Epidemiology of COVID-19 in Essential Workers, including Healthcare Personnel

Sara Oliver MD, MSPH

ACIP Meeting
July 29, 2020
Outline

- Overview of U.S. COVID-19 Epidemiology

- Epidemiology among Essential Workers
  - Healthcare Personnel
    - Workers at Long Term Care Facilities
  - Workers in Food Processing and Agriculture
  - Workers in Correctional Facilities
  - Military Personnel
Overview of U.S. COVID-19 Epidemiology
United States COVID-19 Cases by County

January 21 to July 27, 2020

USA
4,225,687
TOTAL CASES

USA
146,546
TOTAL DEATHS

CDC | Updated: Jul 27 2020 5:45PM

Trends in Number of COVID-19 Cases in the US
January 22 to July 27, 2020

USA
4,225,687
TOTAL CASES

USA
146,546
TOTAL DEATHS

https://www.cdc.gov/covid-data-tracker/index.html#trends
Percentage testing positive is higher in children and adults 18-49 years of age, compared to older adults.

Commercial Laboratories Reporting to CDC
March 1 to July 18, 2020

Percentage positive increasing since June, peak in early July

Pneumonia, Influenza and COVID-19 Mortality
NCHS Mortality Reporting System

Through July 18, 2020

9.1%


NCHS = National Center for Health Statistics
Seroprevalence of Antibodies to SARS-CoV-2

- Cross-sectional study performing serologic testing on a convenience sample of residual sera
  - March 23 through May 12
  - Estimates standardized to site populations by age and sex

- Serum samples tested from **16,025** persons

Havers FP, et al. JAMA IM 2020
Seroprevalence of Antibodies to SARS-CoV-2

- Seroprevalence estimates ranged from 1.0% to 6.9%
- Estimated greater than 10 times more SARS-CoV-2 infections occurred than the number of reported cases
  - By site, the estimated number of infections ranged from 6 to 24 times the number of reported cases

Havers FP, et al. JAMA IM 2020
Large Scale SARS-CoV-2 Serologic Studies in Health Care Workers and First Responders—New York City and Detroit Metro Area

- May 18 to June 13 (Detroit) and July 2 (NYC)
- Questionnaire gathered information about demographics, previous COVID-19 testing and symptoms, previous medical conditions
- Eligibility: No COVID-like illness or +NAAT within previous 2 weeks
- Presence and risk factors for IgG antibody:
  - Testing with ORTHO IgG test (S1 target)
Seroprevalence at 27 Hospitals*, Detroit Metro Area, May 18-June 13, 2020 (N=16,403)

* Focus on ED, ICU, surgery, wrap-around services; includes first responders in Med Control Authorities
Seroprevalence by Agency, New York City, May 18-July 2, 2020 (N=24,682)

Overall agency seroprevalence

- Correctional facilities: 36.5%
- Fire department: 24.9%
- Hospitals: 22.4%
- Police department: 19.7%
- Medical examiner office: 11.3%

Overall: 22.5%
Seroprevalence among healthcare workers: 13 hospitals in April-May

- **Objective:**
  - Estimate seroprevalence of SARS-CoV-2 infection among healthcare workers (e.g. MDs, RN, respiratory therapists, phlebotomists) working in COVID-19 care areas
  - Explore risk factors for infection and immune response

- **Design:** Convenient sample of ~3250 HCWs across ~13 hospitals (250 per site)

- **Assay:** CDC Pan-Ig ELISA against spike protein

- **Data sources:**
  - Interviews from enrolled HCWs
  - Serum collection at baseline and 60 days after enrollment
Seroprevalence among healthcare workers: 13 hospitals in April-May

Seroprevalence ranged from 0.8% to 31%

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<td>31.2%</td>
</tr>
<tr>
<td>MA</td>
<td>10.0%</td>
</tr>
<tr>
<td>TN</td>
<td>7.6%</td>
</tr>
<tr>
<td>CO</td>
<td>6.0%</td>
</tr>
<tr>
<td>MA</td>
<td>4.8%</td>
</tr>
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<td>CA</td>
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</tr>
<tr>
<td>WA</td>
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<td>MN</td>
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<td>MD</td>
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<tr>
<td>OR</td>
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<tr>
<td>OH</td>
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<td>UT</td>
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COVID-19
Epidemiology among Healthcare Personnel
Healthcare Personnel

- **Healthcare Personnel** (HCP) are essential workers defined as **paid** and **unpaid** persons serving in healthcare settings who have the potential for direct or indirect exposure to patients or infectious materials.
Cases among Healthcare Personnel

- CDC reports and routinely updates cases and deaths among healthcare personnel on the CDC website
  - Likely an underestimate

As of July 27th

Cases & Deaths among Healthcare Personnel

Data were collected from 3,184,064 people, but healthcare personnel status was only available for 688,270 (21.6%) people. For the 113,730 cases of COVID-19 among healthcare personnel, death status was only available for 76,253 (67.0%).

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<td>113,730</td>
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EIP COVID-19 Tracking in Healthcare Personnel

- **Emerging Infections Program (EIP)**: network of 10 state health departments and local public health and academic partners
- Sentinel or population-based surveillance for COVID-19 in healthcare personnel
  - 7 sites (Connecticut, Colorado, Maryland, Minnesota, New Mexico, Oregon, Tennessee) conducting sentinel surveillance
  - 2 sites (California, Georgia) conducting population-based surveillance
  - 1 site (New York—Rochester) using hybrid approach: sentinel hospitals, with population-based surveillance for nursing home HCP with COVID-19
- >1100 HCP COVID-19 cases reported; >500 interviewed
  - 464 HCP COVID-19 cases with complete data as of 6/25
  - ~70% from CA or NY

https://www.cdc.gov/ncezid/dpei/eip/index.html
# EIP COVID-19 Tracking in Healthcare Personnel

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<td>38 (30–48)</td>
<td>44 (32–55)</td>
<td>45 (33–56)</td>
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<td><strong>Female – no. (%)</strong></td>
<td>157 (79.3)</td>
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<td><strong>Race – no. (%)</strong></td>
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<tr>
<td>American Indian or Alaska Native</td>
<td>7 (3.7)</td>
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<td>Asian</td>
<td>31 (16.5)</td>
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<td>31 (16.5)</td>
<td>82 (43.2)</td>
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<td>17 (9.0)</td>
<td>21 (11.1)</td>
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<td>6 (3.2)</td>
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<td>Not reported</td>
<td>7 (3.7)</td>
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<td>White</td>
<td>89 (47.3)</td>
<td>64 (33.7)</td>
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<td>29 (15.4)</td>
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<td>79 (42.0)</td>
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<td>Symptoms of COVID-19 in 14 days before positive test – no. (%)</td>
<td>160 (85.1)</td>
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Across healthcare settings, most HCP with COVID-19 were female, and more than half were nurses or patient care assistants.

*21 HCP worked in 2 facility types. These HCP were categorized based on the facility providing the highest acuity of care (e.g., a HCP working in a hospital and nursing home was considered a hospital-based HCP).
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Project COVERED: COVID-19 Evaluation of Risk in Emergency Departments

- 1600-participant enrolled prospective cohort of emergency department personnel in 20 medical centers for 20-week surveillance (serial questionnaires, serology, nasal PCR testing)
- Goals
  - Attributable risks in emergency care providers
  - Identify risk factors associated with COVID-19 acquisition and seroconversion
  - Describe evolution in emergency care practice through COVID-19 pandemic

https://medicine.uiowa.edu/content/covid-evaluation-risk-emergency-departments-covered-project
Project COVERED: COVID-19 Evaluation of Risk in Emergency Departments

- At baseline, **29** (2%) had positive serologies (none had PCR positivity)
  - **22** (75%) had symptoms compatible with COVID-19
    - **19** (90%) had worked in the ED with symptoms (1-16 days)

- **9** COVID-19 HCP incident cases in 7,700 person-weeks of observation
  - None of the participants who developed infection participated in intubation of COVID-19-positive patient

- Projected **2.4%** infection rate over 20-week observation period
  - Preliminary findings

https://medicine.uiowa.edu/content/covid-evaluation-risk-emergency-departments-covered-project
COVID-NET: Hospitalization Surveillance from 14 States

States participating in COVID-NET

Surveillance network collecting hospitalization data

- Catchment area ~10% of US population
- Patients must be a resident of the surveillance area and have a positive SARS-CoV-2 test within 14 days prior to or during hospitalization
- Charts reviewed by trained surveillance officers

MMWR April 17, 2020
COVID-NET = COVID-19-Associated Hospitalization Surveillance Network
https://www.cdc.gov/mmwr/volumes/69/wr/mm6915e3.htm
Healthcare Personnel within COVID-NET
March 1 to July 11, 2020

- 36,426 hospitalizations within COVID-NET
- 9,195 (25%) cases with data on HCP status
- 512 (5.6%) Healthcare Personnel

- Median age: 48 years (IQR: 38-57 years)

- Among Healthcare Personnel, higher proportion of Non-Hispanic Black persons and lower proportion of Hispanic persons

1HCP status unknown for 399 (1.1%)
Healthcare Personnel within COVID-NET
March 1 to July 11, 2020

- Healthcare Personnel Type: N=512
  - Respiratory Therapist: 3 (<1%)
  - Physician: 23 (5%)
  - Nurse: 125 (24%)
  - Other: 276 (54%)
  - Not specified: 85 (17%)

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
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<tbody>
<tr>
<td>Hospital-based patient care support</td>
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<tr>
<td>Other patient care</td>
<td>21</td>
</tr>
<tr>
<td>Housekeeping/Environmental Services</td>
<td>20</td>
</tr>
<tr>
<td>Other nursing home/LTCF staff</td>
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<tr>
<td>Technicians</td>
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<tr>
<td>Management</td>
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<tr>
<td>Home health worker</td>
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<tr>
<td>Emergency medical personnel</td>
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<tr>
<td>Social work/counselor</td>
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<tr>
<td>Pharmacy</td>
<td>9</td>
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<tr>
<td>Food Services</td>
<td>8</td>
</tr>
<tr>
<td>Dentistry</td>
<td>6</td>
</tr>
<tr>
<td>Laboratory</td>
<td>6</td>
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<tr>
<td>Other</td>
<td>57</td>
</tr>
</tbody>
</table>
Healthcare Personnel within COVID-NET
March 1 to July 11, 2020

Underlying Medical Conditions

- **87%** of Hospitalized HCP
- **91%** of Hospitalized Adults

<table>
<thead>
<tr>
<th>Condition</th>
<th>HCP</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obesity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CKD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COPD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td></td>
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</tbody>
</table>

March 1 to July 11, 2020
Healthcare Personnel within COVID-NET

Underlying Medical Conditions

18-49 years

- Diabetes
- Hypertension
- Obesity
- CKD
- COPD
- Asthma

50-64 years

- Diabetes
- Hypertension
- Obesity
- CKD
- COPD
- Asthma

≥65 years

- Diabetes
- Hypertension
- Obesity
- CKD
- COPD
- Asthma

HCP with higher proportion of **obesity** and **asthma**, compared to Overall hospitalized adults

Older HCP with **lower** proportion of most underlying medical conditions
Healthcare Personnel within COVID-NET

March 1 to July 11, 2020

Clinical Outcomes

n=482 HCP with completed chart review

- **Death**: 3.7% (HCP), 13.5% (Overall)
- **Mechanical Ventilation**: 13.5% (HCP), 26.4% (Overall)
- **ICU**: 26.4% (HCP), 32% (Overall)

Hospitalization length of stay for HCP (days): Median 5 days (IQR: 2-8 days)
Summary of COVID-19 among Healthcare Personnel

- HCP with COVID-19 are demographically diverse: geography, occupation, race and ethnicity, and underlying conditions

- Many HCP report direct contact with COVID-19 patients through work (e.g. physicians, nurses, respiratory therapists)

- Among hospitalized HCP, similar proportions with underlying conditions
  - Higher prevalence of obesity and asthma, lower prevalence of diabetes, hypertension, chronic kidney/lung disease
Cases among Staff at Long Term Care Facilities

- Many U.S. states publicly report COVID-19 cases in staff of long-term care facilities (LTCF), including nursing homes and assisted living facilities.

- As of July 16, there were at least 69,438 cumulative confirmed or probable COVID-19 cases based on publicly reported data from 36 U.S. states and territories.

- 342 cumulative confirmed or probable COVID-19 deaths among LTCF HCP based on publicly reported data from 17 U.S. states and territories.

Data from health department websites or other publicly available information.
COVID-19 Cases among Skilled Nursing Facilities

Percentage of Facilities with ≥1 Case among Residents

Week 1, June 22-June 28, N= 14,199

Week 2, June 29-July 5, N= 14,256

Week 3, July 6-13, N= 14,170

Week 4, July 13-July 19, N= 13,765

Data from NHSN LTCF module: https://data.cms.gov/stories/s/COVID-19-Nursing-Home-Data/bkwz-xpvg/
COVID-19 Cases among Skilled Nursing Facilities

Percentage of Facilities with ≥1 Case among Staff

Data from NHSN LTCF module:

Inferred Data: For the purpose of best epidemiological understanding, data that fail quality checks or appear inconsistent with surveillance protocols are assigned a value based on their patterns of data-entry or are excluded from analysis.
COVID-19 Cases among Staff at Skilled Nursing Facilities
Count and Incidence per 1,000 Resident-Weeks

Cases

Deaths

*Number of facilities reporting may vary from week to week

Data from NHSN LTCF module:
Long Term Care Facilities Workforce

- Consists of a variety of occupations with different levels of direct patient contact
- Disproportionately lower-wage workers
- 39% of workers are 50 years of age or older
- 82% of workers are female, 26% non-Hispanic Black persons
  - Among workers overall, 48% are female and 12% are non-Hispanic Black persons
- Staff can be shared among multiple facilities
- In many instances, COVID-19 activity increases among LTCF staff first, and then residents

Data from 2018 American Community Survey (ACS):
COVID-19
Epidemiology among Workers in Food Processing and Agriculture
Among 23 states reporting COVID-19 outbreaks in meat or poultry processing plants, there were 16,233 cases in 239 facilities, including 86 (0.5%) deaths

- Testing strategies and methods varied by workplace

Symptom status reported for 10,284 (63%):
- 9,072 (88%) were symptomatic
- 1,212 (12%) asymptomatic/presymptomatic

MMWR July 10, 2020 https://www.cdc.gov/mmwr/volumes/69/wr/mm6927e2.htm?s_cid=mm6927e2_w
Among 14 states reporting total number of workers in affected meat and poultry processing plants, COVID-19 diagnosed in 9.1% of workers
  – Ranged from 3.1% to 24.5% per facility

Among cases with race and ethnicity reported, 87% occurred among racial or ethnic minorities
  – 56% Hispanic, 19% Black, 13% White, 12% Asian
  – Suggests that Hispanic and Asian workers might be disproportionally affected

MMWR July 10, 2020 https://www.cdc.gov/mmwr/volumes/69/wr/mm6927e2.htm?s_cid=mm6927e2_w
Workers in Food Processing and Agriculture

- Outbreaks have been reported in other food production sectors, including food processing facilities and farms.

- Compared to all U.S. salaried workers, individuals working in agriculture are more likely to be racial and ethnic minority, lacking a high school diploma, and less likely to be born in the United States.

1 https://www.ers.usda.gov/topics/farm-economy/farm-labor/#demographic
Workers in Food Processing and Agriculture

- Multiple factors that increase food processing and agriculture workers’ risk for exposure to SARS-CoV-2:
  - Prolonged close workplace contact with coworkers
  - Frequent community contact with fellow workers
  - Mobility of the work force (i.e. migrant workers)
  - Shared transportation to and from the workplace
  - Lack of paid sick leave
  - Congregate housing
    - Living in employer-furnished housing and shared living quarters
    - Living in crowded and multigenerational housing
COVID-19
Epidemiology among Workers in Correctional Facilities
COVID-19 Confirmed Case Rate per 100,000 in Prison and U.S. Population

- COVID-19 case rate 5.5 times higher among incarcerated persons than case rate in US population

Source: Saloner, et al. JAMA 2020; Data are from the UCLA Law COVID-19 Behind Bars Data Project, US Census & CDC. Rate calculations based upon the US population and the US prison population.

UCLA COVID-19 Behind Bars Data Project
Correction & Detention Facilities

- **985** correctional/detention facilities with ≥1 COVID-19 cases
- **COVID-19** diagnosed in **77,716** incarcerated persons and **18,562** staff
- **707** COVID-19 related deaths reported among incarcerated persons, **56** among staff
- Actual case counts likely higher than reported

Correctional Health Unit, Disproportionally Affected Population Team
CDC Situational Awareness Branch
UCLA COVID-19 Behind Bars Data Project
Correction & Detention Facilities

- Testing of staff does not always occur with larger facility investigations and may be self-reported

- In an analysis of 16 U.S. prisons and jails, 56% identified their first case of COVID-19 among staff members as opposed to incarcerated/detained persons\(^1\)
  - Indicates that staff members can introduce the virus into correctional and detention settings through their daily movements between the facility and the community

\(^1\)Hagan et al. MMWR – projected publication date August 7. Results of Mass Testing for SARS-CoV-2 in 16 Prisons and Jails—Six U.S. Jurisdictions, April–May 2020

Correctional Health Unit, Disproportionally Affected Population Team
COVID-19
Epidemiology among Military Personnel
Cases among Military Personnel

36,590 cases and 56 deaths among Department of Defense personnel

<table>
<thead>
<tr>
<th></th>
<th>Cases</th>
<th>Hospitalized</th>
<th>Recovered</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Military</td>
<td>25,590</td>
<td>465</td>
<td>10,855</td>
<td>3</td>
</tr>
<tr>
<td>Civilian</td>
<td>5,373</td>
<td>264</td>
<td>1,958</td>
<td>33</td>
</tr>
<tr>
<td>Dependent</td>
<td>3,417</td>
<td>103</td>
<td>1,434</td>
<td>7</td>
</tr>
<tr>
<td>Contractor</td>
<td>2,279</td>
<td>128</td>
<td>875</td>
<td>13</td>
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<tr>
<td>Total</td>
<td>36,659</td>
<td>960</td>
<td>15,122</td>
<td>56</td>
</tr>
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</table>

https://www.defense.gov/Explore/Spotlight/Coronavirus/
SARS-CoV-2 Infections from U.S. Navy Service Members
USS Theodore Roosevelt, April 2020

- Aircraft carrier experiencing a COVID-19 outbreak
  - Approximately 1,000 service members infected with SARS-CoV-2
  - Portion provided specimens and questionnaire

- 98/267 (37%) had positive PCR results
- 228/382 (60%) had positive antibodies to SARS-CoV-2 spike protein
- 44/238 (19%) reported no symptoms

Demonstrates risk factors for COVID-19 transmission among military personnel:
  - Congregate living quarters
  - Close working environments

Payne DC et al. June 12, 2020 MMWR https://www.cdc.gov/mmwr/volumes/69/wr/mm6923e4.htm?s_cid=mm6923e4_w
Summary
Summary

- Over 4 million cases of COVID-19 diagnosed in the United States through July
- Information on occupation for COVID-19 cases has not been systematically collected and reported on all cases
- Many occupations appear to have increased risk for COVID-19, including healthcare personnel and staff at long term care facilities, correctional and detention facilities, and food/agricultural settings
- Surveillance/projects ongoing to identify risk factors for COVID-19
For more information, contact CDC
1-800-CDC-INFO (232-4636)

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.
Levels of Influenza-like illness (ILI) and COVID-like illness (CLI) increasing since late June

3.5%
1.0%
COVID-NET: Hospitalization Surveillance from 14 States

March 1 to July 18, 2020

Overall: 121/100,000 population

Among adults ≥65 years of age: 338/100,000 population

Cumulative Hospitalization Rate

https://gis.cdc.gov/grasp/COVIDNet/COVID19_5.html
COVID-NET: Hospitalization Surveillance from 14 States

March 1 to July 18, 2020

Weekly hospitalization rate demonstrates an increase in rates over past several weeks

https://gis.cdc.gov/grasp/COVIDNet/COVID19_5.html
COVID-NET:
Age-adjusted COVID-19-associated hospitalization rates, by race and ethnicity

March 1 to July 18, 2020

Rate per 100,000 population

<table>
<thead>
<tr>
<th>Race and Ethnicity</th>
<th>Rate per 100,000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Hispanic American Indian or Alaska Native</td>
<td>281.0</td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
<td>246.8</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>242.5</td>
</tr>
<tr>
<td>Non-Hispanic Asian or Pacific Islander</td>
<td>66.7</td>
</tr>
<tr>
<td>Non-Hispanic White</td>
<td>53.0</td>
</tr>
</tbody>
</table>

Compared to non-Hispanic White persons
Health Care Personnel and Transmission

- First reported case of community transmission in U.S. in Solano County, CA

Multiple aerosol-generating procedures including BiPAP and intubation, with no PPE

While at Hospital A:
- 121 HCP exposed,
  - Three tested positive

While at Hospital B:
- 146 HCP exposed,
  - None tested positive

Patient remained on a closed system ventilator from arrival to receiving a positive test result

MMWR April 17, 2020  https://www.cdc.gov/mmwr/volumes/69/wr/mm6915e5.htm?s_cid=mm6915e5_w
Health Care Personnel and Transmission

HCP with lab-confirmed COVID-19 associated with:
Performing physical examination
Exposure to the patient during nebulizer treatments
Longer duration exposure to the patient

Of the three HCP with lab-confirmed COVID:
One present for 3 hours while patient on BiPAP
One participated with BiPAP placement and intubation
One reported close contact with patient for 2 hours but not during aerosol generating procedures

MMWR April 17, 2020  https://www.cdc.gov/mmwr/volumes/69/wr/mm6915e5.htm?s_cid=mm6915e5_w
Long Term Care Facilities

- Reports suggest that once COVID-19 has been introduced into a long-term care facility, it has the potential to result in high attack rates among residents, staff members, and visitors.

- Many areas contribute to vulnerability of LTCFs:
  - Inadequate familiarity with PPE
  - Inadequate supplies of PPE
  - High prevalence of underlying conditions
  - Atypical presentations in elderly
  - Facilities share staff and patients

McMichael TM, et al. NEJM 2020
Healthcare Personnel Seroprevalence:
Other published reports

- Nashville, TN\(^1\):
  - 249 HCP in hospital units with COVID-19 patients in April
  - 19 (7.6\%) positive for SARS-CoV-2 antibodies
    - 11 of 19 reported previous symptoms
    - Seropositivity more common among those not universally wearing PPE

- Germany\(^2\):
  - 316 HCP tested in April
  - 5 (1.6\%) positive for SARS-CoV-2 antibodies

\(^2\)Korth et al. JCV 2020 [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7219425/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7219425/)
Healthcare Personnel Risk Factors

- Belgium\(^1\):
  - 3056 hospital staff at a single institution in late April
  - 197 (6.4\%) positive for SARS-CoV-2 antibodies

\(^1\)Steensels et al. JAMA 2020