

# 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.

This article introduces a compartmental model to model the outbreak of an Ebola infection. The authors then use optimal control theory to compute the cost of various disease mitigation strategies. Based on their calculations, and of the strategies considered, the authors find that "lock down and treatment of the infected" is the cheapest option.

**Methodology:** The methodology of the paper is compartmental modelling - specifically, an SEITRD model. This is then supplemented by optimal control theory via the Pontryagin Maximum Principle. The authors carefully state the forward equations and compute the adjoint equations and the stationarity conditions. They then compute semi-explicit formula for the optimal control which minimizes the cost function. The cost function takes account of new infections and the cost of interventions: the optimal value of the cost function therefore represents some "best" tradeoff between minimizing new infections and implementing costly societal-level controls.

**Merit of paper:** Overall the methodology is good and could potentially lead to good findings and recommendations.

However, I find unfortunately that the cost-benefit analysis in Section 5 has been done rather sloppily, so that it is hard to distinguish between the costs of the different scenarios.

Also, and this is just a personal opinion, lockdowns have now been shown to have immense social costs - beyond the time horizon of typical optimal control calculations. Therefore, authors need to produce extremely strong evidence if their calculations show that lockdowns really are the optimal strategy.

Minor points:

1. Initial conditions should be provided on the adjoint equations - and indeed on the forward equations in Section 3.
2. Again in Section 3, the initial population  $N$  should be specified.
3. If this were a high-quality peer-review article, the figures in Section 4 would have to be enlarged and made more visible.
4. The incubation period of Ebola is stated in the Introduction to have a very wide range from 2-21 days. And yet only one instance of the model parameters is considered (Table 1). The authors should investigate the extent to which their findings are robust to variations in the model parameters.
5. The order of the strategies in Table 2 (III-V-IV) is confusing.

6. There are too many digits quoted in the calculations on page 18, it makes it difficult to distinguish between the cost of the different strategies.

Final words: Overall the methodology in this paper is sound and good background reading is provided. There is good scope for improvement in the work. Because of the reservations I mentioned, if this were a traditional peer-review process my recommendation would be “reject with resubmission welcome”.