Utilizing clinical data to predict the severity of presentation of chronic lung diseases

Description:

The Covid-19 pandemic heavily accelerated deployment of telemedicine and remote care services to reduce infection spread and protect essential workers. This has created opportunities to tackle long-standing public health problems endemic to respiratory illness. Annual influenza and coronavirus infections are attributed to 40-70 thousand annual US deaths and ~$21 billion in yearly employer spending. Exacerbations of chronic lung disease account for ~ $70 billion of an astounding $130 billion in annual US direct costs from COPD (chronic obstructive pulmonary disease) and Asthma alone. The lack of accurate, automated, and personalized approaches for self-identification and early care of these illnesses has led to unnecessary healthcare utilization, unmitigated infection spread, increased morbidity, and missed opportunities for timely therapeutic intervention.

Vironix (vironix.ai) specializes in developing consumer validated, cloud-enabled application-programming interface software that – when invoked under smartphones, tablets, computers, monitoring devices, and a variety of institutional HR/Payroll software – delivers on-demand detection and triage of health escalations due to respiratory illness. The major challenge in developing these algorithms, however, is access to relevant data. Electronic medical records are proprietary, often inaccessible, and generally contain hoards of incomplete, dirty, and irrelevant data. Public databases that hold genetic, blood, and biomarker type data sources include some explanatory information, but as this data is generally not available to consumers at-home, it can't be used to guide software-based diagnostics in a reasonable consumer setting.

Some datasets that are available (in the literature and in public databases) include clinical characteristic databases which catalog the features of those presenting with severe and non-severe illness flare-ups in both inpatient and outpatient settings (i.e.: percentage of severe cases in which patients had specific symptoms, vital signs, baseline lung function, height, weight, etc).

We propose a project to identify and leverage clinical characteristic data in the literature to classify severe and non-severe flare-ups of chronic lung disease. Vironix has successfully implemented one approach in which it has converted marginally distributed clinical characteristic data on severe/non-severe Covid-19 patient cases into hypothetical patient scenarios for training ML-classification models. This conversion process used a mix of Bayesian inference and Monte Carlo simulation. During the MPI 2021 workshop, we wish to explore the following:

Specific questions/aims:

1) Identify – in scientific literature and/or public databases – a representative set of data that catalogs the clinical characteristics of patients presenting with both severe and non-severe flare-ups of chronic lung disease. Vironix has made some progress on this already, but we'd like more research done.

2) Identify a methodology for utilizing that data to predict severe/non-severe presentations of chronic lung diseases (e.g., COPD or Asthma). Vironix has some approaches for an alternate disease, but we'd be looking to explore others.

3) Develop and validate a prediction model and show reasonable accuracy, sensitivity, and specificity in detecting adverse health episodes.

4) describe and detail the most important clinical features relevant to predicting severe exacerbations of lung disease.

Some useful literature and links:

Company website: vironix.ai

CovidX: Remote Screening, Surveillance, Triage, and Management of Novel Coronavirus
https://vironix.ai/wp-content/uploads/2021/02/CovidX_CoronaVirus_WhitePaper.pdf

Machine Learning Based Triage Models for Remote Detection and Care of Influenza
https://vironix.ai/wp-content/uploads/2021/02/Vironix_MP2_Influenza_Tech_report_2020-1.pdf

A machine learning approach to triaging patients with chronic obstructive pulmonary disease
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0188532

Economic Burden of Chronic Obstructive Pulmonary Disease (COPD): A Systematic Literature Review
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7049777/