

## ANALYSIS SEMINAR

# Four-tier response system and spatial propagation of COVID-19 in China by a network model

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**Abstract.** In order to investigate the effectiveness of lockdown and social distancing restrictions, which have been widely carried out as policy choice to curb the ongoing COVID-19 pandemic around the world, we formulate and discuss a staged and weighted network system based on a classical SEAIR epidemiological model. Five stages have been taken into consideration according to four-tier response to Public Health Crisis, which comes from the National Contingency Plan in China. Staggered basic reproduction number has been derived and we evaluate the effectiveness of lockdown and social distancing policies under different scenarios among 19 cities/regions in mainland China. Further, we estimate the infection risk associated with the sequential release based on population mobility between cities and the intensity of some non-pharmaceutical interventions. Our results reveal that Level I public health emergency response is necessary for high-risk cities, which can flatten the COVID-19 curve effectively and quickly. Moreover, properly designed staggered-release policies are extremely significant for the prevention and control of COVID-19, furthermore, beneficial to economic activities and social stability and development.