

symptoms and chest infections despite lacking persistent air-flow obstruction. Possible causes for respiratory symptoms in the unobstructed group include deconditioning, obesity, or early signs of airways disease. Further clinical characterisations and long term follow up would be recommended for this group of patients.

#### S45 PREDICTING LIKELIHOOD OF EMERGENCY DEPARTMENT ADMISSION PRIOR TO TRIAGE: UTILISING MACHINE LEARNING WITHIN A COPD COHORT

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10.1136/thorax-2018-212555.51

**Background** Acute exacerbation of COPD is one of the commonest reasons for emergency department (ED) attendance and admission. Optimising ED patient flow requires early identification of patients needing inpatient care to initiate the admissions process, improve bed management and reduce ED length of stay. Stratifying COPD patients by likelihood of admission and length of stay at triage would potentially facilitate these and other operational efficiencies, such as targeting early supported discharge team review and COPD care bundle. We propose a machine learning (ML) based approach to predicting the need for admission from ED amongst a cohort of COPD patients.

**Methods** Retrospective cohort study utilising electronic health record (EHR) data from 13,173 ED encounters in 1,763 COPD patients who attended ED in our healthboard with diagnosis of COPD from April 1st 2013 – March 31st 2017. Utilising only variables obtained at patient registration or already in the EHR from prior visits, we developed predictive models using ML algorithms, specifically ensemble-based methods XGBoost and AdaBoost, to predict a patient's likelihood of admission during that ED encounter. Ten-fold cross-validation was used for model validation.

**Results** The overall admission rate was 68% (8,869 of 13 173 encounters). The AdaBoost model showed superior performance in the derivation of a COPD ED admission risk score, with precision (positive predictive value) of 0.83, recall (sensitivity) of 0.79, accuracy of 0.75, and an area under the receiver operating characteristic curve of 0.79. Precision, recall and negative predictive value improved with year of ED presentation, as data availability increased. The most significant features in the model included those related to prior utilisation of acute care services (both ED and inpatient).

**Conclusions** The use of ensemble ML algorithms to predict ED admissions utilising variables available at patient triage showed good performance. Such results highlight the ability of applied ML in the healthcare setting when incomplete and disordered data is expected. Adding prospective data is likely to further improve model accuracy. Surfacing actionable insights and decision support from ML-derived predictive models to clinicians in real-time, at point of care, offers prospects for optimising COPD management.

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#### BLOOD EOSINOPHIL COUNTS AND RISK OF SHORT-TERM HOSPITAL READMISSION FOR COPD EXACERBATION

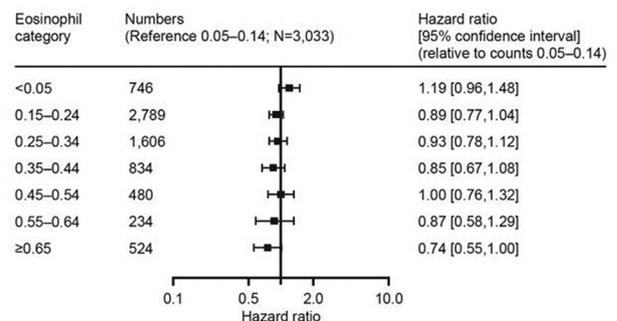
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10.1136/thorax-2018-212555.52

**Introduction and objectives** Elevated blood eosinophil count (BEC) is a proposed biomarker for risk of readmission for patients with COPD. We aimed to determine if preadmission BEC is an indicator of short-term hospital readmission for COPD exacerbation.

**Methods** We analyzed 2 years of medical records data (Clinical Practice Research Datalink with Hospital Episode Statistics linkage historic database) from patients hospitalized for COPD exacerbation (ICD-10 codes J44.0 or J44.1). Patients were included if they had a BEC recorded during stable disease (no exacerbation 4 weeks prior to measurement) within 1 year prior to hospitalization discharge (index date). We analyzed the association between BEC and readmission risk within 4 weeks after index date, with adjustment for age, sex, smoking status, body mass index, and timing of BEC by Cox regression. We also assessed independent clinical predictors of short-term hospital readmission.

**Results** Of 10 246 patients who met the inclusion criteria, 11.6% (n=1,189) were readmitted to hospital for COPD exacerbation within 4 weeks of discharge. Patients with very high BEC ( $\geq 0.65 \times 10^9/L$ ; 5.1%) had the lowest risk (figure 1), which was most accentuated in 53% of patients treated with oral corticosteroids in general practice in the baseline year (hazard ratio [95% confidence interval]=0.53 [0.34–0.81]). A very low BEC ( $< 0.05 \times 10^9/L$ ) was a significant independent risk factor of short-term readmission, in addition to older age, male sex, being underweight, treatment with triple therapy, a greater number of baseline exacerbations, greater degree of dyspnea (modified Medical Research Council dyspnea scale score), lesser% predicted forced expiratory volume in 1 s, and a diagnosis of anxiety or depression.



COPD, chronic obstructive pulmonary disease.  
Adjusted hazard ratios for readmission for COPD exacerbation within 4 weeks for patients assigned to ascending blood eosinophil count categories as compared with a reference blood eosinophil count 0.05–0.14 $\times 10^9/L$ .

**Abstract 46 Figure 1** Short-term readmission for COPD exacerbations within 4 weeks

**Conclusions** Patients with  $\text{BEC} \geq 0.65 \times 10^9/\text{L}$  measured during stable disease state were at reduced risk of short-term readmission for COPD exacerbation, whereas those with eosinopenia were at increased risk, perhaps indicating poor treatment response. Clinical features beyond blood eosinophils may help identifying patients at risk of hospital readmission.

Please refer to page A265 for declarations of interest related to this abstract.

#### S47 A COMPARISON OF THE DECAF SCORE AND NEWS2 TO PREDICT INPATIENT DEATH IN PATIENTS WITH COPD EXACERBATION

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10.1136/thorax-2018-212555.53

**Introduction** The DECAF score accurately predicts death in patients hospitalised with COPD exacerbation. It is superior to other prognostic scores and can be used to guide treatment, such as identifying low risk patients for Hospital at Home.<sup>1</sup> The National Early Warning System was updated in December 2017 (NEWS2), and takes into account patients at risk of hypercapnic respiratory failure who require lower target oxygen saturations. The prognostic benefit of admission NEWS2 in comparison to DECAF has not been examined. Whilst the function of NEWS2 is different from DECAF, if admission NEWS2 were as good or better at risk prediction than DECAF then the principle of parsimony would favour its use.

**Methods** The DECAF score and the original NEWS indices were collected in consecutive admissions of patients with COPD exacerbation (n=2,645) in derivation, internal validation and external validation cohorts from six UK hospitals. COPD was confirmed with spirometry, and an exacerbation was based on GOLD criteria. The original NEWS indices were re-coded to the NEWS2 scoring system, and its discrimination was assessed using the area under the receiver operator curve. DECAF and NEWS2 were compared using the method of DeLong. Missing data were imputed using multiple imputation.

**Results** For in-hospital mortality prediction, DECAF was superior to admission NEWS2 across all three cohorts, and was more consistent between cohorts. Overall, DECAF offered more clinically useful risk stratification: low risk DECAF=1.2%, NEWS2=3.5%; moderate risk DECAF=6.4%, NEWS2=5.6%; high risk DECAF=25.5%, NEWS2=15.4%.

**Discussion** Assessment of in-hospital mortality risk on admission for COPD exacerbation should inform clinical care. Admission NEWS2 showed variable and at best modest performance in different cohorts, which does not support its adoption for this purpose. DECAF offers excellent and consistent prediction of inpatient mortality, and clinically and cost-effective selection for Hospital at Home.<sup>1</sup> This supports retention of DECAF for this purpose. These results do not detract from use of repeated measures of NEWS2 during admission for its intended purpose of identifying deteriorating patients.

**Abstract S47 Table 1** Area under the receiver operator curve and 95% confidence interval for DECAF and admission NEWS2 in predicting inpatient death in patients with COPD exacerbation

Cohort	DECAF	NEWS2	P*
Derivation	0.86 0.82-0.89	0.70 0.64-0.76	<0.001
Internal Validation	0.83 0.78-0.87	0.77 0.72-0.83	<0.001
External Validation	0.82 0.77-0.87	0.68 0.60-0.76	<0.001

\*P value calculated by method of DeLong

#### REFERENCE

- Echevarria. *Thorax* 2018.

#### S48 UNDERSTANDING THE IMPACT OF INTRODUCING A BEST PRACTICE TARIFF ON CLINICAL PROCESS STANDARDS IN THE NATIONAL COPD AUDIT PROGRAMME

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10.1136/thorax-2018-212555.54

**Background** On 1/2/17, the National COPD Audit moved to continuous data collection for a small number of clinical process items with real time feedback presented as run charts designed to support site level quality improvement initiatives. In addition, a best practice tariff (BPT) for COPD admissions was agreed with NHSE to promote hospital management and Board engagement with audit improvement aims. We hypothesised that there would be differences observed in the compliance of clinical process standards for the 2 process items aligned to the BPT compared with the 4 that were not.

**Methods** Data were entered by each site for all eligible cases in hospitals in England and Wales to a bespoke web tool hosted by Crown Informatics. Data on the following key indicators were collected: Patients receiving NIV within 3 hours of arrival, Current smokers prescribed smoking cessation pharmacotherapy, Patients with spirometry result available, Patients prescribed oxygen to target saturation, Patients receiving a discharge bundle, Patients receiving respiratory review by a member of the respiratory team within 24 hours of admission, Patients where care meets best practice tariff (BPT) for COPD; the latter three being related to the BPT.

The BPT was launched on 1 st April 2017. Compliance with clinical process standards was calculated for all cases discharged during the month of February 2017; pre BPT launch, and at the end of the observation period (June 2018), after the BPT had been introduced. The proportion of hospital discharges where the clinical process standard was met were measured.

**Results** Data on 98,506 COPD hospital admissions were entered by 186 hospitals over the 17 months. 4797 cases were discharged in February 2017 and 2804 in June 2018. There were improvements in compliance with all the clinical process standards measured (table 1).