LONGEVITY CATALYSTS

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CURRENT PRACTICE

- Past data

- The past is littered with "one-off" events..

- ...with limited propensity to recur

- Projection models
  - "Interim" cohort projections
  - CMI model
  - Lee Carter
  - CBD
  - P-spline

- Model Risk

PAST KEY DRIVERS IN THE UK

"UNIFORM"

- Birth of the NHS - 1948

- Vaccination programme for polio and diphtheria launched - 1958

- Introduction of breast cancer screening - 1988

SEQUENTIAL

- Evidence emerges of link between smoking and lung cancer - 1954

- Bans on smoking in enclosed places (Ireland and UK) – 2006 / 07

NATURE OF IMPROVEMENTS

PROCESS
Example
Included by actuaries in future improvement allowance?

"BIG BANG"
Smoking Ban
✘

OBSERVABLE IMPACTS ON HEALTH OUTCOMES
Lung cancer incidence in men
✘

OBSERVABLE IMPACTS ON AGGREGATE MORTALITY RATES
Overall death rates in men
✘

t = 0

t = 20?

OBSERVABLE BEHAVIOURAL CHANGES
Smoking prevalence
✘

OBSERVABLE IMPACTS ON CAUSE SPECIFIC MORTALITY RATES
Death rates in men attributable to lung cancer
✘

OBSERVABLE IMPACTS ON AGGREGATE MORTALITY RATES FOR SUSTAINED PERIOD
Overall death rates in men
✔

NATURE OF IMPROVEMENTS

- Not instantaneous, emerge gradually over time

- Lagged process

- Naturally smooth or imposing smoothness

- By definition, we currently have to wait until effects are observed in past data before we can account for them

- Assessments changed more frequently over the past 25 years than any equivalent period prior to that

The drivers of future mortality improvements will not be the same as the drivers of past mortality improvements…

ONE SIMPLE QUESTION

"What future events are we aware of today whose occurrence is likely to be coupled with a significant impact on UK longevity?"

DEFINITION

A **Future Longevity Catalyst** is defined as an event with the following properties

- An event which has not yet occurred

- Its occurrence should be unequivocal and take place at a unique point in time

- Its occurrence is widely expected to lead to a demonstrably significant and positive effect on life expectancy

A **Past Longevity Catalyst** is defined as an event with the following properties

- An event which has already occurred

- Its occurrence is expected to lead to (or has already led to) a demonstrably significant and positive effect on life expectancy

BUILDING A FRAMEWORK

Current practice

- Baseline
- Improvements derived from historic data

Proposed approach

- Baseline
- Improvements derived from historic data
- Schedule of future events or catalysts

BUILDING A FRAMEWORK

- Past Projection model
- Cause of Death
  - Lung / Colon / Prostate cancers (male)
  - Lung / Colon / Breast cancers (female)
  - Coronary Heart Disease / Stroke
  - Respiratory
  - Others
- Equivalence
- Longevity Catalysts
  - What's in your base case?
  - What's not?
- Forward looking approaches can co-exist with and /or supplement existing, traditional approaches

PHILOSOPHY

"It is clearly impossible to foresee all future catalyst events that will significantly impact human lifespan. The situation is thus imperfect. Yet this serves to illustrate the even greater imperfection of ignoring future catalyst events whose future occurrence can be foreseen with reasonable certainty."

A POTENTIAL CLASSIFICATION

- **E**nvironmental
- **M**edical
- **P**olitical
- **E**conomic
- **R**eligious
- **O**ther
- **R**egional
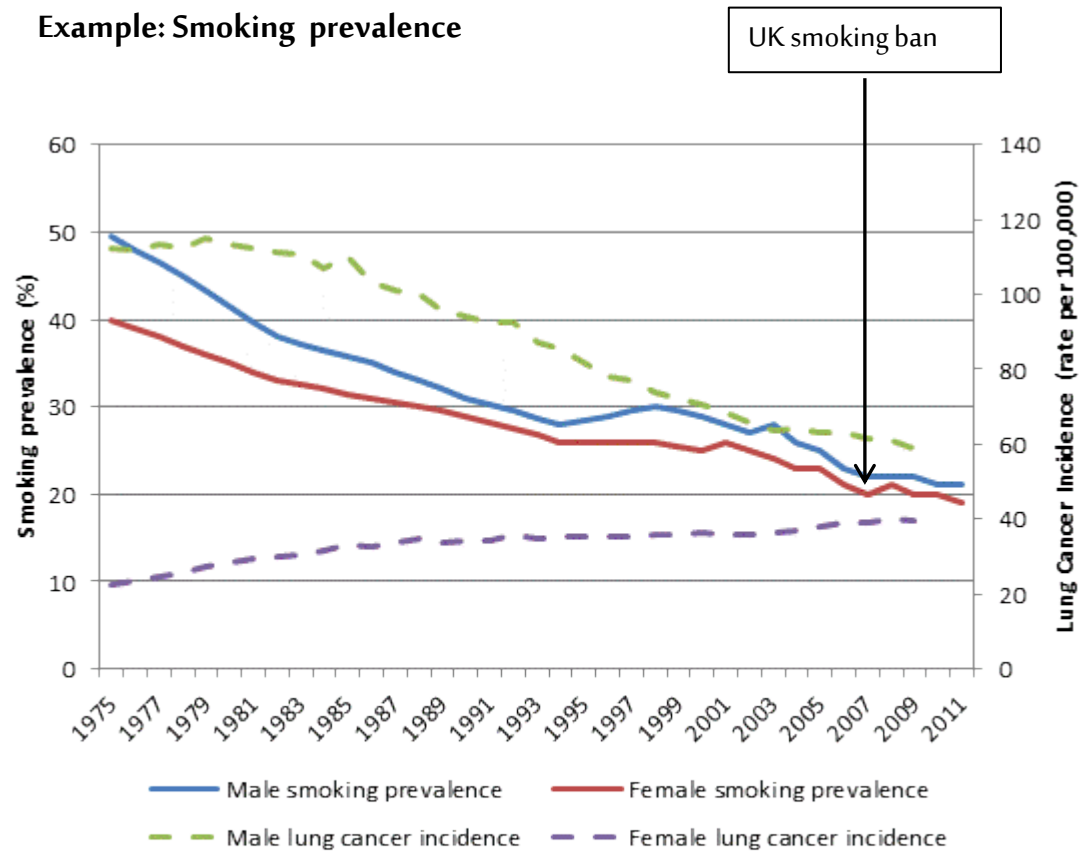- **S**ocial

- (Uniform/Sequential)

USES

- Economic Capital / Solvency II

- Risk appetite

- Best estimate approach – what future events are you already (deliberately or otherwise) allowing for?

- Hedging

- Greater appreciation of
  - dormant risks
  - existing exposure

- Other

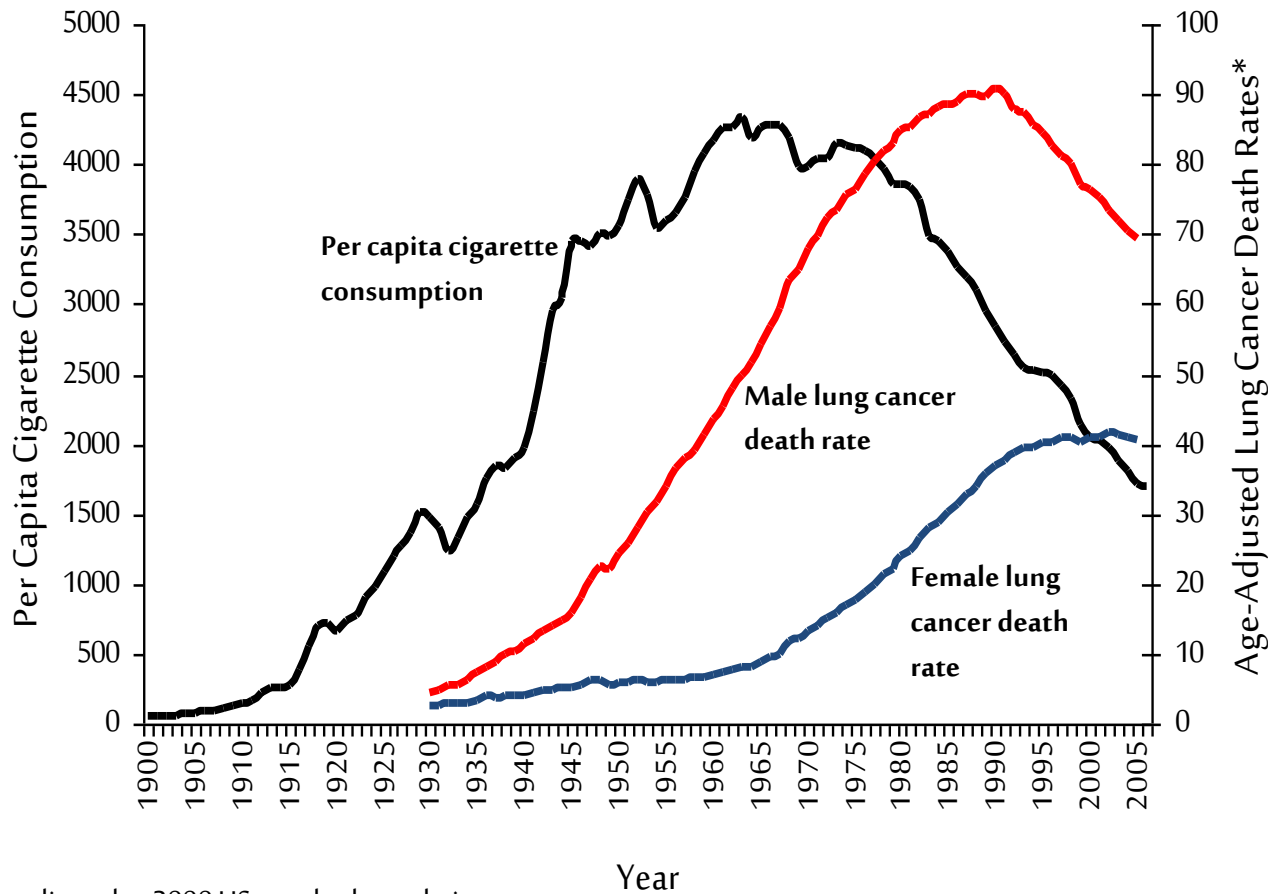# MONITORING OF KEY INDICATORS

Example: Smoking prevalence

UK smoking ban

Male smoking prevalence — Female smoking prevalence

Male lung cancer incidence — Female lung cancer incidence

Source: Office for National Statistics and Cancer Research UK

TOBACCO USE IN THE US, 1900-2005

*Age-adjusted to 2000 US standard population.

Primary source: Death rates: US Mortality Data, 1960-2005, US Mortality Volumes, 1930-1959, National Center for Health Statistics, Centers for Disease Control and Prevention, 2006. Cigarette consumption: US Department of Agriculture, 1900-2007.

Secondary source: also presented by the American Cancer Society 2009

Setting a smoking prevalence threshold

- Analyse historical volatility in smoking rates

- Look at smoking prevalence in other countries and corresponding links to lung cancer related deaths

- Examine time lag between smoking and lung cancer related deaths to gauge impact on mortality projections

- 20 years is often cited

- This still does not give the full story – ideally data trends would be split between people who smoke daily and those who are occasional smokers

Example – Stem cell treatments

Cell types	Stem cells experimental	Stem cells implantation
Skin	Yes	Yes
Cartilage	Yes	Yes
Arteries & veins	Yes	
Trachea	Yes	Yes
Eye (retinal cells)	Yes	Yes
Pancreas (insulin cells)	Yes	Yes
Brain (dopamine cells)	Yes	Yes
Red blood cells	Yes	Yes
Lung	Yes	
Heart	Yes	
Liver	Yes	
Small intestine	Yes	

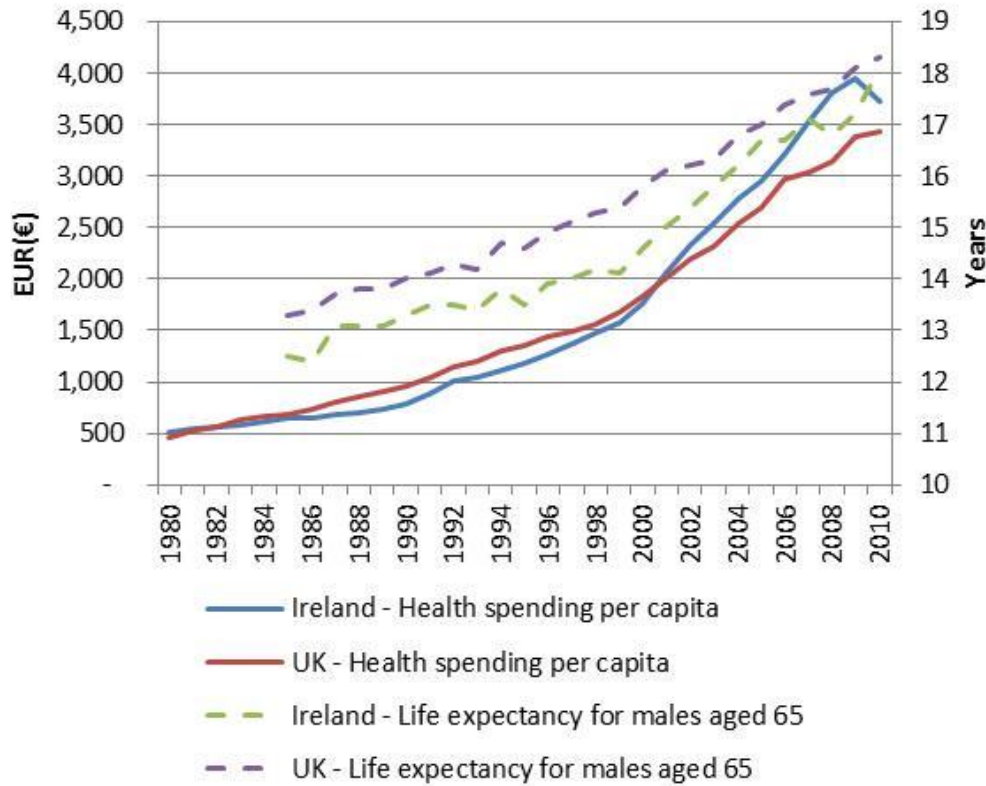# Example – Cancer mortality by diagnosis route

One-year relative survival
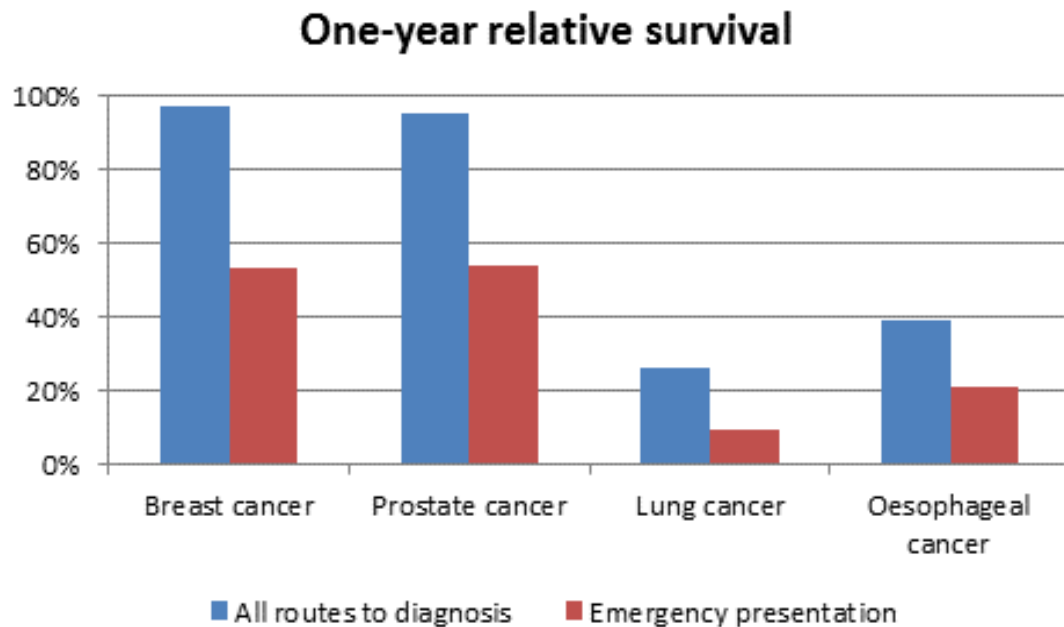
Source: Improving Outcomes, A Strategy for Cancer

- In 2007, over 50,000 cancer patients in the UK were diagnosed on emergency presentation

- Earlier detection would have a very significant impact on cancer mortality rates

Example – Government health spending per capita

EUR(€) axis: 4,500 / 4,000 / 3,500 / 3,000 / 2,500 / 2,000 / 1,500 / 1,000 / 500 / -

Years axis: 19 / 18 / 17 / 16 / 15 / 14 / 13 / 12 / 11 / 10

X-axis: 1980, 1982, 1984, 1986, 1988, 1990, 1992, 1994, 1996, 1998, 2000, 2002, 2004, 2006, 2008, 2010

——— Ireland - Health spending per capita
——— UK - Health spending per capita
– – Ireland - Life expectancy for males aged 65
– – UK - Life expectancy for males aged 65

Source: OECD

Example – Lifestyle changes

Less sedantry higher SECs

Chart — Y-axis: **Proportion taking weekly exercise (min 30 mins of moderate intensity)**, scale from 20% to 50%.
X-axis: 2005/06, 2007/08, 2008/09, 2009/10, 2010/11, 2011/12

Annotations: **13%** (2005/06), **16%** (2011/12)

Legend:
- SEC1,2 Managerial and professional
- SEC3 Intermediate
- SEC4 Small employers / own account workers
- SEC5,6,7,8 Lower supervisory/technical/ routine /semi-routine/never worked /longterm unemployed

Source: Sport England, Active People Survey

Source: OECD

IRELAND

- Existing practice
  - Can learn from UK?
  - Both in terms of analytics and window to future experience?
- Projection models
  - "Interim" cohort projections
  - CMI model
- Model Risk
- Cause of Death model usage

POTENTIAL CATALYSTS

Just a flavour....

DISCLAIMER

Views expressed are our own and do not necessarily represent the views of our employers, the Society of Actuaries in Ireland or the UK Actuarial Profession