Covid-19 Primer for BHHSURG

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Med-Quest Medical Director

“The only thing we have to fear is fear itself”  FDR
Terminology: More Informed Than Media

Coronavirus = name of a class of virus.
    Seven different coronavirus, including one subtype that causes COVID-19.

Covid-19 = Name of Disease
SARS-CoV-2 = Name of Virus
    Flu is the name of a disease caused by the Influenza virus.
    COVID-19 is the name of a disease caused by the SARS-CoV-2 virus.

Naïve Population:
    Covid 100% population Naïve vs Flu with 2/3 elderly immunized for influenza.
    At minimum Covid 3x susceptible elderly population vs Flu.

Case Fatality Rate (CFR):
    Chance of death from a certain disease in a person who has the disease.
Considerations: When in course of outbreak, # cases vary with # tests, location, age.
Virus vs Bacteria

Bacteria within Cells below.
Coronavirus: 1/10 Diameter of Bacteria (Staph or Strep), Relative Size, Replication-Host, Antibiotic vs Antiviral, Childhood Imm: Virus > Bacteria
Coronavirus (7)

• 4 Coronavirus > common cold (URI)
  – Second most common cause of the common cold after rhinovirus.

• 3 Novel Coronavirus (All 3 Zoonotic Disease)
Bats: Viral Reservoir, Viral Diversity, RNA, high metabolism.

SARS, MERS, SARS-CoV-2: Bats > Civets/Camels/? > Humans
Hemorrhagic Fever Ebola: Bats > Primates > Human
Hemorrhagic Fever Marburg: Bats > > Humans

Historical Context: Legends (Vampires, Werewolves) and Rabies
Animal/Bat Saliva > Bite > Rabies > Nerves > Encephalitis > Neurologic Sequelae
Smallpox and 1st Imm

Smallpox devastating disease > 1st Imm
Variolation > Vaccine, 1796
Cowpox vs Smallpox
Vaccine: Latin Origin, Vacca = Cow
Smallpox eradicated:
1949 (U.S.), 1980 (Worldwide)
### Novel Coronavirus and Case Fatality Rate (CFR)

<table>
<thead>
<tr>
<th>Virus</th>
<th>Cases</th>
<th>Deaths</th>
<th>CFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>SARS (2002)</td>
<td>~10,000</td>
<td>800-1000</td>
<td>10%</td>
</tr>
<tr>
<td>MERS (2012)</td>
<td>~3,000</td>
<td>900</td>
<td>35 %</td>
</tr>
<tr>
<td>SARS-CoV-2</td>
<td>1.3 M</td>
<td>70 K</td>
<td>?</td>
</tr>
<tr>
<td>SARS-CoV-2 (U.S.)</td>
<td>340 K</td>
<td>10 K</td>
<td>?</td>
</tr>
<tr>
<td>Influenza (Worldwide)</td>
<td>10% pop</td>
<td>300K – 600K</td>
<td>0.1 %</td>
</tr>
<tr>
<td>Rabies</td>
<td></td>
<td>50 K</td>
<td>100%</td>
</tr>
<tr>
<td>Smallpox</td>
<td>0</td>
<td>0</td>
<td>~ 20 %</td>
</tr>
</tbody>
</table>

**CFR:** Chance of death from a certain disease in a person who has the disease.
- Time relative to surge curve, Age, Denominator, Location
## Covid-19 vs Flu

<table>
<thead>
<tr>
<th></th>
<th>U.S. Cases</th>
<th>Hosp Cases</th>
<th>U.S. Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flu</td>
<td>40 – 60 M</td>
<td>400 – 800 K</td>
<td>25 – 60 K</td>
</tr>
<tr>
<td>Covid-19</td>
<td>340 K</td>
<td>?</td>
<td>10 K</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Hawaii (Oahu) Cases</th>
<th>Hosp Cases</th>
<th>HI Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flu</td>
<td>100,000</td>
<td>1200/yr</td>
<td>~100-150/yr</td>
</tr>
<tr>
<td>Covid-19</td>
<td>371</td>
<td>21</td>
<td>4</td>
</tr>
</tbody>
</table>

**Assumptions:**
- Influenza cases 10% of population, hosp 1-2% cases, deaths 10% hosp
- Influenza 2/3 elderly immunized, Covid no immunization to date (Naïve population)
- Covid 3x susceptible elderly population vs influenza
- Influenza = season, Covid-19 = compressed timeline (Naïve population)
- Covid more infectious and more lethal than influenza

Influenza (U.S.) Deaths estimated from past 3 years CDC data
## Covid-19 vs Influenza Pandemics

<table>
<thead>
<tr>
<th>Influenza Pandemic</th>
<th>U.S. Fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1N1 Flu (2009)</td>
<td>13 K</td>
</tr>
<tr>
<td>Hong Kong Flu (1968)</td>
<td>100 K</td>
</tr>
<tr>
<td>Asian Flu (1957)</td>
<td>115 K</td>
</tr>
<tr>
<td>Spanish Flu (1918-1919) (H1N1)</td>
<td>700 K</td>
</tr>
<tr>
<td><strong>Covid-19</strong></td>
<td><strong>10K and rising</strong></td>
</tr>
<tr>
<td></td>
<td>(est 100 – 250 K)</td>
</tr>
</tbody>
</table>
Flu compared to Covid-19

Influenza cases 10% of population, hosp 1-2% cases, deaths 10% hosp, CFR ~ 0.1%
2019-20: 26M cases, 250K hospitalized, 14K deaths

Source: CDC  www.cdc.gov/flu/about/burden/index.html
How Does the Coronavirus Affect Different Age Groups?

Breakdown of confirmed coronavirus cases by age in South Korea and Italy (in percent)

- **South Korea**
  - 0-9: 0.8%
  - 10-19: 5.0%
  - 20-29: 29.9%
  - 30-39: 10.7%
  - 40-49: 13.7%
  - 50-59: 18.9%
  - 60-69: 12.3%
  - 70-79: 5.7%
  - 80+: 3.0%

- **Italy**
  - 0-9: 0.5%
  - 10-19: 1.1%
  - 20-29: 3.7%
  - 30-39: 5.9%
  - 40-49: 11.1%
  - 50-59: 18.1%
  - 60-69: 18.3%
  - 70-79: 22.2%
  - 80+: 19.1%

Published March 13
Source: Andreas Backhaus (German Federal Institute for Population Research) via Medium
Covid-19 Prognosis and Age

• **Age independent RF**
  - CFR increase with age
  - More underlying health conditions with age does not fully account for increase
  - Functional reserve capacity of lungs decrease with age
  - Innate vs Acquired Immunity

![Lifetime Immunity](chart.png)

**Key:**
- **Red** = Innate Immunity
- **Blue** = Acquired Immunity
## Covid-19 U.S. Hot Spots

<table>
<thead>
<tr>
<th>Region</th>
<th>Covid +</th>
<th>Hosp</th>
<th>ICU</th>
<th>Deaths</th>
<th>Recover</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>330K</td>
<td></td>
<td></td>
<td>9.5 K</td>
<td>17 K</td>
</tr>
<tr>
<td>NY (20 M)</td>
<td>130 K</td>
<td>16 K</td>
<td>4.2 K</td>
<td>5.2 K</td>
<td>12 K</td>
</tr>
<tr>
<td>NYC (8 M)</td>
<td>70 K</td>
<td>13 K</td>
<td>3.5 K</td>
<td>2.6 K</td>
<td></td>
</tr>
<tr>
<td>NJ (9 M)</td>
<td>40 K</td>
<td></td>
<td>920</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MI (10 M)</td>
<td>16 K</td>
<td></td>
<td></td>
<td>620</td>
<td></td>
</tr>
<tr>
<td>LA (4 M)</td>
<td>13 K</td>
<td>1800</td>
<td>560 (Vent)</td>
<td>480</td>
<td></td>
</tr>
<tr>
<td>New Orleans (830 K)</td>
<td>7 K</td>
<td></td>
<td></td>
<td>270</td>
<td></td>
</tr>
<tr>
<td>WA (8 M)</td>
<td>8 K</td>
<td></td>
<td></td>
<td>340</td>
<td></td>
</tr>
<tr>
<td>King County (2 M, Seattle)</td>
<td>3.2 K</td>
<td></td>
<td></td>
<td>210</td>
<td></td>
</tr>
<tr>
<td>Hawaii (1.4 M)</td>
<td>371</td>
<td>21</td>
<td>5</td>
<td>4</td>
<td>85</td>
</tr>
<tr>
<td>Hawaii Hospitals Beds</td>
<td></td>
<td></td>
<td></td>
<td>(1500/2800)</td>
<td>(120/340)</td>
</tr>
<tr>
<td>Hawaii Vents</td>
<td>91/535</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

King County (Seattle): Age > 70 yo account for 80 % deaths (170 / 210).
Life Care NF: Fatalities (34/81 residents, 0/47 staff)
WA: 93 % deaths in Age > 60.
NY: Age > 75 yo are only 8 % cases, but 50 % hosp and ¾ Fatalities. 83% hosp > 65 yo.
## Covid-19 Hawaii vs other State

<table>
<thead>
<tr>
<th>Hawaii</th>
<th>State Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td># 40</td>
</tr>
<tr>
<td>Covid Testing per Capita</td>
<td># 10</td>
</tr>
<tr>
<td>High per capita test + test early</td>
<td># 3</td>
</tr>
<tr>
<td># Covid Cases</td>
<td># 44</td>
</tr>
<tr>
<td># Covid Cases per capita</td>
<td># 45</td>
</tr>
<tr>
<td># Active Covid cases</td>
<td># 45</td>
</tr>
<tr>
<td>Covid Deaths</td>
<td># 46</td>
</tr>
<tr>
<td>Covid Deaths per capita</td>
<td># 48</td>
</tr>
</tbody>
</table>

States with high per capita but testing late in the course of outbreak: NY, NJ, LA, MA, WA.
States with high per capita testing and earlier in outbreak: UT, AK, ND, HI.

Covid Data: Hawaii Relative to Other States

• Testing Occurring relatively early in outbreak relative other states.
  – S. Korea vs Italy and NY
  – Hawaii ramped up testing relatively early in outbreak

• Surveillance Testing
  – Thru 3/20 Neg, Thru last week 1+

• % positive (case +) / (case tested)
  – NYC ½, NY State 1/3
  – Hawaii 260 / 9000 ~ 3 %

• Hawaii
  – Population # 40/50
  – Cases # 42/50
  – Deaths # 48/50
SARS-CoV-2 Infectivity
Children and Coronavirus

—Children 3 A’s: **Allergies**, Atopic derm (Eczema, Rash), **Asthma**
(clockwise top left) Elizabeth Schneider (Seattle, age 37), Jaimuay Sae-Ung (Thailand after visit to Wuhan, age 73), Bridgett Wilkens (Australia after attending wedding in Singapore, age 29) and Andrew O’Dwyer (UK after ski trip to Italy, age 52) All had firsthand experience with Covid-19.
Covid-19: Tobacco, Vaping, Marijuana

- Hubei Province: Tobacco (2.4 x) more likely require ICU/Vent
- U.S.: Vaping RF younger adults (20-44) require Hosp
- Destroys cilia in lung tissue which help clear virus,
  - Decrease clearance of other pathogens, higher risk secondary respiratory infections
  - Influenza, bacterial/viral pneumonia, TB
- Smokers (14 x) more likely develop pneumonia
- Chronic Resp Disease (COPD): Increase CFR (3 x)
- Meth: Resp binds to pulm tissue, CHF, dentition, social RF
Without Protective Measures

With Protective Measures

Healthcare system capacity

Time since first case

Adapted from CDC / The Economist
Masks

• CDC Flip Flop: No > Maybe > Yes
• Mask better than no mask, Yes - Assumptions
  – No change in behavior (SD, Face Touch)
  – Use and reuse appropriately, don’t share masks
  – General public not using N95 at expense of HCW
• Local hospital accepting homemade masks
• Facial Skin Lesions and Telederm
Summary

– National
  • Children and Young Adults do very well. Increase Screening.
  • ? Seasonal, ? Geography, Healthcare Infrastructure
  • Increase Capacity: hospital/ICU beds, hosp D/C options, Vents, PPE

– Hawaii
  • High Testing per capita
  • High Surveillance screening by DOH
  • Overall trending better than other states
  • Leadership Aligned, Clinical Input, Ohana/Aloha
  • Influenza peaked early March and trending down
  • Strong Interventions relatively early in course of outbreak
  • Advantage Learning Curve from other states (NY, LA, WA)

– Personal
  • Anticipate Wave, No need to panic but need to prepare
  • You will be OK, remember the pyramid. Some others more at risk.
  • Retrospective Review a year from now. Organization, Individual.
  • The Children Are Watching
Don’t Be Afraid... Be Helpful

“In The Middle Of Every Difficulty Lies Opportunity” Einstein