

This article presents a method to model Covid-19 using a series of partial differential equations, which the authors claim is a novel method of modeling Covid, and apply the model to infection patterns in France. The benefit of the PDE approach is capturing multiple time bins, the authors track general time, the host age, time since infection, time since clearance, and time since vaccination. The R_0 value is calculated using next generation operation, and investigates future trends in disease spread under future vaccination. Overall the paper was thorough, presented their methods well and were clear about the benefits of the PDE approach.

My main critique is the proposed unique-ness of the PDE approach. This work seems useful and the proposition of age structure being easier to understand in the context of a PDE system is likely true, however, other authors have PDE approaches already and this should be clearly acknowledged in the text with more citations to previous work.

Introduction

Could add something on

Model

I am confused how the full version of your model, which is explicitly age-structured, can be applied to the French dataset if the hospital admission data is not age stratified? Doesn't that make the usefulness of the age structure in your model impossible to show via data?

Results

The importance of variance from the contact matrix is interesting, would be worth discussing how you could include a time-varying version

Overall

I think this paper is very solid. I could find no errors in the model derivation nor in the code implementation. I recommend this paper for publication.