COVID-19 Transmission in Meatpacking Plants in the United States

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The meatpacking industry has been at the center of employee-related COVID infection concerns. However, there is limited information on the scope of the issue. We investigate the extent to which the presence of a large meatpacking (i.e., beef, pork, and broiler chicken) plant has affected county-level COVID-19 transmission dynamics. We find that meatpacking operations significantly increased transmission of COVID, resulting in 334,000 cases and 18,000 deaths from January through October 2020.

The meatpacking industry in the United States—responsible for the harvest and processing of cattle, hogs, and broiler chickens—employs 30% of the food and beverage manufacturing employees in the country. These plants attracted substantial attention from policymakers, the popular press, and consumers alike when they were identified as hotspots for coronavirus (COVID-19) infections. Media coverage became fevered with headlines documenting confirmed cases, worker deaths, and the spread of the virus to rural host communities. To date, the meatpacking industry remains the only segment of the food supply chain that was deemed to be critical infrastructure and essential to national security. This mandated processing plants to remain open and operational and had direct implications for COVID transmission and deaths in surrounding communities. In this paper we investigate the extent to which the presence of a large meatpacking facility (i.e., a processing plant that produces more than 10 million pounds per month) has affected county-level COVID transmission dynamics. We then go on to use these dynamic transmission estimates to quantify the morbidity and mortality impacts that meatpacking facilities have had across the United States from January 22, 2020 to October 3, 2020.

A variety of environmental and infrastructure-related factors likely contribute to increased transmission rates observed within meatpacking plants including: 1) low temperature and low humidity conditions coupled with metallic surfaces where the virus can persist; 2) substantial water use that facilitates the transport of pathogens across surfaces; and 3) constantly re-circulated air that promotes viral transport. Work-related conditions and socio-political factors are also likely contributors to elevated levels of transmission within and outside meatpacking facilities. Shared work and break areas limit the ability to maintain adequate distance, and the pace and physically demanding nature of work make adherence to face coverage mandates challenging. Many meatpacking workers live in multi-generational housing and often share transportation to and from work, increasing transmission risks both inside and outside of the workplace. Undocumented immigrant workers, who comprise a significant portion of meat-processing workforces, are more likely to keep working despite illness, given their inability to access unemployment benefits and fear of job loss or deportation.

COVID-19 Transmission

More than half a million meatpacking workers are concentrated in large processing facilities throughout the United States: 39 beef packing facilities, 31 pork processing facilities, and 139 broiler chicken processing facilities (Figure 1). To determine if these facilities affected COVID-19 transmission dynamics, we utilize daily, county-level confirmed COVID cases. In order to compare per capita infection growth rates across counties, we harmonize disease transmission start dates (i.e., the date the first documented COVID infection that occurred in the county) to ensure we

Figure 1. Large Beef, Pork, and Chicken Processing Facilities in the United States

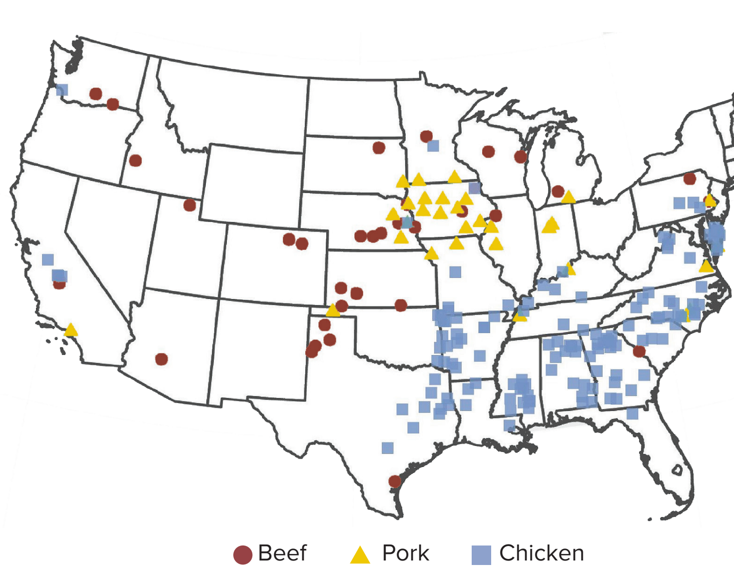
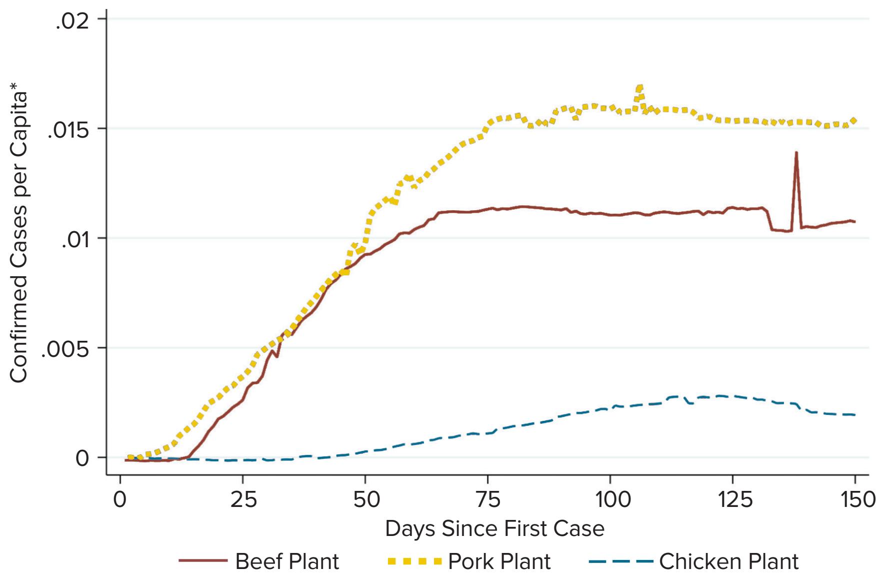


Figure 2. Increased Daily Case Rates in Counties with Meatpacking Plants



*Note: Relative to counties with no meatpacking plant.

are considering counties at the same evolutionary stage.

When attempting to isolate the impact of large meatpacking facilities, it is necessary to control for those factors that are known or are suspected to influence county-level transmission rates. First, in all of the models we estimate, we control for policy and location-specific factors, including emergency declarations, stay-at-home orders, county business closure declarations, state, and climate. The county-specific factors suspected to influence COVID spread are numerous and can be categorized into five areas: 1) structural characteristics (e.g., metropolitan, nursing home or correctional facility in the county); 2) demographic characteristics (e.g., population density, average international migration rate, share of population that is foreign born); 3) economic characteristics (e.g., unemployment rate, median household income); 4) educational characteristics (e.g., share of adults with a high school degree, share with a college degree); and 5) health characteristics (e.g., share of population in poor health, share of smokers, share of obese).

Given the sheer number of control variables, we use an iterated regression approach to estimate a series of models for each type of plant (i.e., beef, pork, chicken). We sequentially select a specific control variable from each of the five categories and iterate variable selection until we estimate a model for every combination of controls across the five categories for each day since the first confirmed COVID case. This process results in 62,400 model specifications run each day for 150 days following the first confirmed case across 3,405 counties in the United States—a total of 9.36 million models. Estimating millions of models allows us to obtain robust estimates of meatpacking plant-related increases in COVID transmission, while the epidemiological literature has yet to determine the factors that have the largest influence on county-level spread.

Meatpacking Plant Transmission Results

Figure 2 summarizes the estimated impact that large beef, pork, and chicken processing plants have had on county-level COVID disease dynamics. The effect that the presence of a meatpacking plant has on transmission changes over time. For example, the day 1 estimates for beef, pork, and chicken plants did not have a detectable impact on county-level COVID case rates. County-level impacts of beef and pork processing facilities then increase up to day 60 before leveling off. By day 150, infection rates in beef- and pork-packing counties are 0.0107 and 0.0154 cases per capita respectively, which are statistically different from counties without meatpacking facilities. For context, at the same point in the outbreak (i.e., day 150), the median no-packing-plant county had an observed per capita case rate of 0.0097. This equates to approximately 650 additional infections in the median-population beef-packing county and an additional 563 cases in the median-population pork-packing county. Thus, the estimated beef- and pork-packing impacts equate to 110% and 160% increases, relative to the infection rate in counties without processing plants. Infection rates in counties with broiler chicken processing facilities had an increase in COVID cases per capita of 0.0019 at the 150-day mark. For the median-population chicken-processing county, this equates to an additional 103 cases, and represents a 20% increase in case rates relative to the median-population no-plant county.

Mortality and Morbidity Costs

Overall, our per capita estimates suggest that large meatpacking plants in the United States generated 333,670 COVID cases from January 22, 2020 to October 3, 2020. Of these cases, 33% were sourced from beef packing facilities, 60% from pork processing facilities, and 7% from broiler chicken processing facilities. We account for the economic consequences of increased infection rates in terms of losses in productivity (i.e., lost wages) and morbidity costs. For each infection attributable to a meatpacking plant, we account for lost wages from the perspective of the infected individual, using the median wage rate ($14.05/hour) of employees in meatpacking plants reported by the Bureau of Labor Statistics and assuming that they were unable to work for three weeks.

When quantifying the mortality costs, we recognize that the medical system has improved COVID-treatment outcomes as the pandemic has evolved by using the contemporaneous 7-day-moving-average case fatality rate (CFR) in the United States. Mortality associated with meatpacking operations is estimated by multiplying cases caused by meatpacking facilities and the CFR. The economic costs of mortality are then calculated by multiplying the wage rate by an 8-hour work day, a 5-day work week, 52 weeks worked a year, and a 20-year work life remaining. Table 1 summarizes the cases, deaths, and the costs associated with forgone wages and mortality.

Our estimates suggest that nearly 334,000 cases and nearly 18,000 deaths were associated with large meatpacking plants in the United States. Taken together, the mortality and morbidity costs total almost $11.2 billion. These cost estimates are likely to dramatically understate the true economic losses and can be considered a lower-bound estimate. For infected people who do not die, we do not account for the potential long-term costs associated with COVID-19-related illnesses, including chronic health issues and quality-of-life reductions. Further, we do not account for the costs associated with medical treatment or the investments made by processors to augment the work environment in an attempt to safeguard worker health.

Table 1. Economic Costs of Morbidity and Mortality

	Infections 1,000	Deaths 1,000	Morbidity Cost Million $	Mortality Cost Million $
Beef Plants	110.3	6.1	186.0	3,548.3
Pork Plants	199.5	10.6	336.4	6,263.0
Chicken Plants	23.8	1.4	40.1	791.0
Total	**333.6**	**18.1**	**562.3**	**10,602.3**

Discussion

The increased COVID-19 transmission rates—coupled with longstanding concerns over the horizontally concentrated and vertically integrated structure of the industry—have prompted critics to question the fundamental resiliency of the industrial meatpacking system. Many of those who are critical of this system have advocated for a smaller and more geographically dispersed industry, suggesting that this would make the meatpacking industry less susceptible to shutdowns and massive disruptions like those experienced during the early parts of the pandemic in 2020. While the infection rates and COVID-19 mortality costs associated with the meatpacking industry are substantial, those critical of the industry's structure must recognize that sacrificing the scale, concentration, and efficiency of the industry we know today, in the name of disease-transmission resiliency, would come at a significant cost.

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For additional information, the authors recommend:

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