All annuitants were made equal…
…but some are more equal than others

Steven Baxter, Hymans Robertson LLP
Alice Woolley, RMS

24 November 2017

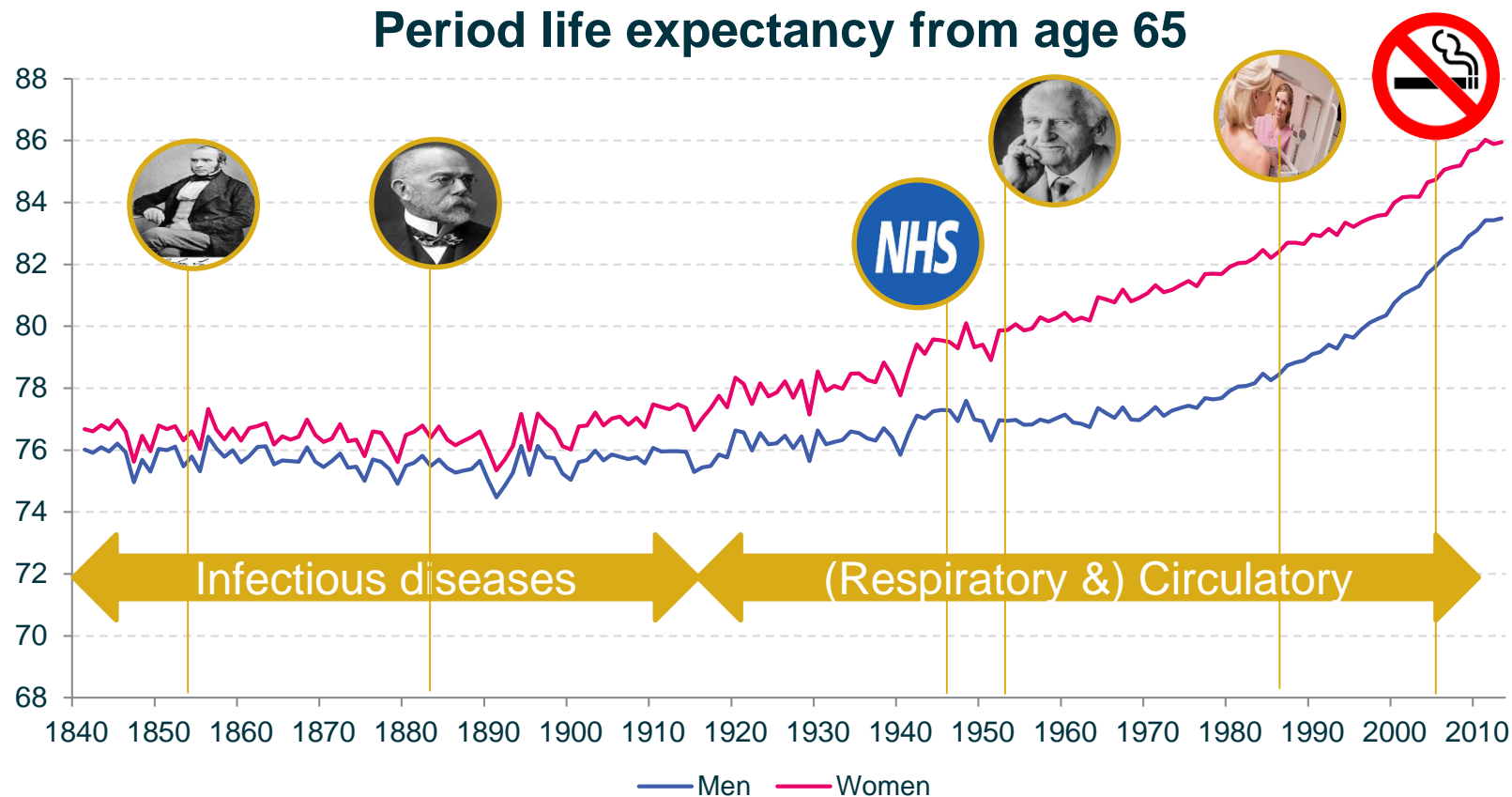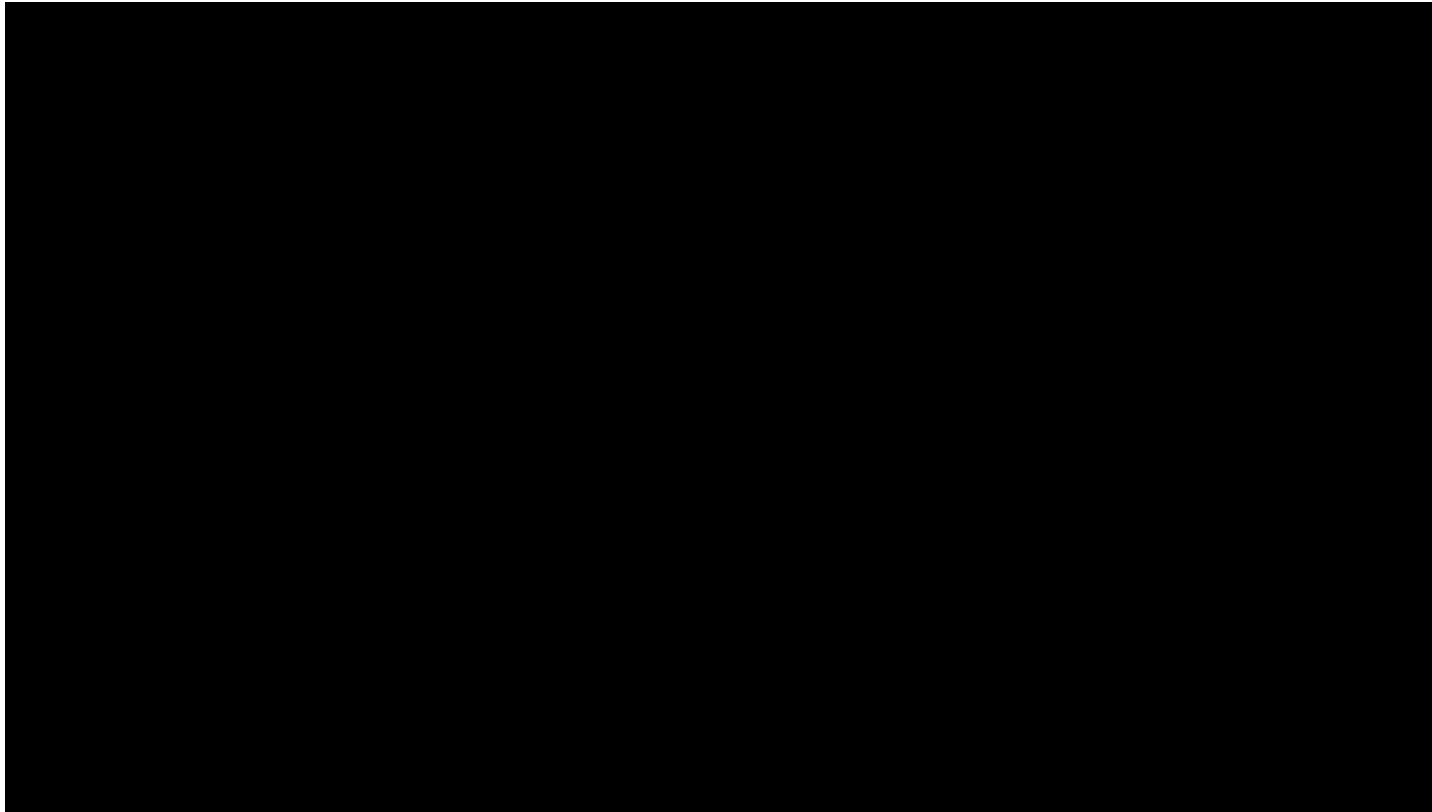# The next 40 minutes…

Historical perspective…

Building projections…

Institute and Faculty of Actuaries

170 years of longevity..

Period life expectancy from age 65

Institute
and Faculty
of Actuaries

A long history of socio-economic differences

Source: BBC via YouTube

Institute
and Faculty
of Actuaries

Why socio-economics matter

Smoking
Over half the difference in premature death between SECs

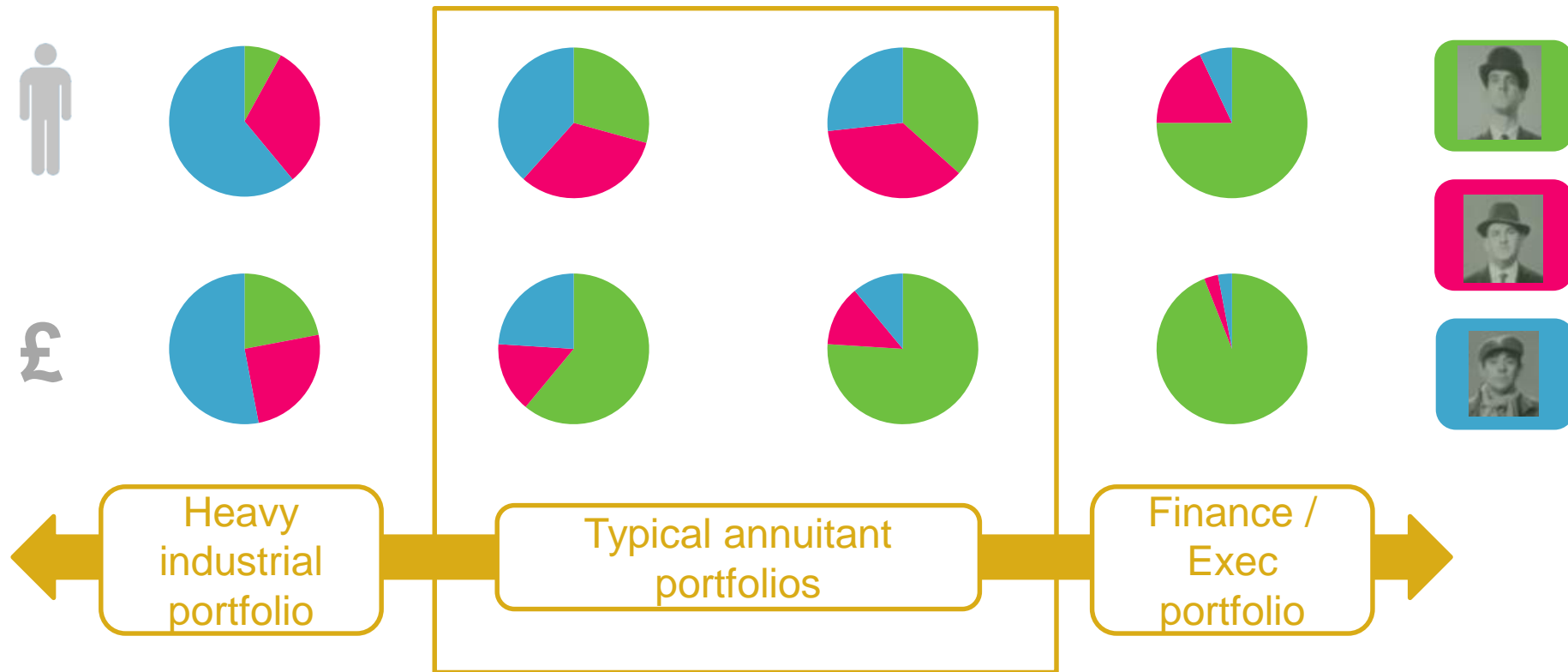(Sharma et al, Wanless et al; death before age 70)

→

Smoking cessation
Higher SECs nearly three times more likely to successfully quit

(Hiscock et al)

Institute
and Faculty
of Actuaries

Why socio-economics matter

Heavy industrial portfolio

Typical annuitant portfolios

Finance / Exec portfolio

Source: Club Vita. Coloured areas relate to Club Vita based socio-economic classes (VitaSegments) which are subtler than the Cleese / Barker / Corbett socio groupings.
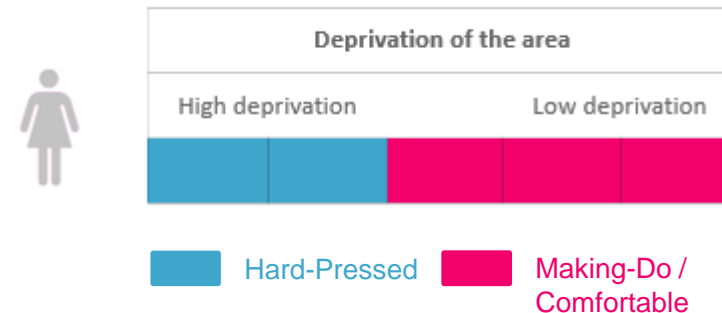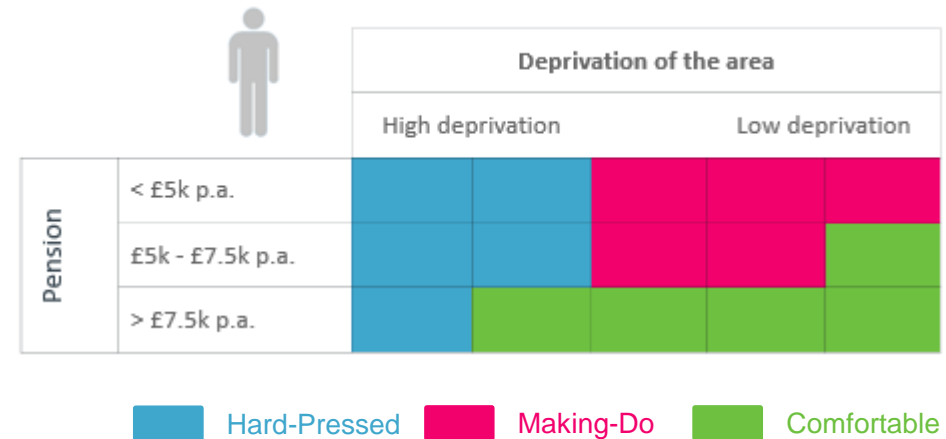
Institute and Faculty of Actuaries

VITASEGMENTS

Key features

1. Calibrated to over 20 years of BPA back history

2. Based on 2m+ lives / 60k annual deaths

3. Use widely available variables

4. Statistically credible groups capturing differences in historical mortality improvements
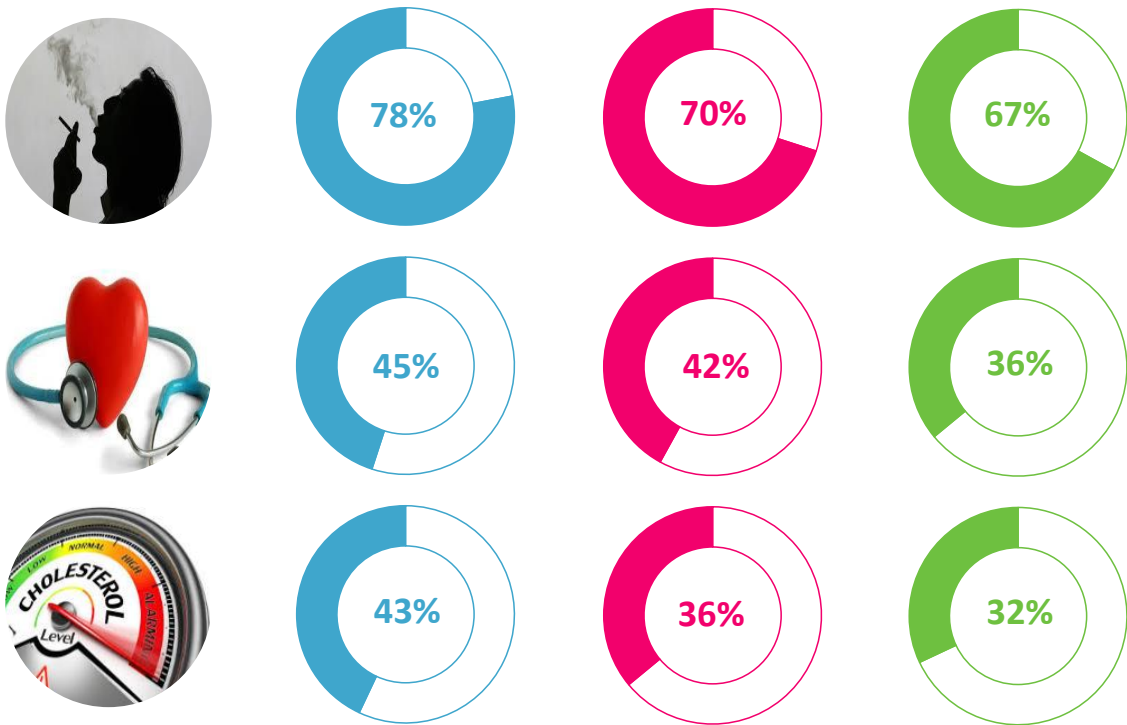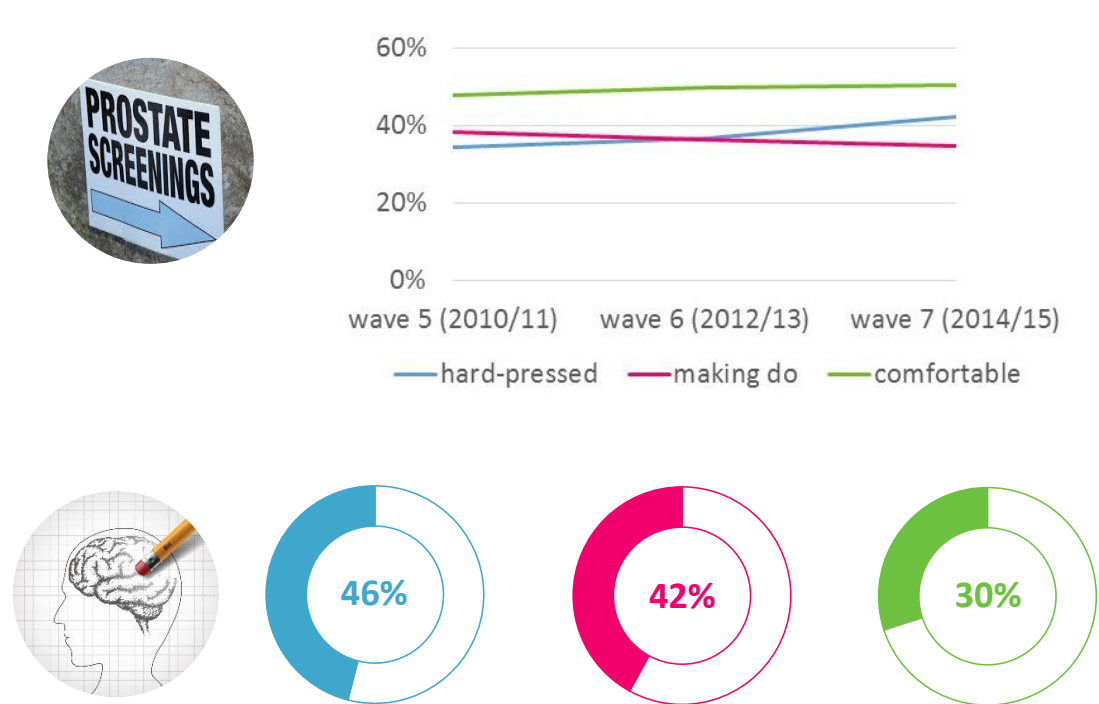

Source: Club Vita

Institute and Faculty of Actuaries

How different are the people in these segments?

Lifestyle attributes

78% 70% 67%

45% 42% 36%

43% 36% 32%

Potential for medical Intervention

60%
40%
20%
0%

wave 5 (2010/11)   wave 6 (2012/13)   wave 7 (2014/15)

— hard-pressed   — making do   — comfortable

46% 42% 30%

Source: Club Vita / Hymans Robertson. Statistics quoted during seminar using Club Vita data and data from English Longitudinal Study of Ageing (ELSA) All comments relate to men in retirement with DB pensions (typically aged 65+). Variables shown: Ever smoked, High blood pressure, High Cholesterol, Attended prostate screening in last year, self-rated poor memory

Have they been experiencing different longevity trends?

Life Expectancy at age 65 (men)
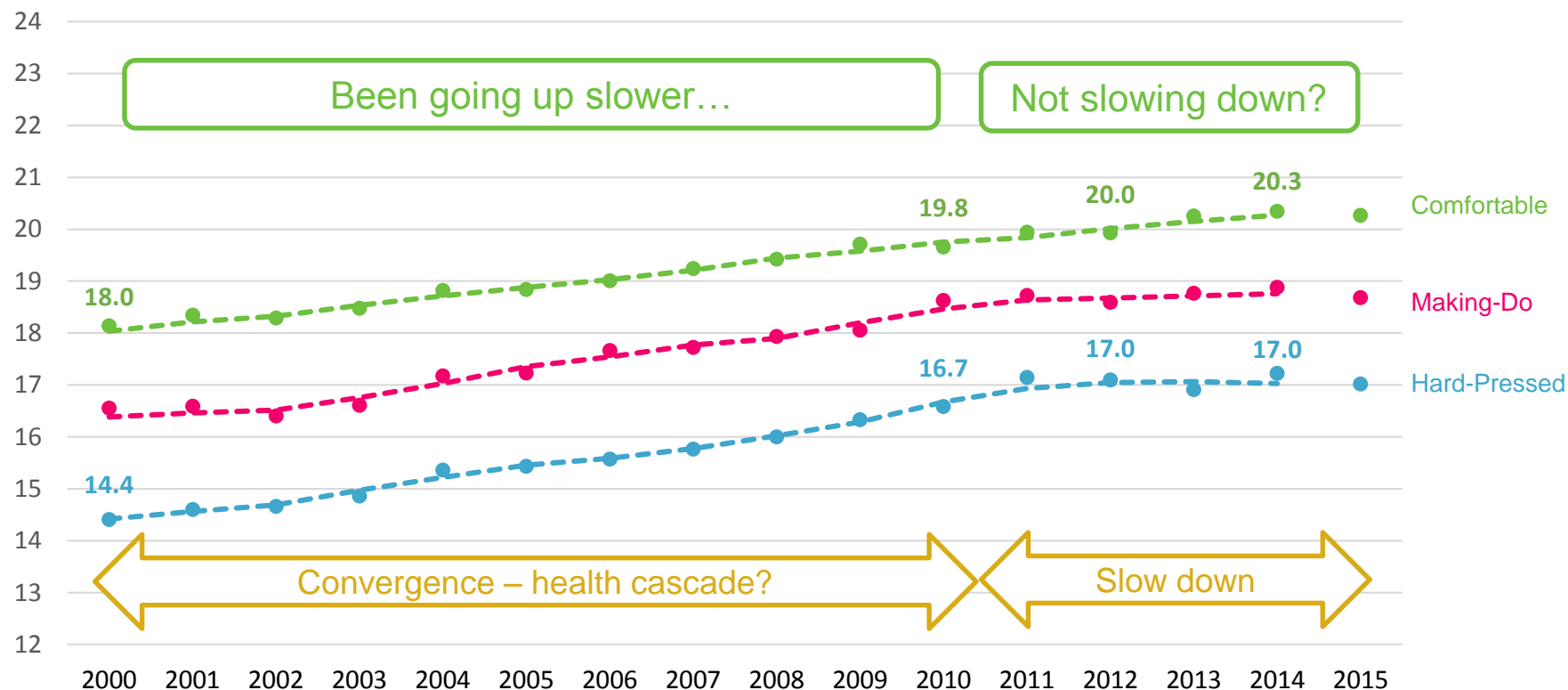
Notes to chart:
(i)   Points relate to life expectancy for the calendar year (using crude mortality smoothed over the age range via a Gompertz curve)
(ii)   Dashed lines apply three year smoothing i.e. calendar year and year prior and after)
(iii) Labels relate to the values under three year smoothing

Source: Club Vita / Hymans Robertson

Underlying improvements

Group	Annualised mortality improvement (age-standardised)		
	2000-2005	2005-2010	2010-2015
England & Wales	2.8% (±0.1%)	2.8% (±0.1%)	1.1% (±0.1%)
Club Vita	2.4% (±0.5%)	2.8% (±0.3%)	1.3% (±0.4%)
Comfortable	2.4% (±1.1%)	2.1% (±0.8%)	2.1% (±0.7%)
Making-do	2.2% (±0.8%)	3.2% (±0.5%)	0.9% (±0.6%)
Hard-pressed	2.5% (±0.7%)	2.9% (±0.5%)	1.0% (±0.6%)

1 — Annuitant improvements mirror national data on a **lives** basis (including recent slowdown)

2 — Comfortable annuitants who dominate liabilities seen **stabler** improvements and no recent slow down

3 — Lower socio-economic groups had been catching-up (convergence, 2005-2010)…
…but recently slowed down (divergence, 2010-2015)

Source: Club Vita / Hymans Robertson. Confidence intervals calculated consistently with the approach set out in CMI WP97

Institute
and Faculty
of Actuaries

Tail winds, head winds and side winds…
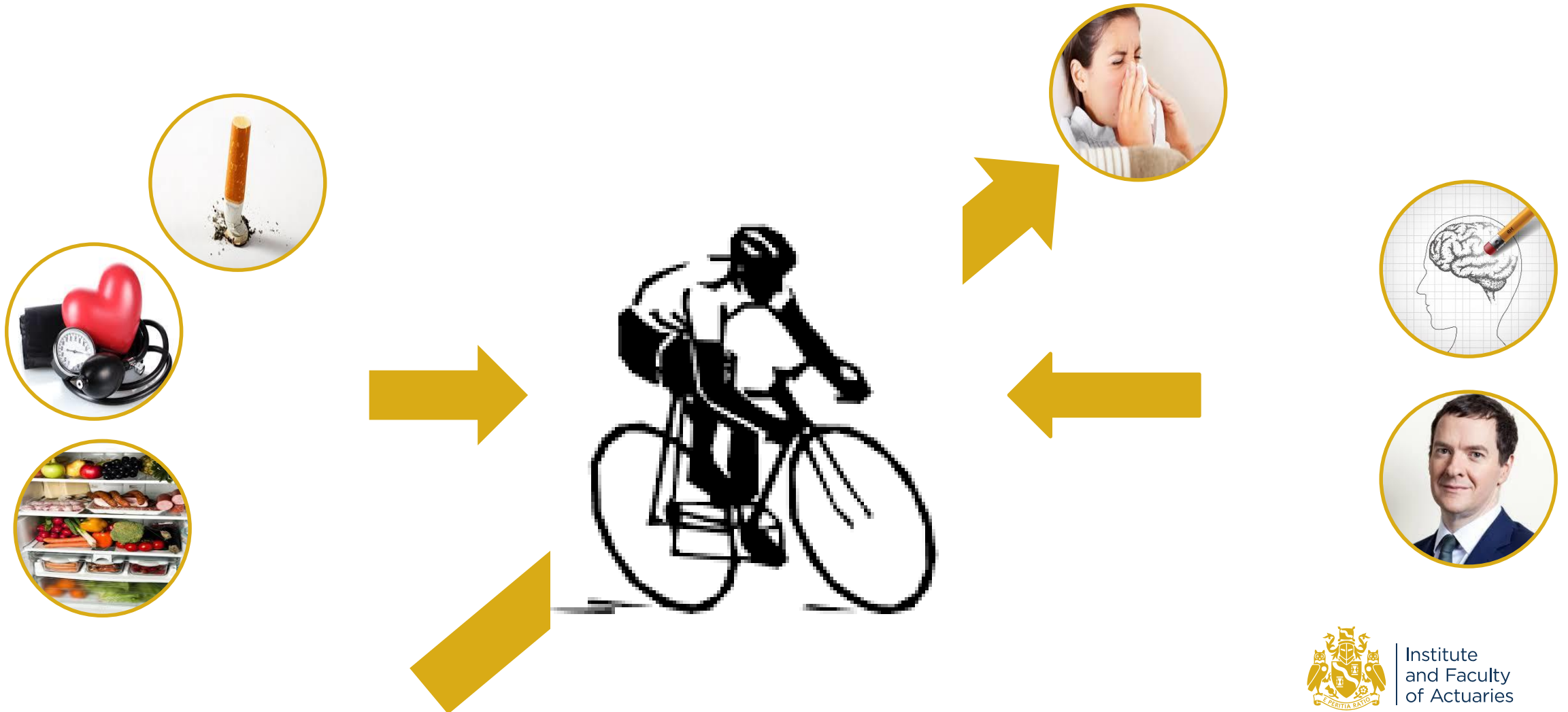
Does it make sense to segment projections by socio-economic class?

Cancer mortality varies between SECs

% gap between lowest and highest deprivation group

More deaths in more deprived →

Cancer Type	% Gap
Larynx	317%
Oropharynx	263%
Oral Cavity	221%
Lung	166%
Anus	137%
Penis	131%
Stomach	101%
Liver	94%
CUP	72%
Testis	70%
Oesophagus	59%
Hodgkin Lymphoma	47%
Bladder	41%
Bowel	28%
Kidney	27%
Pancreas	20%
Malignant Melanoma	-34%

← Fewer deaths in more deprived
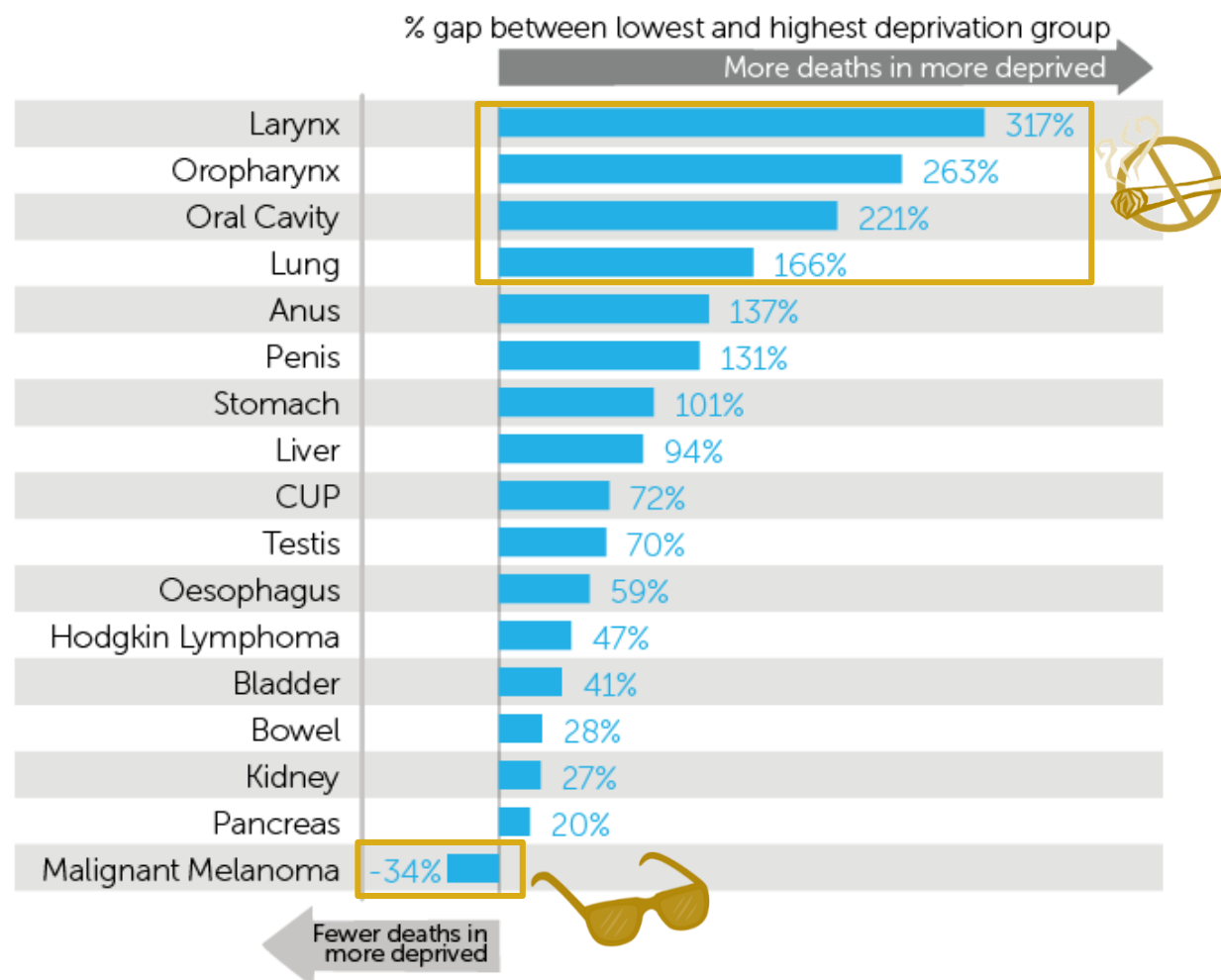
Percentage Deprivation Gap in Age-Standardised Mortality Rates

(Males, England 2007-2011)

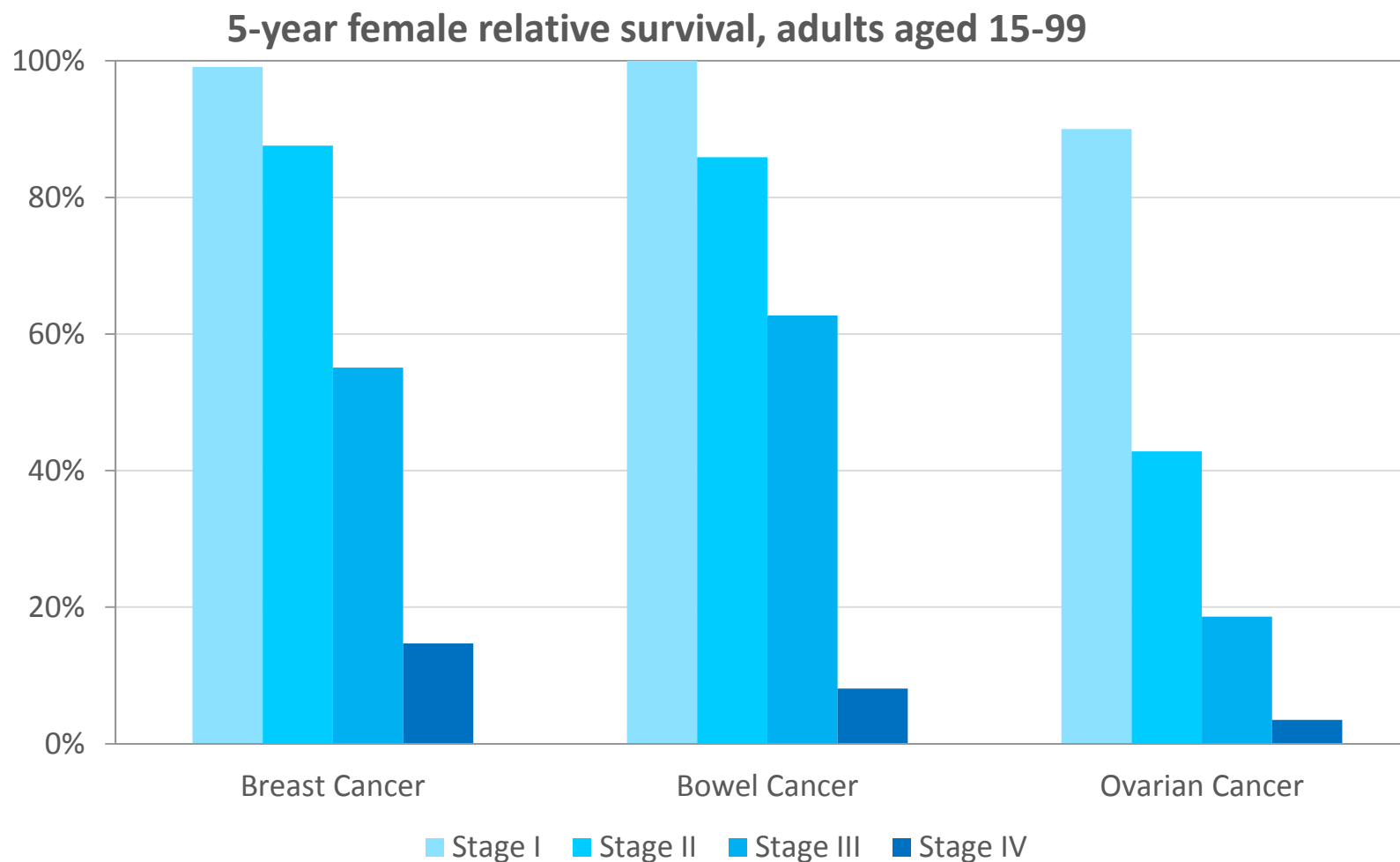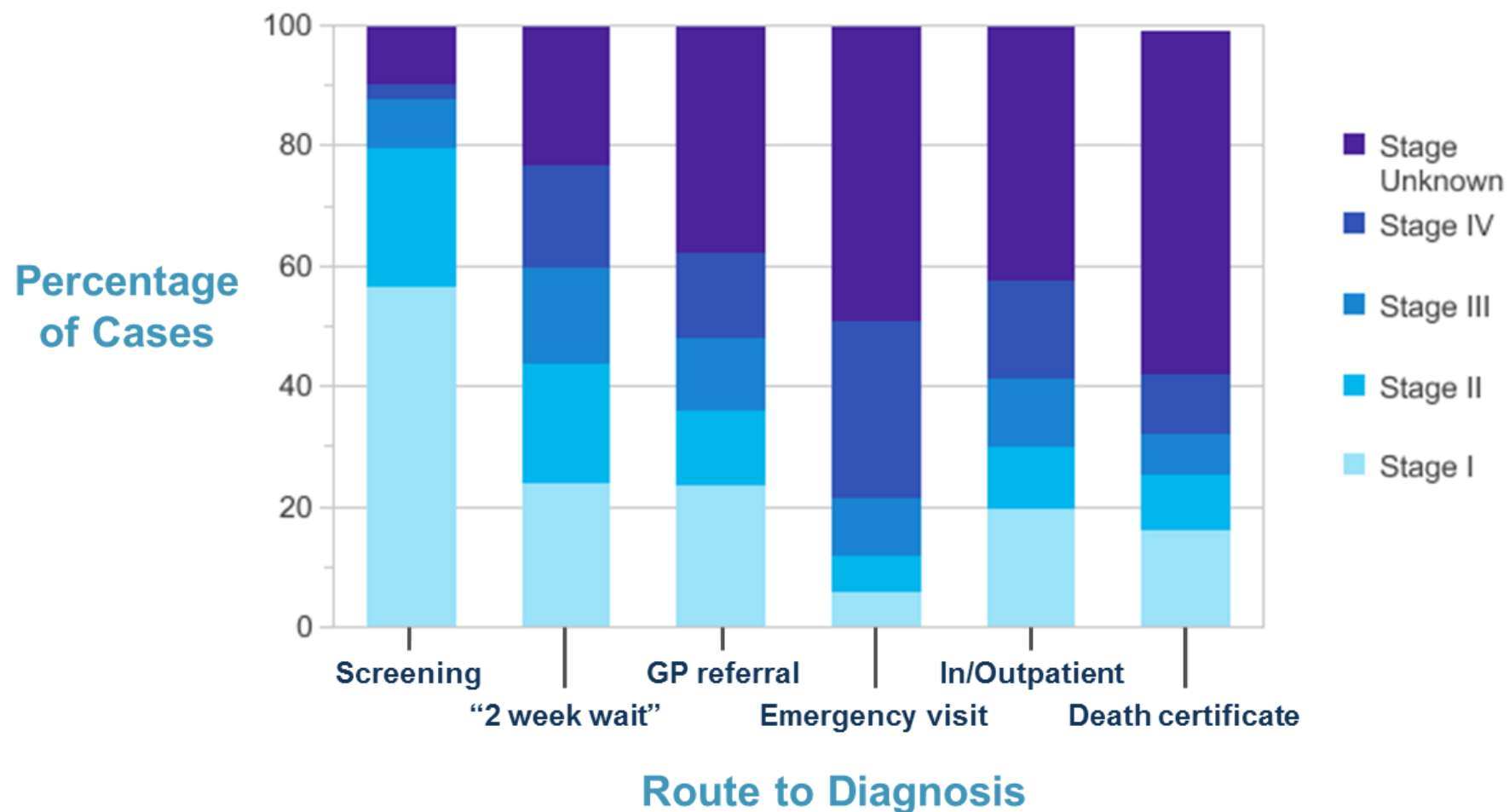# Cancer survival is strongly linked to early detection

5-year female relative survival, adults aged 15-99

Legend: Stage I, Stage II, Stage III, Stage IV (Breast Cancer, Bowel Cancer, Ovarian Cancer)

Screening is the best way to detect cancer early

Responses to screening programs vary by SEC

Bowel Cancer screening

- **2006**: screening using blood tests can reduce bowel cancer mortality by up to 25%.

  - Screening uptake showed marked differences by SEC.

- **2015**: more invasive screening test (tiny camera) can reduce bowel cancer mortality by up to 43%.

  - *"People from poorer neighborhoods were less likely to take up the offer than those in affluent areas"*

IMD quintile	Uptake of blood test screening (%)
5 (most deprived)	41.7
4	50.1
3	55.5
2	59.6
1 (least deprived)	61.4

Does one trend fit all?

Building a segmented longevity trend model

What is driving the changes in mortality rates?

Lifestyle

Health Environment

Medical Intervention

Regenerative Medicine

Anti-Aging Processes

Mortality improvement

Anti-Aging Processes

Regenerative Medicine

Medical Intervention

Lifestyle

Health Environment

Time

Example Scenario (excluding cohort)

Institute and Faculty of Actuaries
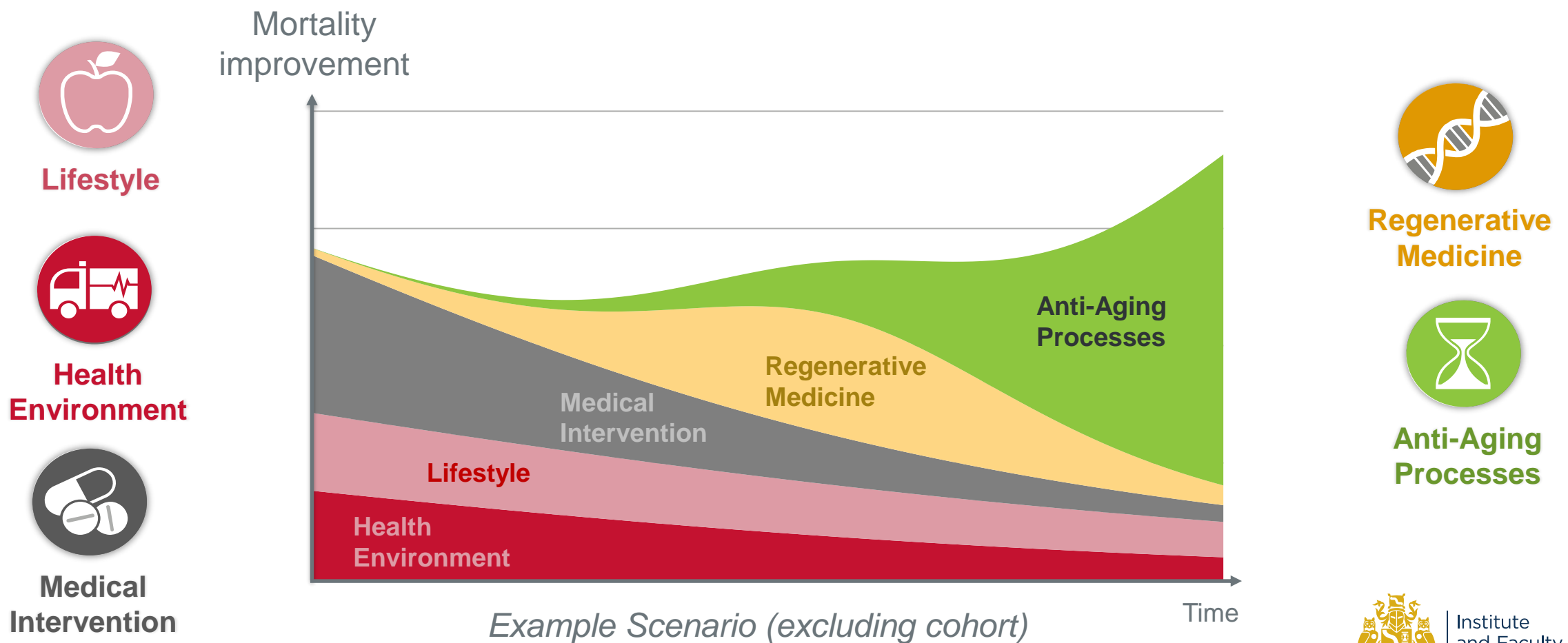
Medically informed projection constraints

How much?

How fast?
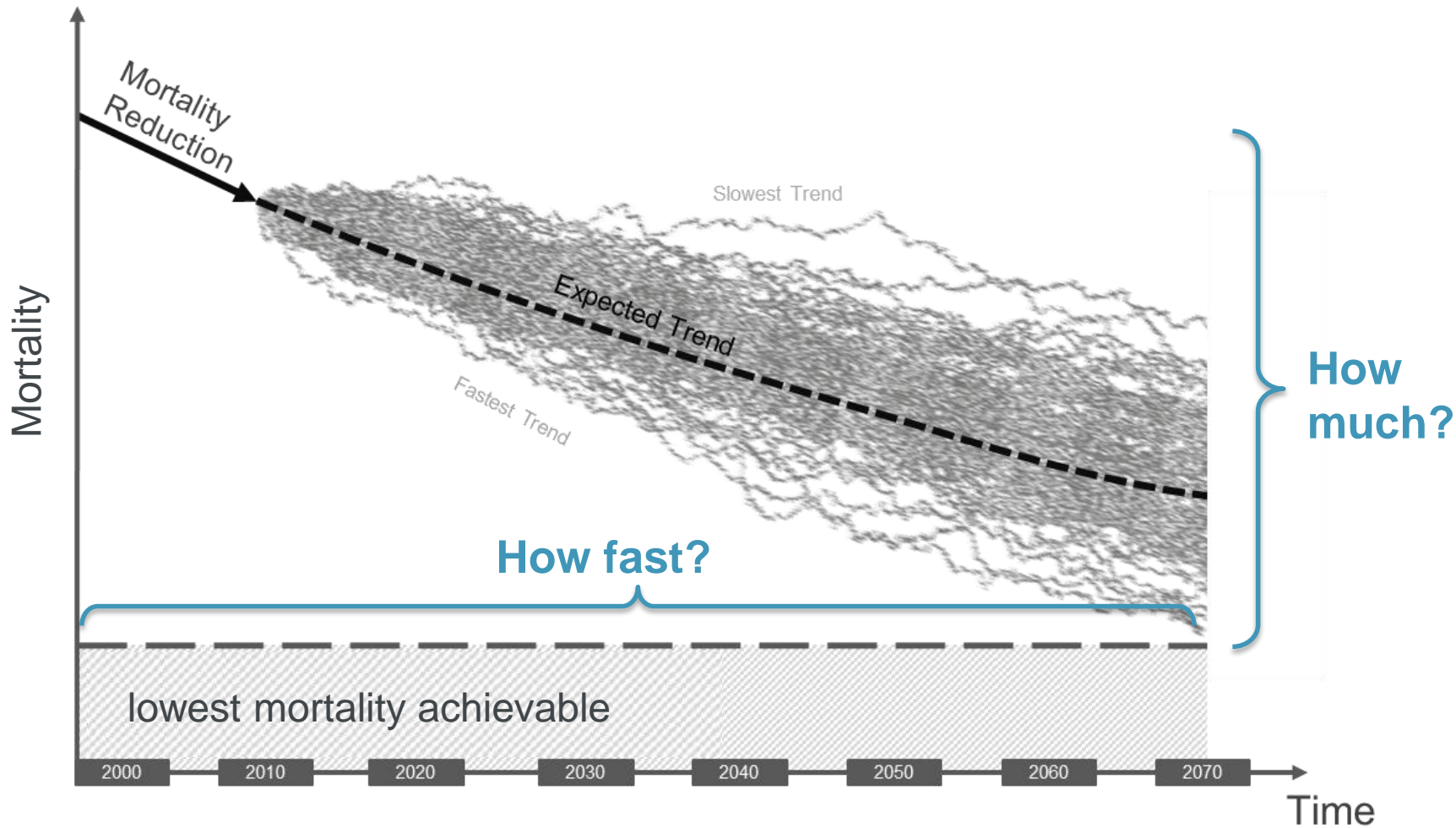
How can we adapt this framework for segmentation?

Institute
and Faculty
of Actuaries

Quantifying lowest mortality: Lifestyle

Current Mortality
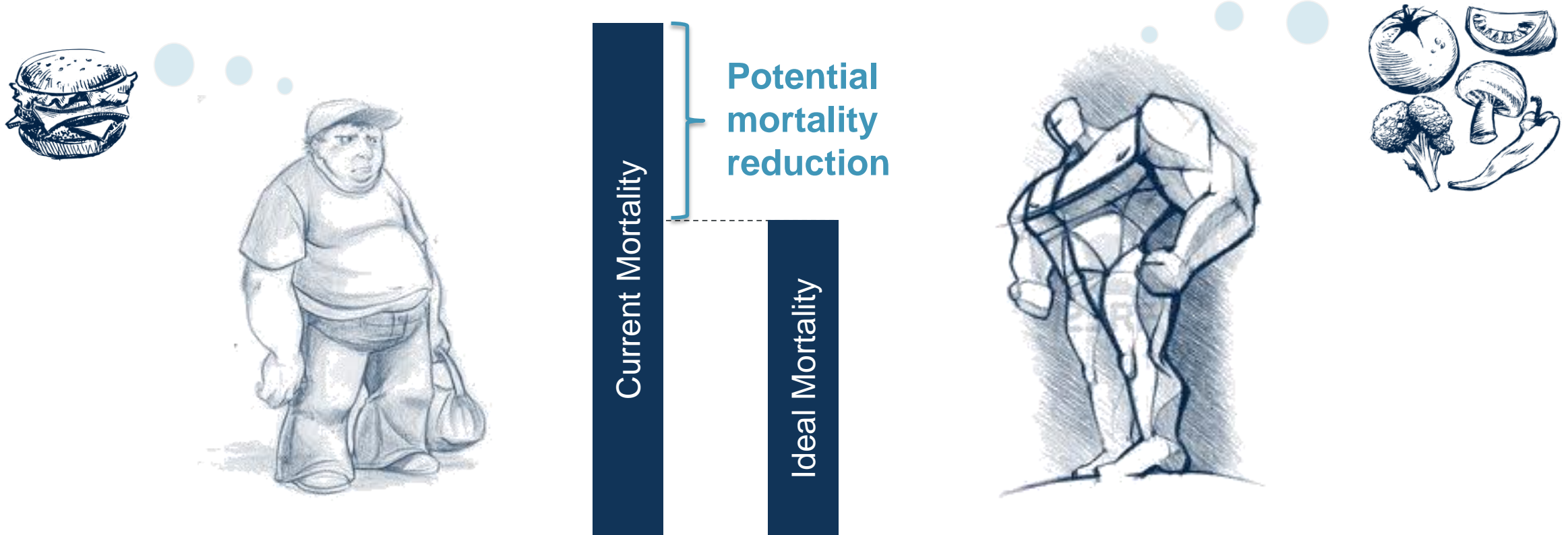
Ideal Mortality

Potential mortality reduction

Lifestyle Risk Factors

27% Reduction in Bowel Cancer Mortality

Parameterizing a segmented model

1 Where can we find a credible dataset for parameterization purposes?

2 What would be a credible SEC segmentation which, in addition, can be easily applied?

Segmented Longevity Trend Model

3 How can we derive the mortality improvements by Cause of Death for each SEC?

4 What additional insights from medical science can inform the projections by SEC?

5 How can we specify a correlation framework which reflects the relationships in SEC improvements?

Institute and Faculty of Actuaries

Parameterizing a segmented model

1 CLUB VITA

"Tracking over 1 in 7 of the UK's pensioners"

2 VITASEGMENTS

	Deprivation of the area	
	High deprivation	Low deprivation
Pension	< £5k p.a.		
	£5k - £7.5k p.a.		
	> £7.5k p.a.		

Hard-Pressed   Making-Do   Comfortable

Segmented Longevity Trend Model

3

Other CoD
COPD
Alzheimer's & Dementia
Influenza & Pneumonia
Cirrhosis
Chronic Pancreatitis
Accidents & Violence

CVD
Stroke
Heart Attack
Non-Heart Attack IHD
Atherosclerosis
Aneurysm

Cancer
Lung   Laryngeal
Bowel   Cervical
Breast   Uterine
Pancreas   Ovarian
Oropharyngeal   Prostate
Oesophageal   Kidney
Liver   Bladder

4 World Health Organization   ANNUAL REVIEWS CONNECT WITH OUR EXPERTS   PubMed.gov   CDC   THE COCHRANE LIBRARY Independent high-quality evidence for health care decision making

5

|	M C	M MD	M HP	F MDC	F HP
M C					
M MD					
M HP					
F MDC					
F HP					

Institute and Faculty of Actuaries

What could trend segmentation mean for my longevity business?

The illustrations on the following slides are based on the RMS UK Segmented Longevity Model, calibrated with Club Vita data up to end of 2014. We are currently in the process of recalibrating this for the latest data to reflect the most recent trends. The analysis shown here is there to illustrate the potential benefits of considering segmentation and broad quantum of these benefits.

Impact on Illustrative Book
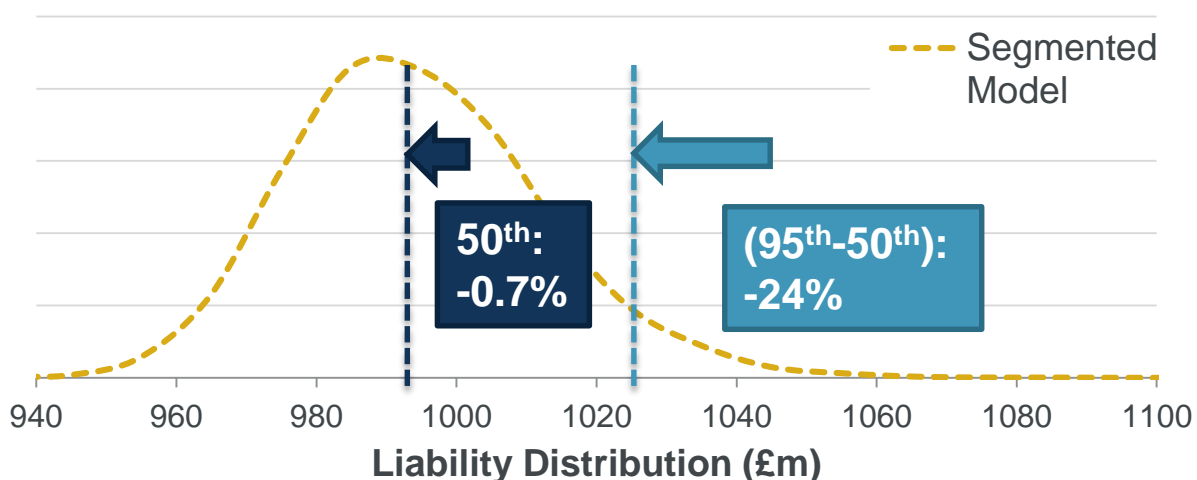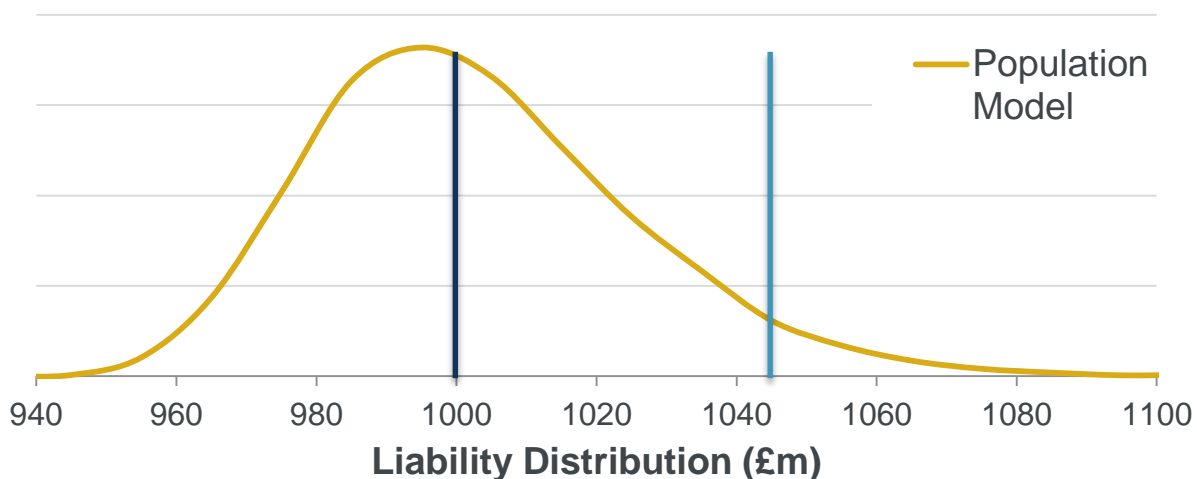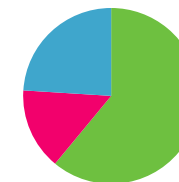
Scenario: heterogeneous pool of annuity business, size £1bn

1 Reduced best estimate:

- Better reflecting socio-economic composition of business
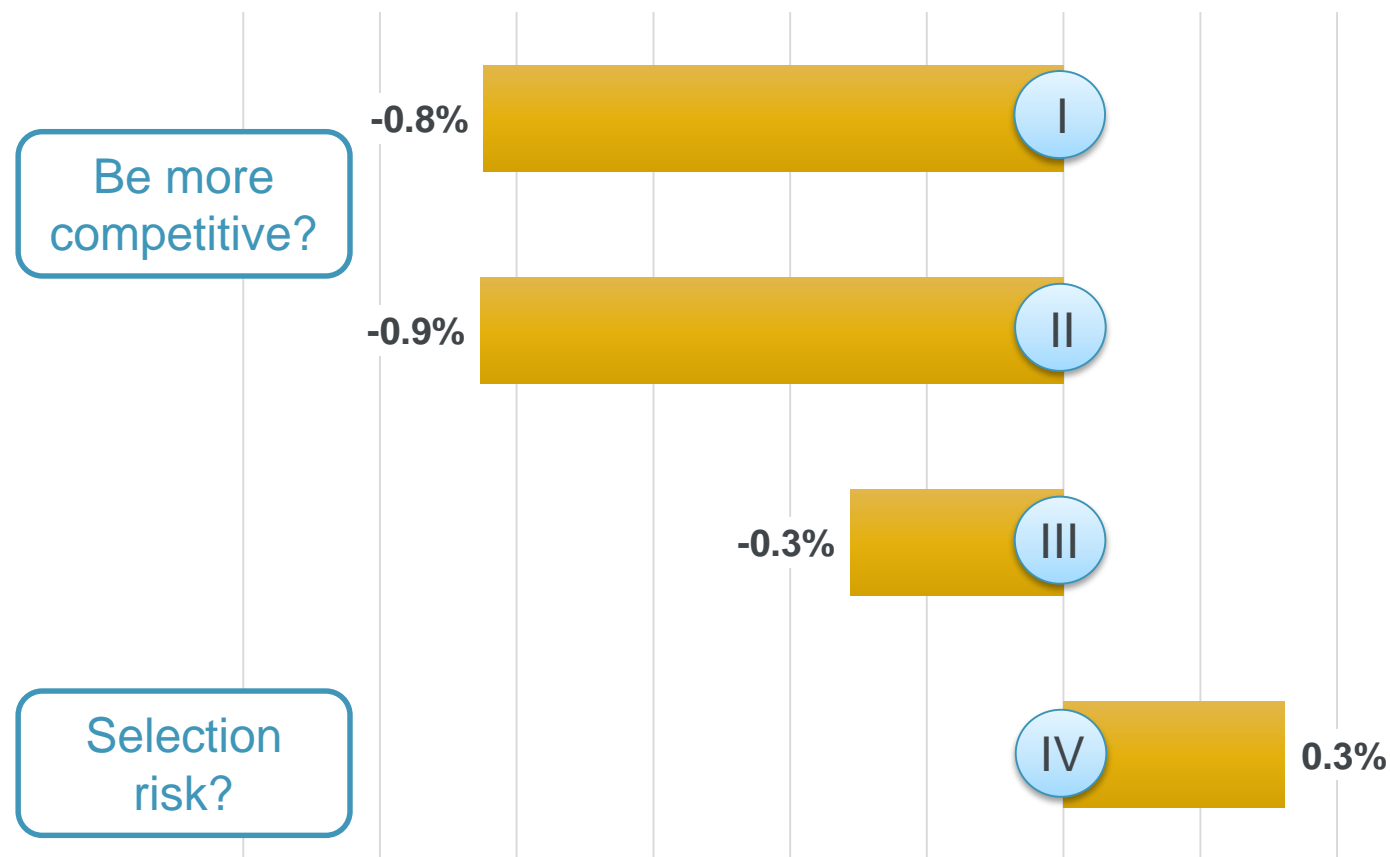
2 Reduced risk distribution:

- Greater certainty in trends for some SECs

- Diversification across SECs

- Reduced basis risk

Implications for New Business

Change in liabilities due to segmentation

Be more competitive?

Selection risk?

- I: -0.8%
- II: -0.9%
- III: -0.3%
- IV: 0.3%

Scenario: 4 pension schemes seeking BPA: identically-sized under population trend assumption..

..but with materially different SEC and age mix

Segmented approach refines liability estimates:

- Refine/challenge pricing
- Improved risk selection
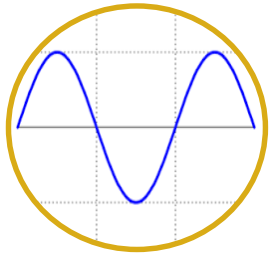- Enhanced competitiveness

What will drive the results for your book?

- **Your approach**
  - Your existing best estimate projections

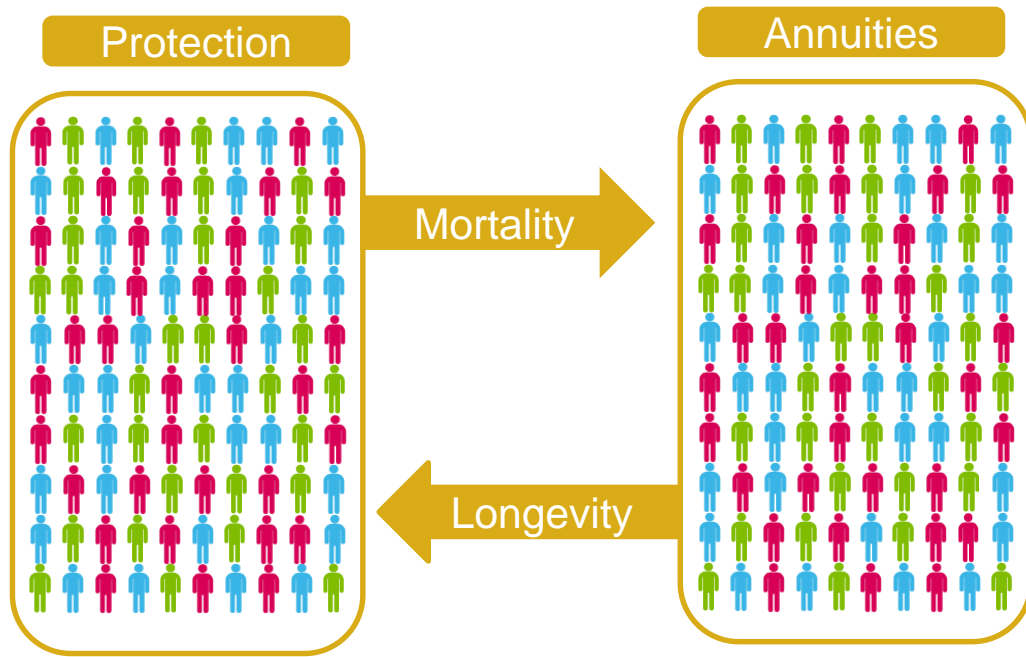- **Latest data**
  - Where in cycle of strong and weak improvements calibrate…
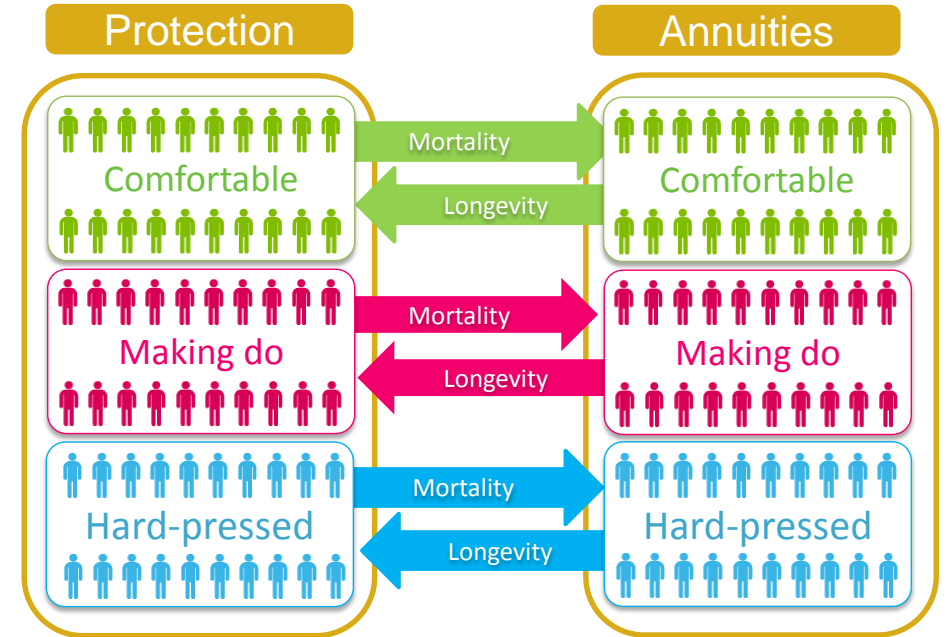 - …and which SEC currently seeing strongest improvements

- **Maximum mortality reduction**
  - Long-term outlook for each SEC

Institute
and Faculty
of Actuaries

…and more generally for your business?

Protection → Mortality → Annuities

Annuities → Longevity → Protection

Low correlation anticipated in pricing

Protection — Comfortable, Making do, Hard-pressed
Annuities — Comfortable, Making do, Hard-pressed

Mortality / Longevity

Or?

Higher correlation, better prices

Summary

One size does not fit all

Socio-economic differentiation offers commercial opportunities

Institute
and Faculty
of Actuaries

Questions   Comments

Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenters.

Institute
and Faculty
of Actuaries