TRANSMISSION PATTERNS

COVID-19 Outbreak Among Attendees of an Exercise Facility – Chicago, Illinois, August-September 2020

The Chicago Department of Public Health (CDPH) examined a COVID-19 outbreak at an in-person exercise facility. Out of 81 attendees from August 24-September 1, 55 (68%) tested positive after attending at least 4 indoor classes. Forty three attendees visited the exercise facility during their infectious periods, 22 of which attended the facility on or after the day they started having symptoms. Those who tested positive attended a median of five classes compared to three classes for those who did not test positive. Masks were variably used and found to be more common in those who did not test positive. After the exercise facility was informed of the cases, they closed for 13 days and informed attendees. These results indicate that mask-wearing and social distancing are important to reduce transmission in exercise facilities, and facilities should improve ventilation, encourage proper hand hygiene, and remind employees and attendees to stay home if sick or positive for COVID-19.

Clusters of SARS-CoV-2 Infection Among Elementary School Educators and Students in One School District – Georgia, December 2020-January 2021

From December 1, 2020 to January 22, 2021 researchers investigated a COVID-19 outbreak among educators and students in six of eight public elementary schools in a school district. The authors identified nine clusters, each with a least three epidemiologically linked cases, involving 13 educators and 32 students. Thirty one of the cases were school-associated and 18 were household cases. Semi-structured interviews were conducted to identify spread settings and results showed that social distancing was not possible due to large group size and classroom constraints, mask wearing was not observed during lunch periods, and small-group instructional settings may have caused spread in seven clusters. Of the nine clusters, four had probable student-to-student, three had probable student-to-educator, and two had probable educator-to-educator transmission. The two probable educator-to-educator events lead to educator-to-student transmission, resulting in 15 of the school-associated cases (48%) and all of the 18 household cases. Authors suggest that educators may be important links in the chain of transmission of COVID-19 in school settings. Mitigation strategies should be focused on this population in particular and physical distancing and mask wearing should be prioritized for all.
**Estimated transmissibility and impact of SARS-CoV-2 lineage B.1.1.7 in England**

Davies et al explored the estimated transmissibility and impact of a novel SARS-CoV-2 variant (lineage B.1.1.7) in England. Analysis of over 150,000 sequenced SARS-CoV-2 samples from the UK revealed the B.1.1.7 variant had a higher relative population growth rate in its first 31 days of observation compared to 307 other SARS-CoV-2 lineages. The authors found that B.1.1.7 may have an estimated 43-90% higher reproduction number than those variants that were already circulating in England. It is therefore spreading faster than those variants, which may be due to an overall higher infectiousness (the modeling analysis did not find that it is due to a shorter generation time or immune escape solely). The model findings indicate that without strong vaccine delivery, COVID-19 cases and deaths in 2021 may exceed totals in 2020 (even with strong non-pharmaceutical interventions).

**PEDIATRICS**

**Characteristics and Outcomes of US Children and Adolescents With Multisystem Inflammatory Syndrome in Children (MIS-C) Compared With Severe Acute COVID-19**

From March 15th to Oct 31st, 2020, investigators collected demographic and clinical data on patients ≤21 years old who had either clinically confirmed multisystem inflammatory syndrome in children (MIS-C) or PCR/antibody-confirmed severe acute COVID-19. A total of 1116 patients from 66 hospitals across 31 US states were included; 48% with MIS-C and 52% with COVID-19. Cardiorespiratory involvement was more common in patients with MIS-C compared to COVID-19 (56.0% vs 8.8%). Lab values revealed higher neutrophil to lymphocyte ratios, higher CRP levels and lower platelet counts in MIS-C patients as well. Fewer patients with COVID-19 were admitted to ICU (43.8% vs. 73.8%); however similar proportions of patients died in-hospital between groups (MIS-C: 1.9% vs. COVID-19: 1.4%). Overall, this national case series helps clinicians ascertain distinguishing features between COVID-19 in children/adolescents and MIS-C.

**PHARMACEUTICAL INTERVENTIONS & VACCINES**

**BNT162b2 mRNA Covid-19 Vaccine in a Nationwide Mass Vaccination Setting**

In NEJM, Dagan et al. evaluated the effectiveness of the BNT162b2 mRNA vaccine among an integrated health organization in Israel. They recruited anyone vaccinated from Dec 20th, 2020 to Feb 1st, 2021 (n=596,618) and matched them to unvaccinated controls. After the first dose, the vaccine was found to be 46% effective among those with asymptomatic COVID-19, 57% among symptomatic COVID-19, 74% among hospitalized patients and 62% among those with severe disease. After the second dose, the vaccine was found to be 92% effective among asymptomatic patients, 94% among symptomatic patients, 87% among hospitalized patients and 92% among severely ill patients. Vaccine effectiveness was largely similar across age-related subgroups; however, was slightly less effective in patients with multiple co-morbidities.
A Randomized Trial of Convalescent Plasma in Covid-19 Severe Pneumonia

This randomized control trial, known as PlasmAr, aimed to understand the effect of convalescent plasma in treatment of SARS-CoV-2 pneumonia. The trial was conducted between May 28 and August 27, 2020 at 12 clinical sites in Argentina and included hospitalized adults with radiologically confirmed pneumonia and one or more severity criteria. Authors found, at day 30 following the intervention, the distribution of clinical outcomes between the convalescent plasma group and the placebo group was not significantly different (95% confidence interval (CI): 0.52 to 1.35, p=0.46). The 30-day mortality in the convalescent plasma group was 10.96%, and among the placebo group, 11.43% (95% CI: -7.8 to 6.8). Median time from enrollment to hospital discharge and adverse events were similar across both groups and no significant differences were observed in time to death or time to clinical improvement. Additionally, at day 2, SARS-CoV-2 antibody titers tended to be higher in the convalescent plasma group. These data demonstrate that convalescent plasma for severe SARS-CoV-2 pneumonia did not result in significant clinical benefits, when compared to the placebo.

Binding and Neutralization Antibody Titers After a Single Vaccine Dose in Health Care Workers Previously Infected With SARS-CoV-2

Saadat et al evaluated the immune system recall response in health care workers with previous symptomatic and asymptomatic COVID-19 upon administration of a single dose of an mRNA-based COVID-19 vaccine. Health care workers (n=59) at the University of Maryland Medical Center were vaccinated using Pfizer-BioNTech or Moderna COVID-19 vaccines. At 0, 7, and 14 days, compared to the antibody negative group, the median reciprocal half-maximal binding titers were higher in the asymptomatic and symptomatic groups (p<0.001 for each). With this same comparison in mind, at 0 and 14 days, median reciprocal ID99 virus neutralization titers of the asymptomatic and symptomatic groups were higher with respect to the antibody negative group (p<0.001 for each). Thus, health care workers with prior COVID-19 infection had a higher antibody titer response to a singular dose of mRNA vaccine than antibody negative individuals who were not previously infected.

A single dose of recombinant VSV-ΔG-spike vaccine provides protection against SARS-CoV-2 challenge

The focus of this study was to develop a recombinant VSV-ΔG-spike vaccine that induces SARS-CoV-2 neutralizing antibodies and provides protection against SARS-CoV-2. Yahalom-Rone et al. used a recombinant vesicular stomatitis virus (rVSV) platform where the VSV G protein was replaced with the SARS-CoV-2 spike protein. The rVSV-ΔG-spike vaccine was generated in BHK-21 cells via infection with MVA-T7, cotransfection with VSV-ΔG-spike and VSV accessory plasmids followed by passaging in Vero E6 cells. After several passages, the authors observed increased plaque formation, three spike mutations and antigenic similarities between SARS-CoV-2 and rVSV-ΔG-spike which confirmed the replacement of VSV G protein with SARS-CoV-2 spike protein. The authors then evaluated the effects of a single dose of the vaccine in an in vivo SARS-CoV-2 hamster model. Doses ranging from 10^4 to 10^8 pfu of the vaccine were tested, and hamsters showed no sign of morbidity after vaccination, indicating vaccine safety. All doses elicited a neutralization
response against SARS-CoV-2 and reduced viral titers when delivered intramuscularly in COVID-19 hamster models. Further verification of vaccine efficacy was carried out by reinfecting vaccinated hamsters with SARS-CoV-2, these vaccinated hamsters showed mild weight loss and significantly low viral titers followed by an instant recovery when compared to the control model (unvaccinated hamsters). Antibody isotype analysis also showed that the vaccine induces a Th1 (T helper type 1) immune response which further highlights its safety and efficacy.

NON-PHARMACEUTICAL/PUBLIC HEALTH INTERVENTIONS

Assessment of a Hotel-Based COVID-19 Isolation and Quarantine Strategy for Persons Experiencing Homelessness

Fuchs et al sought to assess the safety of using hotels for COVID-19 isolation and quarantine for people experiencing homelessness with confirmed or suspected COVID-19 and how this system relates to inpatient hospital capacity. This retrospective cohort study assessed 1,009 persons who were transferred to isolation/quarantine hotels from hospitals, outpatient settings, and public health surveillance programs in San Francisco, California in the spring of 2020. Of the guests who were positive for COVID-19, only 4% needed to be readmitted to a hospital. The authors found the isolation/quarantine hotel system to be associated with preserving hospital inpatient capacity; they also found that this system was implemented rapidly and safely to deliver medical and behavioral care. The authors found that premature discontinuation of isolation/quarantine occurred in 19% of patients and was more likely to occur among the unsheltered homeless and more likely to occur among persons in isolation due to an exposure vs. an active infection.

BIOENGINEERING

Development of new vaccine target against SARS-CoV2 using envelope (E) protein: An evolutionary, molecular modeling and docking based study

Ray et al. suggest that the SARS-CoV-2 envelope (E) protein can serve as a vaccine target. Of the three SARS-CoV-2 outer surface proteins, E protein was found to be the most antigenic (with a VaxiJen score of 0.6025) and therefore can yield the greatest immune response. Researchers utilized computational analysis to identify the six best epitopes for future E protein vaccine studies: three B-cell epitopes (VFLLVTLAIL, ILTALRLCAY and LLFLAFVVFL), two major histocompatibility complex class I (MHC-I) T-cell epitopes (LTALRLCAY and VSLVKPSFY), and one MHC class II (MHC-II) T-cell epitope (VFLLVTAL). These potential epitopes were selected by building a phylogenetic tree with SARS-CoV-2 E protein and related proteins, identifying mutations in the SARS-CoV-2 E protein through comparisons with the consensus E protein of homologous strains, modeling the protein structure and using neural networks on the protein model to predict B-cell and T-cell epitopes. The epitopes generated from this analysis were then tested for antigenicity, hypersensitivity reactions, toxicity, and hydrophilicity to eliminate non-viable antigenic determinants.
Momentum contrastive learning for few-shot COVID-19 diagnosis from chest CT images²

This study addresses the need for a quick and automatic COVID-19 diagnosis and a faster alternative to PCR testing. Researchers Chen et al. proposed a new deep learning algorithm for automated COVID-19 diagnoses requiring only a small sample set for training. The authors used contrastive learning to train an encoder, ResNet-50, which can capture a large variety of information from publicly available lung data sets and prototypically issue diagnoses. Performance of the model was evaluated for accuracy, precision, number of true positives, and the relation between false and true positive results. When sample sizes were larger than 3, the model achieved higher performance over the currently competing alternative model for medical image analysis. Lack of annotated CT scans available as a dataset is a significant challenge to deep-learning based diagnostic methods; however, the team plans to continue to validate the model’s generalizability with further training on COVID-19 datasets. The model is also expected to be useful for further medical imaging analysis in the event of a data shortage such as a novel pandemic.

Role of IgG against N-protein of SARS-CoV2 in COVID19 clinical outcomes⁴

Antibody dependent enhancement (ADE), a phenomenon where antibodies enhance viral entry and access to host immune cells is a characteristic of SARS-CoV-2. This clinical study consisting of 100 RT-PCR confirmed COVID-19 patients (both ICU and non-ICU patients) shows a possible correlation between IgG targeting the N-protein of SARS-CoV-2 and ADE. There are various SARS-CoV-2 structural proteins (N, S, E and M protein) with different functions and the S protein has been shown to be responsible for disrupting interactions between the viral protein and host receptor. Therefore, the authors carried out serum IgG analysis to accurately and specifically measure IgG targeting the N protein (anti-N protein IgG). Statistical analyses were also carried out to make comparisons between age, gender, comorbidities and how these factors relate to COVID-19 and anti-N protein IgG. Observations of these analyses showed that patients with high risk of admission to the ICU and poorer COVID-19 outcomes had higher levels of anti-N protein IgG. Although little is known about the mechanism of ADE in SARS-CoV-2, the findings of this study suggest that high concentrations of IgG targeting the N-protein of SARS-CoV-2 is related to poor clinical outcomes and can therefore be measured as one of the initial diagnostic factors and used as a factor to study COVID-19 progression.
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 undergraduate and doctoral students attending the University of California, Los Angeles and the University of California, San Francisco with the intent of facilitating the rapid dissemination of information to the global community. Anika Kalra, Hannah Thomas, Sarah Gallalee, Shivali Joshi, Anya Bekhtel, Elsa Dubil, Amanda Chan and Amaka Enueme contributed to these summaries. This work is volunteer based.

References:


