TRANSMISSION PATTERNS

**Genomic epidemiology identifies emergence and rapid transmission of SARS-CoV-2 B.1.1.7 in the United States**

Washington et al. study the first emergence and transmission patterns of the B.1.1.7 variant of SARS-COV-2 in the U.S., the strain first identified in the U.K. Phylogenetic analyses and modelling methods were used to find multiple introductions of B.1.1.7 into the U.S. in November 2020, with transmission spreading to at least 30 states by January 2021. The analysis found it likely that the first sustained local transmission occurred in California and the rapid spread coinciding with periods of peak travel over Thanksgiving and subsequent holidays. Results showed a doubling-rate of just over a week and increased transmission by 35-45% in the U.S. from December 2020 to January 2021, which, though it varied by state, was consistent with other countries. Clustering was found predominantly in California and Florida. These findings showed that B.1.1.7 will likely become the dominant variant in the U.S. states by March 2021. Early studies indicated that B.1.1.7 infection could lead to around 30% higher mortality. The authors recommended urgent mitigation efforts including genomic surveillance should be put in place immediately.

* Please note all studies published in medRxiv and bioRxiv are preprints and have not yet undergone a rigorous peer review process.

**Age groups that sustain resurging COVID-19 epidemics in the United States**

The authors aim to test the hypothesis that resurgent COVID-19 is due to an increased spread from young adults by utilizing age-specific population mobility and COVID-19 mortality data to predict how other factors (i.e., changing contact intensities, age) have contributed to the resurgence of COVID-19. After analysis of several data sets from >10 million participants, results reveal that mobility trends declined the most in 18–24-year-old participants during the beginning of the pandemic and mobility levels in < 35-year-old participants did not increase above the levels seen in older individuals. Reproduction numbers were found to be below one for all age groups except participants 20-49 years of age. Participants aged 35-49 (1.39 [1.34 - 1.44]) and 20-34 (1.29 [1.24-1.36]) had the highest reproduction number. This data reveals that before and after school reopening, individuals aged 20-49, specifically individuals 35-49 years of age have led the resurgent COVID-19 epidemics in the US in 2020. Preventative interventions targeting this population are essential in mitigating the resurgent epidemics and COVID-19 related death.

**NON-CLINICAL TRENDS**

**Determinants of the Fiscal Support of Governments in Response to the COVID-19 Pandemic**
Li and Liang analyzed the fiscal support offered to countries by their governments during COVID-19 in reaction to the economic burden created by the pandemic, including stimulus packages, spending, forgone revenues and liquidity support. The study used empirical analyses of cross-sectional data estimations from 129 developed and developing countries. Using the World Pandemic Uncertainty Indices (WPUI), the results showed positive correlation between higher levels of uncertainty related to COVID-19 and fiscal support offered, measured as the share of the country’s Gross Domestic Product (GDP). Authors also found higher fiscal support in countries with larger and older populations, and that fiscal support is not related to per capita income or development indicators. The study concluded that governments have considered COVID-19-related uncertainty outcomes to protect their populations, especially older people.

**Association Between Receipt of Unemployment Insurance and Food Insecurity Among People Who Lost Employment During the COVID-19 Pandemic in the United States**

This study aimed to assess the association between receipt of unemployment insurance and food insecurity among individuals who lost their occupations in April-November, 2020 during the COVID-19 pandemic. Data was collected from the Understanding Coronavirus in America study and 15 survey waves were utilized. Participant requirements included 1) Participate in a minimum of two survey waves, 2) Household income >75,000, 3) Employed in February, and 4) Lost their position in April-November. Results revealed that of the 1119 participants, 53.6% were non-Hispanic White, 23.7% were Hispanic, 12.1% were non-Hispanic Black, the majority of participants were women (65.2%), and the mean age equal to 45. Food insecurity was revealed in 37.1% of participants and financial restrictions led to decreasing eating in 39.1% of participants. In the sample, unemployment insurance was associated with a 5.7 (95% CI, 3.0-8.4) percentage point decrease in eating less and a 4.3 (95%CI, 1.8-6.9) percentage point decrease in food insecurity. Acceptance of unemployment insurance was correlated with a 48% decrease in eating less and a 35% decrease in food insecurity. Authors suggest that policymakers continue expanding unemployment insurance, duration, and eligibility, as it is vital in providing individuals with basic human needs such as housing and food.

**Assessment of Suicide in Japan During the COVID-19 Pandemic vs Previous Years**

Authors evaluated whether suicide rates had risen during the early stages of the COVID-19 pandemic in Japan. Extracting national data from the Japanese health ministry, they compared monthly suicide rates from April- November 2020 (during COVID-19 pandemic) with month-by-month data from previous years. For men, there was an increase in suicide rates in October and November 2020, when compared with these months in 2016, 2017, 2018 and 2019; however, no difference was reported during April-September months in 2020. Conversely, for women, suicide rates increased in July-November 2020 when compared with previous years and no change was found during April-June months in 2020.
Overall, the most prominent rise in suicide rates during the COVID-19 pandemic in Japan occurred in young men <30 years old in November 2020 and women <30 years old in October 2020. These findings have important implications for future suicide prevention and the allocation of mental health resources in Japan during the ongoing coronavirus pandemic.

**PEDIATRIC PRESENTATION**

*SARS-CoV-2 transmission among children and staff in daycare centres during a nationwide lockdown in France: a cross-sectional, multicentre, seroprevalence study*[^6]

Lachassinne et al. conducted a cross-sectional study of children and staff at 22 daycare centers in France from March 15 to May 9, 2020, to assess the seroprevalence of SARS-CoV-2 in the centers that remained open solely for essential workers’ children during the lockdown. The authors utilized capillary whole blood rapid chromatographic immunoassay to determine the prevalence of IgG or IgM. A total of 327 children, 197 staff, and 164 comparator staff (those who stayed at home during the lockdown) were tested. Antibodies were found in 3.7% (95% CI 1.3-6.8) of the children and 6.8% (95% CI 3.2-11.5) of the staff. The control group had a seroprevalence of 5.0% (95% CI 1.6-9.8). These results were interpreted to mean that there were low levels of seroprevalence in young children, and that COVID-19 transmission to children was most likely happening at home rather than at a daycare center.

**ZOONOSES**

*Shifts in global bat diversity suggest a possible role of climate change in the emergence of SARS-CoV-1 and SARS-CoV-2*[^7]

Beyer et al. examined the role of climate change in relation to local bat diversity and how this may have impacted the emergence of SARS-CoV-1 and SARS-CoV-2. Evidence of coronavirus strains in bats similar to SARS-CoV-1 and SARS-CoV-2 have suggested that bats were involved in the crossover event for the current pandemic. The research group determined the geographical ranges of bats at two time points, the beginning of the 20th century and currently, by identifying the different distributions of natural vegetation required by each bat species. It was found that the Chinese Yunnan province, Myanmar, and Laos (along with more sparse patches in Central and South America) had become hotspots for bat proliferation as a result of rising temperatures. The authors recommend epidemiologists include climate change-induced shifts in the biodiversity of pathogen-carrying animals in their analysis of infectious diseases. They emphasize the necessity to preserve natural habitats and reduce human encroachment into wild-life to minimize crossover events, while maintaining that climate change underlies all of these issues.

**NON-PHARMACEUTICAL INTERVENTIONS**
Povidone Iodine Mouthwash, Gargle and Nasal Spray to Reduce Nasopharyngeal Viral Load in Patients with COVID-19: A Randomized Clinical Trial

Previous data has shown that povidone iodine (PI) mouthwash inactivates SARS-CoV-2 in vitro. Based on this known mechanism, Guenezan et al. conducted a randomized control trial in order to evaluate whether PI mouthwash could reduce the nasopharyngeal viral load in patients with COVID-19. Adult patients with RCT-PCR- confirmed SARS-CoV-2 by nasopharyngeal swabs were randomly assigned to the intervention group (n=12) or the control group (n=12). Those in the intervention group underwent four PI mouthwashes and gargles, while those in the control group received a placebo. Notably, patients in the intervention group were significantly younger (median=33y/o) than those in the control group (median=57y/o). From baseline to day 1, patients in the intervention group had a 75% decrease in mean viral titre, compared to 32% in the control group. Over time though (from baseline to day 7), there were no differences in RNA quantification between intervention and control groups. Important side effects of PI included elevated TSH after 5 days of exposure. This study represents an important first step; however, authors call for studies with greater sample size to further investigate the impact of PI on SARS-CoV-2.

BIOENGINEERING

A lymph node–targeted Amphiphile vaccine induces potent cellular and humoral immunity to SARS-CoV-2

Steinbuck et al. (Elicio Therapeutics) utilized an amphiphile vaccine adjuvant (AMP-CpG) to improve the SARS-CoV-2 Spike-2 receptor binding domain protein (RBD) vaccine efficacy. AMP-CpG functions through interactions with endogenous albumin that enhance transport to the lymph nodes to cause a 30-to-50 fold increase in immune response without systemic toxicity. The immune responses of the AMP-CpG adjuvant compared to unmodified CpG and alum were evaluated following murine injection with a repeat-dose regimen. The cytokine producing cell activity within different tissues, neutralizing antibodies, and Spike RBD-specific antibodies were quantified. In general, they found that mice injected with the Amp-CpG Spike RBD adjuvant produced higher levels of cytokine response than the control groups. They also experimented with dose sparing scenarios: even when the dosage was reduced by about 10x, AMP-CpG Spike adjuvant still maintained robust immune response. An enhanced cellular and humoral response compared to unmodified CpG or alum was also observed following a similar vaccination protocol in aged mice.

A diagnostic host response biosignature for COVID-19 from RNA profiling of nasal swabs and blood

Ng et al. aimed to improve COVID-19 testing accuracy by identifying unique elements of the host-response transcriptome following a SARS-CoV-2 infection and comparing them to other viral and non-viral respiratory infections. Key bacterial and viral parameters (abundance, richness, alpha diversity), cell type/proportion, and differentially expressed genes (DEGs) were quantified via analysis of nasopharyngeal (NP) swabs and whole blood
samples from infected patients (with SARS-CoV-2 or other viruses such as influenza or seasonal coronavirus) and healthy patient controls. The authors used this large DEG data set to train a machine learning-based classifier to accurately identify a SARS-CoV-2 infection from other types of respiratory infections. Their complementary diagnostic tool was able to distinctly identify a SARS-CoV-2 infection with ~80% sensitivity and ~90% specificity using expression levels of 19 key genes measured from a NP swab. In future work, the authors hope to explore the ability of this platform to improve asymptomatic COVID-19 diagnosis and predict disease severity.

**Treatment of influenza and SARS-CoV-2 infections via mRNA-encoded Cas13a in rodents**

In this study, Blanchard et al. characterize a novel antiviral approach that uses the CRISPR-Cas system (Cas13a-crRNA) designed to cleave specific RNA sequences present in influenza or SARS-CoV-2 infections that results in inhibited viral replication. The authors first developed and characterized the individual components (Cas13 delivery via mRNA and strain-specific CRISPR RNA (crRNA) guides) against multiple influenza strains and demonstrated RNA knockdown *in vitro* and following nebulizer-based delivery in an *in vivo* mouse infection model. By tailoring the crRNA sequence against the SARS-CoV-2 replicase and nucleocapsid genes, the authors successfully demonstrated positive results as a prophylactic treatment for SARS-CoV-2 in a hamster infection model.

**A smartphone-read ultrasensitive and quantitative saliva test for COVID-19**

Hu et al. developed a quantitative, point-of-care SARS-CoV-2 smartphone-read assay which utilizes CRISPR-Cas12a technology to enhance test sensitivity to viral load (without RNA isolation) present in the saliva. The authors evaluated their CRISPR-fluorescence detection system (FDS) assay against nasal and pharyngeal swab tests to gather insight on the time course and viral load of SARS-CoV-2 in a primate model. They found that their assay enabled a 15-minute signal-to-answer test incubation time and a level of detection of 0.05 copies/μL. The group suggests that saliva samples may be of particular diagnostic relevance due to their potentially higher sensitivity and stability than nasopharyngeal swab RT-qPCR tests. The CRISPR-FDS assay is adapted to chip format to test animal and patient saliva via smartphone, utilizing a smartphone-based fluorescence microscope device. CRISPR-FDS tests (smartphone and plate) were evaluated against RT-qPCR nasopharyngeal tests. While the smartphone test exhibited a 1.3% false positive result and the plate-based test exhibited a 2.3% false negative result, both saliva tests were in complete agreement with RT-qPCR swab samples.

**ADDITIONAL RESOURCES**

UCSF Library COVID-19 Research and Information Resources
UCSF Institute for Global Health Sciences COVID-19 Resources
UC Davis One Health Institute COVID-19 FAQs
Harvard Viswanath Lab Myths vs Facts
Accesocovid.com
Note on this Document: This document was assembled by graduate and doctoral students attending the University of California, San Francisco with the intent of facilitating the rapid dissemination of information to the global community in order to help during this time. Micaela Reyna, Hannah Thomas, Graham Hinchcliffe, Maya Ganeshan, Passa Pungchhai, Tyler Hoffman, Brooke Jackson, and Mariam Carson contributed to these summaries. This work is volunteer based.

References:


