Clinical Research Results Abstract

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Predicting hospitalization of Swedish patients due to COPD exacerbation with machine learning

Karin Lisspers[1], Björn Ställberg[1], Kjell Larsson[2], Christer Janson[1], Mario Mueller[3], Mateusz Luczko[3], Bine Kjoeller Bjerregaard[3], Gerald Bacher[4], Björn Holzhauer[4], Pankaj Goyal[4], Gunnar Johansson[1]
[1]Uppsala University, [2]Karolinska Institutet, [3]IQVIA, [4]Novartis Pharma AG

Aim: COPD exacerbations can negatively impact disease severity, progression, mortality and lead to hospitalizations. Given the serious personal and economic cost of COPD exacerbations, there is a need for tools that predict impending exacerbations and allow pre-emptive intervention to prevent exacerbations and improve outcomes. We aimed to develop a model that predicts a patient's risk of hospitalization due to severe exacerbations (defined as COPD related hospitalizations) of COPD, using Swedish patient level data.

Method: Patient level data for 7,823 Swedish patients with COPD was collected from electronic medical records (EMRs) and national registries covering healthcare contacts, diagnoses, prescriptions, lab tests, hospitalizations and socioeconomic factors between 2000 and 2013. Models were created using machine-learning methods to predict patient hospitalization due to COPD within the next 10 days, in order to predict imminent exacerbations. Exacerbations occurring within this period were considered as one event. Hyperparameters were optimized based on mean cross validation score of area under precision-recall curve (AUPRC) and area under receiver operating curve (AUROC) was used to compare performance with previous studies. Model performance was assessed on a hold-out test set.

Results: The most important factors for predicting severe exacerbations were total number of previous exacerbations, exacerbations in the previous six months, number of COPD-related healthcare contacts and co-morbidity burden (Charlson Comorbidity Index). Validation on test data yielded an AUROC of 0.86 and AUPRC of 0.08, which was high in comparison to previously published attempts to predict COPD exacerbation.

Conclusion: Our work suggests that clinically available information on patient history collected via automated retrieval from EMRs and national registries or directly during patient consultation can form the basis for future clinical tools to predict risk of severe COPD exacerbations.

Declaration of Interest

The main author (KL) is a member of the ARCTIC study steering committee. KL has during last five years participated in educational activities and lectures with AstraZeneca, Novartis, TEVA and Chiesi and advisory boards with AstraZeneca, Novartis, Boehringer Ingelheim and GlaxoSmithKline.