



Predicting asthma attacks using connected mobile devices and machine learning; the AAMOS-00 observational study

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Introduction

Traditional asthma self-management action plans require long-term active monitoring which can be considered tedious by many people with asthma. Mobile health technologies have increasingly provided an avenue to monitor ourselves with minimal active engagement, which is enhanced when multiple devices are connected to capture a multidimensional picture. Machine learning can harness this data to provide timely alerts to avoid asthma attacks.

Objective: To develop and assess the feasibility of an asthma attack predictor system based on data collected from a range of market available smart devices.

Participants

18+

Adult asthma patients



Had a course of OCS for an asthma attack in past 12 month



Prescribed with a pMDI relief inhaler

Participants were recruited through Asthma + Lung UK's and AUKCAR's social media and via letters from the Norfolk and Norwich University Hospital.

Relief Medication

We used the *FindAir ONE* smart inhaler to passively record relief inhaler usage.

Environment

Using the phone's location, we got the latest local weather, pollen, and air quality from *Ambee's* and *OpenWeatherMap's* API.

Peak Flow

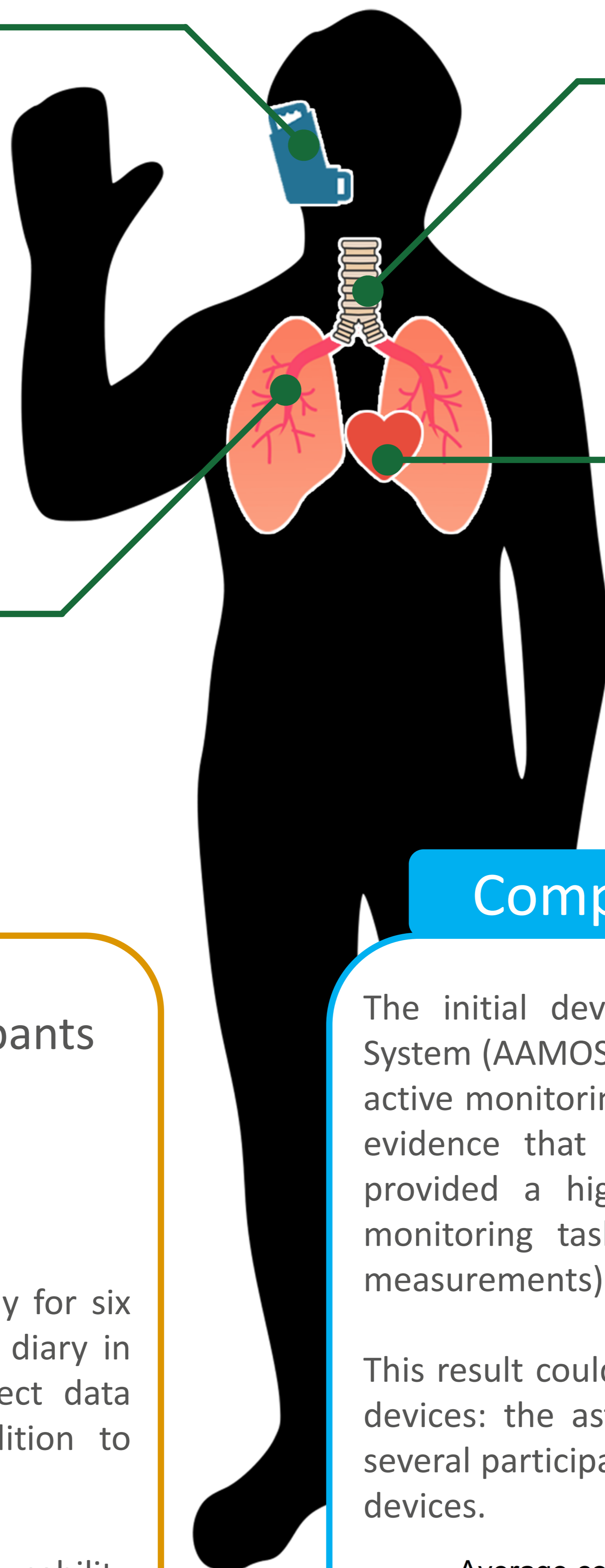
We measured daily peak flow day and night using the *Smart Peak Flow Meter*.

Symptoms

Using daily and weekly questionnaires answered on the *Mobistudy* app, we recorded asthma symptoms, visits to GPs, asthma attacks, and more.

Activity and Heart Rate

The *Mi Band 3* activity tracker, was used to passively measure heart rate, monitor activity throughout the day, and sleep quality.



Study Overview

4 Devices 14 Months 32 Participants

The AAMOS-00 study was split into two phases:

- 1) *Questionnaire monitoring*, daily for one month.
- 2) *Smart device and questionnaire monitoring*, daily for six months. Up to 30 participants who kept a regular diary in phase 1 were given three smart devices to collect data automatically as they used the devices, in addition to completing daily and weekly questionnaires.

At the end of phase 2, we collected feedback about usability and perception of the system of connected devices.

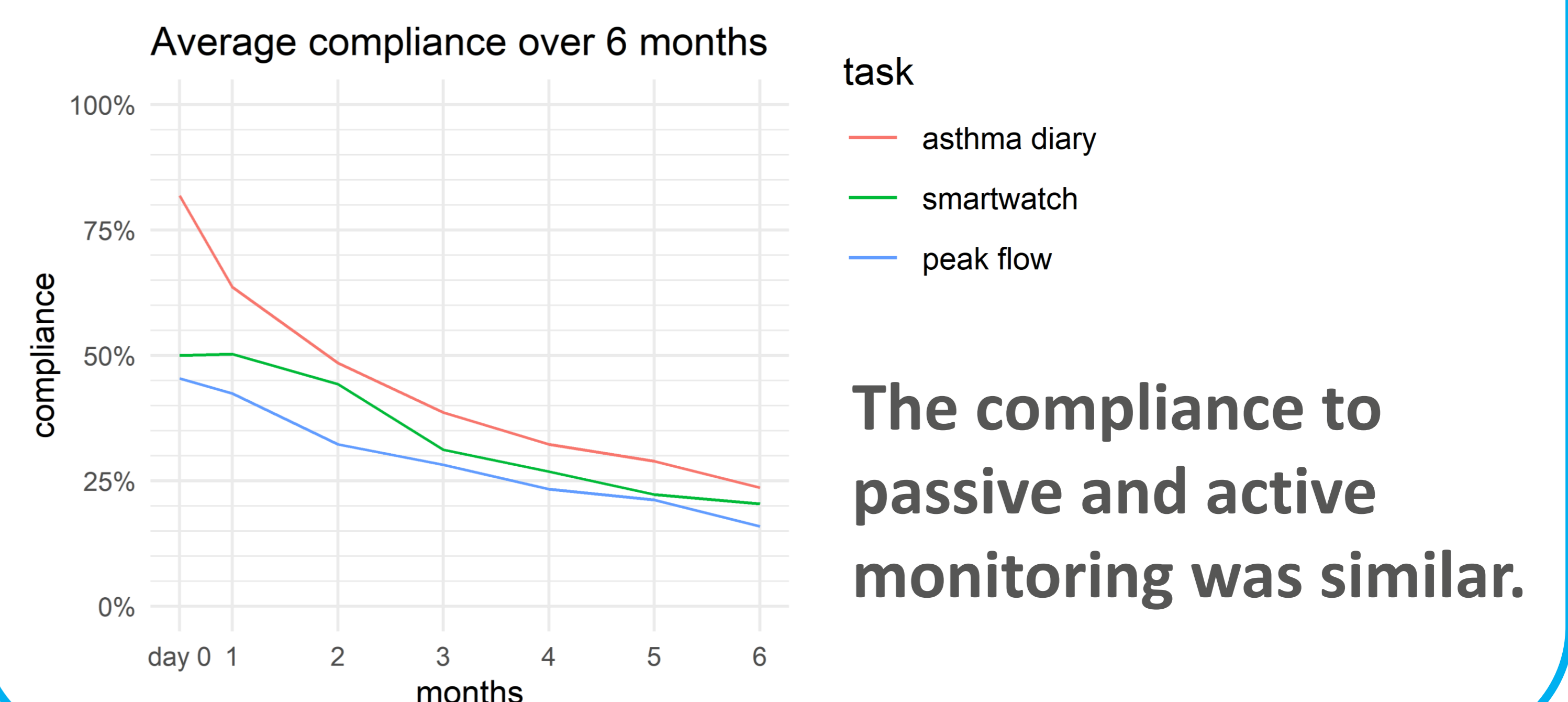
We had recruited 32 participants, 22 of whom completed phase 2 of the study. This amounted to more than 2500 patient-days of study data across 14 months.



Compliance to Monitoring

The initial development of the Asthma Attack Management Online System (AAMOS) investigated the difference in compliance to passive and active monitoring. In phase 2 of the AAMOS-00 study, we have found no evidence that a passive monitoring task (wearing the smartwatch) provided a higher level of engagement when compared to active monitoring tasks (completing asthma diaries and taking peak flow measurements) used in current practice of asthma self-management.

This result could be confounded by the technical issues related with the devices: the asthma diary task had minimal technical issues, whereas several participants encountered issues when using the smart monitoring devices.



The compliance to passive and active monitoring was similar.



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