Model predicts employee illnesses and work absences due to COVID-19 in a produce farm operation

Sarah I. Murphy[1], Christopher Henry[1], Ece Bulut[1], Sebastian Llanos-Soto[1], Claire Zoellner[2], Renata Ivanek[1]
[1]Cornell University; [2]iFoodDecisionSciences

An agent-based model of COVID-19 transmission, called *FInd CoV Control* (**F**ood **Ind**ustry **CoV**id-19 **Control**), has been developed for applications in the food industry. This model tracks the health state of each individual worker (hence the name "agent-based") in an operation or facility at 8-hour intervals. The model structure has 3 key components: (1) SARS-CoV-2 disease model, (2) employee characteristics, and (3) the social contact network. This model* is currently designed specifically for produce farms.

Here, we describe use of the model to simulate COVID-19 spread among workers at a hypothetical fresh produce farm over 90 days, starting when 1 infected worker comes to work on day 0. Briefly, the fresh produce farm has 103 employees, including 1 health and safety manager, 3 supervisors (each supervising 3 crews), and 9 crews (each with 10 workers and 1 foreman). The model can be run for any number of supervisors and crews, thereby offering flexibility with regards to both operation size and internal structure. To allow for assessment of mitigation strategies, first, the baseline version of the model (i.e., no mitigation strategies implemented) is simulated, which provides the baseline results to use for comparison (Figure 1, black curves). Mitigation strategies are then evaluated by simulating the model, and the effectiveness of each strategy is evaluated with respect to their ability to prevent both total infections and worker absences (Figure 1, colored curves).

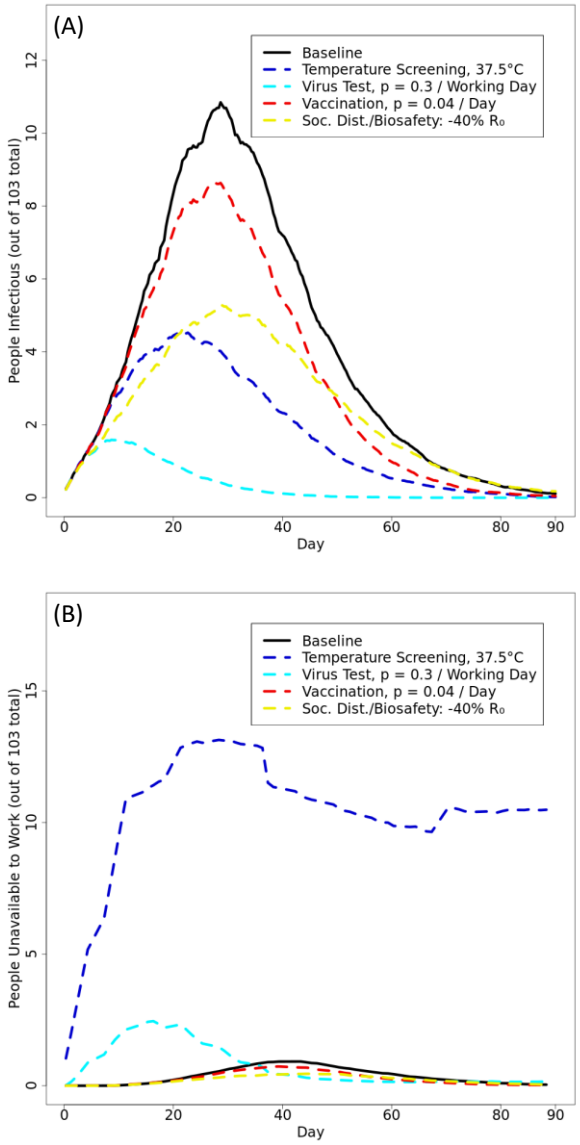

Figure 1. Mean number of (A) infectious workers and (B) workers who are unavailable to work over time, for baseline (in black, solid line) and various mitigation strategies (temperature screening, at a threshold of 37.5°C; virus testing, at a rate of 30% of employees per working day; vaccination, at a rate of an average of 4% of unvaccinated employees vaccinated per day; and social distancing and/or biosafety interventions, resulting in a 40% reduction in the basic reproduction number), with type of intervention indicated by color. ***Depicted predictions are under the assumption of 63% workers vaccinated (current average for the US) and predominance of the Delta variant.***

Overall, subject to model limitations and assumptions, our preliminary assessment of different mitigation strategies showed 3 major findings:

1. Considering mitigation strategies targeting "surveillance", results suggest temperature screening, at a moderate threshold (37.5°C), of all employees daily is less effective at preventing infections than viral testing done less often (about once every 3 working days) (Figure 1A). Moreover, while an important downside of both of these surveillance strategies is increased numbers of workers absent from work, this downside is more severe for temperature screening than for viral testing, due to more false positives associated with temperature screening (Figure 1B).
2. Implementing social distancing/biosafety measures and vaccination are both effective at reducing the number of infections (Figure 1A). Since they prevent the infection from happening in the first place, they result in much lower numbers of worker absences compared to surveillance measures (Figure 1B), and even somewhat lower numbers compared to the baseline, making them the more attractive control strategies for essential employees.
3. The relative effectiveness of different mitigation strategies for a particular operation depends on how much of a worker's risk of infection comes from the broader community and how many workers are already immune on day 0.

*The *FInd CoV Control* model is freely available https://www.foodcovidcontrol.com/FOODCTL/ as an interactive web-based decision support tool.

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