

Excerpt from
Modeling the COVID-19 Pandemic

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3. Model Projections for Santa Clara County

One reasonable question to ask is: What would have happened if Santa Clara County did not implement Social Distancing? In figure 13 we superimpose two simulations: (1) Red: evolution of the pandemic if shelter-in-place had not been ordered, and Black: evolution of the pandemic with shelter-in-place order. One of the first things to see from the data is that the Santa Clara response did not just slow the growth by flattening the curve and shifting it toward the future, but because of timely decision making, it actually created a strong decay in the infections. Comparing the non-managed response (red) to the managed response (black) the impact was a reduction in the maximum number of infected cases, from what would have been about 700 to about 200. Remember this is not the total number of cases of infection. More on that shortly. This max peak of the infections is critical to maintaining a working medical infrastructure—one which does not collapse under extreme loads.

Turning next to the total number of infections. For the simulation with the shelter-in-place order, the total number of infections for the time period simulated was about 2,000. For the same region with no social-distancing requirements that number increases to around 12,000— a six-fold increase. This is even more concerning when one considers the factor k representing the ratio of actual to confirmed cases. The Stanford pre-print referred to earlier in this paper suggests that this is a number on the order of $1/50$. that would imply that a total of some

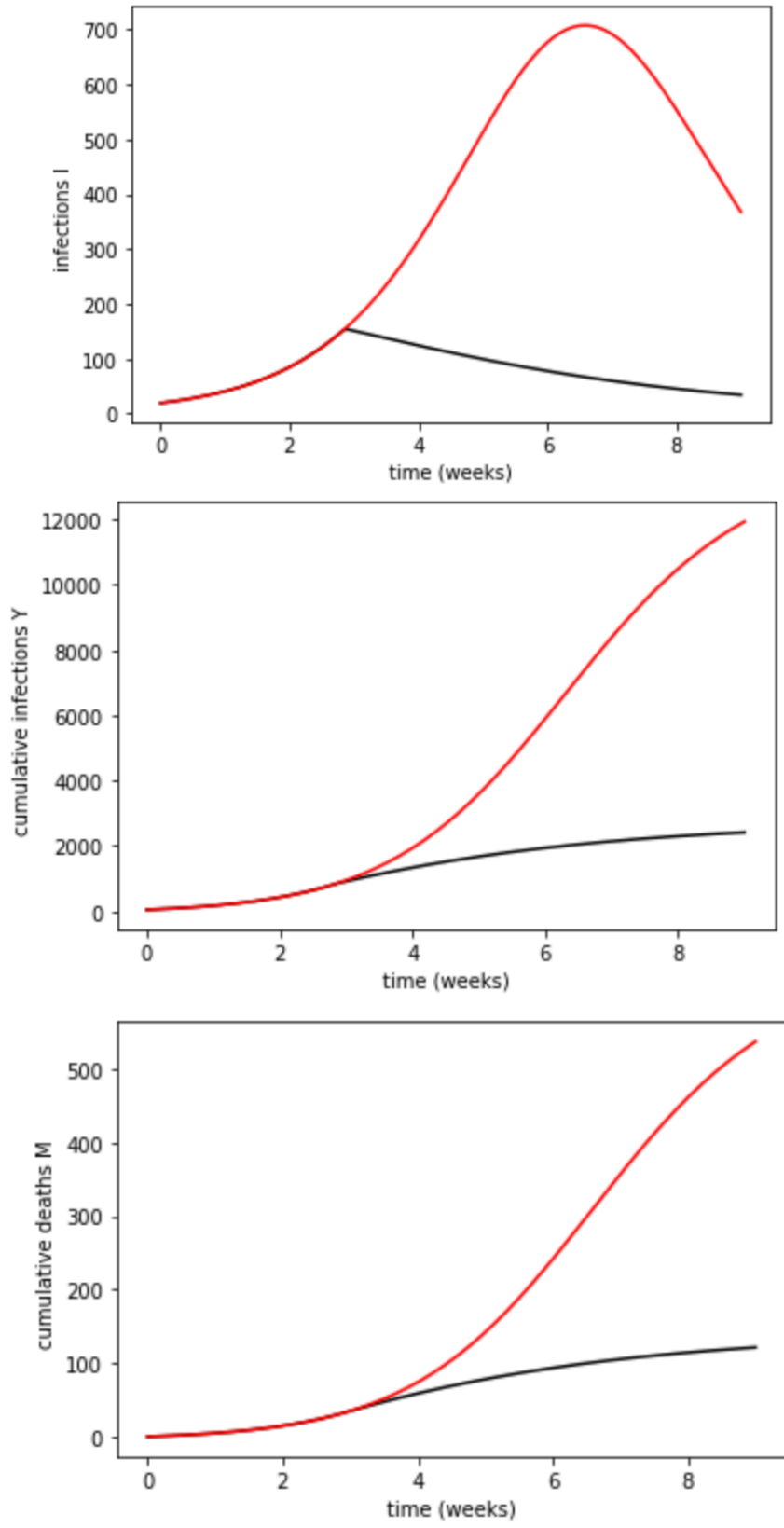


Fig. 13: The response (I , Y , and M) comparing Santa Clara shelter-in-place (black) to no directive (red)

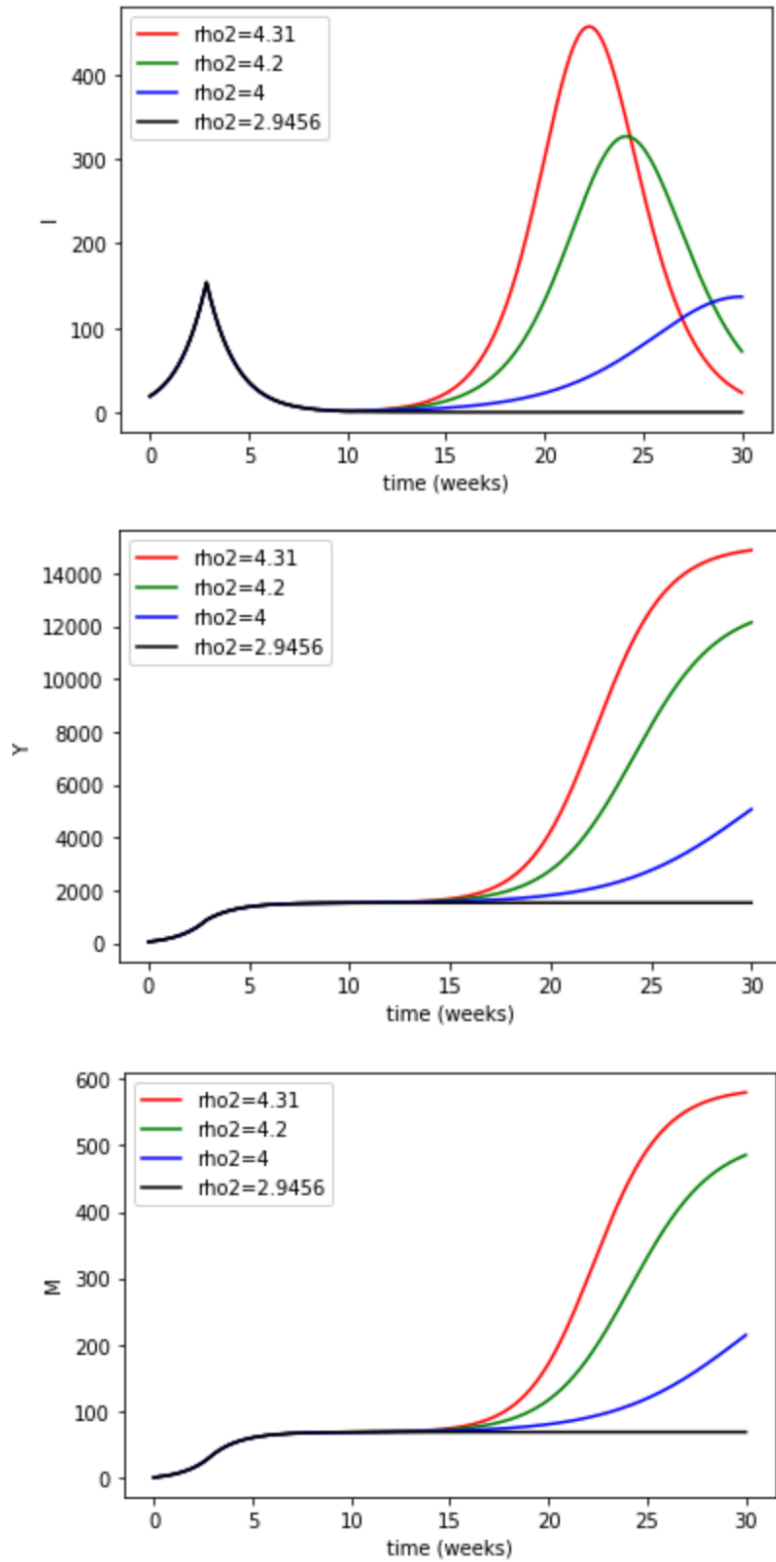


Fig 14: Santa Clara Projections with modification of shelter-in-place order at week 10. (black) continue shelter-in-place, (red) go back to interactions before directive, plus 2 intermediate strategies.

600,000 persons in the county¹ would have been infected without the shelter-in-place order. Deaths also show about a six-fold increase without social distancing requirements.

We ask the question: What will happen if we remove the shelter-in-place order? We can explore this possibility by again simulating several scenarios. The simulation begins 10 MAR 2020 (this is $t=0$). The shelter in place order was effective 30 Mar 2020 (week 2.9), and the date of a *potential modification* of the shelter-in-place directive in the simulation is 19 MAY 2020. In Figure 14, the black curve represents the evolution of the pandemic if we continue on the current shelter-in-place plan. The red curve represents the evolution if we return to interactions pre-SIP. The green and blue curves are intermediate strategies between these two extremes. It is most clear if we focus on the infections $I(t)$. **In all cases, there is a second wave of infections.** It makes sense that the closer we stay to the current SIP state, the smaller the peak. However, worst case scenerio (red) still yields a peak greater than that when SIP was initiated, and about 70% of what would have occurred if we never had a shelter-in-place order in March 2020. This is a strong warning that the way we move out of managing interactions is absolutely critical!

Resources

The full paper is available at:
<http://drfres.com/covid/Covid-2.pdf>

Disclaimer

The author is not a medical doctor or a public health professional. He is a systems engineer with considerable experience in systems modeling and control. The material in this paper has not been peer reviewed and has not been vetted by medical or public health professionals.

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¹ That would amount to about 30% of the county's population.