Grand Rounds 2020

Presented Macon, GA

by Joe Sam Robinson, Jr., M.D.

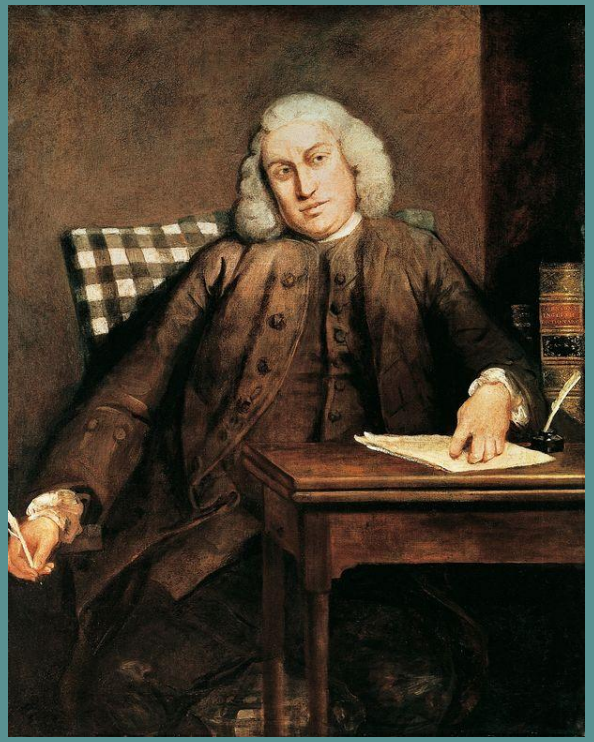
World War C:

A Novel Bat-borne Virus Strikes The World Order

Harry Groce, MIP Jihyun Moon Joe Sam Robinson, MD

Disclaimers

Samuel Johnson (1709-1784) and the Dancing Dog



Thin Ice

An Explosion of Literature - over 4.5 million Papers

Micro vs. Macro ✓

In the Middle of a War

WWII in May, 1943

Major Error #1

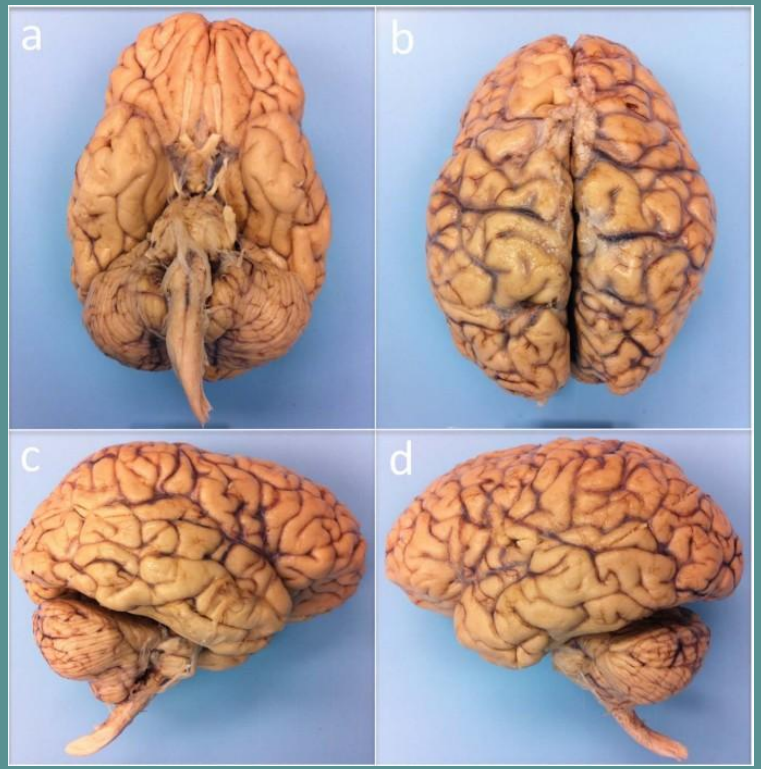
The Perils of Complacency

The Forgotten Vulnerability of Our Species

Human Evolution Had Many False Starts

From Oldest (L) to Youngest (R): *Australopithecus africanus, Homo rudolfensis*, *Homo erectus, Homo heidelbergensis, Homo sapiens*

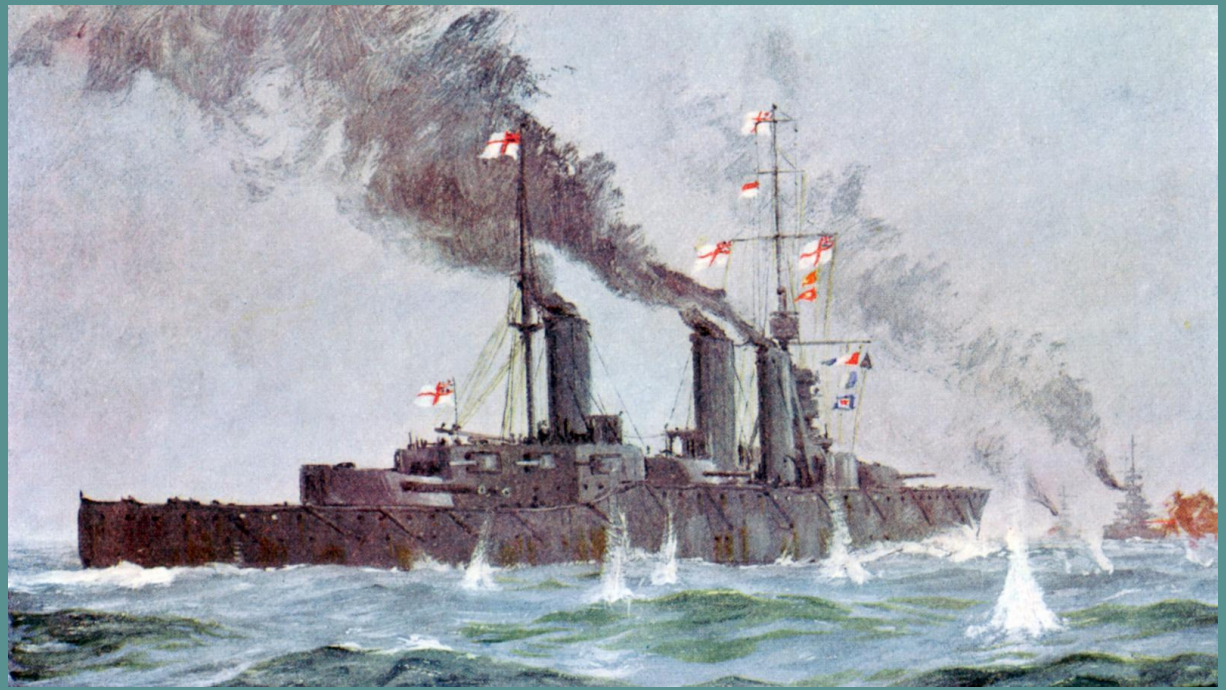
The Imperfect Victor: Retaining Atavistic Neurocircuitry



Survivability as a Random Chance

Almost Extinct 70,000 Years Ago

Many Near Misses - Now the Coronavirus



Four Old Apocalyptic Friends Together Feast Upon Humanity –
Even Now Localized Human Extinctions

Plague

Citizens of Tournai bury plague victims - Pierart dou Tielt - circa 1353

War

Famine

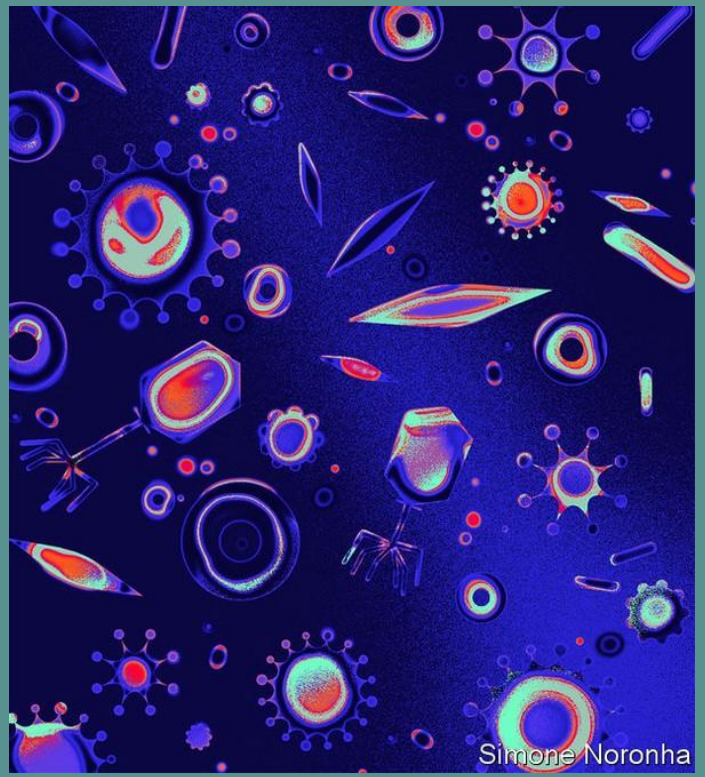
Death

Major Error #2

Underestimating Plague Dangers

After All...We Swim in a Microbial Sea

- Most organisms are single-celled bacteria and archaebacteria
- Estimated 10 virions (individual viruses) for every organism on the planet
- 1L of seawater contains as many as 100 billion virions; 1kg of dried soil contains 1 trillion
- These microscopic entities exist within, on, and around all of us



While Not a Risk for Hunter-Gatherers, Human Progress Depends on Cities, Giving Plague its Chance in the Face of Human-Human Contact

Great Plague Examples

The Black Death (1346-1352)

- 75-200 million dead
- ~33-50 % of Europe killed

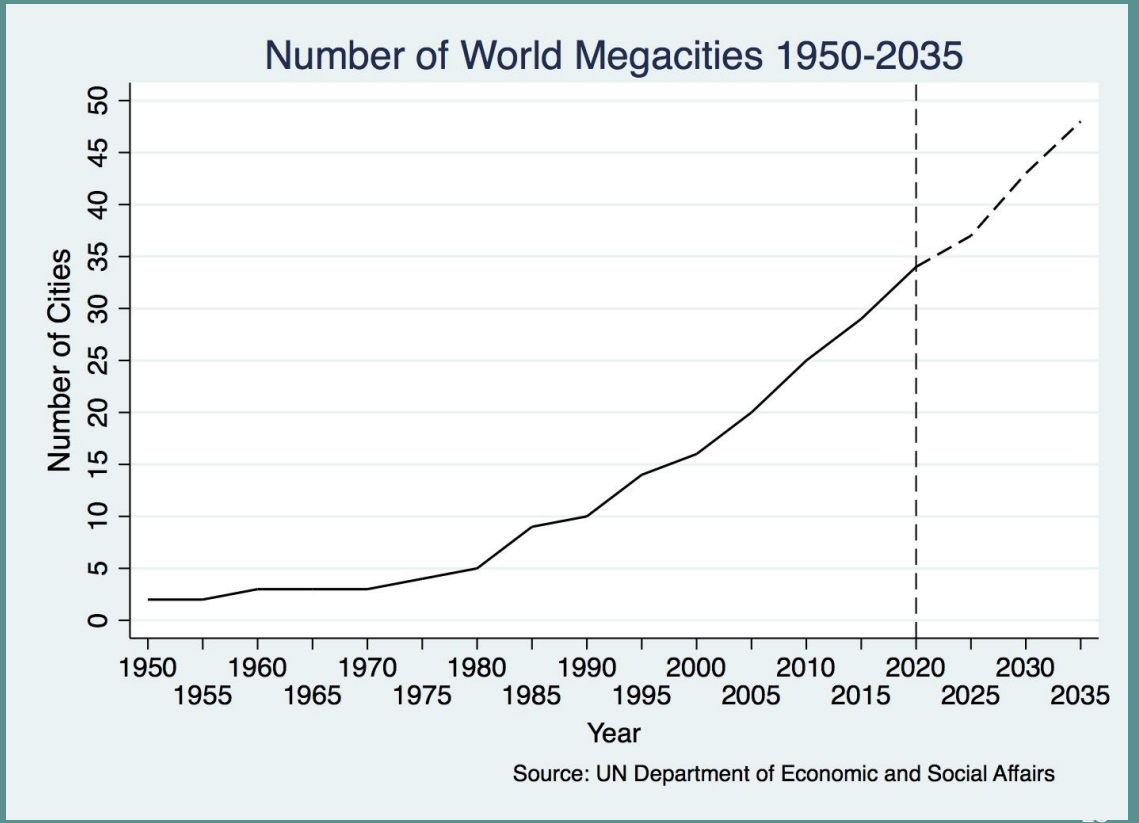
The Spanish Flu (1918-1920)

- 50-100 million killed
- Infected roughly 33% of the world over 4 waves
- Lack of treatments left non-pharmaceutical interventions as only response


Coronavirus Gets its Chance

Urbanization

- Most of the world's population now lives in cities
- Urbanization has dramatically increased in recent decades, cramming millions of people together
- Note: Megacity = 10 million+ inhabitants



Population Density

Dense Cities of Antiquity

- Tenochtitlan c.1520: ~35-75,000/km^2
- Ancient Rome at its peak: ~ 35-70,000/km^2
- Athens c.430 BC: ~40-56,000/km^2

Modern Day Dense Cities

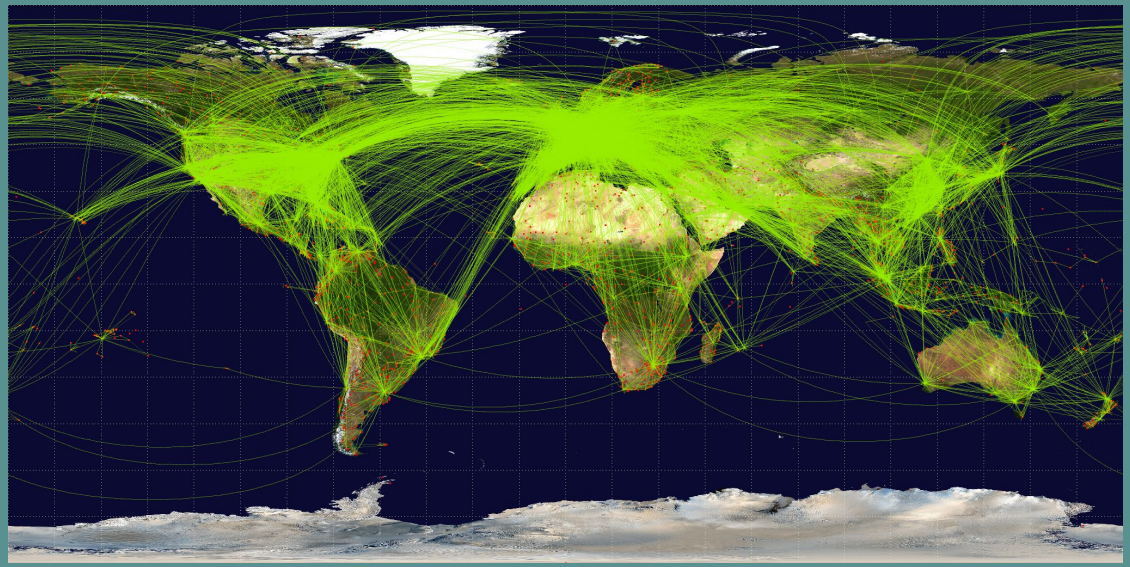
- Manila: 41,515/km^2
- Mumbai: 32,303/km^2
- Manhattan (NYC): 27,544/km^2
- Paris: 20,755/km^2
- Seoul: 15,763/km^2
- Hong Kong: 6,777/km^2

- Population densities of ancient urban areas matched those of contemporary urban cities, predisposing both urban arrangements to plague dangers.
- Improved transportation allows modern urban areas to host large groups of transient workers, increasing coronavirus dangers.
- Risk-laden indoor air circulation is largely an unaddressed variable.

Transportation Advances

Global Air Traffic

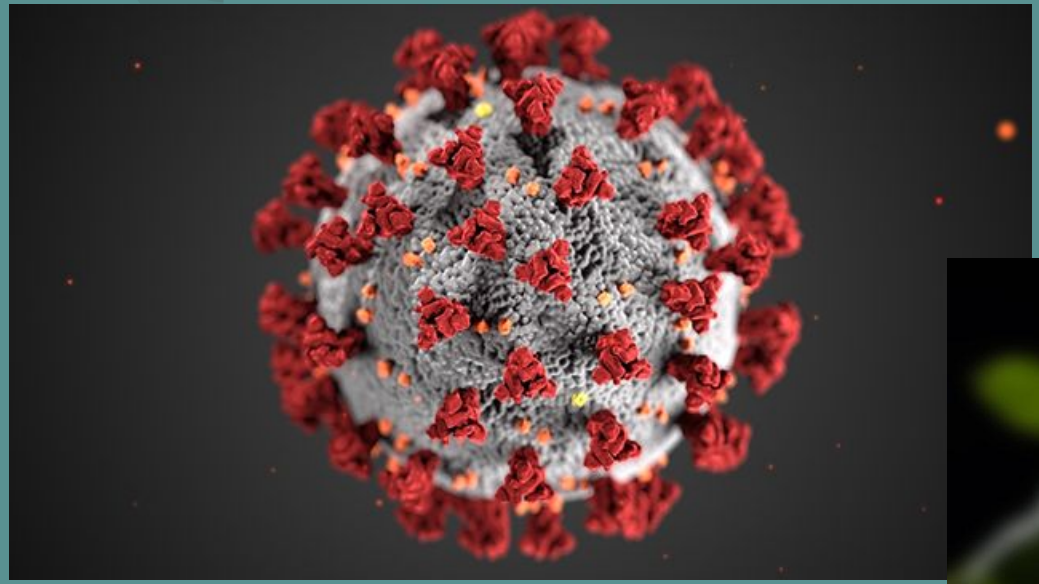
- Over 4 billion people flew in 2018
- Thousands of planes cross the world every day
- Trips that once took months now only take a few hours



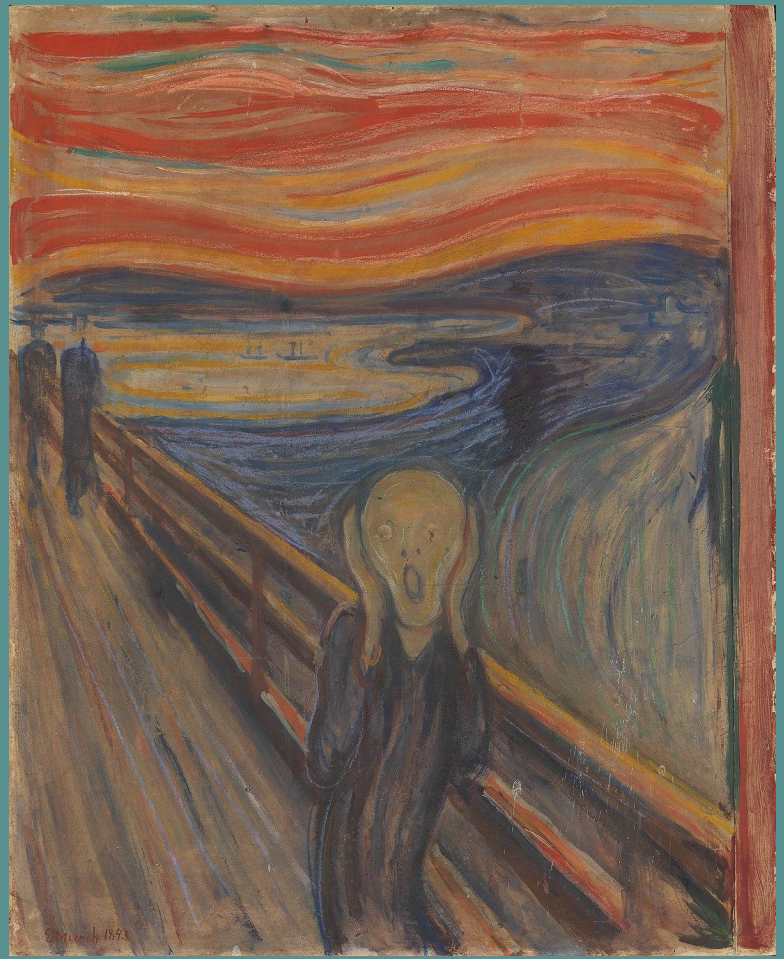
Opening China

New Kinds of Infections: Zoonotic Transfers

The Coronavirus Cometh Upon an Unready World



Unreasoned Terror Awakes



The Nature of the Beast

Much Confusion

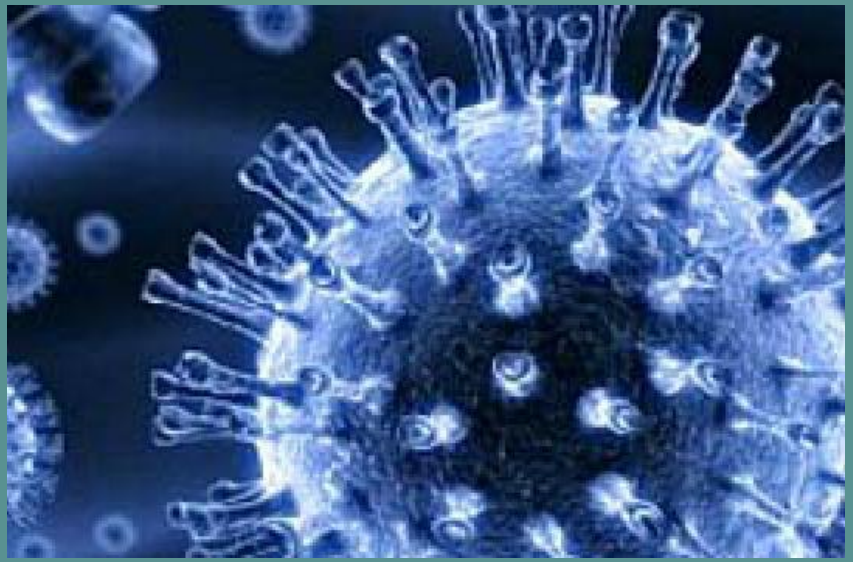
- Confused and inaccurate data (unsurprisingly)
  - When you can't count what's important, you make what you can count important
  - No standardization of data collection
  - No data for much of the world
- Novel pathogen with unknown contagion patterns, risks, and treatments
- Coronaviruses not very well known
- Chinese government kept information close to its chest
- No international cooperation out of the gate

However, Some Improvement with Time

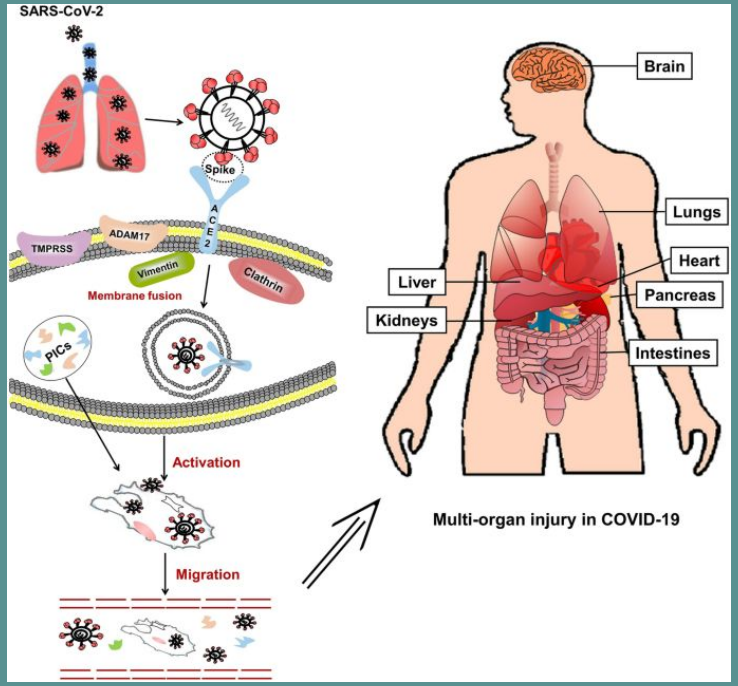
The Picture Slightly Clears

Pathogenesis

1) Coronavirus Protein Spikes

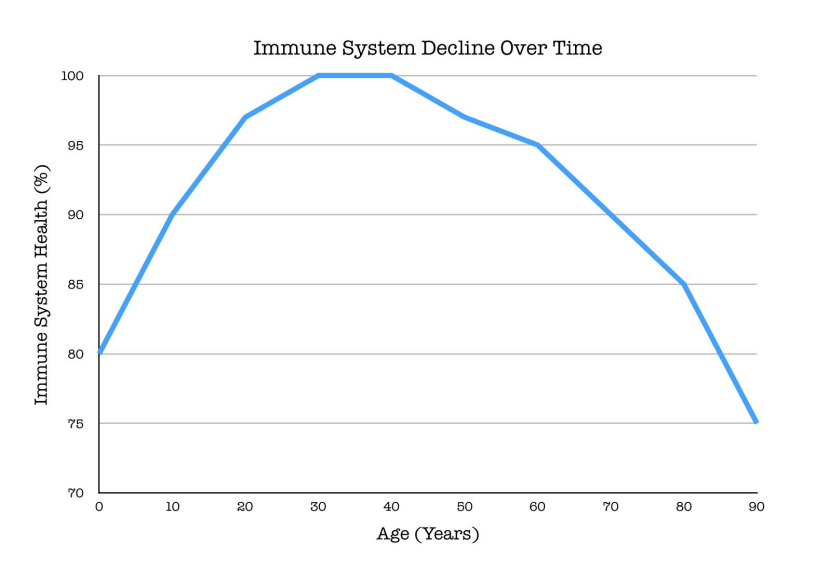


ACE-2 Receptors

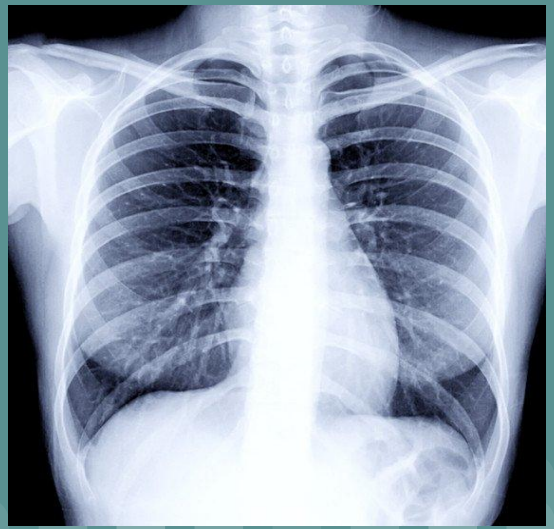


2) Select Vulnerability

- Vulnerable population consists of older people, those with significant comorbidities
- Younger population generally spared



3)Diagnosis



A Variable Clinical Presentation

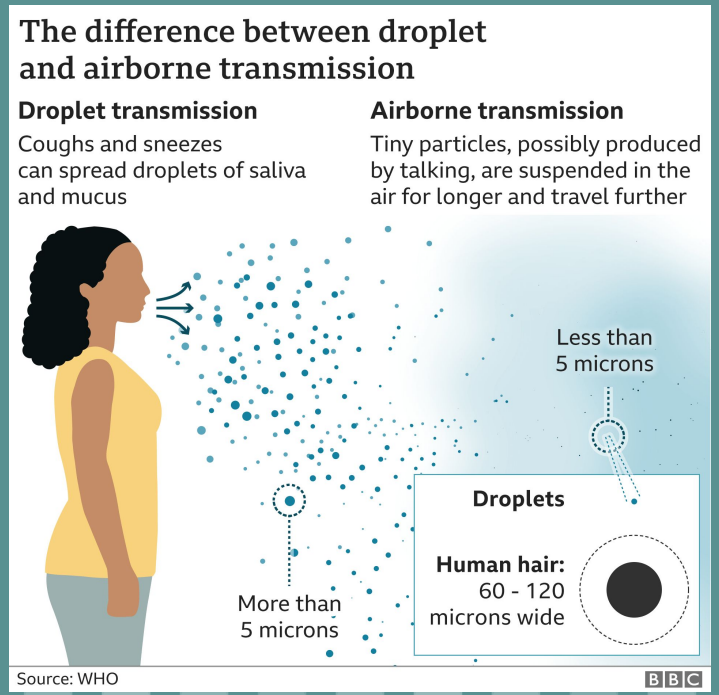
- A preponderant number of cases are asymptomatic
- Myriad of symptoms
- Testing only reliable means of diagnosis

4) Incidence (Unknowable)

- As A Result of Inadequate Testing

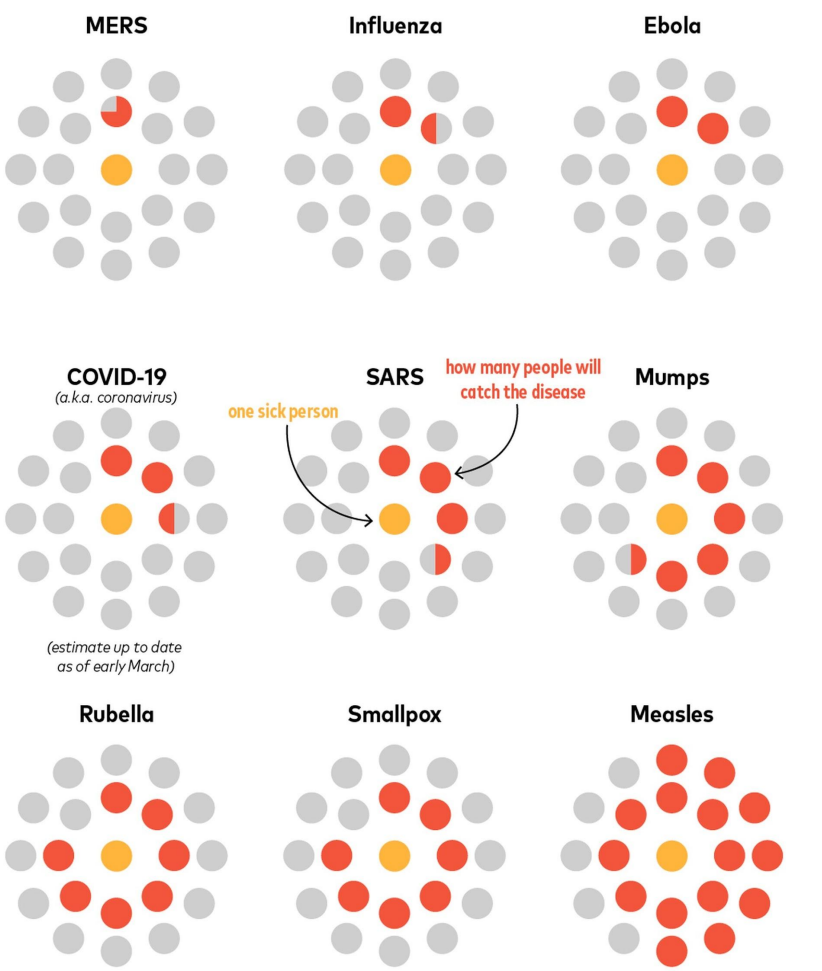
- Far more widespread than confirmed cases would show - likely by a factor of 10-20 times worldwide
- On par with Influenza, which infects upwards of 1 billion people annually around the world
  - Estimated 45 million cases in the US in 2017-18
- Older people, those with significant comorbidities, the immunocompromised, people of color, and men are the most vulnerable
  - Risk not spread out evenly - Europe significantly older than Sub-Saharan Africa, for example, while health care workers are more at risk than stock brokers
- As more people get infected and the herd immunity of the survivors increases, R0 falls and spread slows

5)Transmissibility



The Standard: R0

- The typical number of people a person can infect
- Thus, the epidemiologists' mission is to lower the number to be <1; this is often done by employing social isolation, limiting the number of potential contacts
- However, the R0 is affected by **viral load**, which in turn is affected by immune system particularities, closeness and length of contact, and absence of comorbidities
- R0 is an average; it neglects variability among individuals, raising questions about the impact of superspreaders and rendering any generalized isolation methods imprecise
- Calculation depends on testing and contact tracing



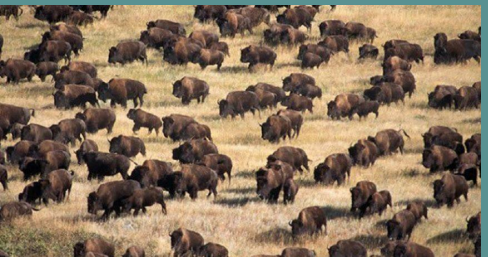
POP SCI

Key Factors in Transmission

1. Intensity of **viral load** inoculum

2. Length of time of exposure

3. Robustness of the recipient's immune system



4. Level of herd immunity and vaccination protection

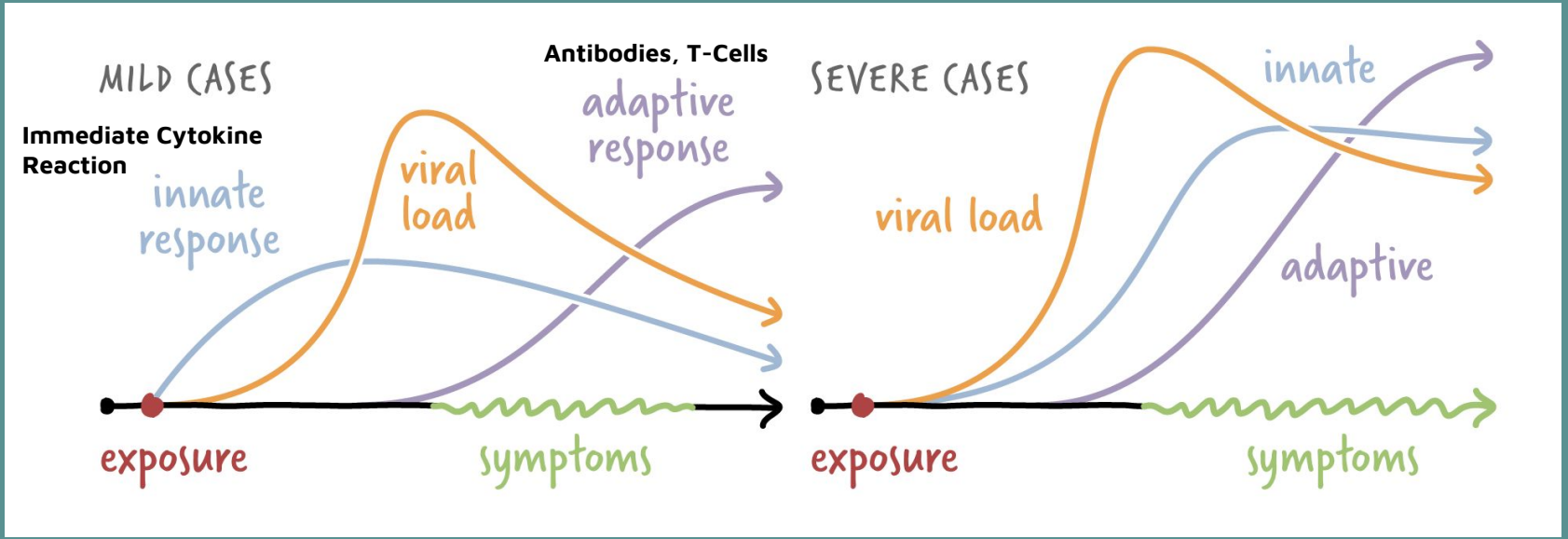
R0 and Herd Immunity

- R0 is highly correlated with herd immunity and vaccination numbers
- If substantial herd immunity or a large vaccinated population exists, a higher individual R0 would be tolerable. Thus isolation restrictions would be largely unnecessary
- As herd immunity increases, subsequent waves will have smaller R0s

6) Lethality - Lessons Learned

- ~3 million deaths worldwide
- Death certificate confusion
- Death rates have shrunk over time, from a peak of 22% in April 2020 to 2% as of May 1, 2021
    - likely even lower than that given that prevalence much greater than currently known
- Life expectancy likely to decrease by around 1 year worldwide
    - Varies based on region and disease prevalence
- Improved outcomes and prevention methods have rendered the disease less deadly than at first

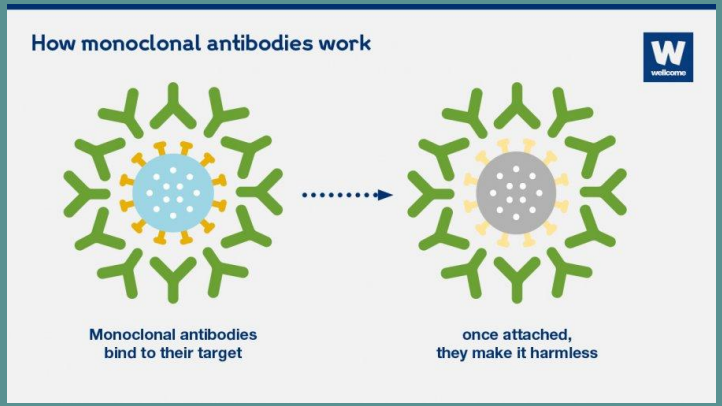
Viral Load and the Immune System



Amelioration Efforts

1) Treatment
(Minimized by Testing Inadequacies)

- Treatment initially ad hoc, with no known care regime
- No consistently effective treatments
- Steroids, antiviral drugs have mixed results
- Various drugs have been touted as wonder drugs, including Regeneron, Remdesiver, and Hydroxychloroquine
- Treatment has since greatly improved, reducing severity of disease and resultant mortality
- New types of treatments have emerged, including plasma therapy and monoclonal antibodies which directly target the virus, but are still not widely used



ICU

- Originally, intubation only treatment for serious cases; high mortality rate
- Less invasive treatments like proning and oxygen masks now producing better results with fewer side effects
- ICU mortality has dropped significantly

2) Transmission Prevention

A Cautionary Note:

If Excessively Applied,
the Real Danger to Our Species' Hegemony

Risk/Cost
Benefit

Limiting Physical Contact, Masks, and Social Distancing

Closing Businesses and Schools

Risk/Cost
Benefit

Isolation/Shelter in Place and Quarantine

Risk/Cost
Benefit

Immigration Restrictions and Border Closures

Risk/Cost
Benefit

Indoor Air Circulation

Advice on Airborne Virus Transmission Vanishes From C.D.C. Website

The new guidance, published only on Friday, had acknowledged that fine particles floating in air may spread the virus.

3) The Endgame? Vaccination

Battlefield Report:
January, 2020 -May, 2021

The Four Horsemen Are Riding

View From a Spaceship: 1/1/2020

An Abbreviated View of The World As It Was, January 1, 2020

- 7.8 billion people
- 195 countries
- Hundreds of ethnic groups
- Thousands of languages
- Nearly $90 trillion global GDP
- Roughly 8.4% of world living in extreme poverty (<$2/day)
    - On track to decline to 7.9%
- Average life expectancy at birth is 72.5 years
- Conflicts raging in Syria, Iraq, Afghanistan, Ukraine, Central Africa, and the Sahel

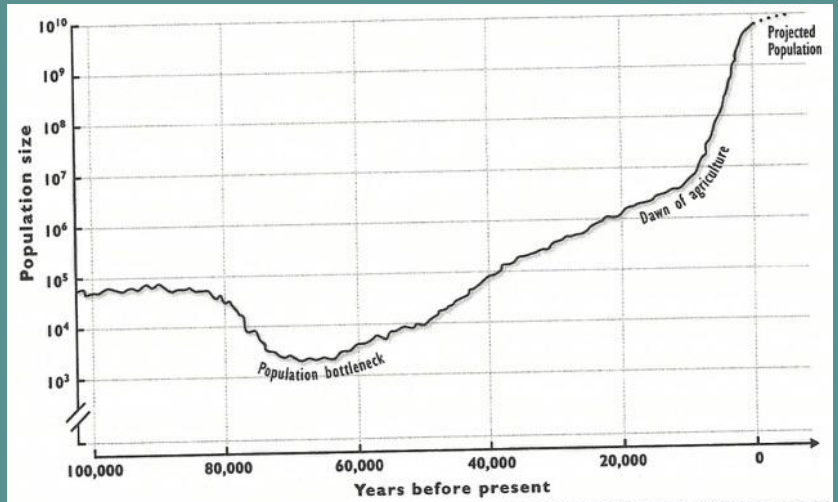
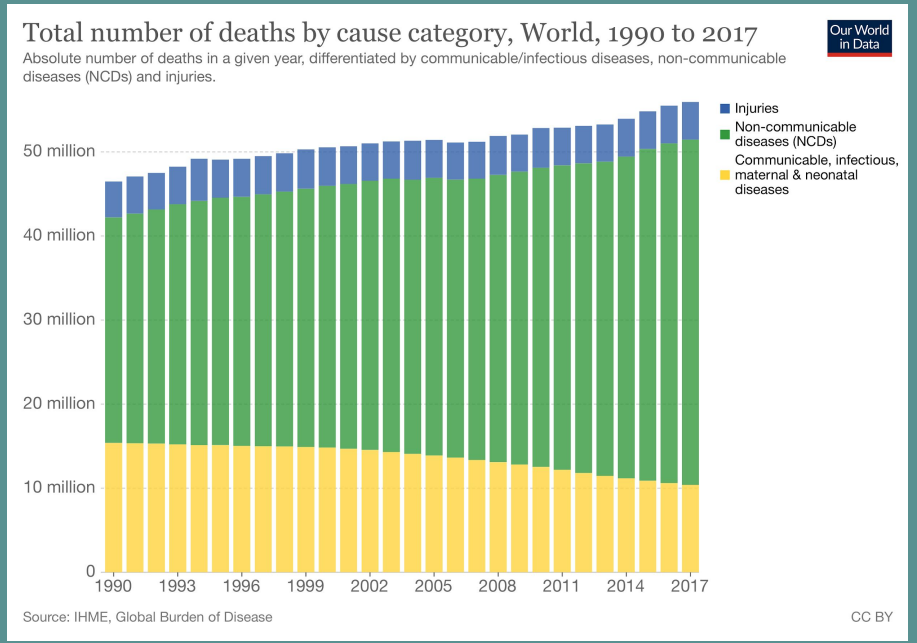


FIGURE 2: THE VARIATION IN HUMAN POPULATION SIZE OVER THE PAST 100,000 YEARS. NOTE THE USE OF A LOGARITHMIC SCALE ON THE VERTICAL AXIS (10^3 = 1,000, 10^6 = 1 MILLION, ETC.).

Major Error #3
Misunderstanding Global Mortality Rates and Causes

- Roughly 56 million people died in 2017 (vs. ~140 million births)
- 4.48 million from injuries/trauma
  - 1.24 million from car accidents
  - 800,000 from suicide
  - 100,000 from snake bites
- 10.39 million from communicable diseases
  - ~400,000 from Malaria (2018), mostly children under 5
  - ~650,000 from Influenza
  - ~1.5 million from TB (2018)
- 41.07 million from non-communicable diseases
  - ~17.8 million from cardiovascular issues
  - ~9.6 million from cancer
  - ~232,000 from malnutrition



War: The Impact on Conflict

- Border skirmishes between China and India
- War between Armenia and Azerbaijan
- Government crackdown on the Tigray people of Ethiopia
- Coups in Mali and Myanmar
- Rebellion in Chad
- Civil unrest around the world, especially in Belarus, Myanmar and the US

Famine: The Impact on the Economy

- Estimated 6.6% drop in global GDP compared to a non-pandemic scenario
- Global debt reached 128% of world GDP, passing the high water mark of 125% set in 1945
- 89 million more people pushed into extreme poverty (<$2/day), increasing rate to between 8.9 and 9.4% of world
- Global food insecurity increased, millions at risk of starvation
- Travel severely impacted
- Supply chain disruptions cause shortages of goods around the world

Death: Impact on Mortality

- Currently ~3 million confirmed COVID deaths worldwide
  - Excess Deaths, which capture all deaths above normal averages for an area, reflect a variety of outcomes but are mostly well above average
  - True number of deaths is probably twice the confirmed total
- Massive disruptions in efforts to curb Malaria, HIV, and TB
  - Likely 200,000 extra deaths from Malaria, 1.4 million extra deaths from TB
- Severe disruptions in diagnosis and treatment of cancer, mental health issues
  - Increasing deaths from suicide, missed cancer

But A Little On The Bright Side

- Most cases seem to be asymptomatic or mild
- Lockdowns have reduced deaths from things like traffic accidents
- Flu season seems to be almost nonexistent so far this year
  - Southern hemisphere hit record low prevalence rates
  - Northern hemisphere seems to be witnessing a similar phenomenon
- Learning a great deal about viruses, gene therapy, and vaccine creation
  - Will have positive impacts on medicine for years to come

What Went Wrong? Why?

Major Error #4

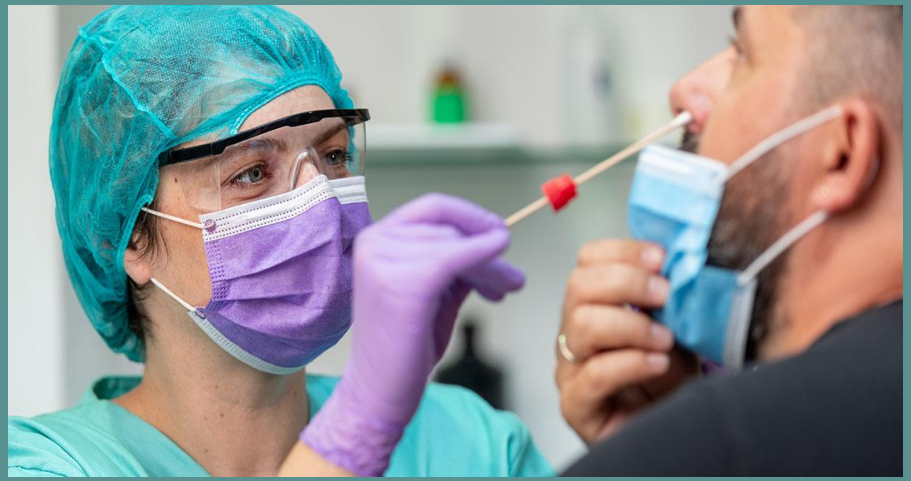
The Animal Got Out of the Cage:

Chinese and World Bureaucrat Bungling

Major Error #5

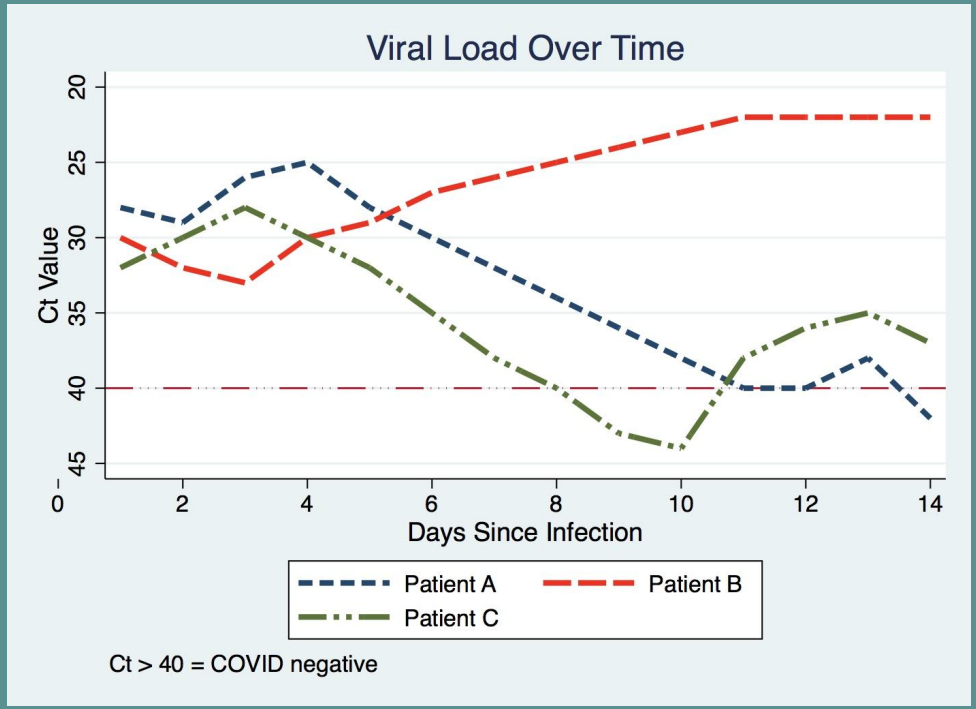
Testing Shortfalls

- Lack of intelligence available for most of the world ✓
- Too infrequent to make the most efficient use of treatments and quarantine
- Random testing rarely done
- Sensitivity issues
- No standardization
- No differentiation based on reason for test
- Inaccuracies
- PCR Expensive
- Slow turnaround time for labs



CT Scores - A Substantial Intellectual Error

- Measurement of viral load
- Clinical application ignored
- Could have important implications for treatment, transmission, isolation arrangements, and disease severity



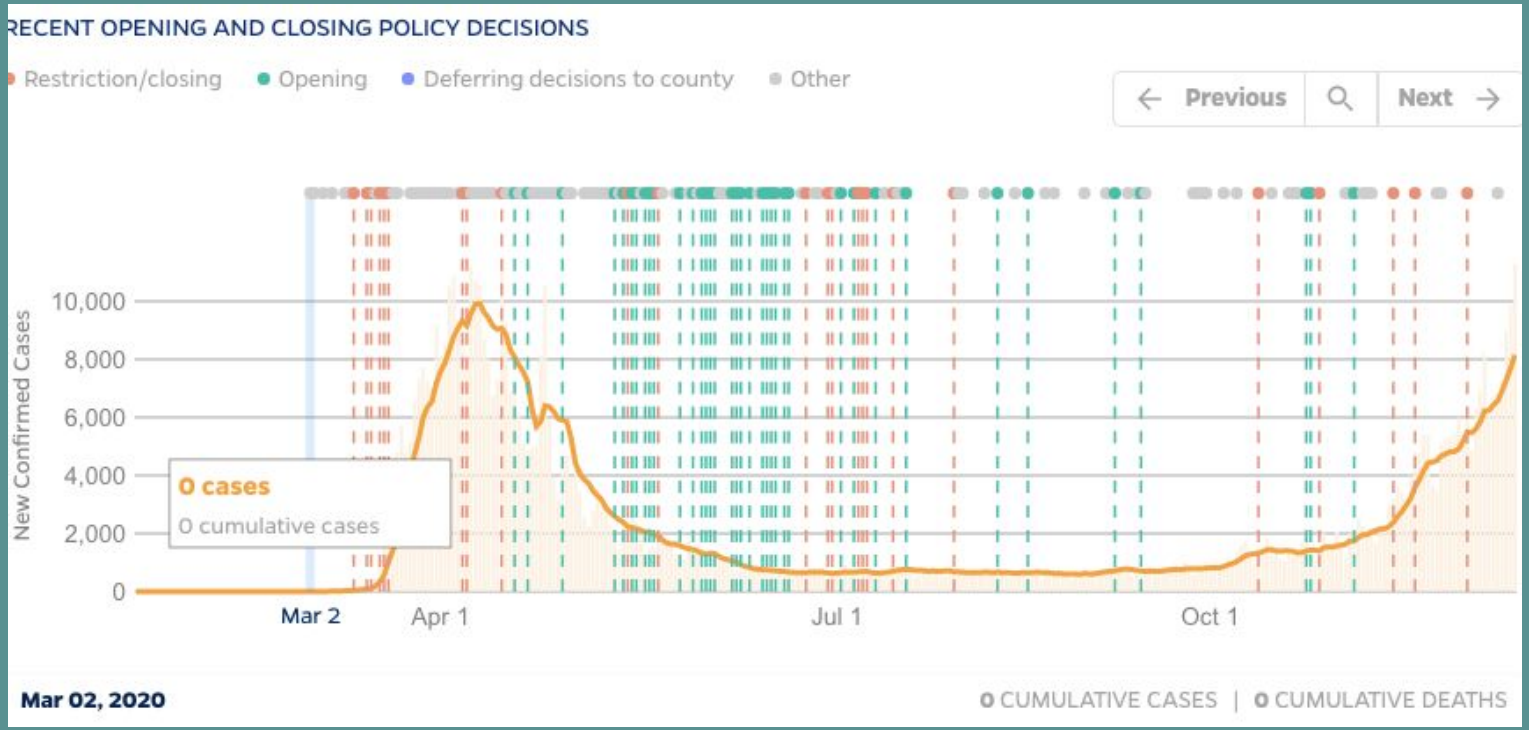
Major Error #6

Defective Lockdown Arrangements Were Employed

Because:

A Benefit

Lockdown Strategies Work



However, Cost/Benefit Assessment Neglected

1. Nature of the lockdown: How invasive is the policy?
2. Enforcement Measures: Law, social pressure, criminal penalties, etc.
3. Cost: Economic, social, and political costs; secondary damage to mental, public health;
    a. long term vs short term
4. Benefit: infections prevented, lives saved; reduction in flu and traffic deaths;
    a. effectiveness at stopping disease
5. Time: How long will the policy last? Set duration vs. indefinite timeline
6. Indications: What markers determine the need for the policy? What markers constitute success?

Confused and Imprecise Markers To Finetune The Implementation of Social Contact Restrictions

1. Test positivity rate in general population
2. Hospital ICU overflow
    a. Hospital admissions
    b. ICU admissions
    c. Critical cases
3. Coronavirus death rate

Statistical Shortfalls

- Relying on Solitary Outcome Projections Instead of Summating Projections
- Binary Analysis
- Need For Multivariate Analysis

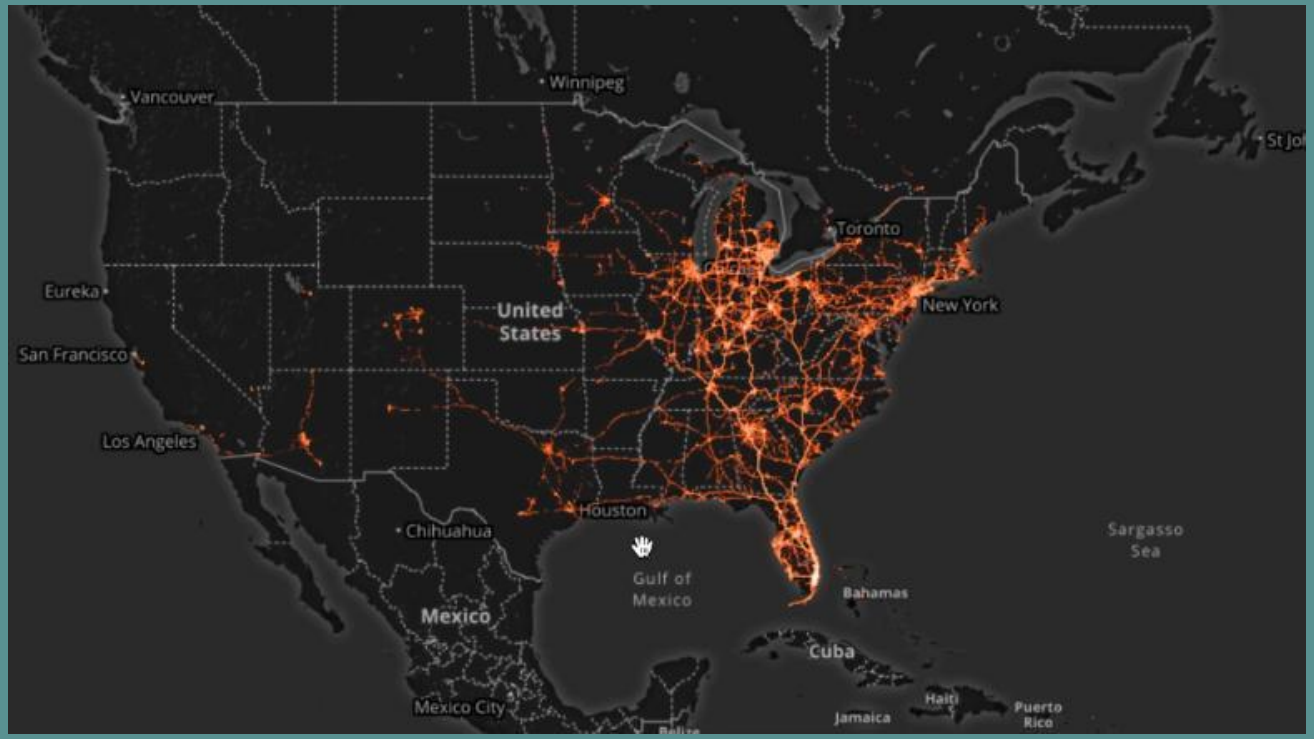
VS.

	Nonviolent Protest
economic globalization	-0.070
	(3.12)**
political globalization	-0.061
	(3.52)**
social globalization	0.217
	(11.42)**
Regime Type	0.105
	(2.47)*
Violent Protest	0.858
	(40.71)**
Population (ln)	2.326
	(10.25)**
Constant	-38.079
	(10.66)**
R^2	0.50
N	3,099

Key Variables to Examine (Often Without Reliable Data)

- Estimated gross population infections
- Estimated gross infection fatality rate
- Age
- Comorbidities
- Earlier exposure to coronavirus family
- Estimated herd immunity
- Population density
- Population connective interchange
- Air flow dynamics
- Individual response to isolation and quarantine laws/suggestions
- Legal framework by which isolation and quarantine regulations may be instituted
- ACE2 receptor and immune response configurations by age, gender, and ethnicity
- Number of multigenerational households
- Environmental factors
- Quality of life
- Healthcare access
- Socioeconomic status

Cell Phone Data Tracking Not Widely Used



In the US:
Policy Structure Shortfalls

Lessons Ignored from SARS (2003)

- SARS showed viruses could cross the globe in a matter of hours, transforming local outbreaks into pandemics quickly, but no international protocols were established
- WHO funding continually cut, its staff spread thin across various emergencies, and its experts continually sidelined, making it even more dependent on the goodwill of member states
    - China in particular
- In 2013, several SARS-like coronaviruses which had already infected humans were discovered in bats in southern China
- US policy actively undercut efforts to prepare for the next pandemic
    - National PPE stockpile not maintained
    - Federal funding to help cities and states to prepare for pandemics and other emergencies fell 35% between 2003 and 2020.
    - In May 2018 NSA John Bolton dismantles the NSC task unit focused on global health security and biodefense
    - Trade war and other escalating tensions with China reduced US presence there just as researchers were increasing alarms for coronavirus threats
- Chinese government allowed restrictions on the trade of wild animals to lapse, stopped enforcing others

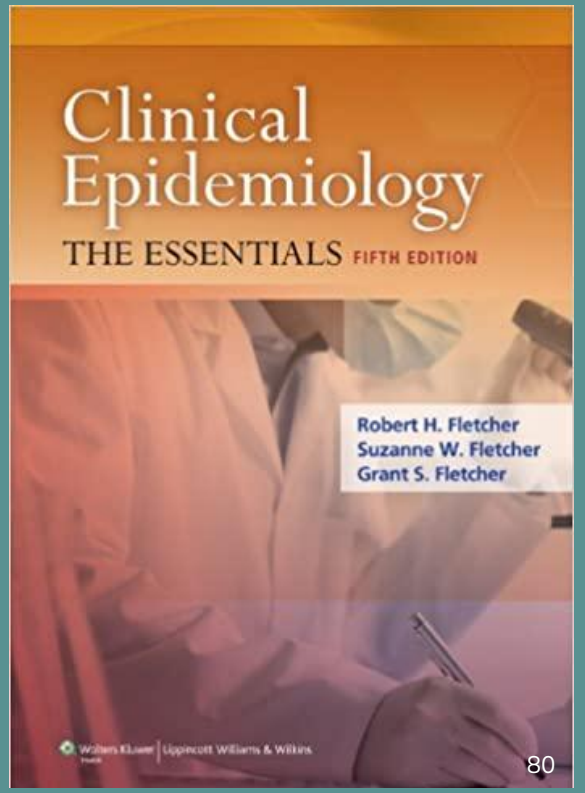
Ill-Equipped Command Structure

Decision Disjunction: The Relationship Between Defuse Decision Makers and Hazy Lockdown Arrangements

- Different political authorities are instituting such restrictions independently of each other
- Imprecise
- Geographically variable
- Markers to establish and discontinue such arrangements have no standardization
- Many metrics have been hashed out of thin air with no attention or knowledge of secondary losses referable to such restrictions

Some of my Best Friends Are Epidemiologists

- An unusual challenge
- Risk/Benefit Ratio suffering from a restricted view of risk
- Lack of a clear understanding of the side effects of isolation policies
- Epidemiological playbook doesn't work well in a globalized society
    - Classic collective action problem: if everyone doesn't buy in, it doesn't work



Political Infighting and Ineptitude

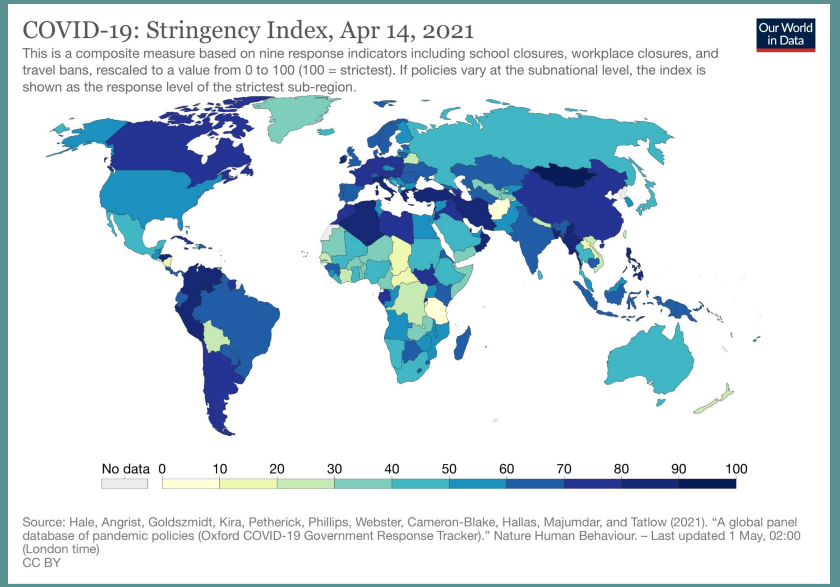
August 25, 1944

Major Error #7

Variegated, Inadequate Response by a Fragile, Unready World Order

Varying Efficacies of Lockdown Arrangements: 4 Broad Categories

1. Little to no lockdown arrangements
   a. Mostly developing countries
2. “Light Touch” policies like Sweden’s
   a. Minimally invasive into society
   b. Relies on social trust
3. Intense, punitive measures like China
   a. Total cessation of movement enforced
   b. Cities locked down tight, borders totally closed
4. Mixed programs like the US
   a. Emphasis on masks, social distancing
   b. Some areas of economy totally locked down, some not; seemingly indefinite



Authoritarian regimes have an advantage

Enforcement Protocols Depend Upon Degrees of Societal Trust and Authoritarian State Power

High Trust Societies: Scandinavia
Control Mechanisms:
Social Trust and Social Pressure

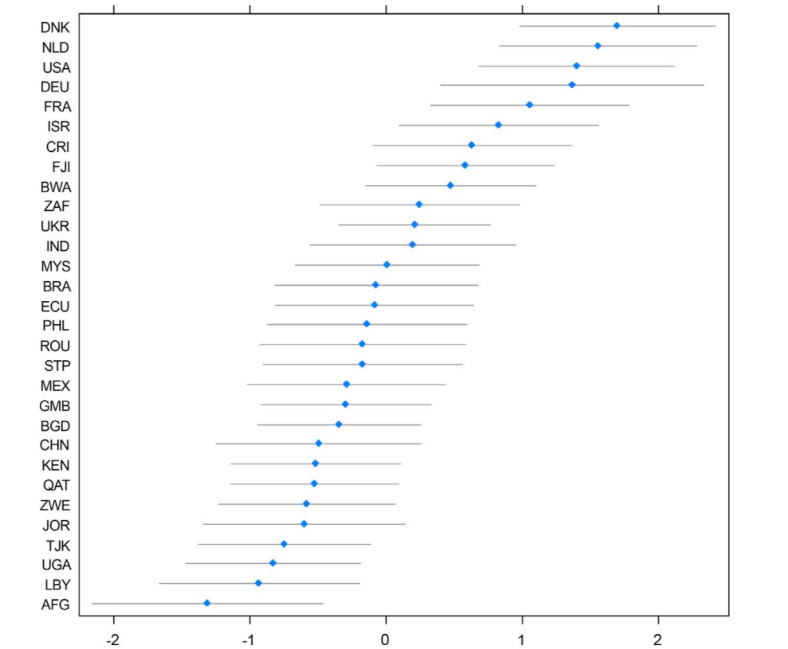


Fig. 2. Mean trust scores for a sample of countries.

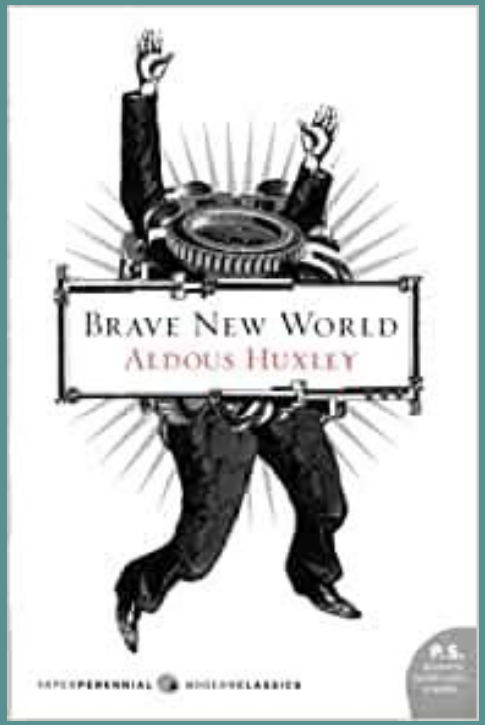
A Particular United States Control Mechanism: The Torte System

Control Mechanism: The Wergild

Expanded Duty and Increased Injured Party Compensation

Control Mechanisms:
CDC Guidelines Trigger the Torte System

Totalitarian Societies



Information Control

Fear

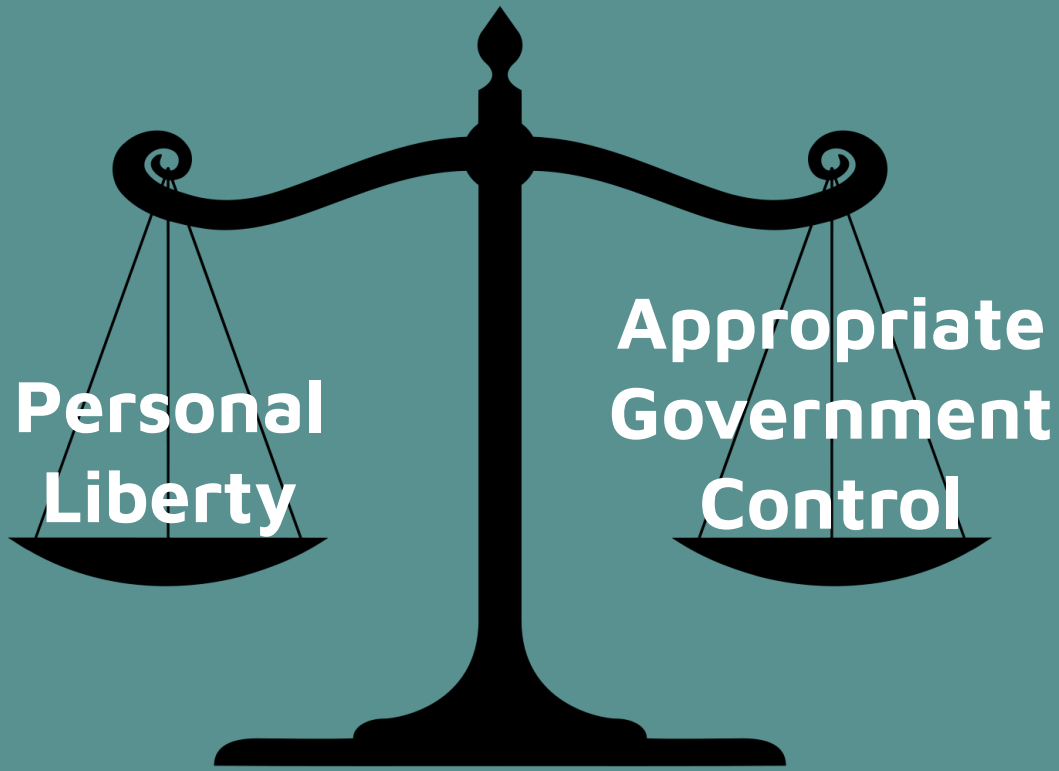
Major Error #8

Not Understanding the Limitations of Control Policies

- Misunderstanding Cultural Limitations
- Underestimating Side Effects of Isolation Policies

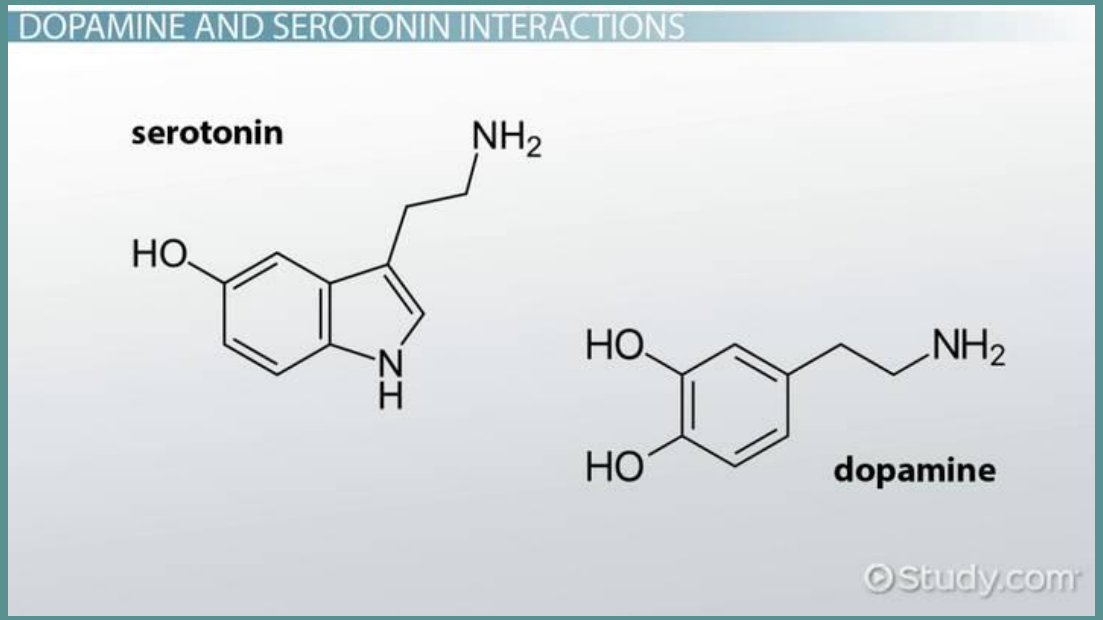
Submarine vs. The Frontiersman

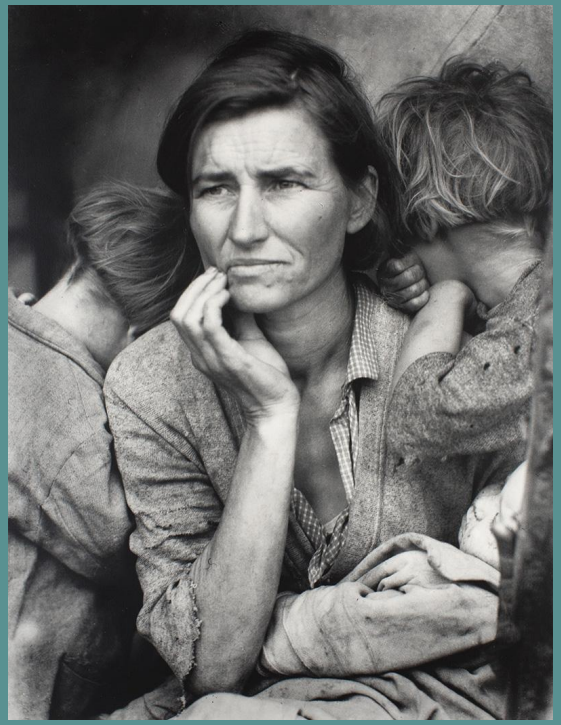
The Balancing Act:



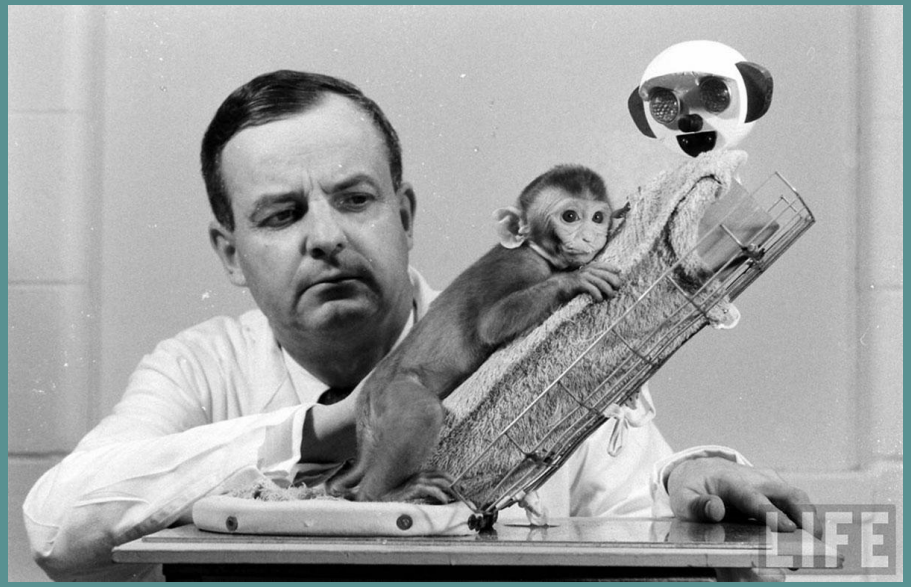
Isolation Limits:
Dare I Eat a Peach?

Misunderstanding Neurotransmitters





Necessary Human Connection



Psychological and Emotional Strain

What Went Right

Vaccines

Incredible Vaccine Progress

AstraZeneca's Coronavirus Vaccine, Easy and Cheap to Produce, Appears Effective

In an early analysis, the drug maker zeroed in on a promising dosing plan for its vaccine.

Early Data Show Moderna's Coronavirus Vaccine Is 94.5% Effective

Moderna is the second company to report preliminary results from a large trial testing a vaccine. But there are still months to go before it will be widely available to the public.

U.K. Approves Pfizer Coronavirus Vaccine, a First in the West

The emergency approval, ahead of the United States and the European Union, clears the way for Britain to begin mass inoculations. "Help is on its way," one official said.

New Pfizer Results: Coronavirus Vaccine Is Safe and 95% Effective

The company said it planned to apply for emergency approval from the Food and Drug Administration "within days."

Vladimir Putin Has a Vaccine, and He's Rushing to Share It

Vaccine Unproven? No Problem in China, Where People Scramble for Shots

Major Error #9

Confused and Unresolved Worldwide Vaccine Access

Questions Arise

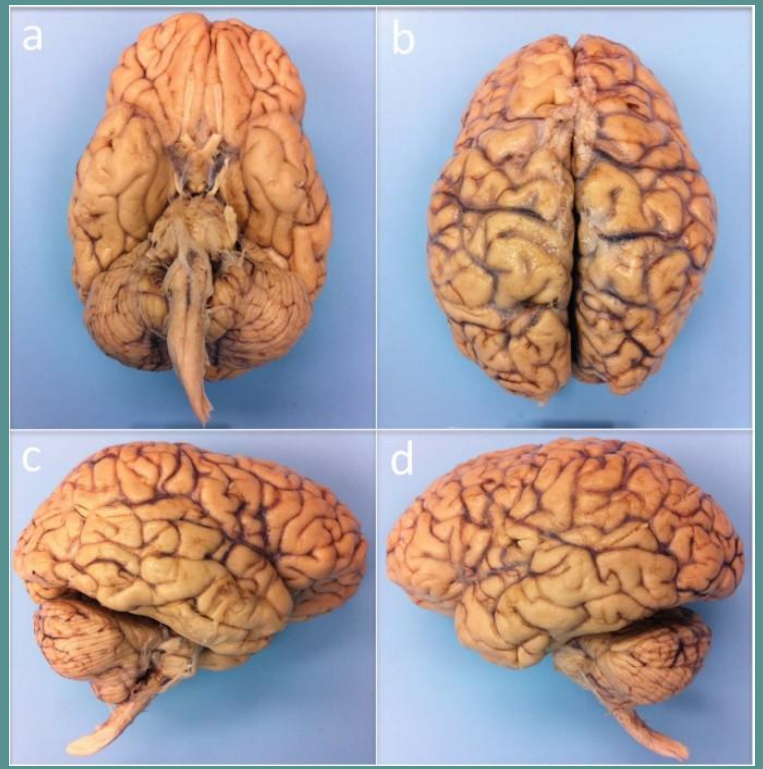
- Should it be mandatory?
  - Locally? Nationally?
- Will it be available worldwide?
- Is repeat dosage required?
- How effective is it?
- How will nation-state competition on vaccine creation affect deployment?
- How much will it cost?
- Will it take us out of the lockdown?
- What are the side effects? (long term and short term)
- What is the benefit to at-risk populations?

Mutations: Necessitating Expeditious Worldwide Vaccination

The Conundrum:

Who Receives its Benefits?

- The selfish brain
- Rich vs. poor
- Young vs. old
- Urban vs. rural
- Healthy vs. impaired



Moreover

Nation-State Restrictions and Rivalry

The Future: 2021 and Beyond

Not Altogether a Rose Garden

A Lingering Healthcare Crisis?

The Appearance of Unrecognized, Virus-Caused Organ Damage

- Some evidence of long term organ damage post-infection, little knowledge of severity of such complications
- Secondary gain may influence the appearance of such complaints
- Increased litigation referable to untoward viral exposure

Lingering Worldwide Destabilization Referable to the Aftereffects of the World Pandemic


More Waves Ahead,
But Diminished


Sunshine Can Appear

Choosing the Right Policy

- As the coronavirus appears to come in waves, what kind of restriction employment over a long period of time is going to produce the most advantage with the smallest negative impact?
- What is the likelihood of a particular geographical area to be efficiently protected by early, costly, draconian lockdowns to prevent any viral damage to a protected population?
- Assuming such policies are successful, the difficulty would be that because of transportation and normal human movements the protected population after substantial sacrifice would be vulnerable to repeated outbreaks of viral contagion
- Arguably, the Swedish policy allowing the early-on development of herd immunity might be more successful
- However, If widespread available vaccination appears, then the policy employed by countries such as New Zealand might be the most effective
- The question remains less clear in continental situations in which initial isolation is less effective and where for many reasons restrictive social contact is culturally unacceptable

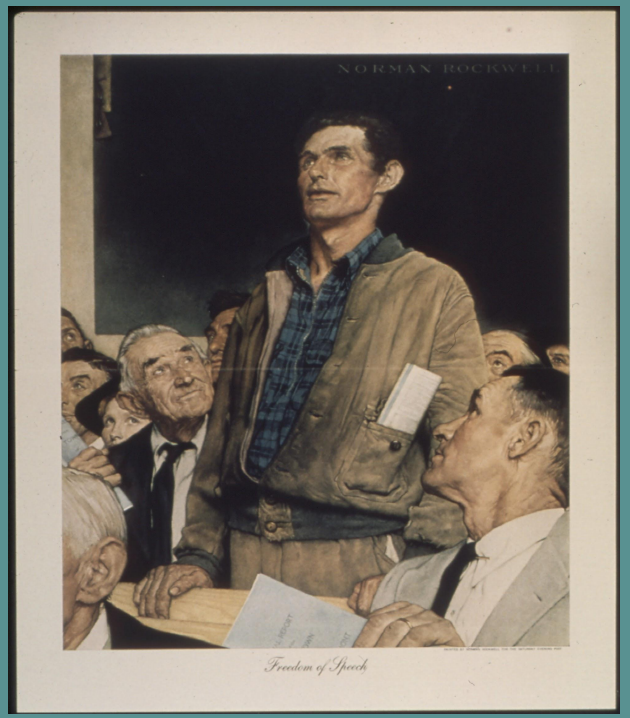
The Great Barrington Declaration

Dr. Martin Kulldorff (L, Harvard), Dr. Sunetra Gupta (C, Oxford), and Dr. Jay Bhattacharya (R, Stanford)

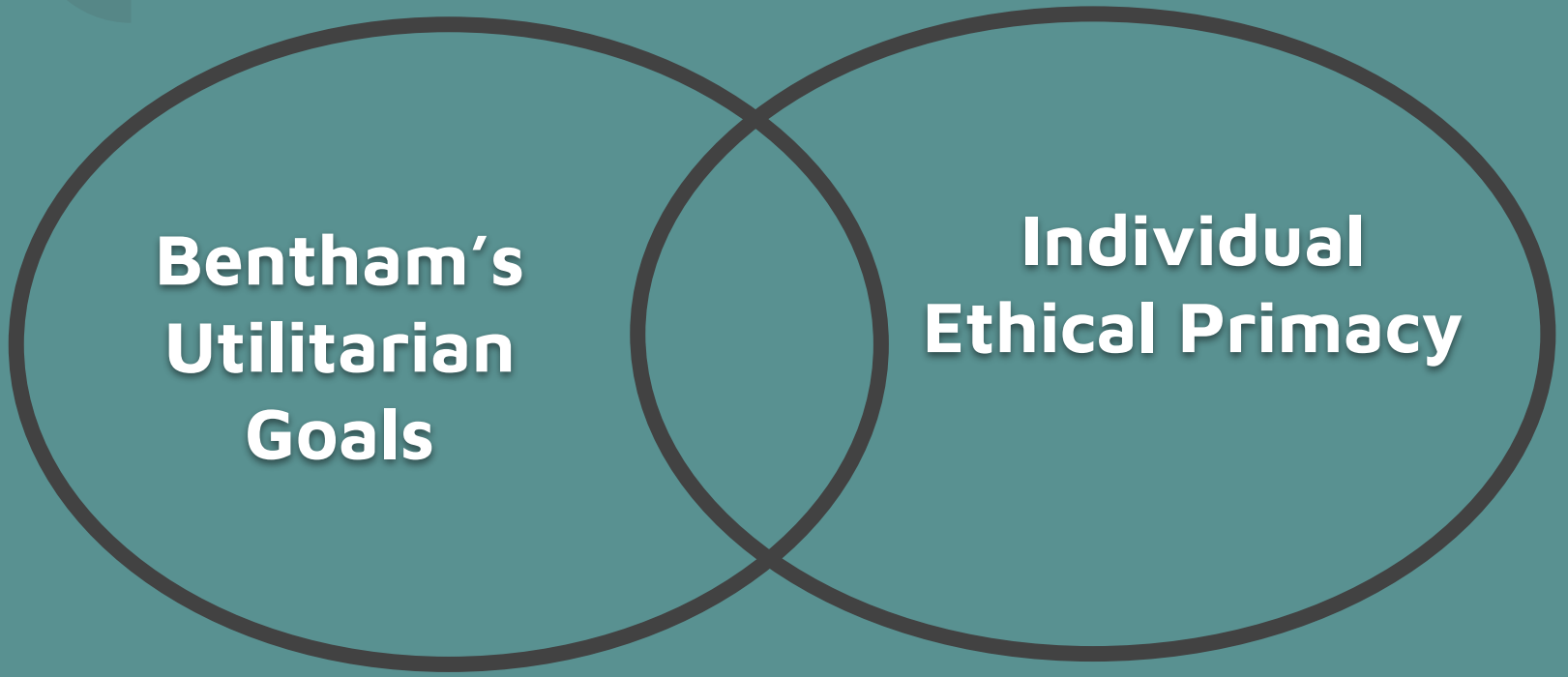
Risk/Cost
Benefit

A Smart Bomb: Targeted Isolation

Is Authoritarianism the Future, Or Will Democracy Adapt?



An Ethical Dilemma



Comparing China and the US*

#	Country, Other	Total Cases	New Cases	Total Deaths	New Deaths	Total Recovered	Active Cases	Serious, Critical	Tot Cases/ 1M pop	Deaths/ 1M pop	Total Tests	Tests/ 1M pop	Population
1	China	90,655	+13	4,636		85,691	328	3	63	3	160,000,000	111,163	1,439,323,776
#	Country, Other	Total Cases	New Cases	Total Deaths	New Deaths	Total Recovered	Active Cases	Serious, Critical	Tot Cases/ 1M pop	Deaths/ 1M pop	Total Tests	Tests/ 1M pop	Population
1	USA	33,103,974	+59,906	590,055	+784	25,710,142	6,803,777	9,625	99,527	1,774	446,627,197	1,342,790	332,611,450

- US GDP (2019): $21.374 trillion; 2.3% growth rate in 2019; -4% growth rate for 2020
- Chinese GDP (2019): $14.342 trillion; 6.1% growth rate in 2019; 2% growth rate projected for 2020

*As of May 1, 2021

Why Has China Presumably Fared So Well?

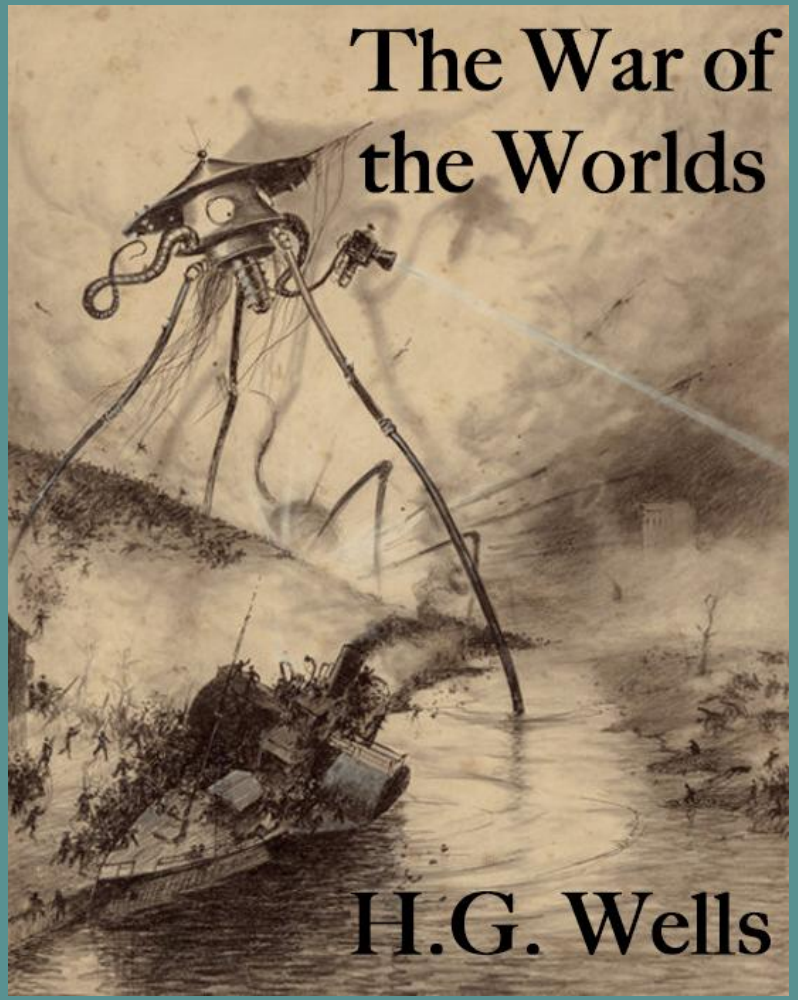
- Less obesity and other major comorbidities
- Possible intrinsic T-cell immunity referable to earlier coronavirus outbreaks
- Though in major metropolitan areas in international purview the great government power has demonstrated the benefits of a rigorous lockdown arrangement
- The population at risk from a utilitarian national power approach is expendable
  - 1.4 billion people
  - Population control, legacy of the “one child policy”
  - Compulsory retirement at age 60
  - The acceptance of old age and death may be less odious than in the West
- It thus may be imagined that the government would not impose economically damaging restrictions easily
- As statistics are totally under government control, and that internet censorship exists about reporting major coronavirus outbreaks, the government may have chosen to avoid alarming the population by ignoring the deaths of a non-productive population

A Mission for the World Order

A Rising Tide Lifts All Ships

All Humanity Against the Virus:

A Useful War Analogy



League of Nations (1919): An Inadequate Post-War Response

United Nations (1945):
A Better But Incomplete Post-War Response

A New San Francisco Conference:
Worldwide Collaboration Against Pandemics

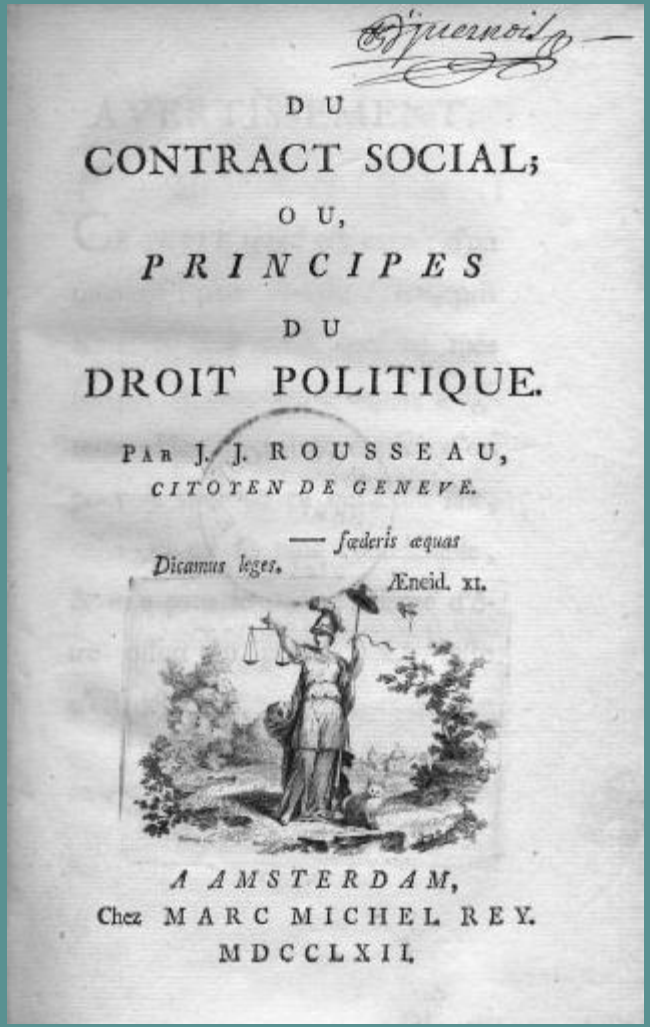
Worldwide Assessment of Humanity's War Against the Coronavirus and Propagation of Future Strategies Against Such Perils

- Better data
- Artificial Intelligence
- Understanding Genetic Differences
- Worldwide Policy

Understanding the Necessity of Maintaining Social Trust

Understanding the Need for a More Responsive World Order and a New and Universal Social Contract in the Face of An Unperfected, Atavistic Human Brain:

A Salutary Impact of the Coronavirus Pandemic

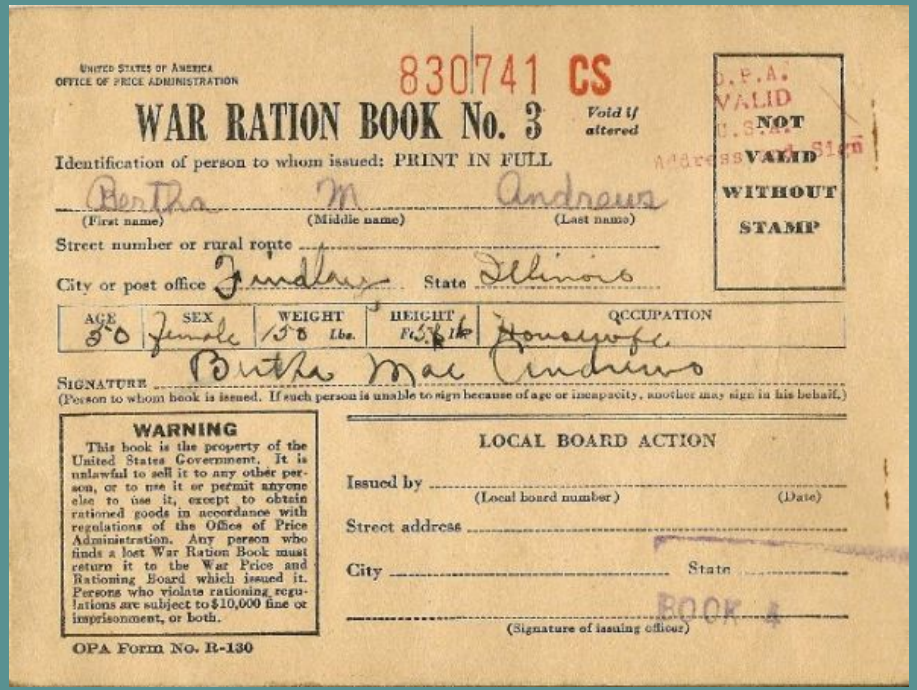


What Can Doctors Do?

Don’t Ignore the Problem

Don’t be Marginalized

Be Aware of Patients Not Getting Care Due to Rationing



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830741 CS

WAR RATION BOOK No. 3

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O.P.A. VALID NOT VALID WITHOUT STAMP

Identification of person to whom issued: PRINT IN FULL

Bertha M Andrews
(First name) (Middle name) (Last name)

Street number or rural route

City or post office Sundale State Illinois

AGE	SEX	WEIGHT	HEIGHT	OCCUPATION
50	female	155 Lbs.	5' 3"	Housewife

SIGNATURE Bertha Mae Andrews
(Person to whom book is issued. If such person is unable to sign because of age or incapacity, another may sign in his behalf.)

WARNING

This book is the property of the United States Government. It is unlawful to sell it to any other person, or to use it or permit anyone else to use it, except to obtain rationed goods in accordance with regulations of the Office of Price Administration. Any person who finds a lost War Ration Book must return it to the War Price and Rationing Board which issued it. Persons who violate rationing regulations are subject to $10,000 fine or imprisonment, or both.

OPA FORM NO. R-130

LOCAL BOARD ACTION

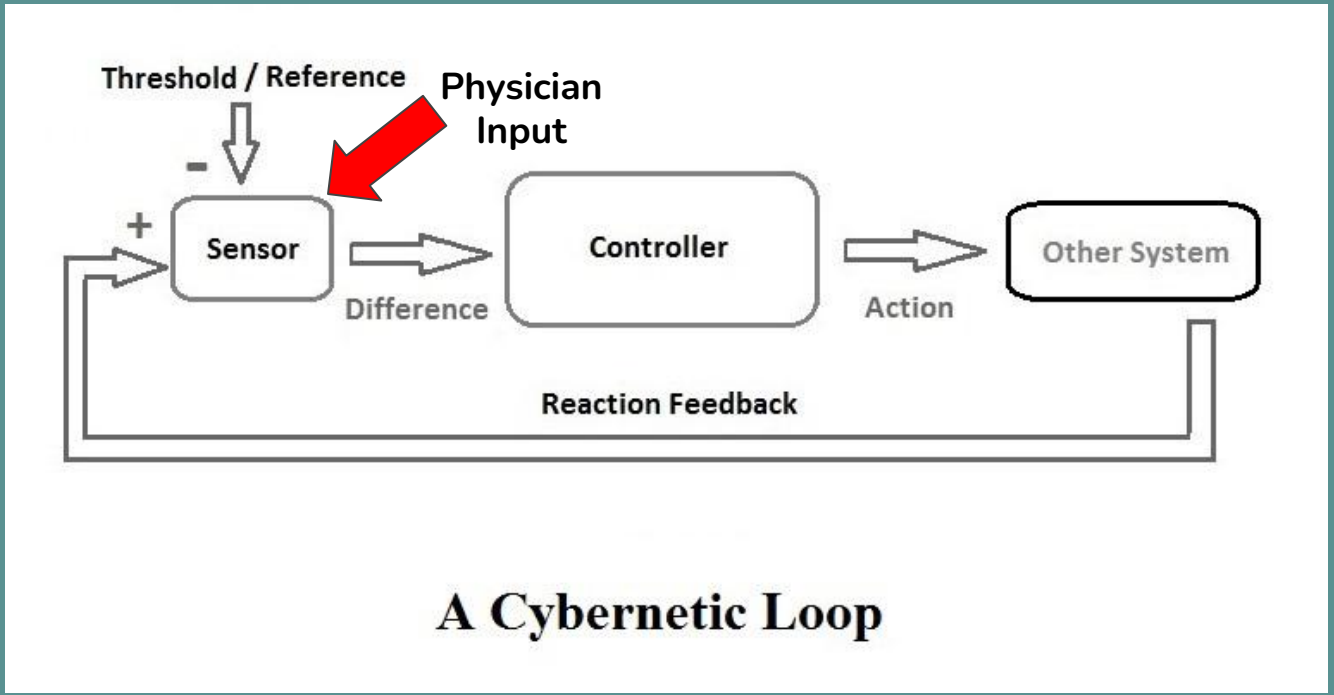
Issued by
(Local board number) (Date)

Street address

City State

BOOK 3
(Signature of issuing officer)

Doctor Input

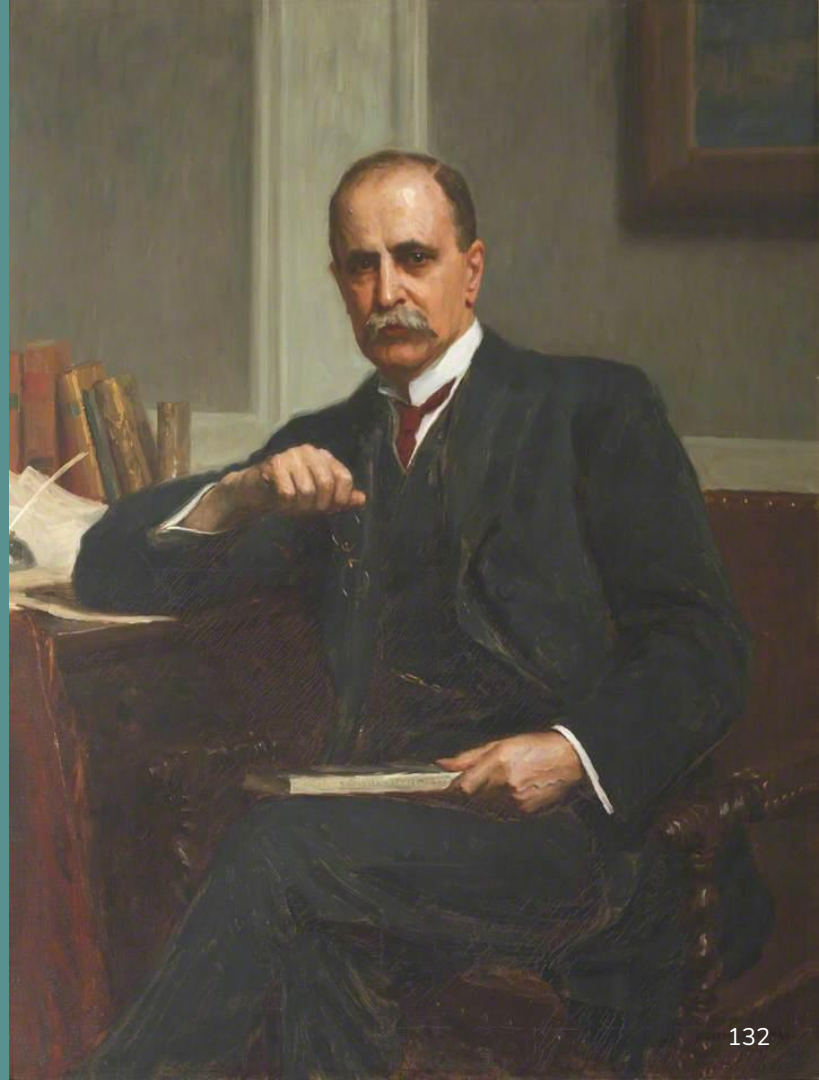


A Cybernetic Loop

The Doctor-Patient Relationship is Sacrosanct

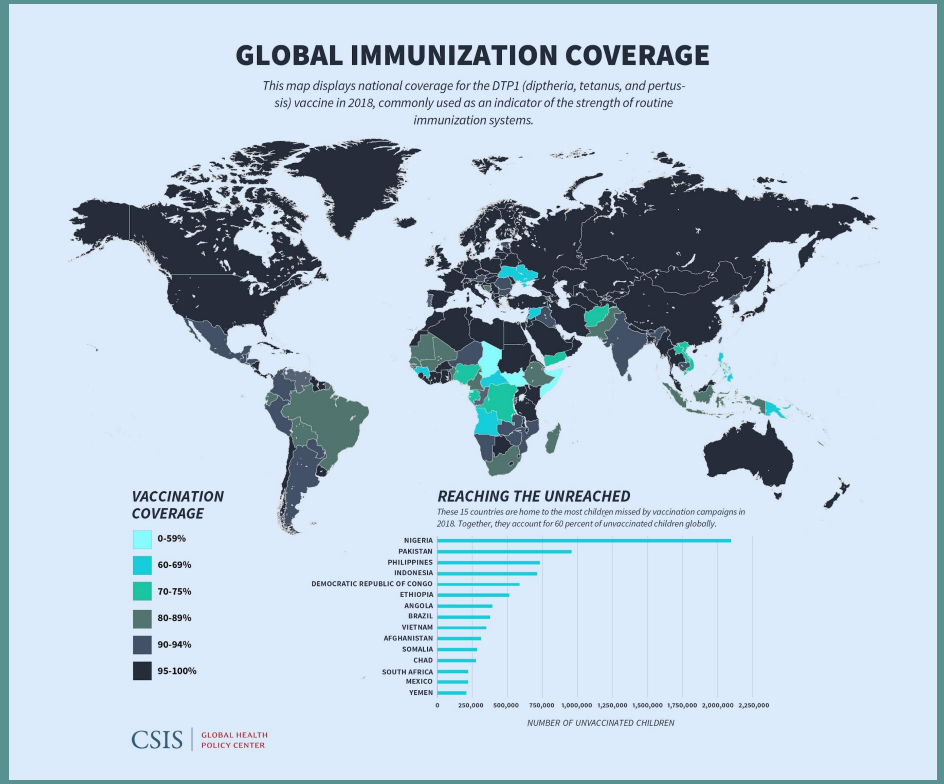
Keep the Patient's Best Interests at the Center

- What is the best thing for the patient?
- What gives the patient the best quality of life going forward?
- "Pneumonia is the old man's friend" - Sir William Osler

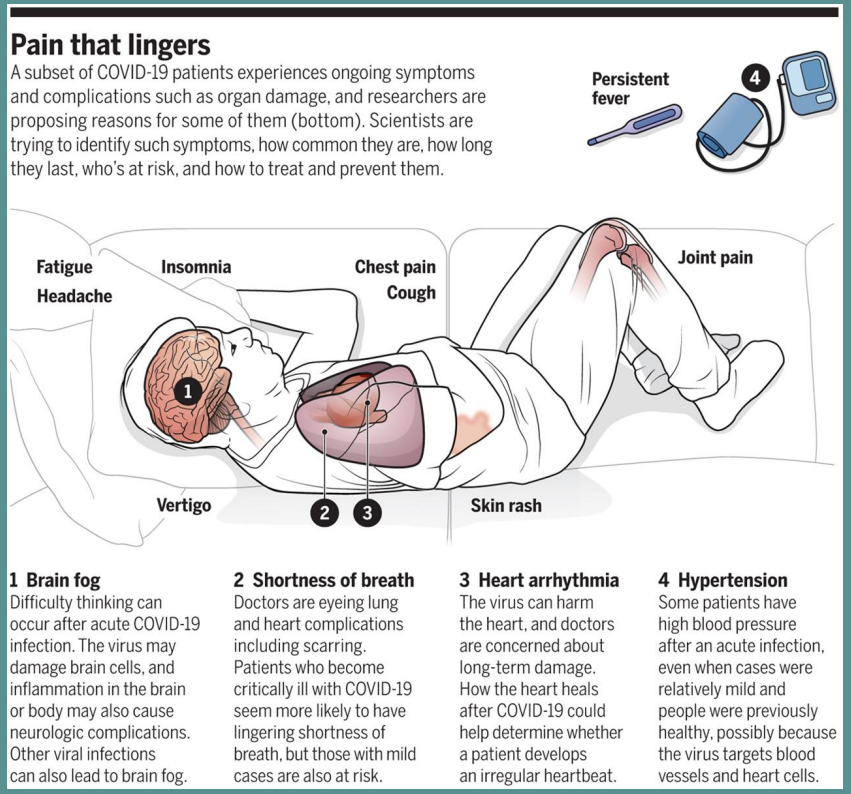


Support an Improved Public Health Apparatus

Advocate Global Vaccination



Look for Long-Term Organ Damage



A Place at the Table


Thank You!