

limitation, which discriminates between groups A/B and C/D. Zogg et al [84] also investigated physical activity levels in COPD patients after classification into GOLD groups. These authors observed more preserved physical activity levels in group A compared to the other groups. Nevertheless, the sample size of each group was small and groups C and D had to be combined, compromising more detailed analyses. Despite the significant influence of GOLD groups on physical activity measures, only little or no influence was observed on physical activity hourly patterns. Only a few studies have investigated hourly patterns in COPD. In the study by Hecht et al [53], the authors observed that the highest activity level occurred during the late morning and early afternoon hours, which is corroborated by our findings. Tabak et al [85], in turn, observed a similar pattern of a dip of lower activity in the early afternoon in both employed and unemployed COPD patients, despite differences in the summary values between groups. Together with our findings this suggests that hourly patterns have the potential to complement the information provided by summary values.

#### **4.6.2 Clusters of Patients with COPD Based on Daily Physical Activity Measures**

The present study is the first to cluster patients with COPD based only on objectively assessed physical activity measures. Indeed, five clusters were identified, each with distinct physical activity measures and hourly patterns. One very active cluster and one very inactive cluster were identified, but clusters in intermediate categories were also observed.

Only a few studies have used objectively measured physical activity data solely for clustering subjects. In 10-to-12-year-old children, De Bourdeaudhuij and colleagues [86] were able to identify a cluster with a mixed arrangement of physical activity (i.e., less time in moderate-to-vigorous intensity + less sedentary time). In our study, we also found a cluster with resembling characteristics (i.e., cluster 4, long very light intensity/long moderate-to-vigorous intensity), confirming that activities of moderate-to-vigorous intensity and sedentary activities are not two sides of one continuum [86]. Based on the amount of time in 10-min bouts of moderate-to-vigorous physical activity, patients from cluster 4 could be considered physically active [81]. Nonetheless, these patients spent over 11 hours in very light intensity (i.e., sedentary behaviour), and previous studies have shown the detrimental effects of prolonged periods of sedentary behaviour on health outcomes [87]. More inactive clusters were also observed in our study (clusters 1, 2 and 3). In middle-aged Chinese adults, Lee et al [52] observed that male subjects from the least active cluster had higher body fat percentage and older age than those from the active group. In our study, patients from cluster 1 had older age, lower FEV<sub>1</sub>, higher BMI, worse dyspnoea and higher ADO index than other clusters. Based on their characteristics patients from this cluster may have a worse prognosis, but no follow-up data are available to confirm this hypothesis.

Although there was little or no overlap between the 95% confidence intervals of the hourly patterns of the clusters, confirming that they are statistically different, the patterns were found to be rather similar. Nevertheless, more inactive clusters seem to present less variability in intensity compared to more active clusters, suggesting that they are similarly inactive throughout the day. We also observed that the more inactive a cluster is, the more similar its hourly patterns of weekdays and weekend days are. This corroborates the findings from Lee et al [9], who observed a consistently low physical activity pattern on both weekdays and weekend