COVID Epidemiology

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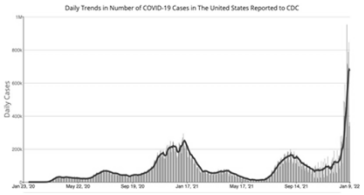
Interpreting the data: Case numbers

- Single day
  - Not all states report daily
  - People often wait until after the weekend to get tested
- 7-day moving averages
  - More reflective of trends



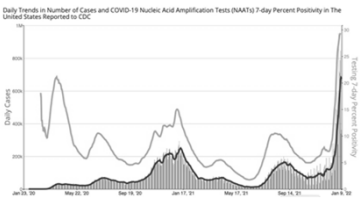
No reports on:
- December 23, 24, 25, & 26
- December 31, January 1, & 2

The problem with case numbers data

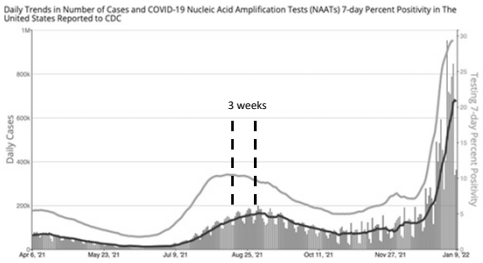
- Always an underestimate
  - Not everyone gets tested
  - Home self-read tests are not reported
- Some geographic areas less accurate than others
  - Regional variation in test availability
  - Regional variation in culture of testing

Testing percent positivity data

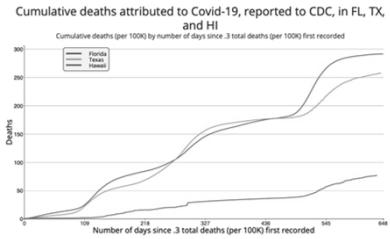
- Correlates with surges
- Begins to rise 1-3 weeks before surges begin
- Can be affected by asymptomatic screening tests:
  - Pre-procedure testing
  - Employee screening



Interpreting the data: Deaths peak 3-4 weeks after cases



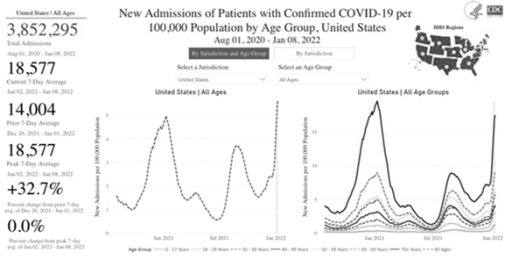
Interpreting the data: Deaths per 100,000 allow better comparisons



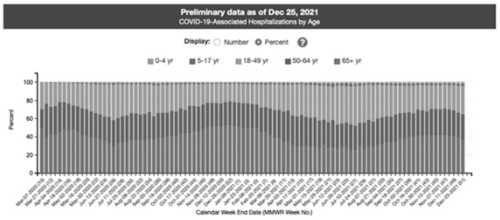
The problem with case death data

- Reliance on death certificates
  - Physicians often do not know circumstances of death when patients die at home
  - If patients are not tested before death, COVID diagnosis goes unknown
  - Physicians sometimes purposefully do not list COVID
- Coroners do not always test for COVID

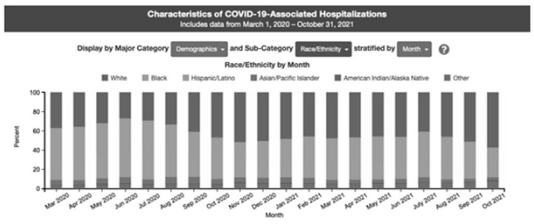
Interpreting the data: Hospitalizations



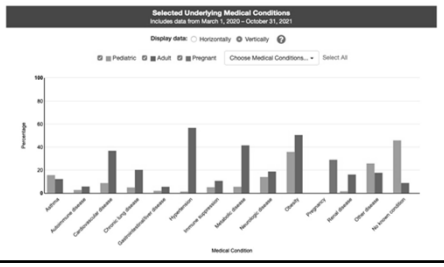
During surges, the elderly comprise a larger percentage of hospitalizations



During surges, minorities comprise a lower percentage of hospitalizations



Hypertension, obesity, diabetes, and cardiovascular disease are the greatest risks

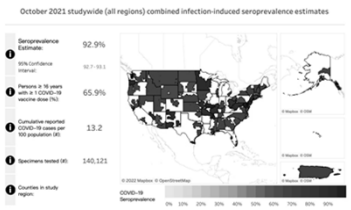


The problem with hospitalization data

- Routine screening picks up asymptomatic patients during non-COVID hospitalizations
- CDC COVID-NET surveillance sample is small and results are based on calculations

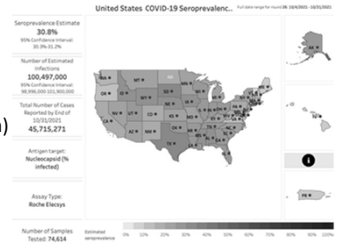
Blood donor seroprevalence program

- Random testing of donated blood for COVID antibodies
- Detects antibodies from infection **and** from vaccination
- Blood donors are not representative of the U.S. population as a whole



Commercial lab seroprevalence program

- Random testing of blood drawn for commercial lab testing
- Only detects antibodies from past infection (not vaccination)
- People getting blood tests are not representative of the U.S. population as a whole



The bottom line…

- No epidemiologic data set is perfect
- Each variant has different epidemiology
- Know where to find your state and county data
- Trends are important
- Testing percent positivity increases predict surges
- Case number increases predict hospital utilization

SARS-CoV-2 Vaccination

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Available SARS-CoV-2 Vaccines

- mRNA (preferred)
  - Pfizer-BioNTech
  - Moderna
- Adenovirus vector
  - Johnson & Johnson's Janssen

mRNA Vaccines

- Have been studied for decades
- Rapid, inexpensive and scalable manufacturing
- First approved use was against SARS-CoV-2
  - Pfizer-BioNTech
  - Moderna

mRNA Vaccines

- Lab developed mRNA encoding SARS-CoV-2 spike protein
- Dendritic cells (antigen presenting cells) phagocytize spike protein and present to T and B cells
  - T cells: immediate immunity
  - B cells: humoral (antibody), future immunity
- Given as 2 dose primary series, followed by booster
  - 3rd dose included in primary series for immunocompromised

mRNA Vaccines

- No live virus
- Does not enter nucleus of the cell
- Preferred SARS-CoV-2 vaccine both for efficacy and lower side effect profile

mRNA Vaccines – Adverse Reactions

- Pain, redness and swelling at injection site
- Headache, myalgias
- Fatigue
- Fever, chills
- Nausea
- Rare cases of myocarditis and pericarditis in adolescents

Pfizer-BioNTech

- FDA approved for ages 16 years and older
- Emergency Use Authorization for ages 5-15
- Primary series: 2 shots, 21 days apart
  - Immunocompromised: 3rd dose 28 days after 2nd dose
- Booster: 5 months after primary series
  - Age 16-17: Pfizer BioNTech only
  - Age 18 and older: Pfizer BioNTech or Moderna (Janssen is alternative)

Moderna

- Emergency Use Authorization for age 18 and older
- Primary series: 2 doses, 28 days apart
  - Immunocompromised: 3rd dose 28 days after 2nd dose
- Booster: 5 months after completion of primary series
  - Pfizer or Moderna preferred
  - Janssen is alternative

Viral Vector Vaccine

- Recombinant, replication incompetent adenovirus vector
- Encodes SARS-CoV-2 spike protein
- Not preferred for SARS-CoV-2 vaccination due to risk of serious adverse events
  - Thrombosis with thrombocytopenia syndrome
- Alternative use:
  - Allergy to components of, or adverse reaction to an mRNA vaccine
  - Limited access to other available vaccines

Johnson and Johnson's Janssen

- Emergency Use Authorization for age 18 and older
- Primary series: 1 shot
- Booster: mRNA (Pfizer or Moderna) recommended 2 months after primary series

Pfizer-BioNTech [1]	Moderna [1]	Johnson & Johnson's Janssen [1,2]
Ages Recommended 5+ years old	**Ages Recommended** 18+ years old	**Ages Recommended** 18+ years
Primary Series 2 doses Given 3 weeks (21 days) apart [3]	**Primary Series** 2 doses Given 4 weeks (28 days) apart [3]	**Primary Series** 1 dose
Booster Dose Everyone ages 18 years and older should get a booster dose of either Pfizer-BioNTech or Moderna (COVID-19 vaccines) at least 6 months after the last dose in their primary series. Teens 16-17 years old may get a Pfizer-BioNTech COVID-19 Vaccine booster at least 6 months after the last dose in their primary series.	**Booster Dose** Everyone ages 18 years and older should get a booster dose of either Pfizer-BioNTech or Moderna (COVID-19 vaccines) at least 6 months after the last dose in their primary series.	**Booster Dose** Everyone ages 18 years and older should get a booster dose of either Pfizer-BioNTech or Moderna (mRNA COVID-19 vaccines) at least 2 months after the first dose of J&J/Janssen COVID-19 vaccine. You may get J&J/Janssen in some situations.
When Fully Vaccinated 2 weeks after 2nd dose	**When Fully Vaccinated** 2 weeks after 2nd dose	**When Fully Vaccinated** 2 weeks after 1st dose

SARS-CoV-2 Vaccination

- Fully vaccinated defined as 2 weeks after completion of primary series

Total Vaccine Doses
Delivered 632,575,655
Administered 515,162,867
Learn more about the distribution of vaccines.

207.0M
People fully vaccinated

73.0M
People received a booster dose**

At Least One Dose	Fully Vaccinated	Booster Doses***
Fully Vaccinated* People	Count	Percent of US Population
Total	207,016,514	62.4%
Population ≥ 5 Years of Age	207,006,442	66.3%
Population ≥ 12 Years of Age	202,375,514	71.4%
Population ≥ 18 Years of Age	188,777,814	73.1%
Population ≥ 65 Years of Age	48,079,504	87.7%

Total Vaccine Doses
Delivered 632,575,655
Administered 515,162,867
Learn more about the distribution of vaccines.

207.0M
People fully vaccinated

73.0M
People received a booster dose**

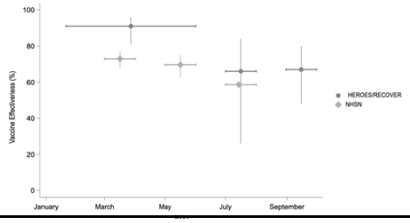
At Least One Dose	Fully Vaccinated	Booster Doses***
Fully Vaccinated* People with a Booster Dose**	Count	Percent of Fully Vaccinated*
Total	72,991,028	35.3%
Population ≥ 18 Years of Age	72,344,151	38.3%
Population ≥ 50 Years of Age	49,191,993	50.1%
Population ≥ 65 Years of Age	28,668,993	59.6%

Vaccine Efficacy

- Clinical Trial Data: Prevention of lab confirmed COVID-19:
  - Pfizer-BioNTech: 95%
  - Moderna: 94.1%
  - Janssen: 66.3%

Vaccine Effectiveness Against Infection Among Adults Ages 18 Years and Older

COVID-19 vaccines were less effective at preventing COVID-19 infection in July and August compared to earlier months. Time has passed since people got vaccinated, and Delta became the predominant variant during this time period.



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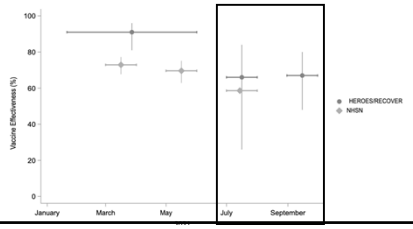
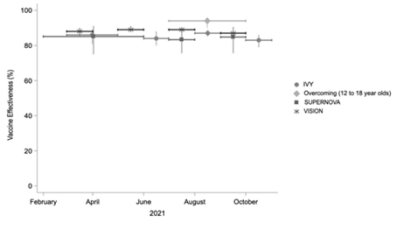


Vaccine Effectiveness Against Hospitalization (All Studies)

COVID-19 vaccines are protecting people from being hospitalized with COVID-19. The vaccines help protect against Delta and other variants and continue to prevent COVID-19 hospitalizations, even though many months have passed since some people got vaccinated.



Risk Factors for Severe COVID-19 Outcomes Among Persons Aged ≥18 Years Who Completed a Primary COVID-19 Vaccination Series — 465 Health Care Facilities, United States, December 2020–October 2021

Weekly / January 7, 2022 / 71(1);19–25

Among 1,228,664 fully vaccinated individuals:

- Only 2,246 developed COVID-19
- 327 of these were hospitalized, 189 with severe disease
- 36 deaths

Omicron?

- Anticipate reduced protection from infection due to numerous changes in spike protein
- Vaccination continues to play a role in controlling spread, hospitalization and death
- Laboratory and epidemiologic studies are still needed

SARS-CoV-2 Vaccination

An ounce of prevention is worth a pound of cure

Summary

- Multiple vaccines widely available in the US
- Vaccines are safe and highly effective
- Even in setting of new SARS-CoV-2 variants and breakthrough infection, vaccines remain important tool in preventing spread, hospitalization and death

Management Of COVID 19 In The Ambulatory Setting

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Symptoms

- Fever
- Cough
- Sore throat
- Malaise
- Myalgia
- Headache
- Loss of sense of taste or smell
- With Omicron, cough, headache, and sore throat without loss of sense of taste or smell are a common presentation

Polymerase Chain Reaction (PCR) versus Antigen (Ag) Testing

- The Gold standard is PCR. With PCR a small sample of DNA is amplified making it easier to detect the desired pathogen in the sample.
- Ag testing is detection of viral surface proteins
- PCR testing is more sensitive than Ag in detecting coronavirus.
- The FDA has stated that the sensitivity of Ag tests may be decreased in the setting of Omicron. SARS-CoV-2 Viral Mutations: Impact on COVID-19 Tests | FDA
- PCR testing will be positive for more days over the course of an illness than Ag testing. This does not mean Ag testing is not useful, but it does mean the interpretation of a negative test should account for this.

First Considerations

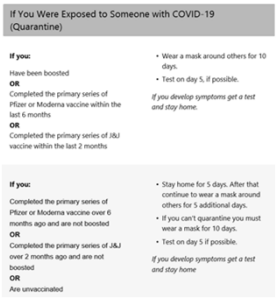
- Does the Patient need seen in person, or can they be managed by Telehealth?
- Outpatient the main treatment is supportive and assessing patients to see who is high risk and may benefit from monoclonal antibodies.
- It is important to advise the patient as to the need for isolation and provide information on how to do so as well as evaluate if others in the household need to quarantine.

Isolation

- Monitor symptoms for progression
- Stay in a separate room from other household members if possible
- Use a separate bathroom, if possible.
- Improve home ventilation, if possible.
- Avoid contact with other members of the household and pets.
- Don't share personal household items, like cups, towels, and utensils.
- Wear a well-fitting mask when you need to be around other people.

COVID-19 Quarantine and Isolation | CDC

Quarantine



https://www.cdc.gov/media/releases/2021/s1227-isolation-quarantine-guidance.html?s=09

Triage

- When possible, patients with symptoms of COVID-19 should be triaged via telehealth visits to determine whether they require COVID-19-specific therapy and in-person care.
- Patients with dyspnea should be referred for an in-person evaluation by a health care provider and should be followed closely during the initial days after the onset of dyspnea to assess for worsening respiratory status.
- Management plans should be based on a patient's vital signs, physical exam findings, risk factors for progression to severe illness, and the availability of health care resources.
- Nonhospitalized Patients: General Management | COVID-19 Treatment Guidelines (nih.gov)

Considerations For Who Needs To Be Seen In Person

- Dyspnea
- Chest Pain
- Mental Status Changes
- Low Pulse Ox (<94%, <90%)
- Pallor
- Underlying conditions that place the patient at risk such as those with cancer, solid organ transplant, or COPD (though this is not an inclusive list)

Therapeutics

Nonhospitalized Adults: Therapeutic Management | COVID-19 Treatment Guidelines (nih.gov)

Therapeutics For Those Who are High Risk

- Monoclonal Antibodies: With Omicron the predominant variant only Sotrovimab provides benefit.
- Pre-exposure Prophylaxis: Tixagevimab/cilgavimab
- Paxlovid (Nirmatrelvir and Ritonavir). Nirmatrelvir (Anti-viral) inhibits a SARS-CoV-2 protein to stop the virus from replicating. Ritonavir (P450 Inhibitor) slows down nirmatrelvir's breakdown to help it remain in the body for a longer period at higher concentrations.
  - Due to P450 action there are a lot drug interactions and dosage adjustments. https://www.fda.gov/media/155071/download
- Molnupravir is an anti-viral.

High Risk Patients

- Cancer
- Chronic Kidney Disease
- Chronic Liver Disease
- Chronic Lung Disease
- Neurologic Conditions
- Diabetes
- Down's Syndrome
- Cardiac Disease
- HIV
- Immunosuppression
- Obesity
- Sickle Cell
- Pregnancy
- Solid Organ Transplant

https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html

Symptomatic Treatment – Non-Hospitalized

- Acetaminophen
- NSAID's
- Benzonatate
- Dextromethorphan
- Albuterol
- Inhaled Corticosteroids

Inpatient Treatment of COVID-19

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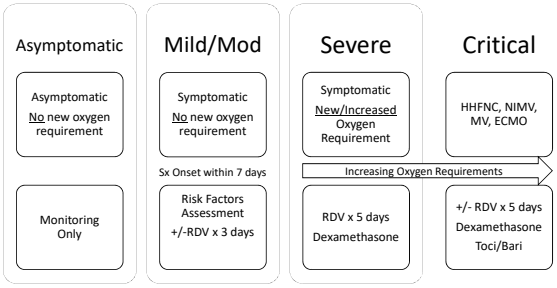
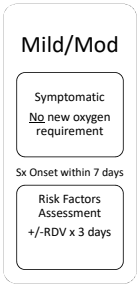
COVID-19 Inpatient Treatment Overview



COVID-19 Inpatient Treatment Overview



- Historically:
  Monoclonal Abs
  Remdesivir
- Evaluation for Home Oxygen Monitoring
- No Dexamethasone

COVID-19 Inpatient Treatment Overview

PINETREE Trial
(Outpatient)

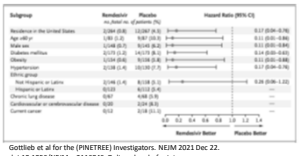
Mild/Mod

Symptomatic
No new oxygen requirement

Sx Onset within 7 days

Remdesivir
200mg IV Day 1
100mg IV Day 2
100mg IV Day 3

- Broader Usage of Remdesivir
- 87% Reduction in COVID-19 hospitalization or death at day 28



Gottlieb et al for the (PINETREE) Investigators. NEJM 2021 Dec 22. doi:10.1056/NEJMoa2116846. Online ahead of print.

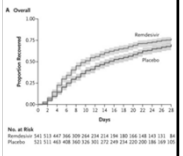
COVID-19 Inpatient Treatment Overview

- Remdesivir 5 days for Severe
  - Median recovery 10 vs. 15 days
  - Mortality 6.7% vs. 11.9% at day 15
- 5 days as good as 10 days for most
- Dexamethasone (RECOVERY)
  - 6mg IV x 10 days
  - 17% lower mortality
- Discharge when patient ready

Severe

Symptomatic
New/Increased Oxygen Requirement

RDV x 5 days
Dexamethasone



Beigel JH, et al. ACTT-1 Study Group Members. Remdesivir for the Treatment of Covid-19 -Final Report. N Engl J Med. 2020 Nov 5;383(19):1813-1826. doi: 10.1056/NEJMoa2007764.

COVID-19 Inpatient Treatment Overview

- Remdesivir
  - Lower Efficacy for Critically Ill (MV/ECMO)
  - Still utilized but evidence is weaker
- Dexamethasone
  - 6mg IV x 10 days
  - 34% lower mortality at 28 days
  - Consider DEXA-ARDS Dosing
    - 20mg IV x 5 days then 10mg x 5 days
      - ICU Mortality 19% vs 31% (noncovid)
      - Vent Free Days 12.3 vs. 7.5 (noncovid)
    - CoDEX Trial – vent free days 6.6 days vs 4.0

Critical

HHFNC, NIMV, MV, ECMO

+/- RDV x 5 days
Dexamethasone
Toci/Bari

COVID-19 Inpatient Treatment Overview

- Tocilizumab
  - One time dose but long half life
  - Presence of inflammation, CRP>75
  - More beneficial in rapidly progressive, early disease but carries risk of infection
  - Trend towards reduced mortality
- Baricitinib
  - 4mg daily dosing x 14 days
  - 44% mortality reduction at 60 days
  - Limited data

Critical

HHFNC, NIMV, MV, ECMO

CRP>75
Toci/Bari

References

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- BeigelJH, et al. ACTT-1 Study Group Members. Remdesivirfor the Treatment of Covid-19 - Final Report. N EnglJ Med. 2020 Nov 5;383(19):1813-1826. doi: 10.1056/NEJMoa2007764.
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- Villar J , Ferrnado C, Martinez D, et al. Dexamethasone Treatment for the Acute Respiratory Distress Syndrome: a multicentre, randomized controlled trial. Lancet Resp Med. 2020;8(3):267-276
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COVID and Travel

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First, the obvious…

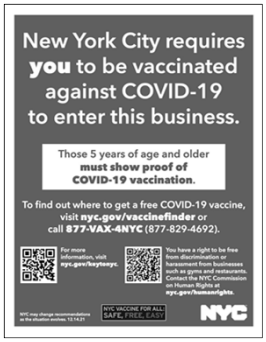
- Delay traveling until you are vaccinated
- If you are vaccinated, get boosted before traveling
- Make sure your traveling companions are vaccinated
- Don't travel if you have COVID symptoms

What Should You Pack?

- Rapid COVID test
- Extra face masks
- Hand sanitizer (< 12 ounces for TSA)
- Thermometer
- Oximeter
- Acetaminophen and/or NSAID
- Vaccine card
- Extra prescription medications

Travel within the U.S.

- Check the websites first!
  - https://covid.cdc.gov/covid-data-tracker/#datatracker-home
  - Individual state & city department of health websites
- Car travel:
  - Consider packing lunch rather than restaurants
  - Wear mask whenever indoors and when outdoors in crowded areas
  - Keep hand sanitizer in the car
- Restaurants:
  - Check restaurant COVID policy for employees and guests
  - Visit at off-hours
  - Consider carry-out



Traveling to somewhere outside of the U.S.?

- Will the country let you in?
- Check the websites first!
  - https://travel.state.gov/content/travel.html
  - https://www.cdc.gov/coronavirus/2019-ncov/travelers/index.html
  - Government websites of countries you will be visiting
- COVID travel insurance often required for entry
- Rapid COVID or COVID PCR test < 24 or 48 hours prior to arrival
  - Retail self-read home tests not accepted
  - Many airports & pharmacies offer travel testing
  - Some countries require testing on arrival (bring cash!)
- Will you need a COVID certificate?

Returning to the U.S.?

- Check the websites first!
  - https://www.cdc.gov/coronavirus/2019-ncov/travelers/
- Rapid COVID or COVID PCR within 1 day of return to U.S.
  - Retail self-read home tests not accepted
  - Some international hotels & airports offer testing
  - Home tests *with telehealth video supervision* accepted:
    - Abbott BinaxNOW
    - Ellume-AZOVA
    - Cue
    - Quered

Minimizing COVID risks during air travel

- The airport is often riskier than the airplane
- In the airport:
  - Avoid busy travel days
  - Use hand sanitizer regularly
  - Maintain physical distancing whenever possible
  - Avoid airport restaurants and bars
- In the plane:
  - Turn on overhead air vent
  - Avoid or minimize eating/drinking
  - Wear a mask at all times

Cloth Mask	Surgical Mask	N-95 Mask
		
Good	**Better**	**Best**

Is It Safe To Travel?

Traveler's Risk Factors:
- Age
- Obesity
- Diabetes
- Hypertension
- Cardiac disease
- Immunosuppression

Travel Destination:
- Indoor crowds
- Restaurants
- Bars
- Outdoor crowds
- Cruises
- Hotel or Airbnb/VRBO
- Masking culture
- Vaccination culture