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DATA PAPER

Physical Activity and Respiratory Health (PhARaoH): Data from a Cross-Sectional Study

Mark W. Orme[1,2], Dale W. Esliger[1,3], Andrew P. Kingsnorth[1], Michael C. Steiner[1,2], Sally J. Singh[1,2], Dominic Malcolm[1], Mike D. Morgan[2] and Lauren B. Sherar[1,3]

[1]National Centre for Sport and Exercise Medicine, School of Sport, Exercise and Health Sciences, Loughborough University, GB

[2]Centre for Exercise and Rehabilitation Science, Glenfield Hospital, University Hospitals of Leicester NHS Trust, GB

[3]Leicester-Loughborough Diet, Lifestyle and Physical Activity Biomedical Research Unit, GB

Corresponding author: Mark W. Orme (m.w.orme@lboro.ac.uk)

The dataset consists of a densely phenotyped sample of adults collected from March to August 2014. The dataset captures behavioural, physical, physiological and psychosocial characteristics of individuals with and without a General Practitioner diagnosis of chronic obstructive pulmonary disease (COPD). Data were collected at Glenfield Hospital on 436 individuals (139 COPD patients and 297 apparently healthy adults) aged 40–75 years, residing in Leicestershire and Rutland, United Kingdom. The dataset includes seven days of raw wrist-worn accelerometry, venous blood biomarkers, non-invasive point-of-care cardio-metabolic risk profiles, physical measures and questionnaire data.

Keywords: Physical activity; respiratory; accelerometry; health
Funding statement: NHS England facilitation funds.

1. Overview

Introduction/Study Description

The Physical Activity and Respiratory Health (PhARaoH) study is a cross-sectional study funded by research facilitation funds from National Health Service (NHS) England. The study was devised, managed and conducted in collaboration between Loughborough University, University Hospitals of Leicester NHS Trust and the Respiratory Biomedical Research Unit at Glenfield Hospital.

The aims of the study were: (i) to examine the role of physical activity and sedentary behaviour on respiratory health with an emphasis on its associations with chronic obstructive pulmonary disease (COPD) and (ii) to investigate associations between behavioural, physical, psychosocial, clinical and demographic information with self-reported symptom severity in COPD patients recruited from primary care.

2. Context

Spatial coverage

The study recruited participants residing in Leicestershire and Rutland and appointments were conducted at the Respiratory Biomedical Research Unit, Glenfield Hospital, Leicester, United Kingdom.

Temporal coverage

10th March 2014–31st August 2014

Species

Homo sapiens

3. Methods

Steps

The Primary Care Research Network (PCRN) invited General Practices across Leicestershire and Rutland, United Kingdom to conduct a search on their databases to identify patients with a diagnosis of COPD of any respiratory stage, aged 40–75 years. Fifteen practices (two from East Leicestershire and Rutland Clinical Commissioning Group (CCG), six from West Leicestershire CCG and seven from Leicester City CCG) sent out invitations to identified patients. Patients wishing to participate were instructed to return the reply form to the Respiratory Biomedical Research Unit, Glenfield Hospital. Upon receipt of the reply form, a researcher from the PhARaoH team contacted the interested individual via telephone to confirm eligibility and to book the visit.

Apparently healthy adults were recruited through posters and leaflets distributed across Leicestershire and Rutland in community organisations and facilities (e.g. libraries, community halls, leisure centres). Targeted recruitment of apparently healthy South Asians was conducted through a Gujarat Hindu Association Health and Wellbeing event and by a radio show and advertisements aired in English and Sikh Punjab (Kohinoor Radio 97.3 FM).

The database comprises 139 (31.9%) COPD patients (65.8 ± 7.0 years, 66.2% male) and 297 (68.1%) apparently healthy adults (56.8 ± 8.9 years, 37.0% male). COPD patients comprise 133 (95.7%) White British, 5 (3.6%) South Asian and 1 (0.7%) Other ethnicities. Apparently healthy adults comprise 163 (54.9%) White British, 117 (39.4%) South Asian and 17 (5.7%) other ethnicities. Other ethnicities are Black African (n = 1), Black Caribbean (n = 2), Other White (n = 2), Other (n = 6), and Mixed White Asian (n = 7).

For the COPD patients, 115 (82.7%) were recruited through General Practice, 12 (8.6%) through an existing research contact database, 3 (2.2%) through word of mouth, 4 (2.9%) through leaflet/poster distribution and 4 (2.9%) through other recruitment methods (e.g. newspaper advert). Of the apparently healthy adults 59 (n = 19.9%) were recruited through leaflet/poster distribution, 59 (19.9%) through University Hospitals of Leicester intranet adverts, 79 (26.6%) through word of mouth, 37 (12.5%) through Kohinoor Radio and 60 (20.2%) through other recruitment sources (e.g. community health events).

All data were collected by trained researchers. Participants were asked to attend the Respiratory Biomedical Research Unit, Glenfield Hospital, Leicestershire, UK for a one-off appointment of approximately 2–3 hours. Written informed consent was obtained from all participants before measures begun. Participants were fully reimbursed for their travel and parking as part of their involvement in the study.

Anthropometrics: Height was measured using a portable stadiometer (SECA, 213). Weight and percentage body fat were obtained using body composition scales (Tanita MC780MA). Waist circumference was measured around the mid-point between the lowest rib and iliac crest [1]; taken twice using a tape measure with a third measure conducted if the difference between the first two exceeded 3cm.

Blood markers: Participants were asked to fast (excluding water) for a minimum of four hours before their appointment. Analysed by the pathology laboratory at Glenfield Hospital the available blood biomarker data includes total cholesterol, low-density lipoprotein, high-density lipoprotein, triglycerides, glucose, HbA1c, sodium, potassium, urea, creatine, glomerular filtration rate, albumin, adjusted calcium, inorganic phosphate, alkaline phosphatase, aspartate transaminase, alanine transaminase, mean cell volume, mean cell haemoglobin, platelet count, neutrophil count, total lymphocyte count, monocytes, eosinophils, basophils, nucleated red blood cells, total bilirubin, free thyroxine, chloride, c-reactive protein, thyroid stimulating hormone, white blood cells, red blood cells, haemoglobin and haematocrit.

Spirometry: An objective measure of lung function was conducted using forced spirometry (MicroLab MK8 spirometer, serial number 68738). Daily expiratory calibration was performed with pass/fail criteria set to within ±3.5% of a fixed 3L volume. Of the 118 calibrations, the mean percentage error was 0.45 ± 1.17% with a range of –2.96% to 3.33%. Exclusion criteria for spirometric assessment were: eye surgery in the last 3 months, chest/abdominal surgery in the last three months, participant or household member tuberculosis exposure, history of aneurysm or collapsed lung, history of detached retina, stroke or heart attack in the last six months, glaucoma or history of coughing up blood in the last month. Eligible participants then completed 3–8 spirometry readings with the number of readings being determined by the attainment of three efforts within <5% variation.

Incremental Shuttle Walk Test (ISWT): The ISWT is a symptom-limited multi-stage test of exercise capacity requiring participants to walk up and down a 10m course in response to a progressive series of beeps [2]. A pre-ISWT suitability to exercise check was conducted using the Physical Activity Readiness Questionnaire (PAR-Q) [3]. If the participant answered 'Yes' to any one or more of these questions they were referred to a qualified healthcare professional for sign-off. Walking speed was externally paced using pre-recorded bleep signals provided by an .mp3 file. Walking pace for the test began at 0.5m/s and increased by 0.17 m/s at the end of each minute (indicated by a triple bleep). The ISWT was terminated if participants reported symptoms (e.g. muscle pain or breathlessness), were unable to maintain the necessary pace, or completed the test (12 minutes, 1020 m). Participants were not permitted to run. The ISWT was repeated by the same operator following rest.

Quadriceps maximal voluntary contraction (QMVC): Participants sat in a purpose-built chair with an inextensible strap connecting the ankle of their dominant leg to a strain gauge (HURLabs, PR1 force transducer, Finland). Care was taken to ensure participants' knees were flexed to 90° and that all the strain gauge and couplings were aligned to ensure an isometric contraction [4]. Participants performed three sustained maximal isometric quadriceps contractions with the strain gauge being reset between efforts. The force produced was visible to the researcher who provided positive feedback and vigorous encouragement. There was a rest period of 30–60 seconds between each effort.

Standing grip strength: Upper body skeletal muscle assessment was obtained using a hand-held dynamometer (Takeii analogue dynamometer, Niigata, Japan). Assessed on both dominant and non-dominant hands, three measures on each hand were conducted with a brief pause between measurements. Participants were asked to squeeze the dynamometer with as much force as possible, with their elbow extended down by their side [5].

Objectively Measured Physical Activity: Physical activity and sedentary time were collected using the ActiGraph wGT3X-BT accelerometer (ActiGraph, Pensacola, USA). Worn on the non-dominant wrist (non-writing hand), monitors were worn continuously except for water-based activities at a sample rate of 100 Hz. Deployed in delay mode on day zero, data capture commenced on day one at 00:00 hrs with a seven day stop time indicated. Each accelerometer was returned via mail after seven full days of wear. Monitors were initialised and downloaded using ActiLife software (ActiGraph, Pensacola, USA) version 6.10.1. All pertinent information related to the accelerometry portion of the study is described in **Table 1**.

Information	Details
Accelerometer Model	Actigraph wGT3X-BT (version 6.10.1–6.11.2; firmware 1.0.0–1.2.0)
Serial number range	113 unique devices were used ranging from MOS2A02140336 – MOS2A02140649; averaged 4 deployments per device (range 1–8)
Piezosensor orientation	Triaxial
Mode setup	Mode 29 (x, y, z, steps, lux)
Original sample rate	100 Hz (.gt3x file format)
Deployment method	Fitted in person by researcher (on day 0)
Location worn	Non-dominant wrist via nylon hook and loop strap
Requested days of wear	7 days (10080 minutes) not including day 0
Initialization	Deployed in delay mode on day 0 and commenced logging on day 1 at 00:00 hrs with a 7 day stop time indicated
Wear instructions	Wear continuously except for water based activities

Table 1: Accelerometry data collection and analytical procedures.

Blood pressure: Blood pressure (Omron 705IT) was taken after a minimum of 10 minutes sitting at rest. Participants were asked to remain seated whilst the researcher placed a blood pressure cuff around the upper right arm (brachial artery) after measuring the upper arm to determine the appropriate cuff size. Three measurements were taken, each separated by one minute.

Point-of-care-measures: Point of care systems for the fast, non-invasive assessment of cardio-metabolic and coronary arterial disease are becoming increasingly important for effective screening. Arterial stiffness was measured using an infra-red photo-plethysmography sensor (PulseTrace PCA2, CareFusion) with the sensor placed upon participants' fingertip for 30–60 seconds. Advanced Glycation Endproducts were measured using a skin autofluorescence device (AGE reader, Diagnoptics Technologies); three measures were conducted taking a total of three minutes.

Questionnaires: Demographics, comorbidities, general health and smoking history were collected using sections from the Health Survey for England 2008 and 2010 and UK Biobank questionnaires. Childhood deprivation and family history questionnaires were used to obtain information regarding early life and surrogate hereditary risk markers for respiratory disease and other chronic conditions in later life. The EuroQol (EQ-5D-5L) was answered by participants to assess their perceived health status [6]. The Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-F) [7] was completed to examine perceived physical, social, emotional and functional well-being. Pulmonary Rehabilitation Adapted Index of Self-Efficacy (PRAISE) [8] was used to examine self-efficacy to pulmonary rehabilitation in diagnosed COPD patients. The COPD Assessment Test (CAT) and Modified Medical Research Council (mMRC) questionnaires were used to examine perceived symptoms severity. The PRAISE and CAT were only completed by diagnosed COPD patients. Physical activity was recalled using a modified version of the short form International Physical Activity Questionnaire (IPAQ) [9] and self-reported weekday and weekend domain-specific sitting time was recalled using the Marshall Sitting Time Survey [10]. Lifetime activity history (frequency and context) was ascertained using a sport inventory checklist across age groups (<18, 18–29, 30–39 and 40–75 years).

Sampling strategy

The PhARaoH sample is comprised of patients with a General Practitioner diagnosis of COPD recruited from primary care and White British and South Asian British adults with no current diagnosis of COPD all residing within Leicestershire and Rutland, United Kingdom.

Quality Control

Data entry was conducted by a trained team of six personnel under the supervision of three supervisors through REDCap (http://projectredcap.org/). The data were 100% double data entered with conflicting entries identified using the REDCap data comparison function and resolved by an independent adjudicator against the source data.

Constraints

N/A

Privacy

All study participants have been guaranteed anonymity therefore identifiable information will not be included in any available research datasets. Researchers wishing to access the data must abide by the terms of usage which forbids any attempt to identify an individual.

Ethics

Ethical approval for PhARaoH was sought from the NHS Research Ethics Committee (REC) system in England. NHS RECs are appointed by the Strategic Health Authorities in England and safeguard the rights, safety, dignity and well-being of research participants. Applications for research are reviewed and an opinion provided about whether the proposed participant involvement and research is considered ethical. PhARaoH received ethical approval from NHS REC East Midlands Nottingham-2 (13-EM-0389).

4. Dataset description

Object name
PhARaoH Study

Data type
Primary data

Ontologies
N/A

Format names and versions
SPSS and .gt3x accelerometer files

Creation dates
Data was collected between March and August 2014.

Dataset creators
Movement Insights Lab

Language
English

Programming language
N/A

Licence
PhARaoH requires new users to register and agree to the conditions of use which can be found at http://www.lboro.ac.uk/research/mi-lab/research/pharaoh/pharaohconditionsofuse/. Instructions for distribution to third parties are also outlined.

Accessibility criteria
Visit the PhARaoH webpage at http://www.lboro.ac.uk/research/mi-lab/research/pharaoh/.

Repository location
Data is available upon request from Movement Insights Lab at http://www.lboro.ac.uk/research/mi-lab/research/pharaoh/pharaohconditionsofuse/. Manuscripts are required to be sent to the PhARaoH study team before submission to peer review journals.

Publication date
Not known

5. Reuse potential

The scope of enquiry from the PhARaoH dataset is broad with data pertaining to General Practitioner diagnosed COPD patients and apparently healthy adults, comprising predominantly White British and South Asian ethnicities all with extensive health examinations. Data for participants include markers for respiratory, cardiovascular, metabolic and immunological health as well as sophisticated methodology for the assessment of physical activity and sedentary behaviour through wrist-worn accelerometry. Therefore, this dataset is of great potential value across a wide range of research disciplines.

Additional Files
The additional files for this article can be found as follows:

- **Additional File 1: Appendix.** http://dx.doi.org/10.5334/ohd.28.s1

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Competing Interests
The authors have no competing interests to declare.

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