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Presented by
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PICA

LONGEVITY RISK AND COVID-19

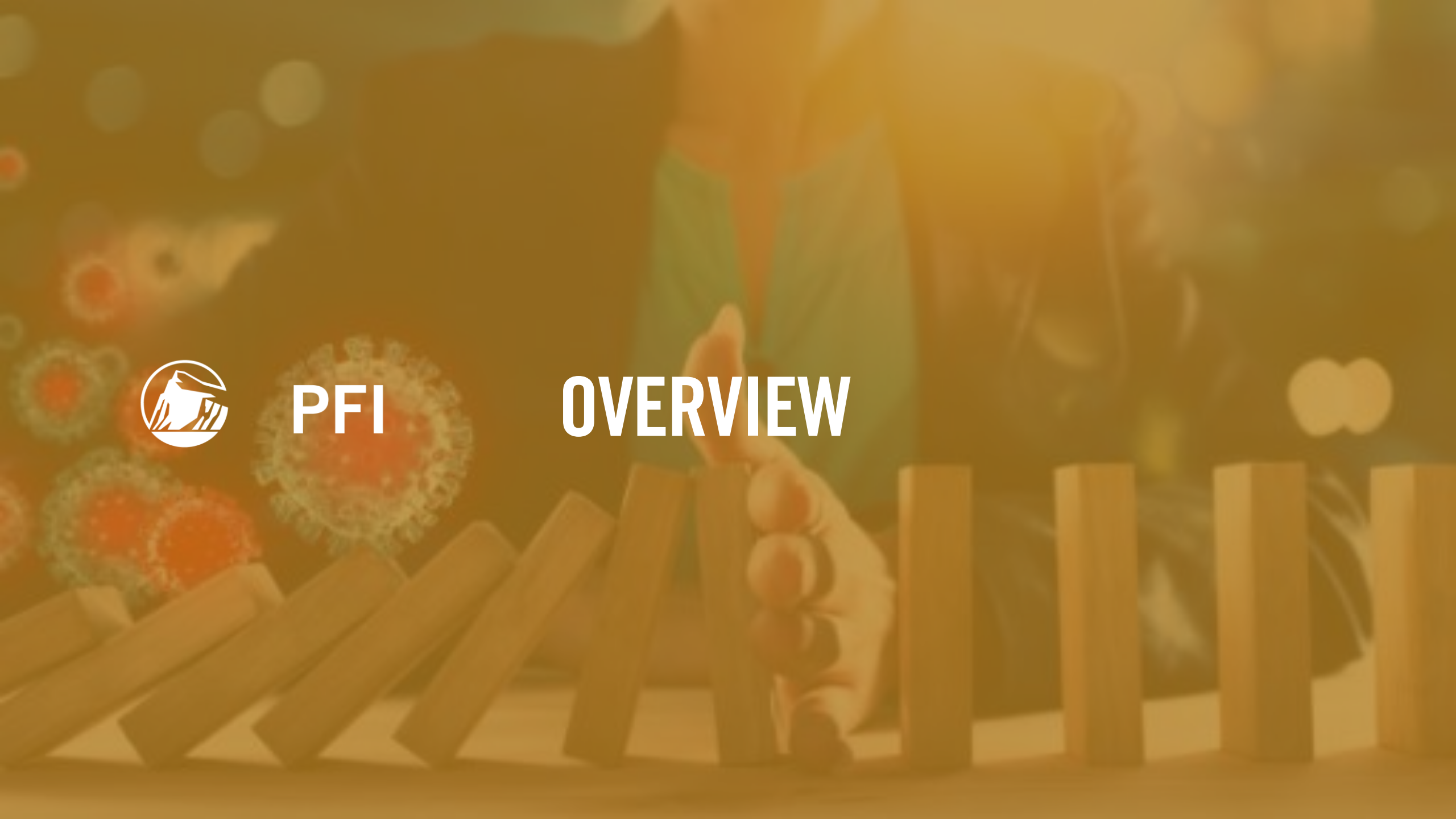
Why pension schemes should stay the course toward a lower-risk future

AGENDA

I OVERVIEW
The impact of the pandemic on pension liabilities

II OUR FINDINGS
A detailed look at the research and the supporting data

III KEY CHALLENGES
Three key challenges in longevity estimation that arise from Covid-19



PFI OVERVIEW

Covid-19 has created the worst global pandemic since the Spanish flu, impacting communities and economies around the world.

The pandemic also has real implications for pension funds, insurance companies and academics who model and measure longevity risk.

THE IMPACT OF COVID-19 ON FUTURE HIGHER-AGE MORTALITY

MAY 2020

Andrew Cairns

Professor of Financial Mathematics at Heriot-Watt University, Edinburgh

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David Blake

Professor, Cass Business School, City University of London
Director of Pensions Institute

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Senior Vice President, Head of International Reinsurance
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Marsha Kessler

CEO, M Kessler Group

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The pandemic has impacted everything…

All aspects of our day-to-day lives

Virtual work and education

Unemployment

Socio-economic disparities

Health disparities

Future higher-age mortality rates

Asset values

Credit spreads

Interest rates

…but pension liabilities have moved very modestly.

Covid-19 has effectively doubled each cohort's mortality rate

The groups with the highest impact were those whose mortality rates were highest in the first place:

Frail elderly

People with significant co-morbidities

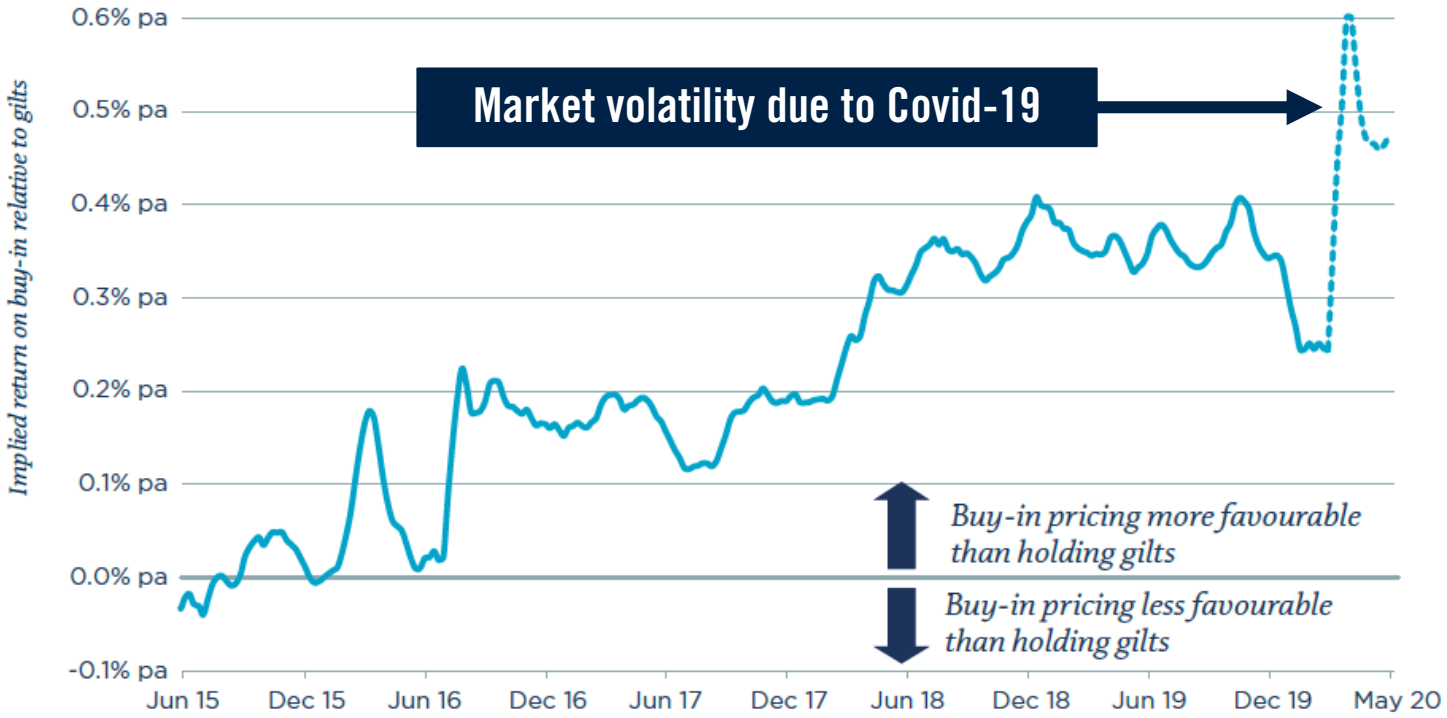
The most deprived among us

Communities of color

These same groups make up a relatively small portion of overall pension liabilities.

But we've all seen the impact of Covid-19 on interest rates, asset values and spreads.

Buy-in and buy-out pricing in the U.K. has actually improved



This graph measures pensioner buy-in pricing since June of 2015 and shows the implied return on the transaction relative to gilts.

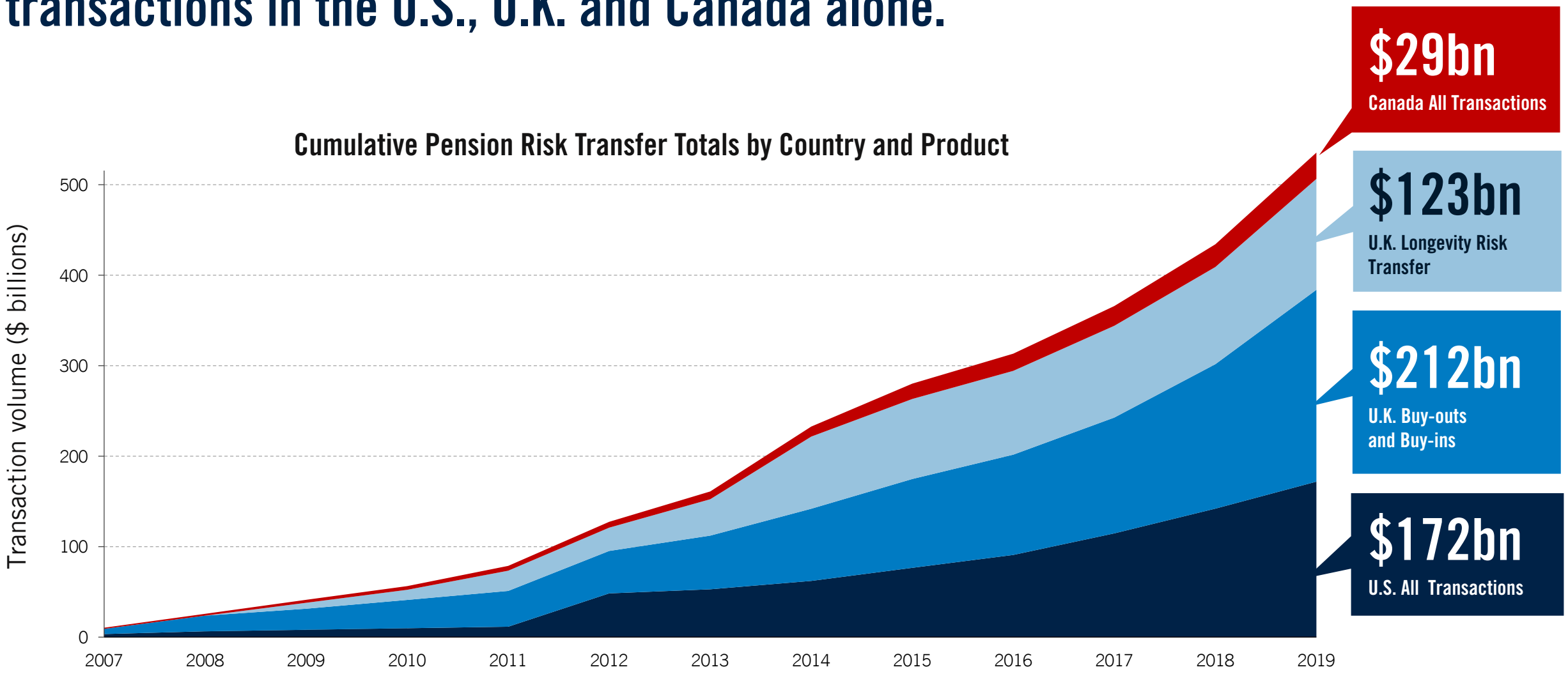
When the blue line is above zero, buy-in pricing has an implied return above gilts, and the higher the better.

Source: Lane Clark & Peacock (LCP) Insurer pricing model, calibrated against actual transaction pricing. LCP analysis of quotation and final transaction pricing. Buy-in pricing depends on a wide range of factors such as transaction size, benefit structure, membership profile and insurer appetite. Used with permission.

IT PAYS TO BE PREPARED

With liabilities moving very little, and buy-in and buy-out pricing improving, pension schemes who were well hedged have been able to continue with their de-risking plans.

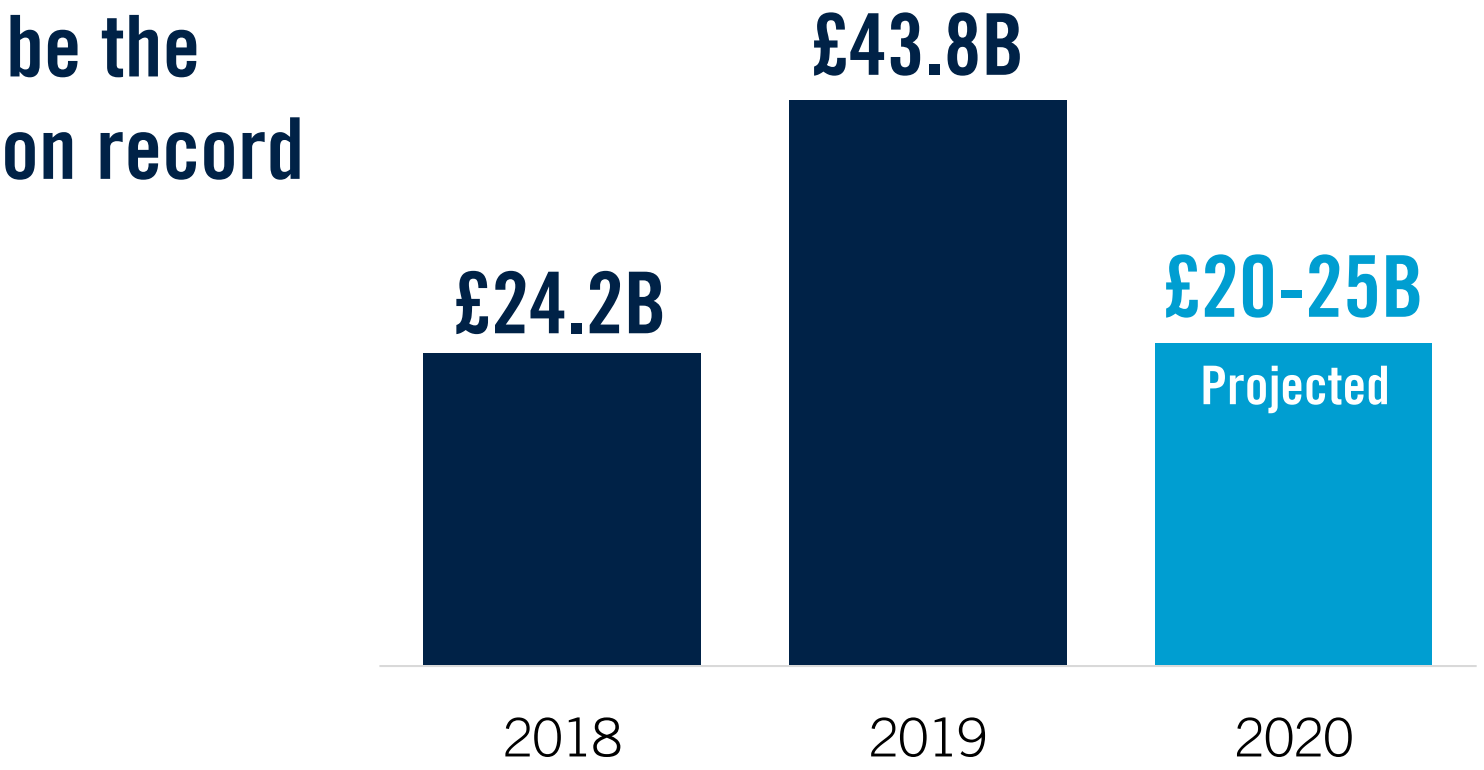
Since 2007, there have been more than $530 billion in pension risk transfer transactions in the U.S., U.K. and Canada alone.



Data in USD billions. Cumulative totals. Sources: LIMRA, Hymans Robertson, LCP and Prudential analysis as of December 31, 2019.

2020

The U.K. market for buy-ins and buy-outs is expected to be the second or third highest on record despite the pandemic.



Source: LCP De-risking Report 2020.

For pension funds that can't transact in 2020, volatility is on the rise

Volatility in longevity improvements

Volatility in the market

Volatility in longevity improvements and financial markets will now be expected to increase.

Any time volatility is higher, hedges like longevity swaps and pension risk transfer are more valuable.

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OUR FINDINGS / ACCELERATED DEATHS MODEL

OUR FINDINGS

1

Covid-19 is increasing each cohort's short-term mortality risk by a common multiplicative factor, no matter what their baseline mortality risk was before the pandemic.

2

A significant proportion of people who've died from Covid-19 are in a frail state, with comorbidities that significantly raise their risk of death.

3

Our model showed that even under the worst-case scenario by the Imperial College, life expectancy was not materially impacted. In four more realistic scenarios, the impact to life expectancy of the surviving elderly population is much smaller.

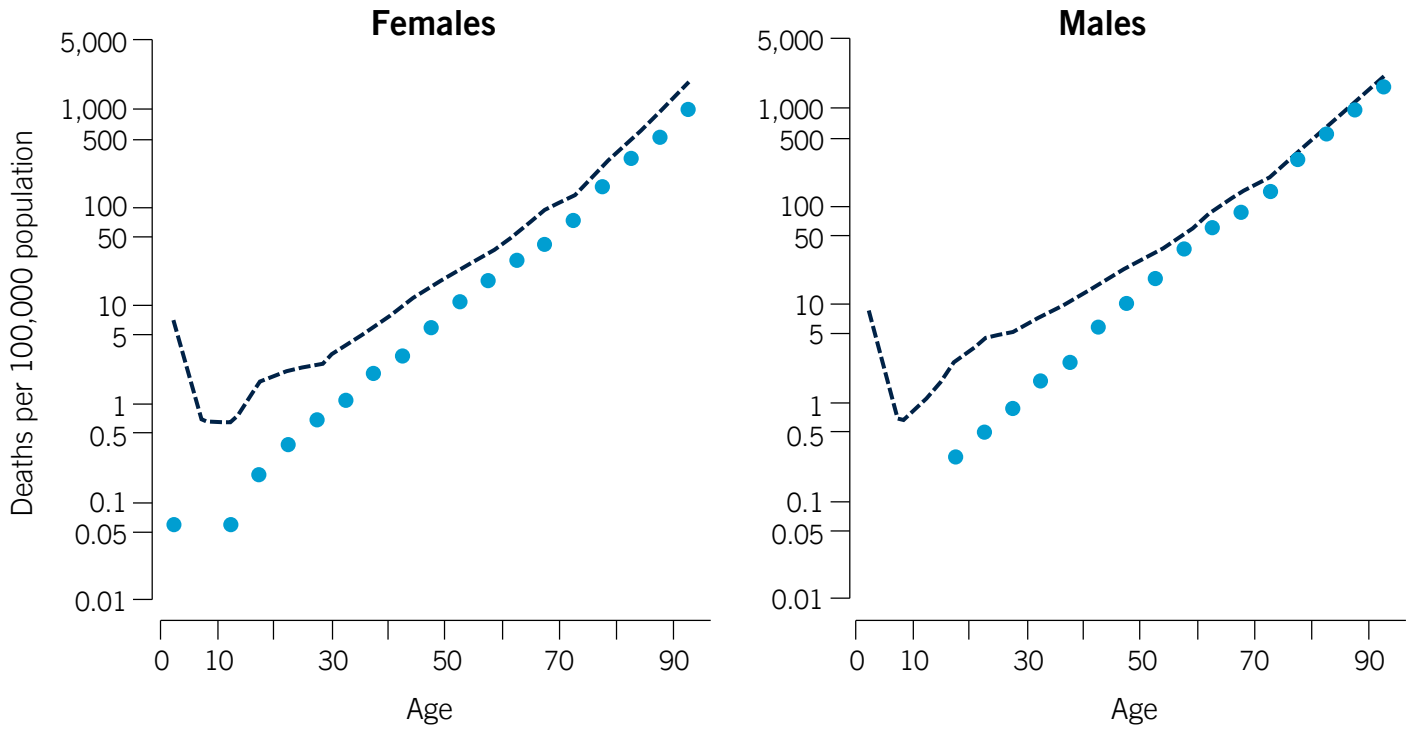
4

Covid-19 mortality among the most deprived socio-economic groups is roughly proportional to the higher all-cause mortality they already experience.

Click here when you're done

Covid-19 mortality seems to be proportional to all-cause mortality at adult ages

Covid death rates on a logarithmic scale compared to all-cause mortality



Five-year average mortality for this period

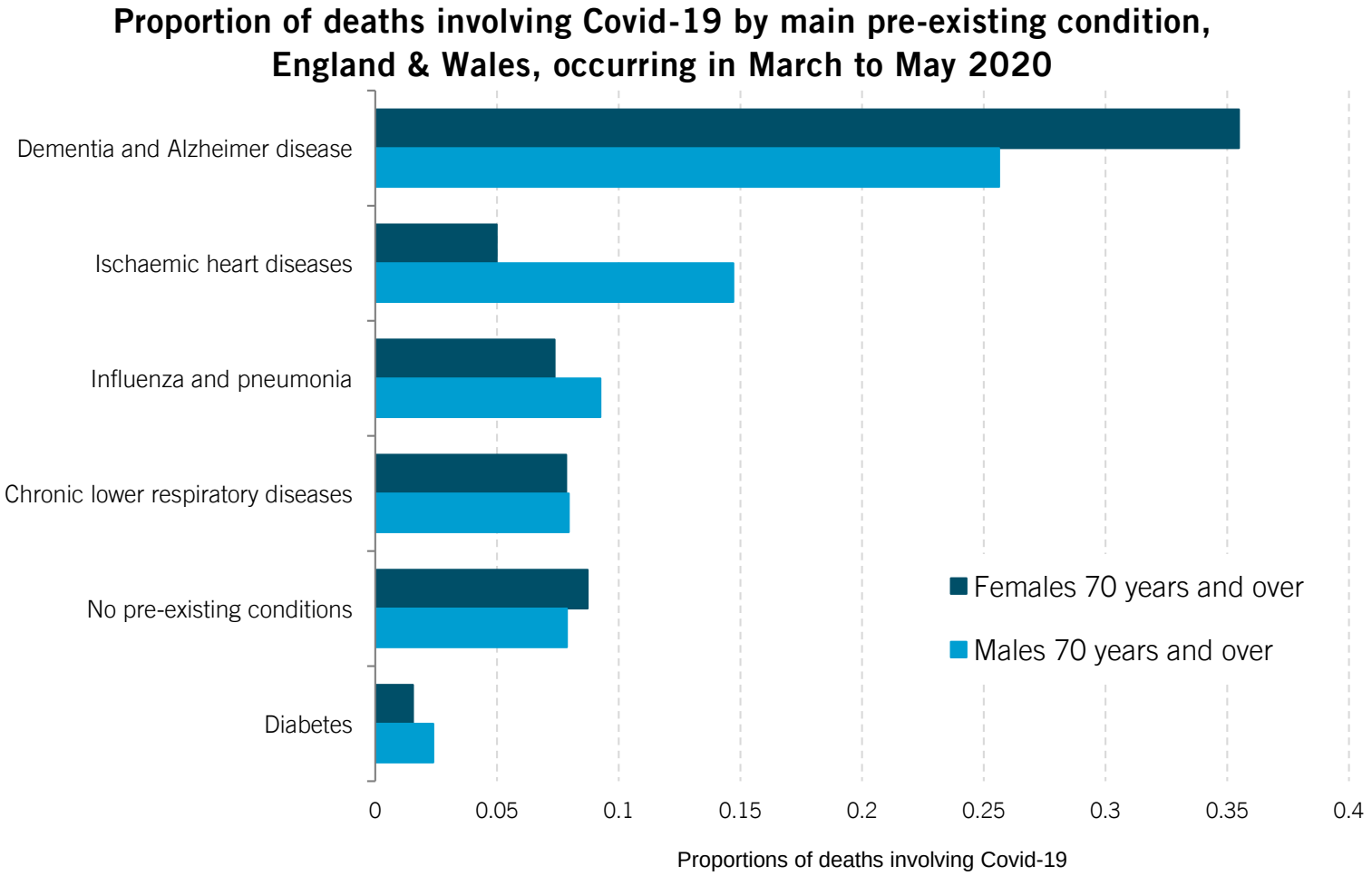
Covid death rates

Covid-19 appears to increase a cohort's short-term mortality risk by a common multiplicative factor, whatever their baseline mortality risk was before the pandemic.

Note: All-cause death rates for England & Wales versus death rates from Covid-19 for males and females. Deaths registered E&W Weeks 14 to 18: 28 Mar–1 May.
Source: Data from ONS. David Spiegelhalter blog, Winton Centre, 13 May 2020; https://medium.com/wintoncentre

BACK

Data point to the fact that a significant proportion of people who die from Covid-19 are in a frail state

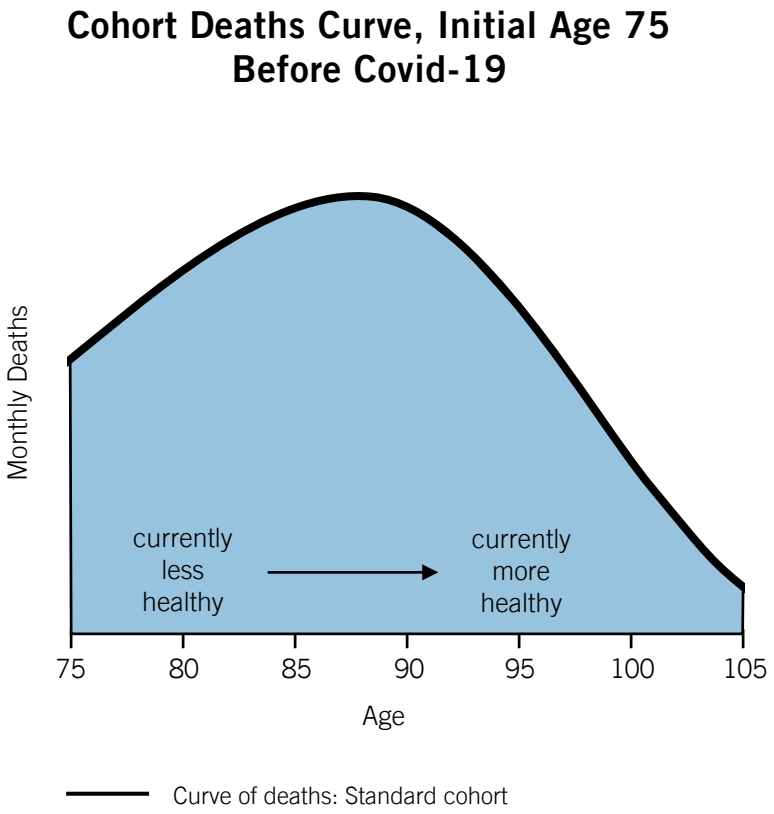


Only about 10% of deaths had no pre-existing conditions.

Source: Figure 10 in Deaths involving COVID-19, England & Wales: deaths occurring in May 2020, Office for National Statistics; https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/deathsinvolvingcovid19englandandwales/deathsoccurringinmay2020

BACK

The Accelerated Deaths Model

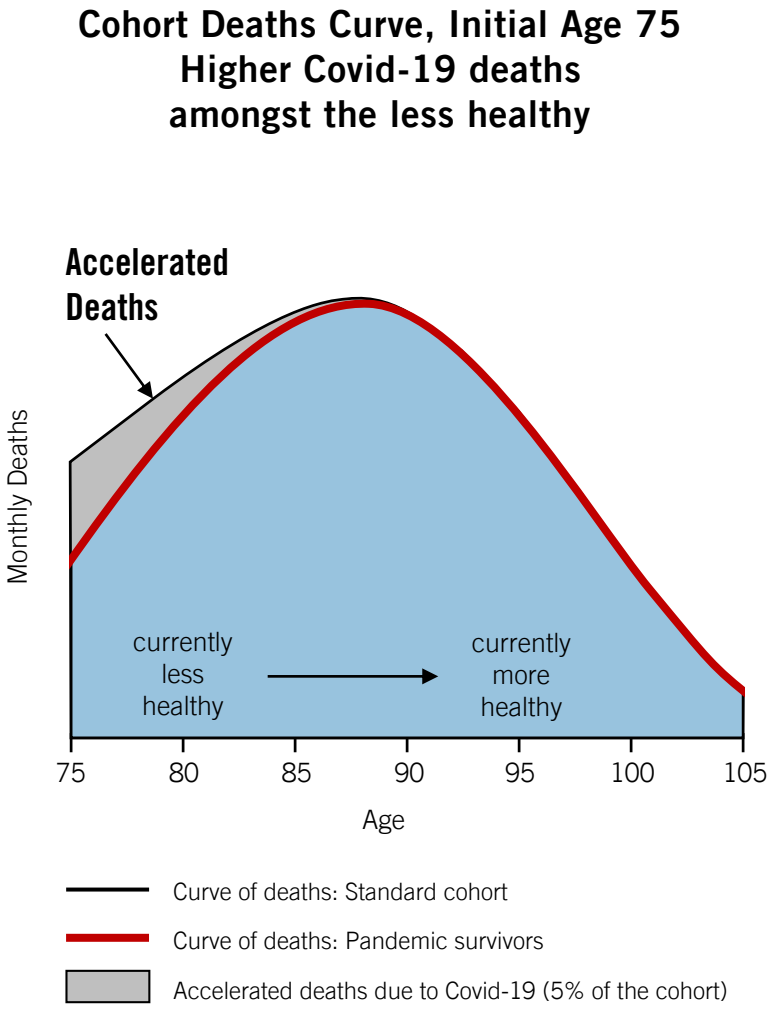


Within a given cohort, some people are in relatively good health and some are in poorer health.

Those currently in poorer health will feature more heavily in early deaths along this cohort deaths curve, while the healthier people will feature heavily in the later deaths.

Source: Andrew J.G. Cairns, David Blake, Amy R. Kessler, and Marsha Kessler, The Impact of Covid-19 on Future Higher-Age Mortality. Available at http://www.pensions-institute.org/wp-content/uploads/wp2007.pdf?utm_source=prudential&utm_medium=newsroom&utm_campaign=covid19

Accelerated Deaths Model: Description



- Monthly deaths: $d_A(t,x)$ in month t for cohort currently aged x

- A *proportion* $\pi(t,x)$ of the anticipated deaths in month t are accelerated as Covid-19 deaths

$$\pi(t,x) = \frac{\alpha(x)}{\rho(x)} \exp[-t/(12\rho(x))]$$

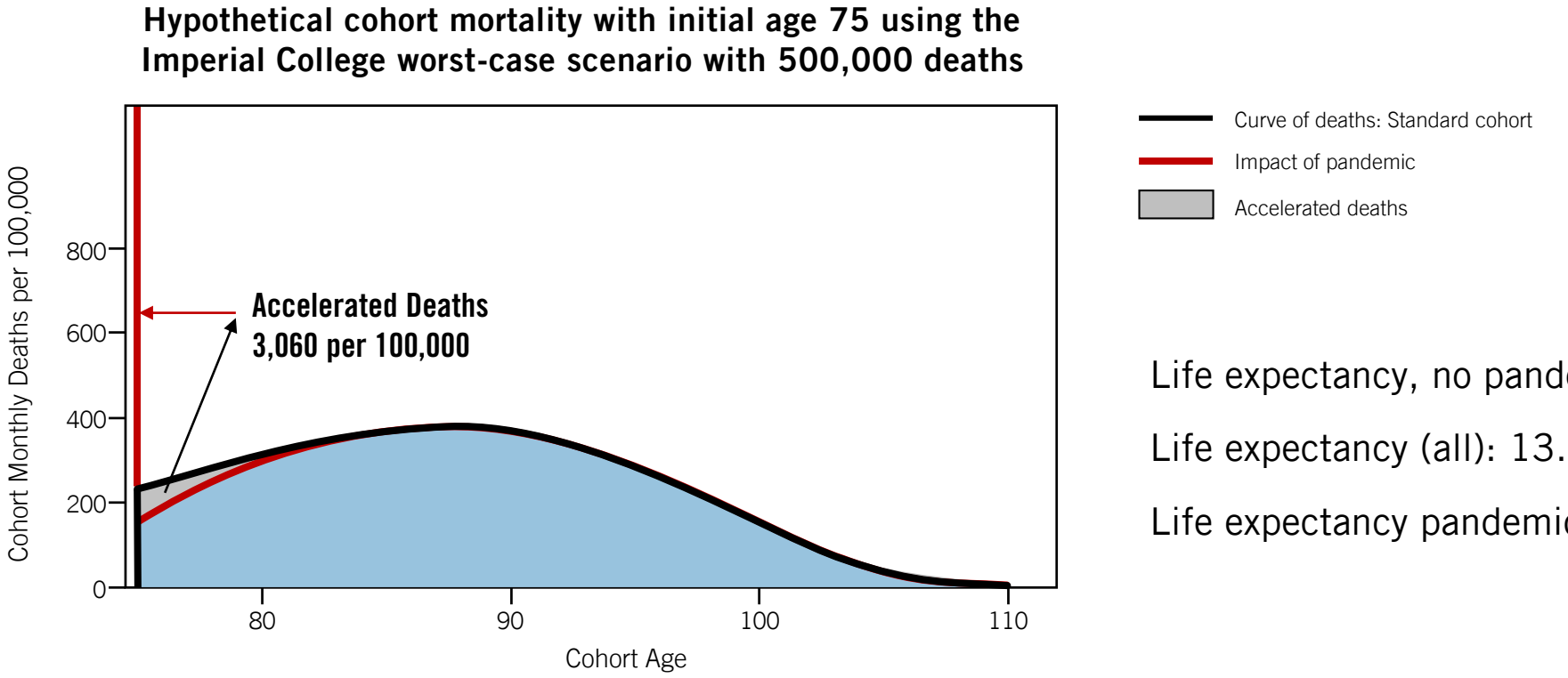
- $\alpha(x)$ = the *amplitude*
- Covid-19 deaths $\approx \alpha(x)$ times expected all-cause deaths in 2020

- $\rho(x)$ = the *reach*
- $\rho(x) \approx$ the average years of life lost by someone aged x who dies from Covid-19

- $\pi(t,x)d_A(t,x)$ governs the shape of the grey accelerated deaths region under the curve of deaths

Source: Andrew J.G. Cairns, David Blake, Amy R. Kessler, and Marsha Kessler, The Impact of Covid-19 on Future Higher-Age Mortality. Available at http://www.pensions-institute.org/wp-content/uploads/wp2007.pdf?utm_source=prudential&utm_medium=newsroom&utm_campaign=covid19

Accelerated Deaths Model: the impact of accelerated deaths on a cohort deaths' curve for an extreme scenario



Life expectancy, no pandemic: 13.14 years

Life expectancy (all): 13.04 years

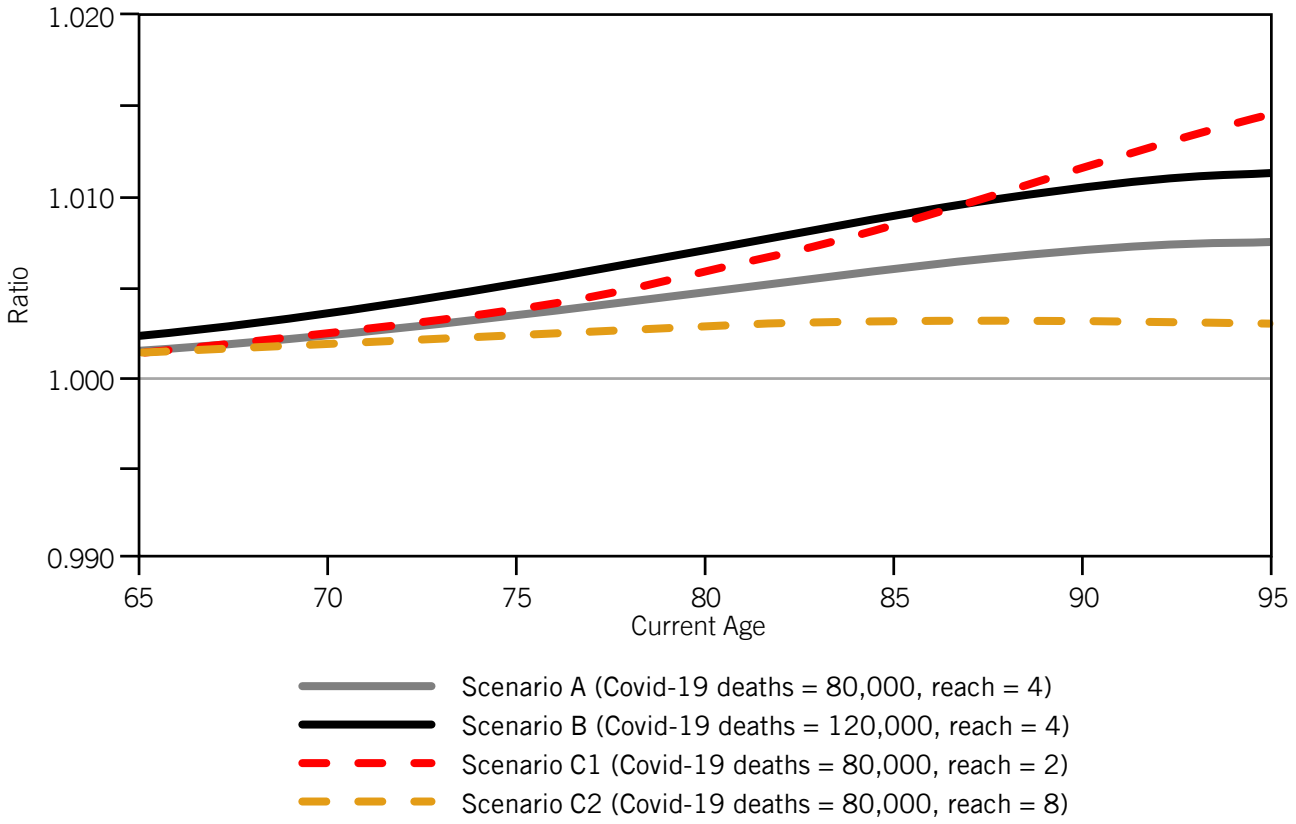
Life expectancy pandemic (survivors): 13.45 years

Source: Andrew J.G. Cairns, David Blake, Amy R. Kessler, and Marsha Kessler, The Impact of Covid-19 on Future Higher-Age Mortality. Available at http://www.pensions-institute.org/wp-content/uploads/wp2007.pdf?utm_source=prudential&utm_medium=newsroom&utm_campaign=covid19

NEXT

The impact on the life expectancy of survivors is likely to be very modest even if deaths were as high as 80,000 in England & Wales

Ratios of the life expectancies of survivors under scenarios A, B and C to life expectancies before the pandemic

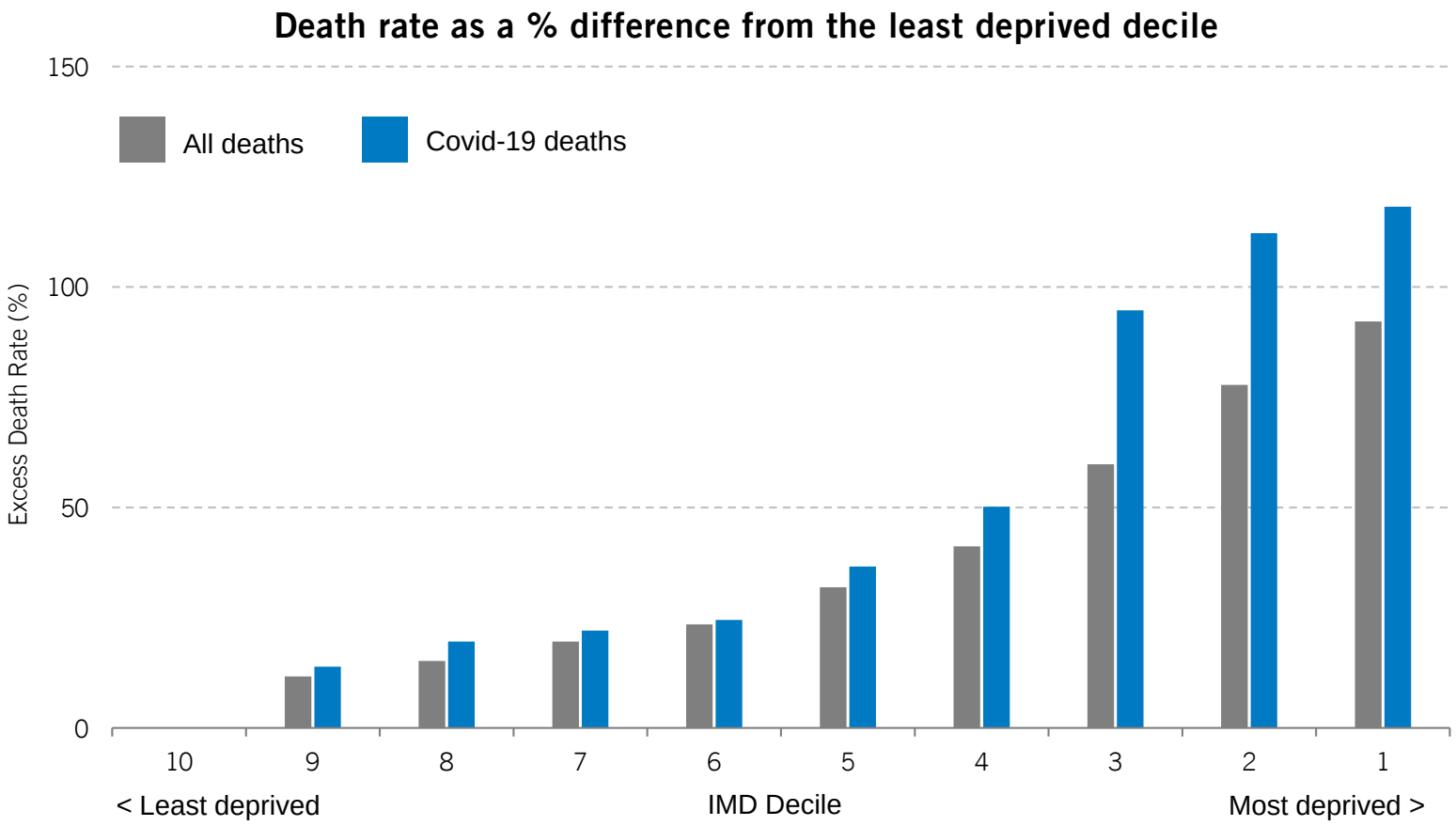


- **Scenario A**: Impact on life expectancies is quite small—less than a 0.2% increase at age 65.
- **Scenario B**: When we increase the amplitude, the impact on life expectancies scales up at all ages.
- **Scenario C1 and C2**: When we change the reach, there is a significant impact on the shape of the life expectancy ratio curve.

Source: Andrew J.G. Cairns, David Blake, Amy R. Kessler, and Marsha Kessler, The Impact of Covid-19 on Future Higher-Age Mortality. Available at http://www.pensions-institute.org/wp-content/uploads/wp2007.pdf?utm_source=prudential&utm_medium=newsroom&utm_campaign=covid19

BACK

We also consider whether lower socio-economic groups have been disproportionately affected by Covid-19



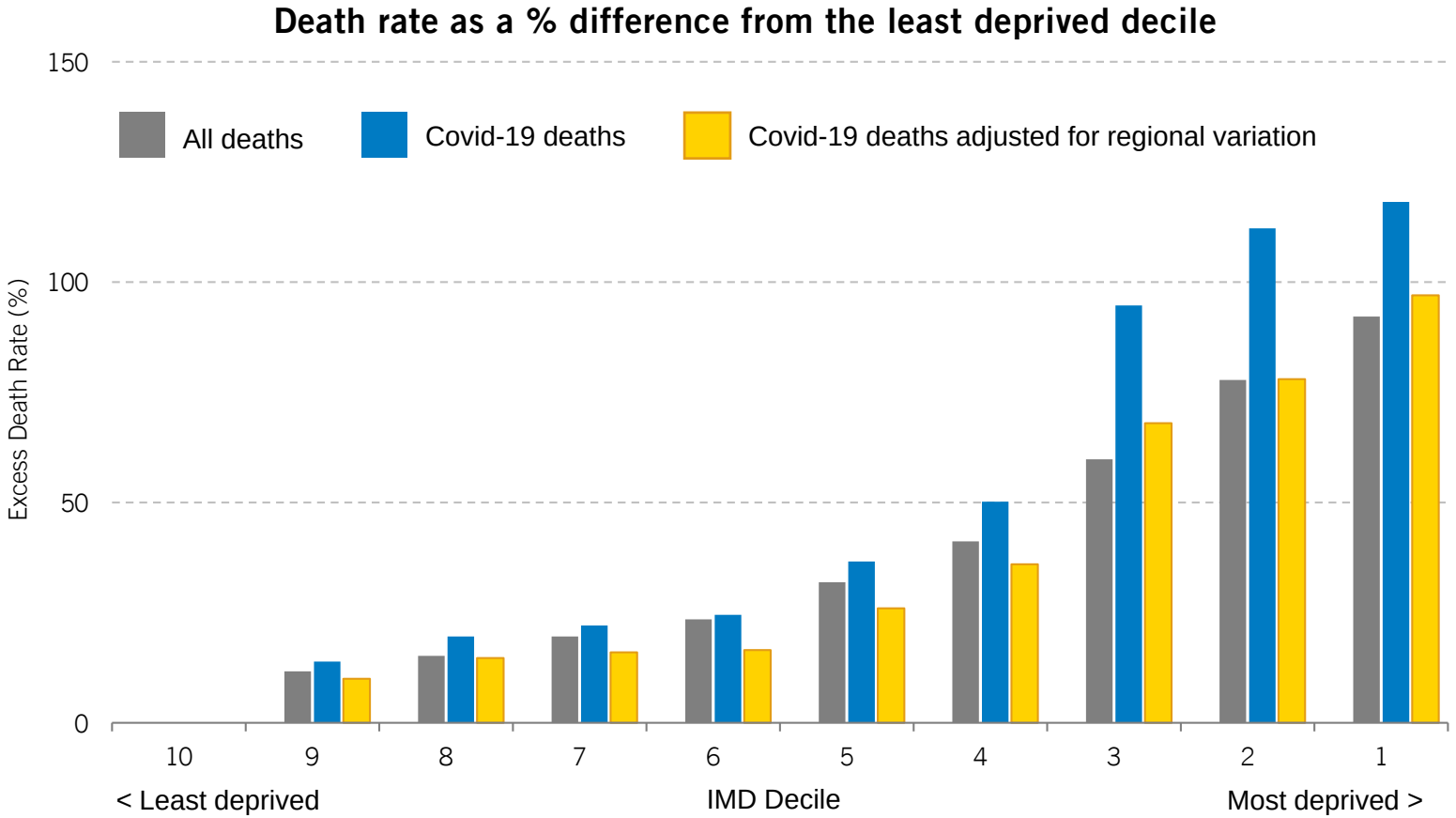
As with all deaths, Covid has the greatest impact on the most deprived areas.

This data suggests that the three most deprived areas have been disproportionately impacted, but there are confounding factors.

Age-standardized mortality rates, all deaths and deaths involving Covid-19, Index of Multiple Deprivation, England.
Source: Office for National Statistics (1 May 2020) *Deaths involving COVID-19 by local area and socioeconomic deprivation: deaths occurring between 1 March and 31 May 2020.*
https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/deathsinvolvingcovid19bylocalareasanddeprivation/deathsoccurringbetween1marchand31may2020.

NEXT

Once regional differences have been allowed for, Covid-19 mortality among the most deprived is approximately proportional to the higher all-cause mortality they already experience



Those most impacted are those whose mortality rates were highest in the first place:

- the frail elderly
- those with significant co-morbidities
- the most deprived among us
- communities of color

Age-standardized mortality rates, all deaths and deaths involving Covid-19, Index of Multiple Deprivation, England.
A simple multiplicative model is used for ASMRs by region, i and IMD decile, j: i.e. $ASMR(i,j) = r_i d_j$. Values for r_i and d_j are derived by matching modelled regional and decile ASMRs to those in Figure 11, taking account of the number of Lower Layer Super Output Areas (LSOAs) by region and IMD decile.

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THREE KEY CHALLENGES

Our research addresses three key challenges in longevity estimation that arise from Covid-19

1 Experience Data

How to adjust experience data from pension schemes and insured annuity blocks in order to avoid misestimating future mortality rates

2 Anti-selection risk

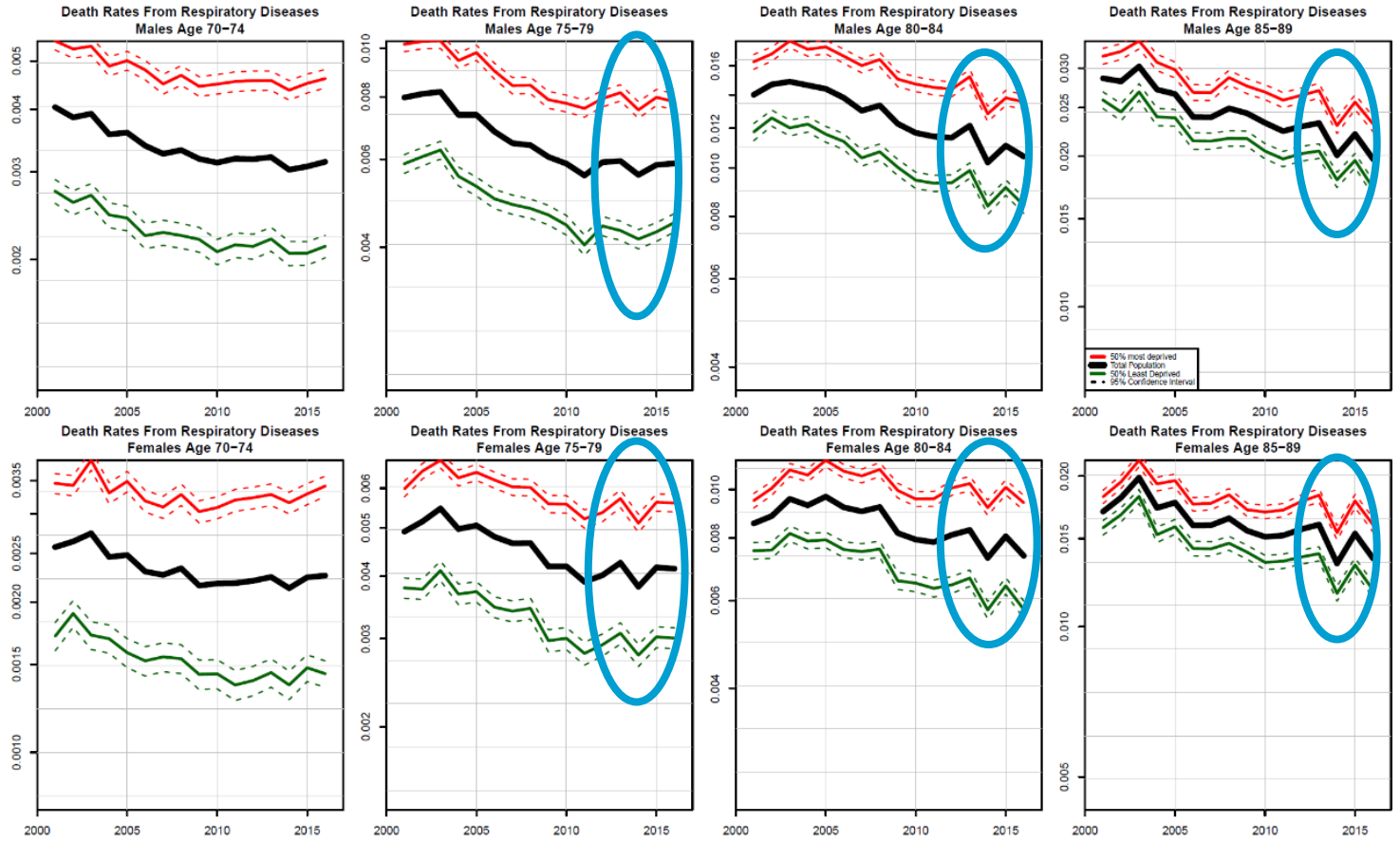
How to assess anti-selection risk, if any, in the surviving population applied under a wide range of outcomes across different countries

3 Near-term volatility

Estimating the volatility that may arise in immediate post-pandemic mortality through an analysis of past seasonal influenza epidemics

Our research and experience suggests there will be more mortality volatility in the aftermath of the pandemic

Death rates (logarithmic scale) from respiratory diseases in England by gender, age group, year and deprivation



There is a remarkably synchronized high-low-high pattern in 2013-2015 due to the 2012-2013 flu, which caused accelerated deaths among people with chronic respiratory disease.

- High-low-high
- Every high age group
- High and low deprivation
- Males and females

See Cairns, Kleinow and Wen (2019) for further details: http://www.macs.hw.ac.uk/~andrewc/ARCresources/Sessional2020/

IT PAYS TO BE PREPARED

Look for opportunities to reduce or transfer risk

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YOUR TEAM

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BIOGRAPHIES

BACK

Andrew Cairns

Professor of Financial Mathematics at Heriot-Watt University, Edinburgh

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Professor Andrew Cairns is well known both in the U.K. and internationally for his research in financial risk management for pension plans and life insurers. In recent years, his research has focused on the modelling of longevity risk: how this can be modelled, measured and priced, and how it can be transferred to the financial markets. Amongst his work in this field, he has developed many new and innovative stochastic mortality models.

He is an active member of the U.K. and international actuarial profession: he qualified as a Fellow of the Faculty of Actuaries in 1993; from 1996 to 2017 he was editor of the leading international actuarial journal ASTIN Bulletin - The Journal of the International Actuarial Association and editor-in-chief for the last 10 of these years; and in 2005 he was elected as a corresponding member of the Swiss Association of Actuaries. From 2016-2020 he was Director of the Actuarial Research Centre of the Institute and Faculty of Actuaries.

His research has received several international prizes including the Halmstad Prize in 2008, the Society of Actuaries Annual Prize in 2009 and the Robert I. Mehr Award in 2016.

In 2016 he was elected as a Fellow of the Royal Society of Edinburgh, Scotland's national academy of science and letters.

BIOGRAPHIES

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David Blake

Professor, Cass Business School,
City University of London
Director of Pensions Institute

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Professor David Blake is Director of the Pensions Institute at Cass Business School, City University of London, and chairman of Square Mile Consultants, a training and research consultancy.

He is also: co-author of the A2Risk attitude to risk questionnaire; co-inventor of the Cairns-Blake-Dowd stochastic mortality model; and co-founder with JPMorgan of the LifeMetrics Indices.

He won the 2016 Robert I. Mehr Award for 'A Two-Factor Model for Stochastic Mortality with Parameter Uncertainty: Theory and Calibration' (with Andrew J. G. Cairns and Kevin Dowd) published in the December 2006 issue of the Journal of Risk and Insurance, the journal of the American Risk and Insurance Association. This Award is presented each year for the paper published in the JRI ten years before that has best stood the test of time.

He has a PhD from LSE.

BIOGRAPHIES

BACK

Amy Kessler is senior vice president and head of International Reinsurance within PFI's Pension Risk Transfer business. Together with her exceptional team, she has closed over $80 billion in international reinsurance transactions since 2011.

Amy led the ground-breaking $28 billion captive longevity reinsurance transaction for British Telecom in 2014, which was named “Deal of the Year” by Risk magazine and earned PFI top honors as “Reinsurer of the Year”—an award her team received for four consecutive years.

With 30 years of experience, Amy helps pension funds proactively manage longevity risk and create retirement security for their members. She is currently leading the launch of Prudential’s longevity and funded reinsurance solutions for Canada, the Netherlands and Australia. Before joining Prudential, Amy served as a principal at Bear Stearns and as Global Head of Pension ALM at Swiss Re in London.

Amy holds a Bachelor’s Degree in economics and a Master’s Degree in international economics and finance from Brandeis University, where she is a Member of the Board of the International Business School and the 2013 recipient of the Dean’s Medal.

Amy Kessler

Senior Vice President, Head of International Reinsurance
Prudential Financial, Inc. (PFI)

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BIOGRAPHIES

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Marsha Kessler is CEO of M Kessler Group, an organization that leverages Malcolm Baldrige principles to help healthcare/healthcare-related organizations achieve data driven transformation.

Marsha is an accomplished leader in organizational transformation, measurement and results, project management, process improvement and strategy alignment. She brings over 20 years of experience leading successful cross-functional and organization-wide change.

Marsha's expertise in the Baldrige framework for performance excellence and background in systems engineering and statistics provides a strong foundation in measurement, analysis and systems thinking. Marsha has coached organizations that achieve exceptional results including national Baldrige recipients such as Adventist Health Castle, Henry Ford Health System, and Southcentral Foundation.

A creative and collaborative leader, Marsha can synthesize complex information facilitating understanding and buy-in. Her passion is to help healthcare organizations increase their ability to understand and use data to drive results.

Marsha has a B.S. degree in optical engineering from the University of Rochester.

Marsha Kessler

CEO, M Kessler Group

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