



# COVID-19

Keeping Up with a Moving Target

## Epidemiology 101

**Jointly provided by Postgraduate Institute for Medicine, DKBmed, and the Institute for Johns Hopkins Nursing.**

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Name of Faculty or Presenter	Reported Financial Relationship
Paul G. Auwaerter, MD, MBA, FIDSA	JNJ: Ownership equity Scientific Consulting: Verily, EMD Serono DMSB: Humanigen

Dr. Auwaerter has indicated that he will be referencing the unlabeled or unapproved use of agents currently being investigated in on-going studies and trials, including a remdesivir, baricitinib, and several vaccine platforms.

All activity, content, and materials have been developed solely by the activity directors, planning committee members, and faculty presenters, and are free of influence from a commercial entity.



## CME Information

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## Learning Objective

- Discuss immunology and virology as they pertain to COVID-19 transmission, disease course, and potential routes for treatment.



This activity is supported by an educational grant from Regeneron Pharmaceuticals.

All activity content and materials have been developed solely by the activity directors, planning committee members, and faculty presenters.

Please see **COVID19.DKBmed.com** for additional resources and educational activities

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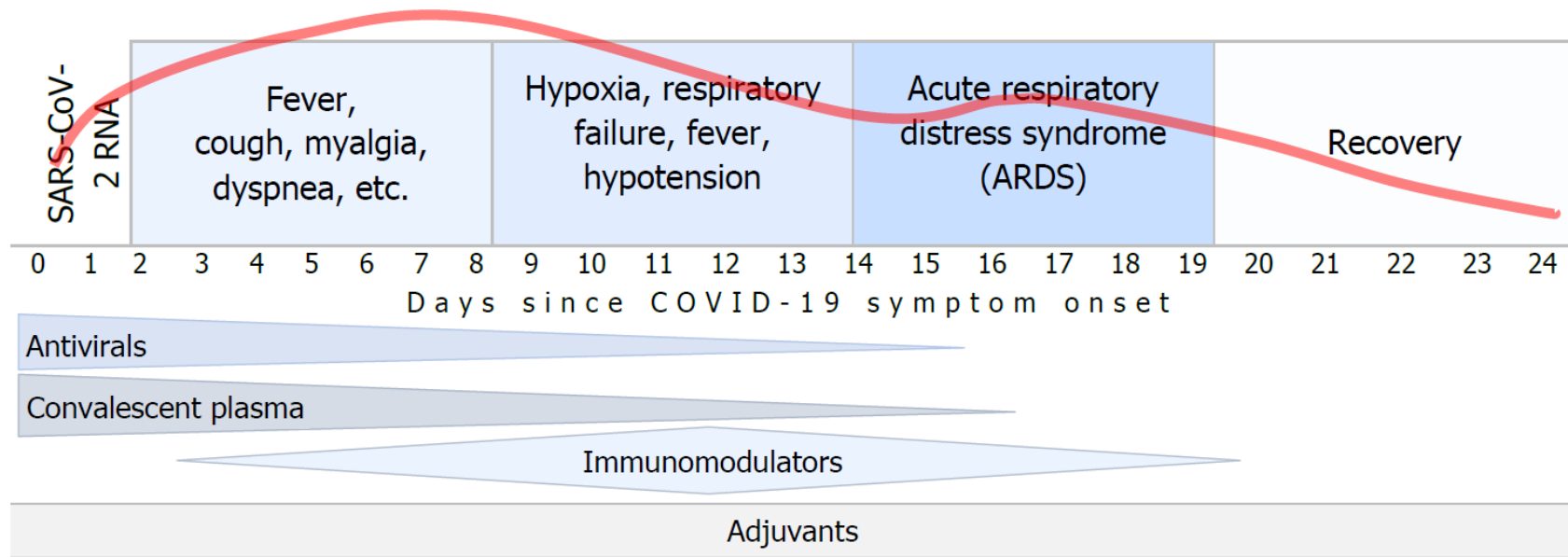
Sherrilyn and Ken Fisher Professor of Medicine

Fisher Center for Environmental Infectious Diseases

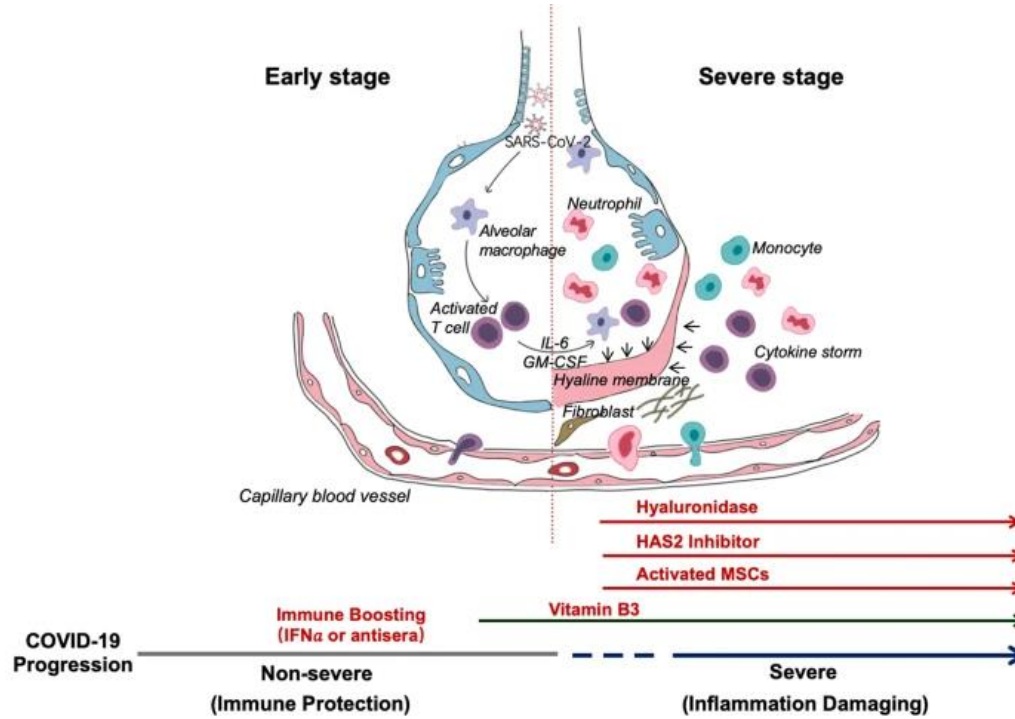
Johns Hopkins University School of Medicine

# Potential COVID-19 Phases and Interventions

**Figure: Schematic of clinical course of severe COVID-19 with representation of SARS-CoV-2 RNA levels, common symptoms, and possible timing of therapeutic use of greatest benefit**



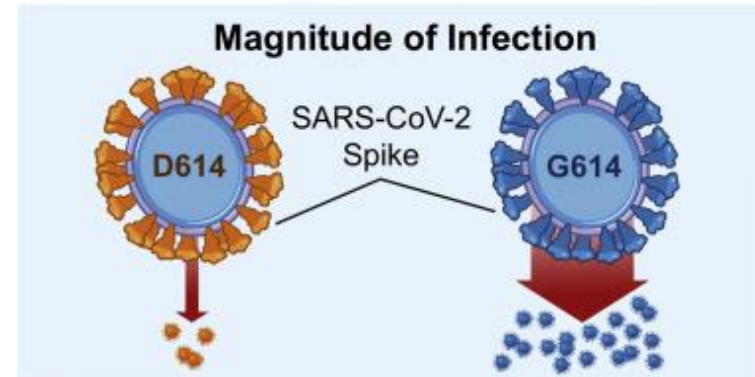
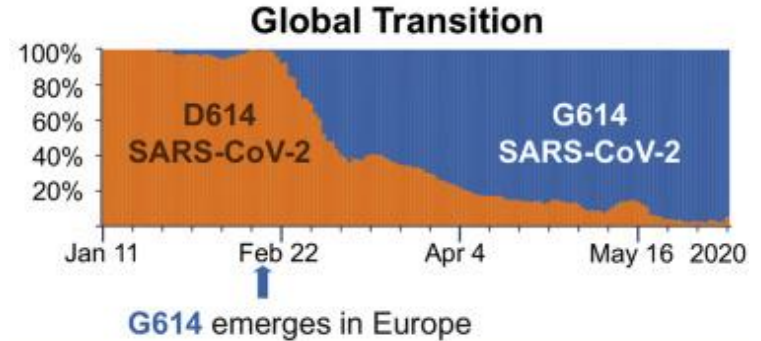
# SARS-CoV-2 Pathogenesis Pulmonary, Vascular, Inflammatory





## Viral Variants: SARS-CoV-2

- Original Wuhan strain, L (Dec 2019)
- Multiple variants (six by spring 2020)
- D614G substitution variant (S-protein)
  - First seen Jan-Feb 2020
  - Has overwhelmed Wuhan strain
  - Jun 2020 = dominant global strain
  - No apparent change in virulence
  - More transmissible?
    - Lower CT values = higher respiratory viral loads



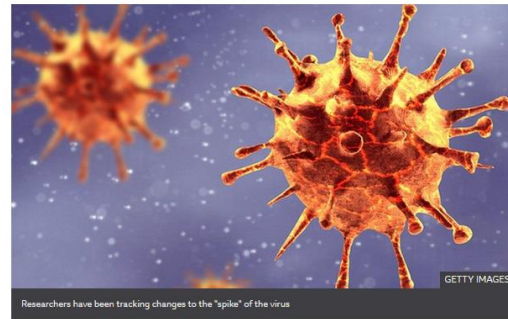
# First Call to Attention: B.1.1.7 Variant SARS-CoV-2



## Covid-19: New variant 'raises R number by up to 0.7'

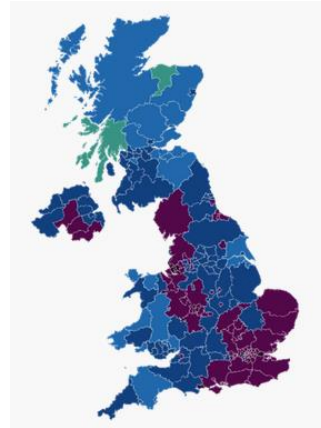
1 day ago

Coronavirus pandemic



Researchers have been tracking changes to the "spike" of the virus  
The new variant of Covid-19 is "hugely" more transmissible than the virus's

BBC 1/1/21



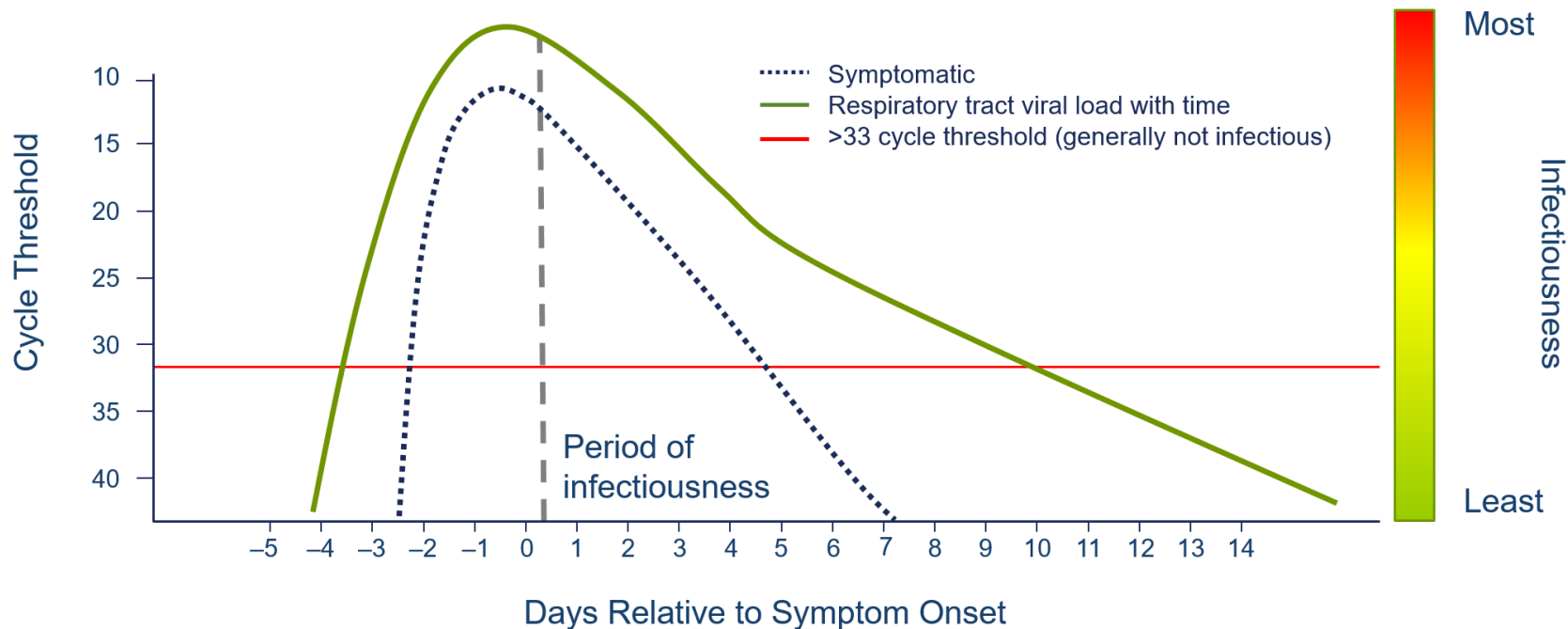
- Transmissibility enhanced by R 0.4-0.7 (Imperial College, best estimate 50%) over earlier strains
- Current R estimated in UK 1.1-1.3
- Spread despite severe November restrictions

## Strains to Watch

Name (Pangolin)	Name (Nextstrain)	First detected	US cases	Countries reporting cases	Key mutations	Transmissibility rate	Virulence
B.1.1.7	201/501Y.V1	UK	Yes	70	69/70 del 144Y N501Y 570d D614G P681H	~50% increase  E484K now described, ?reduce vaccine impact	↑ UK Deaths
P.1	20J/501Y.V3	Japan/Brazil	Yes	>4	E484K K417N/T N501Y D614G	Not known	N/A
B.1.351	20H/501.V2	S. Africa	Yes	>30	K417N/T N501Y D614G	Not known	N/A

Adapted from CDC data (1/27/21)

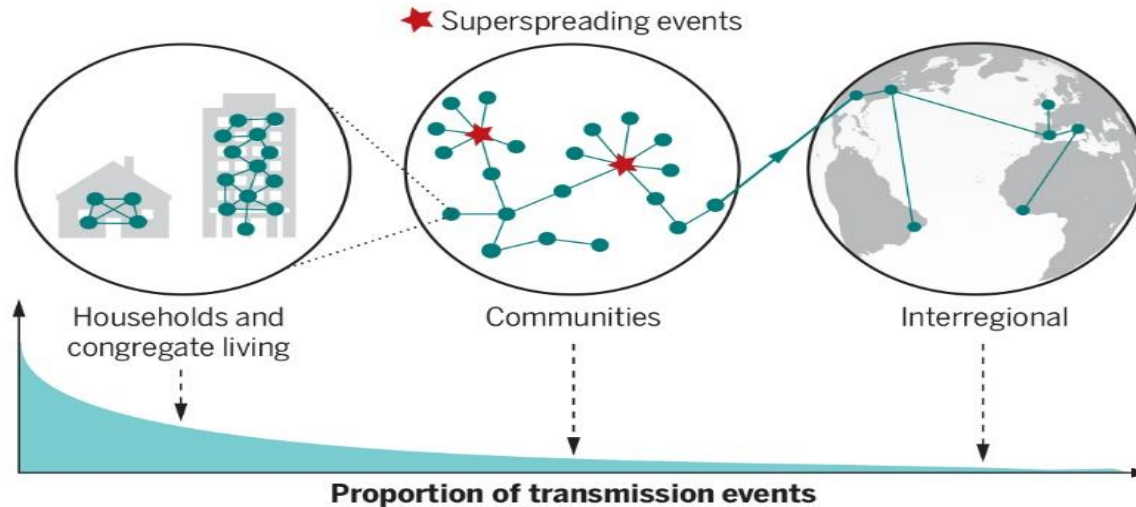
# Most Infectious – 40%-50% Spread & Have No Symptoms



# Where are Most Infections Acquired?

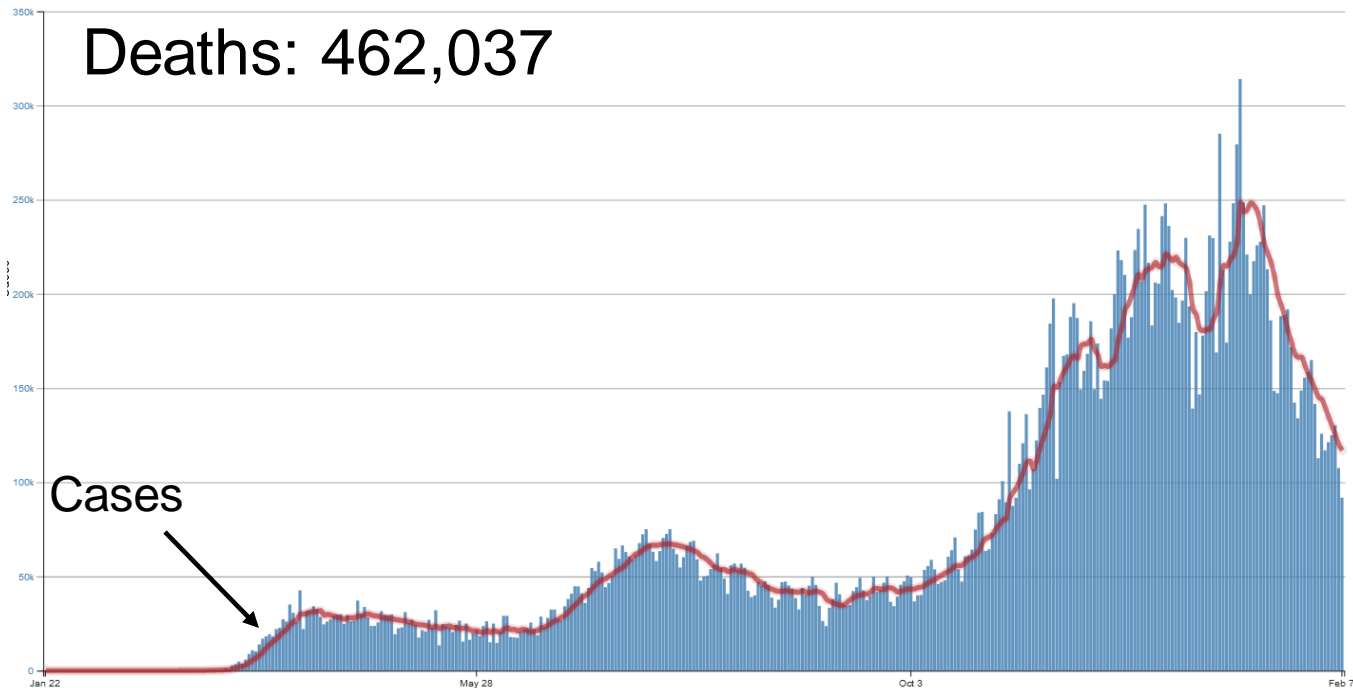
## SARS-CoV-2 spread across spatial scales

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is mostly transmitted within households and household-like settings. A decreasing proportion of transmission events take place at increasing spatial scales, but these events become more critical for sustaining the pandemic.



# Cases and Deaths: US Jan 2020-Feb 2021

Daily Trends in Number of COVID-19 Cases in the United States Reported to CDC



# COVID-19 Disease Burden

CDC estimates that from February–December 2020:

1 in 1.9 (95% UI\* 1.7 - 2.2) COVID-19 hospitalizations were reported

1 in 4.2 (95% UI\* 3.7 – 4.7) COVID–19 symptomatic illnesses were reported

1 in 4.6 (95% UI\* 4.0 – 5.4) total COVID–19 infections were reported

These estimates suggest that during that period, there were approximately:

**83.1 Million**

Estimated Total Infections

**70.4 Million**

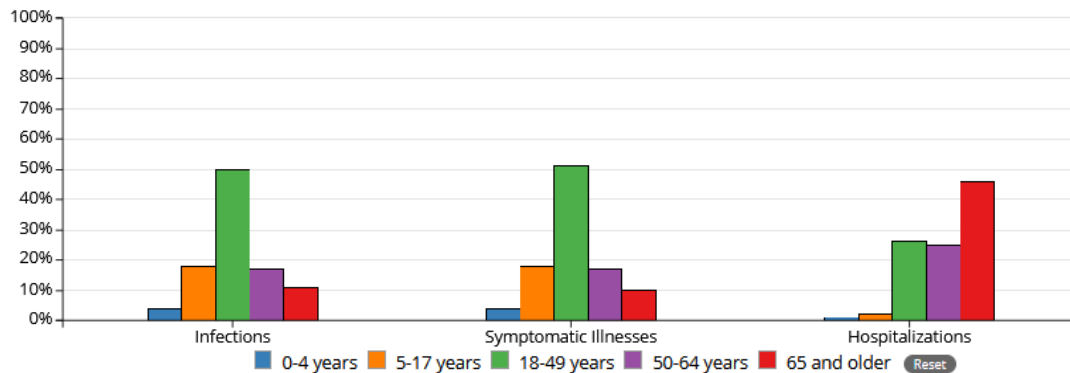
Estimated Symptomatic Illnesses

**4.1 Million**

Estimated Hospitalizations

# COVID-19 Disease Burden

## Percentage of COVID-19 infections, symptomatic illness, and hospitalizations by age group



	Infections	Symptomatic Illnesses	Hospitalizations
<b>0-4 years</b>	4%	4%	1%
<b>5-17 years</b>	18%	18%	2%
<b>18-49 years</b>	50%	51%	26%
<b>50-64 years</b>	17%	17%	25%
<b>65 and older</b>	11%	10%	46%



## CDC COVID-19 Risk Factors

### Increased Risk

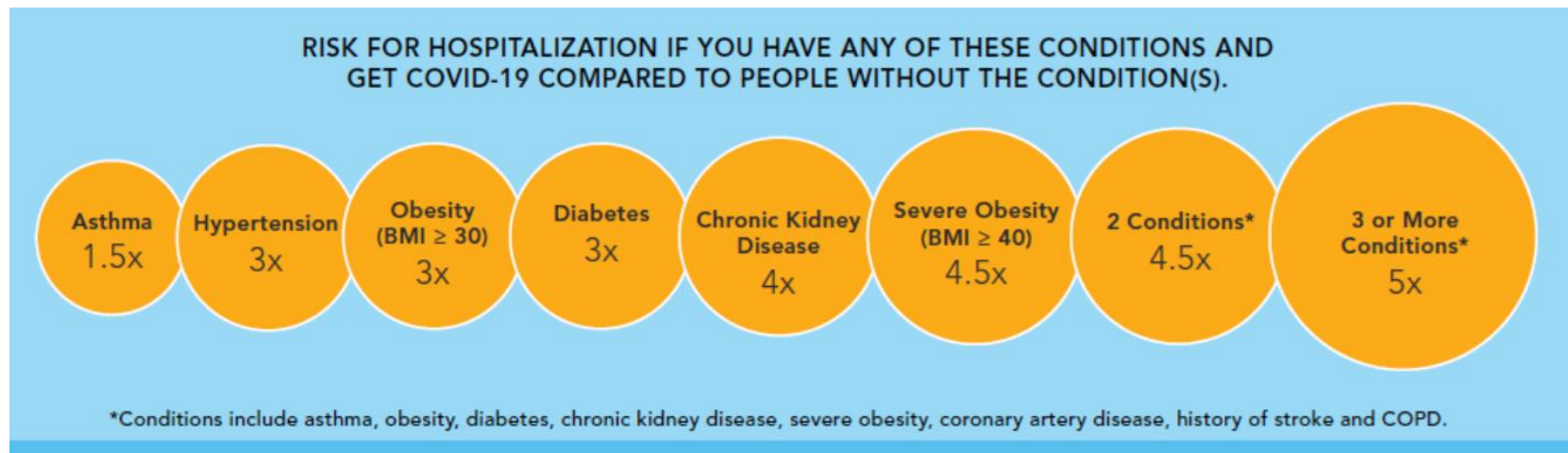
- Cancer
- Chronic renal disease
- COPD
- Down syndrome
- CHF, coronary disease
- Solid organ transplant
- Obesity, BMI > 30 kg/m<sup>2</sup>
- Pregnancy
- Smoking
- Type 2 diabetes

### Possible Increased Risk

- Asthma (mod-severe)
- CVA
- Cystic fibrosis
- Hypertension
- Immunocompromise
- Neurologic dz (dementia)
- Liver disease
- BMI 25-30 kg/m<sup>2</sup>
- Pulmonary fibrosis
- Thalassemia
- Type 1 diabetes

## Risk for Hospitalization among People with Chronic Conditions

- Having more than one of these chronic conditions is related to even worse outcomes
- Notably, many of these conditions cluster together
- Obesity is a strong correlate of the vascular and lung diseases associated with severe COVID-19



# CDC COVID-19 Hospitalization and Death by Race and Ethnicity

Rate ratios compared to White, Non-Hispanic persons	American Indian or Alaska Native, Non-Hispanic persons	Asian, Non-Hispanic persons	Black or African American, Non-Hispanic persons	Hispanic or Latino persons
<b>Cases<sup>1</sup></b>	1.8x	0.6x	1.4x	1.7x
<b>Hospitalization<sup>2</sup></b>	4.0x	1.2x	3.7x	4.1x
<b>Death<sup>3</sup></b>	2.6x	1.1x	2.8x	2.8x

Source CDC, last updated 11/30/20

# Decreasing COVID-19 Mortality NYC Hospitals, Mortality March – August 2020

Mortality fell from 25.6% → 7.6%

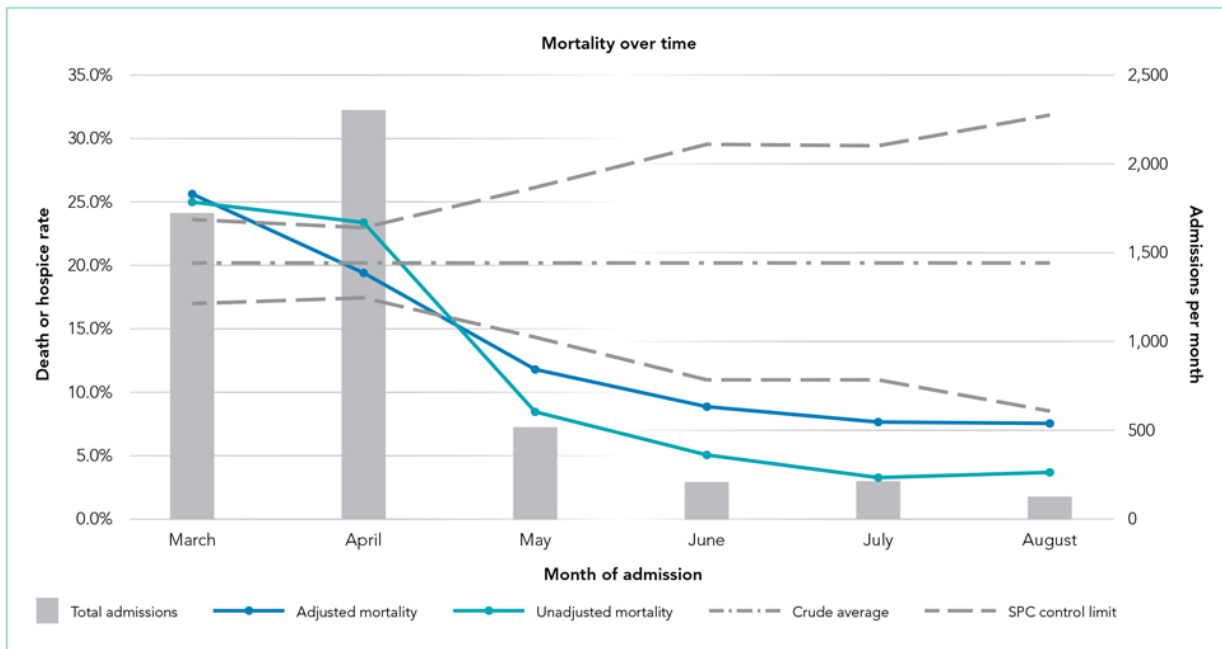


FIG. Adjusted and Unadjusted Mortality or Hospice Rate, by Month of Admission.

## Why Declining Mortality? Likely Many Factors

- Shift to younger patients
- Mask wear and social distancing = exposure to lower viral loads
- Less chaos, more experience
  - Patients presenting earlier
  - Proning
  - Ventilator management
- Treatments
  - Dexamethasone (anti-inflammatory): off-label

## Concluding Thoughts

### Highly successful virus

- Many infected but don't have symptoms
- Viral variants easier to transmit

### Risk factors for severe COVID-19 and death

- Multiple factors (age, race/ethnicity, medical co-morbidities)
- Driving vaccine considerations

# Thank You!

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