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Predicting asthma attacks in New Zealand using machine learning

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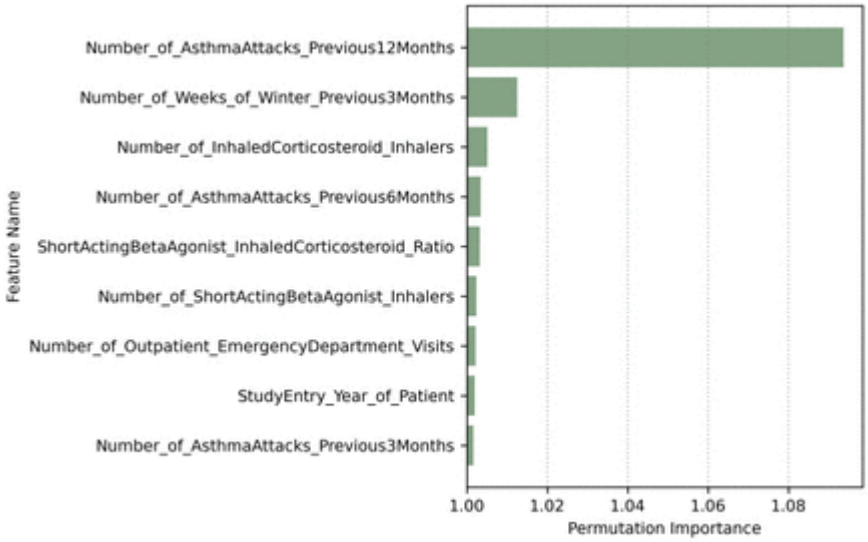
Abstract

Introduction: Identifying the factors that increase the risk of asthma attacks is key for timely patient management. Machine learning (ML) techniques have been increasingly used for risk prediction.

Aims: To identify risk factors for asthma attacks in New Zealand (NZ) and evaluate the performa ML algorithms in predicting the risk of asthma attacks.

Methods: NZ National health datasets from 355,113 patients ≥6 years old with asthma were analysed between 2008 and 2016. The modelled outcome was an occurrence of an asthma attack in 3 months. Two ML models - Extreme Gradient Boosting (XGB) and Random Forest (RF) - and one statistical model - a Logistic Regression (LR) were developed. Feature selection, data pre-processing, imbalance handling and hyperparameter tuning were conducted.

Results: Prior history of asthma attacks, length of exposure to the winter season, number of inhaled corticosteroids (ICS) and short acting beta-agonist (SABA) inhalers were important risk predictors (Fig 1). Overall, XGB with random under-sampling performed marginally better (Area Under the Receiver Operating Curve=0.76 (F1 score=0.27, PPV=0.173, NPV=0.962, Sensitivity=0.622, Specificity=0.763).



Conclusion: ML models performed marginally better than LR in asthma attack prediction. Future research to explore other ML and data imbalance handling techniques is needed to enhance risk prediction.

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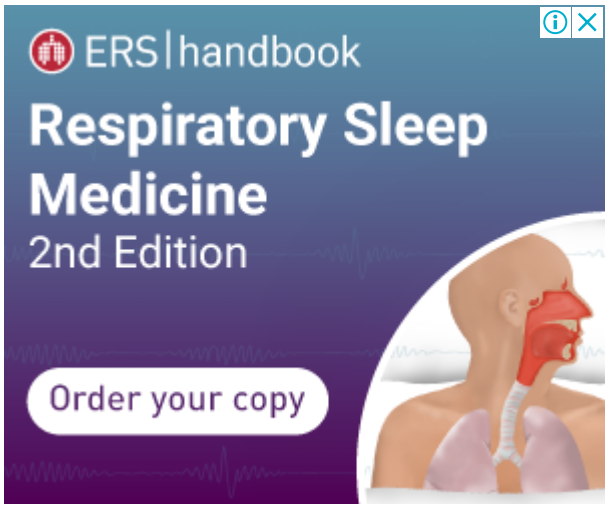
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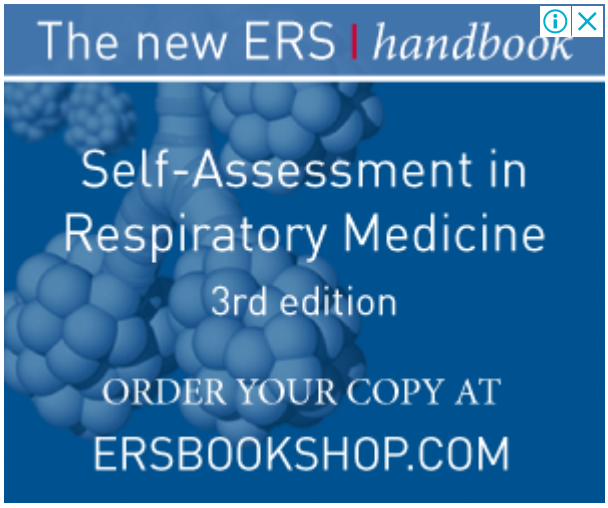
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