International Primary Care Respiratory Group
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Abstract Presentations

5. Karin Lisspers, Sweden

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

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Breathing and feeling well through universal access to right care

Disclosure

Declaration of Interest:

KaL, BS, KjL, CJ and GJ are members of the steering committee on the ARCTIC study, which is funded by Novartis.

KaL and CJ have 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.

BS reports receiving funding from AstraZeneca, Novartis, Boehringer Ingelheim, GlaxoSmithKline, Meda, Teva, and Chiesi outside the submitted work.

KjL has during the last five years served in an advisory board and/or served as speaker and/or participated in education arranged by AstraZeneca, Boehringer Ingelheim, Chiesi, GlaxoSmithKline, Orion, Novartis, Mylan, Sanofi and Teva.

GJ served on advisory boards arranged by AstraZeneca, Novo Nordisk and Takeda.

GB, BH, PG are employees and shareholders of Novartis.

MM, ML, BKB are employees of IQVIA. IQVIA have received funding from Novartis to conduct the study.

Background, rationale and objectives

Background

- COPD exacerbations negatively impact disease severity, progression, mortality and may lead to hospitalizations.

Rationale/clinical need

- Tools that predict impending exacerbations could be used for pre-emptive intervention to prevent exacerbations and thus improve long-term COPD outcomes.

Study objective

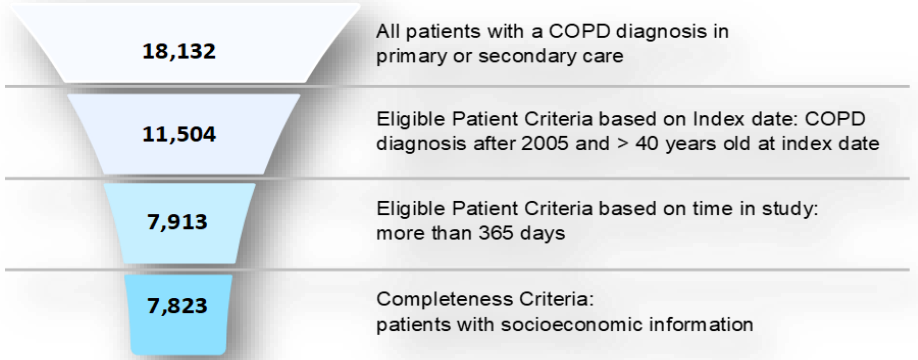
- To develop a model that predicts short term (within 10 days) ris
  factors for hospitalization due to severe exacerbations of COP
  using Swedish patient level data.

Study design

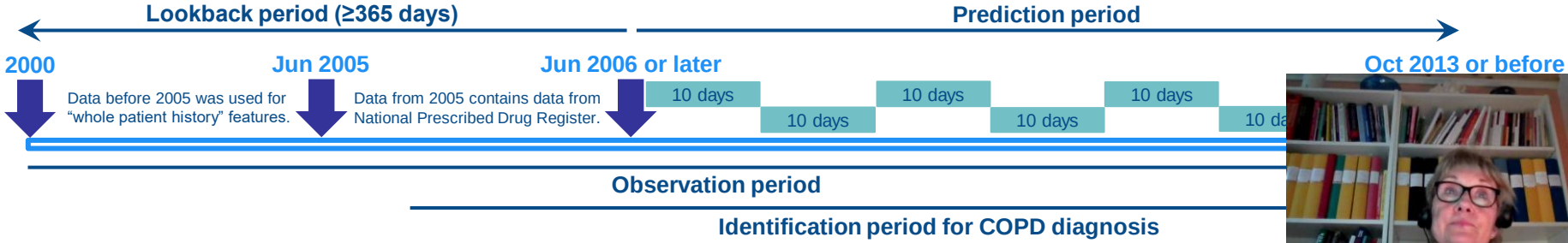
The ARCTIC dataset

- Large retrospective cohort study in Sweden spanning a time period between 2000-2013[1,2].
- Data extracted from electronic medical records (EMR) from 52 primary care centers and linked with national health registries.
- Most COPD patients are treated in primary care in Sweden.

Patient population



Study time period



1. Lisspers K et al. Economic burden of COPD in a Swedish cohort: the ARCTIC study. Int J Chron Obstruct Pulmon Dis. 2018;13:275-285.
2. Lisspers K et al. Gender differences among Swedish COPD patients: results from the ARCTIC, a real-world retrospective cohort study. NPJ Prim Care Respir Med. 2019;29(1):45.

Methods

Prediction factors

- Patient demographics
- History of previous exacerbations
- Comorbidities
- Medications
- Laboratory tests and measurements
- Contacts to the healthcare system
- Seasonal variables

Model selection

Following methods were tested:

1. Logistic regression
2. Random forest
3. Gradient Boosted trees

Final model (Gradient Boosted trees) was selected using cross-validation on the training data.

Validation

- All models were developed on 75% of cohort (5,867 patients) and validated on the remaining *unseen* 25% of cohort (1,956 patients).
- Validation analyses showed superior predictive performance as compared to a *rand*
  - AUROC score = 0.86 (compared to AUROC = 0.50 for a *random classifier*)
  - AUPRC score = 0.08 (12.5 times more effective than a *random classifier*)

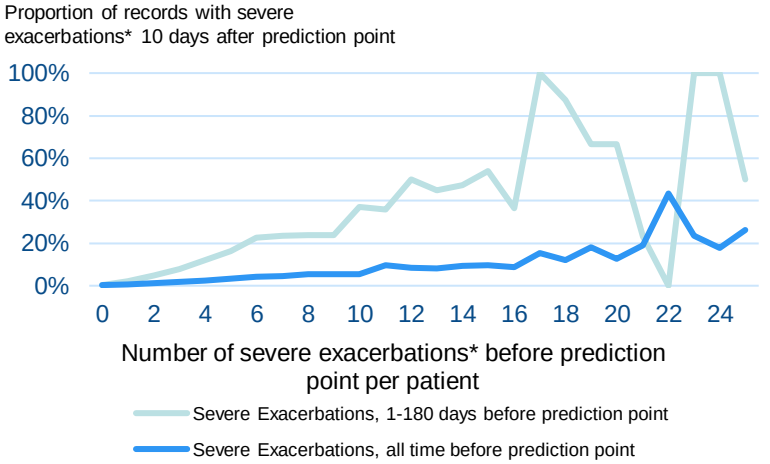
AUROC=Area Under the Receiver Operating Characteristics; AUPRC = Area Under the Precision-Recall Curve

Results

Top most important prediction features

1. Number of severe exacerbations* (last 180 days)
2. Number of severe exacerbations* (whole history)
3. First COPD diagnosis as outpatient
4. Number of COPD related healthcare contacts (whole history)
5. Charlson Comorbidity Index (CCI)
6. First COPD diagnosis as inpatient

Previous severe exacerbations* are prediction factors for future COPD hospitalization



The risk for hospitalization within
increases with the number of p
exacerbations*.

* Severe exacerbations were defined as exacerbation where a hospital stay was required.

Conclusions

Clinical information on patients' history from EMRs and national registries can predict severe exacerbations (hospitalizations).

To identify patients at risk of severe exacerbations focus consultations on:

- History of exacerbations
- Setting of first COPD-diagnosis
- COPD-related contacts to healthcare system
- Comorbidities