

## Daily physical activity in subjects with newly diagnosed COPD

**Rationale** Information about daily physical activity levels (PAL) in subjects with undiagnosed chronic obstructive pulmonary disease (COPD) is scarce. This study aims to assess PA and to investigate the associations between PA and clinical characteristics in subjects with newly diagnosed COPD.

**Methods** Fifty-nine subjects with a new spirometry-based diagnosis of mild ( $n=38$ ) and moderate ( $n=21$ ) COPD ( $63\pm 6$  years, 68% male) were matched with 65 smoking controls ( $62\pm 7$  years, 75% male). PA (daily steps, time spent in moderate-to-vigorous intense physical activities (MVPA) and PAL) was measured by accelerometry. Dyspnoea, complete pulmonary function tests, peripheral muscle strength and exercise capacity served as clinical characteristics.

**Results** PA was significantly lower in COPD versus smoking controls ( $7986\pm 2648$  vs  $9765\pm 3078$  steps,  $64$  (27–120) vs  $110$  (55–164) min of MVPA,  $1.49\pm 0.21$  vs  $1.62\pm 0.24$  PAL respectively, all  $p<0.05$ ). Subjects with COPD with either mild symptoms of dyspnoea (mMRC 1), those with lower diffusion capacity ( $T_{L,CO}$ ), low 6 min walking distance (6MWD) or low maximal oxygen uptake ( $VO_2$  peak) had significantly lower PA. Multiple regression analysis identified 6 MWD and  $T_{L,CO}$  as independent predictors of PA in COPD.

**Conclusions** The reduction in PA starts early in the disease, even when subjects are not yet diagnosed with COPD. Inactivity is more pronounced in subjects with mild symptoms of dyspnoea, lower levels of diffusion capacity and exercise capacity.

The detection of an inactive lifestyle in patients with chronic obstructive pulmonary disease (COPD) is increasingly important since inactivity predicts prognosis in COPD<sup>1</sup> and may even impact on the rate of lung function decline.<sup>2</sup> Data on daily physical activity levels (PAL) are lacking regarding patients unaware of their disease in whom the diagnosis of COPD is based on spirometry screening (preclinical stage). We aimed to objectively investigate daily PALs and to investigate the association between physical activity and different clinical characteristics in subjects with newly spirometry-based diagnosis of COPD.

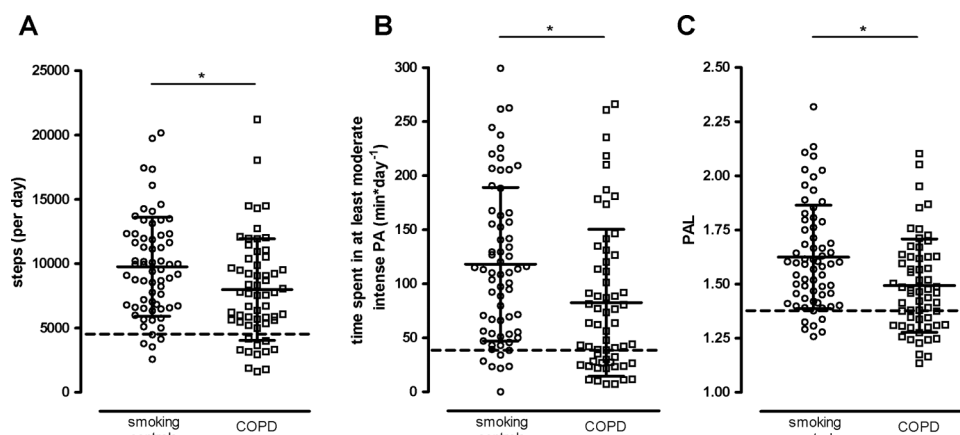
Hundred and twenty-four (ex-) smokers were recruited from a population-based sample (see online supplementary figure S1). Fifty-nine subjects with a new spirometry-based diagnosis of mild ( $n=38$ ) and moderate ( $n=21$ ) COPD ( $63\pm 6$  years, 68% male) were matched with 65 smoking controls ( $62\pm 7$  years, 75% male). Detailed characteristics of the study subjects are summarised in online supplementary table S1. Physical activity (daily steps, time spent in moderate-to-vigorous intense physical activities (MVPA) and PAL) was measured by a multi-sensor activity monitor (SenseWear Pro 3 Armband). Dyspnoea, complete pulmonary function tests, peripheral muscle strength and exercise capacity served as clinical characteristics. Additional information on material and methods is available in the online supplementary.

We found that physical activity was significantly lower in COPD compared to smoking controls (figure 1). Subjects with COPD with either mild symptoms of dyspnoea (mMRC 1), those with lower

diffusion capacity ( $T_{L,CO}$ ), low 6 min walking distance (6MWD) or low maximal oxygen uptake ( $VO_2$  peak) had significantly lower PALs (see online supplementary figure S2–S5). COPD subjects and smoking controls with lower levels of isometric quadriceps force did not show lower daily PALs. Multiple regression analysis identified 6MWD and  $T_{L,CO}$  as independent predictors of physical activity in COPD (see online supplementary table S2).

Our data support the recent advice of Centers for Disease Control and Prevention that physical activity is an important vital sign, even in patients with mild disease.<sup>3</sup>

Several cross-sectional studies found that patients with an established diagnosis of mild-to-moderate COPD, recruited in hospital outpatient settings, were physically inactive compared to a (non-) smoking control group.<sup>4,5</sup> This is the first study that showed that early reduction in physical activity is already present in subjects with mild-to-moderate COPD who did not previously present to healthcare services (ie, preclinical stage). Of importance to clinicians is the finding that some clinical characteristics (mild symptoms of dyspnoea, low values of diffusion capacity and exercise capacity) may identify the inactive subjects. In this group, early therapeutic interventions such as activity counselling programmes could be helpful in preventing deterioration of the PALs, and by consequence, other clinical outcomes such as comorbidity and disease progression.<sup>2</sup> We conclude that the reduction in physical activity starts early in the disease, even when subjects are not yet diagnosed with COPD, especially in those



**Figure 1** Daily physical activity levels (PAL) in subjects with and without chronic obstructive pulmonary disease (COPD); daily steps (A)  $7986\pm 2648$  vs  $9765\pm 3078$  steps, daily time spent in moderate-to-vigorous physical activity (MVPA) (B)  $64$  (27–120) vs  $110$  (55–164) min of MVPA and daily PAL (C):  $1.49\pm 0.21$  vs  $1.62\pm 0.24$  PAL. \* $p<0.05$  COPD versus smoking controls.

with mild symptoms of dyspnoea, lower levels of diffusion capacity and exercise capacity.

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data collection and critically reviewed the manuscript. DL contributed to the protocol development, assisted in the data collection and critically reviewed the manuscript. CB, DL contributed to the protocol development, assisted in the data collection and critically reviewed the manuscript. MD contributed to the protocol development and critically reviewed the manuscript. RG contributed to the protocol development and critically reviewed the manuscript. WJ provided the study idea, contributed to the protocol development and critically reviewed the manuscript. TT provided the study idea, contributed to the protocol development and critically reviewed the manuscript.

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