

# Diagnosis of Chronic Obstructive Pulmonary Disease (COPD) Exacerbations Using a Smartphone-Based, Cough Centred Algorithm

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## Introduction:

COPD is a common respiratory condition associated with several syndromes that can lead to worsening symptoms and hospitalisation (acute exacerbations (AECOPD), heart failure, pneumonia, pneumothorax). Early diagnosis of COPD exacerbations allows patient self-management and initiation of action plans. To determine the accuracy of a smartphone-based algorithm that analyses cough sounds and patient-reported symptoms in detecting exacerbations of COPD in subjects greater than 40 years old.

## Methods:

**Study population:** Only those subjects with identified COPD.

**Data collection:** At least five coughs were recorded from each participant (Figure 1) along with four patient-reported features (age, fever, acute cough, smoking history). A clinical examination was undertaken and spirometry was performed where possible.

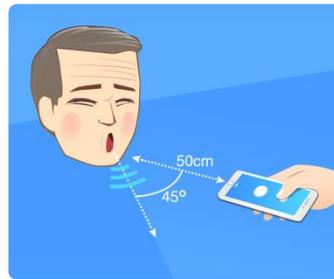


Figure 1

**Index test:** Cough sounds and features were recorded on a standard smartphone and were then analysed using an automated classifier which had been trained on an independent dataset to identify exacerbations of COPD.

**Reference test:** Medical file review by a doctor considering the results of all tests undertaken. An exacerbation of COPD was defined as: worsening symptoms of shortness of breath (SOB) or cough and new lower-respiratory symptoms (SOB, cough, chest pain less than 1 week) or acute fever history in a patient with COPD (FEV1/FVC <0.7 on best test or historical diagnosis of COPD with environmental exposure).

**Diagnostic accuracy:** Determined by percent agreement of index test with reference test.

## Results:

Mean age of participants was  $72.3 \pm 9.5$  years, 55.6% were female.

	In comparison with clinical COPD exacerbation diagnosis (non-standard reference test)	
Index Test	Positive Percent Agreement [95% CI]	Negative Percent Agreement [95% CI]
≥40 years (n=162)	82.1% [72.3%, 89.9%]	91.0% [82.4%, 96.3%]
≥65 years (n=127)	85.9% [75.0%, 93.4%]	88.9% [78.4%, 95.4%]

84 patients were given a reference diagnosis of COPD exacerbation, of these 64 were aged over 65 years.

78 patients were given a reference diagnosis of no COPD exacerbation, of these 63 were aged over 65 years.

## Conclusion:

When compared with the reference diagnosis, the algorithm accurately predicted COPD exacerbations in subjects with known COPD.

This could be a useful tool in the initial assessment of patients in urgent-care settings such as emergency departments or in general practice.

As the algorithm is installed on standard smartphones, it may aid management of COPD patients in remote or resource-limited locations or in patient-initiated treatment.

## Affiliations:

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