

Review of: "An Optimal Control for Ebola Virus Disease with a Convex Incidence Rate: Imputing from the Outbreak in Uganda"

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Potential competing interests: No potential competing interests to declare.

The paper develops an (S-E-I-T-R-D) model for Ebola with a convex incidence rate. Then it considers optimal control of Ebola through three control measures, respectively contact tracing, lock-down and treatment. In the formulation of the optimal control problem the controls are penalised through a cost functional that is linear in E, I and T (exposed, infected and treated sub-populations) and quadratic in the three controls.

The main contributions are:

- An analysis of the disease free equilibrium;
- A characterisation of R_0 ;
- A calculation of the endemic equilibrium;
- A study of the resulting optimal controls with each considered separately, and then also in combination;
- Finally a cost-effectiveness analysis comparison between the various control strategies.

A claimed novelty of the approach is the inclusion of the convex incidence rate in the disease transmission. Aside from that, the development follows a fairly standard approach in a context of optimal control of diseases (equilibrium analysis, optimal control formulation, Pontryagin's maximum principle, Hamiltonian characterisations of optimal controls, numerical solution of optimal controls).

To improve the paper, I strongly suggest the following:

- Make more of the convex incidence rate. How does it impact the optimal controls and disease treatment? As far as I can tell from reading the paper, the incidence rate is not mentioned between pages 4 and 19 even though it appears in the title!
- Do something more with the epidemic equilibrium. This sub-section ends abruptly after equations (2.6 – 2.8) with no further comment or explanation of its significance.
- Include plots of the optimal controls or at least say something about them. For example, in the "lock-down" strategy – How restrictive is it?
- Explore how an optimal control calculated for one set of model parameters performs when applied to a model with a different (but nearby) set of parameters. For example, it is claimed that the incubation period for Ebola is between 2

and 21 days. What happens if we apply an optimal control computed assuming a 21 day incubation period to a model with a 2 day incubation period?

- Add a section discussing the model parameters.
- Read carefully through the manuscript as there are numerous typos, spelling errors, formatting mistakes, etc.