

# Session 13A: Post-COVID-19 mortality assumptions for retirement plans and Social Security programs

October 27, 2022

## Presenters:

Steve Goss, ASA, MAAA  
Chief Actuary, US Social Security Administration

Robert N. Anderson, PhD  
Chief, Mortality Statistics, NCHS, CDC

George Rutherford, M.D., A.M.  
University of California, San Francisco

Anne Case, PhD and Angus Deaton, PhD  
Princeton University

Adrian Gallop, FIA  
UK Government Actuary's Department

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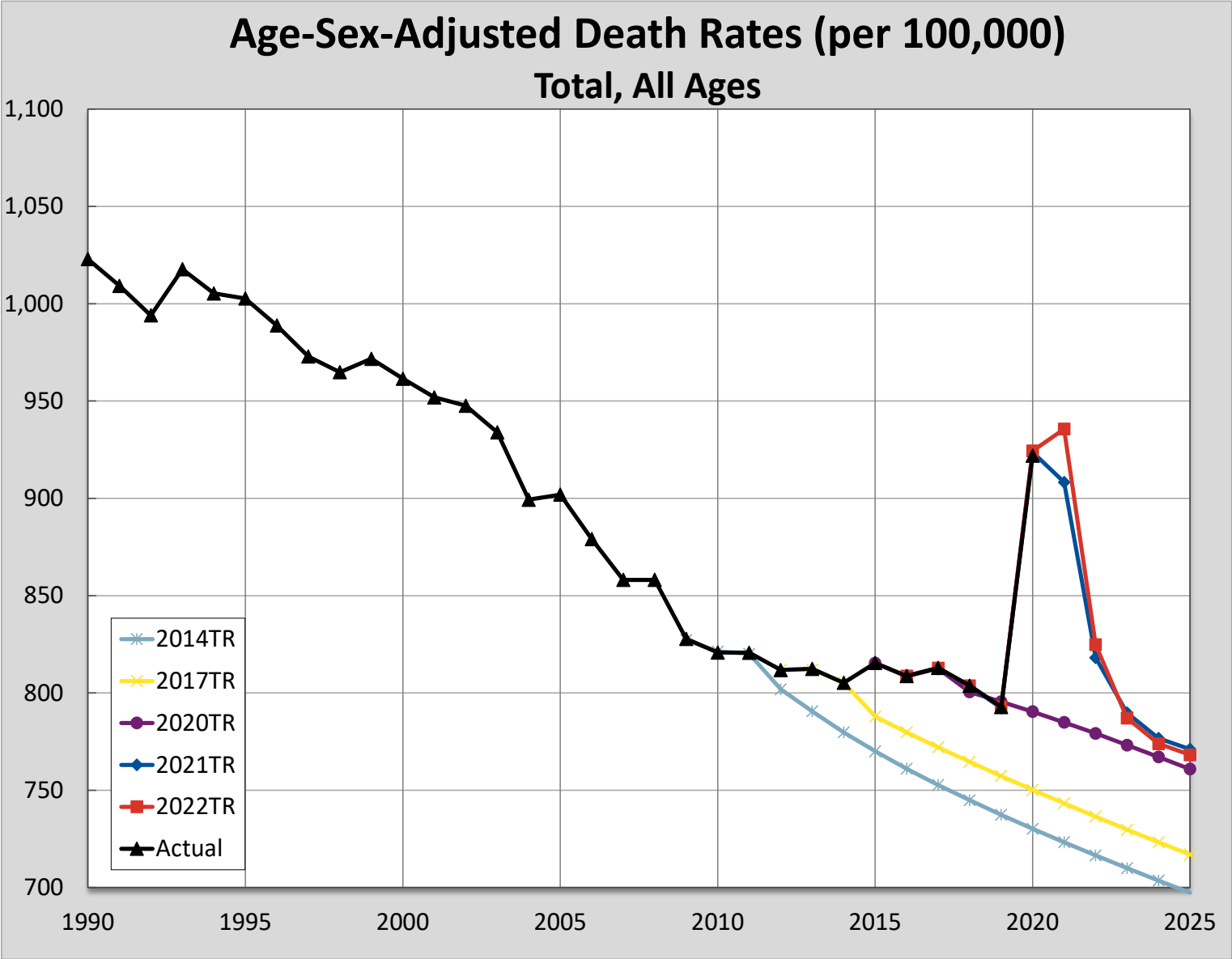
# Mortality has been affected around the world by the COVID-19 Pandemic. What will follow?

- Successive variants of the COVID-19 virus have sustained its impact even with the development of groundbreaking vaccines in record time.
- This pandemic will resolve to endemic but will have some lasting effects
- But our scope today is to look past the pandemic to prospects for future mortality: Will we move back to the modest trends of the last decade? Or to the rapid advances of the last century?
- Future pandemics, medical advances, and our behavior will determine the course.
- We have today a remarkable group of scientists to provide their views and to discuss areas of contrast and agreement

United States Mortality declined rapidly through 2009, but has since decelerated.

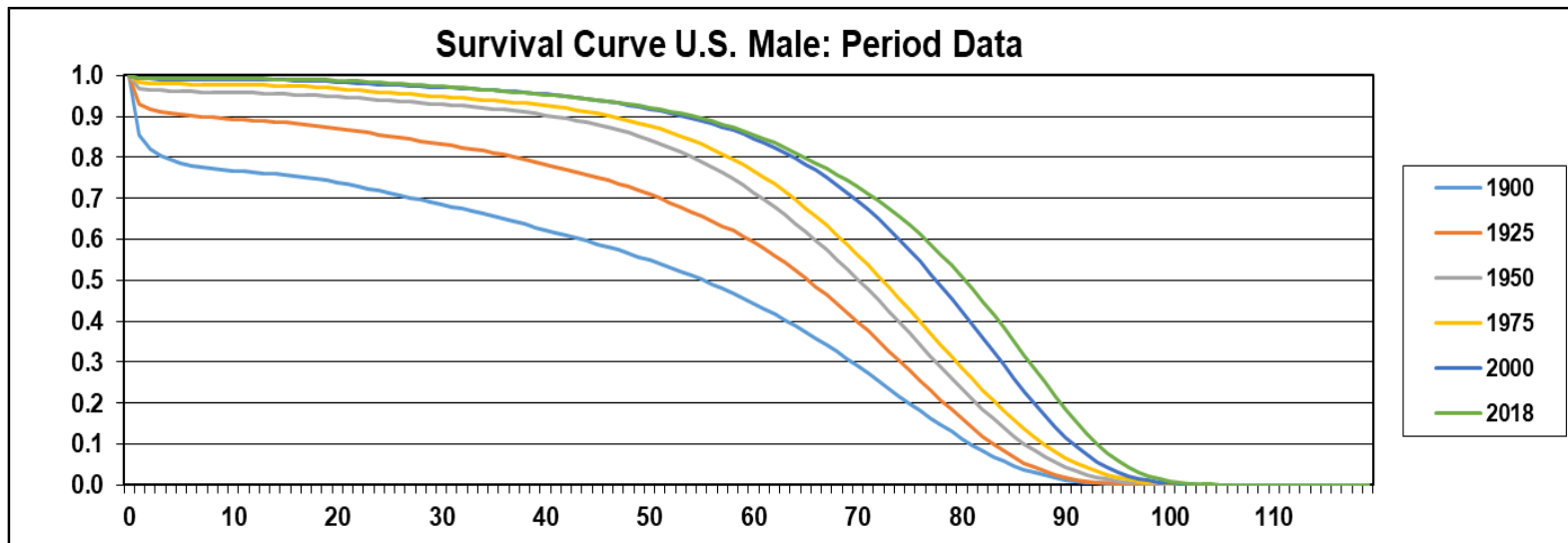
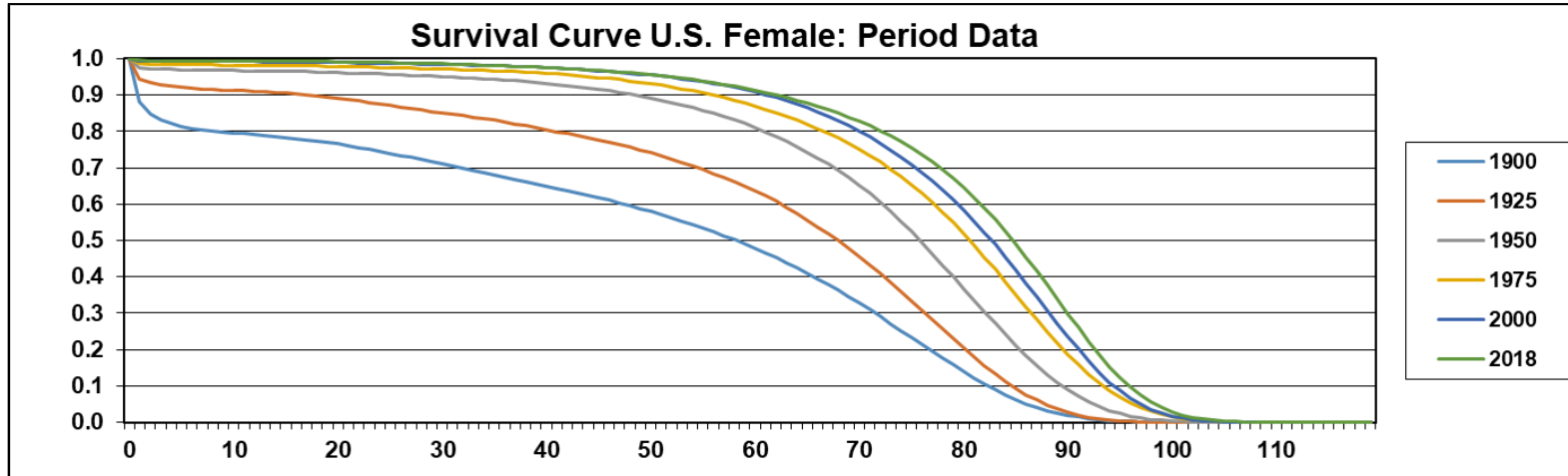
*We have been overestimating improvement.*

Are we approaching human limits on longevity, with remaining diseases more difficult to address, in addition to the effects of our own behavior, like increased obesity?



# Is There an Omega?

*Highest attained age has changed little; it appears we are rectangularizing the survival curve*





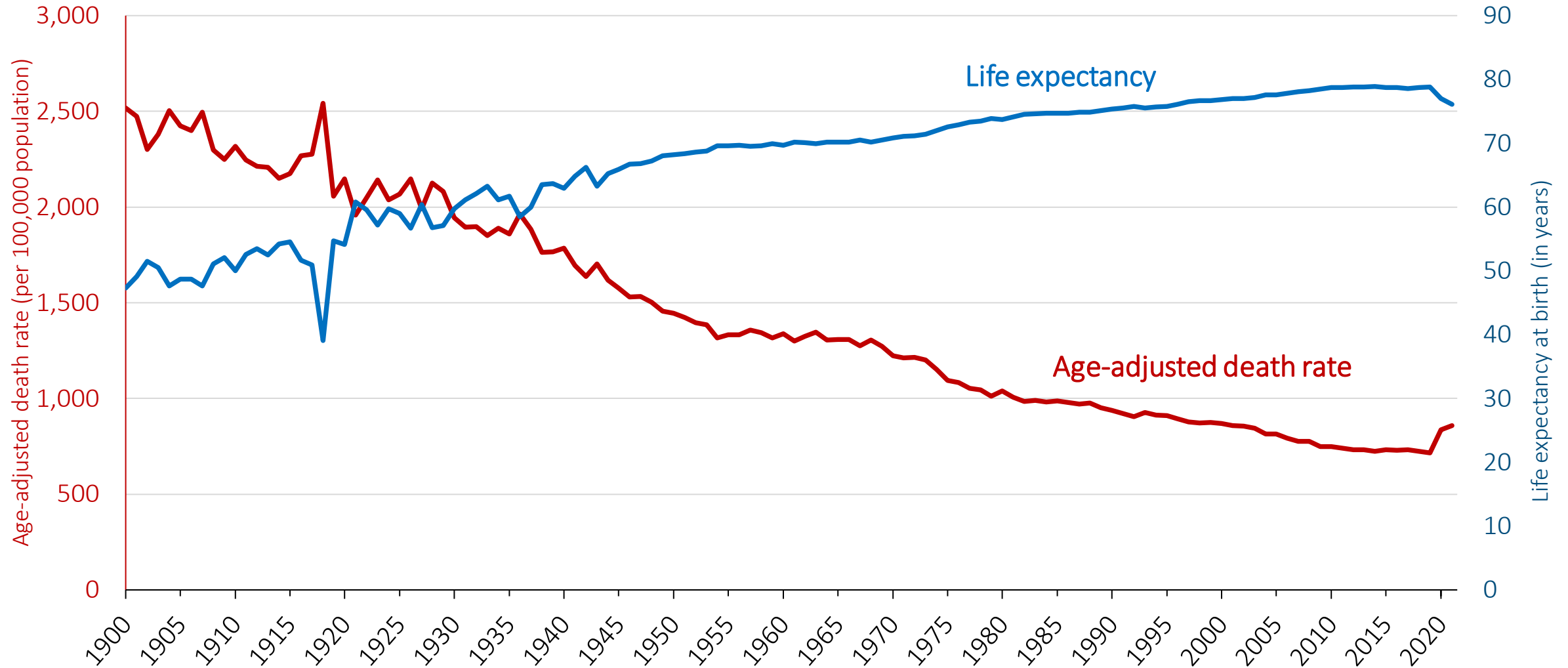
# Mortality Data from the National Vital Statistics System

**Robert N. Anderson, PhD**

**Chief, Mortality Statistics Branch**

**Division of Vital Statistics**

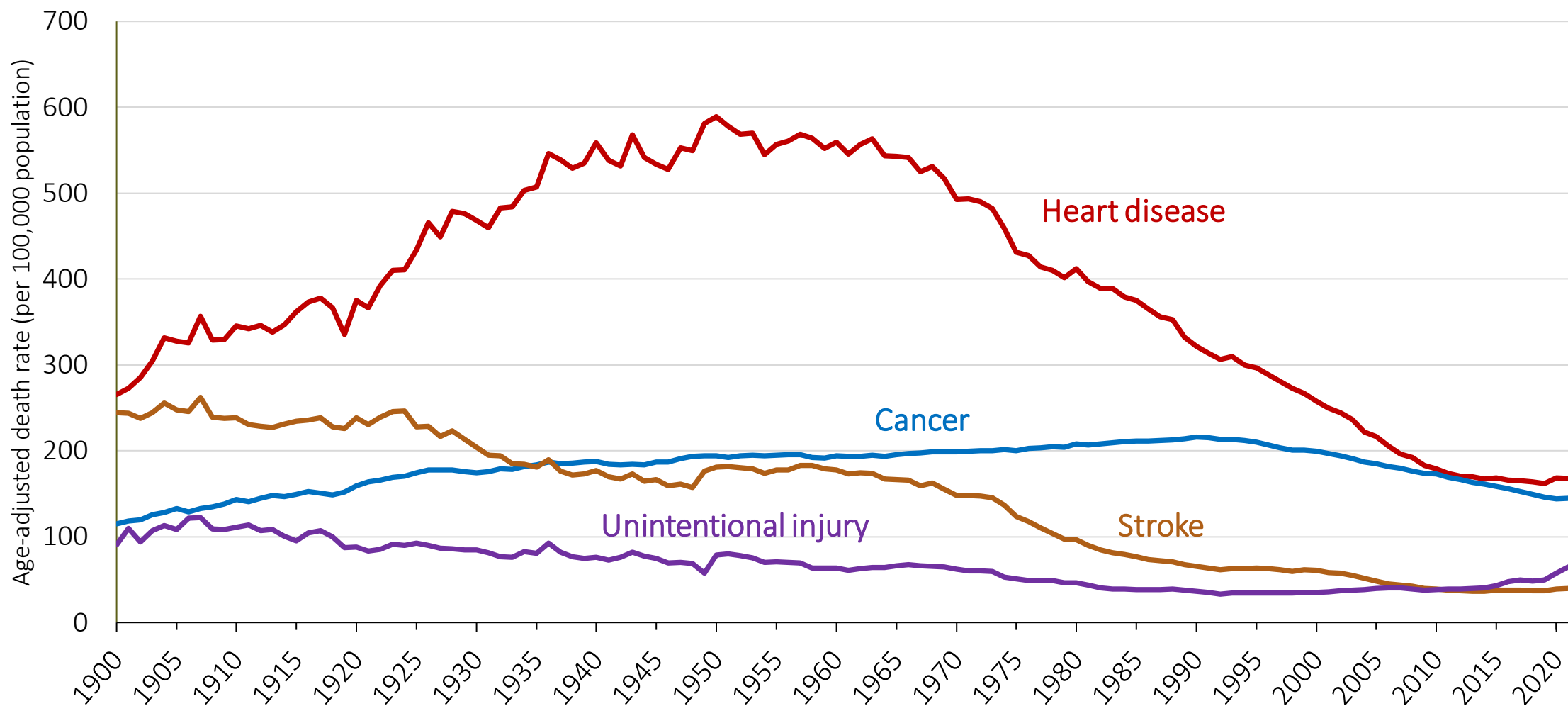
# Age-adjusted death rates and life expectancy at birth: U.S., 1900-2021



Notes: Data are from the National Vital Statistics System. Prior to 1933, data are for death-registration States only. Data for 2021 are provisional.

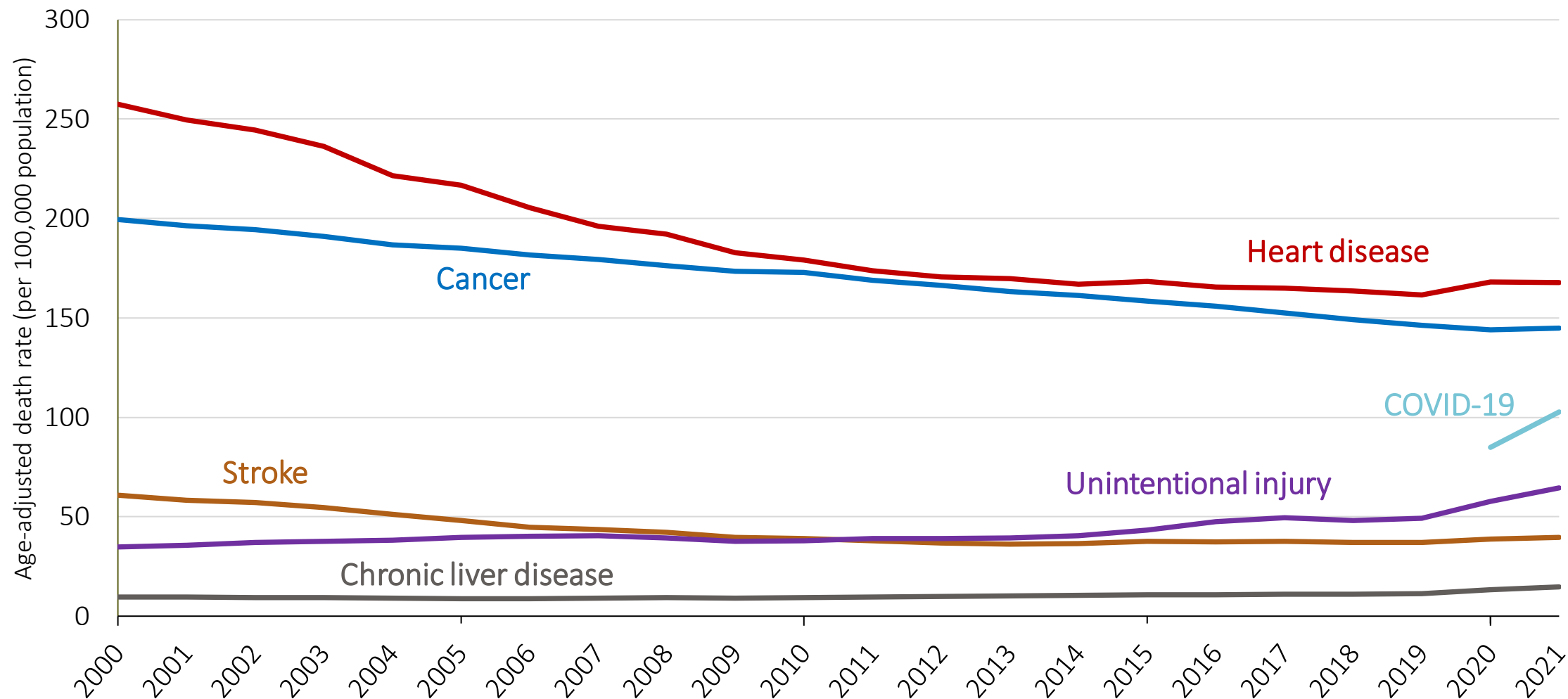


# Age-adjusted death rates due to selected leading causes of death: U.S., 1900-2021



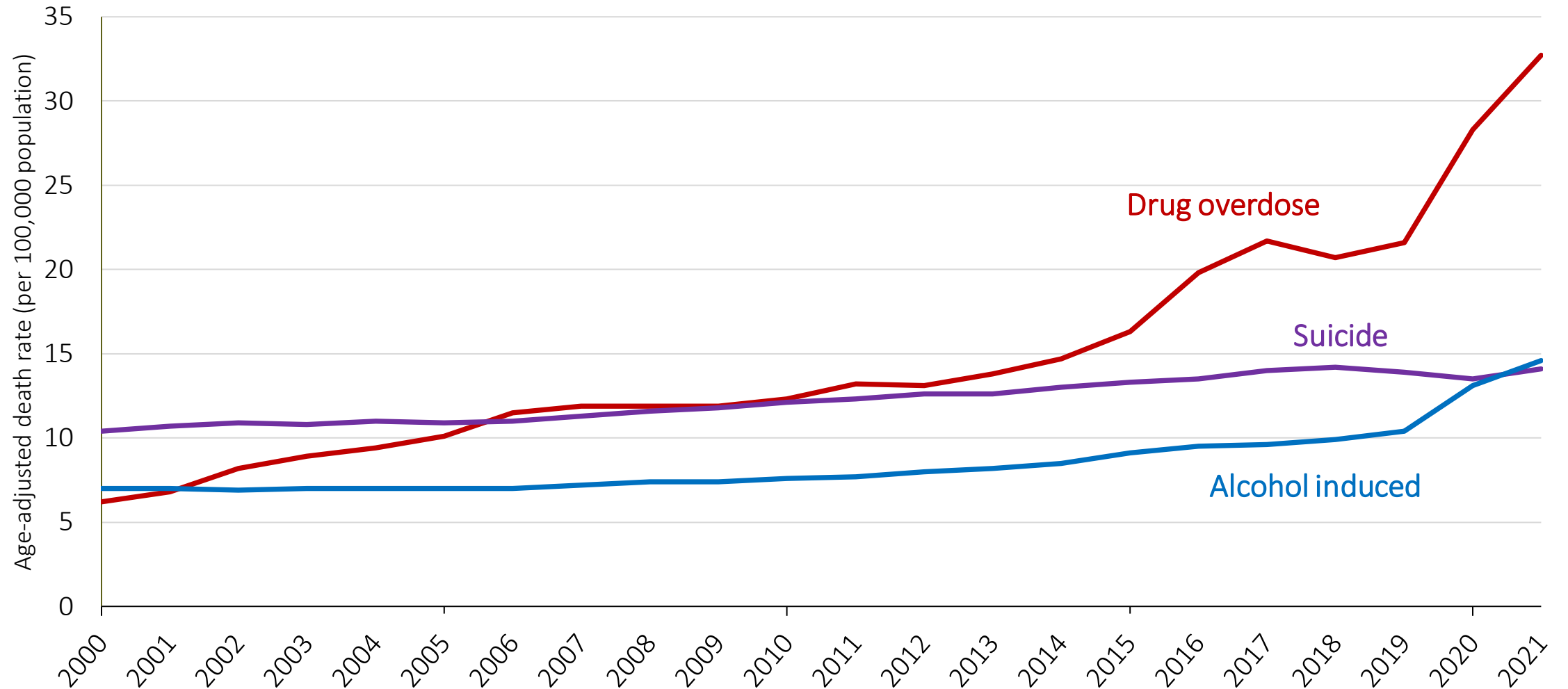
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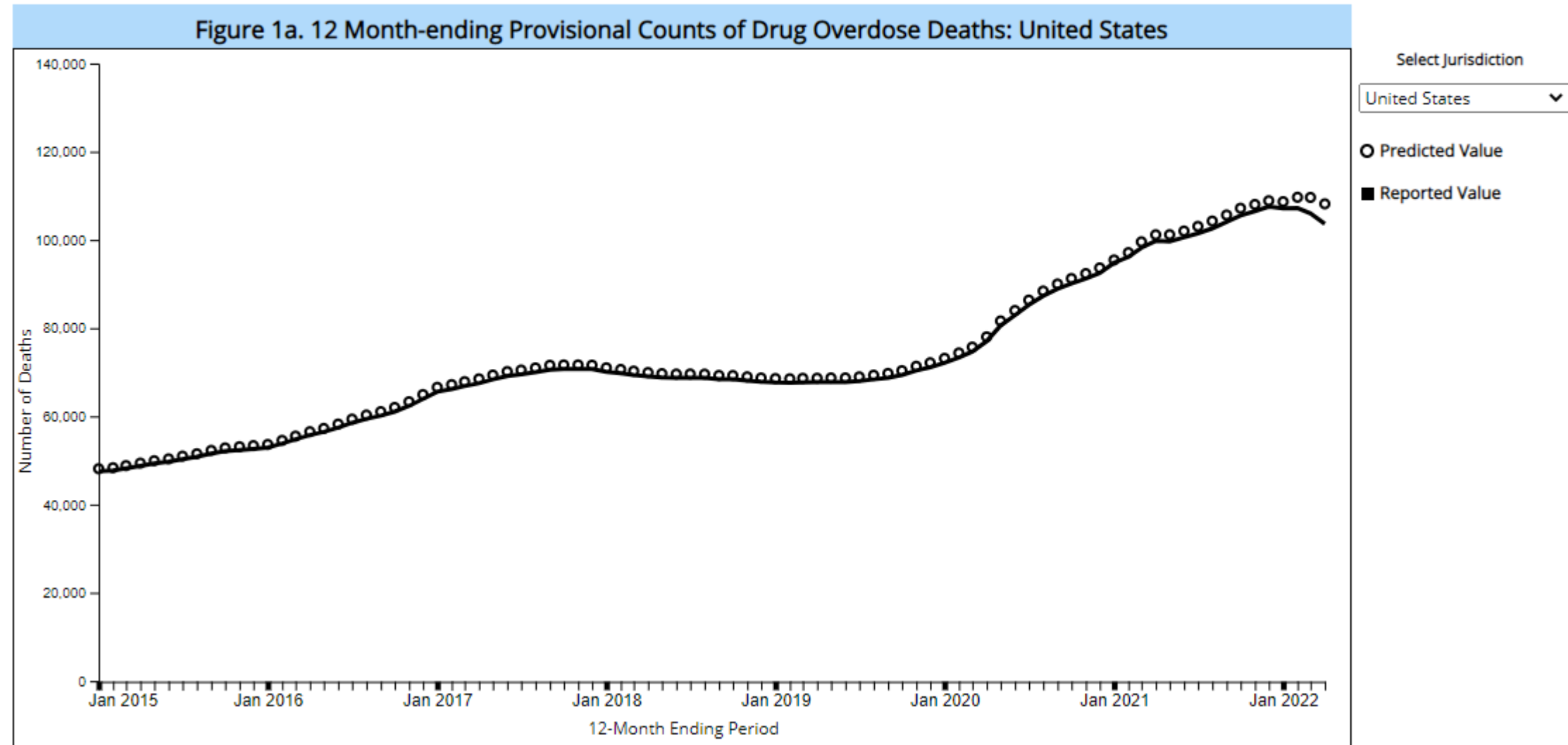
# Age-adjusted death rates due to selected causes of death: U.S., 2000-2021



Notes: Data are from the National Vital Statistics System. Data for 2021 are provisional.

# 12 Month-ending Provisional Number and Percent Change of Drug Overdose Deaths

Based on data available for analysis on: September 04, 2022



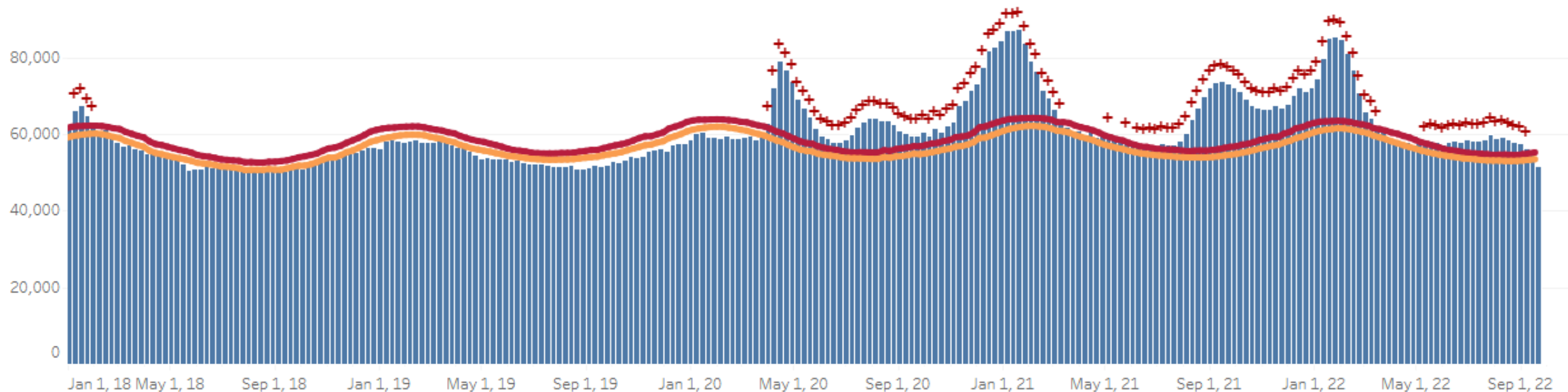
# Excess deaths: United States, 2018-2022

Select a jurisdiction:

United States

- + indicates observed count above threshold
- Predicted number of deaths from all causes
- average expected number of deaths
- upper bound threshold for excess deaths

Weekly number of deaths (from all causes)



# Post-COVID-19 mortality assumptions for retirement plans and Social Security programs

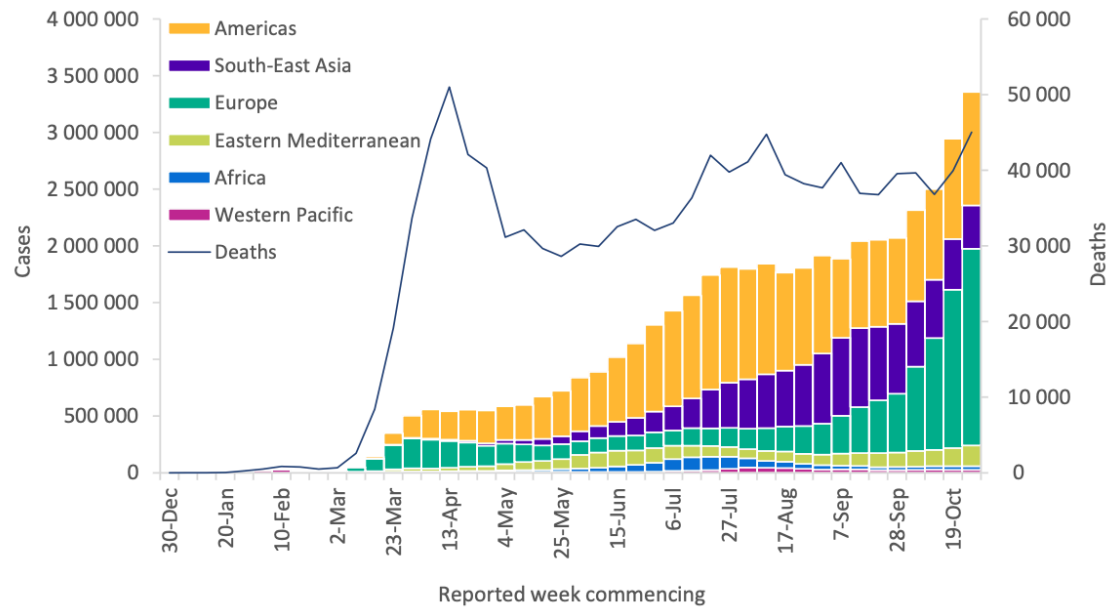
George W. Rutherford, M.D., A.M.  
University of California, San Francisco

Society of Actuaries Annual Meeting  
Thursday October 27, 2022  
Session 13A

# Epidemiology of SARS-CoV-2-related mortality

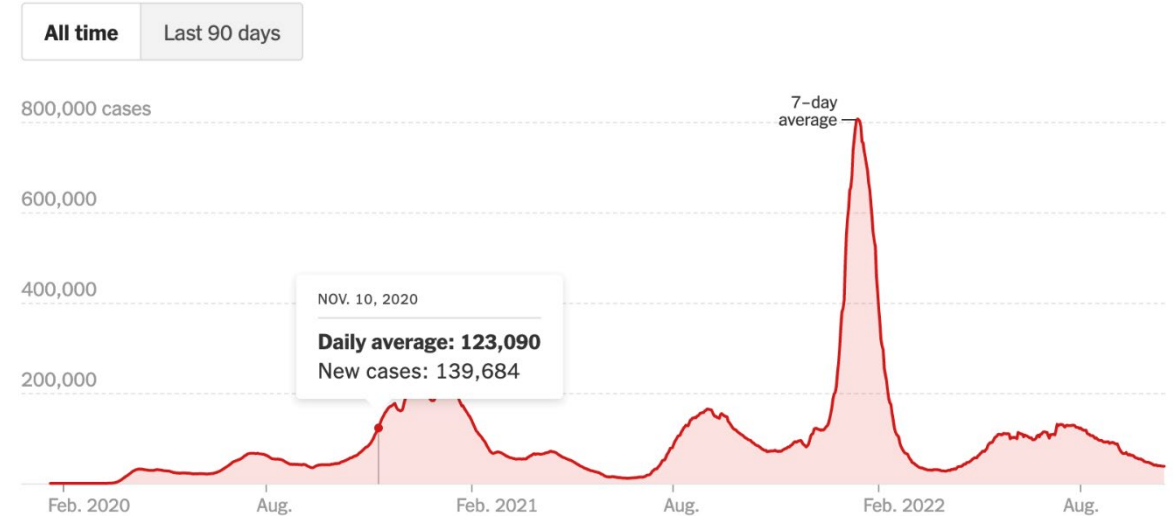
- First of all, we are not post-COVID
- However, we have just seen the decline of the sixth wave of transmission in the World and in the U.S. and probably the start of the seventh in Europe

Figure 1: Number of COVID-19 cases reported weekly by WHO Region, and global deaths, as of 1 November 2020\*\*



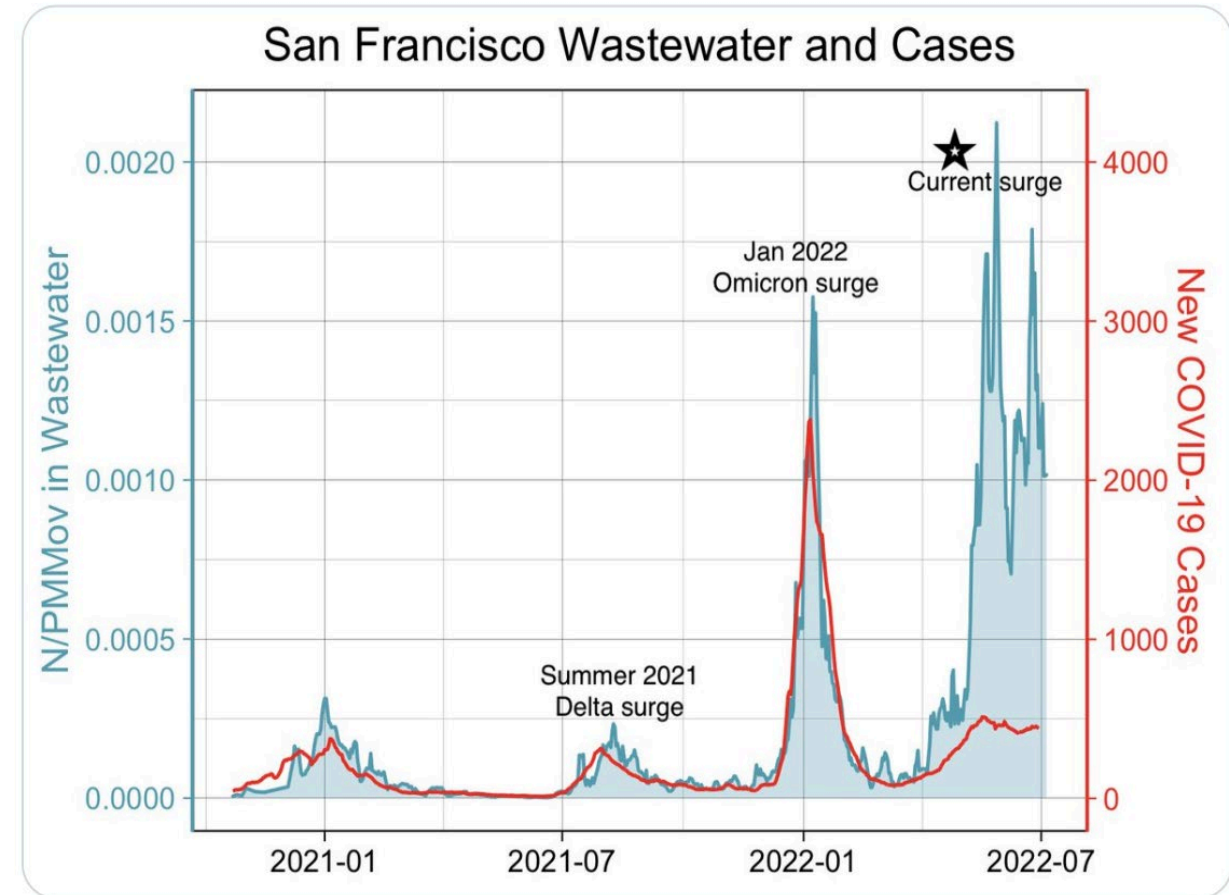
## United States

### New reported cases



# Case counts are no longer predictive of actual incidence of SARS-CoV-2 infection in the U.S.

- Widespread use of home diagnostic kits has led to massive undercounting of symptomatic cases
- Sewage outfall data are now being used to track incident infection





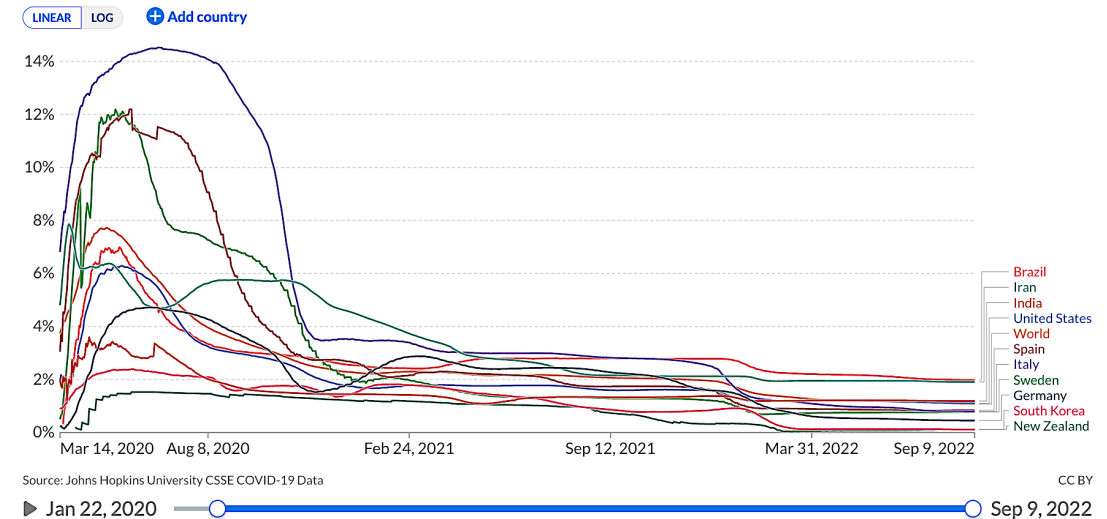
# SARS-CoV-2 variants have different mortality risks

- Original Wuhan strain had a case fatality rate of about 10% (first wave)
- Last year's delta variant had a case fatality rate of 3.4% (South African data)
- This year's omicron variant has a case fatality rate of 1.9%
- Differences are even greater when calculating *infection fatality rate*
- Vaccination, especially boosting reduces risk of hospitalization and mortality but is highly variable across the county
- The virus will continue to evolve in response to immune pressures, and newer variants may arise

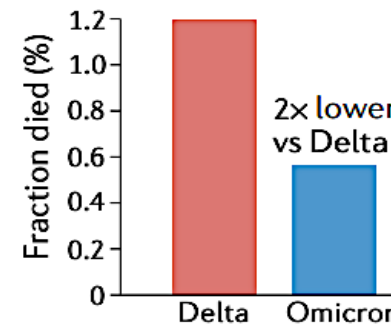
## Case fatality rate of COVID-19

The case fatality rate (CFR) is the ratio between confirmed deaths and confirmed cases. The CFR can be a poor measure of the mortality risk of the disease. We explain this in detail at [OurWorldInData.org/mortality-risk-covid](https://ourworldindata.org/mortality-risk-covid)

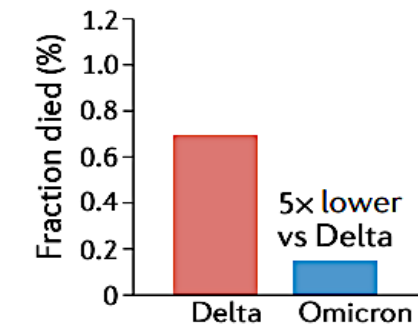
Our World  
in Data



## g Case fatality ratio



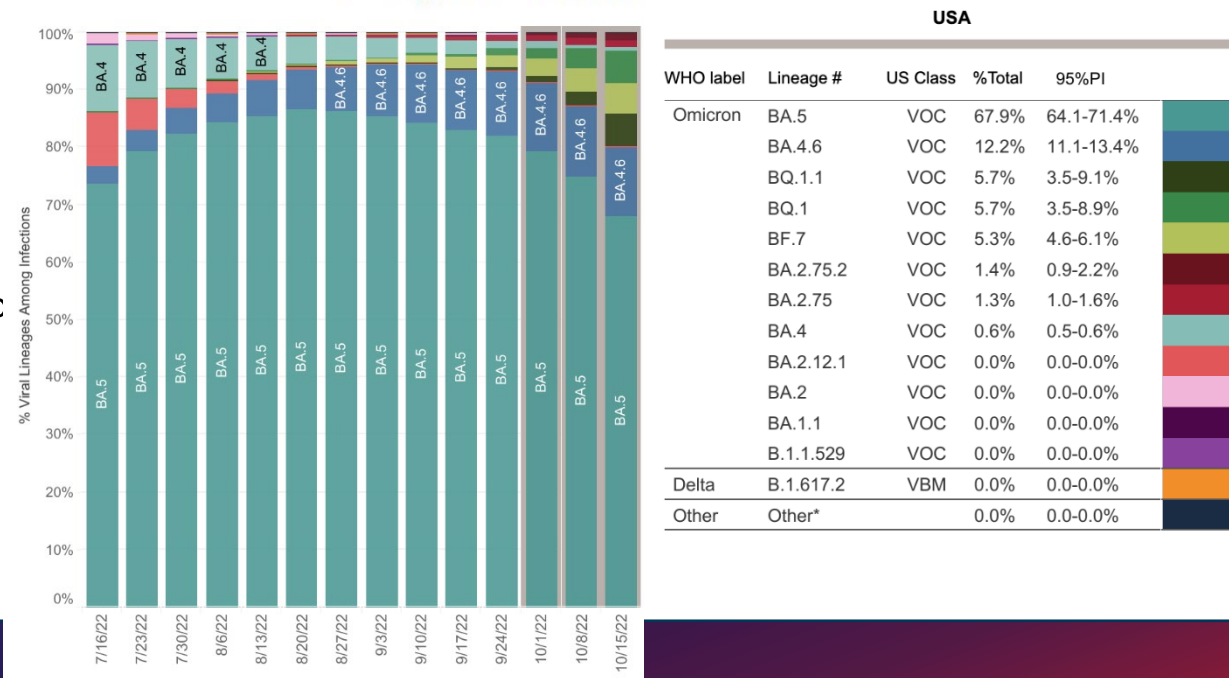
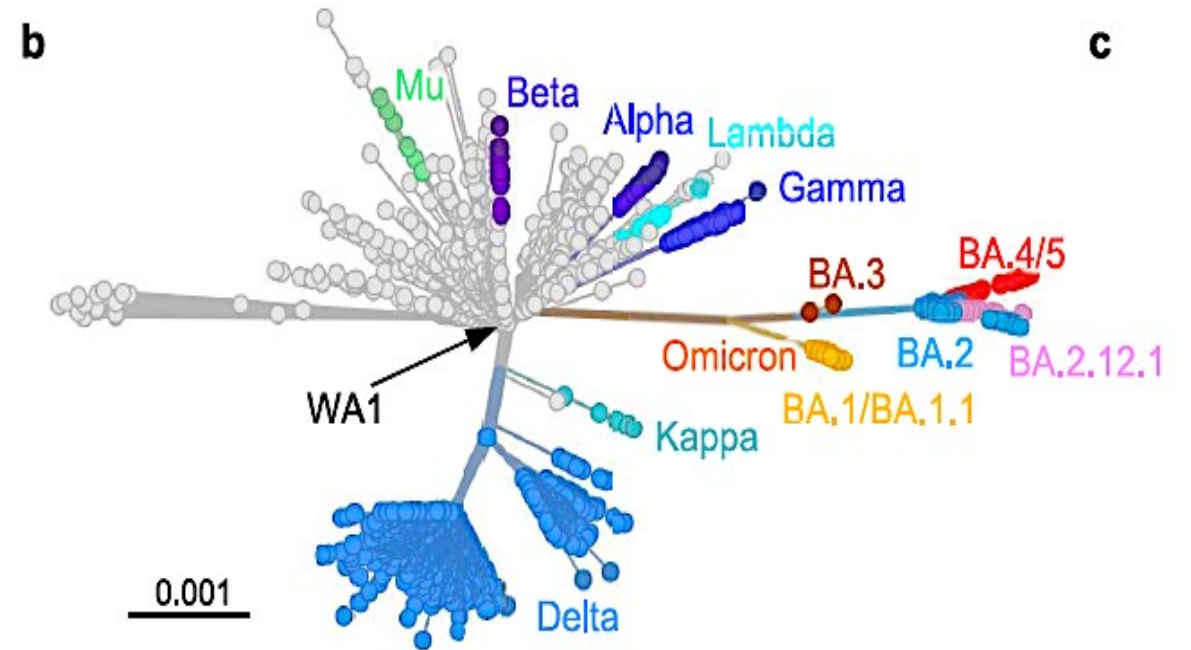
## h Infection fatality ratio



Sigal A, Jassat W. Estimating disease severity of Omicron and Delta SARS-CoV-2 infections. *Nature Rev* 2022; 22:267-69.

# So where are we?

- Rapidly evolving epidemic with newer variants and subvariant tending to less severe disease
- What we need to know
  - What is the incidence of infection?
  - What are the case fatality and infection mortality rates by variant and subvariant?
  - What is the effect of vaccination on risk of infection and severe outcomes
    - Will this fall's bivalent vaccine be even better?
  - How much immunity does naturally acquired infection provide and for how long (by variant)?
  - And we haven't even touched post-acute sequelae of acute SARS-CoV-2 infection (PASC, long COVID)



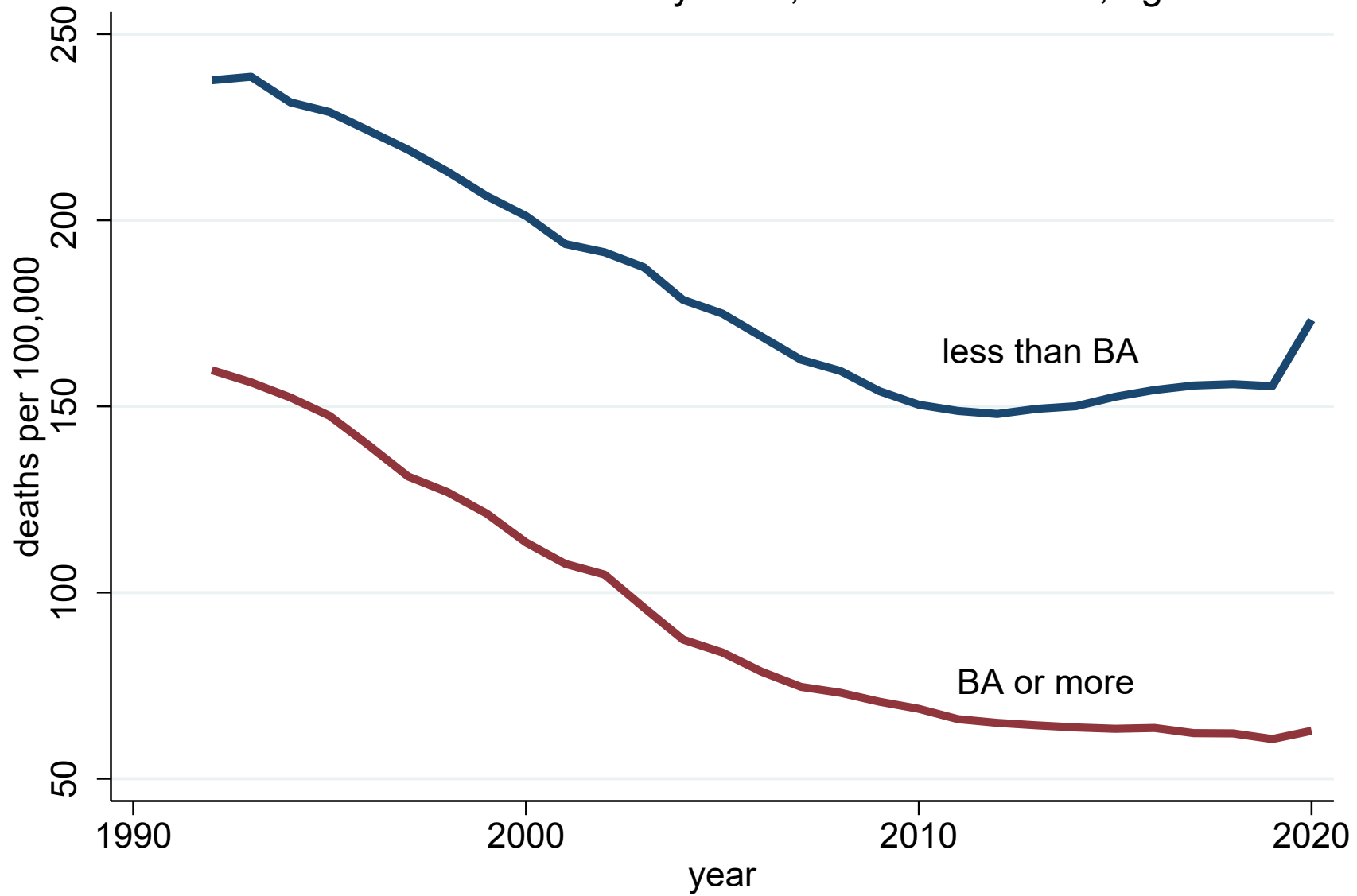
# On forecasting mortality rates

Anne Case and Angus Deaton, October 2022

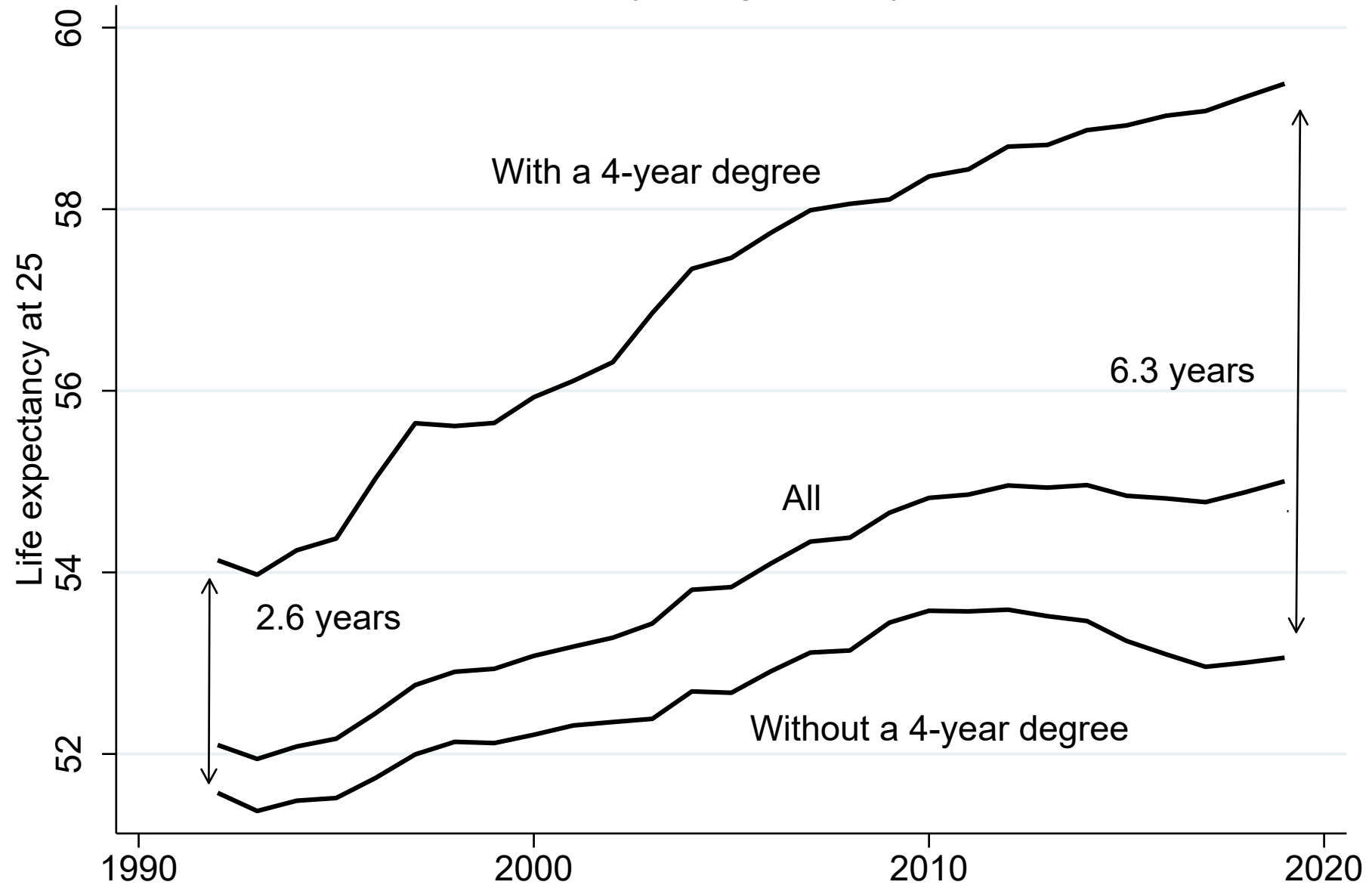
# GOING BACK TO THE PAST IS UNLIKELY TO WORK

- Because previous trends were broken BEFORE the pandemic
- LE at birth fell in three of the four years prior to the pandemic
- Deaths of despair rising rapidly
  - Suicides, drug overdose, alcoholic liver disease
- Rate of decline in deaths from CVD slowed or flattened (obesity?)
  - This was the engine of mortality decline in last quarter of 20<sup>th</sup> century
  - Decline slowed for one-third of Americans with a four year college degree
  - Rising for two-thirds without
  - Forecasting this is a major source of uncertainty
  - Still falling in some other countries: so can't argue it has hit irreducible minimum

Cardiovascular disease mortality rates, men and women, ages 25-74



# Life expectancy at age 25, by education

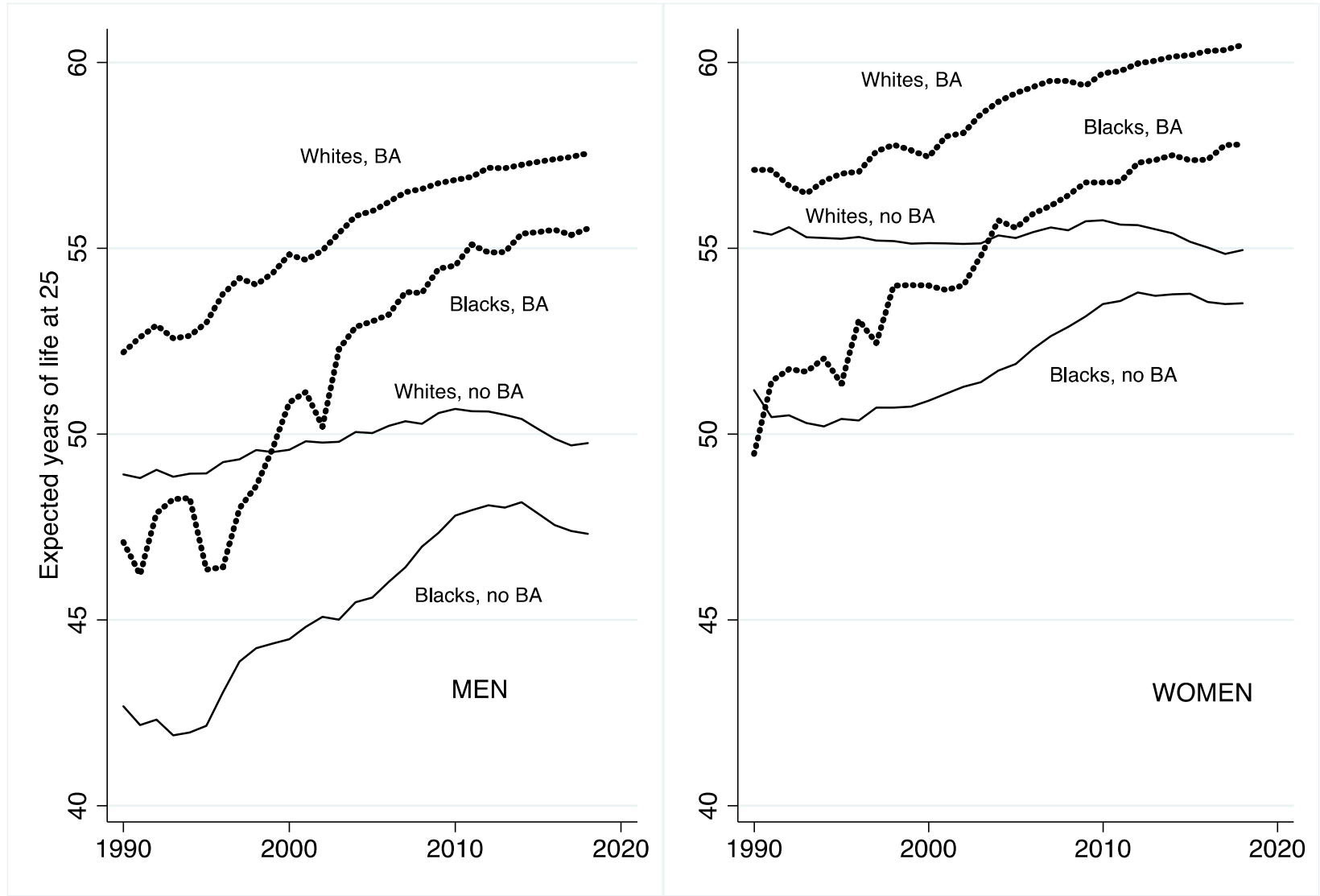


# Education IS becoming more important relative to race

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Worse mortality for AA remains even when stratified by education

# Life expectancy at 25 by race/ethnicity/sex/education





# There was no pre-pandemic normal trend to return to

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Disaggregation by cause of death, by education, or by race/ethnicity, adds insight and understanding but may not improve forecasts

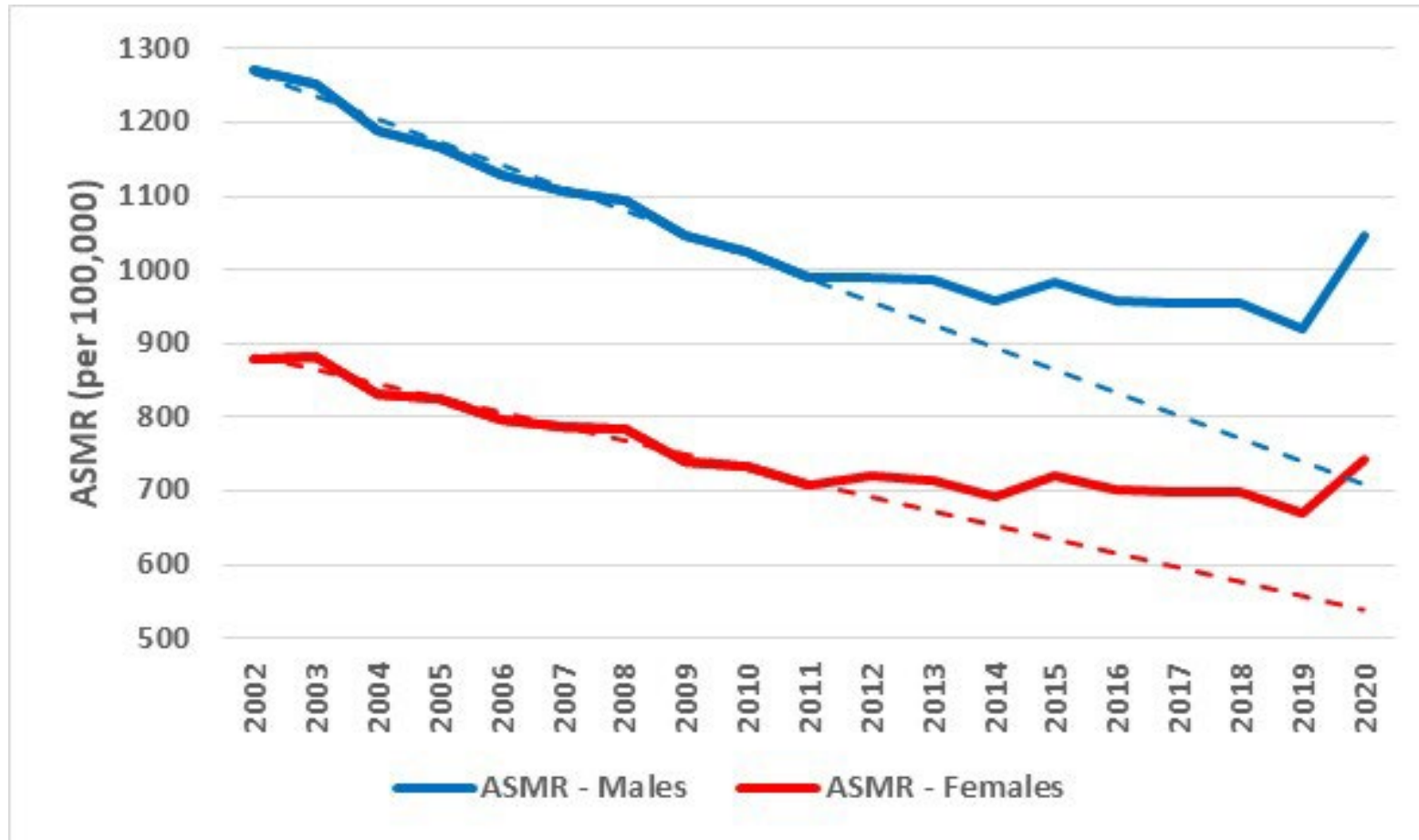
# Post-pandemic mysteries

- LE continued to fall in 2021
  - Did not do better as in some other rich countries: poor vaccination performance?
- Suicide fell in pandemic
- Alcoholic liver disease and drug deaths rose rapidly during pandemic
  - Also CVD deaths as we have seen in 2020 and more in 2021
  - Some argue because of the pandemic
  - We are skeptical, and these deaths may remain elevated in years ahead
  - Suicide may also rise again
- Major uncertainty associated with deaths of despair in 2022 and beyond
  - Depending on whether current increases will go away post-pandemic

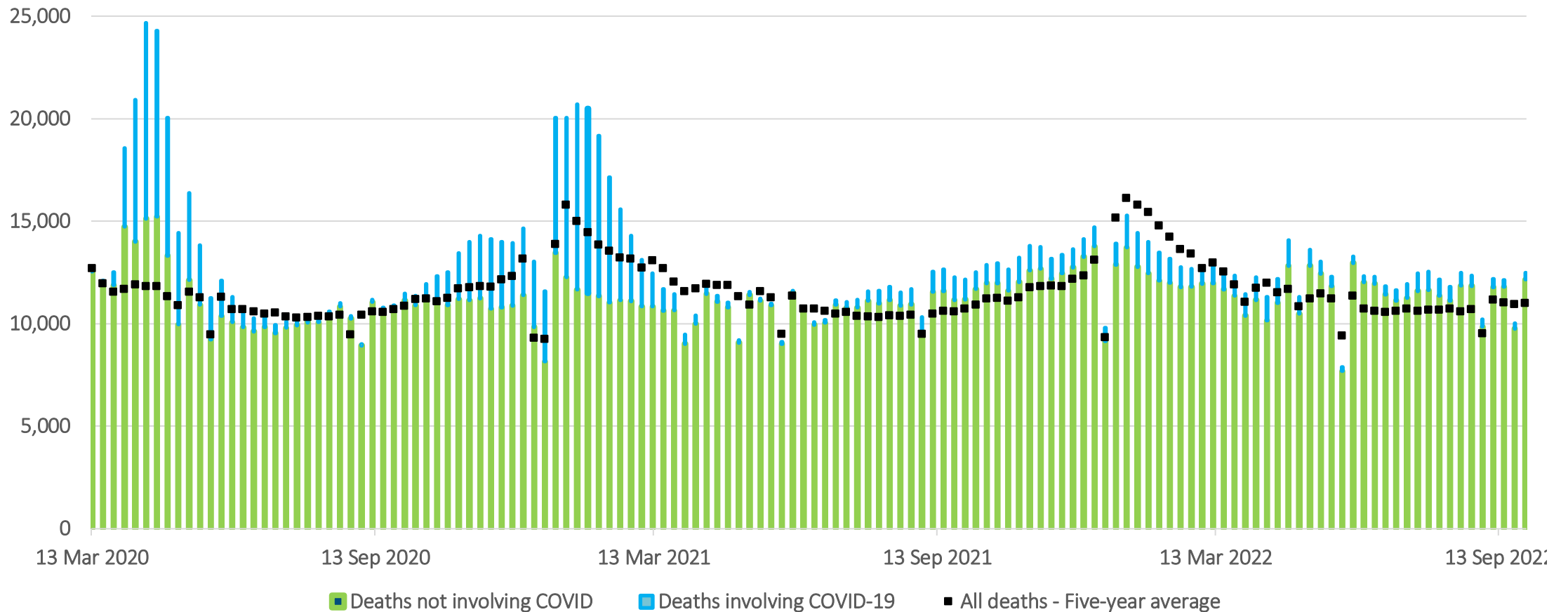
# Perspective from the UK Government Actuary's Department

Adrian Gallop FIA

# Age standardised mortality rates, Males & Females, E&W



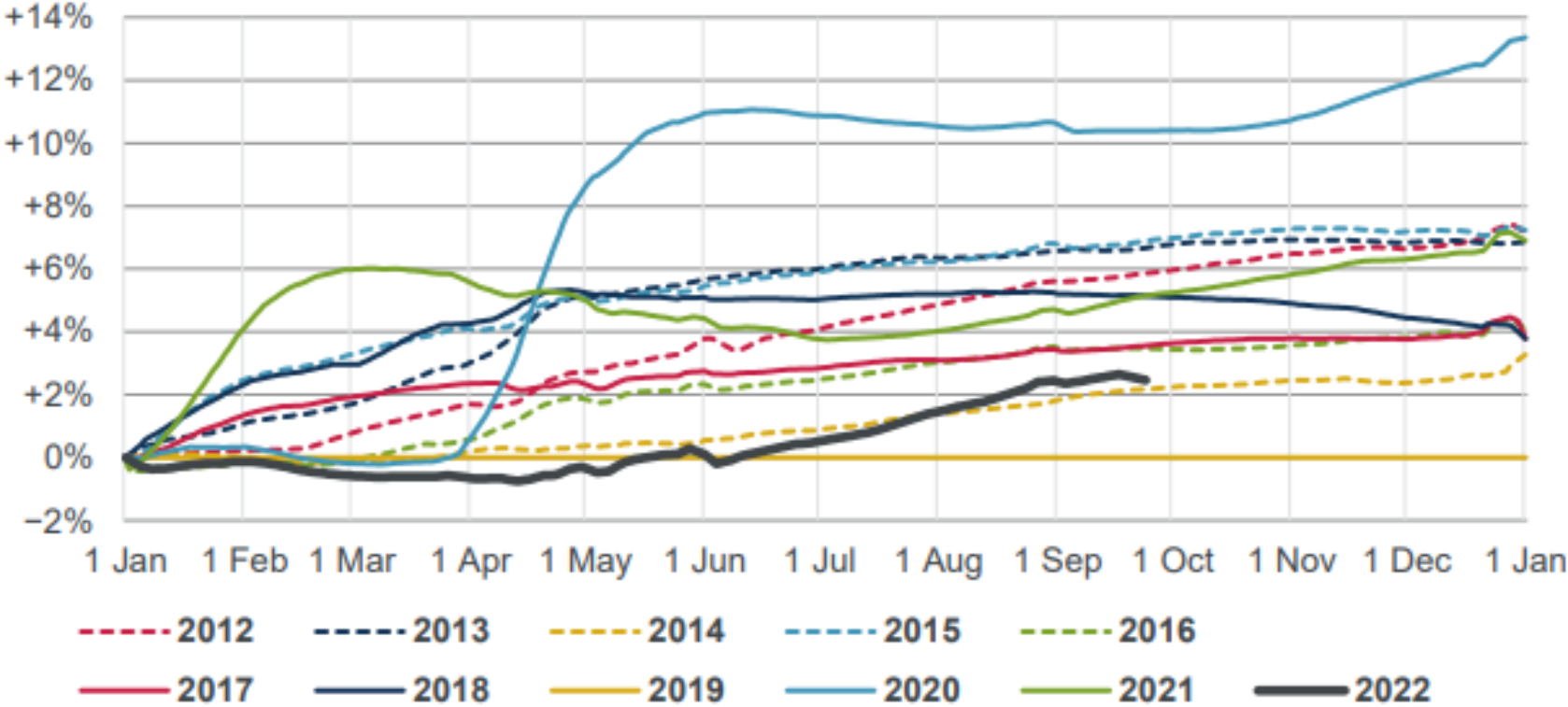
# Number of deaths registered by week, UK, week ending 13 March 2020 to 30 September 2022



Source: ONS

# Cumulative standardised mortality rate compared to 2019

Chart 3: Cumulative standardised mortality rate compared to 2019



Source: CMI mortality monitor – week 38 of 2022

# Excess deaths by cause of death; weeks ending 6 May 2022 to 23 Sept 2022

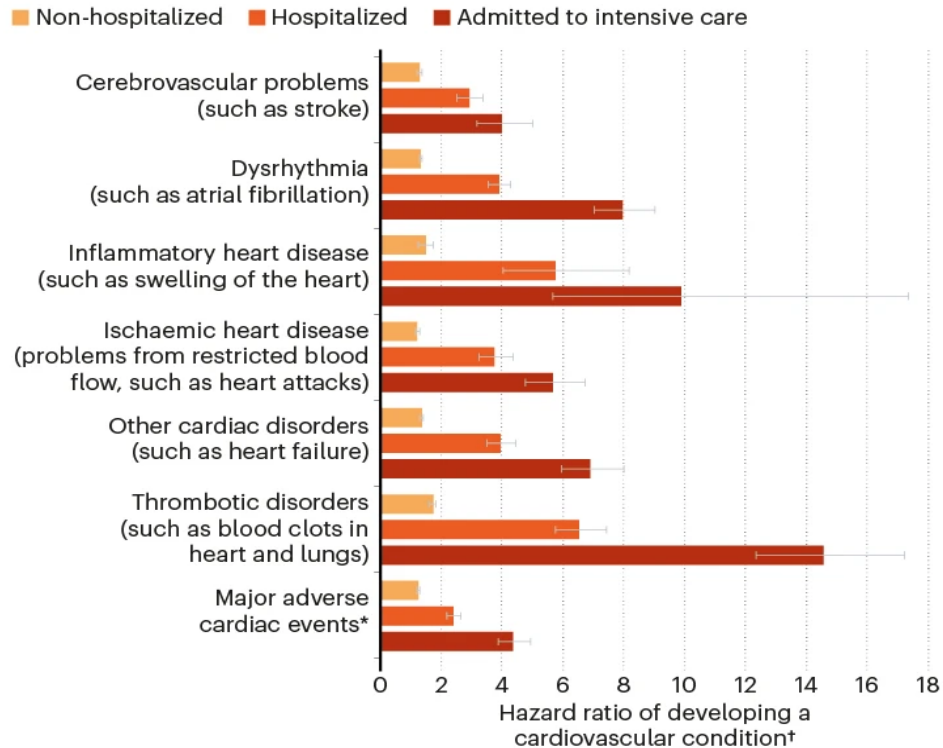
Cause of Death	Registered Deaths	Excess Deaths	Excess %	Underlying Cause COVID	Non-COVID excess	Non-COVID excess %
Heart failure	27,127	4,751	21%	868	3,883	17%
Ischaemic heart diseases	37,026	5,391	17%	802	4,589	15%
Diabetes	24,044	3,415	17%	844	2,571	12%
Other circulatory diseases	72,641	8,459	13%	2,130	6,329	10%
Diseases of the urinary system	25,899	3,094	14%	919	2,175	10%
Cerebrovascular diseases	19,031	1,961	11%	369	1,592	9%
Chronic lower respiratory diseases	24,321	1,782	8%	1,159	623	3%
Cancer	63,376	1,739	3%	798	941	2%
Cerebrovascular diseases	19,031	1,961	11%	369	1,592	9%
Dementia and Alzheimer's	33,377	-251	-1%	881	-1,132	-3%

Source: Office for Health Improvement and Disparities

# Potential effects

## CARDIAC CONCERNS

A study of more than 150,000 people with COVID-19 found that they faced increased risks of various cardiovascular problems after their infection, even if they were not hospitalized. The risks were highest for those who were admitted to intensive care.



\*Composite of heart attacks, strokes and death from cardiovascular incidents.

†Ratio compared with control groups. Two equals a doubling of the risk.

- Elevated cardiovascular risk following COVID infection
- Delays for urgent medical treatment e.g. ambulance response times longer than target, bed blocking
- Disruption to new diagnoses as well as the treatment of chronic conditions
- Waiting lists – 6.7m cf 4.4m Feb 20
- Hidden health needs



# Potential drivers for future mortality change

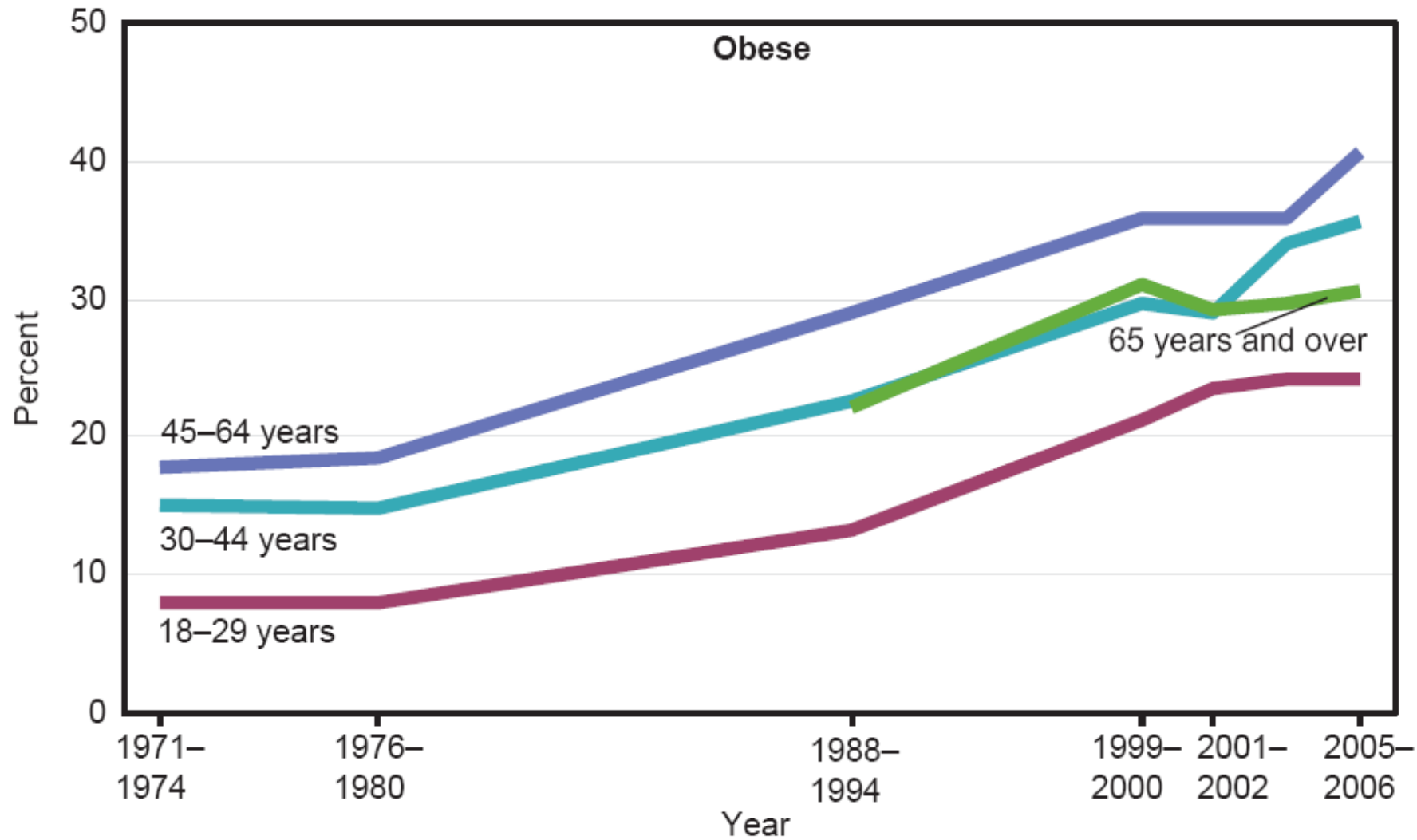
- Changes in bio-medical technology
- Effectiveness of health care systems
- Behavioural changes related to health:
  - Smoking prevalence
  - Lifestyles
  - Obesity
- Emergence of new diseases (eg HIV, SARS)
- Antimicrobial resistance
- Re-emergence of old diseases (eg TB)
- Future economic conditions
- Climate change
- Environmental change, disasters, wars
- Changes in population composition; cohort effects, migrants

# Questions?

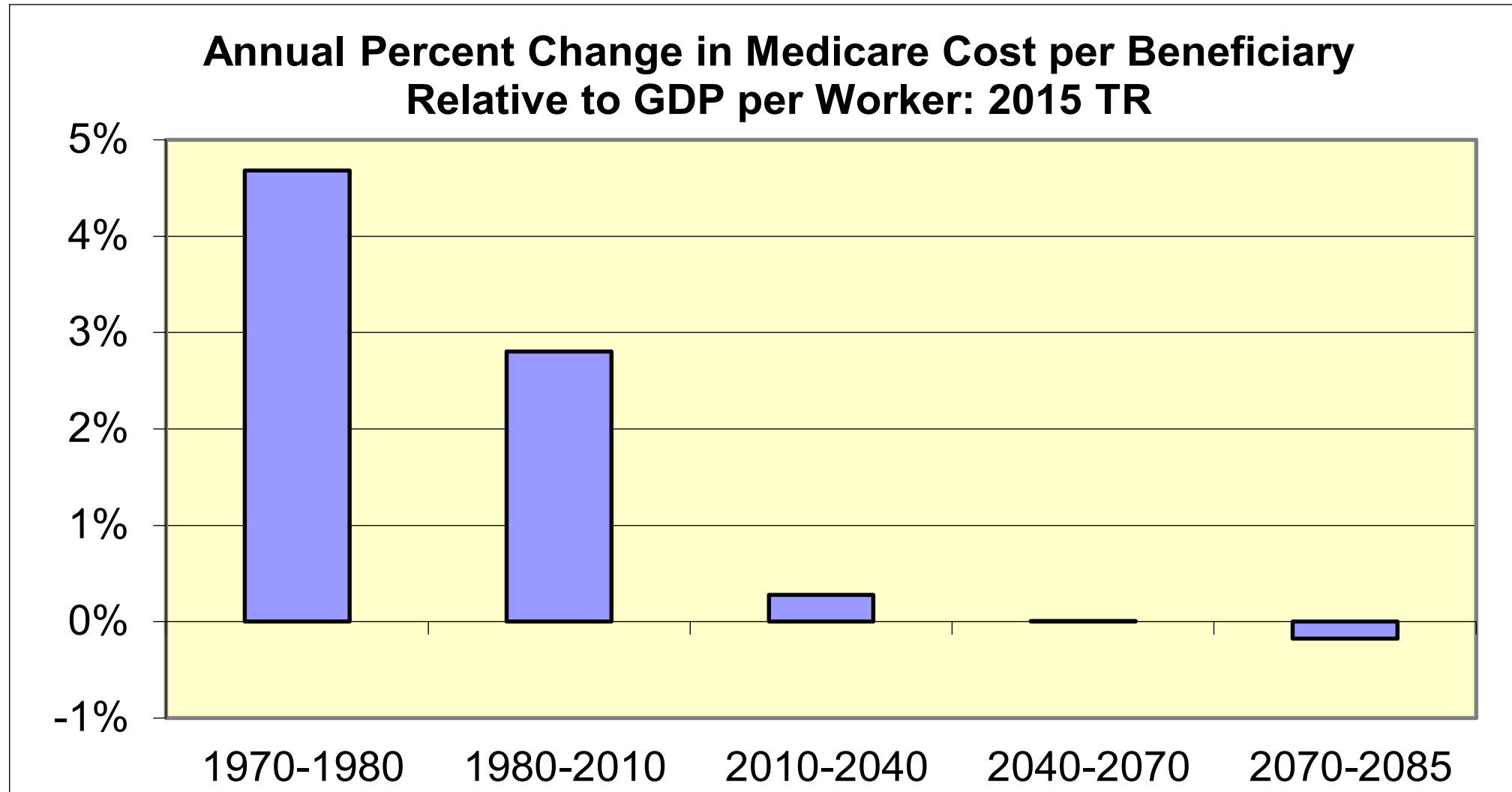
# Appendix Slides: Steve Goss

# Trends in Obesity: US 1971-2006 *Sam Preston 2010*

Must consider *cumulative* effects-- Increasing duration of obesity for aged in future



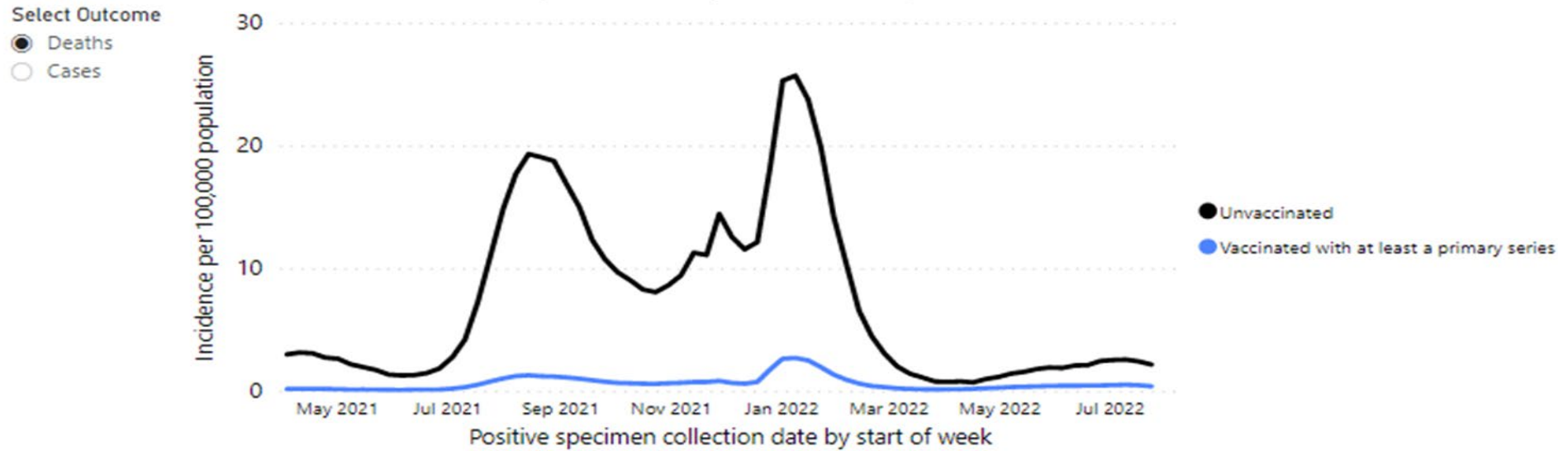
# Health Spending Cannot Continue to Rise at Historical Rates— Effects on Mortality? *Note Trustees' projected deceleration*



# The Remarkable Efficacy of mRNA Vaccination in COVID

Rates of COVID-19 Deaths by Vaccination Status in Ages 6 Months and Older

April 04, 2021–July 30, 2022 (31 U.S. jurisdictions)



Unvaccinated people aged 6 months and older had:

<b>2.4X</b> <i>Risk of Testing Positive for COVID-19</i>	<b>AND</b>	<b>5X</b> <i>Risk of Dying from COVID-19</i>	<b>in July 2022, and</b>
<b>2.7X</b> <i>Risk of Testing Positive for COVID-19</i>	<b>in August 2022, compared to people vaccinated with at least a primary series.</b>		

Source: CDC COVID-19 Response, Epidemiology Task Force, Surveillance & Analytics Team, Vaccine Breakthrough Unit

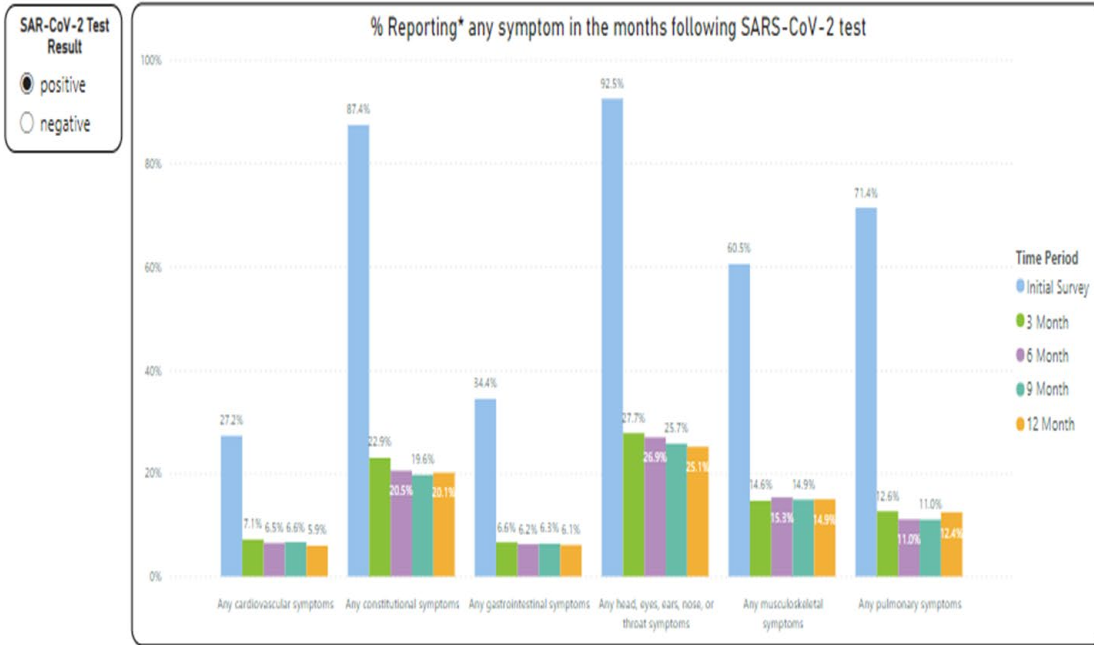
At Least One  
Booster Dose

# Post-COVID Conditions: Both Positive and Negative Test

## Symptom Overview

Data updated through - October 03, 2022

Participant Characteristics | Symptoms | Total Participants 5,954 | Selected Participants 4,498



Symptoms reported at 3, 6, 9, 12, 15, and 18 months:

- Any cardiovascular symptoms (chest pains, palpitations)
- Any constitutional symptoms (tired, chills, feeling hot, fever, shakes)
- Any gastrointestinal symptoms (diarrhea, nausea/vomiting, abdominal pain)
- Any head, eyes, ears, nose, or throat symptom (headache, runny nose, loss of smell, loss of taste, sore throat, loss of hair)
- Any musculoskeletal symptoms (aches, joint pains)
- Any pulmonary symptoms (cough, shortness of breath, wheezing)

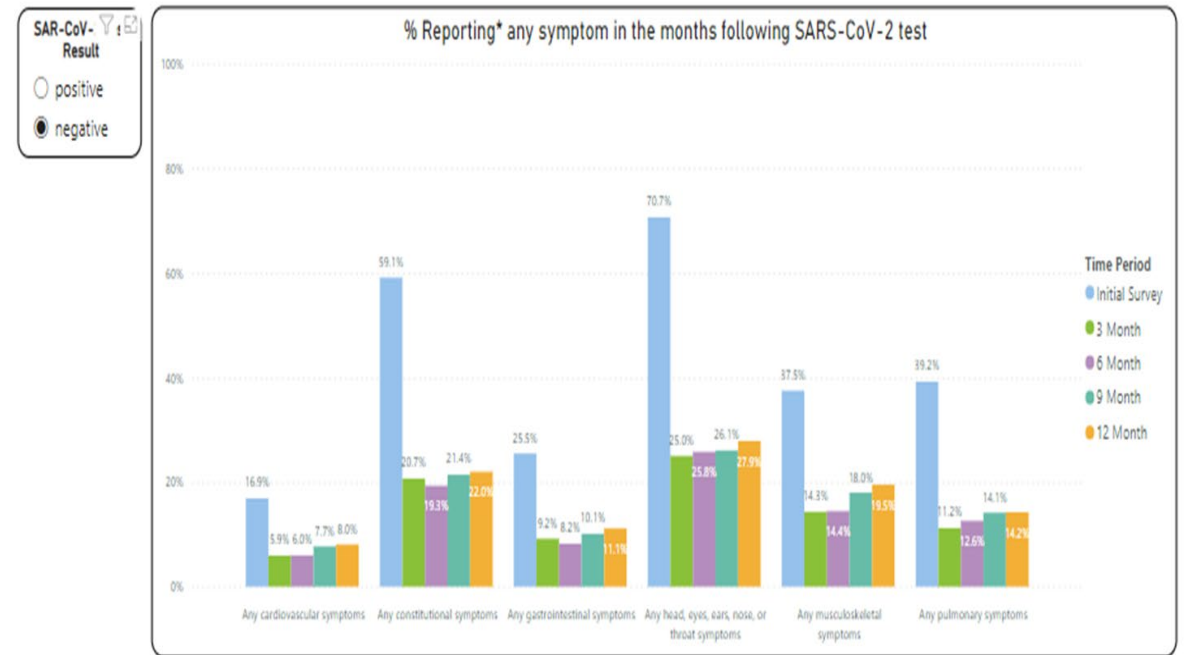
\*Participants can report symptoms in more than one group. Estimates are not adjusted for common demographic and clinical characteristics (e.g. age, co-morbidities). Follow-up and data collection are on-going and missing data is not presented.

COVID + participants had COVID-like symptoms and tested positive for SARS-CoV-2 infection within 42 days of enrollment

## Symptom Overview

Data updated through - October 03, 2022

Participant Characteristics | Symptoms | Total Participants 5,954 | Selected Participants 1,456



Symptoms reported at 3, 6, 9, 12, 15, and 18 months:

- Any cardiovascular symptoms (chest pains, palpitations)
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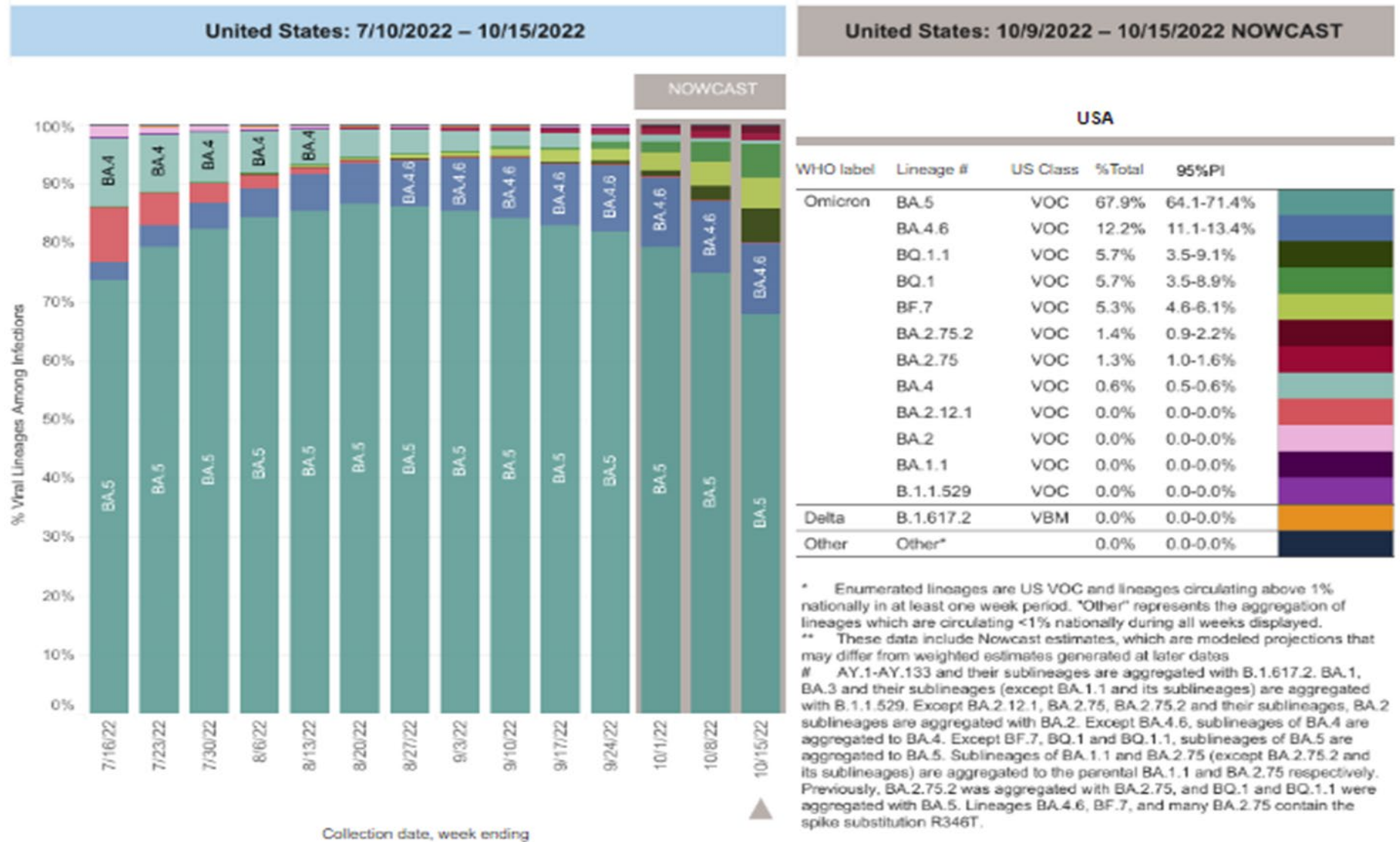
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COVID + participants had COVID-like symptoms and tested positive for SARS-CoV-2 infection within 42 days of enrollment



# Evolving Trends in COVID Variants: More are Coming

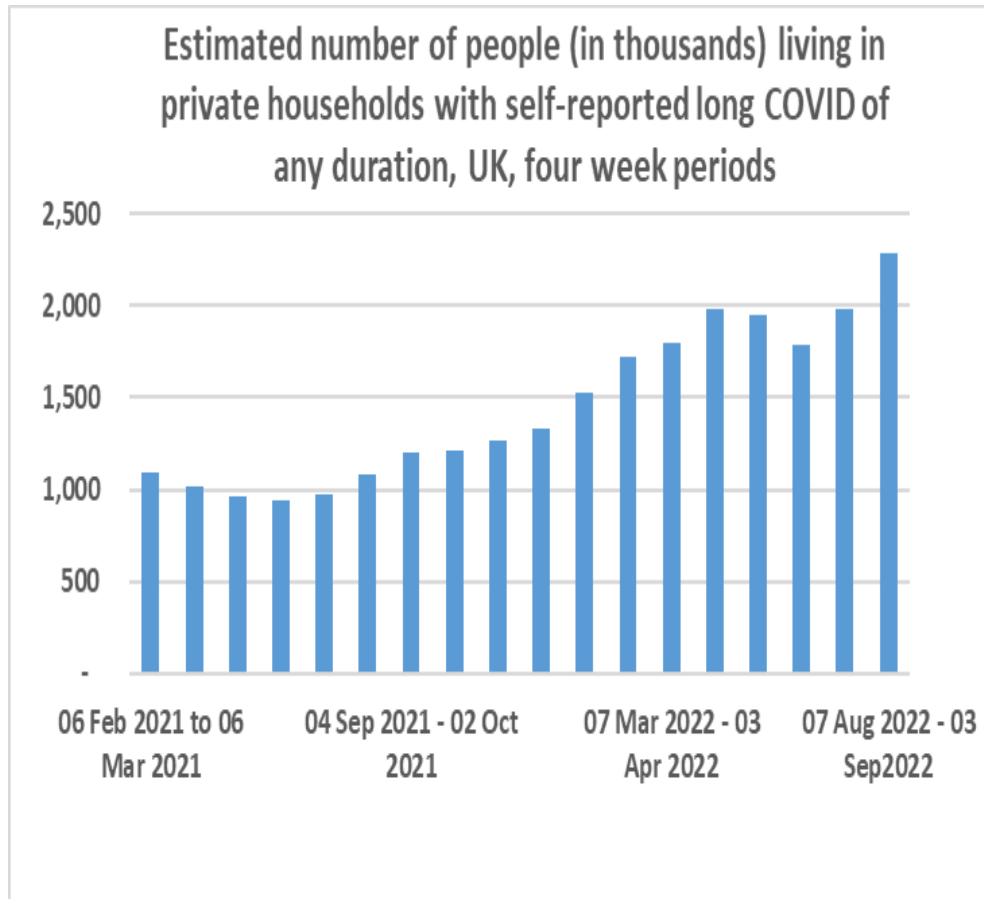
From the 14-day period ending September 30 to the 14-day period ending October 13, reported new COVID infections rose by 43% in the UK, 52% in France, 74% in Sweden, 81% in Germany, 84% in Italy. Rose by 5% in Canada, but declined by 20% in the US.





# Appendix Slides: Adrian Gallop

# Long COVID



- Estimated 2.3 million people living in private households in the UK (3.5% of the population) experiencing self-reported long COVID (symptoms continuing for more than 4 weeks after the first confirmed or suspected COVID-19 infection that were not explained by something else) as of 3 September 2022
- Of these 1.1 million (46%) had COVID at least one year previously, and 514,000 (22%) at least two years previously.
- 342,000 (15%) reported that their ability to undertake their day-to-day activities had been “limited a lot” due to Long COVID.

Source: ONS

# Direct and indirect health impacts of COVID-19 in England

Area	Findings
Direct mortality and morbidity impacts of Covid-19	<ul style="list-style-type: none"><li>• Deaths and hospitalisations from Omicron much lower than previous waves</li><li>• Higher mortality in more deprived areas</li></ul>
Impact of Covid-19 on NHS critical care capacity	<ul style="list-style-type: none"><li>• Omicron did not increase the number of Covid-19 positive patients in critical care beds.</li><li>• Increases in staff absence may have led to increased pressure in critical care.</li></ul>

Source: Direct and indirect health impacts of COVID-19 in England: emerging Omicron impacts, Aug 2022  
Dept for Health and Social Care and ONS

Area	Findings
<p>Indirect impacts of Covid-19 on population health due to living through a pandemic and restrictions</p>	<ul style="list-style-type: none"> <li>• Primary care appointments and referrals were resilient during the Omicron wave of infection. However, lower overall activity across the pandemic has led to ‘missing’ appointments and referrals.</li> <li>• Reported incidence of some conditions has returned to pre-pandemic trends, other conditions are still persistently below the pre-pandemic trend.</li> <li>• Staff absences continue to put pressure on the NHS.</li> <li>• Supply constraints during the Omicron wave of infection have led to longer waits for elective and emergency patients in secondary care.</li> <li>• Elective activity remains below pre-pandemic levels.</li> <li>• Referrals to and people in touch with mental health services are higher than pre-pandemic level.</li> </ul>
<p>Indirect impacts of Covid-19 on the wider population in the long-run</p>	<ul style="list-style-type: none"> <li>• Adult social care has suffered from pre-COVID pressures, including workforce pressures, which have been exacerbated by the pandemic</li> <li>• Economic impacts from Omicron smaller than those seen during previous waves of infection.</li> <li>• Non-Covid-19 pressures mean wider economic climate remains fragile.</li> </ul>

# Cancer - impact of delays in diagnosis and treatment during the pandemic

Decreasing life expectancy	Increasing life expectancy
Medical staff leaving profession	Government pledge to increase nursing numbers
Backlog means later diagnosis/treatment meaning worse prognosis. Could impact for next 5-10 years	MRNA vaccines used for COVID trialled to treat cancer; in early stages
If patient education not improved not all will go to doctor, screening etc. Widen gap between socio economic groups	Hubs being set up to deal with backlog
Possible direct impact on cancer incidents could be increased e.g. lung fibrosis from COVID linked to lung cancer. Other cancers not yet linked but could be 20 years before we know	Genetic testing/personalised care – further off for cancer, but innovations like this possible. But lack of money/staff could delay this.
	<p>Technology making screening/diagnosis/treatment more efficient</p> <p>More self screening (screening rates didn't decline during pandemic)</p> <p>Less affected by recession as relatively cost effective</p>

# Potential drivers for future mortality change

## Climate change

- UK typically has higher death rates in winter.
- During five heat-periods between June and August 2022 the number of deaths was 6.2% above the five-year average.
- The average number of deaths per day was higher for heat-period days than non-heat-period days.
- Each heat-period peak, was followed by a fall in deaths to below the average over the following days; this suggests a short-term mortality displacement, where deaths among vulnerable individuals are 'brought forward' to within the heat-periods.
- Excess winter deaths higher than excess summer deaths so warming may lead to lower deaths overall, excluding other potential effects of global warming