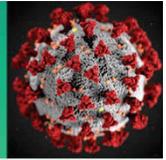


COVID-19 Science Update



From the Office of the Chief Medical Officer, CDC COVID-19 Response, and the CDC Library, Atlanta, GA.
Intended for use by public health professionals responding to the COVID-19 pandemic.

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Epidemiology

PEER-REVIEWED

[The epidemiology and clinical characteristics of co-infection of SARS-CoV-2 and influenza viruses in patients during COVID-19 outbreak.](#) Yue *et al.* Journal of Medical Virology (June 12, 2020).

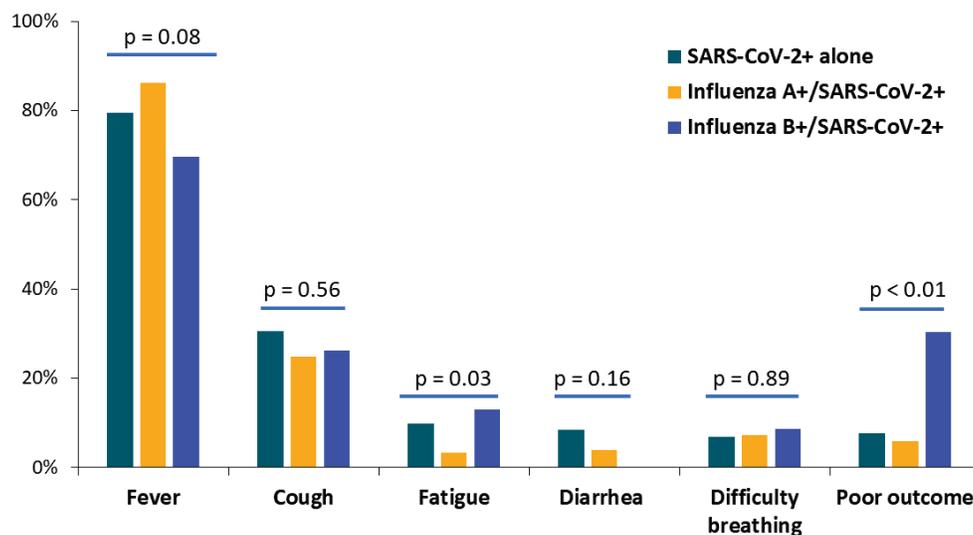
Key findings:

- Of 307 patients with SARS-CoV-2, 153 (49.8%) had influenza A co-infection, 23 (7.5%) had influenza B co-infection.
 - Age and gender were similar across groups.
- COVID-19 patients co-infected with influenza A or B had similar clinical symptoms as patients with only SARS-CoV-2; fatigue was slightly more common those with influenza B co-infection (13%) (Figure).
- COVID-19 patients with influenza B more often had poor outcomes (30.4%) than those with only SARS-CoV-2 (7.6%) or SARS-CoV-2 and influenza A (5.9%) (Figure).

Methods: Cross-sectional study of 307 hospitalized COVID-19 patients, between January 12 and February 21, 2020, Wuhan, China. **Limitations:** Single center; small sample size, may not be representative; end point of poor outcome not clearly defined and likely includes death; number of deaths not reported.

Implications: In this small study, influenza B co-infection worsened COVID-19 prognosis.

Figure:



Notes: Adapted from Yue *et al.* Summary of symptoms and outcomes among patients with SARS-CoV-2 and co-infection with influenza viruses A or B. Statistical comparison among three groups was assessed using Pearson's χ^2 test or Fisher's exact test. Available via Wiley Public Health Emergency Collection through PubMed Central.

[Effects of sterilization with hydrogen peroxide and chlorine dioxide on the filtration efficiency of N95, KN95, and surgical facemasks.](#) Cai *et al.* JAMA Open Network (June 15, 2020; [Correction](#) on August 14, 2020).

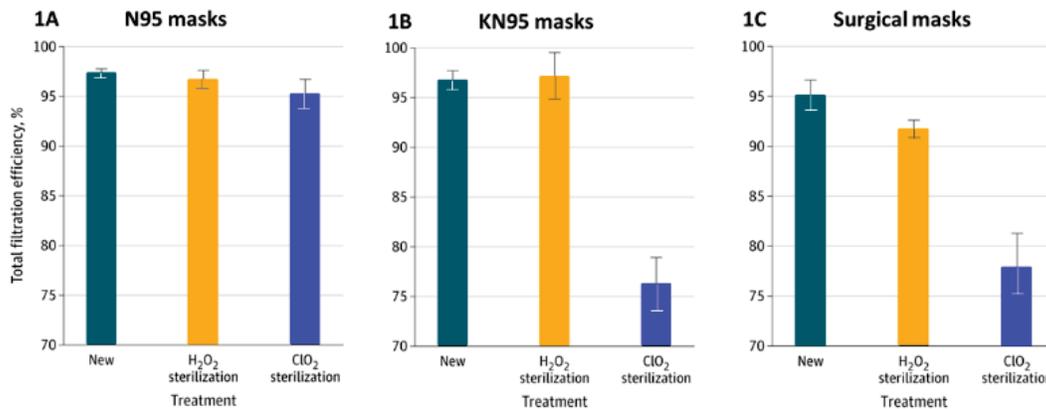
Key findings:

- After hydrogen peroxide (H₂O₂) facemask sterilization, N95s and KN95s (Chinese N95s) retained 95% filtration efficiency (ability to filter out tiny aerosol particles) (Figures 1A&B).
 - H₂O₂ caused small declines in filtration efficiency of N95, KN95, and surgical masks (Figure 1A–C).
- After chlorine dioxide (ClO₂) sterilization, overall filtration efficiency remained >95% with N95s, but declined sharply in KN95s (76%) and surgical masks (78%) (Figure 1A–C).
 - N95 efficiency dropped to 86% for 0.3 micron particles.

Methods: Comparison of H₂O₂ and ClO₂ sterilization on facemask filtration efficiencies. *Limitations:* Small variety of manufacturers; small sample sizes for masks; limited number of conditions and sterilization techniques; only 1 sterilization cycle.

Implications: Sterilization with H₂O₂ impacted facemask filtration efficiency less than with ClO₂. Post-sterilization facemask function may depend on aerosol size.

Figure:



Note: Adapted from Cai *et al.* Figures 1A–C show the filtration efficiency (ability to filter out aerosol) and 95% CIs of **new masks** (left bar), masks after **H₂O₂ sterilization** (middle bar), and after **ClO₂** (right bar), for N95 (A), KN95 (B), and surgical masks (C). Licensed under CC-BY.

[Prevalence of COVID-19 infection and subsequent cohorting in a residential substance use treatment program in Boston, MA.](#) Barocas *et al.* Journal of Addiction Medicine (June 9, 2020).

Key findings:

- At a residential substance use treatment facility with shared rooms, 6/22 (27%) of residents and 4/9 (44%) of staff tested positive for SARS-CoV-2.
- After testing, disinfection, and separating residents by infection status (cohorting), no residents in the COVID-19 negative unit developed symptoms during the next 2 weeks.
 - Residential addiction treatment continued.

Methods: NP RT-PCR testing of all 22 residents and 9/10 staff at a residential substance use treatment facility, April 2020. *Limitations:* No antibody testing to ascertain past infection; no follow-up RT-PCR testing to detect new asymptomatic infections.

Implications: Rapid universal testing and cohorting may allow residential facilities to continue operating during the COVID-19 pandemic.

PREPRINTS (NOT PEER-REVIEWED)

Interregional SARS-CoV-2 spread from a single introduction outbreak in a meat-packing plant in northeast Iowa. Richmond *et al.* medRxiv (June 8, 2020).

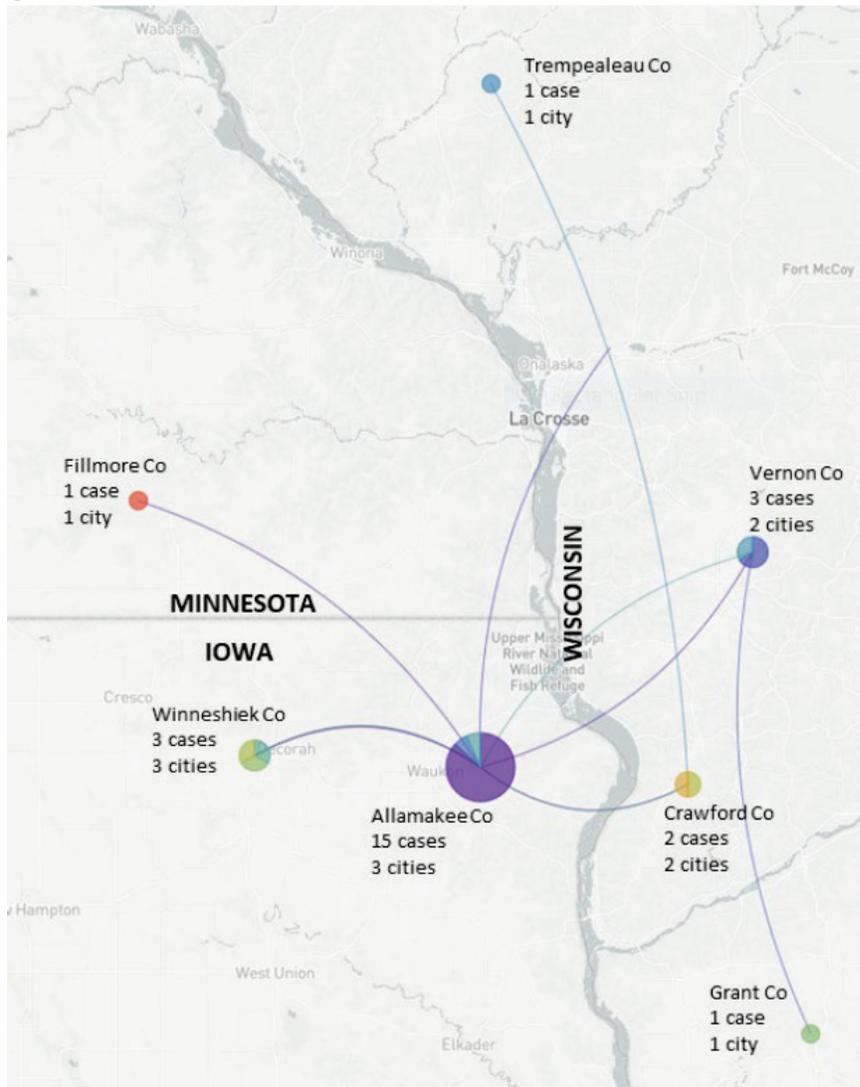
Key findings:

- Phylogenetic analysis suggests SARS-CoV-2 introduction from northeastern US into Postville, Iowa meatpacking plant in early March, 2020.
 - Virus spread to plant workers and their households within 2 weeks.
- Outbreak spread to individuals in 13 cities in 7 counties in Iowa, Wisconsin and Minnesota (spanning 185 square miles) by mid-May, 2020.

Methods: Retrospective next-generation sequencing and phylogenetic analysis of complete viral genomes from NP swabs from 67 COVID-19 patients in Iowa (including from meatpacking plant), Wisconsin, and Minnesota, between March and May 2020. **Limitations:** Small sample size, spread may be under-estimated.

Implications: Phylogenetic analysis can identify transmission chains and spur public health response if available in real-time. Without rapid action and regional coordination, SARS-CoV-2 outbreaks in meatpacking plants may spread widely.

Figure:



Note: Adapted from Richmond *et al.* Phylogenetic data suggest that SARS-CoV-2 spread from Pottsville, Allamakee County, Iowa (central purple pie chart) to counties in Minnesota and Wisconsin, April-May, 2020. Pie charts show the distribution of cases from each city within that county: most Allamakee County cases came from one of the 3 involved cities. Thin purple and blue lines show imputed transmission chains. Licensed under CC-BY-NC-ND 4.0.

Findings from the Diamond Princess

A large SARS-CoV-2 outbreak aboard the Diamond Princess cruise ship in February 2020 was the largest outbreak outside of China at the time and the first of many outbreaks on cruise ships. After a disembarking passenger tested positive for SARS-CoV-2 in Hong Kong, the ship was quarantined off the Japanese coast. Owing to close confines and older passenger ages, >700 of 3,711 passengers and crew members became infected and were admitted to multiple hospitals in Japan. We feature 3 articles that examined development of symptoms, duration of RT-PCR positivity, and seroconversion among those with SARS-CoV-2 infection.

PEER-REVIEWED

A. [Clinical characteristics of COVID-19 in 104 people with SARS-CoV-2 infection on the Diamond Princess cruise ship: a retrospective analysis](#). Tabata *et al.* Lancet Infectious Disease (June 12, 2020).

Key findings:

- Among 104 persons with SARS-CoV-2, 33 (32%) remained asymptomatic, 43 (41%) developed mild COVID-19, 28 (27%) developed severe COVID-19.
- Of 43 initially asymptomatic persons, 10 (23%) developed symptoms (had been pre-symptomatic) and 3 had severe COVID-19.
 - On admission, pre-symptomatic persons more often had evidence of tissue damage (lactate dehydrogenase [LDH] >230 IU/L) than asymptomatic persons (50% vs. 12%, $p=0.02$).
- Among 41 passengers with initial mild symptoms, 5 (12%) developed severe COVID-19.

Methods: 104 older adult (median age 68) passengers and crew members with SARS-CoV-2 (by RT-PCR) admitted to a Japanese hospital, February 2020, and followed for ~2 weeks. **Limitations:** Unclear discharge criteria; follow-up did not extend beyond discharge; mean/median LDH levels not presented.

B. [SARS-CoV-2 shedding and seroconversion among passengers quarantined after disembarking a cruise ship: a case series](#). Hung *et al.* Lancet Infectious Diseases (June 12, 2020).

Key findings:

- Of 9 participants found to have SARS-CoV-2 infection (by RT-PCR or serology) following enrollment, 6 were asymptomatic.
 - 3/6 asymptomatic individuals had lung inflammation by CT; 2/3 symptomatic participants had lung inflammation by CT.
- At baseline;
 - 8/9 participants had serum IgG against *spike receptor-binding protein* (a protein on the surface of the virus); the 9th seroconverted by day 8 of quarantine.
 - 4/9 had IgG against *nucleoprotein* (a structural protein inside the virus); this rose to 7/9 by day 8.
- IgG levels were higher among those with lung inflammation by CT (Figures 1&2).

Methods: Prospective study of 215 individuals who were RT-PCR negative while aboard the Diamond Princess cruise ship and were repatriated to Hong Kong, February 20–21, 2020. During 14 day-quarantine, specimens collected at baseline and every 4 days for RT-PCR, IgG, and IgM. **Limitations:** Small sample size.

Figure 1

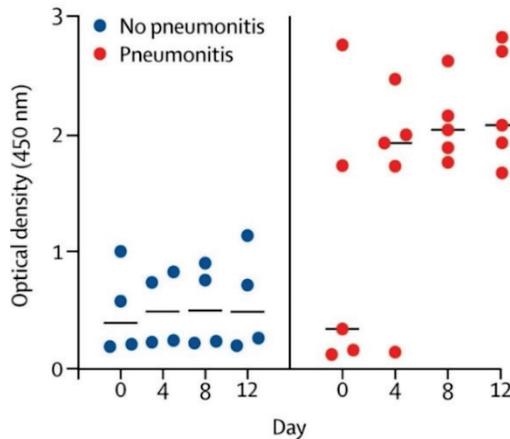
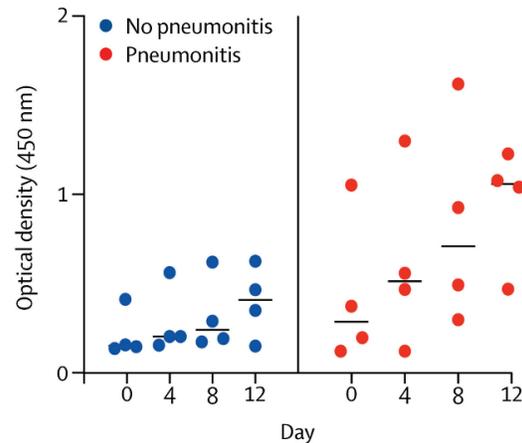


Figure 2



Note: Adapted from Hung *et al.* SARS-CoV-2-specific anti-nucleoprotein IgG levels (**Figure 1**) and SARS-CoV-2-specific anti-spike receptor-binding domain (RBD) IgG levels (**Figure 2**) (optical density [450 nm]) were higher in participants with evidence of **pneumonitis** (lung inflammation) by computed tomography (CT) than those **without pneumonitis**. This article was published in *Lancet Infectious Diseases*, Vol 20, Hung *et al.*, SARS-CoV-2 shedding and seroconversion among passengers quarantined after disembarking a cruise ship: a case series, P1051-1060, Copyright Elsevier 2020. This article is currently available at the Elsevier COVID-19 resource center: <https://www.elsevier.com/connect/coronavirus-information-center>.

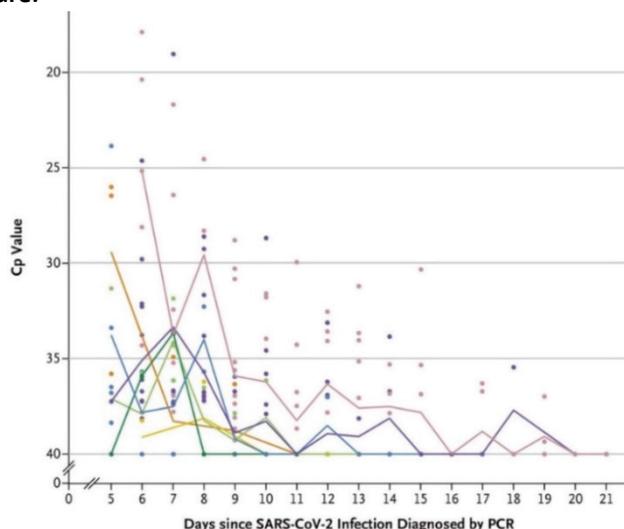
C. Natural history of asymptomatic SARS-CoV-2 infection. Sakurai *et al.* NEJM (June 12, 2020).

Key findings:

- Of 90 asymptomatic persons with SARS-CoV-2, nearly half (n = 43) tested negative (2 consecutive tests) within 8 days of the first positive PCR test (range 5–21 days).
 - Older individuals had higher viral loads and took ~4.4 days longer to turn PCR-negative than younger individuals (95% CI 2.3–6.5 days) (Figure).

Methods: 128 persons (RT-PCR-positive asymptomatic persons and RT-PCR-negative cabinmates) were transferred from the Diamond Princess cruise ship to a Japanese hospital for observation, between February 19 and 26, 2020. RT-PCR testing performed every 48 hours. **Limitations:** Exact time of infection not known; positive RT-PCR test may not indicate patient was infectious.

Figure:



Note: Adapted from Sakurai *et al.* Older adults (pink and purple lines) exhibited higher viral loads (crossing-point [Cp] y-axis) over a longer time period than younger individuals. From NEJM. Sakurai *et al.* 383:885-886. DOI: 10.1056/NEJMc2013020. Copyright ©2020 Massachusetts Medical Society. Reprinted with permission from Massachusetts Medical Society.

Implications for 3 studies (Tabata *et al.*, Hung *et al.* & Sakurai *et al.*): Among older persons with SARS-CoV-2, over 1/4 developed severe COVID-19. Even in asymptomatic persons with SARS-CoV-2, lung inflammation may be present and spur more robust immune responses. SARS-CoV-2 infections may resolve more slowly in older asymptomatic adults than in younger asymptomatic adults.

Clinical Treatment & Management

PEER-REVIEWED

[Cluster of chalazia in nurses using eye protection while caring for critically ill patients with COVID-19 in intensive care.](#) Mégarbane *et al.* Journal of Occupational and Environmental Medicine (May 28, 2020).

Key findings:

- Three ICU nurses caring for COVID-19 patients each developed a chalazion, which is a painless inflammatory lump in blocked oil glands of eyelid (Figure).
 - The cause was attributed to irritation by chemically-disinfected protective glasses, face masks, and reduced blinking and touching one's face.
- All chalazia resolved over a month with antibiotic and anti-inflammatory eye ointments and supportive care.
- No further cases after recommendations to improve rinsing of glasses after chemical disinfection.

Methods: Case reports of ICU nurses, Paris, France. **Limitations:** No historical data on chalazion frequency.

Implications: Chalazia might occur among healthcare workers wearing PPE for extended periods, and may indicate a need for changes in how eyewear is disinfected, rinsed, and worn.

Figure:



Note: Adapted from Mégarbane *et al.* Chalazion of the lower eyelid in a nurse. The nurse was wearing protective glasses disinfected with 0.5% didecyltrimethylammonium chloride and chlorhexidine digluconate. Available for use in accordance with BMJ website terms and conditions for the duration of the COVID-19 pandemic or until otherwise determined by BMJ.

Laboratory Science

PEER-REVIEWED

[Airborne SARS-CoV-2 is rapidly inactivated by simulated sunlight](#). Schuit *et al.* Journal of Infectious Disease (June 11, 2020).

Key findings:

- 90% of aerosolized SARS-CoV-2 was inactivated within 6 minutes of exposure to simulated high-intensity summer sunlight.
 - 90% inactivation took 19 minutes in simulated mid-intensity sunlight (early fall/late winter conditions) and >2 hours in darkness.
 - Relative humidity did not affect inactivation times.

Methods: Aerosol particles (~2 microns) of SARS-CoV-2 suspended in artificial saliva were exposed to simulated sunlight at different intensities mimicking summer or early fall/late winter in the middle of the US. Viral titers determined via infection assays using Vero-6 cells. **Limitations:** The role of aerosol-based SARS-CoV-2 transmission not fully established.

Implications: Natural sunlight may be an effective disinfectant for SARS-CoV-2 in aerosols and on surfaces (as previously demonstrated, [Ratnesar-Schumate *et al.*](#), see [May 29, 2020 Edition of the Science Update](#)). Outdoor gatherings may be less risky than indoor gatherings. Further studies are needed to determine SARS-CoV-2 infectious dose and role of aerosols in spreading SARS-CoV-2.

In Brief

- Rubino *et al.* [New-onset diabetes in COVID-19](#). NEJM. Explores the interactions of COVID-19 and diabetes mellitus and describes a global registry to track epidemiologic features and pathogenesis of new-onset diabetes with COVID-19.
- Scully *et al.* [Considering how biological sex impacts immune responses and COVID-19 outcomes](#). Nature Reviews Immunology. Thorough review of biological sex, immune responses, and differential COVID-19 outcomes by biological sex.
- Sneed *et al.* [Social and psychological consequences of the COVID-19 pandemic in African-American communities: Lessons from Michigan](#). Psychological Trauma: Theory, Research, Practice, and Policy. Authors explore experiences with COVID-19 by communities of color and explore community-based approaches to mitigate psychological consequences.
- Galea *et al.* [COVID-19 pandemic, unemployment, and civil unrest. Underlying deep racial and socioeconomic divides](#). JAMA. Discusses intersection of COVID-19, economic upheaval, and racial injustice.
- Evans *et al.* [Diagnosing and treating systemic racism](#). NEJM. Explores the need to address systemic racism through changes in the healthcare system.
- Mahase. [COVID-19: Urgent cancer referrals fall by 60%, showing “brutal” impact of pandemic](#). BMC. During the COVID-19 pandemic, urgent referrals for cancer care dropped dramatically in England. Delayed cancer diagnoses and treatment are anticipated.
- Oreshkova *et al.* [SARS-CoV-2 infection in farmed minks, the Netherlands, April and May 2020](#). Eurosurveillance. Investigation of SARS-CoV-2 among minks on farms in the Netherlands.
- Chaumont *et al.* [Mixed central and peripheral nervous system disorders in severe SARS-CoV-2 infection](#). Journal of Neurology. Case reports of 4 patients with severe central and peripheral nervous system disorders as late complications of severe COVID-19 following extubation.

- Ogburn *et al.* [Aggregating data from COVID-19 trials](#). *Science*. Discusses a platform for sharing RCT protocols, which may facilitate efficient collaborative research.
- Falkenhain-López *et al.* [COVID-19-related acute genital ulcers](#). *Journal of European Academy of Dermatology and Venereology*. Case report of acute genital ulceration attributed to immune response to SARS-CoV-2. Work-up insufficient to attribute to SARS-CoV-2 with confidence.

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