Webinar: Health in 2040: what could an older population mean for the UK's health?

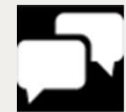This webinar will begin shortly

12 September 2023

This is a Zoom webinar so you will be automatically muted throughout.

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REAL Centre

in partnership with the University of Liverpool

Health in 2040:

Projected patterns of illness in England

September 2023

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New approach to projections – with U. Liverpool

- **Health in 2040:** First report from a long term programme of research 4 years in development with academic partners

- **Better data:** Linked primary care, secondary care and mortality records with complete patient diagnostic history

- **Dynamic methods:** A dynamic model that gives us a better understanding of long term illness, ageing and multimorbidity.

- The model includes **trends in some key risk factors** such as smoking and obesity, relying on published epidemiological evidence.

- We model illness with 20 highly prevalent and/or high cost conditions – summarised by the Cambridge Multimorbidity Score (CMS). "Major illness" is a score above a certain threshold (1.5).

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Key messages

- **2.5 million more people living with major illness by 2040**, an increase of 37%. From 1in 6 people in England in 2019 to nearly 1 in 5.

- We project an **increase in the prevalence of 19 of the 20 illnesses we looked at**, including increases of more than 30% in the number of people living with conditions such as cancer, diabetes and kidney disease.

- 80% of the increase in average illness is projected to be **driven by demographic changes**.

- **Greater complexity of illness**: high numbers of people are projected to be living with multiple long term conditions that are predominantly managed in primary care.

- Several risk factors are moving in the right direction (e.g. smoking and cholesterol). But the **benefits are mitigated by growing obesity** in adults and increase lifetime risk.

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Projections for multimorbidity

We project that the population in England will spend more time with major illness in 2040 compared to 2019

Average life expectancy at birth and years of life people can expect to spend in different states of ill health, England, 2010, 2019 and projected for 2040:
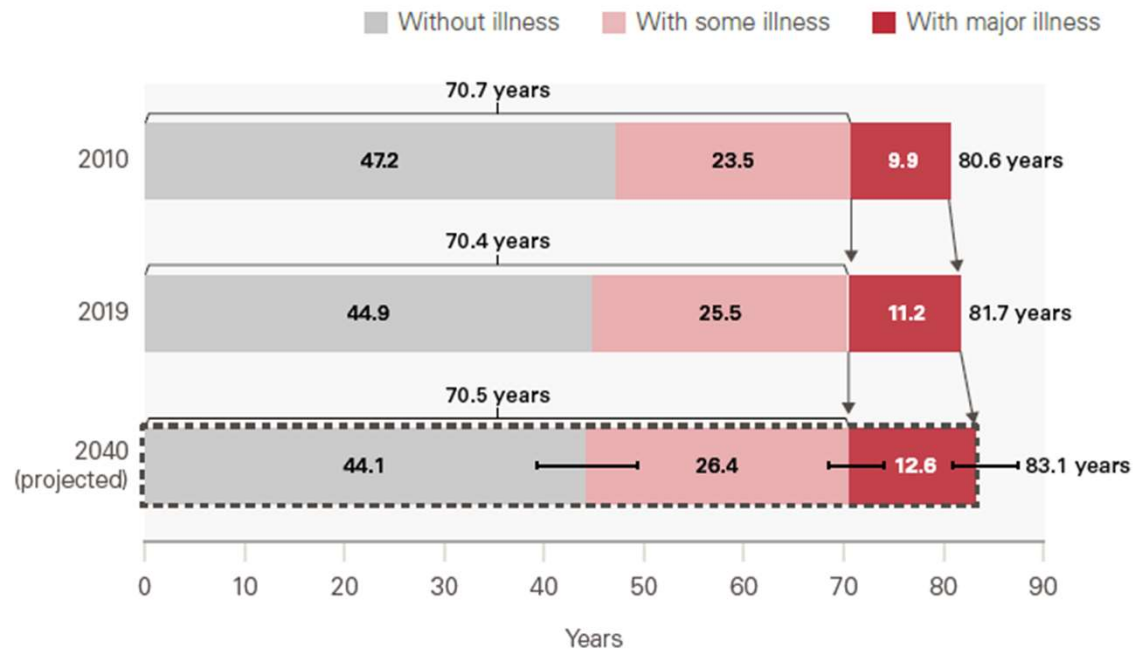
Notes: The black capped bars represent uncertainty intervals. The chart shows expectancy, which is a summary measure. In reality illness and death are distributed across all ages.
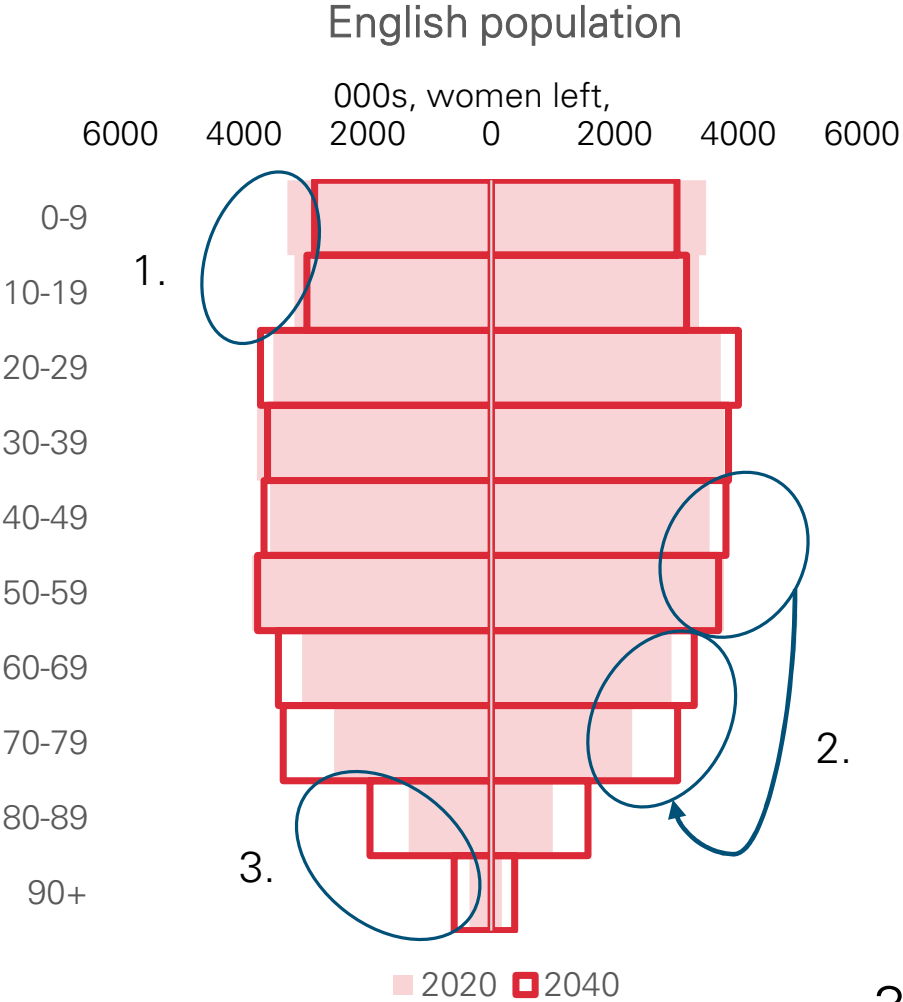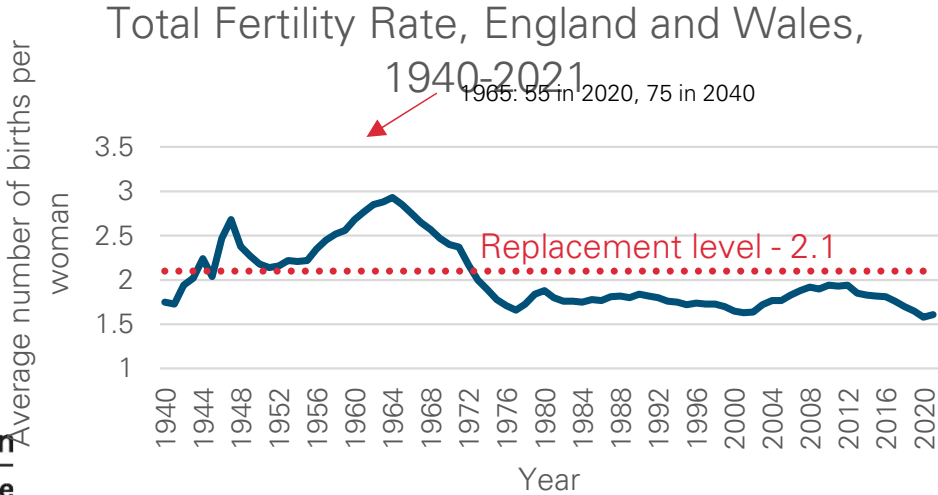
- We project life expectancy to increase by 1.4 years, on average, between 2019 and 2040.

- At the same time, the age at which individuals reach a level of major illness will remain unchanged at around 70 years.

- As a result, time spent with major illness is projected to increase from 11.2 to 12.6 years.

Projected demographic changes

There are three key features of demography in England, now and in the future.

1. Low fertility from 1980 (below replacement)
2. The baby boomers + (high fertility from 1950 to 1975)
3. Lower mortality rates, especially in older ages

There are projected to be 3.5 million more people by 2040, almost all of whom will be over 70.

English population

000s, women left,

| 6000 | 4000 | 2000 | 0 | 2000 | 4000 | 6000 |

0-9
10-19
20-29
30-39
40-49
50-59
60-69
70-79
80-89
90+

1.
2.
3.

1965: 55 in 2020, 75 in 2040

■ 2020 ▢ 2040

Total Fertility Rate, England and Wales, 1940-2021

Average number of births per woman

3.5
3
2.5
2
1.5
1

Replacement level - 2.1

1940 1944 1948 1952 1956 1960 1964 1968 1972 1976 1980 1984 1988 1992 1996 2000 2004 2008 2012 2016 2020

Year

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As a result, we project that there will be 2.5 million more people with major illness by 2040

The estimated number of people living with major illness in England, past and projected
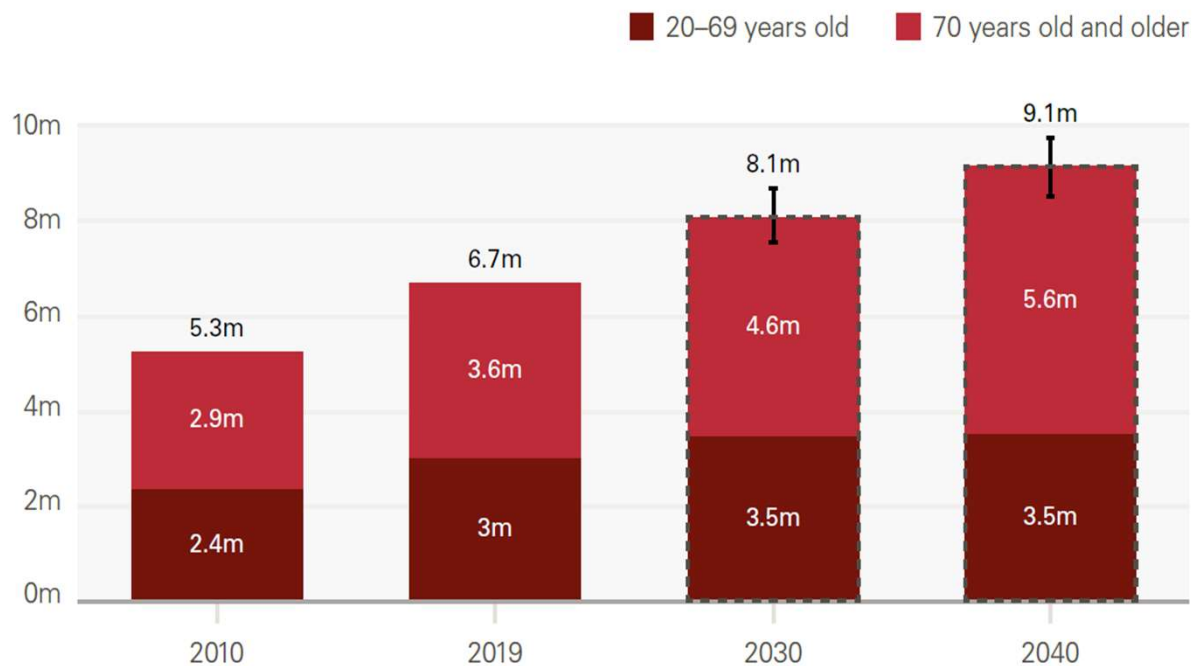
- We project 8.1 million people aged 30 and older to be living with major illness by the end of this decade and 9.1 million people to be living with major illness by 2040.

- 3.5 million of the 9.1 million with major illness (38%) in 2040 will be people of working ages.

- Notice that the increase in demand was high (1.4 million) from 2010 – 2019. During a period where investment growth was slower and the number of GPs didn't increase.

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Individual conditions

Millions of additional disease cases – with particular pressure for primary care

Projected total number of diagnosed cases for the ten conditions contributing the most to the Cambridge Multimorbidity Score among those aged 30 years and older, including demographic changes, England, 2019 and projected for 2040

● 2019   ● 2040

Dementia +45%
Constipation +45%
Heart failure +92%
COPD +37%
Atrial fibrillation +51%
Chronic kidney disease +34%
Cancer +31%
Anxiety or depression +16%
Diabetes +49%
Chronic pain +32%

1m 2m 3m 4m 5m 6m 7m 8m

Source: Analysis of linked health care records and mortality data conducted by the REAL Centre and the University of Liverpool.

Note: Red shaded bars represent uncertainty intervals. COPD is chronic obstructive pulmonary disease.

The biggest rates of increase are for chronic pain and diabetes, both over 1.5 million.

We also project over a 30% increase in the number of people living with cancer, COPD and chronic kidney disease.

In most cases, these increases are driven by population ageing rather than a rise in age-specific rates or earlier onset: rates of illness rise with age – for example 1 in 5 people aged 80–84 has type 2 diabetes, more than double the rate of those aged 55–59.

Our projected increase in prevalence is not the result of large increases in age-specific rates of incidence, of the 20 conditions only asthma is projected to increase in incidence.
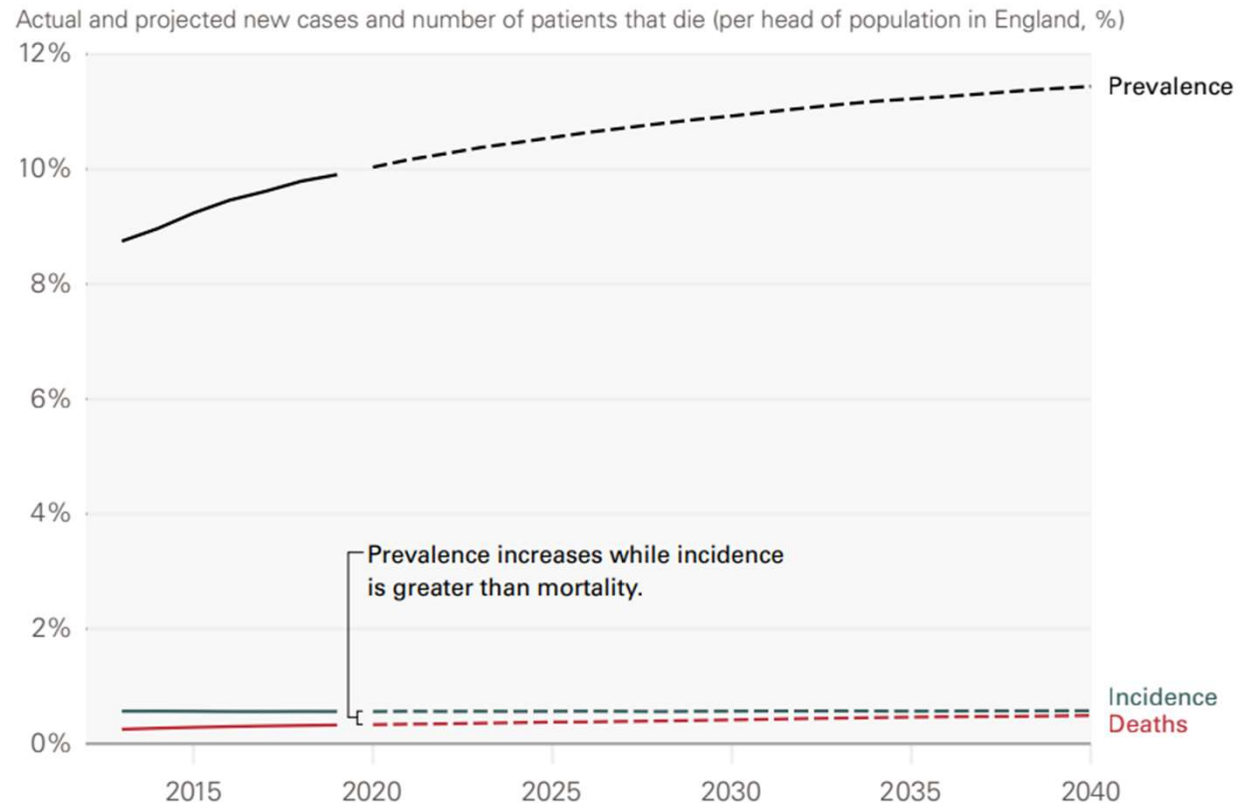
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The relationship between incidence, prevalence and mortality

- Prevalence of long term illness in the population is determined by a combination of accumulated incidence and survival rates (and remission in some cases).

- Compared to the size of the prevalence, the "levers" of prevalence are small. Prevention, where effective, takes time to have impact.

- In the case of type II diabetes, for which prevalence has been growing, incidence rates (by age) have been and are projected to be fairly constant.

- This issue is that deaths for people with T2 diabetes are **lower** than incidence, not that incidence is increasing.

Incidence, prevalence and deaths with type II diabetes, 2013 – 2040 (projected) in England

Actual and projected new cases and number of patients that die (per head of population in England, %)

Prevalence

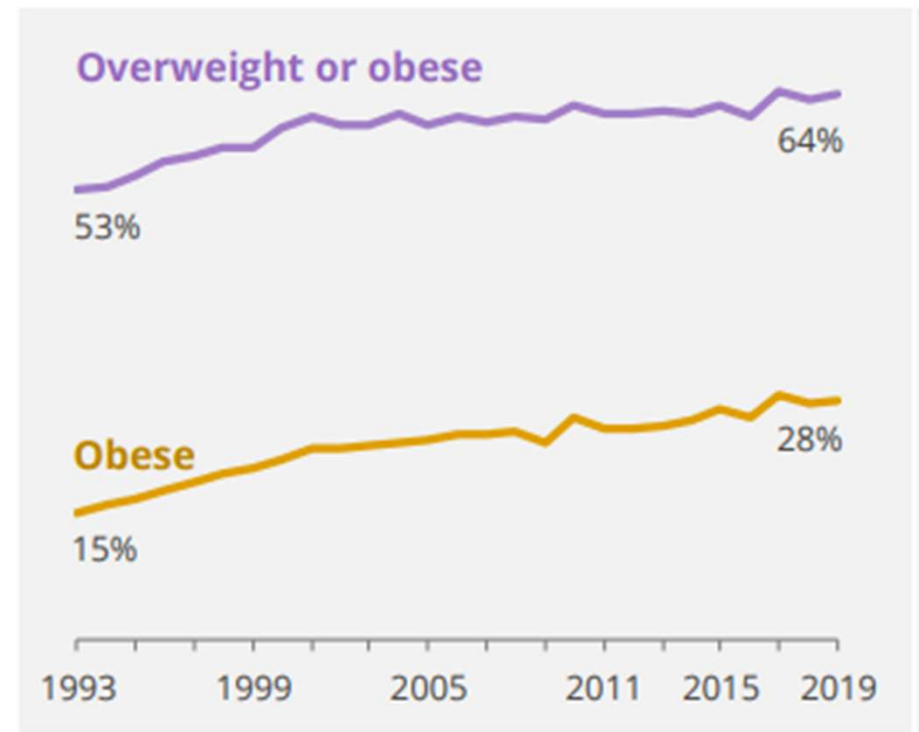Prevalence increases while incidence is greater than mortality.

Incidence
Deaths

Source: Analysis of linked health care records and mortality data conducted by the REAL Centre and the University of Liverpool.

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Lifetime risk: obesity

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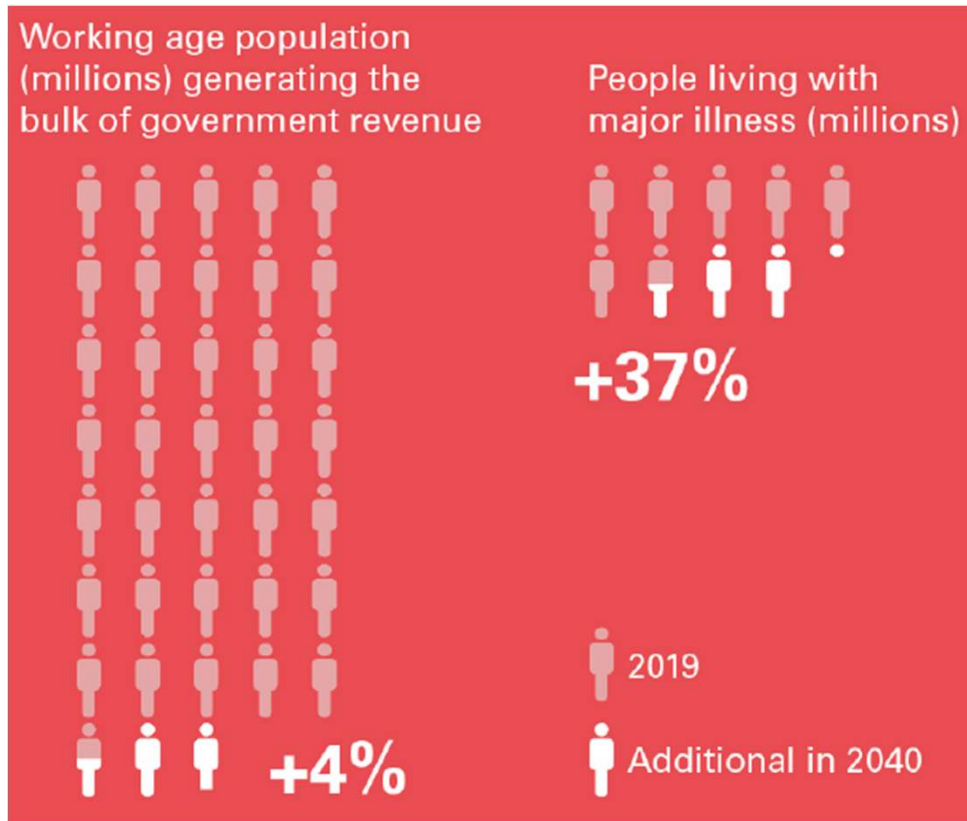REAL Centre

Long(er) run obesity trends

- Since (at least) the early 90s there has been a step change in food environments in the UK.

- The current, obesogenic environment has shifted as high calorie dense food is more readily available and more affordable and other lifestyle factors have changed.

- The recent slow down doesn't mean that he growth in <u>risk</u> is over.

- The increased risk of developing diabetes **in a single year** is not that big. The danger is the accumulated lifetime risk.

- 60 year olds today were 30 in 1993. Therefore 60 year olds in 2040 will have increase lifetime risk.

Obesity levels increased from 15% in 1993 to 28% in 2019.

Overweight or obese — 53% ... 64%

Obese — 15% ... 28%

1993   1999   2005   2011   2015   2019

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Implications

The number of people with major illness is growing faster than the working age population

Working age population (millions) generating the bulk of government revenue

People living with major illness (millions)

+37%

+4%

2019

Additional in 2040

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- The number of people living with major illness is projected to increase by 37% by 2040 (from 6.7m to 9.1m).

- This is nine times the rate of increase in the working age population (20–69-year-olds), which is projected to grow by 4% (from 35.5m to 37.9m).

- This creates additional pressures on working age people to care for and fund a growing population with high health and care needs.

- 2.5m (37%) is a large increase, but over the course of two decades this is manageable (1-2% per year).

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We need to clearly understand the imminent future of illness in England to better prepare the health and care system

- Longer life is an immediate consequence of better health technology and delivery. However, on average the increased life expectancy has happened "after illness", predominantly driven not by better health but better management of conditions through health care.

- It's worth highlighting that while our research shows people living longer with major illness (CMS 1.5), it's not always in debilitating ill health (e.g. diabetes and atrial fibrillation).

- Given more people are projected to be living with major illness and multiple conditions, helping people to live well with illness will be a key challenge for the health service.

- Focusing on prevention and innovation is vital for reducing the impact of illness on the quality of people's lives. Still, it will not necessarily reduce demand for health care, as this also typically increases life expectancy.

- Our findings underline the need for a long-term plan to modernise and invest in the NHS.

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Extra slides

We project the average level of illness in England to increase over the next two decades, largely driven by demographic changes

Projected changes in the average Cambridge Multimorbidity Score relative to 2019, including and excluding population changes, England, 2019–2040
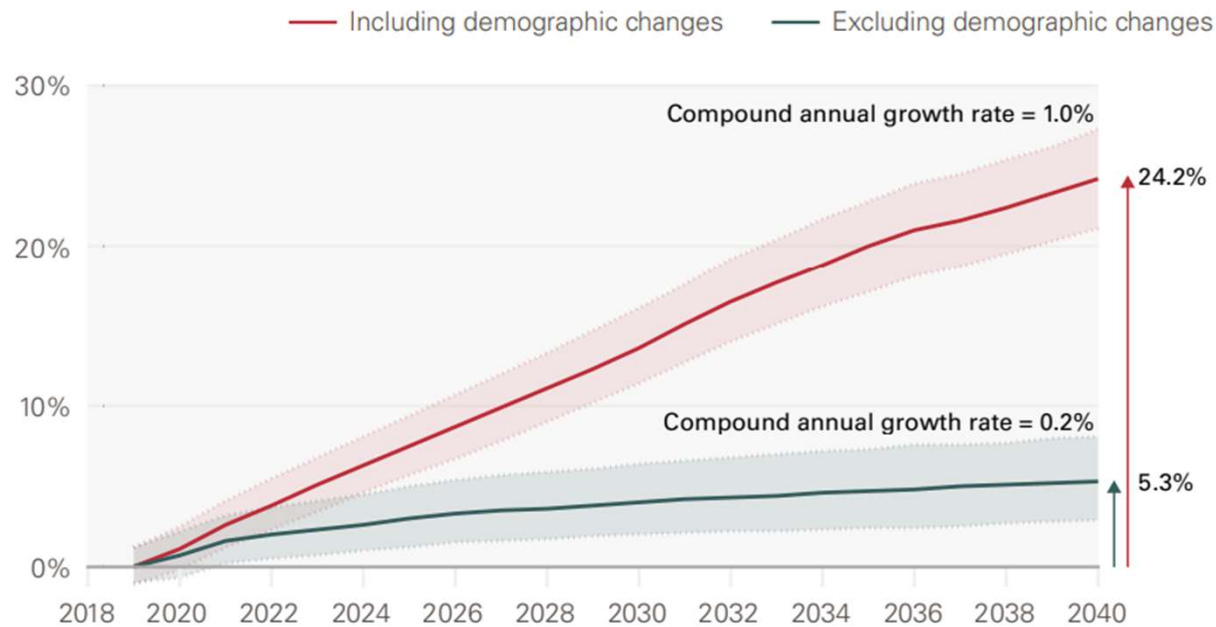
Source: Analysis of linked health care records and mortality data conducted by the REAL Centre and the University of Liverpool.

Note: The shaded areas represent uncertainty intervals.

- The average amount of illness in the population is projected to increase slightly by 5.3% between 2019 and 2040 as a result of longer life expectancies and people spending more time with illness.

- But this is excluding the projected ageing of the population in England.

- When we include demographic changes, the average level of illness is projected to increase by 24.2%.

Model structure

- The IMPACT$_{NCD}$ model that is used in this analysis combines individual-level data on demographics and major risk factors and uses estimates from literature on the causal associations between risk factors and the onset of illness and mortality.

- In microsimulation modelling, people "mathematically" live out their lives. Each year they develop conditions (go into remission) with some probability based on their characteristics, and die with some probability based on their characteristics and conditions.
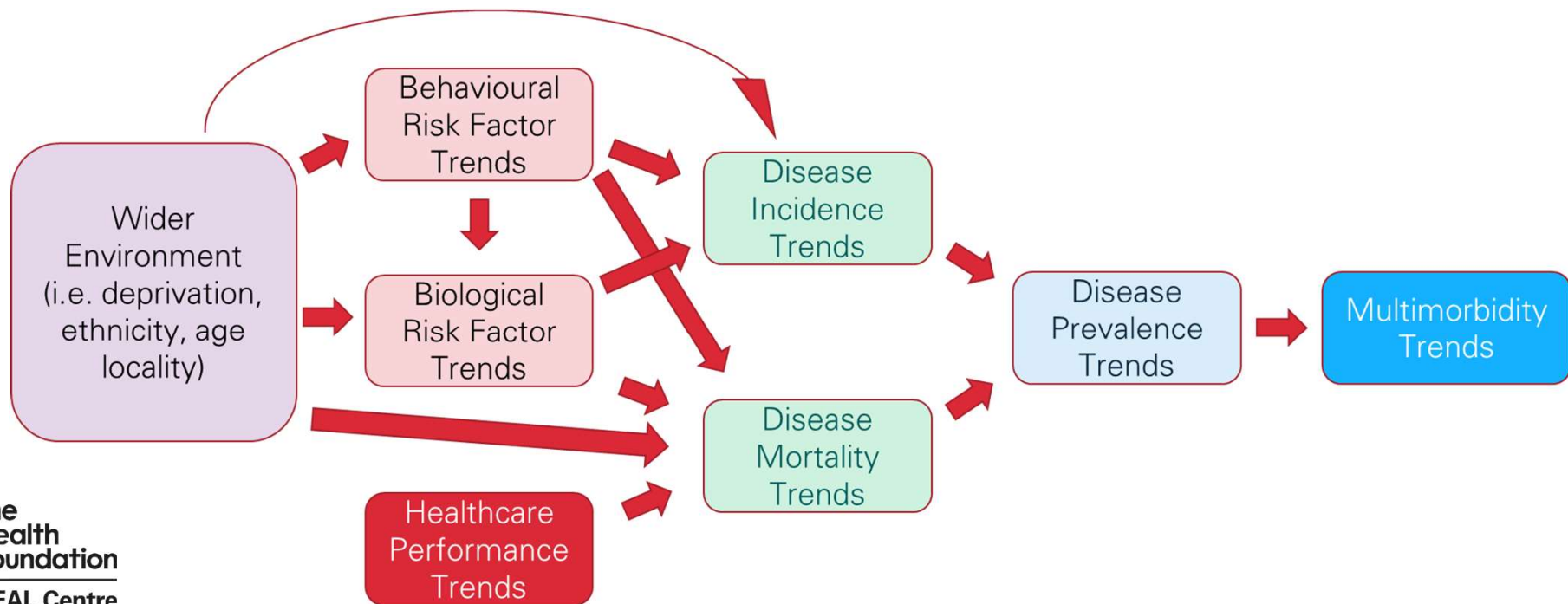
We use the Cambridge Multimorbidity Score (CMS) to measure illness

The Cambridge Multimorbidity Score (CMS) assigns a "score" to 20 of the most common illnesses based on how the illness affects individuals' use of primary care, emergency care or their likelihood of death.

This also helps us compare trends in illness over time and by population subgroups, independently of the specific combination of illnesses.

A patient's multimorbidity score is the sum of the weights of each condition they have. Weights do not vary over time.

For presentation purposes we look at patients with any illness and those with "major illness". A cut off of 1.5 (equivalent to the care and mortality risk associated with a cancer diagnosis).

Condition	Weight
Dementia	2.50
Cancer	1.53
COPD	1.46
Atrial fibrillation	1.34
Heart failure	1.18
Constipation	1.12
Epilepsy	0.92
Chronic pain	0.92
Stroke / transient ischaemic attack (TIA)	0.80
Diabetes (type I or II)	0.75
Alcohol problems	0.65
Psychosis/bipolar disorder	0.64
Chronic kidney disease	0.53
Anxiety/depression	0.50
Coronary heart disease	0.49
Connective tissue disorders	0.43
Irritable bowel syndrome	0.21
Asthma	0.19
Hearing loss	0.09
Hypertension	0.08

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| 0 | 0 - 1.5 | > 1.5 |

•Note: COPD = chronic obstructive pulmonary disease

Individual conditions: % prevalence change

- Demographic changes play different roles in different conditions.

- Without demographic changes, hypertension for example is not projected to fall , or at least not increase in prevalence. But hypertension has one of the larges percentage point increases in prevalence. This is purely a result of demographic changes.

- Other conditions such as cancer, dementia and COPD, similarly have little change projected within age groups, but project increases with the ageing population.

- For diabetes there is a projected 2% increase in prevalence without demographic changes, just under doubling once we include demographic changes.

- CHD is the only one of these conditions that exhibits a reduction in prevalence in both cases. This is likely due to the strong relationship between CHD and smoking, as well as increased effective use of pharmaceuticals.

Projected percentage point changes in prevalence rates by condition, England, 2019 and projected for 2040
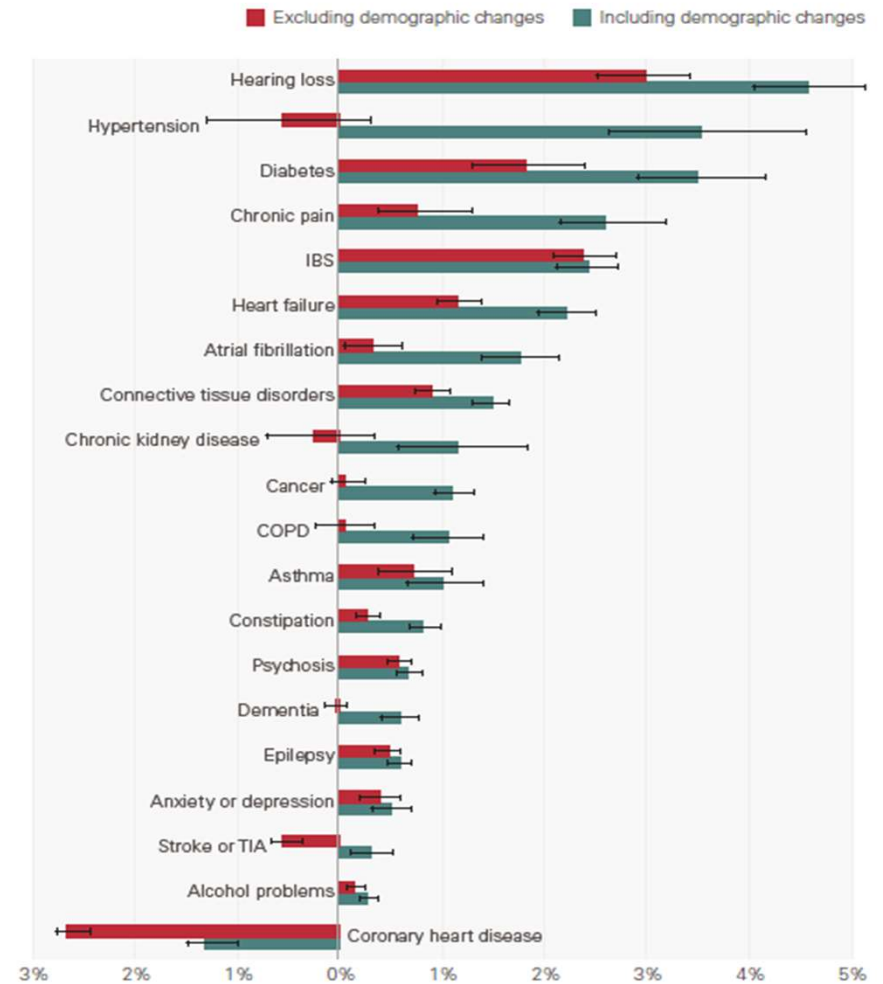
Note: The black capped bars represent uncertainty intervals. IBS is irritable bowel syndrome, COPD is chronic obstructive pulmonary disease, TIA is transient ischaemic attack. Cambridge's definition of 'alcohol problems' incorporates both mental and physical conditions associated with alcohol addiction.

Risk factors are generally projected to move in the right direction over the next two decades

When we adjust for age, major risk factors have been remaining largely constant or improving since 2013 and this is projected to continue to 2040.

For instance, between 2020 and 2040, the share of people who have quit smoking is projected to increase by 40% and number of active days in the population is projected to rise by more than 20%.

Cholesterol, blood pressure and alcohol consumption are projected to fall.

Trends in **helpful** risk factors, 2013-2040

Trends in **harmful** risk factors, 2013-2040
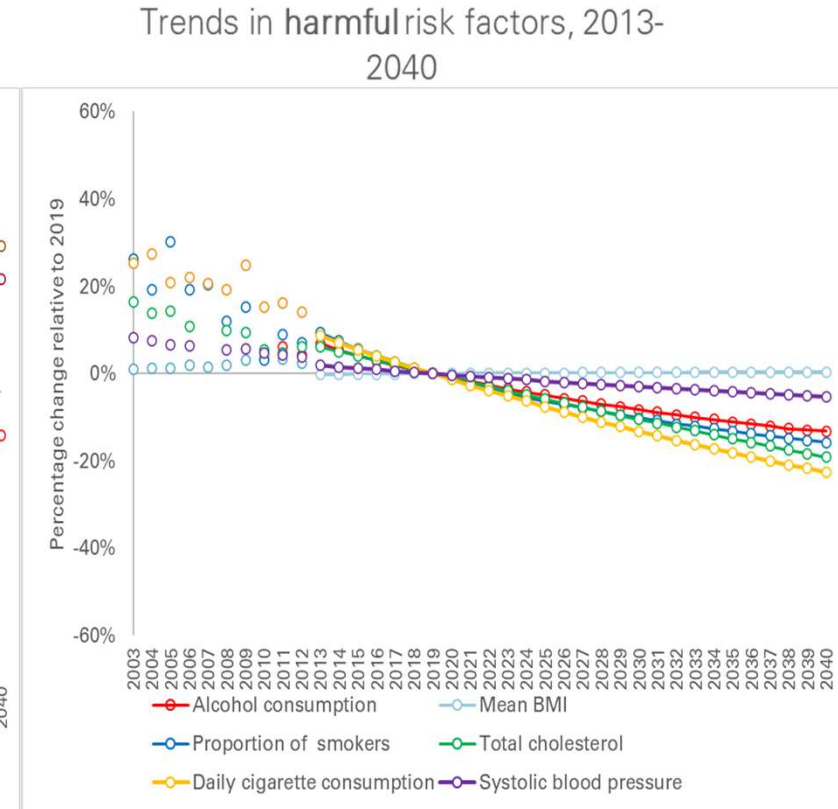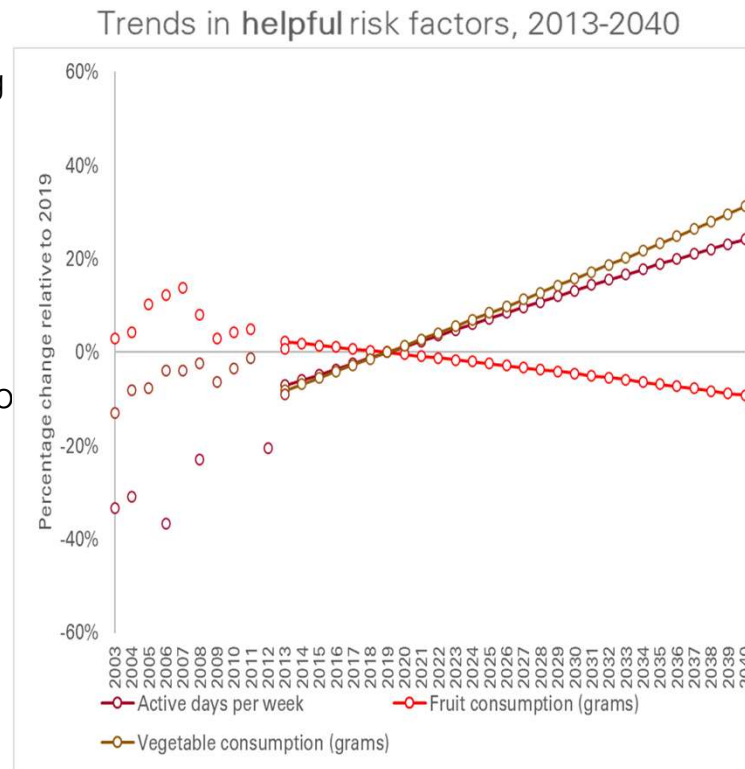
Modelling reported individual level risk factors
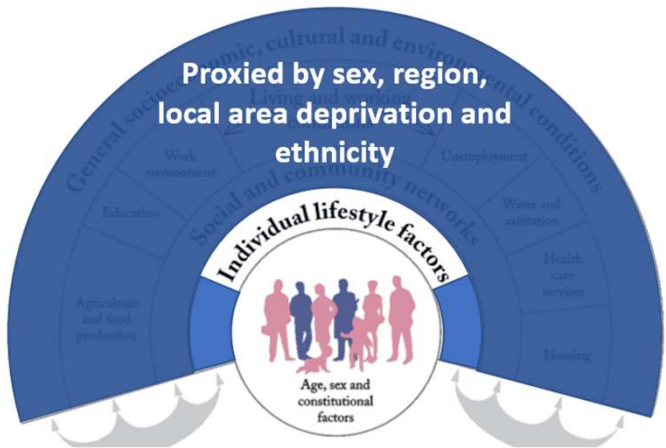
New cases (incidence) attributed to each modelled risk factor (%)
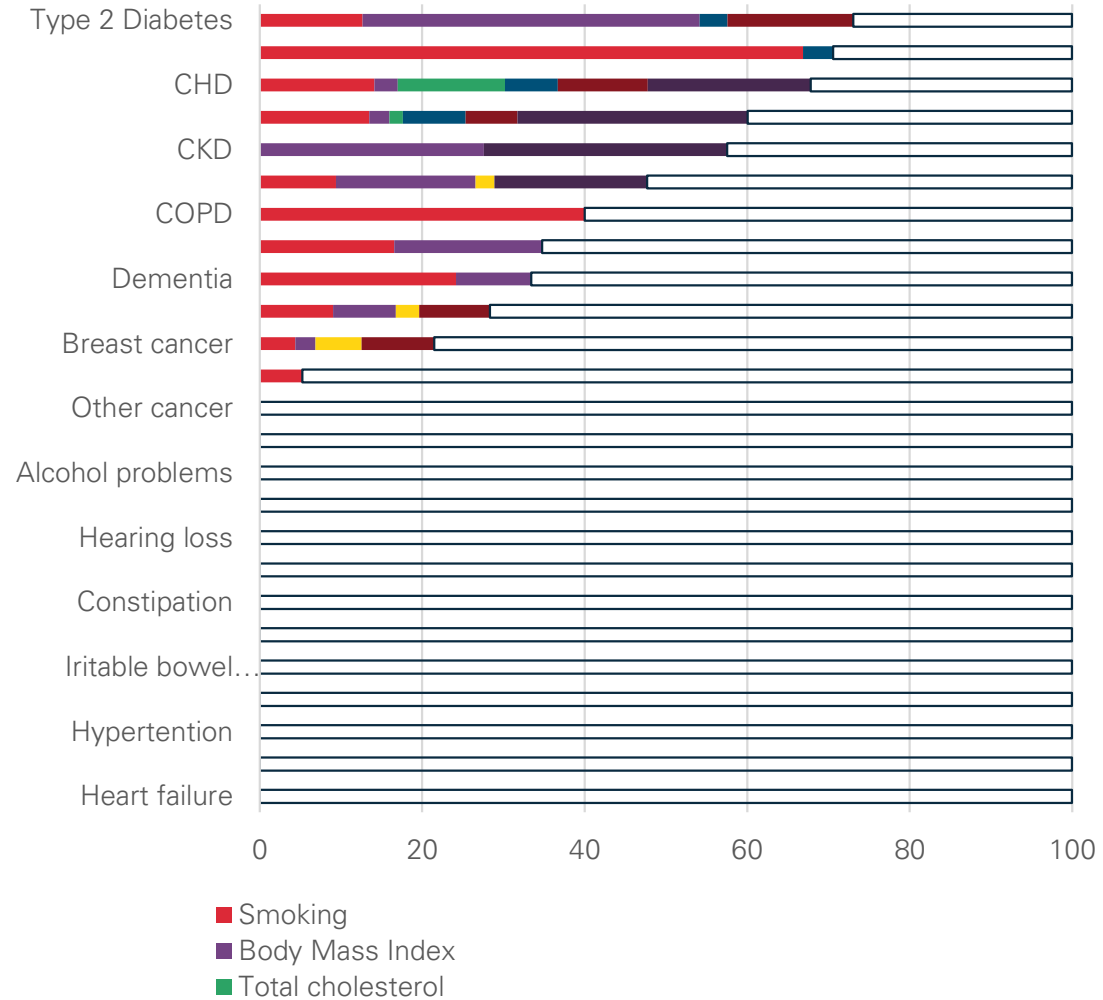
Legend:
- ■ Smoking
- ■ Body Mass Index
- ■ Total cholesterol

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| 0 | 0 - 1.5 | > 1.5 |

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We project the average level of illness in England to increase over the next two decades, largely driven by demographic changes

Projected changes in the average Cambridge Multimorbidity Score relative to 2019, including and excluding population changes, England, 2019–2040

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- The average amount of illness in the population is projected to increase slightly by 5.3% between 2019 and 2040 as a result of longer life expectancies and people spending more time with illness.

- But this is excluding the projected ageing of the population in England.

- When we include demographic changes, the average level of illness is projected to increase by 24.2%.

- So around four fifths of the increase is driven by demographic change.

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Limitations

- Projections are projections of current trends, incorporating true levels of uncertainty is a challenge

- Many risk factors are excluded, approximated by other patient characteristics such as IMD decile

- The evidence base for causal effects of risk factors is limited. The model does not use, quantified evidence of a causal relationships between these risk factors and 12 of the 20 CMS conditions.

- These projections are to 2040, they do not include the impact of the current childhood obesity crisis (because, in the main, chronic illness will occur after 2040 for children today).

- The benefits of better health are limited to "yes / no" disease accumulation. The CMS is fixed for each condition. There is no modelled gain for entering chronic illness in better all round health and no consideration of improved treatment.

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University of Liverpool Microsimulation model: Conditions and their causal risk factors

- The table lists risk factors that are epidemiologically linked with diseases. The links are extracted from peer-reviewed epi literature.

- The incidence of certain conditions such as CHD and stroke is influenced by every risk factor we study whereas others are influenced by just one or two risk factors (only smoking in the case of prostate cancer).

- A risk factor like diet or smoking will have direct impacts on illness, as well as indirect impacts through other biological risk factors (such as SBP).

- Risk factors for people in different groups are gathered from survey data and linked to illness observed in CPRD data

Aetiologic Risk Factors for Common Diseases

	Breast cancer	CHD	Colorectal cancer	Stroke	AF	T2DM	Asthma	CKD	Dementia	COPD	Lung cancer	Prostate cancer
Physical activity	●	●	●	●	-	●	-	-	-	-	-	-
Alcohol	●	●	●	●	●	●	-	-	-	-	-	-
BMI	●	●	●	●	●	●	●	●	●	-	-	-
ETS (second hand smoke)	●	●	-	●	-	●	-	-	-	●	●	-
Fruit	-	●	-	●	-	●	-	-	-	-	●	-
SBP (systolic blood pressure)	-	●	-	●	●	-	-	●	-	-	-	-
Smoking	●	●	●	●	●	●	●	-	●	●	●	●
Cholesterol	-	●	-	●	-	-	-	-	-	-	-	-
Vegetable	-	●	-	●	-	-	-	-	-	-	-	-

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REAL/Liverpool model structure

Smoking	Atrial Fibrillation	Cancer (Breast, Lung, Colorectal, all other), CKD, COPD, Coronary heart disease, Dementia (post-stroke, Alzheimer's, other), Diabetes T2, Heart Failure, Stroke & TIA	Some diseases are not dependent on our modelled risk factors. Anxiety & Depression, Asthma, Chronic pain, Hearing loss, IBS, Psychosis, Epilepsy, Type I diabetes, Arthritis	Death from any modelled disease or any other cause (competing risk framework)	Synthetic population separated:	Life expectancy	Primary care
Diet	BMI				People who die	Disease free life expectancy	Prescribing
Alcohol	T2 Diabetes				Survivors	DALY	A&E
Physical activity	Cholesterol					QALY	O/P
	Systolic blood pressure						Elective I/P
							Non-elective I/P

Step 1: Define age, ethnicity, gender, IMD, region	Step 2: Estimate risk factors on the basis of 1.	Step 3: Estimate biological risk factors given all previous.	Step 4: Estimate modelled disease risk given all previous.	Step 5: Project disease prevalence not attributable to modelled risk factors	Step 6: Estimate mortality given all previous.	Step 7: Estimate diseases prevalence	Step 8: Calculate measures of health given illness	Step 9: Assign health and care resources and costs

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Microsimulation model

Repeat until death or end of simulation

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Developing learning health systems in the UK: Priorities for action

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