

# JNCASR scientists devise adaptive model to estimate & strategize critical resources in pandemic

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Healthcare in a country faces a catch-22 situation in the early stages of an epidemic – specific and accurate tests are required to trace and isolate the infected, and to scale up the novel tests, one needs to have estimates of the expected number of infections weeks to months in advance. And then, these numbers need to be used to predict healthcare inventory requirements in every district of the nation. How does one use models for these estimates when the inputs to the models could be rampant with uncertain parameters?

Scientists from Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), an autonomous institute under Department of Science & Technology, Government of India, and Indian Institute of Science (IISc), have developed a model to address this problem using an adaptive strategy and the early phase of COVID-19 as an example.

The model can be utilized to estimate key aspects of medical inventory requirements, a calculation that is required to scale up both the testing capabilities and the critical care facilities, which are essential to reduce the mortality. It would be extremely relevant for COVID-19, as the disease character and the behavioral patterns of the people change and affect the efficacies of disease spread and management in a second-wave, requiring constant alertness on the part of the forecasters.

The model is based on the recent work of the team accepted for publication in the journal *'Physical Review E'* in which they showed that the uncertainties in the parameters and reported infections can be compensated for by using (phase-space) representations. This reduces errors, exploiting any universalities across geographies which show similar behavior, and by a regular weekly update of the predictions made for a month. Further, by treating reported deaths and infections for making two independent estimates of infections, one can better understand the range of variation of the predicted infections.

The team demonstrated that, with this approach, there is a universality to the evolution of the disease across countries that can then be used to make reliable predictions. This approach allows for planning of requirements for critical resources such as ICUs, PPEs during the pandemic. The approach is designed for simplicity of interpretation, and adaptability over time.

The multi-institution team led by JNCASR tested the model by predicting the number of infections and deaths in Italy and New York State, based on an adaptive algorithm which uses

early available data, and show that our predictions closely match the actual outcomes. They have also carried out a similar exercise for India, where in addition to projecting the number of infections and deaths, they have also projected the expected range of critical resource requirements for hospitalizations in a location.

“Mathematical modeling and simulations are some of the key tools for understanding, planning and decision making in the time of COVID-19. This example further brings to the fore the power of collaborations rather than competition among the best of research groups,” said Prof Ashutosh Sharma, Secretary, DST.

*(Publication Link of Accepted work:*

<https://journals.aps.org/pre/accepted/af070R4dEddE8a1a91d51021b998187c4d3f3e4b0>

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