EPIDEMIOLOGICAL INVESTIGATION OF THE COVID-19 OUTBREAK IN VELLORE DISTRICT IN SOUTH INDIA USING GEOGRAPHIC INFORMATION SURVEILLANCE (GIS)

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BACKGROUND

Geographical Information Surveillance (GIS) is an advanced digital technology tool that maps location-based data and helps in epidemiological modelling. During pandemics a rapid analysis of patterns of spread can help put in place strategies for containment and infection control. We applied GIS to analyse patterns of spread and hotspots of COVID-19 infected cases in Vellore district in Tamil Nadu, South India

METHODS

Laboratory-confirmed COVID-19 patients from Vellore district and neighboring taluks from March 2020 to June 2021 were geo coded (based on addresses) and spatial maps generated. These were then layered as points on the base map to illustrate the distribution of all COVID-19 cases. Time trends exploring urban-rural burden with age-sex distribution of COVID-19 cases and other variables were correlated with outcomes of death, symptoms and complications
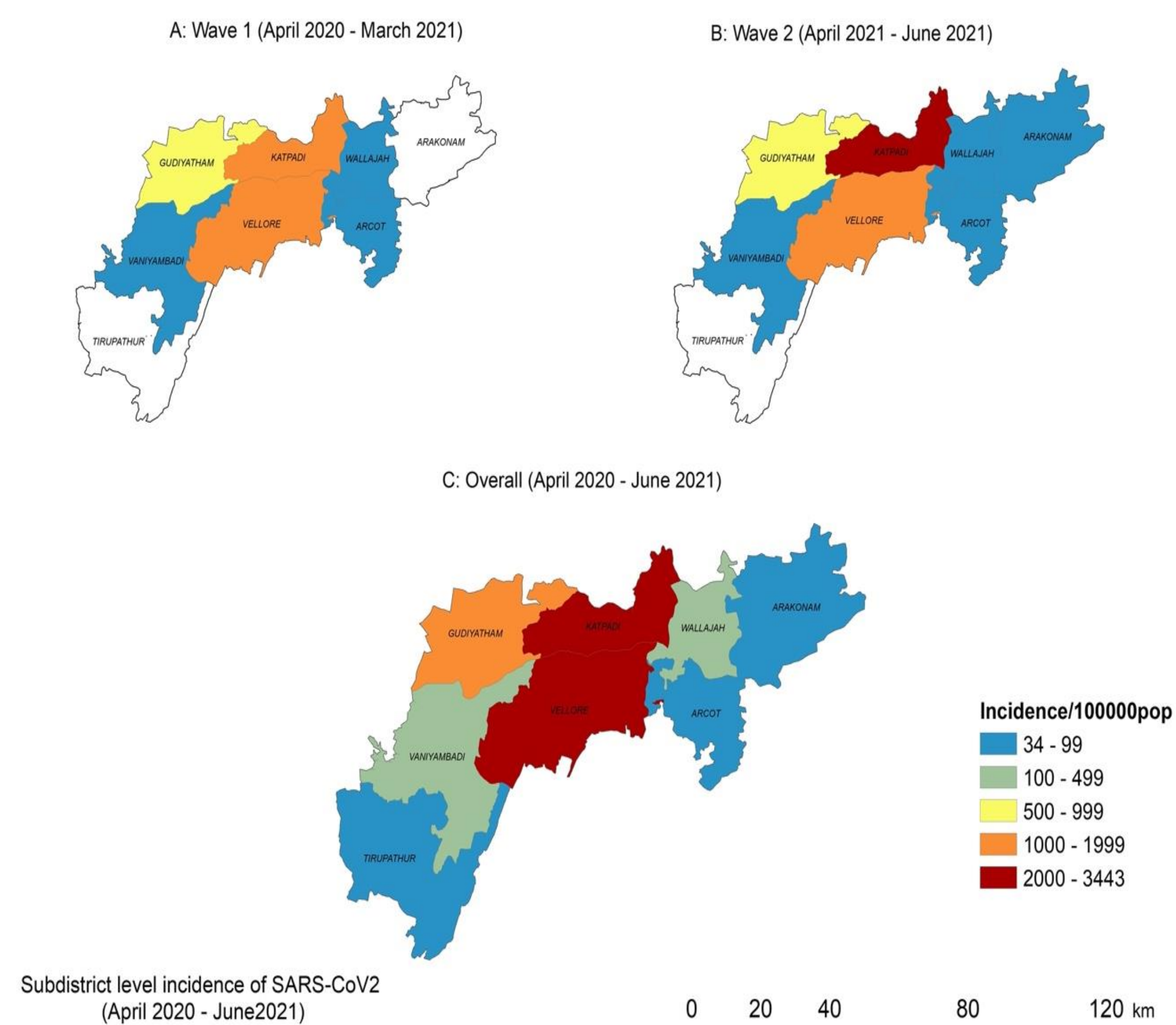
### Fig1. Map of undivided Vellore district showing rural and urban settlements
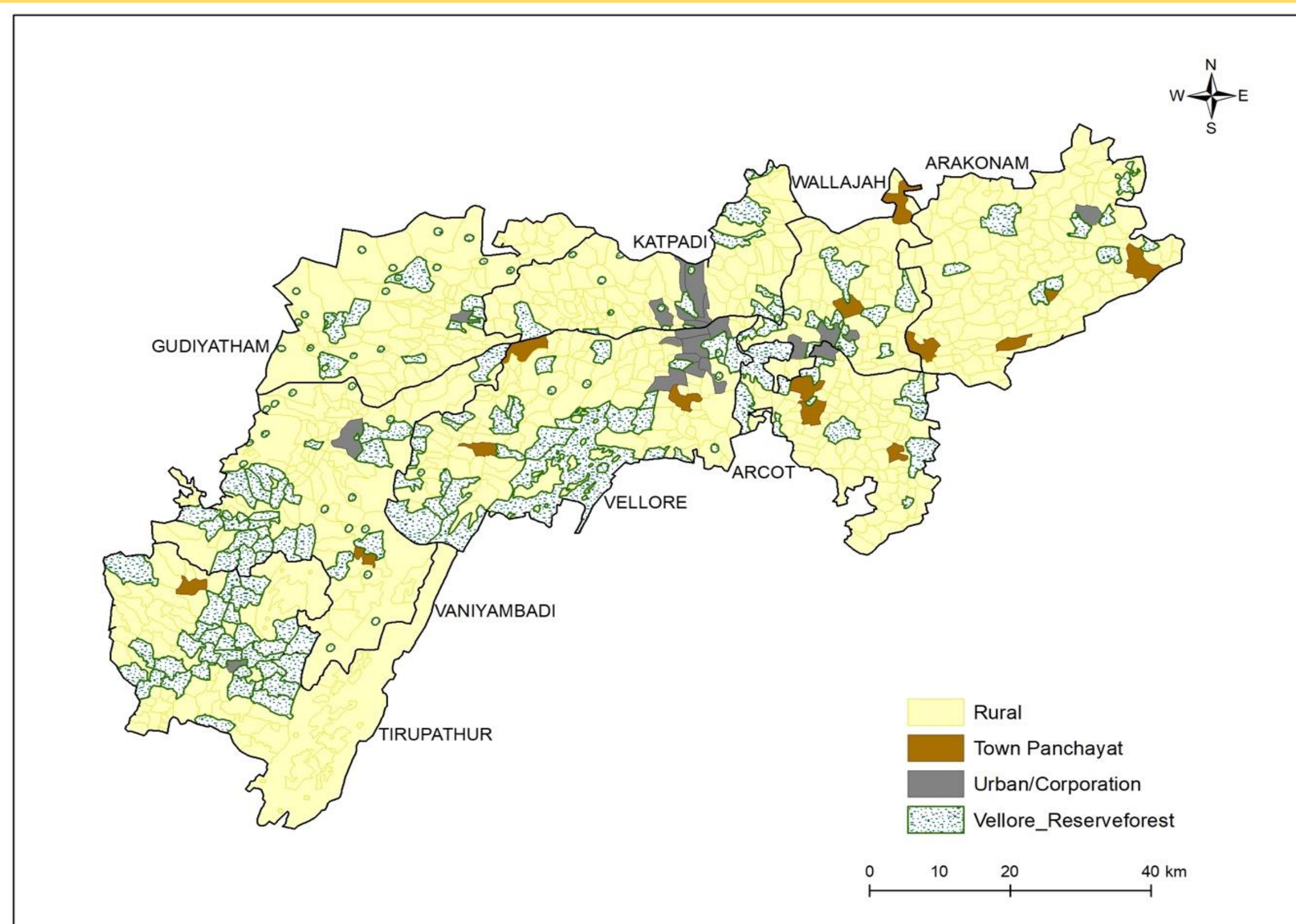
### Fig2. Spatial mapping of COVID-19 cases in the study region for the period of March 2020 to June 2021
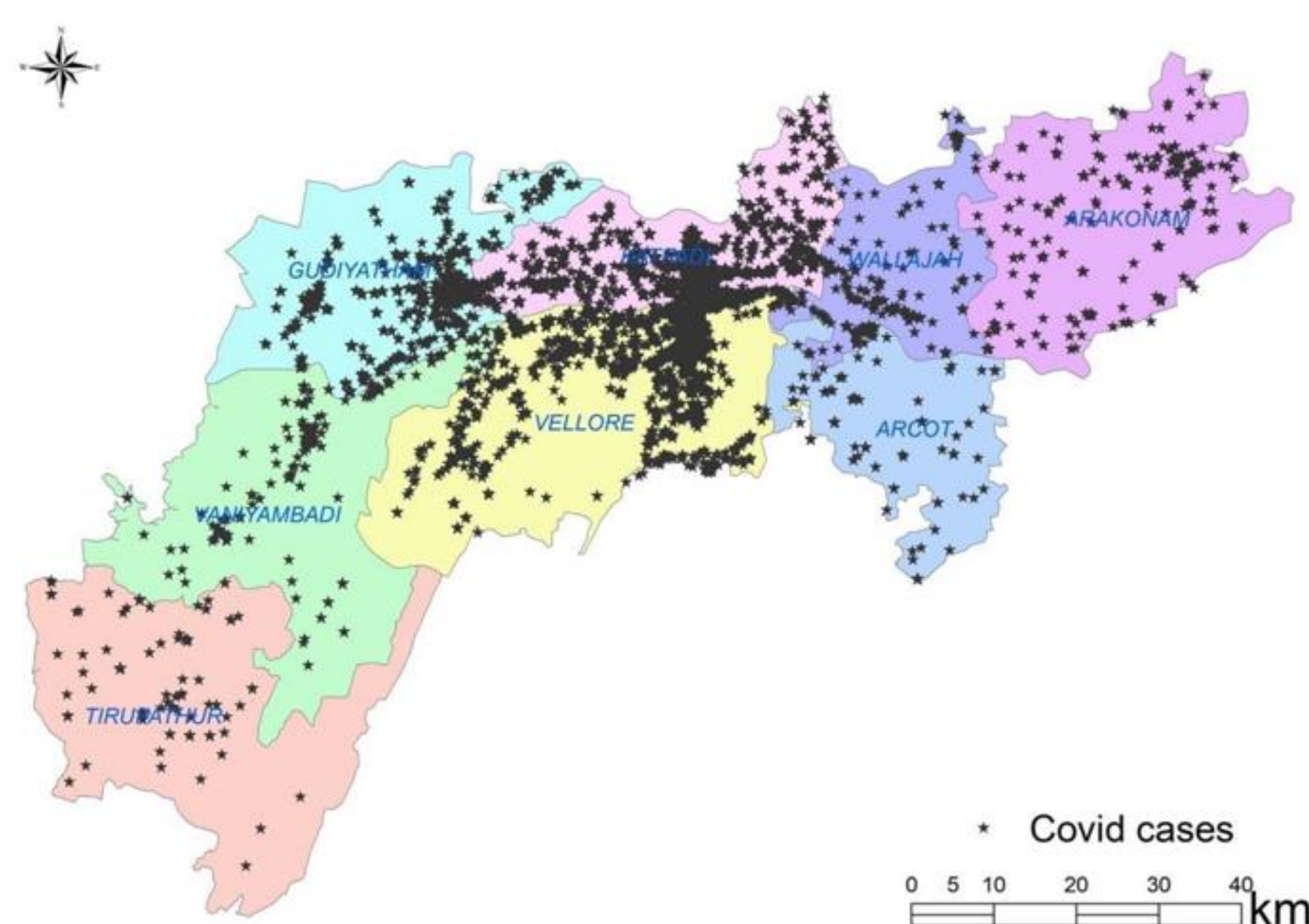
Fig3. Sub district level incidence of COVID-19 during the first and second waves

Subdistrict level incidence of SARS-CoV2 (April 2020 - June2021)

Fig4. Epidemic curve of the COVID-19 pandemic during the first and the second waves
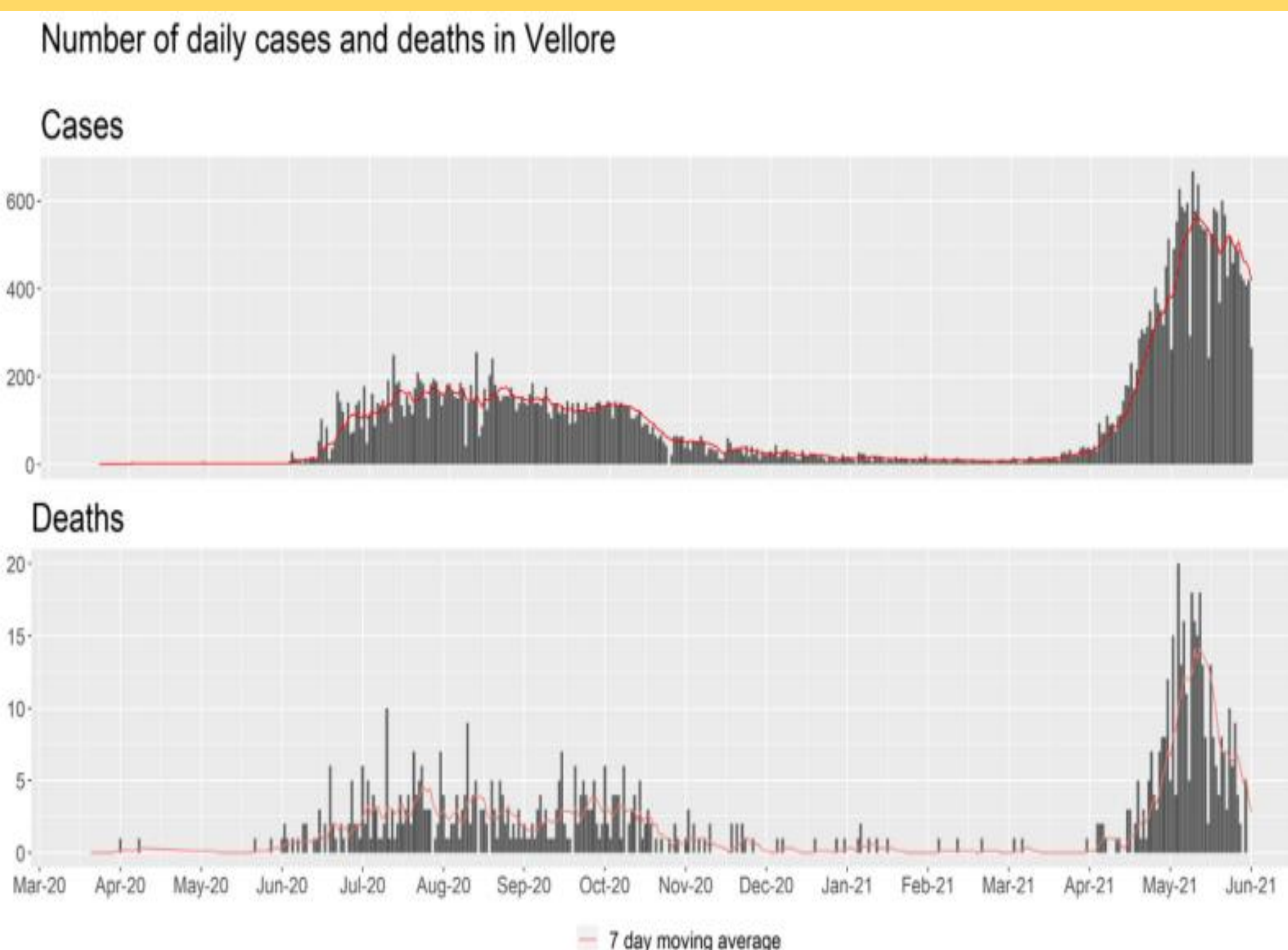
Fig5. Heat maps depicting the spread of COVID-19 cases during the first and second waves in the study area

Point density maps depicting quarterly distribution of Covid -19 cases
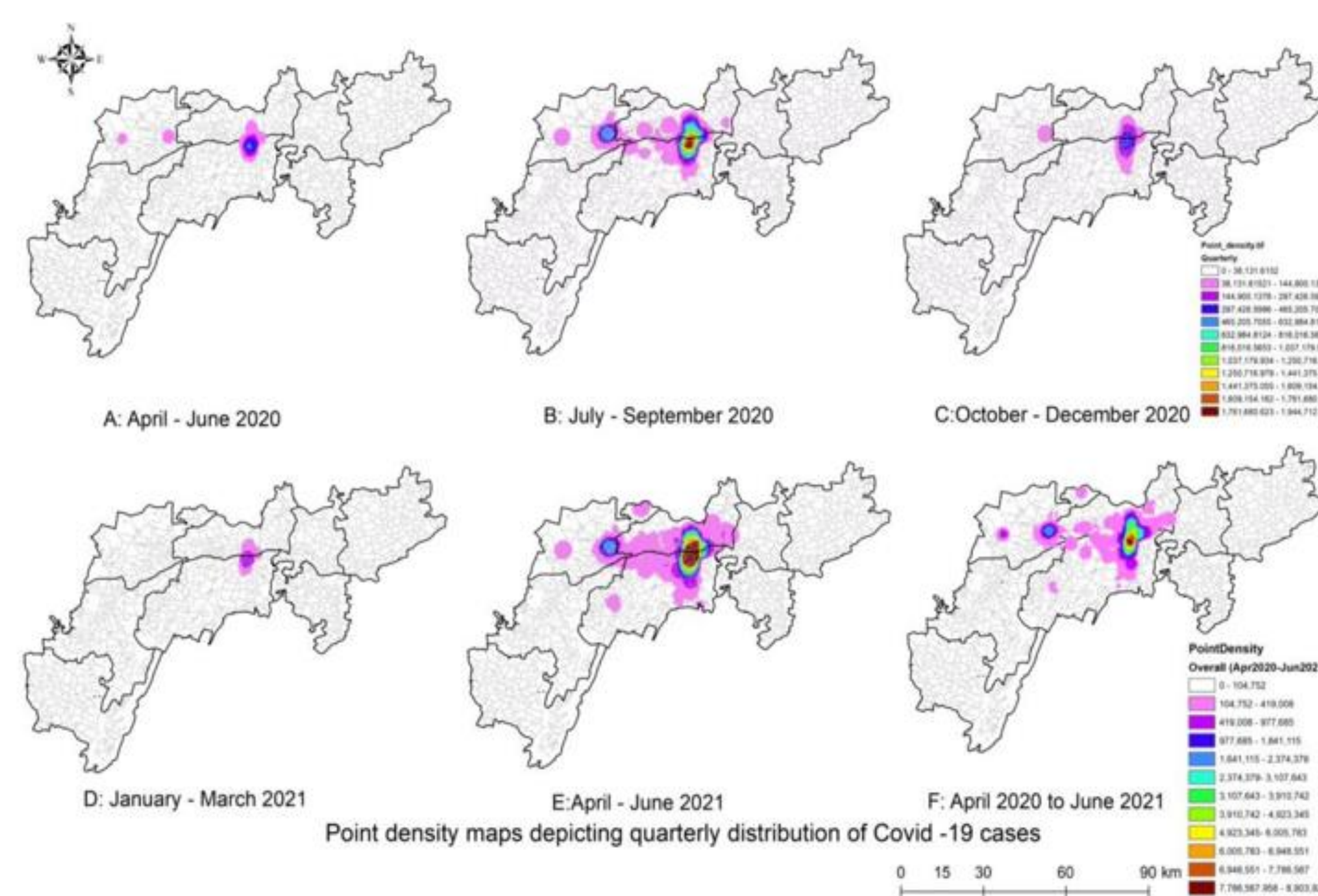
Fig6. Distribution of COVID-19 cases based on age groups across different geographical areas in the study location

Village level distribution of SARS-CoV2 cases (April 2020 - June2021)
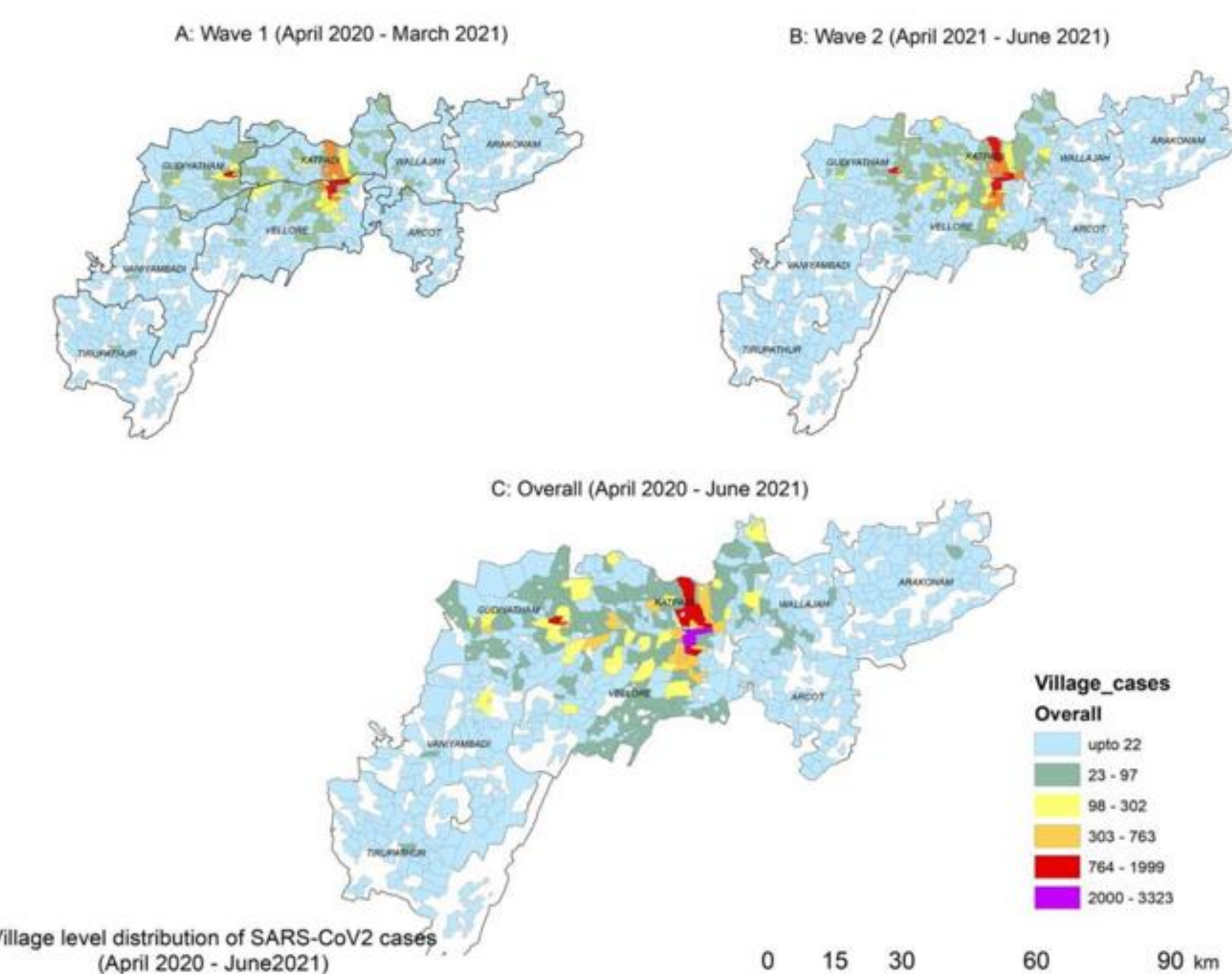
RESULTS

A total of 45,401 cases of COVID-19 were detected between 28 March 2020 to 31 June 2021 with 20730 cases during the first wave (28 March 2020 to 31 March 2021) and 24671 cases during the second wave (1 April 2021 to 30 June 2021). The overall incidence rates of COVID-19 across the study region was 462.8 per 100,000 and 588.6 per 100,000 population during the first and second waves respectively. Pattern of spread revealed epicentres in densely populated urban areas with radial spread, sparing rural areas. Heat maps also confirmed higher densities at these epicentres, however, the second wave had more peri-urban and rural area involvement. Case fatality rate was 1.89% and 1.6% during the first and second waves and increased with advancing age, i.e., 7.38% were aged more than 60 years in the first wave and 5.02% in the second wave. Incidence was higher in men, 2.40%, and 1.76% as compared to women who had 1.16% and 1.38% in the first and second waves respectively. Overall, case fatality rates were the highest among those who had >2 comorbidities (9.52%).

CONCLUSION

Modern surveillance systems like GIS can accurately predict the trends of the outbreak and pattern of spread during future respiratory pandemics. Employing this in real time can help design risk mitigation strategies improving health care access and monitoring with prevention of spread to rural areas.