Review by Wayne Landis
Authors: Duchemin, Veber, Boussa
Bayesian investigation of SARS-CoV-2 related mortality in France.

General notes: This is a very interesting and important paper. The models are based on Flaxman et al (2020), comprehensive development of the relevant models as pertaining to the general European case. Duchemin et al. focus on the situation in France during the spring of 2020. I have read both papers for this review. My conclusion is that Duchemin is suitable for publication and is an important contribution. I have a number of notes that follow.

Duchemin et al. applies the models to describe the effects of various scenarios (weekends, election, and non-pharmaceutical based control methods on SARS-CoV-2 mortality at the scale of the individual regions. There are many important findings. Applied in an adaptive management framework this paper can be vital in the continuing management of SARS-CoV-2 in the world and at a relevant scale. These findings are:

There is a lag period between a change in management strategies (lockdown, social distancing, and the relaxing of controls) and the observed change in mortality. It is like planning on applying the brakes in a car and at 10 second wait for them to work.

There is also a large distribution of the change in Rt depending on the region. Our tools for controlling the spread of the virus do not result in an immediate change in measurement.

The models do predict the course of the infection with useful accuracy. The probabilistic models used in this paper also describe the potential range in outcomes with specific distributions. Bayesian approaches do have advantages over more conventional means.

The output also demonstrates that weekends and the election did little to increase or decrease the rates of infection in France. In the context that I am familiar with (USA) a weekend or voting day could increase a rate of infection by an increase in social contact (weekend) or waiting in lines (voting). In the cases studied in this paper it does not appear that a change in either direction would be likely.

I appreciate the detailed information and graphs presented in the Supplemental section.

Specific notes.

Page 5. Define MCMC for this paper, not everyone is familiar with Markov Chain Monte Carlo.

Page 8. Figure 1. The graph is difficult to read even enlarged and in color. Perhaps there needs to be a larger contrast in the gradient of deaths in the key and in the body of the graphic. I find the very subtle difference in blue to indicate the lower range of mortality difficult to see.

Page 11. Figure 3 very nice. The nature of the data indicates that there may be reporting error or delay that the model smooths out. The word lockdown looks like it is beyond the printable area of the page. Similar note for Figure 3, page 13. Nice figure.

Page 14. Title for section 3.1.2. I try to be careful to not use significant in a scientific paper so that it is not confused with statistical significance. The term “significance” also has a large cultural context. I would just say important or even simply “The reduction of viral transmissibility due to the lockdown.”

Page 16 and 18. I found it difficult to evaluate Figure 6b and the dots. These are simulated distributions so the dots are examples that were outside the boxes? The dots do not show up in the key and should be explained. Same comment with Figure 8b.

Page 20 Figure 10. I like the way this figure summarizes a great deal of information. The regions appear to be in alphabetical order. In my observation there are some clear patterns. The regions Auvergne.rhone.alpes, Bourgogne.franche.comte, Bretagne, centre.val.de.loire, hauts.de.france, occitanie, payes.de.la.loire, and provence.alpes.cote.dazur seem to have a similar pattern. The region ile.de.france is distinct from the other regions. Are there specific reasons why these pattern occur because of the distribution of urban areas, demographics or other factors?

Page 21-22, Counterfactuals and Figure 11. Counterfactuals are a key tool to examine how well the model describes causality. It appears to me that the base and mixture model are very close in prediction. The importance of an early lockdown on the total mortality is very clear.

Questions.

What kinds of datasets would it take to be more definitive that weekends for voting did not make a difference. The model is promising for other countries as well that may have regional differences. Flaxman did more countries but not to the smaller, regional scale.

An important result is the sensitivity of the date of the lockdown on the mortality rate. Again an important result. I assume that the team is now modeling opening up the lockdown and then reapplying it to demonstrate how long it takes the lockdown to reduce the rate of infection at that time. In my role when serving on scientific panels it seems that many scientists and decision makers are not familiar with the long lag times between implementation of a control method and seeing a change in infection and death.