Coronavirus Disease among Workers in Food Processing, Food Manufacturing, and Agriculture Workplaces

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We describe coronavirus disease (COVID-19) among US food manufacturing and agriculture workers and provide updated information on meat and poultry processing workers. Among 742 food and agriculture workplaces in 30 states, 8,978 workers had confirmed COVID-19; 55 workers died. Racial and ethnic minority workers could be disproportionately affected by COVID-19.

High-density workplaces can cause high risk for transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus that causes coronavirus disease (COVID-19) (1–3). US food processing, food manufacturing, and agriculture workplaces employ >3.6 million persons (4). Several factors contribute to workplace and community transmission, including prolonged close contact with coworkers, congregate housing, shared transportation, and frequent community contact among workers (1,2). Prior reports have characterized COVID-19 among meat and poultry processing workers (1,2).

| State† | Type of food manufactured or farmed | No. workplaces affected | No. workers in affected workplaces | Confirmed COVID-19 cases, no. (%) | COVID-19–related deaths, no. (%) ‡ |
|--------|-----------------------------------|-------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Arkansas | Various                           | 14                      | NA                                | 68 (−)                            | 1 (1.5)                           |
| California§ | Fruits, vegetables, dairy, packaged foods, frozen foods, seafood, other | 30                      | NA                                | 518 (−)                           | 2 (0.4)                           |
| Colorado | Vegetables, dairy, baked goods, packaged foods, other | 19                      | 5,773                             | 443 (7.7)                         | 3 (0.7)                           |
| Florida | Vegetables, fruits, spices, other | 10                      | NA                                | 280 (−)                           | 2 (0.7)                           |
| Georgia | Blueberry, seasonal fruits, other | 6                       | 728                               | 268 (36.8)                        | 0                                 |
| Idaho | Vegetables                     | 3                       | 559                               | 100 (17.9)                        | 3 (0.0)                           |
| Illinois | Fruits, dairy, pizza, packaged foods, other | 61                      | NA                                | 967 (−)                           | 6 (0.6)                           |
| Iowa | Eggs, dairy, other             | 9                       | 1,870                             | 391 (20.9)                        | 2 (0.5)                           |
| Kansas | Baked goods, fruits, dairy, seasonings, other | 13                      | NA                                | 140 (−)                           | 0                                 |
| Kentucky | Baked goods, jelly, salad dressing, other | 8                       | NA                                | 53 (−)                            | 1 (1.9)                           |
| Louisiana | Seafood, dairy                 | 5                       | 607                               | 264 (43.5)                        | 0                                 |
| Maine | Seafood                         | 1                       | 65                                | 15 (23.1)                         | 0                                 |
| Massachusetts | Seafood, baked goods, other | 173                      | NA                                | 859 (−)                           | 4 (0.5)                           |
| Minnesota | Fruits, vegetables, baked goods, packaged foods, frozen foods, other | 36                      | 9,829                             | 434 (4.4)                         | 4 (0.9)                           |
| Missouri | Prepared foods, cereal, corn   | 4                       | 2,180                             | 144 (6.6)                         | 1 (0.7)                           |
| Nebraska | Eggs, milk products, baked goods, frozen foods, other | 14                      | 3,348                             | 123 (3.7)                         | 0                                 |
| New Jersey | Produce                        | 3                       | 515                               | 93 (18.1)                         | 2 (2.2)                           |
| North Carolina¶ | Fruits, vegetables, packaged foods | 16                      | NA                                | 302 (−)                           | 2 (0.7)                           |
| Oregon | Vegetables, fruits, frozen foods, packaged foods, other | 22                      | 4,579                             | 211 (4.6)                         | 3 (1.4)                           |
| Pennsylvania | Seafood, mushrooms, apples, cheese, eggs, other | 91                      | NA                                | 968 (−)                           | 6 (0.6)                           |
| Rhode Island | Seafood, apples, cheese, eggs, other | 75                      | NA                                | 346 (−)                           | 13 (3.8)                          |
| South Carolina | Vegetables, fruits, pasta, canned foods, frozen foods, other | 11                      | NA                                | 22 (−)                            | 0                                 |
| South Dakota | Cheese                        | 1                       | 200                               | 7 (3.5)                           | 0                                 |
| Tennessee | Vegetables, fruits, other      | 6                       | NA                                | 323 (−)                           | 1 (0.3)                           |
| Utah | Cherries, dairy, baked goods, candy, other | 19                      | NA                                | 186 (−)                           | 0                                 |
| Vermont | Cheese                         | 1                       | 300                               | 6 (2.0)                           | 0                                 |
| Virginia | Eggs                           | 1                       | 50                                | 4 (8.0)                           | 0                                 |
| Washington | Seafood, mushrooms, vegetables, fruits, pasta, frozen foods | 37                      | NA                                | 755 (−)                           | 1 (0.1)                           |
| Wisconsin | Vegetables, dairy, pizza, baked goods, other | 52                      | NA                                | 667 (−)                           | 1 (0.1)                           |
| Wyoming | Other                          | 1                       | 6                                 | 1 (16.7)                          | 0                                 |
| Total | Various                         | 742                     | 30,609#                           | 8,978                            | 55                                |

*COVID-19, coronavirus disease; NA, not available; †percentage not calculated due to missing data.
†Arizona, Maryland, Montana, New Hampshire, New Mexico, and North Dakota reported no cases of COVID-19 among workers in food manufacturing and agriculture workplaces.
‡Percentage of deaths among cases.
§Data from 7 California counties.
¶Reported cases are among workers and close contacts of workers.
#Among 15 of 30 states that reported the number of workers in affected workplaces, 8.2% of 30,609 workers received COVID-19 diagnoses.
We describe COVID-19 among workers in other US food manufacturing and agriculture workplaces and update information on COVID-19 among meat and poultry processing workers.

The Study

The Centers for Disease Control and Prevention (CDC) collected cumulative aggregate data from state health departments on workers in US food processing, food manufacturing, and agriculture workplaces who had laboratory-confirmed COVID-19 (5). Requested data elements included the number and type of workplaces that reported ≥1 COVID-19 case among workers during March 1–May 31, 2020; the number of workers in affected workplaces; the number, demographics, and symptom status of workers with COVID-19; and the number of COVID-19–related deaths among workers. CDC requested the same information for meat and poultry processing workers and published preliminary data (1). Symptom data collection varied by workplace; clinical signs and symptom severity were not requested. None of these data had personal identifying information.

Workplaces were defined by the North American Industry Classification System codes 111 (Crop Production) and 311 (Food Manufacturing) (6). Demographic and symptom status proportions were calculated after excluding missing and unknown values. Data on sex were missing for 14.8% of food manufacturing and agriculture workers with COVID-19; on age for 13.4%; on symptom status for 33.6%; and on race and ethnicity for 36.3%. Because characteristics of total worker populations in affected workplaces were not available, we compared the racial and ethnic distribution of workers with COVID-19 to the distribution of all workers in the animal slaughtering and processing industry. CDC determined the investigation to be nonresearch as defined in 45 CFR 46.102(l); Paperwork Reduction Act was waived with respect to voluntary collection of information during a public health emergency (7).

Among 50 US states, 36 (72.0%) responded to the CDC inquiry; 33 (91.7%) reported ≥1 laboratory-confirmed COVID-19 case among workers in food manufacturing and agriculture workplaces. The dataset excludes cases among workers for whom information was missing on sex (n = 1,331), age (n = 1,207), race/ethnicity (n = 3,257), and symptom status (n = 3,021). White, Black, and Asian/Pacific Islander workers were non-Hispanic; Hispanic or Latino workers could be of any race. Testing strategies and symptom categorization varied by facility. Symptom status was available for a single timepoint, either the time of testing or the time of interview. Column percentages might not equal 100% due to rounding. COVID-19, coronavirus disease; NH, non-Hispanic; PI, Pacific Islander.
DISPATCHES

Table 2. Laboratory-confirmed COVID-19 among workers in meat and poultry processing facilities in 31 US states, March 1–May 31, 2020*

| State† | Type of meat or poultry | No. workplaces affected | No. workers in affected workplaces | Confirmed COVID-19 cases among workers, no. (%) | COVID-19-related deaths, no. (%)‡ |
|--------|-------------------------|-------------------------|-----------------------------------|-----------------------------------------------|----------------------------------|
| Arizona | Beef                    | 1                      | 1,750                             | 162 (9.3)                                      | 0                               |
| Arkansas | Poultry                | 49                     | NA                                | 779 (–)                                        | 1 (1.3)                         |
| California§ | Beef, lamb, pork, poultry, other | 11               | NA                                | 466 (–)                                        | 2 (0.4)                         |
| Colorado | Beef, bison, lamb, poultry | 7                  | 7,711                             | 422 (5.5)                                      | 9 (2.1)                         |
| Georgia | Poultry                 | 14                     | 16,500                            | 509 (3.1)                                      | 1 (0.2)                         |
| Idaho   | Beef                    | 2                      | 797                               | 72 (9.0)                                       | 0                               |
| Illinois | Beef, pork, poultry | 26                     | NA                                | 1,029 (–)                                      | 10 (1.0)                        |
| Iowa    | Beef, pork, poultry     | 26                     | 22,170                            | 6,131 (27.7)                                   | 19 (0.3)                        |
| Kansas  | Beef, pork, poultry     | 10                     | NA                                | 2,670 (–)                                      | 8 (0.3)                         |
| Kentucky | Pork, poultry           | 7                      | 7,633                             | 559 (7.3)                                      | 4 (0.7)                         |
| Louisiana | Poultry             | 2                      | 1,430                             | 51 (3.6)                                       | 0                               |
| Maine   | Poultry                 | 1                      | 411                               | 50 (12.2)                                      | 1 (2.0)                         |
| Maryland | Poultry                | 2                      | 2,036                             | 208 (10.2)                                     | 5 (2.4)                         |
| Massachusetts | Poultry, other | 33                   | NA                                | 263 (–)                                        | 0                               |
| Minnesota | Beef, pork, poultry, other | 19                   | 15,025                            | 2,120 (14.1)                                   | 2 (0.1)                         |
| Missouri | Beef, pork, poultry     | 9                      | 8,469                             | 745 (8.8)                                      | 2 (0.3)                         |
| Nebraska | Beef, pork, poultry     | 23                     | 26,134                            | 3,438 (13.2)                                   | 14 (0.4)                        |
| New Jersey | Beef                   | 1                      | 500                               | 33 (6.6)                                       | 0                               |
| New Mexico | Beef, pork, poultry | 2                      | 550                               | 24 (4.4)                                       | 0                               |
| North Carolina¶ | Pork, poultry | 28                    | 32,325                            | 2,491 (7.7)                                    | 13 (0.5)                        |
| Oregon  | Beef, pork, poultry, other | 7                  | 1,945                             | 60 (3.1)                                       | 0                               |
| Pennsylvania | Beef, pork, poultry, other | 30              | 15,548                            | 1,169 (7.5)                                    | 8 (0.7)                         |
| Rhode Island | Beef, pork, poultry, other | 6               | NA                                | 78 (–)                                         | 0                               |
| South Carolina | Beef, pork, poultry, other | 16              | NA                                | 97 (–)                                         | 0                               |
| South Dakota | Beef, pork, poultry | 4                      | 6,500                             | 1,593 (24.5)                                   | 3 (0.2)                         |
| Tennessee | Pork, poultry, other     | 7                      | NA                                | 640 (–)                                        | 2 (0.3)                         |
| Utah    | Beef, pork, poultry     | 4                      | NA                                | 67 (–)                                         | 1 (1.5)                         |
| Virginia | Pork, poultry, other    | 14                     | NA                                | 1,109 (–)                                      | 10 (0.9)                        |
| Washington | Beef, poultry    | 7                      | 4,452                             | 468 (10.5)                                     | 4 (0.9)                         |
| Wisconsin | Beef, pork, veal       | 14                     | 14,125                            | 860 (6.1)                                      | 4 (0.5)                         |
| Wyoming# | Beef                    | 0                      | NA                                | 1 (–)                                          | 0                               |
| Total   | Beef, bison, lamb, pork, poultry, veal, other | 382               | 186,011**                         | 28,364 (132)                                   |                                 |

*Preliminary data published in Morbidity and Mortality Weekly Report (1); 8 additional states, Arkansas, California, Iowa, Louisiana, Minnesota, New Jersey, North Carolina, and Oregon, provided data that was not included in the prior assessment. COVID-19, coronavirus disease; NA, not available; –, percent not calculated due to missing data.
†Florida, Montana, New Hampshire, North Dakota, and Vermont reported no cases of COVID-19 among workers in meat and poultry processing facilities.
‡Percentage of deaths among cases.
§Data from 7 California counties.
¶Data from 7 California counties.
#One worker with COVID-19 worked at a meat processing facility in another state.
**Among 20 of 31 states reporting the number of workers in affected workplaces, 11.4% of 186,011 workers received COVID-19 diagnoses.

with race and ethnicity reported, 4,164 (72.8%) workers were Hispanic or Latino, 963 (16.8%) were non-Hispanic White, 362 (6.3%) were non-Hispanic Black, and 232 (4.1%) were non-Hispanic Asian/Pacific Islander. Overall, 83.2% of cases occurred among racial and ethnic minority workers. Symptom status was reported for 5,957 workers; 4,957 (83.2%) workers were asymptomatic and 1,000 (16.8%) were asymptomatic or presymptomatic.

States reported 28,364 cases and 132 (0.5%) deaths among workers in 382 meat and poultry processing facilities in 31 states (Table 2). Demographic characteristics and symptom status of workers with COVID-19 indicated most were symptomatic and members of racial and ethnic minority groups (Figure 2).

Conclusions
We describe COVID-19 among workers in US food processing, food manufacturing, and agriculture workplaces during March 1–May 31, 2020. Among all food manufacturing and agriculture workers in 28 states reporting race and ethnicity data, 36.5% of workers are Hispanic or Latino, 52.6% are non-Hispanic White, 5.9% are non-Hispanic Black, 3.5% are non-Hispanic Asian/Pacific Islander, and 1.5% are of other non-Hispanic race or ethnicity groups (4). However, among workers with COVID-19 for whom race or ethnicity data were reported, 72.8% were Hispanic or Latino, 6.3% were non-Hispanic Black, and 4.1% were non-Hispanic Asian/Pacific Islander, suggesting that Hispanic or Latino, non-Hispanic Black, and non-Hispanic Asian/Pacific Islander workers in these...
workplaces might be disproportionately affected by COVID-19.

The sex, age, and symptom distribution of meat and poultry processing workers with COVID-19 was similar to that observed for food manufacturing and agriculture workers. The racial and ethnic distribution of meat and poultry processing workers with COVID-19 differed slightly; a higher percentage of cases were reported among non-Hispanic Black and non-Hispanic Asian/Pacific Islander workers.

Our study supports findings from prior reports that part of the disproportionate burden of COVID-19 among some racial and ethnic minority groups is likely related to occupational risk (8,9). These findings should be considered when implementing workplace interventions to ensure communication and training are culturally and linguistically tailored for each workforce.

Reports on mass testing in US meat and poultry processing facilities revealed widespread COVID-19 outbreaks and identified high proportions of asymptomatic or presymptomatic infections (10,11). Although most food manufacturing and agriculture workers (83.2%) and meat and poultry processing workers (88.1%) in our study reported symptoms, not all workplaces performed mass testing; therefore, workers with asymptomatic or presymptomatic infections might have been missed. These findings support the need for comprehensive testing strategies, coupled with contact tracing and symptom screening, for high-density critical infrastructure workplaces to aid in identifying infections and reducing transmission within the workplace (12).

Reducing workplace exposures is critical for protecting workers in US food processing, food manufacturing, and agriculture workplaces and might help reduce health disparities among disproportionately affected populations. Adherence to workplace-specific intervention and prevention efforts, including engineered controls, such as physical distancing; administrative controls, such as proper sanitation, cleaning, and disinfection; and providing personal protective equipment likely would protect both workers and surrounding communities (13,14).

This study has several limitations. First, only 36 states reported data; these results might not be representative of all US food processing, food manufacturing, and agriculture workers and workplaces. Second, testing strategies varied by workplace, influencing the number of cases detected and reported among workers. Workers might have been hesitant to report illness or seek healthcare, which could have led to underestimating cases among workers. Delays in linking cases and deaths to workplace outbreaks likely also contributed to an underestimation. Third, demographic characteristics of total worker populations in all affected workplaces were not available, limiting the ability to quantify the degree to which some racial and ethnic minority groups might be disproportionately affected by COVID-19. Fourth, preferred language,
English proficiency, and migration and immigration status of workers were not captured; culturally and linguistically appropriate public health monitoring and interventions are crucial considerations for this workforce. Finally, workers are members of their local communities; transmission of SARS-CoV-2 could have occurred both at the workplace and in the surrounding community and thus could be affected by levels of community transmission.

Comprehensive evaluations in food processing, food manufacturing, and agriculture workplaces and communities are needed to clarify and address risk factors for SARS-CoV-2 transmission among workers. The extent of control measures and timing of implementations should be evaluated to assess effectiveness of workplace interventions. Several factors at the individual-, household-, community-, and occupational-level, including long-standing health and social disparities, likely contribute to disproportionate disease incidence among racial and ethnic minority workers.

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etymologia

Petri Dish [pe′tre ′dish]

Monika Mahajan

The Petri dish is named after the German inventor and bacteriologist Julius Richard Petri (1852–1921). In 1887, as an assistant to fellow German physician and pioneering microbiologist Robert Koch (1843–1910), Petri published a paper titled “A minor modification of the platting technique of Koch.” This seemingly modest improvement (a slightly larger glass lid), Petri explained, reduced contamination from airborne germs in comparison with Koch’s bell jar.

Similar alterations had been suggested earlier by Slavonian researcher Emanuel Klein (1844–1925), who was working in England and described a nearly identical dish in his 1885 book Micro-organisms. An 1886 research paper published by Percy Frankland (1858–1946) in the Proceedings of the Royal Society portrayed a comparable shallow, circular, and covered dish. Available historical complications accord credit of discovery of the Petri dish to other bacteriologists.

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