**Assessing the impact of an emerging respiratory pathogen on US agricultural workers and fruit and vegetable production**

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**Abstract.**

**Introduction.**

* Agriculture is a critical part of the US economy
* Infectious diseases in humans pose a unique threat to agriculturally, especially fruit and vegetable production
  + COVID-19, obviously
  + [Plague](https://onlinelibrary.wiley.com/doi/full/10.1111/j.1365-2699.2006.01674.x)
* The impact of an outbreak will depend on various factors, including timing, severity, and geography.
* Gap: we lack integrated food system/infectious disease models for investigating the impact of disease on the agricultural system

**Methods.**

Study sample and data sources.

Disease transmission model.

Study outcomes and covariates.

Statistical analysis.

**Results.**

Outbreaks among agricultural workers are expected to precede and exceed those in the general population.

Outbreaks in the spring and summer generate the largest agricultural disruptions.

A respiratory virus pandemic could generate $xx-xx in agricultural losses from the fruit and vegetable sector.

**Discussion.**

* Emerging respiratory infectious diseases pose a major risk for fruit and vegetable production because (a) agricultural workers face risk factors that make them at higher risk of infection and (b) fruit and vegetable production is highly labor-intensive.
* The timing and location of epidemic establishment matter. The 2009 pandemic established in regions critical for agricultural production, suggesting that we need tight surveillance to detect outbreaks early. We may not have time to respond, otherwise.
* The economic losses due to fruit and vegetable loss, while moderate in terms of an overall percentage of agricultural production in the US, are still a substantial amount. The downstream impacts on food availability and price are also important, and the availability of key nutrients.
* Alignment with Jayson Lusk’s COVID-19 analysis, and others.
* This extends that work by including geography and seasonality and producing a model that more formally integrates disease transmission and food production, allowing for a wider degree of scenario analyses that are rooted in sound epidemiological theory.
* Together, this work emphasizes the need for workplace protections, surveillance, and for a better understanding of how disease spreads among agricultural workers.
* Our work is limited by various factors: we don’t know much about how agricultural workers move. Our model is parameterized using census data, but various other factors could also be important. We do not model interventions like lockdowns or vaccination, which may be important. We consider only directly transmitted respiratory infections, while other types of infections, like vector-borne diseases, also pose an increasing risk to the agricultural workforce and agricultural production. We only consider the direct impact on agricultural workers, but not the impact e.g. of school closures which could impact the availability of agricultural workers, or the impact of interventions like border closures that could also impact the agricultural workforce. Or, long-term impacts of disease (we assume that infection is acute but passes).
* With this work, we seek to more tightly integrate infectious disease modelling with the food system. Outbreaks can have far-reaching impacts beyond direct morbidity and mortality that should be weighed when considering how to intervene. The impact on the food system a central impact, and this work addresses a need for formal quantitative frameworks for anticipating that impact and, ultimately, assessing how different interventions might result in food system protections.
* There remains a critical need for more directly understanding the agricultural workforce – its demographics, movement patterns, and the dynamics of infectious diseases within those communities.
* For the sake of workforce protection, economics, and food security, models like the one presented here provide a way of protecting all of these concerns.

**References.**