SUA Covid-19 Scientific Advisory Committee

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Introduction:

The purpose of the CSAC is to provide interpretation of current scientific knowledge about the Covid-19 pandemic to support policy development by SUA faculty and administrators.

The scope of the CSAC is a natural science perspective on the pandemic, including biology, medicine, and epidemiology. When we make statements or recommendations with respect to public health policy, we recognize that public health is a discipline that requires perspectives and experiences outside of the natural sciences.

Although we are not experts in Covid-19 biology or epidemiology, we believe that, as biological science professors with strong interests in the biology of this pandemic as well as in the SUA institutional response, we have a contribution to make to institutional planning in response to the epidemic.

Since knowledge about the epidemic is rapidly growing, our sources may include the peer-reviewed literature, reports or policy papers from institutional sources, preprint manuscripts, news reports, or in some cases, expert opinion.

Our goal is to represent consensus scientific thinking on the subject whenever possible, as well as emerging perspectives which may be helpful in applying the precautionary principle to protect student, staff, and faculty health.

The information we present is widely available as published by public health, medical, and scientific authorities. Our role is to assist SUA policy makers in understanding how to apply it to our unique situation at SUA.

Definitions:

SARS-CoV-2: The novel coronavirus, which was first described in Wuhan, China, in December 2019.

Covid-19: The disease caused by SARS-CoV-2.

Pathogenic – causing disease and inflicting damage to the host

Covid-19 Fact Sheet

1. The SARS-CoV-2 Virus

The SARS-CoV-2 virus (which causes the disease Covid-19) is closely related to l SARS-CoV (severe acute respiratory syndrome coronavirus) that caused the 2002-2003 outbreak in Guangdong province, China (Cui, 2019; Huang, 2020; Munster, 2020; Wang, 2020; Zhu, 2020), hence the name SARS-CoV-2. While members of the coronavirus family are quite common, accounting for approximately 30% of common colds, a few members have shown to be more pathogenic including SARS-CoV, SARS-CoV-2, and MERS-CoV (Middle East respiratory syndrome coronavirus) (Fehr, 2015; Cui, 2019). These viruses have RNA as their genetic material rather than DNA, and have a high mutation rate that produces many genetic variants (Fehr, 2015; Cui, 2019). Following the original SARS outbreak in 2002-2003, research laboratories attempted to categorize this variation, since it was almost a certainty that further mutations of the SARS virus would result in future outbreaks (; Hu, 2017). These studies confirmed the large diversity of SARS-like viruses that already existed, especially in wild and domesticated animal populations, and attempted to define the functional effects of these variations (Hu, 2017; Cui, 2019).

The identification of the novel SARS-CoV-2 virus in December 2019 in Wuhan, China led to extreme concern, because this strain had alterations in the region that allows it to bind to human cells (Cui, 2019; Zhu, 2020). Specifically, the new virus attaches to a human protein called ACE2, which is also the target of medications given to patients with high blood pressure (ACE inhibitors; Van Vark, 2012). Further, the new virus has other modifications that likely made it more infectious (Chen, 2020; Coutard, 2020; Huang, 2020; Zhu, 2020; Xu, 2020). Given these concerns, and the high fatality rate observed for the original SARS virus (Drosten, 2003; Munster, 2020; Olsen, 2003), China took the unprecedented approach to quarantine the entire country in late January 2020. Standard infectious disease procedures, in contrast, specify isolating only those suspected of having the disease, along with their immediate contacts (Wang, 2020). Other countries followed this unprecedented whole country quarantine, since the extent of air travel was orders of magnitude greater than during the original 2002-2003 SARS epidemic and rapid spread was likely (Holshue, 2020).

Understanding the structure/function of the SARS-CoV-2 virus, has led to various approaches to inhibit the virus' spread. The virus uses a unique system to replicate itself. To date, Zinc has been shown to interfere with its replication in vitro (outside of the host) (te Velthuis, 2010) and an experimental drug Remdesivir, has been shown in a clinical trial to yield a 31% faster recovery time than a placebo (NIH, 2010) and thus, it has been the only approved Covid-19 drug by the FDA. (Kolata, 2020). More accurate antibody tests for detecting individuals who have been infected by SARS-CoV-2, but are asymptomatic, are under development (Whitman, 2020). These will lead to better procedures for monitoring large populations, identifying individuals at risk, and developing procedures for reopening public and private institutions.

2. Covid-19 Disease

SARS-CoV-2 primarily infects the upper and lower respiratory tract. However, infections of the digestive, neurological, and other organ systems have also been observed.

The symptoms of coronavirus infection may include, cough, shortness of breath, fever, chills, headache, sore throat, and/or loss of taste or smell.

Severe cases of Covid-19 pneumonia may result in critically low blood oxygen levels, requiring emergency hospitalization.

We don't yet know what proportion of individuals infected with the novel coronavirus experience no symptoms. Preliminary studies suggest that 50% or more of infections may be asymptomatic. Many others may experience only mild symptoms, or stronger symptoms similar to influenza. However, lung abnormalities have been seen in a significant proportion of asymptomatic patients, suggesting that the impact of the disease should not be underestimated.

About 20% of symptomatic individuals require hospitalization, often for difficulty breathing. About 5% develop symptoms so severe they must be sedated and ventilated artificially. The case fatality ratio is not well known, but has been reported to vary between 1% and 7%. The severity of Covid-19 disease increases with age, and complicating heath conditions. Mortality rates (case fatality ratios) are a function of the age distribution of the population, the intensity of testing efforts to identify mild or asymptomatic cases, and quality of medical care available.

3. Mode of Disease Transmission

SARS-CoV-2 spreads via virus particles shed from infected individuals, primarily from the respiratory system (lungs and throat). Mucus from the mouth or nose, saliva, droplets, and aerosols spread by coughing, sneezing, talking, or singing.

A person can become infected when viral particles enter their respiratory system, either by inhaling them, or when an object or part of the body contaminated with virus-containing fluids, comes in contact with the eyes, nose, or mouth.

Routes of Infection:

Respiratory droplets and aerosols: When an infected person coughs, sneezes, talks, or sings, small droplets of fluid produced in the lungs, throat and mouth, are expelled into the air.

- The largest of these tend to drop to the ground by the time they travel more than 6 ft. through the air.
- Currents of air, for example from an indoor ventilation system, can carry these particles longer distances.
- Very small particles, called aerosols, can remain suspended in the air for at least 3 hours, and can be carried as far as 24 ft from their source.

***Contaminated surfaces (fomites)*:** Surfaces contaminated directly or indirectly by respiratory secretions (saliva, coughs and sneezes, nasal mucous)

- Respiratory droplets can fall on or be directly deposited on objects

- Respiratory droplets may also be transferred from the hand of the infected person, via face touching, onto surfaces such as door knobs, light switches, tables, chairs, or keyboards.
- An uninfected person touching contaminated surfaces can then transfer viral particles into their respiratory system through touching their own face, primarily the eyes, nose, or mouth.
- Viable viral particles can persist in the environment for 3 days or longer, although their number decays rapidly over time.
  SARS-CoV viral particles have been shown to be inactivated with UV light, heat treatment of 65° C or greater, alkaline treatment (pH > 12) or acidic treatment (pH < 3) as well as harsh chemicals (Darnell et al. 2004).

4. Physical, Pharmaceutical, and Behavioral Protective Measures

In this section, we will discuss only measures that can be taken to protect from contagion in situations where there are no known infections. Persons working in healthcare settings with or living with infected individuals would need to employ additional protective measures.

Physical:

Face masks*:* The purpose of face mask-wearing in a non-healthcare setting is primarily to reduce the chance of infecting others via respiratory droplets. However, careful mask use can also protect against inhaling respiratory droplets produced by infected individuals. The value of masks is now well recognized and their use increasingly mandated.

A variety of different mask types can reduce the spreading of respiratory droplets and aerosols. Presently there is not a standard governing these masks, and when they have been mandated by state and local authorities, little guidance has been given on what kinds of masks are most effective. Consequently, a variety of masks are being used, including disposable surgical masks, commercial masks designed for filtering dust or for cyclists and runners, homemade masks, as well as cloth items like scarfs and bandanas. These items are highly variable in their effectiveness. Some research on homemade masks indicates that tightly woven and thicker fabrics provide more protection than thin fabrics like bandanas or calico.

Masks need to be treated carefully, as they have the potential to become fomites. A mask worn by an infected person is likely to contain very high numbers of viruses. If the wearer touches the inside of the mask, virus particles on their hands could be transferred to surfaces, which could become sources of infection. Reusable cloth masks should be cleaned regularly.

Gloves**:** Since hands neither produce virus, nor are routes of infection, gloves do not directly protect from infection, and instead can further viral contamination if they discourage handwashing. The CDC only recommends the use of gloves when cleaning or caring for the sick. Gloves may offer a false sense of security, and can encourage cross-contamination, while providing little or no protection. However, gloves may be helpful if they reduce the touching of the face. If used, gloves should be changed often if used, to avoid transferring virus from surface to surface.

Shields: barriers made of glass or Plexiglas can protect people who are in close contact by intercepting respiratory droplets and aerosols. Although their effectiveness has not been evaluated, they have been recommended by OSHA and the CDC.

Pharmaceutical:

Pharmaceutical protection from being infected by the virus is not currently available, nor are there any efficacious treatments approved by the FDA.

Vaccines: Many different researchers are testing new vaccines against the coronavirus. However, vaccine testing for safety and effectiveness typically takes many years because it involves three phases of clinical trials in areas that are heavily affected by a disease and thousands of people must be followed over several years to determine if the vaccine is effective at preventing a given disease. Further, developing the capacity to vaccinate the entire population is challenging, and so it is unlikely a successful vaccine will be developed during the next two years.

Given the imperative for speed, there is an indication that vaccines could be available under emergency use or similar protocols by early 2021. This would represent a fundamental step change from the traditional vaccine development pathway, which takes over 10 years on average through the final approval step. Even the accelerated 5-year timescale for development and approval of the first Ebola vaccine, is much longer than the optimistic 1-year goal that will necessitate novel methods for vaccine development. Such novel methods would s involve clinical trials carried out in parallel rather than sequentially, adaptivetrial designs,, innovative regulatory processes, and scaling up manufacturing capacity.

Treatments*:* The development of treatments for Covid-19 is still in the earliest stages. A few drugs have given early indications of efficacy in reducing the severity of Covid-19.

Behavioral:

Social (physical) distancing: Social distancing attempts to reduce the spread of Covid-19 by reducing the opportunities for person to person transmission by inhalation of respiratory droplets or by touching. The probability of contracting Covid-19 is dependent on the number of people one comes in close contact with, and the time spent with them. Transmission can be reduced by reducing the number of people one comes in contact with, as by only having close contact with immediate family, one's own household, or other small group. A six-foot minimum distance has been recommended to reduce the chance of transmission between people. Dilution of respiratory droplets in outdoor settings reduces the risk of infection. In indoor spaces, respiratory droplets can travel farther than 6 feet, causing infection, and remain suspended in the air for up to 14 minutes, and remain viable for up to 3 hours.

5. Testing and surveillance

Understanding who is infected with the coronavirus is important to prevent spread. Because people infected with the virus can shed it even if they show no symptoms, it is important to be able to identify and isolate infected individuals.

Testing needs to be combined with *contact tracing*, a procedure of testing and/or isolating individuals that infected individual may have come into close contact with.

Contactless body temperature monitoring for fever*:* An infrared thermometer can be used to quickly identify individuals with a fever, so they can be referred for treatment, testing, or isolation. However, since individuals with no symptoms are important transmitters of the virus, body temperature monitoring is only helpful as an adjutant to genetic-based testing.

Genetic testing: Tests for the presence of coronavirus genetic material in the body, indicative of active coronavirus infection. Used to diagnose to improve treatment outcomes, and to identify individuals who should be isolated and their contacts traced to control further infection. The sensitivity (ability of the test to correctly identify a person with antibodies), and the specificity (the ability of the test to correctly identify someone without antibodies) of commercially-available tests vary widely, and depending on the actual prevalence of exposure to SARS-CoV-2 in the population, can give misleading results

***Antibody (serological) testing*:** Tests for antibody markers of an immune response to coronavirus infection. This information could be valuable to identify individuals who may have immunity, but the significance of test results is still uncertain. Tests vary in quality and have large and/or unknown rates of false negative and false positive results. Antibody testing could theoretically be used to identify immune individuals who can safely go to work or work with infected individuals. However, not enough is yet known about the significance of antibodies in immunity for these tests to be valuable in controlling Covid-19 spread.

Contact tracing: A public health approach to retracing the movements of a person (via interview or possibly cell phone location data) who has tested positive for the virus, over the period during which they are thought to have been infective, in order to determine whom they may have come into contact with. Those who have been in close proximity to the infected person can then be notified and tested or put into isolation until it is determined that they are not infected.

Quarantine: Restricting the movements and activities of an infected person so that others cannot be infected by them. Quarantining persons infected with the coronavirus requires them to not occupy the same spaces as others. Special precautions need to be taken with handling laundry, food, and trash, to avoid spreading infection.

Testing and surveillance programs*:* Use temperature monitoring and/or genetic testing along with contact tracing to identify infected individuals or individuals who may be infected in order to place them in quarantine and prevent them from infecting others.

Testing and surveillance may be conducted by local public health officials, or may be employed in an institutional setting.

A number of businesses are exploring new technologies for screening of workers using infrared cameras, mobile tracking software, and facial recognition systems. While many of these technologies raise important privacy concerns, their benefits are unknown and untested.

6. Epidemiological outlook for Fall 2020.

Much about the future of the coronavirus epidemic is unknown, but epidemiologists can make projections based on the known characteristics of the coronavirus or similar viruses, and use these characteristics in mathematical models to try to understand what the future holds. We rely here on the results of transmission models.

Although much is uncertain, epidemiologists largely agree that:

- the pandemic is not likely to die out on its own in the next 6 months.
- we are likely to face recurring waves of epidemics whenever social distancing measures are relaxed.

- for at least the next year or two, we can expect to live in a world where some sort of physical barriers, social distancing, and medical interventions are necessary.
- without extensive testing and contact tracing (and the US is nowhere near the trajectory that it needs to be following), very high levels of social distancing will still be required for the foreseeable future to avoid outbreaks.
- these measures are likely to be periodically tightened and relaxed as the risk waxes and wanes (or with the political winds of fortune).
- As social distancing restrictions are relaxed in Orange County and across the US, we can expect cases and fatalities to continue to rise.

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