



A comparison of daily physical activity profiles between adults with severe asthma and healthy controls

To the Editor:

Severe asthma is associated with a substantial burden of disease, including premature death and reduced quality-adjusted life years [1]. Care in specialist centres is associated with reduced exacerbation rates and healthcare utilisation, but at the cost of increased use of systemic steroids and increased body mass index (BMI) [2]. Common comorbidities, such as metabolic syndrome and type 2 diabetes are associated with low levels of moderate–vigorous physical activity (MVPA) [3]. Guidelines recommend that adults accumulate either ≥ 150 min of moderate intensity activity or ≥ 75 min of vigorous intensity activity per week, accumulated in bouts of any length [4]. Adults with severe asthma may avoid MVPA due to negative expectations and fear-avoidance beliefs [5]. A few small studies have reported that daily step count and time spent in MVPA may be reduced in adults with severe asthma compared to controls [6–8]. However, results are conflicting when physical activity levels are adjusted for confounders such as age, gender, obesity and smoking [7]. Furthermore, adults with severe asthma have reduced health-related quality of life (HRQoL), but whether physical activity levels impact on HRQoL is unknown [9].

Therefore, the aims of our study were to compare physical activity levels and how physical activity is accumulated between adults with severe asthma and healthy controls, and to identify whether physical activity is associated with HRQoL in severe asthma. We hypothesised that adults with severe asthma would be less physically active than age- and sex-matched healthy participants and that being less physically active would be associated with worse HRQoL.

Patients were recruited as part of a study (approved by the National Research Ethics Service Committee of the East Midlands, reference 127552) involving asthma-tailored pulmonary rehabilitation [10] from a UK difficult-to-treat asthma service. Inclusion criteria were age 18–80 years, severe asthma (step 4–5 treatment according to Scottish Intercollegiate Guidelines Network/British Thoracic Society guidelines [11]), were not undertaking regular exercise and had not previously completed pulmonary rehabilitation. Age (within 1 year) and sex, individually matched, healthy controls with no history of major medical illness and who were not undertaking regular exercise were recruited from a database of people who had previously expressed an interest in participating in research, and from advertisements within the hospital.

All participants had their ethnicity and smoking status documented, and BMI calculated. Medications were documented and spirometry was performed in those with severe asthma.

Physical activity was measured for 7 days, with the season recorded, using a SenseWear Pro3 Armband worn on the non-dominant upper arm during waking hours. A threshold of ≥ 8 h per day of wear-time was used to determine adequate adherence, and those with ≥ 4 valid days of data were included in the analysis [12]. For each 60-s epoch, step count, stationary time (absence of steps), light activity (≥ 1.5 to < 3.0 metabolic equivalent of task (METs) with steps taken), MVPA (≥ 3.0 METs with steps taken) and MVPA in ≥ 10 -min bouts were extracted and summed for each day. In participants with severe asthma, HRQoL was measured using the EuroQol (EQ-5D-3L), Chronic Respiratory Questionnaire (CRQ) and Asthma QoL Questionnaire (AQLQ) [10].

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Compared to controls, adults with severe #asthma attain fewer daily steps and reduced sustained moderate–vigorous #physicalactivity which are associated with worse quality of life. Physical activity and #exercise interventions are needed for severe asthma. <http://bit.ly/2W8c7Qa>

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Analyses were performed using SPSS v.25.0. Data are presented as mean \pm SD or median (interquartile range) for continuous outcomes, dependent on normality, and as counts and percentages for categorical variables. Independent t-tests or Mann-Whitney U-tests were used to compare between-group differences. Analysis of covariance was used to determine the differences in physical activity levels between groups when controlling for wear-time and BMI. Multivariable linear regression was used to investigate the relationship between physical activity and HRQoL after controlling for wear-time, age (years), forced expiratory volume in 1 s (FEV₁) (L) and BMI (kg·m⁻²). To detect a difference of 2000 steps between adults with severe asthma and healthy controls with a standard deviation of 3000 steps, for 90% power at the 2-sided 5% significance level, 48 participants in each group would be needed [7].

96 participants (n=48 severe asthma, n=48 healthy controls) were recruited, mean \pm SD age 55 \pm 13 years, 35% male with similar ethnicity (severe asthma 90% Caucasian, 10% South Asian; healthy controls 85% Caucasian, 15% South Asian; p=0.76) and smoking status (severe asthma 71% never-smokers, 25% ex-smokers, 4% current; healthy controls 71% never-smokers, 29% ex-smokers, 0% current; p=0.34). BMI was significantly higher in adults with severe asthma 33.0 \pm 6.7 kg·m⁻² compared to healthy controls 26.4 \pm 4.4 kg·m⁻² (p<0.001). For severe asthma, the mean \pm SD FEV₁ was 1.9 \pm 0.7 L and 71.2 \pm 20.1% pred, FEV₁ to forced vital capacity ratio 0.7 \pm 0.1, and 50% were prescribed oral steroids. The EQ-5D-3L index-score was median (interquartile range) 0.80 (0.38) units, total CRQ score 85.6 (19.6) and AQLQ total score 4.98 (1.11).

Figure 1 shows that daily step count, time spent doing \geq 10 min bouts of MVPA and total MVPA were significantly less in adults with severe asthma compared to healthy controls (all p<0.001). The mean \pm SD valid days for the severe asthma group was 6.71 \pm 0.63 days *versus* 6.90 \pm 0.37 days (p=0.126). However, adults with severe asthma wore the activity monitor significantly less per day (severe asthma mean \pm SD 772 \pm 108 min *versus* healthy control 826 \pm 96 min; p=0.011) and this was predominantly due to adults with severe asthma putting on the monitor 53 min later on average than the healthy participants (p=0.002). In our data, there was no association between season and daily physical activity levels, therefore we did not adjust for seasonality. After adjusting for BMI and wear-time, adults with severe asthma completed fewer steps (p=0.009) and spent less time spent doing sustained (\geq 10 min bouts) MVPA (p=0.012), but the difference in total MVPA became non-significant and there were no differences in stationary time.

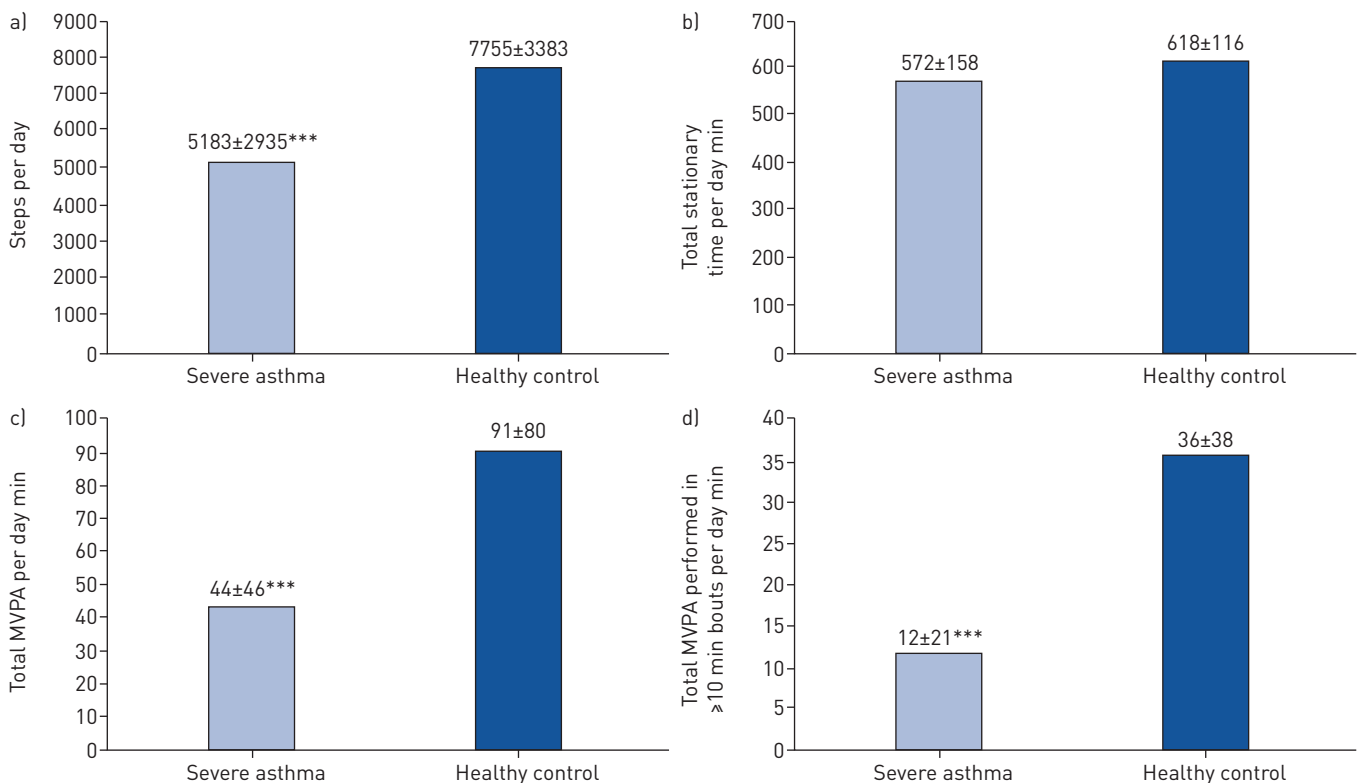


FIGURE 1 A comparison of physical activity levels between adults with severe asthma and healthy participants (non-adjusted data). ***: p<0.001 between severe asthma and healthy participants. MVPA: moderate to vigorous physical activity.

Steps per day were positively associated with EQ-5D-3L score ($\beta=0.31$, $p=0.045$), AQLQ overall score ($\beta=0.36$, $p=0.039$) and CRQ total score ($\beta=0.40$, $p=0.030$), after adjusting for wear-time, age, FEV₁ and BMI. Stationary time was not associated with any of the HRQoL questionnaire total scores: EQ-5D-3L ($\beta=-0.014$, $p=0.94$), AQLQ ($\beta=-0.29$, $p=0.19$) and CRQ ($\beta=-0.37$, $p=0.097$). Time spent doing ≥ 10 min bouts of MVPA was positively associated with total scores for AQLQ ($\beta=0.44$, $p=0.021$) and CRQ ($\beta=0.60$, $p=0.003$), but not EQ-5D-3L score ($\beta=0.18$, $p=0.29$). Total MVPA was also positively associated with total scores for AQLQ ($\beta=0.39$, $p=0.028$) and CRQ ($\beta=0.46$, $p=0.014$), but not EQ-5D-3L ($\beta=0.19$, $p=0.24$).

Our results demonstrate that adults with severe asthma are less physically active compared with their healthy peers. We provide further novel data showing adults with severe asthma accumulate MVPA in shorter bouts (fewer ≥ 10 min bouts of MVPA), and that disease-specific HRQoL is positively related to physical activity levels.

With adequate power our data confirms previous suggestions that adults with severe asthma perform fewer steps than healthy controls [6, 7]. Similar to another study, after appropriate adjustment total MVPA was not significantly lower in adults with severe asthma compared to controls but we cannot exclude a type II error [7]. However, we identified that for adults with severe asthma the deficit in physical activity is within MVPA of >10 min bouts, which are necessary to gain maximum benefit for cardiometabolic health [4]. As adults with severe asthma have an increased cardiometabolic risk [3, 13], modification of contributing lifestyle factors such as low levels of MVPA should be prioritised.

Lower physical activity levels (step count, total MVPA and >10 min bouts of MVPA) were associated with worse HRQoL, and most strongly associated with time spent performing ≥ 10 min bouts of MVPA, in contrast to stationary time where there was no association. A previous study in adults with severe asthma showed a positive association between HRQoL (AQLQ scores) and MVPA [6], estimating that the clinically important difference in AQLQ was associated with approximately 30 min greater daily MVPA [6].

Our data is from a single centre, but our patient characteristics are representative of a typical UK severe asthma service [14]. We are not inferring causality with the association between physical activity levels and HRQoL due to our cross-sectional study design because, while we adjusted for significant differences in BMI and monitor wear-time, residual confounding cannot be excluded.

In conclusion, steps per day and sustained MVPA are significantly lower in adults with severe asthma and a lower frequency of ≥ 10 min bouts of MVPA is associated with worse HRQoL. These novel findings highlight the need for physical activity and exercise interventions for adults with severe asthma.

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