5.1 Introduction

Chronic obstructive pulmonary disease (COPD) is a global health problem and is currently the third leading cause of death worldwide [10]. In addition to progressive chronic airflow limitation, patients with COPD commonly have multiple extra pulmonary effects and comorbidities, which are associated with physical inactivity [16]. Although there is general agreement about the need to assess and improve physical activity in people with COPD, the factors associated with patient's capability to engage in physical activity are not well established, which may limit the impact of physical activity enhancement interventions [17].

Sleep disturbance, such as sleep fragmentation during the night, is common in patients with COPD [96], and is a major complaint after dyspnoea and fatigue [97]. Despite the high prevalence of disturbed sleep in COPD, night-time symptoms are often underestimated and are not a focus of current disease management [96].

Nocturnal sleep has been shown to be markedly impaired in patients with COPD compared to controls [98]. However, there is scant and discordant information on whether objectively assessed sleep disturbances worsen as the severity of dyspnoea and airflow limitation increases [98, 99]. Therefore, more data and in depth analysis are needed for a better understanding of the factors associated with sleep impairment in patients with COPD.

In healthy individuals, better sleep quality has been associated with higher exercise levels [100, 101]. Even though several studies have investigated the daytime consequences of reduced sleep quality in patients with COPD like fatigue, psychiatric problems and impaired quality of life [102, 103], no published study has objectively investigated the association of disturbed sleep with subsequent physical activity in this patient population.

In this study, data were pooled from different studies resulting in a large sample of patients with mild to very severe COPD who had extended objective measures of sleep and physical activity during daily life assessed using a multi-sensor activity monitor. These data were used to: (1) provide insight into the relationship between objectively determined sleep measures and disease severity, dyspnoea, gender, and day group (i.e. weekdays vs weekends); and (2) investigate whether there was an association between objectively assessed sleep measures and next day activity level. Our hypotheses were that: patients with more severe COPD defined according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria and higher Modified Medical Research Council (MMRC) dyspnoea score would have more objectively measured sleep disturbances, and that nights of impaired sleep would be followed by days characterized by lower levels of physical activity.

5.2 Material and methods

5.2.1 Participants

In this retrospective, cross-sectional study, data were pooled from previous studies (details can be found in the appendix) as assessed by the SenseWear Armband or SenseWear Mini Armband activity monitors (BodyMedia Inc., Pittsburgh, PA, USA). Data collected across ten countries from 1384 patients diagnosed with mild to very severe COPD defined spirometrically were considered for analysis. Participants were included if they had COPD with a post-