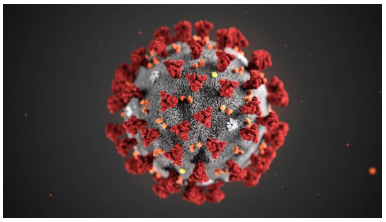
Facts on the Coronavirus **6 September 2020**

The Virus



- COVID-19 (SARS-CoV) is one of several coronaviruses: 4 are known to cause the common cold, one was SARS (2004) and the other MERS (2012).
    - SARS is considered contained and MERS is restricted to the Arabian Peninsula; neither have a vaccine.
    - They are far less infectious but more fatal (10-50% fatality rate) than the current COVID-19.
- It's called a coronavirus because of the "crown" of protein spikes on the surface
- All coronaviruses are spread through aerosolization and mucus exposure.
- COVID-19 has been shown to last about 4 days on impermeable surfaces and about 2 days on permeable surfaces.
- The virus is a sack of fat with protein spikes on the outside and messenger RNA (mRNA) on the inside.
    - The virus itself is not alive, but the protein spikes attach to the cell it is infecting via the ACE2 (Angiotensin-Converting Enzyme 2) receptor.
    - The ACE2 receptor is a vasodilator that influences blood flow, making it a poor target for treatment or a vaccine.
    - The ACE2 receptor is found all over the body but is prevalent on lung cells lining air sacs, which is why this virus infection can cause pneumonia.
    - Once the virus attaches to the cell via the protein spike, it injects the mRNA into the cell which takes over cellular genetic reproduction, causing the cell to become a virus factory. Eventually the cell bursts and releases additional virus.

Infectivity

- COVID-19 is 3 times more infectious than other respiratory viruses.
- The chances of being exposed depend on how many virus particles you are exposed to and the length of time you are exposed.
    - Maximum exposure time is only **15 minutes**.
- The infection rate in the US is 15 times that of the rest of the world, even as it is slowing slightly. We do not have this under control.
    - Countries that had previously controlled spread are re-experiencing rising infection rates: Europe, South Korea, New Zealand, Australia, Japan, China. India and Brazil have infection rates similar to the US.
- All ages can be infected. The severity of the symptomatic response is correlated to age and the presence of other underlying medical conditions, but not exclusively.
- All ages are infectious.
    - **40% of those who are infected are asymptomatic**, but they are still infectious (they just don't know it and neither do you).
    - For those who are infected and will go on to develop symptoms, **they are infectious (more highly infectious) for up to 8 days before symptoms emerge** (so again they don't yet know they are infectious and neither do you).
    - A recent study of young children in the US showed that children – who are mostly asymptomatic – have up to **25 times** the amount of virus in the nasal passages than hospitalized adults. They can be significant vectors of community spread. At last count, testing has shown that 40-90% of children in spots are infected.

- Demonstrated cases of re-infection have been documented. It is not known whether the virus becomes latent (stays in the body and re-emerges, similar to chicken pox becoming shingles later in life) or if it is a true re-infection.

Status

- As of Sept. 4 WHO reports more than 27 million confirmed cases of COVID-19 globally with about 900,000 reported deaths.
    - In the US, we have more than 6 million confirmed cases and almost 190,000 deaths.
    - Cases are rising again in countries who previously had it under control: France, Spain, UK, Italy, Germany, Norway, Sweden, Poland, Lebanon, New Zealand, Australia, India, South Korea, Japan

Fatality, Co-Morbidity and Long-Term Sequelae

- COVID-19 is **10 times more fatal than the flu** (COVID-19 has an overall 1% fatality rate; the flu is about 0.1%).
- A 1% fatality rate in the US is 3.3 Million people
- The fatality rate is generally correlated to age and underlying medical conditions
    - Fatality is 30.5/1000 for 85 years of age and above (3%)
    - Fatality is 6/1000 for 65-84, 4/1000 for 50-64, 1/900 18-29, 0.3/1000 5-17
- The virus affects the respiratory system but also the heart, liver, kidneys, GI tract, central nervous system, pancreas (causing diabetes), thyroid (affecting metabolism), and causes significant clotting in small blood vessels
- The **long-term consequences** are far more significant than other viruses: for every 1 fatality there will be:
    - 19 hospitalizations (62 million)
    - 18 who develop permanent heart damage (in one study, 80% of those who recovered showed heart damage by MRI) (59 million)
    - 10 who develop permanent lung scarring and damage (32 million)
    - 3 who develop permanent kidney damage (10 million)
    - 3 strokes (10 million)
    - 2 permanent neurological defects (up to and including psychoses) (6.5 million)
    - 2 significant cognitive dysfunctions (6.5 million)
    - Long-lasting nerve damage, affecting everything from smell to walking

Symptoms

- Early cardinal symptoms include loss of taste and smell, fatigue, shortness of breath, fever, dry cough, joint pain, heaviness in the chest
- Progressive symptoms include acute respiratory failure, sepsis, intravascular coagulation (blood clots), and multi-organ failure
- Symptoms are long-lasting – 3 months' post recovery only about 12% are symptom-free, and symptoms can recur after abating
- Stillbirths with infection have been reported to be as high as 80% of pregnancies

Treatments

- There are very few significantly effective treatments for COVID-19
- Normal flu treatments (neuraminidase and endonuclease inhibitors) do not work on COVID-19
- Early in the infection treatment with an anti-viral (Remdesivir) showed some promise; later (smaller studies) have called that into question
- Later in the infection, to stem a hyper-immune response and cytokine storm (causing significant inflammation in the body, the cause of some of the long-term consequences), anti-inflammatory agents (Dexamethasone, a steroid) have been shown to be marginally useful

- Convalescent plasma has also shown some promise but has not been sufficiently tested to demonstrate proof. FDA has not approved convalescent plasma for treatment.
- Some physical manipulation, such as lying the patient on their stomach instead of their back, has provided some relief of lung damage
- Studies with monoclonal antibodies for treatment and potentially prevention are underway (Regeneron has one in trials with the NIH; this approach has been shown to be effective for Ebola)

Immunity

- The native immune response to COVID-19 has generally been shown to be weak and short-lived
- T-cell response (one of the types of normal immune cells in the body) to the virus may be a more important measure of immunity than antibody formation and duration, however, tests for antibody are quick and inexpensive, whereas testing for T-cell response is difficult and expensive
- Currently there have been antibodies demonstrated 3-4 months after infection

Vaccines

- There are currently almost 50 vaccines in various stages of testing
- Three vaccine candidates are currently in Phase III (large-scale human) testing
    - Two utilize an mRNA technology, using snippets of the coronavirus mRNA that will infect but not cause disease, to prime the immune system into recognizing the virus and providing early immunity (Moderna and Pfizer)
    - mRNA vaccines have never been commercialized in the US and require extreme transport and storage conditions (up to -70° F), making them difficult to use and requiring some additional safety information for review and approval
    - These manufacturers have promised all safety data will be available to consumers
    - These are showing results similar to the antibody and T-cell responses after recovery from the virus (similar to the body's response)
- Other vaccines are using traditional vaccine manufacture processes, similar to the vaccines on the market today
    - Two of these, from Astra-Zeneca and Novavax, are also in large-scale human testing (Phase III)
    - These are showing results similar to the antibody and T-cell responses after recovery from the virus (similar to the body's response)
    - Others from known US pharma companies known for vaccine development – GlaxoSmithKline and Merck – are beginning to enter Phase III clinical trials
- Many manufacturers are taking a risk and beginning to produce stockpiles of the vaccines before approval to be ready as early as possible
- Manufacturers and scientists are also engaged in an unprecedented open-source data share
- It is likely that vaccines (multiple types) will begin to be approved towards the end of the year
    - First vaccinations will go to first responders, health care workers, those at highest risk
    - The majority of the population will not likely be vaccinated before the middle of next year
    - Current surveys show that 76% of Americans say they will NOT get the vaccine
    - **Only vaccinations will protect – simply having the vaccine and expecting others to be vaccinated will not provide epidemiologic protection sufficient to stop virus spread**

GET YOUR FLU SHOT THIS YEAR!