



**SCOR**

The Art & Science of Risk

**A presentation for the  
NEHOA conference  
October 7, 2022**



# The Indirect COVID-19 Related Deaths Associated with the COVID Pandemic

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10/7/2022

The potential impact on life insurance

# COVID-19 Deaths

The pandemic has been associated with death in many ways

**Direct Cause**

A person develops a COVID-19 infection and dies

**Indirect Cause  
(Lockdown  
associated)**

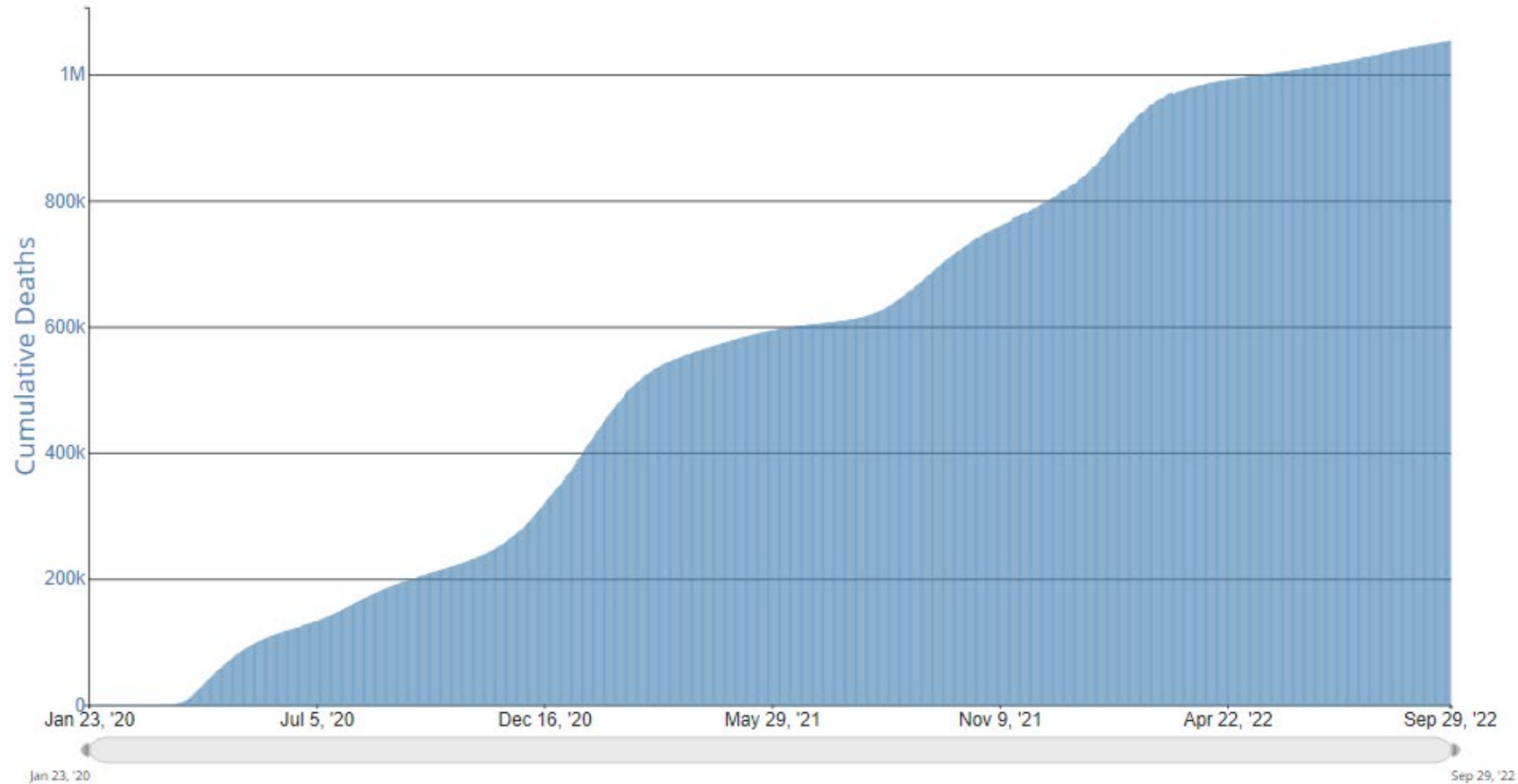
A person dies during the COVID-19 pandemic not by obtaining the infection but instead by being impacted by the pandemic in another way

Today we will look mostly at this “indirect cause” category

# US Population

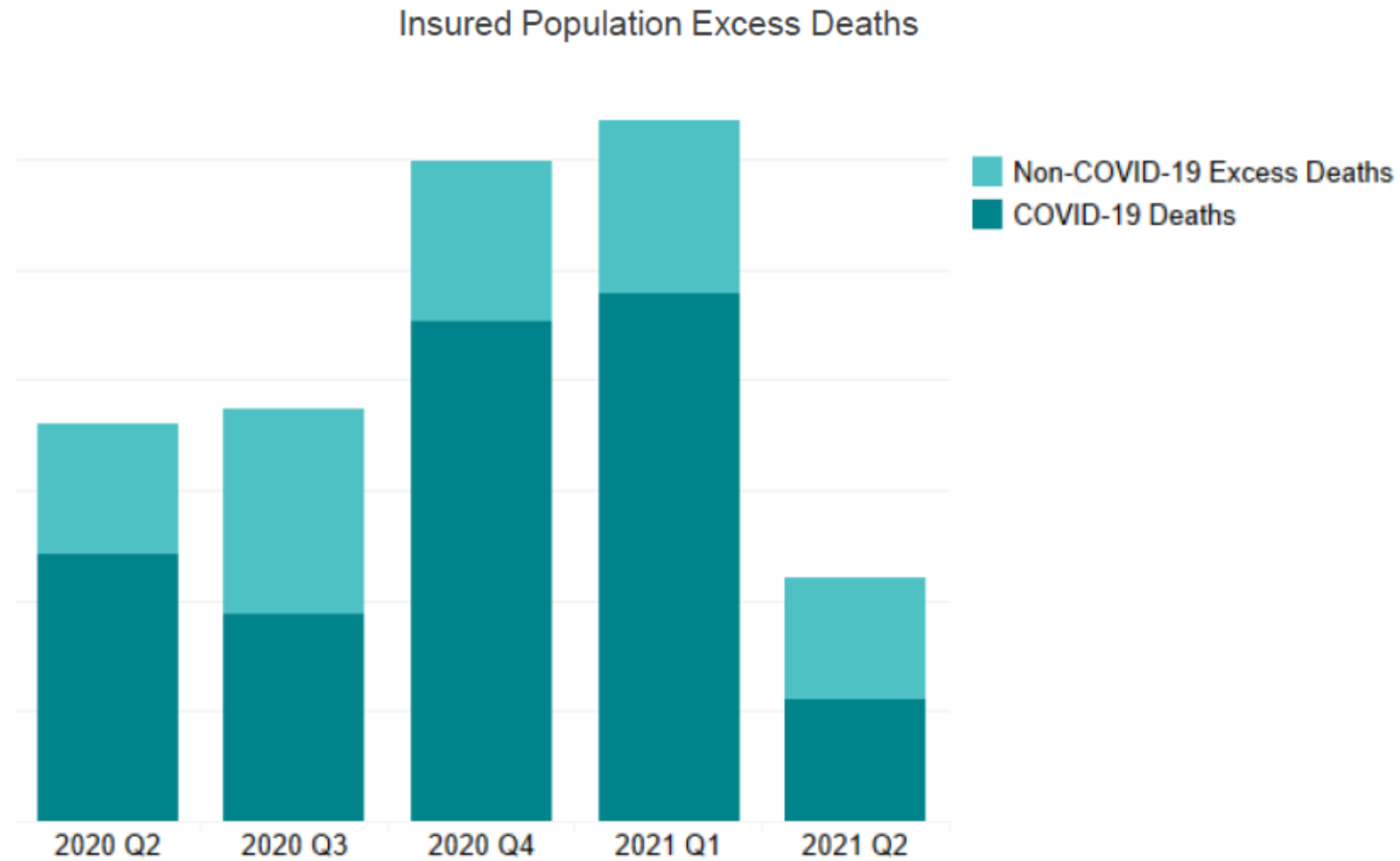
## Cumulative COVID-19 Deaths

Trends in Total Deaths in The United States Reported to CDC



# Excess Deaths: Insured population

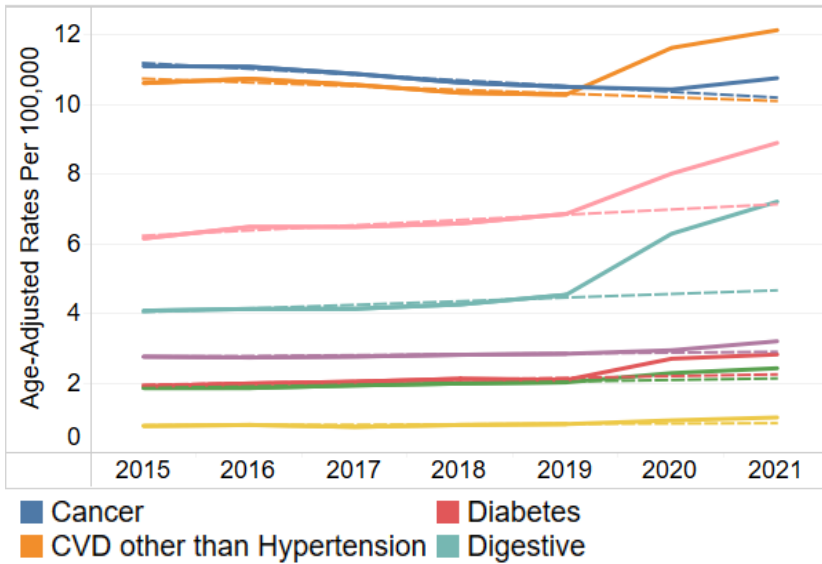
## Direct and indirect deaths



# Excess Deaths from Specific Causes of Death Non-Communicable: US Population

## Ages 5-39

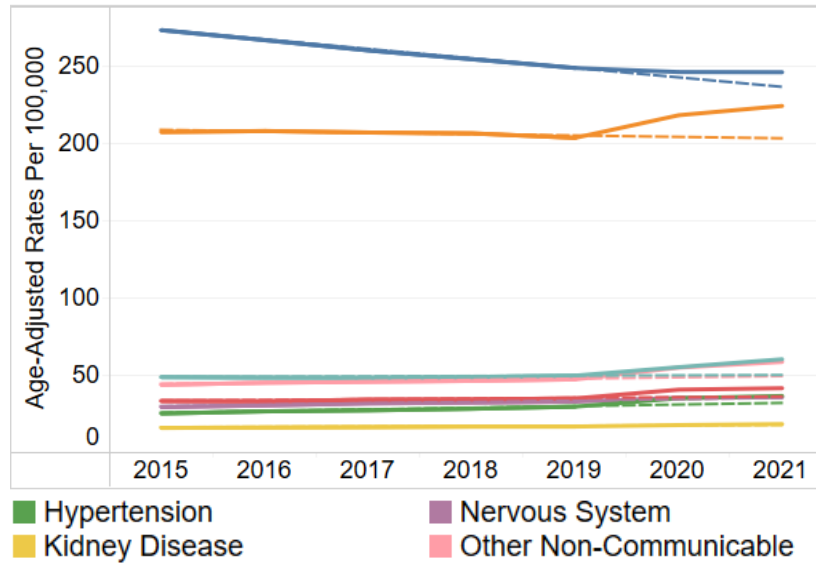
Age-Adjusted Mortality Rates with Linear Trend, Ages 5-44



- Increases were observed in all categories with large increases observed in cardiovascular disease, diabetes, digestive, and other non-communicable
- Larger increases were observed in 2021 than in 2020 for all categories

## Ages 40-74

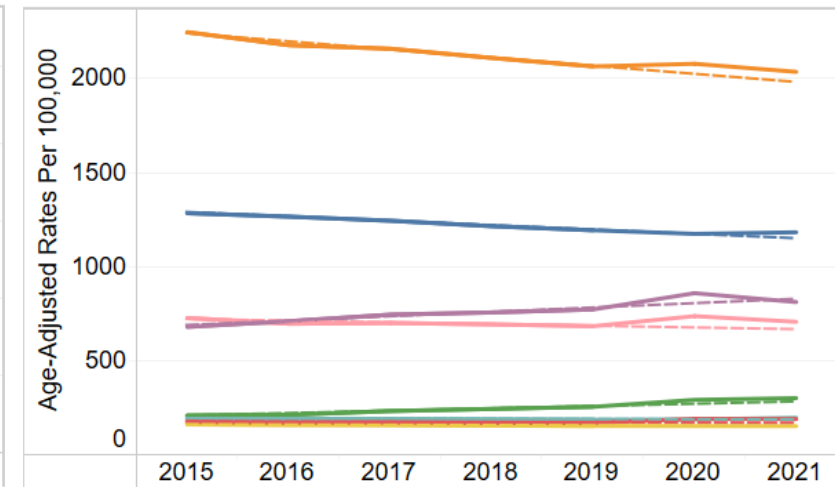
Age-Adjusted Mortality Rates with Linear Trend, Ages 45-74



- Increases were observed in all categories
- Larger increases were observed in 2021 than in 2020 for most, but not all, categories

## Ages 75-94

Age-Adjusted Mortality Rates with Linear Trend, Ages 45-74



- Increases were observed in nearly all categories

# Why did these excess deaths occur?

Let's look at our response to the pandemic

1. How did we respond to a deadly virus emerging all around the world?
2. Remember, we didn't know much about this virus.
3. We had no good diagnostic tests.
4. We had no good preventative meds or vaccines.
5. We had no good treatments.
6. We all knew that previous Coronavirus infections like SARS caused >9% case fatality rates! And MERS caused >35% case fatality rates!!!

# Why did these excess deaths occur?

Let's look at our response to the pandemic

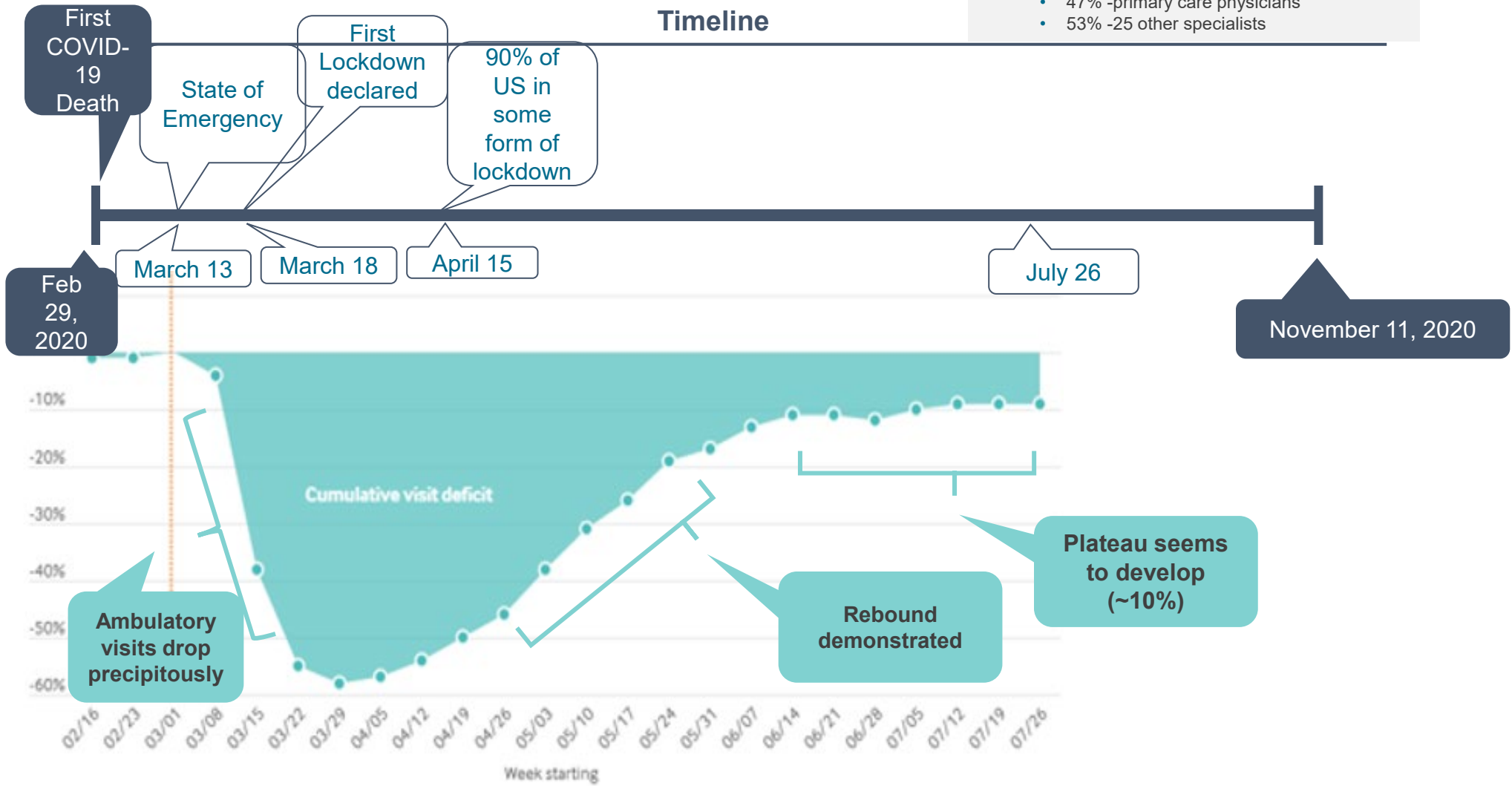
1. Remember that some modeling experts like the Imperial College London were discussing the possibility of >2.2 million deaths in the U.S. if nothing was done. Even under the best of circumstances they discussed the possibility of >1 million deaths.



# The COVID-19 Lockdown

## We quit going to the doctor's office

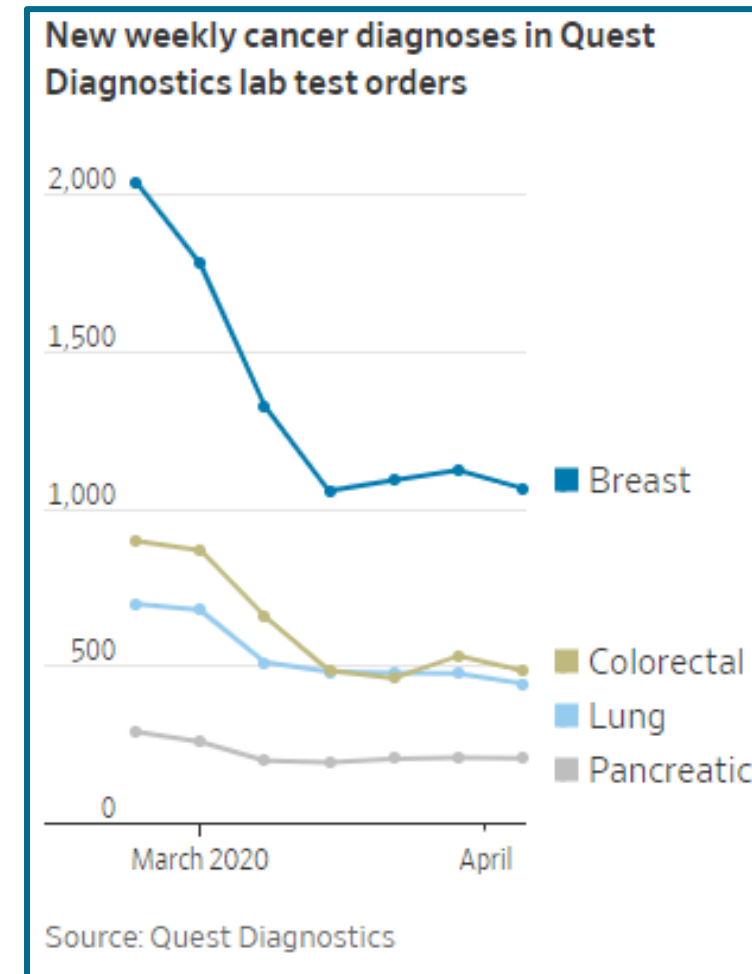
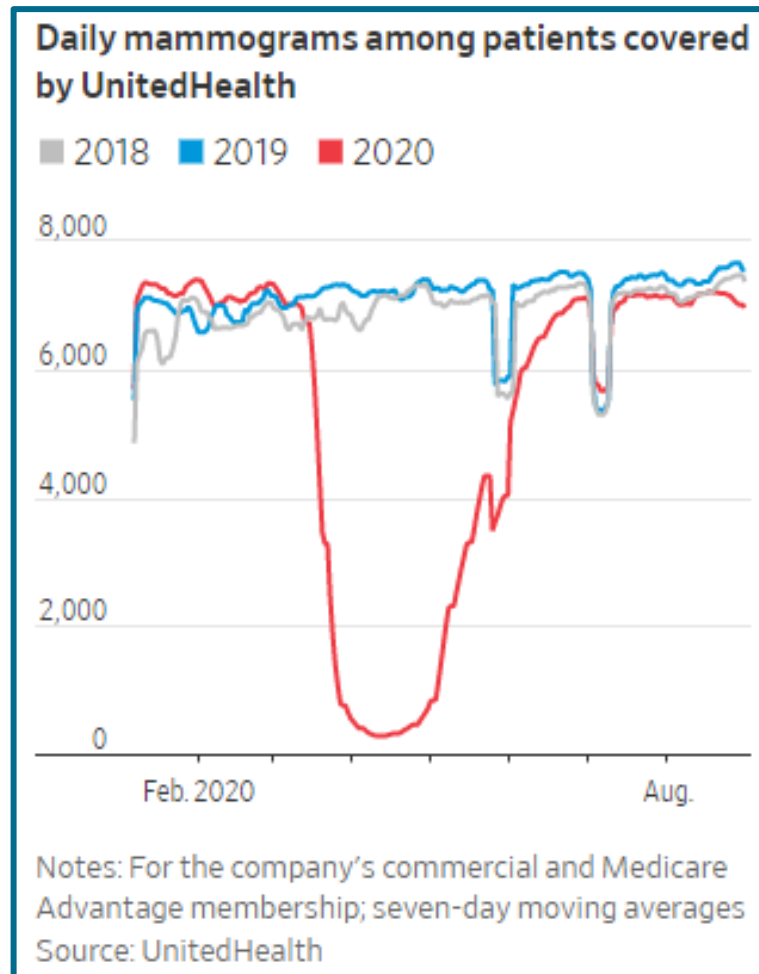
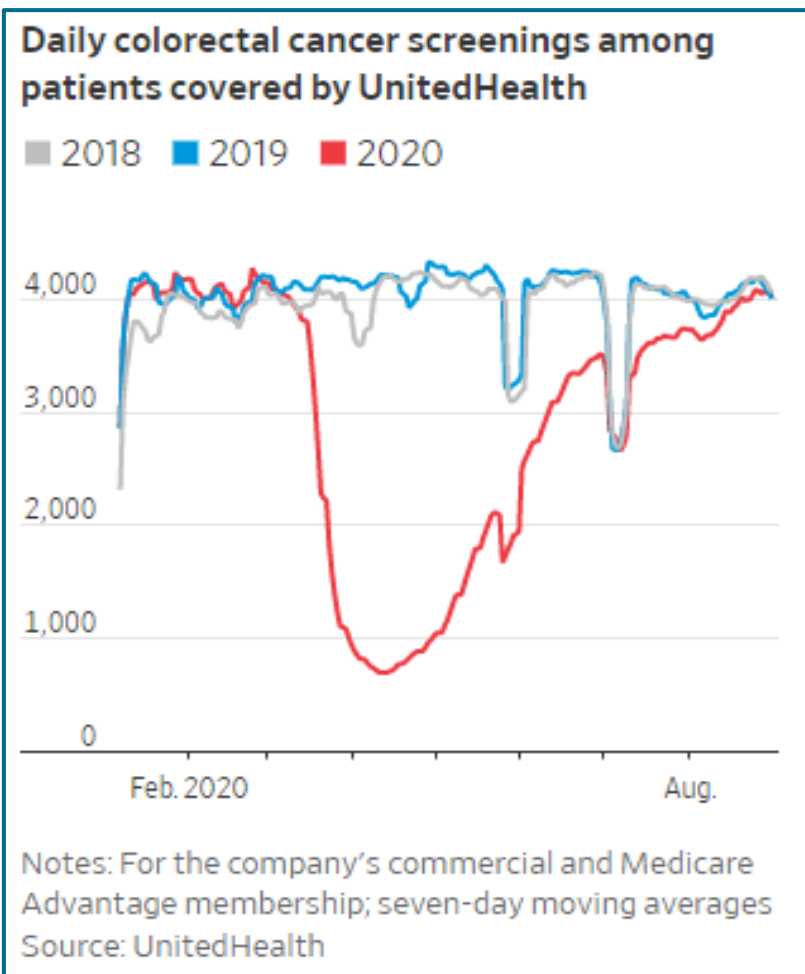
- Key Methods/Findings
- 1,600 provider organizations
  - >50,000 providers
  - All 50 states in the USA
  - >50 million outpatient visits per year as baseline
  - Feb 1, 2020 to Aug 1, 2020 analyzed
  - Baseline visits: Same time period in previous years
    - 47% -primary care physicians
    - 53% -25 other specialists



1) Mehrotra, A et al. The impact of the COVID-19 pandemic on outpatient visits: Changing patterns of care in the newest COVID-19 hotspots August 13th, 2020. The Commonwealth Fund. <https://www.commonwealthfund.org/publications/2020/aug/impact-covid-19-pandemic-outpatient-visits-changing-patterns-care-newest>

# The COVID-19 Lockdown

## We quit getting our cancer screening tests



1. Similarly, we didn't get our symptoms evaluated
2. We didn't get our wellness exams
3. We didn't have our cholesterol and BP checked

# Weight

We ate more

## Children

The CDC reported on Sep 17, 2021, that in those persons aged 2-19:

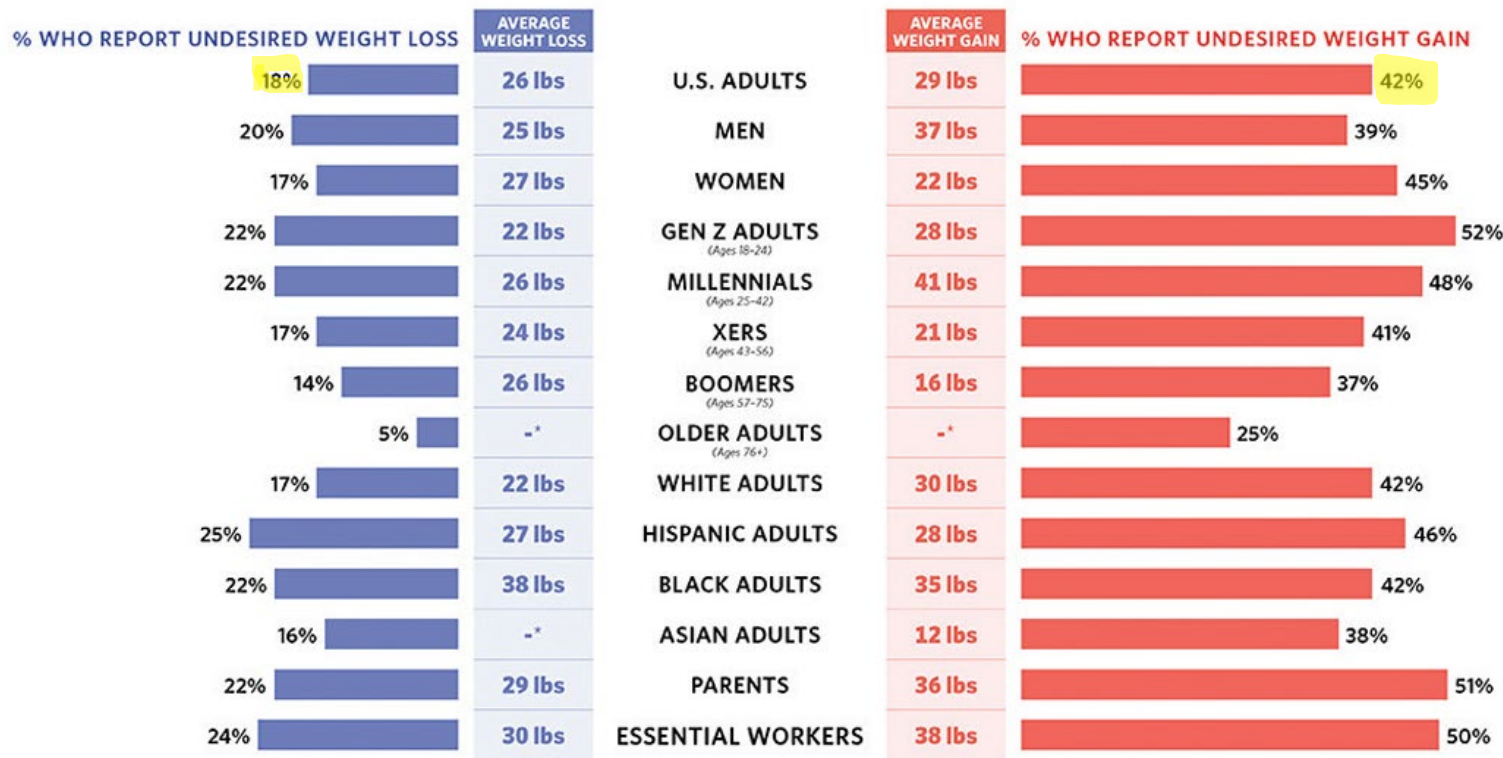
“Overall, the monthly rate of BMI increase nearly doubled during the COVID-19 pandemic period compared with that during the pre-pandemic period (0.100 versus 0.052 kg/m<sup>2</sup>; ratio = 1.93)”

“Based on initial BMI, obesity prevalence was 16 %, including 4.8% with severe obesity.”

## Adults

### PANDEMIC SURVEY

**Slightly More Than 6 in 10 U.S. Adults (61%) Report Undesired Weight Change Since Start of Pandemic**



STRESS IN AMERICA™

\*Insufficient sample size for reporting

© American Psychological Association

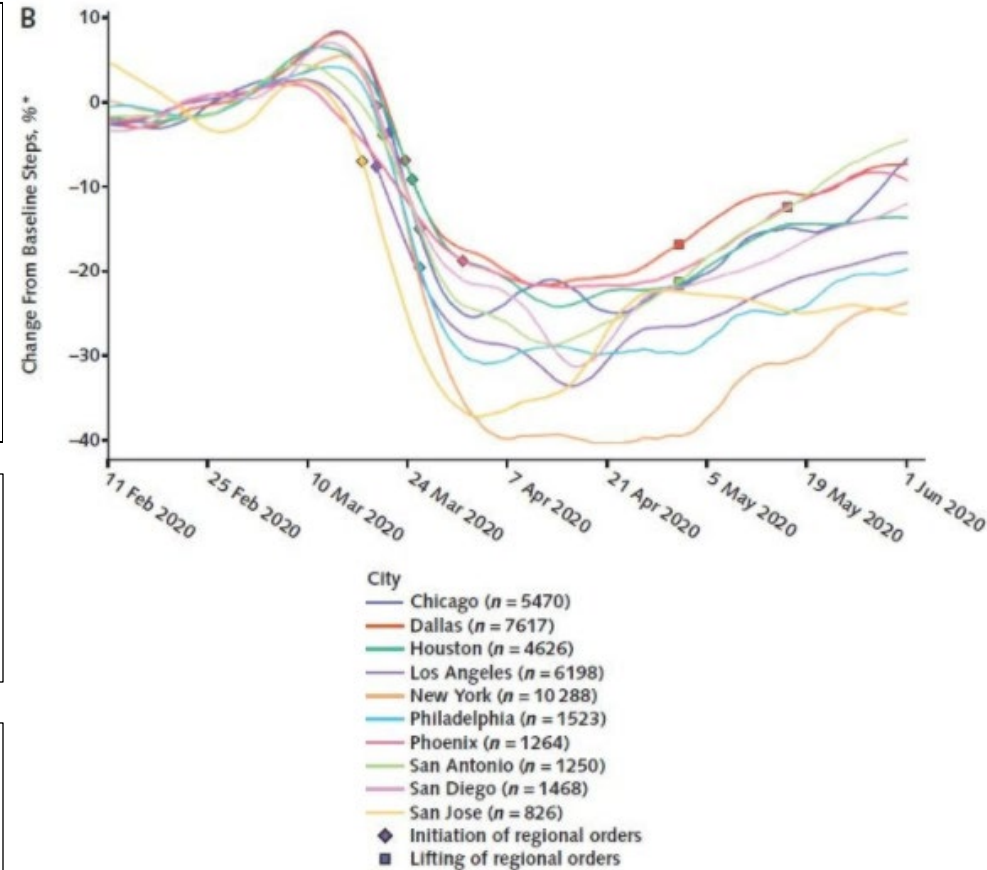
# Physical Activity

## We exercised less (at least in the beginning)

- A June 2020 study published in the Annals of Internal Medicine which monitored step counts globally by use of a smartphone app impacting 455,404 unique users showed a drop in steps of 27.3% within 30 days of the lockdown.
- There was a wide variation in impact. Italy showed a 48.7% decrease. Sweden showed a 6.9% decrease.
- In the United states please see the graph to the right which shows an initial plunge in total steps followed by a gradual recovery but as of June 2020 there still was a significant decrease in steps.

- In a smaller (n=431) self reporting type study focusing on fitness apps in the US the authors found physical activity METS decreased by 18.2% during the pandemic.
  - 13.% high school degree or below

- In a smaller UK study of the initial lockdown in the UK 37% reduction in weekly minutes of exercise was observed. 63% of people decreased their level of activity from pre-covid to the first full week of lockdown.



1) Tison, G et al. Worldwide effect of COVID-19 on physical activity: a descriptive study June 2020 Annals of Internal Medicine

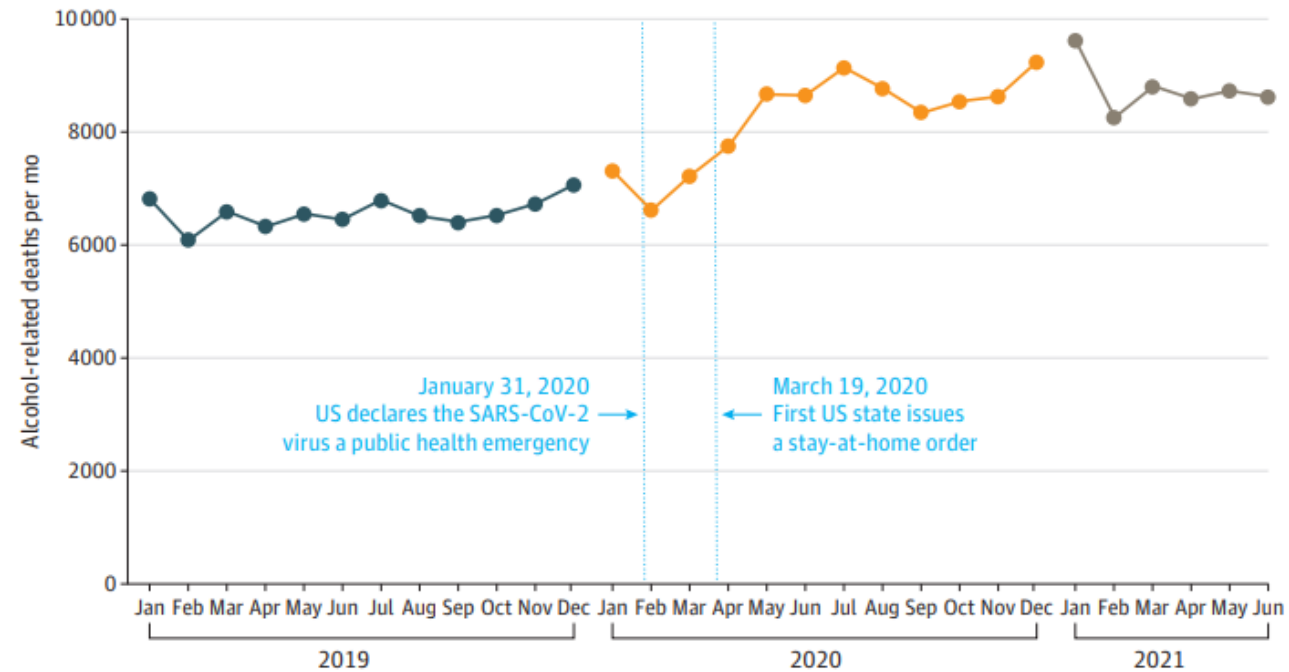
2) Yang, Y. et al. Determinants of physical activity maintenance during the COVID-19 pandemic: a focus on fitness apps. Translational Behavioral Medicine . August 2020

3) McCarthy, H. Physical activity behavior before, during and after COVID-19 restrictions: IE longitudinal smartphone tracking study of 5395 UK adult Journal of medical Internet research August 2020

# Alcohol

## We drank more

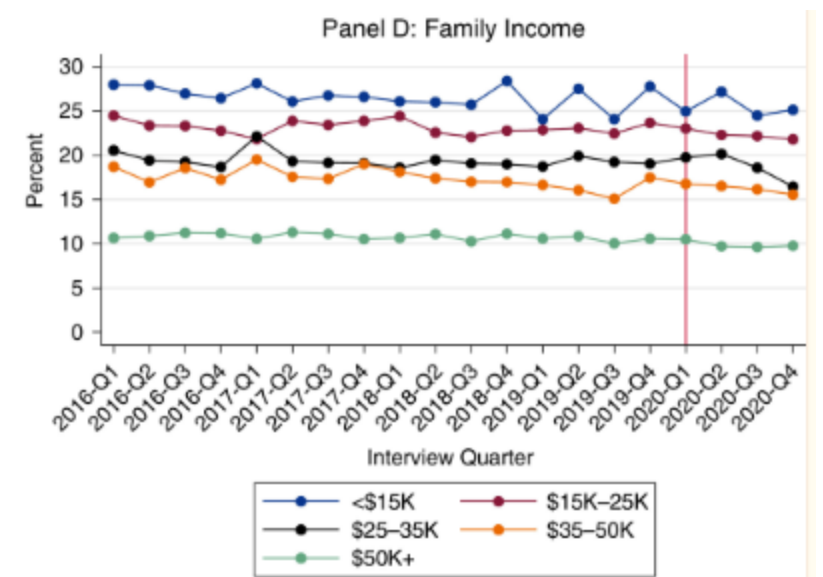
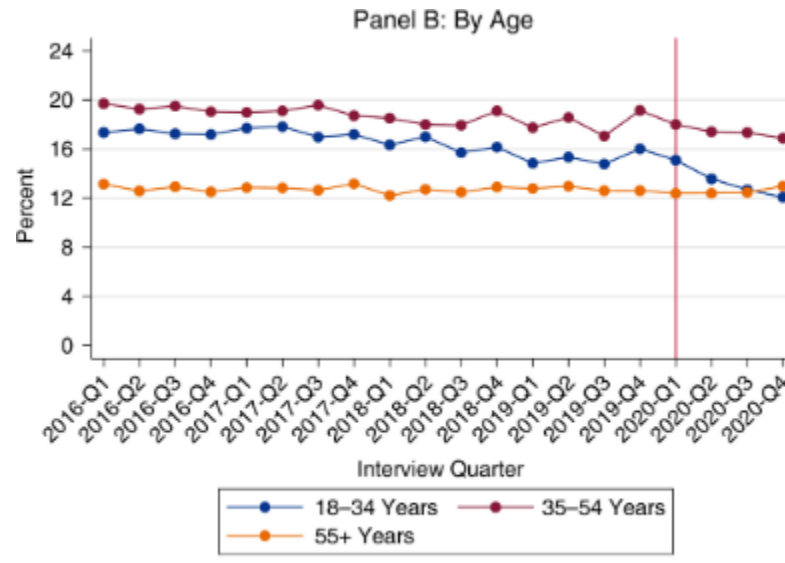
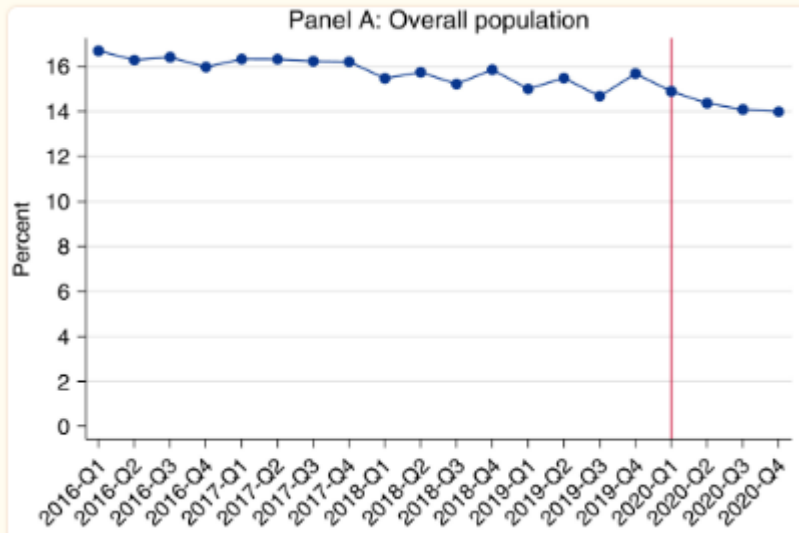
Figure. Monthly Alcohol-Related Deaths Among People 16 Years and Older



The dotted vertical lines indicate important dates in the US at the beginning of the COVID-19 pandemic. Deaths increased in the spring of 2020 as the pandemic unfolded, and the number of deaths remained elevated in the first half of 2021.

# Smoking

Interestingly, here are the smoking statistics



## One additional category

We didn't see our loved ones as much, including those loved ones who rely on close contact.

# So, what would you expect?

Let's try to guess

Decreased hospital admissions?

Increased out of hospital deaths?

Increased Alzheimer's deaths?

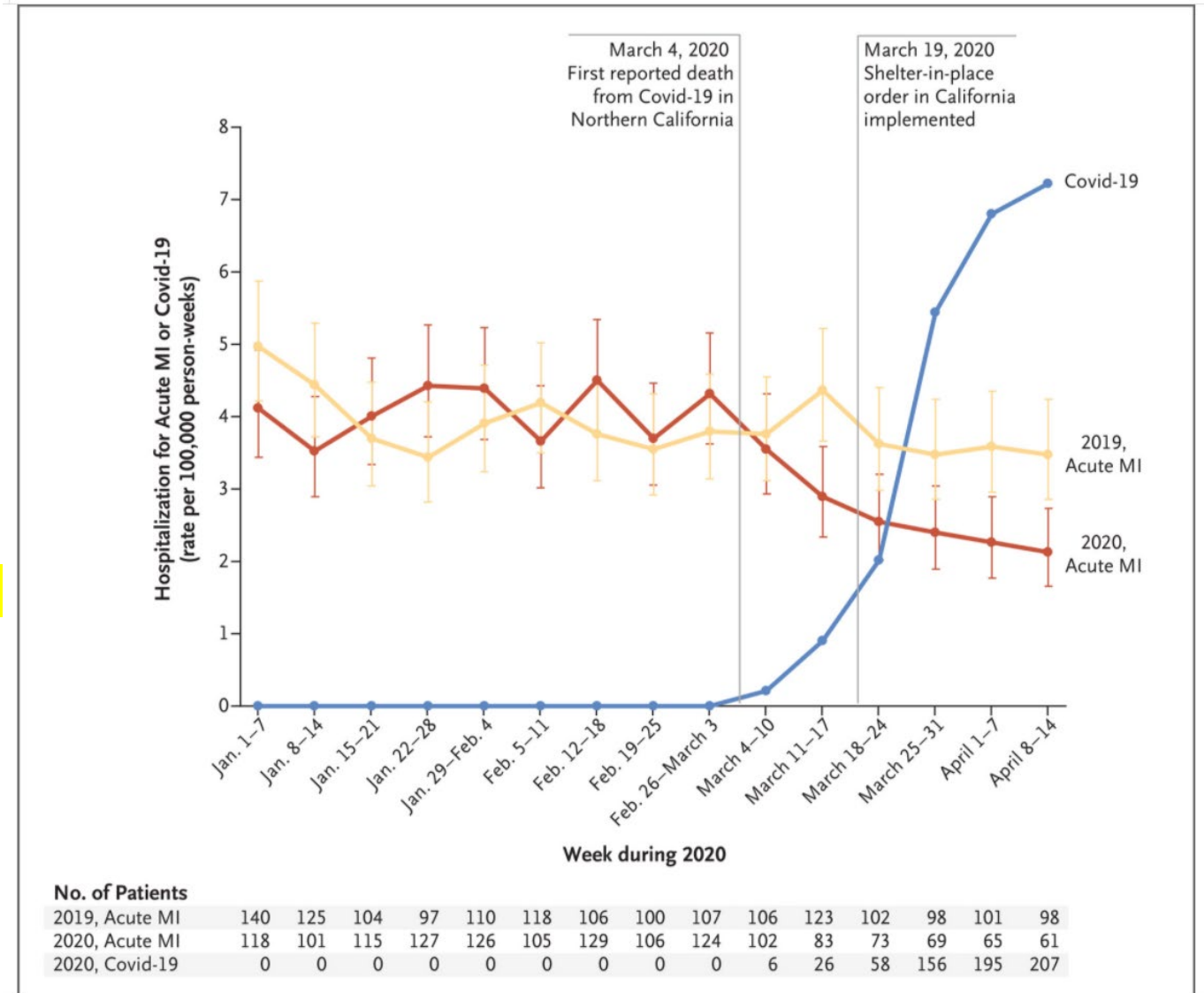
Increased CV deaths,

- Immediately from lack of medical attention?
- Long term from worsening risk factors?

Delay in cancer dx. and therefore, an increase in cancer deaths?

# Hospitalizations for MI's Decreased

- NEJM article
- Data from 4.4 million insured persons in California (43 million person-weeks) – Kaiser Permanente Northern California.
- 1/1 through 4/14/20
- 48% reduction in hospitalizations for acute myocardial infarction (~equal number of NSTEMI and STEMI).

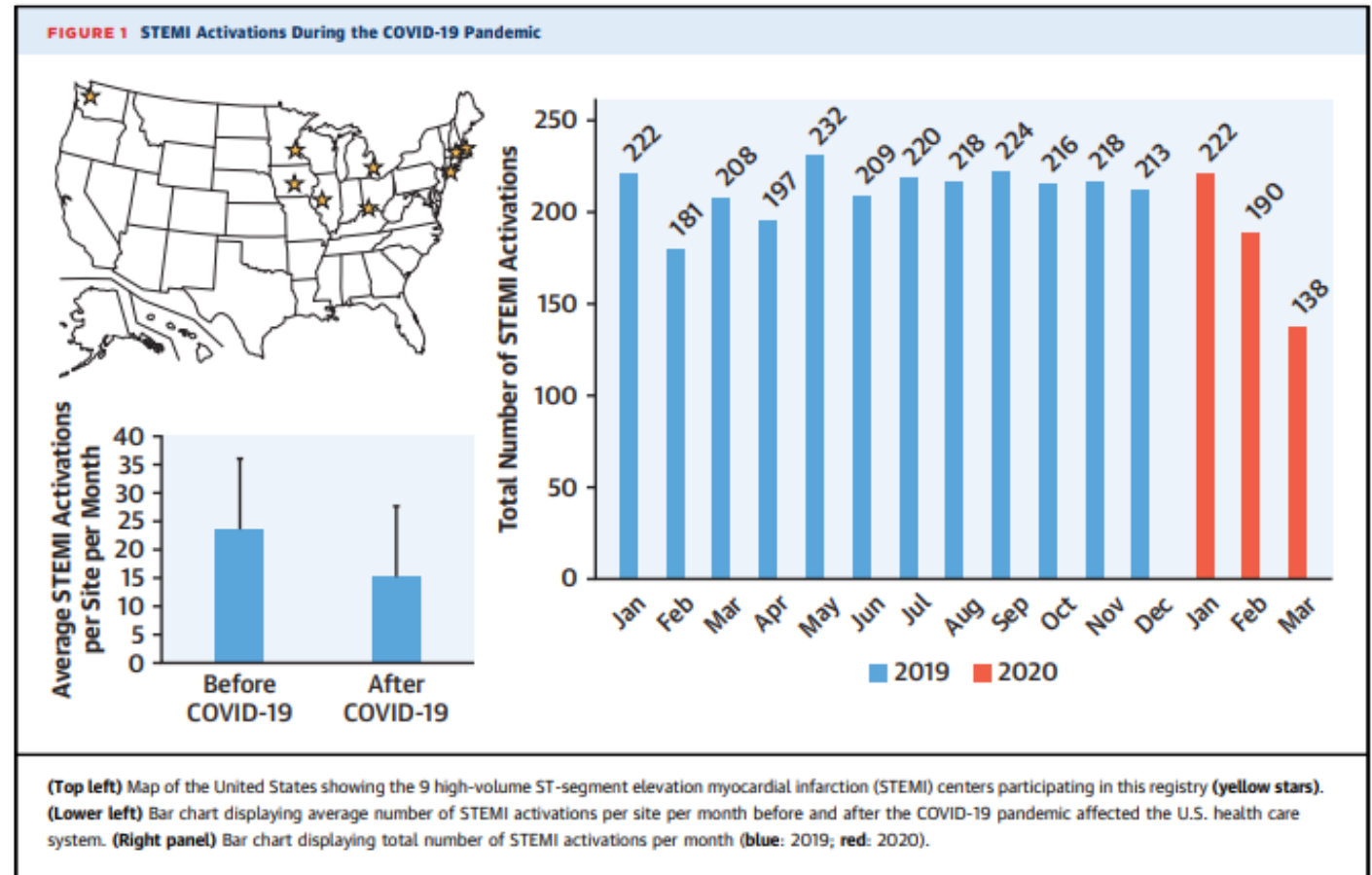




# Cardiac catheterization treatment of ST-segment elevation MI

## Medical treatments decreased

- PPCI is the standard of care for ST-segment elevation myocardial infarction (STEMI) patients.
- Study done in 9 high-volume cardiac catheterization labs in the US from 1/1/2019 to March 31, 2020.
- **38% reduction** in STEMI procedures during the first month of the lockdown.
- The authors comment on the **40% reduction** reported from Spain.



Note:

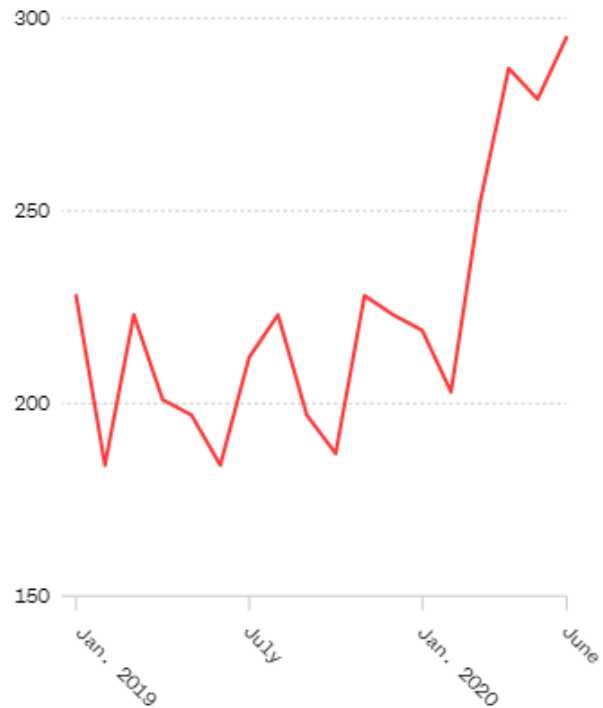
- Similar findings reported in a July 2020 study. March 2020 showed a **43% reduction in hospitalizations** for primary acute CV reasons.
- In-hospital mortality rates did not differ significantly from baseline trends.

# Out of hospital cardiac arrests

## Deaths increased

### Dead on arrival calls in Houston

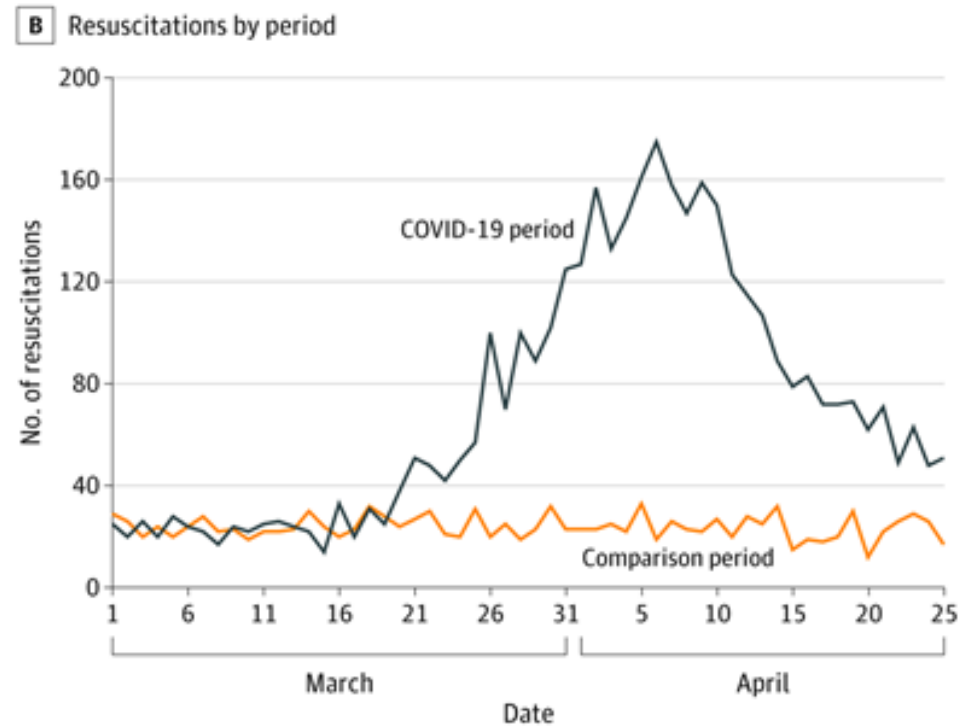
Houston has seen a spike in the number of people dying of cardiac arrest before paramedics can reach them.



Source: Houston Fire Department  
Graphic: Robin Muccari / NBC News

- 1) <https://www.propublica.org/article/a-spike-in-people-dying-at-home-suggests-coronavirus-deaths-in-houston-may-be-higher-than-reported>

Figure. New York City Out-of-Hospital Nontraumatic Cardiac Arrest Resuscitations, March 1 through April 25, 2020



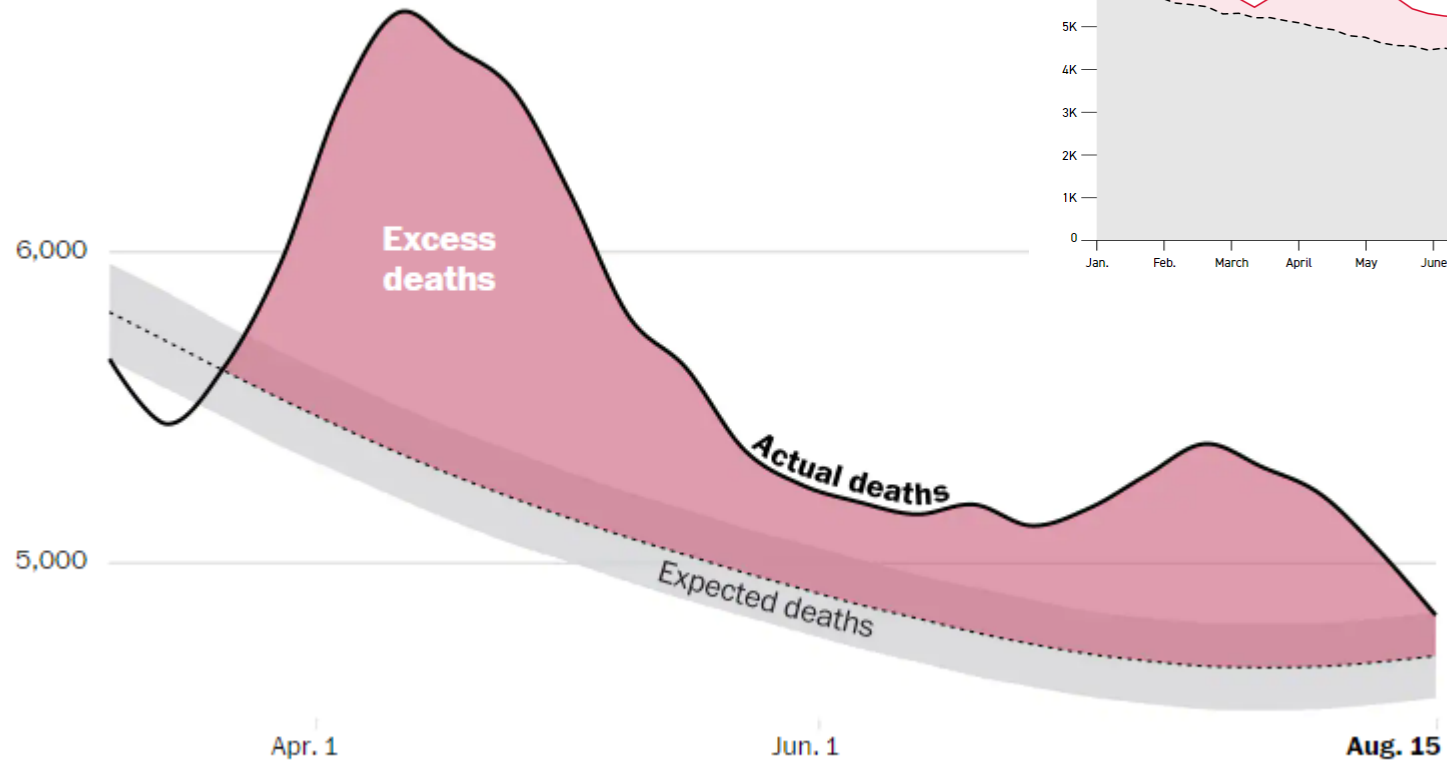
<https://jamanetwork.com/journals/jamacardiology/fullarticle/27676>  
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# Dementia

## Deaths increased

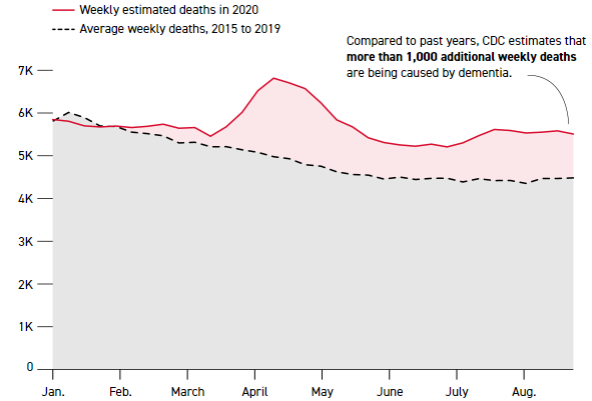
### Excess deaths due to Alzheimer's and dementia

A Washington Post analysis of weekly deaths data from the CDC found about 26,000 extra deaths due to Alzheimer's and dementia since March.



### Over 26,000 extra dementia deaths recorded amid pandemic

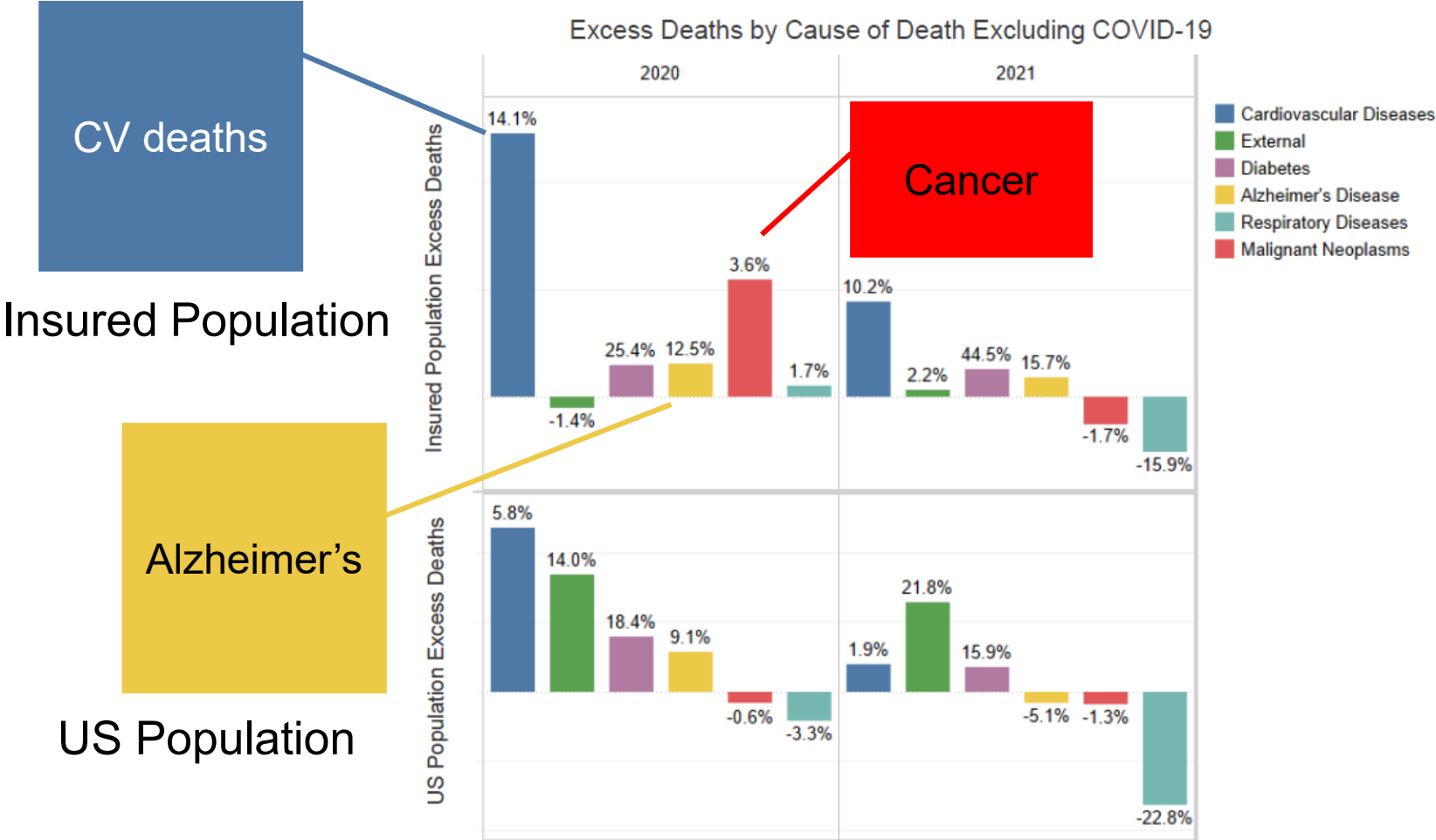
Deaths from Alzheimer's disease and dementia, estimated using death certificates



Source: CDC  
By Tucker Deberry, POLITICO

# Excess Deaths: Insured population

## By COD, excluding COVID-19



- 1) Numbers on bars represent the percent increase in deaths compared to the average number of deaths
- 2) The scales between the Insured and US populations are different
- 3) US population is based on CDC data as of 1/6/2022
- 4) Insured population is based on data as of 12/7/2021
- 5) 2021 deaths only include deaths through June

# So, how would you quantify CV deaths going forward?

Let's try to guess

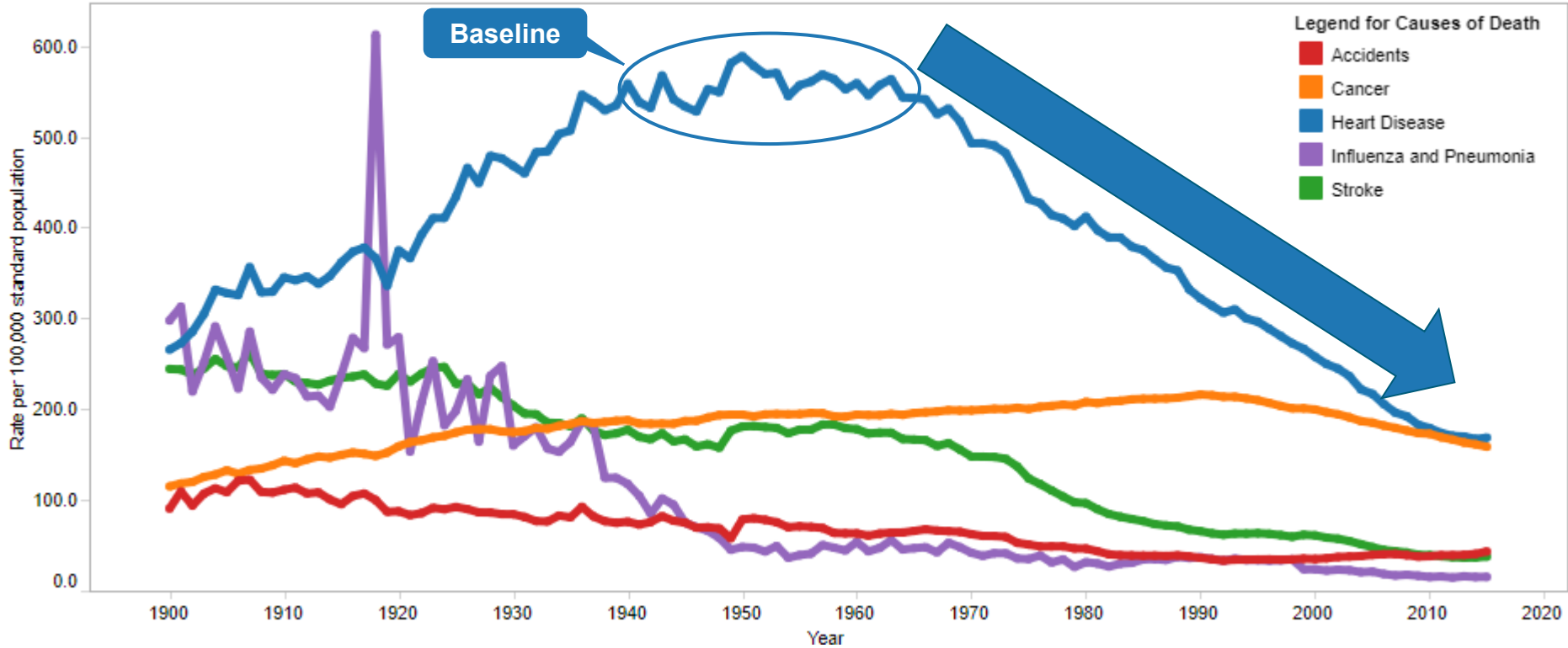
1. Direct impact of a COVID-19 infection
  - a. Immediate
  - b. Delayed
2. Indirect impact of delays in obtaining care
  - a. Screening for and management of risk factors
  - b. Symptoms/signs of CV disease
3. Risk factor changes

Let's start with looking back over the last few decades

# Mortality trends since 1900

Look closely at the CV deaths

Age-adjusted Death Rates† for Selected Major Causes of Death: United States, 1900–2015‡‡‡



1) <https://www.cdc.gov/nchs/data-visualization/mortality-trends/>

# CV mortality

## The IMPACT model

### Mensah et al

- Mensah et al describe the findings of Ford et al who used a validated statistical model (IMPACT Coronary heart disease model) to evaluate the decline in CHD mortality rate from 1980-2000.
- Evaluated the impact of smoking, high BP, elevated T.C.,

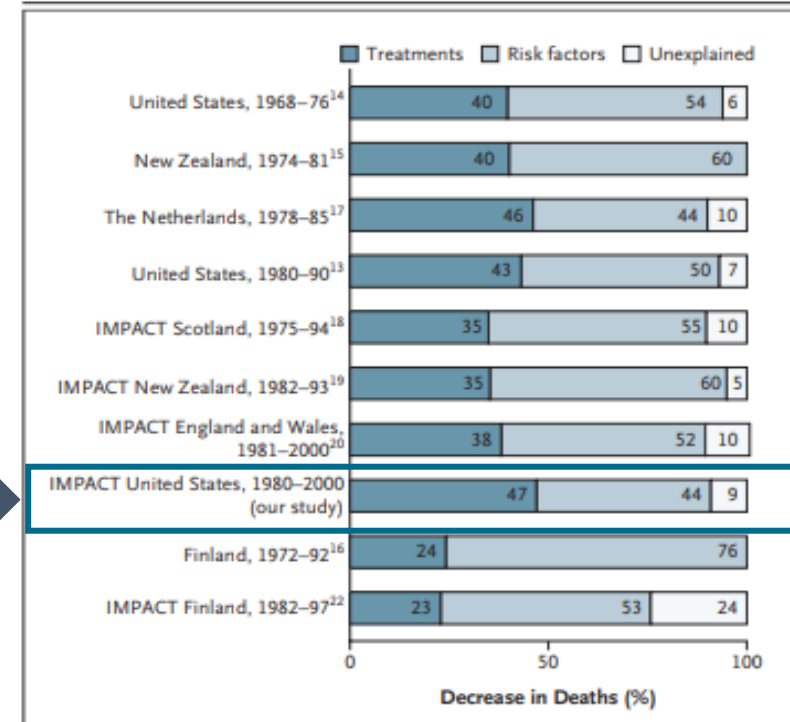
### Evidence-based medical and surgical treatments

11%	Secondary preventative therapies after MI
10%	MI/angina treatment (initial tx)
9%	CHF treatment
5%	Revascularization for chronic angina
12%	Other
<b>47%</b>	<b>TOTAL</b>

### Risk Factor Reduction

24%	Cholesterol reduction
20%	BP reduction
12%	Smoking reduction
5%	Physical Activity Improvement
-7%	BMI
-10%	DM prevalence
<b>44%</b>	<b>TOTAL</b>

### Ford et al



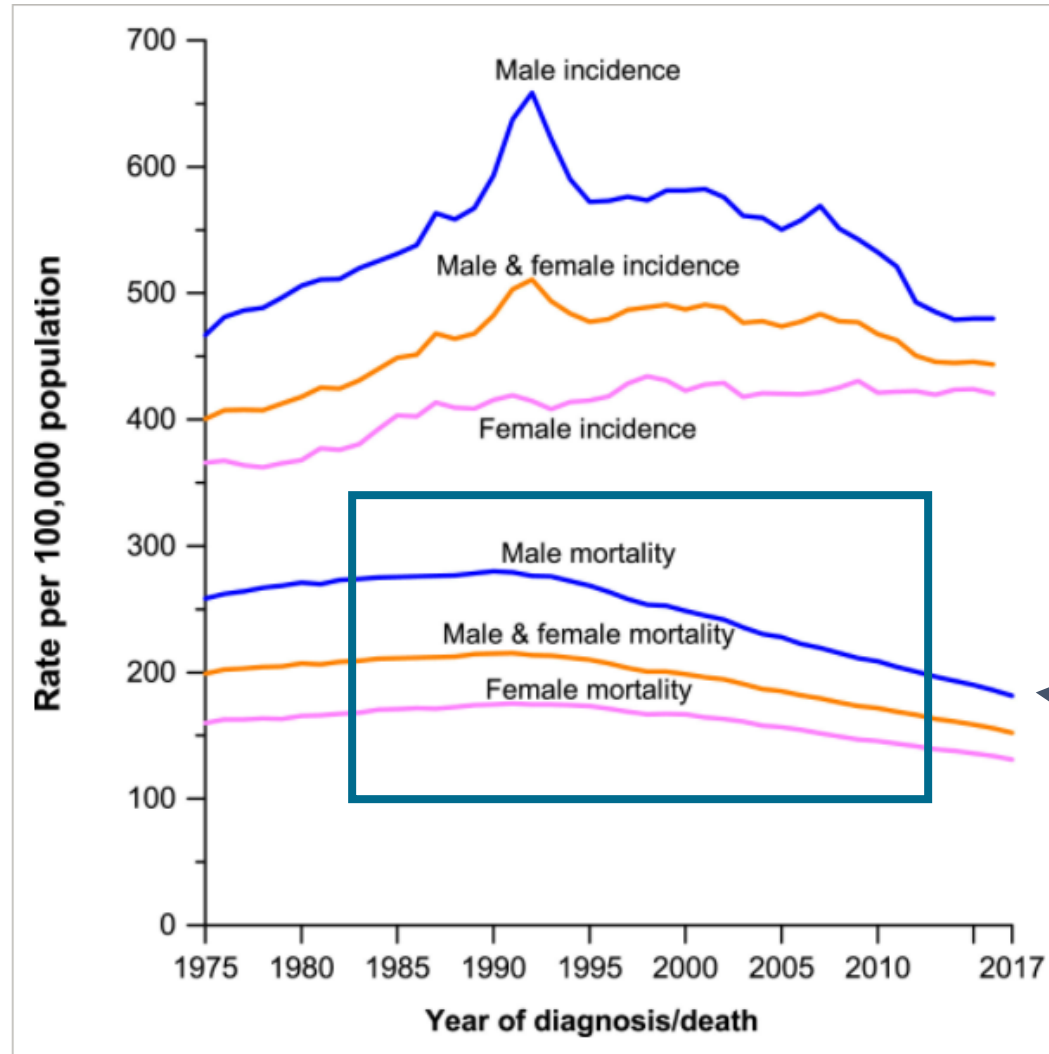
**Figure 2.** Percentage of the Decrease in Deaths from Coronary Heart Disease Attributed to Treatments and Risk-Factor Changes in Our Study Population and in Other Populations.

In the New Zealand study, 1974 to 1981 (Beaglehole<sup>15</sup>), the analysis focused on specific treatments and inferred contribution from risk factors. In the Finland study, 1972 to 1992 (Vartiainen et al.<sup>16</sup>), the analysis focused on risk factors and inferred contribution from treatments.

1) Chart taken from Ford E. et al. NEJM 2007. Explaining the decrease in U.S. deaths from coronary disease. 1980-2000

# Cancer deaths had been improving.

Smoking rates decreasing. Medical treatments improving.



Cancer mortality decreased by ~29% over the last 30 years.



# But not discovering cancer early has its problems

Delay in cancer discovery and treatment can cause death.

Delays can significantly impact survival.

Delays can result in cancer progressing from a lower stage to more advanced stages.



Advanced stages of cancer have a worse prognosis.

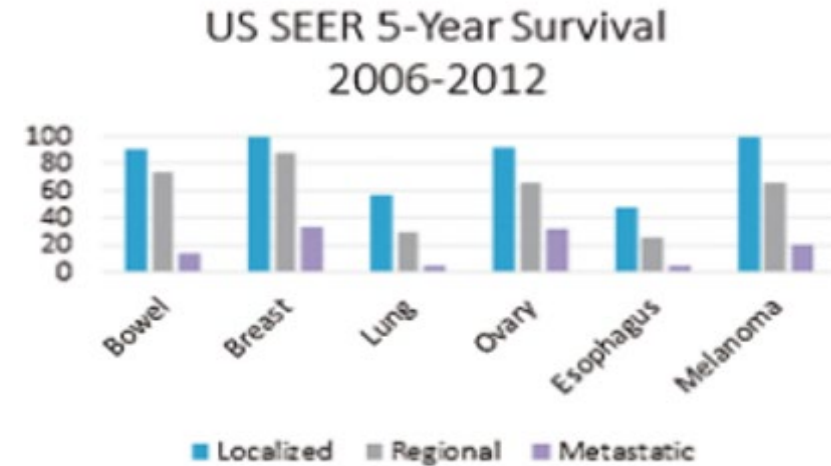
# Here is data showing increased death with late-stage cancers

This finding involves all organs and is found globally

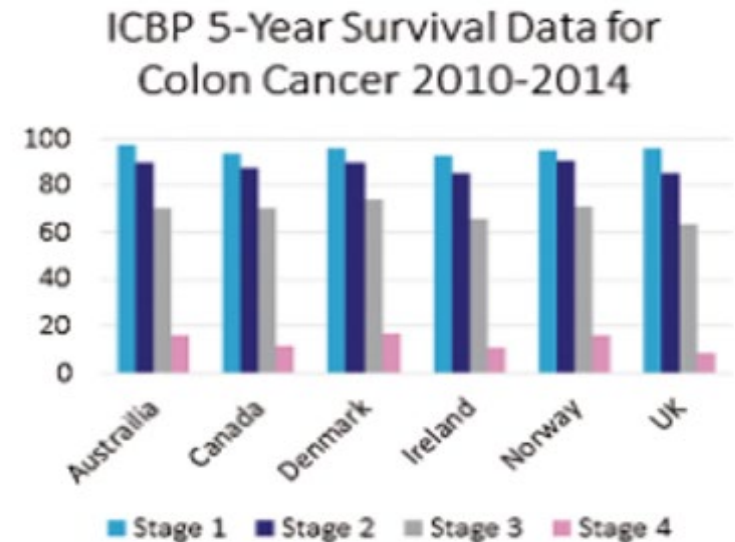
Delays in dx and treatment can be detrimental.

Patients survive longer when cancer is detected at an earlier stage.

**B**

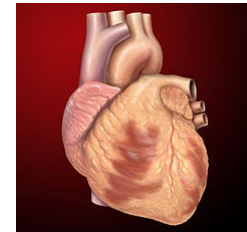
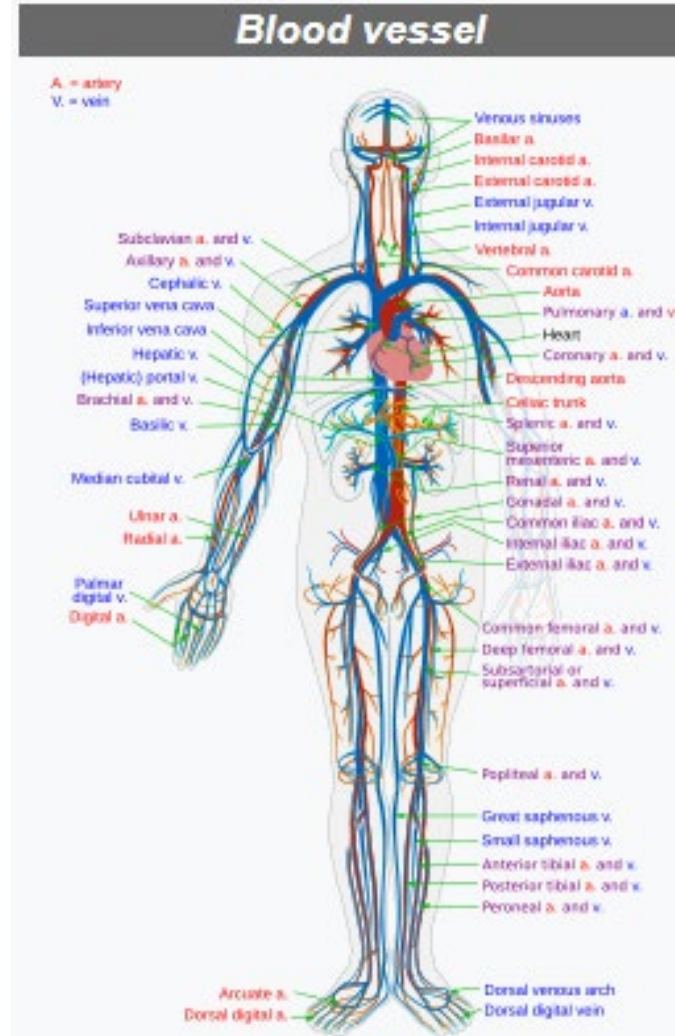
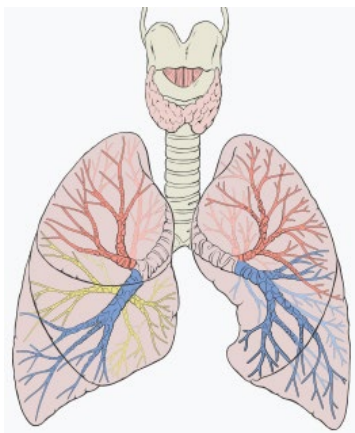
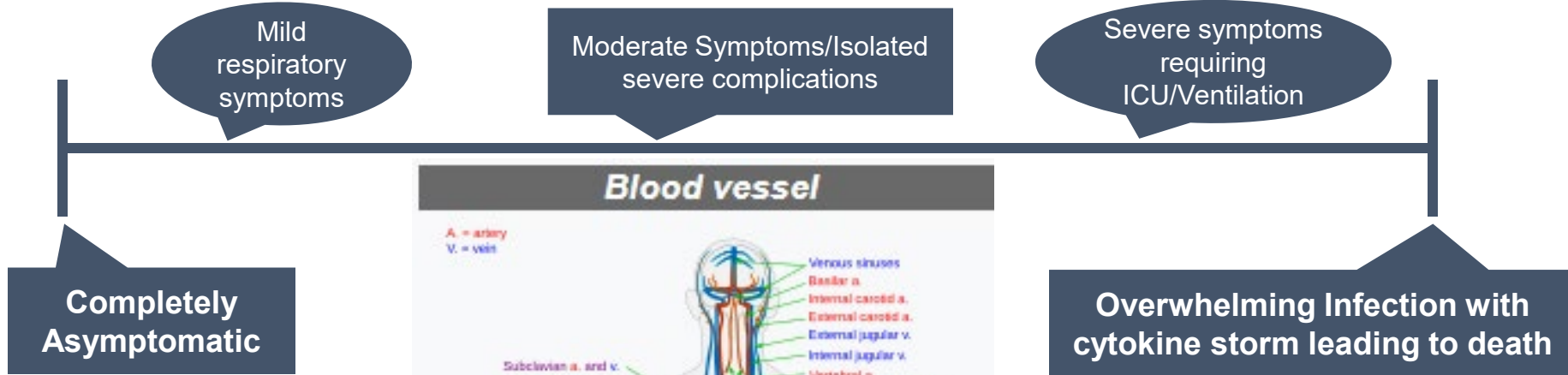


**D**



# What about Long COVID?

Long COVID is real. It does impact mortality.

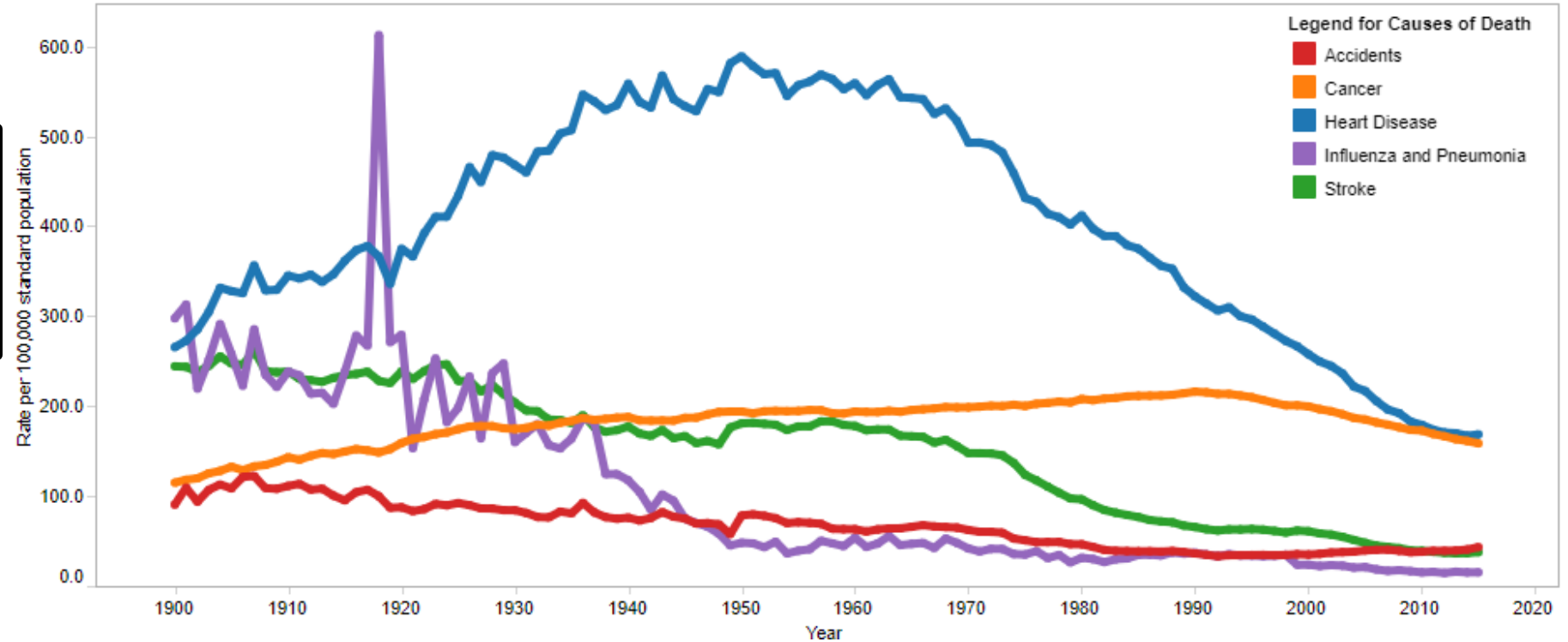


# Positive developments

## Is there anything good that will occur from this pandemic?

- Let's look back at the previous terrible worldwide pandemic and see what happened.
- Do you remember this slide?

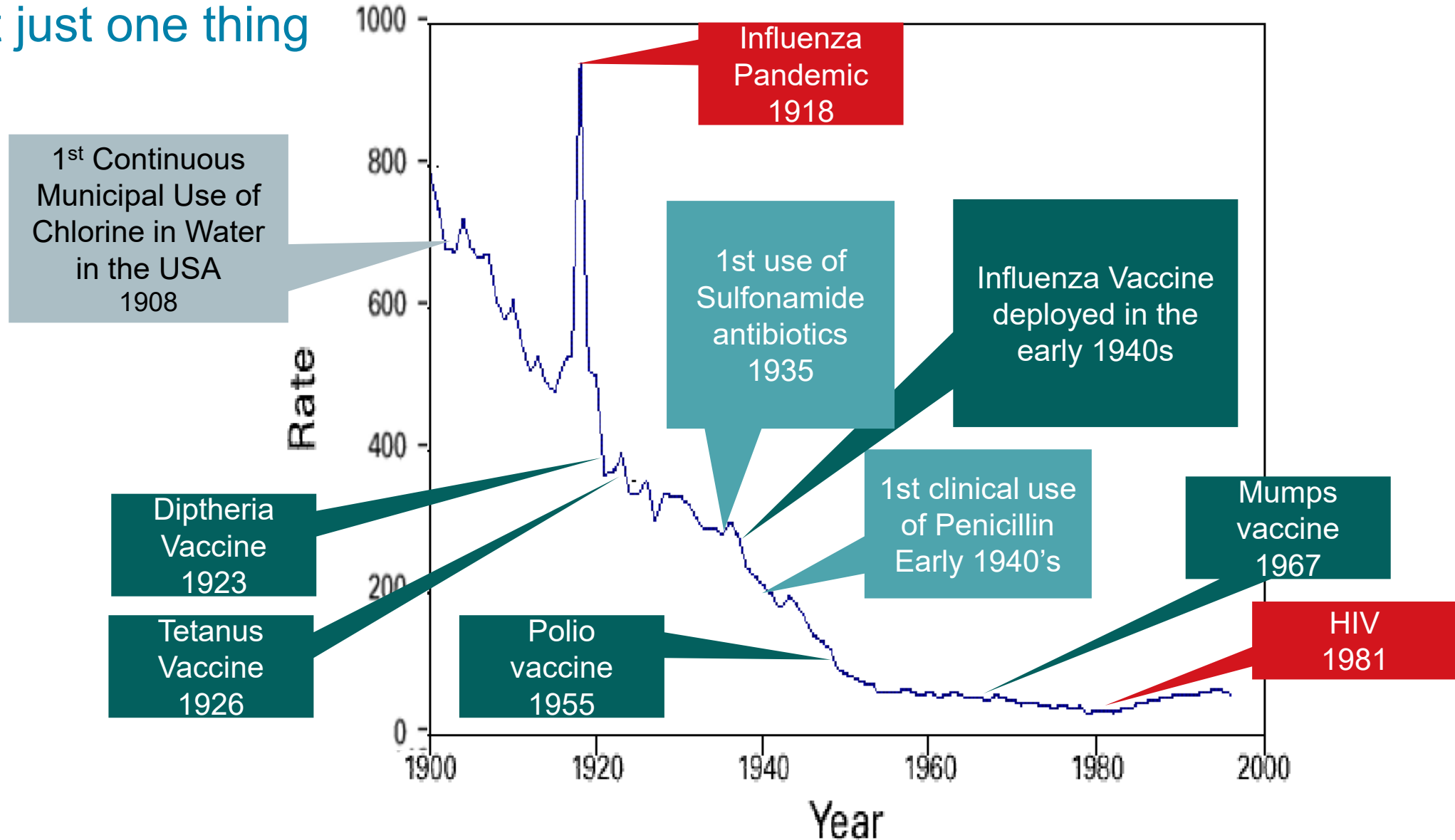
Age-adjusted Death Rates† for Selected Major Causes of Death: United States, 1900–2015‡‡‡



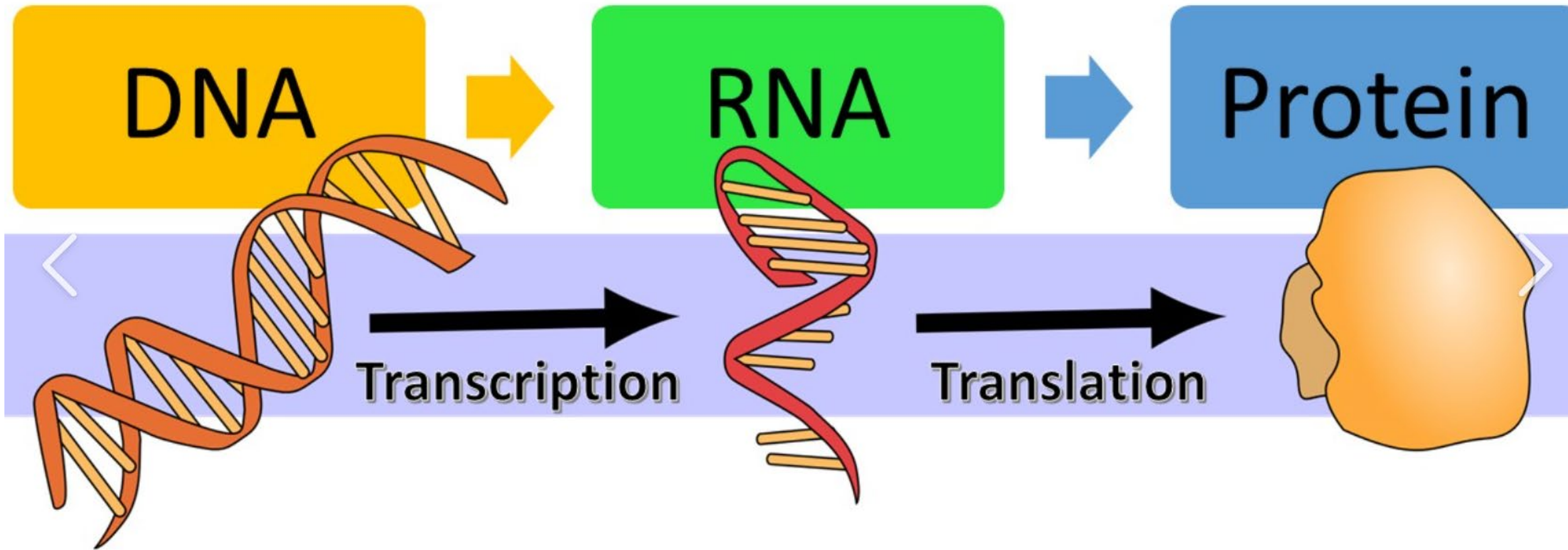
In 1900 infectious disease deaths were one of the big 3 causes of death

# The battle against infectious diseases

Not just one thing

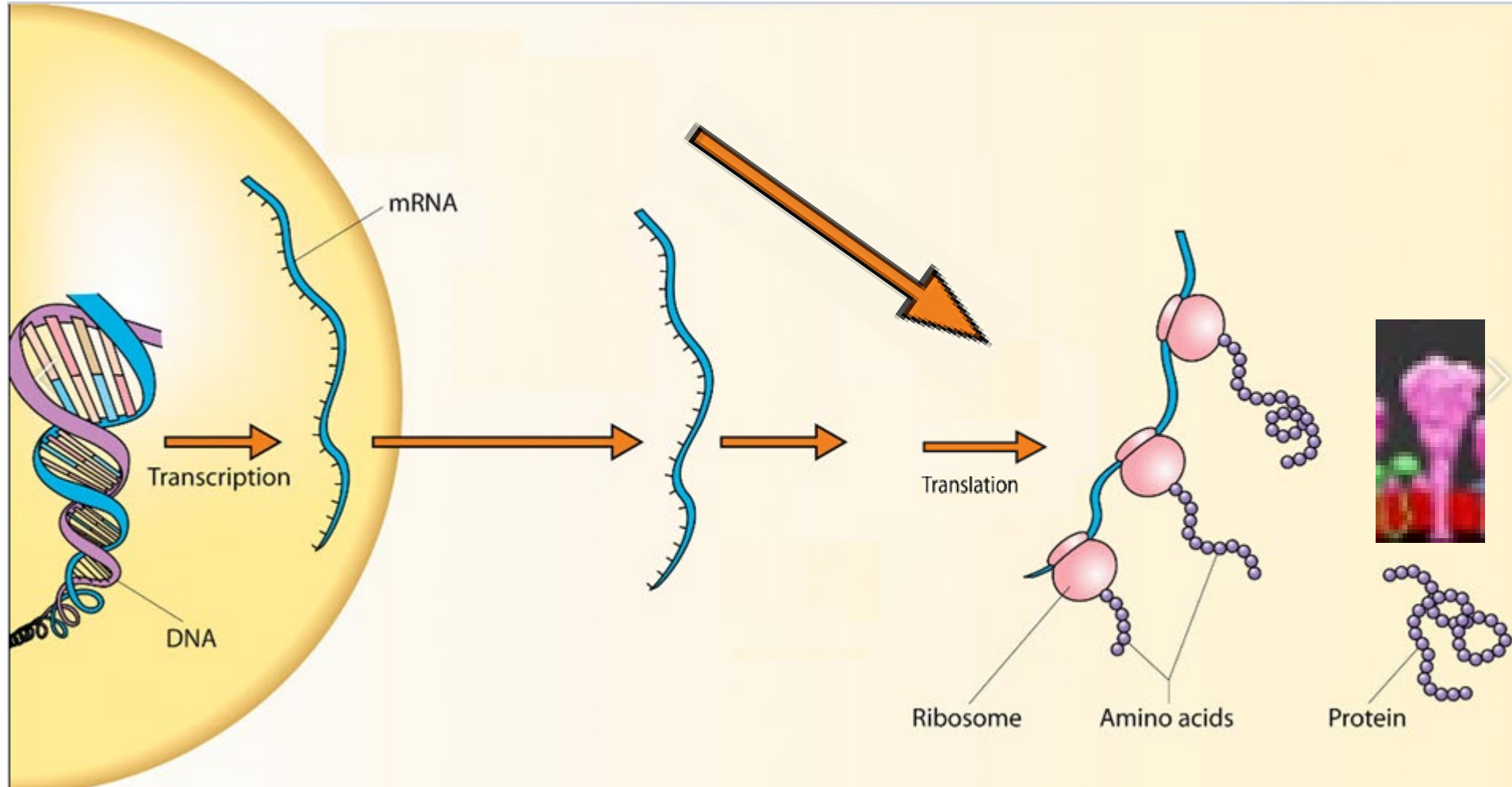


# The Central Dogma



# We are learning about mRNA technology

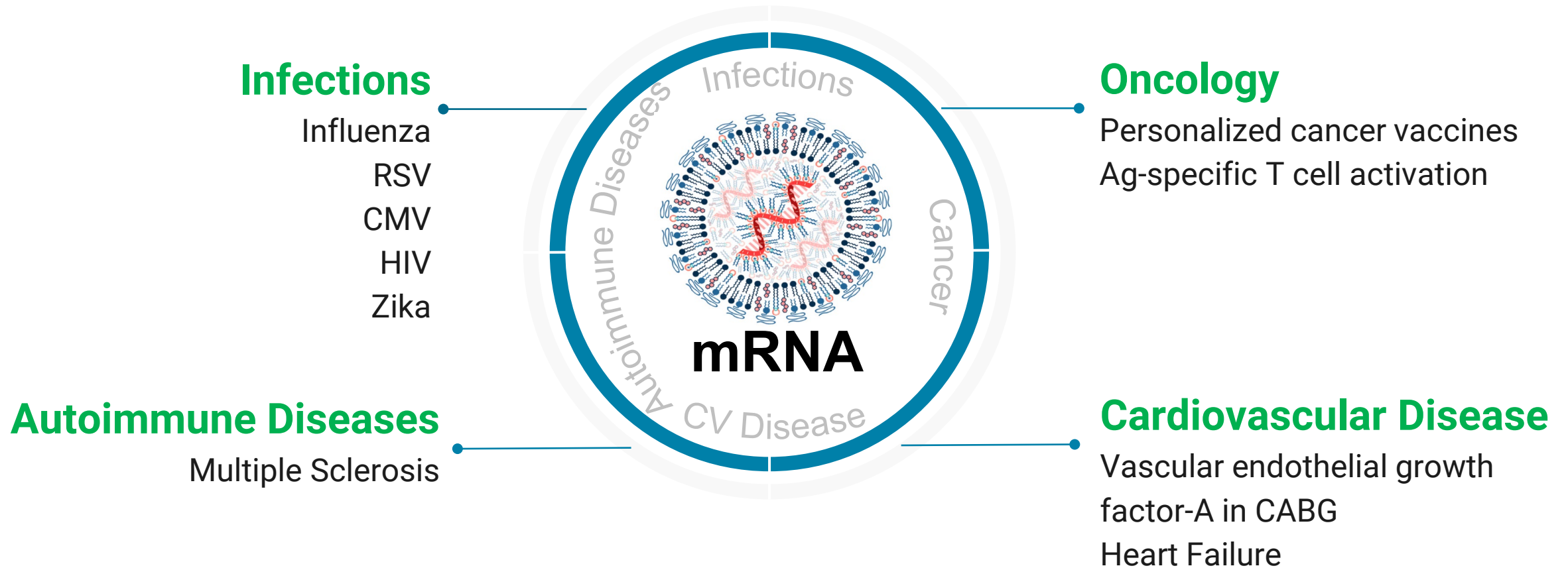
## The vaccine technology has potential



[https://www.bing.com/images/search?view=detailV2&ccid=3%2fQsImxW&id=996819EEEECD04FA26A187C1DF9262FD55F1D25FA&thid=OIP.MQdljWz7D-rkcbmrkgVmJwHaD1&mediaurl=http%3a%2f%2fupload.wikimedia.org%2fwikipedia%2fcommons%2f1%2f19%2fAntisense\\_DNA\\_oligonucleotide.png&exp=1424&expw=2750&q=dna+to+mna+to+protein&simid=608046794685811577&selectedIndex=11&qft=+filterui%3alicense-L2\\_L3&ajaxhist=0](https://www.bing.com/images/search?view=detailV2&ccid=3%2fQsImxW&id=996819EEEECD04FA26A187C1DF9262FD55F1D25FA&thid=OIP.MQdljWz7D-rkcbmrkgVmJwHaD1&mediaurl=http%3a%2f%2fupload.wikimedia.org%2fwikipedia%2fcommons%2f1%2f19%2fAntisense_DNA_oligonucleotide.png&exp=1424&expw=2750&q=dna+to+mna+to+protein&simid=608046794685811577&selectedIndex=11&qft=+filterui%3alicense-L2_L3&ajaxhist=0) Image obtained August 16, 2018 using Bing's "free to modify, share, and use commercially" search engine

# mRNA Technology

Bringing technology forward—there is hope



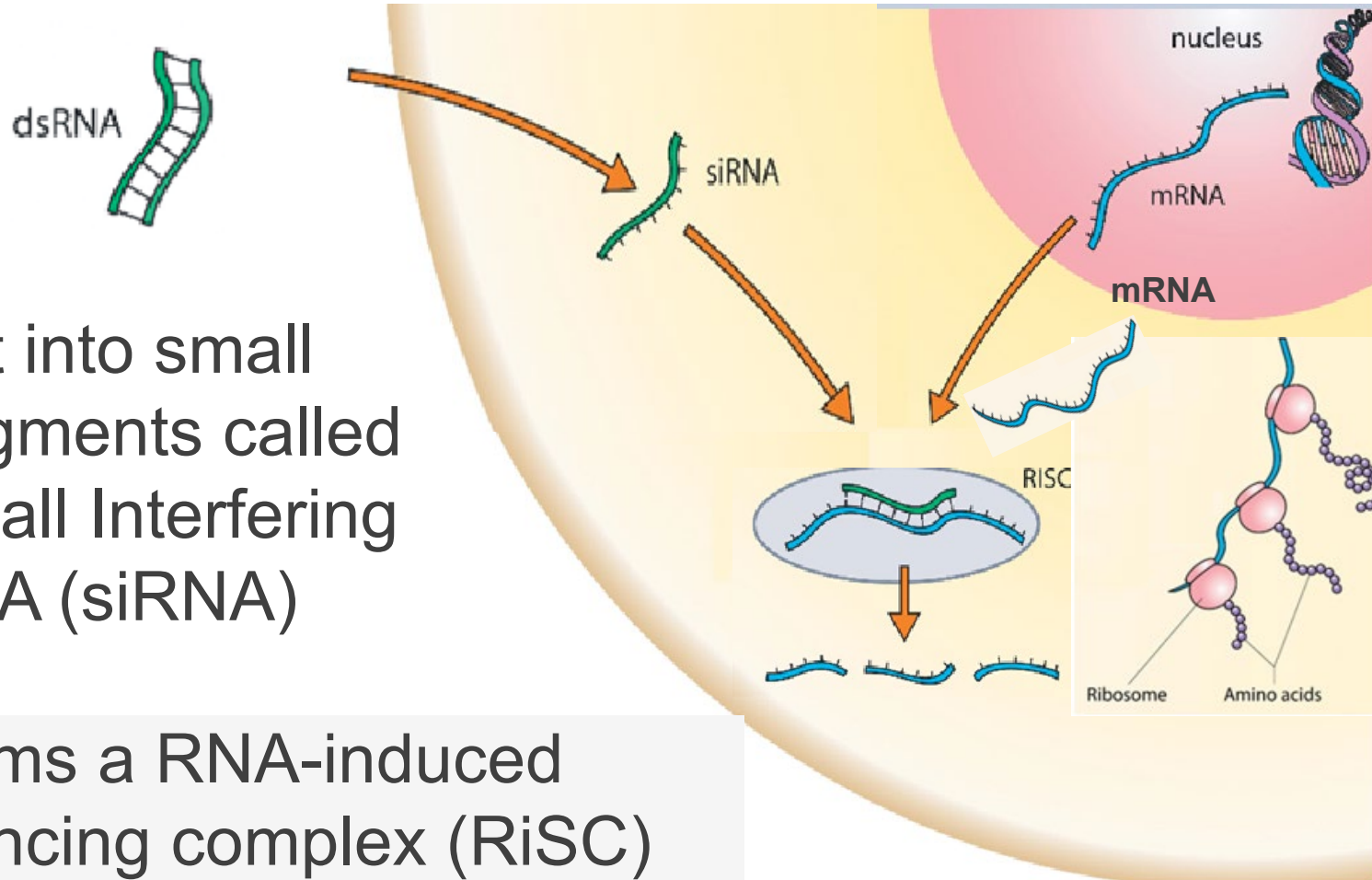


# Gene Silencing

RNA treatments are not all about increasing mRNA

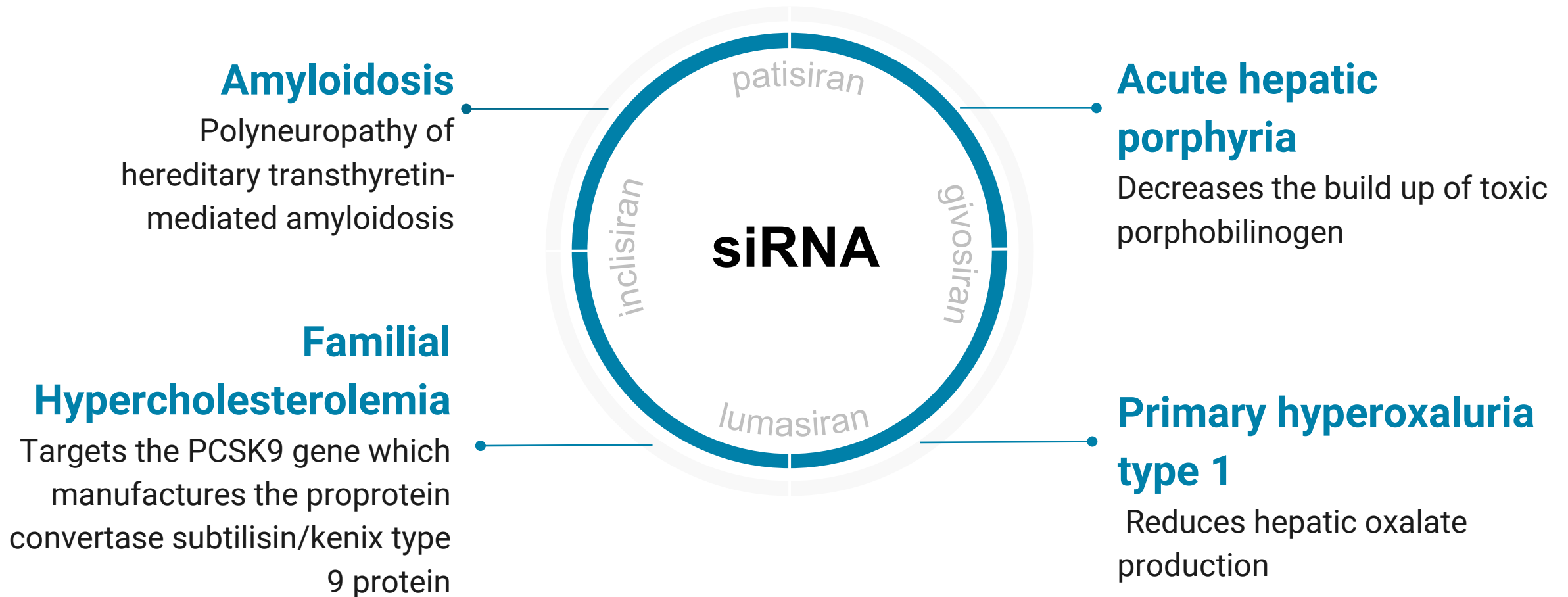
Cut into small fragments called Small Interfering RNA (siRNA)

Forms a RNA-induced silencing complex (RiSC)



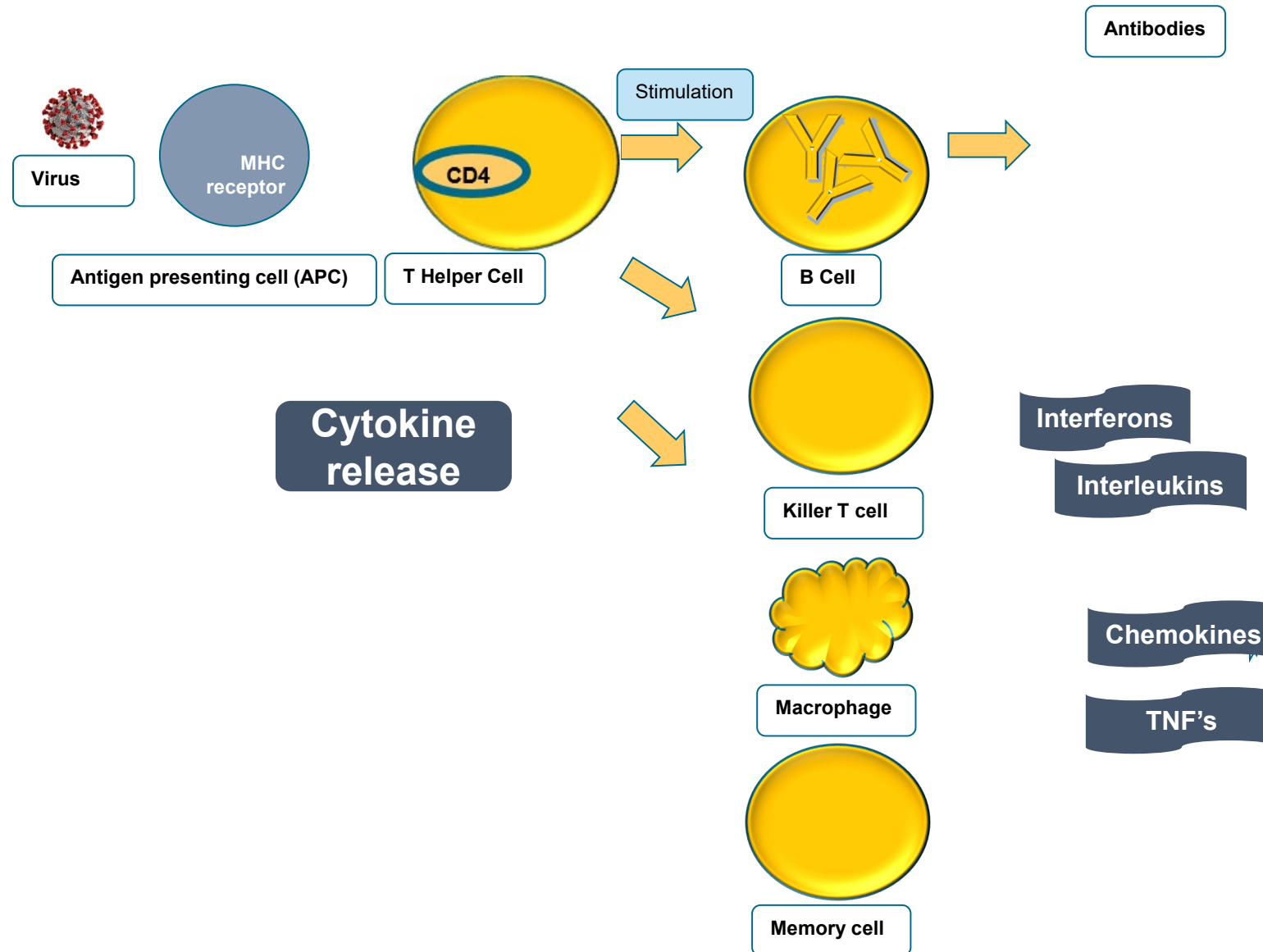
# siRNA Technology

## Gene silencing



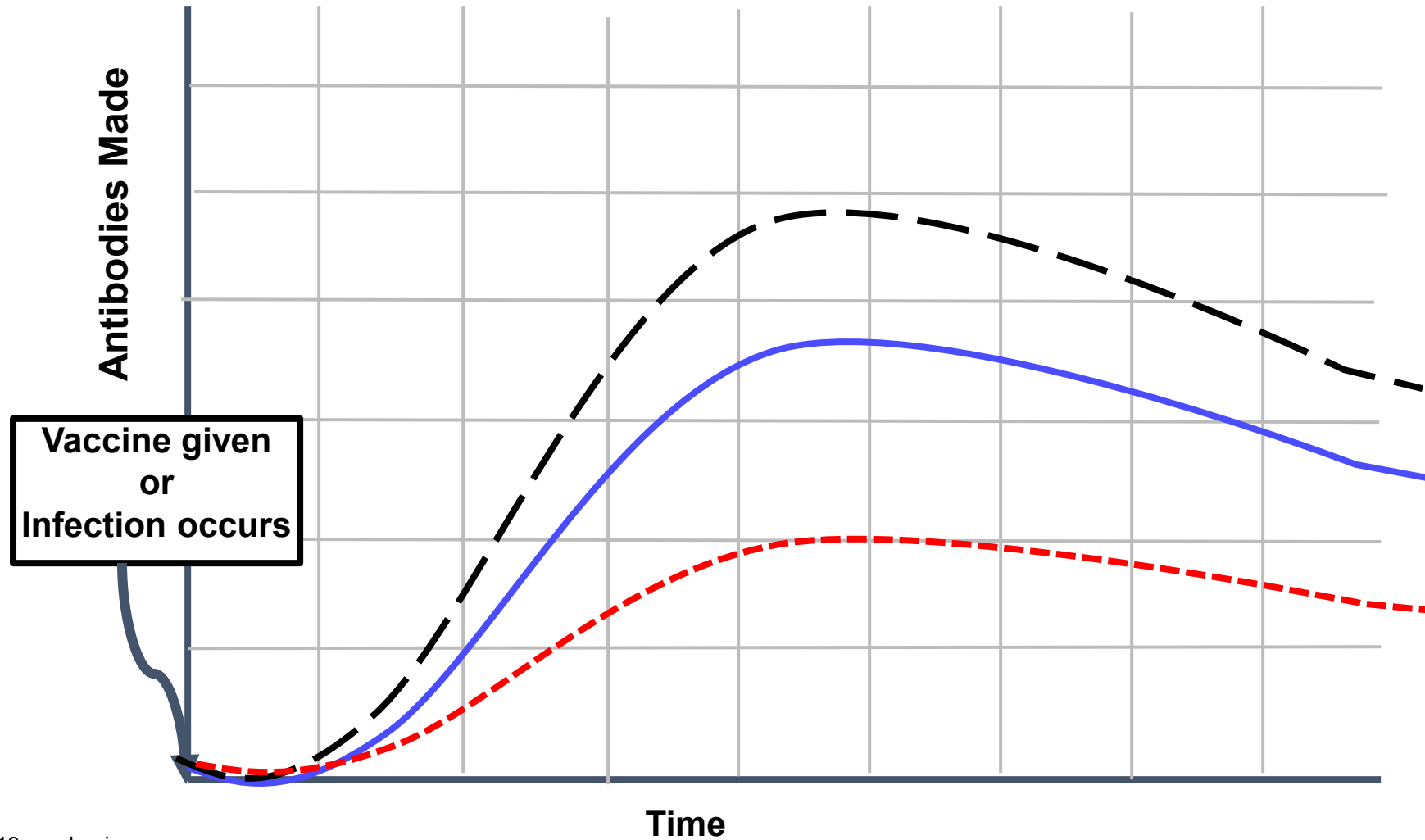
# We are learning more about our immune system

## The immune system— a brief introduction



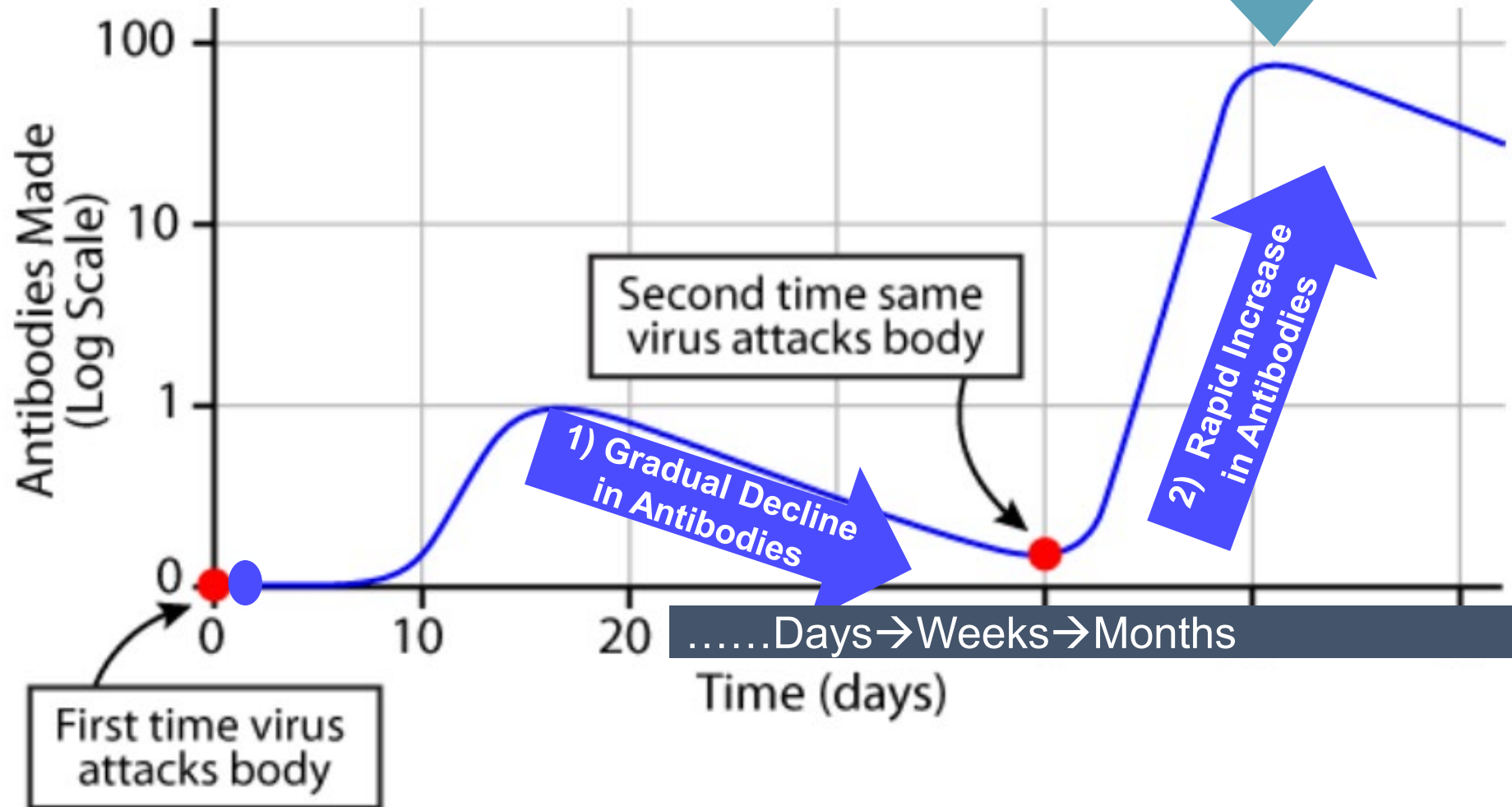
# We know more about our antibody response to SARS CoV2

We develop antibodies but the quantity gradually drops



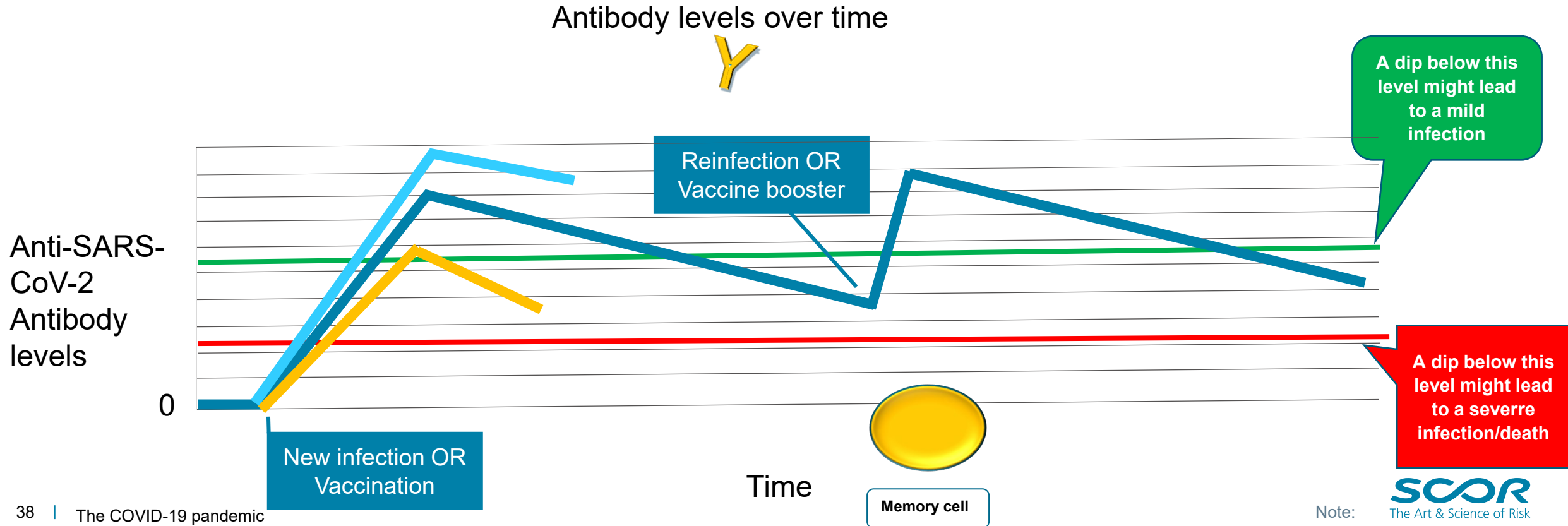
# Antibody Response to re-exposure

3) Reinfection creates a much quicker and much greater antibody response compared to the original infection



# Immunity---Concepts

- 1) Human's immunity is changing
- 2) Both obtaining the virus or obtaining a vaccine impacts our immunity
- 3) We need a correlate of protection established



# Infection versus Injection

## Varied results

Science

SCIENCEINSIDER HEALTH

## Having SARS-CoV-2 once confers much greater immunity than a vaccine—but vaccination remains vital

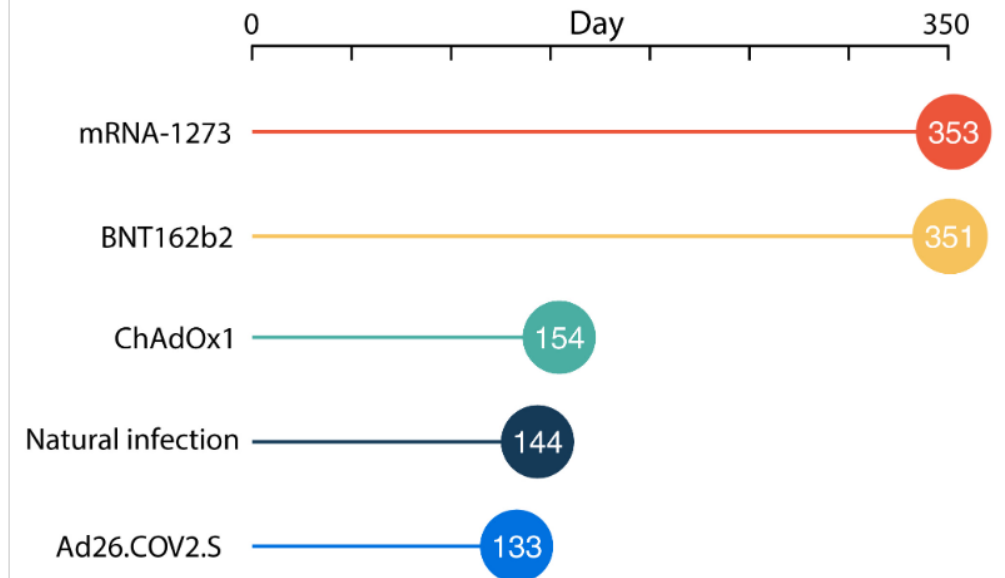
Israelis who had an infection were more protected against the Delta coronavirus variant than those who had an already highly effective COVID-19 vaccine

26 AUG 2021 • 8:00 PM • BY MEREDITH WADMAN

PNAS

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Fig. 2.



Mean time to 5% cumulative risk of natural reinfection or breakthrough infection under endemic conditions for mRNA-1273, BNT162b2, ChAdOx1, and Ad26.COVS.2.S vaccinations against SARS-CoV-2.

RESEARCH ARTICLE | MEDICAL SCIENCES | 8



### The durability of natural infection and vaccine-induced immunity against future infection by SARS-CoV-2

Jeffrey P. Townsend , Hayley B. Hassler, Pratha Sah , and Alex Dornburg  [Authors Info & Affiliations](#)

Edited by David Hillis, The University of Texas at Austin, Austin, TX; received March 11, 2022; accepted May 31, 2022

July 15, 2022 | 119 (31) e2204336119 | <https://doi.org/10.1073/pnas.2204336119>

<https://www.pnas.org/doi/10.1073/pnas.2204336119>

# Immunity

## Antibodies and T cells---bottom line

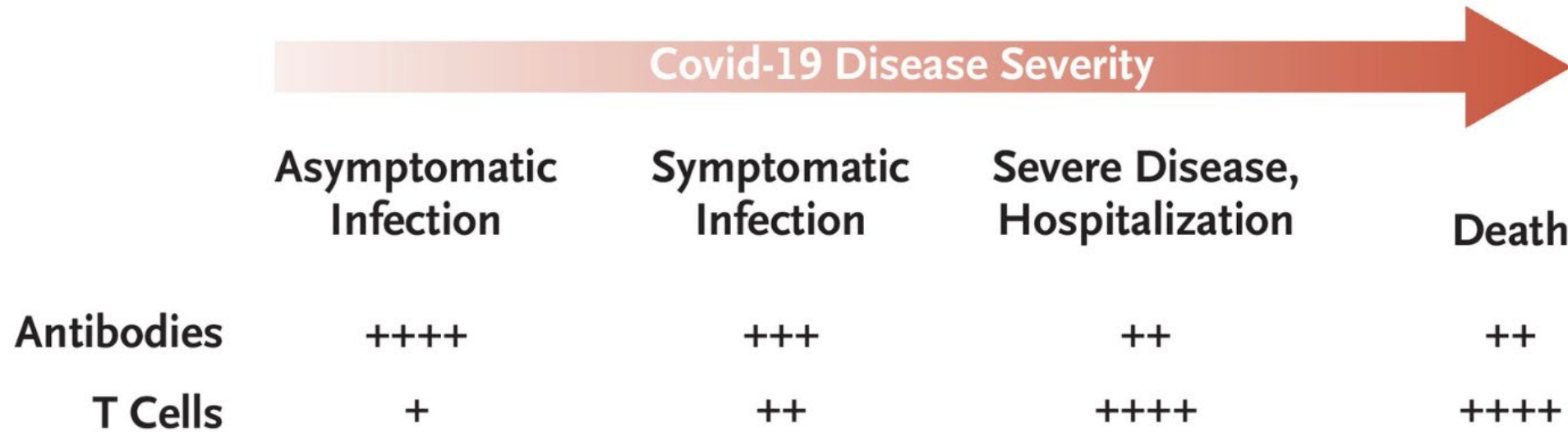
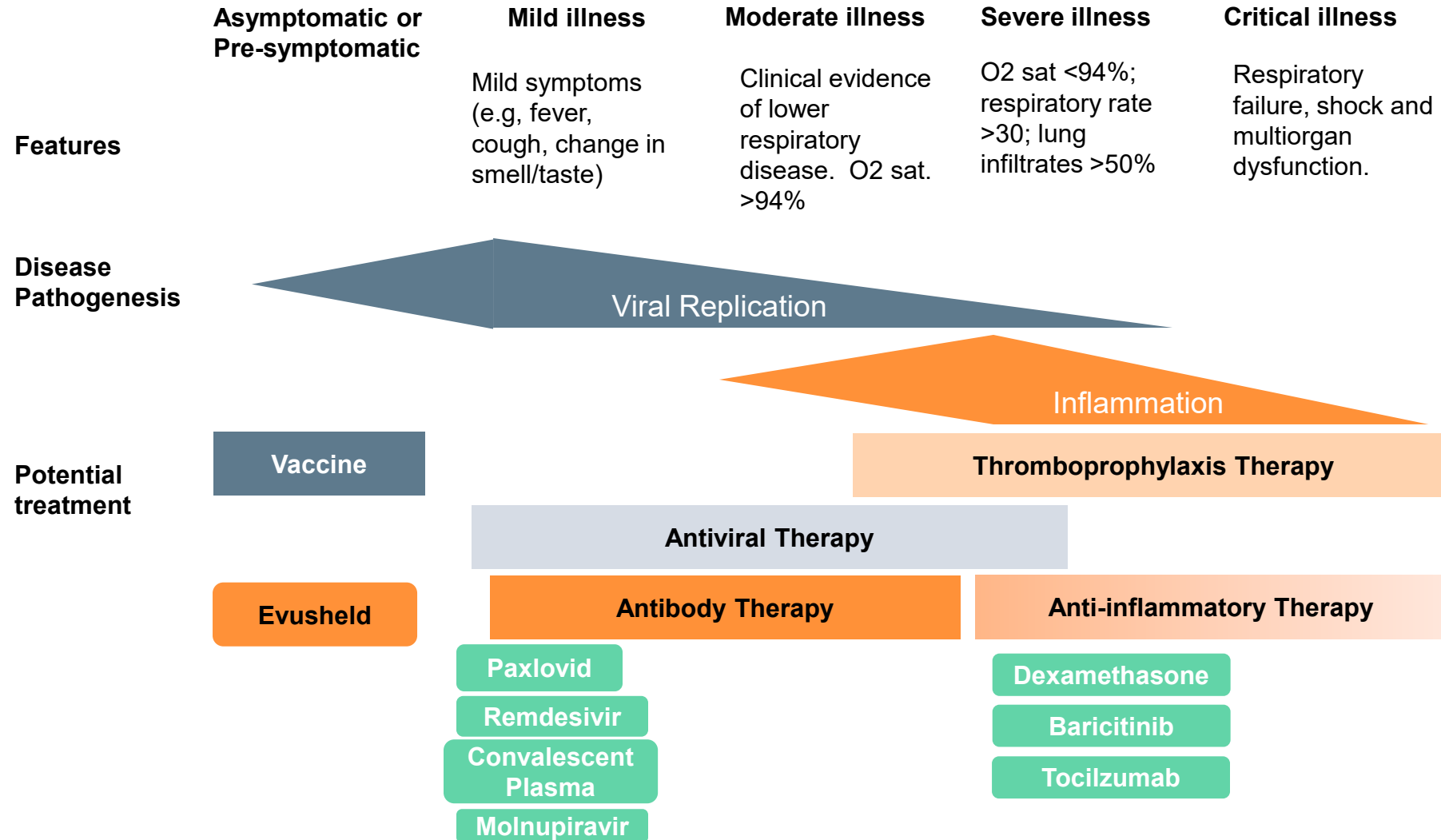


Figure 1. Immune Responses for Protection against Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2).



# COVID Treatments

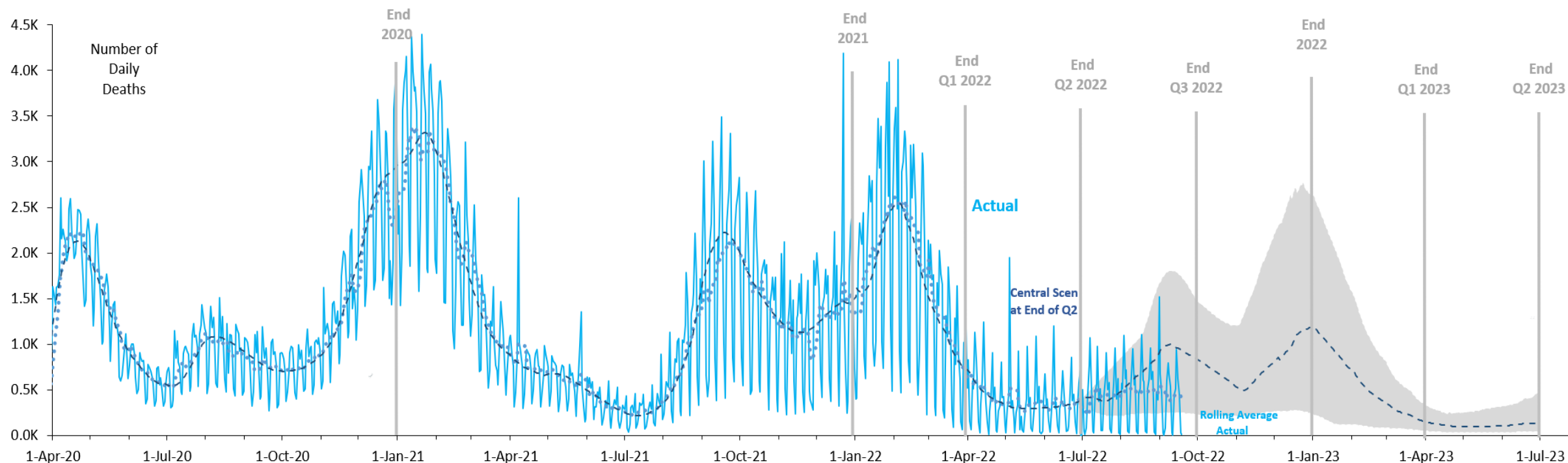
## Treatments have improved



# The Covid picture

Projections remain very uncertain due to uncertainty around immunity and characteristics of any new strain.

Epidemiological models frequently look like this



### 3 potential scenarios for the next 12 months.

- ❑ **Central scenario** assumes immunity from the Omicron wave wears off gradually and is enough to limit some level of infection into Q4. Vaccination will remain at low levels, but immunity should start to build up again as more people become infected with the wave expected at the end of 2022. Paxlovid distribution will continue, and therefore limit the waves of death going forward.
- ❑ **Optimistic Scenario** corresponds to a case where immunity remains very high and antivirals (e.g. Paxlovid) and medications become very widely available as the federal government manages to boost its usage. New strain emerges in H2 2022 and is very similar to Omicron but less lethal. Vaccination is also higher.
- ❑ **Pessimistic scenario** has a new strain with higher immunity escape and transmissibility, and moderately higher lethality. Take up of additional vaccine doses is slower and antivirals are not as widely available. Behavior returns to pre-pandemic levels. This is a relatively high upper bound in that the natural progression of a virus is thought to be a general trend towards lower lethality. Here this is increasing (as occurred with Delta), with a large wave in deaths, yet behavior remains at very relaxed pre-pandemic levels, hence it is assigned a lower probability.

1) The impact of the Covid-19 crisis cannot be accurately assessed at this stage, given the uncertainty related both to the magnitude and duration of the Covid-19 pandemic and possible effects of future governmental actions. Scenarios are derived from SCOR proprietary epidemiological modelling

# Main Drivers of the future Covid Picture

- **Prior Immunity and how long it lasts.** CDC estimates over 95% of the US population has been either vaccinated or had a prior infection.
  - Sterilizing immunity means protection from catching Covid. Functional immunity prevents death, but you can catch covid.
  - These do not necessarily wear off at the same rate.
- **Immune Imprinting.** Immune system is trained by the repeated vaccination or specific variants that infected or reinfected someone.
  - Infected in Initial, Alpha, Delta, or Omicron waves.
  - Vaccinated with one, two, three, or four doses of a vaccine designed for the initial spike sequence, or new bivalent vaccine.
- **New Covid Variants.** Especially if it is better at escaping immunity, or with higher lethality (hopefully less likely).
- **Medical Advances.**
  - Paxlovid and Sabizabulin.
  - Bivalent vaccines which have immunity against strains derived from the initial and Omicron strains.
  - Nasal Vaccines? Could be effective in preventing the transmission, and already approved in India and China.

## So, there is hope

Bottom line, keep yourself in as good a condition as you can.

- 1) You will most likely meet this virus.
- 2) Be as prepared as you can.
- 3) The virus might change---How that might impact mortality
  - a. Recall SARS and MERS case fatality rates
  - b. Recall the 4 coronavirus strains that cause the common cold
- 4) Our immunity will change
- 5) Remember that immunocompromised individuals, older individuals, and those with comorbid conditions are still at risk.



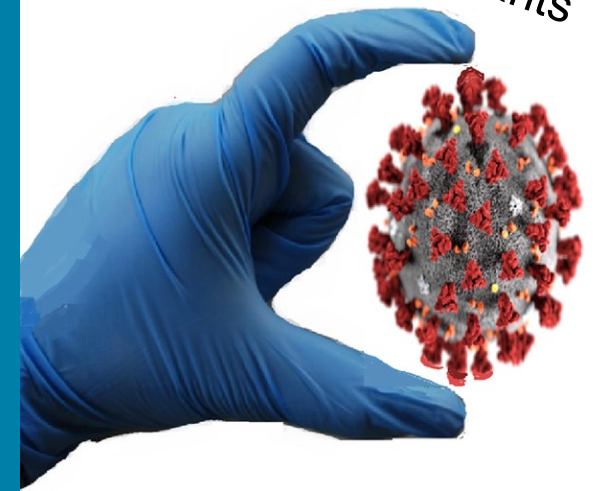
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**Thank  
You!**

????? Questions ??????????

**The Future Unmasked:  
Life After the Arrival of  
COVID-19**

Reinfection  
Arrival of  
Vaccines  
Lessons being learned  
Emerging  
Variants



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The COVID-19 pandemic