PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	The effectiveness of interventions to reduce COVID-19 transmission in a large urban jail: A model-based analysis
AUTHORS	MALLOY, GIOVANNI; Puglisi, Lisa; Brandeau, Margaret; Harvey, Tyler; Wang, Emily

VERSION 1 – REVIEW

REVIEWER	HINA AKBAR University of Tennessee Health Sciences Center, Memphis, TN
REVIEW RETURNED	25-Jul-2020

GENERAL COMMENTS	1- Were any of the described interventions done in parallel? as it would be difficult to phase these intervention in the settings of active infections. 2- Please provide data of what exact tests were used for covid testing and what if tests were repeated within a certain time frame based on new symptoms? 3- Were any new sanitization techniques/interventions were adopted during the study period. 4- Any data on percentage positive tests in the beginning would be helpful.

REVIEWER	Dr. Camilla Rothe LMU University Hospital Centre Division of Infectious Diseases and Tropical Medicine Munich Germany
REVIEW RETURNED	17-Aug-2020

GENERAL COMMENTS	Thank you very much for this interesting piece of research. Please find my comments and suggestions in-text. The reviewer provided a marked copy with additional comments. Please contact the publisher for full details.

REVIEWER	Thomas House University of Manchester, UK
REVIEW RETURNED	18-Oct-2020

GENERAL COMMENTS	I am providing technical / statistical review rather than an overall assessment of the paper. In my view, the paper applies sound methodology to the problem - a compartmental epidemic model is calibrated to time-series data, and inferences about the effectiveness of interventions are made

	on that basis. The methods are clearly described, as well as limitations. The main concern I have is that it seems the average of many model runs is shown in Figure 3, meaning the model looks much 'smoother' than the data - can some sample runs be shown to check that the underlying model exhibits appropriate variability as well as overall trend?

VERSION 1 – AUTHOR RESPONSE

Reviewer 1

Comment 1: Were any of the described interventions done in parallel? as it would be difficult to phase these intervention in the settings of active infections.

Response: The interventions were implemented incrementally, with depopulation only, then single-celling added, then asymptomatic testing added. We have added a sentence to this effect. We also included this information in the abstract.

Location: Interventions subsection of Methods section and abstract. Page 2, Line 36; Page 8, Line 165

Comment 2: Please provide data of what exact tests were used for covid testing and what if tests were repeated within a certain time frame based on new symptoms?

Response: Testing was done using nasal swab PCR tests. We have clarified this in the text. Testing was administered upon admission to the jail, with symptom onset, or during the period of "asymptomatic testing," testing those identified through contact tracing, medically vulnerable populations, and upon admission. We clarified this in the text.

Location: First paragraph of Methods section. Model Instantiation and Calibration subsection of the Methods section. Page 6, Line 113; Page 11, Line 222

Comment 3: Were any new sanitization techniques/interventions adopted during the study period?

Response: Sanitation techniques largely follow Center for Disease Control and Prevention guidance duration of the outbreak, including regular cleaning surfaces and providing incarcerated people with soap or sanitizers. No new large-scale sanitation techniques were introduced during any other phases.

Location: Interventions subsection of Methods section. Page 9, Line 175

Comment 4: Any data on percentage positive tests in the beginning would be helpful.

Response: For each of the phases, we now state the number of COVID-19 tests performed, and the number that were positive. "In phase one: A total of 23 SARS-Co-V-2 tests were performed in this phase; 19 were positive (positivity rate 82.6%)…In phase two: A total of 149 SARS-Co-V-2 tests were performed in this phase; 139 were positive (positivity rate 93.2%)…In phase three: A total of 455 SARS-Co-V-2 tests were performed in this phase; 253 were positive (positivity rate 55.6%)…In phase four: A total of 2741 SARS-Co-V-2 tests were performed in this phase; 523 were positive (positivity rate 19.5%)."

Location: Interventions subsection of the Methods section. Page 9, Line 177; Page 10 Line 183; Page 10, Line 193; Page 11, Line 198

Reviewer 2

Thank you very much for this interesting piece of research.

Comment 1: In Covid 19, the start of infectiousness does not correspond to the incubation time, since there is already pre-symptomatic transmission. Infectiousness starts 2-3 days before the onset of symptoms. So infectiousness = incubation time - (2-3) days. This may have to be recalculated.

Response: Individuals in the infected states are assumed to be infectious, whereas individuals in the exposed state are infected but not infectious. We have clarified this in the text.

We added a sensitivity analysis to account for presymptomatic transmission in which the average length of time spent in the exposed state is 3 days instead of 5.1 days, and the length of the infectious period is correspondingly increased by 2.1 days. The absolute values of β and R_0 were reduced, but the relative reduction in transmission between phases remained similar, and our qualitative results were unchanged: “In sensitivity analysis, when we assumed an incubation period that was 2.1 days shorter, the calibrated baseline transmission rate was β=1.31 (95% CrI: 1.00-1.71). After depopulation began (phase 2), the transmission rate was β = 0.64 (95% CrI: 0.41-0.83). This represents a 51% decrease in the transmission rate from phase 1 (compared to a 56% decrease in the base case results). After the increase in single-occupancy cells (phase 3), the transmission rate was β = 0.36 (95% CrI: 0.25-0.49), a 44% decrease from phase 2 (compared to a 51% decrease in the base case results). Finally, the transmission rate after testing of asymptomatic individuals began (phase 4) was β = 0.17 (95% CrI: 0.09-0.30), a 53% decrease from phase 3 (compared to 66% in the base case). We estimate the following basic reproduction ratios: R_0= 6.22 (95% CrI: 3.56-9.98), R_(0,phase 2)= 3.02 (95% CrI: 1.95-4.32), R_(0,phase 3)= 1.64 (95% CrI: 1.33-2.02), and R_(0,phase 4)= 0.75 (95% CrI: 0.59-0.92).

Over the first 83 days of the outbreak, the sensitivity analysis predicts 637 symptomatic cases (95% CrI: 502-827), 89 hospitalizations (95% CrI: 70-116), and 6 deaths (95% CrI: 5.8-6.8), values very close to those predicted in the base case analysis. Thus, even assuming a shorter incubation period, we estimate that the mitigation strategies led to an 83% reduction in predicted symptomatic cases, hospitalizations, and deaths.”

Location: First paragraph of Model Description subsection of Methods section. Sensitivity Analysis subsection of Methods section and Sensitivity Analysis subsection of Results section. Page 6, Line 126; Page 14, Line 281; Page 16, Line 343

Comment 2: It would be very useful to have a figure graphically depicting the duration of the different phases and the measures taken.

Response: We have added this information to Figures 2 and 3, both in the graphic and in the figure legend, and we now mention this when we describe the interventions.

Location: First paragraph of Interventions subsection of Methods section, and Figure 2. Page 8, Line 167.

Comment 3: Incidence requires a denominator. What is given here is probably new/incident cases?

Response: We mean incident cases per day. We have clarified this throughout the text.

Location: Methods section. Results section. All figures and texts.

Comment 4: Is this incidence (which would require a denominator) or incident cases per day?

Response: We have modified Figure 3 to indicate that we mean incident cases per day.

Location: Figure 3.

Comment 5: See comment to figure 3. (Is this incidence (which would require a denominator) or incident cases per day?)

Response: We have modified Figure 6 to indicate that we mean new daily symptomatic cases.

Location: Figure 6.

Comment 6: May have to be corrected since incubation period is not the same as the time span until the beginning of infectiousness. The latter is 2-3 days shorter than the incubation period.

Response: Please see our response to comment 1 above.

Comment 7: Table 2. It would be useful to also show the de facto figures for day 83, as far as they are known, for comparison.

Response: We included symptomatic cases, hospitalizations, and deaths we received from the jail in Table 2 for comparison.

Location: Table 2.

Comment 8: Figures currently appear twice.

Response: This was a submission error on our part – figures were included in the manuscript, and uploaded separately. We will correct this when uploading our revised manuscript.

Reviewer 3

I am providing technical / statistical review rather than an overall assessment of the paper.

In my view, the paper applies sound methodology to the problem - a compartmental epidemic model is calibrated to time-series data, and inferences about the effectiveness of interventions are made on that basis. The methods are clearly described, as well as limitations.

Comment 1: The main concern I have is that it seems the average of many model runs is shown in Figure 3, meaning the model looks much 'smoother' than the data - can some sample runs be shown to check that the underlying model exhibits appropriate variability as well as overall trend?

Response: Figure 3 shows not only the mean of the runs but also the 95% credible interval of the runs thus reflecting the variability. This was not indicated in the original caption for Figure 3. We have revised the Figure 3 description to indicate that the gray shaded area around the model output line reflects the 95% credible interval of all model runs. We note that any single run provides smooth output, as we select values for parameters stochastically and then run the model with that set of parameter values.

Location: Figure 3.
Additional Revisions

Since the initial submission, we have slightly modified the structure of our model to include quarantine for detected asymptomatic cases after asymptomatic testing was implemented (in phase 4). We have updated the system of differential equations that defines the model and the description of these equations, and we updated the equations defining the reproduction number to be consistent with the new model structure. We modified Figure 1 slightly to demonstrate this structural change. All the results have been updated accordingly. The core conclusions of the paper remain the same. The largest change was that the estimated effect of implementing asymptomatic testing on top of single celling and depopulation is now a 66% reduction in transmission rather than 73%. All other results remain largely unchanged with small differences due to stochastic noise.

Location: Methods in Model Description and Calculations of R_0 and R_t subsections, Results section, Table 2. Page 6, Line 122, Page 12, Line 257, Page 15 Line 3