



Different spreading dynamics throughout Germany during the second wave of the COVID-19 pandemic in the context of public health interventions

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Abstract

Background

The second wave of the COVID-19 pandemic led to substantial differences in incidence rates across Germany.

Methods

Assumption-free k-nearest neighbour clustering from the principal component analysis of weekly incidence rates of German counties groups similar spreading behaviour. Different spreading dynamics was analysed by the derivative plots of the temporal evolution of tuples $[x(t), x'(t)]$ of weekly incidence rates and their derivatives. The effectiveness of the different shutdown measures in Germany during the second wave is assessed by the difference of weekly incidences before and after the respective time periods.

Findings

The implementation of non-pharmaceutical interventions of different extents resulted in four distinct time periods of complex, spatially diverse, and age-related spreading patterns during the second wave of the COVID-19 pandemic in Germany. Clustering gave three regions of coincident spreading characteristics. October 2020 showed a nationwide exponential growth of weekly incidence rates with a doubling time of 10 days. A partial shutdown during November 2020 decreased the overall infection rates by 20–40% with a plateau-like behaviour in northern and southwestern Germany. The eastern parts exhibited a further near-linear growth by 30–80%. Overall the incidence rates among people above 60 years still increased by 15–35% during partial shutdown measures. Only an extended

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shutdown led to a substantial decrease in incidence rates. These measures decreased the numbers among all age groups and in all regions by 15–45%. This decline until January 2021 was about -1.25 times the October 2020 growth rates with a strong correlation of -0.96.

Interpretation

Three regional groups with different dynamics and different degrees of effectiveness of the applied measures were identified. The partial shutdown was moderately effective and at most stopped the exponential growth, but the spread remained partly plateau-like and regionally.

Keywords

COVID-19, cluster analysis, Germany, infectious disease, incidence, lockdown, non-pharmaceutical intervention, SARS-CoV-2, spreading dynamics

Citation

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