

# Socioeconomic and environmental determinants of COVID-19 mortality in England a geographical random forest analysis



Zhiqiang Feng  
University of Edinburgh



## Research questions

- What were the spatial patterns of COVID-19 mortality and how did they change over time?
- What were important socioeconomic and environmental predictors of COVID-19 mortality in England?
- Did the importance of these factors vary over space and time?

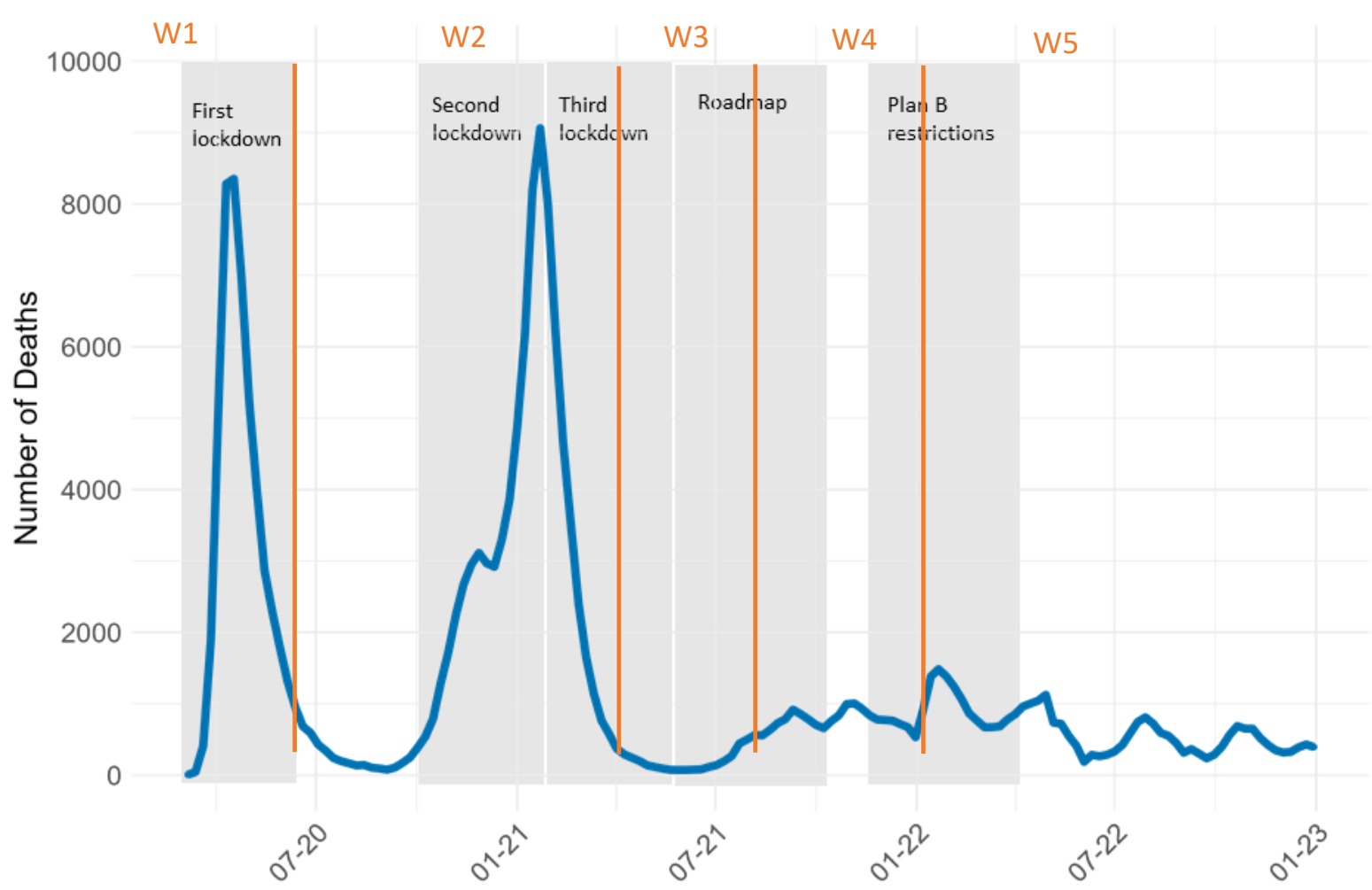


Figure 1 Weekly number of deaths in England

## Data

The COVID-19 death data was acquired from ONS (Office for National Statistics):

- Monthly counts of deaths from 1<sup>st</sup> of March 2020 to 30<sup>th</sup> of April, 2021
- Geography: Middle Lower Super Output Areas (MSOA, average population was 8200, N=6791).

Predictors considered: demographic (age, ethnicity), social deprivation, viral exposure, overcrowding, care home, pollution, underlying medical condition (prevalence of obesity).

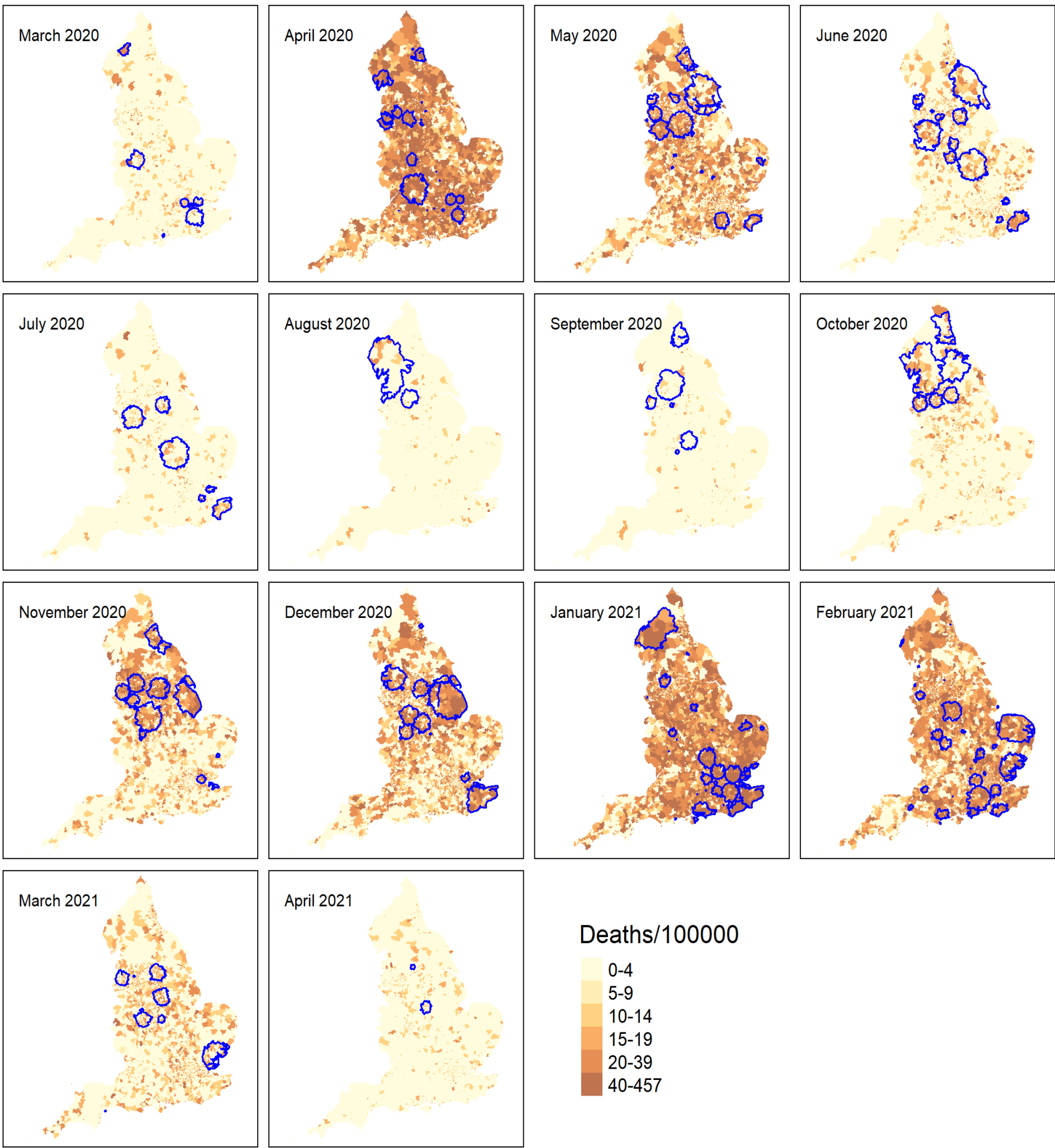


Figure 2 COVID-19 death rates and hotspots by month in England

## Methods

SatScan (Kulldorff, 1997) was used for exploring the hotspots of COVID-19 mortality by month.

The geographical random forests model, an extension of the traditional random forests approach introduced by Georganos et al. (2021) was employed to assess the local feature importance of each factor and to explore changes of local dominant factors for COVID-19 mortality between the first and second waves of the pandemic.

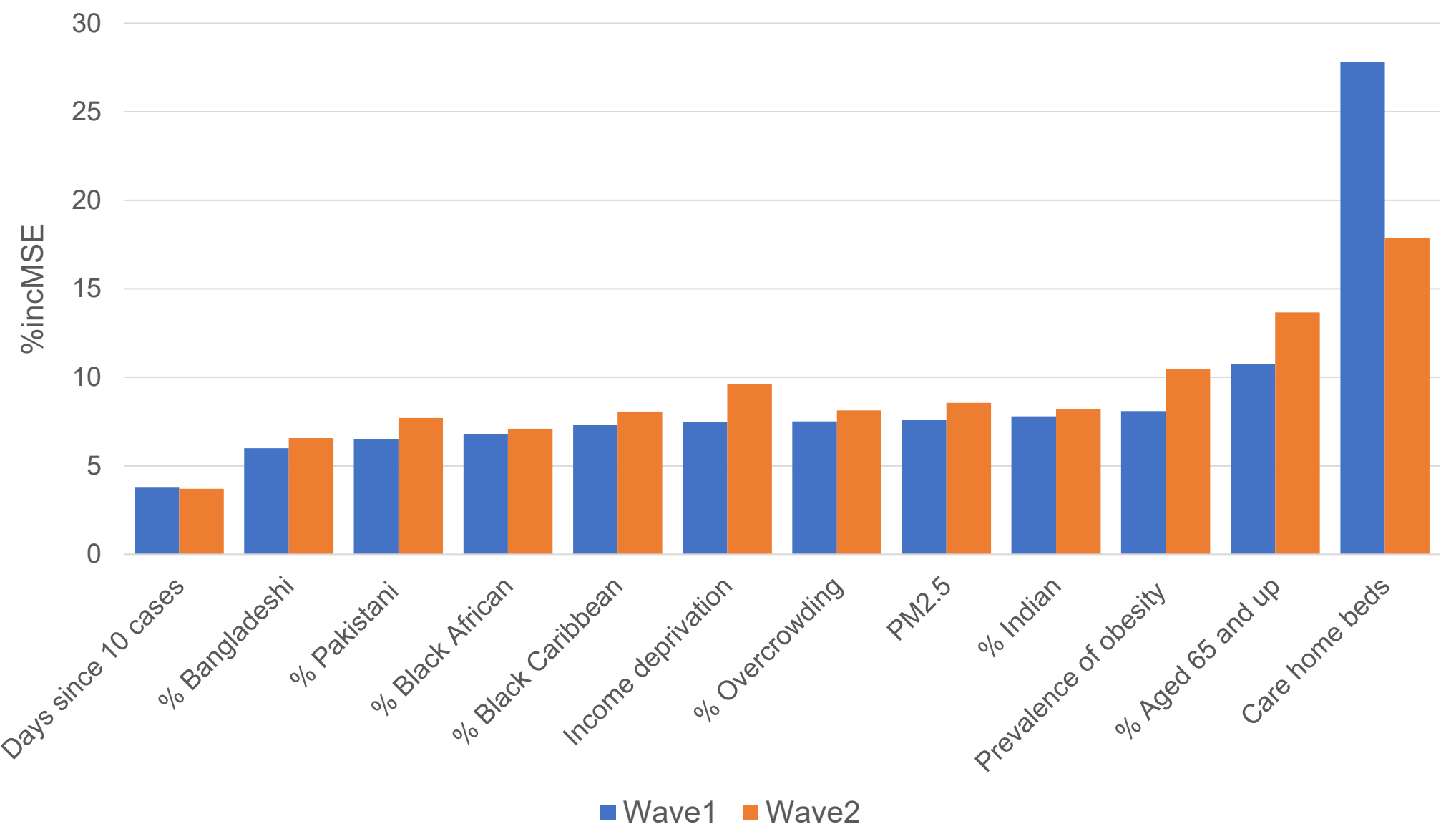


Figure 3 Relative feature importance of predictors by wave

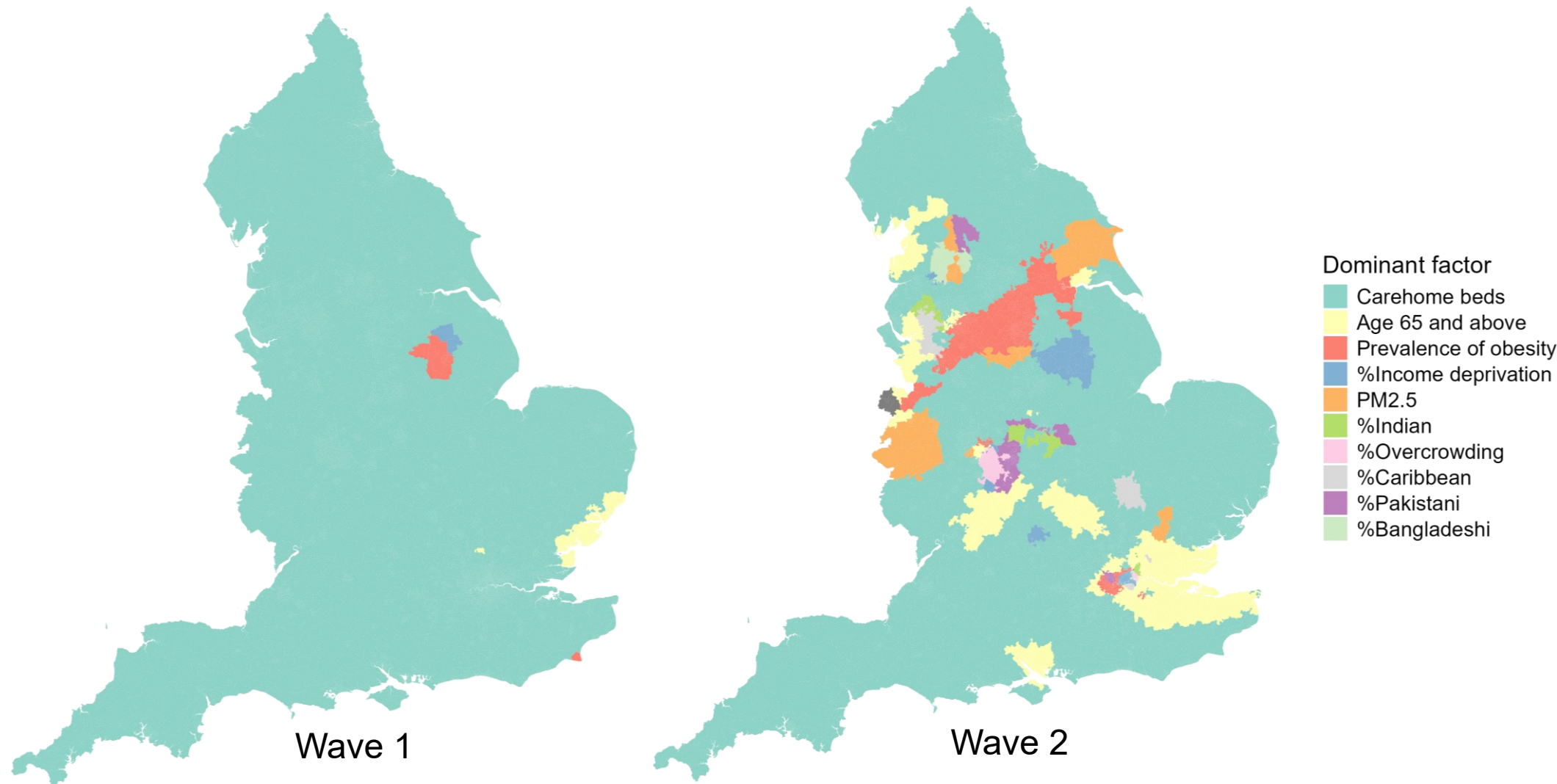


Figure 4 Local dominant predictors across the first and second wave

## Results

The spatial pattern of COVID-19 mortality in England evolved significantly between the first and second waves of the pandemic. During the peak months, mortality hotspots expanded geographically while in quieter periods they were more localised.

The modelling analysis revealed several key determinants of COVID-19 mortality rates: the presence of care homes, age profiles, ethnic composition, obesity prevalence and local pollution levels.

Particularly the presence of care homes emerged as the most critical factor influencing mortality rates in the first wave. However its relative importance declined in the second wave during which the influence of local factors became more varied.