KFAS | EMERGENCY RESILIENCE PROGRAM

KFAS COVID-19 weekly brief

19th of July 2020

Introduction

As the COVID-19 continues to impact the wealth and welfare of our society, much remains to be understood about the pandemic and its impact. Hence, the importance of using scientific research, facts and data for a better understanding of the nature of the pandemic, as well as its associated public health issues, to drive policy making in addressing challenges related to healthcare and wellbeing of the population. This newsletter is intended to provide a weekly overview on the latest information on health-related topics surrounding the COVID-19 pandemic, covering five main themes: infection control and prevention, diagnosis and testing, treatment and therapy, training for healthcare professionals and exit strategies. Each edition of the newsletter will cover a specific sub-theme under the five main themes, providing up to date information on available resources, research, data and studies, along with policy recommendations and implications, based on scientific evidence and facts, for decision makers to utilize in developing polices and measures to address the challenges associated with COVID-19 within the healthcare sector.

News Highlights
(up to 12/07/2020)

- US Covid-19 cases are climbing but some state and local leaders clash over moves to curb the spread **CNN**
- From Houston to Miami, hospitals running short of Remdesivir for Covid-19 patients **STAT**
- Bill Gates warns against coronavirus vaccine going to highest bidder — 'We'll have a deadlier pandemic' **NBC News**
- Scientists call for pandemic investigations to focus on wildlife trade **Nature**
- Pathologist found blood clots in 'almost every organ' during autopsies on Covid-19 patients **CNN**
- These Scientists Raced to Find a Covid-19 Drug. Then the Virus Found Them **NY Times**
- How Covid-19 can damage the brain **BBC**
- NIH launches clinical trials network to test COVID-19 vaccines and other prevention tools **NIH**
- Mounting evidence suggests coronavirus is airborne — but health advice has not caught up **Nature**
- Novavax Wins $1.6B in "Warp Speed" Funding; Plans First 100M Doses of COVID-19 Vaccine **GEN**
- 'Pushing the frontiers': Long lines for COVID tests, stressed labs delay results as demand spikes **USA Today**
- A Better Way to Scale Covid-19 Testing **Harvard Business Review**

Key Takeaways

Executive Summaries

Infection Control and Prevention:

A collaborative effort between multiple Harvard University teams and disciplines has resulted in a new technique to reduce the exposure of healthcare workers to dangerous aerosol droplets from COVID-19 patients . Designed specifically to better protect healthcare providers, a transparent patient isolation hoods covers a patient's head and torso. The hoods have a negative level of air pressure within, which pulls airborne particles away from healthcare providers. Made of a single piece of lightweight plastic, the hoods contain several openings for a doctor's arms and equipment such as a breathing tube. Patient isolation hoods is an innovative way to limit the exposure of healthcare workers to SARS-CoV-2 while maintaining effective and safe treatment of COVID-19 patients.

Diagnosis and Testing:

Fever checks miss asymptomatic and pre-symptomatic cases but smell tests might not. Recent findings have indicated smell tests could be more effective than temperature checks used currently at restaurants, airports, and testing sites. Countries are beginning to develop smell test kits as a large study asserts 65% of positive cases self-reported a loss of smell. A surge in complaints of toe lesions similar to chilblains have coincided with the emergence of the novel coronavirus SARS-CoV-2 leading scientists and doctors to believe the lesions could be linked to the disease. Some studies support the correlation of the two, while others have found cases of patients with Covid-toe testing negative for both viral presence and antibodies. Finally, counties such as the United Kingdom, Germany, and the United States have begun trials, training dogs to detect coronavirus by smell. If successful the dogs should be able to screen about 250 dogs per hour and could be used at airports and testing sites for screening, as well as to prevent a resurgence. One Arabic news website reports the United Arab Emirates has successfully trained K9s to detect the virus with a 92% success rate.

Treatment and Therapies:

Remdesivir is an intravenous (IV) investigational nucleotide pro-drug of an adenosine analog. It has demonstrated in vitro activity against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and in vitro and in

vivo activity (based on animal studies) against SARS-CoV and Middle East respiratory syndrome coronavirus (MERS-CoV).

Remdesivir binds to the viral RNA-dependent RNA polymerase, inhibiting viral replication through premature termination of RNA transcription.

The benefit of remdesivir on reducing time to recovery was clearest in the subgroup of hospitalized patients with severe disease who were not intubated but who required supplemental oxygen. The NIH Panel recommends that hospitalized patients with severe COVID-19 who are not intubated receive 5 days of remdesivir.

Exit Strategies:

Although reopening of schools, along with the rest of the economy, might seem like a relatively straightforward decision for policymakers and governments to make, the issue at hand is quite complicated. There are several factors that need to be weighed against each other. This involves, at the forefront, considering the nature of the pandemic within a given school district or community, as well as the policies in place to reduce and prevent the spread of the virus, including physical distancing, wearing face coverings, and considerations for infection control. It is critical that countries that have yet to reopen their schools, build on the lessons learned from countries that have, and from the expertise of institutions to drive policymaking.

Infection Control and Prevention

Innovation in Infection Control and Personal Protective Equipment
Patient Isolation Hood

Scientists continue to develop innovative solutions to keep patients and healthcare workers (HCW) safe during the COVID-19 pandemic. Innovations are emerging from the pandemic at lightning speed to seek solutions to pressing issues related to patient and HCW safety. These endeavors take into consideration, not only the disease process, but also the availability of medical resources and the risks of transmission to healthcare providers. Improved engineering controls providing barrier protection against droplet sprays and protection against small airborne particles generated during intubation procedures are especially valuable.

The Patient Isolation Hood:

In a unique collaboration project, a group of physicians from Massachusetts General Hospital (MGH) and Brigham and Women's Hospital in Boston worked with around 100 architects and engineers from across the United States to develop a patient isolation hood (PIH). The PIH is intended to contain the virus in clinical settings and help protect HCWs. The project was led by Dr. Samuel Smith, an anesthesiologist at MGH and Eric Howele, from "Holweler + Yoon." Harnessing ideas from architects located in Ohio, California, New Mexico, and beyond, the group delivered two types of hoods.

Figure 1 - Apollo 4 negative pressure isolation hood: https://ether.mgh.harvard.edu/wiki/images/c/c7/Apollo_1_Brochure_v1.pdf

1. Apollo patient isolation hood: The Apollo 4 is a negative pressure isolation hood (NPIH). It is made from a single sheet of plastic film cut on a digital cutting system (Zund CNC machine) and folded like origami into a hood form. The lightweight, portable device uses negative pressure. The suction draws out contaminated air to a HEPA filter. Rapid air exchanges reduce aerosolized particles by >99% in the hood. It also acts as a barrier to large droplets (splash protection) of infected secretions and reduces fine particulate aerosols generated from infected patients.
Two new versions of the booth have also been created:

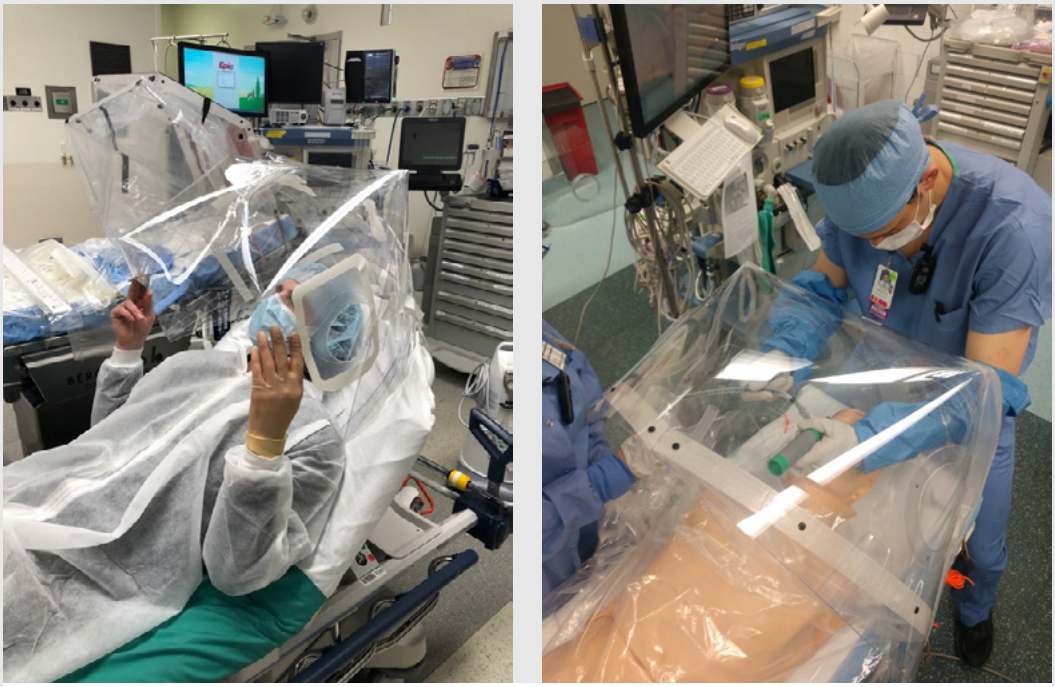


Figure 2-3 : ***Dr. Samuel Smith testing a PIH prototype in the hospital. Photo courtesy MGB Center for COVID Innovation (Architectural records)***

Other main advantages of the Apollo 4 NPIH :
• Lightweight (< 2.5 KG)
• Intuitive for physicians to operate
• Fits over any size bed or mattress
• Easily removable if a doctor has to access a patient in an emergency or a difficult airway
• Fully disposable

2. The second hood uses an adjustable rigid frame that cantilevers over the patient's face and is fitted with transparent plastic. The frame on the cantilevered prototype is reusable. The hood covers a patient's head and torso while physicians conduct aerosol-generating procedures. The hood has two holes for physicians to insert their arms and access the patient, as well as an opening for the breathing tube. Negative pressure is created inside the hood. A drape closes the gap between the hood and the rest of the patient's body and is tucked under them.

Figure 4

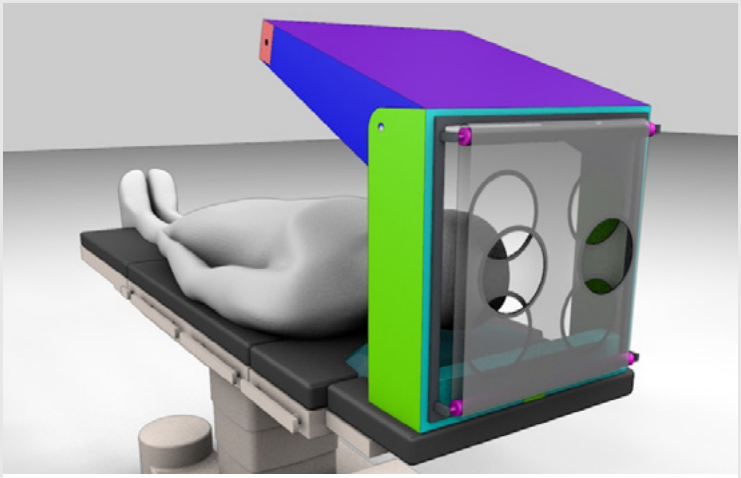


Figure 5

Architect Eric Höweler and a cantilevered PIH mock-up in his office. Photo courtesy MGB Center for COVID Innovation. (Architectural records)

Testing of Patient Isolation Hoods:

The Apollo hood was tested and demonstrated >99% of aerosolized particles >5 um were removed in <79 seconds after Buffalo smoke evacuator (suction) was initiated at 80% power (rated at 240L/min) to test condition for a single aerosolizing procedure. The wall suction (rated at 40L/min) took approximately 12 minutes to achieve the same particle removal. Both methods were effective while simulating patient conditions. CPAP testing, where continual aerosol was generated, and flows are considered most challenging (running at >100 l/ min) the reduction of >90% of particles was rapidly achieved with this suction plan utilizing the smoke evacuator.

Shaw KM, Lang AL, Lozano R, Szabo M, Smith S, Wang J. Intensive care unit isolation hood decreases risk of aerosolization during noninvasive ventilation with COVID-19 [published online ahead of print, 2020 May 26]. Can J Anaesth. 2020;1-3. doi:10.1007/s12630-020-01721-5

Limitations of Other Isolation Hood Techniques:

Many design teams have been making transparent, rigid plastic boxes for physicians to use while intubating COVID-19 patients (most notably the Aerosol Box). Many of these designs are flawed. The aerosol box is a transparent plastic cube covering a patient's head and shoulders with access holes for intubating. Some models add additional holes for an

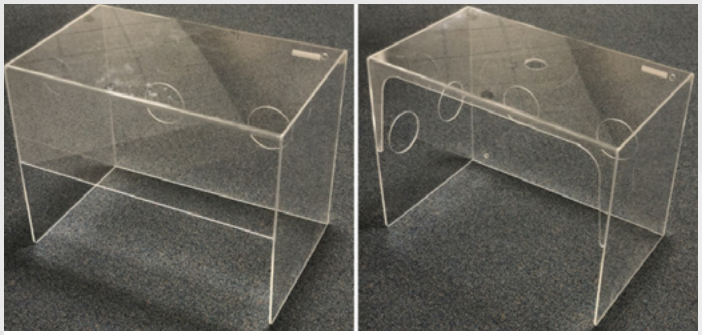


Figure 6-7 aerosol box is a transparent plastic cube -with access holes for intubating

assistant to access the patients head and face as well. These models are restrictive for HCW and weigh about 11.3 kg, making them hazardously heavy in emergency situations. Other studies have shown that the opening to the box caused compromising breaches to the operator's PPE. Other versions, like those made of PVC pipe frames and semi-transparent plastic film, are clunky and don't fit all beds. The hood must function well, both ergonomically and practically, to be effective in treating patients while protecting HCWs.

Begley, J.L., Lavery, K.E., Nickson, C.P. and Brewster, D.J. (2020), The aerosol box for intubation in coronavirus disease 2019 patients: an in-situ simulation crossover study. Anesthesia.

Bottom Line:

Concern over droplet and aerosol transmission of SARS-CoV-2 requires that HCWs wear PPE and N95 respirators during endotracheal intubation, open suctioning and nebulization treatments. Improved methods to better protect HCWs, while allowing comprehensive respiratory care for patients, are needed. The Apollo 4 patient isolation hood has proven to be effective in accomplishing these goals and is currently being used in ICU and emergency departments in the US. The adoption of novel, untested, unproven devices is not recommended, and caution is advised when considering the purchasing and use of untested patient isolation hoods.

Diagnosis and Testing

The Future of Covid-19 Diagnostics?
Sniff Tests, Covid Toes, and K9 Checks

Fever checks miss asymptomatic and pre-symptomatic cases, smell tests might not

As countries open up, fever checks are being implemented everywhere from restaurants to airports to hospitals, using contactless infrared thermometers to identify anyone with a temperature and potentially a contagious disease. Unfortunately, these checks may be less effective than we think, since transmission from asymptomatic and pre-symptomatic cases is still being evaluated and seems likely. Evidence from early studies seems to indicate pre-symptomatic and asymptomatic transmission are in fact possible and perhaps common[1]. Because of this, potentially contagious individuals could easily be missed in a routine temperature check, just as those with a fever might not have COVID-19. A solution has been proposed: make smell tests a part of routine screenings.

New studies indicate the loss of smell and taste could be one of the clearest indicators of infection

Anosmia, or the loss of smell, was at first believed to affect only a small portion of those infected with COVID-19. However, new studies indicate the loss of smell and taste could be one of the clearest indicators of infection. A large study published in Nature reviewed self-reported data from over 2.5 million people in the United States and United Kingdom, and examined diagnostic test results from more than 18,000 individuals, between March 24 and April 21. The study found that of the 7,178 individuals that tested positive for COVID-19, 65% reported a loss of smell and taste. The study also found loss of taste and smell, extreme fatigue, cough, and a loss of appetite were the best indicators of infection and used this data to develop a formula to predict if participants had the disease. The formula was applied to over 800,000 users reporting symptoms and identified 140,000 likely to have COVID-19 with 80% accuracy[2]. Other studies have found anosmia to be present even in the absence of other symptoms, indicating smell tests could be an effective screening tool to identify mild cases a fever check could potentially miss[3]. Smell tests could be used to

1 Furukawa, Nathan W et al. "Evidence Supporting Transmission of Severe Acute Respiratory Syndrome Coronavirus 2 While Presymptomatic or Asymptomatic." Emerging infectious diseases vol. 26,7 (2020): e201595. doi:10.3201/eid2607.201595

2 Menni, C., Valdes, A.M., Freidin, M.B. et al. Real-time tracking of self-reported symptoms to predict potential COVID-19. Nat Med (2020). https://doi.org/10.1038/s41591-020-0916-2

3 Spinato G, Fabbris C, Polesel J, et al. Alterations in Smell or Taste in Mildly Symptomatic Outpatients With SARS-CoV-2 Infection. JAMA. 2020;323(20):2089–2090. doi:10.1001/jama.2020.6771

detect cases earlier than simple temperature checks. A recent study indicated COVID-19 patients were 27 times more likely than others to lose a sense of smell but only 2.6 times more likely to have a fever or chills[4]. Researchers at Massachusetts General Hospital, Brigham and Women's Hospital and others in Boston are currently developing a smell test kit for early detection of the virus[5].

COVID-Toe: toe lesions indicate COVID-19 infection despite absence of other symptoms

Chilblains, painful red or purple lesions that appear on fingers or toes, are an uncommon ailment usually the result of extreme cold weather and most common in the winter. However, doctors and clinics are reporting unusually high numbers of cases all over the United States since the onset of COVID-19 in January. The lesions are the latest among strange symptoms linked to the coronavirus such as lack of smell or mental confusion. Medical reports from Spain, Belgium, and Italy similarly describe a "surge in complaints" related to these lesions on the toes, heels, and soles of patients. Most cases are reported in children or young adults and often in the absence of any other symptoms which could indicate a healthy immune response to the virus.

Toe lesions could indicate a healthy immune response to the virus

Interestingly enough, these lesions are often found in mild or asymptomatic cases and can also develop several weeks after the infection is over. Although the lesions are painful, "the good news is that the chilblain-like lesions usually mean you're going to be fine" one doctor states[6]. Adding to the confusion, some patients with chilblains are testing negative for the virus, but one explanation is that patients had such a mild infection, viral replication was minimal, making the virus undetectable. Another explanation is that the lesions sometimes appear as a delayed response following a prior infection. Spanish researchers successfully detected the presence of SARS-CoV-2 in skin samples from pediatric patients with COVID toes in late April, supporting the theory that the lesions are linked to COVID-19[7,8].

The link between COVID-toes and it's namesake disease is still unclear

Despite this, the link between COVID-toes and their namesake disease is still unclear. COVID-toes are not yet an official symptom of the disease and other more recent studies have concluded Coronavirus was not responsible for the lesions. One study from Spain published in late June concluded the

4 Wagner, Tyler, et al. "Augmented Curation of Clinical Notes from a Massive EHR System Reveals Symptoms of Impending COVID-19 Diagnosis." ELife, vol. 9, 2020, doi:10.7554/elife.58227.

5 Collins, Francis. "Discussing the Need for Reliable Antibody Testing for COVID-19." National Institutes of Health Director's Blog, U.S. Department of Health and Human Services, 2 June 2020, directorsblog.nih.gov/2020/06/04/discussing-the-need-for-reliable-antibody-testing-for-covid-19/.

6 Rabin, Roni Caryn. "What Is 'Covid Toe'? Maybe a Strange Sign of Coronavirus Infection." The New York Times, The New York Times, 1 May 2020, www.nytimes.com/2020/05/01/health/coronavirus-covid-toe.html.

7 McMurty, Alyssa. "Spanish Researchers Isolate Coronavirus in 'COVID Toes'." Anadolu Agency, 25 June 2020, www.aa.com.tr/en/europe/spanish-researchers-isolate-coronavirus-in-covid-toes/1890247.

8 Casas, C. Galván, et al. "Classification of the Cutaneous Manifestations of COVID-19: a Rapid Prospective Nationwide Consensus Study in Spain with 375 Cases." British Journal of Dermatology, vol. 183, no. 1, 29 Apr. 2020, pp. 71–77., doi:10.1111/bjd.19163.

virus was not the cause of the lesions among 20 children hospitalized in April, since they tested negative for viral RNA and antibodies[9]. However a new letter in the Journal of the American Medical Association (JAMA) asks that dermatologists and scientists "not rule out the association" between the lesions and coronavirus infections as the correlation is not yet fully understood[10]. It is still worthwhile to note and record cases of chilblain-like lesions which could be a helpful diagnostic in determining who to test in the future.

Can Dogs be used to Detect the Coronavirus?

Dogs have been trained to identify the scent of malaria, cancer, and Parkinson's disease. Currently in the United Kingdom, dogs are being trained to sniff out individuals infected with the coronavirus. The bio-detection dogs in training, if successful, will be able to screen about 250 people per hour and could be used to detect resurgences in the future. The dogs could be utilized at entry points like airports as well as testing centers. After 8 weeks of phase one training, if successful the dogs will move to phase two where they will be integrated into live situations[11]. According to a recent article in Arab News the United Arab Emirates has successfully trained dogs to detect the virus with a 92% success rate from the armpits of suspected cases. Germany and the United States are also training K9 dogs to detect the virus[12].

9 Roca-Ginés J, Torres-Navarro I, Sánchez-Arráez J, et al. Assessment of Acute Acral Lesions in a Case Series of Children and Adolescents During the COVID-19 Pandemic. JAMA Dermatol. Published online June 25, 2020. doi:10.1001/jamadermatol.2020.2340

10 Hernandez C, Bruckner AL. Focus on "COVID Toes". JAMA Dermatol. Published online June 25, 2020. doi:10.1001/jamadermatol.2020.2062

11 "Coronavirus: Trial Begins to See If Dogs Can 'Sniff out' Virus." BBC News, BBC, 16 May 2020, www.bbc.com/news/uk-52686660.

12 Person. "K9 COVID Sniffers: UAE to Use Dogs to Detect Coronavirus." Arab News, Arabnews, 9 July 2020, www.arabnews.com/node/1702111/offbeat.

Treatment and Therapy

Treatment in development: Updates on Remdesivir.

Remdesivir is an intravenous (IV) investigational nucleotide pro-drug of an adenosine analog. It has demonstrated in vitro activity against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)[1], and in vitro and in vivo activity (based on animal studies) against SARS-CoV and Middle East respiratory syndrome coronavirus (MERS-CoV)[2]. Remdesivir binds to the viral RNA-dependent RNA polymerase, inhibiting viral replication through premature termination of RNA transcription.

Preclinical studies show that remdesivir improves disease outcomes and reduces levels of SARS-CoV in mice.[2] When given as prophylaxis or therapy, Remdesivir also reduces MERS-CoV levels and lung injury in mice. In a rhesus macaque model of MERS-CoV infection, prophylactic Remdesivir prevented MERS-CoV clinical disease[3]. When given to rhesus macaques 12 hours after inoculation with MERS-CoV, Remdesivir reduced viral replication and the severity of lung disease in treated animals compared to control animals. In a rhesus macaque model of SARS-CoV-2 infection, remdesivir treatment was started soon after inoculation in six of 12 monkeys. The remdesivir-treated animals had lower lung virus levels and less lung damage than the control animals[4].

Recommendations for Hospitalized Patients with Severe COVID-19:

• The COVID-19 NIH Treatment Guidelines Panel recommends the investigational antiviral agent Remdesivir for treatment of COVID-19 in hospitalized patients with SpO2 ≤94% on ambient air or those who require supplemental oxygen.

• The Panel recommends Remdesivir for treatment of COVID-19 in patients who are on mechanical ventilation or extracorporeal membrane oxygenation (ECMO).

Rationale:

Data from a multinational, randomized, placebo-controlled trial (the Adaptive COVID-19 Treatment Trial [ACTT]) of hospitalized patients with COVID-19 showed that patients with severe disease who were randomized

1 https://www.ncbi.nlm.nih.gov/pubmed/32020029.
2 https://www.ncbi.nlm.nih.gov/pubmed/28659436
3 https://www.ncbi.nlm.nih.gov/pubmed/32054787.
4 https://www.biorxiv.org/content/10.1101/2020.04.15.043166v2.full.pdf

to receive remdesivir had a shorter time to clinical recovery than those who received placebo[5]. The benefit of remdesivir on reducing time to recovery was clearest in the subgroup of hospitalized patients with severe disease who were not intubated but who required supplemental oxygen. In the preliminary analysis of ACTT, there was no observed improvement in the time to recovery among those who were mechanically ventilated, but the follow-up period may have been too short to have shown a difference.

Recommendation for Duration of Therapy in Patients with Severe COVID-19 Who Are Not Intubated:

The NIH Panel recommends that hospitalized patients with severe COVID-19 who are not intubated receive 5 days of remdesivir.

Rationale

Data from a multinational, open-label trial of hospitalized patients with severe COVID-19 showed that remdesivir treatment for 5 or 10 days had similar clinical benefit in patients who were not on mechanical ventilation or ECMO[6].

Recommendation for Duration of Therapy for Mechanically Ventilated Patients, Patients on ECMO, or Patients Who Have Not Shown Adequate Improvement After 5 Days of Therapy:

There are insufficient data on the optimal duration of therapy for mechanically ventilated patients, patients on ECMO, or patients who have not shown adequate improvement after 5 days of therapy. In these groups, some experts extend the total remdesivir treatment duration to up to 10 days.

Rationale

Because the trial that compared 5 days to 10 days of remdesivir excluded people who were mechanically ventilated or on ECMO, the optimal duration of therapy in this population is not known. Similarly, the optimal duration of therapy for people who do not improve after 5 days of receiving remdesivir is unclear. In the absence of data, some experts may consider extending the total treatment duration of remdesivir for up to 10 days in people who are on mechanical ventilation or ECMO and in those who do not improve after 5 days of remdesivir[7].

5 https://www.ncbi.nlm.nih.gov/pubmed/32445440
6 https://www.ncbi.nlm.nih.gov/pubmed/32459919
7 https://www.fda.gov/media/137566/download

Recommendation for Patients with Mild or Moderate COVID-19

NIH Panel does not have sufficient data to recommend for or against remdesivir for the treatment of patients with mild or moderate COVID-19.

Rationale

In the preliminary analysis of ACTT, there was no observed benefit for remdesivir in people with mild or moderate COVID-19; however, the number of people in this category was relatively small. Remdesivir is being evaluated in another clinical trial for the treatment of patients with moderate COVID-19; complete data from this trial are expected soon. The Food and Drug Administration (FDA) emergency use authorization (EUA) for remdesivir limits its use to people with severe COVID-19.

Updates on the use of Convalescent plasma and Immune globulins

There are insufficient data to recommend either for or against the use of ***COVID-19 convalescent plasma or SARS-CoV-2 immune globulins*** for the treatment of COVID-19. Although convalescent plasma and virus-specific immune globulin have been used for other viral infections, sufficient clinical data are lacking for COVID-19, and potential risks include transfusion reactions. Theoretical risks include antibody-dependent enhancement of infection.

Plasma donated from individuals who have recovered from COVID-19 includes antibodies to SARS-CoV-2[8],and SARS-CoV-2 immune globulin is a concentrated antibody preparation derived from the plasma of people who have recovered from COVID-19. Both products may help suppress the virus and modify the inflammatory response. However, data supporting the use of convalescent plasma for COVID-19 are limited to a small retrospective cohort study, small case series, and case reports.[8] There are no clinical data on the use of SARS-CoV-2 immune globulin or hyperimmune globulin in patients with COVID-19.

8 https://pubmed.ncbi.nlm.nih.gov/32444482/

Exit Strategies

Reopening Schools: All in the How

One of the major repercussions of the COVID-19 pandemic has been the unprecedented effect on schools and children globally. When most of the school systems around the world closed in March 2020, around 1.5 billion students from preschool to higher education were left without formal access to learning and education[1]. In some countries, this also meant a number of children were without access to basic necessities, such as food. Overall, the pandemic challenged educational systems worldwide, and especially the resilience of these systems to deal with public health emergencies, or other potential threats, that would cause school closures. Furthermore, just as health inequity was highlighted and capitalized as a consequence of the pandemic, the issue of educational inequities that existed across and within countries, whether based on socioeconomic status or some other factor, was highlighted as barriers that exist to quality education for all[2].

As policymakers and community leaders start to consider reopening schools, the question is no longer whether schools should reopen; but rather how the reopening should occur. The 'how' requires addressing and developing measures that not only protect students, but more importantly, teachers, school administrators, and ultimately their parents and other family members that may be more vulnerable and susceptible to infection.[1]

As with all national exit strategies, drawing lessons from countries that have already attempted the reopening ofschools will provide some insight into measures and approaches that could be instrumental in establishing strategies and policis towards reopening schools[3]. The basis for reopening schools requires a national plan or strategy in place, to drive the measures needed to ensure a safe and effective reopening. The following paragraphs highlight the approaches that some countries have taken, or considering taking, for opening schools, and the lessons learned.

Lessons Learned from Denmark and Finland[1,3]

Denmark and Finland were two of the first countries to reopen their K-12 schools. In Denmark, the decision to open schools was made by the central government and the Parliament, with an emphasis for municipal

1 https://www.brookings.edu/blog/education-plus-development/2020/07/06/reopening-the-world-reopening-schools-insights-from-denmark-and-finland/

2 https://www.weforum.org/agenda/2020/06/torn-safety-nets-shocks-to-schooling-in-developing-countries-during-coronavirus-crisis/

3 Tanmoy Das et al. "Reopening US Schools in the Era of COVID-19: Practical Guidance From Other Nations"; JAMA Network; https://jamanetwork.com/channels/health-forum/fullarticle/2767982

councils throughout the country to define their own plans[4]. These plans were complemented with strategies developed by the schools themselves, where school administrators and teachers would develop a plan with steps and measures for the reopening, based on guidelines from the National Board of Health.[1]

Finland followed a similar process, where the Minister of Education, Li Andersson, was keen on weighing the basic rights of getting an education, with the current state of the pandemic in the country. Since the pandemic had been contained, the government's decision was that the children's right to education outweighed the risks associated with COVID-19.[1] The government stressed that "the right to basic education is a subjective right laid down in the Constitution and belongs equally to everyone"[5], emphasizing the importance of ensuring equal opportunity and access in relation to education. Denmark had similar sentiments, suspending examination and assessments for the school year, to avoid increasing inequality between those students (many of whom are immigrants) that were not able to get help from home or school.[1]

What measures were included as a part of reopening schools? Both countries made an emphasis on prioritizing the health and safety of students, educators, and parents through measures that reduce the risk of infection and transmission, such as prohibiting morning meetings and food sharing facilities.[1] Preventative measures were also put in place, such as handwashing and frequent cleaning practices. Denmark introduced specific policies, such as[6]:

1. Students in the classroom must be seated at tables, at least two meters (6.5 feet) apart

2. Student should wash their hands every two hours

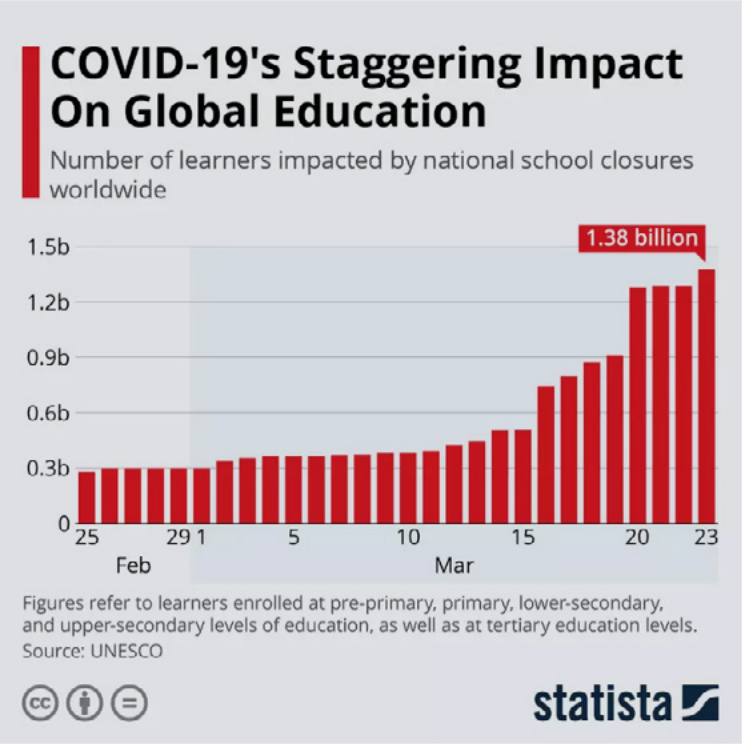
3. All materials and resources should be cleaned twice a day

4. Installing more sinks and toilets for handwashing and hygiene

Both countries also adopted a staggered approach, where younger students attended school first, mainly because these ages groups had shown that they played a limited role in spreading the virus. Denmark opened nurseries and K-5 classrooms first (mid-April) and in Finland, the government reopened early childhood education towards the latter part of April, and opened grades 6-10 by mid-May[7]. Furthermore, a staggered arrival approach was put in place, reducing the potential spread of

4 https://www.uvm.dk/aktuelt/nyheder/uvm/2020/apr/200406-saadan-aabner-dagtilbud-skoler-og-uddannelsesinstitutioner-i-foerste-fase
5 https://www.foreigner.fi/articulo/work-and-study/schools-to-reopen-on-14-may/20200429213902005557.html
6 https://www.sst.dk/da/Udgivelser/2020/Genaabning-af-skoler (original source; information retrieved from bookings.edu; Reference 1)
7 http://www.klfnet.dk/aktuelt/nyhed/artikel/skoleaabning-forsigtig-opstart/ (original source; information retrieved from bookings.edu; Reference 1)

infection. Class sizes were also reduced; Denmark divided a class of 20 students into two or three smaller groups, and whenever possible, held outside. The division of classrooms did raise aconcern over the increase in teacher working hours and did present some issues with staff shortages.[1]



To reduce the risk of transmission, schools reduced their hours, and in some cases, were closed on some days. If a child or a parent of a child presented symptoms of COVID-19, they were asked to not attend school. Students considered high risk, such as those with co-morbidities or compromised immune systems were also asked to stay home. In Denmark, if at least one parent was able to stay home, families were asked to keep their children home and those students received emergency education in the form of remote learning. With this regard, Finland's approach was a little different than Denmark's where once schools reopened, local authorities and schools could not continue with remote education[8].

A key factor that was built into the reopening of schools was the consistent monitoring of the health outcomes of the schools, as well as providing several outlets of support, to ensure that parents were provided with the information needed. These communication channels, such as the one established by the Ministry of Children and Education, in Denmark, not only provided information related to the coronavirus, but also to assess student learning, and on education-specific issues[9]. Finland had a similar approach where the Finnish Agency for Education provided educational tools and advice on the coronavirus and education services. Another main aspect of reopening was improving the digital education platform to ensure that, should there be another outbreak requiring the closure of schools, that students have access to devices and internet connectivity to access online learning while schools remain closed.[1]

Lessons Learned: China, Taiwan, and Japan

When China reported no new local cases of coronavirus, restrictions were gradually lifted, and nine of the mainland provinces reopened

8 https://yle.fi/uutiset/osasto/news/govt_finnish_schools_to_reopen_from_14_may/11329714

9 https://www.uvm.dk/aktuelt/i-fokus/information-til-uddannelsesinstitutioner-om-coronavirus-covid-19/hotline-og-hjaelp (original source; information retrieved from bookings.edu; Reference 1)

their schools for graduating students by earl April (most of the schools remained closed in larger regions). China's Ministry of Education required that students have their temperatures taken prior to entering school, and display a "green" code of health via China's smartphone health code program[10]. Testing through temperature checks is a critical component of reopening; however, at the same, there was also some effort to ensure that a positive result be handled with sensitivity, to avoid any stigmatization by other school children[11]. Schools in China also made some changes to transportation, increasing the number of bus routes, diversifying routes for pickup and drop-off, and ensuring physical distancing while on transportation.

Students in Taiwan eating their lunches with plastic partitions. Source: https://www.businessinsider.com/photos-show-schools-reopening-around-the-world-coronavirus-2020-4#taiwan-reopened-schools-on-february-25-after-extending-winter-break-by-ten-days-2

Taiwan, which took swift action to mitigate the impact of the pandemic, reopened schools in late February, after extending their winter break so that they could prepare the schools for dealing with the pandemic. This included disinfecting the facilities, distributing medical supplies, as well as developing and implementing new procedures for confirmed cases. There were several preventative measures that were also put in place, including temperature checks, along with using plastic tabletop desk partitions as an added security measure. Most of the students were also encouraged to bring their lunch.[4]

Japan opened schools in early April, but not all schools, as the decision was left to the individual municipalities.[3] The Ministry of Health released guidelines for schools, which included physical distance, wearing masks, temperature checks and using open windows to enhance ventilation. Japanese schools have also promoted staggered start times, similar to measures in Denmark.[3]

Guidelines and Guidance for Reopening Schools

As the number of COVID-19 infections start to rise in several states across the United States, and in some cases, hitting the highest number of cases since the start of the pandemic, the Trump administration is pushing for

10 https://www.weforum.org/agenda/2020/05/coronavirus-countries-schools-education-covid19-reopen-classroom/
11 https://abcnews.go.com/International/schools-world-reopening-coronavirus-pandemic/story?id=70641371

the reopening of schools in August. Along with the lessons learned from countries that have already reopened, the American Academy of Pediatrics (AAP), and the Centers for Disease Control (CDC), have provided some guidance to support policymakers on how best to reopen schools that will foster the overall health and learning environment of the students, staff, parents and communities[12].

Guidelines for Policies by AAP

Overall, the recommendations of the Academy are that schools should reopen, as they are fundamental to the development of a child, including their social and emotional skills, physical activity, nutrition and health, as well as addressing other pressing social issues, such as racial and social inequality. School interruptions would also lead to other complicating factors for children and their parents, such as social isolation, child and adolescent physical or sexual abuse, substance use, depression, and suicide. There has also been a substantial impact on food security and physical activity for children and families. In addition, the Academy outlined some key guidelines on the main approaches that should be considered as part of the reopening:12

1. Social Distancing: One of the concerns is maintaining enough space for social distancing and ensuring optimal academic and social/emotional learning in schools. Thus, schools could develop social distancing measures that would continue to balance the requirements for distance and/or space with the learning environment. For example, strict adherence to a specific classroom size for students, for example, should be discouraged, whereas, adults should continue to maintain the 6 feet apart guidelines, and policies should be driven to increase adult-adult physical distance in time. This includes staggered drop-offs and pickups, discouraging parents from entering the building, using physical barriers, such as plexiglass, in employee workplaces where social distancing is not possible. The use of areas where teachers and staff could congregate, such as staff lounges, should also be discouraged. Furthermore, policies should vary between the differentstudent age groups, as shown in the diagram below. The recommendations highlighted in the diagram are not instructional strategies, but rather considerations on how to optimize the return of students, taking into account physical distancing guidelines. There are also recommendations on other aspects of the school environment, such as physical distancing on buses, playgrounds, and cafeterias.

2. Cleaning and disinfection: Infection prevention should center around droplet transmission, which should include measures such as physical distancing, face coverings, and hand hygiene. To reiterate these

12 https://services.aap.org/en/pages/2019-novel-coronavirus-covid-19-infections/clinical-guidance/covid-19-planning-considerations-return-to-in-person-education-in-schools/

behaviors, staff and teachers should serve as role models in trying to promote good hygiene, and frequent handwashing. In addition, schools should adopt cleaning protocols that enhance disinfection, which could entail the use of soap and water, diluted bleach or 70% alcohol solution, as well as other EPA approved disinfectants against COVID-19, that are not strong respiratory irritants or asthma triggers, and have no known carcinogenic, reproductive, or developmental effects. Also, UV light use as a source of a disinfectant should be avoided, as it could lead to potential eye and skin damage. Other measures include decreasing the risk of contamination via contact with surfaces, such as leaving doors open, perhaps the limited use of lockers, and frequently cleaning shared surfaces, such as water fountains and bathroom door handles. Playgrounds should also have a routine disinfection protocol.

3. Testing and Screening: The AAP feels that testing all students for COVID-19 prior to the start of school is not feasible at this point in time, and it is not clear that such testing would reduce the likelihood of spread within schools. There are limitations to testing, for example if a student tests negative for COVID-19 on the first day of school, they may not remain negative for the remainder of the academic year. The CDC guidance is that serological tests should not be used to determine immunity, unless more is understood about the presence, durability, and duration of immunity. It is recommended by the AAP that the same apply for schools.
Without testing, what should schools do? Schools should have policies to support screening students or teachers, and how that will be handled in a school setting. This includes not allowing symptomatic individuals from entering school buildings. School policies for including temperature checks should also consider the feasibility of such an approach, in terms of the time required to complete these assessment for all students and teachers. Parents must also play a greater role in keeping their children at home if a child displays any symptoms. It might also be more feasible to have parents do temperature checks at home, prior to bringing the students to school.

4. Personal Protective Equipment (PPE): Although masks and face coverings are ideal, in some cases, it might be an issue for all students and staff to wear them, because of certain medical conditions (such as respiratory or developmental conditions). When policies are made regarding the use of cloth face coverings by students or school staff, considerations should be given for whether these are feasible and safe, especially in the case of younger students. Older students should be encouraged to wear face coverings. Considerations should also be given for certain students, where the use of the mask may impede learning, such as students that are deaf or hard of hearing, young students in early education programs, and English-language learners. The proper use of these face coverings is extremely important, and students and their families should be trained on properly wearing PPE. School health staff

should be provided with appropriate medical PPE , including N95 masks, surgical masks, clothes, gloves, and face shields.

5. Food Security: It is recommended that plans be made prior to the start of the school year on how students participating in free and reduced meal programs will receive their meals, especially if th school is closed, or if the students are unable to attend. This is vital, as there are both short and long-term effects of food security on children.

6. Academic Curricula: There should be some assessment and plans to make up for lost academic progress due to school closures. This requires teachers and school administrators to set realistic expectations in relation to academic progress for students, as unrealistic ones are more than likely going to serve as a point of stress for students and their families.

7. Behavioral and Emotional Support for Children: Schools should anticipate a wide range of mental health issues when they reopen and should prepare measures to address the mental health support needed. This could include training teachers and staff on how to talk to and support their students, and in case professional help is needed, that these students are referred to mental health professionals. Outreach activities should also be in place for students that do not return, related to separation anxiety and agoraphobia, as well as other issues, such as poverty, insecurity and homelessness. It is important that schools find a way to deter the stress that their students may feel.

8. Mental Health of Staff: The mental wellbeing of staff at the school is equally as important and should be addressed as well. There should be sufficient time given to students and staff alike to adjust to the new norms. Staff would benefit from clear, credible and regular communications about the decisions being made. They should also be included and feel that they are contributing to the decision making process as much as possible.

Policy Implications and Recommendations

The AAP highlighted the following key principles that should be used in policymaking for reopening of schools:

• Policymaking should be flexible. It is critical that strategies developed for reopening, along with school policies be flexible and nimble to adapt to the nature of the viral transmission within the community. This also includes redefining policies if they are found to be ineffective.

• Policies should be practical, feasible and appropriate. They should take into account the various socioeconomic factors, as well as considerations for the vulnerable student population, not only for those that may have medical conditions, but also those that live in poverty, and

may have special needs.

• No child should be excluded. A consortium of pediatricians, families and schools are needed to collaboratively develop and identify the necessary measures to help all children.

• Policies should be consistently communicated in languages other than English, if needed, based on the languages spoken in the community, to avoid marginalization of those limited in English proficiency.

• Policy makers must also consider the mounting evidence regarding COVID-19 in children and adolescents, including the role they may play in transmission of the infection. Although there is ongoing research and several questions remain about the pandemic and its transmission in children, the evidence indicates that children and adolescents are less likely to be symptomatic; hence less likely to spread infection. Polices should take into account the ongoing scientific evidence and data and update their policies accordingly.

• Policy makers should keep in mind that the COVID-19 policies are intended to mitigate, not eliminate risk, and that the interventions that are implemented, greatly reduce risk.

PRE-KINDERGARTEN

Higher-priority strategies:
- Cohort classes to minimize crossover among children and adults within the school.
- Utilize outdoor spaces.
- Limit unnecessary visitors.

Lower-priority strategies:
- Face coverings(cloth) will be a challenge to implement.
- Reducing classmate interactions/play in Pre-K aged children may not provide substantial COVID-19 risk reduction.

ELEMENTARY SCHOOLS

Higher-priority strategies:
- Face coverings when harms do not outweigh benefits.
- Placing desks 3 to 6 feet apart when feasible (balancing this with the number of students).
- Cohort classes to minimize crossover among children and adults within the school.
- Utilize outdoor spaces.

Lower-priority strategies:
- Risk reduction of class sizes in elementary school-aged children with the challenge of doing so.
- Reducing classmate interactions/play may not provide enough COVID-19 risk reduction to justify potential harms.

SECONDARY SCHOOLS

Universal face coverings when social distancing is not possible
Avoidance of close physical proximity in cases of increased exhalation (singing, exercise); safest outdoors and spread out.
Placing desks 3 to 6 feet apart when feasible.
Cohort classes if possible, limit cross-over of students and teachers to the extent possible.
- Ideas that may assist with cohorting:
    - Block schedule
    - Eliminate use of lockers or assign them by cohort
    - Rotate teachers when feasible
    - Utilize outdoor spaces when possible.
    - Teachers should maintain 6 feet from students when possible
    - Restructure elective offerings to allow small groups

Priorities for each grade level in relation to phycisal distancing. Adopted from AAP report (Reference 12)