Levelling up –
The great health challenge

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Outline

- The UK government is committed to removing geographical inequalities; it calls the policy ‘levelling up’
- Some of the biggest inequalities are in health on many axes – e.g. ethnicity, socioeconomic background
- A key aim is to narrow the gap in Healthy Life Expectancy (HLE) between local areas by 2030, and increase HLE by five years by 2035
- It wants to focus on communities with a higher prevalence of risk factors like smoking and diet
- Our focus is on smoking – we ask what difference would a complete cessation of smoking would make to the achievement of the target

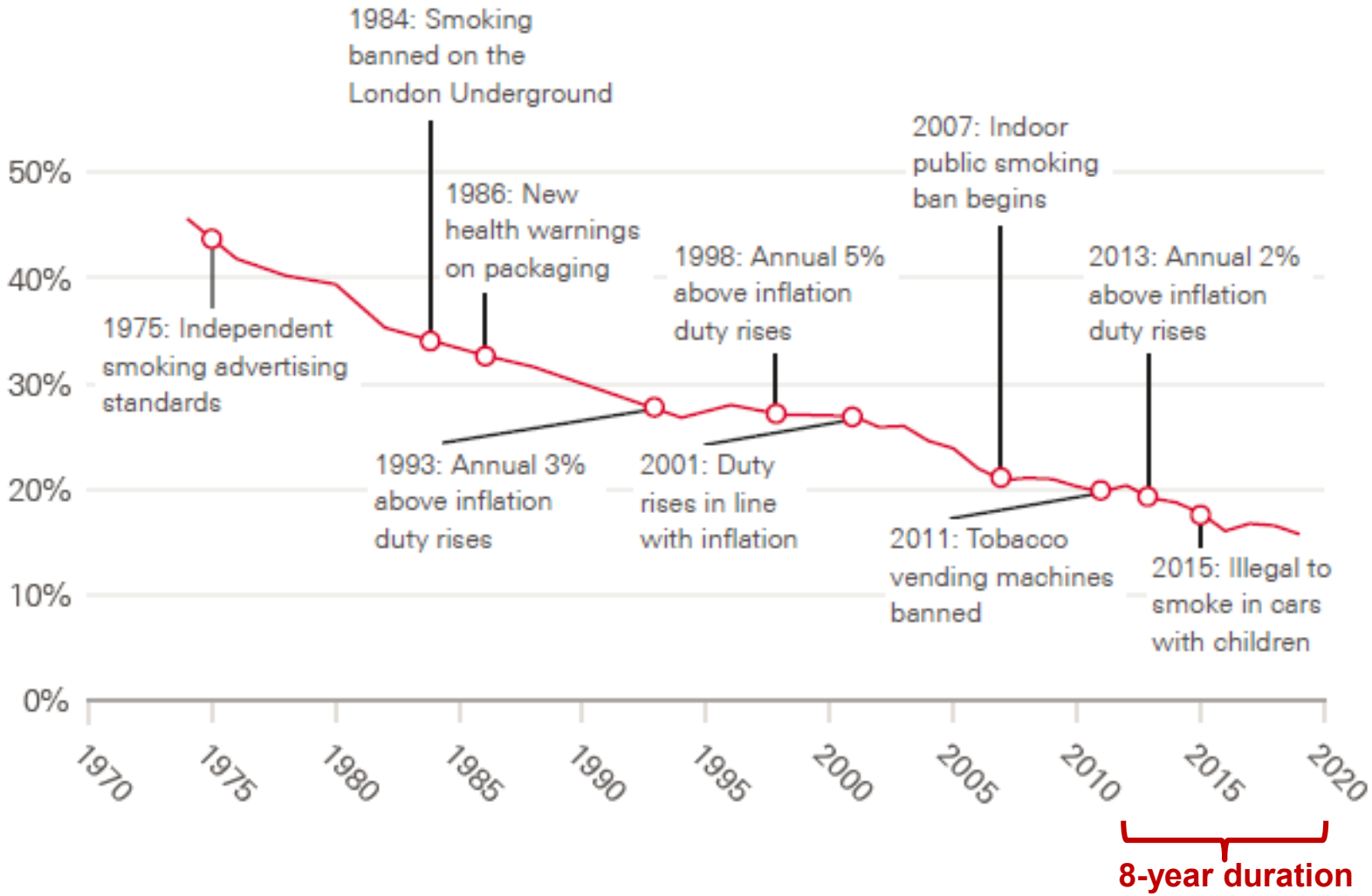
Our approach

- We compare geographical patterns of smoking and its effects on health
- We build on recent ILC research which found the economic cost of smoking is about £20bn a year
- We ask how much would smoking cessation contribute towards the Government's 2035 health target
- We estimate the effect on life expectancy if smoking prevalence had been 20% lower in all years in the past

What do we know?

- Smoking reduces LE at birth by up to 10 years but less is known about its impact on HLE or the proportion of life spent healthy
- Many health risk factors and socioeconomic outcomes are interconnected - smoking, mental illness, obesity, poor housing, deprivation
- Since 2000, life expectancy (LE) has increased by more years than HLE, and therefore the number of years in ill health has been increasing
- We also know that areas where people have the best health are economically more productive, as well as better off financially
- Although smoking prevalence has been falling, it is implicated in 75k deaths from cancer, heart and respiratory disease a year and over 0.5m hospital admissions in England

Trends in smoking prevalence and smoking policy



We do not start with a blank sheet of paper

1950s: First research demonstrating that smoking causes lung cancer deaths (Doll and Hill)

1970-2015: Many initiatives as seen in this chart has resulted in prevalence falling from 50% to 14% today

2022: Most recently UK Government review ('Smoke free by 2030') recommended a multi-pronged set of 15 interventions

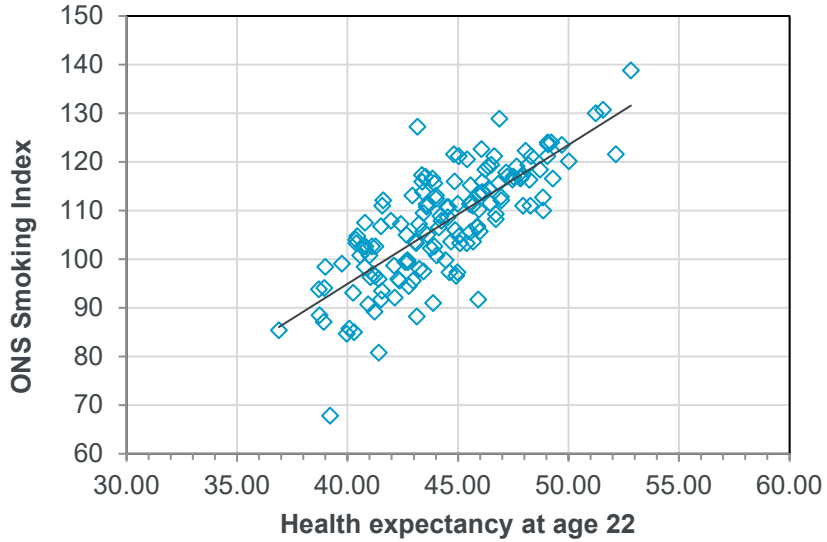
Source: ONS, Health Foundation and ASH

Measures of health expectancy

- Numerous health expectancy measures are used across different contexts:
  - Healthy life expectancy (HLE) at a given age from official statistics is an estimate of the average number of years a person would continue to live in a state of ‘good’ general health
  - A less frequently used measure from official statistics is disability-free LE (DFLE): the average number of years an individual is expected to live free of disability
  - A health economics-focused measure is quality adjusted LE (QALE): the average number of high quality years an individual is expected to live, where years lived are multiplied by a fraction that relates to their quality of life
  - An economics-related measure is working LE (WLE): the average number of years a person would continue to be in the labour market
- We use data from the UK Annual Population Survey and other ONS publications to quantity differences in health between current and ex-smokers and never-smokers.
- Normally HLE is measured at birth or age 65, but here we assess HLE across all ages

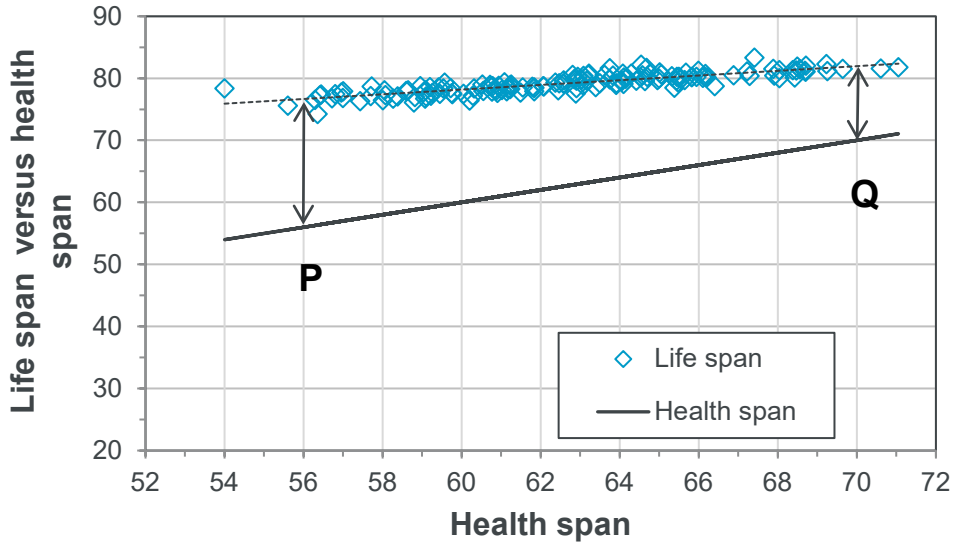
The geography of smoking and health

Smoking versus health expectancy at age 22 by local authority



The geography of smoking is strongly correlated with the geography of HLE (R^2=0.6). On the ONS smoking index, Richmond upon Thames ranks highest in England and the Blackpool and Kingston upon Hull rank lowest

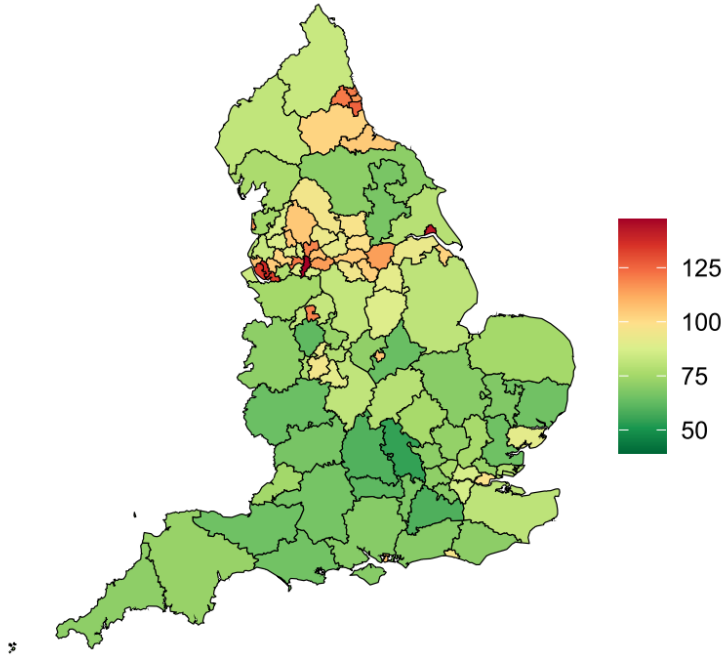
Health expectancy versus life expectancy by local authority



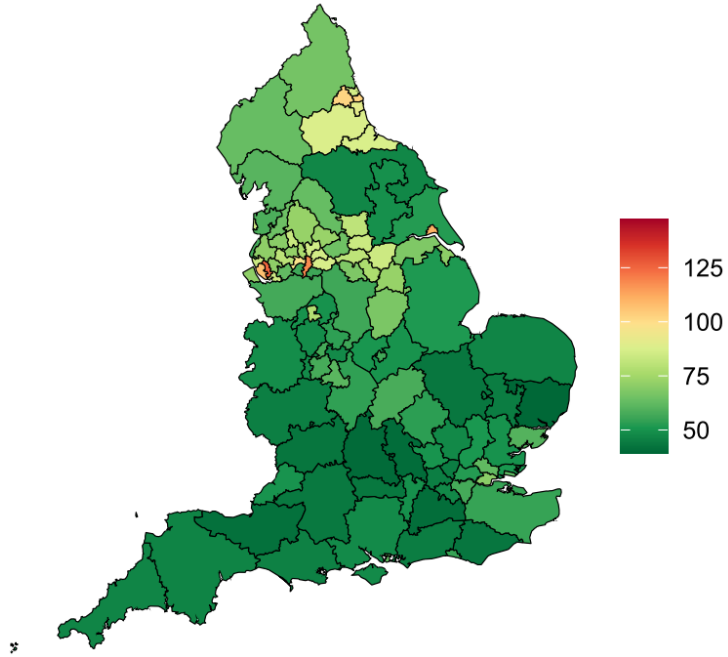
Life span is strongly correlated with health span (R^2=0.74) in which the gap between them declines with improving health. A one-year improvement in health expectancy extends life expectancy by 4-5 months – i.e. it reduces the time in ill health at the end of life (at point P the gap is 21 years and at point Q 12years)

The geography of deaths from lung cancer - ages 20 to 89

Males deaths per 100,000



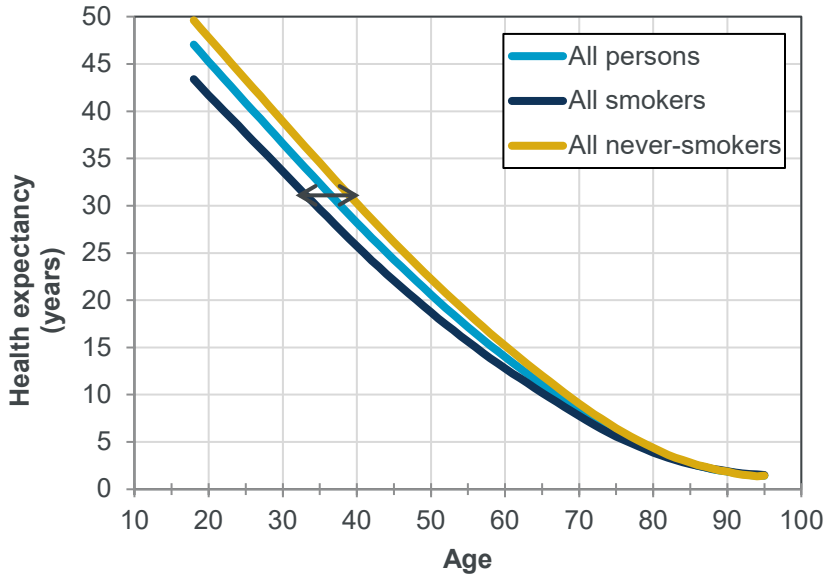
Female deaths per 100,000



Smoking is attributed to deaths from many different causes across respiratory diseases, cardiovascular diseases and cancer – lung cancer being the most well known. Deaths from lung cancer were higher in northern, Midlands and coastal cities. This pattern is similar to the pattern for deaths from heart disease. Whereas for deaths from other types of cancers, the geographical patterns are more dispersed.

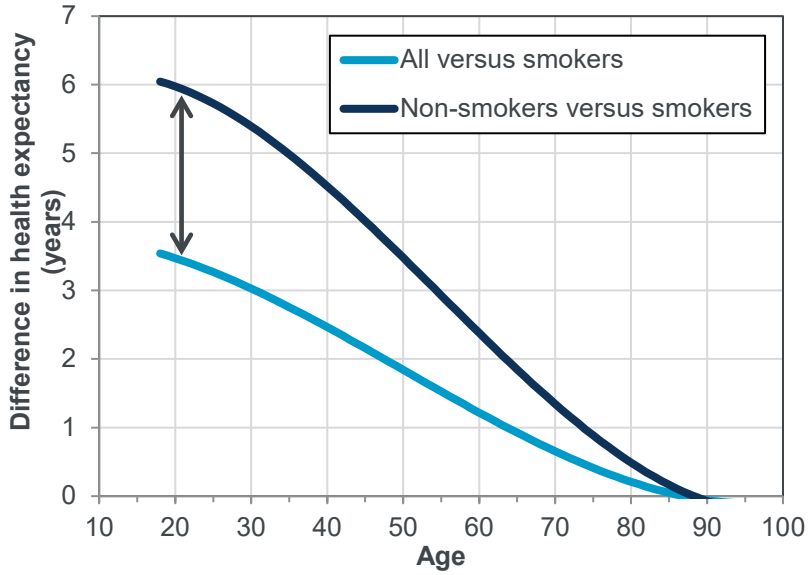
Health expectancy over the life course – Smokers versus never-smokers

Health expectancy by age for smokers and never-smokers



The arrow denotes the age difference of 6 years between a smoker and never-smoker having the same HLE, i.e. if never smokers had a biological age (BA) equal to their chronological age (CA) of 40 years, smokers with a CA of 34 years would have the same BA of 40 years.

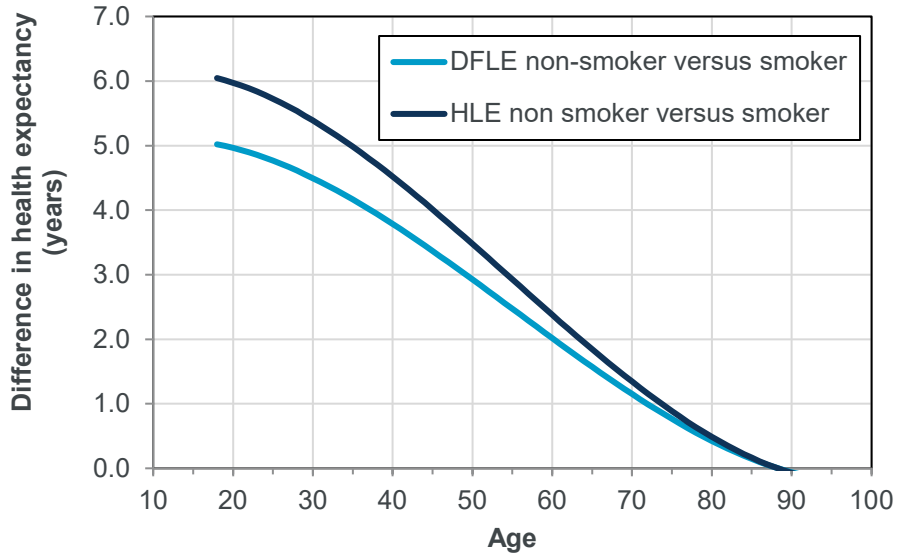
Difference in health expectancy by age for smokers and never smokers



The gap in health expectancy is greatest between non-smokers and never-smokers and is highest in young adults measuring about 6 years. The gap closes with age as remaining years of life decline.

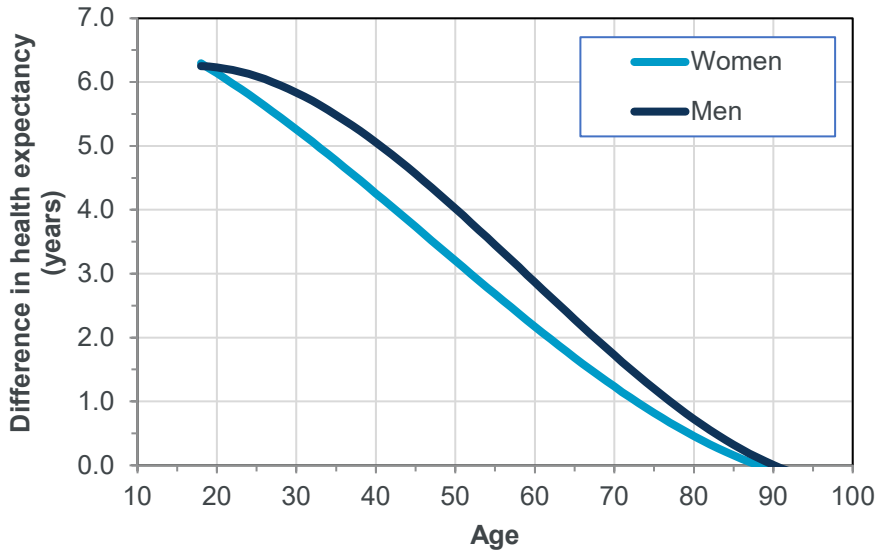
Health expectancy versus disability-free life expectancy from age 20 over the life course - Men versus women

Difference in health expectancies HLE and DFLE



The impact on DFLE from smoking is less than the impact on health – equating to about 1 year at age 20. This suggests that activities of daily living may be less affected by smoking than physical health

Health expectancy gaps between adult male and female smokers and never smokers



Never smoking females enjoy up to 6 extra years of health than female smokers, slightly less than for males. This is because they because they smoke less. Smoking is harmful in pregnancy and to young children.

The economic impact of smoking on male working life expectancy (WLE)

Age	DFLE (years)		Difference (years)	WLE (years)		Difference (years)	Activity rate %		Difference (%)
	Never smoked	Current/ex-smoker		Never smoked	Current/ex-smoker		Never smoked	Current/ex-smoker	
20	47.7	42.7	5.0	42.2	39.7	2.5	61.1	74.1	-13.0
30	39	34.3	4.7	33.9	31.0	2.8	94.8	91.2	3.6
40	30.3	26.1	4.3	24.3	21.9	2.4	95.2	89.7	5.5
50	22.1	18.7	3.5	14.9	13.1	1.7	94.1	86.9	7.2
60	14.8	12.3	2.5	6.1	5.1	1.0	72.5	67.8	4.7
70	8.8	7.2	1.6	1.6	1.0	0.6	19.9	12.3	7.7

Male never-smokers enjoy 5 more years of DFLE at the age of 20 than current/ex-smokers, and 2.5 more years of WLE. They are also more likely to be economically active at ages 30 and above, enjoy 3.5 more years of DFLE at the age of 50, and 1.7 more years of WLE. They are also 7.2% more likely to be economically active than current/ex-smokers at ages 50-60. If all men were never smokers, GDP would be £11.5bn higher. (source: ILC)

The economic impact of smoking on female working life expectancy

Age	DFLE (years)		Difference (years)	WLE (years)		Difference (years)	Activity rate %		Difference (%)
	Never smoked	Current/ex-smoker		Never smoked	Current/ex-smoker		Never smoked	Current/ex-smoker	
20	46.8	41	5.8	35.4	33.5	1.8	60.8	62.8	-2
30	38.1	33.2	4.8	27.7	26.4	1.3	79.9	76.2	3.7
40	29.5	25.6	3.9	19.7	18.7	1.0	79.3	77	2.4
50	21.6	18.6	3.0	11.4	10.9	0.6	84.9	79.4	5.5
60	14.5	12.4	2.0	3.7	3.6	0.1	57.8	58.1	-0.4
70	8.3	7.1	1.2	0.6	0.6	0.0	10.5	8.9	1.6

Female never-smokers enjoy 5.8 more years of DFLE at the age of 20 than current/ex-smokers, 0.8 years more than men They are also more likely to be economically active across ages 30-60, and experience 1.8 years of higher WLE. They are also 5.5% more likely to be economically active than current/ex-smokers at age 50. If all women were never-smokers then GDP would be £7.6bn a year higher (source: ILC).

A complementary approach to assess the impact of smoking cessation on *Life Expectancy*

- **What would happen if smoking prevalence had been 20% lower in all years in the past?**
- **Work in progress:**
  - How do we achieve this?
    - US data by sex, education level and 51 causes of death
    - Model mortality by cause using a CBD-type of mortality model with individual cohort effects for each major controllable risk factor (smoking, alcohol, …)
    - There is a direct link between the smoking cohort effect and the impact of smoking cessation on each cause of death.

What would happen if smoking prevalence had been 20% lower in all years in the past?

- Model + Scenario
  - **20% reduction in smoking prevalence** ⇔
  - **Reduce lung cancer mortality by 20%** (approximately)
  - Impact: death rates from other causes also fall
    - COPD mortality also falls by 18-22%
    - But a much smaller impact on most other causes

Scenario: what if smoking prevalence had been 20% lower

- At the all-cause level:
  - The relative amount of reduction in all-cause mortality depends on
    - Sex, Education level, Age, Cohort (year of birth)
  - Low-educated US males: all-cause mortality falls by 8% to 12%
  - High-educated US females: all-cause mortality falls by 2% to 5%
- Caution #1: in reality this reduction in all-cause mortality would not be immediate
- Caution #2: methodology is experimental, but it gives a flavour of our thinking

Smoking reduction scenario: What impact on HLE?

- **Model + assumptions =>**
  - Impact on mortality and Life Expectancy (LE) is clear
  - Open questions:
    - What is the corresponding impact on HLE of changes in LE?
    - What is the impact on the number of years in poor health?
- **Next steps:**

- Adapting the method to UK data by cause death

  - Establishing a detailed relationship between LE and HLE when smoking is the driver

  - Noting that the relationship will be different from each health driver (smoking, alcohol, diet)

- Estimating robust economic estimates of life style changes

Conclusions from our analysis

- Despite falls in smoking prevalence, we are not out of the woods and there is huge geographic and socio-economic variation
- Although never smokers stand to gain six years of health expectancy at age 20, the impact of smoking cessation will not be immediate due to the legacy problem
- As smoking prevalence has already been lowered, potential advancement is only around 2.5 years; in regions most at risk the potential for improvement is much higher
- Even if all smoking ceased tomorrow, the whole process could take 40 years to work though, so other health improvement measures are also needed
- If smoking prevalence had been 20% lower, lung cancer mortality would reduce by 20% and COPD mortality by 18-22%. This is a large 1-to-1 impact on mortality, but still needs to be translated into HLE impacts

What happens next?

- A ‘Tobacco Control Plan for England’ is due to be published later in 2022. This review is expected to recommend an ambitious multi-pronged set of public health, fiscal, and clinical interventions
- Our results suggest there are gaps in our understanding in terms of what is achievable over the timescale; the Government will struggle to achieve five years
- More research is needed on what works - old or young smokers, socio-economic groups or at-risk areas, people with multiple health behavioural risk factors or multi-morbidity
- In addition the efficacy of smoking cessation initiatives and their effectiveness has not yet been analysed; moreover, the HLE impact of switching to e-cigarettes is not well understood
- Are there wider lessons? Bear in mind that when a measure becomes a target it ceases to be a good target (Goodhart’s law)