'cross-sectional study' or 'prevalence study')

Management of references

The bibliographic details of all retrieved articles will be stored in a RefWorks-COS file RefWorks (http://www.refworks.com/) is an online research management, writing and collaboration tool that is designed to help researchers easily gather, manage, store and share all types of information, as well as generate citations and bibliographies. For a research consortium such as PROactive an online platform is most attractive

because it avoids sending around files that are constantly being updated. Using RefWorks we will have a common workspace that is always up-to-date. The University of Zurich will be offered a licensing agreement with ProQuest, the provider of RefWorks-COS. The agreement allows members of the PROactive consortium to login from any place. Licensing for all institutions of the PROactive consortium will not be required. This special agreement will be offered by ProQuest because they are interested in gaining experience with such research consortiums that are likely to become the standard in the future.

We will have 5 RefWorks-COS bibliographies for the five different reviews. We will remove duplicate records resulting from the various database searches. The source of identified articles (database, hand search, researcher contacts) will be recorded in a "user defined field" of the RefWorks-COS file. Additional "user defined field" will be assigned to individual reviewers where they can record their decision for in- and exclusion.

Study selection

Abstracts and titles screening: the title and abstract of every citation retrieved by the database searches will be scrutinized independently by 2 members of the consortium. We will order all articles that are deemed potentially eligible by at least one member of the consortium. Decisions of the reviewers will be recorded in the RefWorks-COS file (for example for Review/User 1, 0 = exclude; 1 = order for full text assessment; 2 = related study, do not order but may be useful reference).

Full text screening: two members of the consortium will then independently evaluate the retrieved full texts and make a decision on inclusion or exclusion according to the predefined selection criteria. They will record their decision about in- or exclusion in the RefWorks-COS file and will record the reason if the paper is decided to be excluded. In case of persistent disagreement a third member will decide upon in- an exclusion. Each reviewer's decisions as well as the final decisions on journal articles will be recorded in the RefWorks-COS file. All studies that do not fulfill all of the predefined criteria will be excluded and their bibliographic details listed with the specific reason for exclusion. Any disagreements will be resolved by consensus with close attention to the inclusion/exclusion criteria.

Dealing with lack of information

If unclear whether a study fulfils the inclusion criteria or not based on full text assessment we will make three attempts to contact authors by email or telephone giving one week to respond each time. If we fail to retrieve the relevant information we will list the respective study as "potentially relevant study".

Dealing with duplication

Multiple papers may be published for a number of reasons including translations, results at different follow-up period or reporting of different outcomes. We will treat a study with multiple reports as a single study but make reference all the publications.

Reporting study selection

We will use a flow chart to describe the study selection process according to the PRISMA STATEMENT (http://www.prisma-statement.org/) diagram.

Pilot the study selection process: Initially, members of the consortium will pilot the selection process by applying the inclusion and exclusion criteria to a sample of 10 randomly selected papers. Inclusion and exclusion criteria will be refined and clarified.

Data extraction strategy

The data extraction from study reports will be performed independently by 2 members of the consortium. A data collection electronic form adapted for this review will be used to recollect the data. The form will be tested by the reviewers to identify if it is confusing or incomplete. The data form could be modified after consensus between the reviewers.

The reviewers will extract the information from the report following the data extraction form criteria. The information must be explicit and detailed (using 'not reported' or 'unclear' if is necessary), the original information must write in quotes. In case of the reviews were unable to extract the whole information from the report they would contact with study authors.

The reviewers will share the information at the end of the data extraction process. Any disagreements will be resolved by consensus with close attention to the data extraction form. In case of persistent disagreement, a third member of the consortium will resolve it.

Quality assessment

Methods of analysis and synthesis

The different designs will provide different information, from the cross-sectional studies we will learn the strength of association, from the longitudinal studies we will learn about the direction of the association. Therefore, we should conduct a meta-analysis based on the information of the longitudinal studies where PA is the outcome. We should conduct a meta-analysis based on the information of the cross-sectional

studies. And should conduct a meta-analysis based on the information of the longitudinal studies where PA is the exposure.

Organization of review 5

Lead: Milo Puhan and Judith Garcia-Aymerich
Protocol development: Milo Puhan, Anja Frei, Claudia Steurer-Stey, Judith Garcia Aymerich, Elena Gimeno, Roberto Rabinovich, Nick Hopkinson, Michael Polkey, Thierry Troosters, Hans van Remoortel, Niklas Karlsson
Review coordination: Elena Gimeno and Anja Frei
Database searches: Anja Frei
Reviewers: Elena Gimeno, Anja Frei, Milo Puhan, Claudia Steurer-Stey, Judith Garcia Aymerich, Roberto Rabinovich, Nick Hopkinson, Michael Polkey, Thierry Troosters, Hans van Remoortel, Jordi de Batlle

Tentative timelines
Initial protocol: March 5th 2010
Revision of protocol: May 7th 2010
Review of protocol by team: May 28th 2010
Finalize protocol: first week of June 2010
Database search: first week of June 2010
Title and abstract screening: depends on number of refs, tbd
Full text assessment: tbd
Data extraction: tbd
Report writing: tbd

Appendices

Systematic Review 5

Selection criteria for title and abstract screening

Inclusion Criteria

Population:

- Patients with chronic obstructive pulmonary disease (COPD)
- Other populations including COPD patients:
  - if they report results separately for each disease → order full text (1)
  - if they don't report the results separately and COPD population is ≥90% → order full text (1)
  - if they don't report the results separately and COPD population is <90% → exclude (0)
  - if the abstract doesn't explicit the previous points → order full text (1)

Type of article:

Articles that consider:

- measures of physical activity (PA) (any activity monitors and questionnaires -*see below list of questionnaires which we should consider*);
- and any other variable that is associated/correlated with PA, as potential determinant/outcome (e.g. age, BMI, co-morbidities, FEV_1, systemic inflammation, exacerbations, health care use, dyspnea, quality of life, exercise capacity, social participation, etc).

Note: we won't consider PA as measures of fitness/exercise capacity (e.g. 6MWT)

Study design:

- Longitudinal observational studies: prospective and retrospective studies.
- Experimental studies if have "physical activity" as an outcome.
- Cross-sectional studies.
- Validation of PA instruments if they include associations with other variables.

Exclusion criteria

Language restrictions: none

If the Abstract is not clear enough on the eligibility criteria or does not contain the necessary information → please be conservative and order full text (1)

Use your user filed to classify title & abstract screening in RefWorks file:

0 = exclude
1 = order for full text
2 = related study that may be useful reference

List of questionnaires to be consider in this review:

- The Activities Checklist, Arbuckle, 1994
- Zutphen Physical Activity Questionnaire, Caspersen, 1991
- The Adelaide Activities Profile (AAP), Clark, 1995
- The Customary Activity Questionnaire, Dallosso, 1988
- The YALE Physical Activity Survey for Older Adults (YPAS), Dipietro, 1993
- Meaningful Activity Participation Assessment (MAPA), Eakman, 2007
- The Lifetime Total Physical Activity Questionnaire, Friedenreich, 1998
- The Physical Activity Questionnaire, Liu, 2001
- The Veterans Specific Activity Questionnaire (VSAQ), Myers, 1994
- The Physical Activity and Disability Survey (PADS), Rimmer, 2001
- The LSA Physical Activity Questionnaire (LAPAQ), Stel, 2003
- CHAMPS Physical Activity Questionnaire, Stewart, 2001
- Physical activity questionnaire, Voorrips, 1991
- The Physical Activity Scale for the Elderly (PASE), Washburn, 1993
- Scale of Older Adults' Routine (SOAR), Zisberg, 2005

Online supplement 2. Search strategy and results in 4 databases.

We performed searches in the databases Medline, Embase, CINAHL and Psychinfo using the following search terms: chronic obstructive lung disease, chronic bronchitis, emphysema, physical activity, motor activity, activity of daily living, physical inactivity, risk factors, outcome assessment, randomized controlled trial, experimental studies, cohort studies, cross-sectional studies, longitudinal studies. All publications prior to November 2012 (the time of the most recent search) were included. Additionally, we also performed manual searches of (i) all references listed in retrieved full-text articles and (ii) the first 50 references (sorted by link ranking) from PubMed's "Related Articles" search filter of retrieved full-text articles. We also contacted external scientists on this topic to identify further articles.

The bibliographic details of all retrieved articles were stored in a RefWorks-COS file. We removed duplicate records resulting from the various database searches. The source of identified articles (database, hand search, and researcher contacts) was recorded in a "user defined field" of the RefWorks-COS file. An additional "user defined field" was assigned to individual reviewers where they recorded their decision for in- and exclusion.

Ovid MEDLINE(R), Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid OLDMEDLINE(R) 1948 to Present

#	Suchen	Ergebnisse
1	Lung Diseases/	52324
2	chronic.tw.	630259
3	1 and 2	6161
4	lung diseases, obstructive/ or pulmonary disease, chronic obstructive/ or bronchitis, chronic/	31477
5	(COPD or 'chronic lung disease' or 'chronic obstructive lung disease' or 'chronic bronchitis').tw.	29350
6	exp Pulmonary Emphysema/	12869
7	emphysema.tw.	15442
8	emphysema/ or mediastinal emphysema/ or subcutaneous emphysema/	6986
9	7 not 8	12113
10	3 or 4 or 5 or 6 or 9	63861
11	exp Motor Activity/	88894
12	exp "Activities of Daily Living"/	40409
13	exp Exercise/	51689
14	exp Walking/	12461
15	("physical activit*" or 'Motor activit*' or 'activit* of daily living' or 'Chronic Limitation of Activit*' or 'Limitation of Activit*' or 'Daily Living Activit*' or "motor inactivit*" or 'physical inactivit*' or "functional activit*" or walking or "functional performance").tw.	100599
16	or/11-15	235838
17	10 and 16	2330
18	Risk factors of readmission to hospital for a COPD exacerbation: a prospective study.ti.	1
19	Characteristics of Physical Activities in Daily Life in Chronic Obstructive Pulmonary Disease.ti.	1
20	17 and 18	1
21	17 and 19	1
22	"outcome assessment (health care)"/ or treatment outcome/	460397
23	risk factors/	418203

24	(outcome adj3 (measur* or assess*)).tw.	116810
25	("risk factor*" or predictor).mp. or "clinical outcome".tw. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier]	614457
26	((quantif* or measur* or assess*) adj3 (activit* or performance or function)).tw.	138787
27	or/22-26	1222316
28	18 and 27	1
29	19 and 27	1
30	17 and 27	762
31	cohort studies/ or longitudinal studies/ or follow-up studies/ or prospective studies/ or cross-sectional studies/	861267
32	clinical trials as topic/ or controlled clinical trials as topic./ or randomized controlled trials as topic/	217736
33	("longitudinal study" or "randomized clinical trial" or "randomized controlled trial" or "controlled trial" or "comparative study" or "cohort study" or "experimental study" or "cross-sectional study").tw.	233352
34	Comparative Study/	1488243
35	31 or 32 or 33	1188991
36	30 and 35	291
37	limit 36 to humans	290
38	((quantif* or measur* or assess* or investigat* or examin* or evaluat*) adj10 (activit* or performance or function)).tw.	521428
39	22 or 23 or 24 or 25 or 38	1574543
40	17 and 39	998
41	("19255291" or "18708291" or "16738033" or "12740256" or "18573647" or "17268729" or "16537849" or "9554623").af.	8
42	40 and 41	8
43	from 40 keep 1-499	499
44	from 40 keep 500-998	499
45	from 44 keep 1	1

Suchergebnisse: **from 44 [from 41 keep 500-998] keep 1**

Verfügbare Ergebnisse: **1**
Angezeigte Ergebnisse: **#1**

```
<1>
VN  - Ovid Technologies
DB  -
UI  - 15620116
RO  - From MEDLINE, a database of the U.S. National Library of Medicine.
ST  - MEDLINE
AU  - Chou SH
```

ID	Search	Results	Date of search
7	**#3** AND **#6**	**1314**	21 Jun 2010
6	**#4** OR **#5**	**1095605**	21 Jun 2010
5	((**quantif*** OR **measur*** OR **assess*** OR **investigat*** OR **examin*** OR **evaluat***) NEAR/10 (**activit*** OR **performance** OR **function**)):ab,ti	**591744**	21 Jun 2010
4	((**quantif*** OR **measur*** OR **assess***) NEAR/3 (**activit*** OR **performance** OR **function**)):ab,ti OR ((**abilit*** OR **disabilit***) NEXT/3 (**measur*** OR **assess***)):ab,ti OR (**outcome** NEAR/3 **measurement**):ab,ti OR (**outcome** NEAR/3 **assessment**):ab,ti OR **'risk factors'**/exp OR **predictor** OR **'clinical outcome'**:ab,ti OR **'behavioral risk factor surveillance system'**/exp OR **'risk factor'**/exp	**672506**	21 Jun 2010
3	**#1** AND **#2**	**5501**	21 Jun 2010
2	**'motor activity'**/exp OR **'exercise physiology'**/exp OR **'physical activity'**:ab,ti OR **'physical activities'**:ab,ti OR **'motor activity'**:ab,ti OR **'motor activities'**:ab,ti OR **'activity of daily living'**:ab,ti OR **'activities of daily living'**:ab,ti OR **'chronic limitation of activity'**:ab,ti OR **'limitation of activity'**:ab,ti OR **'limitation of activities'**:ab,ti OR **'daily living activity'**:ab,ti OR **'daily living activities'**:ab,ti OR **'motor inactivity'**:ab,ti OR **'motor inactivities'**:ab,ti OR **'physical inactivity'**:ab,ti OR **'physical inactivities'**:ab,ti OR **'functional activity'**:ab,ti OR **'functional activities'**:ab,ti OR **'functional performance'**:ab,ti OR **walking**:ab,ti OR **exercise**:ab,ti OR **'physical activity'**/exp	**566815**	21 Jun 2010
1	**'chronic lung disease'** OR **'chronic lung emphysema'**/exp OR **'chronic lung emphysema'** OR **'chronic obstructive lung disorder'**/exp OR **'chronic obstructive lung disorder'** OR **'copd'**/exp OR **'chronic lung disease'**/exp OR **'chronic obstructive lung disease'**/exp OR **'chronic bronchitis'**:ab,ti OR **'chronic pulmonary disease'**/exp OR **'chronic obstructive pulmonary disease'**/exp	**78004**	21 Jun 2010

S13	S11 and S12	**Search modes** - Find all my search terms	**Interface** - EBSCOhost **Search Screen** - Advanced Search **Database** - CINAHL	6833
S12	chronic	**Search modes** - Find all my search terms	**Interface** - EBSCOhost **Search Screen** - Advanced Search **Database** - CINAHL	77379
S11	(MH "Lung Diseases, Obstructive+")	**Search modes** - Find all my search terms	**Interface** - EBSCOhost **Search Screen** - Advanced Search **Database** - CINAHL	22023
S10	(MH "Outcomes (Health Care)+")	**Search modes** - Find all my search terms	**Interface** - EBSCOhost **Search Screen** - Advanced Search **Database** - CINAHL	110184
S9	(MH "Risk Factors+")	**Search modes** - Find all my search terms	**Interface** - EBSCOhost **Search Screen** - Advanced Search **Database** - CINAHL	50384
S8	(MH "Outcome Assessment")	**Search modes** - Find all my search terms	**Interface** - EBSCOhost **Search Screen** - Advanced Search **Database** - CINAHL	9735
S7	(MH "Treatment Outcomes+")	**Search modes** - Find all my search terms	**Interface** - EBSCOhost **Search Screen** - Advanced Search **Database** - CINAHL	77529
S6	(MH "Motor Activity+")	**Search modes** - Find all my search terms	**Interface** - EBSCOhost **Search Screen** - Advanced Search **Database** - CINAHL	2164
S5	(MH "Exercise+")	**Search modes** - Find all my search terms	**Interface** - EBSCOhost **Search Screen** - Advanced Search **Database** - CINAHL	36565
S4	(MH "Walking+")	**Search modes** - Find all my search terms	**Interface** - EBSCOhost **Search Screen** - Advanced Search **Database** - CINAHL	8650
S3	(MH "Activities of Daily Living") or (MH "Physical Activity")	**Search modes** - Find all my search terms	**Interface** - EBSCOhost **Search Screen** - Advanced Search **Database** - CINAHL	22081
S2	(MH "Emphysema+")	**Search modes** - Find all my search terms	**Interface** - EBSCOhost **Search Screen** - Advanced Search **Database** - CINAHL	939
S1	(MH "Pulmonary Disease, Chronic Obstructive+")	**Search modes** - Find all my search terms	**Interface** - EBSCOhost **Search Screen** - Advanced Search **Database** - CINAHL	4162
			Search Screen - Advanced Search **Database** - CINAHL	
S16	S1 or S2 or S13 or S14	**Search modes** - Find all my search terms	**Interface** - EBSCOhost **Search Screen** - Advanced Search **Database** - CINAHL	9238
S15	TI (("physical activit*" or 'Motor activit*' or 'activit* of daily living' or 'Chronic Limitation of Activit*' or 'Limitation of Activit*' or 'Daily Living Activit*' or "motor inactivit*" or 'physical inactivit*' or "functional activit*" or walking or "functional performance")) or AB (("physical activit*" or 'Motor activit*' or 'activit* of daily living' or 'Chronic Limitation of Activit*' or 'Limitation of Activit*' or 'Daily Living Activit*' or "motor inactivit*" or 'physical inactivit*' or "functional activit*" or walking or "functional performance"))	**Search modes** - Find all my search terms	**Interface** - EBSCOhost **Search Screen** - Advanced Search **Database** - CINAHL	27578
S14	TI ((COPD or 'chronic lung disease' or 'chronic obstructive lung disease' or 'chronic bronchitis')) or AB ((COPD or 'chronic lung disease' or 'chronic obstructive lung disease' or 'chronic bronchitis'))	**Search modes** - Find all my search terms	**Interface** - EBSCOhost **Search Screen** - Advanced Search **Database** - CINAHL	5761

PsycINFO 1806 to June Week 3 2010

#	Suchen	Ergebnisse
1	(COPD or 'chronic lung disease' or 'chronic obstructive lung disease' or 'chronic bronchitis').tw.	737
2	lung disorders/ or exp chronic obstructive pulmonary disease/ or exp pulmonary emphysema/	1251
3	lung emphysema.mp. or pulmonary emphysema.tw. [mp=title, abstract, heading word, table of contents, key concepts]	9
4	1 or 2 or 3	1494
5	"chronic obstructive pulmonary disease".mp. or "chronic pulmonary disease".tw. [mp=title, abstract, heading word, table of contents, key concepts]	873
6	4 or 5	1722
7	("physical activit*" or 'Motor activit*' or 'activit* of daily living' or 'Chronic Limitation of Activit*' or 'Limitation of Activit*' or 'Daily Living Activit*' or "motor inactivit*" or 'physical inactivit*' or "functional activit*" or walking or "functional performance").tw.	27087
8	exp "activities of daily living"/	3061
9	exp Physical Activity/	14400
10	exp exercise/	11680
11	exp walking/	2001
12	exp Motor Performance/	10971
13	or/7-12	44545
14	6 and 13	151
15	exp treatment outcomes/	22382
16	exp risk factors/	23364
17	(outcome adj3 (measur* or assess*)).tw.	19987
18	("risk factor*" or predictor).mp. or "clinical outcome".tw. [mp=title, abstract, heading word, table of contents, key concepts]	73869
19	((quantif* or measur* or assess*) adj3 (activit* or performance or function)).tw.	30715
20	or/15-19	138245
21	14 and 20	42
22	limit 21 to human	42
23	((quantif* or measur* or assess* or investigat* or examin* or evaluat*) adj10 (activit* or performance or function)).tw.	111820
24	15 or 16 or 17 or 18 or 23	214728
25	14 and 24	68
26	from 25 keep 1	1

Suchergebnisse: **from 25 [14 and 24] keep 1**

Verfügbare Ergebnisse: 1
Angezeigte Ergebnisse: **#1**

Online supplement 3. Form for guidance of title and abstract screening process.

Inclusion Criteria

Population:

- Patients with chronic obstructive pulmonary disease (COPD)
- Other populations including COPD patients:
  - if they report results separately for each disease → order full text (1)
  - if they don't report the results separately and COPD population is ≥90% → order full text (1)
  - if they don't report the results separately and COPD population is <90% → exclude (0)
  - if the abstract doesn't explicit the previous points → order full text (1)

Type of article:

Articles that consider:

- measures of physical activity (PA) (any activity monitors and questionnaires -*see below list of questionnaires which we should consider*);
- and any other variable that is associated/correlated with PA, as potential determinant/outcome (e.g. age, BMI, co-morbidities, FEV_1, systemic inflammation, exacerbations, health care use, dyspnea, quality of life, exercise capacity, social participation, etc).

Note: we won't consider PA as measures of fitness/exercise capacity (e.g. 6MWT)

Study design:

- Longitudinal observational studies: prospective and retrospective studies.
- Experimental studies if have "physical activity" as an outcome.
- Cross-sectional studies.
- Validation of PA instruments if they include associations with other variables.

Exclusion criteria

Language restrictions: none

If the Abstract is not clear enough on the eligibility criteria or does not contain the necessary information → please be conservative and order full text (1)

Use your user filed to classify title & abstract screening in RefWorks file:

0 = exclude

1 = order for full text

2 = related study that may be useful reference

List of questionnaires to be consider in this review:

- The Activities Checklist, Arbuckle, 1994
- Zutphen Physical Activity Questionnaire, Caspersen, 1991
- The Adelaide Activities Profile (AAP), Clark, 1995
- The Customary Activity Questionnaire, Dallosso, 1988
- The YALE Physical Activity Survey for Older Adults (YPAS), Dipietro, 1993
- Meaningful Activity Participation Assessment (MAPA), Eakman, 2007
- The Lifetime Total Physical Activity Questionnaire, Friedenreich, 1998
- The Physical Activity Questionnaire, Liu, 2001
- The Veterans Specific Activity Questionnaire (VSAQ), Myers, 1994
- The Physical Activity and Disability Survey (PADS), Rimmer, 2001
- The LSA Physical Activity Questionnaire (LAPAQ), Stel, 2003
- CHAMPS Physical Activity Questionnaire, Stewart, 2001
- Physical activity questionnaire, Voorrips, 1991
- The Physical Activity Scale for the Elderly (PASE), Washburn, 1993
- Scale of Older Adults' Routine (SOAR), Zisberg, 2005

Online supplement 4. Form for guidance of full text assessment process.

Decide on in- and exclusion of study based on the full text and the following inclusion criteria (Systematic review 5 – Conceptual model)

Reviewer: 1st Author: Year: Language:

Inclusion criteria:

1. Patients with COPD defined by spirometry (any definition as long as it is based on spirometry such as the current one: FEV_1/FVC <0.7 and FEV1 in % predicted <80%) (NOTE: consider also item *a* in case of other populations) Yes / No
    a. Other populations including COPD patients: the authors report results separately for each disease *or* they don't report the results separately but COPD population (also by spirometry) is ≥90% Yes / No
2. Study considers measurement of PA[1] (activity monitor or questionnaire (see example*)) Yes / No
3. Study considers any measurements that may be (at least one): Yes / No
    a. a determinant of PA in COPD (defined using any measure of association (e.g. OR, HR, etc.) but not an agreement measure (correlation coefficient, Bland-Altman plot, p-value for mean difference, etc.)) *or*
    b. an outcome of PA in COPD (defined using any measure of association (e.g. OR, HR, etc.) but not an agreement measure (correlation coefficient, Bland-Altman plot, p-value for mean difference, etc.))
4. Study design is: Yes / No
    - longitudinal observational studies (prospective and retrospective) *or*
    - experimental studies if have PA as an outcome / determinant *or*
    - cross-sectional studies *or*
    - validation of PA instruments if they include associations with other variables

If not included, specify reasons below:

- ☐ Study doesn't show an association measure, but an agreement measure (correlation coefficient, Bland-Altman plot, p-value for mean difference, etc.)
- ☐ Not relevant patient group
- ☐ Study does not consider PA[1]
- ☐ PA is measured as exercise/fitness capacity (eg: 6-minute walk distance, maximal exercise test)
- ☐ Article presents data from review and no primary data
- ☐ Other: _____

Final decision: Include ☐ Exclude ☐

***Questionnaires need to include, according to the definition by Caspersen, a quantitative measure of PA (e.g. time spent at x METs) or ADL or I-ADL. Examples of PA questionnaires include but are not restricted to:**

- The Activities Checklist, Arbuckle, 1994
- Zutphen Physical Activity Questionnaire, Caspersen, 1991
- The Adelaide Activities Profile (AAP), Clark, 1995
- The Customary Activity Questionnaire, Dallosso, 1988
- The YALE Physical Activity Survey for Older Adults (YPAS), Dipietro, 1993
- Meaningful Activity Participation Assessment (MAPA), Eakman, 2007
- The Lifetime Total Physical Activity Questionnaire, Friedenreich, 1998
- The Physical Activity Questionnaire, Liu, 2001
- The Veterans Specific Activity Questionnaire (VSAQ), Myers, 1994
- The Physical Activity and Disability Survey (PADS), Rimmer, 2001
- The LSA Physical Activity Questionnaire (LAPAQ), Stel, 2003
- CHAMPS Physical Activity Questionnaire, Stewart, 2001
- Physical activity questionnaire, Voorrips, 1991
- The Physical Activity Scale for the Elderly (PASE), Washburn, 1993
- Scale of Older Adults' Routine (SOAR), Zisberg, 2005

Online supplement 5. Details on methods of data extraction and quality assessment.

The following information was extracted from each included study: (i) bibliographic details such as first author, year, journal, and aim of the study; (ii) study description such as study design, setting, recruitment method, study group characteristics (sample size, sex, age, smoking habit, lung function parameters, dyspnoea, body mass index (BMI)); (iii) measurement of physical activity such as direct and/or indirect measure, and physical activity variables; (iv) information related to determinants of physical activity (if any) such as determinant name, estimate of the association, statistical test or model, and covariates; (v) information related to outcomes of physical activity (if any) such as outcome name, estimate of the association, statistical test or model, and covariates; and (vi) comments from the reviewers. In studies that compared COPD patients with healthy subjects, we extracted only data for the COPD group.

The GRADE approach is used by more than 70 organizations to establish the confidence in effect estimates based on the underlying quality of the evidence. This approach rates the quality of evidence for each variable across studies, this does not rate each study as a single unit. Four reviewers assessed the quality of evidence for each association and reached a consensus on the final rating. Each association started at ++++ (high quality = high confidence that the true effect lies close to that of the estimate of the effect and more studies are unlikely to change the estimate) and was downgraded for specific reasons[S88 S89]. The criteria, all of them referring to threats to validity, to up- or downgrade the confidence in effect estimates were: (i) direction of association; (ii) control for confounding; (iii) consistency of association across studies; (iv) strength of association; (v) directness; (vi) applicability of results to a broader COPD population; (vii) precision; (viii) other: e.g. publication bias or different measures of physical activity. For each threat to validity, we downgraded the confidence rating by -1 but did not further downgrade if the quality was very low (i.e., there is a little

confidence in the effect estimate, the true effect is likely to be substantially different from the estimate of effect and more studies are very likely to change the estimate). The assessment of the quality of evidence for this systematic review was focused on those determinants and outcomes of physical activity assessed by at least 2 manuscripts.

Online supplement Table 1. Reason for exclusion after full text assessment and data extraction process.

Reference	Reason for exclusion
Abdellaoui, A. 2011, Fund Clin Pharmacol	Other: conference abstract
Ade-Oshifogun, J. 2008	Other: conference abstract
Ade-Oshifogun, J. 2009	Other: conference abstract
Ade-Oshifogun, J. 2012, J Nurs Scholar	No physical activity measure provided
Agarwal, V. 2012, J Cardiopulm Rehab Prev	No information on determinants or outcomes of physical activity
Aguilaniu, BC. 2010, Int J Chron Obstruct Pulm Dis	No primary data showed
Al Ahmari, AD. 2011, Am J Respir Crit Care Med	Other: conference abstract
Alcazar, B. 2012, Arch Bronconeumol	No physical activity measure provided
Altenburg, WA. 2011, Am J Respir Crit Care Med	Other: conference abstract
Alvarez-Gutierrez, F. 2007, Arch Bronconeumol	No physical activity measure provided
Alvarez-Nemegyei, J. 2006, Rev Med Instit Mex Seg Soc	No relevant population included
Amudhan, SR.2011, Natl Med J India	No relevant population included
Ando, M. 2003, Nihon Kokyuki Gakkai Zasshi	Other: Japanese language
Anonymous. 2010, Harvard Mens Health Watch	No primary data showed
Antonelli-Incalzi, R. 2007, Dem Geriat Cog Dis	No information on determinants or outcomes of physical activity
Archibald, CJ. 1987, Can J Rehab	No physical activity measure provided
Arne,M. 2011. Int J Chron Obstruct Pulm Dis	No relevant population included
Arvidsson, D. 2006, Clin Nutr	No assumption of directionality
Avdeeva, E. 2000, Klin Med	Other: Russian language
Bae, YO. 2003, Tuberc Respir Dis	Other: Korean language
Balcells Vilarnau, E. 2007, Arch Bronconeumol	No primary data showed
Barchfeld,T. 1999, Med Klin	No assumption of directionality
Batty, G. 2003, Am J Public Health	No relevant population included
Bauldoff, G. 2002, Chest	No physical activity measure provided
Behnke, M. 2000, Respir Med	No physical activity measure provided
Belfer, MH. 2007, COPD	No primary data showed
Beling, J. 2009, Cardiopul Phys Ther Journal	No physical activity measure provided
Bell, KR. 2004, Arch Phys Med Rehabil	No information on determinants or outcomes of physical activity

Belza, B. 2001, Nurs Res	No assumption of directionality
Bentsen,SB. 2010, Patient Educ Couns	No physical activity measure provided
Biger, M. 2010, Fundam Clin Pharmacol	Other: conference abstract
Bon,JM. 2010, Am J Respir Crit Care Med	Other: conference abstract
Bridevaux, PO. 2009, Eur Respir J	Sample includes <90% COPD
Burr,JF. 2012, Can Fam Phys	No primary data showed
Camillo, C. 2008, Lung	No assumption of directionality
Cantley, MEG. 2001 (thesis)	No assumption of directionality
Carrieri-Kohlman,V. 2005, J Cardiopulm Rehabil	No physical activity measure provided
Carter, R. 2002, J Cardiopulm Rehabil	No assumption of directionality
Carter, R. 2011, JNP	No primary data showed
Casaburi, RC. 2007, COPD	No primary data showed
Castro, AAM. 2012, Clinics	No physical activity measure provided
Cavalheri, V. 2011, Respir Med	No assumption of directionality
Cazzola, M.2010, Respir Med	Other: short term pharma study
Centers for Disease Control and Prevention. 2001	No relevant population included
Chang, A. 2008, Contemp Clini Trials	No primary data showed
Chen, G. 2011, J Cent South Univ (Medical sciences)	Other: Chinise language
Cheng,YJ. 2003, Br J Sports Med	No relevant population included
Christensen, CC. 2004, Eur Respir J	No physical activity measure provided
Chu, LW. 1999, Gerontology	No relevant population included
Cindy Ng, LW. 2012, Disab Rehab	No information on determinants or outcomes of physical activity
Clark, N. 2009, Int J Chron Obstruct Pulm Dis	No primary data showed
Cohen, MD. 2010, J Cardiopulm Rehabil	No assumption of directionality
Cohen, MD.2011, Am J Respir Crit Care Med	Other: conference abstract
Cohen,MD. 2012, COPD	No information on determinants or outcomes of physical activity
Cooper, CB. 2011, Am J Respir Crit Care Med	Other: conference abstract
Coronell, C. 2004, Eur Respir J	No assumption of directionality
Correa, KS. 2011, Rev Brasil Fisioter	No assumption of directionality
Costa, F. 2011, Am J respir Crit Care Med	Other: conference abstract
Costi, S. 2009, Chest	No physical activity measure provided
Covey, MK. 2004, Am J Nurs	No primary data showed
Cutaia, M. 2011, Lung	No information on determinants or outcomes of physical activity
de Torres, JP. 2006, Health Qual Life	No physical activity measure provided

Outcomes	
Dechman, G. 2008, Cardiopulm Phys Ther J	No primary data showed
Denkinger, MD. 2012, Z Gerontol Geriatr	No relevant population included
DePew, ZS. 2012, Chron Respir Dis	No information on determinants or outcomes of physical activity
DePew, ZS. 2013, Respir Care	No relevant population included
Dobosz, K. 2007, Fam Med Prim Care Rev	Sample includes <90% COPD
Dodd, JW. 2011, Am J Respir Crit Care Med	Other: conference abstract
Dolmage ,TE. 2012, Chest	No physical activity measure provided
Donaire-Gonzalez, D. 2011, Arch Bronconeumol	No information on determinants or outcomes of physical activity
Donesky-Cuenco, D. 2007, Heart Lung	No information on determinants or outcomes of physical activity
Dubbert, PM. 2002, J Gerontology	No relevant population included
Dyer, CA. 2012, Physother	No information on determinants or outcomes of physical activity
Dyer, CAE. 2002, Thorax	No relevant population included
Eakin, EG. 1997, J Health Psych	No relevant population included
Eisner, MD. 2008, Am J Med	Results not provided for only COPD
Eisner, MD. 2011, Thorax	No physical activity measure provided
Emery, CF. 1998, Health Psych	No physical activity measure provided
Emery, CF. 2001, Am J Respir Crit Care Med	No physical activity measure provided
Emery, CF. 2003, Health Psych	No assumption of directionality
Evans, RA. 2011, Chest	No physical activity measure provided
Fernandes, FL. 2010, J Bras Pneumol	No physical activity measure provided
Folgering, H. 1994, Int J Sports Med	No primary data showed
Fong, KN. 2010, Indoor Air	No information on determinants or outcomes of physical activity
Frey, JG. 1998, Rev Mal Respir	No assumption of directionality
Furlanetto, KC. 2010, Arch Phys Med Rehab	No information on determinants or outcomes of physical activity
Gagnon, P. 2011, Am J Respir Crit Care Med	Other: conference abstract
Garcia-Aymerich, J. 2007, Am J Respir Crit Care Med	No primary data showed
Garcia-Aymerich, J. 2009, Arch Bronconeumol	No primary data showed
Garcia-Polo, C. 2012, Respir Med	No physical activity measure provided
Garcia-Rio, F. 2011, Chest	No physical activity measure provided
Garcia-Rio, FC. 2007, Med Clin	No primary data showed
Garfield, BE. 2012, Eur Respir J	No assumption of directionality
Garrod, R. 2000, Respir Med	No assumption of directionality

Gause-Nilsson, I. 1999, J Nutr Health Aging	No relevant population included
Goris, AHC. 2003, Br J Nutr	No assumption of directionality
Gorzelniak, L. 2012, COPD	No assumption of directionality
Gosker, HR. 2003, Chest	No assumption of directionality
Gouzi, F. 2011, Arch Phys Med Rehab	No information on determinants or outcomes of physical activity
Greenland, P. 2001, J Cardiopulm Rehab	Other: conference abstract
Grimby, GC. 1977, Bull Eur Physiopathol Respir	No primary data showed
HajGhanbari, B. 2011, Respir Med	No assumption of directionality
Hannink, JDC. 2010, Chest	No physical activity measure provided
Hartman, JE. 2011, Am J Respir Crit Care Med	Other: conference abstract
Hassanein, SE. 2009, J Cardiopulm Rehab	No physical activity measure provided
Haughney, J. 2004, Prim Care Resp J	No primary data showed
He, J. 2006, N Engl J Med	No primary data showed
Hecht, A. 2009, COPD	No assumption of directionality
Heppner, PS. 2006, J Cardiopulm Rehab	No physical activity measure provided
Herlitz, J. 2005, Int J Cardiol	No relevant population included
Hernandes, NA. 2009, J Bras Pneumol	No assumption of directionality
Hill, K. 2010, Thorax	No information on determinants or outcomes of physical activity
Hill, K. 2011, Respirology	Other: conference abstract
Hill, K. 2012, Chest	No information on determinants or outcomes of physical activity
Hirayama, F. 2010, J Phys Act Health	No relevant population included
Houchen, L. 2011, Physiotherapy	No physical activity measure provided
Hudon, C. 2008, Can Fam Phys	No primary data showed
Hukkinen, M. 2009, COPD	No relevant population included
Hyland, ME. 1999, Psych Health Med	No assumption of directionality
Incalzi, RA. 1998, Respir Med	No physical activity measure provided
Incalzi, RA. 2005, Chest	No relevant population included
Isoaho, R. 1995, Scand J Prim Health Care	No assumption of directionality
Jackson, AS. 2013, Eur Respir J	No assumption of directionality
Janssens, T. 2011, Chest	No physical activity measure provided
Jardim, JR. 2011, Am J Respir Crit Care Med	Other: conference abstract
Jehn, ML. 2011, Eur J Cardiovasc Prev Rehabil	Other: conference abstract
Jehn, ML. 2011, Respir Med	No assumption of directionality
Jeng, C. 2003, Heart Lung	No physical activity measure provided
Jonkers, CC. 2012, Int Psychoger	No physical activity measure provided

Ju, CR. 2011, Respirology	Other: conference abstract
Ju,CC. 2009, Respirology	Other: conference abstract
Kajiwara, T. 2010, Am J Respir Crit Care Med	Other: conference abstract
Kanda, M. 2012, Int Med	No information on determinants or outcomes of physical activity
Kanervisto, M. 2010, Chron Respir Dis	No physical activity measure provided
Kao, MC. 2011, PM and R	Other: conference abstract
Kapella, MC. 2006, Nurs Res	No physical activity measure provided
Kapella, MC. 2011, Med Sci Sports Exerc	No physical activity measure provided
Kaptein, AA. 1993, Eur Respir J	No assumption of directionality
Kato, DJ. 2012, J Cardiopulm Rehab Prev	No physical activity measure provided
Katula, JA. 2004, Health Qual Life Outcomes	No physical activity measure provided
Katz, P. 2011, J Cardiopulm Rehab Prev	No relevant population included
Katz, PP. 2010, Chest	Sample includes <90% COPD
Katz, PP. 2010, J Cardiopulm Rehab	No relevant population included
Kim, S. 2004, Chest	No relevant population included
Kim, SH. 2011, Korean J Fam Med	No physical activity measure provided
Kiyokawa, N. 2009, Respirology	Other: conference abstract
Kon, SS. 2011, Thorax	No primary data showed
Kon, SS. 2011, Thorax	Other: conference abstract
Koo, P. 2009, Chest	Other: conference abstract
Kovelis, D. 2011, COPD	No physical activity measure provided
Kuyucu, T. 2011, Tuberk Toraks	No relevant population included
Kwua-Yun, W. 2012, Respir Care	No physical activity measure provided
Lahaije, AJ. 2010, Respir Med	No information on determinants or outcomes of physical activity
Langer, D. 2009, J Heart Lung Transplant	No relevant population included
Langer, D. 2009, Thorax	No primary data showed
Langer, D. 2011, Am J Respir Crit Care Med	Other: conference abstract
Langer, D. 2012, Respir Med	No relevant population included
Lareau, SC. 2005 , Int J Ther Rehabil	No primary data showed
Larson, JL. 2007, COPD	No primary data showed
Larson, JL. 2011, Am J Respir Crit Cre Med	Other: conference abstract
Lautenschlager, NT. 2006, Cur Opinion Psych	No primary data showed
Lee, AH. 2011, Ann Epidemiol	No information on determinants or outcomes of physical activity
Lee, JS. 2007, Gerontology	No relevant population included
Leff, B. 2009, J Am Geriatr Soc	No relevant population included
Leidy,NK. 1999, Respir Care	No assumption of directionality
Leung, RW. 2011, Contemp Clin Trials	No physical activity measure provided

Lewis, KE. 2011, Am J Respir Crit Care Med	Other: conference abstract
Lewis, MJ. 2009, Clin Physiol Funct Imaging	No physical activity measure provided
Liddell, F. 2010, Physiotherapy	No physical activity measure provided
Lomundal, BK. 2012, Int J Chron Obstruct Pulm Dis	No physical activity measure provided
Lopez Varela, MV. 2010, Eur Respir J	No physical activity measure provided
Mackenbach, JP. 2001, J Epidemiol Community Health	No relevant population included
Magnussen, H. 2009, Med Klin	No primary data showed
Magnussen, H. 2009, Proc Am Thorac Soc	No primary data showed
Man, WD. 2009, Thorax	Other: conference abstract
Mannino, DM. 2002, Respir Care	No relevant population included
Mantoani, LC. 2011, Rev Brasil Fisiot	No assumption of directionality
Matsunaga, H. 2011, Am J Respir Crit Care Med	Other: conference abstract
McGlone,S. 2006, COPD	No assumption of directionality
Medhi, GK. 2006, J Assoc Physicians India	No relevant population included
Menotti, A. 1985, J Epidemiol Community Health	No relevant population included
Metzner, HL. 1983, Prev Med	No relevant population included
Mikami, M. 1995, Japanese J Thorac Dis	Other: Japanese language
Miller, RR. 2004, J Am Geriatr Soc	Sample includes <90% COPD
Miravitlles, M. 2009, Thorax	No assumption of directionality
Miravitlles, M. 2013, Respir Med	No physical activity measure provided
Mittal, N. 2011, J Invest Med	Other: conference abstract
Mok, M. 2012, J Am Coll Cardiol	Other: conference abstract
Monso, E. 1998, Respir Med	No assumption of directionality
Montes de Oca, M. 2009, Respir Med	No physical activity measure provided
Moore, R. 2009, J Cardiopulm Rehab	No assumption of directionality
Morgan, M. 2003, Thorax	No primary data showed
Morgan, M. 2008, Thorax	No primary data showed
Morimoto, M. 2003, Nihon Kango Kagakkai Shi	No assumption of directionality
Morimoto, M. 2004, Nurs Health Sci	Other: Japanese language
Moy, ML. 2008, J Rehabil Res Dev	No assumption of directionality
Moy, ML. 2010, Am J Respir Crit Care Med	Other: conference abstract
Nader, GA. 2009, Curr Opin Rheumatol	No relevant population included
Nakamura, Y. 2001, Nihon Kokyuki Gakkai Zasshi	Other: Japanese language
Nejjari, C. 1997, Rev Epidemiol Sante Publique	No relevant population included

Nguyen, HQ. 2011, J Nurs Meas	No information on determinants or outcomes of physical activity
Nguyen, HQ. 2012, Arch Phys Med Rehab	No assumption of directionality
No author. 2002, SportEX Health	No primary data showed
No author. 2006, Am J Nurs	No primary data showed
No author. 2006, Medicina Sport	No primary data showed
No author. 2008, Cardiology Rev	No primary data showed
No author. 2008, South Online J Nurs Res	No physical activity measure provided
Novoa, N. 2009, Interact Cardiovasc Thorac Surg	No relevant population included
Ohar, J. 2006, J Respir Dis	No primary data showed
Ortega, FB. 2010, J Allergy Clin Immunol	No relevant population included
Ozkan, S. 2009, Saudi Med J	No assumption of directionality
Ozkan, S. 2012, Nobel Med	No physical activity measure provided
Paffenbarger, R. 1978, Am J Epidemiol	No relevant population included
Parada, A. 2011, Rev Med Chil	No assumption of directionality
Parshin, VD. 2009, Khirurgiia	No physical activity measure provided
Partridge, MR. 2010, Eur Respir J	No physical activity measure provided
Patel, SA. 2005, Respiration	No primary data showed
Pavord, ID. 2009, Lancet	No primary data showed
Perez-Castejon, J. 2007, Rev Multidiscip Gerontol	No primary data showed
Petersen, AMW. 2008, Scand J Med Sci Sports	No physical activity measure provided
Pison, CC. 1999, Rev Mal Respir	No primary data showed
Pitta, F. 2005, Am J Respir Crit Care Med	No assumption of directionality
Pitta, F. 2005, Arch Phys Med Rehab	No assumption of directionality
Regueiro, EM. 2009, Clinics	No assumption of directionality
Reilly, K. 2008, Am J Epidemiol	No physical activity measure provided
Ren, XS. 1998, Med Care	No physical activity measure provided
Riddoch-Contreras, J. 2012, COPD	No relevant population included
Ringbaek, TJ. 2001, Respir Med	No physical activity measure provided
Robles, P. 2012, Can Respir J	Other: conference abstract
Roig, M. 2011, Physiother Can	No relevant population included
Ruhle, KH. 2009, Pneumologie	No information on determinants or outcomes of physical activity
Salvi, SS. 2009, Lancet	No primary data showed
Schonhofer, B. 1997, Eur Respir J	No assumption of directionality
Serres, I. 1998, Chest	No assumption of directionality
Shead, D. 2012, Phys Ther Rev	No primary data showed

Shephard, RJC. 1982, Ann Clin Res	No primary data showed
Sherrill, DM. 2005, J Neuroeng Rehabil	No assumption of directionality
Shrikrishna, D. 2011, Thorax	Other: conference abstract
Shrikrishna, D. 2012, Eur Respir J	No assumption of directionality
Simon, KM. 2011, Rev Brasil Fisiot	No assumption of directionality
Singh, SJ. 2001, J Cardiopulm Rehabil	No assumption of directionality
Singh, SJ. 2001, Respìr Med	No assumption of directionality
Slinde, F. 2003, Clin Nut	No assumption of directionality
Smith, BJ. 2002, Chron Respir Dis	COPD diagnosis not defined by spirometry
Smith, BJ. 2005, Med J Aust	No relevant population included
Snijders, MC. 1998, Stud Health Technol Inform	No physical activity measure provided
Snijders, MC. 2002, Gerontechnology	No information on determinants or outcomes of physical activity
So, CT. 2008, OTJR: Occup, Particip Health	No information on determinants or outcomes of physical activity
Soguel Schenkel, N. 1996, Eur Respir j	No physical activity measure provided
Soicher, JE. 2010, Dissertation Abstracts International	Other: conference abstract
Soicher, JE. 2012, Eur Respir J	No information on determinants or outcomes of physical activity
Sorino, C. 2009, Am J Respir Crit Care Med	No primary data showed
Steele, BG. 2000, Chest	No assumption of directionality
Steele, BG. 2003, J Rehabil Res Dev	No primary data showed
Steele, BG. 2008, Arch Phys Med Rehab	Sample includes <90% COPD
Stein, MB. 2006, Psychol Med	No physical activity measure provided
Steinsbekk, A. 2009, Chron Respir Dis	No physical activity measure provided
Stepanishcheva, LA. 2005, Klin Med	Other: Russian language
Stieb, DM. 2000, Can J Public Health	No relevant population included
Sugino, A. 2012, Respiration	No assumption of directionality
Swallow, EB. 2007, J Appl Physiol	No assumption of directionality
Swisher, AC. 2006, Cardiopulm Phys Ther J	No primary data showed
Swisher, AC. 2008, Cardiopulm Phys Ther J	No primary data showed
Szmidt, M. 2012, Pneumol Alergol Polska	Other: Polish language
Tanaka, Y. 2008, Respirology	No physical activity measure provided
Tanaka, Y. 2009, Respirology	Other: conference abstract
Tantucci, C. 2012, Endocrine	No primary data showed
Thomas, MJ. 2010, Physiotherapy	No primary data showed
Toh, CK. 2006, J Clin Oncol	No primary data showed
Troosters, T. 2010, Eur Respir J	No physical activity measure provided

Vaes, AW. 2012, PloS ONE	No physical activity measure provided
Van den Borst B, 2011, Am J Respir Crit Care Med	Other: conference abstract
Van den Borst B, 2011, Thorax	No relevant population included
Van Der Horst-Graat, JM. 2007, J. Nutr. Health Aging	No relevant population included
Van Dijk, PTM. 2005, J Am Geriatr Soc	No relevant population included
Van Gestel, AJ. 2012, Respiration	No assumption of directionality
Van Helvoort, HA. 2011, Arch Phys Med Rehab	No physical activity measure provided
Van Manen, JG. 2002, Thorax	No physical activity measure provided
Van Remoortel, H. 2011, Am J Respir Crit Care Med	Other: conference abstract
Varga, J. 2007, Respir Med	No physical activity measure provided
Varraso, R. 2007, Am J Epidemiol	COPD diagnosis no defined by spirometry
Varraso, R. 2007, Thorax	COPD diagnosis no defined by spirometry
Varraso, R. 2012, Am J Clin Nutr	No primary data showed
Velloso, M. 2006, Chest	No assumption of directionality
Venkata, A. 2012, J Cardiopulm Rehab Prev	No assumption of directionality
Vilaro, J. 2007, Med Clin (Barc)	No assumption of directionality
Volpato, S. 2008, J Gerontol A Biol Sci Med Sci	No relevant population included
Vozoris, NT. 2012, Can Respir J	No relevant population included
Walker, PC. 2009, Chron Respir Dis	No primary data showed
Walters, JA. 2011, Respirology	Other: conference abstract
Walters, JA. 2012, Respirology	Other: conference abstract
Waschki, B. 2011, Am J Respir Crit Care Med	Other: conference abstract
Waschki, B. 2012, Respir Med	No assumption of directionality
Williams, V. 2011, Qual Health Res	No physical activity measure provided
Willis,JR. 2012, Arch Ophthalmol	No relevant population included
Winkelman, CC. 2010, Heart Lung	No assumption of directionality
Wouters, EF. 2011, Chest	No primary data showed
Wust, R. 2008, Eur J Appl Physiol	No relevant population included
Xu, F. 2005, Chest	No relevant population included
Yeh, M. 2004, J Adv Nurs	No assumption of directionality
Yentes, JM. 2011, Respir Med	No relevant population included
Zagol, B. 2010, Am J Cardiol	No relevant population included
Zanocchi, M. 2002, Minerva Med	Other: Italian language
Zhang, Z. 2008, JCR	Other: Chinese language
Zhang, Z. 2008, Zhongguo Wei Zhong Bing Ji Jiu Yi Xue	Other: Chinese language

Zhou, JH. 2006, Chin J Clin Rehabil	Other: Chinese language
ZuWallack, R. 1998, Monaldi Arch Chest Dis	No primary data showed
Zwerink, M. 2013, Respir Med	No assumption of directionality

Online supplement Table 2. Design, patients' characteristics and instruments for measuring physical activity of 86 studies reporting associations between physical activity and its determinants or outcomes in COPD patients.

Reference	Study design	Study group characteristics					Measure of physical activity	
		n	Sex (male), n (%)	Age (yr), mean (SD)	FEV_1 (%pred), mean (SD)	BMI (kg/m^2), mean (SD)	Direct method	Indirect method
Altenburg, WA. 2013, Respir Med[S1]	cross-sectional	155	102 (66)	*median (P_{25}-P_{75})* 62 (54-69)	*median (P_{25}-P_{75})* 60 (40-75)	*median (P_{25}-P_{75})* 26.1 (22.8-29.0)	Pedometer: Digiwalker SW-200; Yamax, Tokyo, Japan	--
Beauchamp, MK. 2012, Chest[S2]	cross-sectional	37	17 (46)	71 (7)	39 (16)	28.9 (10.5)	--	Physical Activity Scale for the Elderly (PASE) (Washburn, 1993)
Behnke, M. 2005, Respir Med[S3]	non-randomized controlled study	88	71 (81)	60 (8)	43 (14)	24.3 (3.6)	Accelerometer: Trictrac-R3D; Stayhealthy, Monrovia, CA, USA	--
Bendstrup, KE. 1997, Eur Respir J[S4]	randomized controlled trial	Experimental group (EG): 16 Control group (CG): 16	EG: 9 (55) CG: 9 (56)	EG: 64 (3) CG: 65 (2)	not available	not available	--	Activities of Daily Living score specific for COPD (Ogden, 1985)
Benzo, R. 2010, Respiration[S5]	cohort	Group 1 (G1): 394 Group 2 (G2): 203	G1: 130 (33) G2: 85 (42)	G1: 67 (6) G2: 67 (6)	G1: 27 (7) G2: 26 (6)	G1: 24.8 (3.5) G2: 24.7 (3.7)	--	Questions related physical activity*
Berry, M. 2006, Chest[S6]	cross-sectional	291	166 (57)	68 (8)	55 (18)	27.3 (5.4)	--	The Fitness Arthritis and Seniors Trial functional performance

Reference	Study design	Study group characteristics					Measure of physical activity	
		n	Sex (male), n (%)	Age (yr), mean (SD)	FEV_1 (%pred), mean (SD)	BMI (kg/m^2), mean (SD)	Direct method	Indirect method
								inventory (Rejeski, 1995)
Berry, M. 2010, Respir Med[S7]	randomized non-controlled parallel study	G1: 89 G2: 87	G1: 48 (54) G2: 47 (54)	G1: 66 (10) G2: 66 (10)	G1: 53 (19) G2: 51 (20)	not available	--	The Community Health Activities Model Program for Seniors (CHAMPS) (Stewart, 2001)
Bestall, J. 1999, Thorax[S8]	cross-sectional	100	55 (55)	*median (P_{25}-P_{75})* 70 (44-86)	Dyspnoea (MRC 3): 41 (15) Dyspnoea (MRC 4): 37 (16) Dyspnoea (MRC 5) 37 (15)	not available	--	Nottingham Extended Activities of Daily Living (EADL) scale (Lincoln, 1992)
Bon, J. 2011, Am J Respir Crit Care Med[S9]	cross-sectional	190	98 (52)	66 (7)	81 (22)	27.9 (4.1)	--	Stanford Brief Activity Survey (SBAS) (Taylor-Piliae, 2006)
Bossenbroek, L. 2009, J Heart Lung Transp[S10]	case-control	Cases (CA): 47 Controls (CO): 15	CA: 18 (38) CO: 5 (33)	CA: 55 (6) CO: 53 (6)	CA: 93 (28) CO: 20 (5)	CA: 25.0 (5.0) CO: 23.0 (3.3)	Pedometer: Digiwalker SW-200; Yamax, Tokyo, Japan	Short Questionnaire to Assess Health Enhancing Physical Activity (SQUASH) (Wendel-Vos, 2003)
Bourbeau, J. 2007, Eur Respir J[S11]	cohort	421	239 (57)	66 (na)	45 (na)	not available	--	Non-validated Activities of Daily Living (ADL) questionnaire[†]
Breyer, MK. 2010, Respir Research[S12]	randomized controlled trial	60	27 (45)	60 (8)	46 (18)	26.2 (4.6)	Accelerometer: DynaPort Activity Monitor;	--

Reference	Study design	Study group characteristics					Measure of physical activity	
		n	Sex (male), n (%)	Age (yr), mean (SD)	FEV_1 (%pred), mean (SD)	BMI (kg/m^2), mean (SD)	Direct method	Indirect method
							McRoberts BV, The Hague, The Netherlands	
Chao, PW. 2011, COPD[S13]	cross-sectional	21	10 (48)	57 (9)	not available	28 (6)	--	Historical Physical Activity Questionnaire (HPAQ) (DuBose, 2007)
Chen, Y. 2006, Western J Nurs Research[S14]	cohort	145	106 (73)	72 (10)	49 (18)	not available	--	Pulmonary Functional Status Scale (PFSS) (Weaver, 1998)
Coronado, M. 2003, J Cardiopulm Rehab[S15]	non-controlled study	15	13 (87)	67 (9)	54 (16)	23.6 (4.7)	Accelerometer: ADXL05; Analog Devices, Norwood, Mass, USA	--
Dal Negro, R. 2010, Monaldi Arch Chest Dis[S16]	randomized controlled trial	EG: 16 CG: 16	EG: 14 (88) CG: 11 (69)	EG: 75 (7) CG: 75 (7)	not available	EG: 20.2 (1.8) CG: 20.2 (1.4)	Accelerometer: SenseWear Armband PRO3; BodyMedia, Pittsburgh, PA, USA	--
Dallas, MI. 2009, Chron Respir Dis[S17]	non-controlled study	45	21 (47)	69 (8)	45 (18)	27.0 (5.0)	Pedometer: NL-200 Activity Monitor; New Life-styles, Inc; Lee's Summit, MO, USA	--
Daly, C. 2011, Physio Ireland[S18]	non-controlled study	8	4 (50)	62 (6)	P_{25}-P_{75} 35-70	23.8 (3.9)	Accelerometer: RT3; Stayhealthy, Monrovia, CA,	--

Reference	Study design	Study group characteristics					Measure of physical activity	
		n	Sex (male), n (%)	Age (yr), mean (SD)	FEV_1 (%pred), mean (SD)	BMI (kg/m^2), mean (SD)	Direct method	Indirect method
							USA	
de Blok, BM. 2006, Patient Educ Couns[S19]	randomized controlled trial	EG: 10 CG: 11	EG: 5 (50) CG: 4 (36)	EG: 66 (10) CG: 63 (12)	EG: 52 (22) CG: 43 (13)	EG: 29.3 (8.4) CG: 28.2 (6.6)	Pedometer: Yamax Digiwalker SW-200;, Tokyo, Japan	--
Effing, T. 2011, Respir Med[S20]	randomized controlled trial	EG: 77 CG: 76	EG: 45 (58) CG: 44 (58)	EG: 63 (8) CG: 64 (8)	EG: 50 (14) CG: 51 (17)	EG: 26.1 (5.0) CG: 26.8 (4.4)	Pedometer Yamax Digi-Walker SW-200; Tokyo, Japan	--
Egan, C. 2012, Respir Med[S21]	non-controlled study	47	not available	not available	47 (17)	27.5 (6.2)	Accelerometer: SenseWear Armband PRO3; BodyMedia; Pittsburgh, PA, USA	--
Eisner, MD. 2008, Am J Epi[S22]	cross-sectional	1202	511 (43)	58 (6)	62 (23)	not available	--	Self-Reported Functional Limitation (Sternfeld, 2002)
Eliason, G. 2011, COPD[S23]	cross-sectional	44	16 (36)	mild: 64 (6) moderate: 64 (8) severe: 63 (8)	not available	mild: 25.9 (5.3) moderate: 28.0 (6.3) severe: 26.3 (4.2)	Accelerometer: Actigraph GT1M; Manufactoring Technology IC, Fort Walton Beach, FL, USA	--
Esteban, C. 2006, QJM[S24]	cohort	611	597 (98)	67 (8)	50 (15)	not available	--	Non-validated scale‡
Esteban, C. 2010, Eur Respir J[S25]	cohort	391	not available	66 (9)	52 (14)	27.9 (4.3)		Non-validated scale‡

Reference	Study design	Study group characteristics					Measure of physical activity	
		n	Sex (male), n (%)	Age (yr), mean (SD)	FEV_1 (%pred), mean (SD)	BMI (kg/m^2), mean (SD)	Direct method	Indirect method
Esteban, C. 2011, Respir Med[S26]	cohort	611	597 (98)	67 (9)	50 (15)	27.8 (4.3)	--	Non-validated scale‡
Faager, G. 2004, J Rehab Med[S27]	randomized controlled trial	EG: 10 CG: 10	EG: 3 (30) CG: 3 (30)	EG: 72 (9) CG: 70 (8)	EG: 26 (7) CG: 28 (6)	not available	--	Stanford Health Assessment Questionnaire (HAQ) (Ekdahl, 1988)
Faulkner, J. 2010, Prim Care Respir J[S28]	randomized controlled trial	20	not available	not available	EG: 65 (12) CG: 67 (12)	not available	--	Seven day physical activity recall questionnaire (7 day physical activity) (Blair, 1984)
Garcia-Aymerich, J. 2003, Thorax[S29]	cohort	340	313 (92)	69 (9)	36 (16)	26.0 (5.0)	--	Adaptation from the Minnesota Leisure Time Physical (Elosua, 1994)
Garcia-Aymerich, J. 2004, Med Scien Sports Exerc[S30]	cross-sectional	346	317 (92)	69 (9)	35 (16)	26.0 (5.0)	--	Simplification of the Minnesota Leisure Time Physical Activity Questionnaire (Elosua, 1994)
Garcia-Aymerich, J. 2006, Thorax[S31]	cohort	2386	1286 (54)	60 (11)	*n (%)* mild: 833 (35) moderate: 1095 (46) severe:	24.9 (4.2)	--	Validated questionnaire (Saltin and Grimby, 1968)

Reference	Study design	Study group characteristics					Measure of physical activity	
		n	Sex (male), n (%)	Age (yr), mean (SD)	FEV_1 (%pred), mean (SD)	BMI (kg/m^2), mean (SD)	Direct method	Indirect method
					354 (15) very severe: 94 (4)			
Garcia-Aymerich, J. 2008, Ann Epidemiol[S32]	cohort	2226	1161 (52)	54 (10)	*n (%)* mild: 966 (44) moderate: 1027 (47) severe: 190 (9) very severe: 27 (1)	not available	--	Validated questionnaire (Saltin and Grimby, 1968)
Garcia-Aymerich, J. 2009, Chest[S33]	cross-sectional	341	317 (93)	68 (9)	52 (16)	28.2 (4.7)	--	YALE physical activity questionnaire (De Abajo, 2001)
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	cross-sectional	110	104 (95)	63 (8)	47 (14)	27.5 (3.7)	Accelerometer: RT3; Stayhealthy, Monrovia, CA, USA	--
Garcia-Rio, F. 2012, Chest[S35]	cohort	173	157 (91)	64 (8)	49 (14)	27.4 (3.5)	Accelerometer: RT3; Stayhealthy, Monrovia, CA, USA	--
Goto, Y. 2004, Respirology[S36]	non-randomised controlled study	EG: 18 CG: 12	EG: 18 (100) CG: 11 (92%)	EG: 65 (6) CG: 67 (8)	EG: 29 (na) CG: 78 (na)	EG: na CG: na	--	Validated questionnaire[$]
Hartman, JE. 2013, Arch Phys	cross-sectional	113	76 (67)	65 (9)	52 (14-119)*	not available	Accelerometer: DynaPort Activity	--

Reference	Study design	Study group characteristics					Measure of physical activity	
		n	Sex (male), n (%)	Age (yr), mean (SD)	FEV_1 (%pred), mean (SD)	BMI (kg/m^2), mean (SD)	Direct method	Indirect method
Med Rehab[S37]							Monitor; McRoberts BV, The Hague, The Netherlands	
Hataji, O. 2013, Int J Chron Obstruct Pulmon Dis[S38]	non-controlled study	23	21 (91)	70 (2)	65 (4)	21.6 (0.7)	Accelerometer: Lifecorder; Suzuken Corporation, Nagoya, Japan	--
Inal-Ince, D. 2005, Saudi Med J[S39]	cross-sectional	30	30 (100)	62 (10)	37 (12)	23.9 (4.2)	--	Activities of Daily Living Questionnaire (ADL-Q) (Kennedy, 1994)
Jehn, M. 2012, Med Sci Sports Exerc[S40]	cross-sectional	107	76 (71)	65 (11)	43 (15)	26.2 (5.8)	Accelerometer: Aipermon GmbH, Munich, Germany	--
Katajisto, M. 2012, Int J Chron Obstruct Pulmon Dis[S41]	cross-sectional	719	419 (60)	63 (7)	60 (19)	26.6 (5.2)	--	COPEX questionnaire[ll]
Lahaije, A. 2013, Respir Med[S42]	cross-sectional	57	35 (61)	64 (7)	64 (24)	27 (5)	Accelerometer: Actometer; Dep. of Electronics and Instrumental Services of the Psychological Laboratory of the University of Nijmegen, The Netherlads	--

Reference	Study design	Study group characteristics					Measure of physical activity	
		n	Sex (male), n (%)	Age (yr), mean (SD)	FEV_1 (%pred), mean (SD)	BMI (kg/m^2), mean (SD)	Direct method	Indirect method
Lee, H. 2011, Geriatr Nurs[S43]	cross-sectional	131	117 (89)	66 (na)	60 (na)	*n (%)* <18.5: 16 (12) 18.5 to <25: 86 (66) ≥25: 29 (22)	--	International Physical Activity Questionnaire (IPAQ) (Craig, 2003)
Lemmens, KMM. 2008, Patient Educ Couns[S44]	cross-sectional	278	156 (56)	63 (11)	78 (20)	27.5 (4.7)	--	Validated questionnaire[¶]
Lores, V. 2006, Arch Bronconeumol[S45]	cross-sectional	23	20 (87)	62 (7)	45 (13)	27.7 (3.6)	Accelerometer: RT3; Stayhealthy, Monrovia, CA, USA	--
Mador, MJ. 2011, J Cardiopulmon Rehab Prev[S46]	non-controlled study	24	not available	72 (8)	44 (18)	30.3 (4.5)	Accelerometer: RT3; Stayhealthy, Monrovia, CA, USA	--
Miravitlles, M. 2011, Respir Med[S47]	cohort	346	315 (91)	69 (10)	47 (17)	27.4 (4.7)	--	Non-validated scale[‡]
Monteiro, F. 2012, Lung[S48]	cross-sectional	74	45 (61)	65 (9)	40 (15)	27 (6)	Accelerometer: DynaPort Activity Monitor; McRoberts BV, The Hague, The Netherlands; and SenseWear Armband PRO3; BodyMedia, Pittsburgh, PA, USA	--

Reference	Study design	Study group characteristics					Measure of physical activity	
		n	Sex (male), n (%)	Age (yr), mean (SD)	FEV_1 (%pred), mean (SD)	BMI (kg/m^2), mean (SD)	Direct method	Indirect method
Moy, M. 2009, J Rehab Res Develop[S49]	cross-sectional	17	17 (100)	73 (8)	57 (22)	28.0 (4.0)	Accelerometer: Actiped; FitLinixx, CT, USA	Physical activity checklist**
Moy, M. 2013, PLoS ONE[S50]	cohort	169	167 (99)	71 (8)	54 (20)	29.0 (6.0)	Accelerometer: Stepwatch® 3 Activity Monitor; OrthoCare Innovations, Washington DC, USA	--
Nguyen, HQ. 2009, Int J Chron Obstruct Pulm Dis[S51]	randomized controlled trial	EG: 9 CG: 8	EG: 3 (33) CG: 3 (37)	EG: 72 (9f) CG: 64 (12)	EG: 47 (19) CG: 34 (15)	EG: 26.3 (5.5) CG: 25.0 (7.8)	Accelerometer: Stepwatch® 3 Activity Monitor; OrthoCare Innovations, Washington DC, USA	--
Nguyen, HQ. 2013, Chest[S52]	cross-sectional	148	115 (78)	67 (9)	42 (16)	not available	Accelerometer: Stepwatch® 3 Activity Monitor; OrthoCare Innovations, Washington DC, USA	--
Nield, M. 2005, J Cardiopulm Rehab[S53]	non-controlled study	48	14 (29)	66 (8)	35 (15)	not available	--	Human Activity Profile (HAP) (Fix & Daughton, 1988)
Okubadejo, AA. 1997, Eur Respir J[S54]	case-control	CA: 23 CO: 19	CA: 14 (61) CO: 14 (74)	*median (P_{25}-P_{75})* CA: 71 (60-84) CO: 72 (62-75)	CA: 28 (12) CO: 35 (11)	CA: na CO: na	--	Nottingham Extended Activities of Daily Living (EADL)

Reference	Study design	Study group characteristics					Measure of physical activity	
		n	Sex (male), n (%)	Age (yr), mean (SD)	FEV_1 (%pred), mean (SD)	BMI (kg/m^2), mean (SD)	Direct method	Indirect method
								scale (Lincoln, 1992)
Palop Cervera, M. 2010, Rev Clínica Esp[S55]	case-control	CA: 44 CO: 81	CA: 39 (89) CO: 76 (94)	CA: 75 (9) CO: 72 (11)	CA: 40 (17) CO: 49 (16)	CA: na CO: na	--	*ad hoc* questionnaire††
Pitta, F. 2006, Chest[S56]	cohort	17	16 (94)	69 (9)	29 (20-48)*	24.0 (5.0)	Accelerometer: DynaPort Activity Monitor; McRoberts BV, The Hague, The Netherlands	--
Pitta, F. 2006, J Bras Pneumol[S57]	cross-sectional	23	16 (70)	*median (P_{25}-P_{75})* 61 (59-69)	*median (P_{25}-P_{75})* 39 (34-53)	*median (P_{25}-P_{75})* 24 (21-27)	Accelerometer: DynaPort Activity Monitor; McRoberts BV, The Hague, The Netherlands	Pulmonary Functional Status and Dyspnea Questionnaire (PFSDQ-M) (Lareau, 1994)
Pitta, F. 2008, Respir Med[S58]	cross-sectional	40	21 (53)	68 (7)	41 (14)	24.0 (6.0)	Accelerometer: SenseWear Armband PRO3; BodyMedia; Pittsburgh, PA, USA	--
Pitta, F. 2009, Respir Med[S59]	cross-sectional	G1: 40 G2: 40	G1: 21 (53) G2: 18 (45)	G1: 63 (7) G2: 66 (8)	G1: 48 (17) G2: 46 (17)	G1: 26 (4) G2: 26 (6)	Accelerometer: DynaPort Activity Monitor; McRoberts BV, The Hague, The Netherlands	--
Pomidori, L. 2012, J Cardiopulm Rehab Prev[S60]	randomized non-controlled parallel study	G1: 18 G2: 18	G1: 13 (72) G2: 14 (78)	G1: 70 (9) G2: 74 (7)	G1: 48 (13) G2: 49 (12)	G1: 27 (5) G2: 29 (4)	Accelerometer: SenseWear Armband PRO3; BodyMedia,	--

Reference	Study design	Study group characteristics					Measure of physical activity	
		n	Sex (male), n (%)	Age (yr), mean (SD)	FEV_1 (%pred), mean (SD)	BMI (kg/m^2), mean (SD)	Direct method	Indirect method
							Pittsburgh, PA, USA	
Probst, VS. 2011, Respir Care[S61]	randomized non-controlled parallel study	G1: 20 G2: 20	G1: 11 (55) G2: 10 (50)	G1: 65 (10) G2: 67 (7)	G1: 39 (14) G2: 40 (13)	G1: 26 (15) G2: 27 (6)	Accelerometer: DynaPort Activity Monitor; McRoberts BV, The Hague, The Netherlands; and SenseWear Armband PRO3; BodyMedia, Pittsburgh, USA	--
Roig, M. 2011, Respir Med[S62]	cohort	G1: 69 G2: 32	G1: 43 (62) G2: 13 (68)	*median (P_{25}-P_{75})* G1: 72 (70-75) G2: 76 (72-79)	*median (P_{25}-P_{75})* G1: 43 (37-50) G2: 44 (36-51)	*median (P_{25}-P_{75})* G1: 24.9 (23.3-26.5) G2: 27.9 (25-30.8)	--	Physical Activity Scale for the Elderly (PASE) (Washburn, 1993)
Sandland, CJ. 2008, Chest[S63]	randomized controlled trial	EG: 10 CG: 10	EG: 6 (60) CG: 8 (80)	EG: 71 (4) CG: 76 (8)	EG: 43 (16) CG: 44 (29)	EG: 28.2 (5.4) CG: 26.3 (5.5)	Accelerometer: Gaehwiler Z80 – 32k V1 Int; Gaehwiler Electronics, Hombrechtikon, Switzerland	--
Schou, L. 2013, J Telemed Telecare[S64]	randomized controlled trial	EG: 22 CG: 22	EG: 10 (45) CG: 8 (34)	EG: 68 (12) CG: 73 (10)	EG: 39 (20) CG: 44 (15)	EG: na CG: na	--	Lawton Instrumental Activities of Daily Living Scale (Lawton, 1969)
Sewell, L. 2005, Chest[S65]	randomized non-controlled parallel study	G1: 90 G2: 90	G1: 60 (67) G2: 51 (57)	G1: 69 (9) G2: 67 (8)	G1: na G2: na	G1: na G2: na	Accelerometer: Gaehwiler Z80 – 32k V1 Int; Gaehwiler	Canadian Occupational Performance Measure (COPM) (Law,

Reference	Study design	Study group characteristics					Measure of physical activity	
		n	Sex (male), n (%)	Age (yr), mean (SD)	FEV_1 (%pred), mean (SD)	BMI (kg/m^2), mean (SD)	Direct method	Indirect method
							Electronics, Hombrechtikon, Switzerland	1998)
Sewell, L. 2010, J Cardiopulm Rehab Prev[S66]	non-controlled study	95	56 (59)	66 (9)	not available	not available	Accelerometer: Gaehwiler Z80 – 32k V1 Int; Gaehwiler Electronics, Hombrechtikon, Switzerland	--
Silva, DR. 2011, Respir Care[S67]	cross-sectional	95	62 (65)	67 (8)	41 (16)	25.8 (4.7)	--	International Physical Activity Questionnaire (IPAQ) (Craig, 2003)
Skumlien, S. 2006, Chron Respir Dis[S68]	cross-sectional	G1: 65 G2: 45	G1: 65 (100) G2: 45 (100)	G1: 62 (10) G2: 60 (6)	G1: 49 (16) G2: 46 (16)	G1: 25.6 (4.7) G2: 23.9 (5.2)	--	Pulmonary Functional Status and Dyspnea Questionnaire (PFSDQ) (Lareau, 1994)
Skumlien, S. 2008, Respir Med[S69]	non-randomized non-controlled parallel study	G1: 20 G2: 20	G1: 11 (55) G2: 11 (55)	G1: 62 (7) G2: 63 (9)	G1: 48 (17) G2: 50 (13)	G1: 23 (9) G2: 26 (8)	--	Hyrim Physical Activity Questionnaire (HPAQ) (Anderssen, 2000); and Glittre ADL-test (Skumlien, 2005)
Takigawa, N. 2007, Respir Med[S70]	non-controlled study	stage II: 21 stage III: 79 stage IV: 125	stage II: 15 (71) stage III: 68 (86) stage IV: 118 (94)	*median (P_{25}-P_{75})* stage II: 72 (63-81) stage III: 69 (54-84)	stage II: 60 (7) stage III: 38 (6) stage IV: 23 (5)	stage II: 19.1 (2.6) stage III: 19.3 (3.1) stage IV: 18.5	--	Non-validated scale‡‡

Reference	Study design	Study group characteristics					Measure of physical activity	
		n	Sex (male), n (%)	Age (yr), mean (SD)	FEV_1 (%pred), mean (SD)	BMI (kg/m^2), mean (SD)	Direct method	Indirect method
				stage IV: 67 (45-79)		(3.2)		
Troosters, T. 2010, Respir Med[S71]	cross-sectional	70	58 (82)	66 (9)	54 (23)	not available	Accelerometer: SenseWear Armband PRO3; BodyMedia; Pittsburgh, PA, USA	--
Tsara, V. 2008, Respir Care[S72]	case-control	CA: 85 CO: 48	CA: na CO: na	CA: 71 (8) CO: 64 (11)	CA: 38 (16) CO: 57 (16)	CA: 28.6 (6.7) CO: 28.5 (6.1)	--	Non-validated questionnaire[§§]
Van Gestel, AJ. 2012, COPD[S73]	cross-sectional	154	67 (44%)	63 (11)	43 (19)	24.9 (6.1)	Accelerometer: SenseWear Armband PRO3; BodyMedia, Pittsburgh, PA, USA	--
Van Remoortel, H. 2013, Thorax[S74]	cross-sectional	59	44 (75)	63 (6)	85 (17)	26.9 (4.2)	Accelerometer: SenseWear Armband PRO3; BodyMedia, Pittsburgh, PA, USA	
Vergeret, J. 1989, Eur Respir J[S75]	cohort	G1: 75 G2: 84 G3: 51 G4: 33	G1: 63 (84) G2: 76 (90) G3: 45 (88) G4: 31 (94)	G1: 63 (7) G2: 61 (8) G3: 61 (8) G4: 62 (9)	G1: na G2: na G3: na G4: na	G1: na G2: na G3: na G4: na	--	Non-validated questionnaire[‖‖]
Waatevik, M. 2012, COPD[S76]	cross-sectional	370	223 (60)	63 (7)	50 (14)	not available	--	Validated question[¶¶]
Wakabayashi, R. 2011, Geriatr Gerontol[S77]	randomized controlled trial	102	88 (86)	72 (8)	60 (21)	21.8 (2.8)	--	Lawton Instrumental Activities of Daily

Reference	Study design	Study group characteristics					Measure of physical activity	
		n	Sex (male), n (%)	Age (yr), mean (SD)	FEV_1 (%pred), mean (SD)	BMI (kg/m^2), mean (SD)	Direct method	Indirect method
								Living Scale (Lawton, 1969)
Wakabayashi, R. 2011, J Am Geriatr Soc[S78]	cross-sectional	389	315 (81)	73 (8)	58 (26)	not available	--	Lawton Instrumental Activities of Daily Living Scale (Lawton, 1969)
Walker, PP. 2008, Thorax[S79]	non-controlled study	23	12 (52)	66 (9)	36 (12)	not available	Accelerometer: Actiwatch; Neurotechnology Cambridge, UK; and Dynaport Activity Monitor; McRoberts BV, Den Haag, Netherlands	Nottingham Extended Activities of Daily Living (EADL) scale (Lincoln, 1992)
Waschki, B. 2011, Chest[S80]	cohort	G1: 143 G2: 26	G1: 107 (75) G2: 20 (77)	G1: 64 (7) G2: 66 (6)	G1: 59 (21) G2: 41 (22)	G1: 26.7 (5.1) G2: 23.5 (4.3)	Accelerometer: SenseWear Armband PRO3; BodyMedia, Pittsburgh, PA, USA	--
Watz, H. 2008, Am J Respir Crit Care Med[S81]	cross-sectional	170	128 (75)	64 (7)	56 (22)	not available	Accelerometer: SenseWear Armband PRO3; BodyMedia, Pittsburgh, PA, USA	--
Watz, H. 2009, Chest[S82]	cross-sectional	stage I: 34 stage II: 57 stage III: 43 stage IV: 36	stage I: 25 (74) stage II: 41 (72) stage III: 35 (81) stage IV: 27 (75)	stage I: 66 (6) stage II: 63 (7) stage III: 63 (7) stage IV: 64 (6)	stage I: 90 (9) stage II: 63 (8) stage III: 41 (5) stage IV: 33 (11)	stage I: 27.0 (4.2) stage II: 27.8 (5.3) stage III: 25.0	Accelerometer: SenseWear Armband PRO3; BodyMedia, Pittsburgh, PA,	--

Reference	Study design	Study group characteristics					Measure of physical activity	
		n	Sex (male), n (%)	Age (yr), mean (SD)	FEV_1 (%pred), mean (SD)	BMI (kg/m^2), mean (SD)	Direct method	Indirect method
						(5.0) stage IV: 24.6 (5.3)	USA	
Watz, H. 2009, Eur Respir J[S83]	cross-sectional	stage I: 34 stage II: 52 stage III: 41 stage IV: 36	stage I: 25 (74) stage II: 37 (71) stage III: 33 (80) stage IV: 27 (75)	stage I: 66 (6) stage II: 64 (6) stage III: 63 (7) stage IV: 64 (6)	stage I: 90 (9) stage II: 63 (8) stage III: 41 (5) stage IV: 33 (11)	stage I: 27.0 (4.2) stage II: 27.3 (5.0) stage III: 25.1 (5.1) stage IV: 24.6 (5.3)	Accelerometer: SenseWear Armband PRO3; BodyMedia, Pittsburgh, PA, USA	--
Weekes, CE. 2009, Thorax[S84]	randomised controlled trial	EG: 31 CG: 28	EG: 16 (52) CG: 14 (50)	*median (P_{25}-P_{75})* EG: 69 (48-89) CG: 69 (46-85)	EG: 31 (13) CG: 33 (15)	EG: 19.9 (1.4) CG: 19.5 (1.9)	--	Townsend score (Bond, 1982)
Wewel, A. 2008, Respir Med[S85]	non-controlled study	21	17 (81)	65 (9)	32 (9)	25.9 (4.7)	Pedometer: Kasper & Richter GmbH & Co. KG; Uttenreuth, Germany; and accelerometer: ActiTrac-Monitor; Somnomedics, Kist, Germany	--
Yeo, J. 2006, Age Ageing[S86]	cross-sectional	27	16 (59)	76 (4)	*n (%)* mild: 10 (37) moderate: 12 (44) severe: 5 (19)	not available	--	Manchester Respiratory Activity of Daily Living Score (Yohannes, 2000)

Abbreviations: EG: experimental group; CG: control group, CA: cases; CO: controls; na: not available; MRC: Medical Research Council.

*Patients were asked how many days during the previous week they performed lower-extremity endurance exercises, such as walking or cycling, and for how many minutes each day.

†Subjects were asked “How much did your COPD affect your normal daily activities during the previous 24h?” and were required to indicate, by placing a cross on a 10 cm scale, how their COPD affected their normal daily activities.

§Scale from 0 to 3: 0, ‘doesn’t leave the house, life is limited to the bed or armchair, or to doing some domestic chores’, or ‘leaves the house, but walks less than 100 m’; 1, ‘leaves the house and walks a few hundred meters, runs errands, but walks less than 100 m’; 1, ‘leaves the house and walks a few hundred meters, runs errands, but does not walk regularly’; 2, ‘engages in physical activity in the vegetable garden’, or ‘takes walks for up to 8 km, no less than 5 days a week’; and 3, ‘takes walks regularly for >8km, no less than 5 days a week’, or ‘practices sports’.

§Seven standard items related to ADL (eating, toileting, shampooing, bathing, face washing and teeth brushing, dressing, and indoor walking) (Christiansen, 1998).

‖Questions Q1A, Q1B, Q2, Q3, Q4 and Q7 from COPEX questionnaire.

¶Physical activity scale (validated instrument (Deenen, 1996 - originally from Baecke, 1982)

**Physical activity checklist were based on the Pulmonary Functional Status and Dyspnea Questionnaire Activity Assessment (PFSDQ) (Lareau, 1994).

††The physical activity performed by the patients was classified in 3 categories: (1) home-bound, (2) less than 6hours out of home, or (3) more than 6 hours.

‡‡ADL was assessed using questionnaire based on velocity of motion and shortness of breath in daily activity with various grades of exertion during a list of ADL.

§§Independence in ADL was assessed with a questionnaire designed for the study including domestic and physical activities at home and outside the home.

‖‖Questionnaire about patient’s activity and its location.

¶¶Self-reported physical activity was recorded using the question: “How has your physical activity been in your spare time the last year?”

Online supplement Table 3a. Determinants covered by at least 2 articles and their association with physical activity, grouped in main categories and sorted by alphabetical order.

Determinant: Age

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	Age (years)	Mean (SD) 71 (10) in low energy expenditure (0-53 kcal/d); 68 (8) in moderate (54-210 kcal/d); 68 (8) in high (>210 kcal/d); p=0.032 Adjusted OR (95% CI) of low physical activity: 1.04 (1.01 to 1.07); p=0.013	---
Garcia-Aymerich, J. 2009, Chest[S33]	Age (years)	Mean (SD) 71 (8) in quartile 1 (Q1) of energy expenditure in physical activity; 69 (7) in Q2; 67 (8) in Q3; 63 (10) in Q4; p for trend<0.001	---
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	Age (years)	---	Mean (SD) 65 (6) in quartile 1 (Q1) of physical activity; 62 (8) in Q2; 62 (8) in Q3; 62 (8) in Q4; p=0.48
Pitta, F. 2006, J Bras Pneumol[S57]	Age (years)	---	Median (P25-P75) 61 (58-67) in active group *vs.* 63 (60-70) in inactive group; p=0.406
Troosters, T. 2010, Respir Med[S71]	Age (years)	Correlation coefficient -0.33 with number steps per day; p=0.006 Correlation coefficient -0.23 with time spent in activities of mild intensity; p=0.05	---

Watz, H. 2008, Am J Respir Crit Care Med[S81]	Age (years)	---	Unstandardized regression coefficient (95% CI) <0.001 (-0.006 to 0.007) for steps per day; p=0.91

Determinant: Alcohol consumption

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	Alcohol consumption	N (%): 29 (26) in low energy expenditure (0-53 kcal/d); 39 (39) in moderate (54-210 kcal/d); 51 (44) in high (>210 kcal/d); p=0.015	---
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	Alcohol consumption (g/d)	---	Mean (SD): 21 (19) in quartile 1 (Q1) of physical activity; 21 (14) in Q2; 19 (15) in Q3; 20 (15) in Q4; p=0.93

Determinant: BODE index

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	BODE index	Mean (SD): 5.9 (1.9) in quartile 1 (Q1) of physical activity; 4.9 (1.7) in Q2; 2.9 (1.4) in Q3; 2.3 (1.4) in Q4; p=0.001. Mean (SD) daily physical activity (VMU): 259 (91) in quartile 1 of BODE index (0-2) *vs.* 200 (67) in quartile 2 (3-4); p=0.003. Mean (SD) daily physical activity (VMU): 259	Mean (SD) daily physical activity (VMU): 142 (51) in quartile 3 of BODE index (5-6) *vs.* 89 (26) in quartile 4 (7-10); p=0.09.

		(91) in quartile 1 *vs.* 142 (51) in quartile 3 (5-6); p=0.001. Mean (SD) daily physical activity (VMU): 259 (91) in quartile 1 *vs.* 89 (26) in quartile 4 (7-10); p=0.001. Mean (SD) daily physical activity (VMU): 200 (67) in quartile 2 *vs.* 142 (51) in quartile 3; p=0.01. Mean (SD) daily physical activity (VMU): 200 (67) in quartile 2 *vs.* 89 (26) in quartile 4; p=0.001.	
Moy, ML. 2009, J Rehabil Res Dev[S49]	BODE index	Unadjusted coefficient (95% CI): -0.34 (-0.58 to -0.10) for number of checklist physical activity performed; p=0.008	---
Pitta, F. 2006, J Bras Pneumol[S57]	BODE index	Median (P25-P75): 2.5 (1.5-3.5) in active group *vs.* 5 (5-8) in inactive group; 0.001	---
Watz, H. 2008, Am J Respir Crit Care Med[S81]	BODE index	Adjusted unstandardized regression coefficient (95% CI) BODE score quintile 4: -0.119 (-0.235 to -0.003) for physical activity level; p=0.044 Adjusted unstandardized regression coefficient (95% CI) BODE score quintile 5: -0.282 (-0.403 to -0.160) for physical activity level; p<0.001 Adjusted unstandardized regression coefficient (95% CI) BODE score quintile 4: -2646 (-4052 to -1240) for steps per day; p<0.001 Adjusted unstandardized regression coefficient (95% CI) BODE score quintile 5: -4874 (-6346 to -3401) for steps per day; p<0.001	Adjusted unstandardized regression coefficient (95% CI) BODE score quintile 2: -0.073 (-0.186 to 0.040) for physical activity level; p=0.21 Adjusted unstandardized regression coefficient (95% CI) BODE score quintile 3: -0.065 (-0.181 to 0.050) for physical activity level; p=0.27 Adjusted unstandardized regression coefficient (95% CI) BODE score quintile 2: -982 (-2352 to 388) for steps per day; p=0.16 Adjusted unstandardized regression coefficient (95% CI) BODE score quintile 3: -1365 (-2767 to 38) for steps per day; p=0.06

Watz, H. 2009, Eur Respir J[S83]	BODE index	Mean steps per day: 8100 in BODE score 0, 7000 in BODE score 1, 6100 in BODE score 2, 5000 in BODE score 3-4, and 2100 in BODE score 5-10; p-trend<0.001 Mean minutes >3 METs: 152 in BODE score 0, 132 in BODE score 1, 135 in BODE score 2, 110 in BODE score 3-4, and 55 in BODE score 5-10; p-trend<0.001 Mean physical activity level: 1.68 in BODE score 0, 1.57 in BODE score 1, 1.50 in BODE score 2, 1.46 in BODE score 3-4, and 1.28 in BODE score 5-10; p-trend<0.001 *(Note: Numbers derived from the figure)*	---

Determinant: Body Mass Index

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	Body Mass Index (kg/m^2)	---	Mean (SD): 26 (6) in low energy expenditure (0-53 kcal/d); 26 (5) in moderate (54-210 kcal/d); 26 (5) in high (>210 kcal/d); p=0.916
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	Body Mass Index (kg/m^2)	---	Mean (SD): 27 (4) in quartile 1 (Q1) of physical activity; 27 (3) in Q2; 28 (4) in Q3; 28 (4) in Q4; p=0.38

Monteiro, F. 2012, Lung[S48]	Body Mass Index (kg/m^2)	Mean (SD) time spent per day in PA at least moderate activity (min/day): 42 (43) in underweight subjects *vs.* 11 (12) in obese subjects; p<0.05 Mean (SD) time spent walking per day (min/day): 73 (31) in underweight subjects *vs.* 46 (26) in obese subjects; p<0.05 Mean (SD) time spent walking per day (min/day): 69 (34) in normal weight subjects *vs.* 46 (26) in obese subjects; p<0.05	---
Pitta, F. 2006, J Bras Pneumol[S57]	Body Mass Index (kg/m^2)	---	Median (P25-P75) 25 (22-30) in active group *vs.* 21 (21-26) in inactive group; p=0.281
Watz, H. 2008, Am J Respir Crit Care Med[S81]	Body mass index ≥ 30	---	Adjusted unstandardized regression coefficient (95% CI): 0.048 (-0.051 to 0.146) for physical activity level; p=0.34 Adjusted unstandardized regression coefficient (95% CI): -859 (-2104 to 385) for steps per day; p=0.18

Determinant: Cardiovascular

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	High blood pressure	---	N (%): 20 (18) in low energy expenditure (0-53 kcal/d); 16 (16) in moderate (54-210 kcal/d); 27 (23) in high (>210 kcal/d); p=0.335

	Varicose veins	---	N (%): 20 (18) in low energy expenditure (0-53 kcal/d); 18 (18) in moderate (54-210 kcal/d); 28 (24) in high (>210 kcal/d); p=0.432
	Cardiac diseases	---	N (%): 34 (31) in low energy expenditure (0-53 kcal/d); 34 (34) in moderate (54-210 kcal/d); 29 (25) in high (>210 kcal/d); p=0.384
Watz, H. 2008, Am J Respir Crit Care Med[S81]	N-terminal pro-B-type natriuretic peptide (pg/ml)	Adjusted unstandardized regression coefficient (95% CI): -0.049 (-0.093 to -0.006) for physical activity level; p=0.026 Adjusted unstandardized regression coefficient (95% CI): -677 (-1225 to -130) for steps per day; p=0.016	---
	Deceleration time of the early transmittal flow (ms)	Adjusted unstandardized regression coefficient (95% CI): -0.001 (-0.002 to <0.000) for physical activity level; p=0.004 Adjusted unstandardized regression coefficient (95% CI): -15 (-24 to -6) for steps per day; p=0.001	---

Determinant: Cultural groups

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Chen, Y. 2006, West J Nurs Research[S14]	Cultural groups	---	Mean daily functioning score: 3.16 in Fukiens and Hakkas, 3.26 in Aboriginies, and 2.63 in Mainlanders; p=0.06

Pitta, F. 2009, Respir Med[S59]	Cultural groups	Mean (SD) time spent walking (min/day): 40 (36) in Austrian *vs.* 56 (32) in Brazilian; p=0.04 Mean (SD) movement intensity: 1.5 (0.4) in Austrian *vs.* 1.9 (0.4) in Brazilian; p=0.0001 Mean(SD) time spent sitting (min/day): 388 (208) in Austrian *vs.* 296 (109) in Brazilian; p=0.02	---
Troosters, T. 2010, Respir Med[S71]	Cultural groups	---	Mean (SEM) time spent at moderate intensity (min): 27 (7) in Leuven, 21 (7) in Pittsburgh, 10 (8) in Palermo. Mean (SEM) time in mild physical activity (min): 93 (15) in Leuven, 62 (15) in Pittsburgh, 64 (18) in Palermo.

Determinant: Day of the week

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Lores, V. 2006, Arch Bronconeumol[S45]	Monday to Wednesday *vs.* Friday to Sunday	---	Bland-Altman 95% CI: -29.21 to 28.81 of mean VMU between Mon-Wed and Fri-Sun *vs.* difference in VMU between Mon-Wed and Fri-Sun
	Tuesday to Thursday *vs.* Friday to Sunday	---	Bland-Altman 95% CI: -32.13 to -28.43 of mean VMU between Tue-Thu and Fri-Sun *vs.* difference in VMU between Tue-Thu and Fri-Sun
Moy, ML. 2009, J Rehabil	Weekends or weekday	---	"The day of the week, categorized as either

Res Dev[S49]			weekend or weekday, was not significantly associated with either steps per day or daily number of checklist activities performed"
Watz, H. 2009, Eur Respir J[S83]	Sunday *vs.* Weekday	Mean (SD) steps per day in Sunday 6084 (4155) *vs.* a weekday 8081 (4144) in GOLD I; p<0.001; 6109 (3471) *vs.* 7674 (3619) in GOLD II; p<0.001; 3960 (2983) *vs.* 5410 (3995) in GOLD III; p<0.001	Mean (SD) steps per day in Sunday 2439 (1734) *vs.* a weekday 2439 (1734) in GOLD IV; p=ns

Determinant: Dyspnoea

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Bestall, JC. 1999, Thorax[S8]	MRC dyspnoea	Median (P_{10}-P_{90}) EADL score: 19 (15-21) in MRC grade 3 *vs.* 17 (12-20) in MRC grade 4; p<0.003; median(P_{10}-P_{90}) EADL score: 17 (12-20) in MRC grade 4 *vs.* 13 (6-18) in MRC grade 5; p<0.0001 *(Note: Numbers derived from the figure)*	---
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	Dyspnoea at rest (VAS)	Mean (SD): 5.5 (2.9) in low energy expenditure (0-53 kcal/d); 4.7 (2.7) in moderate (54-210 kcal/d); 4.6 (2.7) in high (>210 kcal/d); p=0.031	---
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	MRC dyspnoea	Mean (SD): 2.9 (1.2) in quartile 1 (Q1) of physical activity; 2.5 (1.0) in Q2; 1.8 (0.7) in Q3; 1.8 (0.8) in Q4; p=0.001	---
	SGRQ symptoms	Mean (SD): 50.8 (22.2) in quartile 1 (Q1); 44.5 (21.3) in Q2; 29.4 (16.9) in Q3; 31.6 (14.9) in	---

		Q4; p=0.001	
Katajisto, M. 2012, Int J Chron Obstr Respir Dis[S41]	MRC dyspnoea	Adjusted OR (95% CI) for inactivity: 7 and 12 at dyspnoea levels 3 and 4, respectively, p<0.05	
Nguyen, HQ. 2013, Chest[S52]	Dyspnoea (Shortness of Breath Questionnaire)	Adjusted standardized coefficient: -0.27 for total steps/day; p=0.001	---
Pitta, F. 2006, J Bras Pneumol[S57]	mMRC dyspnoea (0-4)	Median (P_{25}-P_{75}): 2 (1-2) in active group *vs.* 3 (3-4) in inactive group; p=0.002	---
Watz, H. 2009, Eur Respir J[S83]	mMRC dyspnoea (0-4)	Mean steps per day: 8100 in mMRC 0, 6300 in mMRC 1, 4800 in mMRC 2, 3000 in mMRC 3, and 1800 in mMRC 4; p-trend<0.001 Mean minutes >3 METs min: 165 in mMRC 0, 125 in mMRC 1, 95 in mMRC 2, 75 in mMRC 3, and 40 in mMRC 4; p-trend<0.001 Mean physical activity level: 1.65 in mMRC 0, 1.55 in mMRC 1, 1.43 in mMRC 2, 1.38 in mMRC 3, and 1.25 in mMRC 4; p-trend<0.001 *(Note: Numbers derived from the figure)*	---

Determinant: Education

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	Less than primary school education	---	N (%): 61 (55) in low energy expenditure (0-53 kcal/d); 59 (58) in moderate (54-210 kcal/d); 77 (67) in high (>210 kcal/d); p=0.165

Garcia-Aymerich, J. 2009, Chest[S33]	Less than primary school education	---	N (%): 51 (60) in quartile 1 (Q1) of energy expenditure in physical activity; 45 (53) in Q2; 48 (57) in Q3; 56 (65) in Q4; p for trend=0.425
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	University studies	---	Mean (SD): 4 (15) in quartile 1 (Q1) of physical activity; 2 (7) in Q2; 3 (11) in Q3; 2 (7) in Q4; p=0.87

Determinant: Emotional status

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	Self-reported depression	---	N (%): 31 (28) in low energy expenditure (0-53 kcal/d); 28 (28) in moderate (54-210 kcal/d); 19 (17) in high (>210 kcal/d); p=0.141
Nguyen, HQ. 2013, Chest[S52]	Depression (HADS-D)	Adjusted standardized coefficient: -0.19 for total steps per day; p=0.02	---
	Anxiety (HADS-A)	Adjusted standardized coefficient: 0.32 for total steps per day; p<0.001	---

Determinant: Exacerbation

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Bourbeau, J. 2007, Eur	Acute Exacerbation of	Mean (SD) change in ADL score from baseline:	---

Respir J[S11]	COPD (AECOPD) onset	8.7 (31.3); p=0.01	
	4-8 days after AECOPD	Mean (SD) change in ADL score from baseline: 10.2 (34.2); p=0.004	---
	11-15 days after AECOPD	---	Mean (SD) change in ADL score from baseline: 3.7 (30.1); p=ns
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	COPD admissions in the previous year	Mean (SD): 1.9 (2.3) in low energy expenditure (0-53 kcal/d); 1.4 (2.1) in moderate (54-210 kcal/d); 1.3 (1.6) in high (>210 kcal/d); p=0.049	---
Pitta, F. 2006, Chest[S56]	Patients with exacerbation in previous year *vs.* patients without exacerbation	Median (P_{25}-P_{75}) walking time (min/d): 9 (4 to 18) *vs.* 26 (14 to 56); p=0.03	---
	Patients readmitted for another exacerbation in the year following discharge *vs.* patients not readmitted	Median (P_{25}-P_{75}) walking time (min/d): 12 (9 to 27) *vs.* 30 (21 to 100); p=0.03	---

Determinant: Exercise capacity

Paper	Variable / Category	Association	
		Significant	Non-significant
Altenburg, WA. 2013, Respir Med[S1]	6MWD (m)	Adjusted regression standardized coefficient: 0.378 for daily physical activity; p<0.001	---
Berry, MJ. 2006, Chest[S6]	VO_2 peak (mL/kg/min)	Adjusted regression coefficient: -0.041 for self-reported function; p<0.005	---

Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	6MWD (m)	Mean (SD): 199 (82) in quartile 1 (Q1) of physical activity; 263 (76) in Q2; 377 (117) in Q3; 416 (83) in Q4; p=0.001 Adjusted unstandardized regression coefficients (95% CI): 0.39 (0.24 to 0.55) for physical activity level; p=0.001	---
	Work peak (watts)	Mean (SD): 48 (20) in quartile 1 (Q1); 53 (19) in Q2; 60 (22) in Q3; 79 (20) in Q4; p=0.001	---
	V_E peak (L/min)	Mean (SD): 34.3 (9.9) in quartile 1 (Q1); 34.6 (8.3) in Q2; 40.7 (8.5) in Q3; 47.1 (11.4) in Q4; p=0.001	---
	HR peak (beats/min)	---	Mean (SD): 122 (16) in quartile 1 (Q1); 127 (15) in Q2; 126 (12) in Q3; 131 (17) in Q4; p=0.24
	VO_2 peak (mL/min/kg)	Mean (SD): 14.9 (3.3) in quartile 1 (Q1); 16.8 (3.1) in Q2; 19.2 (3.9) in Q3; 21.7 (3.8) in Q4; p=0.001	---
	Endurance time (s)	Mean (SD): 158 (104) in quartile 1 (Q1); 256 (110) in Q2; 301 (133) in Q3; 386 (117) in Q4; p=0.001	---
Hartman, JE. 2013, Arch Phys Med Rehab[S37]	6MWD (m)	Adjusted regression coefficient (SE): 0.015 (0.003) for percentage locomotion; p<0.001	---
Moy, ML. 2009, J Rehabil Res Dev[S49]	6MWD (m)	Unadjusted coefficient (95% CI): 10 (4 to 17) for steps per day; p=0.01	---
Nguyen, HQ. 2013, Chest[S52]	6MWD (ft)	Adjusted standardized coefficient: 0.39 for total steps per day; p<0.001	---

Pitta, F. 2006, J Bras Pneumol[S57]	6MWD (% pred)	Median (P_{25}-P_{75}): 76 (69-79) in active group *vs.* 66 (42-72) in inactive group; p=0.019	---
	VO_2 peak (% pred)	Median (P_{25}-P_{75}): 71 (55-102) in active group *vs.* 49 (36-78) in inactive group; p=0.049	---
	Wmax (% pred)	Median (P_{25}-P_{75}): 69 (58-77) in active group *vs.* 40 (27-67) in inactive group; p=0.013	---
Van Remoortel, H. 2013, Thorax[S74]	6MWD (m)	Adjusted coefficient (SEM): 23 (6) for steps per day; p=0.0002 Adjusted coefficient (SEM): 0.33 (0.09) for MVPA; p=0.0006 Adjusted coefficient (SEM): 0.0008 (0.0003) for PAL; p=0.02	---
Watz, H. 2009, Eur Respir J[S83]	6MWD (m)	Correlation coefficient: 0.63 with steps per day; p<0.001 Correlation coefficient: 0.47 with minutes of at least moderate activity; p<0.001 Correlation coefficient: 0.46 with physical activity level; p<0.001	---

Determinant: FEV_1

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Berry, M. 2006, Chest[S6]	FEV_1 (% pred)	Adjusted regression coefficient: -0.005 for self-reported function; p<0.005	---

Eisner, MD. 2008, Am J Epi[S22]	FEV_1 (L)	Adjusted regression coefficient (SE): -1.4 (0.30) for self-reported functional limitation; p<0.0001; -1.28 (0.32) for limitation in moderate activities; p<0.0001; -1.87 (0.31) for limitation in climbing several flights of stairs; p<0.0001	---
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	FEV_1 (% pred)	---	Mean (SD): 35 (18) in low energy expenditure (0-53 kcal/d); 33 (13) in moderate (54-210 kcal/d); 36 (16) in high (>210 kcal/d); p=0.311
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	FEV_1 (% pred)	Mean (SD): 43 (13) in quartile 1 (Q1) of physical activity; 42 (12) in Q2; 49 (14) in Q3; 54 (13) in Q4; p=0.01	---
	FEV_1 (GOLD stage)	Mean (SD) daily physical activity (VMU): 223 (95) in GOLD II *vs.* 170 (75) in GOLD III; p=0.01; Mean (SD) daily physical activity (VMU): 223 (95) in GOLD II *vs.* 134 (67) in GOLD IV; p=0.001	---
Katajisto, M. 2012, Int J Chron Obstr Pulm Dis[S41]	FEV_1(% pred)	Adjusted OR (95% CI) of exercise inactivity: 3.5 (1.8 to 6.9) in patients with FEV_1<40% compared to FEV_1>40%	---
Lahaije, A. 2013, Respir Med[S42]	FEV_1 (% pred)	---	Adjusted unstandardized coefficients (SE): -0.006 (0.084) for mean daily physical activity; p=0.939
Moy, ML. 2009, J Rehabil Res Dev[S49]	FEV_1 (%pred)	Unadjusted coefficient (95% CI): 0.023 (0.005 to 0.041) for number of checklist physical activity performed; p=0.01	---
Pitta, F. 2006, J Bras	FEV_1 (%pred)	Median (P_{25}-P_{75}): 50 (40-58) in active group *vs.*	---

Pneumol[S57]		34 (33-44) in inactive group; p=0.021	
Pitta, F. 2008, Respir Med[S58]	FEV_1 (l)	---	Correlation coefficients (95% CI) of 0.31 (-0.01 to 0.58) with EEA>3METs, p=0.05; 0.25 (-0.08 to 0.53) with steps/day, p=ns; -0.26 (-0.53 to 0.06) with sedentary activities, p=ns; 0.29 (-0.04 to 0.56) with moderate activities, p=ns; 0.31 (-0.01 to 0.59) with vigorous activities, p=0.05
Troosters, T. 2010, Respir Med[S71]	FEV_1 (GOLD stage)	Mean (SD) daily steps (% healthy pairs): 87(35) in GOLD I; 70(32) in GOLD II; 49(34) in GOLD III; 29(19) in GOLD IV; p<0.05 Correlation coefficient FEV_1 %predicted: 0.51 with number steps per day; p<0.0001 Mean(SD) daily time in moderate physical activity (% healthy pairs): 53(48) in GOLD I; 41(45) in GOLD II; 31(48) in GOLD III; 22(33) in GOLD IV; p<0.05 Correlation coefficient FEV_1 %predicted: 0.33 with time spent in activities of mild intensity; p<0.006	---
Watz, H. 2008, Am J Respir Crit Care Med[S81]	FEV_1 (GOLD stage)	Mean (SD) steps per day: 7990 (3370) in GOLD I; 7160 (3284) in GOLD II; 5126 (3692) in GOLD III and 2773 (1897) in GOLD IV; p<0.001 Unstandardized regression coefficient (95% CI) GOLD III: -2714 (-4155 to -1273) for steps per day; p<0.001 Unstandardized regression coefficient (95% CI) GOLD IV: -4272 (-5801 to -2742) for steps per day; p<0.001	Adjusted unstandardized regression coefficient (95% CI) GOLD II: -939 (-2226 to 349) for steps per day; p=0.28 Adjusted unstandardized regression coefficient (95% CI) GOLD II: -0.009 (-0.111 to 0.093) for physical activity level; p=0.86

		Mean (SD) physical activity level: 1.63 (0.25) in GOLD I; 1.62 (0.27) in GOLD II; 1.45 (0.25) in GOLD 3 and 1.27 (0.17) in GOLD IV; p<0.001 N (%) physical activity level ≥1.70: 9 (26) in GOLD I; 18 (32) in GOLD II; 9 (21) in GOLD III and 1 (3) in GOLD IV; p<0.01 Unstandardized regression coefficient (95% CI) GOLD III: -0.128 (-0.242 to -0.014) for physical activity level; p=0.028 Unstandardized regression coefficient (95% CI) GOLD IV: -0.263 (-0.384 to -0.142) for physical activity level; p<0.001	
Watz, H. 2009, Chest[S82]	FEV_1 (GOLD stage)	Mean (SD) physical activity level: 1.63 (0.25) in GOLD I; 1.62 (0.27) in GOLD II; 1.45 (0.25) in GOLD 3 and 1.27 (0.17) in GOLD IV; p<0.001	---
Watz, H. 2009, Eur Respir J[S83]	FEV_1 (GOLD stage)	Mean steps per day: 5000 in GOLD III *vs.* 8000in GOLD I; p<0.001; 5000 in GOLD III *vs.* 7600 in GOLD II; p=0.001; 4500 in GOLD IV *vs.* 8000 in GOLD I; p<0.001; 4500 in GOLD IV *vs.* 7600 in GOLD II; p<0.001; 4500 in GOLD IV *vs.* 5000 in GOLD III; p=0.003 Mean minutes >3 METs min: 110 in GOLD III *vs.* 145 in GOLD I; p=0.04; 110 in GOLD III *vs.* 145 in GOLD II; p=0.02; 55 in GOLD IV *vs.* 145 in GOLD I; p<0.001; 55 in GOLD IV *vs.* 145 in GOLD II; p<0.001; 55 in GOLD IV *vs.* 110 in GOLD III; p=0.002 Mean physical activity level: 1.46 in GOLD III *vs.* 1.63 in GOLD I; p<0.001; 1.46 in GOLD III *vs.* 1.62 in GOLD II; p<0.001; 1.29 in GOLD IV *vs.* 1.63 in GOLD I; p<0.001; 1.29 in GOLD IV *vs.* 1.62 in GOLD II; p<0.001; 1.29 in GOLD IV	---

		vs. 1.46 in GOLD III; p=0.006 *(Note: Numbers derived from the figure)*	
Yeo, J. 2006, Age and ageing[S86]	FEV_1 (Severity)	Mean (SD) Manchester ADL score: 11.7 (6.5) in mild COPD *vs.* 13.4 (4.6) in moderate COPD; p=0.75; 11.7 (6.5) in mild COPD *vs.* 5.2 (2.8) in severe COPD; p=0.09; 13.4 (4.6) in moderate COPD *vs.* 5.2 (2.8) in severe COPD; p=0.02	---

Determinant: FVC

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	postPBD FVC (% pred)	Mean (SD): 71 (14) in quartile 1 (Q1) of physical activity; 70 (14) in Q2; 80 (15) in Q3; 79 (15) in Q4; p=0.02;	---
Pitta, F. 2006, J Bras Pneumol[S57]	FVC (% pred)	---	Median (P25-P75): 80 (74-113) in active group *vs.* 80 (78-87) in inactive group; p=0.902

Determinant: Gas exchange

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	DL_{CO} (% predicted)	Mean (SD): 61(27) in quartile 1 (Q1) of physical activity; 75(22) in Q2; 77(25) in Q3; 94(23) in	---

		Q4; p=0.001	
Van Remoortel, H. 2013, Thorax[S74]	DL_{CO} (% predicted)	Adjusted coefficient (SEM): 591 (282) for steps per day; p=0.04 Adjusted coefficient (SEM): 0.04 (0.02) for steps per day; p=0.03	---
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	PCO_2 (mmHg)	---	Mean (SD): 45.7 (9.3) in low energy expenditure (0-53 kcal/d); 46.2 (10.3) in moderate (54-210 kcal/d); 45.9 (7.05) in high (>210 kcal/d); p=0.955
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	PCO_2 (mmHg)	---	Mean (SD): 41.8 (5.5) in quartile 1 (Q1); 40.4 (5.8) in Q2; 40.2 (3.5) in Q3; 38.7 (5.1) in Q4; p=0.27
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	PO_2 (mmHg)	Mean (SD): 63.3 (13.3) in low energy expenditure (0-53 kcal/d); 61 (11.7) in moderate (54-210 kcal/d); 65.8 (12.6) in high (>210 kcal/d); p=0.042	---
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	PO_2 (mmHg)	Mean (SD): 64.0 (8.7) in quartile 1 (Q1); 64.3 (8.6) in Q2; 68.3 (6.9) in Q3; 71.0 (6.6) in Q4; p=0.01	---

Determinant: Hyperinflation (Static and Dynamic)

Paper	Variable / Category	Association	
		Significant	Non-significant
Garcia-Rio, F. 2009, Am J	TLC (% pred)	Mean (SD): 112 (16) in quartile 1 (Q1) of physical activity; 112 (21) in Q2; 107 (13) in Q3;	---

Respir Crit Care Med[S34]		99 (17) in Q4; p=0.02	
	RV/TLC (%)	Mean (SD): 60 (7) in quartile 1 (Q1) of physical activity; 59 (9) in Q2; 56 (9) in Q3; 52 (8) in Q4; p=0.002	---
	ΔEELV (l)	Mean (SD): 0.83 (0.49) in quartile 1 (Q1) of physical activity; 0.60 (0.29) in Q2; 0.35 (0.38) in Q3; -0.05 (0.20) in Q4; p=0.001 Adjusted standardized regression coefficients: -0.24 for physical activity level; p=0.001	---
	ΔEILV (l)	Mean (SD): 1.43 (0.53) in quartile 1 (Q1) of physical activity; 1.15 (0.42) in Q2; 1.17 (0.57) in Q3; 0.77 (0.52) in Q4; p=0.001	---
	Dynamic hyperinflation (Y/N)	Adjusted standardized regression coefficients: -0.34 for physical activity level; p=0.001	---
Hartman, JE. 2013, Arch Phys Med Rehab[S37]	RV (l)	Adjusted regression coefficient (SE): -0.612 (0.200) for percentage locomotion; p=0.003	---
Lahaije, AJ. 2013, Respir Med[S42]	IC/TLC	Adjusted unstandardized coefficients (SE): 78.546 (24.677) for mean physical activity; p=0.002	---
	%ΔIC	Adjusted unstandardized coefficients (SE): 0.27 (0.132) for mean physical activity; p=0.046	---
	IRV/TLC	---	Adjusted unstandardized coefficients (SE): -0.027 (0.354) for mean physical activity; p=0.940
Pitta, F. 2006, J Bras Pneumol[S57]	IC/TLC	---	Median (P_{25}-P_{75}): 0.28 (0.21-0.34) in active group *vs.* 0.27 (0.26-0.31) in inactive group;

			p=0.923
Pitta, F. 2008, Respir Med[S58]	IC (l)	Correlation coefficients (95% CI) of 0.35 (0.02 to 0.60) with steps/day, p<0.05; 0.33 (0.01 to 0.59) with vigorous activities; p<0.05	Correlation coefficients (95% CI) of 0.30 (-0.03 to 0.57) with EEA>3METs, p=ns; -0.27 (-0.54 to 0.06) with sedentary activities, p=ns; 0.25 (-0.08 to 0.53) with moderate activities, p=ns

Determinant: Intervention – Long-acting ß2-agonist/Corticosteroids

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	Oral corticosteroids	N (%): 34 (31) in low energy expenditure (0-53 kcal/d); 20 (20) in moderate (54-210 kcal/d); 17 (15) in high (>210 kcal/d); p=0.013	---
	Inhaled corticosteroids	---	N (%): 59 (53) in low energy expenditure (0-53 kcal/d); 64 (63) in moderate (54-210 kcal/d); 70 (61) in high (>210 kcal/d); p=0.282
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	Inhaled corticosteroids	---	N (%): 21 (78) in quartile 1 (Q1) of physical activity; 23 (82) in Q2; 22 (79) in Q3; 19 (70) in Q4; p=0.77
Hataji, O. 2013, Int J Chron Obstruct Pulmon Dis[S38]	Before *vs.* After inhalation	Mean (SEM) steps: 6241 (653) *vs.* 7858 (848); p=0.0002 Mean (SEM) physical activity time: 876 (171) *vs.* 1496 (285) seconds; p<0.0001 Mean (SEM) kilocalories: 148 (18) *vs.* 194 (23); p<0.0001	---

Determinant: Intervention – Dietary

Paper	Variable / Category	Association	
		Significant	Non-significant
dal Negro, RW. 2010, Monaldi Arch Chest Dis[S16]	Essential amino acids supplementation group *vs.* Placebo group	Mean (SD) number of steps after 4 weeks: 880 (837) *vs.* 652 (558); and after 12 weeks: 1141 (524) *vs.* 563 (602); p group x time interaction=0.0027	---
Weekes, CE. 2009, Thorax[S84]	Intervention group *vs.* Control group (intention-to-treat analysis)	Median (P_{25}-P_{75}) ADL score after intervention: 11 (7 to 17) *vs.* 13 (8 to 18); p=0.02	---
	Intervention group *vs.* Control group (who completed study)	Median (P_{25}-P_{75}) ADL score at 6 months: 11 (7 to 17) *vs.* 13 (8 to 18); p=0.02	Median (P_{25}-P_{75}) ADL score at 12 months: 10 (7 to 16) *vs.* 13 (9 to 19); p=0.06

Determinant: Intervention – Exercise training

Paper	Variable / Category	Association	
		Significant	Non-significant
Behnke, M. 2005, Respir Med[S3]	Intervention *vs.* Control group	Mean (SD) activity per day (counts): 126.2 (37.0) *vs.* 72.2 (13.6); p<0.0005	---
Bendstrup, KE. 1997, Eur Respir J[S4]	Intervention *vs.* Control group at week 12	Mean (SEM) ADL score: 17.7 (5.6) *vs.* -4.4 (4.1); p=0.004	---
	Intervention *vs.* Control group at week 24	Mean (SEM) ADL score: 14.4 (4.7) *vs.* -9.8 (6.7); p=0.007	---

Berry, MJ. 2010, Respir Med[S7]	Baseline *vs.* at 3 month	Mean physical activity (kcal/week) in traditional exercise therapy program: 1860 *vs.* 2500; p=0.002 Mean physical activity (kcal/week) in behavioural lifestyle activity program: 1860 *vs.* 2498; p=0.004	---
	Baseline *vs.* at 6 month	Mean physical activity (kcal/week) in traditional exercise therapy program 1860 *vs.* 2210; p=0.039; Mean physical activity (kcal/week) in behavioural lifestyle activity program 1860 *vs.* 2456; p=0.005	---
	Baseline *vs.* at 12 month	Mean physical activity (kcal/week) in behavioural lifestyle activity program 1850 *vs.* 2342; p=0.048	Mean physical activity (kcal/week) in traditional exercise therapy program 1850 *vs.* 2213; p=0.089;
Breyer, MK. 2010, Respir Research[S12]	Intervention *vs.* Control at 3 months	Increase in movement intensity, p<0.01 Increase in walking time, p=0.034 Decrease in sitting time, p=0.014	---
	Intervention *vs.* Control at 6 months	Increase in movement intensity, p<0.01 Increase in walking time, p=0.05 Decrease in sitting time, p<0.01 Increase in standing time, p<0.01	---
	Intervention *vs.* Control at 9 months	Increase in movement intensity, p<0.01 Increase in standing time, p<0.01	---
Coronado, M. 2003, J	Baseline *vs.* after 3-week	Mean (SD) % of total time of medium activity: 4	Mean (SD) % of total time of inactivity: 82 (5)

Cardiopulm Rehab[S15]	rehabilitation program (including training sessions)	(4) *vs.* 7(5); p=0.04	*vs.* 78 (8); p=0.09 Mean (SD) % of total time of low activity: 13 (4) *vs.* 15 (5); p=0.07
	Baseline *vs.* after 3-week rehabilitation program (excluding training sessions)	---	Mean (SD) % of total time of inactivity: 85 (5) *vs.* 82 (9); p=0.13 Mean (SD) % of total time of low activity: 11 (3) *vs.* 13 (5); p=0.24 Mean (SD) % of total time of medium activity: 4 (3) *vs.* 5 (5); p=0.42
Dallas, MI. 2009, Chron Respir Dis[S17]	Baseline *vs.* after 6- to 12-week rehabilitation program	---	Mean (SD) change in pedometer counts per hour: 33 (149); p=0.14
Daly, C. 2011, Physiot Ireland[S18]	Baseline *vs.* after 8-week NMES training program	---	Mean difference in VMU/day: 40158; p=0.401 Mean difference in VMU/min: 21; p=0.575 Mean difference in % activity > 500 VMU: 4; p=0.674 Mean difference in % time > 500 VMU: 3; p=0.327
Effing, T. 2011, Respir Med[S20]	Intervention *vs.* Control group	Mean difference (95% CI) in steps per day at 12 months: 1190 (256 to 2125)	---
Egan, C. 2012, Respir Med[S21]	Baseline *vs.* after 7-week rehabilitation program (short term effects)	---	Mean (SD) total energy expenditure: 1951 (471) *vs.* 1860 (420); p=ns Mean (SD) active energy expenditure: 256 (401) *vs.* 208 (232); p=ns Mean (SD) physical activity duration: 48 (67) *vs.* 51 (53); p=ns

			Mean (SD) % time spend in moderate activity: 74 (104) *vs.* 79 (82); p=ns Mean (SD) METs: 1.2 (0.3) *vs.* 1.2 (0.3); p=ns Mean (SD) daily steps: 3611 (2863) *vs.* 3527 (2870); p=ns Mean (SD) %time sedentary: 94 (8) *vs.* 94 (4); p=ns
	Baseline *vs.* after 20-week (medium term effects)	---	Mean (SD) total energy expenditure: 1951 (471) *vs.* 1953 (485); p=ns Mean (SD) active energy expenditure: 256 (401) *vs.* 227 (312); p=ns Mean (SD) physical activity duration: 48 (67) *vs.* 48 (64); p=ns Mean (SD) % time spend in moderate activity: 74 (104) *vs.* 74 (99); p=ns Mean (SD) METs: 1.2 (0.3) *vs.* 1.1 (0.3); p=ns Mean (SD) daily steps: 3611 (2863) *vs.* 3242 (3436); p=ns Mean (SD) %Time Sedentary: 94 (8) *vs.* 92 (7); p=ns
	Baseline *vs.* after 52-week (long term effects on a subsample, n=17)	---	Mean (SD) total energy expenditure: 1917 (500) *vs.* 2123 (871); p=ns Mean (SD) active energy expenditure: 270 (432) *vs.* 477 (736); p=ns Mean (SD) physical activity duration: 62 (98) *vs.* 79 (112); p=ns Mean (SD) METs: 1.2 (0.3) *vs.* 1.2 (0.3); p=ns

			Mean (SD) daily steps: 3702 (2270) *vs.* 3083 (1938); p=ns Mean (SD) %Time Sedentary: 93 (7) *vs.* 92 (9); p=ns
Faager, G. 2004, J Rehabil Med[S27]	Intervention *vs.* Control group	Mean (P_{25}-P_{75}) ADL score after the rehabilitation program: 0.9 (0.3-1.4) *vs.* 1.3 (0-2.3); p<0.01	---
Faulkner, J. 2010, Prim Care Resp J[S28]	Intervention *vs.* Control group	---	Difference mean (95%CI) of 7 day total physical activity (kcal) after 8-week program: -85.5 (-807 to 636)
Mador, MJ. 2011, J Cardiopulmon Rehab Prev[S46]	Baseline *vs.* after 8-week rehabilitation program	---	Absolute difference of means (SD) of total VMU/min: 3.7 (39.1); p=0.65
Nield, M. 2005, J Cardiopulm Rehab[S53]	Baseline *vs.* after 6-week rehabilitation program	Mean (SD) Human Activity Scale (maximal activity score): 55 (14) *vs.* 64 (13); p=0.001 Mean (SD) Human Activity Scale (adjusted activity score): 42 (15) *vs.* 48 (13); p<0.001	---
Pomidori, L. 2012, J Cardiopulmon Rehab Prev[S60]	Group walked with metronome *vs.* Group walked a fixed distance	Absolute difference between baseline and after 12 months (SD) in METs daily average: 0.17 (0.14) *vs.* 0.04 (0.13); p<0.05 Absolute difference between baseline and after 12 months (SD) in time >3 METs (h): 35 (32) *vs.* 13 (28); p<0.05	---
Probst, VS. 2011, Respir Care[S61]	Baseline *vs.* after 12-week in low-intensity and in high-intensity training program	---	Mean (SD) in time spent per day walking (min): 58 (24) *vs.* 43 (26) in low-intensity group; p=0.051; and 57 (32) *vs.* 53 (39) in high-intensity group; p>0.05 Mean (SD) in time spent per day standing

			(min): 270 (139) *vs.* 228 (127) in low-intensity group; p>0.05; and 248 (95) *vs.* 245 (105) in high-intensity group; p>0.05 Mean (SD) in time spent per day sitting (min): 283 (121) *vs.* 326 (129) in low-intensity group; p>0.05; and 296 (91) *vs.* 312 (106) in high-intensity group; p>0.05 Mean (SD) in time spent per day laying (min): 108 (100) *vs.* 116 (90) in low-intensity group; p>0.05; and 113 (109) *vs.* 100 (78) in high-intensity group; p>0.05 Mean (SD) in total energy expenditure (Kcal): 1331 (596) *vs.* 1365 (824) in low-intensity group; p>0.05; and 1295 (635) *vs.* 1298 (565) in high-intensity group; p>0.05 Mean (SD) in energy expenditure >3 METS (Kcal): 428 (620) *vs.* 337 (466) in low-intensity group; p>0.05; and 408 (620) *vs.* 396 (542) in high-intensity group; p>0.05 Mean (SD) in time spent activities >3 METS (min): 76 (99) *vs.* 54 (67) in low-intensity group; p>0.05; and 76 (89) *vs.* 74 (85) in high-intensity group; p>0.05 Mean (SD) in steps per day: 5002 (4195) *vs.* 4336 (3910) in low-intensity group; p>0.05; and 4568 (3381) *vs.* 4290 (3253) in high-intensity group; p>0.05
Schou, L. 2013, J Telemed Telecare[S64]	Telemedicine intervention *vs.* conventional hospital treatment	---	Mean (SD) in activity of daily living: 2.0 (2.6) *vs.* 1.5 (1.7) 3 days after discharge; p=0.86 Mean (SD) in activity of daily living: 1.5 (2.7) *vs.* 2.2 (2.7) at follow-up after 6 weeks; p=0.79

			Mean (SD) in activity of daily living: 1.9 (2.9) *vs.* 1.1 (1.5) at follow-up after 3 months; p=0.93
Sewell, L. 2005, Chest[S65]	Baseline *vs.* after 7-week in individually targeted exercise program (ITEP)	Mean (95%CI) % change in activity counts: 41% (7 to 74) in individually targeted exercise program (ITEP) rehabilitation program; p=0.02 Mean (95%CI) change in COPM performance score: 1.46 (1.05 to 1.87); p=0.0001 Mean (95%CI) change in COPM satisfaction score: 2.04 (1.56 to 2.52); p=0.0001	---
	Baseline *vs.* after 7-week in general exercise program (GEP)	Mean (95%CI) % change in activity counts: 29% (3 to 55); p= 0.03 Mean (95%CI) change in COPM performance score: 1.71 (1.37 to 2.05); p=0.0001 Mean (95%CI) change in COPM satisfaction score: 2.27 (1.74 to 2.81); p=0.0001	---
Sewell, L. 2010, J Cardiopulm Rehab Prev[S66]	Baseline *vs.* after 7-week rehabilitation	---	Mean change (95% CI) in activity monitor counts (%): 33 (-3 to 70) in spring, 2 (-33 to 37) in summer, 38 (-2 to 78) in autumn, 130 (-2 to 263); p=ns
Skumlien, S. 2008, Respir Med[S69]	Baseline *vs.* after 12-week in resistance training program	---	Mean (95%CI) change in ADL time (min): -0.1 (-0.6 to 0.5); p=ns Mean (95%CI) change in HPAQ score: -60 (-614 to 495); p=ns
	Baseline *vs.* after 12-week in endurance training program	---	Mean (95%CI) change in ADL time (min): -0.3 (-0.6 to 0); p=ns Mean (95%CI) change in HPAQ score: 241 (-498 to 982); p=ns

Takigawa, N. 2007, Respir Med[S70]	Baseline *vs.* after 4- to 8-week rehabilitation program	Mean (SD) velocity of motion in GOLD II: 24.6 (4.1) *vs.* 25.9 (4.2); p=0.023 Mean (SD) velocity of motion in GOLD III: 22.8 (6.0) *vs.* 25.2 (4.5) post-PR; p=0.000 Mean (SD) velocity of motion in GOLD IV: 18.1 (6.5) *vs.* 21.1 (5.9); p=0.000	---
Walker, PP. 2008, Thorax[S79]	Baseline *vs.* after 8-week rehabilitation program	Mean (SE) intensity of activity score: 156 (69.2) *vs.* 208.5 (123.4); p=0.001 Mean (SE) activity score: 81.5 (53.2) *vs.* 117.2 (84.2); p=0.002 Mean (SE) % time spent mobile: 50.0 (2.7) *vs.* 55.2 (2.6); p=0.014 Mean (SE) NEADL score: 16.4 (0.5) *vs.* 18.2 (0.5); p<0.001	---

Determinant: Intervention – Oxygen therapy

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	Long term oxygen therapy (LTOT) utilization	N (%): 51 (46) in low energy expenditure (0-53 kcal/d); 30 (30) in moderate (54-210 kcal/d); 27 (23) in high (>210 kcal/d); p=0.001 Adjusted OR (95% CI) of low physical activity: 2.07 (1.19 to 3.60); p=0.010	---

	Time using LTOT	---	N (%) <1 month: 4 (8) in low energy expenditure (0-53 kcal/d); 5 (17) in moderate (54-210 kcal/d); 3 (11) in high (>210 kcal/d) N (%) 1-5.9 months: 5 (10) in low energy expenditure (0-53 kcal/d); 4 (14) in moderate (54-210 kcal/d); 3 (11) in high (>210 kcal/d) N (%) 6 months-1.9 yr: 13 (25) in low energy expenditure (0-53 kcal/d); 3 (10) in moderate (54-210 kcal/d); 7 (26) in high (>210 kcal/d) N (%) 2-3.9 yr: 13 (25) in low energy expenditure (0-53 kcal/d); 3 (10) in moderate (54-210 kcal/d); 6 (22) in high (>210 kcal/d) N (%) ≥4 yr: 16 (31) in low energy expenditure (0-53 kcal/d); 14 (48) in moderate (54-210 kcal/d); 8 (30) in high (>210 kcal/d) p=0.436
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	Long term oxygen therapy (LTOT) utilization	---	N (%): 4 (15) in quartile 1 (Q1) of physical activity; 4 (14) in Q2; 2 (7) in Q3; 0 (0) in Q4; p=0.19
Okubadejo, AA. 1997, Eur Respir J[S54]	LTOT group *vs.* no LTOT group	Median (P_{25}-P_{75}) Nottingham EADL score: 10 (2-20) *vs.* 17 (6-22); p=0.01	---
Sandland, CJ. 2008, Chest[S63]	Before *vs.* after intervention	---	In oxygen group, mean (SD) domestic activity counts: 4694 (1902) *vs.* 6912 (4171); p=0.46 In air group, mean (SD) domestic activity counts: 6430 (5002) *vs.* 6000 (3808); p=ns
Tsara, V. 2008, Respir Care[S72]	LTOT group *vs.* no LTOT group	Mean (SD) ADL score: 74.5 (37.3) *vs.* 97.4 (2.0); p=0.001	---

Vergeret, J. 1989, Eur Respir J[S75]	Fixed O_2 group *vs.* Portable O_2 group	Mean (SD) walked outdoors (m/day): 520 (370) *vs.* 480(397); p<0.05	---
	Fixed O_2 group *vs.* Portable O_2 group (in oxygen therapy <15 h/day)	---	Mean rest time (h/day): 13 *vs.* 14; p=ns Mean outdoor activity (h/day): 2 *vs.* 2; p=ns Mean distance walked outdoor (m/day): 658 *vs.* 432; p=ns
	Fixed O_2 group *vs.* Portable O_2 group (in oxygen therapy > 18 h/day)	Mean outdoor activity (h/day): 0.1 *vs.* 2; p<0.05 Mean distance walked outdoor (m/day): 20 *vs.* 385; p<0.01	Mean rest time (h/day): 15 *vs.* 14; p=ns

Determinant: Intervention – Physical activity advice

Paper	Variable / Category	Association	
		Significant	**Non-significant**
de Blok, BMJ. 2006, Patient Educ Couns[S19]	Physical activity counselling with pedometer group *vs.* control group	---	Mean steps/day at follow-up: 3927 in intervention group, 3554 in control group, p=0.38
Nguyen, HQ. 2009, Int J Chron Obstruct Pulmon Dis[S51]	MOBILE self-monitored (control group) *vs.* MOBILE coached (intervention group)	Mean (SE) total steps/day: 5229 (1068) at baseline, 4452 (1082) at 3 months, and 5838 (1096) at 6 months, in MOBILE-self monitored *vs.* 6692 (1007) at baseline, 5879(1016) at 3 months, and 5675 (1007) at 6 months, in MOBILE-coached; p group x time interaction=0.04; Mean (SE) % active time at moderate-high	---

		activity: 19.1 (2.7) at baseline, 18.6 (2.8) at 3 months, and 23.5 (2.9) at 6 months, in MOBILE-self monitored *vs.* 27.1 (2.6) at baseline, 24.2 (2.6) at 3 months, and 23.6(2.6) at 6 months, in MOBILE-coached; p group x time interaction=0.003; Mean (SE) total average steps/minute of the best 30 minutes of the day: 61.2 (5.4) at baseline, 59.0 (5.6) at 3 months, and 68.2 (5.8) at 6 months, in MOBILE-self monitored *vs.* 68.4 (5.0) at baseline, 59.0 (5.2) at 3 months, and 56.6 (5.0) at 6 months, in MOBILE-coached; p group x time interaction=0.002	
Wewel, AR. 2008, Respir Med[S85]	Baseline period *vs.* phone call period	Mean (SD) total activity (counts): 192614 (127247) *vs.* 235489 (116953); p=0.017 Mean (SD) activity per hour of monitoring (counts/h): 1061 (636) *vs.* 1330 (726); p=0.007	Mean (SD) total activity without training sessions (counts): 192614 (127247) *vs.* 194476 (103389); p=0.433 Mean (SD) total pedometer reading (m): 31215 (23673) *vs.* 37186 (20341); p=0.079 Mean (SD) pedometer reading per hour (m/h): 184 (119) *vs.* 214 (121); p=0.140

Determinant: Marital status

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	Married	---	N (%) 74 (67) in low energy expenditure (0-53 kcal/d); 77 (76) in moderate (54-210 kcal/d); 88 (77) in high (>210 kcal/d); p=0.172

Garcia-Aymerich, J. 2009, Chest[S33]	Married	N (%): 75 (88) in quartile 1 (Q1) of energy expenditure in physical activity; 73 (86) in Q2; 62 (73) in Q3; 64 (74) in Q4; p for trend=0.005	---

Determinant: Osteoarticular condition

Paper	Variable / Category	Association	
		Significant	Non-significant
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	Arthrosis or rheumatism	---	N (%): 45 (41) in low energy expenditure (0-53 kcal/d); 33 (33) in moderate (54-210 kcal/d); 47 (4) in high (>210 kcal/d); p=0.385
Moy, ML. 2009, J Rehabil Res Dev[S49]	Joint problems	Unadjusted coefficient (95% CI): -2742 (-3723 to -1761) for steps per day; p=0.0002 Unadjusted coefficient (95% CI): -1.1 (-2.2 to -0.083) for number of checklist physical activity performed; p=0.04	---

Determinant: Quality of Life / Health Related Quality of Life

Paper	Variable / Category	Association	
		Significant	Non-significant
Altenburg, WA. 2013, Respir Med[S1]	SGRQ activity	Adjusted regression standardized coefficient: -0.275 for daily physical activity; p=0.006	---

Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	SF-12 physical summary	Mean (SD): 33 (7) in low energy expenditure (0-53 kcal/d); 37 (9) in moderate (54-210 kcal/d); 39 (10) in high (>210 kcal/d); p<0.001 Adjusted OR (95% CI) of low physical activity: 0.93 (0.90 to 0.96); p<0.001	---
	SF-12 mental summary	Mean (SD): 42 (12) in low energy expenditure (0-53 kcal/d); 47 (11) in moderate (54-210 kcal/d); 49 (10) in high (>210 kcal/d); p<0.001 Adjusted OR(95% CI) of low physical activity: 0.96 (0.93 to 0.98); p<0.001	---
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	SGRQ symptoms	Mean (SD): 50.8 (22.2) in quartile 1 (Q1) of physical activity; 44.5 (21.3) in Q2; 29.4 (16.9) in Q3; 31.6 (14.9) in Q4; p=0.001	---
	SGRQ activity	Mean (SD): 62.2 (18.4) in quartile 1 (Q1) of physical activity; 49.7 (17.7) in Q2; 47.9 (17.2) in Q3; 39.0 (14.6) in Q4; p=0.001	---
	SGRQ impact	Mean (SD): 51.3 (17.9) in quartile 1 (Q1) of physical activity; 29.4 (16.3) in Q2; 24.8 (15.0) in Q3; 30.8 (18.8) in Q4; p=0.001	---
	SGRQ total score	Mean (SD): 54.5 (17.5) in quartile 1 (Q1) of physical activity; 38.1 (16.3) in Q2; 33.6 (12.5) in Q3; 34.4 (13.2) in Q4; p=0.001	---
Moy, ML. 2009, J Rehabil	VR-36 physical function	Unadjusted coefficient (95% CI): 29 (12 to 47) for steps per day; p=0.002	---

Res Dev[S49]	SF-36 physical summary	Unadjusted coefficient (95% CI): 67 (35 to 99) for steps per day; p=0.0003	---
	SF-36 mental summary	Unadjusted coefficient (95% CI): -72 (-125 to -19) for steps per day; p=0.002	---
Pitta, F. 2006, J Bras Pneumol[S57]	CRDQ total	---	Median (P_{25}-P_{75}): 82 (63-88) in active group *vs.* 87 (65-104) in inactive group; p=0.399

Determinant: Self-efficacy

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Altenburg, WA. 2013, Respir Med[S1]	PPAS (Perceived Physical Ability Subscale)	Adjusted standardized coefficient: 0.400 for daily physical activity; p=0.000	---
Hartman, JE. 2013, Arch Phys Med Rehab[S37]	LIVAS (Self-efficacy for physical activity)	Adjusted regression coefficient (SE): 0.096 (0.034) for percentage locomotion; p=0.006	---

Determinant: Sex

Paper	Variable / Category	Association	
		Significant	**Non-significant**

Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	Male	N (%) 94 (85%) in low energy expenditure (0-53 kcal/d); 95 (94%) in moderate (54-210 kcal/d); 110 (95%) in high (>210 kcal/d); p=0.007	---
	Female	Adjusted OR (95% CI) of low physical activity: 2.92 (1.11 to 7.70); p=0.031	---
Garcia-Aymerich, J. 2009, Chest [S33]	Male	N (%) 83 (98) in quartile 1 (Q1) of energy expenditure in physical activity; 81 (95) in Q2; 75 (88) in Q3; 78 (91) in Q4; p for trend=0.025	---
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	Male	---	N (%) 26 (96) in quartile 1 (Q1) of physical activity; 26 (93) in Q2; 25 (89) in Q3; 27 (100) in Q4; p=0.34
Pitta, F. 2006, J Bras Pneumol[S57]	Male		N (%) 8 (50) male in active group *vs.* 8 (50) male in inactive group; p=na
	Female		N (%) 4 (57) female in active group *vs.* 3 (43) female in inactive group; p=na
Skumlien, S. 2006, Chron Respir Dis[S68]	Sex	Mean (SD) activity score in home management: 3.9 (2.6) in men *vs.* 4.8 (2.2) in women; p<0.05	---
Watz, H. 2008, Am J Respir Crit Care Med[S81]	Male	---	N (%) 25 (74) in GOLD I; 41 (72) in GOLD II; 35 (81) in GOLD III and 27 (75) in GOLD IV; p=0.74
	Female	---	Unstandardized regression coefficient (95% CI) 0.065 (-0.027 to 0.157) for physical activity level; p=0.16;

Determinant: Smoking habit

Paper	Variable / Category	Association	
		Significant	Non-significant
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	Ex-smoker, current smoker, never smoker	N (%): 70 (65) ex-smoker, 23 (21) current smoker, 15 (14) never smoker in low energy expenditure (0-53 kcal/d); 71 (71) ex-smoker, 25 (25) current smoker, 4 (4) never smoker in moderate (54-210 kcal/d); 74 (65) ex-smoker, 34 (30) current smoker, 6 (5) never smoker in high (>210 kcal/d); p=0.041	---
Garcia-Aymerich, J. 2009, Chest[S33]	Current smoker	N (%): 24 (28) in quartile 1 (Q1) of energy expenditure in physical activity; 28 (33) in Q2; 39 (46) in Q3; 54 (63) in Q4; p for trend=0.007	---
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	Current smoker	---	N (%): 5 (20) in quartile 1 (Q1) of physical activity; 6 (23) in Q2; 5 (19) in Q3; 4 (16) in Q4; p=0.74
	Pack-years	---	Mean (SD): 83 (89) quartile 1 (Q1) of physical activity; 49 (12) in Q2; 48 (29) in Q3; 53 (16) in Q4; p=0.21

Determinant: Socioeconomic status

Paper	Variable / Category	Association	
		Significant	Non-significant
Garcia-Aymerich, J. 2004,	Low socioeconomic status	N (%): 70 (63) in low energy expenditure (0-53 kcal/d); 73 (72) in moderate (54-210 kcal/d); 94	---

Med Sci Sports Exerc[S30]	(grade IV or V)	(81) in high (>210 kcal/d); p=0.007	
	High socioeconomic status (grade I to III)	Adjusted OR (95% CI) of low physical activity: 2.23 (1.24 to 4.02); p=0.007	---
Garcia-Aymerich, J. 2009, Chest[S33]	Low socioeconomic status (grade IV or V)	---	N (%): 68 (83) in quartile 1 (Q1) of energy expenditure in physical activity; 64 (83) in Q2; 64 (80) in Q3; 62 (81) in Q4; p for trend=0.595

Determinant: Systemic inflammation

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	IL-6 (pg/ml)	Mean (SD): 2.1 (3.3) in quartile 1 (Q1) of physical activity; 6.3 (7.8) in Q2; 1.9 (3.2) in Q3; 1.7 (2.5) in Q4; p=0.04;	---
	8-isoprostane (pg/ml)	Mean (SD): 58.9 (20.3) in quartile 1 (Q1); 45.6 (23.8) in Q2; 33.6 (23.0) in Q3; 11.1 (7.1) in Q4; p=0.001	---
	soluble TNF-α receptor 1 (pg/ml)	---	Mean (SD): 4.0 (5.4) in quartile 1 (Q1); 4.4 (10.4) in Q2; 1.0 (1.0) in Q3; 3.2 (4.7) in Q4; p=0.59
Watz, H. 2008, Am J Respir Crit Care Med[S81]	Fibrinogen (mg/dl)	Adjusted unstandardized regression coefficient (95% CI): -0.001 (-0.001 to <0.000) for physical activity level; p=0.001 Adjusted unstandardized regression coefficient (95% CI): -7 (-12 to -2) for steps per day; p=0.006	---

Determinant: Working status

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	Current workers	---	N (%): 6 (5) in low energy expenditure (0-53 kcal/d); 7 (7) in moderate (54-210 kcal/d); 7 (6) in high (>210 kcal/d); p=0.898
Garcia-Aymerich, J. 2009, Chest[S33]	Occupationally active	N (%): 0 (0) in quartile 1 (Q1) of energy expenditure in physical activity; 5 (6) in Q2; 17 (20) in Q3; 39 (46) in Q4; p for trend<0.001.	---
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	Retired or disabled	---	N (%): 20 (74) in quartile 1 (Q1) of physical activity; 13 (46) in Q2; 14 (50) in Q3; 12 (44) in Q4; p=0.10

Online supplement Table 3b. Other potential determinants (only evidenced in 1 study) and their association with physical activity, grouped in main categories and sorted by alphabetical order.

Determinant: Cardiac autonomic function

Paper	Variable / Category	Association	
		Significant	Non-significant
van Gestel, AJR. 2012, COPD[S73]	RR interval (ms)	Unadjusted coefficient: 0.42 for steps per day; p=0.001	---
	HR at rest (bpm)	Unadjusted coefficient: -0.29 for steps per day; p=0.010	---
	Heart Rate Reserve (bpm)	Unadjusted coefficient: 0.28 for steps per day; p=0.015	---

Determinant: Caregivers

Paper	Variable / Category	Association	
		Significant	Non-significant
Wakabayashi, R. 2011, J Am Geriatr Soc[S78]	Living alone *vs.* Living with 1 caregiver	Mean (SD) in instrumental ADLs (range 0-31): 29.1 (3.6) *vs.* 25.6 (3.9); p<0.001	---
	Living alone *vs.* Living with ≥2 caregiver	Mean (SD) in instrumental ADLs (range 0-31): 29.1 (3.6) *vs.* 25.6 (4.2); p<0.001	---

	Living with 1 caregiver *vs.* Living with ≥2 caregiver	---	Mean (SD) in instrumental ADLs (range 0-31): 25.6 (3.9) *vs.* 25.6 (4.2); p>0.99
	Living alone *vs.* Living with 1 caregiver *vs.* Living with ≥2 caregiver	Mean (SD) in ADLs (range 0-31): 29.1 (3.6) *vs.* 25.6 (3.9) *vs.* 29.1 (3.6); p <0.001	Mean (SD) in ADLs (range 0-20): 19.9 (0.5) *vs.* 20.0 (0.3) *vs.* 19.9 (0.8); p=0.79

Determinant: Cataracts

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	Cataracts	---	N (%): 43 (39) in low energy expenditure (0-53 kcal/d); 29 (29) in moderate (54-210 kcal/d); 26 (23) in high (>210 kcal/d); p=0.053

Determinant: Diabetes

Paper	Variable / Category	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	Diabetes	N (%): 32 (29) in low energy expenditure (0-53 kcal/d); 18 (18) in moderate (54-210 kcal/d); 15 (13) in high (>210 kcal/d); p=0.010 Adjusted OR (95% CI) of low physical activity: 2.66 (1.40 to 5.06); p=0.003	---

Determinant: Disease control

Paper	Variable / Category	Association	
		Significant	Non-significant
Garcia-Aymerich, J. 2004, Med Sci Sports Exerc[S30]	≥3 visits per year to control the disease	---	N (%): 44 (43) in low energy expenditure (0-53 kcal/d); 30 (32) in moderate (54-210 kcal/d); 36 (33) in high (>210 kcal/d); p=0.167
	Correctly performed essential inhaler manoeuvres	---	N (%): 54 (53) in low energy expenditure (0-53 kcal/d); 49 (57) in moderate (54-210 kcal/d); 53 (56) in high (>210 kcal/d); p=0.830

Determinant: Intervention – Integrated education

Paper	Variable / Category	Association	
		Significant	Non-significant
Wakabayashi, R. 2011, Geriatr Gerontol[S77]	Integrated education group *vs.* Usual care group (baseline, 6 months, and 12 months)	Mean (SD) instrumental activities of daily living: 26 (4), 27 (4), and 27 (4) *vs.* 27 (4), 26 (4), and 27 (4); p group x time interaction=0.030	---

Determinant: Intervention - Lung volume reduction surgery

Paper	Variable / Category	Association	
		Significant	Non-significant

Goto, Y. 2004, Respirology[S36]	LVRS group *vs.* non-LVRS group	Mean in bathing score at 3 months 0.54 in LVRS group *vs.* 1.64 in non-LVRS group, p<0.005 Mean in indoor walking score at 3 months 0.25 in LVRS group *vs.* 0.73 in non-LVRS group, p<0.005 Mean in bathing score at 12 months 0.53 in LVRS group *vs.* 1.50 in non-LVRS group, p<0.005	Mean in eating score at 3 months 0.15 in LVRS group *vs.* 0.18 in non-LVRS group; p=ns Mean in toileting score at 3 months 0.23 in LVRS group *vs.* 0.27 in non-LVRS group; p=ns Mean in shampooing score at 3 months 0.62 in LVRS group *vs.* 1.10 in non-LVRS group; p=ns Mean in face and teeth washing score at 3 months 0.39 in LVRS group *vs.* 0.73 in non-LVRS group; p=ns Mean in dressing score at 3 months 0.54 in LVRS group *vs.* 0.55 in non-LVRS group; p=ns Mean in eating score at 12 months 0.22 in LVRS group *vs.* 0.42 in non-LVRS group; p=ns Mean in toileting score at 12 months 0.44 in LVRS group *vs.* 0.50 in non-LVRS group; p=ns Mean in shampooing score at 12 months 0.83 in LVRS group *vs.* 1.42 in non-LVRS group; p=ns Mean in face and teeth washing score at 3 months 0.56 in LVRS group *vs.* 0.92 in non-LVRS group; p=ns Mean in dressing score at 12 months 0.56 in LVRS group *vs.* 1.17 in non-LVRS group; p=ns Mean in indoor walking score at 3 months 0.39 in LVRS group *vs.* 1.17 in non-LVRS group, p=ns

Determinant: Intervention - Lung transplant

Paper	Variable / Category	Association	
		Significant	Non-significant
Bossenbroek, L. 2009, J Heart Lung Transplant[S10]	Lung transplant candidates *vs.* Lung transplant recipients	Mean (SD) steps/day: 1407 (1166) *vs.* 6642 (2886); p<0.001 Mean (SD) step equivalents/day: 2636 (2275) *vs.* 9038 (4583); p<0.001 Mean (SD) SQUASH MET/day: 1349 (990) *vs.* 5434 (2945); p<0.001	---

Determinant: Muscle strength

Paper	Variable / Category	Association	
		Significant	Non-significant
Pitta, F. 2006, J Bras Pneumol[S57]	PImax (% pred)	---	Median (P_{25}-P_{75}): 66 (48-88) in active group *vs.* 74 (62-102) in inactive group; 0.644
	PEmax (% pred)	---	Median (P_{25}-P_{75}): 101 (89-109) in active group *vs.* 78 (67-121) in inactive group; 0.132
	QF (% pred)	---	Median (P_{25}-P_{75}): 75 (54-87) in active group *vs.* 76 (58-97) in inactive group; 0.806

Determinant: Other lung function measures (not FEV_1, not FVC, not hyperinflation)

Paper	Variable / Category	Association	
		Significant	Non-significant
Garcia-Rio, F. 2009, Am J Respir Crit Care Med[S34]	postPBD FEV_1/FVC	---	Mean (SD): 48 (13) in quartile (Q1) quartile 1 (Q1) of physical activity; 49 (11) in Q2; 49 (12) in Q3; 55 (11) in Q4; p=0.15
	FRC (% pred)	Mean (SD): 143 (25) in quartile (Q1) quartile 1 (Q1) of physical activity; 144 (42) in Q2; 130 (22) in Q3; 114 (28) in Q4; p=0.002	---
Pitta, F. 2006, J Bras Pneumol[S57]	VE/MVV	---	Median (P25-P75): 100 (85-114) in active group *vsvs.* 83 (64-105) in inactive group; p=0.178
Pitta, F. 2008, Respir Med[S58]	MVV (l)	Correlation coefficients (95% CI) of 0.48 (0.18 to 0.69) with EEA>3METs, p<0.001; 0.49 (0.20 to 0.70) with steps/day, p<0.001; -0.41 (-0.65 to 0.10) with sedentary activities, p<0.001; 0.42 (0.11 to 0.66) with moderate activities, p<0.001; 0.49 (0.20 to 0.71), p<0.001	---

Determinant: Season

Paper	Variable / Category	Association	
		Significant	Non-significant
Sewell, L. 2010, J Cardiopulmon Rehab Prev[S66]	Summer *vs.* Winter	Mean (SD) activity monitor counts: 8857 (7497) *vs.* 3201 (2637); p=0.01	---

Online supplement Table 4a. Outcomes covered by at least 2 articles and their association with physical activity, grouped in main categories and sorted by alphabetical order.

Outcome: Balance

Paper	Variable	Association	
		Significant	**Non-significant**
Beauchamp, MK. 2012, Chest[S2]	BESTest score	Correlation coefficient: 0.40 with self-reported physical activity (PASE); p=0.008 Standardized regression coefficient: 0.341 for self-reported physical activity (PASE); p=0.033	---
Roig, M. 2011, Respir Med[S62]	Falls	---	Mean (95% CI) in PASE score: 109 (92 to 126) in non-fallers *vs.* 86 (66 to 106) in fallers; p=0.1

Outcome: Bone mineral density

Paper	Variable	Association	
		Significant	**Non-significant**
Bon, J. 2011, Am J Respir Crit Care Med[S9]	Bone mineral density	---	Mean (SD) in leisure score: 2.4 (1.2) in normal group *vs.* 2.3 (1.1) in osteopenia group *vs.* 1.9 (1.3) in osteoporosis group; p=ns Mean (SD) in on-the-job score: 1.6 (0.8) in normal group *vs.* 1.6 (0.8) in osteopenia group *vs.* 1.1 (0.4) in osteoporosis group; p=ns
Silva, DR. 2011, Respir	Bone mass (T-score)	---	Median (P_{25}-P_{75}) METs (min/week): 720 (0-2520) in osteoporosis group *vs.* 560 (25-3548)

Care[S67]			in osteopenia group *vs.* 1104 (136-17000) in normal bone mass; p=0.24
	Femoral-neck (T-score)	Correlation coefficient: 0.378 with total activity; p<0.001	---
	Lumbar spine (T-score)	---	Correlation coefficient: 0.150 with total activity; p=0.15

Outcome: Dyspnea

Paper	Variable	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2009, Chest[S33]	severe dyspnea (mMRC score, 3, 4, 5)	N (%) 52 (62) in quartile 1 (Q1) of energy expenditure in physical activity; 34 (40) in Q2; 28 (33) in Q3; 40 (47) in Q4; p for trend=0.036	---
Lemmens, KM. 2008, Patient Educ Couns[S44]	MRC dyspnea	Adjusted regression coefficient 0.20 for physical activity; p<0.01	---

Outcome: Exacerbations

Paper	Variable	Association	
		Significant	**Non-significant**
Benzo, RP. 2010, Respiration[S5]	No hospital admission during 12-month period	Mean (SD) self-reported time of physical activity per week (minutes) 109 (62) in patients with no hospital admission during 12-month period *vs.* 94(65) in patients with at least one	---

		hospital admission during 12-month period; p=0.01 Mean self-reported time of ≥2 h of physical activity per week (%): 42 in patients with no hospital admission during 12-month period *vs.* 30 in patients with at least one hospital admission during 12-month period; p=0.003 Adjusted OR (95% CI) of hospitalization: 0.6 (0.41 to 0.88) in self-reported time of ≥2 h of physical activity per week; p=0.01	
Chen, Y. 2006, Western journal nursing research[S14]	Readmission at 14 days	Adjusted OR (95% CI) of daily functioning: 0.99 (0.53 to 1.85); p<0.05	---
	Readmission at 90 days	Adjusted OR (95% CI) of daily functioning: 0.56 (0.33 to 0.97); p<0.05	---
Garcia-Aymerich, J. 2003, Thorax[S29]	Readmission to hospital for COPD exacerbation	Adjusted HR (95% CI): 0.85 (0.59 to 1.24) usual physical activity 79-232 kcal/day; p=0.400; 0.49 (0.31 to 0.79) usual physical activity >232 kcal/day; p=0.003 Adjusted HR (95% CI): 0.87 (0.60 to 1.27) usual physical activity 79-232 kcal/day; p=0.469; 0.54 (0.34 to 0.86) usual physical activity >232 kcal/day; p=0.010	---
Garcia-Aymerich, J. 2006, Thorax[S31]	COPD admissions	Adjusted IRR (95% CI): 0.72 (0.53 to 0.97) in low/moderate/high physical activity; p=0.033	---
Garcia-Aymerich, J. 2008, Ann Epidemiol[S32]	COPD admissions	Weighted IRR (95% CI): 1.10 (0.82 to 1.49) in moderate physical activity; p=0.522; 0.68 (0.47 to 0.99) in high physical activity; p=0.044	---
Garcia-Rio, F. 2012,	COPD admissions	Adjusted IRR (95% CI): 0.099 (0.033 to 0.293)	---

Chest[S35]		in quartile 4 (Q4) of physical activity; p<0.0001; 0.529 (0.291 to 0.962) in Q3; p=0.0369; and 0.537 (0.285 to 1.013) in Q2; p=0.0547	
Moy, M. 2013, PLoS ONE[S50]	Acute exacerbations	Adjusted RR (95% CI): 1.07 (1.003 to 1.15) in mean daily step count (per 1000 step decrease); p=0.04	---
	COPD-Related hospitalizations	Adjusted RR (95% CI): 1.24 (1.08 to 1.42) in mean daily step count (per 1000 step decrease); p=0.003	---
Pitta, F. 2006, Chest[S56]	Readmission in the year following discharge	Median (P_{25}-P_{75}) walking time per day at 1 month 12 (9-27) min/d in patients readmitted in the year following discharge *vs.* 30 (21-100) min/d in patients not readmitted; p=0.03	---

Outcome: Exercise capacity

Paper	Variable	Association	
		Significant	**Non-significant**
Chao, PW. 2011, COPD[S13]	6MWD (ft)	Mean (SD) 1124 (210) in inactive COPD patients *vs.* 1468 (240) in active COPD patients	---
Eliason, G. 2011, COPD[S23]	6MWD (m)	Adjusted regression coefficient 0.381 for time spent moderately or vigorously active (MVPA); p=0.01 Adjusted regression coefficient 0.333 for mean physical activity; p=0.02	Adjusted regression coefficient -0.155 for time spent sedentary; p=0.32
Garcia-Aymerich, J. 2009,	6MWD (m)	Mean (SD) 397 (115) in quartile 1 (Q1) of energy expenditure in physical activity; 446 (79)	---

Chest[S33]		in Q2; 456 (86) in Q3; 467 (85) in Q4; p for trend<0.001 Adjusted regression coefficient (95% CI) 40.8 (14.4 to 67.2) for Q2 of energy expenditure in physical activity; 41.5 (13.2 to 69.7) for Q3; 44.8 (14.8 to 74.7) for Q4; p for trend=0.006	
	VO2 peak (mL/min)	Mean (SD) 1043 (235) in quartile 1 (Q1) of energy expenditure in physical activity; 1139 (300) in Q2; 1296 (445) in Q3; 1234 (398) in Q4; p for trend=0.004	---
Waatevik, M. 2012, COPD[S76]	6MWD (m)	Adjusted regression coefficient (95% CI) -41.9 (-65.7 to -18.3) for 1-2 hours physical activity per week; and -81.6 (-117.9 to -45.4) for no physical activity per week; p<0.001	---

Outcome: FEV_1

Paper	Variable	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2009, Chest[S33]	post-BD FEV_1 (% pred)	Mean (SD) 49 (16) in quartile 1 (Q1) of energy expenditure in physical activity; 50 (15) in Q2; 57 (16) in Q3; 54 (17) in Q4; p for trend=0.002	---
Lemmens, KM. 2008, Patient Educ Couns[S44]	FEV_1 (% pred)	Adjusted regression coefficient: 0.17 for physical activity; p<0.05	---

Outcome: Mortality

Paper	Variable	Association	
		Significant	**Non-significant**
Esteban, C. 2006, QJM[S24]	Deaths	N (%) 11 (28) in activity level 0; 25 (22) in activity level 1; 54 (16) in activity level 2; 4 (4) in activity level 3; p=0.0007	---
	Mortality	---	Adjusted HR: 1.12 in activity level 1, p=0.78; 0.94 in activity level 2, p=0.88; 0.38 in activity level 3, p=0.12
Esteban, C. 2011, Respir Med[S26]	Mortality	Unadjusted coefficient 1.0540 for very low physical activity level, p=0.0021; 0.7228 for low physical activity level, p=0.0303; 0.6786 for medium physical activity level, p=0.0172	---
Garcia-Aymerich, J. 2006, Thorax[S31]	All-cause mortality	Adjusted HR (95% CI): 0.76 (0.65 to 0.90) in low/moderate/high physical activity; p=0.001 Adjusted HR (95% CI): 1.04 (0.84 to 1.27) in low physical activity; 0.73 (0.61 to 0.86) in moderate physical activity; 0.72 (0.59 to 0.86) in high physical activity; p for trend<0.001	---
	Respiratory mortality	---	Adjusted HR (95% CI): 0.70 (0.48 to 1.02) in low/moderate/high physical activity; p=0.060 Adjusted HR (95% CI): 0.89 (0.55 to 1.44) in low physical activity; 0.64 (0.43 to 0.95) in moderate physical activity; 0.72 (0.46 to 1.12) in high physical activity; p for trend=0.072
	Cardiovascular mortality	---	Adjusted HR (95% CI): 0.77 (0.58 to 1.02) in

			low/moderate/high physical activity; p=0.065 Adjusted HR (95% CI): 0.84 (0.58 to 1.23) in low physical activity; 0.73 (0.54 to 0.98) in moderate physical activity; 0.81 (0.59 to 1.11) in high physical activity; p for trend=0.195
Garcia-Aymerich, J. 2008, Ann Epidemiol[S32]	All-cause mortality	Adjusted HR (95% CI): 0.83 (0.74 to 0.94) in moderate physical activity; 0.80(0.69 to 0.91) in high physical activity; p for trend=0.002 Weighted HR (95% CI): 0.88 (0.76 to 1.01) in moderate physical activity; 0.81 (0.69 to 0.95) in high physical activity; p for trend=0.009	---
Garcia-Rio, F. 2012, Chest[S35]	All-cause mortality	Adjusted HR (95% CI) 0.986 (0.981 to 0.992) for every 10 VMUs increased; p=0.002	---
Palop Cervera, M. 2010, Rev Clin Esp[S55]	Death after ECOPD hospital readmission	N (%) 30 (68) of dead *vs.* 22 (27) of alive in none outside activity group; 14 (32) of dead *vs.* 38 (47) of alive in 1-6h outside activity group; 0 (0) of dead *vs.* 21 (25) of alive in >6h outside activity group; p<0.01	---
	Mortality	Adjusted OR (95% CI): 2.97 (1.2 to 7.3) in low or lack of physical activity; p<0.05	---
Waschki, B. 2011, Chest[S80]	All-cause mortality	Adjusted HR (95 %CI): 0.009 (0.001 to 0.085) in physical activity level; p<0.001	---

Outcome: QoL / HRQoL

Paper	Variable	Association	
		Significant	**Non-significant**
Esteban, C. 2006, QJM[S24]	SF-36 physical component	Mean (SD) 35.6 (7.0) in activity level 0; 42.8 (8.0) in activity level 1; 45.3 (7.3) in activity level 2; 47.8 (8.3) in activity level 3; p<0.0001 Adjusted HR: 2.86 in activity level 1; p=0.024; 3.99 in activity level 2; p=0.001; 3.60 in activity level 3; p=0.010	---
	SGRQ total	Mean (SD) 57.5 (20.3) in activity level 0; 46.1 (18.5) in activity level 1; 39.5 (16.1) in activity level 2; 31.3 (17.2) in activity level 3; p<0.0001	Adjusted HR: -1.22 in activity level 1; p=0.65; -4.04 in activity level 2; p=0.11; -5.27 in activity level 3; p=0.07
	CRQ total	Mean (SD) 82.6 (24.6) in activity level 0; 93.3 (26.2) in activity level 1; 99.9 (22.1) in activity level 2; 106.6 (25.2) in activity level 3; p<0.0001	Adjusted HR: 0.43 in activity level 1; p=0.91; 2.70 in activity level 2; p=0.47; 2.35 in activity level 3; p=0.59
Esteban, C. 2010, Eur Respir J[S25]	SGRQ total	Adjusted regression coefficient for each PA category (change baseline/5years), using low/low as reference category: - low/moderate-high: 15.9, p=0.0005 - moderate/moderate: 10.2, p=0.007 - moderate/high: 18.4, p<0.0001 - high/high: 16.9, p<0.0001	Adjusted regression coefficient for each PA category (change baseline/5years), using low/low as reference category: - moderate/low: -0.7, p=0.87 - high/moderate-low: 8, p=0.05
	CRQ total	Adjusted regression coefficient for each PA category (change baseline/5years), using low/low as reference category: - moderate/moderate: 10.3, p=0.005 - moderate/high: 14.8, p<0.0004	Adjusted regression coefficient for each PA category (change baseline/5years), using low/low as reference category: - low/moderate-high: 8.7, p=0.05 - moderate/low: 2.6, p=0.56

		- high/moderate-low: 10.7, p<0.005 - high/high: 13.6, p<0.0003	
Jehn, M. 2012, Med Sci Sports Exerc[S40]	SF-36 physical component	Adjusted regression coefficient (95% CI): 0.30 (0.06 to 0.57) for fast walk (min/d); p=0.015	---
	SF-36 mental component	Adjusted regression coefficient (95% CI): 0.23 (-0.03 to 0.49) for fast walk (min/d); p=0.08	---
	SGRQ symptoms	Adjusted regression coefficient (95% CI): 0.76 (-0.13 to 0.28) for fast walk (min/d); p=0.08	---
	SGRQ activity	Adjusted regression coefficient (95% CI): -0.07 (-0.25 to 0.12) for fast walk (min/d); p=0.04	---
	SGRQ impact	Adjusted regression coefficient (95% CI): -0.16 (-0.34 to 0.15) for fast walk (min/d); p=0.042	---
	SGRQ total	Adjusted regression coefficient (95% CI): -0.08 (-0.26 to 0.10) for fast walk (min/d); p=0.045	---
Lemmens, KM. 2008, Patient Educ Couns[S44]	CRQ dyspnea	Adjusted regression coefficient: 0.38 for physical activity; p<0.01	---
	CRQ emotional	Adjusted regression coefficient: 0.17 for physical activity; p<0.05	---
	CRQ fatigue	Adjusted regression coefficient: 0.43 for physical activity; p<0.01	---
	CRQ mastery	Adjusted regression coefficient: 0.19 for physical activity; p<0.01	---
	CCQ symptoms	Adjusted regression coefficient: 0.31 for physical activity; p<0.01	---

	CCQ mental state	Adjusted regression coefficient: 0.25 for physical activity; p<0.01	---
	CCQ functional state	Adjusted regression coefficient: 0.44 for physical activity; p<0.01	---
	Health status	Adjusted regression coefficient: 0.43 for physical activity; p<0.01	---

Online supplement Table 4b. Other potential outcomes (only evidence in 1 study) and their association with physical activity, grouped in main categories and sorted by alphabetical order.

Outcome: Bronchial colonization

Paper	Variable	Association	
		Significant	Non-significant
Garcia-Aymerich, J. 2009, Chest[S33]	Bronchial colonization	N (%) 24 (43) in quartile 1 (Q1) of energy expenditure in physical activity; 19 (33) in Q2; 20 (35) in Q3; 12 (22) in Q4; p for trend = 0.035.	---

Outcome: Depression

Paper	Variable	Association	
		Significant	Non-significant
Lee, H. 2011, Geriatr Nurs[S43]	Depression (CES-D ≥ 16)	---	Correlation coefficient: 0.15 with physical activity; p=ns

Outcome: Gas exchange

Paper	Variable	Association	
		Significant	Non-significant
Garcia-Aymerich, J. 2009,	D_{LCO} (% pred)	Mean (SD) 58 (20) in quartile 1 (Q1) of energy expenditure in physical activity; 66 (21) in Q2;	---

Chest[S33]		68 (20) in Q3; 68 (22) in Q4; p for trend=0.004 Adjusted regression coefficient (95% CI): 5.8 (-0.26 to 11.9) for Q2 of energy expenditure in physical activity; 5.9 (-0.31 to 12.2) for Q3; 8.7 (2.4 to 14.9) for Q4; p for trend=0.012	
	PO_2 (mmHg)	---	Mean (SD) 74.5 (11.7) in quartile 1 (Q1) of energy expenditure in physical activity; 75.4 (11.1) in Q2; 75.0 (9.9) in Q3; 72.3 (10.7) in Q4; p for trend=0.187
	PCO_2 (mmHg)	---	Mean (SD) 41.7 (5.6) in quartile 1 (Q1) of energy expenditure in physical activity; 41.4 (5.2) in Q2; 42.0 (4.7) in Q3; 42.1 (5.8) in Q4; p for trend=0.530

Outcome: Muscle strength

Paper	Variable	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2009, Chest[S33]	PEmax (% pred)	Mean (SD) 60 (21) in quartile 1 (Q1) of energy expenditure in physical activity; 68 (25) in Q2; 67 (22) in Q3; 71 (23) in Q4; p for trend=0.004	Adjusted regression coefficient (95% CI): 7.4 (-0.44 to 15.2) for Q2 of energy expenditure in physical activity; 4.5 (-3.4 to 12.4) for Q3; 8.5 (0.6 to 16.4) for Q4; p for trend=0.081
	PImax (% pred)	---	Mean (SD) 61 (28) in quartile 1 (Q1) of energy expenditure in physical activity; 62 (17) in Q2; 68 (23) in Q3; 65 (23) in Q4; p for trend=0.169

	Non-dominant handgrip (% pred)	---	Mean (SD) 104 (29) in quartile 1 (Q1) of energy expenditure in physical activity; 105 (22) in Q2; 105 (29) in Q3; 102 (28) in Q4; p for trend=0.593

Outcome: Nutritional status

Paper	Variable	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2009, Chest[S33]	BMI (kg/m^2)	Mean (SD) 27.5 (4.6) in quartile 1 (Q1) of energy expenditure in physical activity; 27.7 (4.4) in Q2; 28.6 (4.3) in Q3; 28.9 (5.3) in Q4; p for trend=0.023	---
	FFMI (kg/m^2)	---	Mean (SD) 19.8 (3.4) in quartile 1 (Q1) of energy expenditure in physical activity; 19.2 (2.9) in Q2; 19.5 (2.7) in Q3; 20.0 (3.2) in Q4; p for trend=0.524

Outcome: Other lung function parameters (not FEV_1)

Paper	Variable	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2009, Chest[S33]	post-BD FEV_1/FVC (%)	Mean (SD) 51 (13) in quartile 1 (Q1) of energy expenditure in physical activity; 51 (12) in Q2; 56 (11) in Q3; 55 (11) in Q4; p for trend=0.002	---

	IC/TLC (%)	Mean (SD) 0.30 (0.09) in quartile 1 (Q1) of energy expenditure in physical activity; 0.29 (0.09) in Q2; 0.33 (0.11) in Q3; 0.32 (0.09) in Q4; p for trend=0.033	---
	RV/TLC (%)	Mean (SD): 58 (9) in quartile 1 (Q1) of energy expenditure in physical activity; 57 (10) in Q2; 54 (10) in Q3; 54 (10) in Q4; p for trend=0.004	---

Outcome: Relapse

Paper	Variable	Association	
		Significant	**Non-significant**
Miravitlles, M. 2011, Respir Med[S47]	Clinical failure on exacerbation (relapse)	Mean (SD) walking time per day (min) at baseline: 67 (45) in clinical success group *vs.* 48 (52) in clinical failure; p<0.001	---

Outcome: Self-efficacy

Paper	Variable	Association	
		Significant	**Non-significant**
Inal-Ince, D. 2005, Saudi Med J[S39]	Self-efficacy	Adjusted regression coefficient: 0.623 for activities of daily living; p<0.0001	---

Outcome: Systemic inflammation

Paper	Variable	Association	
		Significant	**Non-significant**
Garcia-Aymerich, J. 2009, Chest[S33]	TNF-α ≥ 0.5 (pg/mL)	N (%) 38 (48) in quartile 1 (Q1) of energy expenditure in physical activity; 32 (38) in Q2; 29 (35) in Q3; 18 (21) in Q4; p for trend<0.001 Adjusted OR (95% CI): 0.8 (0.4 to 1.6) in Q2 of energy expenditure in physical activity; 0.6 (0.3 to 1.3) in Q3; 0.4 (0.2 to 0.8) in Q4; p for trend=0.011	---
	CRP ≥ 3 (mg/L)	N (%) 53 (68) in quartile 1 (Q1) of energy expenditure in physical activity; 51 (60) in Q2; 40 (50) in Q3; 43 (52) in Q4; p for trend=0.023 Adjusted OR (95% CI): 0.7 (0.4 to 1.3) in Q2 of energy expenditure in physical activity; 0.5 (0.3 to 0.9) in Q3; 0.5 (0.3 to 1.0) in Q4; p for trend=0.036	---

Online supplement references

S1 Altenburg WA, Bossenbroek L, de Greef MH, et al. Functional and psychological variables both affect daily physical activity in COPD: A structural equations model. Respir Med 2013;**107**:1740-1747.

S2 Beauchamp MK, Sibley KM, Lakhani B, et al. Impairments in systems underlying control of balance in COPD. Chest 2012;**141**:1496-1503.

S3 Behnke M, Wewel AR, Kirsten D, et al. Exercise training raises daily activity stronger than predicted from exercise capacity in patients with COPD. Respir Med 2005;**99**:711-717.

S4 Bendstrup KE, Ingemann Jensen J, Holm S, et al. Out-patient rehabilitation improves activities of daily living, quality of life and exercise tolerance in chronic obstructive pulmonary disease. Eur Respir J 1997;**10**:2801-2806.

S5 Benzo RP, Chang CC, Farrell MH, et al. Physical activity, health status and risk of hospitalization in patients with severe chronic obstructive pulmonary disease. Respiration 2010;**80**:10-18.

S6 Berry MJ, Adair NE, Rejeski WJ Use of peak oxygen consumption in predicting physical function and quality of life in COPD patients. Chest 2006;**129**:1516-1522.

S7 Berry MJ, Rejeski WJ, Miller ME, et al. A lifestyle activity intervention in patients with chronic obstructive pulmonary disease. Respir Med 2010;**104**:829-839.

S8 Bestall JC, Paul EA, Garrod R, et al. Usefulness of the Medical Research Council (MRC) dyspnoea scale as a measure of disability in patients with chronic obstructive pulmonary disease. Thorax 1999;**54**:581-586.

S9 Bon J, Fuhrman CR, Weissfeld JL, et al. Radiographic emphysema predicts low bone mineral density in a tobacco-exposed cohort. Am J Respir Crit Care Med 2011;**183**:885-890.

S10 Bossenbroek L, ten Hacken NHT, van der Bij W, et al. Cross-sectional assessment of daily physical activity in chronic obstructive pulmonary disease lung transplant patients. J Heart Lung Transplant 2009;**28**:149-155.

S11 Bourbeau J, Ford G, Zackon H, et al. Impact on patients' health status following early identification of a COPD exacerbation. Eur Respir J 2007;**30**:907-913.

S12 Breyer MK, Breyer-Kohansal R, Funk GC, et al. Nordic walking improves daily physical activities in COPD: a randomised controlled trial. Respir Res 2010;**11**:112-

S13 Chao PW, Ramsdell J, Renvall M, et al. Does a history of exercise in COPD patients affect functional status? A study using a lifetime physical activity questionnaire investigates a correlation between exercise and functional status as evidenced by six-minute walk distance. COPD 2011;**8**:429-436.

S14 Chen YJ and Narsavage GL Factors related to chronic obstructive pulmonary disease readmission in Taiwan. Western J Nurs Research 2006;**28**:105-124.

S15 Coronado M, Janssens JP, de Muralt B, et al. Walking activity measured by accelerometry during respiratory rehabilitation. J Cardiopulm Rehabil 2003;**23**:357-364.

S16 Dal Negro RW, Aquilani R, Bertacco S, et al. Comprehensive effects of supplemented essential amino acids in patients with severe COPD and sarcopenia. Monaldi Arch Chest Dis 2010;**73**:25-33.

S17 Dallas MI, McCusker C, Haggerty MC, et al. Using pedometers to monitor walking activity in outcome assessment for pulmonary rehabilitation. Chron Respir Dis 2009;**6**:217-224.

S18 Daly C, Coughlan GF, Hennessy E, et al. Effects of neuromuscular electrical stimulation on the activity levels and exercise capacity of patients with moderate to severe COPD. Physio Ireland 2011;**32**:6-11.

S19 de Blok BMJ, de Greef MHG, ten Hacken NHT, et al. The effects of a lifestyle physical activity counseling program with feedback of a pedometer during pulmonary rehabilitation in patients with COPD: a pilot study. Patient Educ Couns 2006;**61**:48-55.

S20 Effing T, Zielhuis G, Kerstjens H, et al. Community based physiotherapeutic exercise in COPD self-management: a randomised controlled trial. Respir Med 2011;**105**:418-426.

S21 Egan C, Deering BM, Blake C, et al. Short term and long term effects of pulmonary rehabilitation on physical activity in COPD. Respir Med 2012;**106**:1671-1679.

S22 Eisner MD, Iribarren C, Yelin EH, et al. Pulmonary function and the risk of functional limitation in chronic obstructive pulmonary disease. Am J Epidemiol 2008;**167**:1090-1101.

S23 Eliason G, Zakrisson AB, Piehl-Aulin K, et al. Physical activity patterns in patients in different stages of chronic obstructive pulmonary disease. COPD 2011;**8**:369-374.

S24 Esteban C, Quintana JM, Aburto M, et al. A simple score for assessing stable chronic obstructive pulmonary disease. Q J Med 2006;**99**:751-759.

S25 Esteban C, Quintana JM, Aburto M, et al. Impact of changes in physical activity on health-related quality of life among patients with COPD. Eur Respir J 2010;**36**:292-300.

S26 Esteban C, Quintana JM, Aburto M, et al. The health, activity, dyspnea, obstruction, age, and hospitalization: prognostic score for stable COPD patients. Respir Med 2011;**105**:1662-1670.

S27 Faager G and Larsen FF Performance changes for patients with chronic obstructive pulmonary disease on long-term oxygen therapy after physiotherapy. J Rehabil Med 2004;**36**:153-158.

S28 Faulkner J, Walshaw E, Campbell J, et al. The feasibility of recruiting patients with early COPD to a pilot trial assessing the effects of a physical activity intervention. Prim Care Respir J 2010;**19**:124-130.

S29 Garcia-Aymerich J, Farrero E, Felez MA, et al. Risk factors of readmission to hospital for a COPD exacerbation: a prospective study. Thorax 2003;**58**:100-105.

S30 Garcia-Aymerich J, Felez MA, Escarrabill J, et al. Physical activity and its determinants in severe chronic obstructive pulmonary disease. Med Sci Sports Exerc 2004;**36**:1667-1673.

S31 Garcia-Aymerich J, Lange P, Benet M, et al. Regular physical activity reduces hospital admission and mortality in chronic obstructive pulmonary disease: a population based cohort study. Thorax 2006;**61**:772-778.

S32 Garcia-Aymerich J, Lange P, Serra I, et al. Time-dependent confounding in the study of the effects of regular physical activity in chronic obstructive pulmonary disease: an application of the marginal structural model. Ann Epidemiol 2008;**18**:775-783.

S33 Garcia-Aymerich J, Serra I, Gomez FP, et al. Physical activity and clinical and functional status in COPD. Chest 2009;**136**:62-70.

S34 Garcia-Rio F, Lores V, Mediano O, et al. Daily physical activity in patients with chronic obstructive pulmonary disease is mainly associated with dynamic hyperinflation. Am J Respir Crit Care Med 2009;**180**:506-512.

S35 Garcia-Rio F, Rojo B, Casitas R, et al. Prognostic value of the objective measurement of daily physical activity in patients with COPD. Chest 2012;**142**:338-346.

S36 Goto Y, Kurosawa H, Mori N, et al. Improved activities of daily living, psychological state and health-related quality of life for 12 months following lung volume reduction surgery in patients with severe emphysema. Respirology 2004;**9**:337-344.

S37 Hartman JE, Boezen HM, de Greef MH, et al. Physical and psychosocial factors associated with physical activity in patients with chronic obstructive pulmonary disease. Arch Phys Med Rehabil 2013;**94**:2396-2402.

S38 Hataji O, Naito M, Ito K, et al. Indacaterol improves daily physical activity in patients with chronic obstructive pulmonary disease. Int J Chron Obstruct Pulmon Dis 2013;**8**:1-5.

S39 Inal-Ince D, Savci S, Coplu L, et al. Factors determining self-efficacy in chronic obstructive pulmonary disease. Saudi Med J 2005;**26**:542-547.

S40 Jehn M, Schindler C, Meyer A, et al. Daily Walking Intensity as a Predictor of Quality of Life in Patients with Chronic Obstructive Pulmonary Disease. Med Sci Sports Exerc 2012;**44**:1212-1218.

S41 Katajisto M, Kupiainen H, Rantanen P, et al. Physical inactivity in COPD and increased patient perception of dyspnea. Int J Chron Obstruct Pulmon Dis 2012;**7**:743-755.

S42 Lahaije AJ, van Helvoort HA, Dekhuijzen PN, et al. Resting and ADL-induced dynamic hyperinflation explain physical inactivity in COPD better than FEV1. Respir Med 2013;**107**:834-840.

S43 Lee H, Kim I, Lim Y, et al. Depression and sleep disturbance in patients with chronic obstructive pulmonary disease. Geriatr Nurs 2011;**32**:408-417.

S44 Lemmens KMM, Nieboer AP, Huijsman R Designing patient-related interventions in COPD care: empirical test of a theoretical model. Patient Educ Couns 2008;**72**:223-231.

S45 Lores V, Garcia-Rio F, Rojo B, et al. Recording the daily physical activity of COPD patients with an accelerometer: An analysis of agreement and repeatability. Arch Bronconeumol 2006;**42**:627-632.

S46 Mador MJ, Patel AN, Nadler J Effects of pulmonary rehabilitation on activity levels in patients with chronic obstructive pulmonary disease. J Cardiopulm Rehabil Prev 2011;**31**:52-59.

S47 Miravitlles M, Izquierdo I, Herrejon A, et al. COPD severity score as a predictor of failure in exacerbations of COPD. The ESFERA study. Respir Med 2011;**105**:740-747.

S48 Monteiro F, Camillo CA, Vitorasso R, et al. Obesity and physical activity in the daily life of patients with COPD. Lung 2012;**190**:403-410.

S49 Moy ML, Matthess K, Stolzmann K, et al. Free-living physical activity in COPD: assessment with accelerometer and activity checklist. J Rehabil Res Dev 2009;**46**:277-286.

S50 Moy ML, Teylan M, Weston NA, et al. Daily step count predicts acute exacerbations in a US cohort with COPD. PLoS One 2013;**8**:e60400.

S51 Nguyen HQ, Gill DP, Wolpin S, et al. Pilot study of a cell phone-based exercise persistence intervention post-rehabilitation for COPD. Int J Chron Obstruct Pulmon Dis 2009;**4**:301-313.

S52 Nguyen HQ, Fan VS, Herting J, et al. Patients With COPD With Higher Levels of Anxiety Are More Physically Active. Chest 2013;**144**:145-151.

S53 Nield M, Hoo GS, Roper J, et al. Usefulness of the human activity profile, a functional performance measure, in people with chronic obstructive pulmonary disease. J Cardiopulm Rehabil 2005;**25**:115-121.

S54 Okubadejo AA, O'Shea L, Jones PW, et al. Home assessment of activities of daily living in patients with severe chronic obstructive pulmonary disease on long-term oxygen therapy. Eur Respir J 1997;**10**:1572-1575.

S55 Palop Cervera M, Diego Damia A, Leon Fabregas M, et al. Precipitating factors of mortality in chronic obstructive pulmonary disease patients with frequent exacerbations. Rev Clinica Esp 2010;**210**:323-331.

S56 Pitta F, Troosters T, Probst VS, et al. Physical activity and hospitalization for exacerbation of COPD. Chest 2006;**129**:536-544.

S57 Pitta F, Troosters T, Probst VS, et al. Potential consequences for stable chronic obstructive pulmonary disease patients who do not get the recommended minimum daily amount of physical activity. J Bras Pneumol 2006;**32**:301-308.

S58 Pitta F, Takaki MY, Oliveira NH, et al. Relationship between pulmonary function and physical activity in daily life in patients with COPD. Respir Med 2008;**102**:1203-1207.

S59 Pitta F, Breyer MK, Hernandes NA, et al. Comparison of daily physical activity between COPD patients from Central Europe and South America. Respir Med 2009;**103**:421-426.

S60 Pomidori L, Contoli M, Mandolesi G, et al. A simple method for home exercise training in patients with chronic obstructive pulmonary disease: one-year study. J Cardiopulm Rehabil Prev 2012;**32**:53-57.

S61 Probst VS, Kovelis Dt, Hernandes NdA, et al. Effects of 2 Exercise Training Programs on Physical Activity in Daily Life in Patients With COPD. Respir Care 2011;**56**:1799-1807.

S62 Roig M, Eng JJ, MacIntyre DL, et al. Falls in people with chronic obstructive pulmonary disease: an observational cohort study. Respir Med 2011;**105**:461-469.

S63 Sandland CJ, Morgan MDL, Singh SJ Patterns of domestic activity and ambulatory oxygen usage in COPD. Chest 2008;**134**:753-760.

S64 Schou L, Ostergaard B, Rydahl-Hansen S, et al. A randomised trial of telemedicine-based treatment versus conventional hospitalisation in patients with severe COPD and exacerbation - effect on self-reported outcome. J Telemed Telecare 2013; *[Epub ahead of print]*

S65 Sewell L, Singh SJ, Williams JEA, et al. Can individualized rehabilitation improve functional independence in elderly patients with COPD? Chest 2005;**128**:1194-1200.

S66 Sewell L, Singh SJ, Williams JE, et al. Seasonal variations affect physical activity and pulmonary rehabilitation outcomes. J Cardiopulm Rehabil Prev 2010;**30**:329-333.

S67 Silva DR, Coelho AC, Dumke A, et al. Osteoporosis prevalence and associated factors in patients with COPD: a cross-sectional study. Respir Care 2011;**56**:961-968.

S68 Skumlien S, Haave E, Morland L, et al. Gender differences in the performance of activities of daily living among patients with chronic obstructive pulmonary disease. Chron Respir Dis 2006;**3**:141-148.

S69 Skumlien S, Aure Skogedal E, Skrede Ryg M, et al. Endurance or resistance training in primary care after in-patient rehabilitation for COPD? Respir Med 2008;**102**:422-429.

S70 Takigawa N, Tada A, Soda R, et al. Comprehensive pulmonary rehabilitation according to severity of COPD. Respir Med 2007;**101**:326-332.

S71 Troosters T, Sciurba F, Battaglia S, et al. Physical inactivity in patients with COPD, a controlled multi-center pilot-study. Respir Med 2010;**104**:1005-1011.

S72 Tsara V, Serasli E, Katsarou Z, et al. Quality of life and social-economic characteristics of greek male patients on long-term oxygen therapy. Respir Care 2008;**53**:1048-1053.

S73 van Gestel AJ, Kohler M, Steier J, et al. Cardiac autonomic function and cardiovascular response to exercise in patients with chronic obstructive pulmonary disease. COPD 2012;**9**:160-165.

S74 Van Remoortel H, Hornikx M, Demeyer H, et al. Daily physical activity in subjects with newly diagnosed COPD. Thorax 2013;**68**:962-963.

S75 Vergeret J, Brambilla C, Mounier L Portable oxygen therapy: use and benefit in hypoxaemic COPD patients on long-term oxygen therapy.[Erratum appears in Eur Respir J 1989 Mar;2(3):292]. Eur Respir J 1989;**2**:20-25.

S76 Waatevik M, Johannessen A, Hardie JA, et al. Different COPD disease characteristics are related to different outcomes in the 6-minute walk test. COPD 2012;**9**:227-234.

S77 Wakabayashi R, Motegi T, Yamada K, et al. Efficient integrated education for older patients with chronic obstructive pulmonary disease using the Lung Information Needs Questionnaire. Geriatr Gerontol Int 2011;**11**:422-430.

S78 Wakabayashi R, Motegi T, Yamada K, et al. Presence of in-home caregiver and health outcomes of older adults with chronic obstructive pulmonary disease. J Am Geriatr Soc 2011;**59**:44-49.

S79 Walker PP, Burnett A, Flavahan PW, et al. Lower limb activity and its determinants in COPD. Thorax 2008;**63**:683-689.

S80 Waschki B, Kirsten A, Holz O, et al. Physical activity is the strongest predictor of all-cause mortality in patients with COPD: a prospective cohort study. Chest 2011;**140**:331-342.

S81 Watz H, Waschki B, Boehme C, et al. Extrapulmonary effects of chronic obstructive pulmonary disease on physical activity: a cross-sectional study. Am J Respir Crit Care Med 2008;**177**:743-751.

S82 Watz H, Waschki B, Kirsten A, et al. The metabolic syndrome in patients with chronic bronchitis and COPD: frequency and associated consequences for systemic inflammation and physical inactivity. Chest 2009;**136**:1039-1046.

S83 Watz H, Waschki B, Meyer T, et al. Physical activity in patients with COPD. Eur Respir J 2009;**33**:262-272.

S84 Weekes CE, Emery PW, Elia M Dietary counselling and food fortification in stable COPD: a randomised trial. Thorax 2009;**64**:326-331.

S85 Wewel AR, Gellermann I, Schwertfeger I, et al. Intervention by phone calls raises domiciliary activity and exercise capacity in patients with severe COPD. Respir Med 2008;**102**:20-26.

S86 Yeo J, Karimova G, Bansal S Co-morbidity in older patients with COPD--its impact on health service utilisation and quality of life, a community study. Age Ageing 2006;**35**:33-37.

S87 Caspersen CJ, Powell KE, Christenson GM Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. Public Health Rep 1985;**100**:126-131.

S88 Guyatt GH, Oxman AD, Schunemann HJ, et al. GRADE guidelines: a new series of articles in the Journal of Clinical Epidemiology. J Clin Epidemiol 2011;**64**:380-382.

S89 Schunemann H, Hill S, Guyatt G, et al. The GRADE approach and Bradford Hill's criteria for causation. J Epidemiol Community Health 2011;**65**:392-395.