2019-nCoV Literature Situation Report (Lit Rep)

May 20, 2020

The scientific literature on COVID-19 is rapidly evolving and these articles were selected for review based on their relevance to Washington State decision making around COVID-19 response efforts. Included in these Lit Reps are some manuscripts that have been made available online as pre-prints but have not yet undergone peer review. Please be aware of this when reviewing articles included in the Lit Reps.

Key Takeaways

- **Based on a fluid particle dynamics model of the behavior of droplets released from the cough of an infectious person, the social distancing policy of 6 feet may not be sufficient under some wind and relative humidity conditions.**
- **A phylogenetic analysis of the COVID-19 pandemic provides additional evidence for three distinct lineages, with each having different demographic trajectories.**
- **The performance of 100% cotton masks is shown to be comparable to that of medical grade masks in suppressing respiratory droplets in microenvironments such as a bedroom or a car.**
- **While climate and weather conditions may influence the efficacy of control measures, modeling indicates that the population susceptibility remains the fundamental driver of controlling COVID-19 outbreaks.**

Non-Pharmaceutical Interventions

- Ho et al. compared performance of medical masks and cotton masks in suppressing respiratory droplets from a coughing infectious person. Particles with size ranging 20-1000 nm ($NC_{0.02\text{-}1}$) were measured for each participant while they were in a bedroom and a car wearing a medical mask and 100% cotton mask. There were no significant differences in $NC_{0.02\text{-}1}$ between participants with medical masks and cotton masks in either environment, suggesting that cotton masks could be an effective substitute for medical masks in curbing transmission in public.

  Ho et al. (May 2020). Medical Mask versus Cotton Mask for Preventing Respiratory Droplet Transmission in Micro Environments. Science of the Total Environment. https://doi.org/10.1016/j.scitotenv.2020.139510

Transmission

- Feng et al use a validated computational fluid particle dynamics model to simulate the behavior of SARS-CoV-2 laden droplets emitted by coughs. They find that under various wind and relative humidity conditions, microdroplets can be transported much farther than the recommended social distancing policy of 6 feet.
- The simulations also support previous studies that even wearing facial masks in an unrealistically loose condition when coughing can significantly reduce the suspension of small droplets in the air.

  Feng et al. (May 2020). Influence of Wind and Relative Humidity on the Social Distancing Effectiveness to Prevent COVID-19 Airborne Transmission: A Numerical Study. Journal of Aerosol Science. https://doi.org/10.1016/j.jaerosci.2020.105585

Geographic Spread

- Fountain-Jones et al. studied the phylogenetic structures underlying the SARS-CoV-2 pandemic and find support for three distinct lineages, each having different demographic trajectories. While the majority of sequences classified in Lineage A and B originated in China and have been subsequently found in Washington State and throughout the US, Lineage C was predominantly European with no evidence that it circulated in China.
- Demographic dynamics of the lineages are also concordant with known epidemiologic factors - for instance mutations affecting the increase in viral mutation rate specific to Lineage C support the hypothesis that Lineage C may have increased transmissibility compared to other lineages

  Fountain-Jones et al. (May 19, 2020). Emerging Phylogenetic Structure of the SARS-CoV-2 Pandemic. Pre-print downloaded May 20 from https://doi.org/10.1101/2020.05.19.103846

Testing and Treatment

- Luciferase immunopreciptation assay systems (LIPS) were found to be more sensitive to SARS-CoV-2 specific antibodies to the nucleocapsid than antibodies to the spike protein at 15 or more days after symptom onset.
- Sampling daily from patients showed that immunocompromised patients generally had a delayed antibody response.
- Though this study only included symptomatic patients, among whom antibody levels are likely higher, the high sensitivity of LIPs shows promise and has implications for larger seroepidemiologic studies.

  Burbelo et al. (May 19, 2020). Detection of Nucleocapsid Antibody to SARS-CoV-2 Is More Sensitive than Antibody to Spike Protein in COVID-19 Patients. The Journal of Infectious Diseases. https://doi.org/10.1093/infdis/jiaa273

- Mei et al. developed an artificial intelligence (AI) algorithm that integrates chest CT findings with clinical history to provide rapid diagnosis of COVID-19. The algorithm achieved high discriminative performance (AUC=0.92) with equal sensitivity compared to a senior thoracic radiologist (84.3% vs 74.6%) on a test set of 279 patients.
- The algorithm also correctly identified 17 of 25 patients who presented with normal CT scans but had positive RT-PCR results, whereas radiologists classified all as COVID-19 negative
- While the generalizability of the algorithm is limited by sample size, it has useful implications as a potential screening tool.

  Mei et al. (May 19, 2020). Artificial Intelligence-Enabled Rapid Diagnosis of Patients with COVID-19. Nature Medicine. https://doi.org/10.1038/s41591-020-0931-3

- Suhandynata et al. evaluated the clinical performance of the Diazyme SARS-CoV-2 IgM/IgG serology assay using a cohort of 54 PCR positive patients and an additional 235 negative samples. The assay had a sensitivity of 100% and specificity of 98.7% at 15 or more days after SARS-CoV-2 confirmation.
- The study also evaluated time to seroconversion in 14 patients who were seronegative on admission. The observed median seroconversion to IgM and IgG was 5 days and 4 days following a positive PCR result, respectively.

Suhandynata et al. (May 19, 2020). Longitudinal Monitoring of SARS-CoV-2 IgM and IgG Seropositivity to Detect COVID-19. The Journal of Applied Laboratory Medicine. https://doi.org/10.1093/jalm/jfaa079

Clinical Characteristics and Health Care Setting

- An observational cohort study identified 1,150 adults with laboratory confirmed COVID-19 admitted to two New York hospitals and followed 257 (22%) critically ill participants for the primary outcome of in-hospital mortality. Results support previous studies showing that older age and cardiopulmonary comorbidities were associated with increased in-hospital mortality while also adding biomarkers for inflammation and thrombosis as independent risk factors.

  Cummings et al. (May 19, 2020). Epidemiology, Clinical Course, and Outcomes of Critically Ill Adults with COVID-19 in New York City: A Prospective Cohort Study. Lancet. https://doi.org/10.1016/S0140-6736(20)31189-2

Mental Health and Personal Impact

- Wright et al. found that in a cohort of 35,784 adults in the UK, the number of self-reported episodes for worrying about adversities related to COVID-19, as well as the number actual experienced events of adversity were related to both anxiety and depression. Worrying about adversities was more strongly associated with anxiety than with depression.
- There was some evidence of a stronger relationship between adverse experiences and both anxiety and depression among people of low socioeconomic status.

  Wright et al. (May 19, 2020). How Are Adversities during COVID-19 Affecting Mental Health Differential Associations for Worries and Experiences and Implications for Policy. Pre-print downloaded May 20 from https://doi.org/10.1101/2020.05.14.20101717

Modeling and Prediction

- Baker et al. applied a climate-dependent epidemic model with parameters drawn from endemic coronaviruses and influenza to understand the potential climate dependence of SARS-CoV-2. The global model provided detailed results for nine cities. Researchers found that the extent to which the population builds immunity remains the fundamental driver of peak incidence during the pandemic phase, while climate plays a modest role in affecting the size of the pandemic outbreak and efficacy of control measures.

  Baker et al. (May 18, 2020). Susceptible Supply Limits the Role of Climate in the Early SARS-CoV-2 Pandemic. Science. https://doi.org/10.1126/science.abc2535

- Worden et al. used a model to determine that transmission in many areas in the US may not yet be controlled despite stable or declining case counts. Based on data available on May 9, 2020, the only states to have achieved a threshold at which the epidemic fades out ($R_t < 1$) are New York, Michigan, New Jersey, and Louisiana. The model uses the Wallinga-Teunis method and accounts for uncertainty in delays from symptom onset to case reporting to estimate time varying reproduction number (R_t) in counties and regions in California and in other states over time.

  Worden et al. (May 19, 2020). Estimation of COVID-19 Transmission Rates in California and the U.S. with Reporting Delays. Pre-print downloaded May 20 from https://doi.org/10.1101/2020.05.14.20101162

Public Health Policy and Practice

- Raamkumar et al. compared the outreach efforts of public health authorities (PHAs) in Singapore, United States, and England using Facebook posts. The authors classified posts into themes and compared mean posts per day, mean comments per day, and the positive to negative sentiment ratio between countries. Overall, the Singapore Ministry of Health covered more diverse themes, posted more frequently, and received comments with a more favorable sentiment than other PHAs.

  Raamkumar et al. (May 13, 2020). Measuring the Outreach Efforts of Public Health Authorities and the Public Response on Facebook during the COVID-19 Pandemic in Early 2020: A Cross-Country Comparison. Journal of Medical Internet Research. https://doi.org/10.2196/19334

Other Resources and Commentaries

- CRISPR tool scales up to interrogate a huge line-up of viral suspects – Nature (May 18)
- COVID-19 and cancer: do we really know what we think we know? – Nature Reviews (May 18)
- Several neonates reported positive for COVID-19 – Infectious Diseases (May 19)
- The impact of super-spreaders in COVID-19: mapping genome variation worldwide – Bioxriv (May 19)
- Need for Transparency and Reliable Evidence in Emergency Use Authorizations for Coronavirus Disease 2019 (COVID-19) Therapies – JAMA Internal Medicine (May 19)
- Cross-neutralization of SARS-CoV-2 by a human monoclonal SARS-CoV antibody – Nature (May 18)
- Strategies for Optimizing the Supply of N95 Filtering Facepiece Respirators During the Coronavirus Disease 2019 (COVID-19) Pandemic – Disaster Medicine (May 19)

Report prepared by the UW MetaCenter for Pandemic Preparedness and Global Health Security and the START Center in collaboration with and on behalf of WA DOH COVID-19 Incidence Management Team