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A cross-sectional study analysing the association between habitual physical activity levels and quality of life in adults with asthma

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Abstract

Background: People with asthma believe their condition prevents them from undertaking physical activity. The objective was to determine the association between habitual physical activity levels and the quality of life in adults with asthma and meeting the physical activity guidelines. Material/Methods: A cross-sectional survey of adults (aged >18) with asthma was conducted in three general practices in Nottingham, UK (n = 128). A self-reported short form International Physical Activity Questionnaire, mini Asthma Quality of Life Questionnaire and a demographic questionnaire (age, gender, ethnicity and BMI) were used to collect data. Physical activity was provided in minutes for different activities to enable the habitual weekly MET-minutes to be calculated, and the quality of life score was determined. Results: Among 128 respondents, 22% met the physical activity guidelines. Mostly younger, white, male, normal weight participants had higher physical activity levels and better asthma quality of life. Mean total asthma quality of life score was 4.5. Linear regression modelling showed a positive association between the total physical activity and the quality of life score ($p < 0.001$); thus higher physical activity levels were associated with less/no asthma quality of life impairment (higher score). Conclusions: The majority of asthmatics in this study had low physical activity levels, did not meet the recommended physical activity guidelines and had impaired quality of life. A strong positive association between physical activity and asthma quality of life supports the view that adults with asthma should be encouraged to be sufficiently physically active, which could be associated with a better asthma related quality of life.

Keywords

motor activity, exercise, general practice, respiratory health, quality of life

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ORIGINAL

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Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

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INTRODUCTION

Suffering from asthma, being less physically active and having a poor quality of life are all individually associated with increased morbidity and mortality [1, 2, 3]. Hence co-existence of these three conditions can be associated with worse clinical outcomes.

Asthma is a common Chronic Inflammatory Lung Disease which causes reversible narrowing of the airways [4]. Approximately 1 in 12 UK adults (n = 5.4 million) are receiving treatment for asthma. In the UK, there are three deaths a day due to asthma, the highest in Europe, most of them avoidable [5] with a 1.5 times higher risk of dying prematurely [6]. Asthma related health expenditure is more than £1 billion in the UK [7]. Thus, asthma poses a serious economic burden [7] and global public health problem with 235 million people suffering from this condition worldwide [8].

Physical inactivity is the fourth highest cause of global mortality responsible for approximately 3.2 million deaths worldwide (6% of deaths globally) [9]. There has been a substantial reduction in physical activity levels [10] with an increase in adverse health outcomes. Regular physical activity reduces the risk of cardiovascular diseases, stroke, diabetes, colon and breast cancer, depression as well as helpsto control weight [9, 12]. The UK Chief Medical Officer recommended physical activity guidelines state that adults should perform at least 150 minutes of moderate intensity exercise every week [12, 13]. This can be achieved by exercises including brisk walking, gardening and water aerobics for 30 minutes a day, 5 days a week. Quality of life (QoL) can be defined as “general well-being” [14] whereas health related quality of life includes the individuals’ “physical and mental health perceptions” [15]. Measuring the quality of life in adults with asthma helps predict their general health andthe effectiveness of asthma medications. Evidence suggests worsening the quality of life with increasing asthma severity [16] and worsening asthma control [17, 18].

What is known?

It is known that vigorous physical activity causes narrowing of the airways [19]. Many patients with asthma feel that their condition prevents them from strenuous physical activity and exercise, hence they often avoid such activities [20] due to concern about possibly worsening their asthma symptoms [21]. Tolerance to physical activity can be built over time, leading to a reduction in the exercise-induced narrowing of airways, thus making an asthma attack less likely. This can be achieved with effective management of asthma; an exercise management plan including specific exercise schedules, repeated brief bouts of exercise and a steady increase in activity under supervision [22]. However, asthma patients are rarely aware of such exercise schedules and hence hold negative views on physical activity and exercise [23].

How this study fits in?

Recent British Guidelines for the Management of Asthma [24] suggest that adults with asthma should be encouraged to lose weight, undertake exercise programmes involving breathing and physiotherapist-taught methods to improve their quality of life and reduce asthma symptoms. Studies have shown an improvement in asthma symptoms and the quality of life with

supervised physical activity programs [25] with aerobic exercise programs being recommended [3]. There have been limited studies related to physical activity in adults with asthma [20, 23, 25]. Most of the studies on asthma patients, exercise and the quality of life have been on children and adolescents [26, 27]. Hence, it was felt there is a need to assess the association between physical activity levels and asthma quality of life in adults within a primary care population.

This study aims to investigate physical activity levels in adults with asthma, to see if they meet the UK government guidelines for physical activity and whether there is any association between physical activity levels andthe quality of life in these patients.

MATERIAL AND METHODS

Ethical approval

The study protocol was reviewed and given a favourable opinion by the National Research Ethics Committee North West – Lancaster ref no: 12/NW/0031 (January 2012). The Research and Graduate Services at University of Nottingham also approved this study sponsor's ref no: 11119. Approval was also granted by the Research and Development Department at Nottingham City Primary Care Trust and by the management of the three GP surgeries.

Design and study population

This was a questionnaire-based cross-sectional survey in the Primary Care setting across three NHS GP Surgeries in Nottingham, UK. Nottingham has a predominant white ethnic population (85%) and a high deprivation index [28].

Diagnosis of asthma was based on all adult patients on the Asthma QOF register at the three general practices that were invited to participate (n = 571). These patients had been diagnosed as having asthma by their GPs and had been using asthma medications within the last 12 months [7, 29]. There were no exclusion criteria, although information packs were only available in English. The pack, including the questionnaires, was posted to potential participants to be returned (posted back in a stamped self-addressed envelope or handed in to the surgery) within 8 weeks. At 4 weeks, participants were sent a reminder to complete and return their questionnaires. Completion and return of the questionnaires was considered as informed consent from the participants.

Data Source

Participants were asked to complete three questionnaires: the validated International Physical Activity Questionnaire Short Form (IPAQ–SF) (Appendix Figure 1), to determine participants' habitual physical activity levels (METS minutes per week)(IPAQ, 2005); the validated mini Asthma Quality of Life Questionnaire (mini AQLQ) (Appendix Figure 2), to determine whether asthma affected the participants' quality of life [30]; and General Information Questionnaire (GIQ) (Appendix Figure 3), to gather demographic data. The IPAQ is a commonly used questionnaire to assess the physical activity and inactivity, developed with the WHO in the 1990s [31]. The short form of the IPAQ is a phy-

sical activity recall for the last seven days, a self-administered questionnaire that shows good reliability and validity after being tested in many countries [32]. It has a Flesch Reading Ease score of 64.8 with Flesch–Kincaid Grade Level of 8.6 [33].The 15-question mini AQLQ is a validated and reliable short form of the original 32 question AQLQ used to measure the asthma health related problems, across 4 domains (physical, social, occupational and emotional) over a 2-week recall period [18, 30]. Short forms of both questionnaires were used to encourage full completion. The GIQ collected data on age (in years), gender (male/female), ethnicity (white/other), height (in metres) and weight (in kg).Time to completion of the questionnaires (29 questions) was anticipated to be less than 10 minutes.

In order to be able to detect a two-tailed change in AEE of 550 KJ (equivalent to brisk walking for 30 minutes), a difference of two means paired t-test formula (with standard assumptions of 80% power and statistical significance of 5%) required a sample of 110 participants.These analyses were undertaken in SPSS software (version 20).

Data analyses

Asthma prevalence was calculated using the total number of registered patients compared to those on the asthma QOF register at the three surgeries [7]. The responses to the IPAQ-SF were used to calculate each participants' Activity-related Energy Expenditure (AEE) by multiplying the total activity duration of minutes/week of each activity by the activity's corresponding METS value (walking 3.3 METS; moderate intensity activity 4.0 METS; vigorous intensity activity 8.0 METS) [34]. This information was used to determine whether these patients were meeting the physical activity guidelines. Meeting the UK CMO recommended physical activity guidelines were those performing at least 150 minutes of at least moderate intensity exercise a week [13]. These guidelines also recommend some weekly muscle strengthening activity [13], but these data are not collected by IPAQ.

The 15 mini-AQLQ questions each required a response from severe impairment to no impairment. The mean score for each participant was calculated resulting in one of seven ordinal categories (1 severe impairment; 7 no impairment). The data from the GIQ was used to determine participants' body mass index (BMI) (weight in kg divided by their height in metres squared). The number and percentage of participants meeting the guidelines in each of these sub-groups was calculated and statistical significance tested with an unpaired t-test.

To examine the relationship between physical activity and asthma quality of life, two linear regression models were constructed, both with asthma quality of life as the dependent variable and MET minutes/week of physical activity as the independent variable. The complex model also adjusted for age, sex, ethnicity and BMI.

RESULTS

Asthma prevalence across the three surgeries was 6.7%. 571 questionnaire packs were sent out; 146 responded (26% response rate). Exclusions were due to incomplete questionnaire data (n = 13), did not want to participate (n = 3) or had moved home (n = 2), resulting in 128 participants.The participants were more likely to be female, white and older ($p = 0.018$; $p < 0.001$; $p < 0.001$ respectively).The majority were overweight or obese (31% and 43% respectively).

Twenty eight (22%) participants met the physical activity guidelines. 16% of participants were sedentary (weekly MET mins < 100). Mean total physical activity levels were 2895 MET minutes/week (SD 3624; range 0 to 21462). Participants ranged from 0 to 4 hours of mean moderate or vigorous physical activity (MVPA) per day (mean 0.5 hours) and 0 to 11 hours of mean total physical activity per day (mean 1.7 hours).

The percentages of respondents meeting the physical activity guidelines are broken down by study demographics in Table 1. This shows that less women than men met the physical activity guidelines (20% and 25% respectively; $p = 0.23$); older people were less likely to meet the physical activity guidelines (12% of over 50 years and 45% of under 50 years met the physical activity guidelines; $p < 0.001$);and normal weight participants were more likely to meet the physical activity guidelines (38%; $p = 0.16$). The data showed that white participants were less active than non-white ones (21% and 27% met the guidelines respectively), but the sample size for non-white was small (n = 11, $p = 0.45$).

The data also show a dose response between QoL score and meeting the physical activity guidelines ($p = 0.01$): few of the participants who had severe or very impaired QoL (n = 13) met the physical activity guidelines (8%); of those with moderate to very slight impairment (n = 59) more met the guidelines (25%); and of the hardly/not impaired (n = 32), 38% met the guidelines. That is, participants with better QoL (less impairment) were more likely to meet the physical activity guidelines, with a mean total asthma QoL score of 4.5 (SD 1.4; range 1-7).

The simple linear regression model showed a positive association between total physical activity (MET mins per week) and total asthma QoL score ($p < 0.001$). The standardised coefficient β was 0.306 ($p < 0.001$), showing that a unit change in physical activity increased the standardised QoL score by this amount.Thus more active participants had a higher asthma QoL score (i.e. less/no impairment), with the model explaining 9% of the variation in QoL scores.

The complex regression model was also adjustedfor age, sex, ethnicity and BMI; it also showed a positive association between total physical activity (MET mins) and total asthma QoL score ($p = 0.01$). This increased the coefficient of determination sothat the model now explained 11.5% of the variation in QoL score.The standardised β for physical activity was 0.253 ($p = 0.008$), age -0.134 ($p = 0.15$), sex -0.030 ($p = 0.74$), BMI -0.004 ($p = 0.96$), and ethnicity -0.078 ($p = 0.36$). Thus age, sex, BMI and ethnicity all showed negative relationships with QoL. Namely, older people mostly over 50, women, those with higher BMI, and not white had a lower QoL score (i.e. more impaired); of these associations only physical activity had a statistically significant association with QoL.

Table 1. Summary of study demographics and of patients who met the physical activity guidelines

	Number (percentage %) N=128	Number (percentage %) meeting physical activity guidelines N=28	P value
Sex			
Male	43 (34)	11 (26)	
Female	85 (66)	17 (20)	0.23
Race			
Caucasian	117 (91)	25 (21)	
Other	11 (9)	3 (27)	0.45
Age in years			
18-29	16 (13)	6 (38)	
30-39	4 (3)	3 (75)	
40-49	18 (14)	8 (44)	
50-59	26 (20)	4 (15)	
60-69	29 (23)	4 (14)	
70-79	23 (18)	3 (13)	
80+	12 (9)	0 (0)	<0.001
BMI			
Underweight (<18.5)	2 (2)	0 (0)	
Normal weight (18.5–24.9)	32 (25)	12 (38)	
Overweight (25–29.9)	39 (30)	6 (15)	
Obese (>30)	55 (43)	10 (18)	0.16
Physical activity (METmins)		Number	
Sedentary (METmins<100)	21 (16)	0 (0)	
Low (100-999)	29 (23)	1 (3)	
Medium (1000-3999)	47 (37)	7 (15)	
High (4000+)	31 (24)	20 (65)	<0.001
QOL Score			
Severely impaired	2 (1)	0 (0)	
Very impaired	11 (9)	1 (9)	
Moderately impaired	18 (14)	1 (6)	
Slightly impaired	24 (19)	1 (4)	
Very slightly impaired	41 (32)	13 (32)	
Hardly impaired	23 (18)	9 (39)	
Not impaired	9 (7)	3 (33)	0.01

DISCUSSION

Based on QoL figures, asthma prevalence in the study area was high (6.7%) compared to the UK national average(5.9%) [29]. This study showed that those of 'normal' BMI were more active than overweight or obese participants. Most participants (88%) did not meet the UK CMO recommended guidelines for physical activity. Also, women, older people, and overweight or obese people were less likely to meet the guidelines ($p < 0.001$), although age was the only statistically significant predictor.

Age, sex, BMI and ethnicity all had a negative association with QoL, albeit only age was statistically significant. It was surprising to note that approximately one third of those with a normal BMI had moderate to severely impaired quality of life. When stratified by age, sex, BMI and ethnicity, it was seen that mostly younger, male, white people with lower BMI had a better asthma QoL (less impairment).

The most significant finding in this study was the strong association between physical activity levels and Asthma Quality of Life; with those more active having a better asthma related quality of life (less impairment). Majority (61% n = 19) of participants with low physical activity levels also had moderate to

severe QoL impairment, and conversely most with moderate to high physical activity levels (81% n = 26) had no impairment of their quality of life. This could be due to the fact that those with worse asthma have a poor QoL, as they are unable to be as physically active as those with a higher QoL.This is in line with recent research recommending physical activity like aerobic exercise to improve quality of life in asthmatics [3]. Similarly, a study by Turner et al. (2011) on the effect of exercise training on asthma QoL suggested an improvement in the QoL of asthmatic adults [25]. However, there are limited studies on the relationship between physical activity and asthma quality of life.

Comparison with Existing Literature

Health Survey for England 2012 reported 61% adults meeting the physical activity guidelines as compared to only 22% in this study [35].The true disease prevalence of asthma in the community is 8-10% [36, 37, 38] which is higher than in this study (6.7%). Work by other authors shows a poor quality of life in asthmatic elderly patients as compared to younger asthmatics [25]. It is also suggested that obesity may be associated with poor asthma control and quality of life [39].

UK Department of Health [6] has highlighted the importance of asthma control but has not specified any physical activity interventions for patients with asthma [6]. Some physical activity promotion trials have shown good long-term results in primary care [40, 41]. Swimming has been reported as one of the top beneficial aerobic exercises and the most common sport general public participate in, so it could be considered for future primary care exercise schemes [42]. Whilst blood pressure, cholesterol levels, weight and other measures are routinely measured in clinic, but physical activity is omitted often due to problems with accurate and quick measurement.

Strength and Limitations

This study has several strengths. In particular, it used validated questionnaires to gather the data: IPAQ has been validated as an effective tool for measuring physical activity [43]; mini AQLQ is an asthma specific questionnaire that has been validated to be administered in the UK primary care population [44]. In order to improve the response rate, reminders were sent to participants to complete and return the questionnaires. By way of limitations, whilst this study had sufficient power, it was a cross sectional study with a low response rate (26%), albeit not unusual for this style of study design and in line with other surveys undertaken by the Department of Health for these three GP surgeries [45]. A higher response rate may have been achieved if the questionnaire had been interview based, particularly given the older age of the participants [46]. Additionally, average age of the participants was 58; most aged over 50 (70% n = 90). Hence, results of this study could be generalised to adults over 50 with asthma. Despite a strong association between physical activity levels and asthma quality of life, the direction of this relationship cannot be determined with this study design.

CONCLUSION

It is globally accepted that physical activity plays an important role in improving general health and well-being. However, majority of asthmatic adults in this study had low PAL, did not meet the recommended PA guidelines and

had impaired asthma QoL. Also, a strong positive association between physical activity levels and QoL (more active, lower impairment) was seen, suggesting that adults with asthma who have higher physical activity levels also have better asthma quality of life and vice versa. This study adds to the evidence base, with 78% of adults with asthma being insufficiently active for good health. It also supports the view that adults with asthma can be advised that being sufficiently physically active could be associated with a better asthma related quality of life.

Implications for practice and research

This study adds to the weight of the literature suggesting that physical activity measuring tools can be routinely used in primary care as part of the patient general health screening. This would enable the clinician to determine which of their patients were insufficiently active for good health and thus facilitate them to devise and monitor physical activity interventions/'green prescriptions' to improve health. Ultimately this would reduce the health burden of chronic health conditions due to Ahmad A.N., Edwards K.L. Physical activity aaand athma quality of life association in adults Balt J Health Phys Act 2015; 7(1): xxx-xxx 85 inactivity, particularly as it has been found that patients are more willing to increase their physical active levels if advised to do so by their physician or nurse [47].

Further work is needed to determine the impact of physical activity intervention programs in primary care and their effect on the improvement in quality of life of adults with asthma, in addition to any improvement in asthma control and severity, in order to ascertain the direction of the relationship. Similarly, longitudinal studies would enable the evaluation of the long-term impact of asthma severity or poor control on the quality of life of adults with asthma and their physical activity levels.

How might this study impact on clinical practice in the near future?

- Much more needs be done in primary care in order to make individuals aware of the recommended physical activity levelsand to help them to achieve these guideline levels.

- We recommend surveillance for physical activity and asthma quality of life and control,using validated questionnaires(e.g. GPPAQ/IPAQ and mini AQLQ/+SF-36), whichshould become routine part of general health and asthma checks in primary care.

- Strategies should be introduced to educate adult patients with asthma that their condition should not limit physical activity. They should also be informed that being insufficiently active could be associated with poor quality of life along with causing other chronic health conditions.

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APPENDIX

1a. During the last 7 days, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling,?

Think about *only* those physical activities that you did for at least 10 minutes at a time.

_____ **days per week** ⇨

1b. How much time in total did you usually spend on one of those days doing vigorous physical activities?

_____ **hours** _____ **minutes**

or

☐ **none**

2a. Again, think *only* about those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ **days per week** ⇨

2b. How much time in total did you usually spend on one of those days doing moderate physical activities?

_____ **hours** _____ **minutes**

or

☐ **none**

3a. During the last 7 days, on how many days did you **walk** for at least 10 minutes at a time? This includes walking at work and at home, walking to travel from place to place, and any other walking that you did solely for recreation, sport, exercise or leisure.

_____ **days per week** ⇨

3b. How much time in total did you usually spend walking on one of those days?

_____ **hours** _____ **minutes**

or

☐ **none**

The last question is about the time you spent sitting on weekdays while at work, at home, while doing course work and during leisure time. This includes time spent sitting at a desk, visiting friends, reading traveling on a bus or sitting or lying down to watch television.

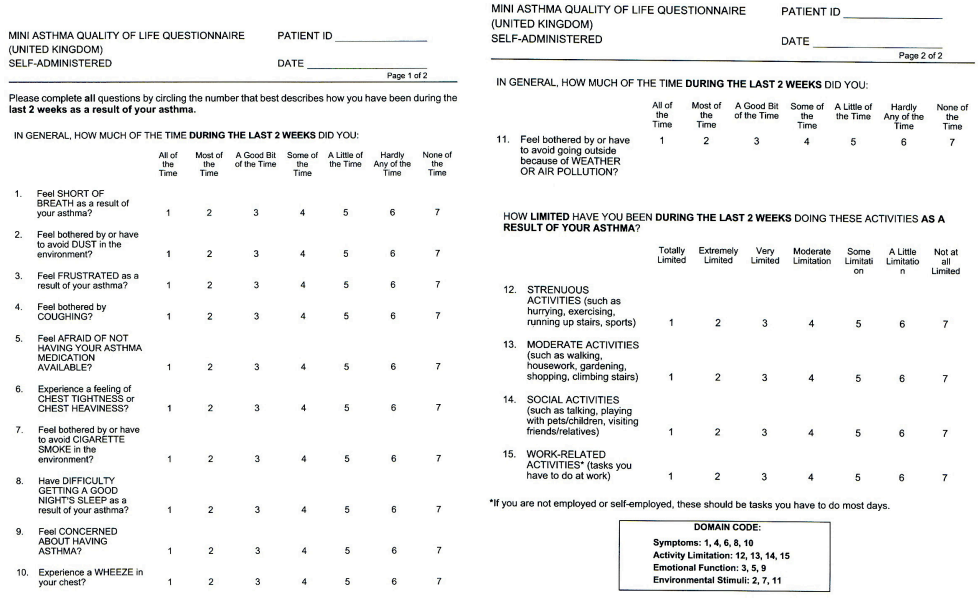
4. During the last 7 days, how much time in total did you usually spend *sitting* on a **week day?**

____ **hours** _____ **minutes**

This is the end of questionnaire, thank you for participating.

This is the final SHORT LAST 7 DAYS SELF-ADMINISTERED version of IPAQ from the 2000/01 Reliability and Validity Study. Completed May 2001.

Fig. 1. International Physical Activity Questionnaire short form (IPAQ-SF)



MINI ASTHMA QUALITY OF LIFE QUESTIONNAIRE
(UNITED KINGDOM)
SELF-ADMINISTERED

PATIENT ID _____

DATE _____

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Please complete **all** questions by circling the number that best describes how you have been during the **last 2 weeks as a result of your asthma.**

IN GENERAL, HOW MUCH OF THE TIME **DURING THE LAST 2 WEEKS** DID YOU:

	All of the Time	Most of the Time	A Good Bit of the Time	Some of the Time	A Little of the Time	Hardly Any of the Time	None of the Time
1. Feel SHORT OF BREATH as a result of your asthma?	1	2	3	4	5	6	7
2. Feel bothered by or have to avoid DUST in the environment?	1	2	3	4	5	6	7
3. Feel FRUSTRATED as a result of your asthma?	1	2	3	4	5	6	7
4. Feel bothered by COUGHING?	1	2	3	4	5	6	7
5. Feel AFRAID OF NOT HAVING YOUR ASTHMA MEDICATION AVAILABLE?	1	2	3	4	5	6	7
6. Experience a feeling of CHEST TIGHTNESS or CHEST HEAVINESS?	1	2	3	4	5	6	7
7. Feel bothered by or have to avoid CIGARETTE SMOKE in the environment?	1	2	3	4	5	6	7
8. Have DIFFICULTY GETTING A GOOD NIGHT'S SLEEP as a result of your asthma?	1	2	3	4	5	6	7
9. Feel CONCERNED ABOUT HAVING ASTHMA?	1	2	3	4	5	6	7
10. Experience a WHEEZE in your chest?	1	2	3	4	5	6	7

MINI ASTHMA QUALITY OF LIFE QUESTIONNAIRE
(UNITED KINGDOM)
SELF-ADMINISTERED

PATIENT ID _____

DATE _____

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IN GENERAL, HOW MUCH OF THE TIME **DURING THE LAST 2 WEEKS** DID YOU:

	All of the Time	Most of the Time	A Good Bit of the Time	Some of the Time	A Little of the Time	Hardly Any of the Time	None of the Time
11. Feel bothered by or have to avoid going outside because of WEATHER OR AIR POLLUTION?	1	2	3	4	5	6	7

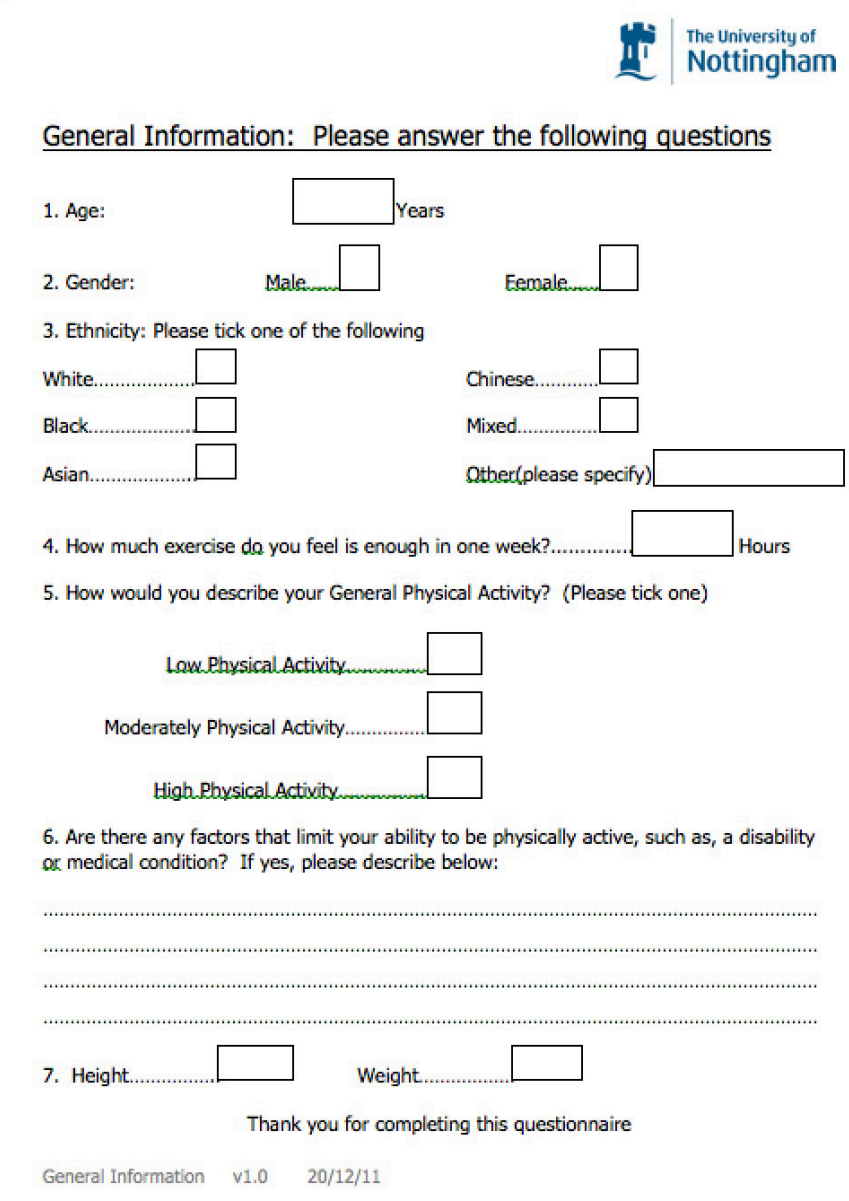
HOW **LIMITED** HAVE YOU BEEN **DURING THE LAST 2 WEEKS** DOING THESE ACTIVITIES **AS A RESULT OF YOUR ASTHMA**?

	Totally Limited	Extremely Limited	Very Limited	Moderate Limitation	Some Limitation	A Little Limitation	Not at all Limited
12. STRENUOUS ACTIVITIES (such as hurrying, exercising, running up stairs, sports)	1	2	3	4	5	6	7
13. MODERATE ACTIVITIES (such as walking, housework, gardening, shopping, climbing stairs)	1	2	3	4	5	6	7
14. SOCIAL ACTIVITIES (such as talking, playing with pets/children, visiting friends/relatives)	1	2	3	4	5	6	7
15. WORK-RELATED ACTIVITIES* (tasks you have to do at work)	1	2	3	4	5	6	7

*If you are not employed or self-employed, these should be tasks you have to do most days.

DOMAIN CODE:
Symptoms: 1, 4, 6, 8, 10
Activity Limitation: 12, 13, 14, 15
Emotional Function: 3, 5, 9
Environmental Stimuli: 2, 7, 11

Fig. 2. Mini Asthma Quality of Life Questionnaire (mini-AQLQ)



The University of Nottingham

General Information: Please answer the following questions

1. Age: ☐ Years

2. Gender: Male ☐ Female ☐

3. Ethnicity: Please tick one of the following

White ☐ Chinese ☐

Black ☐ Mixed ☐

Asian ☐ Other(please specify) ☐

4. How much exercise do you feel is enough in one week? ☐ Hours

5. How would you describe your General Physical Activity? (Please tick one)

Low Physical Activity ☐

Moderately Physical Activity ☐

High Physical Activity ☐

6. Are there any factors that limit your ability to be physically active, such as, a disability or medical condition? If yes, please describe below:

.....

.....

.....

.....

7. Height ☐ Weight ☐

Thank you for completing this questionnaire

General Information v1.0 20/12/11

Fig. 3. General information Questionnaire (Demographic Data)

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