P224 / A1866 - Use of a Mobile Application (patientMpower) to Capture Longitudinal Data on Air Quality and Home Spirometry in United States Based Pulmonary Fibrosis Patients

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RATIONALE

Idiopathic pulmonary fibrosis (IPF) is a chronic, progressive, and incurable lung disease that affects middle-aged and older adults.

Previous studies have reported that air pollution exposure is associated with acute exacerbation, disease progression, and mortality in IPF patients.[1,2,3] Ozone (O_3) exposure is associated with increased risk of acute exacerbation of IPF[1], while mortality risk increases with greater exposure to particulate matter < 2.5 µm.[3]

More than four in 10 people (41%) in the United States (U.S.) live in counties that have unhealthy levels of O_3 or particle pollution e.g. particulate matter < 2.5 µm ($PM_{2.5}$).[4] More than 133.9 million people live in the 215 counties that had unhealthy ozone or particle pollution in 2014-2016.[4]

The U.S. Environmental Protection Agency (EPA) have recently taken steps that detrimentally affect future air quality for IPF patients.[4]

Given the sensitivity of IPF patients to air pollution and recent threats to the Clean Air Act, a database of U.S. based home spirometry recordings and corresponding air quality data may be of value.

Figure 1: The patientMpower mobile application and MIR Spirobank Smart spirometer used in this study.

OBJECTIVES

The objective of this study was to use a mobile application (patientMpower) to capture longitudinal data on air quality and home spirometry in a group of pulmonary fibrosis patients.

METHODS

The patientMpower mobile application is currently being used by a cohort of IPF patients in the U.S. to objectively measure lung function (e.g. Forced Vital Capacity (FVC) and air quality in real-world settings.

Study participants were recruited via patient support groups and online promotion (Google Adwords, Facebook Advertising). Participants were provided with the patientMpower app for pulmonary fibrosis and portable Bluetooth home spirometers (Spirobank Smart, MIR Srl, Italy).

Participants were free to use the patientMpower app/spirometer as often as they wished. For every lung function measurement recorded via the patientMpower app, corresponding historical ground level O_3 and $PM_{2.5}$ data were obtained from the AirNow database[5].

RESULTS

In a 16-month period (July 2017 - October 2018), 125 U.S. based pulmonary fibrosis patients used the patientMpower app to record location tagged home spirometry.

O_3 information was available for 6,464 spirometry readings from 93 patients, while $PM_{2.5}$ information was available for 5,927 spirometry readings from 88 patients (see Table 1).

Table 1: Descriptive information on the air quality and home spirometry data analyzed

Air Pollutant	Number of patients (N)	Total Number Spirometry recordings with Air Pollutant Data	Mean ± SD number Spirometry Recordings per patient	Median	Range
O_3	93	6,464	70 ± 201	12	1 - 1,568
$PM_{2.5}$	88	5,927	67 ± 194	13	1 - 1,558

22% (1,447) of the total lung function measurements were recorded during times of moderate/unhealthy O_3 levels, while 28% (1,660) of the total lung function measurements were recorded during times of moderate/unhealthy $PM_{2.5}$ levels.

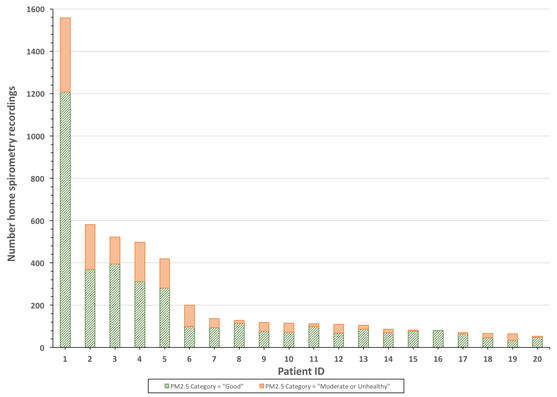

Figure 2: The number of lung function recordings obtained from the 20 most engaged spirometry users and the distribution of 'good' versus 'moderate/unhealthy' $PM_{2.5}$ levels during these recordings.

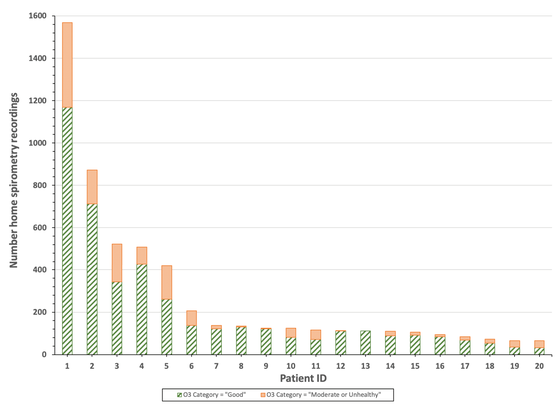

Figure 3: The number of lung function recordings obtained from the 20 most engaged spirometry users and the distribution of 'good' versus 'moderate/unhealthy' O_3 levels during these recordings.

DISCUSSION

This study demonstrated the feasibility of using the patientMpower application as a tool to record longitudinal data on air quality and home spirometry in a group of pulmonary fibrosis patients.

The majority of patients in this study were exposed to moderate or unhealthy levels of O_3 and $PM_{2.5}$ at varying time points, increasing the risk of acute exacerbation, disease progression, and mortality.

Over time, a database of home spirometry and air quality data could be built up. Such a database may be of clinical benefit in investigating the impact of air quality on IPF patients' health and how changes to air quality regulations impact this group.

REFERENCES

[1] Johannson KA, Vittinghoff E, Lee K, et al. Acute exacerbation of idiopathic pulmonary fibrosis associated with air pollution exposure. Eur Respir J. 2014;43(4):1124-1131.
[2] Sesé L, Nunes H, Cottin V, et al. Role of atmospheric pollution on the natural history of idiopathic pulmonary fibrosis. Thorax. 2018;73(2): 145-150.
[3] Winterbottom CJ, Shah RJ, Patterson KC, et al. Exposure to ambient particulate matter is associated with accelerated functional decline in idiopathic pulmonary fibrosis. Chest. 2018;153(5):1221-1228.
[4] State of the Air 2018 Report - American Lung Association
[5] AirNow API - https://docs.airnowapi.org/

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