

Extreme Longevity

A science-based scenario analysis

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Acknowledgements and disclaimer

This presentation is based on joint work published in the following white paper:

- **Guy Coughlan & Richard Faragher, “*Extreme Longevity: A science-based scenario analysis*,”**
White Paper, 20 July 2026 (<https://www.guycoughlan.com/s/Extreme-Longevity-Coughlan-Faragher-2026-07-20.pdf>)

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The *Extreme Longevity Scenario*

A STEP-CHANGE REGIME SHIFT

A *gerotherapeutic* intervention delivers a significant increase in *lifespan* and *healthspan* to the population within a decade

Financial consequences



Repricing longevity risk - before demographic impact realised



Short-term turmoil - potential disruption of the financial system



Long-term dividend - potential for huge economic benefits

Enablers



Geroscience maturity

Ageing is a modifiable biological process, underlying all age-related diseases



Accelerated pathways

- AI-enabled discovery
- Repurposed drugs
- “TAME”-style clinical trials
- Regulatory flexibility
- Government-aided rollout

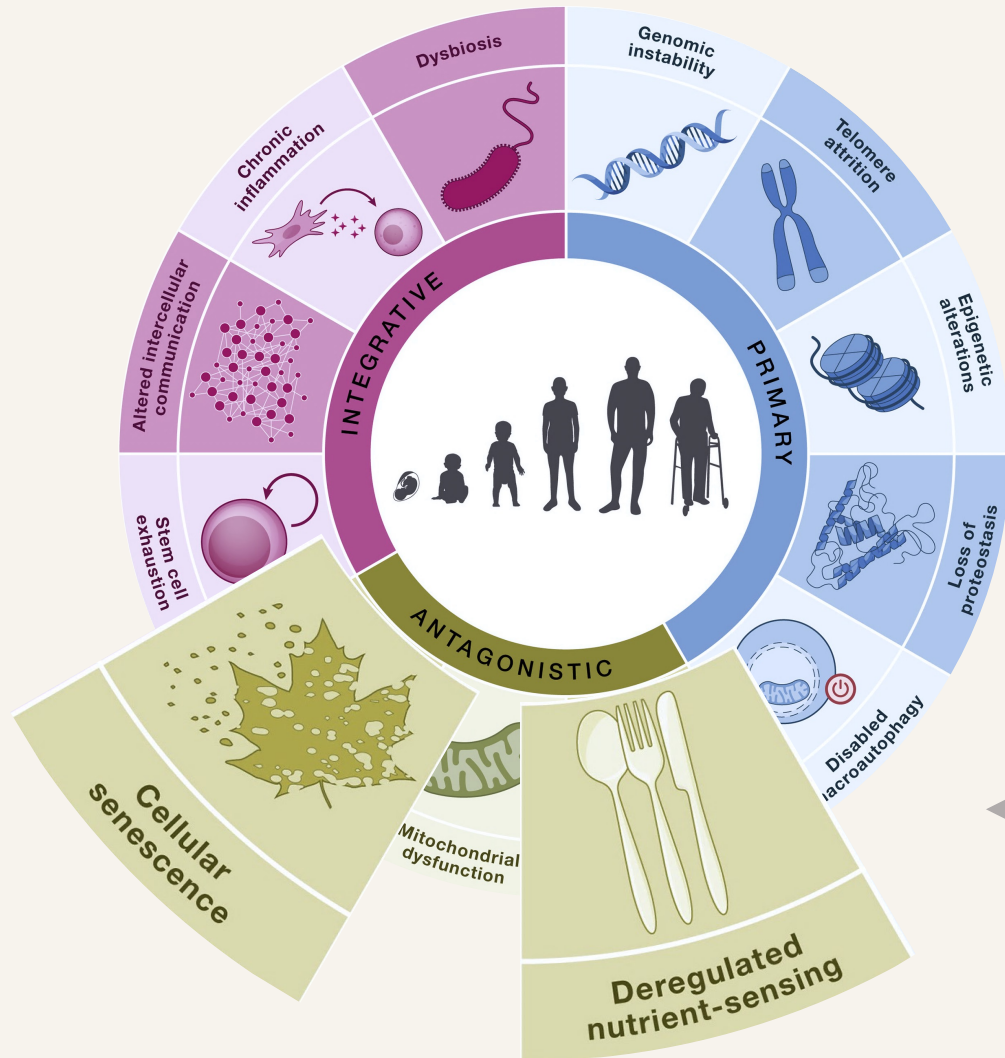


Gradualist bias

Financial models are calibrated to slow, linear improvements

This is not a prediction, but a plausible near-term scenario

Target the “Hallmarks of Ageing”¹ – the processes that drive decline



Paradigm shift

From treating individual age-related diseases to targeting the mechanisms that drive them all

Scientific evidence:

- Gerotherapeutics targeting the hallmarks of ageing:
 - Extend lifespan and healthspan in animal models
 - Improve metrics of biological ageing in humans
- Combinations of gerotherapeutics have additive effects

Two promising hallmarks:
Cellular senescence & Deregulated nutrient sensing

Potential for significant increases in healthspan & lifespan

1. Source: López-Otín, et al., 2023

The treatment and the scientific motivation for the scenario

THE TREATMENT

- ✓ A combination of repurposed drugs
- ✓ With an established safety profile
- ✓ Targeting multiple hallmarks of ageing
- ✓ Not expensive
- ✓ Not a daily pill for life

Context

Human evidence for life extension is indirect

- Observed improvements in biomarkers of ageing, such as epigenetic clocks, immune response, functional tests

Animal models are relevant but require care

- Hallmark mechanisms are shared by other species
- Hallmark targeting improves human biomarkers

The Science

Reduction in biological age in humans

- **−4.6 years** – Fitzgerald et al. (2023)
- **−3.9 years** – Tharmapalan et al. (2025)

Slowing the rate of ageing in mice

- **−39%** – Crystallise Ltd, (2024)

Increase in mice life expectancy

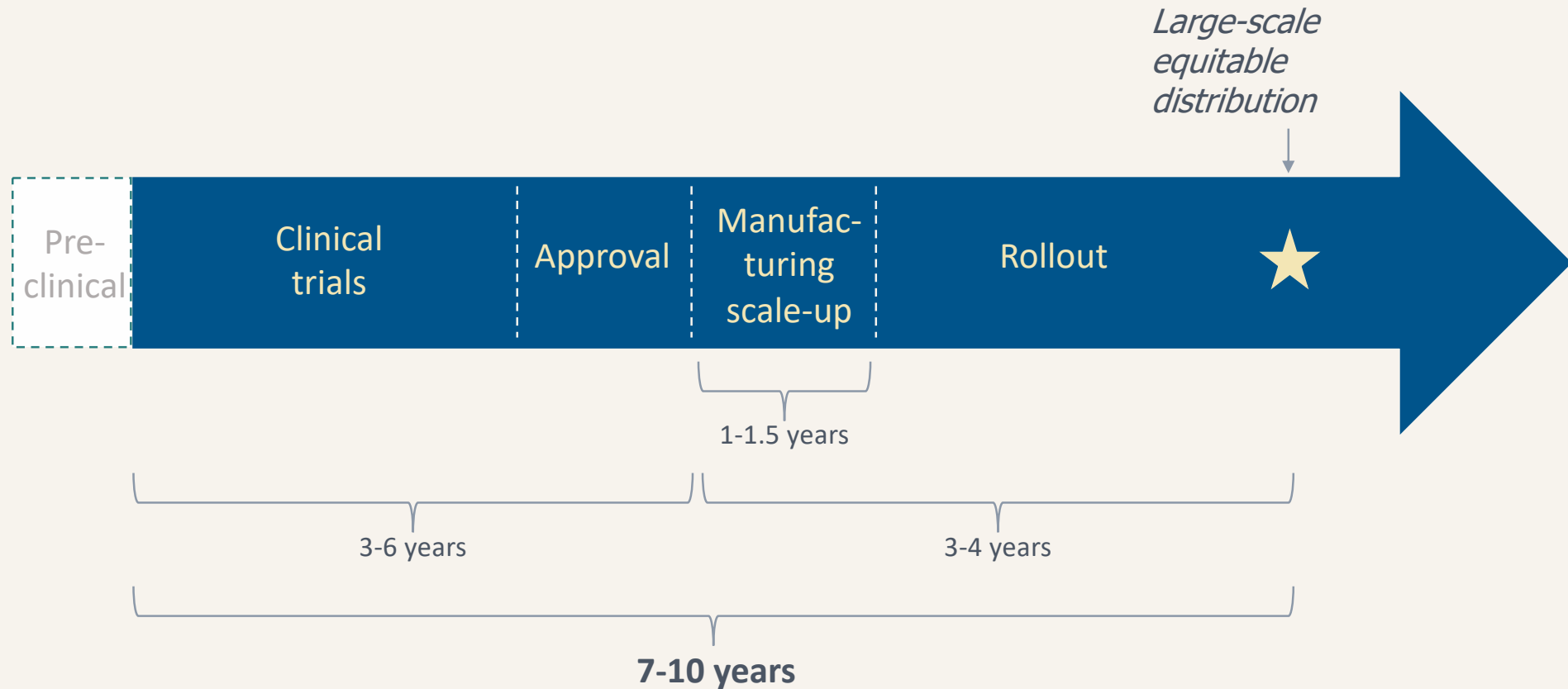
Targeting *one* hallmark:

- **+27-29%** Deregulated nutrient sensing – Gkioni et al. (2025)
- **+17-35%** Cellular senescence – Baker et al. (2016)
- **+36%** Cellular senescence – Xu et al. (2018)

Combinations of different treatments:

- Additive impact – Gkioni et al. (2025); Panchin et al. (2024)

Timeline for emergence of extreme longevity



85% coverage of 60+ population in 7-10 years (comparable to UK statin coverage 2024)

Emergence of this scenario

Pre-clinical

- Increased funding (historically underinvested)
- AI-driven discovery
- Repurposed drugs

Clinical trials & regulatory approval

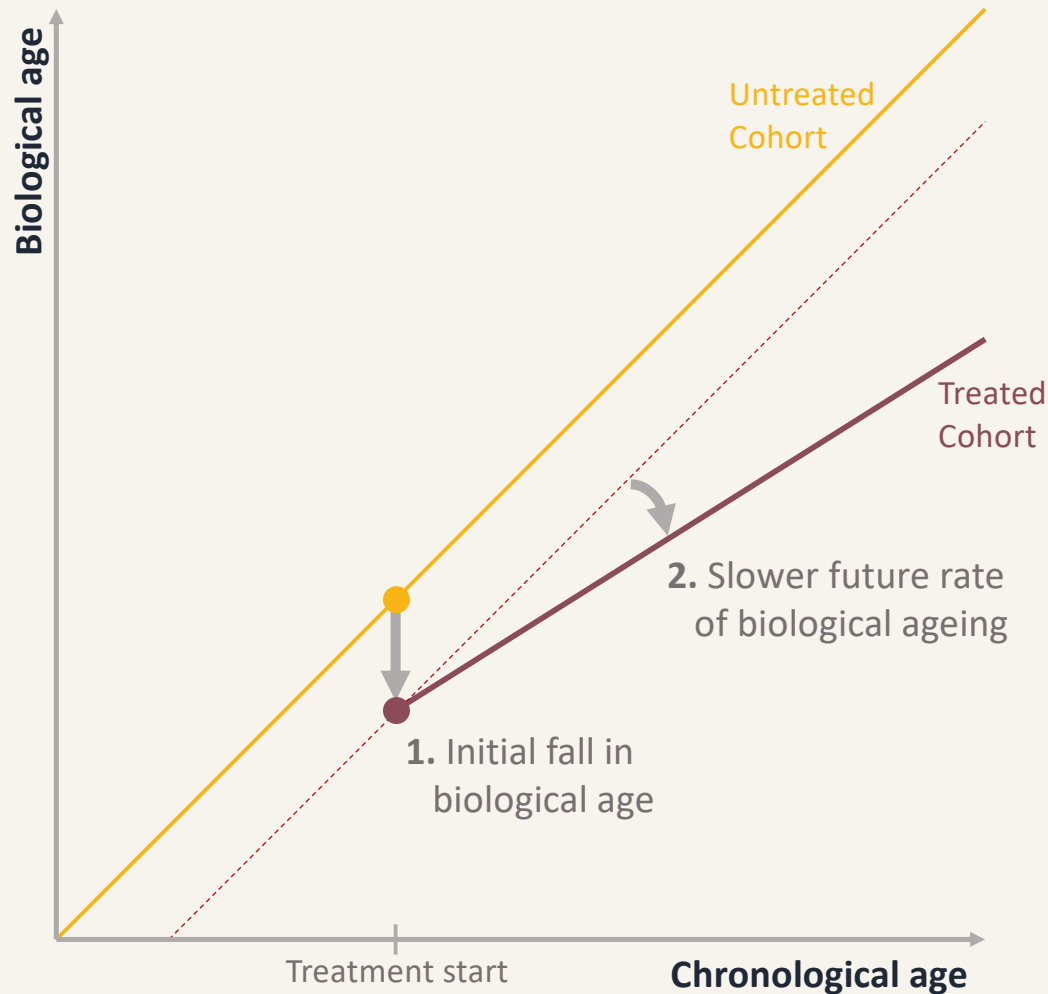
- Repurposed drugs (skip Phase 1 trials)
- “TAME”-style trials (multi-morbidity compression in high-risk cohorts)¹
- Regulatory acceleration strategies

Rollout (Government aided)

- Transition to pathology and...
- Biological inflection points at 34, 60, and 78²

1. Barzilai et al., 2016
2. Lehallier et al., 2019

The malleability of biological age



Gerotherapeutic impact



1. Initial impact: Damage repair

Partial reversal of accumulated molecular damage, "resetting" the biological clock to a younger age shortly after starting treatment



2. Ongoing impact: Slower ageing

Continued treatment attenuates the future rate of damage accumulation, causing the biological clock to tick more slowly

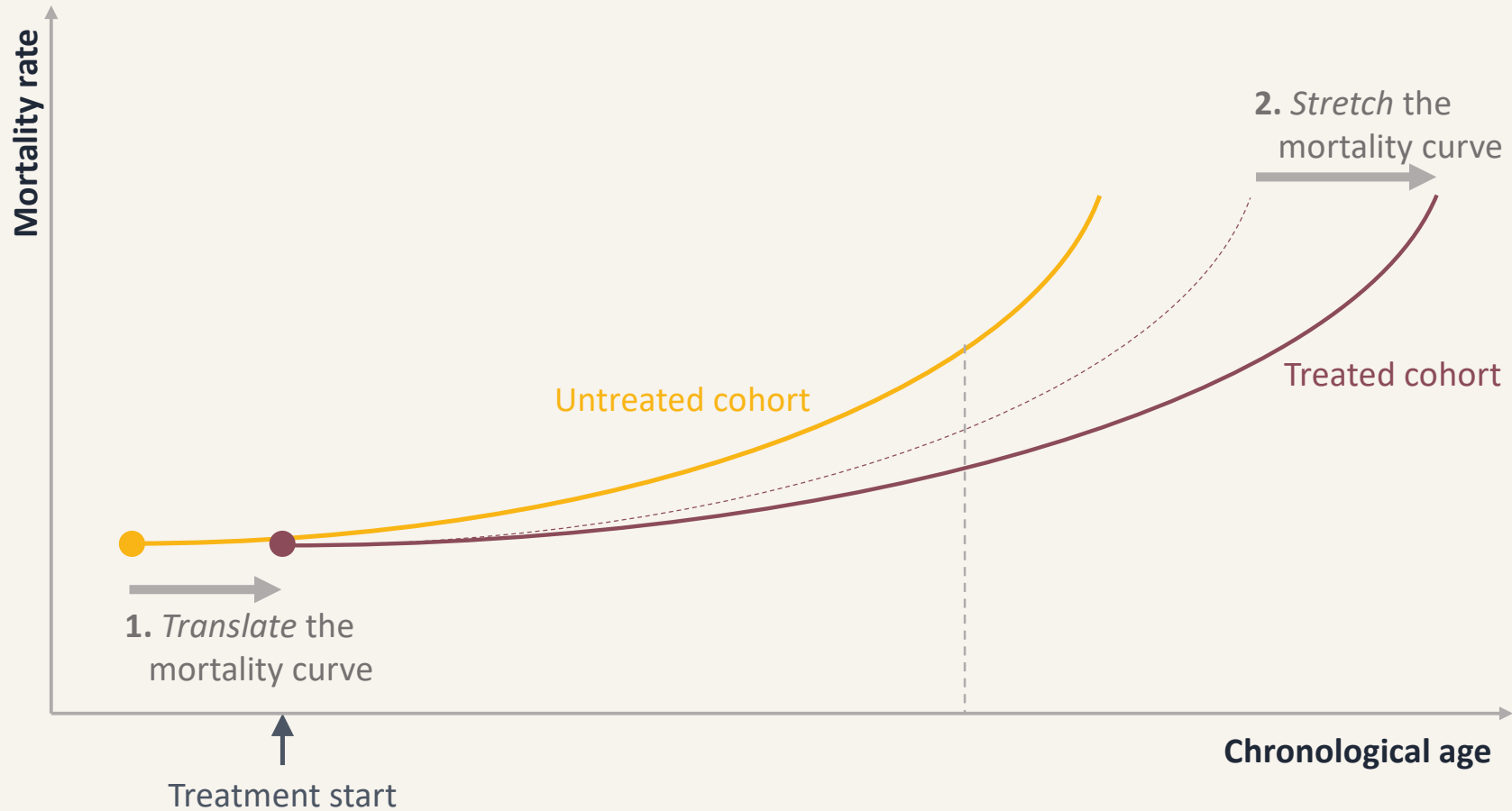
Scenario

–4 years

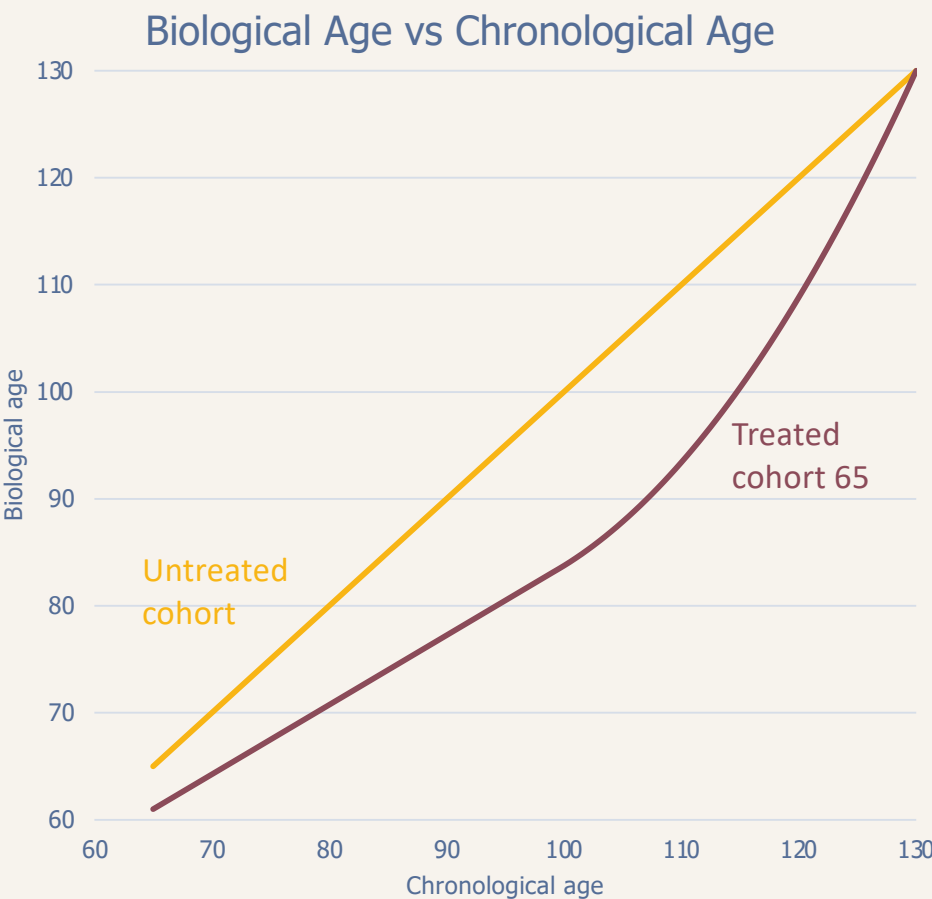
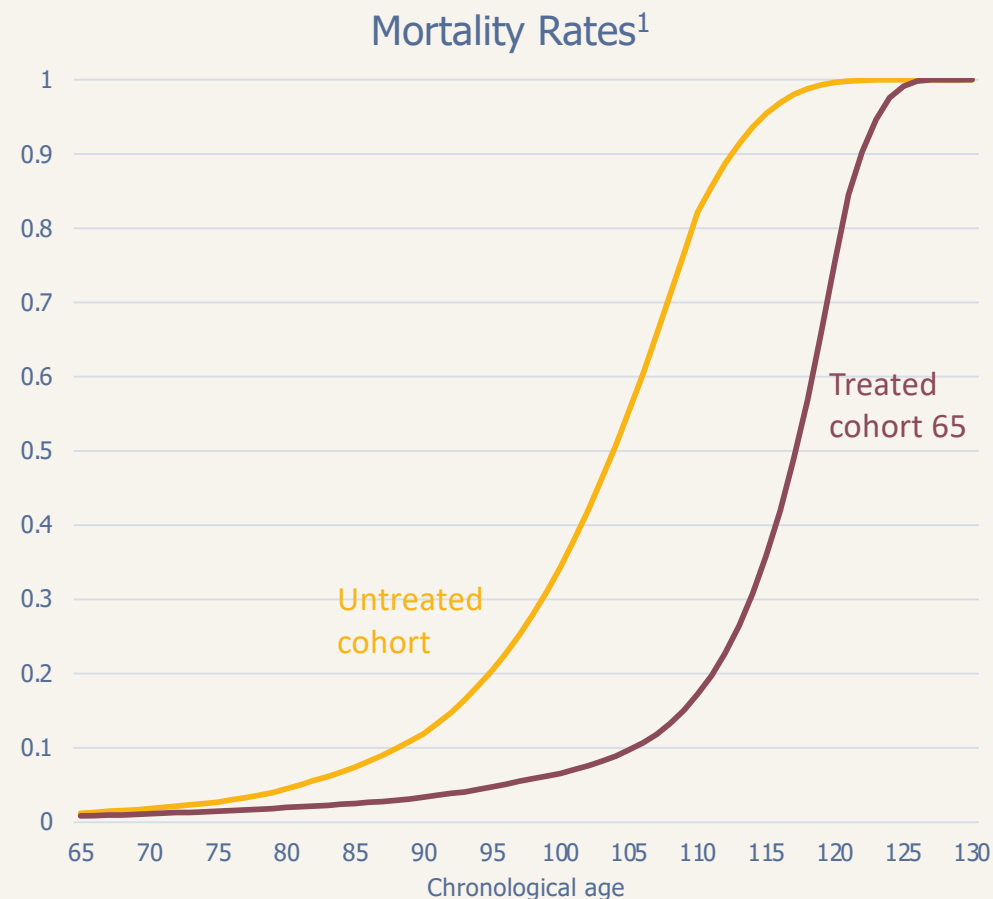
–35%

Implications for mortality rates

Gero-modulation: Rescale chronological age to reflect biological age

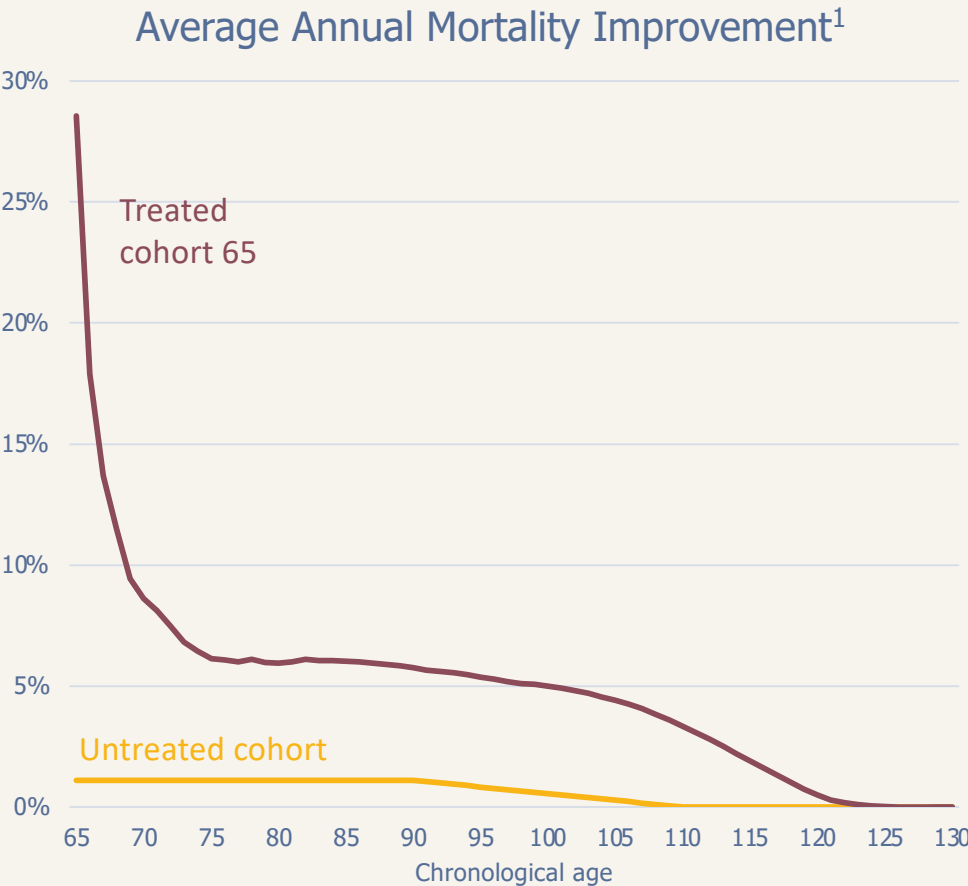
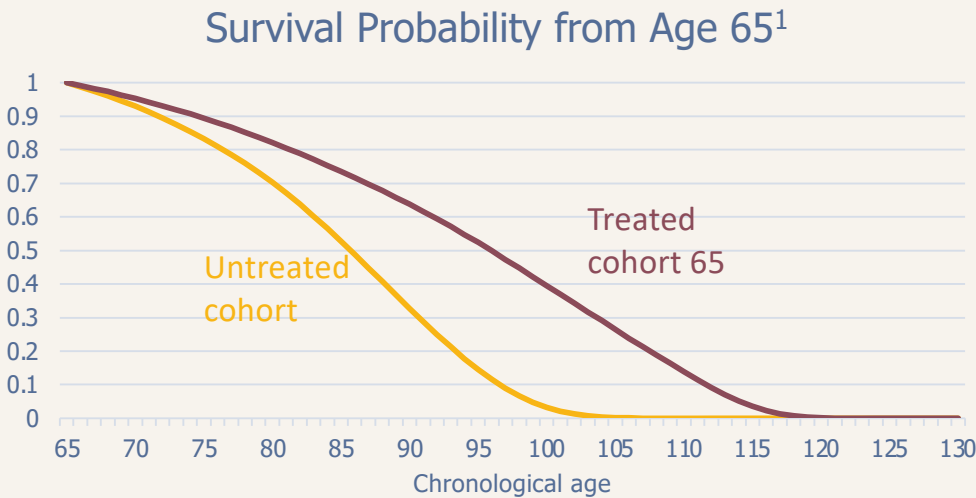
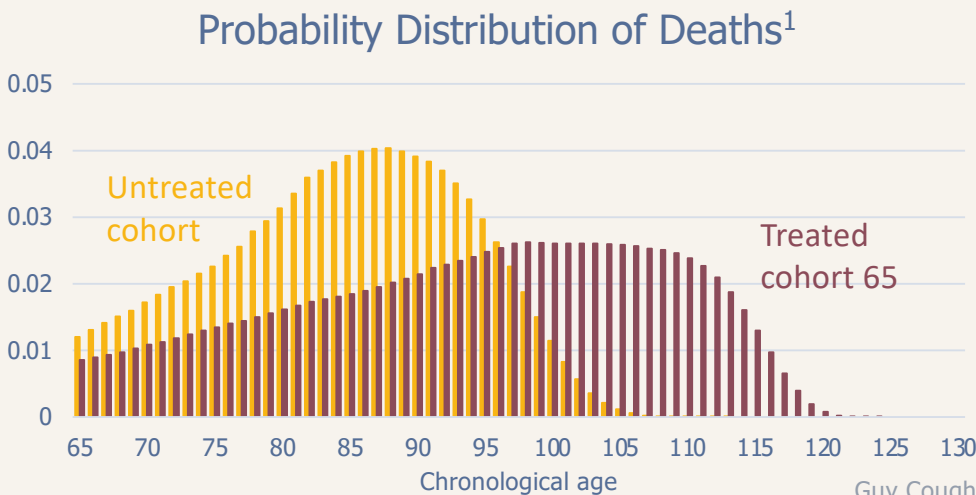


Mortality rates for cohort starting treatment aged 65



1. ONS (2025) UK male mortality data 2022-2024

Mortality improvements, survival and deaths for cohort starting treatment at aged 65



1. ONS (2025) UK male mortality data 2022-2024 and author calculations

Across treated cohorts, the increase in life expectancy is c. 40-50%
The increase in cost of providing lifetime retirement income is c. 35-60%

Increase in remaining life expectancy¹

Starting treatment at:	40	+18.9 years	(+43%)
	50	+15.2 years	(+45%)
	65	+9.5 years	(+48%)
	80	+4.5 years	(+51%)
	90	+2.1 years	(+51%)

Increase in cost of DB pensions & annuities^{1,2}

Starting treatment:	40	+62%
	50	+53%
	65	+33%
	80	+40%
	90	+41%

Accompanied by a similarly large increase in healthspan

1. ONS (2025) UK male mortality data 2022-2024 and author calculations.
2. Inflation-linked benefits beginning at 65 discounted at a real rate of 2%.

This is a fundamental repricing of the cost of retirement

Pension & annuity liabilities in aggregate would increase 30%-45%,¹ putting many institutions and governments under significant stress

Institution	Exposure	Mitigations	Vulnerabilities
DB Pension Plans	Pre- and post-retirement	Longevity reinsurance	Counterparty default
Annuity insurers	Concentrated post-retirement	Longevity reinsurance Mortality exposure offset	Counterparty default Lapse risk
Reinsurers	International longevity risk	Mortality exposure offset	Lapse risk
Governments (e.g. UK)	1. UK state pension £4.8tr ² 2. Public sector pension £1.4tr ³	Policy change	Sovereign debt crisis

1. Depending on uptake and age profile
2. ONS (2021), data for 2018
3. HM Treasury (2024), data for 2023

This could lead to a systemic risk event in the short term

Extreme longevity is a macroeconomic transition risk

SHORT-TERM TURMOIL



Financial volatility:

Repricing of longevity risk triggers procyclical capital strain



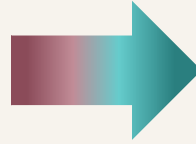
Sovereign debt shock:

Unfunded state pension obligations repriced and recognised as long-term debt



Distributional effects:

Uneven impact across cohorts and sectors leading to social strain and policy lag



LONG-TERM DIVIDEND



Morbidity compression:

Increased healthspan reduces healthcare and long-term care costs



Productive workforce:

Larger labour force offsets demographic headwinds from low birth rates



Economic growth:

Higher levels of savings, investment, and consumption over longer horizons

Call to action: Build resilience and response plans



INSURERS, REINSURERS & PENSIONS

- ✓ Stress test extreme longevity shocks
- ✓ Review counterparty resilience & mortality offset
- ✓ Assess protection lapse risk under longevity shocks



RISK MANAGERS & ACTUARIES

- ✓ Incorporate non-linear regime-shift mortality models
- ✓ Distinguish trend vs. technology-driven discontinuity risk
- ✓ Develop forward-looking gero-clinical indicators



REGULATORS

- ✓ Monitor systemic pro-cyclical capital strain risks
- ✓ Evaluate resilience of longevity reinsurance market
- ✓ Encourage broader spreading of longevity risk



POLICYMAKERS

- ✓ Prepare structural reforms: pensions, labour market, healthcare
- ✓ Plan for longer lives: labour flexibility, reskilling, social acceptance
- ✓ Support equitable access to gerotherapeutics

Extreme longevity is a plausible near-term scenario