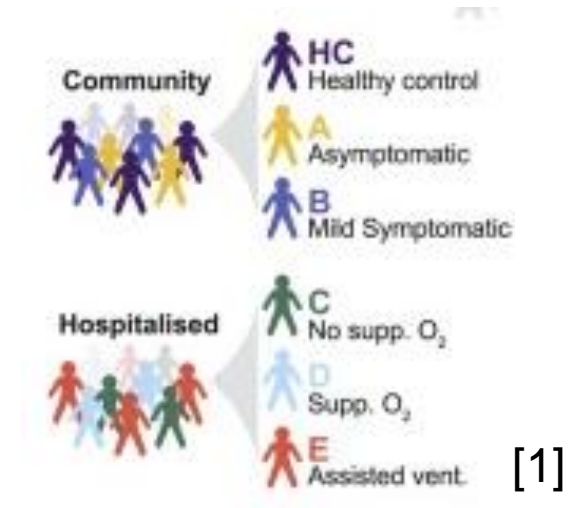# Predicting the severity of Covid-19 Using Full Blood Counts

Samuel Tull

Introduction

- NHS was not prepared for the Covid-19 pandemic

- Unclear who would develop severe symptoms

- Can we use full blood counts?

- Five categories of clinical severity: A-E [1]

[1] Bergamaschi, L, et al. (2021) Longitudinal analysis reveals that delayed bystander CD8+ T cell activation and early immune pathology distinguish severe COVID-19 from mild disease.

Why Full Blood Counts?

- Most common medical test

- Can diagnose Covid-19 using FBCs [2]

- Large amount of data:
  - 4000 Covid-19 positive hospital patients
 - 83% had FBC in first 24hrs
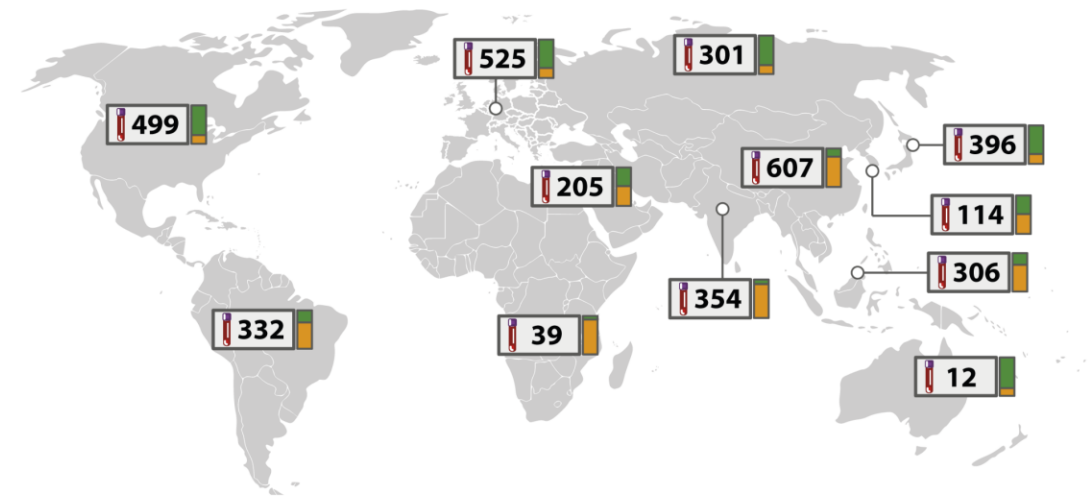
Global FBC testing. Numbers represent millions of tests, coloured bars represent the proportion of tests performed in primary (green) and secondary (orange) healthcare settings.

[2] Zuin, G, et al. (2022). Prediction of SARS-CoV-2-positivity from million-scale complete blood counts using machine learning.
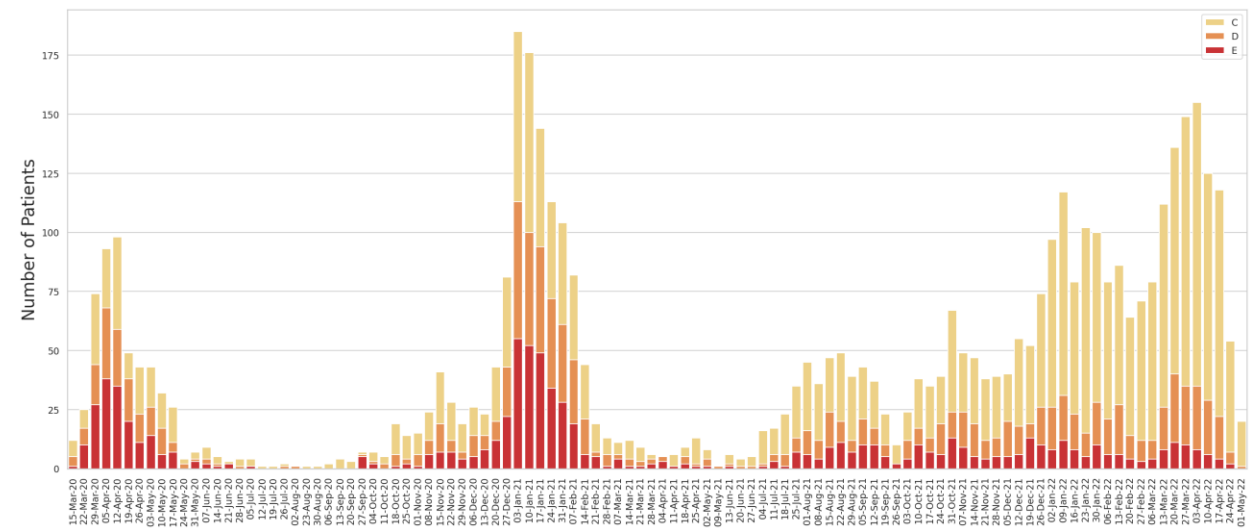
Data

- Removed non-covid admissions

- Removed patients who did not take FBC test within 48hrs
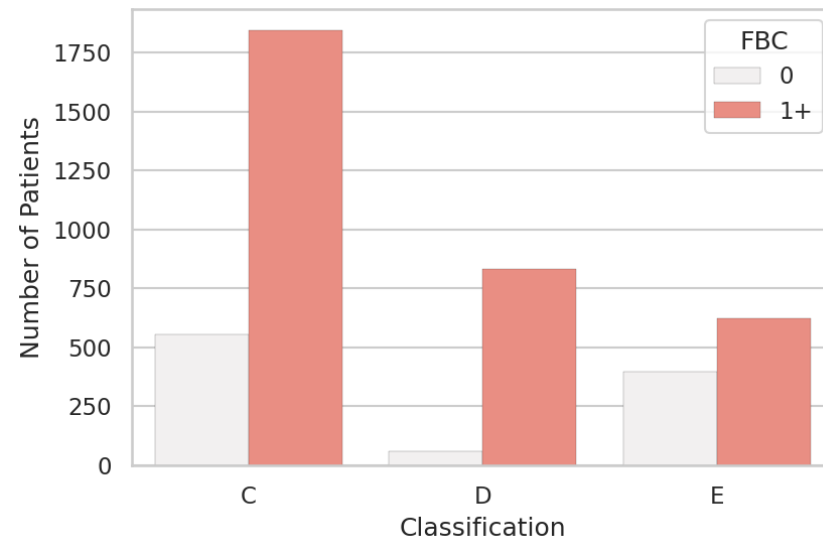
Number in each Covid-19 severity group for patients admitted to Addenbrookes hospital, coloured by number of full blood counts.
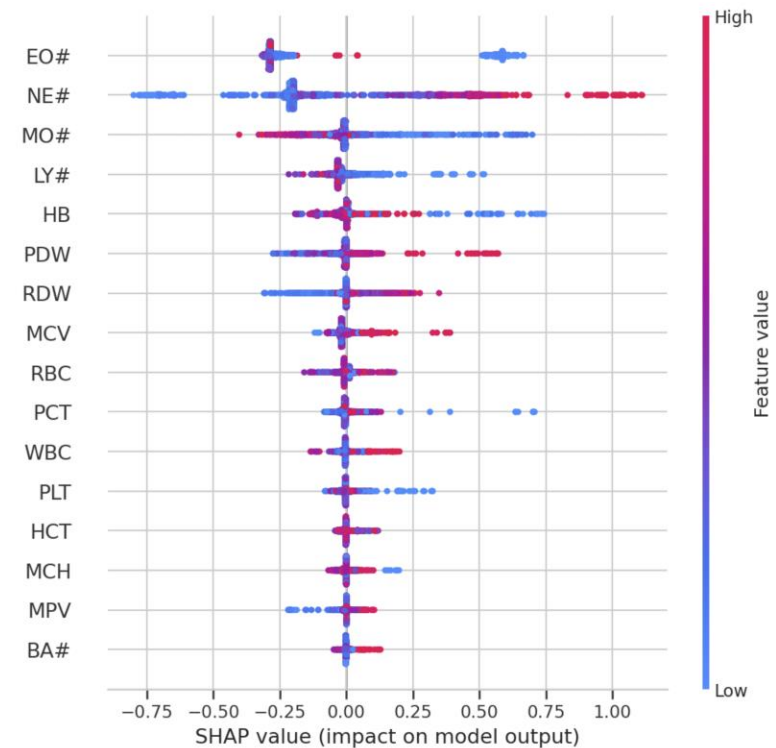
Weekly number of Covid-19 positive admissions to Addenbrookes hospital, coloured by covid severity class.

Results

- We take the first FBC following admission for each patient

- Classifying C/D/E achieves
  - Accuracy- 63%

- Classifying C/E achieves
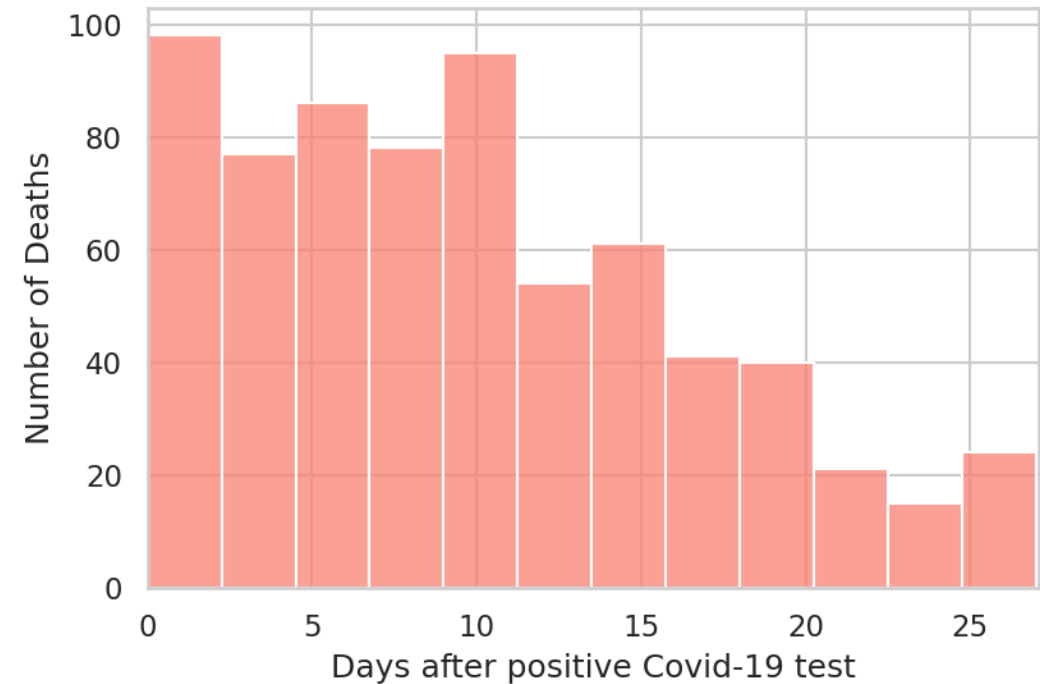 - Accuracy- 81%,
  - AUROC- 0.88

Model is XGBoost with 5-fold cross validation

The shapley values for this model. Higher features have been learnt to be more useful when classifying the severity of Covid-19.

Deaths within Group E

- 600 from group E had a FBC at admission

- 50% died within 28 days of testing positive

- Classifying Death vs Recovered
  - Accuracy- 68%

Histogram displaying the distribution of the number of days between patients testing positive for Covid-19 and passing away.

Model is XGBoost with 5-fold cross validation

Future Directions

- Some signals in the FBCs may help to predict the severity of Covid-19

- Consider other respiratory viruses

- Outbreak detection models