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Find Cov Control Decision Support Tool Forecasts The Effects Of Covid-19 On Human Health And Productivity In The Food Industry Sector

Renata Ivanek Cornell University Christopher Henry Cornell University Daisy Tang Cornell University Ece Bulut Cornell University
Sarah Murphy Cornell University Aaron Adalja Cornell University Claire Zoellner iFoodDecisionSciences
Diane Wetherington iFoodDecisionSciences

The Coronavirus Disease 2019 (COVID-19) pandemic has had a tremendous impact on the world. In the United States (US), the food industry has been among the hardest hit, resulting in supply chain disturbances and food insecurities. This has significant national security implications.

We developed Flnd CoV Control, a customizable agent-based model for simulating COVID-19 transmission and the counterfactual effects of various interventions within a produce farm or food processing facility, with input from industry stakeholders. We incorporated this model into an online decision-support tool designed to facilitate decisions by upper-level industry stakeholders about cost-effective interventions to prepare for and to react to future outbreaks of COVID-19 or other respiratory pathogens with similar transmission characteristics. The model includes a heterogeneous employee population, infection within the workplace and from the broader community, multiple infectious stages, vaccination and boosting, and immune waning following natural infection and vaccination. User-settable parameters include not only the fractions of employees fully vaccinated, boosted, and recovered from natural infection at the simulation start but also some measures of the 'recency' of vaccination and boosting. Using this model, we simulate an outbreak and estimate the cost-effectiveness of a variety of possible interventions on the number of infections, employee absences, and the potential for shortages that affect production capacity. Additionally, we estimate quantitative losses in production capacity, direct costs of implementing interventions, and total cost to the company.

The developed tool can be used both for COVID-19-related decision-making and more broadly to understand applicable patterns and dynamics of respiratory infectious disease threats. As preliminary results, we find that intensive virus testing can effectively prevent infections but is also expensive due to the cost of test kits. Likewise, in some circumstances, even very intensive physical distancing and/or biosafety measures may be cost-effective (albeit unpopular). These observations hold even in highly vaccinated populations. However, for proactive control of COVID-19 in the food industry work environment, a cost-effective approach is to maintain a vaccinated and boosted workforce to be prepared for a new outbreak. Looking across a variety of scenarios, we see several additional phenomena of relevance to national security preparedness in this critical infrastructure sector. Namely, many of the most effective interventions require not only intensive effort on the part of individual companies but stockpiles and logistical networks at a national level. In many scenarios, reactive vaccination after an outbreak has already begun is simply too slow to make a significant dent in transmission. The infection dynamics and relative effectiveness of different interventions depend on pathogen characteristics and initial conditions, implying an essential role for rapid data gathering and analysis.

In closing, Flnd CoV Control is a customizable agent-based model that forecasts the effects of COVID-19 on human health and productivity in the food industry sector. This simulation-based decision support tool will enhance the operational readiness of the US food supply in response to the current and future respiratory disease threats.

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