

GREAT DECISIONS

Pandemic Preparedness

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The Overview

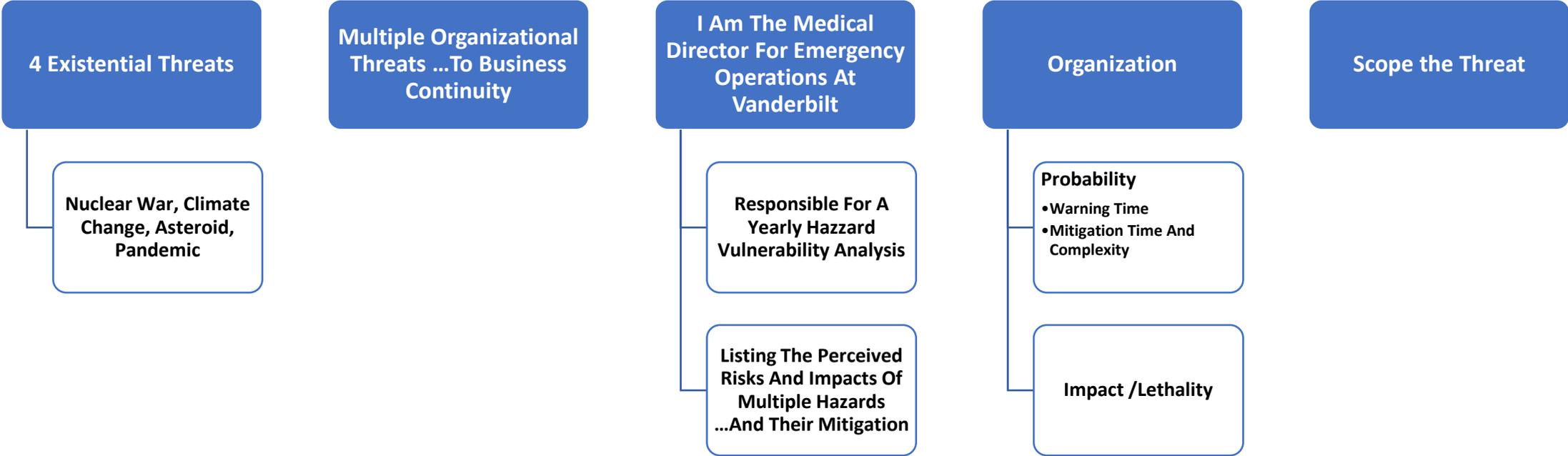
How To Think About Emerging Threats

General Principles Of Pandemic Preparedness

Steps In Preparation

One Man's View

Threat Matrix



Process of “Scoping” A Threat

Historical Context

- Plague, Smallpox Cholera

The Great Influenza Pandemic 1919 The “Spanish Flu”

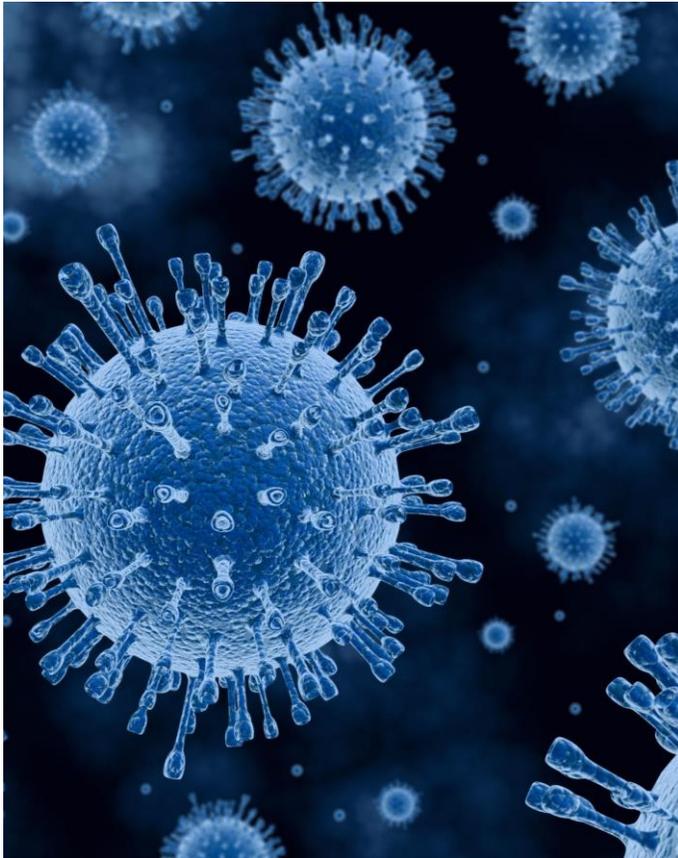
- The Great influenza By John Barry

Polio HIV SARS Ebola

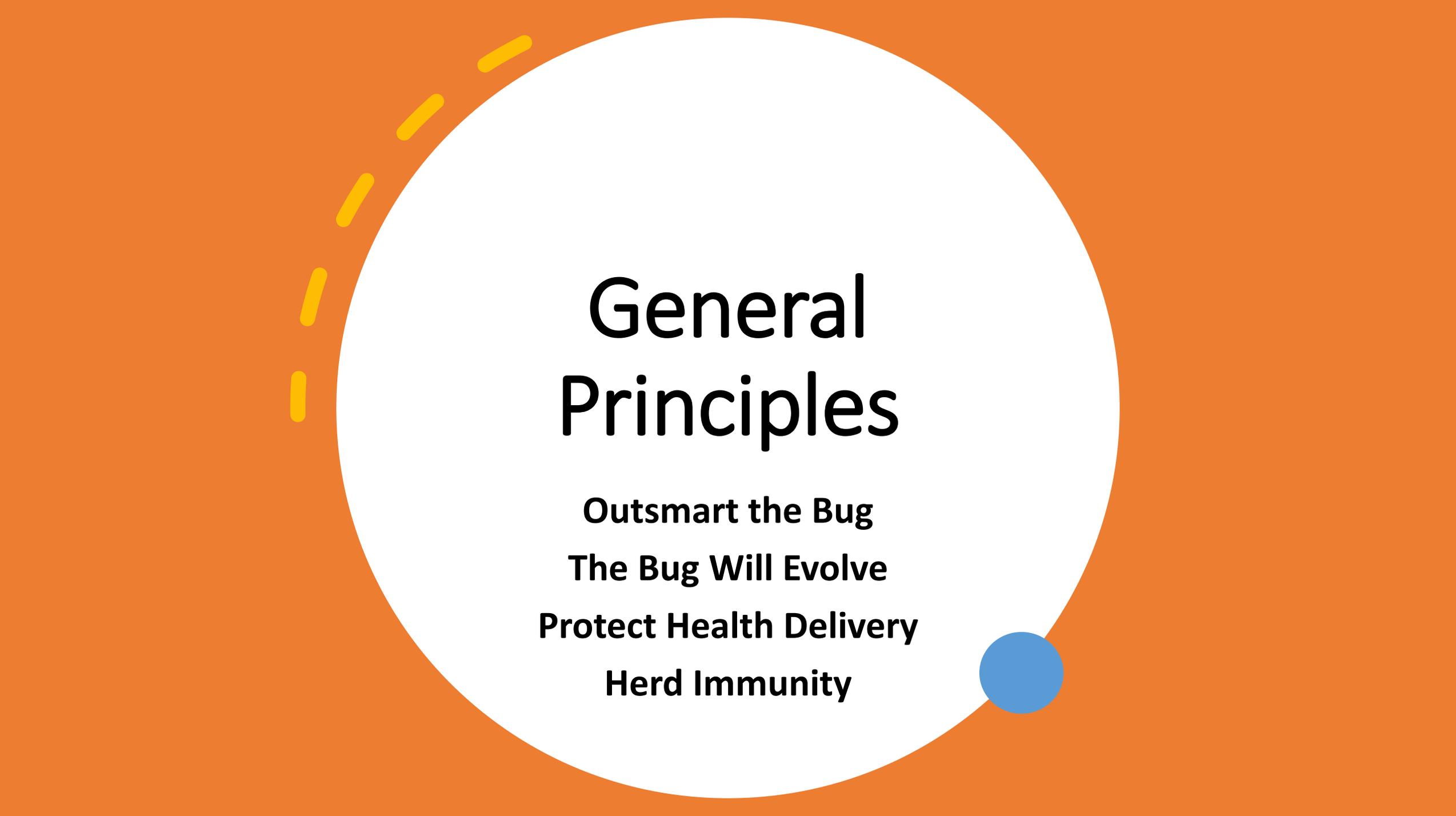
Well Recognized Cycles Of Pandemics 100 Years / Epidemics 20 Years

- Pandemic On VUMC Hazard Vulnerability Analysis
- For Last 10 Years

Evolution & the Microbiome



- **The Microbiome:**
 - **Humans Coexist With A Global Array Of Microbes:**
 - Prions, Bacteria, Rickettsia, Fungi ,Viruses
 - **Outweighs Every Other Component Of The World's Biomass Combined**
- **Evolution Is The Force That Drives Diversity**
 - **It Is Based On Stress**
 - **The Better An Organism Of Any Size Adapts To Stress**
 - The Better It's Survival Chances
 - **Microbes Are Hyper Evolutionary**
 - **A Human Generation Is 25 Years / A Viruses' Generation Is 25 Minutes**
 - **For 3 Billion Years All Evolution Involved Microbes**
 - **They Were Here Before Us And They Will Be Here After Us**
- **We Humans Are The Newcomers**
 - **Trying To Anticipate And Respond To Their Evolution**



General Principles

Outsmart the Bug
The Bug Will Evolve
Protect Health Delivery
Herd Immunity

General Principles

Overtime The Bug Will Evolve to Maximize Its Ability To Reproduce

- **More Transmissible Less Lethal**

The Key To Weathering A Pandemic: Protect Health Delivery

- **Healthcare /Nutrition /Power infrastructure**
- **The Concept of the Essential Worker**

The Canary In The Cage:

- **Viability Of The Health System: Hospitals & Health Delivery Systems**
 - **If The Health System Is Overwhelmed Viral Lethality Increases**
 - **Loss Of Control Of Other Lethal Diseases Such As Cancer And Heart Disease**

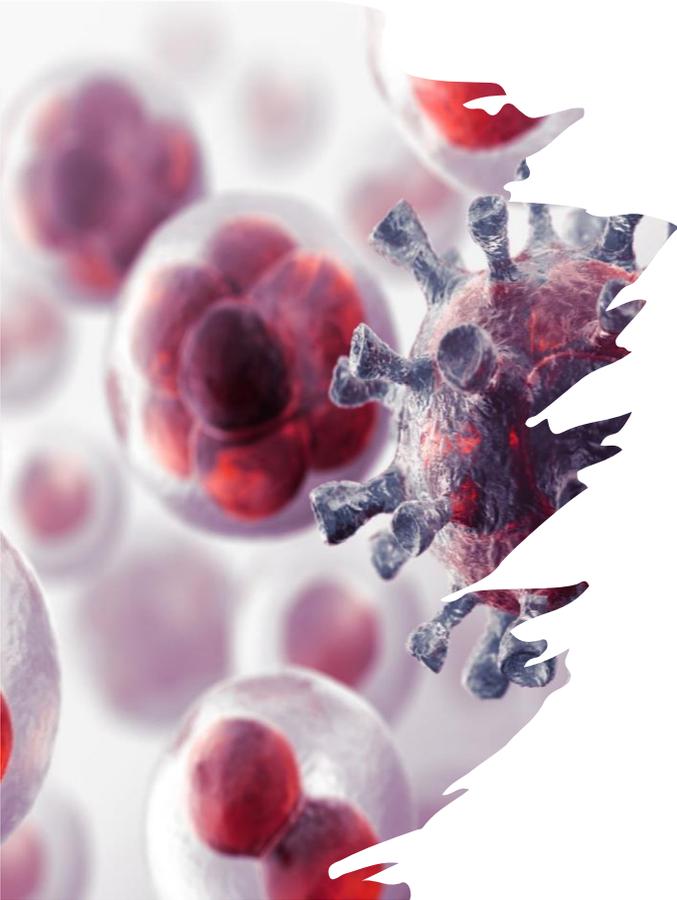
General Principles

- **Apply NPIs: Non-Pharmacologic Interventions**
 - **In A Phased Fashion**
 - Handwashing / Remote Work
 - PPEs And Masking
 - Isolation
 - Lockdown
- **Relax: As Soon As Possible**
- **The Metric: Status Of The Healthcare System**
- **The Goal:**
 - **Support The Health System Until Herd Immunity Achieved**



Herd Immunity

- **Concept of Indirect Protection:**
 - **When Sufficient Percentage of A Population ...Becomes Immune To Infection**
 - Whether Through Previous Infection or Vaccination
 - **GOAL:**
 - **Reduce Risk In Individuals Who Lack Immunity**
 - Once Herd Immunity Is Achieved:
 - The Disease Gradually Disappears ...or Mutates





Building Blocks of Pandemic Preparation

7 Steps In the Process of Preparation

7 Steps of Pandemic Preparation

Surveillance

- **Disease Surveillance: Prevalence & Geography**
- **Genetic Surveillance: Is The Virus Mutating For The Good / Bad**

Isolation & Identification (Novel Pathogen)

Sequencing

Test Development & Distribution

Vaccine Design & Testing

- **Entirely Novel Clinical Trial Model: 40,000 Patients/ 3 Different Designs: In 7 Months**

Mass Production: 600 M Doses ...Over time

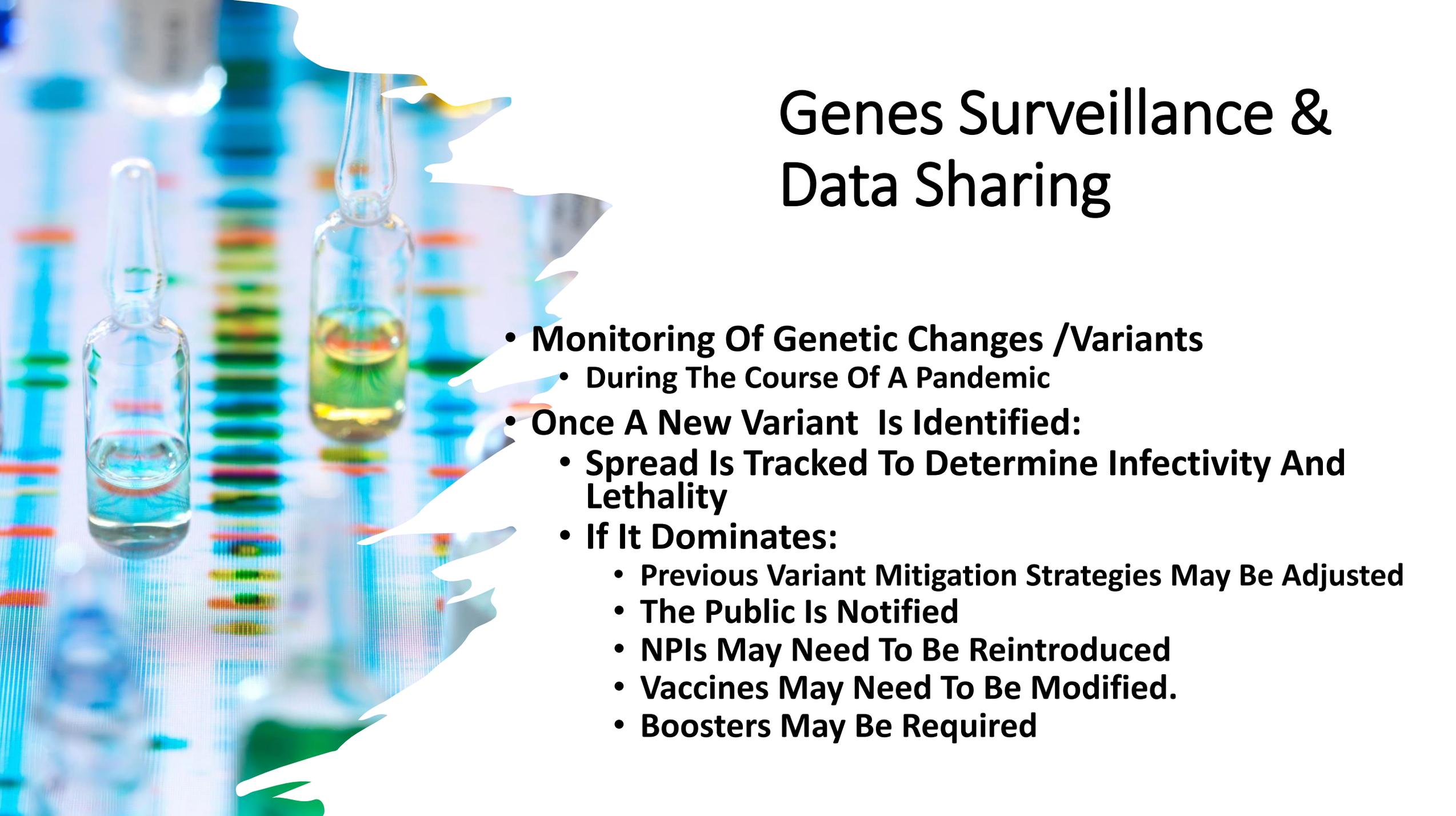
Distribution & Communication

- **Populations At Risk Elderly / Young/ Immunocompromised**
- **Developed World / Global South**

Surveillance & Data Sharing



- **Disease Surveillance**
 - **Global Monitoring/Data Collection**
 - **The Creation Of New Platforms & New Problems**
 - **Social Media**
 - **Google Search**
 - **Community Waste Sampling**
 - **But Requires Global Buy In (Lesson Learned)**
 - **China's Initial Reluctance To Share Data**
 - **US: No National System To Share**
 - **With States & Providers**
 - **NHS In UK Israel & South Africa**

A laboratory setting with several glass vials and test tubes containing liquids of various colors (blue, green, yellow, orange) on a reflective surface. The background is slightly blurred, focusing attention on the foreground objects.

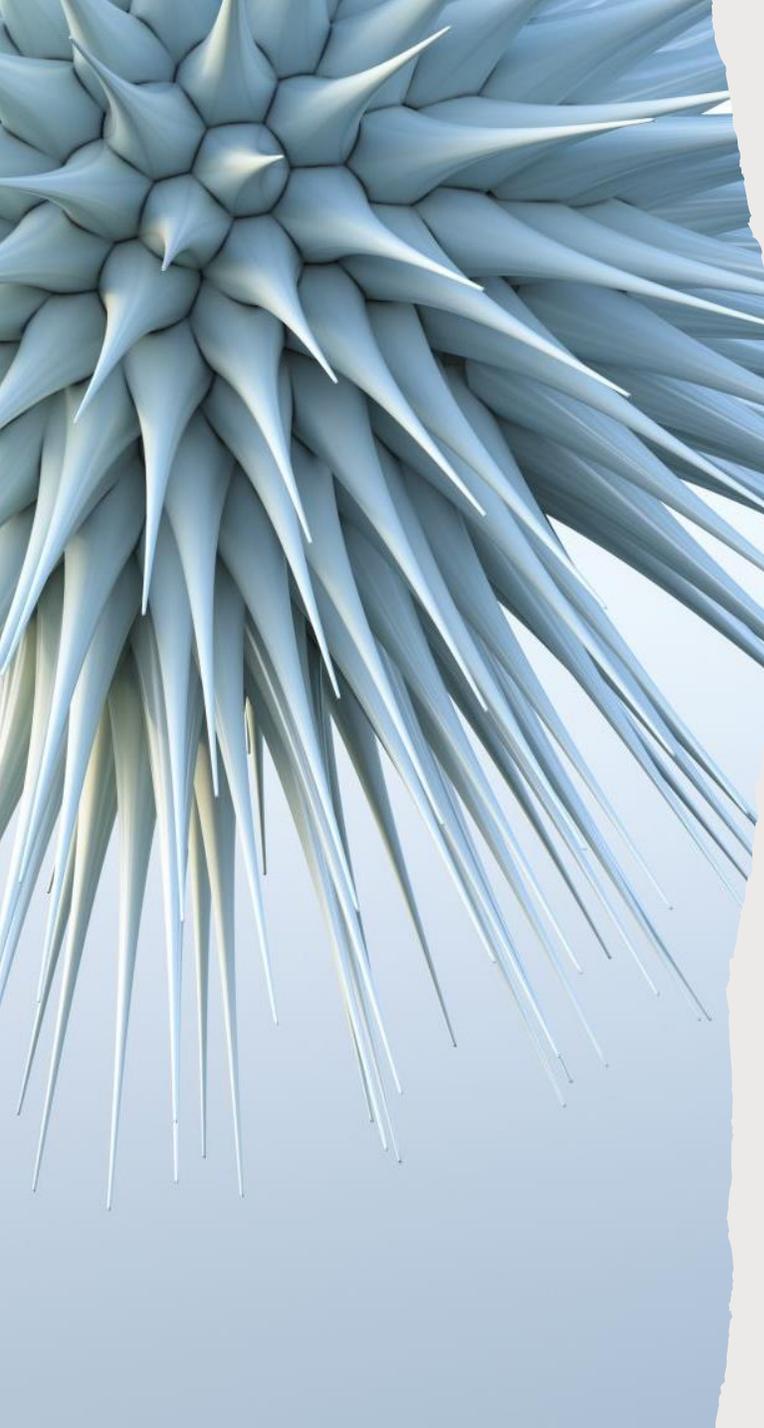
Genes Surveillance & Data Sharing

- **Monitoring Of Genetic Changes /Variants**
 - **During The Course Of A Pandemic**
- **Once A New Variant Is Identified:**
 - **Spread Is Tracked To Determine Infectivity And Lethality**
 - **If It Dominates:**
 - **Previous Variant Mitigation Strategies May Be Adjusted**
 - **The Public Is Notified**
 - **NPIs May Need To Be Reintroduced**
 - **Vaccines May Need To Be Modified.**
 - **Boosters May Be Required**



Isolation and Identification

- **Once A Potential Out Break Is Identified**
- **Specialized Teams Are Dispatched To Collect Samples**
- **Which Are Returned To A Lab And Genus And Species Are Identified**
 - **Sars CoV2 Identified By Chinese In 7 Days (Jan1)**
 - **12 Days To Sequence And Share**
 - **30 Days To Global Health Emergency**
 - **March 11 Global Pandemic**
- **The Initial NPIs Are Specific To The Offending Organism**
 - **Respirator**
 - **Body Fluids**
 - **Fomite**



Sequencing: The Golden Egg

- **Novel Pathogen**
 - **Complete Sequencing Of Pathogens Molecular Structure**
 - **Performed Simultaneously In Labs Around The World**
 - **Adoption mRNA Vaccine as a new Strategy**
 - **The Science**
 - **mRNA Codes Antigen (Spike Protein)**
 - **Presented To A Host Cell**
 - **Cell Reproduces The Antigen Within The Cytoplasm**
 - **Displayed Surface Recognized By The Immune System**
 - **Jumpstarting The Immune Response If Virus Becomes Present**
 - **mRNA Process Is Faster Cheaper and More Scalable**
 - **Than Traditional Vaccine Production**
- **Known Pathogen**
 - **Many Have Been Sequenced**
 - **But There Are Insufficient Resources To Create And Test Pharmacologic Solutions**



Traditional Vaccine Design and Testing a 10 Year Process

- **Once The Virus Has Been Sequenced 4 Planning Processes Start:**
 - **Rapid Test Design**
 - **Testing Allows Monitoring of The Virus**
 - **Spread Lethality and Mitigation Strategies**
 - **Vaccine Candidate Determination**
 - **Vaccine Production**
 - **Establishment Of Clinical Trials: 3 Phases**
 - **Safety & Efficacy**
 - **Requires Thousands Of Patients/ Multiple Sites/ And Ethnicities**
 - **Typically Requires 3 -5 Years**
- **SIMULTANOUSLY**

Operation Warp Speed: Concepts

Create

Create A
Government Private
Partnership

- HHS, DOD, Industry
- To Minimize Risk:
Diversify

Maximize

Maximize Industry
Incentives

- Guaranteed Federal
Purchase Independent
of Outcome
- Portfolio of Candidates

Eliminate

Eliminate Barriers

- Logistical / Political /
Bureaucratic

Stack

Stack Processes To
Occur
Simultaneously Not
Sequentially

- Selection, Production,
Trials & FDA Approval

A photograph of laboratory glassware on a green shelf. From left to right: an Erlenmeyer flask containing blue liquid, a beaker with a scale (0, 50, 100, 150, 200 ml) containing blue liquid, and a test tube containing blue liquid. The background is a blurred laboratory setting.

Production: Fertile Ground

- **Pre Covid Virtually All Production Facilities Located 1st World.**
 - **Exception India**
 - **Facilities Are Technical And Expensive**
- **Solution: Regional Production ...Global South**
 - **Once The Offending Organism Is Identified Production Is Dispersed.**
- **What Happens To These Facilities During Non Pandemic Time?**
- **How Is The Vaccine Developer Compensated?**

Distribution

- **The Problems:**
 - **Super Cooling**
 - **Scheduled Booster**
 - **Initial Quantities Of The Vaccine Will Be Limited**
 - **Who Gets It First? ...Vaccine Triage**
- **The Population Dilemma**
 - **A Global Distribution Model?**
 - **No Political Leader Will Send A Nationally Produced Vaccine Out Of Country While Voters Are Waiting.**
 - **Solution: A Distributed Production Model**
 - **Need To Solve The IP Rights Issue**
 - **National Distribution Model**
 - **Essential Services: Need A Solid Definition Pre-event**
 - **High Risk/High Productivity**



Distribution: “The Last Mile”



- **Feds Hands The Distribution To The States**
 - **Falls To The Public Health Sector**
 - **No Infrastructure ...Underfunded For Years.**
 - **States Look To The Private Sector**
 - **Health Systems /Pharmacies / “Good Samaritans”**
 - **Recipe For Unequal Distribution**
 - **Compounded By Cold Storage And Requirement For Booster**
 - **Many Health Systems Lacked Cold Storage Ability**
 - **All Public Health Systems Lacked Ability To Communicate And Schedule**
 - **The Hare And The Tortoise Approach**
 - **Hare: Single large Event, With No Record Keeping, Scheduling Or Triage**
 - **Tortoise: Smaller Daily Scheduled Events Captured In EMR**
 - **VUMC: Chose The Tortoise: 1,000 To 1500 Vaccinations/Day ...7 Days / Week.**
 - **Depending On Vaccine Supply**



Communication: The Message Is The Mission

- **Principles: All We Have To Fear...**
 - **Transparency**
 - **What We Don't Know**
 - **Consistency**
 - **Data Based**
- **What Is The Source of Truth?**
 - **Data Is The Source Of Truth**
 - **Role Of Big Data Platforms And Interconnectivity**
 - **Expect The "Truth" To Change ...As New Data Arrives**
 - **Old Information Is Not Disinformation**
 - **The Role Of Social Media**

Grading the Pandemic Preparation / Response



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Surveillance: Grade B

- Disease Surveillance & Genetic Surveillance

Isolation & Identification (Novel Pathogen): Grade A

Sequencing: Grade A

Test Development & Distribution: Grade C

Vaccine Design & Testing: Grade A

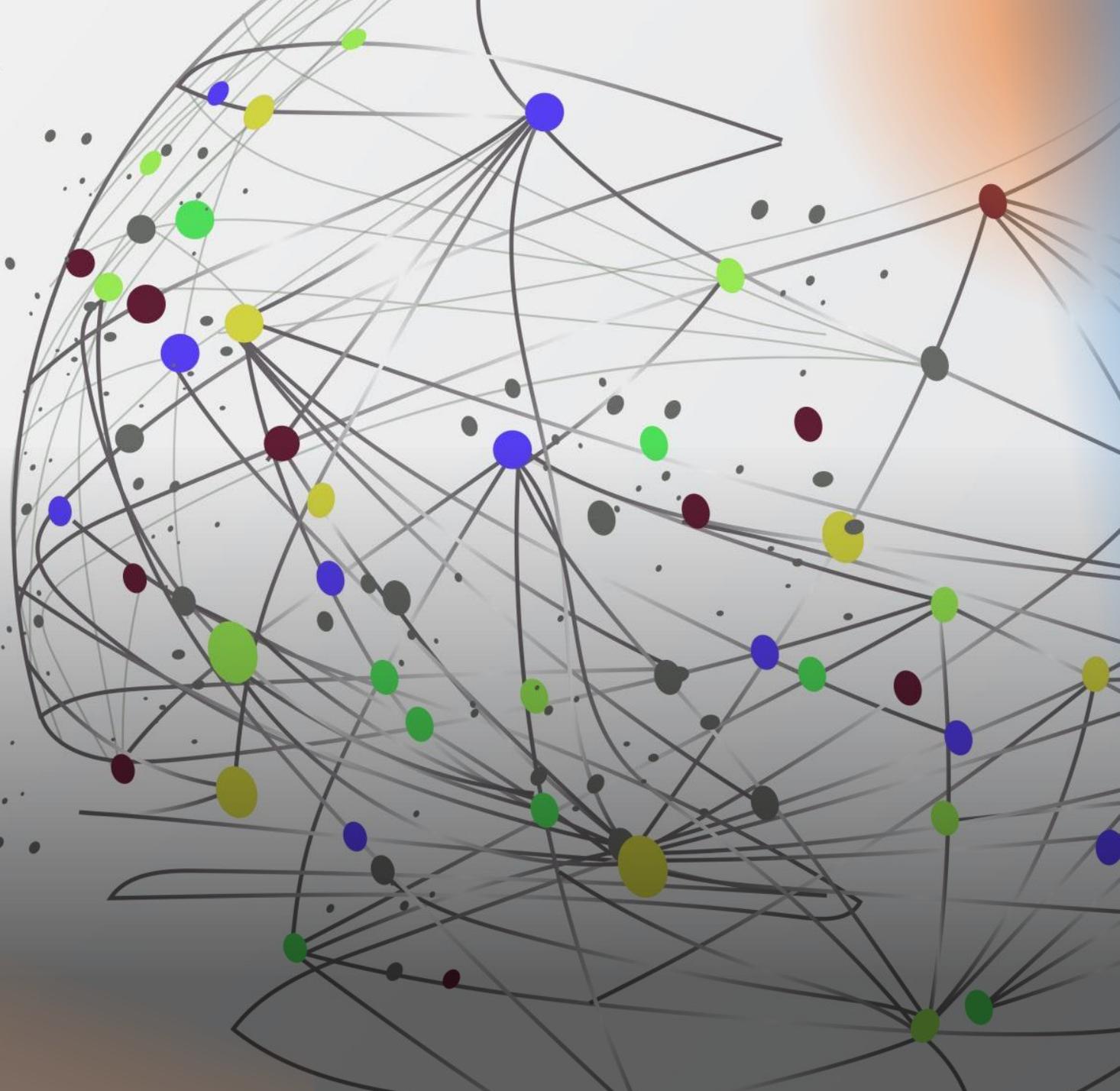
- Warp Speed Was A Tremendous Success

Production: Grade A

Distribution & Communication: Grade D

- Populations At Risk Elderly / Young/ Immunocompromised
- Developed World / Global South

One Man's View



Vanderbilt Medical Center Preparation

- **January Weekly Meetings For Emergency Preparation**
 - **Followed China /Seattle Closely**
- **February Full Pandemic / Surge Planning**
- **March 5th Wilson County Tornado**
- **March 6th VUMC Command Center Opened**
 - **Supply Chain Management**
- **Mid March**
 - **COVID-19 Hotline 32,000 Calls**
 - **Mass Testing Site Staffed (Over 52,000 Assessments)**
- **April:**
 - **Emergency Department Expansion**
 - **The HealthCare weak link Senior Care**
 - **Skilled Nursing Facility Program Consultation And On Site Education**
 - **Hospital At Home**
 - **Hoteling For Staff (Purchased Over 19,000 Hotel Days)**
 - **Hoteling for Patients ...Dead in the Water**



Vanderbilt Medical Center Preparation

- **Mission Shift**
 - **New Staffing Models Initiated**
 - **Faculty And Resident Cross Training**
 - **Remote Work For Back Office Staff**
- **Telehealth**
 - **20,000 Visits A Year To 20,000 Visits A Month**
 - **2500 Physicians Trained In The Use Of Telehealth Over 2 Week Span**
- **Initiated Mass Testing & Vaccination Program**

Staffing: The Point of the Spear

- **The Stress**
 - **Uncertainty**
 - **Will I (My Family) “Get IT”**
 - **Who Will Care For My Children ...School Is Out**
 - **Work Place Changes**
 - **Physical And Mental Exhaustion**
 - **PPE**
 - **Workplace Violence**
 - **Death Alone**
 - **Massive Retraining Program**
- **Staffing And Wellness**
 - **No Lay-offs**
 - **Essential Worker Status**
 - **Hired Over 500 “Travelers”**
 - **Over \$52M In Expense**
 - **Increased Front Line Salaries By 10%**
 - **Hoteling Program: Over 19,000 Nights**

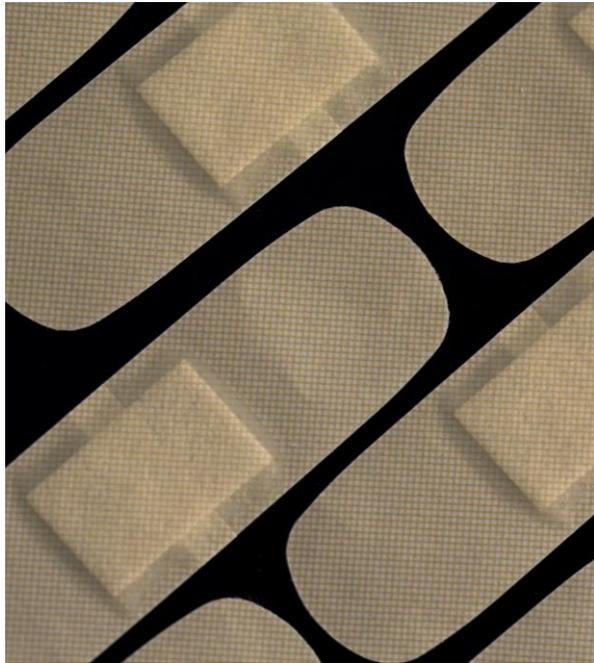


Mass Vaccination

- **Early Decisions**
 - **The Tortoise And The Hare**
 - **The IT Build**
 - **Scheduling**
 - **Booster**
 - **Special Populations Healthcare, Elderly, Educators**
 - **Notification: My Health@vanderbilt**
 - **Triage**
 - **The Medical Record**
 - **Finances**
 - **The Clinical Build**
 - **Location / Staffing**
 - **Homeless Vaccination Program 10,000 Doses**



Mass Vaccination Program



- **Difficult Decisions**
 - **Early Choice of Pfizer Vaccine**
 - **Cold Storage Issues / Need For Boosters**
 - **Despite Moderna Clinical Trial**
 - **Decision To Prioritize Vanderbilt Staff & Patients**
 - **Scheduling and Modulation of Patient Volume**
...Based on Drug Availability
 - **Myhealth@vanderbilt: 2m Users**
 - **Vital Communication Tool**
 - **Patients Were Notified When Eligible**
 - **...According To Federal Guidelines**
 - **Allowed Full Integration With Medical Record**
Allowed Post Vaccination Follow Up
For Long Term Consequences
 - **The IT Build / Parking / Space**
 - **The Tortoise And The Hare Phenomenon**
 - **1,000 – 1,500 Patient Visits A Day**
- **Over 250,000 Vaccinations**

Was The Health System Overwhelmed?

It Depends on Where You Lived

NYC: YES Middle Tennessee ... Dangerously Close

Elective Surgeries Cancelled

134,000 Undiagnosed Cancers

Staffing Ratios Changed

Temporary Beds Were Opened

Science Was Demonized

Healthcare Finances Were Devastated

- Elements Of Rural Healthcare May Never Recover
- The Urban /Rural Healthcare Divide Widened

Summary: How Did We Do As A Nation?

WHAT WE DID WELL

Identification

Genetic Sequencing

Vaccine Development & Testing

Production

Warp Speed

WHAT WE DID BADLY



Surveillance



Supply Chain



Structural Change



Communication

Development of Trust

- Transparency

Areas For Discussion

- **Vaccine Distribution**
 - **How To Triage**
 - **Based On Risk Of Death/Productivity/ Profession**
 - **Healthcare, Educators, Essential Workers**
- **Healthcare Surge Capacity**
 - **Beds /Supply Chain/ Professionals**
- **Long Term Impact ...Disease / Vaccine**
 - **Long Covid /Delayed Care/Education Impact/Remote Work**

Contentious Issues

- **School Closures**
- **Stockpiling Vital Supplies**
 - **Cost / Benefit / Expiration**
- **Surge Planning**
- **Definition of Essential Workers**
- **Diversification of Supply Chain (Friend Sourcing)**