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ORIGINAL RESEARCH

Discriminant Validity of a Single Clinical Question for the Screening of Inactivity in Individuals Living with COPD

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Introduction: Quantifying physical activity in chronic obstructive pulmonary disease (COPD) with questionnaires and activity monitors in clinical practice is challenging. The aim of the present study was to analyse the discriminant validity of a single clinical question for the screening of inactive individuals living with COPD.

Methods: A multicentre study was carried out in stable COPD individuals both in primary and tertiary care. Patients wore the *Dynaport* accelerometer for 8 days and then answered 5 physical activity questions developed for the study, referring to the week in which their physical activity was monitored. Receiver operating characteristic (ROC) curve analysis with physical activity level (PAL) as the gold standard reference was used to determine the best cut-off point for each of the 5 clinical physical activity questions tested.

Results: A total of 86 COPD participants were analysed (males 68.6%; mean (SD) age 66.6 (8.5) years; FEV_1 50.9 (17.3)% predicted; mean of 7305 (3906) steps/day). Forty-two (48.8%) participants were considered physically inactive (PAL ≤1.69). Answers to 4 out of 5 questions significantly differed in active vs inactive patients. The Kappa index and ROC curves showed that the answer to the question "On average, how many minutes per day do you walk briskly?" had the best discriminative capacity for inactivity, with an area under the curve (AUC) (95% Confidence interval (CI)) of 0.73 (0.63–0.84) and 30 min/day was identified as the best cut-off value (sensitivity (95% CI): 0.75 (0.60–0.87); specificity: 0.76 (0.61–0.88)).

Conclusion: The present results indicate that self-reported brisk walk time lower than 30 min/day may be a valid tool for the screening of inactivity in individuals living with COPD in routine care, if more detailed physical activity measures are not feasible.

Keywords: chronic obstructive pulmonary disease, physical activity, outcome assessment, validation studies

Introduction

Chronic and progressive dyspnoea is the most characteristic symptom of chronic obstructive pulmonary disease (COPD), which, in turns, reduces patient's physical activity.[1] Additionally, the reduction in physical activity leads to physical deconditioning and further impairment of respiratory symptoms. This configures a vicious circle of dyspnoea-inactivity that helps to explain the natural history of COPD.[2]

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Reduced physical activity is observed early in the course of the disease[3] and is a strong predictor of exacerbation,[4] hospital admission[5,6] and mortality.[7,8] Thus, physical inactivity has recently emerged as an important therapeutic target in COPD.

For all these reasons, the assessment of physical activity in people living with COPD has gained interest in recent years, and the body of literature has grown considerably.[9] In fact, as there are many methods and choices available to measure physical activity, selecting a physical activity assessment method can be a challenging proposition.[10] In this sense, although activity monitors and hybrid instruments are among the most valid tools to assess physical activity in COPD,[11,12] they are impractical/not feasible in routine care due to costs and practical constraints associated with these devices.[13] Conversely, questionnaire-based assessments of physical activity are frequently used in research settings due to their simplicity, high patient acceptance and low cost.[14] However, they are still time-consuming and difficult to implement routinely in clinical practice.[15,16]

As an alternative, clinicians often ask their patients a single clinical question, such as "On average, how many minutes a day do you engage in moderate to strenuous exercise?", in order to have an approximation of how active their COPD patients are.[17] Indeed, single-item measures of physical activity have been developed for various populations in the past[18–22] and in most cases, this single item refers to the time spent in moderate-to-vigorous physical activity during the last week. Interestingly, it has been observed that such a measure might not be suitable for all populations, especially for older adults due to their difficulty in judging the intensity of different activities.[23,24] Therefore, the present study was aimed at analysing the discriminant validity of five single clinical questions to assess inactivity in COPD. Such a simple tool would help healthcare professionals to identify insufficiently active COPD individuals and prioritise them for physical activity promotion interventions in settings where time and resources for more comprehensive physical activity assessment are limited.

Methods

Design and Participants

This was an observational, prospective, multicentre study aimed at identifying and validating a single question that could be used for the screening of inactive individuals living with COPD. We included consecutive patients older than 40 years with a confirmed COPD diagnosis at least 6 months prior to study enrolment, defined as post-bronchodilator forced expiratory volume in 1 second/forced vital capacity (FEV_1/FVC) <0.7,[1] cigarette smoking history of at least 10 pack-years, and a stable medical condition for more than one month before study participation. Exclusion criteria were the presence of a respiratory medical condition other than COPD, serious cardiovascular or neurological diseases, disabling cognitive problems and other pathologic conditions that could affect physical activity, and the inability to understand study questionnaires.

Patients were recruited from 10 Spanish clinical centres, comprising primary and tertiary care, to ensure geographical representation and a wide range of disease severity. The study was conducted according to the principles of the Declaration of Helsinki, the study was approved by the following Clinical Research Ethics Committees: Hospital Universitari Vall d´Hebron/Vall d'Hebron Institut de Recerca (VHIR), Barcelona, Spain (number 155–2018), Hospital Galdakao, Galdakao, Bizkaia, Spain (number PI2018062), Hospital CH de Navarra, Pamplona, Spain (number 155–2018), Hospital Urduliz, Urduliz, Bizkaia, Spain (number PI2018062), Hospital de Cruces, Bilbao, Spain (number PI2018062), Hospital Universitario Central de Asturias, Oviedo, Spain (number 44/18), Hospital Arnau de Vilanova-Lliria, Valencia, Spain (number ACTA 04/2018), Hospital Universitario Virgen del Rocío, Sevilla, Spain (number 155–2018), Hospital Universitario La Paz-IdiPAZ, Madrid, Spain (number PI3342), and written informed consent was obtained from all participants.

Measurements

The study was organised in 2 visits. In visit 1, the candidates signed the informed consent form, the inclusion and exclusion criteria were verified, and an accelerometer was delivered to study participants with instructions of use to objectively measure their physical activity over the next week.

Physical activity was objectively measured with the *Dynaport* accelerometer (McRoberts BV, The Hague, The Netherlands) which has previously been validated in COPD.[25,26] Subjects were asked to wear the device, placed on the centre of the lower back with an elastic strap, 24 hours per day (with the exception of time spent on personal hygiene) for an 8-day period. A valid physical activity measurement was defined as a minimum of 4 days with at least 8 hours of recording time during waking hours.[27]

Visit 2 was scheduled one week later, during which the participants returned the accelerometer and underwent the rest of the study assessments.

Subjects answered five physical activity questions, referring to the previous week in which their physical activity was monitored with the accelerometer. For the development of the five questions, the steering committee adapted the previous question used in COPD by Moy et al[17] and four other variants were added according to their clinical experience: i) On average, how many minutes per day do you walk?; ii) On average, how many minutes per day do you walk briskly?; iii) On average, how many minutes per day do you walk outside?; iv) On average, how many minutes per day do you engage in physical activity?; and v) On average, how many minutes per day do you engage in moderate to vigorous physical activity (such as brisk walking, cycling, swimming, dancing, etc.)? Patients also answered the questions of the clinical visit-PROactive Physical Activity instrument and the total score (0 to 100, with higher numbers indicating a better condition) was calculated.[12]

During visit 2, the investigators also collected information on socio-demographic data, smoking history, respiratory symptoms (modified Medical Research Council (mMRC) scale[28] and the COPD assessment test (CAT)[29]), body mass index (BMI) and comorbidities according to the Charlson index.[30] Post-bronchodilator spirometry was performed according to ERS/ATS guidelines[31] and Global Lung Function Initiative (GLI) equations were used as reference values.[32] Exercise capacity was assessed using the 6-min walking distance (6MWD) following published recommendations.[33] The Body mass index, airflow Obstruction, Dyspnoea and Exacerbations (BODE index) was calculated.[34]

Analysis

Since prior information about subject distribution according to the answers to the clinical questions was not available, the sample size estimation was based on the relationship between the response to the clinical questions and the physical activity level measured by the accelerometer. To obtain correlation coefficients greater than or equal to 0.3[35] and accepting an alpha risk of 0.05 and a beta risk of 0.2 in a two-sided contrast, 95 subjects were necessary with an anticipated drop-out rate of 10%. This sample size was rounded up to 100 for convenience.

The results are expressed as absolute numbers and their corresponding percentages for qualitative variables, as mean and standard deviation (SD) for quantitative variables with a normal distribution and as the median and 25th to 75th percentiles for quantitative variables with a non-normal distribution. No imputation of missing data or adjustment for multiplicity was performed.

The physical activity level (PAL; total energy expenditure divided by resting energy expenditure) was used to categorize patients as inactive (PAL $\leq$1.69) and at least moderately active (PAL > 1.70).[3,36] Comparisons between groups were performed using the chi-squared with the Fisher's exact test, Student's t or Wilcoxon test, as appropriate. The relationship between quantitative variables was assessed by the Pearson correlation coefficient, whereas their reliability was analysed by intraclass correlation coefficients (ICC). Receiver operating characteristic (ROC) curve analysis with PAL as the gold standard reference was used to determine the best cut-off point for each of the 5 clinical physical activity question tested. Cut-off points were chosen to maximise the sum of sensitivity and specificity. The area under the curve (AUC) was calculated, and sensitivity, specificity, and positive and negative predictive values with their 95% confidence intervals (CI) were also analysed. Also, the agreement between the binary ratings across the two instruments (accelerometer and clinical question) was evaluated by the Kappa index and values between 0.41 and 0.60 that indicates moderate agreement,[37,38] were deemed acceptable. Further, comparison of the AUC to discriminate inactivity was also analysed using the combination of the five different questions and taking the one with best statistical performance as reference. The equality of AUCs was assessed by the DeLong et al method.[39]

Finally, to evaluate the association between socio-demographic, clinical and functional variables with inactivity (according to the selected cut-off point), stepwise multivariate logistic regression modelling was performed with the best physical activity question to detect inactivity as a dependent variable.

All statistical analyses were performed using the SAS© system for Windows version 9.4; a p value <0.05 was considered statistically significant.

Results

Participants Characteristics and Objective Measurement of Physical Activity

A total of 101 subjects were screened, of whom 15 (15%) were excluded (8 patients had no valid accelerometer data, 5 patients did not answer the physical activity questionnaires and 2 did not meet COPD spirometry criteria).

The socio-demographic, clinical, functional, and physical activity characteristics of the 86 study participants are shown in Table 1. Most of the subjects were male (68.6%) with a mean (SD) age of 66.6 (8.5) years. Overall, 42 (48.8%) showed a dyspnoea score of grade 2 or higher, a mean (SD) FEV_1 of 50.9 (17.3)% predicted, and a 6MWD of 447.0 (107.6) metres. According to accelerometer data, patients walked a mean of 7305 (3906) steps/day, during 82.8 (37.8) min/day and they engaged a mean of 36.7 (31.3) min/day in physical activities of at least moderate intensity (>3 METs).

Table 1 Socio-Demographic, Clinical and Functional Characteristics of the Study Participants

	All Patients n = 86
Socio-demographic, clinical and functional parameters	
Males, n (%)	59 (68.6)
Age (years)	66.6 (8.5)
Active workers, n (%)	16 (18.5)
Living alone, n (%)	13 (15.1)
At least secondary studies, n (%)	45 (52.3)
Current smokers, n (%)	13 (15.1)
Smoking (pack-years)	46.9 (22.9)
Years from COPD diagnosis	5.3 (3.8–9.9)
Charlson index of comorbidity	4 (3–6)
mMRC dyspnoea score ≥2, n (%)	42 (48.8)
CAT total score	13 (7–18)
BODE index	2 (1–3)
Body mass index (kg/m^2)	27.0 (4.8)
Postbronchodilator FEV_1 (% pred)	50.9 (17.3)
Postbronchodilator FVC (% pred)	84.8 (22.1)
Postbronchodilator FEV_1/FVC (%)	48.4 (16.5)
6-min walking distance (meters)	447.0 (107.6)
Long term oxygen therapy, n (%)	8 (9.3)
Pulmonary rehabilitation, n (%)	4 (4.7)
COPD exacerbation in the previous year, n (%)	39 (45.3)
Physical activity parameters	
Walking time (minutes per day)	82.8 (37.8)
Steps/day	7305 (3906)
Physical activity level	1.75 (0.18)
Minutes in at least moderate PA (>3MET)	36.7 (31.3)
PROactive clinical visit (Total score)	40.8 (8.7)

Note: Data are presented as n (%), mean (SD) or median (P_{25}-P_{75}).
Abbreviations: BODE, BMI, obstruction, dyspnoea, exercise capacity; CAT, COPD assessment test; FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity; mMRC, modified Medical Research Council dyspnoea scale; METs, metabolic equivalent; PAL, physical activity level; PA, physical activity.

The mean PAL was 1.75 (0.18) and 42 (48.8%) patients were considered physically inactive (PAL ≤1.69). Participants wore the device 22.5 h/day on average during at least 6 days.

Physical Activity Measured by the Five Clinical Questions and Relationship with Objective Measurements

Participants reported i) walking on average a median (p25–75) of 112.5 (60.0–180.0) min/day; ii) walking briskly 27.5 (5.0–60.0) min/day; iii) walking outside 60.0 (30.0–120.0) min/day; iv) engaging in physical activity 65.0 (30.0–120.0) min/day; and v) performing moderate to vigorous physical activity 22.5 (0.0–60.0) min/day.

Except in the case of the question "On average, how many minutes a day do you walk outdoors?", the answers to the remaining clinical questions showed a significant relationship with the PAL (Table 2), albeit of weak-moderate intensity. Similarly, the ICC showed poor validity between the responses and the PAL measured by the accelerometer (ICC <0.5, in all cases) (Table 2). However, in the bivariate analysis, comparison of the answers to the five physical activity questions among active and inactive patients according to PAL showed that in 4 out of 5 questions the median self-reported min/day of physical activity significantly differed between groups (Figure 1).

Selection of the Best Clinical Question to Identify Inactive Patients

We then explored the discriminative capacity of the five physical activity questions and selected the cut-off point with the best sensitivity and specificity for inactivity in each case. The Kappa index and ROC curves showed that self-reported brisk walk time had the best discriminative capacity (Table 3), with an AUC (95% CI) of 0.73 (0.63–0.84). The best cut-off value was 30 min/day, with a sensitivity (95% CI) of 0.75 (0.60–0.87), a specificity of 0.76 (0.61–0.88), a positive predictive value of 0.77 (0.61–0.88), and a negative predictive value of 0.74 (0.59–0.87). It was also found that the combination of different clinical questions did not significantly increase the AUC of the self-reported brisk walk time (Table 4).

Characteristics of Active and Inactive Patients According to the Time of Briskly Walking. Multivariate Analysis

Table 5 shows the comparison of socio-demographic, clinical, functional, and physical activity variables between patients who reported walking briskly for more than 30 minutes a day and those who did not. All objective physical activity parameters and the PROactive total score were higher in the first subgroup. Moreover, patients that reported walking briskly less than 30 min/day were more prone to being current smokers (23.3 vs 6.7%, p = 0.035), having a worse dyspnoea score (mMRC ≥2) (62.8 vs 34.9%, p = 0.010) and CAT score (CAT ≥10) (81.4 vs 55.8%, p = 0.011), and presenting a lower 6MWD (426 vs 467 m, p=0.043) than those reporting higher daily brisk walking times.

Table 2 Relationship and Intraclass Correlation Among the Values of the Five Physical Activity Questions Tested and the Physical Activity Level (PAL)

	Correlation	Analysis	ICC (95% CI)
	r	p-value	
On average, how many minutes per day do you walk?	0.230	0.033	0.314
On average, how many minutes per day do you walk briskly?	0.405	<0.001	0.292
On average, how many minutes per day do you walk outside?	0.176	0.105	0.289
On average, how many minutes per day do you engage in physical activity?	0.228	0.035	0.248
On average, how many minutes per day do you engage in moderate to vigorous physical activity (such as brisk walking, cycling, swimming, dancing, etc.)?	0.295	0.006	0.211

Abbreviations: 95% CI, 95% confidence interval; ICC, intraclass correlation coefficient; r, Pearson correlation coefficient.

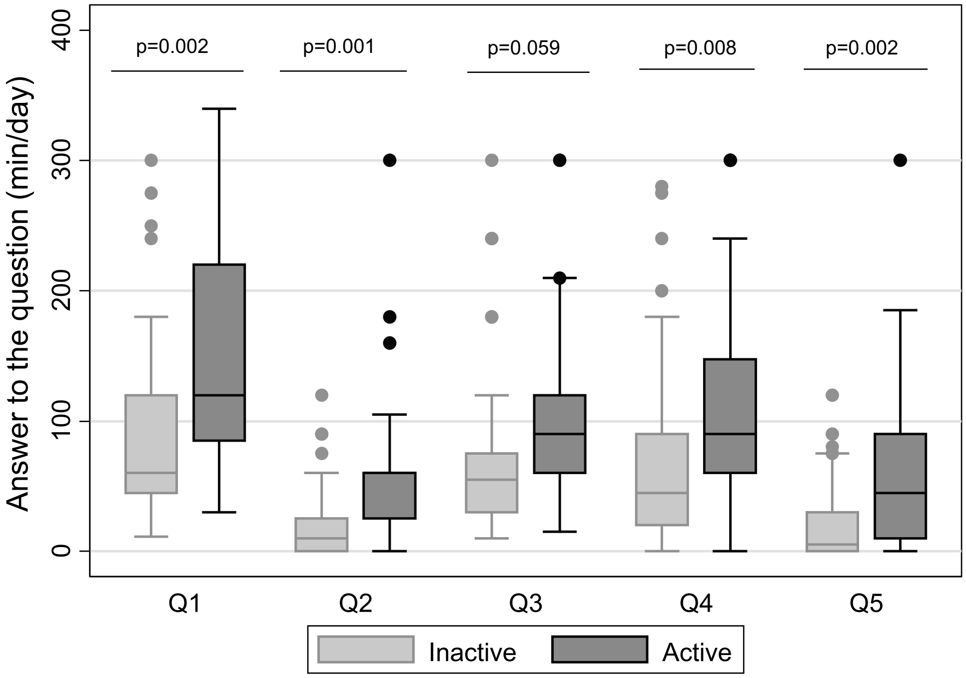

Figure 1 Answer to the five physical activity questions among active and inactive patients according to the physical activity level (PAL).
Notes: Q1. On average, how many minutes per day do you walk? Q2. On average, how many minutes per day do you walk briskly? Q3. On average, how many minutes per day do you walk outside? Q4. On average, how many minutes per day do you engage in physical activity? Q5. On average, how many minutes per day do you engage in moderate to vigorous physical activity (such as brisk walking, cycling, swimming, dancing, etc.)?

A forward stepwise multiple logistic regression model was built with socio-demographic, clinical and functional variables that were significant at a p-value of <0.1 on bivariate analysis. A self-reported daily brisk walking time of less than 30 minutes was independently associated with current smoking status, mMRC ≥2 and CAT ≥10 (Table 6).

Discussion

The present study evaluated the discriminant validity of a single clinical question to screen inactive COPD subjects by comparing self-reported physical activity information to 5 clinical questions with objective physical activity data gathered with the *Dynaport* accelerometer. We found that 1) the response to the clinical question "On average, how many minutes per day do you walk briskly?" had the best discriminative capacity for inactivity using PAL as the gold standard; 2) the best cut-off value was 30 min/day of self-reported daily brisk walking time; and 3) this cut-off point was able to detect statistically significant differences in all accelerometer parameters and the PROactive physical activity hybrid tool, as well as relevant clinical and functional variables. Based on these results, this single clinical question was found to have the potential to identify inactive people living with COPD in clinical settings in which lack of time is one of the major problems for the routine assessment of physical activity.

Although previous studies have analysed the relationship between the response to a single physical activity question and sociodemographic, clinical, and functional variables in COPD,[40,41] the present study is, to our knowledge, the first to examine the discriminant validity for inactivity of such a tool. While it is unlikely for the single question "On average, how many minutes per day do you walk briskly?" to be an accurate measure of physical activity, as shown by the low to moderate correlations obtained, our study highlights its usefulness to stratify individuals living with COPD according to their level of physical activity. Notwithstanding, the magnitude of the correlations observed between the five physical activity questions and the PAL is mainly explained by the fact that each of the questions collects specific physical activity information, while PAL is calculated based on all the activities a person performs over a long period of time, which may include activities of both very low and very high intensity. In addition, it is important to note that the correlation coefficient obtained between the self-reported daily brisk walking time and the PAL in our study was in line with data

Table 3 Validity Parameters for Each of the Five Physical Activity Questions Tested

	AUC (95% CI)	Cut-Off Point	Sensitivity (95% CI)	Specificity (95% CI)	Positive Predictive Value (95% CI)	Negative Predictive Value (95% CI)	Kappa Index (95% CI)
On average, how many minutes per day do you walk?	0.71 (0.60–0.82)	80 min	0.80 (0.65–0.90)	0.55 (0.39–0.70)	0.65 (0.51–0.77)	0.72 (0.53–0.86)	0.35 (0.15–0.54)
On average, how many minutes per day do you walk briskly?	0.73 (0.63–0.84)	30 min	0.75 (0.60–0.87)	0.76 (0.61–0.88)	0.77 (0.61–0.88)	0.74 (0.59–0.87)	0.51 (0.33–0.69)
On average, how many minutes per day do you walk outside?	0.69 (0.57–0.80)	90 min	0.46 (0.30–0.61)	0.81 (0.66–0.91)	0.71 (0.51–0.87)	0.59 (0.45–0.71)	0.26 (0.07–0.45)
On average, how many minutes per day do you engage in physical activity?	0.71 (0.59–0.82)	60 min	0.82 (0.67–0.92)	0.55 (0.39–0.70)	0.66 (0.51–0.78)	0.74 (0.55–0.88)	0.37 (0.18–0.56)
On average, how many minutes per day do you engage in moderate to vigorous physical activity (such as brisk walking, cycling, swimming, dancing, etc.)?	0.71 (0.60–0.82)	35 min	0.57 (0.41–0.72)	0.81 (0.66–0.91)	0.76 (0.58–0.89)	0.64 (0.50–0.77)	0.38 (0.19–0.56)

Abbreviations: 95% CI, 95% confidence interval; AUC, area under the curve.

Table 4 Comparison of the Areas Under Curve (AUC) to Discriminate Inactive Subjects According to Question 2 with Respect to Several Combinations of the Clinical Questions

Clinical Questions	AUC Increase (95% CI)	p value
Q2+Q1	0.051 (−0.013–0.114)	0.119
Q2+Q3	0.011 (−0.018–0.040)	0.440
Q2+Q4	0.057 (−0.014–0.128)	0.119
Q2+Q5	0.011 (−0.017–0.039)	0.449
Q2+Q4+Q1	0.063 (−0.011–0.137)	0.095
Q2+Q4+Q3	0.056 (−0.015–0.127)	0.124
Q2+Q4+Q5	0.051 (−0.017–0.118)	0.140
Q2+Q4+Q1+Q3	0.074 (−0.001–0.149)	0.052
Q2+Q4+Q1+Q5	0.059 (−0.014–0.132)	0.114
Q2+Q4+Q1+Q3+Q5	0.068 (−0.003–0.139)	0.059

Notes: Q1. On average, how many minutes per day do you walk? Q2. On average, how many minutes per day do you walk briskly? Q3. On average, how many minutes per day do you walk outside? Q4. On average, how many minutes per day do you engage in physical activity? Q5. On average, how many minutes per day do you engage in moderate to vigorous physical activity (such as brisk walking, cycling, swimming, dancing, etc.)?
Abbreviations: AUC, area under curve; 95% CI, 95% confidence interval.

Table 5 Relationship Between Socio-Demographic, Clinical, Functional, and Physical Activity Parameters and the Answer to the Best Physical Activity Question to Detect Inactivity (Less Than 30 Min vs 30 Min or More of Self-Reported Daily Brisk Walking)

	<30 Min n = 43	≥30 Min n = 43	p-value
Socio-demographic, clinical and functional parameters			
Males, n (%)	28 (65.1)	31 (72.1)	0.486
Age (years)	68.0 (1.2)	65.1 (1.3)	0.127
Active workers, n (%)	6 (14.0)	10 (26.3)	0.268
Living alone, n (%)	8 (18.6)	5 (11.6)	0.366
At least secondary studies, n (%)	19 (44.2)	26 (60.5)	0.131
Current smokers, n (%)	10 (23.3)	2 (6.7)	0.035
Charlson index of comorbidity	5 (3–6)	4 (3–6)	0.520
mMRC dyspnoea score ≥2, n (%)	27 (62.8)	15 (34.9)	0.010
CAT total score ≥10, n (%)	35 (81.4)	24 (55.8)	0.011
BODE index	2 (1–4)	2 (1–3)	0.157
Body mass index (kg/m^2)	27.0 (5.5)	26.9 (4.0)	0.928
Postbronchodilator FEV_1 (% pred)	50.5 (2.9)	51.4 (2.4)	0.821
6-min walking distance (meters)	426 (88)	467 (121)	0.043
Long term oxygen therapy, n (%)	6 (13.9)	2 (4.7)	0.138
Any COPD exacerbation in previous year, n (%)	21 (48.8)	18 (41.9)	0.516
Physical activity parameters			
Walking time (minutes)	70.7 (29.4)	94.9 (41.6)	0.002
Steps/day	6063 (2781)	8547 (4469)	0.003
Physical activity level	1.65 (0.11)	1.85 (0.18)	<0.001
Time in at least moderate PA (min)	23.2 (20.9)	50.2 (34.2)	<0.001
Proactive clinical visit (Total score)	38.9 (7.7)	42.7 (9.3)	0.048

Note: Data are presented as n (%), mean (SD) or median (P_{25}-P_{75}).
Abbreviations: BODE, BMI, obstruction, dyspnoea, exercise capacity; CAT, COPD assessment test; FEV_1, forced expiratory volume in 1 second; mMRC: modified Medical Research Council dyspnoea scale; PA, physical activity.

Table 6 Multivariate Logistic Regression Analysis with Self-Reported Daily Brisk Walking Time Lower Than 30 Minutes as a Dependent Outcome Variable

	OR (95% CI)	p-value
Current smoker	10.45 (1.94–56.30)	0.006
mMRC ≥2	2.93 (1.09–7.86)	0.033
CAT ≥10	4.64 (1.36–15.79)	0.014

Abbreviations: 95% CI, 95% confidence interval; CAT, COPD assessment test; mMRC, modified Medical Research Council dyspnoea scale; OR, odds ratio.

reported in previous studies analysing the validity of physical activity questionnaires against different objective physical activity parameters (ICCs 0.30–0.40).[42–44]

There are several factors that demonstrate the consistency of the identified cut-off point for the clinical physical activity question evaluated. First, for the identification of inactivity, we used accepted PAL categories,[3,36] and values of self-reported daily brisk walking time of less than 30 minutes proved to be useful for identifying this situation. Also, the cut-point of 30 minutes of self-reported daily brisk walking had the potential to differentiate all accelerometer parameters tested and the PROactive total score. Furthermore, the factors independently associated with inactivity in our study (current smoking status, mMRC ≥2 and CAT ≥10) were consistent with those previously reported using objective physical activity data. In this sense, lower physical activity has been observed in smokers compared with matched non-smokers without a spirometric diagnosis of airflow limitation.[45] Further, in a cluster analysis of COPD patients, a higher prevalence of active smokers was observed in the subgroup of patients with reduced physical activity.[46] Active smoking in COPD probably reflects not only a lifestyle but also an attitude towards the disease that can negatively interfere with engagement in physical activities. The relationship between dyspnoea and inactivity has long been reported in COPD using objective physical activity measures.[3,47] Moreover, a recent study analysing physical activity progression over time identified that a higher mMRC dyspnoea score was independently related to an inactive pattern.[48] These observations are most likely due to the respiratory mechanical constraints resulting from the development of dynamic hyperinflation.[49,50] Finally, regarding the independent association between the CAT score and inactivity observed in our study, quality of life was consistently related to physical activity in a former systematic review analysing the determinants and outcomes of physical activity in COPD.[46] Indeed, quality of life may be seen as a consequence and not a determinant of physical activity, as longitudinal studies have demonstrated that an increment of physical activity contributes to an improvement in quality of life.[51]

Physical activity has emerged as a modifiable behaviour that is significantly associated with COPD outcomes.[4–6,8] Therefore, national and international guidelines on the management of COPD recommend the assessment and promotion of physical activity in these patients.[1,52] However, the implementation of such recommendations is mostly precluded by the difficulty of measuring physical activity using validated activity monitors and questionnaires in clinical practice. As an alternative, we propose the use of a single clinical question for the screening of inactive COPD patients. Gathering such information is inexpensive and not time-consuming compared to previous physical activity questionnaires validated in COPD. Indeed, up to 20 minutes are needed to administer the Yale Physical Activity Survey (YPAS),[43] 15 minutes for the Stanford Seven-Day Physical Activity Recall questionnaire[44] and 5 minutes in the best of the scenarios for the case of the Spanish Physical Activity Questionnaire in COPD (SAQ-COPD).[53] Moreover, in addition to the administration time one should consider the time for scoring the data derived from the questionnaire that is very variable and, in some cases, may even require the need for an application. Thus, the use of our single clinical question would be easier to implement in clinical practice and could contribute to the early detection and treatment of inactivity in COPD.

The strengths of our study include a wide sample of individuals living with COPD, followed both in primary care and hospital settings. The use of an objective physical activity measure over a long period of time, the *Dynaport* accelerometer, as the gold standard is another strength of the present study. Among potential limitations, first, the results of our study should be extrapolated with caution to different populations or COPD subjects with other severity distribution, since not only the selected clinical questions but also the cut-off point identified might be influenced by the physical activity pattern observed in our COPD sample. Second, we acknowledge that the present study does not evaluate reliability and responsiveness; however, we only intended to explore the usefulness of such a clinical question for the screening of physical inactivity in routine practice. In any case, simple questionnaires generally show the highest coefficients of reliability, as subjects may become bored and confused when long questionnaires are used.[54] Further studies are needed to fully analyse the psychometric properties of this simple physical activity tool.

Conclusions

In conclusion, the response to the clinical question "On average, how many minutes per day do you walk briskly?" provides an estimation of physical activity, which, when stratified according to the cut-off point of 30 min, has a reasonably good sensitivity and specificity for identifying active and inactive individuals living with COPD according to data from a validated activity monitor. Although self-reported brisk walking time is unlikely to usefully measure physical activity on an individual basis, it may be a useful tool for the stratification of COPD individuals according to their level of physical activity, particularly when device-based measures or longer self-report measures are not feasible.

Abbreviations

ATS, American Thoracic Society; AUC, Area under the curve; BMI, Body mass index; BODE, Body mass index, obstruction, dyspnoea and exercise index; CAT, COPD assessment test; CI, Confidence interval; COPD, Chronic obstructive pulmonary disease; ERS, European Respiratory Society; FEV_1, Forced expiratory volume in one second; FVC, Forced vital capacity; GLI, Global lung function initiative; HADs, Hospital anxiety and depression scale; ICC, Intraclass correlation coefficient; MET, Metabolic equivalents; mMRC, Modified Medical Research Council; PAL, Physical activity level; ROC, Receiver operating characteristic; SD, Standard deviation; 6MWD, 6-min walking distance.

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